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# **Logistical Analysis of Convenience Food Substitution in a Typical Navy Menu for a Wasp-Class Amphibious Assault Ship (LHD)**

by

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## Preface

The Convenience Food Logistics Model (CFLM) and its supporting Database Management Information System (DBMS) were developed by Information Technology Systems, Inc. (ITS) as a decision support system for the Naval Supply Systems Command (NAVSUP). The project was completed under the direction of US Army Natick Research, Development & Engineering Center from September 1994 until June 1995. The purpose of this effort was to develop a computer-based information system that projects the potential impact of prepared or "convenience" foods on food service aboard 21st century Navy warships.

This report is one of four reports published as a result of the efforts for the Navy Food Service 2000 (NFS 2000) project. The purpose of this project was to investigate the impact of using convenience foods in Navy food service. The other three reports focus on the development of a logistics model used to analyze the impact of substituting Armed Forces Recipe Service menu items with similar convenience food items and the results of the NFS 2000 project. Their respective titles and Technical Report numbers are: "Convenience Food Logistics Model - Design," Miller, J., Saraf, S., PhD., and Evangelos, K., NATICK/TR-96/016; "Convenience Food Logistics Model - User's Manual," Miller, J. and Evangelos, K., NATICK/TR-96/017; and "Analysis of the Impact of Convenience Foods on Navy Food Service," Evangelos, K., Adams, S., Dr.PH, RD, Short, P. et al., NATICK/TR-96/019.

The authors extend their appreciation to Dean-Michael Sutherland, Operations Research Systems Analyst, Advanced Systems Concepts Division, for his efforts in project documentation and technical editing.



# **Logistical Analysis of Convenience Food Substitution in a Typical Navy Menu for a Wasp Class Amphibious Assault Ship (LHD)**

## **Summary**

The substitution of convenience foods for selected recipes in a typical Navy menu on an Amphibious Assault Ship (LHD) can result in logistical benefits if the substitution strategy is designed and implemented properly. For the ship and menu studied with the current data in the Convenience Food Logistics Database, it was found that main entrees and side dishes offer the greatest potential for achieving logistical benefits through convenience food substitution. In addition, desserts can provide some small benefits in terms of reductions in labor requirements, but with an increase in freezer storage requirements. Substitutions for breakfast entrees, breakfast side dishes, breads and appetizers can only provide limited benefits as a degree of "convenience" substitution already exists in current menus for these recipe categories. When applying these results one should be aware of the data used and scenarios simulated in this study. The study was performed using an inport scenario using current prices for convenience foods and A-Ration items. A-Ration items refer to the ingredients purchased through the Navy's Supply System, which are used to prepare recipes from the Armed Forces Recipe Service (AFRS) from scratch or from a mix. As food item prices and availability change over time, the analysis may need to be updated.



## **1. Introduction**

The Convenience Foods Logistics Model (CFLM) was developed to aid in analyzing the impact of convenience food substitution on logistical requirements of Navy menus. With the CFLM, a user can run scenarios to simulate the logistical impact of various category-specific substitution percentages for given selection and attendance patterns for any typical Navy ship. The user can also generate the optimal substituted menus for either food cost, labor hours or storage minimization objectives. A detailed description of the CFLM and its algorithms can be found in the "Convenience Foods Logistics Model - Design" report. Instructions for using the CFLM model are provided in the "Convenience Foods Logistics Model - User's Guide".

This report describes an analysis, conducted using the CFLM, of the impact of convenience food substitution on logistical requirements for a typical Navy menu on an LHD ship. The analysis results are provided to validate the algorithms in the CFLM. The next section of this report describes the test menu and the logistical requirements for a complete cycle of this menu. Section 3 describes the methodology used in analyzing the impacts of convenience food substitution in the test menu and Section 4 describes the results of this analysis.

## **2. Test Menu and Other Ship Parameters**

The ship selected for this analysis is the USS WASP LHD-1, a US Navy Amphibious Assault Ship. In the CFLM, the ship type is used to provide the typical complement size and the dry, chilled and freezer storage available on the ship. The relevant ship information for the USS WASP LHD-1 is shown in Appendix A, which is used in the scenarios simulated in this study. As shown in Appendix A, the USS WASP has a typical complement size of 3151 and has approximately 12,294, 5171, and 5062 cubic feet of available dry, chilled and freezer storage, respectively. The CFLM model uses built-in assumptions about attendance patterns, which can be overridden by the user, if desired. This study applies the CFLM's built-in attendance rate assumptions. The built-in attendance rates in the CFLM were developed through an extensive survey of existing Navy ships for when both inport and at sea. The logistical analysis described herein concentrates on the inport scenario.

The menu used in this study was developed by reviewing typical menus in use on LHD ships. Using these typical menus, a 35-day test menu with three meals per day was developed. In developing the test menu, care was taken to substitute any recipe items for which cost, labor or storage information was not complete in the CFLM databases by similar recipe items for which logistical information was more complete and current. The test menu is provided in Appendix B.

The first step in the study was to assess the logistical requirements for the test menu without any convenience food substitution. The CFLM provides capability for computing logistical requirements not only for a substituted menu but also for a regular Navy menu. The logistical requirements are developed using the CFLM databases storing the information from the Armed Forces Recipe Service (AFRS) recipe cards, the Group 89 Federal Stock Catalog, and the Price List (NAVFSSNOTE 7330), which provides cost information on the ingredients). Appendix C provides the computations of the logistical requirements generated by the CFLM for the test menu. As shown in Appendix C, the test menu results in \$269,805 food cost, 3308 labor hours, and 6067, 2965, and 2575 cubic feet in dry, chilled, and freezer storage requirements, respectively.

### **3. Analysis Methodology**

The CFLM allows simulation of logistical impact by recipe categories. The categories refer to specific parts of the meals in the menu. For example, the model currently allows for simulation of different substitution percentages for appetizers, breakfast entrees, breakfast side dishes, breads, entrees, side dishes and desserts.

To study the impacts of the convenience food substitutions, it was decided to evaluate the following two types of substitution scenarios:

- A. Substitution percentages of 10%, 20%, 30% and 40% across all recipe categories.
- B. Substitution percentages of 10%, 20%, 30%, 40% and 50% for each individual recipe category. (For example, substitution percentages of 10% - 50% were simulated for only desserts, allowing no substitutions for any other recipe categories.)

The scenarios of type A provide general trends for the logistical impacts of increasing convenience food substitutions while scenarios of type B help in identification of category-specific substitution strategies. As we will see in Section 4, substitutions in different recipe categories have vastly different effects on logistical requirements. Therefore, substitution strategies that allow for varying substitution percentages for different recipe categories are likely to yield more cost and labor savings than uniform substitution strategies.

The scenarios of type A and B were simulated with cost, labor and freezer storage minimization objectives. In addition, a weighted objective consisting of 50% weight for cost and 50% weight for freezer storage was also simulated. The following section will summarize the results obtained from this analysis.

## 4. Analysis Results

The results for the scenarios simulated are shown in Table 1. Some of the important results are graphically shown in Figures 1 through 4. Based on the results in Table 1, the following observations can be made.

### 4.1 Scenarios with Uniform Substitution for All Recipe Categories (Type A)

By studying the results from type A scenarios, one can make the following observations:

- o In general, as the substitution percentage is increased, labor hours, dry and chilled storage requirements decrease.
- o Cost and freezer storage requirements eventually increase if substitution percentages are increased beyond certain limits. However, for substitution percentages below these limits, one could also reduce cost and freezer storage requirements. For example, as shown in Figure 1 (p. 10), food cost can be reduced from \$269,805 to \$234,049 (a reduction of 13.3%) when all recipe categories are allowed to substitute up to 30% by convenience foods. Similarly, freezer storage requirements can be reduced from 2575 cubic feet to 2179 cubic feet (a reduction of 16%) with a substitution percentage of 10%, as shown in Figure 2 (p. 11). In fact, as shown in Figure 3 (p. 12), one can reduce logistical requirements related to both food cost and freezer storage in addition to reducing requirements for labor, dry, and chilled storage by implementing a 20% substitution by convenience foods. At first glance, it may appear counter-intuitive that food costs or freezer storage requirements can be reduced by convenience food substitutions. The following are possible causes for this outcome:
  - The test menu under study is not optimized for logistical requirements among the "nonconvenience" recipes. In comparison of logistics for a nonoptimized menu with those for optimized menus, reductions in food cost and freezer storage requirements are plausible. The computed savings are partly due to convenience food substitution and partly due to optimization of a nonoptimized menu. To isolate the impacts of convenience food substitution, one would need first to optimize the input Navy menu for the objective under consideration by allowing for the substitutions among similar "nonconvenience" recipe items. The logistical requirements for this optimized menu should then be compared with those for the substituted menu.

**Table 1. Logistical Requirements for Test Menu for Varying Substitution Percentages**

	Substitution Percentage										Storage (Cu. Ft.)		
	Breakfast				Breakfast								
Optimization Objective	Appetizers	Entrees	Side Dishes	Breads	Entree	Side Dishes	Desserts	Cost (\$)	Labor Hrs		Dry	Chilled	Freezer
No Optimization	0	0	0	0	0	0	0	269,805	3,308		6,067	2,965	2,575
Cost Minimization	10	10	10	10	10	10	10	239,877	3,167		5,460	1,900	3,432
	20	20	20	20	20	20	20	234,687	3,086		4,610	1,738	3,838
	30	30	30	30	30	30	30	234,049	2,976		3,977	1,570	4,243
	40	40	40	40	40	40	40	236,591	2,863		3,290	1,438	4,870
	10	0	0	0	0	0	0	269,816	3,300		6,021	2,956	2,615
	20	0	0	0	0	0	0	270,379	3,300		5,984	2,956	2,653
	30	0	0	0	0	0	0	270,994	3,297		5,955	2,954	2,685
	40	0	0	0	0	0	0	271,834	3,294		5,924	2,951	2,724
	50	0	0	0	0	0	0	272,759	3,290		5,897	2,949	2,762
	0	10	0	0	0	0	0	270,219	3,303		5,960	2,914	2,675
	0	20	0	0	0	0	0	270,985	3,316		5,855	2,914	2,695
	0	30	0	0	0	0	0	271,890	3,321		5,805	2,912	2,798
	0	40	0	0	0	0	0	273,082	3,339		5,767	2,910	2,920
	0	50	0	0	0	0	0	275,339	3,338		5,749	2,896	3,041
	0	0	10	0	0	0	0	269,844	3,303		6,066	2,942	2,588
	0	0	20	0	0	0	0	269,886	3,298		6,065	2,918	2,602
	0	0	30	0	0	0	0	269,943	3,293		6,062	2,885	2,622
	0	0	40	0	0	0	0	270,005	3,289		6,058	2,854	2,641
	0	0	0	10	0	0	0	269,570	3,304		6,045	2,964	2,588
	0	0	0	20	0	0	0	269,420	3,303		6,016	2,961	2,609
	0	0	0	30	0	0	0	269,342	3,311		5,999	2,960	2,621
	0	0	0	40	0	0	0	269,313	3,312		5,993	2,959	2,625
	0	0	0	50	0	0	0	269,332	3,315		5,988	2,959	2,630
	0	0	0	0	10	0	0	251,805	3,244		5,828	2,921	2,747
	0	0	0	0	20	0	0	245,955	3,180		5,558	2,883	2,869
	0	0	0	0	30	0	0	242,723	3,104		5,253	2,836	2,943
	0	0	0	0	40	0	0	240,831	3,028		5,000	2,809	3,099
	0	0	0	0	50	0	0	239,683	2,975		4,841	2,756	3,240
	0	0	0	0	0	10	0	259,611	3,235		5,985	2,050	3,040
	0	0	0	0	0	20	0	259,666	3,216		5,685	1,962	3,208
	0	0	0	0	0	30	0	260,767	3,190		5,499	1,877	3,372
	0	0	0	0	0	40	0	262,651	3,169		5,261	1,820	3,549
	0	0	0	0	0	50	0	265,467	3,168		5,060	1,750	3,883
	0	0	0	0	0	0	10	267,840	3,327		5,959	2,946	2,627
	0	0	0	0	0	0	20	267,224	3,322		5,853	2,937	2,649
	0	0	0	0	0	0	30	267,219	3,310		5,809	2,937	2,649
	0	0	0	0	0	0	40	267,703	3,282		5,691	2,928	2,760
	0	0	0	0	0	0	50	268,748	3,251		5,593	2,917	2,899

**Table 1. Logistical Requirements for Test Menu for Varying Substitution Percentages (Cont'd)**

Optimization Objective	Substitution Percentage								Cost (\$)	Labor Hrs	Storage (Cu. Ft.)		
	Breakfast				Breakfast						Dry	Chilled	Freezer
	Appetizers	Entrees	Side Dishes	Breads	Entree	Side Dishes	Desserts						
No Optimization	0	0	0	0	0	0	0	0	269,805	3,308	6,067	2,965	2,575
Labor Minimization	10	10	10	10	10	10	10	10	296,868	2,806	5,405	2,091	4,027
	20	20	20	20	20	20	20	20	318,986	2,467	4,570	1,668	4,938
	30	30	30	30	30	30	30	30	340,717	2,231	4,043	1,179	6,135
	40	40	40	40	40	40	40	40	360,885	2,086	3,545	915	6,844
	10	0	0	0	0	0	0	0	271,703	3,286	6,031	2,945	2,646
	20	0	0	0	0	0	0	0	273,127	3,267	6,005	2,921	2,719
	30	0	0	0	0	0	0	0	274,093	3,258	5,996	2,914	2,753
	40	0	0	0	0	0	0	0	275,044	3,248	5,983	2,905	2,788
	50	0	0	0	0	0	0	0	276,267	3,243	5,937	2,903	2,846
	0	10	0	0	0	0	0	0	271,864	3,288	6,009	2,949	2,668
	0	20	0	0	0	0	0	0	273,096	3,281	5,927	2,900	2,801
	0	30	0	0	0	0	0	0	278,520	3,283	5,909	2,781	2,925
	0	40	0	0	0	0	0	0	279,464	3,294	5,849	2,778	2,993
	0	50	0	0	0	0	0	0	280,327	3,312	5,748	2,778	3,024
	0	0	10	0	0	0	0	0	269,908	3,302	6,065	2,933	2,586
	0	0	20	0	0	0	0	0	270,000	3,296	6,062	2,908	2,594
	0	0	30	0	0	0	0	0	270,080	3,291	6,061	2,882	2,603
	0	0	40	0	0	0	0	0	270,170	3,286	6,058	2,854	2,613
	0	0	0	10	0	0	0	0	270,819	3,288	6,038	2,961	2,703
	0	0	0	20	0	0	0	0	271,365	3,281	6,027	2,961	2,755
	0	0	0	30	0	0	0	0	272,059	3,281	6,012	2,961	2,833
	0	0	0	40	0	0	0	0	272,812	3,280	5,996	2,961	2,917
	0	0	0	50	0	0	0	0	273,325	3,280	5,985	2,961	2,972
	0	0	0	0	10	0	0	0	273,952	3,170	5,825	2,930	2,753
	0	0	0	0	20	0	0	0	277,436	3,079	5,532	2,920	2,874
	0	0	0	0	30	0	0	0	282,983	3,002	5,246	2,858	3,141
	0	0	0	0	40	0	0	0	286,952	2,938	5,064	2,799	3,297
	0	0	0	0	50	0	0	0	289,972	2,874	4,787	2,728	3,448
	0	0	0	0	0	10	0	0	277,344	3,144	5,924	2,220	3,040
	0	0	0	0	0	20	0	0	284,999	3,027	5,654	1,925	3,181
	0	0	0	0	0	30	0	0	289,283	2,936	5,567	1,668	3,455
	0	0	0	0	0	40	0	0	297,675	2,874	5,443	1,531	3,579
	0	0	0	0	0	50	0	0	303,730	2,824	5,186	1,469	3,691
	0	0	0	0	0	0	10	0	280,106	3,177	5,916	2,945	3,079
	0	0	0	0	0	0	20	0	287,793	3,084	5,766	2,924	3,462
	0	0	0	0	0	0	30	0	292,527	3,030	5,656	2,907	3,873
	0	0	0	0	0	0	40	0	297,597	3,014	5,557	2,879	4,106
	0	0	0	0	0	0	50	0	300,219	3,010	5,458	2,871	4,322

