

PRELIMINARY ECONOMIC ANALYSIS OF THE TRIFOOD SYSTEM(U)
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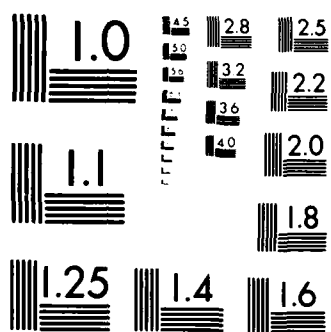
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PRELIMINARY ECONOMIC ANALYSIS
OF THE TRIFOOD SYSTEM

ARTHUR D. LITTLE, INC.
Acorn Park
Cambridge, Massachusetts 02140

November 20, 1984

ADL Reference 50511

Final report for period 12/15/83-11/20/84

Prepared for
TRIMIS PROGRAM OFFICE
5401 Westbard Avenue
Bethesda, Maryland 20816

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The TRIMIS Program Office is currently preparing the Functional Description of the computerized TRIFOOD system, which will support food service activities in Medical Treatment Facilities. Current plans are to release a Request for Proposal to potential vendors early in 1985 and to implement the first pilot systems beginning in the fall of 1985 at three pilot sites. This report presents a Preliminary Economic Analysis of the TRIFOOD system, using preliminary estimates of the benefits and costs associated with the system. <i>(PEA)</i>		

EXECUTIVE SUMMARY

A. INTRODUCTION

The Tri-Service Medical Information Systems (TRIMIS) Program Office (TPO) is currently preparing the Functional Description (FD) of a computerized system, referred to as the TRIFOOD system, which will support food service activities in Medical Treatment Facilities (MTFs). Current plans are to release a Request for Proposal (RFP) to potential vendors in the early part of 1985 and to implement the first pilot systems beginning in the fall of 1985. The three pilot sites now being considered for the system are Naval Hospital Bethesda (Navy), Wilford Hall USAF Medical Center (Air Force), and Womack Army Community Hospital, Fort Bragg (Army).

This report presents a Preliminary Economic Analysis (PEA) of the TRIFOOD system, using preliminary estimates of the benefits and costs associated with the system.

B. APPROACH

In preparing the list of benefits and costs, we have:

- reviewed the preliminary Functional Description working papers for the TRIFOOD system and the studies that have analyzed benefits for the food system installed at Walter Reed Army Medical Center;
- reviewed the literature on computerized hospital food service systems installed in civilian hospitals;
- had discussions with and requested information from several civilian hospitals that have installed systems to support food service operations;
- had discussions with TRIMIS staff about the benefit equations and parameter values, and cost estimates.

C. SUMMARY OF FINDINGS

Analysis of the anticipated benefits and costs of the TRIFOOD system indicates that it is very cost-effective. Annual undiscounted and uninflated primary benefits are valued from \$85,000 to \$178,000 per site, and total \$1.4 million per year for the initial 12 candidate sites. Approximately 32% of the benefits represent a reduction in

food costs that is due to improved forecasting, more accurate calculation of ingredients required for portions, less spoilage of outdated inventory, and more accurate control of food costs (Figure S-1). The remainder of the primary benefits are due to a reduction in the time required for personnel to maintain inventories, prepare procurement documents, and prepare daily worksheets.

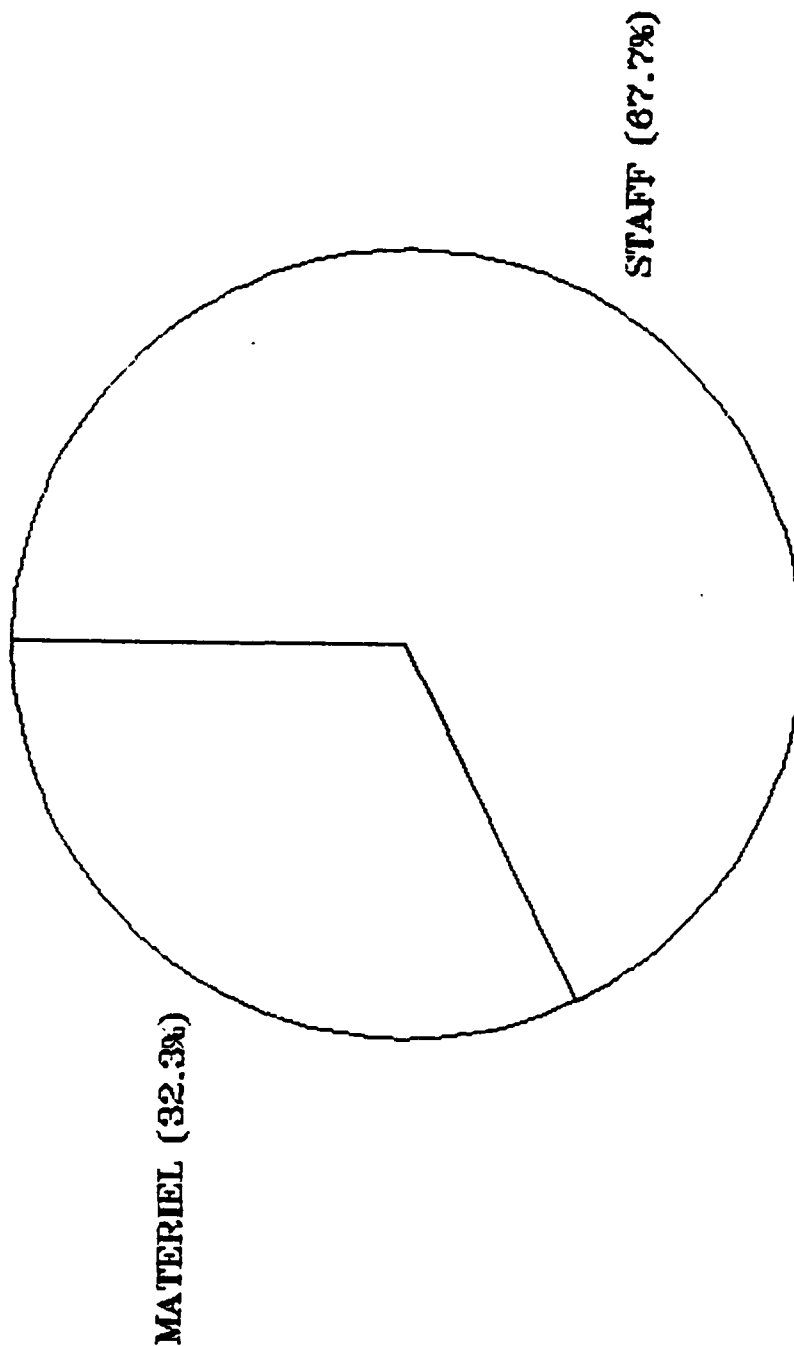
In addition to the primary benefits, there are benefits that are due to functions that are currently not performed or not fully performed because of lack of resources or personnel. These functions include nutritional assessments of inpatients and outpatients, nutritional analyses of diets, and determination of issue quantities. These benefits are therefore characterized as "additional." The additional annual undiscounted and uninflated benefits are valued between \$659,000 and \$1.5 million per site, and total \$11.3 million per year for the initial candidate sites. Total annual undiscounted and uninflated benefits, including both primary and additional, are approximately \$12.7 million per year.

There are a number of other benefits that could not be quantified, including:

- improved quality of patient care because of more frequent nutritional analyses;
- improved quality of patient care because of an increase in the number of patients receiving dietitian services;
- increased number of nutritional assessments of patients;
- less opportunity for fraud, waste, and abuse because of more timely and accurate management data;
- improved management of the Food Service Department because of increased completeness and accuracy of reports;
- increased satisfaction because of improved food quality;
- increased job satisfaction by dietitians because of more involvement with professional rather than procedural activities.

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NOTE: Benefits were inflated using DoD Inflation Index and discounted at 10%.

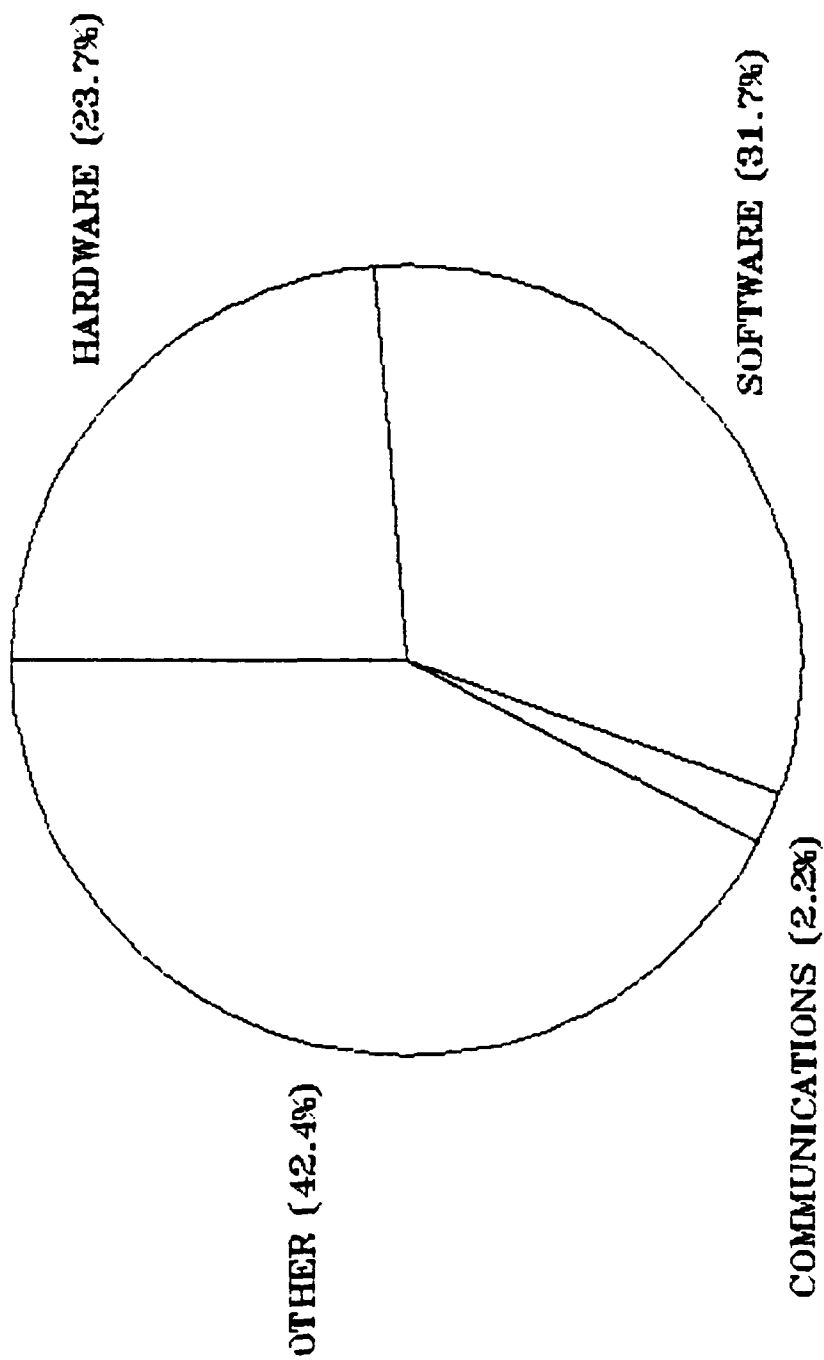
FIGURE S-1. DISTRIBUTION OF PRESENT VALUE LIFECYCLE BENEFITS OF TRIFOOD IN 12 CANDIDATE SITES

One-time costs of the system for the nine medium sized hospitals are estimated to be approximately \$91,600 per site, and annual undiscounted recurring costs are estimated to be \$20,600. Total lifecycle cost, assuming an eight-year lifecycle for the system, is approximately \$256,000 per site (undiscounted and uninflated). For the three larger hospitals (with an average census over 400), one-time average acquisition costs are estimated to be approximately \$109,000, and annual recurring costs are about \$26,900. The total eight-year lifecycle cost is therefore approximately \$325,000 for each of the larger hospitals. The largest one-time cost is for computing equipment, with the remaining costs for purchase of software, installation, and site preparation (Figure S-2). The recurring costs are mainly for equipment maintenance and supplies.

The total estimated present value lifecycle benefits and costs of TRIFOOD, broken down into major categories for the initial 12 candidate sites are shown in Table S-1. Dollar values for the base-case benefits and costs were inflated using the DoD inflation index and discounted at a rate of 10%. The present value of lifecycle primary benefits for the 12 initial sites is approximately \$7.6 million, and of additional benefits approximately \$60.4 million, totaling \$68 million. The present value of lifecycle costs of TRIFOOD for 12 candidate sites is \$2.6 million. The net lifecycle primary benefits (primary benefits minus costs) of TRIFOOD for 12 candidate sites are approximately \$4.9 million, while the net lifecycle total of all benefits is \$65.3 million.

Figure S-3 compares the cumulative annual estimated present value costs and primary benefits of TRIFOOD in the 12 candidate sites over the lifetime of the TRIFOOD project. After 1987, the estimated cumulative primary benefits exceed the estimated cumulative costs until the project terminates in 1995.

Sensitivity analyses show that the positive net benefits in general are not affected by different assumptions about inflation rates or by assumptions about major benefits.



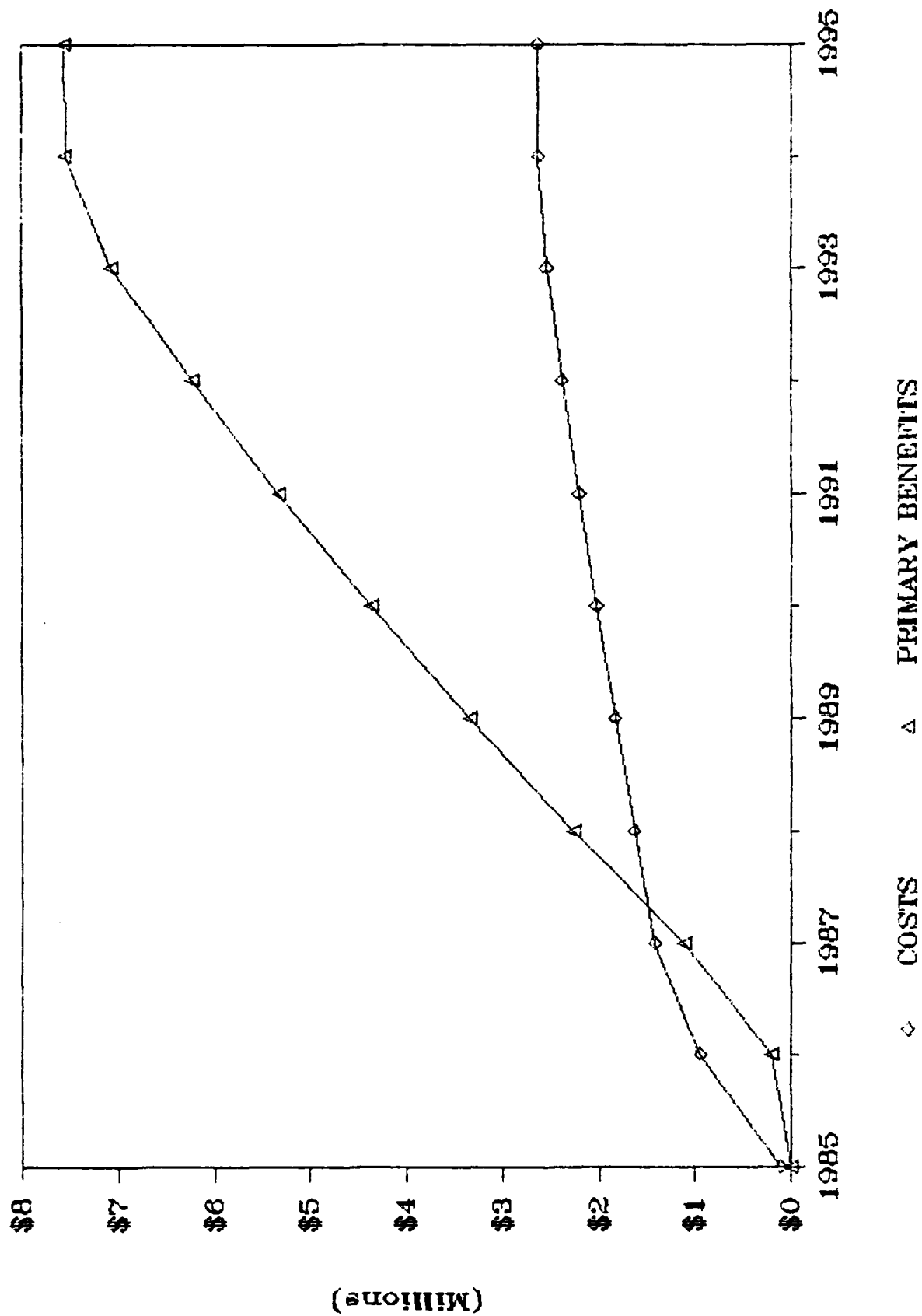
NOTE: Costs were inflated using DoD Inflation Index and discounted at 10%.

FIGURE S-2. DISTRIBUTION OF PRESENT VALUE LIFECYCLE COSTS OF TRIFOOD IN 12 CANDIDATE SITES

TABLE S-1

TOTAL ESTIMATED PRESENT VALUE LIFECYCLE BENEFITS AND COSTS
OF TRIFCOD BY MAJOR CATEGORY FOR 12 CANDIDATE SITES

	Present Value Lifecycle (Millions of \$)	Percentage of Total
<u>BENEFITS</u>		
<u>Primary</u>		
Increased availability of MTF personnel time	5.12	7.5
Materiel savings	<u>2.44</u>	<u>3.6</u>
TOTAL PRIMARY BENEFITS	7.56	11.1
<u>Additional</u>		
Increased availability of MTF personnel time	60.41	88.9
TOTAL FOR ALL BENEFITS	67.97	100.0
<u>COSTS</u>		
Hardware	0.62	23.7
Software	0.83	31.7
Communication	0.06	2.2
Other	<u>1.12</u>	<u>42.4</u>
TOTAL COSTS	2.63	100.00
NET BENEFITS (Primary)	4.93	
NET BENEFITS (All)	65.35	



NOTE: Benefits and costs were inflated using DoD Inflation Index and discounted at 10%.

