

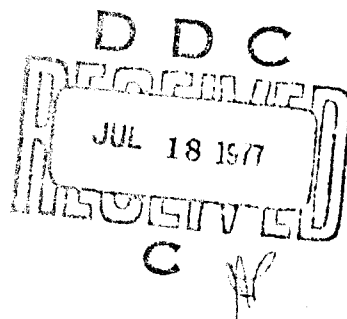
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EVALUATION OF FROZEN MEAT ENTREES



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UNITED STATES ARMY

RESEARCH AND DEVELOPMENT COMMAND

NATICK, MASSACHUSETTS 01760



Food Engineering Laboratory

FEL-64

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Oven Fried Chicken, Swiss Steak with Brown Gravy, Baked Lasagna, Sweet and Sour Pork, Turkey a la King, and Creole Pork Slices were prepared. Portions were furnished to the Navy for a submarine feeding test. Other portions were used for determination of storage stability, nutritional studies, and to determine preparation methods for the Navy. This report details the results of the in-house storage stability study and the Navy evaluation of six frozen meat entree items: Oven Fried Chicken, etc.		

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➤ In general, the Navy cooks and leading mess management specialists found the food items convenient and easy to use and the directions for preparation legible and clear. Eighty percent of the cooks and mess management specialists rated the products good to very good. Between 49 and 69 percent of the Navy consumers rated the products between 6 and 8 on a 9-point scale (9= like extremely), depending on the product. Results of the in-house storage stability study show that at -18°C the products, except Swiss Steak, were acceptable after 12 months. At -12°C , Oven Fried Chicken, Turkey a la King, and Sweet and Sour Pork were acceptable after 12 months; and Baked Lasagna and Creole Pork Slices were borderline. Swiss Steak with Brown Gravy was acceptable after 6 months.

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PREFACE

In 1975, six meat entrees and six vegetable items were produced by the U.S. Army Natick Development Center (NDC), renamed the U.S. Army Natick Research and Development Command (NARADCOM) in 1976 for the purposes of (a) evaluating and refining production methods, (b) obtaining nutritional data during preparation and under conditions of use, (c) determining the storage stability of the items produced, (d) preparing heating instructions, and (e) determining the feasibility of using convenience foods aboard submarines in-port in an operating situation. Technical report 76-31-FEL¹ details the production and initial screening of the meat entrees. This document reports the results of the storage stability studies and the Navy evaluation of the meat entrees. The results of the nutritional analyses will be published in a separate report.

The authors wish to thank Mrs. Carol Kanter for conducting the technological evaluations of the meat entrees.

The present effort was undertaken under project No. IT 762724 AH 043 military food service and subsistence technology.

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¹Tuomy, J.M., G. C. Walker and L. C. Hinnergardt. 1976. Pilot Plant Production of Frozen Entree Items for the Navy NARADCOM Technical Report 76-31-FEL.

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EVALUATION OF FROZEN MEAT ENTREES

INTRODUCTION

The increasing use of convenience foods in the commercial and institutional fields has prompted the Armed Forces to investigate this type of feeding in garrison situations. The U.S. Army Natick Research & Development Command, (NARADCOM) previously known as the Natick Development Center (NDC) has expended considerable effort in the development and evaluation of frozen entrees.^{2,3} As part of this effort NARADCOM prepared six meat entrees and six vegetable items, which were used for storage stability, nutritional analyses, preparation of heating instructions, and evaluation by the Navy.

This report is concerned with the results of the storage stability study of the meat entrees conducted by NARADCOM and the feeding study conducted by the Navy by the Commander Submarine Forces Atlantic (COMSUBLANT) during the calendar year 1975.

²Helmer, R. L. and H. T. Schlup. 1975. Meat Entree Item Production Guides Developed for use in Ft. Lee Interim Central Food Preparation Facility. NDC Technical Report 74-27-FEL.

³Walker, G. C., J. M. Tuomy and C. G. Kanter. 1976. Egg Products for use in a Cook-Freeze System. NARADCOM Technical Report 76-28-FEL.

MATERIALS AND METHODS

Materials

The materials used for this study were:

- a. Oven Fried Chicken, Recipe L-138⁴ as modified,²
- b. Swiss Steak with Brown Gravy, Recipe L-16⁴ as modified,²
- c. Baked Lasagna, Recipe L-25⁴ as modified,²
- d. Sweet and Sour Pork, Recipe L-82⁴ as modified,²
- e. Turkey a la King, Recipe L-129-1⁴ as modified,²
- f. Creole Pork Slices, Recipe L-83-1⁴ as modified,²

The chicken entree was packaged in 26 cm x 20 cm x 6.5 cm rigid foil, half-size steamtable pans, 16 pieces per pan. Each of the other five entrees was packaged in 2.3-kg amounts in the same size pans.

Storage

Products for in-house technological evaluation were stored at -12°, -18°, and -23°C. Withdrawals were made at 0, 3, 6, 9, and 12 months, except for Swiss Steak which was terminated after 6 months.

