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FINAL REPORT

7 May, 1970

DEVELOPMENT OF NON-CREAM STYLE SOUPS

Contract No. NAS 9-9032

Submitted to: NASA Manned Spacecraft Center
2101 NASA Boulevard
Houston, Texas 77058

Submitted by: Whirlpool Corporation
Life Support Systems Group
300 Broad Street
St. Joseph, Michigan 49085

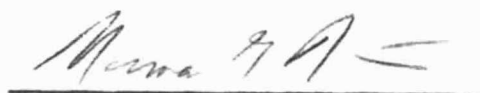
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FINAL REPORT

CR 108603

Task 13 - Development of Non-Cream Style Soups

Contract NAS 9-9032

The objective of this task was to develop at least two new non-cream type soups for use in the Apollo feeding system. The soups were to be shelf stable for two weeks at $100^{\circ} \pm 5^{\circ}\text{F}$ when vacuum packaged in a flexible pouch. The product was to comply with the Quality Assurance Provisions Addendum 2B and the Microbiological Requirements for Space Food Prototypes Addendum 1D.

Thirty servings each of the five soups listed below packaged in aluminum foil laminate pouches were submitted to NASA-MSC for their evaluation:

Vegetable Beef Soup
Oxtail Soup
Mulligatawny Soup
Chicken Noodle Soup
Chicken Vegetable Soup

A Space Food Prototype Production Guide was written for the soups and it is attached to this report and completes this task.

Space Food Prototype
Production Guide SLF-4-10
Whirlpool Corporation
St. Joseph, Michigan
27 April, 1970

NON-CREAM STYLE SOUPS, DEHYDRATED

1. SCOPE

1.1 Scope - This Production Guide covers the manufacture of pre-cooked, freeze-dehydrated, non-cream style soups for use in aerospace feeding.

1.2 Classification - The product shall be of the following types specified (see 6.1):

Type 1 - Mulligatawny Soup

Type 2 - Chicken Noodle Soup

Type 3 - Chicken Vegetable Soup

Type 4 - Vegetable Beef Soup

Type 5 - Oxtail Soup



2. APPLICABLE DOCUMENTS

2.1 The following documents of the issue in effect on date of invitation for bids or request for proposal, form a part of this purchase description to the extent specified herein:

STANDARDS

FEDERAL

Federal Test Standard No. 101, Preservation,
Packaging, and Packing Materials: Test Procedures.

MILITARY

MIL-STD-668 Sanitary Standards for Food Plants.

NASA

ADDENDA TO SPACE FOOD PROTOTYPE PRODUCTION GUIDES

Addendum No. 1 - Microbiological Requirements
for Space Food Prototypes

Addendum No. 2 - Quality Assurance Provisions

(Copies of addenda and specifications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer)

2.2 Other Publications - The following documents form a part of this purchase description to the extent specified herein. Unless otherwise indicated, the issue in effect on the date of invitation for bids or request for proposal shall apply:

U.S. Department of Health, Education and Welfare

**Federal Food, Drug, and Cosmetic Act and
Regulations Promulgated Thereunder.**

(Applications for copies should be addressed to the Superintendent of Documents, US Government Printing Office, Washington, D.C. 20402).

3. REQUIREMENTS

3.1 Preaward Sample. When specified (See 6.1), a sample of the product the supplier proposes to furnish shall be submitted for use in evaluating bids or proposals. The sample shall be packaged, labeled, packed, and marked in accordance with Section 5, and submitted as instructed by the contracting officer. Sample evaluation will be based on compliance with the applicable requirements of 3.5. When a sample is required, the quantity will also be specified.

3.2 First Article. When specified (See 6.1), a sample of the product shall be submitted to the contracting officer for approval before production commences. This sample shall be representative of the product the supplier proposes to furnish under the contract. Sample approval will be based on compliance with the applicable requirements of 3.5. When a sample is required, the quantity will also be specified.

3.3 Material (All Types). All ingredients and materials shall be clean and free from foreign material, foreign odor, foreign color, and foreign flavor.

3.3.1 Vegetables and Fruits, Fresh. The fresh carrots, celery, green peppers, mushrooms, parsley, onions, red potatoes, turnips, apples and lemons shall be of good quality and in excellent condition at time of use.