**Table 1. Logistical Requirements for Test Menu for Varying Substitution Percentages (Cont'd)**

Optimization Objective	Substitution Percentage								Cost (\$)	Labor Hrs	Storage (Cu. Ft.)		
	Breakfast		Breakfast		Entree	Side Dishes	Desserts	Dry			Chilled	Freezer	
	Appetizers	Entrees	Side Dishes	Breads									
No Optimization	0	0	0	0	0	0	0	269,805	3,308	6,067	2,965	2,575	
Cost and Freezer Storage	10	10	10	10	10	10	10	262,141	3,186	4,940	2,897	2,301	
	20	20	20	20	20	20	20	255,851	3,068	4,387	2,518	2,418	
Minimization	30	30	30	30	30	30	30	255,635	2,929	3,834	2,110	2,721	
(Equally Weighted)	40	40	40	40	40	40	40	258,939	2,812	3,391	1,900	3,188	
	10	0	0	0	0	0	0	269,917	3,303	6,028	2,959	2,610	
	20	0	0	0	0	0	0	270,489	3,301	5,993	2,956	2,648	
	30	0	0	0	0	0	0	271,141	3,297	5,972	2,951	2,680	
	40	0	0	0	0	0	0	272,018	3,293	5,943	2,949	2,719	
	50	0	0	0	0	0	0	272,919	3,291	5,909	2,949	2,759	
	0	10	0	0	0	0	0	270,505	3,322	5,961	2,965	2,582	
	0	20	0	0	0	0	0	271,384	3,326	5,900	2,951	2,662	
	0	30	0	0	0	0	0	272,776	3,325	5,835	2,888	2,771	
	0	40	0	0	0	0	0	274,184	3,311	5,783	2,885	2,894	
	0	50	0	0	0	0	0	275,783	3,328	5,742	2,882	3,029	
	0	0	10	0	0	0	0	269,875	3,303	6,066	2,942	2,582	
	0	0	20	0	0	0	0	269,947	3,298	6,065	2,918	2,590	
	0	0	30	0	0	0	0	270,047	3,293	6,062	2,885	2,601	
	0	0	40	0	0	0	0	270,152	3,289	6,058	2,854	2,612	
	0	0	0	10	0	0	0	269,688	3,308	6,062	2,965	2,578	
	0	0	0	20	0	0	0	269,644	3,311	6,053	2,964	2,583	
	0	0	0	30	0	0	0	269,690	3,314	6,046	2,964	2,589	
	0	0	0	40	0	0	0	269,628	3,312	6,031	2,964	2,597	
	0	0	0	50	0	0	0	269,719	3,314	6,024	2,964	2,604	
	0	0	0	0	10	0	0	258,727	3,235	5,644	2,937	2,471	
	0	0	0	0	20	0	0	254,994	3,174	5,388	2,923	2,425	
	0	0	0	0	30	0	0	250,910	3,121	5,204	2,895	2,460	
	0	0	0	0	40	0	0	249,646	3,059	5,054	2,856	2,509	
	0	0	0	0	50	0	0	250,201	3,009	4,920	2,840	2,560	
	0	0	0	0	0	10	0	273,560	3,253	5,625	2,965	2,353	
	0	0	0	0	0	20	0	269,614	3,203	5,474	2,644	2,384	
	0	0	0	0	0	30	0	271,078	3,163	5,318	2,379	2,487	
	0	0	0	0	0	40	0	273,786	3,135	5,221	2,254	2,637	
	0	0	0	0	0	50	0	278,661	3,106	5,087	2,173	2,801	
	0	0	0	0	0	0	10	268,698	3,310	5,959	2,956	2,573	
	0	0	0	0	0	0	20	268,608	3,300	5,918	2,953	2,574	
	0	0	0	0	0	0	30	268,823	3,266	5,803	2,940	2,581	
	0	0	0	0	0	0	40	268,354	3,263	5,705	2,929	2,670	
	0	0	0	0	0	0	50	269,298	3,233	5,640	2,921	2,799	

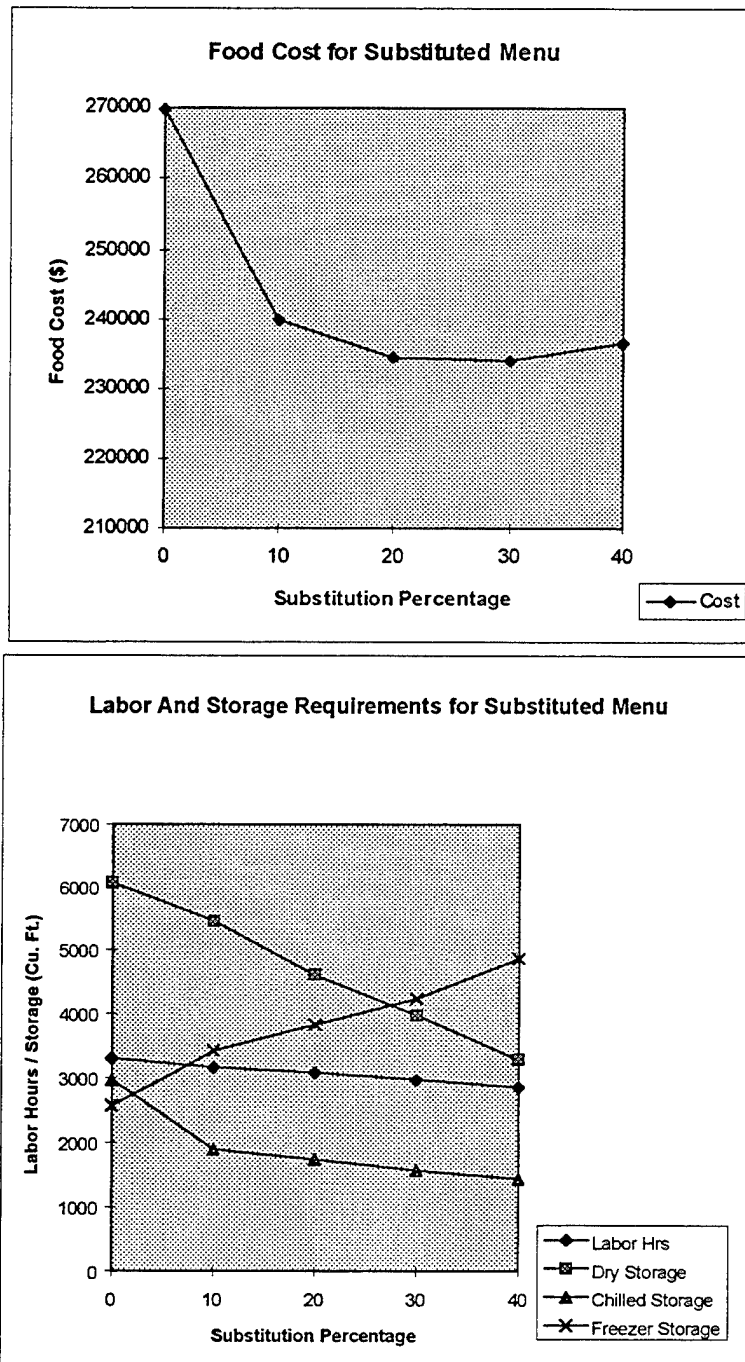
**Table 1. Logistical Requirements for Test Menu for Varying Substitution Percentages (Cont'd)**

Optimization Objective	Substitution Percentage								Cost (\$)	Labor Hrs	Storage (Cu. Ft.)		
	Breakfast				Entree	Side Dishes		Desserts			Dry	Chilled	Freezer
	Appetizers	Entrees	Side Dishes	Breads									
No Optimization	0	0	0	0	0	0	0	269,805	3,308	6,067	2,965	2,575	
Freezer Storage Minimizati	10	10	10	10	10	10	10	281,035	3,144	4,931	2,903	2,179	
	20	20	20	20	20	20	20	289,868	3,049	4,276	2,828	2,197	
	30	30	30	30	30	30	30	295,865	2,951	3,834	2,541	2,503	
	40	40	40	40	40	40	40	302,052	2,891	3,476	2,311	2,961	
	10	0	0	0	0	0	0	270,528	3,300	6,043	2,957	2,607	
	20	0	0	0	0	0	0	271,289	3,297	6,016	2,955	2,644	
	30	0	0	0	0	0	0	271,908	3,294	5,991	2,955	2,675	
	40	0	0	0	0	0	0	272,822	3,288	5,967	2,945	2,715	
	50	0	0	0	0	0	0	273,731	3,285	5,937	2,945	2,755	
	0	10	0	0	0	0	0	270,958	3,333	5,961	2,965	2,579	
	0	20	0	0	0	0	0	272,672	3,342	5,901	2,952	2,654	
	0	30	0	0	0	0	0	275,564	3,335	5,867	2,918	2,749	
	0	40	0	0	0	0	0	277,176	3,356	5,821	2,909	2,874	
	0	50	0	0	0	0	0	278,852	3,377	5,751	2,883	3,008	
	0	0	10	0	0	0	0	269,877	3,303	6,066	2,942	2,582	
	0	0	20	0	0	0	0	269,950	3,298	6,064	2,919	2,590	
	0	0	30	0	0	0	0	270,051	3,294	6,061	2,887	2,601	
	0	0	40	0	0	0	0	270,159	3,288	6,058	2,855	2,612	
	0	0	0	10	0	0	0	269,820	3,309	6,065	2,965	2,577	
	0	0	0	20	0	0	0	269,866	3,311	6,058	2,965	2,582	
	0	0	0	30	0	0	0	269,822	3,313	6,049	2,964	2,588	
	0	0	0	40	0	0	0	269,912	3,315	6,042	2,964	2,596	
	0	0	0	50	0	0	0	269,977	3,319	6,032	2,964	2,604	
	0	0	0	0	10	0	0	275,271	3,228	5,603	2,947	2,364	
	0	0	0	0	20	0	0	277,038	3,167	5,371	2,940	2,296	
	0	0	0	0	30	0	0	278,122	3,108	5,183	2,925	2,304	
	0	0	0	0	40	0	0	279,822	3,064	5,082	2,913	2,337	
	0	0	0	0	50	0	0	282,440	3,012	4,946	2,872	2,393	
	0	0	0	0	0	10	0	273,580	3,253	5,625	2,965	2,353	
	0	0	0	0	0	20	0	278,061	3,232	5,374	2,942	2,312	
	0	0	0	0	0	30	0	280,234	3,192	5,286	2,746	2,454	
	0	0	0	0	0	40	0	282,024	3,166	5,183	2,587	2,606	
	0	0	0	0	0	50	0	283,221	3,125	5,095	2,351	2,779	
	0	0	0	0	0	0	10	269,831	3,268	5,973	2,953	2,566	
	0	0	0	0	0	0	20	269,821	3,251	5,896	2,947	2,566	
	0	0	0	0	0	0	30	268,992	3,264	5,801	2,938	2,580	
	0	0	0	0	0	0	40	268,966	3,263	5,727	2,930	2,669	
	0	0	0	0	0	0	50	269,450	3,234	5,640	2,924	2,799	

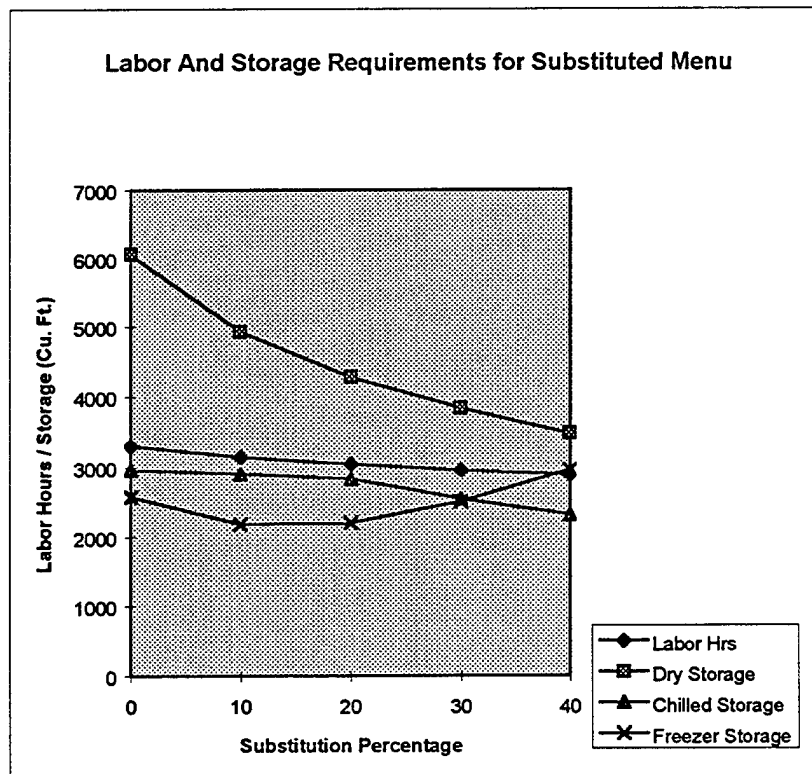
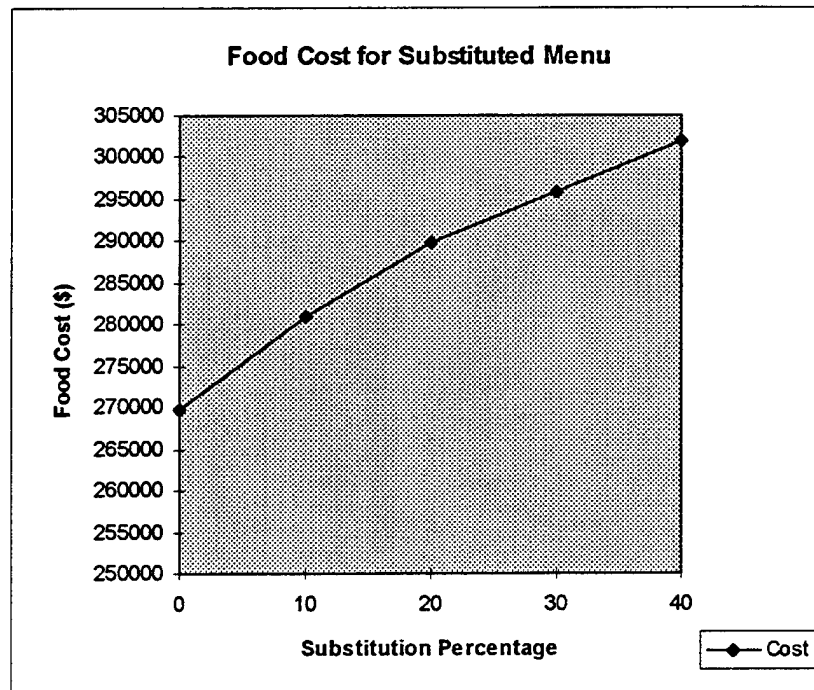
- Currently, the CFLM categorizes recipes based solely on recipe category (entree, dessert, side dish, etc.) and product type (chicken, fish, pasta, etc.). These two categorizations are used to determine which convenience foods may serve as substitutions for selected recipes. A result of having just two criteria is a list of substitutes with some being potentially incompatible replacements, such as turkey pot pie for roast turkey. To reduce the occurrence of these types of substitutions, one may add a third level of recipe categorization to capture the "expensiveness"/quality of item.
- Freezer storage requirements for some convenience food substitutes are less than those for corresponding recipes because convenience foods have already eliminated the preparation waste. For example, it may take less freezer storage to store chicken patties than to store frozen chicken pieces or whole chickens.

