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Activities Report

"Partners in Progress" by Senator J. Caleb Boggs (Delaware) and 22nd Annual Meeting Papers, 1968, presented at Baltimore, Maryland

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Activities Report

Per Mr. Mike Kohn
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This issue contains the papers delivered at the 22nd Annual Meeting, held at Baltimore, Maryland, April 15–17, 1968.

Activities Report is prepared under the direction of an Editorial Board, the membership of which includes Dr. D. M. Doty (Fats and Proteins Research Foundation), Chairman, Dr. Ferdinand P. Mehrlich (U.S. Army Natick Laboratories), Mr. John H. Moriarty (Arthur D. Little, Inc.) and Prof. Alvin I. Nelson (University of Illinois). Dr. Martin S. Peterson, under direction of the Board, edits the *Activities Report*.

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Vol. 20, No. 2 Fall, 1968

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Activities Report

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Editorial

BUT WHAT CAN I DO?

Elwood F. Caldwell
President, the Associates

But what can I do?

How many times have you heard this? Or said it yourself? In what differing contexts? If you're like most of us, you have heard it or said it *frequently* in various contexts, and the answer you were expecting was a frustrating (or perhaps welcome) "not much, I guess."

To the extent that this frame of mind might have applied to military food and container problems, the Associates offer a fresh approach, a forum for ideas, and a means of action.

At least, these were the thoughts that came to mind as a result of reading the previous issue of Activities Report, especially Deputy Assistant Secretary of Defense Paul Riley's talk to the 1967 Fall Conference of R&D Associates and the transcripts of four of the workshop sessions at that same conference.

Data bank of standard recipes . . . computerized automatic ordering system . . . cost, quantity and quality controls . . . these were some of the objectives Mr. Riley described for a new food service information system that would be Department of Defense wide. And the workshop sessions which followed showed how a group of government, institutional and industry people can dig into problems and can generate, not the solutions on the spot—that would be too much to expect—but the ideas, the interest, the organization, and

the volunteers who can bring about the solution.

Especially the *volunteers* . . . which brings us to the point of this piece, and the headline question, "What can *I* do?"

If you are in the food or container industries, your company can join the Associates as an industrial member, and you and your colleagues can attend conferences such as the one at which Mr. Riley spoke and at which the transcripted workshop sessions took place, and you can participate constructively in the continuing activities of one or more of the task groups. Four task group workshops were reported—Flexpack, Compact Foods, Spice Single Pack,

and Specifications—but there are others, including a very active one on Easy Open Cans, and sub-groups on particular specifications have now been formed as was anticipated last fall.

If you are in a university or non-profit technical organization, you can join the Associates individually as an institutional member (non-dues-paying), with the same participatory opportunities as those from member companies.

If you are in government service, activities and services of the Associates are available wherever appropriate for the accomplishment of the objectives of formalized task groups or of potential task groups—the ones that are needed and should be established but aren't yet—and as a medium for technical and professional communication in food, container and food service research and development.

But what can *you* do? If the problem is related to foods, containers or food service . . . if the solution is likely to be obtained as a result of someone's past, current or future research and development . . . the Associates offer a constructive approach and a means of action.

FOR YOUR APPOINTMENTS CALENDAR, 1969:
April 22, 23, & 24
Twenty-third Annual Meeting of the Research and Development Associates
U.S. MILITARY ACADEMY, WEST POINT, N.Y.

SENATOR J. CALEB BOGGS

PARTNERS IN PROGRESS

IT IS A PLEASURE to be with you tonight and I very much appreciate the opportunity of talking to representatives of so many of our leading firms involved in the broad food industry. It is also a pleasure to have an opportunity to meet representatives of our Defense Department and scientific groups who are also concerned with progress in the area of research and development affecting food.

This progress has already resulted in our troops in the field receiving a diet remarkable for its taste and wholesomeness under war conditions; and I know that all of you who have contributed to making this possible derive great satisfaction from the role you have played. I am sure as well that from your discussions during this annual meeting will come further refinements of the food service our fighting men are receiving. Please accept my congratulations for what you are doing; and I know that you will continue strong in your resolve to provide a ready reserve of technical experts to meet any food or container problem.

And I know that in speaking to an informed group like this, it is not necessary to dwell on the essential role which food is playing and will play in the peaceful development of our world. You know much better than I the problems involved in increasing the availability of food and in processing and packaging it. I am more than impressed at just the wide variety of new foods which have come on the market in the last few years; and I am sure that what you are doing now in the way of research and product development will bring even more surprises and advances in the years ahead.

Besides our concern that people elsewhere in the world are better fed, it is also well to remember that the advances made in the food industry need to be made available to more people in our own nation. I am sure you have noted the recent studies which indicate that millions of people in our nation—especially the very old and very young—are existing on inadequate diets.

Public and Private Sectors Need to Cooperate

I would like to compliment the Research and Development Associ-

[1] United States Senator, Delaware, and featured speaker at the Annual Banquet, 22nd Annual Meeting of the Research and Development Associates, Baltimore, 16 April 1968.

ates for recognizing and acting upon the need for cooperation among industry, scientific groups and the military. What you are doing in the general field of rations and packaging research and development is a model for what is becoming more and more essential in other aspects of life in the United States today.

The degree to which the private sector responds to the challenges of our times will determine the degree to which governments at all levels, as representatives of the public, will find it necessary to become involved in influencing our lives and businesses. As demand grows for more action to meet today's problems, my concern is that there will tend to be a dramatic increase in the Government's role in satisfying these demands. As our nation has grown in population and complexity, it is understandable that the Government's role and responsibility has also increased.

It can be seen, however, that if the role becomes too large, we will get to the point where individual freedom and business freedom will be so constricted that we will lose the spirit of innovation and competition which has made our economic machine so efficient. For example, proposals are heard that the Federal government provide millions of jobs in the public service field in order to dry up our areas of unemployment. True, such a program would make it possible to offer a job to all. It would also be very costly. And, once started, it could be expected to continue indefinitely.

But what would be the result? If persons were hired without any skills or need to improve what slight skills they have, there would be little pride in such employment. I think it is evident from various reports on civil disorders that the point of pride and self-respect is very much involved in lessening our urban tensions. An added difficulty would be the political consequences of providing millions of jobs, regardless of the idealistic basis for such action. The political party which could claim the most credit for hiring these people might also gain first allegiance to their vote. The result could well be a solid bloc which would alter the viability of our two-party system.

In making these comments, I am not ruling out a public works program of some kind. Some projects might be started with safeguards to insure that they are temporary, or are involved in job training. But we should not lose sight of the possible grave consequences if such a program gets out of hand.

To continue on this topic for a minute, let me say that, in my view, we need a greatly expanded system of job training programs which equip an individual for an existing job. I have been impressed by the Opportunities Industrialization Centers which were started in Philadelphia four years ago and which are rooted in the people of the communities where the job training is most needed. These OIC programs help illustrate the point I want to make to you tonight, and that is the great need for cooperation between the public and private sectors if we are to develop our nation in full peace and prosperity.

Your organization is an example of what can be done when private industry and representatives of the

Government combine and cooperate in working out problems of mutual interest. If I can be forgiven for coming close to former Defense Secretary Charlie Wilson's famous expression: "What is good for the food industry is good for the country." Public and private interests are not mutually exclusive, as your organization demonstrates. The military have specific needs in the field of rations, especially in the light of our current foreign commitments. These needs are answered most quickly and efficiently with the ready organization of a cooperative group such as Research and Development Associates.

Public Problems Cannot Be Ignored

This general idea of public-private cooperation is becoming more and more prevalent in the conduct of other businesses. Earlier this month the President of the duPont Company, Charles B. McCoy, talked to the Delaware Governor's Conference on Business and Industry and said:

> "Businessmen can no more turn their backs on urban and community problems, in areas where they have the ability to make a contribution, than they can ignore production or sales problems."

In his remarks, Mr. McCoy emphasized that a business corporation's first obligation is to fulfill its role as a producer and seller of goods or services. Unless it does this successfully, he said, it will have "no jobs to offer, no payroll to put into the community, no ability to pay taxes to support public services, and no way of surviving."

But the fact remains that a business—any business—does not operate in a vacuum and shares a responsibility for action to solve public problems. It seems to me that in many cases this can best be accomplished through groups or associations. Increasingly, chambers of commerce in our nation are becoming more oriented to their responsibility in the public arena.

You are all aware of the task undertaken by the National Alliance of Businessmen to hire and train a half-million hard-core unemployed in our largest cities. The Urban Coalition also illustrates a new vitality and urgency in cooperative efforts among civic, business, labor, religious and civil rights leaders. If private industry—individually or in concert with others—uses its skills and ability and resources to attack public problems, I am convinced that this investment in the future will yield great rewards.

Naturally, the role of Government will continue as well. But if private business tends to hold back or tries to ignore the public problems of our communities, I am gravely concerned about both the duration of these problems and the rise in the activity of Government agencies which will be necessary to cope with them.

It is not that the private sector hasn't made great contributions to life in our country. It has, simply by its success in the marketplace. Beyond that, it has supplied individuals who have been the driving forces behind civic improvement. Many of our service groups like Rotary and Kiwanis draw most of their membership from the business community.

A New Ball Game

I do not for a minute intend to suggest that those who manage and

direct our nation's progress have been unaware of their civic responsibilities. But I am concerned that events have escalated to the point that we are in a new ball game. What passed for a sufficient degree of interest yesterday is not enough today. Our nation looks to and needs the services of its best people if we are to protect and enhance life in the United States now and in the future.

No doubt there will be disappointments. I do not doubt that many of you have already had worthwhile projects rebuffed. Still, when the stakes are considered, there is no rational choice other than to try again, and try harder.

We speak a great deal about the fact that the Earth has become smaller through advances in transportation and communication. So it has. From West Coast to East Coast is a matter of a few hours. It takes only a little more than half a day to straddle half the globe. But the distance from center city to our suburban areas has also decreased. It used to be a tremendous gulf. It is no longer. What happens in center city vitally affects life in surrounding suburbs. That is another way of saying that the problems of center city are also the problems of the suburbs.

I do not need to add that this involves a heightened responsibility for doing something to solve them. It also involves an opportunity for each of us to make a lasting contribution to a better America.

Again, may I congratulate the Research and Development Associates for your emphasis on communication and cooperation to deal with your common problems. I know that this cooperation is part of the strength of the American system to adapt itself to changing conditions.

I salute you for the work you are doing; and again may I say what a pleasure it is to be with you.

GEORGE B. WAREHAM [1]

A VIEW OF THE RESEARCH AND DEVELOPMENT PROGRAM FROM THE PENTAGON

THAT YOU all came to this three-day conference because you are interested in solving a common problem—seems self-evident. The problem to us here today also seems self-evident—providing tasty, nutritious, wholesome food to the uniformed members of Army, Navy, Air Force and Marine Corps units, whether they are on patrol in the hot, humid jungles of Vietnam, in a submarine under the arctic ice, in an orbiting space station, or in any of our thousands of dining halls all over the world. We not only must give them really good food, but must do so with minimum burden on our logistic system and at minimum cost to the taxpayer; at the same time, we would like to serve it attractively. Certainly not everyone here is interested in all the many aspects of this problem; but your long record of assistance makes it clear that each of you has an interest in some part of the research and development program and desires to help in reaching a solution. It is a distinct honor to address this distinguished group of scientists and administrators.

The Cost of Food R&D for the Military Services

Our annual military food bill exceeds one billion dollars. We spend less than three-tenths of 1 percent of that amount for the food research and development programs. In the Defense program for FY 1968, research and development (The RDT&E Appropriation) gets one-third as much money as procurement. For example, R&D on the large new transport aircraft, the C-5A, cost about 38 percent of the sum planned for its procurement. But perhaps it would be more realistic to compare the food program to one that also involves a high-volume item, such as small-arms ammunition. In that field, R&D expendi-

[1] Staff Assistant, Office of the Director of Defense Research and Engineering, Department of Defense.

tures are less than 1 percent of the associated procurement bill.

Food accounts for some 5 percent of the DoD's procurement appropriation, while less than four-one-hundredths of 1 percent of the research and development appropriation goes for R&D on food.

You may ask, "Why all the statistics, and what do they mean?" My reason for making these comparisons is to point out that the resources allotted by the Department of Defense to the food R&D program are indeed a very small percentage of Defense expenditures for both food procurement and all research and development. I will discuss some of the reasons for these low ratios and let you decide, in terms of your own criteria, whether or not they are appropriate.

We in the Office of the Director of Defense Research and Engineering have been criticized for not giving sufficient attention or devoting enough manpower to the food R&D program. I intend neither to challenge that criticism nor to defend our actions. Instead, I'd like to point out some of the factors and conditions that make it possible to keep on serving our troops delicious, satisfying meals without spending large sums for R&D on food, even in the face of constantly changing modes of warfare.

Factors Influencing Defense R&D on Food

First, the industrial and commercial base for the production, distribution and serving of food is enormous. Most of the 200 million people in the United States eat three meals a day, and a lot of them earn their living by producing, processing, packaging, distributing, preparing or serving the food for the whole country.

Second, because the food industry is highly competitive, there is incentive for each of its many separate members to develop new products, new preservation techniques, new packaging, and new methods of serving merely to survive or to retain its share of the business. As a result, industry carries on a large amount of research and development in food, food products and food-service equipment. For example, two large and successful food corporations spend some 25 million dollars annually for R&D.

The older people in this audience can see the effects of this R&D activity by comparing the grocery store and butcher shop of your youth with the modern supermarket and, again, by comparing the old-fashioned kitchen and its coal- or wood-burning range with the modern kitchen in today's home or restaurant. Try to recall that childhood scene of your mother or grandmother in the kitchen preparing the family meal, and then spend a few moments watching your wife or daughter doing the same job now. Pay particular attention to where she gets the food items, their form, how they are packaged, how she prepares them, and what equipment she uses.

Visualizing these contrasting scenes helps one realize how greatly the food industry's R&D activity has changed our eating and cooking habits.

Let us think for a moment about this tremendous food industry with its R&D programs, and compare it with a modern weapon system such as an ICBM or the NIKE missile.

You will see that there is little or no similarity in the two. There is no industrial base for the missile systems. Their successful development depends on technology and materials that existed only in man's dreams just a few years ago; the Department of Defense, therefore, must shoulder the entire cost of research, development, engineering, testing, tooling and production. The cost of R&D for these sophisticated weapon systems may be a significant portion of—or may even exceed—procurement costs.

The third factor to be considered is that food R&D work is largely centralized in one military department and at one laboratory, the U.S. Army Natick Laboratories. We believe that, by centralizing management and performer in this way, our R&D dollars are used with greater efficiency than would be possible if the work were fragmented among sevtral military agencies.

The fourth and last factor I have chosen to emphasize in this brief discussion is the marriage of Defense and industrial research and development interests through the services provided by your organization, the Research and Development Associates, Inc. We know that the Department of Defense has benefited from this association, and we hope that the benefit has been mutual.

Potential Benefits of this Defense/Industry Association

This brings me to the point of my major concern: How can we—you, the R&D Associates, and we, the Department of Defense—derive still greater advantages from this cooperative situation? How can the DoD spend its $2.5 to $3.5 million in R&D funds per year in such a manner that it will, in the highest possible degree, enhance our troop feeding and, at the same time, stimulate the food industry to produce food products desired by the military services? How can you, the R&D Associates, help us to use your impressive industrial base for both production and R&D to improve and perhaps revolutionize our program of troop feeding? I seriously doubt that we have "wrung out" all the opportunities for mutual benefit that exist in this association.

I am nearly always discouraged, and sometimes frustrated, by the rate of our progress in R&D, particularly regarding the time and money it takes to get over the hump from the successful development of an item to its appearance as a useful product in the field. A good example is the food-irradiation program, started by the Navy back in 1951 and taken over by the Army the next year when it assumed responsibility for all food R&D of interest to more than one military department. Significant progress was made in the ensuing 17 years. Some very difficult technical and political barriers have been overcome, but we are still struggling to get irradiated foods into our operational menus. Irradiation sterilized bacon was approved for human consumption by the Food and Drug Administration in 1963. Significant test quantities have been procured and they are well received in troop feeding programs. Wheat and wheat products, white potatoes and some contact packaging materials, for use in irradiating packaged foods, were approved during the period 1964–1966. The experimental work in support of petitions to the

Food and Drug Administration on several additional food items has been completed. Petitions have been submitted for both irradiation sterilized and pasteurized items; however, no irradiated food items have been approved since 1966 although the approval of irradiation sterilized ham is expected very soon.

I have cited this program as an example of a research and development effort which has taken longer than planned and one which produced more than its share of frustrations. Those of you who are involved in the program are well aware of the problems ahead so I shall not discuss them here. Your assistance may accelerate solutions.

In defending this program some years ago, I came near to losing my job when I was accused of basing my defense on emotion rather than fact. Several years and several millions of dollars later, I had some second thoughts that cast serious doubts on the wisdom of the earlier position. Dr. E. S. Josephson, who directs the program at the Natick Laboratories, must have experienced some of the same frustrations—or, at least, some anxious moments—but, if he did, those feelings were never apparent. His careful analytical and scientific approach, his unshakable faith in the project, his enthusiasm and his dogged determination seem to overcome whatever inner frustrations he may feel. His enthusiasm and determination permeate the Pentagon.

Occasionally, when discouragement strikes, I take from my desk drawer a little card listing some nowadays common items and showing how long it took to bring each one from the laboratory-model stage —that is, when the principle was demonstrated and proved—to its practical use as a reliable product. It reads as follows:

The zipper—30 years
The fluorescent lamp—80 years
Magnetic recording—40 years
The self-winding watch—17 years
The gyrocompass—56 years

Now please don't cite these as targets, and don't even mention them to project managers! We are trying to avoid such development times; and we seek your help, as representatives of U.S. industry, in getting the products of our research and development over the engineering/production hurdle and into the military supply system. Then, and only then, will our troops receive the benefits of the R&D efforts.

How is it possible to enhance the mutual benefits of this DoD—R&D Associates relationship? That must be left to you, who are directly concerned. Certainly, mutual confidence and trust must prevail, and there must be free communication. Let us assume that these conditions already exist. Then, only the imagination and devotion of a 1968 version of Colonel Isker are needed in both parties to bring about rewards of a higher order.

Meeting the Challenge of Change

Conditions under w' ' h troops are fed change with changing modes of warfare and transportation and with the advent of new weapons systems. It is reported that 90 percent of our troops in South Vietnam eat in dining halls. Since this type of food service closely resembles the feeding of large civilian groups, it appears to be a fine opportunity for the food industry's R&D people to contribute

to the improvement of military feeding.

In the last few years, industry has introduced a large number of foods and food products that fall generally into the category of "convenience foods." This includes packaged meals and foods that have been dehydrated, freeze dried or condensed. We hope you will someday offer foods preserved by ionizing irradiation. How the military can make greater use of these foods in dining hall feeding is the subject of much study; and we are trying to determine what R&D is required in food preparation and food-service equipment before those convenience foods, in large quantities, can be introduced into both dining hall and field feeding. Here, again, is an area in which the combined efforts of industry and the military departments could have mutually beneficial results.

Before coming to speak at this luncheon, I asked Captain James A. Warren, USN, Director for Food Service in the Department of Defense, whether he had any message I could convey to you. He told me that you have assigned projects to seven separate technical task groups within the Research and Development Associates and that they are working closely with people at the Army's Natick Laboratories in their studies. Among the problems being examined are the following:

- improvement of specifications for food products,
- packaging and quality assurance,
- increased utilization of stable, compact and convenience foods, and
- development of improved, more convenient packaging for operational rations.

Your organization, consisting of research, scientific and technical representatives of reputable, nationally known firms in the food, food-packaging and food-equipment industries, provides an ideal forum for advice and assistance in developing new items for military menus, better packaging for subsistence, and innovations in purchasing, distributing, storing and serving food. Captain Warren needs this kind of help in the solution of problems that arise in the DoD's food-service program. We are pleased that you are helping him through the Natick Laboratories. This response to his needs shows clearly how you can assist the Department of Defense. I trust that it is not entirely a one-way street—that industry, as well as Defense, will reap some benefits from the work.

In closing, I would like to pay tribute to Colonel Isker for his foresight in recognizing the potential mutual advantages in a close association of R&D people in the Department of Defense and their counterparts in industry. His efforts in the early years of the R&D Associates resulted in clear benefits to our troops and, I hope, were also helpful to industry. I also wish to commend Harlan Wills and the officers and members of the R&D Associates for continuing their active relationship with DoD people in the R&D program on food and packaging.

Thank you for inviting me; it has been a pleasure to be here.

F. P. MEHRLICH [1]

TROOP SUPPORT—SUBSISTENCE

SUBSISTING THE TROOPS is big business by any measure. It is a profoundly important business too—not only is the capacity to fight aggressively dependent in a very real way on the availability of good food, but also food of good quality is one of the most important factors in keeping morale high.

We are the "Keepers of Quality"; we write the specifications; we provide the technical backup to the men who procure the food. Hence, our abiding concern is for the superior welfare of the fighting man, the practicality and workability of our documents; a proper interpretation of these essential instruments; and a vigorous, motivated inspection operation, adequate to assure compliance with stipulated quality characteristics.

Subsistence in Terms of Pounds and Dollars. Many elements of the military establishment are concerned with the procurement, movement, storage, and serving of food. All of these agencies deal with quantities of commestibles that are staggering when compared to the householders' experience, or even to the largest chain of food establishments.

As an example, during the Fiscal Year 1967, the U.S. Armed Forces consumed approximately 543 million pounds (543,349,311 lbs) of red meat (ham, bacon, pork, canned hams, veal, beef) valued at $327 million ($326,620,576.62). Shortening compounds and lard were purchased in the amount of 60 million pounds (60,163,249 lbs); margarine, 54 million pounds (53,682,028 lbs); mayonnaise and salad dressings, 29 million pounds (29,236,802 lbs); and salad oils alone, 45 million pounds (45,379,699 lbs).

Chicken for the tables of our customers cost $32 million ($31,610,247.14); turkey cost $15 million ($15,055,754.81) for the year. Shell eggs required the outlay of $45 million ($44,621,272.68); bacon to go with them and for other purposes cost $34 million ($33,822,624.46); canned hams added another $22 million ($21,822,974.02).

The Armed Forces were prime customers of fruit and vegetable vend-

[1] Director, Food Laboratory, U.S. Army Natick Laboratories, Natick, Massachusetts.

ors, too. Fresh citrus fruits in quantities approximating 79 million pounds (78,862,687 lbs of grapefruit, lemons, oranges and tangerines) were consumed, valued at approximately $8 million ($7,869,598.88). Ten million pounds (10,250,563 lbs) of strawberries were eaten. Talk about peeling potatoes—315 million pounds (315,356,842 lbs) were eaten last year, and the 12 million pounds of cucumbers (11,647,903 lbs) in the Armed Forces' salads, if laid end to end would have reached a fair way to the moon! And so the shopping list goes, adding up to a respectable total of $1,272,960,786.00!

At point of use, as served to our customers, the estimated value of these commestibles increases to a whopping $3 billion per year. This value is almost 4% of the total budget of the Department of Defense for all purposes—for payment of the troops; for the operation of the Navy; the purchase of new planes and helicopters; construction of new facilities; transportation of troops worldwide; in short, 4% of the military budget for all purposes is spent in subsisting the "troops."

It is challenging and stimulating to have an important part in an operation of this magnitude for it is of vital importance to the well-being of our nation.

Eleven "Staffs of Life"

Dominating the shopping list are a very limited number of commodities of recurring use; our "staffs of life," we might call them. The top eleven of these account for nearly 40% (37.9%) of the total dollars spent for commestibles, considering cost at point of first delivery, as is customary.

Relative to the total expenditure of $462.00 for food to subsist an enlisted man during the fiscal year just past, the top eleven commodities rank as noted below. The list shows prominently the traditional meat, potatoes, bread and coffee of our Armed Forces through the decades of our national history.

Food Commodities: The Big Eleven

Item	*Cost/Man Year/Dollars*	*Percent of Total Food Cost*
Beef	62.00	13.4
Pork	21.00	4.5
Drinking Milk	17.26	3.7
Poultry	16.80	3.6
Eggs	16.00	3.4
Ham	15.00	1.0
Bacon	12.00	2.6
Veal, Fresh	0.90	2.0
Coffee, Roasted	0.90	2.0
Bread	0.42	0.9
White Potatoes	0.40	0.8
TOTAL		37.90

Toward Better "Specs" and Better Foods

Having defined the *big eleven,* we will now consider certain technical studies, past and present, relative to the improvement of each. Please bear in mind that these eleven foods are the *big* ones on a dollar basis. There are others that have *big* morale value, but do not appear at the top of the dollar heap. They should receive and, to a degree, are receiving commensurate attention. Then there is a third group which comes to its zenith as "exploding novae"—as stars of the first magnitude—because of national or local interests, and to these we also give our earnest attention.

Not to be overlooked are the hundreds of lesser lights, each one demanding attention in its peculiar

way, at times quite disproportionately to its rank in the hierarchy of military foods. There is currently an inventory of 494 food specifications. Each is updated at least once in three years. For 262 of these, we have the preparation responsibility; for the other 232 we are the military coordinators, writing in the special requirements of the Services. If rumors are to be credited, we will soon embrace another 145 to 150 documents, the majority of which will cover perishable produce.

Through this maze (or should I say, haze) of reexamination, it seems essential to put in our best licks on those stalwarts of the *big eleven* and on foods having high morale importance to the "troops."

We are endeavoring to lay the basis for writing better, more precise, more definitive and hopefully, less complex, specifications.