FIGURE S-3. CUMULATIVE PRIMARY BENEFITS AND COSTS OF TRIFOOD IN 12 CANDIDATE SITES

TABLE OF CONTENTS

	<u>Page</u>
EXECUTIVE SUMMARY	iii
I. INTRODUCTION	1
A. BACKGROUND	1
B. APPROACH	4
C. LITERATURE REVIEW	4
D. SYSTEM FUNCTIONS: PRELIMINARY DESCRIPTION	7
II. SYSTEM BENEFITS	10
A. FOOD COST SAVINGS	10
B. INVENTORY REDUCTION	11
C. PERSONNEL SAVINGS	12
1. Management and Financial Reporting	12
2. Inventory Maintenance	13
3. Service Management	13
4. Clerical Assistance	14
5. Menu Planning: Cost and Nutrition Analysis	15
6. Patient Nutritional Analysis and Assessment	16
D. WORKLOAD DATA REQUIREMENTS	17
E. QUALITATIVE BENEFITS	21
REFERENCES	23
III. TRIFOOD SYSTEM COSTS	24
Hardware Acquisition	24
Hardware Maintenance	24
Software Acquisition	24
Software Maintenance	24
Software Modification, Documentation, and Installation	24
Communications	25
Site Preparation	25
Training	25
Supplies	25
Data Collection	26
Total	26
IV. ESTIMATED PRESENT VALUE LIFECYCLE BENEFITS AND COSTS	28
A. ASSUMPTIONS	28
B. ESTIMATED PRESENT VALUE LIFECYCLE BENEFITS	28
C. ESTIMATED PRESENT VALUE LIFECYCLE COSTS	32
D. COMPARISON OF ESTIMATED PRESENT VALUE LIFECYCLE BENEFITS AND COSTS	32

TABLE OF CONTENTS (continued)

	<u>Page</u>
V. SENSITIVITY OF RESULTS TO MAJOR ASSUMPTIONS	35
A. INTRODUCTION	35
B. INFLATION INDEXES	35
C. DISCOUNT RATES	37
D. CHANGE IN BENEFIT ESTIMATES	37
 APPENDIX A: LITERATURE REVIEW	 1
APPENDIX B: DESCRIPTION OF FOOD SERVICE ACTIVITIES	B-1
APPENDIX C: BENEFIT FORMULAS	C-1
APPENDIX D: DETAILED RESULTS OF BENEFIT AND COST ANALYSES	D-1

LIST OF FIGURES

<u>Figure #</u>		<u>Page</u>
S-1	Distribution of Present Value Lifecycle Benefits of TRIFOOD in 12 Candidate Sites	v
S-2	Distribution of Present Value Lifecycle Costs of TRIFOOD in 12 Candidate Sites	vii
S-3	Cumulative Primary Benefits and Costs of TRIFOOD in 12 Candidate Sites	ix
1	Annual Primary Benefits versus Average Daily Census of Candidate Sites	20

LIST OF TABLES

<u>Table #</u>		<u>Page</u>
S-1	Total Estimated Present Value Lifecycle Benefits and Costs of TRIFOOD by Major Category for 12 Candidate Sites	viii
1	Characteristics of Candidate TRIFOOD Sites	2
2	Time Phasing of Candidate TRIFOOD Sites	3
3	Dollar Value of Time for Personnel in Medical Treatment Facilities, FY1984	18
4	Annual Benefits of TRIFOOD in Candidate Sites	19
5	Estimated TRIFOOD System Costs	27
6	Inflation Rates Used in Lifecycle Analysis of Benefits and Costs	29
7	Estimated Present Value Lifecycle Benefits of TRIFOOD in 12 Candidate Sites	30
8	Estimated Present Value Lifecycle Costs of TRIFOOD in 12 Candidate Sites	33
9	Total Estimated Lifecycle Benefits and Costs of TRIFOOD by Major Category, by Year for All 12 Candidate Sites	34
10	Sensitivity Analysis of Estimated Present Value Benefits and Costs of TRIFOOD in 12 Candidate Sites	36
 <u>Appendixes</u>		
C-1	TRIFOOD System Annual Benefits Impact: Food Savings	C-2
C-2	TRIFOOD System Annual Benefits Impact: Management and Financial	C-3
C-3	TRIFOOD System Annual Benefits Impact: Inventory Maintenance	C-4
C-4	TRIFOOD System Annual Benefits Impact: Service Management	C-5
C-5	TRIFOOD System Annual Benefits Impact: Clerical Assistance	C-6
C-6	TRIFOOD System Annual Additional Benefits: Cost and Nutritional Analysis	C-7

LIST OF TABLES (continued)

<u>Table #</u>		<u>Page</u>
D-1	Estimated Present Value Lifecycle Benefits of TRIFOOD in 12 Candidate Sites Using Department of Defense Inflation Index and 10% Discount Rate	D-2
D-2	Estimated Present Value Lifecycle Costs of TRIFOOD in 12 Candidate Sites Using Department of Defense Inflation Index and 10% Discount Rate	D-3
D-3	Estimated Present Value Lifecycle Benefits of TRIFOOD in 12 Candidate Sites Using Health Care Financing Administration Inflation Index and 10% Discount Rate	D-5
D-4	Estimated Present Value Lifecycle Costs of TRIFOOD in 12 Candidate Sites Using Health Care Financing Administration Inflation Index and 10% Discount Rate	D-6
D-5	Estimated Present Value Lifecycle Benefits of TRIFOOD in 12 Candidate Sites Using Rate Control Inflation Index and 10% Discount Rate	D-8
D-6	Estimated Present Value Lifecycle Costs of TRIFOOD in 12 Candidate Sites Using Rate Control Inflation Index and 10% Discount Rate	D-9
D-7	Estimated Present Value Lifecycle Benefits of TRIFOOD in 12 Candidate Sites Using Department of Defense Inflation Index and 0% Discount Rate	D-11
D-8	Estimated Present Value Lifecycle Costs of TRIFOOD in 12 Candidate Sites Using Department of Defense Inflation Index and 0% Discount Rate	D-12
D-9	Estimated Present Value Lifecycle Benefits of TRIFOOD in 12 Candidate Sites Using Department of Defense Inflation Index and 6% Discount Rate	D-14
D-10	Estimated Present Value Lifecycle Costs of TRIFOOD in 12 Candidate Sites Using Department of Defense Inflation Index and 6% Discount Rate	D-15
D-11	Estimated Present Value Lifecycle Benefits of TRIFOOD in 12 Candidate Sites Using Department of Defense Inflation Index and 8% Discount Rate	D-17
D-12	Estimated Present Value Lifecycle Costs of TRIFOOD in 12 Candidate Sites Using Department of Defense Inflation Index and 8% Discount Rate	D-18
D-13	Estimated Present Value Lifecycle Benefits of TRIFOOD in 12 Candidate Sites Using Department of Defense Inflation Index and 12% Discount Rate	D-20
D-14	Estimated Present Value Lifecycle Costs of TRIFOOD in 12 Candidate Sites Using Department of Defense Inflation Index and 12% Discount Rate	D-21

I. INTRODUCTION

A. BACKGROUND

The Tri-Service Medical Information Systems (TRIMIS) Program Office (TPO) is currently preparing the Functional Description (FD) of a computerized system, referred to as the TRIFOOD system, which will support food service activities in Medical Treatment Facilities (MTFs). Current plans are to release a Request for Proposal to potential vendors in the early part of 1985, and to begin to implement the first pilot systems beginning in the fall of 1985. The three pilot sites now being considered for the system are Naval Hospital Bethesda (Navy), Wilford Hall USAF Medical Center (Air Force) and Womack Army Community Hospital, Fort Bragg (Army). Twelve initial candidates for the TRIFOOD system have been identified: four Navy, four Army, and four Air Force sites. Table 1 identifies the candidate sites and presents specific characteristics of the workload for each. The facilities vary in size, with average daily census ranging from 125 to 630. After installation of the first system in August 1985, it is anticipated that the installation process will continue through November 1986. The projected dates for installing the TRIFOOD system in each of the 12 candidate sites are shown in Table 2.

Military treatment facilities generally have limited Automatic Data Processing support in the food service departments. According to the TRIFOOD FD, the Army has AMEDD (Army Medical Department Hospital Food Service System, Version II) in all of its Medical Centers and in some of its Medical Department Activities, the Navy has a computerized food service system in one hospital, and the Air Force has limited automated support in conjunction with the a la carte pricing system. The automated system with the most extensive capabilities is the Interim Food Service System installed at Walter Reed Army Medical Center (WRAMC). This system was designed to meet the specific needs of WRAMC.

TABLE 1

CHARACTERISTICS OF CANDIDATE TRIFOOD SITES

FY83 Workload Statistics ^a										
Site	No. of Major Menu Changes per Year	No. of Days within Menu Cycle	No. of Recipes	No. of Patient Trays per Day	Average		Outpatient Visits to Nutrition Clinic	Dollars of Subistence Value	Average Inventory Dollar Value	No. of Subistence Items in Inventory
					Daily Admissions	Daily Census				
NAVHOSP Bethesda	1	14	1500	837	46	414	9	\$1,400,000	\$21,500	575
Wilford Hall USAF Med Cen	2	28	900	1704	61	630	17	\$1,500,000	\$47,500	612
Womack Army Hosp, Ft. Bragg	2	28	530	395	37	170	16	\$ 480,000	\$28,800	456
NAVHOSP San Diego	1	21	1500	1188	87	525	15.3	\$1,645,000	\$ 4,400	680
USAF Med Cen Keesler	2	35	2826	555	31	268	14	\$ 596,000	\$15,000	470
Darnall Army Hosp, Ft. Hood	1	28	600	367	40	146	52	\$ 402,000	\$22,000	480
NAVHOSP Oakland	1	21	1500	600	42	260	8	\$ 750,000	\$ 5,550	480
Wright Patterson Med Cen Hosp	4	28	800	439	24	211	21	\$ 500,000	\$21,300	800
Martin Army Hosp, Ft. Benning	1	21	900	437	36	189	29	\$ 453,170	\$42,000	400
NAVHOSP Camp Pendleton	2	21	1500	325	31	165	19	\$ 491,000	\$ 1,850	325
D. Grant USAF Hosp, Travis AFB	2	28	2853	670	31	232	21	\$ 546,000	\$17,000	572
Walson Army Hosp, Ft. Dix	1	28	2000	375	28	125	6	\$ 318,000	\$21,000	480

^aWorkload data provided by the TRIMIS Program Office.

TABLE 2
TIME PHASING OF CANDIDATE TRIFOOD SITES

<u>Site</u>	<u>Location</u>	<u>Projected Date of Installation^a</u>
NAVHOSP Bethesda	Bethesda, MD	August 1985
Wilford Hall USAF Med Cen	San Antonio, TX	October 1985
Womack Army Hosp, Ft. Bragg	Fayetteville, NC	January 1986
NAVHOSP San Diego	San Diego, CA	March 1986
USAF Med Cen Keesler	Biloxi, MS	May 1986
Darnall Army Hosp, Ft. Hood	Killeen, TX	July 1986
NAVHOSP Oakland	Oakland, CA	September 1986
Wright Patterson Med Cen Hosp	Dayton, OH	September 1986
Martin Army Hosp, Ft. Benning	Columbus, OH	September 1986
NAVHOSP Camp Pendleton	Oceanside, CA	November 1986
D. Grant USAF Hosp, Travis AFB	Fairfield, CA	November 1986
Walson Army Hosp, Ft. Dix	Pemberton, NJ	November 1986

^aProjected date of installation provided by the TRIMIS Program Office.

B. APPROACH

This report presents a Preliminary Economic Analysis (PEA) of the TRIFOOD system, and uses preliminary estimates of the benefits and costs associated with the system.

In preparing the list of benefits and costs, we have:

- reviewed the preliminary Functional Description working papers for the TRIFOOD system and the studies on benefits of the food system installed at WRAMC;
- reviewed the literature on computerized hospital food service systems installed in civilian hospitals;
- had discussions with and requested information from several civilian hospitals that have installed systems to support food service operations;
- had discussions with TRIMIS staff about the benefit equations and parameter values and the cost estimates.

The next sections of this chapter summarize the literature review and briefly describe food service operations in typical MTFs and the functions planned for the TRIFOOD system. Chapter II lists the anticipated benefits and equations for estimating them. These equations are used to define workload data for a sample set of MTFs analyzed in this PEA. Chapter III presents estimates of TRIFOOD system costs. Chapter IV presents the results of the cost-benefit calculations, and Chapter V, the results of sensitivity analyses.

C. LITERATURE REVIEW

This section briefly summarizes the literature reviewed. A more complete review is presented in Appendix A, which also lists the references.

Most of the literature cites some benefits of automated food service systems; however, these tend to be either qualitative, or unquantifiable when extrapolated to different settings. Each system described in the literature is unique to a particular facility; thus it is difficult to determine just how such savings would occur in a different environment.

Several articles cited overall food cost savings from a computer system. University Hospitals of Cleveland saved \$30,000⁽¹⁰⁾ in the

first six months and \$700,000⁽⁹⁾ in a five-year period from 1971 to 1975. They had a total food management system but tended to attribute the cost savings to "rigid control over the types and the amounts of ingredients that are made available for food service preparation."⁽⁹⁾

Food cost savings have also been attributed to computerized menu planning. An article by Balintfy⁽¹⁵⁾ reports the results of an experiment that compared computer-assisted menu planning with manual menu planning. He found a cost savings of 18.7% from the automated approach and, as an additional benefit, the computerized method ensured that nutritional requirements would also be met.

Another article⁽¹⁹⁾ suggests that up to 34% of costs can be saved when a computer-assisted menu planning (CAMP) system is fully operational. The Research Hospital and Medical Center in Kansas City, Mo., has a CAMP system and reports a 12.5% reduction in the average cost of raw foods "despite a 2.6 percent increase in the number of meals served and a 4.8 percent rise in USDA cost-of-food index."⁽¹⁷⁾

Several articles have reported a combination of food and labor savings. For example, Los Alamitos General Hospital, an acute care hospital with 173 beds, reported "less than 20% reduction in food costs and one-half of an FTE."⁽¹⁸⁾ The automated food system at this hospital was being run on a microcomputer. The Community Hospital of Indianapolis reported that it expected to save \$64,000 a year in food and labor costs.⁽⁷⁾ An article about University Hospitals of Cleveland also cited a food and labor savings of \$2.3 million over a five-year period.⁽⁹⁾

One of the articles cited several benefits, quantitative and qualitative, from a change in the forms used by the food department. The University of Missouri, during a two-week observational period following the implementation of its system, found that the number of forms the department used daily was reduced by 45%. They also reported that "the daily preparation time for completing food stores requisitions was reduced from 20 min. to 8." Two qualitative benefits were that employees were pleased that there were fewer forms and that the forms were more legible.⁽³⁾

Two other hospitals with automated systems, West Allis Memorial Hospital in Wisconsin,⁽¹⁶⁾ and Fairview General Hospital, Cleveland,⁽¹¹⁾ reported savings from computerizing its menus. West Allis Hospital reported an annual savings in 1973 of \$3,289. Fairview claimed significant savings in several areas, including reduced use of paper and reduced storage space. Savings related to personnel were also reported: the print shop saved 110 hours per year; 60% of the dietary secretary's time was freed because she no longer had to type the menus; and 1,095 hours of the supervisor's time could be re-directed from menu-related activities to processing food and managing personnel.

As previously stated, the majority of benefits described in the articles are essentially qualitative and can be categorized as increased patient satisfaction, increased job satisfaction, improved quality of care, and improved management. Increased patient satisfaction may result from improved quality of food⁽¹⁰⁾ and a better correlation between food ordered and food received. One hospital could add a personal touch to their menus by printing special messages, such as "Happy Birthday."⁽¹⁶⁾

Several articles suggested that an automated food service system might enhance job satisfaction. Systems eliminated some of the repetitive daily tasks and enabled dietitians to perform more professional rather than procedural tasks.⁽¹¹⁾ An unexpected benefit at Case-Western Reserve University during the process of designing and implementing the system was "more dialogue among clerical and food production dietitians which facilitated decision-making about recipe, menu, food ingredient and food product changes."⁽¹²⁾ It was suggested that increased job satisfaction might lead to a reduction in personnel turnover⁽¹⁷⁾ in an industry where turnover is about 10.4% per month.⁽⁴⁾

Quality of care can be improved by a number of factors, including more accurate nutritional analyses⁽¹²⁾ and more patients receiving personal attention from the dietitian.⁽¹¹⁾ Also, menus can serve as a teaching tool for people on special diets by showing patients the various types of food that they can eat.⁽¹¹⁾

Benefits from improved management can be achieved in a variety of ways. For example, more accurate management reports, more timely and more available information, and more accurate inventories are some of the potential benefits leading to better management of food services.

D. SYSTEM FUNCTIONS: PRELIMINARY DESCRIPTION

The preliminary Functional Description (FD) working papers for the TRIFOOD system outline the desired functions and capabilities of an automated food service system for a military hospital. As defined in the FD draft, Medical Food Service Management is "the process of gathering, processing, and dispensing information necessary to: (1) assure the preparation and service of palatable and nutritionally adequate diets within established monetary limitations and time constraints to patients and personnel authorized to subsist, (2) provide appropriate staff and patient education, and (3) provide appropriate dietetic treatment of patients." A more complete description of military food service activities is presented in Appendix B.

The major objectives of automating dietary departments are:

- to improve patient care by improving food services; and
- to reduce the cost of food services.

Medical Food Service in military hospitals has been divided into ten functional areas. The activities within seven of these ten categories are considered part of the functions associated with the TRIFOOD system. The remaining three activities are addressed in the Clinical Dietetics module of the Composite Health Care System (CHCS).

The intended functions and capabilities of the TRIFOOD system are, briefly:

- Menu planning. The system should allow the user to write, price, and print menus for regular and therapeutic meals. It should be able to generate menus in various formats for use by patients, dining-room personnel, and kitchen personnel.
- Production control. The system is intended to assist the user in activities associated with preparing and producing food. The capabilities are expected to include scheduling production of food, estimating quantities of

food needed, calculating proportions of ingredients needed when the yield of a recipe changes, and converting the amounts of ingredients into standard units of issue. The system should also generate various reports for the different areas involved in production. It will act as a link between menu planning and subsistence inventory.

- Service Management. The system is intended to allow the user to compute service requirements (meal census and meal preference) based on patients' selections and the number of diners and/or to make projections using historical data. These actual and projected values can be compared and used for reference. Also, the system should be able to print documents that will assist in the proper transfer of food from production areas to service areas. Such documents will include nourishment labels, tray assembly menus, and so forth. Additionally, the system will verify diners' authorization.
- Inventory control. It is expected that the system will control the subsistence inventory. Information provided will include food purchase and issue transactions and a perpetual inventory.
- Financial Control. The system is expected to handle all financial aspects of the food service department, including accounting for rations, subsistence, materiel, equipment, and personnel costs. It will be able to calculate the cost of recipes (per serving or per food item), purchase costs over a specified period of time, and costs associated with maintaining levels of subsistence inventory. It is intended to monitor the number of cash meals served and the number of meals patients receive. It should also analyze the various budgets and should generate all financial reports that are required by regulations.
- Nutritional Analysis. The system is intended to compute the nutritional values of menus and recipes. It should

also be able to analyze and evaluate a patient's nutritional intake. The obtained values can be compared to a nutritional standard such as the Recommended Daily Allowance (RDA). The system is also intended to provide individual nutritional assessments.

- Management Data and Reporting. The system is intended to provide management and system support. It will act as a reference file for information on all functions and will allow both batch-method in-putting and on-line use of the system. As well as being able to update data files, the system will generate data for the Uniform Chart of Accounts (UCA) and other reports. Also, system security and user access should be provided by the system.

Three other functional areas that are part of the Medical Food Service are scheduled to be included in the Composite Health Care System (CHCS): Personnel Management, Training, and Clinical Dietetics.

When initially implemented, TRIFOOD is intended to be a stand-alone system. However, it is anticipated that the TRIFOOD system will eventually interface with CHCS.

In summary, the TRIFOOD system is expected to be a flexible system that will meet the needs of the food service department. Professional time will be re-allocated to direct patient care activities because of a reduction in repetitive clerical tasks. More complete and rapidly available management data will improve overall efficiency of the operation and allow more of management's time to be focused on patient care activities.

II. SYSTEM BENEFITS

This chapter discusses the benefits, both quantitative and qualitative, which may be expected to accrue from implementation of a TRIFOOD system. They have been grouped into those associated with food cost savings, inventory, and savings of personnel time. The savings of personnel time include those expected from reducing the time required to perform current functions and also in the time saved for functions that are currently not performed because of a lack of resources or personnel. These latter savings are therefore characterized as "additional" benefits. The benefits are summarized in Tables C-1 through C-6 of Appendix C.

A. FOOD COST SAVINGS

Savings in the costs of raw food after implementation of an automated food system result from several factors:

- (1) improved forecasting and more accurate calculation of ingredients required for a given number of portions reduce overproduction and waste of food;
- (2) more accurate control of food costs, because pricing menus has become easier;
- (3) reduced pilferage, because more consistent review of "book" versus actual inventory highlights discrepancies.

Any reduction in food costs from these factors may not immediately reduce the subsistence budget for food. Under current regulations, Army and Air Force MFSs are required to make the total amount spent on food annually fall within a narrow corridor of their annual food budget, which is based on the total number of meals and estimated ration costs. Navy MFSs have the option of spending less than the subsistence target budget or shifting funds within the total MFS budget.

Reducing food costs will, however, enable dietary managers to upgrade the quality of food served. Any resulting reduction in food costs is therefore considered a legitimate benefit.

The following savings have been cited by hospitals that have implemented food systems (a list of references is at the end of this chapter).

- Community Hospital of Indianapolis reported a 12% reduction in food costs (private communication).
- University Hospital of Cleveland reported⁽¹⁾ a savings of \$700,000 over five years. At 2.3 million meals annually and at an average cost of raw food of \$1.25⁽²⁾ per meal, the percent of costs saved is $\$700,000 / (5 \times \$1.25 \times 2,300,000) = 5\%$.
- Users of computer-assisted menu planning reported that they "can anticipate savings of up to 34% in raw food costs."⁽³⁾
- The results of one experiment showed that computer-assisted menu planning reduced food costs associated with manual planning by 18.7%.⁽⁴⁾
- Five residential institutions run by New Jersey's Department of Human Services reported spending 13% less for food.⁽⁵⁾

The reported savings in food costs thus vary from 5% to 34%. Since it is not clear how much of the savings will be applicable to the military environment, to be conservative, the lowest figure (5%) was used for estimating benefits.

B. INVENTORY REDUCTION

The system's inventory module should facilitate improved control of the food and inventory providing a more balanced inventory, by minimizing shortages as well as overstocking.