As shown in Figure 4 (p.13), the labor hour requirements could be reduced by up to 37% (40% substitution, labor minimization scenario) but food cost and freezer storage requirements increase astronomically in this scenario. This scenario results in a decline of labor hour requirements from 3308 hours to 2086 hours, but at the same time increases food costs by approximately \$91,000 (34%) and freezer storage requirements by 4269 cubic feet (166%). Although the freezer storage requirements increase dramatically, the total storage requirements (dry, chilled, and freezer combined) are very similar to those for the input menu.

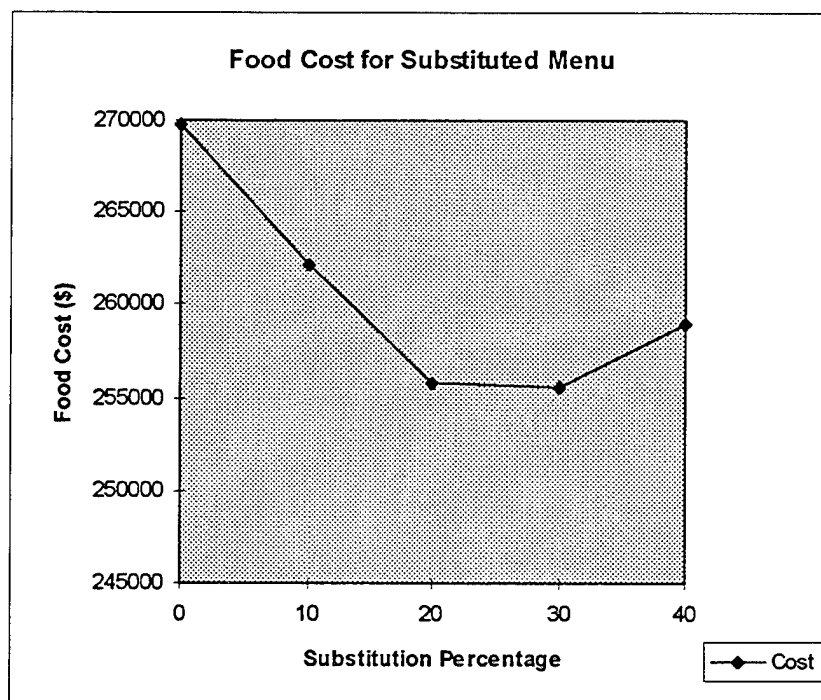
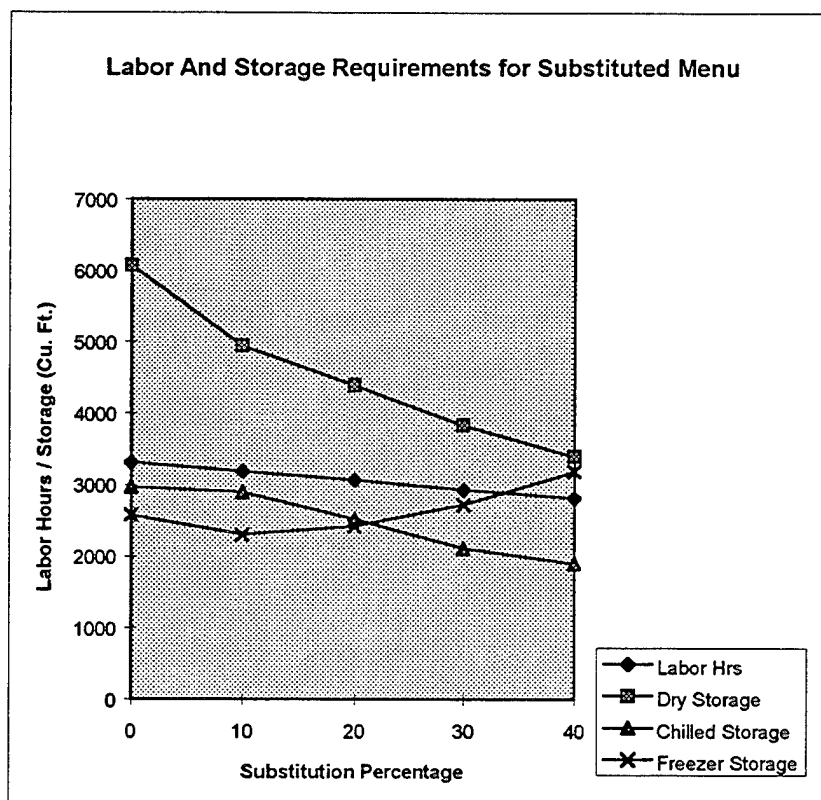




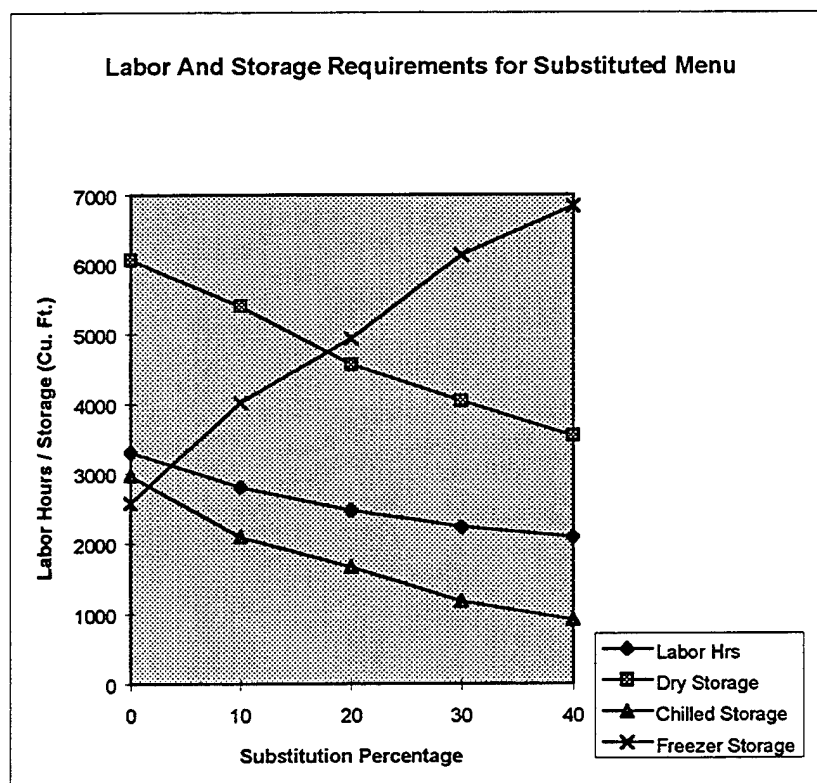
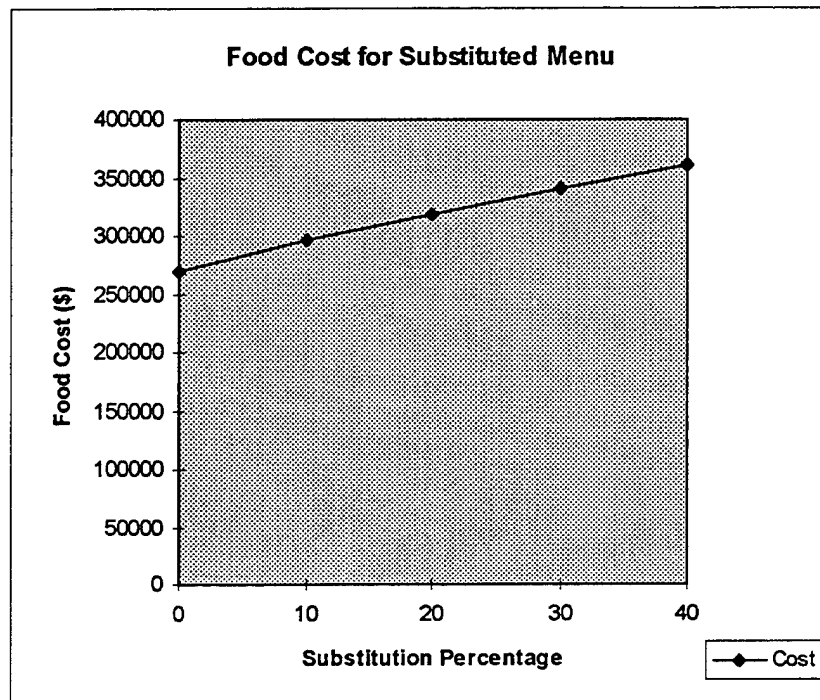
**Figure 1. Logistical Requirements for Test Menu for Varying Substitution Percentage for All Categories (Cost Minimization Objective)**



**Figure 2 . Logistical Requirements for Test Menu for Varying Substitution Percentage for All Categories (Freezer Storage Minimization Objective)**



**Figure 3. Logistical Requirements for Test Menu for Varying Substitution Percentage for All Categories (Equally Weighted Cost and Freezer Storage Minimization Objective)**



**Figure 4. Logistical Requirements for Test Menu for Varying Substitution Percentage for All Categories (Labor Minimization Objective)**

## 4.2 Scenarios for Category Specific Substitutions (Type B)

By studying the results for type B scenarios, one can observe the following:

- o Substitutions of appetizers, breakfast entrees, breakfast side dishes and breads with convenience foods do not result in significant savings in labor hours, food costs, or chilled storage requirements. However, dry storage requirements could be reduced somewhat with increases in freezer storage requirements by a similar magnitude. This insensitivity of logistical requirements to convenience food substitution in these recipe categories may be a result of the fact that these recipe categories may already incorporate a significant amount of convenience type foods in the current Navy menus. Any further substitution for these recipe categories does not seem to result in any substantial logistical benefits. Another reason for this outcome is that these recipe categories are smaller contributors to the total logistical requirements. (For example, breakfasts tend to have smaller portions and additionally, the attendance rate for breakfast is lower than that for other meals. Hence, breakfast entrees and breakfast side dishes are relatively smaller contributors to the overall logistical requirements.)
- o Substitutions of desserts with convenience foods may reduce labor hour requirements but will increase food cost and freezer storage requirements. Freezer storage requirements increase sharply as the substitution percentage is increased beyond a certain limit, unless the minimize freezer storage objective is selected for optimization.
- o Entrees and side dishes provide the greatest savings in food costs and labor hours as substitution percentages are increased. However, freezer storage requirements increase as substitution percentage is increased unless freezer storage is included in the optimization objective.

As recipe categories behave differently when substitution percentages are increased, strategies that allow for differing substitution percentages for different recipe categories are likely to yield more logistical benefits than the uniform substitution strategies. As an example, consider the uniform substitution scenarios shown in Figure 3. This figure shows how the logistical requirements change as substitution percentages are increased across the board when equally weighted cost and freezer storage is used as the objective function. For the 10% and 20% substitution scenarios all five of the logistical requirements (cost, labor, dry, chilled and freezer

storage) are less than those for the input menu. However, when substitution percentages are increased from 20% to 30%, the freezer storage requirements (2721 cubic feet) exceed those for the input menu (2575 cubic feet). Hence, if one wanted a uniform substitution strategy offering maximum logistical benefits without allowing any of the five logistical requirements to exceed those for the input menu, one would stop at 20%. However, consider the scenario where equally weighted cost and freezer storage objectives are minimized with substitution percentages of 45%, 30%, and 20% for entrees, side dishes, and desserts, and zero for all other recipe categories. A comparison of logistical requirements for this scenario to those for the uniform 20% substitution scenario is provided in Table 2. As shown in Table 2, one can obtain substantially more logistical savings through a well designed nonuniform substitution strategy.

**Table 2. Comparison of Uniform and Nonuniform Substitution Strategies**

	Input	Uniform		Non Uniform	
	Menu	Substitution Scenario	Savings	Substitution Scenario	Savings
Substitution % -- Appetizers		20%		0%	
Substitution % -- Bkf Entrees		20%		0%	
Substitution % -- Bkf Side Dishes		20%		0%	
Substitution % -- Breads		20%		0%	
Substitution % -- Entrees		20%		45%	
Substitution % -- Side Dishes		20%		20%	
Substitution % -- Desserts		20%		30%	
Food Costs (\$)	269,805	255,851	5.17%	248,732	7.81%
Labor Hours	3,308	3,066	7.32%	2,890	12.64%
Dry Storage (cu ft)	6,067	4,387	27.69%	4,125	32.01%
Chilled Storage (cu ft)	2,965	2,518	15.08%	2,506	15.48%
Freezer Storage (cu ft)	2,575	2,418	6.10%	2,345	8.93%

## 5. Conclusions

It appears that substantial logistical benefits can be derived through the use of convenience foods; however, the results presented in this report should not be extrapolated to other situations. Results may vary for a different ship, at-sea status, and different selection rates than those modeled here. In addition, the results are dependent on the prices and convenience food items contained in the CFLM database. As the prices and availability of various food items change in the future, one would need to conduct a follow-up study to update the results. The CFLM is

based on several assumptions which should be understood before applying the results of this study.

The current menus may not be logistically "optimized" among the nonconvenience recipes. A portion of the savings may even be realized without any convenience food substitutions. It is conceivable that by optimizing the current menus among nonconvenience recipes, one can realize part of the savings.

As discussed above, the CFLM categorizes recipes based solely on recipe category (entree, dessert, side dish, etc.) and product type (chicken, fish, pasta, etc.). These two categorizations are used to determine which convenience foods may serve as substitutions for selected recipes. A result of having just two criteria is a list of substitutes with some being potentially incompatible replacements, such as turkey pot pie for roast turkey. To reduce the occurrence of these types of substitutions, one may add a third level of recipe categorization to capture the "expensiveness"/quality of item.

There are several effects not modeled by the CFLM, which may enhance the savings through convenience food substitutions. Firstly, the convenience food prices in the CFLM are based on current market prices. If the Navy or Department of Defense begins procuring these items in bulk, the competition among food manufacturers could drive down prices, which would lead to additional savings. Secondly, reductions in labor hour requirements may involve fewer food service personnel aboard the ship, leading to reduced operations and maintenance costs throughout the ship's remaining life cycle.

The results of the study have different implications for existing and new ships. Existing ships have limited space for freezer storage and the scenarios that require more freezer space than available on the ship may entail more frequent replenishments, thereby increasing operating costs. When applying the results for design of new ships, this is not as important a consideration because the designer could potentially design the ship with more freezer space and less dry storage space. It should also be noted that in most substitution scenarios presented in Table 1, total storage requirements (dry, chilled and freezer combined) are less than those using the input menu. This indicates that the conversion of some dry or chilled space on existing ships to freezer space, in conjunction with convenience food substitutions, is a viable strategy.

## 6. References

1. Information Technologies Solutions, Inc., "Convenience Foods Logistics Model - User's Guide", Report to Department of the Army, U.S. Soldier Systems Command (1995).
2. Miller, Judy and Saraf, Sampat, "Convenience Foods Logistics Model - Design", Report to Department of the Army, U.S. Soldier Systems Command (1995).