An ever-present challenge. Communication with the field keeps us alert to the ever-present challenge to keep our know-how sharp, up to date, and leading the pack in essential areas. We are responsive to the national urgency to cast our ideas promptly into new or improved hardware. We have a couple of winners out of our shop about which a word or two will be said.

We are alert to opportunities to support our fighting men with whatever foods, meals, packets, or commestibles that either necessity or mature evaluations may establish as essential or highly desirable.

Beef and veal. Annual procurements of beef, boneless, approximate 296 million pounds (295,964,536 lbs), and are valued at approximately $173 million dollars ($172,620,574.69). Veal purchases amount in value to approximately one-sixth (15%) of the beef purchases. Rounding off the numbers, we find that for beef and veal, the annual outlay approaches $199 million ($198,738,451.17). That is a lot of money—and a lot of meat—and a lot of fuel for physiological fires. This meat should be as good as it can be considering availability of supplies and available appropriations, but Federal Specification PP-B-221 for Beef, Fresh (Chilled or Frozen) prepared by another Federal agency has not been revised adequately for military procurement since September 1952.

To assure an adequate document, Natick Laboratories requested and received from GSA (General Supply Agency) authority for the preparation of a new Interim Revision. Work is in progress to develop definitive requirements and quality assurance provisions for beef wholesale cuts procured for use by the military services, such as beef carcass, rib, round and tenderloin.

The choice of many Americans, in and out of uniform, for a quick snack is a hamburger and a Coke, or the equivalent. This is reflected in the annual consumption of ground beef, variously estimated to range between 60 and 70 million pounds (65,826,739 lbs)! In an effort to stabilize the quality of this product at an acceptable level—a highly important undertaking—we have developed, tested, and specified a new thermal extraction method for the rapid, reproducible estimation of fat in randomly selected samples. This method, published in MIL-B-003854-D(GL) uses the Hobart Fat Percentage Indicator, Model F-100. The results of our study appear in an article in the *Journal of Food Sci-*

ence, September-October 1967, entitled "A Comparison of Solvent and Thermal Techniques for Determining the Fat Content of Ground Beef." Studies are continuing relative to ground veal.

At the request of the combined military services, DPSC is scheduling a series of ground beef procurements in which fat analyses will be made of statistically determined numbers of random samples to be analyzed in unit assays using the thermal technique.

In-house work is in progress to establish a definitive end item method for determining the particle size of ground beef. The method involves cooking the beef and washing it through a series of sieves of different sizes. Reproducible results are obtained, but there must be considerably more work before a practical method and device will be available to the Inspection Service for routine use.

We are continuing to study, with promising results, the preservation of beef using ionizing irradiation. That, however, is a separate story to be told at another time.

Enough has been said to indicate that problems concerning the acquisition of beef of high quality are high on our priority list and well engrained in the minds of our technologists and scientists.

Pork. Nearly a nickel (4.5 cents) spent out of every dollar for military meals is for pork. For example, 94 million pounds (94,138,747 lbs) of pork are eaten each year, plus 62 million pounds (62,016,478 lbs) of bacon, plus 21 million pounds (20,707,566 lbs) of fresh hams and the like. Taken together, fresh pork, ham, and bacon virtually equal three-fourths of the cost of paramount beef—costs for these products approximate $128 million ($127,882,125.45) per year.

New definitive standards and requirements for wholesale pork cuts, including butts, hams, loins, spareribs and tenderloins were prepared during the current fiscal year by our laboratory. These will be published as Interim Revision PP-P-571a, under transfer of authority from GSA (General Supply Agency). This is the first definitive revision, and the first to reflect military requirements since July 1956.

Significant genetic, nutritional and environmental improvements effected by the pork producers have assured pork cuts that are more tender, flavorful, juicy and meaty than in the past. These characteristics have allowed the use of heavier animals and cuts, for use by the military customer. Examples include the increase in maximum acceptable loin weights from 18 pounds (bone-in basis) to 22 pounds and possibly to 24-pound levels. A change of this type was estimated by DPSC to be capable of saving $2,436,000 on a procurement of 7,530,000 pounds of bone-in pork loins.

Bacon. Over a million pounds (1,213,542 lbs) of prefried bacon was purchased for about $1½ million ($1,535,495.25). Prefrying reduces substantially the amount of preparation required before serving, and eliminates shrinkage and fat disposal problems.

Irradiation Preservation

An interesting experiment is underway to combine the logistic advantages of prefried bacon with those of irradiation preservation.

User services have indicated that certain lots of canned, prefried bacon are saltier to the taste than is desirable. They have also intimated that separation of the bacon into slices is very difficult in some instances, and causes the breaking of slices, detracting from the appearance of the product.

Salt levels of from 2.5 to 3.0 percent are representative of most lots of prefried bacon, which are somewhat higher than that characterizing the product in the consumer channels. This higher salt level is to protect the product against spoilage during the considerably longer shelf life of the military item.

Moderate doses of gamma irradiation, combined with a lower salt content at levels ranging around 1.5 to 2.0 percent, give a product of excellent appearance and flavor. Trials completed many months ago indicated that the minimum sterilizing dose for "normal" runs of bacon is approximately 2.9 Mrads.

It is noteworthy in this regard to recall the highly successful first "commercial" trials of irradiated bacon by the Army and the Air Force. In May 1966, DPSC awarded two contracts to members of the meat packing industry to produce 15 tons of bacon irradiated at levels ranging from 4.5 to 5.6 Mrads. High acceptance scores were accorded this product when tested by troops at Forts Benning and Gordon during December 1966. Respondents numbering 2,187 and 1,000 respectively scored the product at levels of 6.46 and 6.33, respectively, on the nine-point hedonic scale. Air Force evaluations held at 12 bases across the country accorded a slightly higher average of 6.50 from 12,788 respondents.

We are also working with industry in the development of a prefried, institutional sized, flex-pack of bacon, which has a low salt content ranging from an estimated 1.5 to 2.0 percent.

Ham. Gamma irradiated canned hams have been tested over a period of years in our laboratories and at Fort Lee, Virginia, to determine their shelf life and level of acceptance by the troops. We have found that after receiving treatment by gamma rays of cobalt 60 at levels ranging from 3.5 to 5.6 Mrads, hams of excellent quality have kept on the shelf without refrigeration for as long as two years.

Ham is a meat well liked by the troops. From data at hand, it appears that DPSC purchased about 33 million pounds (32,508,881 lbs) of canned hams during Fiscal Year 1967. Other ham purchases amounted to about 21 million pounds (20,707,566 lbs) or a total of some 53 million pounds (53,216,447 lbs); costs exceeded $35 million ($35,684,153.49) for both items.

A petition to the Food and Drug Administration to permit the production and sale of gamma irradiated ham was filed July 26, 1966. Covered was fully cooked smoked product treated with the gamma rays of either cobalt 60 or cesium 137 to dose levels ranging from 3.5 to 5.6 Mrads. Disposition of the petition is expected momentarily from FDA.

The Federal Government is interested in the establishment of a semi-commercial pilot plant meat irradiator having an initial capability of processing 3 million pounds of product annually. Design permits expansion as required to a capacity of 50 million pounds.

The Atomic Energy Commission

(U.S. AEC) has awarded a contract to Irradiated Products, Incorporated (IRRADCO) of Allentown, Pennsylvania, to design, build and operate this pilot plant meat irradiator with Government cooperation; construction will be started as soon as ham has been approved for manufacture and sale.

IRRADCO is a joint venture of Allen Products Company (a subsidiary of Liggett & Meyers Tobacco Company); Isotopes, Incorporated, (a subsidiary of Teledyne, Inc.); Martin-Marietta Corporation; and Uniroyal (formerly U.S. Rubber). The AEC, under terms of the contract, will help defray part of the cost of the cobalt 60 source, and the Department of Defense has obligated itself to procure 300,000 pounds of irradiated product during each of the first three years of operation of the facility. Plans have been completed and a site for building has been selected.

The pilot plant will make available to the Armed Forces larger quantities of irradiated meats than have been available heretofore for testing in various theatres. Production will be under simulated commercial conditions, and will allow an approximation of the probable large scale product costs. Scale-up problems are to be worked out with respect to an array of items as each is cleared for production by FDA, and in appropriate cases, by USDA as well.

Pork products will be prominent among the issue from the projected pilot plant, and we are optimistic that construction can start at an early date.

Poultry. Poultry consumption by the Armed Forces is one of the big four in point both of the weight consumed and the dollar outlays required. Last Fiscal Year, about 98 million pounds (97,931,154 lbs) of chicken were consumed, and of turkey, the amount was about 34 million pounds (33,862,280 lbs). Together the cost totaled in excess of $46 million ($46,665,992.95). The quality of both chickens and turkeys is accordingly a matter of important concern, especially their microbiological wholesomeness.

Poultry and poultry products have been implicated as prime carriers of Salmonella, and Salmonellosis has been described as the most prevalent of the diseases occurring during the past decade. Anyone who has suffered one or more bouts with one of the hundreds of strains of this enteritic bacterium needs not be told the essentiality of exterminating it.

Our attention, accordingly, has been directed to the study of this group of organisms and other pathogens on poultry, and currently we are emphasizing studies related to chicken specifically. Irradiation is considered to offer unique potentials for the control of such contamination in fresh and frozen birds. To this end, we have engaged in an intensive investigation of the organisms, their ecology, their prevalence on poultry, their relative susceptibility to destruction by low doses of gamma irradiation, to the related effects of such irradiation on the gustatory qualities of the birds, to the practical extension of shelf life, and to matters of economics.

In our efforts we have been joined by the U.S. AEC and the Atomic Energy Commission of Canada, Ltd., a profit making "Crown" corporation of Canada. Investigations

started during 1966 will be continued for at least another two years, to satisfy fully the requirements of a safe process of a practical nature. Results to date justify optimism that through irradiation can be found the solution to our problem in this area.

Potatoes and flour. A staggering 315 million pounds (315,356,842 lbs) of potatoes were eaten by our troops last year. Potatoes and bread have always been stalwarts in the arsenal of military foods. Our contributions in both of these areas have centered around their irradiation. For potatoes, a very low exposure to gamma rays retards sprouting for many months or may prevent it entirely. During the past year, 200 tons of Russett-Burbank potatoes were irradiated in Idaho for user tests by the Army and the Air Force. Levels of irradiation applied ranged from 5 to 15 kilorads; the higher dose was sufficient to control sprouting completely. The lowest dose appears to have allowed some sprouts to start but not to exceed one-half to two-thirds of an inch in length, at which point they died.

Army tests at Fort Lewis in the state of Washington, and at Camp Pendleton in California, indicated that the irradiated potatoes were as good as freshly procured potatoes available on the market, on a selected basis. The Air Force made observations at Anderson AFB in Guam, and at Eielson AFB at Fairbanks, Alaska. A majority of the test potatoes were as good as fresh controls, but in at least one case, some mould developed in the irradiated potatoes. It is believed that this was related to unusual environmental conditions obtaining at the time of harvest of the crop. Additional tests are being planned, but it has been demonstrated clearly that low dose gamma irradiation can prevent sprouting and enable the carryover of this most important vegetable from one producing season to the next.

During July 1967, under contracts with the Hawaiian Flour Mills, Inc., of Honolulu, Hawaii, and the Helix Milling Company of Helix, Oregon, the first "commercially" irradiated flour was produced for tests by the Services. Sixty-six tons of hard wheat flour for bread making was prepared in tin containers, 35 pounds of flour to the container. Of this flour 79,380 pounds were irradiated in the Hawaiian Development Irradiator of the State of Hawaii, and the remainder, 52,150 pounds, was irradiated at Dawsonville, Georgia, by the Lockheed Georgia Company. In each case, the dose given was within the range of 30 to 50 kilorads, enough to destroy the insects therein, or eggs from which they might have stemmed.

Baking tests have been conducted at several sites either by our Natick Laboratory bakers or by the Using Services. The flour has been found to be insect free and to be equal to unirradiated flour in baking qualities. Testing continues; hence, a final report cannot be given at this time.

A very significant test of the effectiveness of similarly low gamma irradiation has been carried out at the U.S. Department of Agriculture, Stored-Product Insects Research and Development Laboratory at Savannah, Georgia. There, through the cooperation of Mr. Hamilton Laudani, the Director, flour inoculated with six of the most common species of flour beetles and moths was irra-

diated to a dose level ranging between 30 and 50 kilorads. This was compared to uninoculated flour, irradiated and unirradiated. Observations indicated that at the end of a one month period there were a few survivors, sterile and weakened, and that these died without increasing their populations. Observations after three months and six months showed that there were no survivors in the irradiated product.

Flour in Vietnam, as in any warm climate, unless treated to prevent the germination of insect eggs, will in a short time become infested to a point of denying the use of the product. We see in the application of low dose irradiation the solution to a long-standing problem—provided, of course, that additional study does not turn up unforeseen implications.

The use of low gamma irradiation has been approved by FDA for both of the uses reported herein; namely, to prevent the sprouting of potatoes and to suppress insects in wheat flour and wheat flour products.

Meals by the Million

Meals and packets. Requests for engineering support from Procurement and new product development are demanding, day to day activities, requiring alert, imaginative dedication on the part of our food technologists and subsistence quality control specialists. Our job is to assure the continuing global suitability, the quality, and the acceptability of the meals and packets originally stemming from our R and D undertakings. A feel for the magnitude of this task can be gleaned from the the numbers of these items in use in the current conflict. Since October 1965, more than 311 million Meals, Combat, Individual have been procured, and current purchases are at the level of at least 100 million a year. During the past year we have performed a number of services to keep this meal attractive and nutritious. A ration supplement, beverage pack was designed and many tens of millions of these have been issued. A review of canned meats used in the meals was conducted and the specification was strengthened with respect to them. Ham and lima beans were deleted and were substituted for by spaghetti and meat balls; bread was taken out and fruit was substituted to increase the acceptability of certain of the menus. The chocolate bar used in some of these meals was studied to assure that the most nutritious and palatable product would be stipulated. There was a flurry of other actions of similar sorts.

The Chief of our Experimental Kitchens has served recently as an Army representative of the Department of Defense committee to unify the Army/Air Force, the Navy and the Marine Corps recipes into one recipe service to be used by all of our U.S. military forces.

Response from Southeast Asia

When the GI stops griping about his food and offers to spend his own money to buy issue items, THAT IS NEWS! Through the industrial suppliers of the Food Packet, Long Range Patrol, affectionately renamed the "LURP" by the troops, we are receiving fan mail from Southeast Asia. I have selected a couple of these to read to you—there are many, many more that certainly warm the cockles of the heart of my staff and our associates in R&D.

March 29, 1968

"Dear Sir:

In a recent operation, we had the opportunity to have some of the meals that your Company puts out. Like Chicken Stew, Chili con Carne, Beef with Rice, etc. Since it is an Army issue, it was the first time that us Marines came across them. They are delicious. To us it was like a home cooked meal. Well, anyways since these came to us, we would like to know if we can purchase them some how. We sure would appreciate it, if we could obtain some somehow.

Yours truly,
PFC Ronald P. Ramiez
PFC Brian M. Craig
PFC Tom J. Haley"

* * *

March 8, 1968

"Dear Sirs:

I am writing this letter while in a bunker at Phu Lok, Viet Nam. The reason for my writing is my interest in a product with which your firm is associated.

Upon moving into my present area I found quite by accident, a bag of your Beef with Rice, dry food product. This was the first I had ever seen of your product, and being inquisitive by nature, I immediately set about its preparation. Being a little hesitant at first, I just nibbled a few of the dry morsels. NOT BAD! Hey, Forbes, try some of this stuff. How 'bout you Chiles? OK, let me cook it up real proper. I added some hot water and stirred it up a bit, then "dug in." I was astonished to say the least! This stuff is fantastic. Now, try some guys. Great ain't it? Darn, wish we had more.

This brings me back to the purpose of this letter: Gentlemen, if you would be so kind, would you please send me the information needed to order more of your incredible and most delicious product. Even a short note to my parents, so they would take the steps necessary to send more of your product, would be immensely appreciated. Their address is as follows:

(I have deleted the address)

If you do decide to send the information to me directly, please use the following address:

Pfc. R. C. Fliss 2380053 USMC
2nd Battalion 5th Marines
E Company 2nd Platoon
FPO San Francisco, Calif. 96602

Yours truly,
Pfc Robert C. Fliss.

P.S. If you have a cute little secretary have her write also!"

There are eight menus of the Food Packet, Long Range Patrol, or of the "LURP," if you like that more descriptive title. The packets are currently being procured at the rate of approximately 1 million per month.

Conclusion

Gentlemen, in preparing the outline of my presentation to you, I included another chapter, entitled "More Precise Specifications"—but I think it would be anticlimactic to add more at this time. Perhaps you will afford us another opportunity to give, in depth, a picture of the intensive, integrated efforts of several of our groups in coming up with more definitive, more explicit specifications . . . but it seems better to save that for another time.

In concluding my presentation, may I make use of a quotation borrowed from across the seas, and from another era, but too true to be forgotten: John Ruskin said:

> "There is hardly anything in the world that some man cannot make a little worse and sell a little cheaper."

And to this, may I add: Deliver us from it! And that is a considerable part of our job.

COLONEL THOMAS A. CAPPER [1]

MENU PLANNING FOR VIETNAM

THE OBJECTIVE of the food program in Vietnam has always been to have all troops, except those actually engaged in combat, on a perishable type ration. From the time of the escalation of our operation in Vietnam in the 1964–65 period until the present, every effort has been made to achieve this goal. In fact, for the past two years approximately 90 percent of the troops have been supplied the "A" Ration. The "A" Ration, in Army terminology, is the garrison ration, the same ration supplied to every soldier in most installations world-wide. This ration consists of highly acceptable fresh, frozen, canned, and dehydrated foods served in well-balanced, palatable meals and resembles the diet of the average well fed American as closely as possible.

During the initial phases of the escalation of operations in Vietnam in 1965, the Army assumed the responsibility from the Navy of supplying subsistence to United States and Allied Forces in what is known as the II, III and IV Corps areas of the Republic of Vietnam. The Navy still retains responsibility in the I Corps area. At that time U.S. Army, Vietnam, determined that the Army supported troops would adopt the same Master Menu utilized within the Continential United States and other Army Oversea Commands. Certain obvious changes were made, particularly in the area of dairy products, such as providing for canned sterilized milk in lieu of fresh, dehydrated cottage cheese, etc. Highly perishable products such as melons were also deleted.

Within a six month period, as the number of our forces grew and were deployed over a greater area, the distribution of the perishables became increasingly complicated by several factors. These included the lack of railroads and highways and destruction of bridges and mining of roads by the Viet Cong. In addition, the roads could only be used during the daylight hours, and there was a lack of airfields capable of receiving larger aircraft. Thus, many camps were supplied by helicopter or air drop. With increased tonnage of food, a serious shortage of refrigerated storage space developed. It soon became obvious that in order to maintain the program of supplying the "A" Ration to all troops except those actively engaged in combat some modification of the menu would have to be made in order to reduce the amount of refrigeration required and to simplify the supply system. It was imperative that this be accomplished with a minimum effect on the overall acceptability of the ration.

Cyclic Menu for Vietnam Proposed

Late in 1965, U.S. Army, Vietnam, requested that they be autho-

[1] Colonel Thomas A. Capper is Chief, U.S. Army Food Service Center, Chicago, Illinois.

rized to use a 31-day cyclic "A" Ration which had been developed by this Center for use in the Dominican Republic. This menu had been designed for use where refrigeration facilities were limited and therefore did not include frozen fruits and vegetables and only a limited variety of fresh fruits. The requirement for freezer space, for example, was reduced from 1.373 cubic feet per man per day to .637 cubic feet per man per day. The Master Menu utilized within the United States includes a total of 287 items whereas this particular menu included 203 items. This represents an elimination of 84 line items from the system—which greatly reduced the problems involved in requisitioning and supply.

The concept of using a cyclic menu was so successful that in August 1966 U.S. Army, Vietnam, requested the U.S. Army Food Service Center to develop, in coordination with their own food service personnel, a special cyclic menu for exclusive use in Vietnam. A team of food specialists from the Center visited Saigon to initiate the work on the project. It was at this time that the 28 Day Master Menu was developed. The 28 Day Master Menu covers a four-week period and the four-week cycle is designed to be repeated thirteen times during the calendar year, thus stabilizing the supply system while providing a variety of foods to be requisitioned and issued for normal troop feeding purposes (Table 1).

Table 1. Comparison of storage requirements for the A Ration Menu and 28-Day Cyclic Menu

	Gross Wt/Man/Day	
	A Ration	*28-Day Cyclic Menu* [1]
Freeze	1.3730	.778
Chill	.0897	1.151
Vent	.641	.103 [2]
Dry	3.8963	2.656
Total	6.0000	4.688
	Cubic ft.	
	A Ration	*28-Day Cyclic Menu* [1]
Freeze	.0413	.019
Chill	.0374	.052
Vent	.0197	.003 [1]
Dry	.0846	.077
Total	.1830	.151

[1] Without ice cream, milk, cottage cheese.
[2] Computation based on onions, dry and potatoes, fresh.

The menu provides for integration of a variety of locally grown fresh fruits and vegetables as well as fresh produce, frozen meats, canned and dehydrated items to be supplied from the United States. In addition, the menu provides for a limited quantity of canned meats to ensure a ready supply of nonperishable entree components for emergency use. This menu consists of 43 perishable items as compared to the total of 105 perishable items used in the current regular master menu.

The daily caloric value of the 28-Day Master Menu is 4100 calories. The menu is designed on the logistic concept that it should contain as many foods as possible that are weight and space saving. Therefore, frozen prefabricated meats and poultry, and canned or dehydrated fish, fruit and vegetable items have been used wherever applicable. In addition, the menu can be used where limited refrigeration facilities are available though not adequate enough to support the use of frozen fruits, fruit juices or vegetables. Fresh vegetables have been used for salads, relishes, and for some desserts; however, in each case a non-

perishable alternate has been provided. Both items, the perishable and the nonperishable alternate, are shown in the menu.

A brief review of some of the items included may be of interest (Table 2).

In the meat area, vacuum packed sliced bacon or prefried canned bacon is used. Boneless frozen portionized beef steaks and roasts as well as diced and ground beef, veal cutlets and boneless veal steaks, pork chops, and pork roasts, cooked ham and boneless turkey rolls, chicken cut-up packed without necks, backs and giblets are examples of the meat and poultry items included. The fish products include freeze-dehydrated shrimp and freeze-dried fish squares. Dairy products usually present the greatest problems when supplying troops in the field because of their highly perishable nature. Dairy items in the 28-Day Master Menu that are of special interest are dehydrated cheddar cheese, freeze-dried cottage cheese, scrambled egg mix, sterilized canned milk, and ice cream mix. The ice cream mix, until quite recently, was used to produce ice cream in the field by means of portable freezers. Dehydrated potato granules are programmed for all servings of mashed potatoes. Diced or sliced dehydrated potatoes are used in other recipes. Since the life of a fresh potato when stored at the temperature and humidity prevalent in Vietnam is about four days, only three servings per 28-day cycle are programmed. These three servings are used to provide the variety in the menu of a fresh baked potato. Also, to provide variety, fresh frozen French fried potatoes are scheduled four times per cycle. The frozen French fries, incidentally, are the only frozen vegetable used at present. Dehydrated green peppers, dehydrated onions, instant juices, cake mixes, and other bakery mixes are scheduled to the maximum extent practicable. All menu items are developed so that they can be prepared on field equipment.

Revision in Progress

The U.S. Army Food Service Center is now working on a revision to the 28-Day Master Menu. This revision will incorporate some changes that reflect an improved supply system and increased refrigeration

Table 2. Day 20, 28-Day Menu

Breakfast	*Dinner*	*Supper*
Fresh Bananas	Shrimp Creole	Grilled Steak (A-11)
Chilled Orange Juice	Buttered Rice (K-7)	Baked Potatoes (G-78)
Ready-to-Eat Cereal	Buttered Cream Style Corn (G-39)	Buttered Carrots (G-28)
Eggs to order	Raw Spinach, Cucumber and Radish Salad w/Vinegar and Oil Dressing (H-100)	Pear and Cottage Cheese Salad (H-16)
Hot Ham Chunks	or Pickled Beets and Onion Salad	Bread
Hot Biscuits	Bread	Butter
Butter	Butter	Ice Cream or Jelly Roll (D-30)
Jelly	Pineapple Upside Down Cake	Iced Tea
Coffee (R-21)	Iced Beverage Base	Lemon
Milk	Milk	Milk

capability. The caloric value has been upped to 4300 calories. Fresh recombined milk is used as a beverage, instead of the canned sterilized variety. This milk is produced from nonfat dry milk and a vegetable fat. Upon reconstitution, this milk is handled like the fresh product and it tastes more like the fresh item than does the canned variety. Ice cream will be produced in contractor operated recombining plants as well as cottage cheese. The first frozen vegetable will be added in the form of three servings of mixed frozen vegetables.

Even though the 28-Day Master Menu is a cyclic type in that it is intended to be repeated thirteen times during the calendar year does not mean that it is a static document. Plans call for it to be revised at six month intervals so it will be kept abreast with increased refrigeration and distribution capabilities within Vietnam as well as to incorporate the use of newly developed food items. The U.S. Army Food Service Center works closely with Research and Development, Defense Personnel Support Center, and food service personnel in Vietnam to improve their food program. The important contribution that good food makes toward the soldier's morale largely comes about through the menu.