However, a reduction in the total dollar value of inventory will not be obtained in the short run, since MTF inventory levels are currently designated by each military department (MilDep). The automated system may enable the MilDeps to achieve reductions in the long run, when more of the automated systems have been proliferated. Consequently, no quantitative benefits are included, although a number of qualitative benefits may accrue, as well as other benefits difficult to estimate, such as:

- preventing food shortages that would lead to the substitution of items with higher costs or perhaps even a complete menu change at the last minute;
- allowing for more exact compliance with regulations, thereby reducing the possibility of overstocking;
- reducing errors in ordering.

C. PERSONNEL SAVINGS

1. Management and Financial Reporting

The financial control and management data and reporting modules will facilitate the preparation of the required periodic financial and management reports, including workload reporting, UCA and ration accounting, and inventory pricing. Since the number and type of reports required are generally independent of the size of the hospital, it is assumed that each facility will receive an equal benefit from the implementation of the TRIFOOD system.

The estimates of benefits outlined below are based on discussions with TPO staff.

a. Daily Pricing of On-Hand Inventory

The daily pricing of on-hand inventory is currently being done only in the Air Force. This benefit, therefore, will be characterized as a primary benefit for the Air Force and additional benefit for the Army and the Navy.

TRIMIS staff estimates that 20 hours per week of an E-5 level staff person's time are currently devoted to this task. The TRIFOOD system should eliminate 90% of this effort.

b. Monthly Inventory Pricing Reconciliation

This currently involves about 16 hours per month of an E-5 level staff person. It is estimated that 90% will be saved with TRIFOOD.

c. Ration Accounting (comparison of earnings versus expenditures)

In the Air Force, this involves a daily effort and a monthly summarization, while in the other two MilDeps only monthly reports are prepared. The benefit for weekly ration accounting is considered to be additional for the Army and Navy.

It is estimated that this task requires 4 hours per month by an E-5 level staff person in all three MilDeps, plus an additional 5

hours per week in Air Force MTFs, and that 50% of this effort will be saved with TRIFOOD.

d. Monthly Workload Reporting (including that required for Uniform Chart of Accounts (UCA) and Uniform Staffing Methodology (USM)).

It is estimated that this currently requires 15 hours per month by an O-3 level staff person, of which 75% will be saved.

2. Inventory Maintenance

The system's inventory function includes maintenance of perpetual inventory, determination of purchase requirements (based on forecast usage, reorder points, and economic order quantities [EOOs]), determination of issue quantities to production, preparation of purchasing and associated documents, and periodic analysis of inventories.

a. Maintain On-hand Subsistence (Food) Inventory

This task is estimated to require 20 hours per week of an E-5 level staff person, of which 90% will be saved.

b. Determination of Purchase Requirements

This task is estimated to require 10 hours per week of an E-5 level staff person, of which 90% will be saved.

c. Determination of Production Issue Quantities

This function is performed only informally now, and is estimated to require 10 hours per week of an E-5 level staff person, of which 90% will be saved. To do this function accurately (by nonautomated methods) would require an estimated 1/3 hour for each of the 1,050 recipes per week, or 350 hours per week of an E-5 level staff person. It is estimated that 90% of this time would be saved, as an additional benefit.

d. Monthly Inventory Analysis (including comparison of physical and "book" inventories)

It is estimated that this requires 10 hours per month of a dietitian (O-3 level), and that 50% of this effort will be saved.

3. Service Management

This includes forecasting the census, determining item preferences, computing service quantities, and comparing forecast with actual usage. Because of lack of resources, these functions are being only

partially performed. The benefits in this area have therefore been characterized as partly primary, and partly additional.

a. Census Forecasting

It is anticipated that 2 hours per week of an E-6 level staff person is devoted to this task currently, of which 50% will be saved. If the census forecasting were done more accurately, it is estimated that an additional 5 hours per week would be required, of which 50% would also be saved.

b. Item Preference

Assuming that the number of menu items is fairly constant from site to site, it is estimated that currently 4 hours per week of an E-6 level staff person is devoted to this task, of which 50% will be saved. If the task were performed more accurately, an additional 12 hours per week would be required, of which 50% would be saved.

c. Computing Service Quantities (servings)

Approximately 4 hours per month of an E-6 level staff person is estimated to be devoted to this task, all of which will be saved. To perform this function more accurately would require an additional 10 hours per week, all of which would be saved.

d. Evaluation

This involves comparing actual requirements with forecasted requirements. It is estimated that 2 hours per week of an E-6 level staff person are currently devoted to this task, all of which will be saved. If the task were performed more accurately, as will be possible with TRIFOOD, it would require an additional 12 hours per week, all of which would be saved.

4. Clerical Assistance

Considerable secretarial effort is now devoted to typing cyclical menus and the various documents required for the tray assembly and dining-room service, production reports, and procurement.

a. Cycle Menus

It is estimated that 4.3 hours of a GS-4 level staff person is required to type menus for each day in the menu cycle, and that 67% of this time will be saved.

b. Daily Service Reports

(1) Tally Reports

The Air Force is the only service that currently tallies all items. Time now spent on this activity in the Army and Navy is considered to be minimal; therefore, the benefit for these services will be characterized as additional. It is estimated that the savings are 2.5 hours of a GS-3 level staff person, per 1,000 inpatient meals served.

(2) Tray Assembly Reports

It is anticipated that this task requires 3 hours per day of a GS-3 level staff person, of which 67% will be saved.

c. Production Reports

(1) Daily Worksheets

These are estimated to require 21 hours per week of an E-6 level staff person, 67% of which will be saved.

(2) Cycle Menu Production Preparation Documents

This task is estimated to require 1.4 hours of a GS-4 level staff person per menu-day of the menu cycle, for each major menu update, all of which will be saved.

d. Procurement Documents

This is estimated to require 10 hours per week of an E-6 level staff person, of which 90% will be saved.

5. Menu Planning: Cost and Nutrition Analysis

The system's nutritional analysis and cost modules will assist in menu planning, by improving and facilitating calculations of the nutritional content and costs of menus and recipes. Because of the time required, these calculations are now carried out on a very restricted basis. The estimated benefits are therefore considered to be additional, rather than a reduction of the time personnel now spend on these tasks.

a. Nutritional Analysis

This is estimated to require 16 hours per menu day of a dietitian (0-3 level) for each day in the menu cycle, for each major menu change. It is estimated that 90% of that time will be saved.

b. Menu Price Analysis per Menu Cycle

This is estimated to require 4 hours of an E-6 level staff person per menu-day, of which 90% will be saved.

c. Menu Price Analysis for Price Updates

This is estimated to require 12 hours of an E-6 level staff person for each monthly price update change, and that 90% of this will be saved.

d. Annual Recipe Price Analysis

This is estimated to require 1/3 hour of an E-6 level staff person per recipe in the recipe file; 90% is estimated to be saved.

e. Recipe Price Update Analysis

This is estimated to require 5 minutes of an E-6 level staff person per recipe updated per cycle, that 10% of the recipes are updated per cycle, and that 90% of this effort would be saved.

6. Patient Nutritional Analysis and Assessment

The capability to perform these activities will be included in the TRIFOOD system because it will contain the required data base, although they are functions of clinical dietetics. Nutritional analysis is expected to be carried out for all patients who are on modified diets and selected patients on regular diets. Nutritional assessment is conducted for all patients; however, the depth of the evaluation will vary. Benefits in this area are also additional.

a. Patient Nutritional Analysis

It is estimated that 50% of inpatient admissions will receive a nutritional analysis of their food intake and diet which requires 1 hour of an O-3 level staff person per patient; an estimated 80% of this time will be saved.

In addition, it is estimated that 90% of the outpatients in the nutrition clinic will receive a nutritional analysis, also requiring 1 hour of an O-3 level staff person per patient, of which 80% will be saved.

b. Nutritional Assessment/Anthropometric Calculations

All inpatients will receive a nutritional assessment requiring an estimated 1/4 hour of a GS-3 level staff person; 50% of the inpatients will receive an intermediate assessment requiring 1 hour of an O-3

level staff person; and 5% of inpatients will receive a 20-hour in-depth assessment by an 0-3 level staff person.

Further, it is estimated that all of the outpatients seen in the nutritional clinic will receive an assessment requiring 1/4 hour of a GS-3 level staff person, and that 50% will also require an intermediate assessment.

It is estimated that the TRIFOOD system will save 50% of the time required for these assessments.

D. WORKLOAD DATA REQUIREMENTS

The estimating equations for benefits are summarized in Tables C-1 through C-6 in Appendix C. The MTF-specific data required for calculating the value of those benefits dependent on workload are:

- Annual raw food expenditures
- Number of major menu changes per year
- Number of days in a menu cycle
- Average number of trays per day
- Number of recipes on file
- Average daily admissions
- Average number of outpatient visits to the nutrition clinic
per day
- Percent of inpatients on modified diets
- Percent of nutrition clinic patients on modified diets.

Table 3 presents the estimated time-costs of active-duty and civilian personnel at a site. Costs are based on salary scales and fringe benefits applicable in FY84. The annual site benefits were estimated (in 1984 dollars) in Table 4, using the personnel time-cost estimates in Table 3 and the estimating equations presented in Tables C-1 through C-6 in Appendix C.

The annual primary benefits (inflated using the DoD inflation index and discounted at 10%) vary from \$85,000 to \$178,000 per site, and total \$1.4 million for the 12 sites. The fixed benefits (those independent of a site's workload) average \$76,000 per site; the remainder are dependent on the workload at an individual site (see Figure 1, where the annual primary benefits are plotted against the average daily census, which is used as an indicator of facility

TABLE 3

DOLLAR VALUE OF TIME FOR PERSONNEL IN
MEDICAL TREATMENT FACILITIES, FY1984

Grade or Rank	Dollar Value of Time ^a			
	<u>Per Year</u>	<u>Per Day</u>	<u>Per Hour</u>	<u>Per Minute</u>
<u>0-3</u>				
Navy	59,987	230.74	28.84	.48
Air Force	57,990	223.04	27.88	.46
Army	54,766	210.64	26.33	.44
<u>E-6</u>				
Navy	37,544	144.40	18.05	.30
Air Force	36,774	141.44	17.68	.29
Army	34,674	133.36	16.67	.28
<u>E-5</u>				
Navy	30,763	118.32	14.79	.25
Air Force	30,680	118.00	14.75	.25
Army	29,286	112.64	14.08	.23
<u>GS-4</u>	20,197	77.68	9.71	.16
<u>GS-3</u>	17,992	69.20	8.65	.14

^aCivilian salaries from 1984 Pay Schedule for Federal White-Collar Workers Table published in Personnel Hilites, December 1983. Includes leave and holiday allowance of 18% and other fringes of 21.7% of base pay.

Military salaries: Includes basic pay from annual composite standard rates table (FY83), increased by 4% to adjust for 1984 pay raise. Rates for Basic Allowance for Quarters, Miscellaneous Expense, Permanent Change of Station Expense, and Incentive and Special Pays were added to the basic pay. These combined rates were adjusted by the leave and holiday allowance of 18%, and the retirement and other benefits allowance of 34.5% for officers and 49.5% for enlisted personnel.

TABLE 4
ANNUAL BENEFITS OF TRIFOOD IN CANDIDATE SITES (1984 Dollars)

	BETHESDA	VILFORD	WOMACK	SAN DIEGO	KEESLER	DARRELL	OAKLAND	V-PAT	MARTIN	PENDLE	GRANT	VALSON	TOTAL
P R I M A R Y B E N E F I T S													
Inventory Pricing	0	13,884	0	0	13,884	0	0	13,884	0	0	13,884	0	555,324
Inventory Reconciliation	2,556	1,560	2,433	2,556	2,500	2,433	2,556	2,500	2,433	2,556	2,500	2,433	128,150
Billion Accounting -- weekly	0	1,910	0	0	1,910	0	0	1,910	0	0	1,910	0	17,870
Billion Accounting -- monthly	355	355	338	355	355	338	355	355	338	355	355	338	16,188
Workload Reporting	3,893	3,764	3,555	3,893	3,764	3,555	3,893	3,764	3,555	3,893	3,764	3,555	146,447
Maintain Subunit Inventory	13,884	13,884	13,179	13,884	13,884	13,179	13,884	13,884	13,179	13,884	13,884	13,179	563,313
Determine Purchase Quantities	4,922	4,983	4,589	4,922	4,983	4,589	4,922	4,983	4,589	4,922	4,983	4,589	181,457
Determine Issue Quantities	4,922	4,983	4,589	4,922	4,983	4,589	4,922	4,983	4,589	4,922	4,983	4,589	181,457
Inventory Analysis	1,730	1,473	1,500	1,730	1,473	1,500	1,730	1,473	1,500	1,730	1,473	1,500	619,932
Costs Forecasting	939	939	847	939	939	847	939	939	847	939	939	847	3,810,899
Item Preference	1,877	1,839	1,734	1,877	1,839	1,734	1,877	1,839	1,734	1,877	1,839	1,734	7,230,798
Computing Service Quantities	3,754	3,677	3,467	3,754	3,677	3,467	3,754	3,677	3,467	3,754	3,677	3,467	14,633,597
Evaluation	1,877	1,839	1,734	1,877	1,839	1,734	1,877	1,839	1,734	1,877	1,839	1,734	7,230,798
Cyclical Menu	398	1,568	1,568	398	1,568	1,568	398	1,568	1,568	398	1,568	1,568	6,164,421
Tally Reports	0	13,450	0	0	13,450	0	0	13,450	0	0	13,450	0	124,584
Tray Assembly	4,310	4,310	4,310	4,310	4,310	4,310	4,310	4,310	4,310	4,310	4,310	4,310	175,412
Daily Worksheets	13,140	12,871	13,140	13,140	12,871	13,140	13,140	12,871	13,140	13,140	12,871	13,140	553,589
Menu Production Prep Doc	190	741	741	190	741	741	190	741	741	190	741	741	3,137
Procurement Documents	8,447	8,274	7,882	8,447	8,274	7,882	8,447	8,274	7,882	8,447	8,274	7,882	33,003
Yearly subtotals	973,154	1,103,183	970,440	973,154	974,494	1,094,400	973,445	975,519	949,190	974,315	995,821	949,400	3,961,545
MATERIAL SAVINGS													
Food Purchase	970,000	975,000	926,000	982,350	939,000	910,100	937,500	935,000	932,459	924,550	927,300	915,900	3,654,859
Yearly subtotals	970,000	975,000	926,000	982,350	939,000	910,100	937,500	935,000	932,459	924,550	927,300	915,900	3,654,859
YEARLY TOTALS	1,943,154	2,178,183	1,896,440	1,955,405	1,913,494	1,994,500	1,910,945	1,910,519	1,881,649	1,898,865	1,923,121	1,865,300	7,616,404
A D D I T I O N A L B E N E F I T S													
Inventory Pricing	913,803	90	913,179	913,803	90	913,179	913,803	90	913,179	913,803	90	913,179	3,600,889
Billion Accounting -- weekly	1,923	0	1,920	1,923	0	1,920	1,923	0	1,920	1,923	0	1,920	17,870
Determine Issue Quantities	335,338	334,782	324,041	335,338	334,782	324,041	335,338	334,782	324,041	335,338	334,782	324,041	1,376,326
Costs Forecasting	3,347	2,398	2,167	3,347	2,398	2,167	3,347	2,398	2,167	3,347	2,398	2,167	12,720
Item Preference	4,493	4,334	4,093	4,493	4,334	4,093	4,493	4,334	4,093	4,493	4,334	4,093	154,494
Computing Service Quantities	9,304	9,194	8,440	9,304	9,194	8,440	9,304	9,194	8,440	9,304	9,194	8,440	37,092
Evaluation	11,243	11,032	10,482	11,243	11,032	10,482	11,243	11,032	10,482	11,243	11,032	10,482	45,920
Tally Reports	4,497	0	3,116	4,497	0	3,116	4,497	0	3,116	4,497	0	3,116	18,700
Nutritional Analysis	5,814	22,482	21,233	5,814	22,482	21,233	5,814	22,482	21,233	5,814	22,482	21,233	93,759
New Price Analysis	2,337	3,364	3,361	2,337	3,364	3,361	2,337	3,364	3,361	2,337	3,364	3,361	13,462
New Price Updates	2,337	3,364	3,361	2,337	3,364	3,361	2,337	3,364	3,361	2,337	3,364	3,361	13,462
Annual Recipe Price Analysis	8,641	4,716	2,624	8,641	4,716	2,624	8,641	4,716	2,624	8,641	4,716	2,624	34,864
Recipe Price Update Analysis	2,437	1,432	795	2,437	1,432	795	2,437	1,432	795	2,437	1,432	795	9,902
Patient Nutritional Analysis	348,410	333,412	310,445	348,410	333,412	310,445	348,410	333,412	310,445	348,410	333,412	310,445	1,384,573
In Nutritional Assessment	301,312	409,435	301,312	301,312	409,435	301,312	301,312	409,435	301,312	301,312	409,435	301,312	1,234,551
Out Nutritional Assessment	24,334	44,434	39,495	24,334	44,434	39,495	24,334	44,434	39,495	24,334	44,434	39,495	98,353
Yearly subtotals	953,007	61,164,000	606,745	61,519,300	677,875	61,110,521	609,402	672,292	698,340	681,859	680,773	645,495	2,516,365
YEARLY TOTALS	1,926,007	61,164,000	1,533,185	61,519,300	1,652,369	61,110,521	1,578,847	1,647,804	1,647,529	1,656,174	1,678,593	1,590,895	10,132,819
GRAND TOTALS	3,869,161	61,332,183	3,422,185	61,475,402	3,611,369	61,221,042	3,580,347	3,647,811	3,647,216	3,576,214	3,673,294	3,561,295	14,179,664

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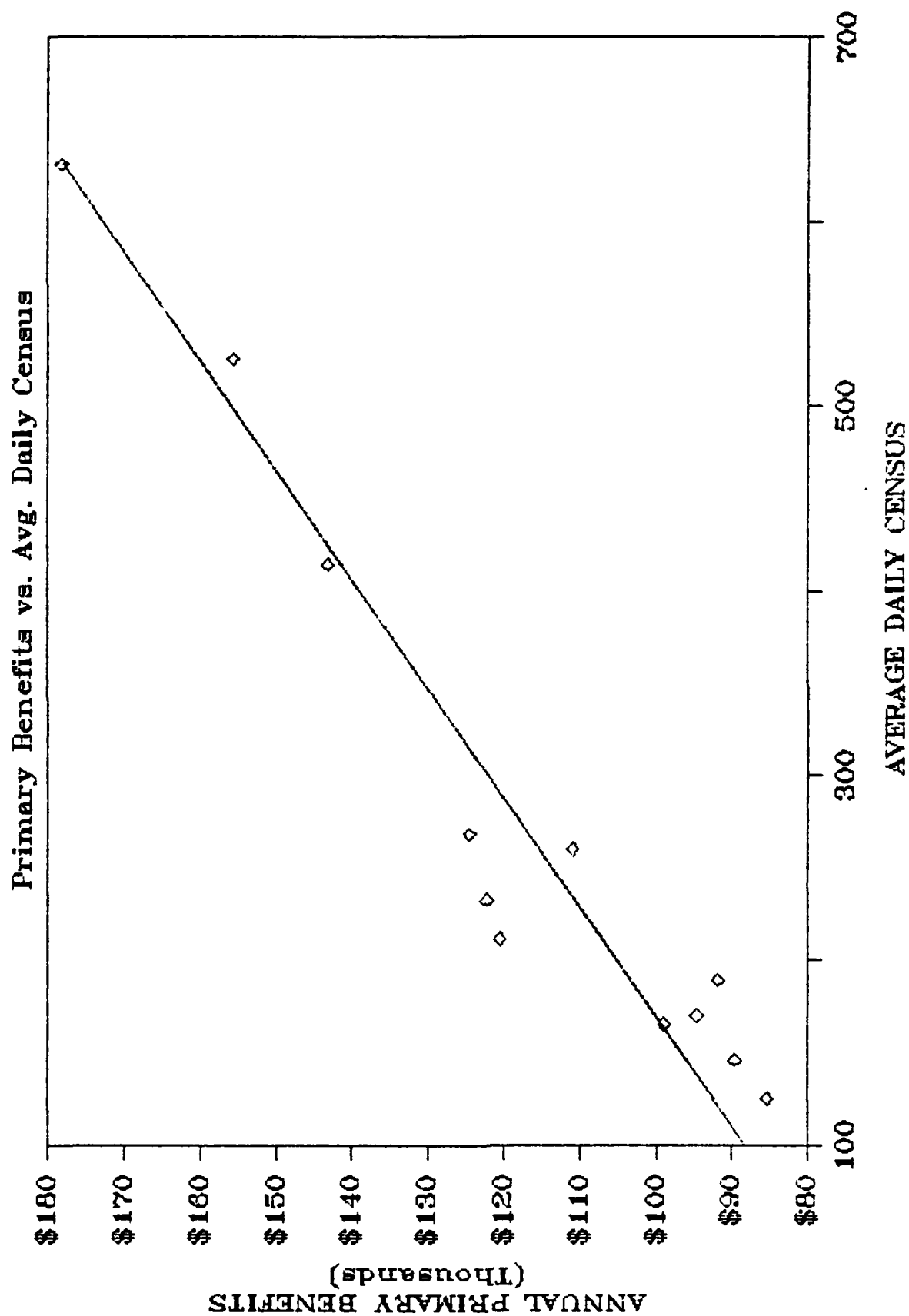


FIGURE 1. ANNUAL PRIMARY BENEFITS VERSUS AVERAGE DAILY CENSUS OF CANDIDATE SITES (1984 DOLLARS)

workload). The additional benefits are between \$659,000 and \$1,519,000 per site, and total \$11 million. Total annual benefits for the 12 sites, including both primary and additional, are \$12.7 million.