3.3.2 Spices, Seasonings, and Flavorings. The following commercially available household type spices, seasonings and flavorings shall be in excellent condition at time of use: Bay leaves, cayenne, curry powder, cloves, celery salt, chili powder, garlic powder, mace, mertase, monosodium glutamate, paprika, black pepper, white pepper and worcestershire sauce.

3.3.3 Salt. The salt shall be white, refined sodium chloride with or without anticaking agents. Salt labeled and sold as iodized shall not be used.

3.3.4 Tomatoes, Canned. The canned whole tomatoes shall be commercially available product of high quality.

3.3.5 Sweet Peas, Canned. The canned sweet peas shall be commercially available product of high quality.

3.3.6 Corn, Yellow, Canned. Whole kernel canned yellow corn shall be commercially available product of high quality.

3.3.7 Flour, Wheat. White flour made from wheat and bearing the commercial designation, "All Purpose Flour", shall be used.

3.3.8 Margarine. The margarine shall be commercially processed, colored and flavored and in excellent condition at time of use.

3.3.9 Noodles. Pure egg type noodles, commercially available of high quality, fine size (approximately 1/16 x 1/32 inch) shall be used.

3.3.10 Chicken, Whole. Fresh Grade A broiler type chickens shall be in excellent condition at time of use.

3.3.11 Chicken, Breast Meat. Fresh Grade A chicken breasts shall be in excellent condition at time of use.

3.3.12 Beef, Shank with Meat. Fresh Grade A beef shank shall be in excellent condition at time of use.

3.3.13 Oxtail. Fresh Grade A oxtail shall be in excellent condition at time of use.

3.3.14 Chicken Broth. Canned, commercially available, freshly opened chicken broth shall be used.

3.3.15 Chicken Flavored Stock Base. The chicken flavored stock base shall be commercially available, and of high quality. French's brand was used in development.

3.3.16 Chicken Flavored Concentrate. The chicken flavored concentrate CF-1, manufactured by Florasynth, Inc. or its equivalent shall be used.

3.3.17 Beef Broth. Canned, commercially available, freshly opened beef broth shall be used.

3.3.18 Beef Flavored Concentrate. The beef flavored concentrate F-1, manufactured by Florasynth, Inc. or its equivalent shall be used.

3.3.19 Nitrogen. The nitrogen shall be labeled USP Grade and be water or liquid nitrogen pumped.

3.4 Processing. Components complying with 3.3 shall be processed in accordance with 3.4.1 through 3.4.1.12.

3.4.1 Preparation of Components. Components shall be prepared as follows:

3.4.1.1 Carrots and turnips shall be cleaned and diced into 1/4 inch cubes for processing.

- 3.4.1.2 Potatoes shall be peeled and diced into 1/4 inch cubes.
- 3.4.1.3 Apples shall be peeled, cored, and cut into 1/8 x 1/2 x 3/4 inch slices.
- 3.4.1.4 Onions shall be peeled and finely chopped.
- 3.4.1.5 Celery shall be washed and diced into approximately 1/4 inch cubes.
- 3.4.1.6 Green peppers shall be cleaned and finely chopped.
- 3.4.1.7 Mushrooms shall be finely chopped for processing.
- 3.4.1.8 Uncooked chicken breasts shall be diced into 1/4 x 1/2 inch cubes.
- 3.4.1.9 Lemon juice shall be squeezed from fresh lemons.
- 3.4.1.10 Sweet peas, canned shall be drained.
- 3.4.1.11 Tomatoes, canned, whole, shall be drained, chopped, and hard cores removed.
- 3.4.1.12 Noodles shall be freshly cooked in boiling water until tender (approximately 20 minutes) and drained.

3.5 Formula. The product formulations shall be in accordance with Table I.

3.5.1 Mixing and Cooking. The mixing of ingredients (see 3.5) shall be as shown in 3.5.1.1 through 3.5.1.5.

3.5.1.1 Type 1, Mulligatawny Soup. The diced raw chicken breasts, onions, carrots, celery, green pepper and apples shall be sauteed in butter. The chicken broth, flour, curry powder, mace, cloves, parsley, tomatoes and monosodium glutamate shall be added to the mixture and simmered for approximately 1 hour or until vegetables are tender. The mixture shall be heated to $185^{\circ} \pm 5^{\circ}\text{F}$ and maintained at that temperature for 5 minutes. The solids shall be separated from the liquor while still hot and each placed in freezer drying trays, covered, and frozen.