ROGER MERWIN [1]

AIR FORCE FEEDING IN SOUTHEAST ASIA

OF ONE THING you may be assured, there are literally thousands of people who are experts on Southeast Asia, probably hundreds who are experts on food service, and many who are experts on both. I have studied the definitions of experts and since most of you qualify in one form or another and probably have heard all of the definitions, I shall not bore you with yet another. I suspect that my own classification is that of an interested observer. There really is no substitute for first hand observation and information. However, even that is only as good as one's ability to adapt and understand what he sees. Our office is in a rather fortunate position in that we are able to have people on the scene, have access to people who have served there, and then ultimately to go and look for ourselves and relate all these factors.

Recently, I attended a meeting at Fort Lee, Va. It was an interservice/industry meeting dedicated to discussing items that related to industry and food service. It was an excellent meeting with many fine ideas and programs generated therefrom. One of the items discussed, for instance, was the "SPEED" kitchen developed at your own Natick Laboratories. Many of you are familiar with its inception, objectives, and progress. Similarly, we heard presentations relating to the problems of feeding aboard submarines and how these could be resolved. Among other areas of discussion at this meeting were situations relating to feeding afloat, under field or combat conditions, normal garrison, or ashore feeding. Each of these situations brought forth certain underlying areas of commonality in the world of troop feeding. This commonality of feeding and feeding situations demands the establishment and actions of groups such as are represented here today. Their effectiveness in achieving the goals that we of the services share in the realm of standard equipment, materials and practices has been demonstrated in countless previous situations.

At the same time that we were discussing these many situations and items of equipment or methods of operation at Fort Lee, I tried to envision the Air Force utilization of them. For example, take "SPEED" —the principle and the adaptation of it has great potential, but where in the Air Force do we have a need to feed 200 people under field conditions (or even 400 or 600)? As we think and review these things, a nagging number of differences and a lack of similarity become evident. Gradually, more and more of these differences begin to appear with an increasing degree of variety and scope.

We can look to the automobile industry for certain lessons in this

[1] USAF Services Office, Philadelphia, Pennsylvania.

area. The automobile industry, next to the defense establishment, is perhaps the greatest segment of the American business scene. Looking at the automobile itself, we can analyze what it is used for, why we need one, and what can or will it do for us. Fundamentally, the automobile will move a certain load, a given distance, at an acceptable rate of speed, with a pre-determined amount of comfort and with or without driver conveniences like automatic transmission, power brakes, power steering, power windows, remote trunk lock, etc. How different then are the real basic needs of an automobile? What differences should there be then between a Ford and a Cadillac, a Jeep and a Volkswagon? Here we have all the essential ingredients for standardization, but standardization does not exist to any real degree. GM differs from Ford, American from Chrysler, and even within these giant companies themselves, there are great differences in cars—Chrysler, Dodge, Plymouth, Imperial for example. Unquestionably, there are many similarities but it is the *dis*similarities that make the difference. How else would it be possible to convince such acknowledged car experts as you and I that we must have a certain make and model of car year after year after year?

While certain parts of this analogy may not stand up to intense scrutiny, it does outline the fact that even though all the essential ingredients for standardization exist within the automobile industry, there are still wide differences. It should be no surprise then that differences exist among the services' feeding systems. Each service plays a very definite role in the Defense Department picture. Each has its missions, its needs, its capabilities, and its peculiarities. However, when you get right down to the nitty-gritty, the real mission of the Army is to put the rifleman on a patch of ground and be darned sure that he can claim and keep that ground for his own. The efforts of all other elements of the Army—tanks, artillery, rockets—are directed toward that goal. So also in like manner are the resources of the other services directed to that task of making sure the infantryman can get and hold a piece of ground.

The Air Force fulfills its obligation to support the infantryman in his aims by bringing him into position along with his battalions, regiments, and divisions. We continue to help after he gets there; hauling in things like ammunition, gasoline, food, supplies, and even more men when he needs them. Finally, we give him what we really came for and this is the additional fire power that he can't carry. We must make the area he wants unattractive to those who now have it; we must prevent the enemy in reserve from coming to help, and we must interdict the enemy behind the lines from mounting attacks or accumulating stocks and materiel.

While all of our ultimate goals are the same, there are fundamental differences in our mission that have a profound effect on the way we operate and the way in which we live. The Army, up close to the action, lives and acts in accord with what the situation dictates; the Navy, moving primarily from ships and fixed bases, lives according to that situation. The Air Force, with

the speed and range of its modern aircraft, lives a little more remote from the action. We firmly believe that even though a man enters a combat area, he does not have to forego all of his civilized habits. For that reason, we insist that our people make every possible effort to improve their lot. We may well be in a bum place, but we don't have to live like bums. Bases and installations generally are more permanent, require a greater amount of stability, and usually are less prone to enemy ground action. Vietnam has proven to be an exception to this; however, it is true to a large extent of Air Force life in Thailand. The buildup of forces in Thailand by the Air Force represents almost a classic example of our way of life and for that reason, I would like to direct the bulk of my remarks to the Air Force in Thailand as an example of the Southeast Asian problem.

Thailand

There are many peculiarities in Thailand that make it unique. Perhaps a brief review of what has happened there as a prelude to our build-up would be of interest to you. In its early stages, Thailand military elements were supported by the Navy by virtue of their initially having a small facility and then assuming responsibility of the American Embassy and the various missions. As Thailand began to become more involved and the action in Vietnam heated up, the Army began to move in and assume some of the responsibility. Shortly thereafter, the Army established the 9th Logistical Command to take over our support role. At about the same time, the Air Force began to move into Thailand. Our units generally were elements of the 13th Air Force with headquarters in Clark AB, PI. As a matter of fact, although the Air Force does not have a bonafide headquarters in Thailand, we do exercise a degree of in-country staff surveillance in food service through an office located at Don Muang Airport on Bangkok.

Throughout the buildup of our forces in Thailand, there has not been a "Status of Forces" agreement. I am not competent or knowledgeable enough on this to give you an account of it. All I know is that it has considerably complicated the manner in which we must do business. I shall mention later on some of our enterprises and you can well imagine the effect of a lack of such arrangements. It complicates life because all changes, major or minor, in our way of doing things must be handled through diplomatic channels. Such changes would cover additional personnel, materials to be brought in (from a tax or duty point of view), use of land areas, utility needs, support of facilities, etc.

Without going into a great deal of detail on location and giving you names which I can't pronounce and you probably wouldn't remember, there are seven major bases scattered throughout Thailand. These are Air Force installations but usually there are smaller units of the other services located nearby and supported by the base. The bases are logistically supported by five Army ration points, or breakdowns or sub-depots or whatever phrase one wishes to use. Under normal conditions, these points are able to supply subsistence

on a 2-2-3 cycle. This pattern established one of the bases that permits the Air Force to operate in a manner similar to that here in the ConUS. Initially, subsistence was provided by the Navy, and the menus were a cross between a Navy menu and an Army menu; a certain amount of local ingenuity was required to fulfill subsistence needs since some items did not get delivered and substitutes had to be found.

Food Service in Thailand

At the present time, Thailand is using the Army Vietnam Menu—a very excellent menu indeed and very similar to that provided for troops in this country. It is a 28-day cycle menu, utilizing a minimum of canned or dehydrated items. For example: today, Monday, is the 16th day and for breakfast we would have had fresh apples, applesauce, ready-to-eat cereal, eggs to order, bacon, doughnuts, toast, coffee, etc. For the noon meal (dinner), we would be having baked chicken and noodles, buttered green beans, sliced tomato salad with dressing, hot rolls, apricot cobbler, cold beverage, and milk (if available). Most Air Force installations are juggling that meal to where they would be probably serving additionally, a soup, another entree (in all likelihood, Spanish Pot Roast from the next day), maybe two more vegetables and another dessert. This is in keeping with our general procedures. For supper tonight, we would be having breaded veal steak and cream gravy, hashed brown potatoes, buttered limas, chef's salad with french dressing, chilled plums for dessert along with beverage, bread, etc. Likewise at an Air Force installation, this menu would be augmented to provide another entree, another vegetable, several additional dressings, another basic salad and another dessert (perhaps ice cream—more about that later). Those are pretty good meals for the day. Generally, the canned or dehydrated items are used to substitute for those things that fail to show up because of supply difficulties or for rotation purposes. Happily, our supply difficulties, particularly regarding fresh produce, have diminished considerably with the advent of the "WESTPAC" run. This is an arrangement that runs refrigerated ships between ports in Japan, Okinawa, RVN, and Thailand bringing in high quality locally grown produce. At last report, they were providing about ten different items, both fruit and vegetables. Hopefully, this program can be expanded upon.

To further improve the quality of food service, we are planning to provide an augmented schedule of bread and dairy products. At the present time, bread is delivered out of Bangkok and arrives, usually, in reasonably good shape, the road network being what it is. We are in the process of establishing three bakeries—one at Udorn (Northeast); one at Korat (Central); and the third at U-Tapao. In addition to Air Force needs, these bakeries will supply the needs of other services located in the vicinity with the products distributed through the Army breakdown points. The bakeries will provide a minimum variety initially but we believe they will be able to offer a full range of baked goods quite soon. Similarly, we are in the process of providing more milk. No matter how

you cut it, milk and ice cream are about the most popular items on the menu. We are now preparing ice cream at many of our bases with small locally operated ice cream making plants. At U-Tapao, we have combined the assets authorized to all dining facilities producing 17 varieties, and the U-Tapao facility is unofficially known as "Howard Johnson's East." Presently, all milk is produced by a commercial recombining plant in Bangkok, owned and operated by Foremost Dairies, Inc. We are shipping milk as far as time, temperature, and transportation will permit. In the plan, we will have milk recombining plants at the same locations as the bread bakeries producing milk, ice cream, and cottage cheese. Once again, serving all the units through the Army breakdown points. In the case of the milk plants, we plan that they will be built by the Air Force and operated by a commercial contractor. The ingredients will be Air Force supplied, primarily for convenience as relates to duty, etc. The bread bakeries, although under Air Force control, will undoubtedly use a large percentage of native labor. One of the problems that has been a deterrent to the construction of these facilities has been the scarcity of potable water. It may seem odd to you that in countries that are more often than not inundated, or at least characterized by great reaches of marshes and swamps, that water could possibly be a problem. It is, however, and we are making a great effort to solve it. Certainly, one of the most far reaching consequences of the American presence in Thailand will be the improvement to native health and utility capability through proper water and sewerage systems.

As stated earlier, our objective is to get settled as quickly as possible into a situation that facilitates and accommodates our way of life instead of simply spending the time making do.

In Thailand, we moved into our feeding facilities in three stages or phases. Our first phase or our earliest installation was accomplished with what we call our "Gray Eagle" package. The second phase of our settling in was fixed base and, of course, the final phase was the so-called permanent installation. We do not like to think of anything overseas as a permanent installation, but certainly looking back on the past in Korea and other "actions," it is wishful thinking to believe that we need not build buildings that will endure. All of you are too well aware of the temporary buildings in Washington, the temporary airfields we built in Korea, and a host of other examples. Let me explain some of the above phases in a little more detail.

The Gray Eagle and other Food Service Installations

The Gray Eagle is essentially an air transportable or prepositioned housekeeping set that contains, among other things, a kitchen and dining facility. As far as the food service aspect of the kit is concerned, the basics are composed of a canvas cover and sufficient storage, preparation, and serving equipment to serve an austere menu utilizing a maximum of canned items and dehydrates and a minimum of fresh items. It contains serving trays, washing and sterilizing equip-

ment, ranges, ovens, mixers, and such essential gear. The man generally has his own eating ware.

As soon as this Gray Eagle is operational, we begin to improve on it. The first step is the addition of a concrete floor and some basic plumbing and some additional electricity. We then brace the canvas with wood framing, roll up the sides and replace with screening, louvers, etc. In Thailand, we covered these tents as soon as possible with galvanized roofing. The addition of the roofing reduced the temperature by some 15 degrees during the heat of the day. With all this in, we now extract the canvas and actually have a different building made from the old one—sort of like a butterfly emerging from its cocoon. We then brace the interior where necessary and begin the self-improvement campaign. Whether it is due to the fact that time hangs heavy or that our cooks' artistic talent is not confined to culinary arts I am not sure, but I do know the decoration begins almost immediately and continues thereafter. At the same time, additional kitchen equipment is added to permit a more diversified menu selection, individual dinnerware is added, dishwashing machines, tables and chairs, etc. This is about as far as we can go with this type of structure. Once again, our philosophy is to take the basic structure we get and then improve on it as completely and as rapidly as possible.

The next type is our fixed base or so-called permanent installation. Words here become a little difficult. Some people hate to use the word "permanent" or similar words. In any case, they are the second generation facility, when it appears we are going to be in a place for a while. An example you will see is the dining hall at Don Muang Airport. This is the Bangkok Municipal Airport. We moved in there quickly because it was an available airstrip; we put in "Gray Eagle" and then went across the road and built a permanent installation when it was apparent we would be there for a while. These buildings were designed in consonance with our standard Air Force definitive drawing for dining halls, but they were modified to feed about 600 men.

We built several of these buildings, and they have proved quite satisfactory. They are built generally of masonry, using locally available materials and in accordance with local construction practices. The design is adapted to the tropical Southeast Asian climate, making use of large open areas, cross ventilation, some forced air ventilation in kitchen areas and with refrigeration augmentation. It has about the same equipment as would be found in a CONUS dining hall with the exception that we have, almost entirely, electric equipment. I would say this has been successful. The basic building is austere, but once again, we urge and encourage initiative to improve the interior as well as the exterior. A factor in this improvement could well be the number of local nationals that are employed. The Thais can make anything grow; hence the attractive exteriors that you will see.

At our so-called permanent locations, we build a building patterned after our standard Air Force definitive drawing AD 36-05-98. An example of the location of this type

building is at U-Tapao. This base is a part of the Sattahip Complex and if we're anywhere for a while, we'll certainly be there. As I mentioned, this building is patterned after our standard and again uses locally available materials.

It is very similar to any dining hall here in the states. It is capable of storing and preparing and serving a fully augmented selective menu on a round-the-clock basis. It is designed to feed 1,000 men and this particular one now is doing just about that.

The bulk of construction has of course been done by commercial contractors working for the Department of the Army. We have found it necessary to augment our construction capability with "Red Horse" Squadrons. These units are capable of accomplishing unsophisticated construction jobs. Basically, they use standard, prefabricated buillings that have been prepositioned or are located at certain places. They have limited design talent but excellent construction and building capability. In concept, the "Red Horse" is probably somewhat similar to the Seabees or the Army Combat Engineers. They would be unable, for example, to design and construct a dining hall, but they would very handily be able to construct our milk plants using the prefab buildings and designs that have been furnished them.

At the present time the AF has about 28,000 men in the country for whom we have a feeding responsibility. This is generally the number stationed on our bases. Of this number 46% are on separate rations, as a matter of information our worldwide overseas average is only slightly higher than that at 49%. As mentioned earlier there are 7 major installations with a total of twelve dining halls. These feed an average of about 850 men or about 2,500 meals per day per dining hall. This size is somewhat over our average size in the US. The cost of feeding for the last month reported was $1.515 as provided under the newly established Basic Daily Food Allowance. Our bases under our management concept operate well within our limits.

Thailand is a beautiful and tranquil country, but full of contradictions. In this land the name of the game for the AF is to get the plane on the target and to support that rifleman wherever he may be, to help him to hold what he's got or to go a long way behind the lines and keep the enemy from mounting an effective campaign or to roust him out of where he is. These kinds of missions keep the dining halls operating day and night. As in almost all of SEA the land seems to be either delta or mountain. This is a typical scene with a river, canal or klong slicing through the countryside (Figure 1). While there are a few roads visible here, they are local in nature and peter out before going very far, bridges likewise are infrequent or non-existent. Water is the highway for most transportation. A little closer look at a village (Figure 2) shows more of the same—few roads or bridges make it a difficult country for travel. The other kind of country is the mountains (Figure 3). Long spiny ridges traverse the countryside making hamlet to hamlet communication most difficult and the primitive road building capability is no match for

Figure 1. Typical Bangkok Klong

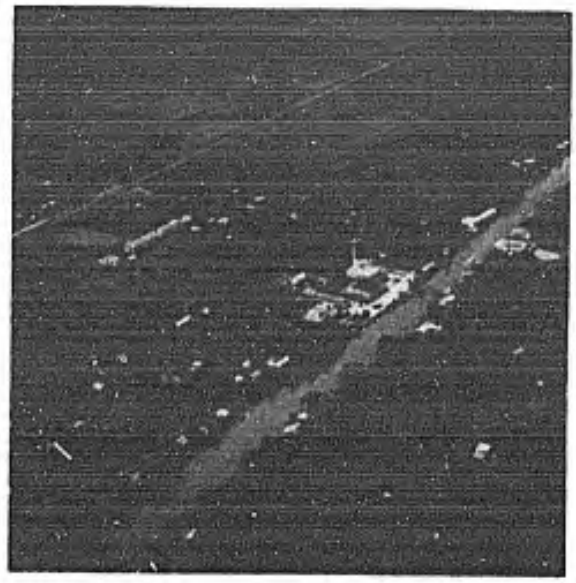

Figure 2. Temple Klong Side

them. These pictures taken from about 2,500 ft give a good idea of the terrain.

The land of contrast is reflected in the complications of our way of life. In the simple existence of the Thais there's little problem with food. Growing, harvesting, shipping, marketing, inventory control and customer satisfaction pose little or no problem when you can operate in this manner. The next few pictures show a "Gray Eagle" Dining Hall at Udorn in its last stages (Figure 4). Here it is shown with wood sides, galvanized roof and concrete floor. The shed contains the additional refrigeration necessary to support this facility. We were feeding about 600 in this dining hall. Kitchen equipment is basic but adequate. Interior improvements have made this an attractive facility, tablecloths, chairs, individual tableware and hopefully satisfied customers. The next generation is illus-

Figure 3. En route to Udorn, 3500 feet up

Figure 4. Gray Eagle Dining Hall at U-Tapao

Figure 5. Dining Hall at Don Muang

trated (Figure 5) by these shots of the dining hall at Don Muang. A 'U' shaped building, well landscaped, and neatly built and situated to take advantage of the breezes and to avoid the rain, this is a highly acceptable facility. Once again we have augmented the basic capacity with refrigeration. There are walk-ins behind the van. Inside, in the kitchen (Figure 6) we have improved, we have attempted to make it easier to maintain, more pleasant to work in and provide a better capability to offer a varied menu. We have improved and beautified the dining area in an attempt to make it more pleasant. It may be interesting to note that last year as a part of the AF Hennessy Award we included a special award for the best operated facility in SEA. This year when we included SEA again PACAF included only RVN because the dining halls in Thailand had improved so much they felt they were on a par with the rest of the Command and should be so judged.

Our final and permanent (Figure 7) building is shown here in the final stage of construction. This particular facility is located on the base at U-Tapao. Our original installation at U-Tapao had three "Gray Eagle" dining halls. When it became apparent that the Sattahip complex was going to be a major and lasting one we began planning this facility. As typical of AF installations, it is across the runway from the original installation. When food service is transferred to this facility the abandoned "Gray Eagle"

Figure 6. Kitchen at Udorn

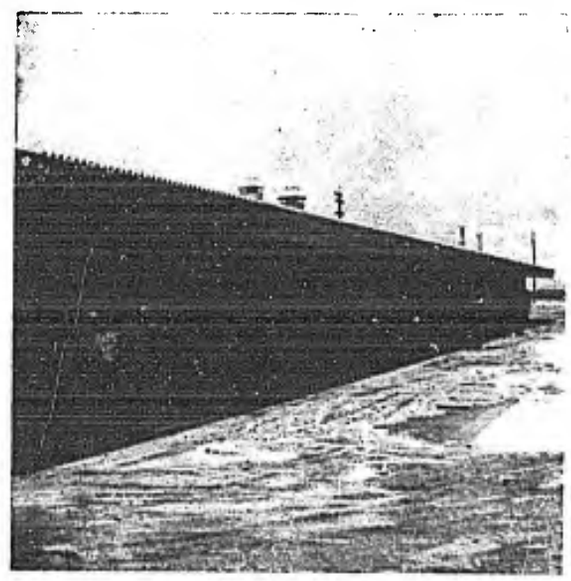

Figure 7. Exterior of dining hall at U-Tapao

dining halls will be used for storage purposes. Certain of the equipment that is reusable will be placed back into the system. There are now three such dining halls operating at U-Tapao serving about 6,000 meals daily.

I mentioned earlier that transportation is one of the major headaches in Thailand and it starts almost as soon as the ship leaves the States (or wherever it originates). Unloading facilities are at a premium and the military cargo must compete with other cargo going into the Thailand economy that is an essentially peacetime one. These ships (Figure 8) are waiting in the river to get into docks in Bangkok. At the time we were there, a similar number were in the Gulf, waiting to get into the channel. Due to this unloading shortage we undertook construction of the complex at Sattahip. The Navy people with whom I traveled on this trip said that Sattahip was one of the most perfect natural harbors in SEA. Initially our unloading was done from DeLong pier that could accommodate two ships with a small pipeline running into U-Tapao, and from a berth that could accommodate one tanker. We immediately began construction on a deep water terminal that will accommodate four ships simultaneously, with excellent unloading facilities, a new and improved road network to the installations in the area and a pipe line to truly support our needs. This tremendously improved our logistic position in Thailand with a minimum disruption to the Thailand economy.

Figure 8. Ships waiting in stream

I hope that I have been able to give you some insight into food service in SEA as represented by the Air Force in Thailand. It is certainly not the same as feeding in Vietnam under combat conditions with the Charlies knocking at the door. It is the major AF effort and this is the way we are handling it. I hope I have been able to help you to understand that we have no great abiding desire to be different, simply that our mission and situations are different. I know all of you have seen and heard much of Vietnam—perhaps some of you have been there, maybe in Thailand as well. As I said earlier, it takes a long time and a fortuitous set of circumstances for a person to become an expert in these matters. The information I've passed on to you today comes from an interested observer.

JOSEPH P. AKREP [1]

DEVELOPMENT IN PALLETIZATION AND CONTAINERIZATION

PRESSURES GENERATED by the needs of the troops in Southeast Asia have fostered many rapid and interesting design changes and improvements in packaging and have resulted in remarkably efficient unitization systems at reasonable cost considering the extreme conditions involved. It is my privilege to discuss them with you today.

The history of military use of unit loads and mechanization in the handling of supplies is of much interest. The forklift truck and pallet combination made great strides in World War II. It was used extensively by the Army Quartermaster and the Navy in their depot operations and resulted in impressive savings in time and manpower. Indeed, the development of extensive depot palletized operations is often quoted as one of the major achievements of the Army Quartermaster in World War II.

However, it should be noted that the rapid use of palletization did not extend over to the field agencies, since the state-of-the-art did not at that time furnish anything but warehouse type forklift equipment. The day of the rough terrain forklift truck was still far in the future. This lack of field type equipment had been the major stumbling block to the introduction of palletized loads into the field supply operation. Even up to and including Korea, our warehousing operations were highly developed models of efficient palletization practices, whereas the field supply organizations on the other end of the line had scarcely changed their procedures from horse-and-buggy days.

But with the advent of rough terrain forklift equipment, the entire picture has changed; the demand from the field is for unitized loads delivered as far forward as possible. Additionally, limitations on covered storage in forward areas have resulted in demands for more protection from the packaging, since most of these supplies would be stored outdoors. Prior to our involvement in Southeast Asia, the U.S. Army Natick Laboratories had already prepared a general palletization specification for nonperishable subsistence (MIL-L-35078—Loads, Unit, Nonperishable Subsistence In). The loads in this specification are separated into two types for convenience: palletized and containerized. A palletized load is one consisting of a group of separate cases stacked on a separate pallet base, the whole load suitably strapped and/or sheathed and capped to form a solid load. A containerized load consists of an actual box or container intended to be loaded *into,* so that in effect there is a large single container filled with separate items.

The first loads prescribed several

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years ago in the original document were relatively simple. They consisted of either a number of boxes, in any material, stacked and strapped on a pallet, with or without sheathing, or a palletized lightweight fiberboard container for consolidation of more fragile items such as bagged goods.

But experience in Southeast Asia rapidly changed the requirements, and rapid improvement in the design of unitized loads was thereby generated. It was requested from Southeast Asia that all possible materiel be unit-loaded with no loose cargo. Further requested were stringent protective requirements for performance against the extreme environmental conditions encountered in outdoor storage in Vietnam. These criteria caused a shift from fiberboard to plywood to achieve the desired protection and performance.

As a design problem, the development required an evaluation of the performance capabilities of the various materials and constructions against the performance requirements dictated by Southeast Asia experience. The major boundary conditions revolved around rough handling, weather resistance, and stacking under high temperature and high humidity—all of which could cause rapid deterioration of any but the most resistant packaging and packing systems.