## **APPENDIXES**



## **Appendix A**

### **User Inputs to CFLM model**

**Menu File:** C:\CFLM\MENUS\Test Menu.DBF

**Ship Name:** USS WASP: LHD - 1

**Ship Status:** Inport

**Available Storage (Based only on personnel subsisting from the general mess) (cubic feet)**

**Dry:** 12293.63

**Chill:** 5170.79

**Freezer:** 5062.08

**Number of Customers:** 3151

**Attendance Rates Used (%):**

	<b>Weekday Rates</b>	<b>Weekend Rates</b>
<b>Breakfast:</b>	40.0	28.3
<b>Lunch:</b>	83.3	36.7
<b>Dinner:</b>	40.0	36.7
<b>Midrats:</b>	0	0

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**Logistical Requirements for Miscellaneous Menu Items During this Menu Cycle:**

**Storage (cubic feet)**

**Dry:** 3062.77

**Chill:** 1492.00

**Freezer:** 871.25

**Cost:** \$100,605.00

**Water (cu ft):** 1197.38

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**Logistical Requirements for Salad Bar Menu Items During this Menu Cycle:**

**The values shown are based on a 14-day period.**

**Storage (cubic feet)**

**Dry:** 782.78

**Chill:** 2190.99

**Freezer:** 1.43

**Cost:** \$32,780.37

**Water (cu ft):** 69.08



## **Appendix B**

### **Test Menu**



# TEST MENU

DAY	MEAL	ITEM #	ITEM NAME	SELECTION
1	1	D02200	FRENCH TOAST	57.1
		D02507	WAFFLES (PANCAKE MIX)	57.1
		Q04600	HASHED BROWN POTATOES	47.8
		E00200	BUTTERED HOMINY GRITS	47.8
		F00700	GRILLED EGGS TO ORDER	57.1
		M01200	COTTAGE CHEESE SALAD	47.8
		W00401	DOUGHNUTS	70.9
1	2	L05600	SOUTHERN FRIED CATFISH	62.7
		Q04800	MASHED POTATOES	71.2
		E00800	RICE PILAF	71.2
		Q01601	BROWN GRAVY (MIX)	49.6
		QG0202	BROCCOLI (FRESH)	71.2
		QG0207	CORN-ON THE-COB W/ BUTTER	71.2
		D01502	HUSHPUPPIES (CORNBREAD MIX)	80
		W00302	CAKE, LAYER	70.9
		J01000	PINEAPPLE CRUNCH	70.9
		J01405	CHOCOLATE CREAM PUDDING	70.9
		J00600	FRUIT CUP	51.8
1	3	E00500	STEAMED RICE	71.2
		Q05001	FRANCONIA POTATOES	71.2
		Q02500	VEGETABLE STIR FRY	71.2
		QG0302	BEANS (GREEN) (FROZEN)	71.2
		O01602	CHICKEN OR TURKEY GRAVY	49.6
		W01811	ROLLS, BREAD, PAN RUSK (DINNER)	80.0
		W01632	PIE, BAKED, 8", 9" OR 10" (FZ)	70.9
		W02708	COOKIES, OATMEAL W/ RAISINS	70.9
		J00702	FRUIT FLAVORED GELATIN	70.9
2	1	L11001	CORNERD BEEF HASH (CANNED)	62.7
		L00700	GRILLED STEAK	57.1
		L07103	GRILLED HAM SLICES	57.1
		D00101	BAKING POWDER BISCUITS	80
		O01700	CREAM GRAVY	49.6
		D02505	PANCAKES (PANCAKE MIX)	57.1
		E00102	HOT BREAKFAST CEREALS	57.1
		Q04700	HOME FRIED POTATOES	47.8
		DG0703	CINNAMON SWEET ROLLS	70.9
2	2	L09200	BARBECUED SPARERIBS	62.7
		L14703	TURKEY A LA KING (FROZEN)	62.7
		E00500	STEAMED RICE	71.2
		M04002	POTATO SALAD WITH VINEGAR	71.2
		QG0208	COLLARD GREENS (FRESH)	71.2
		MG0213	CAULIFLOWER, FRESH	71.2

DAY	MEAL	ITEM #	ITEMNAME	SELECTION
		D01500	CORNBREAD (CORNBREAD MIX)	80
		PG0110	VEGETABLE SOUP (CONDENSED)	51.8
		H00201	BROWNIES (CHOCOLATE	70.9
		H01101	PEANUT BUTTER COOKIES BAR	70.1
		M02900	ITALIAN PASTA SALAD	71.2
2	3	P00400	ONION SOUP	51.8
		L03700	SALISBURY STEAK	62.7
		L13300	BAKED TUNA AND NOODLES	62.7
		Q04400	BAKED POTATOES	71.2
		E00500	STEAMED RICE	71.2
		Q01701	GLAZED CARROTS, CANNED	71.2
		QG0307	BRUSSEL SPROUTS (FROZEN)	71.2
		Q01600	BROWN GRAVY	49.6
		I02201	CHERRY PIE (PIE FILLING,	70.9
		W02739	CHEESECAKE, (FROZEN)	70.9
		J01400	VANILLA CREAM PUDDING	70.9
		J00700	FRUIT GEL (FRUIT CKTL W/O	70.9
3	1	L00203	GRILLED CANADIAN BACON	57.1
		L05200	CREAMED CHIPPED BEEF	57.1
		D02506	TOASTED PLAIN WAFFLES	57.1
		L08900	GRILLED SAUSAGE PATTIES	57.1
		Q04603	LYONNAISE POTATOES	47.8
		D01201	CRUMB CAKE (MIX)	80
3	2	PG0107	MINESTRONE SOUP (CONDENSED)	51.8
		L03800	SPAGHETTI WITH MEAT SAUCE	62.7
		L14800	CHICKEN CACCIATORE	62.7
		Q06100	BAKED HUBBARD SQUASH	71.2
		QG0202	BROCCOLI (FRESH)	71.2
		W02736	CAKE, LOAF, (FROZEN)	70.9
		H02001	CHOCOLATE CHIP	70.9
		J01403	PINEAPPLE CREAM PUDDING	70.9
		M01500	CUCUMBER AND ONION SALAD	71.2
3	3	P00201	CHICKEN NOODLE SOUP	51.8
		L14200	HONEY GLAZED ROCK CORNISH	62.7
		L07300	SCALLOPED HAM & POTATOES (CN	62.7
		E00800	RICE PILAF	71.2
		O02101	APPLE DRESSING	71.2
		Q00101	VEGETABLE COMBOS: BROCCOLI	71.2
		Q00800	HARVARD BEETS	71.2
		I03100	PECAN PIE	70.9
		J01600	BREAD PUDDING	70.9
		M03100	KIDNEY BEAN SALAD	71.2
4	1	D02300	FRENCH TOAST PUFF	57.1
		D02506	TOASTED PLAIN WAFFLES	57.1
		L09101	BAKED SAUSAGE LINKS (BKFT)	57.1

DAY	MEAL	ITEM #	ITEM NAME	SELECTION
		Q04602	HASH BRN POT	71.2
		E00102	HOT BREAKFAST CEREALS	57.1
		D03601	SWEET DOUGH W/GLAZE (MIX)	80
4	2	P00800	NAVY BEAN SOUP	51.8
		L03502	TOMATO MEAT LOAF	62.7
		L08501	GRILLED PORK CHOPS	62.7
		O02101	APPLE DRESSING	71.2
		Q04800	MASHED POTATOES	71.2
		QG0305	LIMA BEANS (FROZEN)	71.2
		QG0320	SUCCOTASH (FROZEN)	71.2
		H02103	VANILLA COOKIES	70.9
		H00903	OATMEAL RAISIN COOKIES (MIX)	70.9
		M00501	CARROT AND PINEAPPLE SALAD	71.2
4	3	PG0105	CHICKEN W/ RICE SOUP	51.8
		L01200	COUNTRY FRIED STEAK	62.7
		L11301	BAKED KNOCKWURST WITH	62.7
		E00500	STEAMED RICE	71.2
		Q05100	POTATOES AU GRATIN	71.2
		Q00106	VEGETABLE COMBOS: CORN	71.2
		QG0115	PEAS, BLACKEYED (CANNED)	71.2
		O01600	BROWN GRAVY	49.6
		G02901	PINEAPPLE UPSIDE DOWN CAKE	70.9
		J00804	BLUEBERRY CRISP (PREP. PIE	70.9
		I00601	BANANA CREAM PIE	70.9
		M04000	POTATO SALAD	71.2
5	1	L00202	GRILLED BACON	57.1
		L09100	GRILLED SAUSAGE LINKS (BKFT.)	57.1
		D02200	FRENCH TOAST	57.1
		D02506	TOASTED PLAIN WAFFLES	57.1
		Q04602	HASH BRN POT	71.2
		E00200	BUTTERED HOMINY GRITS	47.8
		F00700	GRILLED EGGS TO ORDER	57.1
		ZE0001	BREAKFAST CEREAL, ASSORTED,	57.1
		J00501	YOGURT FRUIT CUP	70.9
		M01200	COTTAGE CHEESE SALAD	47.8
		D01903	LONGJOHNS	70.9
5	2	L11904	HERBED BAKED FISH	62.7
		L01800	BARBECUED BEEF CUBES	62.7
		E00401	BUTTERED NOODLES	71.2
		QG0320	SUCCOTASH (FROZEN)	71.2
		Q03200	SOUTHERN FRIED OKRA	71.2
		E00800	RICE PILAF	71.2
		PG0106	MANHATTAN CLAM CHOWDER	51.8
		I00901	APPLE PIE (PREPARED PIE	70.9

DAY	MEAL	ITEM #	ITEM NAME	SELECTION
		G02800	STRAWBERRY CAKE (MIX)	70.9
		H00400	CHEWY NUT BARS	70.9
		J01405	CHOCOLATE CREAM PUDDING	70.9
		M02700	GERMAN COLE SLAW	71.2
5	3	L04101	SWEDISH MEATBALLS (BEEF &	62.7
		L12100	SHRIMP SCAMPI	62.7
		E00401	BUTTERED NOODLES	71.2
		E00500	STEAMED RICE	71.2
		OG0317	PEAS AND CARROTS (FROZEN)	71.2
		Q05800	STEWED TOMATOES	71.2
		PG0113	CREAM OF MUSHROOM	51.8
		H01002	DOUBLE CHOCOLATE CHIP BARS	70.9
		M02504	JELLIED STRAWBERRY SALAD	71.2
6	1	L11001	CORNEED BEEF HASH (CANNED)	62.7
		L00700	GRILLED STEAK	57.1
		L07103	GRILLED HAM SLICES	57.1
		D00101	BAKING POWDER BISCUITS	80
		O01700	CREAM GRAVY	49.6
		D02503	BUCKWHEAT PANCAKES	57.1
		D02504	BUTTERMILK PANCAKES	57.1
		E00102	HOT BREAKFAST CEREALS	57.1
		Q04700	HOME FRIED POTATOES	47.8
		D03700	QUICK COFFEE CAKE (BISCUIT	80
6	2	L02800	CHILI CON CARNE	62.7
		L10904	OVEN FRIED CHICKEN FILLET	62.7
		O00800	SWEET SOUR SAUCE	49.6
		Q04501	FRENCH FRIED POTATOES	71.2
		OG0201	ASPARAGUS (FRESH)	71.2
		P00802	KNICKERBOCKER SOUP (BEAN,	51.8
		G01005	MARBLE CAKE (MIX)	70.9
		J01006	PEACH CRUNCH (FROZEN	70.9
		M05001	APPLE, CELERY, AND RAISIN SALAD	71.2
6	3	L01300	PEPPER STEAK	62.7
		L08000	PORK CHOP SUEY	62.7
		E00701	PORK FRIED RICE (GRIDDLE)	71.2
		MG0218	CHOW MEIN NOODLES, # 10	80
		Q01201	CALICO CABBAGE	71.2
		Q01701	GLAZED CARROTS, CANNED	71.2
		P01803	CHICKEN-NOODLE VEGETABLE	51.8
		H00900	OATMEAL COOKIES (MIX)	70.9
		G02103	LEMON POUND CAKE (POUND	70.9
		J01500	BAKED RICE PUDDING	70.9
		J00703	FRUIT GELATIN (CRUSHED ICE	70.9
7	1	L00203	GRILLED CANADIAN BACON	57.1

DAY	MEAL	ITEM #	ITEM NAME	SELECTION
		L03000	CREAMED GROUND BEEF	57.1
		D02400	APPLE FRITTERS	70.9
		D02506	TOASTED PLAIN WAFFLES	57.1
		L08900	GRILLED SAUSAGE PATTIES	57.1
		Q04603	LYONNAISE POTATOES	47.8
		D03702	QUICK FRENCH COFFEE CAKE	70.9
7	2	L16100	ROAST TURKEY	62.7
		L06900	BAKED HAM	62.7
		O02000	CORN BREAD DRESSING	71.2
		Q06700	CANDIED SWEET POTATOES	71.2
		QG0311	CORN, WHOLE, KERNEL (FROZEN)	71.2
		Q02600	HERBED GREEN BEANS	71.2
		W01811	ROLLS, BREAD, PAN RUSK (DINNER)	80
		O00900	PINEAPPLE SAUCE	49.6
		A00911	CRANBERRY SAUCE, #10	49.6
		PG0104	CHICKEN NOODLE SOUP	51.8
		G00601	BANANA CAKE (BANANA CAKE	70.9
		W01632	PIE, BAKED, 8", 9" OR 10" (FZ)	70.9
		J01403	PINEAPPLE CREAM PUDDING	70.9
		M04500	THREE BEAN SALAD	71.2
7	3	L02500	LASAGNA	62.7
		PG0111	VEGETABLE W/ BEEF SOUP	51.8
		L08801	BAKED ITALIAN SAUSAGE LINKS	62.7
		MG0235	PEPPERS, SWEET, FRESH, DICED	71.2
		MG0229	ONIONS, SLICED, DRY	71.2
		Q04700	HOME FRIED POTATOES	47.8
		QG0202	BROCCOLI (FRESH)	71.2
		Q02701	CORN O'BRIEN	71.2
		H02000	CHOCOLATE CHIP COOKIES	70.9
		I01003	CHERRY COBBLER	70.9
		J00704	STRAWBERRY GELATIN	70.9
8	1	L11001	CORNED BEEF HASH (CANNED)	62.7
		L00700	GRILLED STEAK	57.1
		L07100	BAKED CANNED HAM	62.7
		D00101	BAKING POWDER BISCUITS	80
		Q01700	CREAM GRAVY	49.6
		D03701	QUICK APPLE COFFEE	70.9
		E00200	BUTTERED HOMINY GRITS	47.8
		Q04700	HOME FRIED POTATOES	47.8
		W00401	DOUGHNUTS	70.9
8	2	PG0112	CREAM OF CHICKEN	51.8
		L01700	BRAISED BEEF AND NOODLES	62.7
		L11903	LEMON BAKED FISH (PERCH)	62.7
		E00800	RICE PILAF	71.2