E. QUALITATIVE BENEFITS

In addition to the quantifiable benefits expected from implementation of the TRIFOOD system, the following qualitative benefits are anticipated:

- Improved quality of patient care because of more frequent nutritional analyses.
- Improved quality of patient care because of an increase in the number of patients interacting with dietitians.
- As indicated above, one of the objectives of the TRIFOOD system is to facilitate nutritional assessment of patients. A number of studies⁽⁷⁻⁹⁾ have shown that up to 50% of patients admitted to a hospital suffer from protein-calorie malnutrition. Although as yet there apparently have been no properly defined randomized prospective studies showing that nutritional intervention can favorably affect a patient's morbidity, mortality or length of stay, it is not unreasonable to expect such benefits.
- Less opportunity for fraud, waste, and abuse, because of more timely and accurate management data.
- Improved management of the Food Service Department because reports will be more complete and accurate, enabling personnel to make more effective management decisions.
- Increased compliance with military department regulations.
- Reduction in transcription and computation errors in inventory records and purchase orders.
- Increased patient and diner satisfaction because of the reduced chance of shortages of preferred food.

- Increased patient satisfaction because of improved preparation, quality, or kind of food served.
- Increased job satisfaction of all food service personnel because of the elimination of tedious, monotonous, and repetitive clerical tasks.
- Increased job satisfaction of dietitians because of more involvement with professional rather than procedural activities.
- Increased job satisfaction of the food manager because of more timely and accurate management reports and inventories.

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III. TRIFOOD SYSTEM COSTS

The following estimates of costs of the TRIFOOD system are based on reviews of costs of similar systems, preliminary estimates developed by TRIMIS staff, and discussions with TRIMIS staff. System costs are characterized as either one-time costs (including system acquisition, site preparation, and training), or recurring costs (including maintenance and supplies).

Hardware Acquisition

Although the precise configuration for the computer system has not yet been determined, the cost of a similar system is approximately \$25,000 for a medium-sized hospital. It is anticipated that the larger hospitals in the initial implementation plan (NAVHOSP Bethesda, Wilford Hall USAF Medical Center, and NAVHOSP San Diego), will require additional peripheral devices, resulting in hardware costs of \$32,000.

Hardware Maintenance

Based on estimates provided to the TPO, annual hardware maintenance is estimated at 18% of equipment cost, or \$4,500 per year for the medium-sized hospitals and \$5,800 per year for the three larger hospitals.

Software Acquisition

Software rights will probably be acquired one time, rather than purchased separately for each site. This cost has been allocated to the 12 initial sites and is estimated at a cost of \$35,000 per site.

Software Maintenance

Software maintenance of the basic automated food system is estimated at \$65,000 per year. This amount has been allocated to the initial 12 sites, at a cost of approximately \$5,400 per site.

Software Modification, Documentation and Installation

Modifications will probably have to be made to the basic food system's software to meet TRIMIS requirements; the cost of such software modifications and the associated documentation is estimated at a one-time cost of \$93,000. Vendor implementation assistance costs are estimated at approximately \$2,500 per site. If the software

modification costs are prorated among the initial 12 sites, we arrive at a total of about \$10,250 per site for software modification, documentation and installation.

Communications

A conservative estimate of \$500 per device for communication lines between CRTs and printers was used in this analysis. The total communication cost for medium-sized hospitals is estimated at \$3,000 and for larger hospitals at \$5,500.

Site Preparation

The major cost of site preparation is expected to be for the installation of additional power outlets. The cost of site preparation is estimated as \$1,000 per site for medium-sized hospitals and \$2,000 per site for larger hospitals.

Training

Based on estimates provided by the TPO, travel expenses incurred in the training of the key personnel from each site will initially cost \$9,000 for a medium-sized hospital and \$13,000 for a larger hospital. It is also anticipated that one member from each site will attend a yearly meeting, thereby incurring a recurring cost of \$700 per year.

It is estimated that at the medium-sized hospitals four officers (O-3 level), four NCOs (E-6 level), two storeroom personnel (E-5 level), two supervisors (E-5 level), and one cost accountant (GS-4 level) will receive ten hours of training each in use of the system. The time cost of the staff involved in the training activities, using the hourly rates presented in Table 3, is approximately \$2,500. In the three larger hospitals it is estimated that ten officers, ten NCOs, four storeroom personnel, four supervisors, and one cost accountant will receive ten hours of training each. The training time cost of the personnel is approximately \$5,800 in the larger hospitals.

Supplies

It is estimated that the cost of the initial supplies needed by each site will be \$5,000. The recurring supply costs for medium-sized hospitals are estimated at \$10,000 per year and for larger hospitals at \$15,000 per year.

Data Collection

It is estimated that ten hours of a dietitian (O-3 level) and 30 hours of an NCO (E-6 level) will be required to collect and verify the data needed for building the initial files at each site. The time cost of this data collection is therefore approximately \$800 per site.

Total

Table 5 summarizes the TRIFOOD system's estimated costs, categorized as either one-time or recurring.

As indicated, for each medium-sized hospital, the total one-time cost is estimated at \$92,000, and annual recurring costs are \$21,000. Total lifecycle cost, assuming an eight-year lifecycle for the system, is therefore approximately \$256,000 (undiscounted and uninflated).

For each of the three larger hospitals, total one-time costs are estimated at approximately \$109,000, and annual recurring costs are about \$27,000. The total eight-year lifecycle cost is therefore approximately \$325,000 (undiscounted and uninflated).

TABLE 5

ESTIMATED TRIFOOD SYSTEM COSTS
(Thousands of Dollars)

	<u>Medium-Sized Hospitals</u>		<u>Large Hospitals</u>	
	<u>One-Time</u>	<u>Annual Recurring</u>	<u>One-Time</u>	<u>Annual Recurring</u>
Hardware-acquisition and maintenance	\$25.0	\$4.5	\$32.0	\$5.8
Software-acquisition and maintenance	35.0	5.4	35.0	5.4
Software-development and documentation	7.8	--	7.8	--
Communication	3.0	--	5.5	--
Site Preparation	1.0	--	2.0	--
Installation (vendor)	2.5	--	2.5	--
Training of Key Personnel	9.0	.7	13.0	.7
Staff Training	2.5	--	5.8	--
Supplies	5.0	10.0	5.0	15.0
Data Collection	<u>0.8</u>	<u>--</u>	<u>0.8</u>	<u>--</u>
TOTAL	\$91.6	\$20.6	\$109.4	\$26.9

IV. ESTIMATED PRESENT VALUE LIFECYCLE BENEFITS AND COSTS

A. ASSUMPTIONS

This section presents the results of a base-case lifecycle analysis of the TRIFOOD system for the 12 initial candidate sites. The estimated present value lifecycle benefit and cost analyses incorporate the estimates of benefits and costs derived in Chapters II and III with the following assumptions:

- The system's lifecycle for each site was taken as eight years, beginning with the estimated date of installation of each system, as presented in Table 2.
- Benefits were assumed to be realized beginning six months after installation of the system at each candidate site. It was assumed that it would take this time for the system to be fully functional and the personnel to be sufficiently experienced to take advantage of its labor-saving functions.
- In the base case, dollar values for benefits and costs were inflated annually over the lifecycle, using the DoD Inflation Index. Sensitivity analyses (Chapter V) were performed using two additional inflation indexes, the Health Care Financing Administration (HCFA) and Rate Control indexes. Inflation indexes are shown in Table 6.
- The 10% discount rate mandated by DoD was used in the base-case analyses. Discount rates of 0%, 6%, 8%, and 12% were also tested as sensitivity factors (Chapter V).

B. ESTIMATED PRESENT VALUE LIFECYCLE BENEFITS

The present value lifecycle benefits are presented in Table 7. The primary present value lifecycle benefits are approximately \$7.6 million, of which \$5.1 million (68%) result from personnel time-savings (Figure S-1). The major components of the primary benefits are reduced food purchase costs and a reduction of personnel time for maintaining the subsistence inventory and preparing daily worksheets.

TABLE 6

INFLATION RATES USED IN LIFECYCLE ANALYSIS OF BENEFITS AND COSTS

INFLATION INDEX/CATEGORY	Inflation (Percent per Year)			
	1985	1986	1987	1988-1995
<u>DoD Index^a</u>				
Operating and Maintenance Costs	4.8	4.5	4.2	3.9
Personnel Costs				
Salary	4.8	4.5	4.2	3.9
Benefits	4.9	4.6	4.3	4.0
<u>HCFA Project Inflation^b</u>				
Other Miscellaneous Costs	6.2	6.2	6.2	6.2
Personnel Costs				
Salary	6.7	6.7	6.7	6.7
Benefits	9.6	9.6	9.6	9.6
<u>Rate Control^c</u>				
Other	5.2	6.5	6.5	6.5
Personnel Costs				
Salary	6.8	7.5	7.5	7.5
Benefits	12.5	12.8	12.8	12.8

^aDepartment of Defense, Office of Budget and Finance, OASD(C) memorandum dated January 11, 1984.

^bAs shown in Rate Control Supplement, Vol. 7, No. 2, February 1983.

^cRate Control Supplement, Vol. 8, No. 1, January 1984.

TABLE 7

ESTIMATED PRESENT VALUE LIFECYCLE BENEFITS OF
TRIFOOD IN 12 CANDIDATE SITES

<u>Primary Benefit</u>	<u>Present Value Lifecycle Benefits (Thousands of Dollars)</u>	<u>Percent of Primary Benefit</u>
<u>Increased Availability of MTF Personnel Time</u>		
1. Inventory Pricing	294.2	3.9
2. Inventory Pricing Reconciliation	160.6	2.1
3. Ration Accounting - Weekly	40.9	0.5
4. Ration Accounting - Monthly	22.3	0.3
5. Workload Reporting	238.9	3.2
6. Maintain Subsistence Inventory	870.1	11.5
7. Determine Purchase Quantities	435.0	5.8
8. Determine Issue Quantities	435.0	5.8
9. Inventory Analysis	106.2	1.4
10. Census Forecasting	58.1	0.8
11. Item Preference	116.1	1.5
12. Computing Service Quantities	232.2	3.1
13. Evaluation	116.1	1.5
14. Cyclical Menus	77.6	1.0
15. Tally Reports	143.2	1.9
16. Tray Assembly Reports	403.2	5.3
17. Daily Worksheets	812.7	10.7
18. Menu Production Preparation Documents	37.9	0.5
19. Procurement Documents	<u>522.5</u>	<u>6.9</u>
Subtotal	5,122.7	67.7
<u>Materiel Savings</u>		
20. Food Purchases	2,440.0	32.3
TOTAL PRIMARY BENEFITS	7,562.8	100.0

TABLE 7 (continued)

ESTIMATED PRESENT VALUE LIFECYCLE BENEFITS OF
TRIFOOD IN 12 CANDIDATE SITES

<u>Additional Benefit</u>	<u>Present Value Lifecycle Benefits (Thousands of Dollars)</u>	<u>Percent of Additional Benefit</u>
<u>Increased Availability of MTF Personnel Time</u>		
21. Inventory Pricing	575.8	1.0
22. Ration Accounting - Weekly	80.0	0.1
23. Determine Issue Quantities	14,790.9	24.5
24. Census Forecasting	145.1	0.2
25. Item Preference	290.3	0.5
26. Computing Service Quantities	580.5	1.0
27. Evaluation	696.6	1.2
28. Tally Reports	191.1	0.3
29. Nutritional Analysis	1,111.6	1.8
30. Menu Price Analysis	175.7	0.3
31. Menu Price Updates	144.7	0.2
32. Annual Recipe Price Analysis	482.3	0.8
33. Recipe Price Update Analysis	146.1	0.2
34. Patient Nutritional Analysis	16,703.3	27.6
35. Inpatient Nutritional Assessment	21,200.5	35.1
36. Outpatient Nutritional Assessment	<u>3,100.1</u>	<u>5.1</u>
TOTAL ADDITIONAL BENEFITS	60,414.7	100.0
TOTAL ALL BENEFITS*	67,977.5	

*Includes primary and "additional" benefits.

The additional benefits total approximately \$60.4 million and account for 88.9% of the total benefits. Three additional benefits, determination of issue quantities, patient nutritional analysis, and inpatient nutritional assessment, contribute approximately \$52,695,000 of the additional benefits.

The total estimated lifecycle benefits are \$68 million.

C. ESTIMATED PRESENT VALUE LIFECYCLE COSTS

Table 8 summarizes the present value lifecycle costs for the 12 candidate sites. The total cost of TRIFOOD in the 12 candidate sites is approximately \$2.63 million. Approximately 32% of the cost is due to software acquisition, development and documentation, and maintenance. Hardware acquisition and maintenance account for almost 24% of the total cost. Supplies account for approximately 30% of the total cost and the remaining 14% is for communication and miscellaneous costs.

D. COMPARISON OF ESTIMATED PRESENT VALUE LIFECYCLE BENEFITS AND COSTS

As indicated above, the present value lifecycle primary benefits of TRIFOOD are estimated to total approximately \$7.5 million in the 12 sites considered in this analysis. The present value costs of the system in the 12 sites are \$2.6 million. The net lifecycle primary benefits for the 12 sites are therefore \$4.9 million. If the additional benefits of approximately \$60.4 million are added, the net benefits for the TRIFOOD system total \$67.9 million. The PEA thus indicates that the TRIFOOD system is very cost-effective.

The specific annual TRIFOOD benefits and costs by major category are shown in Table 9 for each project year. As indicated, the time stream of estimated costs will begin in 1985 and the time stream of estimated benefits will begin in 1986, six months after the date of installation. The yearly present value of benefits will exceed the yearly present value of costs in 1987 for primary benefits and 1986 for total benefits. Beginning in 1988, the estimated cumulative present value of primary annual benefits exceeds the estimated cumulative present value of costs each year until the expiration dates for the project (Figure S-3). Total cumulative net benefits exceed total cumulative costs in 1986.

TABLE 8

ESTIMATED PRESENT VALUE LIFECYCLE COSTS OF
TRIFOOD IN 12 CANDIDATE SITES

<u>Cost Category</u>	<u>Present Value Lifecycle Costs (Thousands of Dollars)</u>	<u>Percent of Total Cost</u>
<u>HARDWARE</u>		
<u>Non-Recurring</u>		
Hardware Acquisition	288.5	11.0
<u>Recurring</u>		
Hardware Maintenance	<u>334.1</u> 622.6	<u>12.7</u> 23.7
<u>SOFTWARE</u>		
<u>Non-Recurring</u>		
Software Acquisition	376.8	14.3
Development and Documentation	84.0	3.2
<u>Recurring</u>		
Software Maintenance	<u>373.1</u> 833.9	<u>14.2</u> 31.7
<u>COMMUNICATIONS</u>		
<u>Non-Recurring</u>		
Communication Lines	<u>59.2</u> 59.2	<u>2.2</u> 2.2
<u>OTHER</u>		
<u>Non-Recurring</u>		
Site Preparation	21.5	0.8
Installation (Vendor)	26.9	1.0
Supplies	53.8	2.0
Training Key Personnel	140.0	5.3
Staff Training	36.0	1.4
Data Collection	8.6	0.3
<u>Recurring</u>		
Training Key Personnel	49.7	1.9
Supplies	<u>780.1</u> 1,116.7	<u>29.6</u> 42.4
TOTAL	2,632.4	100.0

TABLE 9

TOTAL ESTIMATED LIFECYCLE BENEFITS AND COSTS OF TRIFOOD
BY MAJOR CATEGORY, BY YEAR FOR ALL 17 CANDIDATE SITES

BENEFITS	Present Value Annual Total (Thousands of Dollars) ^a											Percent of Total
	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	TOTAL
<u>Primary Benefits</u>												
Increased Availability of MTF Personnel Time	0	112.4	599.0	780.0	735.3	693.2	653.5	616.1	573.5	348.9	10.7	5,122.7
Materiel Savings	0	87.8	318.6	367.7	346.6	326.8	308.1	290.4	266.8	124.2	3.0	2,440.0
Subtotal	0	200.3	917.5	1,147.7	1,082.0	1,020.0	961.6	906.5	840.2	473.2	13.7	7,562.8
<u>Additional Benefits</u>												
Increased Availability of MTF Personnel Time	0	1,405.8	7,318.0	9,180.7	8,654.9	8,159.2	7,691.9	7,251.4	6,740.3	3,907.3	105.4	60,414.7
TOTAL BENEFITS ^b	0	1,606.0	8,235.5	10,328.4	9,736.9	9,179.2	8,653.5	8,157.9	7,580.5	4,380.4	119.1	67,977.5
<u>COSTS</u>												
Hardware	31.4	214.0	113.0	46.9	44.2	41.7	39.3	37.0	34.3	20.1	0.6	622.6
Software	41.6	330.7	164.5	52.5	49.5	46.6	44.0	41.4	38.5	23.8	0.7	833.8
Communication	5.2	39.8	14.1	0	0	0	0	0	0	0	0	59.2
Other	30.8	248.6	187.2	116.1	109.5	103.2	97.3	91.7	84.5	46.4	1.3	1,116.7
TOTAL COSTS ^b	109.1	833.2	478.8	215.5	203.2	191.5	180.5	170.2	157.4	90.4	2.7	2,632.4
PRIMARY NET BENEFITS ^c												
- by year	(109.1)	(632.9)	438.8	932.2	878.8	828.5	781.1	736.3	683.8	382.8	11.0	
- cumulative	(109.1)	(742.0)	(303.2)	629.0	1,507.9	2,336.4	3,117.4	3,853.8	4,536.6	4,919.4	4,930.4	
TOTAL NET BENEFITS ^d												
- by year	(109.1)	772.8	7,765.8	10,112.9	9,533.7	8,987.7	8,473.0	7,987.7	7,423.1	4,290.1	116.4	
- cumulative	(109.1)	663.8	8,420.5	18,533.4	28,067.2	37,054.9	45,577.8	53,515.5	60,938.6	65,228.7	65,345.1	

^a Discount Rate of 10%; DoD Inflation Index.^b May not add to sum of results for each category and year because of rounding for each year.^c Net benefits equal subtotal of primary benefits minus total costs.^d Net benefits equal total benefits minus total costs.

V. SENSITIVITY OF RESULTS TO MAJOR ASSUMPTIONS

A. INTRODUCTION

In the previous chapter the base-case estimated present value lifecycle benefit and cost analyses of the TRIFOOD system in 12 candidate sites were presented, using one set of assumptions with regard to inflation rates and discount rate. This chapter presents the results of sensitivity analyses which investigate the effect on the net benefits of the system that are due to alternative assumptions about:

- inflation rates;
- discount rates;
- estimated benefits.

The benefits and costs of each sensitivity analysis are discussed below and are summarized in Table 10. Individual tables showing the detailed effects of the various inflation indexes and discount rates are presented in Appendix D.

B. INFLATION INDEXES

Three alternative inflation projections were investigated in this analysis:

- Inflation projections prepared by the Comptroller (Program/Budget), Office of the Assistant Secretary of Defense, for costs of operation and maintenance of all DoD activities, not specifically health care.
- Inflation projections by the Health Care Financing Administration (HCFA), U.S. Department of Health and Human Services, for all public and private hospitals in the U.S.; and
- Hospital-industry inflation projections for U.S. hospitals (which tend to project higher rates of inflation than HCFA), called here "Rate Control Supplement."

The first of these, the DoD Inflation Index, was used in the base-case analysis (Chapter IV).