The requirements for palletized loads as set forth in the specification are relatively straightforward. They provide for various combinations on the pallet base such as glued and/or strapped loads, with or without weather-resistant cap, sheathing, and internal polyethylene shroud. These designs are intended primarily for items which are self-supporting (such as cases of canned goods) and do not need any compressive reinforcement since there is little likelihood of collapse of a stack of the palletized loads. Therefore, the primary requirement is for the necessary degree of weatherproofing and strapping. Figure 1 illustrates a standard unit load of cases strapped

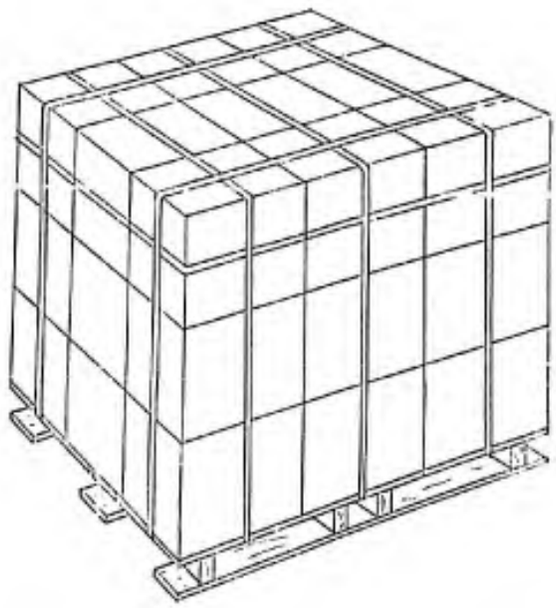


Figure 1. Palletized load, strapped

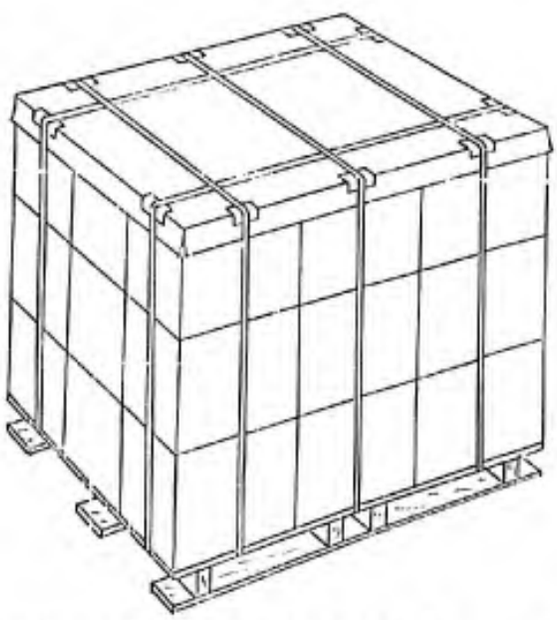


Figure 2. Palletized load w/cap and strapping

to a pallet, the system with which we are familiar. Figure 2 illustrates the same load with the added protection of a cap. Figure 3 shows a completely sheathed and strapped load. This particular load may also have added the supplemental protection of a 3-mil polyethylene shroud under the weather-resistant fiberboard sheath.

However, the containerized loads are intended to furnish more protection and, therefore, contain design features to achieve the necessary protection. These consist of two types, fiberboard and plywood, depending on the degree of protection required. The fiberboard containers are essentially open top boxes with a cap, fastened to a pallet, with one style utilizing an additional fabricated liner for protection of the load. Figure 4 illustrates a flanged sleeve of heavy-duty fiberboard nailed to the pallet, with a 12-inch-deep cap to allow a limited capability for telescoping for a tight load. Figure 5 shows a variation in the design where a lighter weight sleeve with a regular slotted bottom is used with a tubular insert to provide the required design resistance to rough handling and compression stresses. The plywood containers are intended for shipment to Southeast Asia of items easily damaged by the extremes of open storage in areas of heavy rainfall, high humidity, and

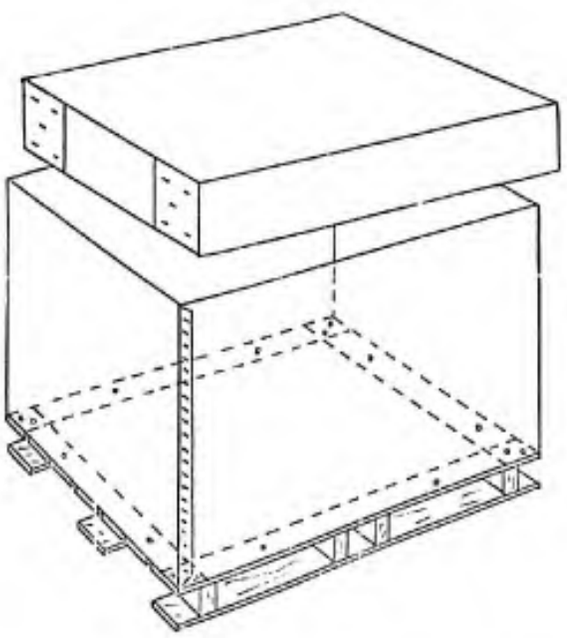


Figure 4. Containerized load, flanged tube w/cap

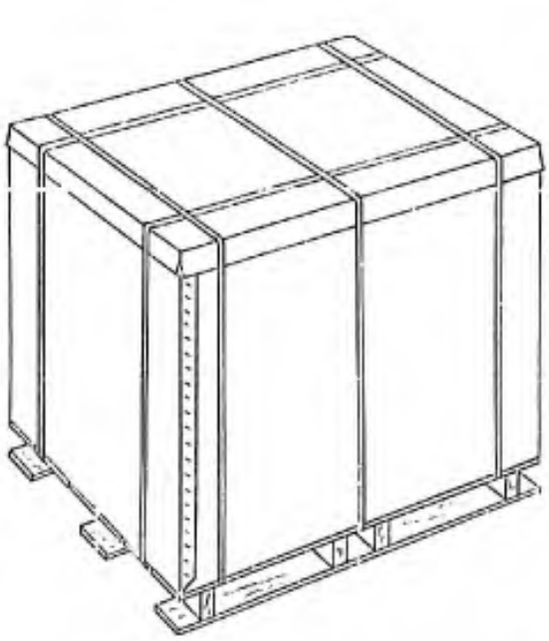


Figure 3. Palletized load w/cap, sheath and strapping

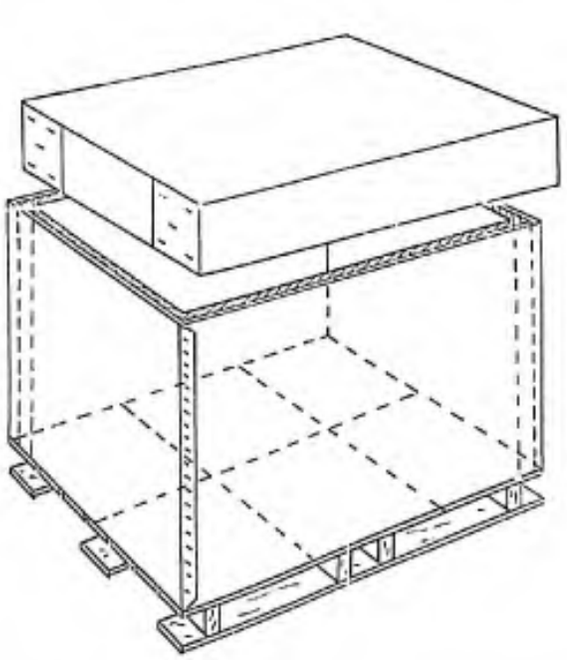


Figure 5. Containerized load, half RSC w/liner and cap

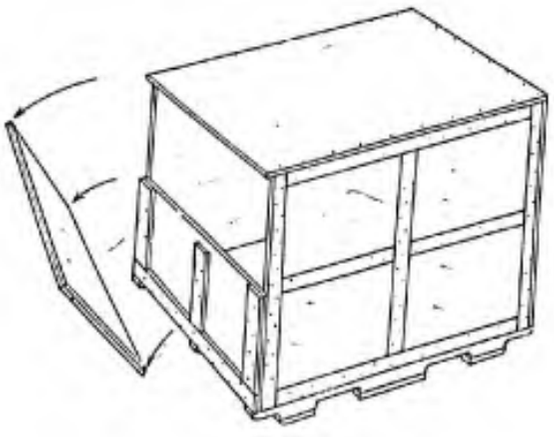


Figure 6. Containerized load, cleated plywood w/split end

adverse environmental conditions. Figure 6 shows a cleated plywood panel design which utilizes the additional feature of a split end for easy loading. These containers will give maximum protection against rough handling, adverse weather conditions, and abnormal stacking pressures.

The material problems rapidly developed into a quest for quality, especially of the fiberboards. Only high quality weather-resistant fiberboard would perform satisfactorily. The high quality requirements apply equally to pallets, lumber, strapping, and other components. The specification is quite detailed with respect to the grades, thicknesses, and weights to be used of all components, including the plywood and cleats in the plywood containers.

Previously, there had been no problems with sizes of these loads, since the overall dimensions of palletized loads had been fixed to conform basically to available dimensions in rail cars and trucks. These dimensions were 43″ x 52″ x 54″ H overall on a standard 4-way entry 40″ x 48″ pallet, and gave good utilization in common carriers. The load with conventional canned goods was approximately 2,000 pounds which was also satisfactory.

However, a new element has been added in that the Army has contracted for extensive use of container ships of the SEAVAN variety, which introduces a new dimension as a controlling parameter. The SEAVANS are 35′ 4″ long with an 8′ x 8′ cross section, which means that the standard 54″ height cannot be stacked, leaving a void or waste space which has to be filled with loose cargo in order to fully utilize the cube and weight available. To eliminate this problem, the transportation authority involved required that all unit loads intended for SEAVAN shipment be no more than 43″ high to permit double stacking. This cross section in Figure 7 illustrates the dimensional problem involved where the 43″ high loads can be double-stacked, while the 54″ load can only be single-layer loaded.

Since this lowering of the maximum height also reduces the load carried per unit, it has been necessary to design several sizes with larger pallet bases in order to move suf-

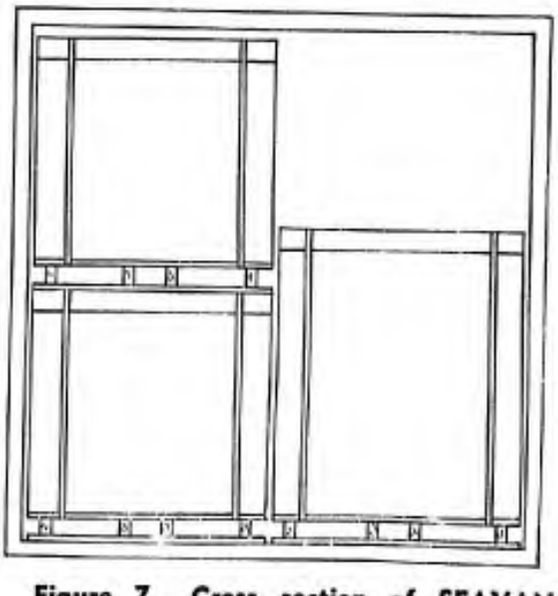


Figure 7. Cross section of SEAVAN Loading—43″ vs. 54″ load ht.

ficient tonnage per lift and fully utilize the length of the SEAVAN with minimum loss. For very low density items such as cereal, a double height containerizer may also be possible. Figure 8 shows several combinations which have been selected for this problem of variable loads and dimensions, and the specification includes a table which delineates the 5 different size and weight combinations which have been selected for most efficient utilization of the cube available within the SEAVAN.

For the problem of correctly stacking boxes on a pallet for the palletized loads, the specification contains a pallet pattern selection chart for quick and easy determinations of the most efficient pallet pattern. Figure 9 illustrates the method of operation. The chart is entered with the length and width of the box in question, so that the correct pallet pattern may be read out and examined in the table of patterns. The appendix to the specification also contains an extensive tabulation of common can and box sizes and indicates the appropriate pallet pattern, number of containers per layer, number of layers, and total number of containers for both the 54″ and the 43″ high loads.

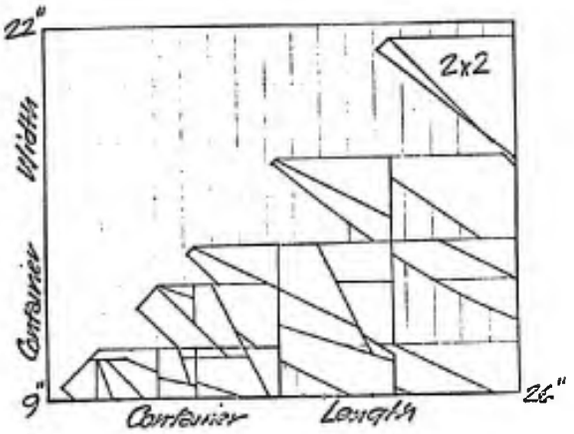


Figure 9. Pallet pattern selection chart

For the containerized loads, patterns have also been selected for best cube utilization. The appendix contains a tabulation indicating the appropriate pattern and containerizer size for the various bagged items which would be candidates for this type of load. Figure 10 illustrates one example of the pattern layout, in this case for 12 five-pound bags of salt in a 60-pound shipping sack.

Probably the most important innovation from the user's viewpoint has been the design and inclusion into this document of a selection guide so that the required unit load

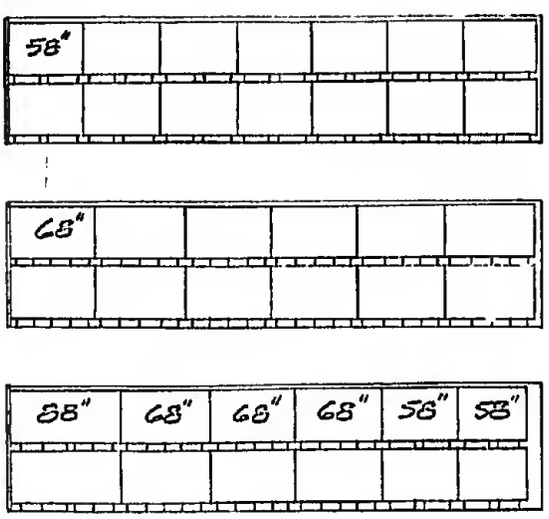


Figure 8. Side view of SEAVAN Load —various sizes

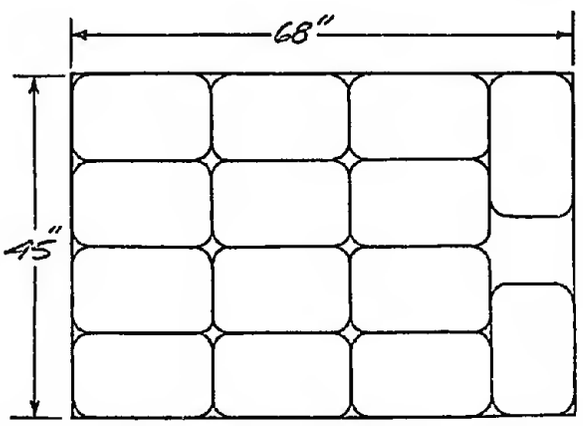


Figure 10. Load pattern layout 12/5 lb. bags salt in 60 lb. shipping sack

may be selected for any given destination and method of original pack. The chart is intended to permit selection by cross-reference to destination, method of pack of item to be loaded, and design of load system recommended.

A tabulation has also been included to provide for supplemental waterproofing requirements for extreme conditions such as would be encountered in Southeast Asia. It is this table which outlines the use of the internal polyethylene shroud for certain commodities and load types, and specifies plywood containerizers with individual overpack, where required, for bagged subsistence.

It is hoped that the foregoing discussion has given some idea of the efforts in this area to provide the best design information available on a current basis. Shipments to Southeast Asia have, of course, been one of the major problems. This document, Military Specification MIL-L-35078, will go a long way toward supplying the answers.

GEORGE H. NORMAN [1]

TODAY'S PX FOOD SERVICE— A FAR CRY FROM CAESAR'S CANTEENS

THIS OCCASION, the first for an Army and Air Force Exchange Service representative at a Research and Development Association annual meeting, is a significant one. We are happy to be aboard as part of the agenda to discuss "Food Service in the Exchange System."

It may interest many of you to learn that the earliest recorded history of a PX service was that rendered Caesar's legionnaires in the form of a wine cellar over 2000 years ago. They called it a "canteen" in those days—a name, incidentally, that came down through the pages of history right up to the turn of the century. Canteen was the official designation of the post exchange and the main service was food and refreshments. We have dropped the wine of Roman days, and the "booze" of the Sutler's wagon have been prohibited; but refreshments and beverages furnished the military by civilians are still the basis for Webster's unabridged dictionary definition for a canteen and hence for the post exchange.

Our earliest document relating to an American PX (at Fort Monroe, Virginia—1891) records a meeting of the "canteen council." This council recommended the following items be added to the stock structure: oyster, pigs feet, cider, and beer. Regular items carried during 1891 were: ginger ale, lemonade, pickled tongue, cheese, boiled eggs, cigars, tobacco, stationery, toilet articles and mineral water.

What is the status of the Army and Air Force Exchange Service today? One thing is sure—it resembles its forerunners as little as soldiers, sailors, and airmen do their predecessors. Today AAFES is big business with approximately 2 billion dollars in annual sales. It is considered one of the largest retailers in the nation. Its mission is "to supply the troops, at reasonable prices, with articles of ordinary use, wear and consumption not supplied by the Government, and to afford them means of recreation and amusement."

Earnings turned back to welfare funds are used by the military for libraries, service clubs, day rooms, barracks day rooms, and so forth.

Earnings are generated through

[1] Chief, Food Branch Services Division, Hq. Army & Air Force Exchange Service, Dallas, Texas.

AAFES major services consisting of retail stores, mini-marts, gasoline stations, beauty and barber shops, car wash activities, garage service, photo and optical and laundry and dry cleaning services, and, of course, the main topic of this presentation, our food service which includes vending operations.

On a nationwide rating, our overall food service is rated as number 16 based on sales volume. The extent of food service in AAFES is best indicated by the following:

Current Annuals Sales (Including vending)	$266,000,000
Number of Food Facilities	2,430
Number of Personnel	17,000

Areas served are far reaching. In addition to our operations in the United States, including Alaska and Hawaii, AAFES food service extends to Europe, the Far East, South Atlantic, Africa, the Philippine Islands, Greece, Turkey and many other places including, of course, Vietnam.

Scope

The only answer as to the type of facility operated as food activities by AAFES is *varied*. They range from tents and leans-to's with limited service to fanciful restaurants offering steak dinners by candlelight served with wine. Food operations fall into the following categories: cafeterias, snack bars, vending operations, portable snack stands, portakamps, mobile units, central kitchens and oversea food manufacturing plants as well as facilities for processing ice cream, milk, bakery and meat products for the exchange facilities and, in many instances, for the military troops. We also have specialty operations ranging from Bavarian beer halls and rathskellers to pizza parlors, steak houses and take-home chicken huts.

Throughout Southeast Asia, we are in the final planning stages for setting up portable bakeries, central sandwich preparation areas (packaging 10,000 to 20,000 units per day) and central portable ice cream plants. These portable food activities are shipped completely equipped. Just utility hook-ups and personnel are required to get them into operation. These activities will serve our most forward units, which are also portable units, limited in preparation and storage capabilities. In Vietnam today you will find AAFES food service dispensed from a tent, and from mobile and portable units on to full-line cafeterias. Storage requirements and the proper preparation of food are just two of our problems. However, the use of central preparation areas to prepare cold and hot sandwiches, bakery goods under supervision and the use of a reconstituted French fry mix at larger installations have solved some of our problems. Limited menu items, standard and simple equipment have been one key to successful service in Vietnam.

Research and Development

As research and developers to the food industry, you will be interested in the AAFES contribution to this effort. In 1954 through 1956, the *Journal of Dairy Science* and related dairy magazines published the following articles which were researched and written by AAFES employees:

(1) Use of buttermilk powder to improve flavor of reconstituted milk.
(2) Hot cheese packs in the manufacture of cream cheese by reconstitution.
(3) Improvement in ice cream flavor using sweet cream buttermilk powder.

1957. Invention of a circular hamburger patty machine.

1960. Invention of an automatic can opener and solid product flusher.

1965. Establishment of requirements for a mechanically refrigerated cream dispenser (developed by industry).

All Of This, and Still A Five Cent Cup of Coffee

Over 360 million cups of coffee, 60 million hamburgers, 10 million hot dogs and many, many milk shakes are sold annually at controlled prices throughout the system. By control on the price and portion of 39 items, we save the G.I. a substantial amount on his food expenditures, wherever he may be.

The exchange system is committed to a policy that will insure the maximum degree of uniformity, quality, portion sizes and prices throughout the world. These 39 controlled food items constitute 60% of all food sales. Specifications, weights and price criteria are clearly stipulated to assure conformity. Other nonstandard food items are authorized to allow for individuality in merchandising and to accommodate local and regional specialities. For uniformity, china, silverware, trays, uniforms, glassware and paper service are also standardized worldwide for economy as well as image.

Our major problem today is the trend toward higher personnel and food costs, lack of trained personnel and, of course, higher equipment and installation costs. To counter these trends, it is apparent that an immediate counterattack must be launched.

First, let's look at prices. Admittedly, this is an area that has stood up to the current economic trends. When all else around us has gone up, food prices remain constant.

Coffee is 5 cents. One-quarter pound pure beef hamburger is 25 cents; hot dogs are 15 cents. Cheese, bologna and liverwurst sandwiches are 15 cents and there are many more items at similar low prices. Our prices and portions reflect the greatest customer savings ever. Under these prices, it has been difficult (and will be even more difficult in the future) to maintain our minimum goals.

We have made a very careful analysis of our food pricing, and we do recognize the need for a change. However, pricing is not the only answer. As professional food service operators, and in compliance with our mission of supplying the military with the finest quality product at the lowest possible price, we are implementing programs as fast as we can to arrest the ever upward spiraling cost factors.

Our methods of fighting costs include the increased use of convenience foods to aid in the reduction of personnel costs and preparation time. Where feasible, we have implemented at base/post levels central preparation areas. These central areas prepare and deliver complete food entrees, prepared sandwiches, and bakery goods to a number of outlets—thereby reducing preparation and personnel costs at individual food facilities.

We have requested industry to de-

velop what we call "Selectra-Serve" equipment. This equipment was developed and recently installed at one of our air bases. Other installations ranging from small to large capacities are planned.

The Selectra-Serve concept, a coinless operation utilizing hot and cold upright merchandisers, self-service equipment and microwave ovens, enables a 100% self-service concept during specific periods of operation, in addition to allowing for counter attendance during breakfast or peak meal periods, as desired. This system has reduced personnel costs considerably and at the same time enabled AAFES to maintain the desired service and quality.

In the future we are looking for:

(1) Increased use of basic types of convenience foods.

(2) A substitute for ice in cooling drinks, a far reaching proposal; our present self-service equipment is bulky, lacks storage and the required capacity.

(3) The use of special convenience food equipment to supersede present conventional equipment.

(4) In addition, we are looking forward to a refrigerant that will reduce the mechanics involved in our present systems of transportation and holding.

This, then, is the AAFES food story. Thank you for the opportunity to present it to you.

LT. CMDR.
PERRY LEE WESTMORELAND [1]

AUTOMATED FOOD SERVICE SYSTEM AT THE U.S. NAVAL ACADEMY

HOW DO YOU serve 4,000 hungry young men a sit-down dinner in twenty-five minutes?

We perform this task three times a day, seven days a week at the Naval Academy when the brigade of midshipmen march into the mess hall.

The midshipmen mess does this in a very easy and efficient manner, thanks to what we call the RAFT System. Before I describe the RAFT System, let me give you a short thumb nail sketch of the midshipmen mess.

The midshipmen mess hall is probably the largest single area dining room in the world. It contains 350 dining tables, and twelve midshipmen sit at each table.

The midshipmen are fed a diet amounting to over 4500 calories a day. The mess division receives $1.50 ration allowance per day for each midshipman. This works out to about $1,500,000 a year spent for food. All the food served is top grade with most beef: Grade Choice; and canned goods: Grade A Fancy.

Food is served in tremendous quantities: as much as two tons of beef steaks are served for one meal. A ton and a half of potatoes are eaten most every day. Four thousand quarts of milk are served each day.

The fresh milk is received each morning from the Naval Academy Dairy. The mess makes its own ice cream and has its own bake shop where all bread and pastries are made. The freshness of these products is a real advantage.

To run this operation, the midshipmen mess has a staff of about 185 civilians and 250 military stewards. The civilians are responsible for purchasing, storage, food preparation, and scullery work with the stewards responsible for service in the mess hall.

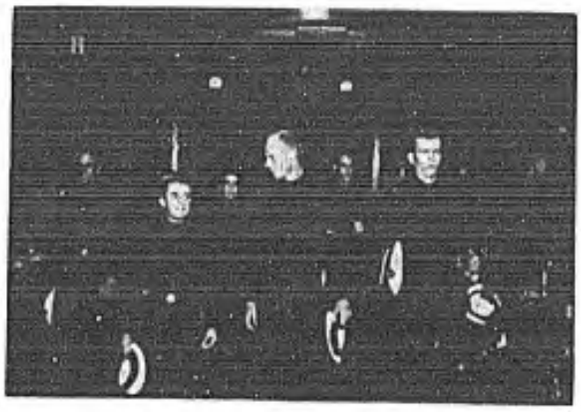
One steward is responsible for four mess hall tables. The food is all portioned in the galley to 12 servings per dish which is enough for each table. Then, these dishes for each table are set up on a serving tray. The steward delivers one of these trays to each of his four tables, and the midshipmen pass the dishes around the table just as you do at home.

The big problem we face is to have 4,000 rations of food ready out of the galley at one time. Since this is impossible, we are forced to resort to holding ovens.

Rapid Automated Food Preparation Techniques (RAFT)

The success story I'm here to tell you about today is that the time to accumulate the 4,000 meals has been *greatly* reduced. In addition, the time required to deliver the food from the holding ovens to the midshipmen's table has been reduced. These improvements were made

[1] Midshipmen Mess Officer, U.S. Naval Academy, Annapolis, Maryland.



Midshipmen leaving the mess hall. A sit-down dinner is served 4000 young men in 3 minutes; total time for meal, 25 minutes.