DAY	MEAL	ITEM #	ITEM NAME	SELECTION
		Q06000	CLUB SPINACH	71.2
		Q02701	CORN O'BRIEN	71.2
		K00900	LEMON SAUCE	49.6
		H01002	DOUBLE CHOCOLATE CHIP BARS	70.9
		J01600	BREAD PUDDING	70.9
		M03400	MACARONI SALAD	71.2
8	3	PG0110	VEGETABLE SOUP (CONDENSED)	51.8
		L15001	CHICKEN POT PIE (CANNED	62.7
		L01800	BARBECUED BEEF CUBES	62.7
		E00401	BUTTERED NOODLES	71.2
		QG0316	PEAS (FROZEN)	71.2
		ZD0004	JELLY ROLL	70.9
		I02201	CHERRY PIE (PIE FILLING,	70.9
		J01400	VANILLA CREAM PUDDING	70.9
		M02501	JELLIED ORANGE SALAD	71.2
9	1	L00203	GRILLED CANADIAN BACON	57.1
		L05200	CREAMED CHIPPED BEEF	57.1
		D02504	BUTTERMILK PANCAKES	57.1
		D02503	BUCKWHEAT PANCAKES	57.1
		E00102	HOT BREAKFAST CEREALS	57.1
		L08900	GRILLED SAUSAGE PATTIES	57.1
		W01818	ROLLS,SWEET	70.9
9	2	P02203	LOGGING SOUP (CONDENSED)	51.8
		L06400	CREOLE MACARONI (AM CHOP	62.7
		L11301	BAKED KNOCKWURST WITH	62.7
		Q05001	FRANCONIA POTATOES	71.2
		Q01200	FRIED CABBAGE	71.2
		Q00202	BAKED BEANS (PINTO)	71.2
		I01200	SWEET POTATO PIE	70.9
		G01002	BLACK WALNUT CAKE	70.9
		J01000	PINEAPPLE CRUNCH	70.9
		M05301	COUNTRY STYLE TOMATO SALAD	49.6
9	3	PG0110	VEGETABLE SOUP (CONDENSED)	51.8
		L02400	STUFFED CABBAGE ROLLS	62.7
		L07103	GRILLED HAM SLICES	57.1
		Q05301	SCALLOPED POTATOES AND	71.2
		F00100	BAKED MACARONI AND CHEESE	71.2
		Q00700	LYONNAISE GREEN OR WAX	47.8
		QG0208	COLLARD GREENS (FRESH)	71.2
		G02501	SPICE CAKE (YELLOW CAKE MIX)	70.9
		H00500	SHORTBREAD COOKIES	70.9
		J00702	FRUIT FLAVORED GELATIN	70.9
10	1	L00202	GRILLED BACON	57.1
		L09100	GRILLED SAUSAGE LINKS (BKET.)	57.1

DAY	MEAL	ITEM #	ITEM NAME	SELECTION
		D02300	FRENCH TOAST PUFF	57.1
		D02506	TOASTED PLAIN WAFFLES	57.1
		Q04603	LYONNAISE POTATOES	47.8
		F00700	GRILLED EGGS TO ORDER	57.1
		ZE0001	BREAKFAST CEREAL, ASSORTED,	57.1
		J00501	YOGURT FRUIT CUP	70.9
		M01200	COTTAGE CHEESE SALAD	47.8
		W01818	ROLLS, SWEET	70.9
10	2	P01000	CHICKEN GUMBO SOUP	51.8
		L15500	FRIED CHICKEN	62.7
		L13600	CREOLE SHRIMP	62.7
		E01000	RED BEANS WITH RICE	71.2
		QG0316	PEAS (FROZEN)	71.2
		W01632	PIE, BAKED, 8", 9" OR 10" (FZ)	70.9
		G01601	STRAWBERRY FRUIT SHORTCAKE	70.9
		M04001	DEVILED POTATO SALAD	71.2
10	3	P02205	VEGETABLE SUPREME SOUP	51.8
		L08801	BAKED ITALIAN SAUSAGE LINKS	62.7
		MG0235	PEPPERS, SWEET, FRESH, DICED	71.2
		MG0229	ONIONS, SLICED, DRY	71.2
		L15800	SAVORY BAKED CHICKEN	62.7
		E00701	PORK FRIED RICE (GRIDDLE)	71.2
		Q01701	GLAZED CARROTS, CANNED	71.2
		Q00300	BOSTON BAKED BEANS (WHITE	71.2
		W02709	COOKIES, SANDWICH, CHOCOLATE/	70.9
		J01405	CHOCOLATE CREAM PUDDING	70.9
11	1	L00203	GRILLED CANADIAN BACON	57.1
		L00700	GRILLED STEAK	57.1
		Q04602	HASH BRN POT	71.2
		E00200	BUTTERED HOMINY GRITS	47.8
		D02400	APPLE FRITTERS	70.9
		W00401	DOUGHNUTS	70.9
		ZE0001	BREAKFAST CEREAL, ASSORTED,	57.1
		D02701	KOLACHES W/ CHERRY PIE	70.9
11	2	PG0103	BEEF NOODLE SOUP (CONDENSED)	51.8
		L16700	CHUCK WAGON STEW	62.7
		L08100	ROAST PORK	62.7
		E00500	STEAMED RICE	71.2
		Q04800	MASHED POTATOES	71.2
		Q01600	BROWN GRAVY	49.6
		Q00900	HOT SPICED BEETS	71.2
		QG0307	BRUSSEL SPROUTS (FROZEN)	71.2
		I01000	APPLE COBBLER	70.9
		M00905	VEGETABLE COLE SLAW	71.2

DAY	MEAL	ITEM #	ITEM NAME	SELECTION
11	3	P00200	CHICKEN RICE SOUP	51.8
		L10300	VEAL PARMESAN	62.7
		E01200	NOODLES JEFFERSON	71.2
		L02700	BEEF BALLS STROGANOFF	62.7
		Q05800	STEWED TOMATOES	71.2
		OG0320	SUCCOTASH (FROZEN)	71.2
		G02604	CHEESE CAKE WITH CHERRY	70.9
		ZM0010	CUCUMBER, ONION & SOUR	71.2
12	1	L11001	CORNED BEEF HASH (CANNED)	62.7
		L07103	GRILLED HAM SLICES	57.1
		D00101	BAKING POWDER BISCUITS	80
		O01700	CREAM GRAVY	49.6
		D02502	BLUEBERRY PANCAKES	57.1
		F00700	GRILLED EGGS TO ORDER	57.1
		E00102	HOT BREAKFAST CEREALS	57.1
		Q04602	HASH BRN POT	71.2
		D01802	CAKE DOUGHNUTS(DOUGHNUT	70.9
12	2	P00802	KNICKERBOCKER SOUP (BEAN,	51.8
		L14000	SEAFOOD NEWBURG	62.7
		E00500	STEAMED RICE	71.2
		Q05100	POTATOES AU GRATIN	71.2
		Q03200	SOUTHERN FRIED OKRA	71.2
		Q02800	EGGPLANT PARMESAN	71.2
		J01400	VANILLA CREAM PUDDING	70.9
		W02702	COOKIES, COCONUT MACAROON	70.9
		J00804	BLUEBERRY CRISP (PREP. PIE	70.9
		M02600	JELLIED FRUIT COCKTAIL SALAD	71.2
12	3	P01301	NEW ENGLAND CLAM CHOWDER	51.8
		L13700	FRENCH FRIED SHRIMP	62.7
		L08000	PORK CHOP SUEY	62.7
		E00700	PORK FRIED RICE (OVEN METHOD)	71.2
		F00100	BAKED MACARONI AND CHEESE	71.2
		M00800	COLE SLAW	71.2
		OG0201	ASPARAGUS (FRESH)	71.2
		Q02701	CORN O'BRIEN	71.2
		W02701	COOKIES, CHOCOLATE CHIP	70.9
		J01403	PINEAPPLE CREAM PUDDING	70.9
		M03700	PICKLED BEET AND ONION SALAD	71.2
13	1	L00202	GRILLED BACON	57.1
		L00203	GRILLED CANADIAN BACON	57.1
		D02506	TOASTED PLAIN WAFFLES	57.1
		Q00700	LYONNAISE GREEN OR WAX	47.8
		D02200	FRENCH TOAST	57.1
		F00700	GRILLED EGGS TO ORDER	57.1



DAY	MEAL	ITEM #	ITEM NAME	SELECTION
		ZE0001	BREAKFAST CEREAL, ASSORTED,	57.1
		ZF0002	COTTAGE CHEESE	47.8
		D01200	CRUMB CAKE (SNICKERDOODLE)	70.9
13	2	P02000	CHICKEN VEGETABLE	51.8
		N01700	COLD CUT SANDWICH	62.7
		Q00200	BAKED BEANS	71.2
		Q04501	FRENCH FRIED POTATOES	71.2
		G03202	BOSTON CREAM PIE(CAKE MIX)	70.9
		G01601	STRAWBERRY FRUIT SHORTCAKE	70.9
		J02000	CREAMY RICE PUDDING	70.9
		J00705	PEACH GELATIN	70.9
13	3	P02000	CHICKEN VEGETABLE	51.8
		L14800	CHICKEN CACCIATORE	62.7
		L08700	PORK CHOPS MEXICANA	62.7
		E00900	SPANISH RICE	71.2
		Q03801	REFRIED BEANS (CANNED	71.2
		QG0321	MIXED VEGETABLES (FROZEN)	71.2
		Q02000	FRENCH FRIED CAULIFLOWER	71.2
		H00201	BROWNIES (CHOCOLATE	70.9
		I02401	PEACH PIE (PREP. PIE FILLING)	70.9
		M05000	WALDORF SALAD	71.2
14	1	L00700	GRILLED STEAK	57.1
		L08900	GRILLED SAUSAGE PATTIES	57.1
		D02400	APPLE FRITTERS	70.9
		D02506	TOASTED PLAIN WAFFLES	57.1
		J00501	YOGURT FRUIT CUP	70.9
		ZE0001	BREAKFAST CEREAL, ASSORTED,	57.1
		Q04600	HASHED BROWN POTATOES	47.8
		F00700	GRILLED EGGS TO ORDER	57.1
		D03700	QUICK COFFEE CAKE (BISCUIT	80
14	2	P00900	EGG DROP SOUP	51.8
		L01300	PEPPER STEAK	62.7
		L12900	SALMON LOAF	62.7
		Q05000	OVEN BROWNED POTATOES	71.2
		E00500	STEAMED RICE	71.2
		Q02500	VEGETABLE STIR FRY	71.2
		Q02300	SCALLOPED CREAM STYLE CORN	71.2
		I00901	APPLE PIE (PREPARED PIE	70.9
		G02101	ALMOND POUND CAKE (MIX)	70.9
		M02504	JELLIED STRAWBERRY SALAD	71.2
14	3	P01100	CORN CHOWDER	51.8
		L02800	CHILI CON CARNE	62.7
		L07300	SCALLOPED HAM & POTATOES (CN	62.7
		E00500	STEAMED RICE	71.2

DAY	MEAL	ITEM #	ITEM NAME	SELECTION
		QG0202	BROCCOLI (FRESH)	71.2
		QG0317	PEAS AND CARROTS (FROZEN)	71.2
		J01601	CHOCOLATE CHIP BREAD	70.9
		G02603	CHEESE CAKE WITH BLUEBERRY	70.9
		J01400	VANILLA CREAM PUDDING	70.9
		M03100	KIDNEY BEAN SALAD	71.2
15	1	L00202	GRILLED BACON	57.1
		L07103	GRILLED HAM SLICES	57.1
		D02200	FRENCH TOAST	57.1
		D02506	TOASTED PLAIN WAFFLES	57.1
		Q04700	HOME FRIED POTATOES	47.8
		F00700	GRILLED EGGS TO ORDER	57.1
		J00501	YOGURT FRUIT CUP	70.9
		E00200	BUTTERED HOMINY GRITS	47.8
		W01818	ROLLS,SWEET	70.9
15	2	P01100	CORN CHOWDER	51.8
		L16100	ROAST TURKEY	62.7
		L13500	CREOLE SCALLOPS	62.7
		O01602	CHICKEN OR TURKEY GRAVY	49.6
		E00500	STEAMED RICE	71.2
		Q04800	MASHED POTATOES	71.2
		QG0207	CORN-ON THE-COB W/ BUTTER	71.2
		QG0202	BROCCOLI (FRESH)	71.2
		ZD0004	JELLY ROLL	70.9
		H02101	ALMOND COOKIES	70.9
		J00704	STRAWBERRY GELATIN	70.9
15	3	P00201	CHICKEN NOODLE SOUP	51.8
		L10600	ROAST VEAL	62.7
		L02800	CHILI CON CARNE	62.7
		QG0202	BROCCOLI (FRESH)	71.2
		E00500	STEAMED RICE	71.2
		O01601	BROWN GRAVY (MIX)	49.6
		G02501	SPICE CAKE (YELLOW CAKE MIX)	70.9
		J01500	BAKED RICE PUDDING	70.9
		M02900	ITALIAN PASTA SALAD	71.2
16	1	L11001	CORNERD BEEF HASH (CANNED)	62.7
		L03000	CREAMED GROUND BEEF	57.1
		D02200	FRENCH TOAST	57.1
		D02506	TOASTED PLAIN WAFFLES	57.1
		E00200	BUTTERED HOMINY GRITS	47.8
		Q04603	LYONNAISE POTATOES	47.8
		D03702	QUICK FRENCH COFFEE CAKE	70.9
16	2	L09200	BARBECUED SPARERIBS	62.7
		L10300	VEAL PARMESAN	62.7

DAY	MEAL	ITEM #	ITEM NAME	SELECTION
		E01200	NOODLES JEFFERSON	71.2
		F00100	BAKED MACARONI AND CHEESE	71.2
		Q06902	MARSHMALLOW SWEET	71.2
		QG0208	COLLARD GREENS (FRESH)	71.2
		QG0115	PEAS, BLACKEYED (CANNED)	71.2
		D01500	CORNBREAD (CORNBREAD MIX)	80
		PG0108	SPLIT PEA SOUP W/ HAM	51.8
		I03301	LEMON MERINGUE PIE (PREP PIE	70.9
		H00600	CRISP TOFFEE BARS	70.9
		M03601	GOLDEN GLOW SALAD	71.2
16	3	PG0106	MANHATTAN CLAM CHOWDER	51.8
		L11202	BAKED CORNED BEEF (FROZEN)	62.7
		L04300	FAJITAS	62.7
		Q03300	PARSLEY BUTTERED POTATOES	71.2
		Q03200	SOUTHERN FRIED OKRA	71.2
		G02904	PINEAPPLE UPSIDE DOWN CAKE	70.9
		J01405	CHOCOLATE CREAM PUDDING	70.9
		M00502	CARROT, CELERY, AND APPLE	71.2
17	1	L00700	GRILLED STEAK	57.1
		L08900	GRILLED SAUSAGE PATTIES	57.1
		D02400	APPLE FRITTERS	70.9
		D00101	BAKING POWDER BISCUITS	80
		O01700	CREAM GRAVY	49.6
		ZE0001	BREAKFAST CEREAL, ASSORTED,	57.1
		J00501	YOGURT FRUIT CUP	70.9
		D03703	QUICK CHERRY COFFEE	70.9
17	2	P00900	EGG DROP SOUP	51.8
		L01301	ORIENTAL STEAK	62.7
		L07800	CHICKEN ADOBO	62.7
		E00500	STEAMED RICE	71.2
		B00200	CHINESE EGG ROLLS (OVEN)	51.8
		F00600	EGG FOO YOUNG (HAM)	62.7
		Q02500	VEGETABLE STIR FRY	71.2
		G00800	FLORIDA LEMON CAKE	70.9
		H00201	BROWNIES (CHOCOLATE	70.9
		J01404	BUTTERSCOTCH CREAM PUDDING	70.9
17	3	PG0109	TOMATO SOUP (CONDENSED)	51.8
		L08600	BREADED PORK CHOPS	62.7
		L06600	SAUERBRATEN	62.7
		E00800	RICE PILAF	71.2
		Q04900	O'BRIEN POTATOES	71.2
		Q03200	SOUTHERN FRIED OKRA	71.2
		Q02300	SCALLOPED CREAM STYLE CORN	71.2
		I01300	PUMPKIN PIE	70.9

