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Report HCSD-77-006



# FOOD SERVICE SYSTEM ENGINEERING CONSULTANT REVIEW

Stephens-Bangs Associates, Inc
3011 East Grand Boulevard
Detroit, Michigan 48202

November 1977

Final Report







Prepared for:

UNITED STATES ARMY HEALTH SERVICES COMMAND (HSPA)
Fort Sam Houston, Texas 78234

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The purpose of this study was to evaluate and report the capabilities of the food service system at the new Walter Reed Army Hospital, to include technical narrarive of food service through receiving, production, packaging, freezing, storage, and service.

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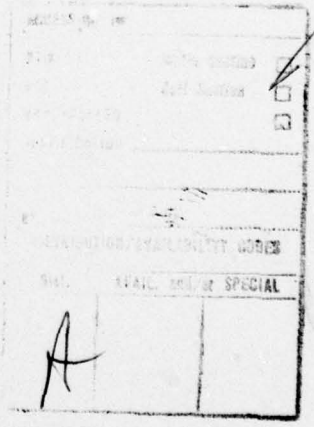
# FOOD SERVICE SYSTEM ENGINEERING CONSULTANT REVIEW

## SUMMARY

The Army had decided to construct a new Walter Reed Army Hospital (WRAH), which was to be of the latest technical design utilizing state-of-the-art in medical care delivery technology. From the onset of planning in 1970 for the new food service system, an anticipated requirement existed for a final review and development of technical procedures and specifications required to implement the new system. In-house technical knowledge, skills, and equipment for this study were not available to develop the required procedures and technical operating information for the new food service system. Stephens-Bangs Associates was awarded a consultant review contract in 1975. It was concluded that: (1) The objectives of the contractual effort were met; and (2) The Technical Narrative can serve as a useful document for WRAMC Food Service officials to use in developing specific operating procedures for the new food service system.



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1. INTRODUCTION:

1.1 Purpose. The purpose of this study was to evaluate and report the capabilities of the food service system at the new Walter Reed Army Hospital, to include technical narrative of food service through receiving, production, packaging, freezing, storage, and service.

1.2 Background. The Army had decided to construct a new Walter Reed Army Hospital (WRAH), which was to be of the latest technical design utilizing state-of-the-art in medical care delivery technology. From the onset of planning in 1970 for the new food service system, an anticipated requirement existed for a final review and development of technical procedures and specifications required to implement the new system. In-house technical knowledge, skills, and equipment for this study were not available to develop the required procedures and technical operating information for the new food service system. This led to the award of an engineering consultant review contract to Stephens-Bangs Associates in 1975.

2. OBJECTIVES: The objectives of this study were to:

2.1 Develop engineering specifications and drawings for semi-automated ware washings.

2.2 Conduct subsystem testing of patient tray delivery systems.

2.3 Provide preliminary drawings and a draft technical narrative for the semi-automatic patient tray assembly subsystem.

2.4 Analyze the WRAMC food storage capabilities.

2.5 Conduct a production analysis for the food production subsystem.

2.5 Provide draft technical narratives for receipt, storage, issue, ingredient preparation and evaluation of subsystems.

3. METHODOLOGY: The contractor performed an on-site technical appraisal to address the study objectives. The appraisal was based on blueprints/ architectural drawings, conversations with the WRAMC food service officials and personnel observations of the new facility. These data were used to develop system requirements.

The contractor used his knowledge of the state-of-the-art of food service operations to develop alternative systems and procedures from which proposed systems and procedures were chosen and incorporated into the technical narrative and other documents furnished to WRAMC.

4. FINDINGS:

4.1 The technical narrative describes the semi-automated warewashing system in considerable detail as Sub-System8. The contractor furnished additional specifications and drawings to WRAMC personnel.

4.2 Although details of the testing of the patient tray delivery sub-system were furnished directly to the Food Service operators, the contractor provided a treatise on the sub-system in Part 7 of the technical narrative.