Evaluation

The products were prepared for in-house technological evaluations by tempering one pan of product withdrawn from each storage temperature for 16±1 hour at 10°C. The products were heated in a conventional oven set at 191°C to an internal temperature of 74°C. Evaluation was conducted using a panel of food technologists familiar with the products. Entrees were rated on a scale of 1 to 9 where 1 denotes an extremely poor product and 9 is the rating for an excellent product. The organoleptic factors evaluated were color, odor, flavor and texture.

Analysis of Data

Data from the in-house storage stability study were subjected to an analysis of variance (ANOVA) and a components of variance analysis. The procedures of Sokal and Rohlf⁵ for single classification ANOVA with unequal sample size and for estimation of variance components in a single classification ANOVA with unequal sample sizes were followed.

⁴U.S. Army. 1972. Armed Forces Recipe Service. TM 10-412.

⁵Sokal, R. R. and F. J. Rohlf. 1969. Biometry. W. H. Freeman and Company. San Francisco. 776 pp.

EVALUATION OF FROZEN MEAT ENTREES

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This report is concerned with the results of the storage stability study of the meat entrees conducted by NARADCOM and the feeding study conducted by the Navy by the Commander Submarine Forces Atlantic (COMSUBLANT) during the calendar year 1975.

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Evaluation of Entrees by the Navy

Forty-eight pans (109 kg) of chicken and 40 pans (91 kg) of each of the other entrees were furnished to the Navy for evaluation. Two questionnaires were used. Figure 1 shows the questionnaire used to obtain the cooks' opinion of the food, ease of preparation, how it was served, etc. Figure 2 is the rating sheet given to the consumer. The data from the two questionnaires were summarized and will be discussed in the next section. The data did not lead to meaningful statistical analysis.

RESULTS AND DISCUSSION

Table 1 shows the results of the analysis of variance and the percent of variation attributable to the effect of storage on Oven Fried Chicken. Storage at -12°C influenced flavor. However, only 27.1 percent of the variance was attributable to the storage temperature. The effect of storage temperature on the other organoleptic factors was not significant. Table 2 shows the mean technological panel scores for Oven Fried Chicken. Overall, this product remained acceptable under the conditions used to evaluate its storage stability. Most of the comments received from the panelists concerned the texture of the chicken. Panel members indicated that they expected a crisp coating and skin, similar to what they would receive at a fast food outlet serving fried chicken. The methods of preparation and heating for serving virtually precludes that degree of crispness. It is possible that using the term "Fried" in the name of the item creates a misnomer. However, renaming the item would be difficult because of the multitude of other chicken products that can be prepared, some of which are similar to the oven fried chicken.

Table 3 presents the analysis of variance and percent of variation attributable to storage for Swiss Steak with Brown Gravy. Storage of Swiss Steak at -12°C significantly influenced the color, odor, and flavor of the product. Swiss Steak stored at -18°C showed deterioration of the odor and flavor. None of the organoleptic factors were significantly influenced at -23°C . Storage temperature did not affect the texture of the product. The mean technological scores for Swiss Steak (Table 4) show that at -12°C the flavor of the Swiss Steak was borderline after 3 months and the odor and flavor were unacceptable after 6 months. No further evaluation of the samples stored at -12°C were conducted. Evaluation of the Swiss Steak stored at -18°C and -23°C was terminated after 9 months because the samples were lost. The rapid deterioration of the Swiss Steak stored at -12°C was due to the development of oxidative rancidity. Rapid breakdown of the frying fat during the preparation of Creole Pork Slices was traced to the flour dredge used on the pork slices. We theorized from this observation that the dredge used on the Swiss Steaks could be a contributing factor to their deterioration. The dredge used for the Swiss Steak was composed of wheat flour (91.8%), salt (7.5%), and black pepper (0.7%). Examination of Table 8 of TR-76-13 (see reference 1) shows that these dredging mix ingredients contribute substantial amounts of pro-oxidants. Further experiments are being conducted to evaluate this theory. The results will be published in a future report.

Table 5 shows that storage at -12°C of Baked Lasagna has a significant effect on all of the organoleptic factors studied. Flavor was significantly affected at all storage temperatures. However, examination of the mean technological scores for flavor for product stored at -18°C and -23°C (Table 6) shows an average score which is lower after 9 months than after 6 or 12 months. Examination of the raw scores shows that after 9 months at both -18°C and -23°C the range of the scores was 5 to 7. After 6 months the range was 6 to 8 and after 12 months, 6 to 7. An attempt to explain the 9 month score scores would be speculation. Numerous influences can affect panelists at any one time and thus their evaluations of a

product. The most prevalent comment by the panelists was that the tomato ingredient was too acid. Another frequent comment was that the product did not have enough cheese.

The analysis of variance for the effect of storage on Sweet and Sour Pork is shown in Table 7. Storage had no significant effect on the organoleptic factors evaluated. Table 8 shows the mean technological panel ratings. No discernible trend is observed from the rating scores, although comments did indicate some changes were occurring. Few comments were received at the initial and 3-month evaluations. At the initial evaluation the product was well accepted. At the 6, 9, and 12-month evaluations, the panelists criticized the product for an old meat flavor at 6 months, which progressed to a slightly rancid flavor at 9 months, and to an oxidized flavor at 12 months. As expected, the most severe criticism was made of the sweet and sour pork stored at -12°C . However, the flavor received some unfavorable comment at all storage temperatures. Texture of the meat was characterized as being slightly to moderately tough after 6 months of storage at all temperatures. The toughening was not noted as being worse at 9 and 12 months than at 6 months.