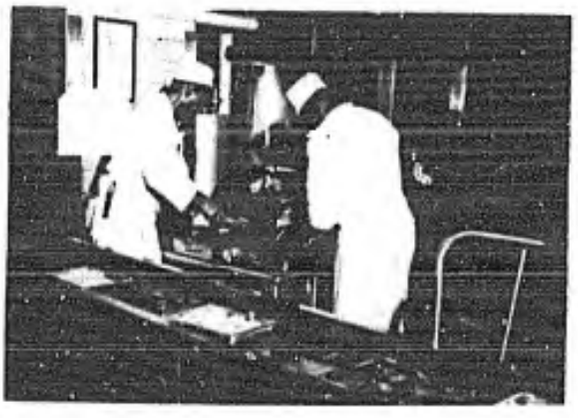
through the installation of the Rapid Automated Food Preparation Techniques or, what we call RAFT.

Because of academic schedules and the military nature of the Naval Academy, food service *must* be family style. After the midshipmen are seated on command, their food is served in three minutes, and within 25 minutes the midshipmen leave the mess hall. To meet this tight time schedule, the use of *automated food service equipment* is imperative. Our automated equipment, though, is unique only in its application since such equipment has been used by the food processing industry for several years.

Several pieces of equipment are used in our system coupled with the use of convenience type foods and the distribution of food trays employing mobile transportation equipment. Two major pieces of equipment contribute most to the success of our operation. The first of these is the *infrared broiler* designed to the specifications of Navy Research & Development. We have two of these units. This unit consists of 11 series of over head infrared quartz elements drawing a total "full power" load of 216 kw. The product passes under the first half of these lamps on a variable speed stainless steel belt to the center of the unit where it is picked up by a small high speed "flipping" belt. The flipping belt turns over the product, dropping it on another variable speed belt which carries it under the remaining lamps. Degree of doneness is varied by changing belt speed and/or lamp intensity. This machine can broil a variety of products ranging from toasted cheese sandwiches and waffles to bacon and steaks.

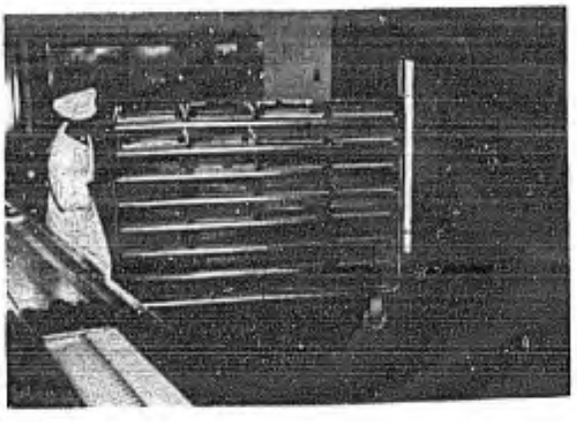
Belts are continuously washed during operation by a washing and rinsing system located at each end of the machine. One man can successfully load the majority of food products and a maximum of two men can unload, portion and pan any given product. Our production testing yields approximately 1,800 lbs. of steak or hamburger per hour. Hamburger for the brigade is presently being prepared and plattered by eight men in 55 minutes. Toast for the brigade is prepared in 15 minutes.

Next is the *continuous deep fat*



Rapid Automated Food Preparation Technique (RAFT) begins in the kitchen. Infrared broilers and continuous deep fat fryers are major pieces of equipment.

fryer. This equipment is common to the peanut and potato chip industry. We also have two of these units. Each unit consists of a 1,200 lb. fat capacity frying tank which is heated by a series of burner tubes. The product is carried through the fat on a stainless steel mesh belt, the speed of which is varied dependent on the desired frying time. Another belt keeps the product under the surface of the fat. One man can easily load the majority of products in each fryer and a maximum of two men are required for unloading and portioning. Upon completion of the frying operation, fat is pumped through a filtering tank and into a 1,500 lb. capacity storage tank where it is stored until the next frying operation. Production tests yield 3,000 lbs. per hour of french fried potatoes and 1,250 lbs. per hour of veal cutlets. Veal cutlets for the entire brigade are now prepared and plattered by six men in one hour. The operation previously required 15 men approximately two hours. The items prepared in these machines include french fried potatoes, steaks, all types of fish, chicken, french toast and so on.



Mobile transportation equipment cluding a conveyor belt moves food from holding ovens to 250 dining room stewards who serve 350 tables in three minutes.

As I have said, the infrared broiler and continuous deep fat fryer with their wide range of products are the most important units in our RAFT System. We have other automated equipment of interest.

An example is the *donut machine* located in the bake shop. Its basic operation is similar to the deep fat fryer. A depositor head extrudes five donuts at a time into a compartmented belt that travels through the hot fat. Production rates for this machine are as high as 500 dozen donuts per hour. It was designed for cooking cake donuts only. However, we have been able to use it, with special attachments to make fritters. Recently, we worked out a system to cook raised donuts. Before this machine was installed, we served donuts that we had purchased which were about two days old. Thanks to this machine we can now make all the fresh donuts the midshipmen desire.

I have only covered the major pieces of new type automated equipment used at the academy. Other equipment that saves labor and contributes to better service for our midshipmen ranges from food shaping machines to self-cleaning grill hoods, and a modern system for disposing of garbage and trash. Another innovation is that prepared foods from the broilers and fryers and other cooking equipment travels to the holding ovens by conveyor belts under infrared lamps.

I regret to say that one piece of equipment, the continuous steam blancher, which you will see in the movie,* is not used. This would be a wonderful piece of equipment for a

* A film, "Dinner on the Double," was shown following these remarks.

centralized galley for cafeteria service. But it was too slow for our system. Most of the items that this machine was designed to prepare are now cooked in our 200-gallon steam kettles.

The use of automated food service equipment or what we call RAFT has reduced the holding time for food after preparation, and it has made a breeze of the almost unimaginable job of feeding 4,000 midshipmen at one time. Since its installation at the Naval Academy in 1963, we have become so dependent upon RAFT and its efficiencies over the small batch appliances that we can't live without it.

LT. T. J. DEANE[1]
Supply Corps
U.S. Navy

FUNCTION AND PERFORMANCE OF THE NAVY FIELD FOOD SERVICE TEAMS

MY PRESENTATION will start with an excerpt from a War Dept. circular published by the Surgeon General's Office on 1 May 1875.

The Cook's Creed

"Remember that beans, badly boiled, kill more than bullets: and fat is more fatal than powder. In cooking, more than in anything else in this world, always make haste slowly. One hour too much is vastly better than five minutes too little, with rare exceptions. A big fire scorches your soup, burns your face, and crisps your temper. Skim, simmer, and scour, are the true secrets of good cooking."

We are very concerned with the problem of an effective cook's creed in the military. We think we have found a solution to this problem in the use of Navy Field Food Service Teams (FFST). These teams are under the management and technical control of the Navy Subsistence Office. Washington, D.C. Their original mission was to help stabilize and improve the management of Navy food operations during the post-war years. The first Field Food Service Team was organized to assist Navy general messes on the East Coast. It became operational in November of 1952. This team, based at Norfolk, Va., consisted of one officer in charge and three chief commissarymen. They were proficient in every aspect of Navy food service. Just three months later, in February, 1953, a second team was formed in San Diego to assist West Coast messes. The requests for team services were so numerous, that by 1956 we had expanded to eight teams. Navy teams are now in Newport, two teams in Norfolk, Va., Charleston, Long Beach, San Diego, Hawaii and Yokosuka, Japan. They consist of a total of 8 officers and 32 CPO's.

In FY'67, these teams visited 283 messes afloat, 35 in CONUS, and 19 overseas; they held 11 seminars, assisted in the reactivation of 13 naval ships and completed 39 visits to messes in the Republic of Vietnam. This is an enviable record, and the best year for FFST visits—400 visits in all. Teams have assisted in Antarctica in Operation Deep Freeze; they hold regular seminars for Supply Corps officer students at Athens, Ga., and in Dec. 1967 completed our 5th team visit to in-country Navy messes in Vietnam.

Mission

The mission of the teams is one of assistance in on the job training. Team members are *not* inspectors and visits by a team are scheduled only upon the request of a command desiring food service assistance. The normal team visit is of two weeks' duration. Requests from ships are given first priority because of their limited in-port periods. Most of the training is presented on a "Do As I

[1] Head, Training Branch, Food Service Division, U.S. Naval Subsistence Office, Washington, D.C.

Do" basis. However, of necessity, part of the training is theory and is presented in a formal classroom type atmosphere. Something rarely seen is a Chief CS rolling up his sleeves and actually working in the food service spaces, other than the office, but when the teams visit an activity this is the case and it is quite impressive. The team instructors are hand-picked on the basis of their service reputation, their ability to get along with people and, most important, for their unique ability to impart their extensive food service knowledge to others. By working in a different Navy general mess every two weeks, the team instructors amass a tremendous amount of know-how and are able to pass it along during subsequent visits. Figures 1 through 6 graphically review the activities of the teams.

As I have mentioned, the work of the teams is (OJT) *on-the-job* training. They point out new developments and techniques, ways of making meals more appealing and in general, show the commissarymen how to keep our navymen eating the best and best-prepared food. During the actual training, new developments and finer techniques in food preparation and service are stressed. Basic principles involved in menu planning applied cookery, baking, sanitation and mess management are also included.

When the team arrives aboard ship, the OinC meets with the commanding officer to explain the program and tell him what they will try to accomplish for his general mess. The team meets with the Supply Officer, Food Service Officer, and key commissarymen. The first two days of the visit are usually spent in watching and determining how the mess operates—this is ample time to "break the ice" and get better acquainted with the ship's CS. The CS are encouraged to ask questions about items on the menu and to discuss any problems regarding their mess operation. Team members work side-by-side with ship's cooks and bakers and learn the problems of *that particular ship.* By combining OJT and theory, the CS is able to

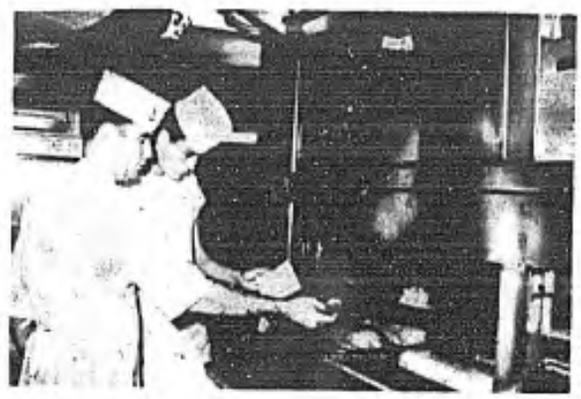


Figure 1. Team chiefs instructing in shipboard food preparation work areas. 85% of team training time is spent aboard ships. Slide taken aboard USS Vancouver (APD-2) shows team member instructing in the galley.

Figure 2. FMT chief assisting in Navy food service training film. Team chief was technical assistant in shooting of "Pastry and Pies" film at Naval Air Facility, Washington, in Feb. '68. Navy commissarymen were used as the actors in filming.

step from the classroom work to the very real problems of applying the theory under the fire of a working schedule. The team takes this opportunity to: solve local food service problems and exchange food service ideas with our operating force.

On the last day of the team's visit a departure conference is held with all food service personnel. Emphasis is placed on the fact that this visit is not an inspection nor is a written report made of any shortcoming of the mess. Ship's company personnel are given the chance to comment on the observations and recommendations of the team, the commanding officer is apprised of the condition of his general mess and the FFST moves on to assist another ship to improve Navy food service.

Mobile FFST's give Navy management a hand on the pulse of operations which financial statements and inspections don't reveal. The teams afford valuable feed-back on observations and recommendations on feeding trends and problems. Success tips from outstanding units funnel back to management from the teams. The teams have been a powerful catalyst in bringing about product standardization and navy-wide high acceptance of ration-dense products. In the past 15½ years, Navy FFST's have demonstrated the value of the "soft sell" style OJT

Figure 3. The Southwest food management team from San Diego, Calif., spent 10 weeks in training assistance to Navy general messes in the Republic of Vietnam combat zone. One officer and four chief commissarymen made this trip. They completed on-the-job training in various Navy messes in the I corps area and afforded ten straight days of training at each mess. Team chiefs demonstrating proper menu item preparation and portion control.

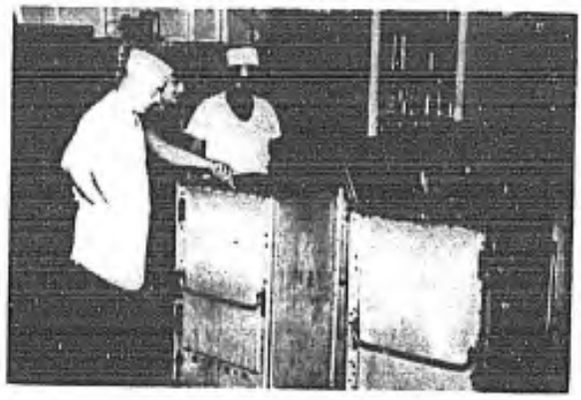


Figure 4. Team chief instructing commissarymen in the proper maintenance, cleaning and repair of the Mark-1937 field range burner unit. There are still some field equipment units in use in the I Corps.

Figure 5. View of the Reefer farm at Phu Bai (Marine subsistence issue site). Refrigerated units are mobile with a temporary wooden structure built over them to keep the heat of the sun off the units. This Marine issue complex supports Navy messes in the area. Subsistence support is excellent. Most food items are plentiful and available. Ration-dense foods are used in great quantities. Foremost milk recombining plants in Danang and Chu Lai provide filled milk of excellent quality made with vegetable oil. They produced egg-nog during the holidays and are now making cottage cheese for our troops. A Marine bake shop is set up in a corner of the dry provisions warehouse to the extreme left.

training. This success story hints that multi-unit managers who employ mobile cook instructor teams may have the best possible solution to the military and industry-wide need for trained chefs and improved high quality food service. I am happy to report that in compliance with a recent DoD directive, U. S. Army and Air Force will form FFST's in the very near future.[2]

[2] Effective 1 July 1968 the teams were redesignated Food Management Teams.

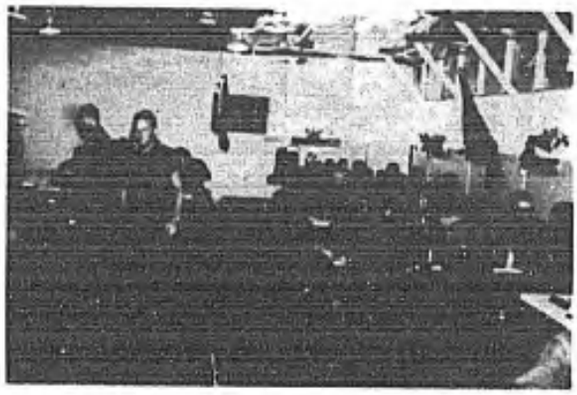


Figure 6. MCB-6 enlisted dining area in Chu Lai taken during the noon meal. FMT instructors are present in the food preparation and serving areas during all meals.

HAROLD B. KIRKENDOLL [1]

VALUE ENGINEERING IN THE SUBSISTENCE FIELD—A CASE STUDY

THE PURPOSE of this presentation is two-fold: (1) to acquaint you with the Value Engineering Program and (2) to encourage your personal and company participation in the DoD Value Engineering Program. This presentation will be slanted towards the subsistence Value Engineering Program because that is the area where many of you have your primary interest—and it is the area on which my job depends.

As A Management Tool

Value Engineering (VE) is a means to an end and not an end in itself. It is one means, among others, by which management achieves primary objectives. In industry the primary objective is economic and profitable production and distribution. In the military, the objective is strong military capability acquired at a reasonable cost.

Schools of Thought

VE, as Value Engineering is commonly called, has developed four schools of thought. The first school thinks that VE is simply old medicine in a new bottle. The second school is convinced that VE is a "cure all" for all cases of bad management. The third school considers VE as an ephemeral fad that will soon pass away; and the last school considers it, as a realistic means to an end. We consider ourselves, after five years' experience in the program, as a member of the fourth school. We think the demonstrated results by application of VE methodology have proved VE's merit and it is here to stay.

Perspective Value of Engineering

In Business: Competition in business is becoming increasingly severe. There are pressures to produce products of optimum value at minimum cost. VE is an instrument to respond to these pressures, by developing a cheaper way to do the job as well as or better than before.

In Government: Government subsistence procurement is also confronted with a similar challenge. We must furnish food both quantitatively and qualitatively, as required, to the military. Food costs are spiraling and we are limited in our funds. We can only accomplish our mission by eliminating the "fluff." The VE methodology is a proven tool which has helped us meet this challenge.

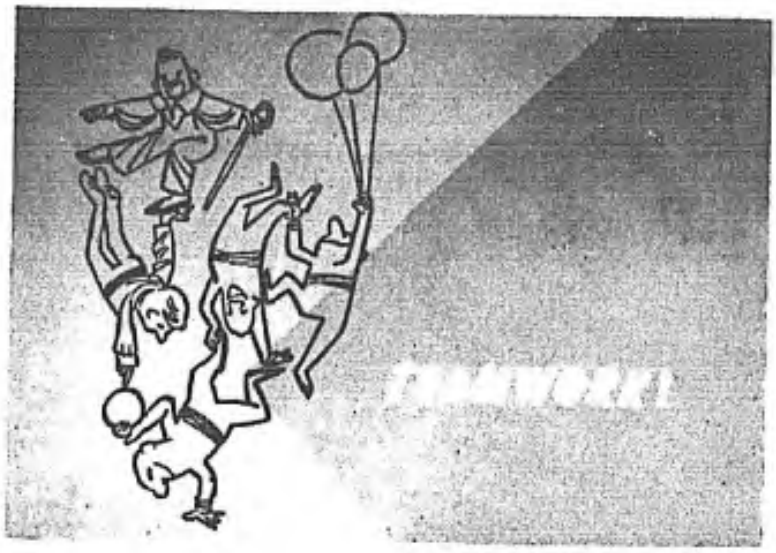
Value Engineering Defined

That's a short sketch of the background of *why* Value Engineering. Now for *our* definition of VE:

"VE is an organized approach to seek out and reduce or eliminate nonessential requirements which add to the cost of an item." *Essential* food quality must not be affected by our VE studies.

[1] Value engineering analyst, Defense Personnel Support Center, Philadelphia, Pennsylvania.

VE Study Procedures



Teamwork—the VE approach

We have obtained our best results from a team approach to VE. In our committee, we bring together representatives of procurement, supply operations, technology and Value Engineering. The product to be studied is selected prior to the study and the various representatives gather all available data on the product from their particular area of interest. We then get together and, with this experience in mind, proceed through a series of logical steps by asking ourselves these questions:

What Is It?

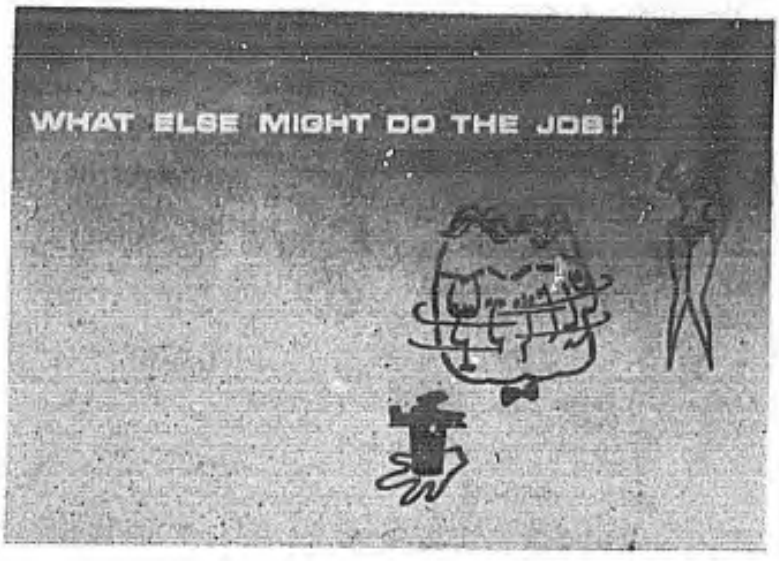
For subsistence items, there is usually no problem in answering this question. A can of beans, pork chop, ground beef, etc. . . . will define the item.

What Does It Do?

The broader the answer to this question, the more avenues for a value study are opened. We would define a "pork chop" study in such broad terms as "provides nourishment." If we limit this question by answering "pork item" or "meat entree," we would obviously limit our potential study. Many avenues and ideas would be blocked.

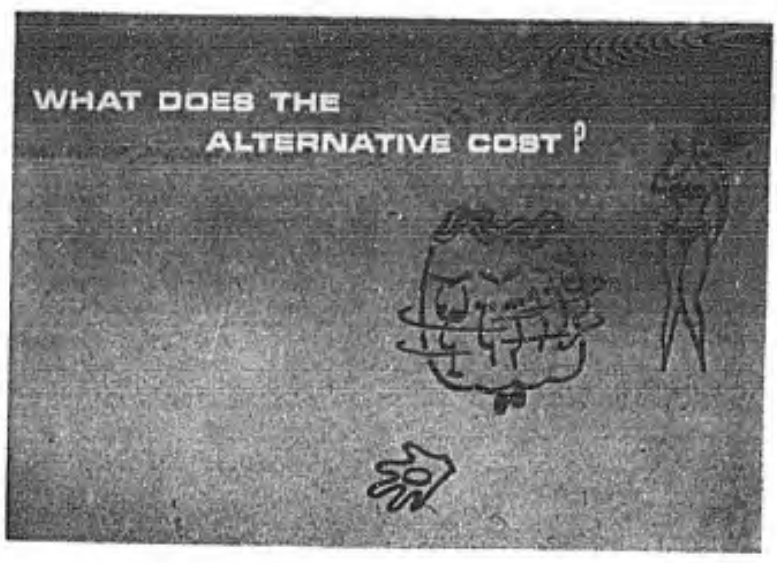
What Does It Cost?

Function compared to worth is a consideration in answering this question. We know what we are paying for pork chops but establishing a value on "providing nourishment" when compared to actual procurement cost of a pork chop becomes the prime factor.



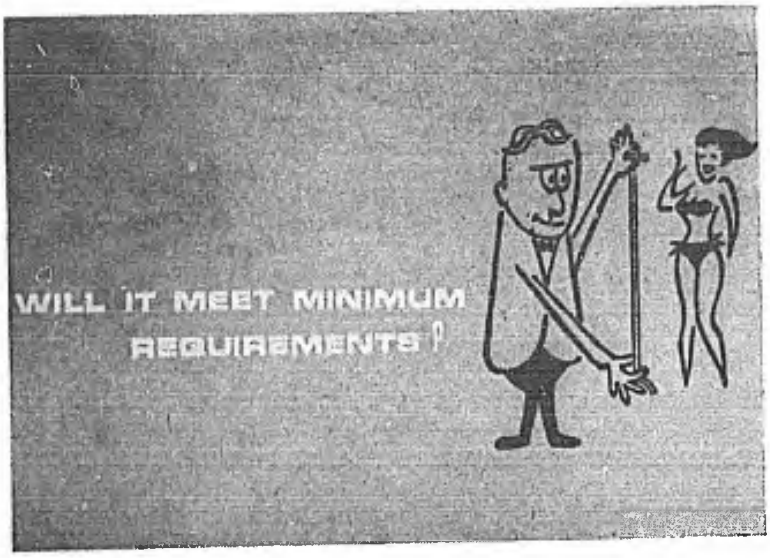
What Else Will Do The Job?

We know there's a better way to do any job. Here we brainstorm and find an alternative or alternatives to pork chops which will provide nourishment and do the job at less cost. From a practical standpoint, evaluation of these ideas developed during the brainstorming sesion must keep in mind that the alternative selected has to be sold to the decision authority. Don't waste time on an alternative you know you can't sell; however, don't discard any ideas as they may be parlayed into workable acceptable ideas.



What Does The Alternative Cost?

Our objective is to reduce cost. If the alternative costs more, why change?



Will It Meet Minimum Requirements?

The proof of the pudding with us, as with you, is user satisfaction. We do not consider a VE project complete until the user has expressed satisfaction with the new or changed product over a reasonable length of time under actual use conditions. In a nutshell, that's our in-house application of the VE methodology. The results have been rewarding.

EXAMPLE OF ACCEPTABLE VECP
(SUBSISTENCE)

INSTANT CONTRACT 12,550 CASES
VECP SAVINGS/CASE $34
TOTAL SAVINGS $426,700
CONTRACTOR'S SHARE (75%)——— $320,025

FUTURE ACQUISITIONS 50,200 CASES
VECP SAVINGS/CASE $34
TOTAL SAVINGS $1,706,800
CONTRACTOR'S SHARE (20%)——— $341,360

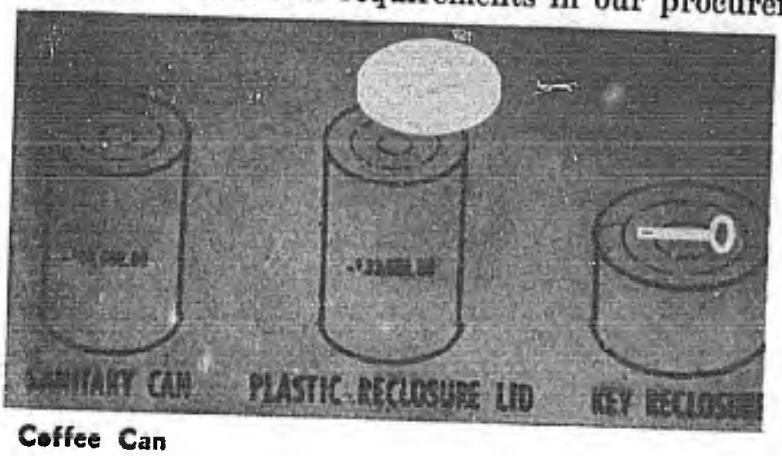
INCREASED PROFIT
TO CONTRACTOR $661,385

Contractor Input:

Our subsistence contractors submit many VE ideas for evaluation pursuant to our contracts which include contractor VE incentive provisions. These provisions establish a sharing arrangement of savings realized on government application of acceptable VE ideas submitted by these contractors. Included in the sharing arrangement are savings on the instant contract as well as on future acquisitions. We have published a manual which explains the subsistence contractor VE Program. If you do not have one of these manuals and are interested, a request to our center marked Attn: DPSC-STT will get you a copy. DSA DPSC Manual 4155.31 is the official number.