4.3 The technical narrative discussed the semi-automatic patient tray assenbly in Part 6; preliminary drawings were provided to WRAMC personnel.

4.4 Food storage capabilities of WRAMC Food Service are addressed as Sub-System 2 of the Technical Narrative.

4.5 The Technical Narrative addresses food production as part of Sub-System 4.

4.6 The Technical Narrative discusses receipt, storage, and issue as Sub-System 2. Ingredient preparation is included as Sub-System 3. Results of the Sub-Systems test were furnished under separate cover directly to WRAMC personnel.

5. DISCUSSION:

5.1 There were six objectives associated with the contractual efforts as stated in paragraph 2 above. All objectives were addressed by the contractor and were met to the satisfaction of WRAMC Food Service operating officials. Some of the objectives related to the contractor furnishing specific engineering drawings and specifications, plus performing specific test. These items are not considered appropriate to include in the final report and are therefore, not included.

5.2 The contractor furnished WRAMC Food Service Division a Technical Narrative dated 2 May 1977 which is included in this report as Appendix A. The Introduction to the Technical Narrative explains that it is designed to facilitate an understanding of the Food Service Division's complex internal relationships, as well as it's service and educational relationships to patients and staff.

6. CONCLUSIONS:

6.1 The objectives of the contractual efforts were met.

6.2 The Technical Narrative at Appendix A can serve as a useful source document for WRAMC Food Service officials to use in developing specific operating procedures for the new food service system.

7. RECOMMENDATIONS: That Food Service officials at WRAMC use the Technical Narrative (Appendix A) in developing operating procedures for the new food service system.

8. REFERENCE: Contract No. DADA 15-75-C-0087 (21), 21 Jan 75, issued by P & C Branch, Contract Administration, Walter Reed Army Medical Center, Washington, DC 20012, with changes.