Table 9 shows that all storage temperatures had a significant effect on the flavor and texture but not the color or odor of Turkey a la King. Samples of product stored at -12°C and -23°C and evaluated after 6 months of storage were criticized as being oxidized, whereas the sample stored at -18°C was found to have acceptable flavor. Also, product evaluated after 3 months and 9 months of storage was mainly criticized for having too high a level of pepper. No panel member noted any oxidized flavor at these evaluations. Overall, the product remained acceptable throughout the evaluation period (Table 10). Most of the comments about the texture were concerned with the turkey meat. In general, the turkey was described as stringy, tough, and dry at 6 months, but at 12 months the turkey was described as mushy. Table 10 shows that despite the comments made about the texture the panel members scored the product relatively high.

Table 11 shows the results of the analysis of variance and the percentage of variation attributable to storage of Creole Pork Slices, and Table 12 shows the mean technological panel scores. The results are not consistent, which probably stems from the problems experienced during production of the product. During cooking of the pork slices the oil used for deep fat drying broke down rapidly (see reference 1). The result of this oil breakdown was the imparting of a smoky flavor to the pork. The flavor became stronger as the fat deteriorated during the deep fat frying step. It was necessary to change the frying oil several times. Thus, for each change of oil there was a gradation of the smoky flavor in the pork slices roughly corresponding to the deterioration of the oil. The degrees of smoke flavor and oil breakdown were not quantified, however. The pork slices were panned as they came out of the deep fat fryer which tended to randomize the product. The result was that pork slices from all stages of cooking were put into storage. The flavor was described as being burned, scorched, or smoky to lacking flavor. Noticeable oxidized or rancid flavors seemed to develop only after 6 months storage and only in the samples stored at -12°C . The texture of the meat stored at -18°C and -23°C

was described by the panel as being dry and slightly to moderately tough. The -12°C samples were described as being tender. The production problems encountered with Creole Pork Slices are being studied. Findings will be reported in the future.

Table 13 shows the mean consumer ratings of the six meat entrees. Each consumer who rated the food filled out a questionnaire such as shown in Figure 2. The USS Blue Fish rated all of the entrees unacceptable (dislike slightly to dislike moderately). In general, the three other ships found the foods acceptable. The analysis of responses show that 63 to 82 percent of the consumer ratings were 5 or above, and that 49 to 69 percent of the consumers rated the products between 6 and 8. Further investigation of the USS Blue Fish portion of the evaluation revealed that the crew was not properly briefed and was reacting to fears that food quality was in the process of being down graded. Other crews were properly briefed.

An analysis was made of responses from ships' cooks and leading mess management specialists to the questionnaire on convenience foods. Figure 1 shows the questionnaire completed by the ships' cooks and leading mess management specialists. The numbered paragraphs in Appendix B correspond to the questions shown in Figure 1.

REFERENCES

1. Helmer, R. L. and H. T. Schlup. 1975. Meat Entree Item Production Guides for use in Ft. Lee Interim Central Food Production Facility. NDC Technical Report 74-27-FEL.
2. Sokal, R. R. and F. J. Rohlf. 1969. Biometry. W. H. Freeman and Company, San Francisco. 776 pp.
3. Tuomy, J. M., G. C. Walker and L. C. Hinnergardt. 1976. Pilot Plant Production of Frozen Meat Entree Items for the Navy. NARADCOM Technical Report 76-31-FEL.
4. U. S. Army. 1972. Armed Forces Recipe Service. TM 10-412.
5. Walker, G. C., J. M. Tuomy and C. G. Kanter. 1976. Egg Products for use in a Cook Freeze System. NARADCOM Technical Report 76-28-FEL.

TABLE 1. ANALYSIS OF VARIANCE AND PERCENT OF VARIATION ATTRIBUTABLE TO THE EFFECT OF TIME IN STORAGE AT -12° , -18° , OR -23°C FOR OVEN FRIED CHICKEN.

Factor	Color		Odor		Flavor		Texture	
	ANOVA	%	ANOVA	%	ANOVA	%	ANOVA	%
Stored at -12°C Not Accounted For	n.s.		n.s.		*	27.1 72.9	n.s.	
Stored at -18°C Not Accounted For	n.s.		n.s.		n.s.		n.s.	
Stored at -23°C Not Accounted For	n.s.		n.s.		n.s.		n.s.	