3.5.1.2 Type 2, Chicken Noodle Soup. Fresh chicken stock shall be prepared from broiler chicken cooked in sufficient water to cover meat. Add salt and cook until bones are easily removed. The chicken shall be skinned and deboned and the meat diced into 1/4 x 1/2 inch cubes. The onions shall be sauteed in margarine until glossy and added to the chicken stock. The fresh lemon juice shall be added with stirring. The mushrooms, tomatoes, white pepper, celery salt, chicken flavor base and chicken flavor concentrate shall be added. The flour and water shall be mixed thoroughly and added gradually to the broth with constant stirring. The cooked, diced chicken shall be added to the broth in equal proportions of dark and light meat. The mixture shall be simmered until vegetables are tender. Then add the previously cooked noodles and previously drained canned peas. The mixture shall be heated to $185^{\circ} \pm 5^{\circ}\text{F}$ and maintained at that temperature for 5 minutes. The solids shall be separated from the liquor while still hot and each placed in freezer drying trays, covered, and frozen.

TABLE I - PRODUCT FORMULA

Ingredients	Quantity (Percent by Weight)
<u>Type 1 - Mulligatawny Soup</u>	
Chicken	14.68
Chicken Broth	62.37
Tomatoes	2.95
Onions	1.91
Carrots	2.10
Celery	2.35
Green Pepper	4.23
Apples	3.93
Margarine	3.03
Flour, Wheat	2.24
Curry Powder	.082
Mace	.002
Cloves	.004
Parsley	.040
Monosodium Glutamate	.082
	100.000

Type 2 - Chicken Noodle Soup

Chicken	6.22
Chicken Stock	72.39
Lemon Juice	0.12
Onions	1.69
Peas	3.88
Mushrooms	1.29
Tomatoes	4.98
Margarine	0.11
Salt	0.15
White Pepper	0.01
Flour	1.28
Noodles	2.57
Chicken Flavor Base	0.23

Table I - Product Formula (continued)

6.

Ingredients	Quantity (Percent by Weight)
<u>Type 2 - Chicken Noodle Soup (cont.)</u>	
Chicken Flavor Concentrate	0.45
Celery Salt	0.11
Water	<u>4.52</u>
	100.00

Type 3 - Chicken Vegetable Soup

Chicken Stock	63.970
Chicken	5.270
Salt	0.249
Onions	3.030
Potatoes	10.680
Tomatoes	13.150
Garlic Powder	0.002
Paprika	0.009
Black Pepper	0.010
Chili Powder	0.022
Corn	3.280
Chicken Flavor Concentrate	0.299
Monosodium Glutamate	<u>0.029</u>
	100.000

Type 4 - Vegetable Beef Soup

Beef Shank with Meat	25.96
Water	59.56
Bay Leaves	0.002
Salt (No. 1)	0.22
Carrots	2.59
Celery	2.59
Onions	1.73
Potatoes	3.46
Salt (No. 2)	0.33
Black Pepper	0.033
Tomatoes	3.48
Mertase	0.002
Monosodium Glutamate	0.033
Beef Flavor Concentrate	<u>0.010</u>
	100.000

Table I - Product Formula (continued)

Ingredients	Quantity (Percent by Weight)
<u>Type 5 - Oxtail Soup</u>	
Oxtail	24.020
Beef Broth	51.309
Flour	0.446
Margarine	2.624
Carrots	2.676
Turnips	2.398
Onions	2.485
Celery	1.981
Water	11.594
Salt	0.110
White Pepper	0.003
Cayenne	0.001
Worcestershire Sauce	0.152
Lemon Juice	0.149
Monosodium Glutamate	0.052
	100.000

3.5.1.3 Type 3 - Chicken Vegetable Soup. Chicken stock shall be prepared the same as Type 2 (see 3.5.1.2). The onions, potatoes, corn, tomatoes, garlic powder, paprika, black pepper, chili powder and salt shall be added to fresh chicken stock and simmered until vegetables are tender. The cooked diced meat in equal proportions of dark and light meat diced into 1/4 x 1/2 inch cubes, chicken flavored concentrate and monosodium glutamate, shall be added with stirring. Simmer for 5 to 10 minutes. The mixture shall be heated to $185^{\circ} \pm 5^{\circ}\text{F}$ temperature and maintained at that temperature for 5 minutes. The solids shall be separated from the liquor while still hot and each placed in freeze drying trays, covered, and frozen.