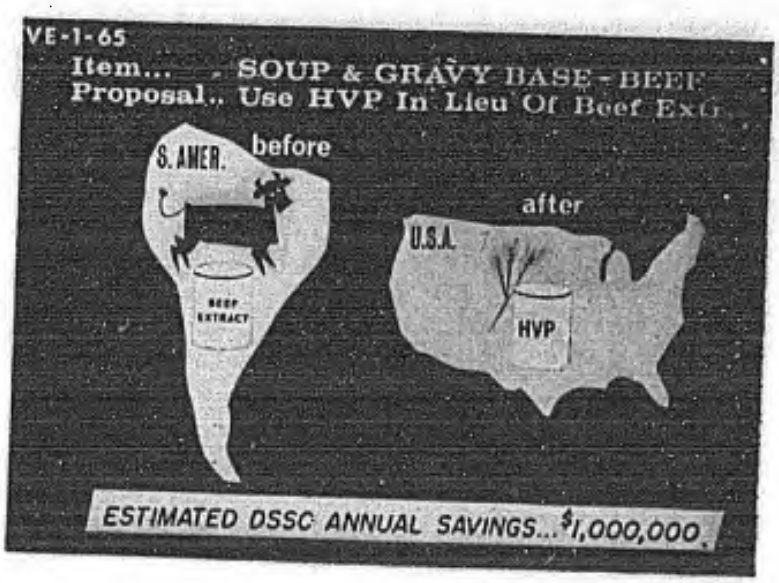
Examples

If you are wondering how the VE methodology has been applied to subsistence, here are visualizations of some applications—charts showing eliminated non-essential requirements in our procurements.



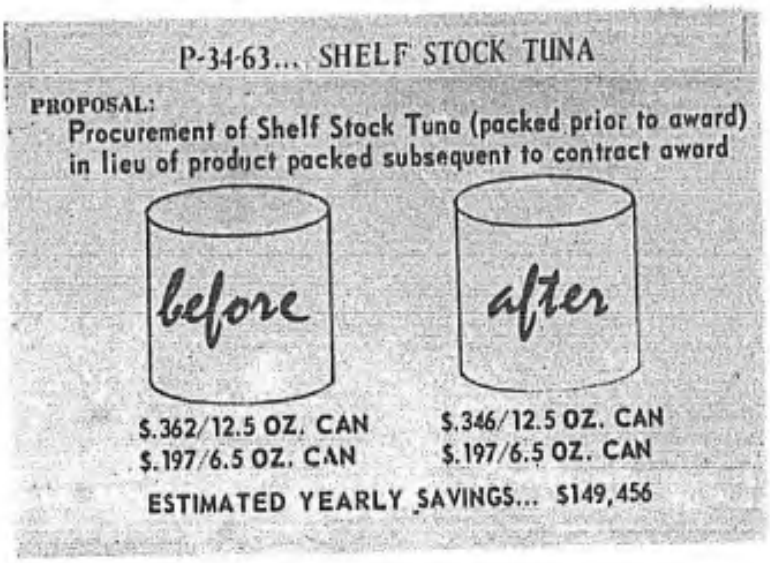
Coffee Can

Our first VE project on coffee eliminated the squat key reclosure feature type can and replaced it with a common less costly sanitary can with plastic reclosure lid. We eliminated the reclosure feature completely on the 2 lb can. Further actions on this product have eliminated the 1 lb size can as a standard military item. Coffee is one of our high dollar items so we are constantly watching industry developments on this product for savings potential: My point here is that high dollar items offer the greatest savings potential for VE studies and should have priority. You cannot save as much on a low dollar volume item.



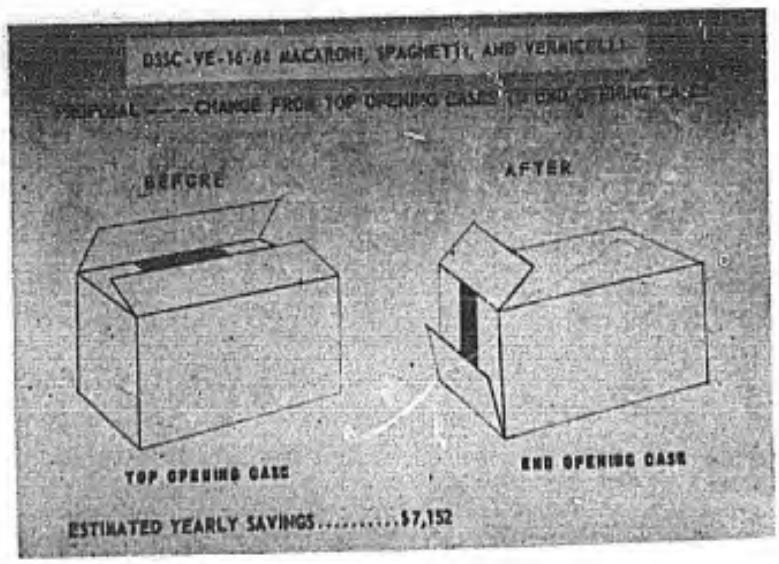
Soup and Gravy Base Beef

Our dehydrated soup and gravy base, beef flavored, had as the major component, a foreign produced natural beef extract. This component contributed over half the cost of the end item. A value study revealed a hydrolyzed vegetable protein made especially to replace natural beef extract, without loss of essential qualities. Not only is this change saving over a $1 million per year on our procurements of this item, but the flow of gold program was also helped by that amount.



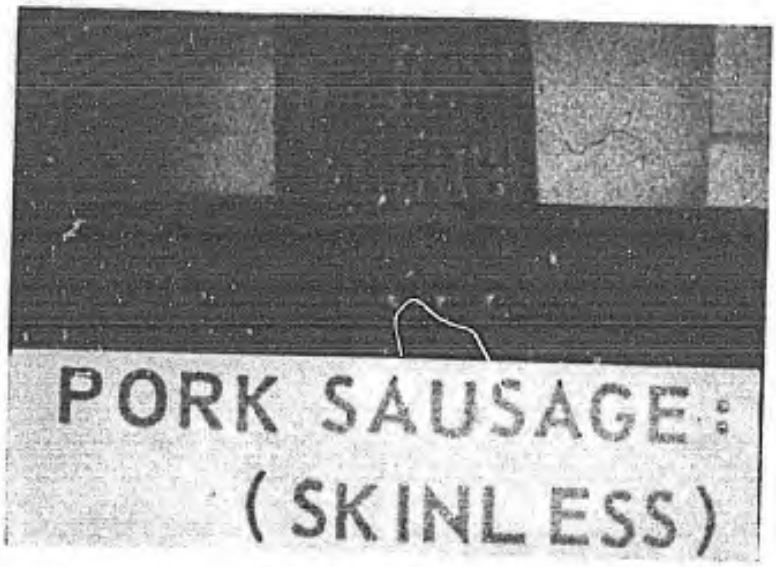
Tuna, Canned

This proposal recommended a change in procurement procedures. Our procurements had specified that canned tuna had to be packaged after date of award. A seasonal type item, this requirement was costing us a great deal of money. Now we buy shelf stock tuna and are receiving a product equal to the quality previously received at much lower cost. This is one of the advantages of having a procurement representative on our committee. We have just recently adopted a 4 lb can in lieu of the 12½ oz can of tuna—which is saving us an additional 3¢ lb on our procurements of this item.



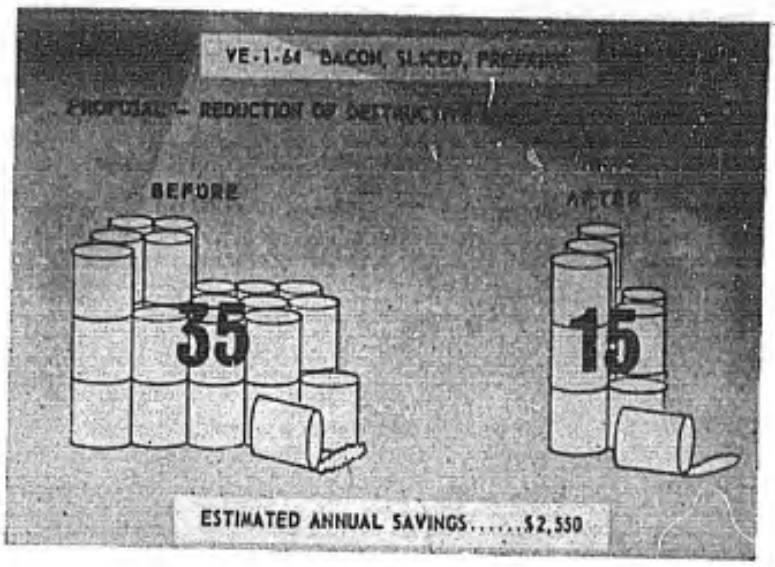
End Opening Cases

Here is a simple packing change which saves a small but worthwhile amount per case. We now permit the commercially utilized end opening case on many of our products. We started with macaroni, spaghetti, and vermicelli and then extended it to many items. The savings per case are small, but when multiplied by our total annual procurement, the savings reach significant figures.



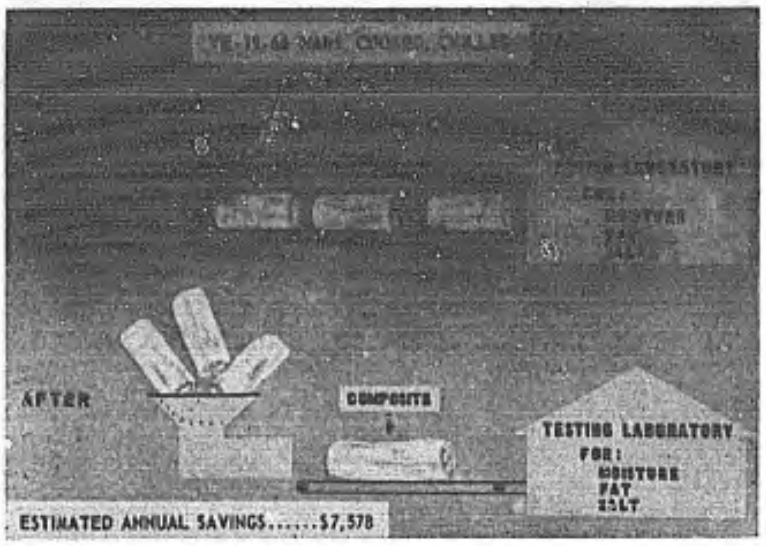
Pork Sausage

We were requiring the sheep casing on our procurements of link sausage. We questioned this requirement and found it non-essential. Industry had developed the molded link sausage and we found this met the military requirement. Savings—an amazing 10¢/lb. The VE Program, if properly implemented, establishes a communication channel which permits questioning the designer's and user's requirements. This does not take away from the designer's mission but conversely, provides him with ideas for future application.



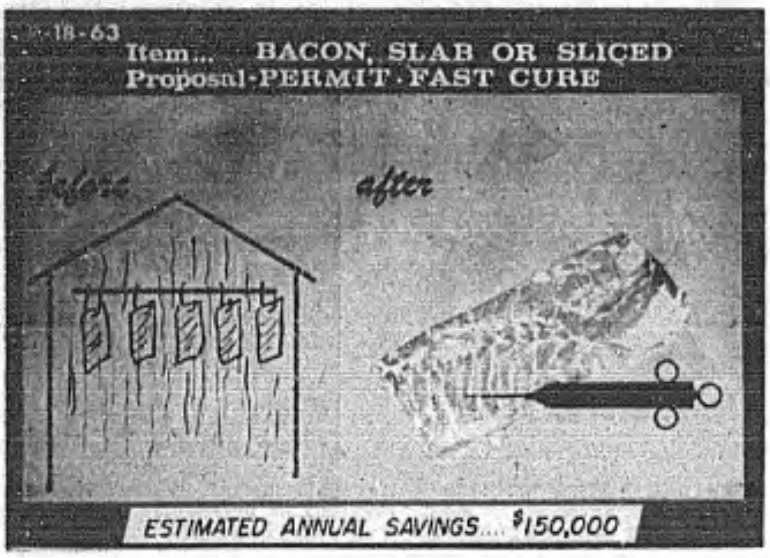
Bacon, Sliced, Pre-fried

Our specification on this item required a sample size of 35 cans for destructive type testing. Changing this sample size to 15 cans afforded required protection and saved 20 cans of this high priced product per inspection lot. We think this area of destructive sampling offers a great target for savings potential.



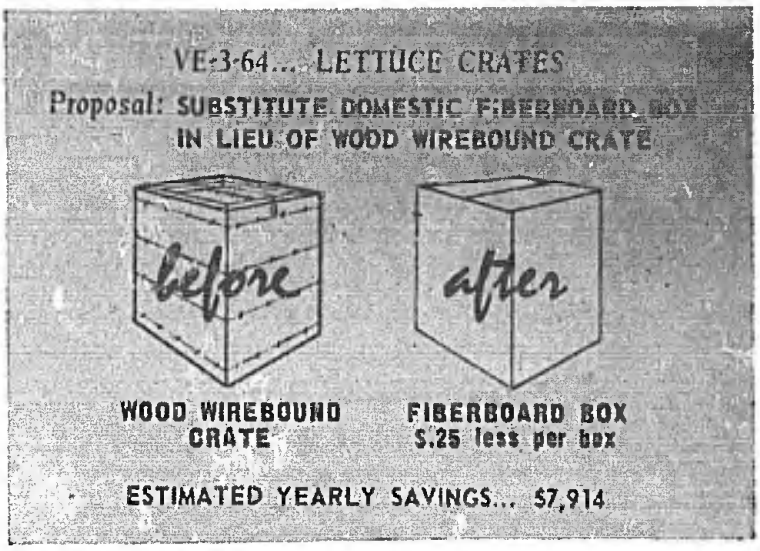
Ham, Cooked, Chilled

Here again a change in destructive sampling effected important savings. This time we changed from unit testing to composite testing for moisture, fat, and salt on this product. No essential quality was lost and we reduced contractor and government testing costs.



Slab Bacon Processing

Our specification required separate operations for the smoking and curing of slab bacon. The whole process required about 72 hours. By permitting the quick cure process whereby the injection of curing solution and smoking are performed simultaneously, the total time was reduced to 12 hours. Our saving for 1 year amounted to $150,000 by this change.



Lettuce

During our study of this item, we found commercial shipments going overseas in fiberboard boxes right beside our product packed in wood wirebound overpack. With overseas user's concurrence, test shipments were conducted and the wirebound overpack was found to be unnecessary. We have now made this change on many similarly packed products. This overpack was costing us $.40 each and was adding several days to our lead time because industry was not commercially using the overpack and had to order them after receipt of a contract. Reduction in lead time is one of the many fringe benefits from our VE studies. Fringe benefits have proved to be a major factor in VE studies. The Department of Defense selected 100 successful VE projects to determine what effect they had on such factors as quality, producibility, production lead time, weight, human factors, etc. In each instance, the fringe effects were significant. Producibility was favorably affected in 90 of the 100 cases evaluated, lead time in 76 of the cases on down to the low of packaging which was favorably affected in 18 cases. In no instance were there adverse effects found in more than 3 cases and in most of the characteristics evaluated, the projects studied had no adverse effects.

Conclusion

As you can probably tell by now, I am most enthusiastic about this program. I have lived it the past four years and personally think it is the greatest management tool to reduce costs devised to date. As indicated, the savings realized by the Government as a result of the VE Program have justified the resources expended many times over. The "targets of opportunity" for savings never deplenish. New areas arise every day. If you see fit to adopt a Value Engineering Program, I am certain it will benefit your firm and possibly the Government. Remember—this program doesn't cost—it saves!

Thank you

RAUNO A. LAMPI *

THE RELIABILITY OF FLEXIBLE PACKAGES **

The development of flexible packaging for items needing a high level of package integrity, such as freeze-dried or thermoprocessed ration items, has brought into sharper focus two distinct yet interrelated facets of packaging reliability. These are the performance of the package itself capability of the packaging system to perform properly.

Concurrent to the development of optimum packaging, "reliability" and "reliability engineering" concepts as applied to products and manufacturing processes have become formalized.[1,2] Programs to apply "reliability" reasoning to existing situations are well underway. Reliability by a prevalent definition[1,2] is the mathematical probability that a product will function for a stipulated period of time. Other definitions, perhaps more apropos to packaging, include average numbers of failures per part per number of hours of use or average time between failures.[1] Translation and adaptation to our packaging efforts, on recognition of the types of failures encountered, becomes useful and valid only when the two distinct reliability facets of the package and the packaging or manufacturing system are recognized.

Before any valid quantitative reliability "number" can be applied to either facet, appropriate test methods must be developed.

This report will present some efforts to assess the level of reliability attainable with flexible packages for thermoprocessed foods. Initially, the results have been in abstract and relative terms. As progress is made and data becomes available, the qualitative assessment will become quantitative.

The Military has been investigating the use of flexible materials for thermoprocessed foods to replace the rigid metal containers for approximately a decade.[3,4,5] Initial effort was limited to a search for suitable materials but over the past four to five years significant overall progress has been made. Effort to date has indicated that it is technically feasible to use flexible, laminated packaging materials to hermetically contain thermoprocessed foods. Films are available which are capable of withstanding 250° F processes and which comply with FDA regulations. Various heating media have been evaluated and either steam, steam-air mixtures or water can be used.[6,7] Storage stability can be equivalent to or greater than that attained with rigid cans.[4] Most significantly, field tests have shown that

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** This paper reports research undertaken at the U.S. Army Natick (Mass.) Laboratories and has been assigned No. TP. 493 in the series of papers approved for publication. The findings in this report are not to be construed as an official department of the Army position.

the anticipated advantages—portability and lighter weight—can be achieved.[8]

Reliability

There are three modes available through which information pertinent to reliability assessment can become available:

1. Experience with actual use.
2. Stress-strain testing (Abuse or accelerated).
3. Nondestructive testing procedures.

Experience with Actual Use

Experience through actual use is the most direct method of gathering information on and assessing the reliability of the end item. Experience forms the basis against which all other methods can be compared and evaluated.

Although the application of flexible packaging to thermoprocessed foods is still in the developmental stage, some data of this type are available.

Engineering/service tests incorporating the thermoprocessed flexible packages have been carried out. These tests consist of shipping the test rations to the point of issue; in this case, to advanced troops on field training maneuvers. The rations, following preliminary inspection, are issued prior to the exercises, carried by the troops until consumed in the field, and evaluated by filling out enclosed cards. Preliminary familiarization briefings are given for the totally new ration. Records are kept of defective packages.

A recent test report [8] indicated, in addition to gross defects eliminated at the point of manufacture, the presence of defects at a rate of 0.30% based on over 50,000 individual meal items inspected. Approximately two-thirds of the defects were related to sealing and one-third to mishandling. The nature of the defects indicated that further effort is required to improve the reliability of the manufacturing operations. Furthermore, the results indicated that if the packages were sound at the point of manufacture, they held up excellently during shipment and field use.

Stress Strain Tests

Stress-strain tests have involved the entire package and consist of simulated or accelerated use or abuse tests. Two approaches have been attempted with thermoprocessed foods in flexible packages. The results of both indicated that in comparison with packages of similar laminated materials and design the packages performed well. But, little confidence or sense of reliability of an *absolute* nature would be gained. Use had apparently been made of the best materials available, but no assessment could be made as to whether these were good enough. The intent had been to establish stress-strain procedures that would simulate actual use; however, the results indicated that the abuse given the packages was not ordinary.

One stress-strain evaluation procedure was established by the Continental Can Company.[9,10] This consisted of subjecting the packages, in the listed sequence, to the following:

1. Vibration of cartons at 1G for 1 hour (jacketed pouches in corrugated cartons)
2. Carton drop test, 10 random drops from 30 inches (ASTM D1776-61, Objective B)
3. Jacketed pouch drop test, 10 random drops from 3 feet.
4. Static load of 200 pounds on

jacketed pouches for 3 minutes.
5. Biotesting of unjacketed pouches for 30 cycles in inoculated water.

The results, based on exposure of 418 packages to the above cycle, indicated a failure rate of 5%. A direct comparison with actual use is not possible since the objective of the stress-strain cycle was measurement of pouch and material performance. No notation was therefore made of non-leak seal defects,—a type related to the manufacturing operation. The actual disparity between the results of the two approaches, therefore, is much greater than tenfold.

A second approach to stress-strain evaluations of the flexible packages was the use of an obstacle course at the General Equipment Test Activity, Fort Lee, Virginia.[11] Tests consisted of personnel carrying a package in each of four field jacket pockets and traversing a course of 16 rather rugged obstacles such as crawling under wire, climbing over wooden barriers, and using cobblestone slides. Each package was subjected to 10 traversals. Results showed the same magnitude of failures as the Continental Can Company procedure. Chicken a la king failed at a 5.5% rate and green beans at 7.4%; again significantly above rates evidenced in actual use.

Both stress-strain procedures gave quantitative data. The significance of the numbers, both as to magnitude and assignment to causes, is a matter of judgment and the validity of this judgment will be strengthened by experience and comparison with actual use. One summation of the stress-strain tests has been that any package that passes is a good one; but conversely, nothing derogatory can be said about the failures. Modifications of the procedures and courses are underway.

Nondestructive Testing

The third mode for gathering information relative to reliability is nondestructive testing. Effort in this area related to the flexible package for thermoprocessed foods has been aimed at detecting two types of defects, pinholes and seal defects. In addition, some work has gone into establishing definable "synthetic" defects in the specified packaging material. These "synthetic" defects are to be used for establishing the basic sensitivity of candidate test techniques and for calibrating the developed systems.

Pinholes are perforations through the body area of the pouch or seal channels that leak and could permit bacterial recontamination of the pouch contents. Foil breaks are excluded. Present knowledge concerning bacterial penetration, critical defect size, and ease of detection is limited and empirical.

It is known that:

1. Microscopic examination, because of the irregularity of shape and tortuosity of path, is inadequate for detailed definition or size estimation of pinholes.

2. Holes approximately 100 microns in diameter can be detected with the naked eye and product will exude through such holes on application of pressure.

3. Pouches punctured with 500 micron diameter needles did not totally indicate penetration following submersion in an inoculated media.[5] Only 50% of pouches tested indicated contamination. Surface

tension and wettability are suspected factors affecting bacterial penetration.

4. A Biotester, whereby individual pouches are subjected to kneading action while submerged in an inoculated bath, has improved the detection of purposely punctured pinholes. Table 1, although based on a limited number of replicates, shows recovery rates obtained with purposely punctured packages using two sizes of puncturing probes. These improved recovery rates were mostly in the 80 to 100% range. In addition to the known punctures, the Biotester has detected holes not visible to the naked eye, resulting from extreme abuse of packages.[9, 10, 12] The size range of these latter pinholes was 33-160 microns.

Table 1. Summary of Laboratory Biotest Runs Recovery Rates with Various Products

Product	*Number of Replicates*	*Diameter of Puncturing Probe*	*Per Cent Positive*
Chicken a la King	30	100	60
	85	300	78
Chicken Loaf	10	100	90
	10	300	100
Beef Loaf	10	100	70
	10	300	90
Beef Steak	10	100	80
	10	300	80
Pork Sausage	10	100	100
	10	300	80
Beef Stew	10	100	50
	10	300	100
Ham and Chicken Loaf	10	100	90
	10	100	90

Organism; Aerobacter aerogenes at concentration of 6×10^6 viable cells/mil.
Biotest conditions; Line pressure: 5 psig; Seconds/cycle: 30; Number of cycles: 30.

5. Methods commonly used for performance tests in the laboratory, such as drum tumbling, vibration, and twisting (Gelbo), have caused pinholes larger than 95 x 140 microns (microscopic estimation). Likewise, the finest probe found strong enough to puncture the packaging material of interest causes holes estimated at 60 microns in diameter.

Pending clarification of the smallest defect through which bacteria will pass under simulated distribution or field conditions and/or the smallest defect likely to be encountered, the Biotester developed by the Continental Can Company is considered the primary pinhole detection device. Its measurement is direct and its effect on packages is essentially nondestructive.[10]

For on-line usage, a significantly more rapid method is necessary. To this end, studies have been initiated to establish the applicability of gas leak detection methods. Appropriate methodology for many applications is well documented; however, specific to the package for thermoprocessed foods, at least three factors must be resolved; namely, moisture can effectively block gas flow through small pores, the total residual and tracer gas in the package should be no greater than 10 cubic centimeters, and the gas used must be legally and organoleptically compatible with the food.

For use as sensitivity criteria for candidate gas leak methods and for calibration, methods have been established for drilling small, definable holes in pouches of the suitable materials by a laser beam. Holes with diameters as small as 3 microns are feasible. Similar defects will be used to further define the capabilities of the Biotester.