TABLE 10

SENSITIVITY ANALYSIS OF ESTIMATED PRESENT VALUE BENEFITS
AND COSTS OF TRIFOOD IN 12 CANDIDATE SITES
(Thousands of Dollars)

<u>Sensitivity Factor</u>	<u>Costs</u>	<u>Benefits</u>		<u>Net Benefits</u>	
		<u>Primary</u>	<u>All</u>	<u>Primary</u>	<u>All</u>
Base Case (10% discount, DoD Inflation Index)	2,632.4	7,562.8	67,977.5	4,930.4	65,345.1
<u>Inflation Index</u>					
HCFA inflation index	2,859.0	9,203.0	85,260.6	6,344.0	82,401.6
Rate Controls inflation index	2,864.0	10,000.4	95,263.1	7,136.4	92,399.1
<u>Discount Rate</u>					
12% discount rate	2,440.4	6,787.9	60,990.5	4,347.5	58,550.1
8% discount rate	2,849.6	8,456.6	76,040.0	5,607.1	73,190.4
6% discount rate	3,096.5	9,492.1	85,382.5	6,395.6	82,286.0
0% discount rate	4,077.1	13,758.2	123,895.8	9,681.1	119,818.7
<u>Benefits</u>					
50% of Food Purchase	2,632.4	6,342.8	66,757.5	3,710.4	64,125.1
200% of Food Purchase	2,632.4	10,002.8	70,417.5	7,370.4	67,785.1
50% of Maintain Subsistence Inventory	2,632.4	7,127.8	67,542.5	4,495.4	64,910.1
50% of Daily Worksheets	2,632.4	7,156.4	67,571.1	4,524.0	64,938.7
50% of Determine Issue Quantities	2,632.4	--	60,582.1	--	57,949.7
50% of Patient Nutritional Analysis	2,632.4	--	59,625.8	--	56,993.4
50% of Inpatient Nutritional Assessment	2,632.4	--	57,377.2	--	54,744.8

Table 10 displays and compares the base-case results with those obtained with the other two inflation indexes. Using the HCFA inflation index, the primary net benefits increase to \$6.3 million and the total net benefits to \$82.4 million. The primary net benefits and total net benefits using the Rate Control index are \$7.1 million and \$92.4 million, respectively. As shown, changing the inflation index confirms the basic conclusion that lifecycle benefits exceed lifecycle costs by a substantial margin.

C. DISCOUNT RATES

In order to compare the time stream of costs in each year with the time stream of benefits in each year, they are discounted to convert the time streams into a common basis--their present value. Discounting reflects the opportunity foregone by investing in the program under consideration (i.e., the opportunity cost). The choice of discount rate can affect the outcome of the economic analysis.

In the base-case analysis, the DoD-mandated discount rate of 10% was used. The effect of using alternative discount rates is presented in Table 10. As would be expected, the lower discount rates yield a greater net present value benefit. With a 6% discount rate, the primary net benefits increase by \$1.5 million, and the total net benefits by \$16.9 million over the base case. An 8% discount rate increases the primary net benefits and total net benefits by \$677,000 and \$7.8 million, respectively. A 12% discount rate decreases the primary net benefits by \$583,000 and the total net benefits by \$6.8 million. However, at all discount rates employed in this analysis, the benefits exceed the costs by substantial margins.

D. CHANGE IN BENEFIT ESTIMATES

Sensitivity analyses were performed to test the effect of changes in those benefit estimates that represent approximately 10% or more of the estimated primary benefits and of the estimated total benefits. Six benefits were investigated, five of which resulted from a reduction in the time personnel spend on the following activities:

- maintaining subsistence inventory (primary);
- preparing daily worksheets (primary);

- determining issue quantities (additional);
- performing nutritional analysis on patients (additional);
- performing nutritional assessment of patients (additional).

The sixth benefit was due to a reduction in food purchase (primary) costs.

As shown in Table 10, a 50% reduction in the primary benefit of personnel time-savings for maintaining subsistence inventory and preparing daily worksheets reduces net benefits by approximately \$435,000, and \$406,000, respectively. When three additional benefits in personnel time-savings, determination of issue quantities, patient nutritional analyses, and inpatient nutritional assessment are reduced by 50%, the decrease in total net benefits is \$7.4 million, \$8.4 million, and \$10.6 million, respectively.

The benefit of reduction in food purchase costs was analyzed in two ways: by reducing the benefit by 50% (consistent with the above sensitivity analyses), and by doubling the benefit. The reason for this second sensitivity analysis is that a conservative estimate of 5% of food costs savings was used in the base case. The literature indicated savings in food costs of up to 34%, so using even a 10% reduction is conservative. The result of the first sensitivity assumption is to decrease net benefits by \$1.2 million. The result of the second sensitivity assumption is to increase the net benefits by \$2.4 million, or 49% of the primary net benefits and 4% of the total net benefits.

The sensitivity analyses thus support the conclusion that the net lifecycle benefits of TRIFOOD in the 12 candidate sites exceed the net lifecycle costs. This conclusion is insensitive to the major benefit and economic assumptions tested.

APPENDIXES

APPENDIX A

LITERATURE REVIEW

A review of the literature yielded two articles that discussed the overall state of food service automation. One article, "The Evolution of Computers: A Review,"⁽¹⁾ gives a brief description of the historical development of food service automation. The article points out that the automation of food service departments, whether in universities or hospitals, has been a fairly recent occurrence. Joseph L. Balintfy was one of the original pioneers in the field of food service automation. In 1962 at Tulane University, he was the principal investigator for a computer-assisted menu planning (CAMP) system, a system designed to "plan lowest cost menus that met criteria for nutritive values, menu pattern, and frequency of offering."⁽¹⁾ It is still used today; however, it has been greatly modified since its initial development. The article also discusses computer applications related to food service management, including inventory control/purchasing systems, forecasting, recipe adjustment, production control, tray assembly and delivery, and menu planning and printing. The article contains some details about computer applications in clinical dietetics, the use of the computer as an instructional tool, and some of the things that should be considered during the planning and conversion process. The article has a lengthy bibliography, 135 references, which encompass a wide variety of areas related to food service automation.

The second article, "Automated Hospital Information System Functions for Dietetics,"⁽²⁾ published in 1982, presented the results of a mail survey of HIS vendors and hospitals that was conducted by the Health Services Research Center/Health Care Technology Center (at University of Missouri-Columbia). Surveys were mailed to 241 vendors and 1,066 hospitals; the response rate was 70 and 250, respectively. Of the respondents, 24 vendors and 101 hospitals had computerized dietetic functions. The most prevalent functions offered by vendor firms were charge capturing, meal scheduling, menu planning and production of reports and, finally, food selection for purchasing. Hospitals

most frequently used charge capturing, diet change notification, meal scheduling, stores inventory, and menu planning. The article goes into more detail about the distribution of functions with regard to hospital size and draws the conclusion that there is a "growth in acceptance of automated hospital information system functions for dietetic departments."⁽²⁾

This conclusion seems to be supported by a more recent study. A survey of hospitals in the United States to determine the extent of utilization of computer assistance for dietary departments carried out under the auspices of the R&D Committee of the American Society for Hospital Food Service Administrators (ASHFSA) (Mr. Alan McLaren, Community Hospital, Indianapolis, private communication) showed that currently many hospitals of 500 or more beds have some food service application on computers. The major applications being used are forecasting, recipe file, derived ingredient lists, and food purchase lists. Many hospitals utilize a variation of the original CAMP system to prepare "optimum" menus, to prepare nutritionally appropriate menus, and to determine the cost per item or per meal.

The literature⁽¹⁻¹⁸⁾ cites a number of hospitals and universities which have varying degrees of automation with their food service department. There are, however, three institutions that appear to have been instrumental in the development of automated food service systems and about which a fair amount has been published, including discussions of the major functions associated with such systems.

The University of Missouri-Columbia Medical Center is one of these institutions. It was very involved in the early development of food service systems and has perhaps had the most published about it.⁽²⁻⁶⁾ Dietitians began developing applications of computers for food services in 1964, and by 1970 four subsystems were operational:

- Food Cost Accounting
- Patient Nutrient Intake
- Production Control
- Inventory Control.

The system has been continually upgraded and new modules have been designed and implemented. One of the more recent modules was a computer-assisted personnel data system to improve labor management by providing labor-related information that had previously been too tedious or time-consuming to calculate manually.

University Hospitals of Cleveland began to implement an automated food service system in 1969.⁽¹⁰⁾ They chose to implement first inventory control, then recipe standardization, ingredient control functions, and, finally, a nutrient control program. This last module was the final phase of the system's development and was designed to "assist dietitians in nutrition assessment of patients, to plan menus and modified diets, to monitor patients' intakes, to facilitate the education of patients and hospital personnel and to produce documentation for accrediting agencies."⁽¹²⁾

As the system was being installed, the food service department at University Hospitals became highly centralized. As part of this process a decision was made to create an ingredient room,⁽⁹⁾ where ingredients are carefully measured and packaged for each recipe; this appears to have significantly contributed to realizing benefits, particularly of food costs savings but also of labor savings.

Another food service department with a computerized information system is in the Community Hospital of Indianapolis.^(7,8) In the early 1970s, Community Hospital began to use a computerized selective menu program that had been developed in-house. However, the results were not entirely satisfactory and it soon became necessary to make substantial changes. Community Hospital decided to extend the original system, which was a hospital-wide master information system, and to adapt a Food Operator's Ongoing Data System (FOODs), a service of TransTech, Inc., to their needs. This method worked well until the mid-1970s when the hospital's mainframe computer was no longer adequate. The decision was made to interface mini- and microcomputers with the mainframe to provide the necessary additional capabilities. After ten years of hardware changes and development, the automated food service system at Community Hospital is being run on a mini-computer and the hospital administrators are considering marketing the system.

As has been frequently mentioned in the literature and illustrated in this discussion, the process of implementing an automated food service system can be time consuming and expensive. However, as more systems are developed and marketed, the cost to an individual hospital in dollars and time invested is expected to be considerably reduced.

Heretofore, automated food systems have generally been implemented on the hospital's mainframe computer. The trend now, however, is to convert food system applications from the mainframe computer to a stand-alone micro- or minicomputer. A number of commercial vendors have developed food service systems that operate on microcomputers. There are a number of such systems in university food services but the use of such minicomputer systems in hospitals is not yet widespread. Use of stand-alone systems is expected to grow in the next several years, however, aided in part by the developments of commercial vendors.

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APPENDIX B
DESCRIPTION OF FOOD SERVICE ACTIVITIES

Description of Food Service Activities

This brief description of Food Service Activities is based on Section 2.3 of the Preliminary TRIFOOD Functional Description. The major functions are generally consistent throughout MTFs, but regulations and procedures vary from one MilDep to another, and to a lesser extent from site to site, so that the details will vary. The major differences among the MilDeps are included in this discussion.

Menu Planning

There are two major types of menus: "hotel-restaurant" and "cycle." The hotel-restaurant menu has a large selection but remains the same day to day. The cyclical menu may be non-selective or selective and usually changes every 4-6 weeks. All military hospitals offer regular selective menus in cycle format or hotel-restaurant format for patients. The Army, Navy, and Air Force have selective and non-selective therapeutic menus for patients at some MTFs. It should also be noted that the menu for staff and other diners may be different from the patients' menu.

When planning a menu, several factors must be taken into consideration. These include: local availability of foods, regional preferences, clientele, food color and texture, flavor combinations, overall acceptability, cost, and nutritional adequacy. Menus are planned well in advance; therefore it is sometimes necessary to make changes at a later date. Reasons for such changes include unavailability of foods and changes in the population. When changes are made on very short notice, patients are not notified, but when time allows, patients receive menus that have been changed manually to indicate the new meal planned.

Menus are preprinted and given to the patients so that they may make selections. The menus are collected and returned to the food service area where they are tabulated in various ways, depending upon the military department, type of menu, and method of food preparation. They are then used for assembling the patients' trays.

Production Control

There are two types of production systems: conventional and ready-foods. In the conventional system, food is prepared immediately before it will be served, while in the ready-food system, food is prepared ahead of time and stored chilled or frozen until it is scheduled to be used. The Army uses both systems, the Navy generally uses the conventional method, and the Air Force uses the conventional system, except in small MTFs, which are supported from the base's food service.

The type of production system affects other parts of the production cycle. For example, under the conventional system, there are peaks and valleys in the production cycle that correspond with meal-times. Under the ready-food system, the production cycle runs more evenly but involves handling the food twice. Various delivery and heating systems are used.

Another aspect of the production cycle is the extension of standardized recipes. Recipes must be adjusted to yield the appropriate number of servings. Currently, this calculation is usually estimated by production personnel because it is too time consuming to compute manually the exact quantity needed. Some Army sites have ADP support and therefore can adjust recipes to make the specific number of servings required.

Once the menus have been planned and the recipes adjusted to the appropriate quantities, worksheets are prepared. They are usually arranged by production area.

Service Management

The activities that will be affected by this module of the automated system are actually activities of clinical dietetics, food production, and food service. These activities include determining the number of meals required, the process of transferring food from production area to the serving areas, monitoring the food service, accounting for shortages and leftovers, determining patron eligibility, and accounting for money collected. Again, there are some differences in procedures between ready-foods and conventional environments, and among military departments.

The quantity of food (number of servings required) is usually estimated by the production manager on the basis of the expected or actual number of inpatients and the anticipated number of people eating in the cafeteria or dining room. Using the census as well as the experience of the service, the manager predicts the proportion of people choosing certain items on the menus. The Air Force is the only MilDep that tallies the patients' menus to determine the actual count.

The process of determining patron eligibility and collecting money for meals is similar within the Army and the Air Force. Basically, a Medical Food Service (MFS) person is assigned to be cashier and check eligibility. In the Navy, the comptroller or financial office performs this function.

Inventory Control

The military departments differ somewhat in their methods of "subsistence" (food) inventory. In the Army and the Air Force subsistence is purchased from the commissary. The commissary establishes contacts with vendors, stores the food, and provides prices to the appropriate accounting personnel (MFS personnel in the Army and Medical Service Accounts (MSA) personnel in the Air Force).

The process of obtaining subsistence begins with determining requirements, cross-checking with on-hand subsistence, completing the appropriate forms, going to the commissary, collecting the foods, and returning to the hospital. Then, the foods are entered into the subsistence inventory and become the responsibility of the MFS manager.

In the Army, storeroom personnel maintain documentation regarding food issued and received, while accounting personnel maintain the official record, the perpetual inventory, of subsistence purchased. In the Air Force, the storeroom personnel maintain an unofficial perpetual inventory but MSA personnel calculate the official record.

The major difference in the Navy is that the food service officer acts in two capacities: as a commissary officer and as an MFS food manager. The food service officer is responsible for establishing

contract requirements and maintaining a large storeroom of received subsistence items within the MFS, in addition to the regular responsibilities of a food service manager.

Financial Control

The area of financial control is where the military departments differ most. The MilDeps have four budget lines from which to work: subsistence, materiel, equipment, and personnel. In the Navy, however, although there is a division of funds, there can be shifts among budget lines. This is not the case in the other two MilDeps.

In the Army, the monetary allotment for subsistence is determined monthly by MFS personnel, using the Basic Daily Food Allowance (BDFA) for troops and adjusting it according to the additional nutritional requirements of patients. In the Air Force, the subsistence allotment is also based on the BDFA; however, MSA personnel make the final adjustments. The subsistence budget in the Navy is not tied to the BDFA; rather, monthly allocations are made and the MFS manager is expected to keep within the funding ceiling.

Although the MFS manager in the Army and the Air Force is responsible for the materiel and equipment budgets, it is in more of a review and control capacity rather than in an accounting capacity. The Navy MFS manager has greater say over the use and redistribution of these funds, as well as over personnel funds.

Most financial reports in the Army and the Navy are prepared manually by the MFS personnel. In the Air Force, the MSA compiles the official reports manually.

Nutritional Analysis

Nutritional analysis is currently limited to a review of the dining-room and regular patient menus to determine if the major nutritional requirements of staff and patients are being met, based on accepted dietetics standards. Patterns of use of therapeutic menus are periodically examined to ensure that the Recommended Daily Allowances (RDA) are being met. Nutritional analysis of a specific patient's food intake and a nutritional assessment of a specific patient are done only when requested or warranted.

Management Data and Reporting

Although the Army has some ADP support, most of the maintenance of management data or reference data in the three MilDeps, including recipe files and dietary standards, is done manually. Management of regulations and forms is accomplished at a headquarters. These regulations and forms are disseminated to the MTF through an established distribution system.

The MFS personnel collect and report summary data, including Uniform Chart of Accounts (UCA) and Uniform Staffing Methodology (USM) data, to other sections of the MTF and to headquarters.

APPENDIX C
BENEFIT FORMULAS

The exhibits in this appendix present the formulas used to quantify the benefits of the TRIFOOD system.

TABLE C-1
TRIFOOD SYSTEM
ANNUAL BENEFITS IMPACT

Food Savings

Preliminary Estimates

Estimating Equation

Area

Food Purchases	$A \times P_1$	$P_1 = 5\% \text{ of annual food costs}$
Inventory Reductions	$I \times C \times P_2$	$P_2 = 0 \text{ (provisionally)}$

Definitions

- A = annual food purchases
- P_1 = percent of food purchases saved
- I = dollar value of inventory
- C = annual carrying cost (%)
- P_2 = percent of inventory saved

TABLE C-2
TRIFOOD SYSTEM
ANNUAL BENEFITS IMPACT
Management and Financial

<u>Task</u>	<u>Estimating Equation</u>	<u>Preliminary Estimates</u>	<u>Grade</u>	<u>Percent Saved</u>
* Inventory Pricing	$52 \times H \times S$	H = 20 hours per week	E-5	90%
Inventory Pricing Reconciliation	$12 \times H \times S$	H = 16 hours per month	E-5	90%
* Ration Accounting - Weekly	$52 \times H_1 \times S$	$H_1 = 5$ hour per day	E-5	50%
Ration Accounting - Monthly	$12 \times H_2 \times S$	$H_2 = 4$ hours per month	E-5	50%
Workload Reporting	$12 \times H \times S$	H = 15 hours per month	O-3	75%

Definitions

H = hours saved
S = hourly salary

*Benefit for Air Force only; "additional" benefit for Army and Navy

TABLE C-3
TRIFOOD SYSTEM
ANNUAL BENEFITS IMPACT
Inventory Maintenance

<u>Task</u>	<u>Estimating Equation</u>	<u>Preliminary Estimates</u>	<u>Grade</u>	<u>Percent Saved</u>
Maintain Subsistence Inventory	$52 \times H \times S$	H = 20 hours per week	E-5	90%
Determine Purchase Quantities	$52 \times H \times S$	H = 10 hours per week	E-5	90%
Determine Issue Quantities	$52 \times H \times S$	H = 10 hours per week * H = 340 hours per week	E-5	90%
Inventory Analysis	$12 \times H \times S$	H = 10 hours per month	O-3	50%

Definitions

H = hours saved
S = hourly salary

*If performed accurately, an "additional" benefit.

TABLE C-4
TRIFOOD SYSTEM
ANNUAL BENEFITS IMPACT

Service Management

<u>Task</u>	<u>Estimating Equation</u>	<u>Preliminary Estimates</u>	<u>Grade</u>	<u>Percent Saved</u>
Census Forecasting	$52 \times H \times S$	H = 2 hours per week * H = 5 hours per week	E-6	50%
Item Preference	$52 \times H \times S$	H = 4 hours per week * H = 10 hours per week	E-6	50%
Computing Service Quantities	$52 \times H \times S$	H = 4 hours per week * H = 10 hours per week	E-6	100%
Evaluation	$52 \times H \times S$	H = 2 hours per week * H = 12 hours per week	E-6	100%

Definitions

H = hours saved
S = hourly salary

* If performed accurately, an "additional" benefit.