3.5.1.4 Type 4 - Vegetable Beef Soup. The fresh beef shank with meat shall be cooked in water with bay leaves and salt (no. 1) until tender. The meat shall be removed from the bones and chopped into small pieces. The carrots, celery, onions, potatoes, salt (no. 2), black pepper, tomatoes, beef flavor concentrate, mertase and monosodium glutamate shall be added to the beef broth and the mixture simmered 30 to 40 minutes. Excess fat from the surface of the mixture shall be skimmed off. The mixture shall be heated to $185^{\circ} \pm 5^{\circ}\text{F}$ and maintained at that temperature for 5 minutes. The product shall be poured in freeze drying trays, covered, and frozen.

3.5.1.5 Type 5 - Oxtail Soup. The fresh oxtail shall be cut in small pieces, washed, drained, and sprinkled with salt and white pepper. Dredge with flour and fry in margarine until brown. Add beef broth (see 3.3.17) and simmer until meat is easily removed from bones. The meat shall be removed from bones and added to the broth. The carrots, turnips, onions, and celery shall be parboiled 20 minutes. The parboiled vegetables and vegetable water shall then be added to the broth and simmered until vegetables are tender. The fresh lemon juice, worcestershire sauce, cayenne, and monosodium glutamate shall be added while the mixture is simmering. The mixture shall be heated to $185^{\circ} \pm 5^{\circ}\text{F}$ and maintained at that temperature for 5 minutes. The product shall be poured in freeze drying trays, covered, and frozen.

3.5.2 Freeze Dehydration. The product shall be freeze-dehydrated at a maximum pressure of 1.0 mm and a maximum dry product temperature of 120°F . The dehydrator vacuum shall be broken with nitrogen.

3.5.3 Finished Product. The finished product shall comply with the requirements of 3.5.4, 3.5.5, and Table II, which are applicable to the type of product specified.

3.5.4 Moisture. The finished product shall have a moisture content of not greater than 3.0 percent (see 4.2.1).

3.5.5 Microbiological. The finished product shall comply with the requirements specified in Addendum #1 (see 4.2.3).

3.6 The product shall be processed in establishments meeting the sanitary requirements of MIL-STD-668.

3.7 All deliveries shall conform in every respect to the provisions of the Federal Food, Drug, and Cosmetic Act and Regulations Promulgated Thereunder.

TABLE II - FINISHED PRODUCT REQUIREMENTS

Item No.	Requirements
<u>Dehydrated Product</u>	
1.	There shall be no foreign odor, such as, but not limited to, burnt, scorched, stale, sour, rancid, musty or moldy odor.
2.	There shall be no foreign material, such as, but not limited to, dirt, insect, insect part, wood, paper, paint, glass or metal.
3.	There shall be no foreign color.
4.	The product shall be dry and show no evidence of incomplete dehydration.
5.	When packaged in flexible packages (see 5.1.2), the weight and tolerance per serving shall comply with 5.1.2.

Table II - Finished Product Requirements (continued)

Item No.	Requirements																		
<u>Rehydrated Product</u>																			
6.	The product shall rehydrate with the following amounts of hot water (150°F) and within the specified time when tested in accordance with Addendum #2.																		
	<table><tr><th></th><th><u>Water (fl. oz.) (150°F)</u></th><th><u>Time Mins.</u></th></tr><tr><td>Type 1 - Mulligatawny Soup</td><td>4</td><td>3-5</td></tr><tr><td>Type 2 - Chicken Noodle Soup</td><td>4</td><td>3-5</td></tr><tr><td>Type 3 - Chicken Vegetable Soup</td><td>4</td><td>5-10</td></tr><tr><td>Type 4 - Vegetable Beef Soup</td><td>4</td><td>3-5</td></tr><tr><td>Type 5 - Oxtail Soup</td><td>4</td><td>3-5</td></tr></table>		<u>Water (fl. oz.) (150°F)</u>	<u>Time Mins.</u>	Type 1 - Mulligatawny Soup	4	3-5	Type 2 - Chicken Noodle Soup	4	3-5	Type 3 - Chicken Vegetable Soup	4	5-10	Type 4 - Vegetable Beef Soup	4	3-5	Type 5 - Oxtail Soup	4	3-5
	<u>Water (fl. oz.) (150°F)</u>	<u>Time Mins.</u>																	
Type 1 - Mulligatawny Soup	4	3-5																	
Type 2 - Chicken Noodle Soup	4	3-5																	
Type 3 - Chicken Vegetable Soup	4	5-10																	
Type 4 - Vegetable Beef Soup	4	3-5																	
Type 5 - Oxtail Soup	4	3-5																	
7.	The product shall have an acceptable flavor, color, and odor when tested in accordance with Addendum #2.																		
8.	The rehydrated product shall have a good consistency.																		