*: $P > 0.01$

n.s.: Not Significant

TABLE 2. MEAN TECHNOLOGICAL PANEL SCORES FOR OVEN FRIED CHICKEN

Temperature of Storage	Months in Storage	ORGANOLEPTIC FACTOR			
		Color	Odor	Flavor	Texture
-12°C	0	6.9	7.1	7.0	6.7
	3	6.8	6.6	6.9	6.8
	6	6.4	6.6	6.1	6.2
	9	6.6	6.2	5.3	6.3
	12	6.8	6.3	5.4	6.8
-18°C	0	6.9	7.1	7.0	6.7
	3	6.7	6.8	6.6	6.8
	6	6.9	6.7	6.1	6.5
	9	6.4	6.5	5.5	6.4
	12	6.5	6.4	5.8	6.9
-23°C	0	6.9	7.1	7.0	6.7
	3	6.9	7.0	7.1	6.9
	6	6.6	6.8	6.3	6.1
	9	6.4	6.7	6.6	6.4
	12	7.0	7.2	6.8	6.7

TABLE 3. ANALYSIS OF VARIANCE AND PERCENT OF VARIATION ATTRIBUTABLE TO THE EFFECT OF TIME IN STORAGE AT -12°C, -18°C, or -23°C FOR SWISS STEAK WITH BROWN GRAVY

Factor	Color		Odor		Flavor		Texture	
	ANOVA	%	ANOVA	%	ANOVA	%	ANOVA	&
Stored at -12°C	*	22.2	*	59.1	*	78.5	n.s.	
Not Accounted For		77.8		40.9		21.5		
Stored at -18°C	n.s.		*	21.0	**	19.3	n.s.	
Not Accounted For				79.0		80.7		
Stored at -23°C	n.s.		n.s.		n.s.		n.s.	
Not Accounted For								

*: $p > 0.01$

** : $p > 0.05$

n.s.: Not Significant

TABLE 4. MEAN TECHNOLOGICAL PANEL SCORES FOR SWISS STEAK
WITH BROWN GRAVY

Temperature of Storage	Months in Storage	ORGANOLEPTIC FACTOR			
		Color	Odor	Flavor	Texture
-12°C	0	7.2	7.3	7.1	6.9
	3	7.0	5.9	5.0	6.7
	6	6.2	4.4	3.4	5.9
	9	-	-	-	-
	12	-	-	-	-
-18°C	0	7.2	7.3	7.1	6.9
	3	7.1	7.2	7.1	7.0
	6	7.0	7.0	7.0	6.7
	9	6.8	6.5	6.2	6.7
	12	-	-	-	-
-23°C	0	7.2	7.3	7.1	6.9
	3	7.1	7.1	6.8	6.8
	6	7.0	7.0	6.7	6.1
	9	6.9	6.9	6.4	6.6
	12	-	-	-	-

TABLE 5. ANALYSIS OF VARIANCE AND PERCENT OF VARIATION ATTRIBUTABLE TO THE EFFECT OF TIME IN STORAGE AT -12°C, -18°C, or -23°C FOR BAKED LASAGNA

Factor	Color		Odor		Flavor		Texture	
	ANOVA	%	ANOVA	%	ANOVA	%	ANOVA	%
Stored at -12°C	*	31.3	*	29.8	*	51.2	*	24.2
Not Accounted For		68.7		70.2		48.8		75.8
Stored at -18°C	n.s.		**	13.0	*	19.3	**	11.8
Not Accounted For				87.0		80.7		88.2
Stored at -23°C	n.s.		n.s.		*	25.9	n.s.	
Not Accounted For						74.1		

* : $p > 0.01$

** : $p > 0.05$

n.s.: Not Significant

TABLE 6. MEAN TECHNOLOGICAL PANEL SCORES FOR BAKED LASAGNA

Temperature of Storage	Months in Storage	ORGANOLEPTIC FACTOR			
		Color	Odor	Flavor	Texture
-12°C	0	7.4	7.3	7.4	7.5
	3	6.9	6.9	6.5	6.8
	6	6.4	6.5	6.3	6.8
	9	5.8	6.4	4.9	6.7
	12	5.8	5.7	5.0	6.2
-18°C	0	7.4	7.3	7.4	7.5
	3	6.9	6.9	6.9	7.2
	6	7.1	6.5	6.8	6.9
	9	6.8	6.4	6.3	7.0
	12	6.8	5.7	6.8	6.8
-23°C	0	7.4	7.3	7.4	7.5
	3	7.0	7.1	7.2	6.8
	6	7.1	7.0	7.0	7.1
	9	6.7	6.9	6.3	6.9
	12	6.8	6.9	6.9	7.0

TABLE 7. ANALYSIS OF VARIANCE AND PERCENT OF VARIATION ATTRIBUTABLE TO THE EFFECT OF TIME IN STORAGE AT -12°C, -18°C, or -23°C FOR SWEET AND SOUR PORK

Factor	Color		Odor		Flavor		Texture	
	ANOVA	%	ANOVA	%	ANOVA	%	ANOVA	%
Stored at -12°C Not Accounted For	n.s.		n.s.		n.s.		n.s.	
Stored at -18°C Not Accounted For	n.s.		n.s.		n.s.		n.s.	
Stored at -23°C Not Accounted For	n.s.		n.s.		n.s.		n.s.	

n.s.: Not Significant

TABLE 8. MEAN TECHNOLOGICAL PANEL SCORES FOR SWEET AND SOUR PORK

Temperature of Storage	Months in Storage	ORGANOLEPTIC FACTOR			
		Color	Odor	Flavor	Texture
-12°C	0	7.2	7.1	6.9	7.1
	3	7.2	7.1	7.1	7.0
	6	7.1	6.9	6.6	6.5
	9	7.2	6.9	6.1	6.7
	12	7.0	6.8	6.3	6.3
-18°C	0	7.2	7.1	6.9	7.1
	3	7.1	7.1	7.0	7.1
	6	7.1	6.9	6.9	6.4
	9	7.2	7.0	6.6	6.8
	12	7.0	6.9	6.9	6.5
-23°C	0	7.2	7.1	6.9	7.1
	3	7.2	7.1	7.1	7.2
	6	7.1	7.0	6.8	6.6
	9	7.2	7.1	6.6	7.0
	12	7.1	6.8	6.6	6.6