DAY	MEAL	ITEM #	ITEM NAME	SELECTION
		J00804	BLUEBERRY CRISP (PREP. PIE	70.9
18	1	L00203	GRILLED CANADIAN BACON	57.1
		D02300	FRENCH TOAST PUFF	57.1
		D02504	BUTTERMILK PANCAKES	57.1
		Q04600	HASHED BROWN POTATOES	47.8
		F00700	GRILLED EGGS TO ORDER	57.1
		E00102	HOT BREAKFAST CEREALS	57.1
		D01900	RAISED DOUGHNUTS	70.9
18	2	PG0102	BEAN W/ BACON SOUP	51.8
		L01002	YANKEE POT ROAST	62.7
		L11301	BAKED KNOCKWURST WITH	62.7
		O01800	NATURAL PAN GRAVY	49.6
		Q05001	FRANCONIA POTATOES	71.2
		E00500	STEAMED RICE	71.2
		Q04105	PEAS WITH MUSHROOM (CANNED	71.2
		QG0321	MIXED VEGETABLES (FROZEN)	71.2
		I01002	BLUEBERRY COBBLER (PRP.PIE	70.9
		H00903	OATMEAL RAISIN COOKIES (MIX)	70.9
		J01400	VANILLA CREAM PUDDING	70.9
18	3	PG0101	BEEF WITH VEGETABLE	51.8
		L15501	SOUTHERN FRIED CHICKEN	62.7
		L01800	BARBECUED BEEF CUBES	62.7
		Q05000	OVEN BROWNEED POTATOES	71.2
		E00401	BUTTERED NOODLES	71.2
		O01602	CHICKEN OR TURKEY GRAVY	49.6
		QG0202	BROCCOLI (FRESH)	71.2
		QG0311	CORN, WHOLE, KERNEL (FROZEN)	71.2
		G02901	PINEAPPLE UPSIDE DOWN CAKE	70.9
		J01006	PEACH CRUNCH (FROZEN	70.9
19	1	L00202	GRILLED BACON	57.1
		L09100	GRILLED SAUSAGE LINKS (BKFT.)	57.1
		L05200	CREAMED CHIPPED BEEF	57.1
		Q04603	LYONNAISE POTATOES	47.8
		ZE0001	BREAKFAST CEREAL, ASSORTED.	57.1
		D02506	TOASTED PLAIN WAFFLES	57.1
		D03702	QUICK FRENCH COFFEE CAKE	70.9
19	2	P01501	CREAM OF POTATO SOUP (FRESH	51.8
		L01200	COUNTRY FRIED STEAK	62.7
		O01609	ONION AND MUSHROOM GRAVY	49.6
		L11903	LEMON BAKED FISH (PERCH)	62.7
		E00801	ORANGE RICE	71.2
		Q04800	MASHED POTATOES	71.2
		MG0213	CAULIFLOWER, FRESH	71.2
		QG0311	CORN, WHOLE, KERNEL (FROZEN)	71.2

DAY	MEAL	ITEM #	ITEM NAME	SELECTION
		QG0315	OKRA (FROZEN)	71.2
		MG0215	CELERY,STICKS OR STRIPS,FRESH	71.2
		G02101	ALMOND POUND CAKE (MIX)	70.9
		H01100	PEANUT BUTTER COOKIES	70.9
		J01600	BREAD PUDDING	70.9
		M04500	THREE BEAN SALAD	71.2
19	3	PG0109	TOMATO SOUP (CONDENSED)	51.8
		L02900	BEEF PORCUPINES	62.7
		L12403	FRENCH FRIED FISH PORTIONS	62.7
		Q05100	POTATOES AU GRATIN	71.2
		QG0317	PEAS AND CARROTS (FROZEN)	71.2
		Q00800	HARVARD BEETS	71.2
		J01500	BAKED RICE PUDDING	70.9
		I01701	BLUEBERRY PIE (PREPARED PIE	70.9
		M02504	JELLIED STRAWBERRY SALAD	71.2
20	1	L11001	CORNED BEEF HASH (CANNED)	62.7
		L00700	GRILLED STEAK	57.1
		L07103	GRILLED HAM SLICES	57.1
		D00101	BAKING POWDER BISCUITS	80
		Q01700	CREAM GRAVY	49.6
		D02504	BUTTERMILK PANCAKES	57.1
		E00102	HOT BREAKFAST CEREALS	57.1
		Q04700	HOME FRIED POTATOES	47.8
		D03703	QUICK CHERRY COFFEE	70.9
20	2	P02201	CHICKEN-MUSHROOM SOUP	51.8
		L03101	CHEESE RAVIOLI	62.7
		N00600	GRILLED CHEESE SANDWICH	62.7
		Q04500	FRENCH FRIED POTATOES	71.2
		QG0321	MIXED VEGETABLES (FROZEN)	71.2
		QG0308	CARROTS (FROZEN)	71.2
		H01800	FRUIT NUT BARS	70.9
		I01300	PUMPKIN PIE	70.9
		M02500	JELLIED FRUIT SALAD	71.2
20	3	P00200	CHICKEN RICE SOUP	51.8
		L02400	STUFFED CABBAGE ROLLS	62.7
		L06901	GRILLED HAM STEAKS	62.7
		Q05100	POTATOES AU GRATIN	71.2
		Q06900	MASHED SWEET POTATOES	71.2
		Q00202	BAKED BEANS (PINTO)	71.2
		G01300	CARROT CAKE (MIX)	70.9
		H02001	CHOCOLATE CHIP	70.9
		W02739	CHEESECAKE, (FROZEN)	70.9
		ZM0011	CUCUMBER,ONION,TOMATO &	71.2
21	1	L00202	GRILLED BACON	57.1

DAY	MEAL	ITEM #	ITEM NAME	SELECTION
		L09100	GRILLED SAUSAGE LINKS (BKFT.)	57.1
		D02200	FRENCH TOAST	57.1
		D02506	TOASTED PLAIN WAFFLES	57.1
		Q04602	HASH BRN POT	71.2
		E00200	BUTTERED HOMINY GRITS	47.8
		F00700	GRILLED EGGS TO ORDER	57.1
		ZE0001	BREAKFAST CEREAL, ASSORTED	57.1
		J00501	YOGURT FRUIT CUP	70.9
		ZF0002	COTTAGE CHEESE	47.8
		DG0702	PECAN ROLLS	70.9
21	2	PG0104	CHICKEN NOODLE SOUP	51.8
		L14200	HONEY GLAZED ROCK CORNISH	62.7
		L09600	ROAST FRESH HAM	62.7
		O02000	CORN BREAD DRESSING	71.2
		F00100	BAKED MACARONI AND CHEESE	71.2
		Q00703	GREEN BEANS NICOISE	71.2
		Q06700	CANDIED SWEET POTATOES	71.2
		G00601	BANANA CAKE (BANANA CAKE	70.9
		H02001	CHOCOLATE CHIP	70.9
		J01405	CHOCOLATE CREAM PUDDING	70.9
		J00701	BANANA GELATIN	70.9
21	3	PG0102	BEAN W/ BACON SOUP	51.8
		L14500	CHICKEN VEGA	62.7
		Q05000	OVEN BROWNED POTATOES	71.2
		QG0207	CORN-ON THE-COB W/ BUTTER	71.2
		QG0307	BRUSSEL SPROUTS (FROZEN)	71.2
		W01632	PIE, BAKED, 8", 9" OR 10"	70.9
		I01004	STREUSEL-TOPPED APPLE	70.9
		M00100	APPLE, CELERY AND PINEAPPLE	71.2
22	1	L11001	CORNERED BEEF HASH (CANNED)	62.7
		L00700	GRILLED STEAK	57.1
		D00101	BAKING POWDER BISCUITS	80
		O01700	CREAM GRAVY	49.6
		D02504	BUTTERMILK PANCAKES	57.1
		E00102	HOT BREAKFAST CEREALS	57.1
		Q04700	HOME FRIED POTATOES	47.8
		D03701	QUICK APPLE COFFEE	70.9
22	2	L15300	CHINESE FIVE-SPICE CHICKEN	62.7
		L03500	MEAT LOAF	62.7
		Q04800	MASHED POTATOES	71.2
		E00703	SHRIMP FRIED RICE	71.2
		E01000	RED BEANS WITH RICE	71.2
		Q02500	VEGETABLE STIR FRY	71.2
		O01600	BROWN GRAVY	49.6

DAY	MEAL	ITEM #	ITEM NAME	SELECTION
		PG0109	TOMATO SOUP (CONDENSED)	51.8
		W02738	CAKE, SHEET, (FROZEN)	70.9
		H02001	CHOCOLATE CHIP	70.9
		J00704	STRAWBERRY GELATIN	70.9
22	3	L03700	SALISBURY STEAK	62.7
		L13300	BAKED TUNA AND NOODLES	62.7
		Q04400	BAKED POTATOES	71.2
		E00500	STEAMED RICE	71.2
		Q01701	GLAZED CARROTS, CANNED	71.2
		OG0307	BRUSSEL SPROUTS (FROZEN)	71.2
		O01600	BROWN GRAVY	49.6
		PG0111	VEGETABLE W/ BEEF SOUP	51.8
		I01300	PUMPKIN PIE	70.9
		I02201	CHERRY PIE (PIE FILLING)	70.9
22	3	M04000	POTATO SALAD	71.2
		L09100	GRILLED SAUSAGE LINKS (BKFT.)	57.1
		L07103	GRILLED HAM SLICES	57.1
		D02506	TOASTED PLAIN WAFFLES	57.1
		D02300	FRENCH TOAST PUFF	57.1
		W01818	ROLLS, SWEET	70.9
23	2	L09700	JAMBALAYA	62.7
		L09600	ROAST FRESH HAM	62.7
		Q04800	MASHED POTATOES	71.2
		OG0305	LIMA BEANS (FROZEN)	71.2
		Q05801	STEWED TOMATOES WITH	71.2
		O01600	BROWN GRAVY	49.6
		P01001	SHRIMP GUMBO	51.8
		I01100	CHOCOLATE MOUSSE PIE	70.9
		H02002	CHOCOLATE CHIP BARS (SUGAR	70.9
		M03700	PICKLED BEET AND ONION SALAD	71.2
23	3	L04101	SWEDISH MEATBALLS (BEEF &	62.7
		L07300	SCALLOPED HAM & POTATOES (CN	62.7
		E00401	BUTTERED NOODLES	71.2
		Q06401	SAVORY SUMMER SQUASH	71.2
		OG0320	SUCCOTASH (FROZEN)	71.2
		P02201	CHICKEN-MUSHROOM SOUP	51.8
		G01201	DEVIL'S FOOD CAKE (MIX)	70.9
		J01400	VANILLA CREAM PUDDING	70.9
24	1	M02501	JELLIED ORANGE SALAD	71.2
		L00202	GRILLED BACON	57.1
		L09100	GRILLED SAUSAGE LINKS (BKFT.)	57.1
		D02200	FRENCH TOAST	57.1
		D02506	TOASTED PLAIN WAFFLES	57.1
		Q04601	COTTAGE FRIED POTATOES	47.8

DAY	MEAL	ITEM #	ITEM NAME	SELECTION
		E00200	BUTTERED HOMINY GRITS	47.8
		F00700	GRILLED EGGS TO ORDER	57.1
		ZE0001	BREAKFAST CEREAL, ASSORTED.	57.1
		J00501	YOGURT FRUIT CUP	70.9
		ZF0002	COTTAGE CHEESE	47.8
		D01901	BEIGNETS (NEW ORLEANS	70.9
24	2	L13800	SHRIMP CURRY	62.7
		E01001	HOPPING JOHN (BLACKEYE PEAS	71.2
		D02000	DUMPLINGS (MIX)	71.2
		P01100	CORN CHOWDER	51.8
		I00300	MINCEMEAT PIE	70.9
		H02100	LEMON COOKIES	70.9
		ZM0003	SHIMMERY FRUIT AND	71.2
24	3	L14600	BARBECUED CHICKEN	62.7
		L01001	GINGER POT ROAST	62.7
		OG0115	PEAS, BLACKEYED (CANNED)	71.2
		OG0208	COLLARD GREENS (FRESH)	71.2
		D01500	CORNBREAD (CORNBREAD MIX)	80
		P01900	PEPPER POT SOUP	51.8
		G01300	CARROT CAKE (MIX)	70.9
		J01404	BUTTERSCOTCH CREAM PUDDING	70.9
		M05300	GERMAN STYLE TOMATO SALAD	71.2
25	1	L00203	GRILLED CANADIAN BACON	57.1
		L05200	CREAMED CHIPPED BEEF	57.1
		D02506	TOASTED PLAIN WAFFLES	57.1
		L08900	GRILLED SAUSAGE PATTIES	57.1
		Q04603	LYONNAISE POTATOES	47.8
		D03900	DANISH DIAMOND	70.9
25	2	L14700	CHICKEN A LA KING	62.7
		E00500	STEAMED RICE	71.2
		L08000	PORK CHOP SUEY	62.7
		O01601	BROWN GRAVY (MIX)	49.6
		Q04201	GREEN BEANS PARISIENNE	71.2
		I00702	COCONUT CREAM PIE (INSTANT	70.9
		H01300	SUGAR COOKIES	70.9
		I02801	CHOCOLATE CREAM PIE (DES.,	70.9
		J00700	FRUIT GEL (FRUIT CKTL W/O	70.9
25	3	P00101	BEEF BARLEY SOUP	51.8
		L02400	STUFFED CABBAGE ROLLS	62.7
		L07103	GRILLED HAM SLICES	57.1
		Q06700	CANDIED SWEET POTATOES	71.2
		MG0207	BEETS, SLICED, # 10	71.2
		OG0110	CORN, CREAM STYLE (CANNED)	71.2
		G00300	CHOCOLATE MACAROON CAKE	70.9



DAY	MEAL	ITEM #	ITEM NAME	SELECTION
		I01001	PEACH COBBLER (PRP.PIE	70.9
		M04900	VEGETABLE SALAD	71.2
26	1	L07103	GRILLED HAM SLICES	57.1
		L00700	GRILLED STEAK	57.1
		D00101	BAKING POWDER BISCUITS	80
		Q04601	COTTAGE FRIED POTATOES	47.8
		F00700	GRILLED EGGS TO ORDER	57.1
		D03703	QUICK CHERRY COFFEE CAKE	70.9
26	2	P00201	CHICKEN NOODLE SOUP	51.8
		N03500	HOT ROAST BEEF SANDWICH	62.7
		L05600	SOUTHERN FRIED CATFISH	62.7
		Q04800	MASHED POTATOES	71.2
		E00800	RICE PILAF	71.2
		O01601	BROWN GRAVY (MIX)	49.6
		QG0202	BROCCOLI (FRESH)	71.2
		QG0311	CORN, WHOLE, KERNEL (FROZEN)	71.2
		D01502	HUSHPUPPIES (CORNBREAD MIX)	80
		H00500	SHORTBREAD COOKIES	70.9
		I00702	COCONUT CREAM PIE (INSTANT	70.9
		G01601	STRAWBERRY FRUIT SHORTCAKE	70.9
		J00704	STRAWBERRY GELATIN	70.9
26	3	L02300	EL RANCHO STEW	62.7
		L12500	CHIPPER PERCH	62.7
		E00500	STEAMED RICE	71.2
		Q05001	FRANCONIA POTATOES	71.2
		QG0317	PEAS AND CARROTS (FROZEN)	71.2
		QG0201	ASPARAGUS (FRESH)	71.2
		W01632	PIE, BAKED, 8", 9" OR 10"	70.9
		G02103	LEMON POUND CAKE (POUND	70.9
		M03400	MACARONI SALAD	71.2
27	1	L00202	GRILLED BACON	57.1
		L08900	GRILLED SAUSAGE PATTIES	57.1
		D02200	FRENCH TOAST	57.1
		D02506	TOASTED PLAIN WAFFLES	57.1
		E00102	HOT BREAKFAST CEREALS	57.1
		Q04700	HOME FRIED POTATOES	47.8
		D02502	BLUEBERRY PANCAKES	57.1
		J00501	YOGURT FRUIT CUP	70.9
		ZF0002	COTTAGE CHEESE	47.8
		ZE0001	BREAKFAST CEREAL, ASSORTED	57.1
		D01200	CRUMB CAKE (SNICKERDOODLE)	70.9
27	2	L04000	STUFFED GREEN PEPPERS	62.7
		Q05000	OVEN BROWNED POTATOES	71.2
		O01900	TOMATO GRAVY	49.6