TABLE C-5
TRIFOOD SYSTEM
ANNUAL BENEFITS IMPACT

Clerical Assistance

<u>Task</u>	<u>Estimating Equation</u>	<u>Preliminary Estimates</u>	<u>Grade</u>	<u>Percent Saved</u>
Cyclical Menus	$n \times S \times H \times L$	H = 4.3 hours per day	GS-4	67%
*Tally Reports	$365 \times T \times H \times S$	*H = 2.5 hours per 1000 meals	GS-3	100%
Tray Assembly Reports	$365 \times H \times S$	H = 3 hours per day	GS-3	67%
Daily Worksheets	$52 \times H \times S$	H = 21 hours per week	E-6	67%
Menu Production Preparation Documents	$n \times S \times H \times L$	H = 1.4 hours per menu day	GS-4	100%
Procurement Documents	$52 \times H \times S$	H = 10 hours per week	E-6	90%

Definitions

H = hours saved
S = hourly salary
n = number of menu cycles per year
L = number of days in menu cycle
T = average inpatient trays per day

*Benefit for Air Force only; "additional" benefit for Army and Navy

TABLE C-6
TRIFOOD SYSTEM
ANNUAL ADDITIONAL BENEFITS
Cost and Nutritional Analysis

Task	Estimating Equation	Preliminary Estimates	Grade	Percent Saved
*Nutritional Analysis	$H \times n \times S \times L$	H = 16 hours per menu day	0-3	90%
*Menu Price Analysis	$H \times n \times S \times L$	H = 4 hours per menu day	E-6	90%
*Menu Price Updates	$H \times n_1 \times S$	H = 12 hour per update	E-6	90%
*Annual Recipe Price Analysis	$H \times R \times S$	H = 1 1/3 hour per recipe	E-6	90%
*Recipe Price Update Analysis	$H \times n_1 \times S \times R \times P$	H = 5 minutes per recipe	E-6	90%
*Patient Nutritional Analysis	$S[(365 \times H_1 \times A \times P_1) + (250 \times H_2 \times OP \times P_2)]$	$H_1 = 1 \text{ hour per patient-day}$ $H_2 = 1 \text{ hour per outpatient}$	0-3	80%
*Inpatient Nutritional Assessment	$365 \times A [(H_1 \times S_1) + S_2 \times (H_2 \times P_3 + H_3 \times P_4)]$	$H_1 = .25 \text{ hours per patient}$ $H_2 = 1 \text{ hour per patient assessed (intermediate)}$ $H_3 = 20 \text{ hours per patient assessed (in-depth)}$	GS-3 0-3 0-3	50% 50%
*Outpatient Nutritional Assessment	$250 \times OP \times S_2 (H_1 + H_2 \times P_3)$			

Definitions

- H = hours saved
 S = hourly salary
 n = number of menu cycles per year
 L = number of days in menu cycle
 A = average daily admissions
 n_1 = 12 price changes per year
 R = number of recipes
 P = percent of recipes updated per cycle
 P_1 = percent of inpatients evaluated
 P_2 = percent of nutrition clinic outpatients evaluated
 OP = average nutrition clinic patients per day
 P_3 = percent of patients evaluated (intermediate)
 P_4 = percent of patients evaluated (in-depth)
 * If performed accurately; "additional" benefit.

APPENDIX D
DETAILED RESULTS OF BENEFIT AND COST ANALYSES

The tables in this appendix present detailed results of the benefit and cost analyses of the TRIFOOD system for the 12 candidate sites.

Tables D-1 and D-2 present the base case. Tables D-3 through D-6 present the results of the sensitivity analyses as inflation rates change, and Tables D-7 through D-14 present changes in discount rates.

TABLE D-1. ESTIMATED PRESENT VALUE LIFE-CYCLE BENEFITS OF TRIFOOD IN 12 CANDIDATE SITES
USING DEPARTMENT OF DEFENSE INFLATION INDEX AND 10 DISCOUNT RATE

PRIMARY BENEFITS	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	TOTAL
INCREASED AVAILABILITY OF MTF PERSONNEL TIME												
Inventory Pricing	50	56,153	635,549	640,001	602,235	639,816	637,536	635,366	633,360	619,436	6616	5194,329
Inventory Reconciliation	0	3,492	10,713	20,467	33,844	51,745	76,099	10,315	17,941	11,409	337	104,635
Ration Accounting -- weekly	0	648	4,001	6,232	5,306	5,306	5,313	4,915	4,431	3,738	46	540,865
Ration Accounting -- monthly	0	478	2,509	3,398	3,064	3,064	3,043	2,884	2,495	1,537	47	423,309
Workload Reporting	0	5,153	37,483	36,381	36,197	32,333	36,181	28,735	24,438	14,438	502	423,309
Maintain Subunit Inventory	0	18,647	181,343	131,519	116,719	117,783	111,637	106,676	97,269	57,939	1,027	1,078,950
Determine Purchase Quantities	0	9,323	38,481	46,265	42,469	38,491	35,319	32,329	28,664	19,979	916	443,825
Determine Issue Quantities	0	9,323	38,481	46,265	42,469	38,491	35,319	32,329	28,664	19,979	916	443,825
Inventory Analysis	0	2,191	11,375	16,169	15,243	14,378	13,547	12,721	11,864	7,365	223	104,160
Costs Forecasting	0	1,250	6,764	6,442	6,336	7,458	7,400	6,994	6,400	3,994	123	55,652
Item Preference	0	2,501	13,532	17,485	16,472	15,717	14,817	13,946	12,979	7,921	244	616,104
Computing Service Quantities	0	5,002	27,864	35,349	33,364	31,494	29,436	27,026	25,958	15,964	600	433,312
Evaluation	0	2,361	13,532	17,485	16,472	15,717	14,817	13,946	12,979	7,921	244	616,104
Cyclical Menu	0	1,338	8,943	11,444	11,165	10,564	9,923	9,335	8,788	5,378	137	177,481
Tally Reports	0	6,066	18,599	21,535	20,381	19,139	18,002	17,009	16,035	6,264	196	163,349
Tray Assembly	0	8,377	41,940	41,412	37,895	36,579	34,653	32,401	30,042	17,401	447	403,151
Daily Vorthsheets	0	17,305	94,732	121,793	116,783	110,811	103,718	97,778	90,855	55,948	1,787	1,042,742
Menu Production Prep Doc	0	453	4,345	5,781	5,430	5,138	4,844	4,564	4,284	2,719	77	437,879
Menu Procurement Documents	0	15,353	68,813	79,581	75,823	70,716	66,476	62,457	58,406	35,946	1,077	433,877
Yearly subtotals	50	112,447	559,949	570,021	575,349	602,236	615,530	615,101	616,764	610,710	610,604	5,122,723
MATERIAL SAVINGS												
Food Purchase	50	107,813	5310,552	5167,782	5166,443	5556,395	5388,970	5290,433	5266,764	5126,336	13,026	52,400,800
Yearly subtotals	50	107,813	5310,552	5167,782	5166,443	5556,395	5388,970	5290,433	5266,764	5126,336	13,026	52,400,800
YEARLY TOTALS	50	220,260	10917,501	11,147,730	11,401,996	11,678,631	11,604,500	11,606,534	11,603,516	1073,151	613,709	57,562,771
ADDITIONAL BENEFITS												
INCREASED AVAILABILITY OF MTF PERSONNEL TIME												
Inventory Pricing	50	612,394	666,796	687,720	682,284	677,947	673,582	669,292	663,929	640,303	61,289	5575,821
Ration Accounting -- weekly	0	1,721	9,277	13,184	11,487	10,819	10,289	9,634	8,899	5,598	160	87,975
Determine Issue Quantities	0	316,993	1,793,166	2,232,995	2,123,768	2,002,313	1,887,327	1,779,327	1,652,964	1,019,297	31,061	11,790,858
Costs Forecasting	0	3,126	16,915	22,104	20,400	19,666	18,321	17,468	16,234	9,908	303	1145,132
Item Preference	0	6,352	31,829	46,312	41,488	39,292	37,443	35,421	32,448	19,908	610	439,265
Computing Service Quantities	0	12,504	67,459	80,423	83,359	78,585	74,064	69,481	64,846	39,946	1,219	550,530
Evaluation	0	15,005	81,191	106,100	100,831	94,382	88,009	82,009	77,475	47,952	1,463	696,436
Tally Reports	0	5,399	26,310	28,926	27,249	25,787	24,335	22,847	20,874	11,309	347	191,123
Nutritional Analysis	0	19,168	127,982	169,664	159,810	150,780	142,153	134,811	125,758	79,918	2,261	81,111,550
Menu Price Analysis	0	2,028	26,223	26,823	25,287	23,839	22,473	21,184	19,481	12,433	357	175,730
Annual Recipe Price Analysis	0	3,116	16,843	22,938	20,776	19,566	18,464	17,489	16,174	9,939	304	106,466
Recipe Price Update Analysis	0	1,198	53,847	73,718	69,476	65,513	61,743	58,224	54,001	33,491	1,073	482,364
Patient Nutritional Analysis	0	2,484	16,317	21,339	21,859	19,853	18,716	17,444	16,093	10,893	444	166,101
In Nutritional Assessment	0	379,317	2,037,594	2,337,991	2,192,434	2,035,481	1,884,431	1,740,431	1,605,415	1,076,431	26,499	114,703,323
Out Nutritional Assessment	0	570,167	2,444,738	3,211,073	3,054,503	2,854,503	2,691,010	2,536,896	2,353,311	1,538,042	32,149	921,200,510
Yearly subtotals	50	51,405,751	57,317,908	59,100,483	58,454,800	56,159,192	57,691,893	57,251,357	56,740,297	53,907,270	1,085,307	560,410,704
YEARLY TOTALS	50	51,405,751	57,317,948	59,100,483	58,454,800	56,159,192	57,691,893	57,251,357	56,740,297	53,907,270	1,085,307	560,410,704
GRAND TOTALS	50	51,406,011	58,335,519	60,328,413	59,736,877	57,179,319	58,453,380	58,157,491	57,500,510	54,300,439	1,119,896	567,977,475

TABLE D-2. ESTIMATED PRESENT VALUE LIFECYCLE COSTS OF TRIFOOD IN 12 CANDIDATE SITES
USING DEPARTMENT OF DEFENSE INFLATION INDEX AND 10% DISCOUNT RATE

													TOTAL
													as a percent of
													Hardware
													Costs
													46.3%
													11.0%
Hardware Acquisition													630,407
RECURRING													
Hardware Maintenance													9331
yearly subtotals:													6304,090
													6223,570

TABLE D-2. ESTIMATED PRESENT VALUE LIFECYCLE COSTS OF TRIFOOD IN 12 CANDIDATE SITES
(cont'd) USING DEPARTMENT OF DEFENSE INFLATION INDEX AND 10% DISCOUNT RATE

NET PRIMARY BENEFITS	(1107,456)	(1432,912)	8438,766	1932,226	4070,844	6820,511	9781,060	1234,326	1602,887	8302,793	811,443
by year	(1107,456)	(1741,777)	(8382,212)	6620,825	11,587,869	62,226,300	93,117,437	93,853,765	86,536,575	86,919,368	86,930,411
NET TOTAL BENEFITS	(1107,456)	8772,438	87,756,733	810,112,919	19,533,725	68,487,782	98,492,932	17,987,403	17,423,186	86,298,871	8116,438
by year	(1107,456)	8663,774	10,418,537	618,533,446	928,067,171	637,856,873	945,537,824	633,515,589	640,738,415	865,228,466	865,345,116
NET TOTAL BENEFITS	(1107,456)	8772,438	87,756,733	810,112,919	19,533,725	68,487,782	98,492,932	17,987,403	17,423,186	86,298,871	8116,438
by year	(1107,456)	8663,774	10,418,537	618,533,446	928,067,171	637,856,873	945,537,824	633,515,589	640,738,415	865,228,466	865,345,116

TABLE D-3. ESTIMATED PRESENT VALUE LIFECYCLE BENEFITS OF TRIFOOD IN 12 CANDIDATE STATES
USING HEALTH CARE FINANCING ADMINISTRATION INFLATION INDEX AND 10% DISCOUNT RATE

PRIMARY BENEFITS												as a percent of Primary Total Benefits
1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	TOTAL	
INCREASED AVAILABILITY OF NUT PERSONNEL TIME												
Inventory Pricing												
Inventory Reconciliation	50	16,474	638,302	651,705	650,481	650,457	649,271	648,322	647,273	639,414	9766	9373,565
Ration Accounting -- weekly	0	3,476	28,740	28,256	27,814	27,370	26,957	26,562	25,270	16,599	520	6204,271
Ration Accounting -- monthly	0	927	5,320	7,181	7,407	6,953	6,463	6,239	6,435	4,805	134	151,044
Ration Accounting -- quarterly	0	511	3,002	3,726	3,883	3,483	3,144	3,046	3,379	2,383	72	924,371
Workload Reporting	0	5,469	36,720	41,724	40,991	40,284	39,484	38,736	37,729	24,214	772	9308,462
Maintain Subsidy Inventory	0	19,928	112,304	153,855	150,459	148,380	146,814	143,770	139,589	89,911	3,064	91,104,409
Determine Purchase Quantities	0	9,964	56,193	76,527	75,329	74,150	73,000	71,885	69,794	44,955	1,432	9533,235
Determine Issue Quantities	0	9,964	56,193	76,527	75,329	74,150	73,000	71,885	69,794	44,955	1,432	9533,235
Inventory Analysis	0	2,440	13,453	16,545	16,210	17,984	17,462	17,304	16,740	10,742	343	9133,539
Costs Forecasting	0	1,315	7,495	10,596	10,434	9,476	9,738	9,570	9,389	5,993	198	573,606
Item Preference	0	3,470	14,994	20,394	20,846	19,752	19,440	19,140	18,577	12,946	301	9147,348
Computing Service Quantities	0	5,360	27,979	40,793	40,136	39,583	38,479	38,200	37,154	23,493	742	9294,230
Evaluation	0	2,478	14,790	20,394	20,846	19,752	19,440	19,140	18,577	12,946	301	9147,348
Cyclical Menu	0	1,484	9,454	13,285	13,874	13,358	12,261	11,941	11,403	7,417	221	993,321
Tally Reports	0	6,391	20,885	26,082	23,419	23,833	22,321	21,720	21,175	14,807	475	9170,794
Tray Assembly	0	9,885	50,782	40,450	44,785	45,119	43,454	41,944	59,400	30,894	1,198	9444,319
Daily Worksheets	0	16,491	104,927	141,793	140,475	138,242	136,474	133,901	130,393	83,423	3,444	91,031,519
Menu Production Prep. Doc.	0	445	4,713	6,646	6,484	4,130	5,974	5,429	5,644	3,718	100	545,553
Procurement Documents	0	12,816	67,453	91,788	90,385	88,883	87,479	86,131	83,597	53,759	1,716	9463,119
Yearly subtotals:	50	1119,747	6461,307	8095,696	8000,379	8465,467	8481,607	8436,771	8412,454	6516,346	616,501	94,456,775
MATERIAL SAVINGS												
Food Purchase												
Yearly subtotals:	50	190,413	6394,391	6394,577	6300,955	6367,787	6355,076	6302,814	6322,506	6353,853	63,836	92,746,213
YEARLY TOTALS:												
	50	1310,160	9995,779	9130,671	9134,558	9133,434	9126,683	9117,785	91135,150	9070,199	680,335	99,202,908
ADDITIONAL BENEFITS												
Inventory Pricing												
Inventory Accounting -- weekly	50	613,347	674,004	6101,350	609,770	601,243	604,745	605,247	601,413	600,497	61,499	9232,904
Ration Accounting -- weekly	0	1,480	10,290	16,076	15,570	15,483	15,437	15,229	15,253	8,402	264	9101,792
Determine Issue Quantities	0	330,467	1,916,367	2,401,930	2,341,194	2,321,097	2,402,372	2,445,083	2,373,410	1,350,400	40,491	9100,973
Costs Forecasting	0	3,338	18,737	25,096	25,085	24,498	24,300	23,735	23,221	14,933	476	9104,200
Item Preference	0	4,676	37,474	50,991	50,170	49,377	48,599	47,830	46,403	29,666	952	9340,400
Computing Service Quantities	0	13,351	74,940	101,948	100,339	98,750	97,104	95,701	93,885	59,732	1,905	9736,799
Evaluation	0	14,821	97,937	132,378	130,487	118,510	116,438	114,441	111,462	71,471	2,205	9004,159
Tally Reports	0	5,469	24,353	33,241	31,457	30,472	29,400	28,186	27,564	15,493	349	9120,753
Nutritional Analysis	0	20,394	101,800	104,546	101,102	102,794	104,516	101,402	107,483	117,768	3,400	9132,753
Menu Price Analysis	0	3,232	22,392	30,917	30,417	29,754	29,455	29,082	28,419	18,644	557	9123,190
Menu Price Updates	0	3,217	18,479	25,417	25,000	24,614	24,223	23,833	23,150	14,807	475	9123,633
Annual Recipe Price Analysis	0	8,755	56,453	65,022	63,450	62,335	61,221	59,792	57,406	53,730	2,299	9413,649
Recipe Price Update Analysis	0	2,453	16,874	25,746	25,340	24,950	24,563	24,179	23,454	16,281	697	9105,948
Patient Nutritional Analysis	0	403,985	2,340,137	2,910,908	2,859,495	2,810,350	2,742,919	2,716,100	2,631,597	1,304,331	91,103	930,976,315
In Nutritional Assessment	0	404,744	2,937,965	3,470,745	3,416,156	3,350,457	3,409,740	3,439,920	3,317,357	1,800,100	49,246	934,324,641
Out Nutritional Assessment	0	49,910	394,899	502,839	533,172	523,493	514,978	504,105	494,207	336,459	1,364	93,904,870
Yearly subtotals:	50	51,497,710	50,002,410	510,545,645	510,314,935	510,109,720	510,010,591	50,456,455	49,557,307	65,701,523	616,006	976,657,506
YEARLY TOTALS												
	50	51,497,710	50,002,410	510,545,645	510,314,935	510,109,720	510,010,591	50,456,455	49,557,307	65,701,523	616,006	976,657,506
GRAND TOTALS:												
	50	51,707,900	51,070,109	511,436,116	511,629,400	511,423,158	511,236,474	511,630,400	510,492,585	66,451,721	610,379	985,310,574

TABLE D-5. ESTIMATED PRESENT VALUE LIFECYCLE BENEFITS OF TRIFOOD IN 12 CANDIDATE SITES
USING RATE CONTROL INFLATION INDEX AND 10% DISCOUNT RATE