TABLE 9. ANALYSIS OF VARIANCE AND PERCENT OF VARIATION ATTRIBUTABLE
TO THE EFFECT OF TIME IN STORAGE AT -12°C, -18°C, or -23°C
FOR TURKEY A-LA KING

Factor	Color		Odor		Flavor		Texture	
	ANOVA	%	ANOVA	%	ANOVA	%	ANOVA	%
Stored at -12°C Not Accounted For	n.s.		n.s.		**	11.1	*	25.9
						88.9		74.1
Stored at -18°C Not Accounted For	n.s.		n.s.		**	16.7	*	33.3
						83.3		66.7
Stored at -23°C Not Accounted For	n.s.		n.s.		**	69.5	*	45.4
						30.5		54.6

* : $p > 0.01$

** : $p > 0.05$

n.s.: Not Significant

TABLE 10. MEAN TECHNOLOGICAL PANEL SCORES FOR TURKEY A LA KING

Temperature of Storage	Months in Storage	ORGANOLEPTIC FACTOR			
		Color	Odor	Flavor	Texture
-12°C	0	7.1	7.1	7.4	7.4
	3	6.8	7.0	6.9	6.8
	6	6.9	7.0	6.8	6.7
	9	7.0	7.0	6.9	6.9
	12	7.0	6.9	6.8	6.8
-18°C	0	7.1	7.1	7.4	7.4
	3	6.8	7.0	7.0	7.0
	6	6.8	7.0	7.0	6.8
	9	6.9	7.0	7.0	7.1
	12	7.0	6.9	6.8	7.0
-23°C	0	7.1	7.1	7.4	7.4
	3	6.7	7.0	6.9	7.1
	6	6.8	6.9	6.6	6.8
	9	6.9	7.0	7.0	6.9
	12	6.9	6.9	6.8	7.0

TABLE 11. ANALYSIS OF VARIANCE AND PERCENT OF VARIATION ATTRIBUTABLE TO THE EFFECT OF TIME IN STORAGE AT -12°C, -18°C, or -23°C FOR CREOLE PORK SLICES

Factor	Color		Odor		Flavor		Texture	
	ANOVA	%	ANOVA	%	ANOVA	%	ANOVA	%
Stored at -12°C	*	43.4	**	11.8	*	28.2	n.s.	
Not Accounted								
For		56.6		88.2		71.8		
Stored at -18°C	**	16.7	*	24.0	*	24.0	*	25.5
Not Accounted								
For		83.3		76.0		76.0		74.5
Stored at -23°C	*	21.0	n.s.		*	18.4	*	25.0
Not Accounted								
For		79.0				81.6		75.0

* : $p > 0.01$

** : $p > 0.05$

n.s.: Not Significant

TABLE 12. MEAN TECHNOLOGICAL PANEL SCORES FOR CREOLE PORK SLICES

Temperature of Storage	Months in Storage	ORGANOLEPTIC FACTOR			
		Color	Odor	Flavor	Texture
-12°C	0	7.4	6.8	6.2	6.9
	3	7.2	6.9	6.9	6.7
	6	6.5	6.6	5.8	6.8
	9	6.7	6.5	5.5	6.7
	12	5.6	6.0	4.7	6.4
-18°C	0	7.4	6.8	6.2	6.9
	3	7.2	7.0	6.9	7.2
	6	6.9	6.9	6.6	6.3
	9	6.6	5.8	4.5	6.1
	12	6.9	6.2	6.1	5.9
-23°C	0	7.4	6.8	6.2	6.9
	3	7.1	6.7	7.2	7.3
	6	6.8	6.9	6.6	6.7
	9	6.8	6.5	6.4	6.4
	12	6.7	6.3	5.9	6.0

TABLE 13. MEAN CONSUMER RATINGS OF SIX MEAT ENTREES BY SHIP
AND DATE SERVED

Meat Entrees and Date(s) Produced	USS BLUEFISH		USS LAPON	
	Date(s) Served	Mean Rating	Date(s) Served	Mean Rating
Oven Fried Chicken	11 June 1975	3.4 ^a	29 Sept 1975	5.5
24 Feb, 17 Mar 1975	18 June 1975		3 Oct 1975	5.7
Swiss Steak w/brown gravy	13 June 1975	4.9 ^a	23 Sept 1975	6.0 ^b
19 Feb 1975	21 June 1975			
Baked Lasagna	9 June 1975	4.6 ^a	26 Sept 1975	5.8 ^b
3, 4 March 1975	17 June 1975			
Sweet and Sour Pork	10 June 1975	4.5 ^a	27 Sept 1975	4.9 ^b
13 March 1975	20 June 1975			
Turkey A La King	14 June 1975	4.4 ^a	25 Sept 1975	4.7 ^b
20 March 1975	19 June 1975			
Creole Pork Slices	12 June 1975	3.5 ^a	24 Sept 1975	5.3 ^b
10, 11 March 1975				
4 April 1975	16 June 1975			

^a No differentiation was made in consumer ratings by date served.