4. QUALITY ASSURANCE PROVISIONS

4.1 Quality Assurance Provisions shall be in accordance with Addendum #2.

4.2 Tests

4.2.1 Moisture. The analysis for moisture content shall be as follows:

(a) Weigh two (2) samples of approximately 2 grams each of finished product into tared, dry aluminum dishes (approximately 2 to 2-1/2 inches in diameter and 3/4 inch in depth) with tight fitting covers.

(b) Place the dishes, with cocked lids in a vacuum oven for 16 hours at 60°C under a pressure of not more than 50 mm of Mercury. During drying, admit to the oven a slow current of air (approximately 2 bubbles per second) dried by passing through concentrated sulfuric acid.

(c) Remove the dishes, close the lids and allow to cool to room temperature in a desiccator, then weigh.

(d) Calculate the percent moisture by dividing the weight loss by the original sample weight and multiplying by 100. The average of the duplicate samples shall be reported to the nearest 0.1 percent.

4.2.2 Headspace Oxygen. The oxygen content shall be determined in accordance with method 237 of Fed. Std. No. 101 - Preservation, Packaging, and Packing Materials: Test Procedures. The oxygen content shall be reported to the nearest 0.1 percent.

4.2.3 Microbiological. The finished product shall be tested in accordance with Addendum #1.

5. PREPARATION FOR DELIVERY

5.1 Packaging. After dehydration, the product shall be immediately packaged in accordance with 5.1.1 or 5.1.2.

5.1.1 Interim Packaging in Cans. The finished product shall be filled into cans of any convenient size. The cans shall be evacuated and flushed with nitrogen enough times so that the headspace gas contains not more than 2.0 percent oxygen (see 4.2.2). Cans shall be held at not more than 50°F until packaged in accordance with 5.1.2.

5.1.2 Flexible Packages. Unless otherwise specified (see 6.1) the following weights of products shall be put into flexible material (see 6.1).

	<u>Weight (grams)</u>
Type 1 - Mulligatawny Soup	12 ± 1.5
Soup Base	- 8 grams
Soup Solids, Dehydrated	- 4 grams
Type 2 - Chicken Noodle Soup	13 ± 1.5
Soup Base	- 9 grams
Soup Solids, Dehydrated	- 4 grams
Type 3 - Chicken Vegetable Soup	12 ± 1.5
Soup Base	- 8 grams
Soup Solids, Dehydrated	- 4 grams
Type 4 - Vegetable Beef Soup	12 ± 1.5
Type 5 - Oxtail Soup	12 ± 1.5

5.2 Labeling, Packaging and Marking. Assembly and sub-assembly documents will contain the detailed instructions for labeling, intermediate packaging, packing and marking. However, when the product is to be shipped other than as part of a sub-assembly or assembly (see 6.1), labeling, packaging and marking shall be in accordance with 5.2.1 through 5.2.3.

5.2.1 Labeling. The following information shall appear on a label glued to the package:

- (a) Name of the product
- (b) Number of this Production Guide
- (c) Net weight
- (d) Date of manufacture
- (e) Name of manufacture
- (f) Lot number
- (g) Contract or proposal number

5.2.2 Packing. The cans or flexible packages shall be packed and sealed (glue or tape) in a fluted fiberboard box. The contents shall be prevented from shifting by a tight fit or by padding.

5.2.3 Marking. The following information shall appear on a label or be marked on the box:

- (a) Name and address of addressee
- (b) Name and address of addressor
- (c) An attention line
- (d) The words FRAGILE or HANDLE WITH CARE

6. NOTES

6.1 Ordering Data. Purchasers should exercise any desired options offered herein and procurement documents should specify the following:

- (a) Title, number and date of this Production Guide
- (b) Type of product required (see 1.2).
- (c) The packaging materials required (see 5.1.2)
- (d) When the weight of the product per package is other than that specified (see 5.1.2 and Item 5, Table II)
- (e) When preaward sample is to be furnished, and the quantity (see 3.1)
- (f) When first article sample is to be furnished, and the quantity (see 3.2)
- (g) When product is to be shipped as other than assembly or sub-assembly (see 5.2).