DAY	MEAL	ITEM #	ITEM NAME	SELECTION
		QG0201	ASPARAGUS (FRESH)	71.2
		P02000	CHICKEN VEGETABLE	51.8
		I00702	COCONUT CREAM PIE (INSTANT	70.9
		H02103	VANILLA COOKIES	70.9
		J00701	BANANA GELATIN	70.9
27	3	P00200	CHICKEN RICE SOUP	51.8
		L16700	CHUCK WAGON STEW	62.7
		L15800	SAVORY BAKED CHICKEN	62.7
		E00500	STEAMED RICE	71.2
		Q05200	RISSOLE POTATOES	71.2
		Q00600	SPANISH STYLE LIMA BEANS	71.2
		Q02300	SCALLOPED CREAM STYLE CORN	71.2
		G01100	EASY CHOCOLATE CAKE	70.9
		J01601	CHOCOLATE CHIP BREAD	70.9
		M04500	THREE BEAN SALAD	71.2
28	1	L11001	CORNERD BEEF HASH (CANNED)	62.7
		L00700	GRILLED STEAK	57.1
		L07103	GRILLED HAM SLICES	57.1
		D00101	BAKING POWDER BISCUITS	80
		Q01700	CREAM GRAVY	49.6
		D02400	APPLE FRITTERS	70.9
		E00200	BUTTERED HOMINY GRITS	47.8
		Q04602	HASH BRN POT	71.2
		D03702	QUICK FRENCH COFFEE CAKE	70.9
28	2	N02101	DEEP FAT FRIED CHICKEN FILLET	62.7
		Q04500	FRENCH FRIED POTATOES	71.2
		Q00106	VEGETABLE COMBOS: CORN	71.2
		P02203	LOGGING SOUP (CONDENSED)	51.8
		P02202	DOUBLY GOOD CHICKEN SOUP	51.8
		G02102	VELVET POUND CAKE (YELLOW	70.9
		I00902	DUTCH APPLE PIE (PREPARED PIE	70.9
		J02000	CREAMY RICE PUDDING	70.9
28	3	P01703	MEXICAN ONION CORN SOUP	51.8
		L06500	HUNGARIAN GOULASH	62.7
		L08101	ROAST PORK TENDERLOIN	62.7
		E00401	BUTTERED NOODLES	71.2
		E01001	HOPPING JOHN (BLACK EYE PEAS	71.2
		Q01601	BROWN GRAVY (MIX)	49.6
		Q00700	LYONNAISE GREEN OR WAX	47.8
		D03801	TEMPURA BATTER (FOR	71.2
		QG0205	CARROTS, 2 " STRIPS (FRESH)	71.2
		H00400	CHEWY NUT BARS	70.9
		G02604	CHEESE CAKE WITH CHERRY	70.9
		J00704	STRAWBERRY GELATIN	70.9

DAY	MEAL	ITEM #	ITEM NAME	SELECTION
29	1	L11001	CORNERD BEEF HASH (CANNED)	62.7
		L00700	GRILLED STEAK	57.1
		D00101	BAKING POWDER BISCUITS	80
		O01700	CREAM GRAVY	49.6
		D02200	FRENCH TOAST	57.1
		E00102	HOT BREAKFAST CEREALS	57.1
		DG0703	CINNAMON SWEET ROLLS	70.9
29	2	P02000	CHICKEN VEGETABLE	51.8
		L02600	SYRIAN BEEF STEW	62.7
		L08101	ROAST PORK TENDERLOIN	62.7
		O01600	BROWN GRAVY	49.6
		E00500	STEAMED RICE	71.2
		Q04800	MASHED POTATOES	71.2
		Q06801	TEMPURA FRIED CAULIFLOWER	51.8
		Q00105	VEGETABLE COMBOS: GREEN	71.2
		G01201	DEVIL'S FOOD CAKE (MIX)	70.9
		H01101	PEANUT BUTTER COOKIES(SUGAR	70.9
		M00301	CABBAGE,APPLE, AND RAISIN	71.2
29	3	P00401	FRENCH ONION SOUP	51.8
		L14000	SEAFOOD NEWBURG	62.7
		L15800	SAVORY BAKED CHICKEN	62.7
		E00800	RICE PILAF	71.2
		Q02700	CALICO CORN	71.2
		G03202	BOSTON CREAM PIE(CAKE MIX)	70.9
		H00201	BROWNIES (CHOCOLATE	70.9
		J01402	COCONUT CREAM PUDDING	70.9
		J00602	BANANA FRUIT CUP	51.8
30	1	L07103	GRILLED HAM SLICES	57.1
		D02300	FRENCH TOAST PUFF	57.1
		D02504	BUTTERMILK PANCAKES	57.1
		Q04601	COTTAGE FRIED POTATOES	47.8
		F00700	GRILLED EGGS TO ORDER	57.1
		J00501	YOGURT FRUIT CUP	70.9
		L08900	GRILLED SAUSAGE PATTIES	57.1
		D01802	CAKE DOUGHNUTS(DOUGHNT	70.9
30	2	P02205	VEGETABLE SUPREME SOUP	51.8
		L01001	GINGER POT ROAST	62.7
		L08200	SWEET AND SOUR PORK	62.7
		E00500	STEAMED RICE	71.2
		MG0247	TOMATOES,SLICED,FRESH	71.2
		MG0229	ONIONS,SLICED,DRY	71.2
		Q00702	GREEN BEANS W/ MUSHROOM	71.2
		O01800	NATURAL PAN GRAVY	49.6
		I01000	APPLE COBBLER	70.9

DAY	MEAL	ITEM #	ITEM NAME	SELECTION
		H00903	OATMEAL RAISIN COOKIES	70.9
		G01300	CARROT CAKE (MIX)	70.9
		M02501	JELLIED ORANGE SALAD	71.2
30	3	PG0109	TOMATO SOUP (CONDENSED)	51.8
		L16100	ROAST TURKEY	62.7
		L05400	STEAK RANCHERO	62.7
		O02100	SAVORY BREAD DRESSING	71.2
		O05600	GOLDEN POTATO BALLS (INST	71.2
		Q01701	GLAZED CARROTS, CANNED	71.2
		OG0313	GREENS(MUSTARD - FROZEN)	71.2
		G02601	CHEESE CAKE (MIX)	70.9
		J01405	CHOCOLATE CREAM PUDDING	70.9
		M00800	COLE SLAW	71.2
31	1	L00202	GRILLED BACON	57.1
		L09100	GRILLED SAUSAGE LINKS (BKFT.)	57.1
		D02400	APPLE FRITTERS	70.9
		D02506	TOASTED PLAIN WAFFLES	57.1
		E00200	BUTTERED HOMINY GRITS	47.8
		F00700	GRILLED EGGS TO ORDER	57.1
		ZE0001	BREAKFAST CEREAL, ASSORTED	57.1
		ZF0002	COTTAGE CHEESE	47.8
		D03701	QUICK APPLE COFFEE	70.9
31	2	L15501	SOUTHERN FRIED CHICKEN	62.7
		L06900	BAKED HAM	62.7
		F00100	BAKED MACARONI AND CHEESE	71.2
		OG0208	COLLARD GREENS (FRESH)	71.2
		Q06901	SWEET POTATOES SOUTHERN	71.2
		Q00704	SOUTHERN STYLE GREEN BEAN	71.2
		I01200	SWEET POTATO PIE	70.9
		H01301	SUGAR COOKIES (SUGAR COOKIE	70.9
		M03100	KIDNEY BEAN SALAD	71.2
31	3	PG0103	BEEF NOODLE SOUP (CONDENSED)	51.8
		L03800	SPAGHETTI WITH MEAT SAUCE	62.7
		L16500	PIZZA	62.7
		OG0303	WAX BEANS (FROZEN)	71.2
		Q02701	CORN O'BRIEN	71.2
		D00700	TOASTED GARLIC BREAD	80
		OG0202	BROCCOLI (FRESH)	71.2
		G01201	DEVIL'S FOOD CAKE (MIX)	70.9
		J00700	FRUIT GEL (FRUIT CKTL W/O	70.9
32	1	D02300	FRENCH TOAST PUFF	57.1
		D02506	TOASTED PLAIN WAFFLES	57.1
		L09100	GRILLED SAUSAGE LINKS (BKFT.)	57.1
		Q04700	HOME FRIED POTATOES	47.8

DAY	MEAL	ITEM #	ITEM NAME	SELECTION
		E00102	HOT BREAKFAST CEREALS	57.1
		F00700	GRILLED EGGS TO ORDER	57.1
		DG0709	BEAR CLAWS	70.9
32	2	P00200	CHICKEN RICE SOUP	51.8
		L02800	CHILI CON CARNE	62.7
		L13300	BAKED TUNA AND NOODLES	62.7
		E00500	STEAMED RICE	71.2
		Q06401	SAVORY SUMMER SQUASH	71.2
		QG0321	MIXED VEGETABLES (FROZEN)	71.2
		G01202	GERMAN CHOCOLATE CAKE	70.9
		J01000	PINEAPPLE CRUNCH	70.9
		J00600	FRUIT CUP	51.8
32	3	PG0109	TOMATO SOUP (CONDENSED)	51.8
		L11901	BAKED FISH WITH GARLIC	62.7
		L02100	BEEF POT PIE W/ BISCUIT TOPPING	62.7
		Q05100	POTATOES AU GRATIN	71.2
		Q00101	VEGETABLE COMBOS: BROCCOLI	71.2
		Q01701	GLAZED CARROTS, CANNED	71.2
		I03300	LEMON MERINGUE PIE	70.9
		H01400	COCONUT RAISIN DROP COOKIES	70.9
		M04001	DEVILED POTATO SALAD	71.2
33	1	L00203	GRILLED CANADIAN BACON	57.1
		L05200	CREAMED CHIPPED BEEF	57.1
		D02504	BUTTERMILK PANCAKES	57.1
		L07103	GRILLED HAM SLICES	57.1
		Q04603	LYONNAISE POTATOES	47.8
		ZF0002	COTTAGE CHEESE	47.8
		D01903	LONGJOHNS	70.9
33	2	LG0400	STEAMED CRAB LEGS	62.7
		P01300	NEW ENGLAND FISH CHOWDER	51.8
		L13702	FRIED BREADED SHRIMP	62.7
		L12600	FRIED OYSTERS	62.7
		L13400	FRIED SCALLOPS	62.7
		L11900	BAKED FISH (FLOUNDER)	62.7
		F00100	BAKED MACARONI AND CHEESE	71.2
		D01502	HUSHPUPIES (CORNBREAD MIX)	80
		Q00704	SOUTHERN STYLE GREEN BEAN	71.2
		J01700	CREAM PUFFS	70.9
		H00600	CRISP TOFFEE BARS	70.9
		J00100	APPLE CRISP	70.9
		ZM0011	CUCUMBER, ONION, TOMATO &	71.2
33	3	L11301	BAKED KNOCKWURST WITH	62.7
		Q04800	MASHED POTATOES	71.2
		QG0315	OKRA (FROZEN)	71.2

DAY	MEAL	ITEM #	ITEM NAME	SELECTION
		Q04103	PEAS WITH ONIONS	71.2
		G02900	PINEAPPLE UPSIDE DOWN CAKE	70.9
		H01800	FRUIT NUT BARS	70.9
		I01900	BUTTERSCOTCH CREAM PIE	70.9
		J00704	STRAWBERRY GELATIN	70.9
34	1	L00200	OVEN FRIED BACON	57.1
		L09100	GRILLED SAUSAGE LINKS (BKFT.)	57.1
		J00801	CHERRY CRISP (PREPARED PIE)	70.9
		Q04602	HASH BRN POT	71.2
		E00200	BUTTERED HOMINY GRITS	47.8
		D02506	TOASTED PLAIN WAFFLES	57.1
		F00700	GRILLED EGGS TO ORDER	57.1
		ZE0001	BREAKFAST CEREAL, ASSORTED	57.1
		J00501	YOGURT FRUIT CUP	70.9
		ZF0002	COTTAGE CHEESE	47.8
		D03700	QUICK COFFEE CAKE (BISCUIT	80
34	2	P02201	CHICKEN-MUSHROOM SOUP	51.8
		L06400	CREOLE MACARONI (AM CHOP	62.7
		N00600	GRILLED CHEESE SANDWICH	62.7
		E00801	ORANGE RICE	71.2
		Q03500	FRENCH FRIED ONION RINGS	71.2
		OG0320	SUCCOTASH (FROZEN)	71.2
		I03100	PECAN PIE	70.9
		H00201	BROWNIES (CHOCOLATE	70.9
		J01400	VANILLA CREAM PUDDING	70.9
		M02900	ITALIAN PASTA SALAD	71.2
34	3	PG0102	BEAN W/ BACON SOUP	51.8
		L06900	BAKED HAM	62.7
		K00700	PINEAPPLE SAUCE	49.6
		L01601	SWISS STEAK WITH BROWN	62.7
		E00500	STEAMED RICE	71.2
		Q03001	SAUTEED MUSHROOMS AND	71.2
		G01300	CARROT CAKE (MIX)	70.9
		H02100	LEMON COOKIES	70.9
		J00702	FRUIT FLAVORED GELATIN	70.9
35	1	L11001	CORNED BEEF HASH (CANNED)	62.7
		L00700	GRILLED STEAK	57.1
		L07103	GRILLED HAM SLICES	57.1
		D00101	BAKING POWDER BISCUITS	80
		Q01700	CREAM GRAVY	49.6
		D03704	QUICK ORANGE-COCONUT COFFEE	70.9
		E00102	HOT BREAKFAST CEREALS	57.1
		Q04700	HOME FRIED POTATOES	47.8
		D03703	QUICK CHERRY COFFEE CAKE	70.9