^b Served only once.

TABLE 13. (CONTINUED)

USS HAMMERHEAD		USS FINBACK		ANALYSIS OF RESPONSES			
Date(s) Served	Mean Rating	Date(s) Served	Mean Rating	Total No.	Percent 1-4	Percent 5	Percent 6-9
6 Aug 1975	5.1	15 Aug 1975	3.2	144	33.3	14.6	52.1
13 Aug 1975	7.8	22 Aug 1975	5.9				
4 Aug 1975	7.0	18 Aug 1975	6.2	150	18.0	16.0	66.0
15 Aug 1975	6.7	23 Aug 1975	5.6				
8 Aug 1975	7.0	19 Aug 1975	5.7	133	19.5	11.3	69.2
14 Aug 1975	7.1	28 Aug 1975	6.9				
9 Aug 1975	4.9 ^b	16 Aug 1975	5.9	98	31.6	19.4	49.0
		17 Aug 1975	5.5				
7 Aug 1975	6.3	20 Aug 1975	5.8	81	34.6	11.1	54.3
12 Aug 1975	5.1	27 Aug 1975	5.7				
5 Aug 1975	6.5	21 Aug 1975	3.3	144	36.8	11.1	52.1
16 Aug 1975	6.8	26 Aug 1975	5.6				

APPENDIX A

QUESTIONNAIRE ON CONVENIENCE FOODS

The attached questionnaire has been prepared to obtain information desired by this Center on each of the multi-portion pans ($\frac{1}{2}$ size steam table size) of precooked frozen entrees and vegetables prepared for test by the Submarine Force US Atlantic Fleet.

The test items are:

Entrees

Oven Fried Chicken
Swiss Steak
Lasagna
Sweet and Sour Pork
Turkey ala King
Creole Pork Slices

Vegetables

Glazed Sweet Potatoes
Mexican Corn
Peas with Mushrooms
O'Brien Potatoes
Lyonnaise Potatoes
Escalloped Potatoes

The Natick Development Center would appreciate having some of these twelve products rated by all cooks and leading mess management specialists responsible for the storage, handling, preparation, and serving of these products.

The questionnaire data are intended to supplement the preference data (consumer ratings) to be obtained by SUBLANT and are needed to complete NDC's report covering the development of these items.

These foods represent one type of convenience foods which might prove suitable for future submarine feeding use. Any suggestions concerning these or other types of convenience foods considered suitable for SUBLANT use will be appreciated.

Food Engineering Laboratory
Natick Development Center

Figure 1. Questionnaire completed by cooks or leading mess management specialists

QUESTIONNAIRE FOR COOKS AND LEADING MESS MANAGEMENT SPECIALISTS

Name of Product Tested: _____

Date of Test: _____

YES

NO

1. Removing pan from its protective sleeve was it

Very easy _____
Very difficult _____
Slightly easy _____
Slightly difficult _____

2. Were lids and pans

Loose _____
On tight _____

3. When pans were received in the kitchens were they

Dented _____
Punctured _____
Warped _____
In good condition _____
Had other damage. Explain _____

4. Are directions for preparation legible? _____

5. Are directions for preparation easy to follow? _____

6. Was recommended preparation procedure followed? _____

7. How many hours did it take the product to reach 165°F in your oven? (Report to nearest 1/2 hour) _____

8. What oven temperature was used? _____

9. What temperature was product when removed from your oven? _____

10. How long was product held before serving?

Less than 30 minutes _____
30 minutes _____
45 minutes _____
60 Minutes _____
75 minutes _____
90 minutes or more _____

Figure 1. Continued

- YES NO
11. How many men did one pan serve? _____
12. Was spillage in the oven during heating _____
- None at all _____
- A little _____
- A lot _____
13. Was spillage in handling during serving _____
- None at all _____
- A little _____
- A lot _____
14. Was burning or scorching in cooking _____
- None at all _____
- A little _____
- A lot _____
15. Was there any other problem? _____
- If Yes, explain _____
- _____
- _____
16. How as the product served? _____
- Family style from pan to table _____
- Transferred to serving dishes and then served _____
- family style _____
- Preportioned and served on individual plates _____
17. How would you rate the quality of this product? _____
- Very good _____
- Good _____
- Fair _____
- Poor _____
- Very Poor _____
18. Did you find it convenient to use? _____
19. Did it save time? _____
20. Did you receive any complaints from the consumer about the product? _____
- None at all _____
- A few _____
- A lot _____
- If any, explain _____

Figure 1. Continued

YES

NO

21. Did you receive any compliments from the consumers about this product?

None at all _____

A few _____

A lot _____

If any, explain _____

ANSWER FOR OVEN FRIED CHICKEN ONLY:

22. Were instructions for a crisper chicken followed?

Were they adequate?

If not, how would you change them? _____

Questionnaire on Convenience Foods

This questionnaire has been prepared to obtain information for use by the Food Engineering Laboratory, Natick Development Center and Commander Submarine Forces Atlantic.