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	TOTAL
PRIMARY BENEFITS												
Inventory Pricing	66	61,096	640,369	655,324	655,740	656,010	656,210	656,467	656,904	655,972	61,284	601,566
Inventory Reconciliation	6	3,082	31,873	30,378	30,516	30,669	30,834	31,028	30,798	30,369	641	630,621
Ration Accounting -- weekly	6	958	5,464	7,712	7,958	7,779	7,821	7,868	7,916	7,916	167	656,560
Ration Accounting -- monthly	6	320	3,830	4,319	4,330	4,330	4,330	4,300	4,274	4,215	92	132,450
Workload Reporting	6	5,640	31,341	44,409	46,459	46,750	46,458	46,194	46,508	39,156	949	636,390
Maintain Sublist Inventory	6	20,596	119,400	164,507	165,294	164,121	162,470	160,848	164,741	109,790	2,579	61,259,729
Determine Purchase Quantities	6	10,297	59,340	82,274	82,449	82,449	82,510	82,534	82,301	56,495	1,789	625,100
Determine Issue Quantities	6	10,297	59,340	82,274	82,449	82,449	82,510	82,534	82,301	56,495	1,789	625,100
Inventory Analysis	6	2,316	14,329	19,824	19,853	19,889	19,937	19,997	19,778	13,950	422	610,566
Census Forecasting	6	1,306	7,895	10,955	10,999	11,003	11,103	11,163	11,049	7,777	237	610,120
Item Preference	6	2,759	15,790	21,911	21,970	22,094	22,206	22,331	22,139	14,554	475	616,356
Computing Service Quantities	6	5,519	31,580	43,821	45,994	46,100	46,412	46,462	46,277	29,100	949	632,513
Evaluation	6	2,759	15,790	21,911	21,970	22,094	22,206	22,331	22,139	14,554	475	616,356
Cyclical Menu	6	1,420	9,944	13,763	13,763	13,763	13,763	13,763	13,763	8,595	254	610,562
Tally Reports	6	6,499	30,407	35,017	34,700	34,402	34,402	34,402	34,402	9,770	583	610,562
Tray Assembly	6	9,159	52,321	71,362	70,464	69,389	68,713	67,794	66,249	42,742	1,371	610,562
Daily Workbooks	6	19,316	110,322	153,937	153,937	153,456	153,456	153,456	153,456	101,878	3,322	61,163,795
Menu Production Prep Doc	6	4,497	6,855	6,710	6,430	6,349	6,460	6,349	6,349	4,196	124	610,931
Procurement Documents	6	12,417	71,856	98,591	98,991	99,422	99,927	100,409	99,626	65,493	2,136	620,154
yearly subtotals:	66	613,325	6,074,767	6,056,777	6,040,710	6,043,455	6,045,705	6,049,514	6,051,091	6,033,919	610,378	67,341,591
MATERIAL SAVINGS												
Food Purchase	66	609,641	6,332,704	6,394,123	6,381,409	6,369,404	6,357,790	6,346,467	6,334,405	6,316,357	63,907	62,750,776
yearly subtotals	66	609,641	6,332,704	6,394,123	6,381,409	6,369,404	6,357,790	6,346,467	6,334,405	6,316,357	63,907	62,750,776
YEARLY TOTALS	66	613,325	6,074,767	6,056,777	6,040,710	6,043,455	6,045,705	6,049,514	6,051,091	6,033,919	610,378	67,341,591
ADDITIONAL BENEFITS												
Inventory Pricing	66	613,496	670,130	6109,825	6109,549	6110,111	6110,710	6111,421	6109,797	673,917	62,374	602,733
Ration Accounting -- weekly	6	1,982	10,851	15,142	15,315	15,393	15,374	15,495	15,250	10,344	330	615,102
Determine Issue Quantities	6	350,104	2,014,154	2,797,330	2,810,839	2,824,042	2,839,327	2,857,159	2,835,200	1,844,425	60,832	621,254,746
Census Forecasting	6	3,469	19,730	27,417	27,408	27,417	27,417	27,414	27,423	18,193	593	620,820
Item Preference	6	6,890	39,474	54,727	54,995	55,234	55,315	55,427	55,347	36,385	1,164	6415,441
Computing Service Quantities	6	13,797	70,753	109,554	109,798	110,469	111,454	112,454	110,493	72,778	2,373	6831,262
Evaluation	6	16,556	94,741	131,464	131,900	132,563	133,233	133,902	132,324	87,324	2,840	6997,538
Tally Reports	6	3,745	27,040	33,403	33,198	32,778	31,365	31,993	30,487	17,450	400	6265,278
Menu Price Analysis	6	21,018	140,824	189,927	188,195	186,530	189,025	189,493	189,392	141,777	4,204	61,567,415
Menu Price Updates	6	3,338	23,574	33,199	33,323	33,443	33,443	33,443	33,441	22,944	494	6251,422
Annual Recipe Price Analysis	6	3,439	19,477	27,304	27,413	27,532	27,672	27,824	27,500	10,137	591	6307,101
Recipe Price Update Analysis	6	9,650	41,842	61,317	61,700	62,104	62,521	62,959	62,355	45,443	2,042	6493,254
Patient Nutritional Analysis	6	2,742	19,463	27,478	27,740	27,910	28,052	28,207	27,550	17,421	607	6210,077
Menu Price Analysis	6	416,456	2,359,596	3,112,144	3,116,279	3,121,944	3,129,511	3,139,344	3,109,844	1,907,844	50,408	623,465,656
Menu Price Update Analysis	6	625,226	3,081,314	3,930,619	3,932,719	3,934,619	3,936,419	3,938,419	3,940,419	2,320,019	40,435	629,599,162
Menu Price Assessment	6	51,459	413,430	500,833	500,643	501,543	502,793	504,448	502,257	404,495	10,245	64,371,595
yearly subtotals	66	613,546,494	6,079,595	6,111,200,521	6,111,311,747	6,111,340,313	6,111,375,457	6,111,410,730	6,111,305,774	6,095,492	610,540	66,342,495
YEARLY TOTALS	66	613,546,494	6,079,595	6,111,200,521	6,111,311,747	6,111,340,313	6,111,375,457	6,111,410,730	6,111,305,774	6,095,492	610,540	66,342,495
GRAND TOTALS	66	613,750,221	6,079,595	6,111,200,521	6,111,311,747	6,111,340,313	6,111,375,457	6,111,410,730	6,111,305,774	6,095,492	610,540	66,342,495
ADDITIONAL BENEFITS												
Inventory Pricing	66	613,496	670,130	6109,825	6109,549	6110,111	6110,710	6111,421	6109,797	673,917	62,374	602,733
Ration Accounting -- weekly	6	1,982	10,851	15,142	15,315	15,393	15,374	15,495	15,250	10,344	330	615,102
Determine Issue Quantities	6	350,104	2,014,154	2,797,330	2,810,839	2,824,042	2,839,327	2,857,159	2,835,200	1,844,425	60,832	621,254,746
Census Forecasting	6	3,469	19,730	27,417	27,408	27,417	27,417	27,414	27,423	18,193	593	620,820
Item Preference	6	6,890	39,474	54,727	54,995	55,234	55,315	55,427	55,347	36,385	1,164	6415,441
Computing Service Quantities	6	13,797	70,753	109,554	109,798	110,469	111,454	112,454	110,493	72,778	2,373	6831,262
Evaluation	6	16,556	94,741	131,464	131,900	132,563	133,233	133,902	132,324	87,324	2,840	6997,538
Tally Reports	6	3,745	27,040	33,403	33,198	32,778	31,365	31,993	30,487	17,450	400	6265,278
Menu Price Analysis	6	21,018	140,824	189,927	188,195	186,530	189,025	189,493	189,392	141,777	4,204	61,567,415
Menu Price Updates	6	3,338	23,574	33,199	33,323	33,443	33,443	33,443	33,441	22,944	494	6251,422
Annual Recipe Price Analysis	6	3,439	19,477	27,304	27,413	27,532	27,672	27,824	27,500	10,137	591	6307,101
Recipe Price Update Analysis	6	9,650	41,842	61,317	61,700	62,104	62,521	62,959	62,355	45,443	2,042	6493,254
Patient Nutritional Analysis	6	2,742	19,463	27,478	27,740	27,910	28,052	28,207	27,550	17,421	607	6210,077
Menu Price Analysis	6	416,456	2,359,596	3,112,144	3,116,279	3,121,944	3,129,511	3,139,344	3,109,844	1,907,844	50,408	623,465,656
Menu Price Update Analysis	6	625,226	3,081,314	3,930,619	3,932,719	3,934,619	3,936,419	3,938,419	3,940,419	2,320,019	40,435	629,599,162
Menu Price Assessment	6	51,459	413,430	500,833	500,643	501,543	502,793	504,448	502,257	404,495	10,245	64,371,595
yearly subtotals	66	613,546,494	6,079,595	6,111,200,521	6,111,311,747	6,111,340,313	6,111,375,457	6,111,410,730	6,111,305,774	6,095,492	610,540	66,342,495
YEARLY TOTALS	66	613,546,494	6,079,595	6,111,200,521	6,111,311,747	6,111,340,313	6,111,375,457	6,111,410,730	6,111,305,774	6,095,492	610,540	66,342,495
GRAND TOTALS	66	613,750,221	6,079,595	6,111,200,521	6,111,311,747	6,111,340,313	6,111,375,457	6,111,410,730	6,111,305,774	6,095,492	610,540	66,342,495

TABLE D-6. ESTIMATED PRESENT VALUE LIFECYCLE COSTS OF TRIFOOD IN 12 CANDIDATE SITES
(cont'd) USING RATE CONTROL, INFLATION INDEX AND 10% DISCOUNT RATE

NET PRIMARY BENEFITS	6109,733	6462,400	6525,520	61,121,405	61,110,217	61,115,425	61,113,519	61,112,391	61,094,395	6466,371	610,402
NET TOTAL BENEFITS	6109,733	6752,134	6896,599	61,413,316	63,138,861	64,141,311	63,358,763	63,469,156	67,315,587	67,315,587	67,315,587
NET TOTAL BENEFITS	6109,733	6702,494	67,014,123	612,410,124	612,419,765	612,455,920	612,480,504	612,531,121	612,400,171	67,451,463	6322,410
NET TOTAL BENEFITS	6109,733	6792,742	67,000,005	622,110,011	630,440,975	647,106,913	659,593,499	672,134,430	684,534,791	692,176,454	692,399,044

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TABLE D-7. ESTIMATED PRESENT VALUE LIFECYCLE BENEFITS OF TRIFOOD IN 12 CANDIDATE STATES USING DEPARTMENT OF DEFENSE INFLATION INDEX AND 0% DISCOUNT RATE

P E R M A N E N T B E N E F I T S												
	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	TOTAL
INCREASED AVAILABILITY OF MTF PERSONNEL TIME												
Inventory Pricing	10	97,566	646,011	645,593	648,020	670,537	673,167	675,653	678,660	658,981	61,762	6536,132
Inventory Reconciliation	0	6,165	35,967	35,321	37,147	38,322	39,797	41,413	42,351	38,711	762	252,961
Ration Accounting --- weekly	0	1,855	4,398	9,110	9,407	10,159	10,559	10,535	10,725	7,681	345	74,741
Ration Accounting --- monthly	0	5,319	37,659	4,975	5,159	5,326	5,399	5,754	5,882	3,988	134	40,838
Workload Reporting	0	6,337	37,659	55,265	55,336	57,280	59,399	61,597	63,532	42,431	1,431	437,084
Maintain Subst. Inventory	0	22,582	136,916	194,836	201,715	208,460	216,381	224,367	229,401	155,517	5,213	1,532,287
Determine Purchase Quantities	0	11,281	47,457	97,010	150,400	184,330	188,190	192,193	194,781	77,759	2,687	794,143
Determine Issue Quantities	0	11,381	47,457	97,010	150,400	184,330	188,190	192,193	194,781	77,759	2,687	794,143
Inventory Analysis	0	3,772	16,421	33,623	34,549	35,458	36,452	37,376	37,978	18,946	436	191,348
Census Forecasting	0	1,513	9,005	13,946	13,975	13,932	14,437	14,971	15,382	10,325	348	106,254
Item Preference	0	2,024	10,811	25,092	26,158	27,164	28,074	29,742	30,484	18,727	474	212,467
Computing Service Quantities	0	4,052	31,022	31,788	33,780	35,087	37,748	39,884	41,209	41,658	1,371	414,933
Evaluation	0	3,036	18,011	35,092	26,056	27,084	28,074	29,742	30,484	28,729	496	212,467
Cyclical Menu	0	1,619	11,983	17,348	17,983	18,497	19,337	20,053	20,702	16,448	487	142,479
Tally Reports	0	7,344	24,755	31,539	33,495	35,160	36,440	37,810	38,353	16,353	674	256,484
Tray Assembly	0	10,378	62,419	89,913	93,240	96,470	100,247	103,977	106,327	72,513	2,414	737,918
Daily Northshells	0	21,181	124,075	181,245	187,951	194,985	202,116	209,555	214,230	145,133	6,449	1,407,232
Menu Production Prep Doc	0	798	5,810	8,464	8,771	9,495	9,708	9,788	10,105	7,052	314	47,568
Procurement Documents	0	13,417	81,649	116,516	120,828	125,376	129,932	134,748	137,719	93,281	3,138	936,103
yearly subtotals	10	9136,061	9797,356	91,942,032	91,186,287	91,220,106	91,273,565	91,310,667	91,352,164	9095,082	139,482	69,369,600
MATERIAL SAVINGS												
Food Purchase	50	5186,253	6023,993	6538,310	6550,379	6570,935	6600,356	6622,569	6629,816	6322,330	90,433	66,308,615
yearly subtotals	50	5186,253	6023,993	6538,310	6550,379	6570,935	6600,356	6622,569	6629,816	6322,330	90,433	66,308,615
YEARLY TOTALS	50	9136,061	9797,356	91,942,032	91,186,287	91,220,106	91,273,565	91,310,667	91,352,164	9095,082	139,482	69,369,600
ADDITIONAL BENEFITS												
INCREASED AVAILABILITY OF MTF PERSONNEL TIME												
Inventory Pricing	50	914,997	680,983	6126,643	6133,195	6138,123	6163,234	6168,533	6150,761	6104,536	63,451	61,056,155
Ration Accounting --- weekly	0	2,083	12,348	17,313	18,479	19,184	19,894	20,438	20,736	18,319	479	146,410
Determine Issue Quantities	0	393,582	2,293,333	3,208,610	3,420,439	3,567,223	3,670,471	3,814,574	3,899,823	2,648,995	88,432	27,048,872
Census Forecasting	0	3,781	31,513	33,363	33,363	38,084	38,091	37,438	38,255	35,911	878	265,584
Item Preference	0	7,585	45,027	67,730	67,425	69,409	72,148	74,455	76,511	51,823	1,739	531,148
Computing Service Quantities	0	15,138	98,056	129,461	134,351	139,218	145,349	149,711	153,822	103,445	3,474	1,042,337
Evaluation	0	18,155	100,045	155,353	141,101	167,841	173,203	179,453	183,426	124,376	4,174	1,294,004
Tally Reports	0	6,533	32,356	43,358	43,917	45,362	47,227	48,975	49,321	39,332	784	346,158
Nutritional Analysis	0	23,184	170,138	248,488	257,599	267,131	277,814	287,244	296,512	202,207	4,451	2,041,009
Menu Price Analysis	0	3,468	26,916	39,722	40,725	42,332	43,794	45,415	46,879	32,767	1,818	322,681
Annual Recipe Price Analysis	0	2,771	21,648	32,246	33,459	34,677	35,981	37,312	38,138	35,832	867	286,747
Recipe Price Update Analysis	0	9,719	71,477	107,938	111,923	116,064	120,359	124,812	127,521	93,239	4,263	887,481
Patient Nutritional Analysis	0	3,884	31,710	31,768	33,916	35,171	36,492	37,822	38,443	38,982	0	26,982
In Nutritional Assessment	0	458,974	2,712,041	3,715,873	3,453,361	3,995,935	4,163,785	4,307,105	4,397,823	2,793,822	74,175	30,445,293
Out Nutritional Assessment	0	489,982	3,546,754	4,702,503	4,676,982	5,856,926	5,248,926	5,430,941	5,540,749	3,243,037	91,234	31,458,100
yearly subtotals	50	51,700,959	99,740,241	913,641,620	913,930,771	914,454,506	914,989,322	915,513,927	915,893,267	910,136,073	9300,400	9110,137,585
YEARLY TOTALS	50	51,700,959	99,740,241	913,641,620	913,930,771	914,454,506	914,989,322	915,513,927	915,893,267	910,136,073	9300,400	9110,137,585
GRAND TOTALS	50	51,943,274	910,941,409	915,121,036	915,405,401	916,337,916	916,341,567	916,463,234	917,487,163	911,361,704	9339,794	9133,495,610
												100.00

TABLE D-3. ESTIMATED PRESENT VALUE LIFECYCLE COSTS OF TRIFOOD IN 12 CANDIDATE STATES
USING DEPARTMENT OF DEFENSE INFLATION INDEX AND 0% DISCOUNT RATE

	TOTAL												as a percent of Hardware Total Costs
Hardware Acquisition	933,536	933,536	945,597	94	94	94	94	94	94	94	94	94	37.3%
Hardware Maintenance	91,813	918,633	946,700	946,458	971,190	973,836	976,555	979,300	980,951	982,621	91,720	939,923	41.7%
Hardware subtotals	933,536	933,536	945,597	946,458	971,190	973,836	976,555	979,300	980,951	982,621	91,720	939,923	37.3%
Software Acquisition	936,468	936,468	949,431	949,431	962,474	965,479	968,484	971,489	974,494	977,499	91,720	989,219	41.7%
Software Maintenance	945,764	945,764	958,727	958,727	971,770	974,775	977,780	980,785	983,790	986,795	91,720	998,515	41.7%
Software subtotals	936,468	936,468	949,431	949,431	962,474	965,479	968,484	971,489	974,494	977,499	91,720	989,219	41.7%
Communication Costs	95,764	95,764	96,839	96,839	97,914	98,989	100,064	101,139	102,214	103,289	91,720	114,009	10.0%
Other Costs	91,720	91,720	91,720	91,720	91,720	91,720	91,720	91,720	91,720	91,720	91,720	91,720	1.0%
Grand Totals	933,536	933,536	945,597	946,458	971,190	973,836	976,555	979,300	980,951	982,621	91,720	939,923	100.0%

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TABLE D-8. ESTIMATED PRESENT VALUE LIFECYCLE COSTS OF TRIPOD IN 12 CANDIDATE SITES
(cont'd) USING DEPARTMENT OF DEFENSE INFLATION INDEX AND 10% DISCOUNT RATE

NET PRIMARY BENEFITS	By Year	6119, 7613	6745, 8353	4583, 597	61, 344, 407	61, 415, 300	61, 447, 757	61, 523, 844	61, 574, 341	61, 610, 829	61, 647, 447	621, 587
	cumulative	6119, 7613	6005, 7963	6501, 7951	61, 043, 800	63, 478, 475	63, 946, 333	65, 468, 599	67, 046, 477	68, 658, 764	69, 449, 573	69, 401, 001
NET TOTAL BENEFITS	By Year	6119, 7613	6735, 824	4583, 597	61, 404, 325	63, 354, 139	63, 922, 263	64, 511, 287	65, 123, 300	65, 753, 296	66, 406, 478	67, 087, 187
	cumulative	6119, 7613	6015, 813	6119, 7613	61, 025, 945	64, 399, 605	65, 722, 140	67, 335, 535	69, 055, 843	70, 859, 130	72, 746, 678	74, 718, 646

TABLE D-9. ESTIMATED PRESENT VALUE LIFECYCLE BENEFITS OF TRIFOOD IN 12 CANDIDATE STATES USING DEPARTMENT OF DEFENSE INFLATION INDEX AND 6% DISCOUNT RATE

PRIMARY BENEFITS												
	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	TOTAL
INCREASED AVAILABILITY of MTF PERSONNEL TIME												
Inventory Pricing	10	54,734	538,432	551,554	538,839	549,726	546,447	547,391	546,559	528,448	678	6370,049
Inventory Reconciliation	0	3,707	28,913	28,314	17,759	27,156	31,367	35,991	35,008	16,032	507	203,074
Ration Accounting -- weekly	0	935	5,345	7,214	7,068	6,966	6,757	6,410	6,468	3,956	129	51,390
Ration Accounting -- monthly	0	513	3,985	3,985	3,855	3,772	3,690	3,410	3,482	2,237	70	20,844
Workload Reporting	0	5,551	31,115	43,191	41,276	48,300	39,584	38,447	37,241	33,004	754	308,482
Maintain Subunit Inventory	0	28,001	113,276	153,495	158,368	147,097	143,945	140,783	135,782	86,640	2,704	1,094,565
Determine Purchase Quantities	0	10,448	54,438	74,487	75,188	73,549	71,953	70,391	67,491	43,638	1,373	547,383
Determine Issue Quantities	0	10,448	54,438	74,487	75,188	73,549	71,953	70,391	67,491	43,638	1,373	547,383
Inventory Analysis	0	2,447	13,829	18,345	17,947	17,552	17,157	16,762	16,540	10,577	323	133,347
Group Forecasting	0	1,307	7,561	10,554	10,831	9,418	9,101	8,783	8,465	5,270	103	73,021
Item Preference	0	2,693	15,122	20,508	20,844	19,416	18,183	16,784	16,113	11,575	366	146,843
Computing Service Quantities	0	5,364	38,144	41,414	40,184	38,353	36,485	34,577	32,639	23,150	733	293,123
Cyclical Menu Evaluation	0	2,493	13,122	20,307	20,047	19,429	18,789	18,146	18,115	11,575	366	146,843
Tally Reports	0	1,441	9,994	13,735	13,146	13,146	13,146	12,581	12,254	8,048	234	97,752
Tray Assembly	0	6,554	28,785	24,974	23,982	23,383	22,876	22,379	9,074	9,074	355	170,716
Daily Worksheets	0	9,236	53,447	71,220	69,474	68,484	67,494	66,504	65,514	40,323	1,273	502,311
New Production Prep Doc	0	10,453	105,455	143,563	140,546	137,608	134,670	131,582	128,794	101,825	2,545	1,023,432
Procurement Documents	0	703	4,785	6,785	6,559	6,333	6,107	5,881	5,655	3,428	115	47,715
yearly subtotals	50	6121,094	5669,390	5904,594	5884,908	5884,766	5884,766	5884,766	5884,766	5583,349	616,057	66,443,147
MATERIAL SAVINGS												
Food Purchase	00	684,545	6355,993	6436,431	6437,179	6437,179	6437,179	6437,179	6437,179	6437,179	6437,179	6437,179
yearly subtotals	00	684,545	6355,993	6436,431	6437,179	6437,179	6437,179	6437,179	6437,179	6437,179	6437,179	6437,179
YEARLY TOTALS	00	6121,094	5669,390	5904,594	5884,908	5884,766	5884,766	5884,766	5884,766	5583,349	616,057	66,443,147
ADDITIONAL BENEFITS												
INCREASED AVAILABILITY of MTF PERSONNEL TIME												
Inventory Pricing	10	613,347	974,445	610,129	599,531	597,321	595,259	593,192	591,124	588,372	61,810	5724,494
Ration Accounting -- weekly	0	1,154	10,727	14,120	13,084	12,516	11,948	11,380	10,812	8,107	252	100,424
Determine Issue Quantities	0	341,269	1,928,495	2,612,480	2,556,112	2,500,630	2,446,393	2,393,311	2,340,299	1,474,281	46,485	10,407,409
Census Forecasting	0	3,249	18,782	25,443	25,004	24,536	24,083	23,643	23,243	14,449	450	102,379
Item Preference	0	6,733	37,085	51,272	50,148	49,072	48,007	46,965	45,937	30,938	916	345,134
Computing Service Quantities	0	13,405	75,411	102,545	100,350	98,143	96,411	93,930	90,573	57,075	1,832	730,300
Tray Assembly	0	16,158	98,733	123,854	120,384	117,772	115,216	112,716	109,484	69,458	2,199	874,378
Tally Reports	0	5,814	27,167	33,546	32,818	32,104	31,409	30,727	29,134	16,751	371	223,649
Nutritional Analysis	0	10,434	145,935	194,743	193,493	189,316	184,130	180,333	175,585	115,748	3,390	1,400,234
Menu Price Analysis	0	3,241	21,400	31,167	30,432	29,723	29,016	28,494	27,748	18,277	534	221,371
Menu Price Updates	0	3,354	48,945	35,557	35,003	34,400	33,730	33,418	32,374	16,436	457	183,015
Annual Recipe Price Analysis	0	8,828	48,774	80,491	81,211	80,485	79,389	78,309	75,408	52,044	2,314	400,043
Recipe Price Update Analysis	0	2,475	18,335	25,704	25,344	24,794	24,256	23,730	23,478	15,777	671	104,241
Patient Nutritional Analysis	0	400,465	3,227,081	1,945,326	3,879,455	3,816,976	3,755,453	3,696,057	3,603,775	1,559,409	40,120	20,900,740
In Nutritional Assessment	0	414,611	2,977,735	3,424,002	3,444,002	3,444,002	3,444,002	3,411,707	3,284,216	1,022,043	40,120	24,579,043
Out Nutritional Assessment	0	58,492	399,373	349,101	537,245	535,407	514,183	503,045	488,711	331,184	8,100	3,907,381
yearly subtotals	50	61513,848	40,170,094	510,444,478	610,415,841	610,109,454	59,940,756	59,752,452	59,407,300	55,459,037	6150,395	575,890,376
YEARLY TOTALS												
	50	61,513,848	40,170,094	510,444,878	610,415,841	610,109,454	59,940,756	59,752,452	59,407,200	55,459,037	6150,395	675,490,376
GRAND TOTALS												
	50	61,719,507	40,105,477	511,977,905	611,710,807	611,443,749	61,215,007	610,971,403	610,579,858	56,240,317	6178,999	685,302,409