DAY	MEAL	ITEM #	ITEM NAME	SELECTION
35	2	L00800	TERIYAKI STEAK	62.7
		L14200	HONEY GLAZED ROCK CORNISH	62.7
		E00801	ORANGE RICE	71.2
		QG0307	BRUSSEL SPROUTS (FROZEN)	71.2
		Q00800	HARVARD BEETS	71.2
		G03202	BOSTON CREAM PIE(CAKE MIX	70.9
		H01801	GINGER FRUIT BARS(COOKIE MIX)	70.9
		J00800	PEACH CRISP	70.9
		M03700	PICKLED BEET AND ONION SALAD	71.2
35	3	L11200	SIMMERED CORN BEEF	62.7
		L15200	CHICKEN TETRAZZINI	62.7
		QG0213	POTATOES, WHITE (FRESH)	71.2
		QG0203	CABBAGE (FRESH)	71.2
		QG0308	CARROTS (FROZEN)	71.2
		G01100	EASY CHOCOLATE CAKE	70.9
		M02504	JELLIED STRAWBERRY SALAD	71.2

## **Appendix C**

### **Logistical Requirements for Test Menu**



# Test Menu - Logistical Summary

(A-Ration Logistics and Optimized Menu Logistics)

(Optimized using 20% substitution rate for all categories  
and equally weighted cost and freezer minimizing objectives)

Day	Meal	A-Ration Logistics						Optimized Menu - Logistics					
		Cost (\$)	Labor (min.)	Storage (cu ft)				Cost (\$)	Labor (min.)	Storage (cu ft)			
				Dry	Chilled	Freezer	Ovens (#)			Dry	Chilled	Freezer	Ovens (#)
1	1	371.3	831.16	16.6	28.26	0	0	371.3	831.16	16.6	28.26	0	0
1	2	4054.	4643.7	60.0	134.72	15.93	9.3	4054.	4643.7	60.0	134.72	15.93	9.3
1	3	310.6	713.7	13.9	15.89	9.7	2.7	463.7	628.9	4.39	15.89	5.75	6.3
2	1	2695.	1205.6	30.2	9.58	10.4	9.6	2715.	1127.0	29.9	2.83	12.57	9.6
2	2	5906.	3944.1	112.	113.85	44.19	58.7	4777.	3376.2	61.5	53.67	40.31	87.1
2	3	1405.	1868.2	54.1	19.83	17.26	21.9	1460.	1783.4	42.1	19.83	10.89	25.5
3	1	1138.	715.39	23.2	6.21	15.01	7.4	1075.	846.14	9.5	6.21	18.42	6.4
3	2	3816.	2724.0	114.	113.43	39.17	66.3	3598.	2318.7	56.3	107.83	25.01	58.8
3	3	2372.	2338.3	81.8	14.98	37.01	28.7	2321.	2000.0	45.3	13.36	15.78	26
4	1	473.2	781.71	33.4	0.82	17.26	10.7	571.8	795.14	17.4	0.82	16.95	12.5
4	2	4031.	4399.2	121.	35.52	70.99	80.7	4408.	4035.4	77.3	35.52	49.69	95.7
4	3	2189.	1943.5	68.5	26.68	22.06	28.2	2189.	1943.5	68.5	26.68	22.06	28.2
5	1	905.2	1632.7	38.7	32.57	19.56	5.6	1003.	1646.1	22.8	32.57	19.25	7.4
5	2	5043.	3561.7	141.	26.3	56.53	39.4	5018.	3513.2	113.	22.58	45.88	73
5	3	2732.	1636.8	62.8	8.49	29.12	14.6	2875.	1475.8	48.5	8.49	24	30.7
6	1	1973.	914.4	21.3	7.29	7.38	6.5	2091.	904.98	14.1	1.94	29.21	5.8
6	2	2370.	1515.8	40.7	27.82	26.76	19.8	1555.	1233.5	20.8	9.77	25.66	16
6	3	1832.	1713.1	44.2	27.04	13.89	28.9	1940.	1626.4	41.5	27.04	17.85	28.9
7	1	735.5	709.42	18.7	5.62	11.45	4.9	922.4	716.61	5.89	0.51	18.49	5.6
7	2	1977.	2105.2	71.3	5.03	30.12	21.8	2161.	2027.8	56.3	5.03	30.7	25.1
7	3	1497.	2304.4	45.5	52.91	10.84	24.3	1515.	2230.0	45.3	46.72	12.83	24.3
8	1	2748.	963.3	27.1	11.19	10.22	11.7	2767.	884.72	26.8	4.44	12.39	11.7
8	2	4412.	3287.5	113	22.62	22.29	39	4411.	3146.8	105.	22.62	22.29	65.1
8	3	1677.	1404.1	55.6	12.7	15.45	18.9	1809.	1319.3	44.9	12.7	10.33	22.5
9	1	1051.	767	14.3	0	6.85	0	1051.	767	14.3	0	6.85	0
9	2	2897.	3723.6	103.	57.73	20.36	52.8	2897.	3723.6	103.	57.73	20.36	52.8
9	3	1989.	1641.0	29.0	54.96	9.63	32.9	1624.	1323.8	26.7	26.04	14.48	37.7
10	1	799.0	1173.5	25.1	33.16	12.74	2.4	851.8	1236.8	17.0	33.16	13.32	2.4
10	2	5866.	3593.1	139.	33.32	93.31	9.3	6183.	2221.8	83.2	33.32	68.5	23.4
10	3	1213.	1535.5	44.2	9.06	22.64	14.7	1210.	1297.0	26.7	8.98	15.84	10
11	1	2474.	1055.6	28.7	1.08	18.41	17.9	2519.	1005.7	20.8	1.08	17.52	19.7
11	2	4156.	3128.8	131.	34.93	46.33	22.5	4271.	2946.9	106.	34.93	33.06	30
11	3	1670.	1471.0	48.4	11.96	22.44	15.6	1778.	1386.2	37.7	11.96	17.32	19.2

		A-Ration Logistics						Optimized Menu - Logistics					
Day	Meal	Cost (\$)	Labor (min.)	Storage (cu ft)			Ovens (#)	Cost (\$)	Labor (min.)	Storage (cu ft)			Ovens (#)
				Dry	Chilled	Freezer				Dry	Chilled	Freezer	
12	1	899.8	943.65	27.3	13.9	6.82	4	945.6	893.75	19.4	13.9	5.93	5.8
12	2	5684	3160.2	92.8	75.17	30.52	37.3	5684	3160.2	92.8	75.17	30.52	37.3
12	3	3920	1775.7	54.5	45.59	16.07	9	3317	1503.2	51.4	23.5	27.19	12.6
13	1	624.8	641.7	21.8	12.19	11.44	3.2	708.0	813.08	5.98	7.2	24.92	2.5
13	2	1021	982.74	54.7	12.93	21.59	11.5	1039	936.54	43.4	12.93	15.74	13.1
13	3	2327	1818.2	74.4	16.25	38.36	22.2	2397	1486.6	29.7	12.63	25.28	35.1
14	1	1842	1017.1	25.0	19.07	15.79	3.6	1880	1041.8	15.8	14.27	19.67	2.9
14	2	1714	1709.4	36.6	28.62	7.42	29.8	1714	1709.4	36.6	28.62	7.42	29.8
14	3	2039	1698.1	49.4	38.37	14.74	11.9	2258	1534.0	35.2	36.93	15.02	15.2
15	1	982.2	1099.2	26.9	34.89	10.36	0	1035	1162.5	18.8	34.89	10.94	0
15	2	7805	3934.3	101	141.76	58.04	57	7805	3934.3	101	141.76	58.04	57
15	3	2193	1623.3	34.9	41.77	18.18	19.7	1754	1384.8	22.0	41.77	19.13	18.1
16	1	749.8	719.09	34.9	13.2	10.98	6.9	693.6	929.65	21.5	12.48	12.63	6
16	2	7464	4177.9	176	77.42	48.49	71.7	6352	3205.1	131	17.24	43.68	102
16	3	1455	1894.8	37.0	18.96	17.29	10.8	1455	1894.8	37.0	18.96	17.29	10.8
17	1	2501	1054.9	31.6	11.36	14.22	8.5	2501	1054.9	31.6	11.36	14.22	8.5
17	2	4107	2531.0	104	52.12	55.55	40.5	4007	2438.5	44.7	45.7	44.72	70.2
17	3	3530	1606.5	64.5	17.25	12.01	25	2207	1486.5	46.9	16.7	19.45	21.9
18	1	650.0	942.7	13.7	16.55	1.37	0	650.0	942.7	13.7	16.55	1.37	0
18	2	4030	3074.2	137	17.85	50.29	52.6	4299	2892.3	114	17.85	39.64	60.1
18	3	2090	1564.9	62.6	42.27	34.08	14.4	2220	1360.1	35.4	42.27	22.16	21.2
19	1	857.6	755.64	22.3	6.93	14.58	6.9	801.4	966.2	8.99	6.21	16.23	6
19	2	5556	5292.7	125	59.82	72.39	73	5958	4928.9	80.5	59.82	51.09	88
19	3	1685	1710.1	58.6	17.93	30.36	23.3	1829	1625.3	48	17.93	25.24	26.9
20	1	1928	789.02	20.5	7.23	7.37	6.1	2043	766.6	18.1	2.45	21.15	6.1
20	2	1234	1192.4	52.5	18.58	21.28	9.7	1513	1254.0	27.6	18.09	20.87	27.8
20	3	1648	1703.7	34.6	27.36	9.09	32.7	1647	1632.4	31.3	27.36	9.09	33.8
21	1	656.1	859.63	29.3	18.05	13.98	3.8	677.0	989.91	7.53	13.76	20.63	3.8
21	2	2432	2036.2	75.8	16.02	41.55	45.5	2470	1717.2	32.4	15.11	27.36	44.1
21	3	1442	1369.1	47.5	32.21	26.43	18.6	1529	1119.1	13.4	32.21	19.4	17.5
22	1	2359	786.98	27.9	7.47	10.22	8.5	2359	786.98	27.9	7.47	10.22	8.5
22	2	4458	3349.6	121	46.73	61.17	69.8	4011	2944.3	75.6	46.73	50.8	65.6
22	3	1483	1932.0	57.6	25.84	17.26	28.9	1538	1847.2	45.7	25.84	10.89	32.5
23	1	578.0	430.67	16.8	3.46	10.44	0	630.9	494	8.79	3.46	11.02	0
23	2	5869	4092.0	125	32.94	52.83	41.7	4267	2789.5	54.7	17.63	45.63	68.7
23	3	1938	1529.2	57.2	7.84	24.14	12.4	2110	1444.4	40.4	7.84	24.77	16
24	1	798.2	1491.4	31.7	31.73	12.74	0	851.1	1554.8	23.7	31.73	13.32	0
24	2	4336	2783.6	79.6	23.66	18.71	45.6	4335	2783.6	79.6	23.66	18.71	45.6
24	3	2370	1569.1	48.4	42.51	21.45	18	1923	1210.3	28.0	13.59	20.22	15.3
25	1	1204	956.27	23.1	6.39	18.22	11.7	1064	920.2	9.5	6.21	16.74	6
25	2	2993	2953.1	111	26.97	53.6	60.1	3290	2688.5	78.4	20.39	44.05	66.7

		A-Ration Logistics						Optimized Menu - Logistics					
Day	Meal	Storage (cu ft)						Storage (cu ft)					
		Cost (\$)	Labor (min.)	Dry	Chilled	Freezer	Ovens (#)	Cost (\$)	Labor (min.)	Dry	Chilled	Freezer	Ovens (#)
25	3	1618.	1422.8	52.0	20.89	4.21	25	1618.	1422.8	52.0	20.89	4.21	25
26	1	2492.	784.18	20.3	18.93	10.4	8.5	2492.	784.18	20.3	18.93	10.4	8.5
26	2	5549.	5267.0	145.	87.82	74.16	71.4	5886.	4818.6	118.	87.82	62.02	81.3
26	3	2681.	1668.6	34.1	35.66	21.07	11.2	2157.	1404.1	23.4	15.99	21.52	18.4
27	1	693.2	956.22	27.9	17.97	10.1	3.2	784.6	1029.1	7.68	7.03	31.24	2.5
27	2	1598.	1559.5	17.1	47.25	4.17	30.8	984.6	1390.9	17.1	29.2	9.28	34.1
27	3	1394.	1580.0	56.0	14.47	17.57	22.9	1391.	1352.4	39.9	14.4	11.33	18.5
28	1	1949.	824.61	26.2	2.96	12.2	6.1	1904.	887.24	16.9	2.45	12.32	6.7
28	2	1164.	1030.3	26.9	28.4	5.84	10.5	1341.	1030.3	16.4	28.4	16.4	10.5
28	3	2369.	1602.9	49.1	15.07	19.11	16.1	2260.	1649.5	46.5	13.43	19.11	27.6
29	1	2334.	859.58	35.9	6.07	10.4	9.6	2334.	859.58	35.9	6.07	10.4	9.6
29	2	4703.	3502.5	77.9	68.33	38.59	60.2	4084.	3121.5	63.4	68.33	39.58	53.6
29	3	2864.	1456.5	54.8	14.25	24.43	16.9	2843.	1275.9	32.3	14.17	17.63	23.8
30	1	1008.	1198.5	21.0	28.85	3.82	0	1008.	1198.5	21.0	28.85	3.82	0
30	2	3959.	3903.0	112.	35.85	38.12	66.2	3959.	3903.0	112.	35.85	38.12	66.2
30	3	2165.	1964.6	81.8	9.99	46.33	16.6	1949.	1680.8	50.4	7.46	29.17	20.2
31	1	520.7	831.17	21.6	10.94	12.74	4.5	573.6	894.5	13.5	10.94	13.32	4.5
31	2	5578.	3850.5	121.	72.51	58.06	67.2	4752.	3405.1	87.2	12.33	55.49	81.3
31	3	1355.	1676.2	49.8	37.38	13.59	22.5	1508.	1591.4	40.3	37.38	9.64	26.1
32	1	474.0	952.44	22.8	17.86	10.44	9.3	526.8	1015.7	14.8	17.86	11.02	9.3
32	2	2615.	2896.2	100.	10.86	43.5	25.2	2884.	2714.3	77.8	10.86	32.85	32.7
32	3	2335.	1876.0	44.1	26.35	17.55	34.9	2326.	1738.4	41.3	26.08	17.55	36.1
33	1	1174.	1198.8	9.22	9.31	3.03	8	1174.	1198.8	9.22	9.31	3.03	8
33	2	2361	5114.9	158.	36.09	94.03	51	1601	3975.7	114.	28.26	155.37	101.9
33	3	1273.	1312.6	50.9	10.86	30.91	18.3	1474.	1260.6	29.2	8.97	24.09	38
34	1	616.4	940.6	26.7	14.33	14.18	11.9	671.4	992.51	12.4	13.76	15.88	12.5
34	2	1426.	1638	52.6	18.73	12.69	10.5	1567.	1612.2	32.7	18.73	13.27	24.5
34	3	1740.	1479.3	28.6	5.06	11.74	25.1	1856.	1351.7	20.5	4.08	16.77	26.2
35	1	1945.	719.34	22.4	8.18	7.43	9.3	2016.	726.75	21.2	3.4	15.09	9.3
35	2	3030.	1599.4	86.9	2.46	52.89	26	1521.	1173.4	26.8	2.46	23.75	33.6
35	3	1299.	1324.4	25.4	28.93	14.65	9.9	1443.	1416.8	19.3	28.93	13.66	13.2
Totals		2698	198492	6067	2965.32	2574.67	2392.4	2555	184071	4399	2520.02	2419.21	2849

### Summary of Logistical Requirements

			Storage (cu ft)			
	Cost (\$)	Labor (min)	Dry	Chilled	Freezer	Ovens (#)
A-Ration Menu	269,804.8	3308.2	6067.38	2965.32	2574.67	2392.4
Optimized Menu	255,571.6	3067.9	4399	2520.02	2419.2	2849.4
% Savings	5.3	7.3	27.5	15	6	-19.1