The following pre-prepared food items were served aboard the USS BLUEFISH (SSN 675) during the period of 9 through 21 June 1975:

Oven Fried Chicken	_____	Glazed Sweet Potatoes	_____
Swiss Steak	_____	Mexican Corn	_____
Lasagna	_____	Peas with Mushrooms	_____
Sweet and Sour Pork	_____	O'Brien Potatoes	_____
Turkey Ala King	_____	Lyonnaised Potatoes	_____
Creole Pork Slices	_____	Escalloped Potatoes	_____

Indicate your evaluation of the items you actually sampled by placing a number from 1 to 9 beside the item (based upon the table listed below). If you did not sample the item, leave it blank. Any specific comments may be written on the back of this questionnaire.

- 9 - Like extremely
- 8 - Like very much
- 7 - Like moderately
- 6 - Like slightly
- 5 - Neither like nor dislike
- 4 - Dislike slightly
- 3 - Dislike moderately
- 2 - Dislike very much
- 1 - Dislike extremely

Figure 2. Questionnaire completed by the consumer

APPENDIX B

1. Of 41 responses to this question, 38 (92.7%) found it very easy to remove the pan from the sleeve while 3 (7.3%) found it slightly easy. No one found it difficult in any degree.
2. Only 3 (7.3%) of the 41 persons answering this question found pans with loose lids.
3. Forty responses were received. Three (7.5%) reported dented pans, one (2.5%) found a warped pan. No other kind of damage was reported.
4. All respondents (40) said the directions for preparation were legible.
5. All respondents (40) indicated the directions for preparation were easy to follow.
6. Thirty-nine (97.5%) of the persons answering the question said that they followed the directions on the pan. One (2.5%) used a different method for oven fried chicken than that given on the pan.
7. The information received on this question is summarized below.

Heating Time (hours)	Oven Fried Chicken	Swiss Steak w/brown gravy	Baked Lasagna	Sweet and Sour Pork	Turkey a la King	Creole Pork Slices
1	1*					
1.5	2	2	2			1
2	3	2	5	6	7	6

* Number of respondents.

8. The Oven Temperatures Used are Summarized Below.

Oven Temperature	Oven Fried Chicken	Swiss Steak w/brown gravy	Baked Lasagna	Sweet and Sour Pork	Turkey a la King	Creole Pork Slices
177°C	2*					
188°C	1					
191°C	2	3	3		3	2
204°C	2	2	3	5	3	4
219°C		2	1	1		1

* Number of cooks heating product in an oven set at the temperature shown

9. The temperatures of the products when removed from the oven are shown below.

Product Temperature	Oven Fried Chicken	Swiss Steak w/brown gravy	Baked Lasagna	Sweet and Sour Pork	Turkey a la King	Creole Pork Slices
71°C	1*					
74°C	5	4	4	3	3	3
76°C				1		
76°C			1			
77°C	1	3	1	1	2	1
79°C						1
79°C				1	1	1
82°C			1			

* Number of measurements showing the product temperature in left column.

10. Summarized below are the holding times for the meat entrees prior to serving.

	Oven Fried Chicken	Swiss Steak w/brown gravy	Baked Lasagna	Sweet and Sour Pork	Turkey a la King	Creole Pork Slices
30	6*	5	5	4	5	4
30		2	2	2	1	3
45	1					
60					1	
75						
90						

*Respondents served product within 30 minutes, after 30 minutes, etc.

11. The servings obtained per pan are shown below:

Meat Entree	USS Bluefish		USS Lapon	
	Date(s)	Number of Servings	Date(s)	Number of Servings
	Served	Per Pan	Served	Per Pan
Oven Fried Chicken	11 June 1975	6	29 Sept 1975	8
	18 June 1975	8	3 Oct 1975	5
Swiss Steak w/Brown Gravy	13 June 1975	7	23 Sept 1975	4
	21 June 1975	7		
Baked Lasagna	9 June 1975	7	26 Sept 1975	5
	17 June 1975	7		
Sweet and Sour Pork	10 June 1975	9	27 Sept 1975	15
	20 June 1975	7		
Turkey a la King	14 June 1975	7	25 Sept 1975	6
	19 June 1975			
Creole Pork Slices	12 June 1975	7	24 Sept 1975	*
	16 June 1975			

Question No. 11
Continued

Meat Entree	USS Hammerhead		USS Finback	
	Date(s)	Number of Servings	Date(s)	Number of Servings
	Served	Per Pan	Served	Per Pan
Oven Fried Chicken	6 August 1975	10	15 August 1975	*
	13 August 1975	5		
Swiss Steak w/Brown Gravy	4 August 1975	6	18 August 1975	8
	15 August 1975	6	23 August 1975	7
Baked Lasagna	8 August 1975	5	19 August 1975	5
			28 August 1975	10
Sweet and Sour Pork	9 August 1975	7	16 August 1975	*
			17 August 1975	7
Turkey ala King	7 August 1975	10	20 August 1975	*
	12 August 1975	10	27 August 1975	*
Creole Pork Slices	5 August 1975	6	21 August 1975	9
	16 August 1975	6	26 August 1975	*

* No response to question.