The second type of defect pertains to seals. Seal defects include wrinkles, voids and occluded matter. Occluded matter is usually the result of the filling operation and can consist of food fibers or particles, grease or moisture. The defective seal with the defect may or may not be leaking at the time of inspection.

No sources of quantitative or reproducible data on flexible package seal defects were found. Therefore, to simulate such defects, single food fibers (celery, pineapple), freeze-dried pork, food particles (weighed amounts of dehydrated potato powder, single sugar crystals), grease (oleo) streaks, and moisture were occluded separately in the seal area. For "fabricated" voids, 3.5, 5.5, and 8 mil diameter threads were sealed in and then withdrawn. To obtain defects of a quantitative nature, the various sized threads were left imbedded in the seals. It is difficult to visualize the frequent occurrence of smaller defects.

Various nondestructive testing and scanning techniques were considered and several were evaluated by cursory trials with representative seal defects. Three methods showed promise:

1. Ultrasonics
2. X-Rays (30–50 Kilovolts; 5–9 Milliamperes; Vidicon pick-up transmitted to a 17" TV screen)
3. Infrared measurement of thermal impedance.

The first two methods detected a majority of the defects. Ultrasonics missed voids and wrinkles whereas X-Rays missed grease and fine powder. The infrared scanning system did respond to some degree to all the defects and therefore greater emphasis was put on establishing the feasibility of the infrared approach.

The infrared detection procedures measure the impedance to heat flow through the seal thickness caused by defects. Figure *1* illustrates the test

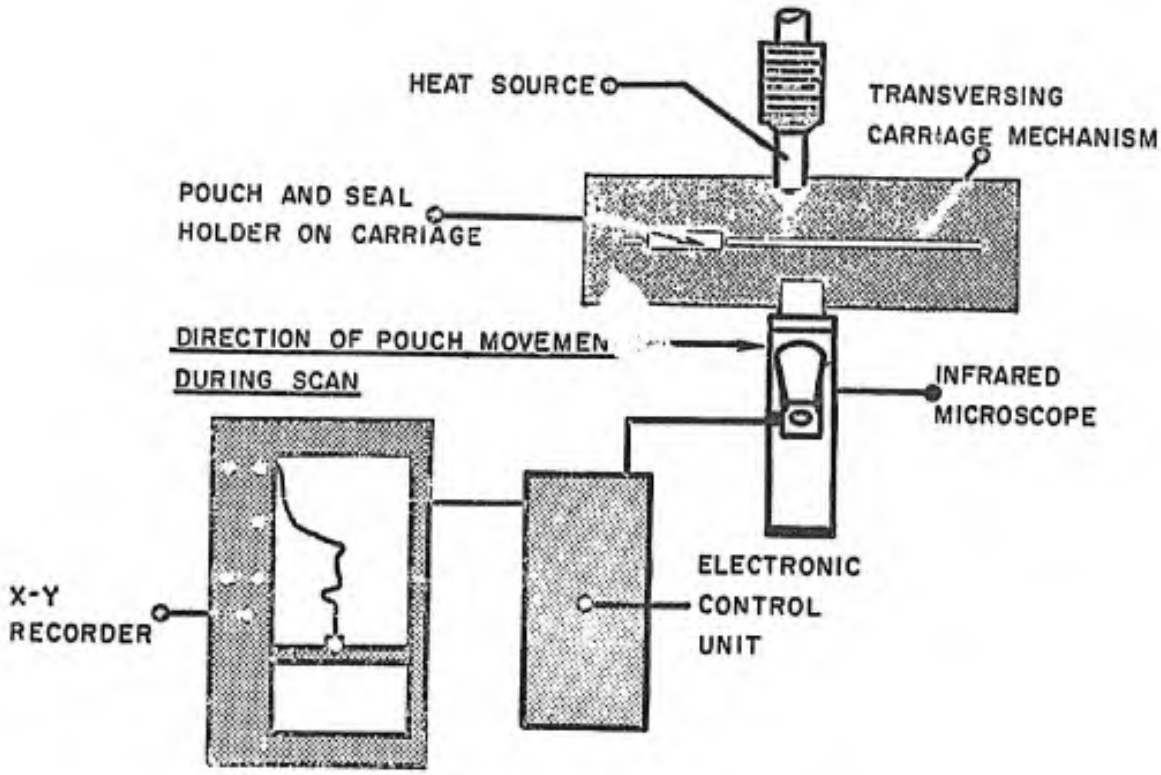

Figure 1. (Top view) Schematic of infrared seal scanning apparatus.

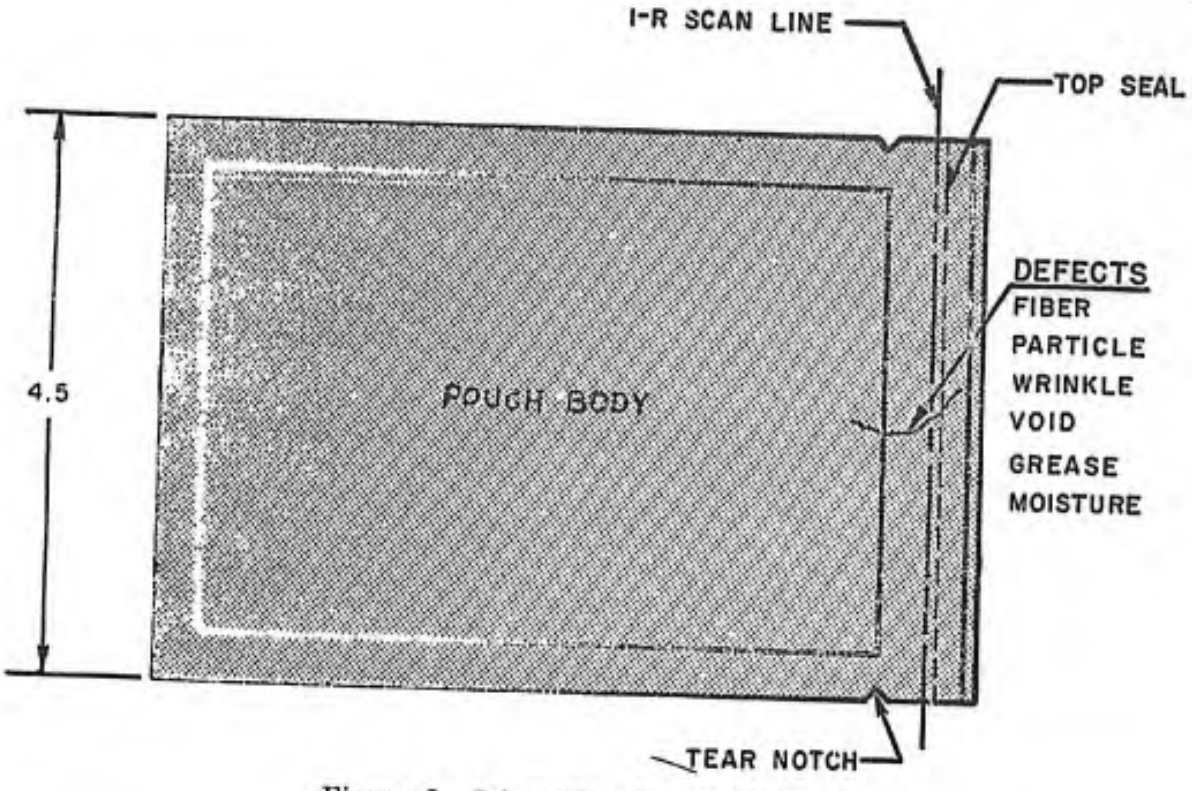

Figure 2. Schematic of seal defects.

procedures. A stream of hot air is directed at one side of the seal area and the infrared microscope at the other to detect the resultant variations in surface temperatures. In practice the heat source and the infrared microscope are stationary while the package seal area is moved between the two components at a constant speed. The output can be in degrees of temperature or in millivolts.

Figure 2 shows the scan line and the location of the simulated defects relative to the package. Thus far, the final seal only has been scanned since it is the one most likely to contain contamination. This figure also lists generically the defects sought. Table 2 lists the specific defects and corresponding infrared responses in terms of millivolts above the maximum background noise level.[13] Figure 3 shows a response curve from a scan of a void left by the withdrawal of a

Table 2. Response of Infrared Microscope to Thermal Impedance Caused by Simulated Seal Defects

		Response—Mv Replicate—Samples	
Description	*Size/Quantity*	*I*	*II*
Pork Fibers	0.5 mg; 1.0 mg	16	18
	1.0 mg	40	
Celery Fiber	Single	26	
Pineapple Fiber	Single	17	30
Sugar Crystals	Single	14	
	3 each	18	
Potato Powder	0.5 mg	7	14
	1.0 mg	14	
Grease	Streaks	20	16
Moisture	Droplets	11	Off Scale
Wrinkle	1/16" Fold*	10	
Void	3.5 Mil**	9	8
	26 Mil	Off Scale	
Thread	3.5 Mil**	17	10
	5.5 Mil	13	
	8.0 Mil	11	

* 1/8" difference in length of seal surfaces.

** Nominal diameter of thread or wire prior to sealing.

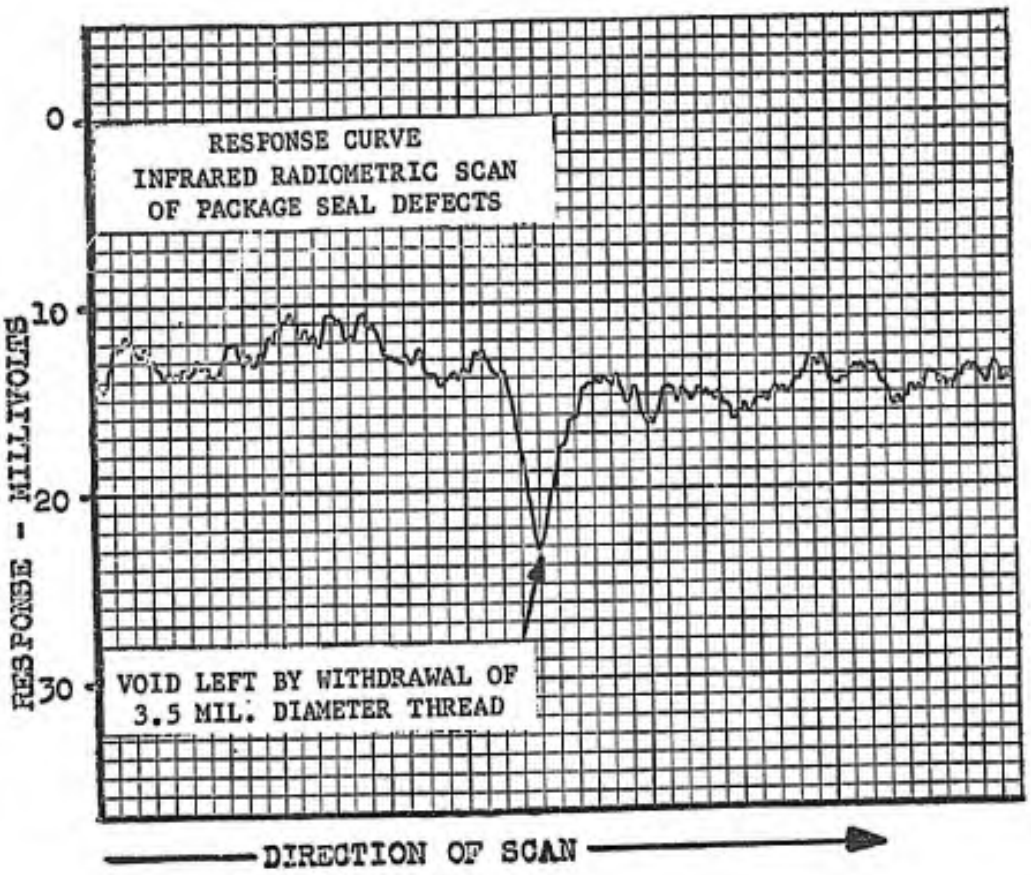

Figure 3.

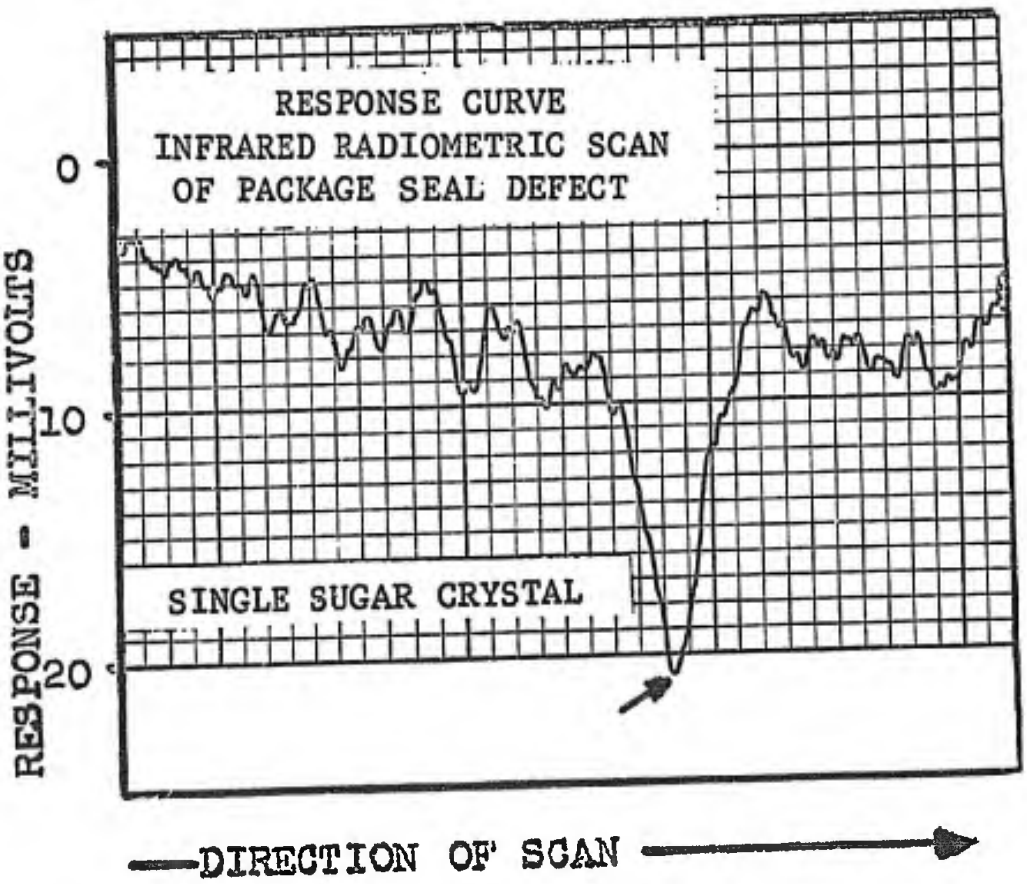

Figure 4.

3.5 mil diameter thread from the seal. Figure *4* shows the results of scanning a seal containing a single granulated sugar crystal. Based on these preliminary tests, the infrared scanning method is considered a very promising nondestructive seal defect detection method.

Summary

Without delving extensively into the philosophies of prediction, probability, or reliability, this report has attempted to present the approaches to and status of the NLABS testing efforts to establish confidence in, and therefore, establish the reliability of, the flexible package for thermoprocessed foods.

Experience using the package in the field during training maneuvers followed by an assessment of the types and causes of the defects encountered revealed that the package *per se,* properly prepared, performs well. This actual usage experience, therefore, brought into focus the need to consider two distinct aspects of reliability—the package and its preparation operations. Stress-strain (accelerated use) experience confirmed that the package is strong.

The basic causes of the defects encountered at the present stage of development are attributed to the preparation (form, fill, seal operation; package handling) operations. In addition to elimination of these causes, test methodology, preferably nondestructive, must be developed as a prerequisite to full assessment of the degree of reliability that can be attained. Progress on testing for pinhole type defects is presently limited to cursory definition of the sizes likely to be encountered. For the second major category of defects, contaminated or badly wrinkled seals, an infrared scanning procedure shows promise.

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MAJ. AVALON L. DUNGAN[1]

THE SPEED SYSTEM AFTER A YEAR OF EXPLORATORY DEVELOPMENT[2]

A YEAR AGO the R&D Associates were introduced to a project of the U.S. Army Natick Laboratories called Subsistence Preparation by Electronic Energy Diffusion (SPEED). The objective of this project is to produce a food service preparation, serving and sanitizing system for the Army in the field. At the time of the presentation the key elements of the system, a mobile kitchen and a bakery, were still under development. Since that time conceptual models have been completed and have been extensively tested. This report updates the SPEED project.

The primary emphasis of SPEED has been the exploration of the use of a large microwave oven to prepare any foods currently in or proposed to be in the subsistence supply system. It was found that in this approach, microwaves were best used in what is termed an "Integrated Cooking System." To fully understand what is meant by this term and how the equipment is employed, a description of the current equipment configuration of the SPEED Bakery and Kitchen is presented.

[1] Research and Development Coordinator, Army Field Feeding Study Team, 1970–1990. Major Dungan is stationed at the U.S. Army Natick Laboratories, Natick, Mass.

[2] This paper reports research undertaken at the U.S. Army Natick (Mass.) Laboratories and has been assigned No. TP-559 in the series of papers approved for publication. The findings in this report are not to be construed as an official Department of the Army position.

The kitchen and bakery are designed to be completely self-supporting for up to one day. The kitchen was designed to feed 200 men and the bakery to support 5000 men. Maximum interchangeability of components was a major design objective and from external appearance, the two units are identical. The shelters or "pods" are 12′ x 7′ x 8′ in external dimensions.

Both units have a 60 KW gas turbine generator for electrical requirements of the food preparation equipment. The turbine generator set has a power output equal to that of a standard diesel generator set, almost the size and weight of one of the pods. The on-board power plant has proved to be exceptionally reliable under all operating conditions experienced so far. In addition to power output, the turbine provides water heating through an exhaust heat exchanger and a turbine bleed air-operated air cycle air-conditioning system. The turbine exhaust is combined with exhaust from an incinerator to act as an afterburner to eliminate smoke. Maximum performance is obtained from JP4 jet fuel but the turbine can operate on practically any of the common volatile hydrocarbon fuels such as diesel, gasoline or kerosene. Figure 1 is a sketch showing the location of the power plant in both the kitchen and bakery.

SPEED Kitchen

Figure 2 is an exploded view of

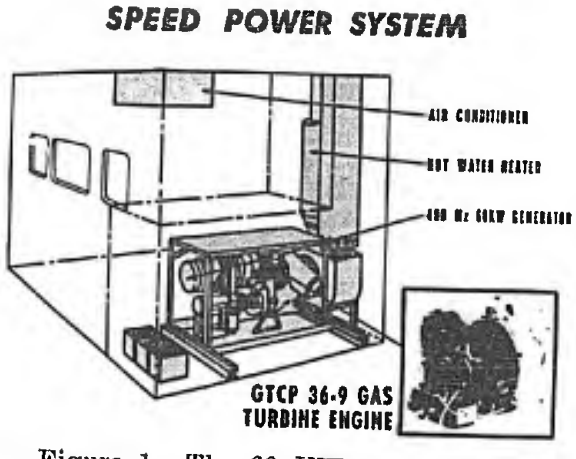


Figure 1. The 60 KW gas turbine engine-generator set provides power for the microwave ovens and other electric food preparation equipment. It also provides hot water heating through an exhaust heat exchanger and turbine bleed-air is used in an air cycle air conditioning system. Storage batteries are used to power the refrigerator when the generator is not in use.

the kitchen which shows the food preparation equipment layout. This layout shows modifications made during the design and construction phase. It has been found in tests that the two man crew has sufficient room for all food preparation activities. It has also been found that the addition of a third person to assist the two cooks at meal time results in a much reduced serving time. In future models storage space for pans of prepared food will be provided close to the microwave ovens, to hold foods which are ready for serving.

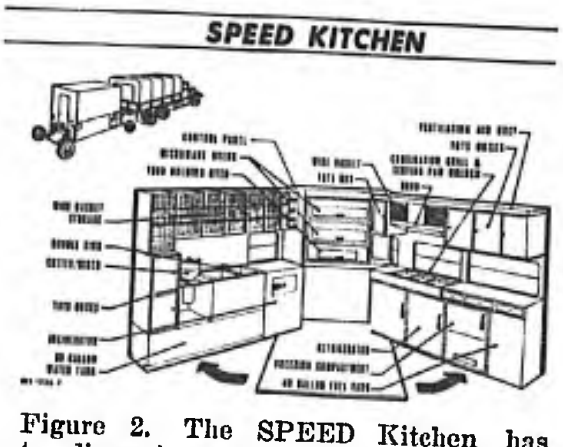


Figure 2. The SPEED Kitchen has outer dimensions of 12 x 7 x 8 ft. It has sufficient inside area to store both perishable and nonperishable ration components for 200 men for one day.

The integrated cooking system consists of the microwave ovens, convection oven and grill. The 6 KW microwave ovens, especially designed for the SPEED project, are believed to be the largest batch-type microwave ovens being used for prime cooking. They have been used alone and in combination with the convection oven and grill to prepare all types of dishes and baked items from raw ingredients. They have also been used to reheat precooked frozen and freeze dehydrated entrees. These microwave ovens have a unique rf energy distribution system that applies energy to all sides of the food. Roasting and baking of practically any food can be accomplished with uniform results throughout the cavity.

The forced air convention oven, located below the microwave ovens, is used for browning microwave baked goods, for holding certain cooked foods prior to serving, and for rapid conventional cooking.

The grill has several functions besides serving as an ordinary grill for production of the Army standard a la carte breakfast. It also serves as the heat source for the serving line. Although the grill has functioned adequately in all field tests, a tilting fry pan is being evaluated as a possible replacement item. The fry pan can handle additional functions such as frying, stewing and even baking, giving more versatility to the overall system.

The refrigerator has 22 cubic feet of 38° F storage space and two cubic feet of 0° F space for storage of perishable components of the ration.

The refrigeration unit is powered by 12 volt D.C. current and operates from storage batteries when the turbine generator is shut down.

A 40-gallon fuel tank is located on the serving line side of the pod. The fuel consumption of the turbine has been averaging 11–13 gallons of JP4 per hour. An increase in size of tank to about 80 gallons is being considered. This could be achieved by placing the water and fuel tanks in the floor. The added fuel would allow bread and pastry baking in the kitchen pod during off cycle periods.

The water capacity has been found to be fairly adequate due to the use of expendable mess gear and the use of dual purpose cooking and serving pans. An increase in capacity might be achieved by placing the tank in the floor. This would support increased water requirements if the kitchen is used to produce bread and pastry.

An item of food preparation equipment that is even more versatile than originally expected is the 15-quart vertical cutter mixer. Its value has been proved in such functions as mixing, chopping and blending. For example, its extremely high speed allows thorough mixing of prepared cake mix in 15 seconds. Another example of its versatility is its use to reconstitute dehydrated potato granules. The granules are placed in the mixing bowl, boiling water and seasonings (heated in the microwave oven) added, and the ingredients mixed for one minute. A smooth fluffy product is produced which is at the proper temperature for serving. The only change indicated in testing so far is the use of a larger model—probably a 25-quart bowl size.

The incinerator originally had a design capacity permitting the disposal of 65 pounds of garbage and expendable mess gear per hour. During field tests the actual capacity was found to be nearer 100 pounds per hour. The incinerator, developed especially for the SPEED project, employs a completely different principle of cooling by "transpiration." Air is forced through a laminated wall of slotted stainless steel and silica fiber. This absorbs heat conducted across this wall and dumps it back into the incinerator cavity. Internal temperatures may run as high as 1700° F without the external wall temperature exceeding 125° F. The top of the incinerator serves as work space.

The incinerator design has proved so satisfactory that the Army Surgeon General is investigating the use of a larger model to dispose of field hospital wastes. Even though the capacity is higher than it was designed to be, it is contemplated that a capacity of possibly 150 pounds per hour would be more advantageous. Since 200 men can be served from the kitchen in about 25–35 minutes, the incinerator must be able to keep up with the speed of serving. The diners finish and dispose of their mess gear in about the same period of time.

SPEED Bakery

Figure 3 is an exploded view of the SPEED Bakery. With a few exceptions, the equipment of the bakery is identical to that of the kitchen. The bakery is also operated with a two man crew. Two units are designed to produce sufficient bread and pastries for a brigade size unit (5000 men).

SPEED BAKERY

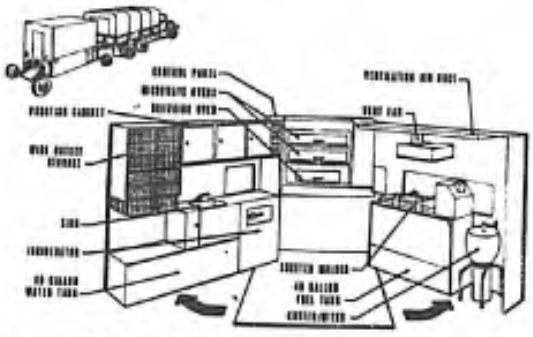


Figure 3. The SPEED Bakery is the same size as the kitchen. It is designed to produce bread or pastry products for 5,000 men daily.

The vertical cutter mixer in the bakery is a larger (40 quart) model of the mixer in the kitchen. It provides the same ultrarapid mixing capabilities as the smaller model. Bread ingredients are mixed in about 80 seconds. The extremely high speed (2000 RPM) produces a smooth warm dough and very uniform distribution of yeast. This mixing action allows elimination of the first proofing step found in a conventional bakery process.