TABLE D-11. ESTIMATED PRESENT VALUE LIFECYCLE BENEFITS OF TRIFOOD IN 12 CANDIDATE SITES
USING DEPARTMENT OF DEFENSE INFLATION INDEX AND 3% DISCOUNT RATE

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	TOTAL
PRIMARY BENEFITS												
INCREASED AVAILABILITY OF MTF PERSONNEL TIME												
Inventory Pricing	10	16,487	136,535	640,213	646,294	646,450	642,481	640,941	639,350	632,414	625,414	9,239,258
Inventory Reconciliation	0	3,571	16,772	34,338	35,382	34,275	33,387	32,381	31,186	30,289	29,188	179,818
Ration Accounting -- weekly	0	781	5,893	6,494	6,474	6,474	5,928	5,492	5,465	5,288	5,105	45,783
Ration Accounting -- monthly	0	494	3,764	3,657	3,511	3,372	3,237	3,108	2,983	2,847	2,717	24,775
Workload Reporting	0	5,300	39,419	39,151	37,593	36,484	34,459	32,279	31,401	19,745	19,745	414
Maintain Subunit Inventory	0	19,344	107,009	142,421	136,944	131,491	124,254	121,229	114,758	72,435	72,435	2,334
Outsource Purchase Quantities	0	9,472	33,349	71,311	48,472	45,744	43,128	40,415	37,379	36,817	36,817	1,110
Determine Issue Quantities	0	2,377	13,875	17,401	16,788	16,043	15,484	14,791	13,994	13,817	13,817	1,110
Inventory Analysis	0	1,297	7,149	9,514	9,137	8,773	8,424	8,080	7,435	7,274	7,274	273
Census Forecasting	0	2,594	14,266	19,416	18,274	17,564	16,844	16,127	15,310	14,481	14,481	149
Item Preference	0	5,106	20,595	30,463	34,547	35,492	33,495	32,354	30,428	19,283	19,283	597
Computing Service Quantities	0	1,304	14,304	19,401	18,274	17,564	16,844	16,127	15,310	14,481	14,481	149
Evaluation	0	1,304	9,499	12,764	12,751	11,751	11,283	10,834	10,356	6,492	6,492	192
Cyclical Menu	0	6,214	19,451	23,173	22,722	21,384	20,513	19,498	18,914	7,518	7,518	287
Tally Reports	0	6,877	49,464	44,889	43,458	40,791	38,174	35,174	33,449	33,449	33,449	1,834
Trip Assembly	0	10,140	100,803	133,228	137,116	132,423	117,933	113,238	107,144	97,211	97,211	3,004
Daily Worksheets	0	678	4,412	5,726	5,974	5,726	5,368	5,230	5,035	4,747	4,747	94
Menu Production Prep Doc	0	11,474	44,339	85,442	82,332	78,458	75,414	72,764	68,494	45,387	45,387	586,597
Procurement Documents	0											
Yearly subtotals:	10	6116,450	6433,066	1039,437	1006,086	9773,915	9703,102	9713,515	9676,419	9419,191	9113,873	65,734,104
MATERIAL SAVINGS												
Food Purchase	10	991,095	9336,579	9395,711	9379,955	9366,420	9350,383	9336,355	9316,465	9149,255	93,702	13,722,467
Yearly subtotals:	10	991,095	9336,579	9395,711	9379,955	9366,420	9350,383	9336,355	9316,465	9149,255	93,702	13,722,467
YEARLY TOTALS												
	10	6107,946	1049,446	61,335,138	11,195,961	61,139,703	61,093,486	61,049,870	60,982,884	58,668,446	58,668,446	10,456,431
ADDITIONAL BENEFITS												
INCREASED AVAILABILITY OF MTF PERSONNEL TIME												
Inventory Pricing	10	112,837	970,574	194,407	199,450	607,001	103,575	100,240	975,000	640,420	61,480	644,443
Ration Accounting -- weekly	0	1,786	9,402	13,112	13,578	12,009	11,408	11,146	10,473	6,725	49,337	49,337
Determine Issue Quantities	0	328,843	1,020,401	2,410,577	2,320,043	2,235,332	2,146,352	2,060,431	1,950,402	1,324,500	36,000	16,550,323
Census Forecasting	0	3,743	17,872	23,769	21,401	21,933	21,959	20,231	19,137	11,002	373	142,472
Item Preference	0	4,984	35,744	47,579	45,444	43,045	42,119	40,484	38,226	24,804	744	314,743
Competing Service Quantities	0	12,971	71,400	95,157	91,349	87,331	84,330	80,404	74,504	40,400	1,492	449,106
Evaluation	0	15,545	85,785	114,180	109,443	105,277	101,085	97,801	91,839	57,409	1,790	779,463
Tally Reports	0	5,581	35,106	31,139	37,409	37,409	37,357	36,460	34,423	13,366	383	213,531
Nutritional Analysis	0	19,877	135,100	182,307	173,318	160,328	141,435	133,200	140,338	94,814	3,747	1,245,185
Menu Price Updates	0	3,141	21,367	28,844	27,717	26,413	25,554	24,159	23,451	15,177	437	194,859
Menu Price Analysis	0	3,233	17,817	23,714	22,772	21,645	20,995	20,159	19,678	11,945	373	161,972
Annual Recipe Price Analysis	0	8,584	56,494	79,332	74,173	73,160	70,210	67,432	63,792	43,187	1,002	589,484
Recipe Price Update Analysis	0	2,577	17,261	24,040	23,043	22,144	21,281	20,434	19,331	13,047	546	163,704
Patient Nutritional Analysis	0	393,494	2,152,705	2,731,274	2,432,533	2,510,117	2,417,959	2,321,592	2,200,607	1,293,710	32,478	10,484,764
In Nutritional Assessment	0	591,400	2,815,529	3,454,400	3,318,461	3,104,721	3,059,443	2,938,016	2,775,754	1,511,417	39,339	23,493,443
Out Nutritional Assessment	0	40,400	372,593	509,417	489,327	483,004	453,130	433,174	413,039	274,720	6,427	3,473,721
Yearly subtotals:	10	61,050,280	67,732,110	69,879,858	67,404,493	69,100,790	68,746,126	68,397,400	67,950,570	64,494,321	6128,957	647,583,353
YEARLY TOTALS												
	10	61,650,280	67,732,110	69,879,858	67,404,493	69,100,790	68,746,126	68,397,400	67,950,570	64,494,321	6128,957	647,583,353
GRAND TOTALS												
	10	61,661,730	68,704,550	70,579,716	68,819,478	70,240,493	69,842,612	69,447,200	68,901,140	65,188,742	6190,915	670,039,784

TABLE D-12. ESTIMATED PRESENT VALUE LIFE CYCLE COSTS OF TRIFOOD IN 12 CANDIDATE SITES
USING DEPARTMENT OF DEFENSE INFLATION INDEX AND 8% DISCOUNT RATE

										TOTAL	as a percent of	
											Hardware	Total
											Costs	Costs
											46.4%	10.5%
HARDWARE												
NON-RECURRING												
Hardware Acquisition	931,052	926,930	947,942	90	90	90	90	90	90	90	9297,923	
RECURRING												
Hardware Maintenance	9730	931,310	931,432	930,460	940,451	940,532	940,409	942,091	940,496	924,100	9730	55.4%
yearly subtotals	931,090	9282,040	9119,373	930,460	940,451	940,532	940,409	942,091	940,496	924,100	9730	100.0%
SOFTWARE												
NON-RECURRING												
Software Acquisition	931,943	9262,494	935,110	90	90	90	90	90	90	90	9391,940	43.4%
Development & Documentation	7,369	58,509	31,100	0	0	0	0	0	0	0	87,355	9.6%
RECURRING												
Software Maintenance	1073	931,500	937,070	936,473	934,325	933,866	939,993	940,002	945,451	930,302	1005	46.4%
yearly subtotals	102,405	9393,034	9173,794	936,473	934,325	932,866	949,993	940,002	945,451	930,302	1005	100.0%
COMMUNICATION												
NON-RECURRING												
Communication Lines	15,337	161,313	114,947	90	90	90	90	90	90	90	161,597	100.0%
OTHER												
NON-RECURRING												
Site Preparation	61,941	615,032	65,435	90	90	90	90	90	90	90	922,309	1.0%
Installation (Vendor)	2,426	10,770	7,794	0	0	0	0	0	0	0	27,999	1.3%
Training Key Personnel	6,432	37,357	13,300	0	0	0	0	0	0	0	35,997	4.4%
Staff Training	12,415	97,440	35,330	0	0	0	0	0	0	0	145,392	1.1%
Data Collection	5,428	24,975	4,794	0	0	0	0	0	0	0	37,390	1.3%
yearly subtotals	931,303	9257,930	9197,755	9124,973	9119,997	9115,310	9110,432	9106,227	9197,722	935,707	91,439	0.1%
RECURRING												
Training Key Personnel	1079	95,915	97,409	97,321	97,029	96,749	96,401	96,223	95,477	91,434	90	4.5%
Supplies	2,426	32,032	10,030	117,432	112,968	100,470	100,151	100,005	94,245	51,352	1,639	7.1%
yearly subtotals	931,303	9257,930	9197,755	9124,973	9119,997	9115,310	9110,432	9106,227	9197,722	935,707	91,439	100.0%
GRAND TOTALS												
	9111,075	9064,324	9505,470	9231,985	9222,472	9213,406	9105,394	9197,120	9105,468	9100,537	93,762	100.0%

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TABLE D-12. ESTIMATED PRESENT VALUE LIFECYCLE COSTS OF TRIFOOD IN 12 CANDIDATE SITES
(cont'd) USING DEPARTMENT OF DEFENSE INFLATION INDEX AND 8% DISCOUNT RATE

NET PRIMARY BENEFITS	(1111,073)	(1636,540)	(5063,596)	61,403,133	6963,287	6934,934	6004,110	6052,750	6005,415	6059,490	613,513
by year											
cumulative	(1111,073)	(1707,655)	(6300,660)	609,173	61,462,461	61,507,398	63,475,500	64,318,350	65,133,673	65,593,563	65,607,076
NET TOTAL BENEFITS	(1111,073)	600,718	48,195,713	110,403,891	610,407,203	610,833,716	619,636,325	619,350,450	60,756,006	65,156,111	6162,469
by year											
cumulative	(1111,073)	600,718	48,195,713	110,403,891	610,407,203	610,833,716	619,636,325	619,350,450	60,756,006	65,156,111	6162,469



TABLE D-13. ESTIMATED PRESENT VALUE LIFE CYCLE BENEFITS OF TRIFOOD IN 12 CANDIDATE SITES
USING DEPARTMENT OF DEFENSE INFLATION INDEX AND 1% DISCOUNT RATE

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	TOTAL
PRIMARY BENEFITS												
Inventory Pricing	16,432	532,750	641,484	630,397	635,724	633,000	630,634	628,364	626,100	616,415	616,415	6,243,810
Inventory Reconciliation	3,321	17,728	22,744	21,076	19,514	18,070	16,731	15,372	14,003	12,624	11,245	144,603
Billion Accounting --- weekly	636	4,569	5,706	5,346	4,943	4,540	4,137	3,734	3,331	2,928	2,525	36,640
Billion Accounting --- monthly	641	2,462	3,143	2,916	2,711	2,516	2,321	2,126	1,931	1,736	1,541	20,000
Workload Reporting	4,972	36,378	33,851	31,342	28,833	26,324	23,815	21,306	18,797	16,288	13,779	214,140
Maintain Subunit Inventory	17,987	96,819	123,213	116,175	109,137	102,099	95,061	88,023	80,985	73,947	66,909	780,819
Determine Purchase Quantities	8,993	48,814	41,437	37,007	32,577	28,147	23,717	19,287	14,857	10,427	5,997	200,000
Defensive Issue Quantities	8,993	48,814	41,437	37,007	32,577	28,147	23,717	19,287	14,857	10,427	5,997	200,000
Inventory Analysis	2,210	11,713	13,045	13,730	14,415	15,100	15,785	16,470	17,155	17,840	18,525	180,000
Census Forecasting	1,204	6,410	6,327	7,410	7,453	8,536	8,579	9,662	9,705	10,788	10,831	95,177
Unit Preference	3,413	13,810	16,655	15,135	14,104	13,073	12,042	11,011	9,980	8,949	7,918	84,000
Computing Service Quantities	4,824	25,439	32,918	30,471	28,024	25,577	23,130	20,683	18,236	15,789	13,342	184,000
Evolution	2,412	12,420	16,455	15,135	14,104	13,073	12,042	11,011	9,980	8,949	7,918	84,000
Critical Mass	1,201	6,410	6,327	7,410	7,453	8,536	8,579	9,662	9,705	10,788	10,831	95,177
Tally Reports	5,871	17,448	20,837	18,322	15,807	13,292	10,777	8,262	5,747	3,232	7,453	67,216
Tray Assembly	6,373	48,984	57,161	51,767	46,373	40,979	35,585	30,191	24,797	19,403	14,009	130,949
Daily Worksheets	16,886	89,738	113,184	106,440	99,694	92,948	86,202	79,456	72,710	65,964	59,218	720,453
Menu Production Prep. Doc	430	4,136	5,310	6,484	7,658	8,832	9,996	11,170	12,344	13,518	14,692	107,000
Procurement Documents	16,455	57,469	76,647	68,510	60,373	52,236	44,099	35,962	27,825	19,688	11,551	448,410
Yearly subtotals	110,067	656,970	673,702	667,996	662,196	656,407	650,619	644,831	639,044	633,257	627,470	6,459,147
MATERIAL SAVINGS												
Food Purchase	10,000,705	630,790	630,137	630,790	630,387	629,571	628,755	627,939	627,123	626,307	625,491	6,194,798
Yearly subtotals	10,000,705	630,790	630,137	630,790	630,387	629,571	628,755	627,939	627,123	626,307	625,491	6,194,798
YEARLY TOTALS	119,972	1,287,760	1,303,839	1,298,786	1,292,583	1,286,000	1,279,374	1,272,745	1,266,116	1,259,488	1,252,859	12,653,945
ADDITIONAL BENEFITS												
Inventory Pricing	611,955	653,379	681,430	673,570	669,977	664,792	659,998	654,359	648,720	643,081	637,442	6,514,200
Billion Accounting --- weekly	1,440	4,709	11,337	10,407	9,719	9,021	8,323	7,625	6,927	6,229	5,531	71,684
Determine Issue Quantities	305,273	1,432,492	2,096,327	1,940,776	1,797,134	1,653,953	1,509,643	1,365,333	1,221,023	1,076,713	932,403	13,244,318
Census Forecasting	2,815	16,815	20,567	19,444	18,322	17,200	16,078	14,956	13,834	12,712	11,590	138,517
Workload Reporting	4,931	32,409	30,347	28,285	26,223	24,161	22,100	20,038	17,976	15,914	13,852	240,233
Computing Service Quantities	12,941	64,899	81,729	76,177	70,625	65,073	59,521	53,969	48,417	42,865	37,313	520,467
Evolution	18,473	76,918	91,413	84,439	78,464	72,489	66,514	60,539	54,564	48,589	42,614	624,540
Tally Reports	5,268	23,831	27,844	24,910	22,977	21,044	19,111	17,178	15,245	13,312	11,379	171,483
Nutritional Analysis	18,482	121,172	137,616	124,144	110,671	97,200	83,729	70,258	56,787	43,316	30,845	550,726
Menu Price Updates	2,921	19,159	24,958	23,100	21,242	19,384	17,526	15,668	13,810	11,952	10,094	157,402
Annual Recipe Price Analysis	3,006	15,925	20,505	18,916	17,327	15,738	14,149	12,560	10,971	9,382	7,793	127,716
Recipe Price Update Analysis	7,908	51,814	60,551	53,300	46,049	38,798	31,547	24,296	17,045	9,794	2,543	431,091
Patent Nutritional Analysis	2,376	13,357	16,743	15,151	13,559	11,967	10,375	8,783	7,191	5,599	4,007	130,876
In Nutritional Assessment	365,891	1,938,377	2,361,585	2,106,580	1,851,465	1,596,352	1,341,237	1,086,122	831,007	575,892	320,778	14,940,213
Out Nutritional Assessment	549,984	2,514,511	2,940,526	2,767,935	2,594,934	2,421,933	2,248,932	2,075,931	1,902,930	1,729,929	1,556,928	19,038,463
Yearly subtotals	61,355,994	66,932,911	68,562,277	67,909,333	67,373,102	66,788,408	66,203,722	65,618,936	65,034,144	64,449,352	63,864,560	654,202,597
YEARLY TOTALS	61,355,994	1,354,692,911	1,372,394,979	1,366,698,669	1,360,000,000	1,353,300,000	1,346,600,000	1,339,900,000	1,333,200,000	1,326,500,000	1,319,800,000	13,818,342,542
GRAND TOTALS	119,972	1,287,760	1,303,839	1,298,786	1,292,583	1,286,000	1,279,374	1,272,745	1,266,116	1,259,488	1,252,859	12,653,945



TABLE D-14. ESTIMATED PRESENT VALUE LIFECYCLE COSTS OF TRIFOOD IN 12 CANDIDATE SITES
(cont'd) USING DEPARTMENT OF DEFENSE INFLATION INDEX AND 12% DISCOUNT RATE

NET PRIMARY BENEFITS	by year	6507,100	6610,519	6015,677	6067,410	6003,139	5703,411	6100,585	6037,401	6500,393	6319,677	69,058
	cumulative	6507,100	6717,637	6301,950	6365,461	61,300,390	62,102,201	62,000,706	63,428,107	64,010,700	64,330,636	64,307,310
NET TOTAL BENEFITS	by year	6507,100	6745,475	67,300,509	69,409,407	60,712,342	60,064,714	67,608,913	66,715,413	66,311,064	63,502,704	695,494
	cumulative	6507,100	6430,367	67,946,956	617,396,403	626,109,085	636,175,710	601,646,633	640,560,005	650,071,909	658,430,615	658,550,110



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