12. Thirty-six (87.7%) of the respondents indicated no spillage occurred in the oven while 5 (12.2%) said only a little spillage occurred during heating. The products for which spillage was recorded were: Oven Fried Chicken, one time; Turkey ala King, one time; and Creole Pork Slices, three times. No further details were noted.

13. Forty-one responses were given. Thirty-eight (92.7%) said no spillage occurred during serving and three (7.3%) indicated a little spillage occurred. Oven Fried Chicken was spilled once and Swiss Steak with brown gravy twice. No details were given on how the spillage occurred.

14. Thirty-two (78%) of 41 responses said no burning or scorching occurred during cooking. Nine (22%) indicated only a little scorching or burning was found. Turkey a la King was found to be burned or scorched most often, 5 times, Lasagna 2 times; Swiss Steak with brown gravy and Creole Pork Slices, one time each.

15. Other problems reported were:

- Swiss Steak with brown gravy. Not enough Swiss Steak in each pan.
- Sweet and Sour Pork. Corner of pan has sharp edge and can cut fingers. Labels don't pull off or rip and are difficult to remove.
- Turkey a la King. Sauce needed stirring which made the product appear OK.
- Creole Pork Slices. Sharp edges on corner of containers (lids).

16. The style in which the entree was served is shown below.

Meat	Family Style from Pan to Table	Transferred to Serving Dishes Then Served Family Style	Preproportioned and Served on Individual Plates
Oven Fried Chicken	2*	3	2
Swiss Steak w/Brown Gravy	1	3	3
Baked Lasagna	3	1	3
Sweet and Sour Pork	4	2	
Turkey a la King	2	1	4
Creole Pork Slices	1	2	4

* Number of times served in this manner.

17. The quality of the products was rated as follows:

Rating	Oven Fried Chicken	Swiss Steak w/brown gravy	Baked Lasagna	Sweet and Sour Pork	Turkey a la King	Creole Pork Slices
Very Good	2*	4	1	1	1	
Good	1	2	6	4	5	5
Fair	3	1		1	1	1
Poor	1					
Very Poor						

* Number of respondents.

18. Of 40 responses, 39 cooks (97.5%) said they found the products convenient to use. One cook (2.5%) did not recognize the convenience with oven fried chicken.

19. Forty-one responses were received. Forty (97.6%) said it saved time. One cook (2.4%) did not find it saved any time with Turkey a la King.

20. Thirteen (31.7%) of the cooks reported no complaints, 25 (61%) reported a few complaints, but only 3 (7.3%) reported a lot of complaints. The comments reported by the cooks are:

- a. Swiss Steak with Brown Gravy
 - (1) "Some people said the meat had no taste."
 - (2) "Out of all the men fed only one complaint."
 - b. Baked Lasagna: "Some said it was too dry."
 - c. Sweet and Sour Pork:
 - (1) "Taste was bland".
 - (2) "Not much taste."
 - (3) "Not appetizing."
 - (4) "Don't especially like Sweet and Sour Pork."
 - d. Turkey a la King:
 - (1) "Needs more turkey but good sauce."
 - (2) "Some crew members couldn't be pleased even if you served them broiled lobster and tenderloin steaks."
 - (3) "Under seasoned."
 - e. Creole Pork Slices:
 - (1) "Too much fat."
 - (2) "Tough meat, sauce leaves after taste bad."
 - (3) "They don't like the flavor."
 - (4) "Meal just didn't appeal to them."
21. Nine cooks (22.5%) reported no compliments, 27 (67.5%) reported that there were a few compliments, and 4 cooks (10%) said that crew members gave a lot of compliments. The comments reported by the cooks were:
- a. Oven Fried Chicken: "Most men thought the chicken and sweet potatoes were very good."
 - b. Swiss Steak with Brown Gravy:
 - (1) "The men fed like this way of feeding."
 - (2) "Swiss steak was tender and I felt meal was a well planned meal."
 - (3) "There were compliments about the meat being exceptionally tender."
 - c. Baked Lasagna:
 - (1) "Crew liked the Lasagna."
 - (2) "Most people liked the taste."
 - d. Sweet and Sour Pork:
 - (1) " . . . but 85% of the plates were clean, very little waste."
 - (2) "Better than most of the other products tested."

e. Turkey a la King:

- (1) "Better product of items tried on this ship."
- (2) "Said it was better than way we cook it onboard."

f. Creole Pork Slices:

- (1) "Pretty good in flavor."
- (2) "Tasted fairly good."

22. Fifty-seven percent of the cooks followed the instructions whereas 43% either did not follow them, using the standard method for heating, or used a different method. Only 33% found the instructions for a crisper chicken adequate. Sixty-seven percent found them inadequate. Where methods other than those given on the pans were followed, they were provided by consubstant and consisted of removing chicken from the aluminum pan and placing it onto sheet pans prior to heating.

CONCLUSIONS

1. The feeding concept evaluated in this report is workable aboard submarines when they are in port.
2. Overall, the products tested are acceptable to the consumers.
3. The products tested are stable and acceptable to a technological panel over a prolonged storage period when stored at -18°C .

This paper reports research undertaken at the US Army Natick Research and Development Command and has been assigned No. NATICK/TR-77/013 in the series of papers approved for publication.