A sheeter molder provides for rapid molding of bread loaves and sheeting of pastry dough. After panning, the bread goes into the proofing cabinet (160° F) for 20 minutes and then into the microwave oven. An oven load of six, 1½-pound loaves is baked in about nine minutes. Bread coming directly from the microwave oven has the appearance of "brown and serve" rolls although it is fully baked. The bread can be browned in the bakery convection oven or issued, as is, and browned in the receiving kitchen convection oven.

Climate Control

Both the kitchen and bakery have climate control mechanisms, cooling or heating as required. The current series of testing has included extremely cold conditions at Fort Devens, Massachusetts, and warm weather at Fort Lee, Virginia. The air-conditioning mechanism functioned well in both cases. There is some excessive air noise in the heating mode which will be corrected in the next model.

Integrated Cooking System

When the microwave oven first appeared on the commercial market it was thought to signal a major revolution in food service operations. It was quickly learned that conventional techniques for cooking and baking were not applicable to microwave ovens and that it was not just simply a "faster" oven. In a normal or conventional cooking process, regardless of whether it is baking, broiling or frying, heat is applied only to the surface of the food being cooked. The rate of cooking is dependent upon the heat transfer by conduction from the surface throughout the rest of the food mass. In microwave cooking the principle is completely different. There is no heat generated within the cavity except in the food itself. The microwaves, dependent upon their frequency, penetrate the food to a certain distance. Within this distance the energy of the microwaves is released, generating heat inside the food. It is theorized that this heat results from the rapid realignment of the polarized food molecules within the alternating microwave field. Since the frequency of the microwaves in the SPEED oven is 2450 MH_z, the agitation of molecules would occur 2,450 million times per second. The primary constituent which the mic-

rowaves act upon is thought to be the water molecule; other food components are affected, but at different rates.

In the SPEED system of integrated cooking only a few items are entirely cooked by microwaves. The microwave is used primarily to get a large amount of heat (energy) into the product in a short period of time.

Used in conjunction with the microwave oven is the convection oven. It has several functions. One of its primary functions comes after the microwave oven has put the energy into the food. The outer temperature is maintained by the convection oven until the heat has a chance to equalize by conduction throughout the product. This is especially important in thicker masses where the energy only penetrates to a certain depth and then must go further into the product through conductive heat transfer. Another function of the convection oven is to act as a holding oven to keep food warm until it is ready to place on the serving line.

Certain products which have characteristically dry outer surfaces, such as steaks, chops, and breaded items, retain a certain amount of moisture on the outside when cooked in the microwave oven. For this reason they are placed in the convection oven to allow the fast moving hot air to dry the surfaces. The convection oven is used to brown bread and other baked goods after they have first been baked in the microwave oven.

The large grill, like the convection oven, is used in conjunction with the microwave oven. For example, thin cuts of meat such as chops and steaks are not browned or seared by the microwave oven as with conventional cooking. Therefore, these items are placed on a hot grill for approximately one minute on each side to get the browning and searing effect before being finished in the microwave oven. The grill also serves as a heat source to keep food hot on the serving line.

Microwave Cooking

Roasts of beef have been one of the more difficult meat items to cook properly in the microwave oven. Early researchers reported the high shrinkage and dry product associated with microwave cooking. A definite technique involved in the microwave preparation of roast beef has been developed:

(1) *The roast must be completely thawed, preferably to a temperature of around 40°F.* The microwaves have a greater affinity for the polarized water molecule than they do for the ice molecule. Therefore, a partially thawed roast will cook unevenly.

(2) *The geometry of the roast should be uniform.* The roast should be such that the smallest dimension (thickness) of the roast is not greater than four inches. This has been found to be the greatest thickness at which the conductive heat will cook the interior of the roast before the microwaves overcook the outer portions of the roast. An ideal configuration is a round roast.

(3) *The energy must be cycled into the roast.* In the large 6kw SPEED oven, which can cook 40 pounds of boned roast (the quantity for 100 men) at a time, the roasts are given an initial cycle of high power for 10 minutes. Then they are turned over and allowed to rest for

10 minutes. The final cycle in the microwave oven is for 20 minutes on medium power, after which they are immediately transferred to the convection oven. The center temperature of the roasts when transferred to the convection oven should be between 110° F. and 130° F., depending upon the thickness of the roast. The thicker the roasts, the lower the internal temperature and the longer the holding time in the convection oven. The temperature of the outer portions will be much higher than the center and this heat will travel inward by conduction until the center temperature reaches approximately 150° F. after 20 minutes in the convection oven.

Roasts prepared in the SPEED Kitchen have a characteristic brown coloring on the outside and an excellent profile on the inside—from a *pink* in the center to the *well-done* on the ends. The average shrinkage on SPEED prepared roasts is between 20% and 25% as compared to conventional cooking loss of 30%.

Pork roasts and lamb roasts are easier to prepare than beef roasts in the SPEED Kitchen as they are normally smaller in diameter and of a more uniform configuration. The same cooking principles apply to them.

Stews and casseroles lend themselves very readily to microwave preparation as the meats and vegetables are immersed in a semi-liquid medium and the microwaves heat the medium as well as the product. This speeds up the cooking process and reduces product drying.

In cooking poultry, it is difficult to cook the whole bird because of its configuration, i.e., the small diameter of the legs and large diameter of the breast. A fabricated turkey roll is cooked without difficulty by microwaves due to its fairly uniform cross section. An excellent oven-fried chicken is prepared by using the convection oven and the microwave oven. The initial heating is done by the microwaves and the convection oven is used to finish the product, giving it a crispy brown appearance. Barbecued chicken is also easily prepared in the microwave oven.

In cooking frozen or fresh vegetables, a minimum amount of water is added to the cooking container which is then covered. The action of microwaves on the water creates a steam atmosphere and aids in the cooking process. The preparation of canned vegetables is merely a reheating operation where microwaves are used most efficiently.

Microwave bread baking by earlier researchers had produced a dry, tough product. After several months of experimentation with various bread formulas and baking techniques, a highly acceptable microwave baked product has now been developed. Modifications of the standard Army bread formula included increases in the quantities of yeast and shortening, the addition of an emulsifier and a dough conditioner, and the elimination of the non-fat dry skim milk and egg solids. The emulsifier aided in retaining moisture in the product, and the dough conditioner made the crumb more pliable. A quicker proof was obtained by increasing the yeast content, changing the mixing procedure and raising the proofing temperature.

Cake baking presented several problems which were resolved by

additional ingredients in the cake mix. There was, however, one additional problem, an edging effect due to the porous characteristic of the product and the configuation of the sheet pan used for baking. The microwave energy continuously bounces around inside the oven cavity until it is absorbed by the cake. Therefore, the energy comes in not only from the top and bottom but also from the sides. This means that around the perimeter of the cake the energy is entering from three sides, causing a faster cooking in this area. To overcome this, the baking containers have been modified by placing aluminum foil on their outer side walls to prevent the energy from coming in from the side. Work has also been done with metal pans which allow the energy to come into the product only from the top. This has shown some promise but it requires careful positioning of the metal pans to prevent arcing.

The bottom crust of pies baked in the microwave oven does not have the brown appearance of conventionally baked pies. Browning the bottom crust is achieved in the convection oven.

Cooking Times

Table 1 compares preparation and cooking times of specific food items by SPEED and the current Army field feeding system. The times were computed using the standard Army recipes and the quantities required to feed 100 men.

The question of how to determine cooking times, using microwave energy, presented itself as soon as SPEED recipe development began. In conventional cooking a time-temperature-weight relationship exists, whereas in microwave cooking there is a time-energy-weight relationship. A system has been developed whereby all cooking instructions have been reduced to kilowatt minutes per pound of product. All SPEED microwave ovens will be calibrated so that the exact wattage is known, and the cook will only need to know the weight of the product. The recipe will indicate power setting (low, medium or high) and cooking time per pound of product. It has been determined that the time-energy-weight relationship is linear. Therefore, if 20 pounds of an item is cooked for 60 minutes at a 1000 watt setting, the same quantity of the item would be cooked for 30 minutes at a 2000 watt setting.

Cooking Containers

One problem encountered when cooking with microwaves is that of a suitable cooking container. It is

Table 1. Comparative Food Preparation/Cooking Times (in minutes)

	Field Equip.			*SPEED Kitchen*		
Food Item	*Prep*	*Cook*	*Total*	*Prep*	*Cook*	*Total*
Turkey Roll	15	180	195	15	45	60
Canned Vegetables	10	25	35	10	8	18
Bread	240	45	285	43	9	52
Cake, Premix	20	30	50	15	15	20
Roast Beef	20	240	260	20	50	70
Meat Loaf	45	105	150	45	38	83
Baked Pork Chops	30	120	150	30	27	57
Roast Pork	20	240	260	20	45	65

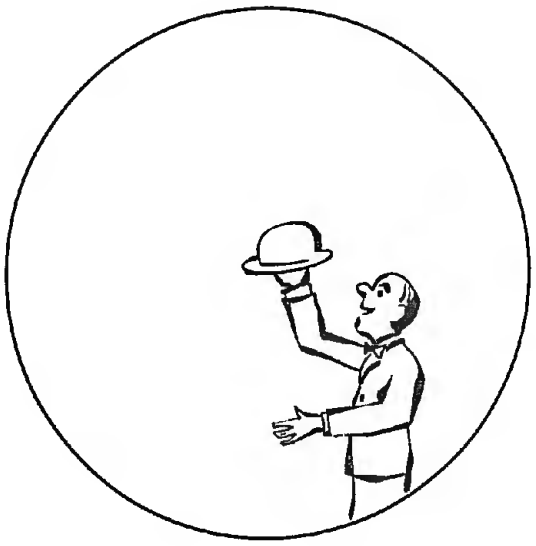
not advisable to use metal cooking pans in a microwave oven because of (1) the possibility of arcing within the oven cavity, and (2) reflection by the metal of the microwave energy, allowing the food to be cooked from the top only. The ideal material would be transparent to microwaves and have high heat resistance, so that the same pans can be used in both the microwave oven and convection oven.

A commercially available ceramic material transparent to microwaves and able to withstand very high temperatures is presently being used in the SPEED Kitchen, although it is relatively bulky and fragile. Several plastic materials are being investigated for possible use in cooking containers. Commercial plastics such as high density polyethylene, polypropylene, some of the polystyrenes, were found to be transparent to microwaves but were unable to withstand the high temperatures generated in the melted fats of the meats being cooked. Several new plastics now under investigation which show promise are polysulfoam, TPX, and a polyamide imide. All three can withstand high heats for limited periods of time and have been approved by the Food and Drug Administration for use with foods.

Conclusion

The SPEED system is still undergoing evaluation. Some of the more important areas of exploration include its potential application to "convenience foods" and improvement of the basic microwave oven design. It is further planned to evaluate the inclusion of an airline type coffee maker and an ultrasonic dishwasher for cleaning conventional mess trays. Much developmental work is still to be accomplished, including economic application considerations. However, the feasibility of a self-contained mobile electric kitchen has been demonstrated. Also, considerable knowledge of practical applications of microwaves to cookery has been made available to the food service industry. It has been and should continue to be a profitable investment in the future feeding of the Armed Forces.

Notes about Notables



GENERAL GERACE NOW IN COMMAND AT THE NATICK LABORATORIES

Brigadier General Felix J. Gerace, appointed Commanding General of the U.S. Army Natick (Mass.) Laboratories early this year, addressed the Associates at the Annual Meeting in Baltimore in April and hence is no longer a newcomer and needs no formal introduction.

General Gerace's background is a distinguished one. He has served in World War II, in Korea, and in Southeast Asia. Before his Natick assignment he was Assistant Chief of Staff, G-4, Headquarters, Eighth U.S. Army in Korea, after a tour of duty as executive officer in the Office, Assistant Secretary of the Army for Installations and Logistics, Washington, D.C.

Born in Turin, Italy, on March 12, 1918, he attended public schools in Brooklyn, New York. In 1941, he earned his Bachelor of Science degree in Engineering from the United States Military Academy and was commissioned a second lieutenant in the Quartermaster Corps. General Gerace was awarded a Master's degree in Business Administration at Stanford University, California, in 1948.

Among his past assignments, General Gerace was commandant of the U.S. Army Logistics Management Center, Fort Lee, Virginia; Chief of the Logistics Division of the Military Assistance Advisory Group, Laos; and was staff officer with the Joint Chiefs of Staff, Joint Military Assistance Directorate, in Washington, where he was responsible for advising the Department of Defense on the need for military assistance funds in the Middle East and Africa.

During World War II, he was a member of the 12th U.S. Army Group, in London, which planned and managed requirements for invasion of the continent. Later, he was commanding officer, 543rd Quartermaster Group, Europe, managing the determination of requirements, receipt, and distribution of all Quartermaster supplies and services for about 60,000 troops; staff officer of the American Graves Registration Command, in Paris, where he arranged with foreign governments for the repatriation of U.S. war dead; and staff officer of Headquarters, 15th U.S. Army Board, Germany, where he analyzed and recorded lessons of the war.

Upon return to the U.S. in 1948, he became executive officer to the post Quartermaster at the U.S. Military Academy, managing and operating all house keeping requirements for students and residents at West Point. From 1952 to 1954, he served as a logistics officer in Germany and France.

In 1955 he was appointed Special Advisor on airborne matters to the Quartermaster General, in Washington. In this capacity he managed the entire Quartermaster airborne program, from research and development of hardware to personnel assignments and budget preparation. He became a division chief in the Office, Deputy Chief of Staff for Logistics in 1958 and was responsible for personnel and training activities of officers in the Army's technical services. He managed assignments and career development of 1,000 senior logistics officers.

General Gerace holds the Legion of Merit with Oak Leaf Cluster, the Bronze Star Medal, and the Army Commendation Medal with Oak Leaf Cluster.

His military education includes graduation from the Command and General Staff School, The Infantry School, Armed Forces Staff College, and the Industrial College of the Armed Forces.

General and Mrs. Gerace, the former Doris Elisabeth McGahan, of New York City, are the parents of two sons and three daughters. They reside at the Military Reservation at Sudbury, Mass.

MRS. MARY V. KLICKA PRESENTED ARMY'S TOP CIVILIAN AWARD

The Exceptional Civilian Service Award, the Army's top civilian decoration, was presented to Mrs. Mary V. Klicka, a ration design specialist at the Army Natick Laboratories, by Secretary of the Army Stanley S. Resor, at a special Ladies' Day ceremony held in his office at the Pentagon.

Mrs. Klicka has been responsible for the planning and design of operational, survival, and special rations for the Armed Forces since 1957. She has also provided "significant creative ability and leadership" in guiding technologists in the development of new or improved foods for use in space flights.

Born in Winnipeg, Canada, Mrs. Klicka received her bachelor's degree from the University of Washington and her master's from the University of Chicago.

Mrs. Klicka, on a special assignment, served the United Nations by participating in an on-site study of ration problems for the U.N. Emergency Force in Gaza, Egypt in 1958, which was faced with feeding a unified group of military personnel from various nations and ethnic groups.

She is a member of the American Dietetic Association, National Council on Aging, Institute of Food Technologists, and the Research Society of America.

William J. Klicka, her son, attended the ceremony as a special guest of the Army. He is a student at the University of Massachusetts.

Head Table,
Annual Banquet,
R & D Associates,
17, 18 April 1968
Baltimore

Upper picture, left to right: Mrs. A. I. Totten Jr., Dr. R. L. Hall, Mrs. Herbert Ames, Senator J. Caleb Boggs, Delaware.

Lower picture, left to right: Dr. K. T. Farrell, Mrs. R. L. Hall, Mr. A. I. Totten Jr., Mrs. K. T. Farrell, Mr. Herbert Ames.

DR. CLARENCE K. WADSWORTH PRESENTED THE ISKER AWARD

Dr. Clarence K. Wadsworth, supervisory food technologist, of the U.S. Army Natick (Mass.) Laboratories, was presented the Research and Development Associates Rohland A. Isker Award for his outstanding contributions to the development and commercialization of irradiated foods for military and civilian use at the Baltimore meeting of the Associates.

Dr. Wadsworth was cited specifically for his work on processing of white potatoes using ionizing energy to inhibit sprouting. Treated potatoes can be stored from one growing season to the next without spoilage caused by sprouting. The Food and Drug Administration, in 1964, approved irradiated potatoes for human consumption.

The Isker Award is presented annually by the R&D Associates, Inc., a non-profit, military-industry liaison organization, for significant accomplishments in the fields of food and container research and development.

Before his entry into Federal employment, Dr. Wadsworth was manager of research and development for William Underwood Co., Watertown, Mass., and research manager for General Foods Corp., White Plains, N.Y. Earlier, he was employed as a food research chemist with A&P Tea Co., in New York City.

Born in Gardiner, Maine, he earned his B.S. in 1934 at the University of Maine, and his M.S. (1937) and Ph.D. (1944) in Bacteriology and Chemistry at Michigan State University.

He is affiliated with the American Chemical Society, American Association for the Advancement of Science, American Society for Quality Control, and the Institute of Food Technology.

Dr. and Mrs. Wadsworth, the former Phyllis Wing Johnson, of Orono, Maine, reside at 12 Northgate Road, Wellesley, Mass.

CLIFFORD J. ROBERTSON APPOINTED TO POST AT THE UNIVERSITY OF MASSACHUSETTS

Mr. Clifford J. Robertson, who heads up our task group on fats and oil products, has been appointed Lecturer with the Department of Food Science and Technology, University of Massachusetts, Amherst. Beginning with the Fall Semester, he will give a course in hotel and restaurant management and one in food preparation and science. A chemistry major, Mr. Robertson was graduated from Harvard College in 1931, joining Lever Brothers Co. soon thereafter. For the last 21 years he has been with the Procter and Gamble Co. as eastern technical representative.

Mr. Robertson's knowledge of the technology and utilization of fats is extensive. His special field is filled dairy and bakery product technology and deep fat frying. He is widely known for his work in the development and marketing of many commercial fat and oil products. Mr. Robertson has long been active in the technical societies concerned with food. He is a member of the Food Update Seminars, a series of nation-wide and industry-wide symposiums to be held in Boston during 1969. Additionally, he is a member of the Institute of Food Technologists, the American Association of Cereal Chemists, the American Oil Chemists' Society, and the American Society of Bakery Engineers.

NATICK'S FOOD ACCEPTANCE GROUP

Taste makes waste, U.S. Army scientists claim. Give a serviceman a food he doesn't like, and down the drain goes his morale—along with the taxpayers' dollars. As the nation's largest buyer of edibles, the Armed Forces constantly practice quality control from purchase point to consumer.

Taste testing studies conducted at the Army's Natick (Mass.) Laboratories confirm that the proof of the pudding is still in the eating. The Food Acceptance Group at Natick, headed by Joel Sidel, a psychologist, provides acceptability data on foods produced by new processes, such as freeze drying, or stored under typical field conditions. It also tests food samples submitted by prospective suppliers bidding on government contracts, because, according to Sidel, although a food may be wholesome and economical to buy, it may fall below acceptable taste levels, and many servicemen may not eat it. The Acceptance Group has also participated in military-sponsored nationwide surveys of food preferences of men in the Armed Forces, a study done periodically to assist in planning the yearly master menu for all Army and Air Force installations.

Foods for the Gemini Space Flights, all Natick developments, were tested extensively by the Acceptance Group prior to their adoption by the astronauts.

Subjects for the tests are selected at random by computer from a list of about 650 Natick civilian and military volunteers representing varying social, economic, educational and age groups, comparable to a cross section in the U.S. Armed Forces. A test may involve from 30 to 40 consumers. During a test each subject is given from one to five samples of a food. He indicates his degree of like or dislike on a card imprinted with the "Hedonic Scale," which shows gradations of acceptance from one (dislike extremely) to nine (like extremely). The results are later compiled by computer into an average which shows how well a random selection of people liked the food, thereby giving an indication of how well it may be accepted by servicemen.

A full day for the Acceptance Group consists of two tests—one in the morning and one in the afternoon. The pace for the kitchen crew depends on the degree of preparation required for the food being tested. Food is served at precise temperatures to insure that all taste testers receive identical samples. Equal portion sizes are also maintained.

Natick's Acceptance Group also explores new methods of acceptance testing. Environmental factors such as sights, sounds and odors are very important, Sidel explains, as a consumer's degree of food acceptance may be influenced by these and other variables. Often a change of name for the same food will bring a different response.

Military research on testing methods provides the U. S. food industry with valuable data for conducting its own acceptance tests to determine which foods are most profitable to produce and market.

DR. RICHARD L. HALL HONORED BY DEPARTMENT OF DEFENSE

Dr. Richard L. Hall was honored last April by the Department of Defense in recognition of patriotic civilian service. A certificate of appreciation was presented by Colonel Clifford T. Riordan to Dr. Hall for his immeasurable contributions to the food field of the Armed Forces, while serving as Director of Research and Development for McCormick & Company, Inc.

The award, the second highest given to a civilian by the Defense Department, was presented during the 22nd annual meeting of the Research and Development Associates held in Baltimore.

In making the presentation, Colonel Riordan commented, "Dr. Hall's consistent and dedicated support of the food research projects of the Armed Forces contributed significantly to improvement in the field of food additives, spices and flavors."

ARMY R&D AWARD PRESENTED TO JUSTIN M. TUOMY

The Army Research and Development award for a significant scientific contribution has been won by Justin M. Tuomy (right), a food technologist at the U.S. Army Natick (Mass.) Laboratories. It was presented by Lt. General Austin W. Betts, Army Chief of Research and Development. Tuomy, Chief of the Dairy, Poultry and Dehydrated Products Branch, Food Laboratory, at Natick, was among 18 Army scientists and five scientific teams receiving national recognition for their accomplishments.

Mr. Tuomy developed a new process for improving the Army's long range combat patrol packet for Vietnam in which the main menu item is a combination food such as chili con carne or chicken stew. Tuomy devised a method for cooking meat and vegetables together before freeze drying instead of separately as was done previously. As a result faster rehydration of the freeze dried foods in hot or cold water is possible, and food flavor is enhanced if the food must be eaten dry. The food packet has won wide acceptance by combat soldiers in Vietnam.

Born in Bemidji, Minnesota, Tuomy is

a graduate of Austin High School, Chicago, Ill., and the University of Minnesota (1938) with a Bachelor's degree in Chemical Engineering. The author of 10 scientific papers on freeze dried foods, he holds five patents in the field of food technology. Tuomy is a member of the American Chemical Society, American Society for Quality Control, and the Institute of Food Technologists.

Tuomy lives with his wife, Mrs. Joyce Tuomy, and their son, James, 17, at 83 Davidson Rd., Framingham, Massachusetts.

COLONEL HOWARD JAMES RETURNS TO NATICK LABORATORIES AS DEPUTY COMMANDER

Colonel Howard James has returned to the Natick Laboratories as Deputy Commander.

A veteran of 28 years of active Army duty, Colonel James served as Plans Officer at Natick from June 1964 to June 1966 when he was assigned to Camp Carroll Depot, near Taegu, Korea, as Commanding Officer.

He was Deputy Commander at Sharpe Army Depot, Lathrop, Calif., from September, 1967 until his return to Natick.

A native of Emporia, Kansas, Colonel James received a B.A. degree in mathematics and science, a B.S. degree in education in 1939 from Emporia State Teachers College, and an M.S. degree in chemistry in 1939 from the University of Cincinnati, Ohio. He is also a graduate of the U.S. Army Command and General Staff College, Fort Leavenworth, Kansas, and the U.S. Army War College, Carlisle Barracks, Pa.

Colonel James, who enlisted in the Kansas National Guard in 1935, taught mathematics and science at Allen Rural High School, Kansas before entering active duty in December, 1940 with the 116st Field Artillery Band. He was commissioned in 1942.

He has been decorated with the Bronze Star and the Army Commendation Medal with Oak Leaf Cluster.

Colonel James is a member of the American Chemical Society, the Defense Supply Association, the Association of the U.S. Army.

Colonel and Mrs. James, the former Helen Griffith of Wamego, Kansas, reside at the Military Reservation, Sudbury. They have two children, Judith, 20, a senior at Kansas State University, Manhattan, Kansas; and William, 18, a cadet at the U.S. Military Academy, West Point.

NEWLY CONSTRUCTED RESEARCH INSTITUTE DEDICATED OCTOBER 17, 1968, AT NATICK

The U.S. Army's newly constructed Research Institute of Environmental Medicine was dedicated at ceremonies held at the Army Laboratory in Natick, with 400 persons attending. Above (left to right): Brig. Gen. F. J. Gerace, Commanding General of the Natick Laboratories; Dr. David E. Bass, Deputy Scientific Director of the U.S. Army Research Institute of Environmental Medicine (ARIEM); Major Gen. S. M. Blumberg, Commanding General of the U.S. Army Medical Research and Development Command; Dr. E. F. Adolph, Professor of Physiology (Emeritus), University of Rochester, (N.Y.) Medical School; Col. J. E. Hansen, Commanding Officer, ARIEM; and Lt. Gen. A. W. Betts, Army Chief of Research and Development.

The new center is designed to conduct basic and applied research to determine how heat, cold, high terrestrial altitude and work affect the soldier's life processes, his performance and his health.

The goal is to understand the complex effects of climatic stresses on the human body, the body's defenses, and the techniques, equipment and procedures best calculated to make the soldier operationally effective to an optimal degree and give him optimal environmental protection.

The dedication address, "Environmental Physiology: Past and Present" was by Dr. E. F. Adolph, Professor of Physiology (Emeritus) of University of Rochester.