APPENDIX A

WALTER REED ARMY MEDICAL CENTER

FOOD SERVICE DIVISION

TECHNICAL NARRATIVE

WALTER REED ARMY MEDICAL CENTER

FOOD SERVICE DIVISION

# TECHNICAL NARRATIVE



APRIL, 1977

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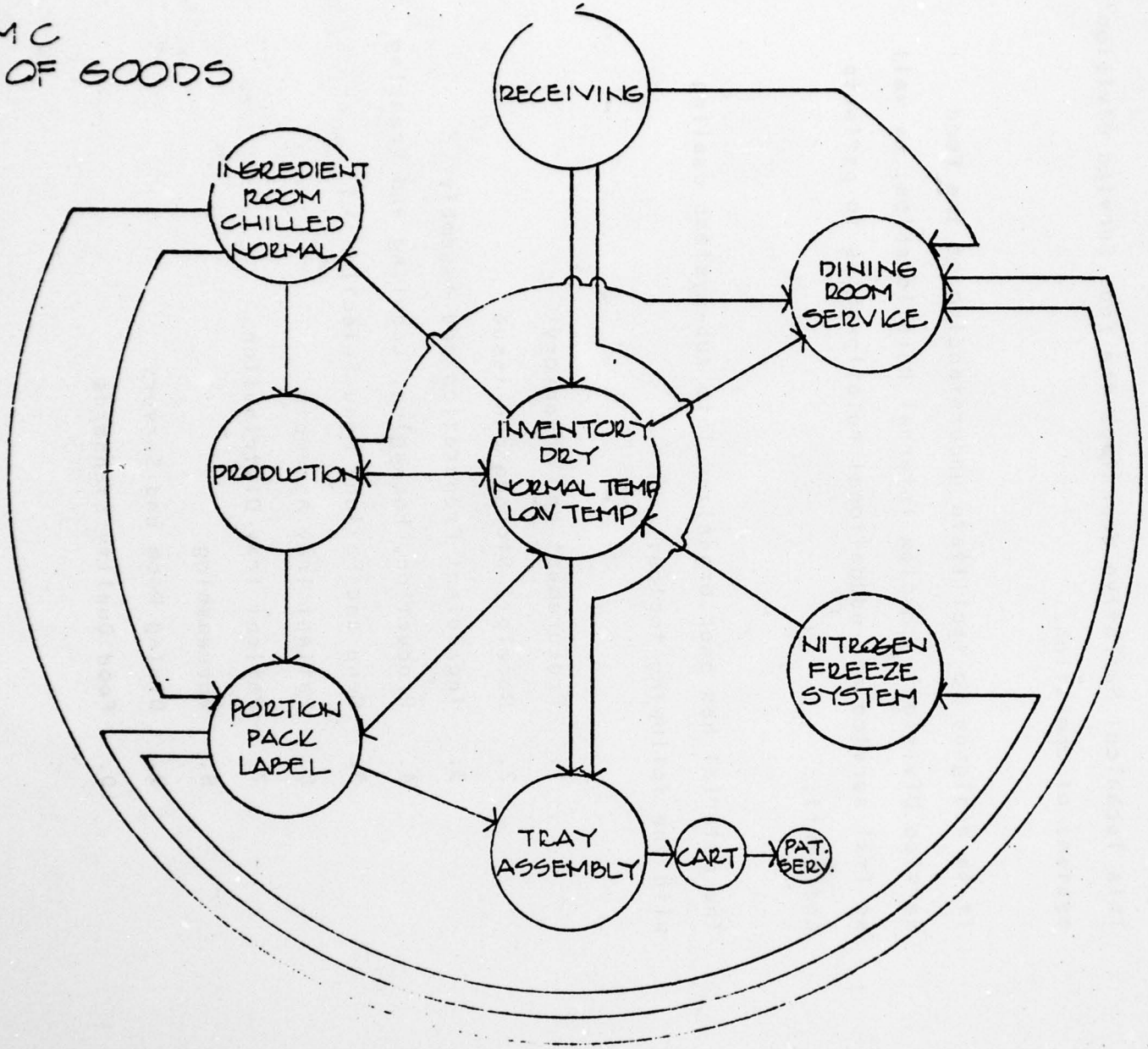
WRAMC
FLOW OF GOODS

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## INTRODUCTION



This Technical Narrative describes the Food Service Division's systems of operation.

It is designed to facilitate understanding of the Food Service Division's complex internal relationships, as well as its' service and educational relationships to patients and staff.

The material has been organized into sub-systems dealing with the following topics:

1. Procurement and Inventory
2. Receipt, Storage and Issue
3. Ingredient Preparation and Assembly
4. Production, Packaging, Labeling and Freezing
5. Menu and Patient Menu Selection
6. Patient Tray Assembly
7. Patient Tray Distribution
8. Warewashing
9. Dining Room and Servery
10. Food Quality Standards

## SUB-SYSTEM I - PROCUREMENT AND INVENTORY SUB-SYSTEM

This section describes the system used to order, inventory and control the use of goods at WRAMC.

The procurement and inventory sub-system assists the Chief, Food Production in ordering foods at the proper time and in the proper quantity for timely production at WRAMC. It is based on the menu, the inventory and historical data derived from the census and the actual service quantities of each food item. A computer maintains files of all parameters and performs all calculations required to establish procurement amounts.

The inventory system continuously maintains, on a theoretical basis, all products as purchased, (the raw goods inventory), as well as goods produced on the premises and held in low temperature storage (the finished goods inventory). A physical inventory is done monthly to comply with U. S. Army accounting requirements.

### PROCUREMENT PROCEDURES

Procurement for service is determined on the basis of inventory, planned production and usage. The planning function is straightforward. It is of course, based on the menu. One

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(1) day's menu is considered as a separate entity, although any number of day's menus may be considered at any planning meeting.

In order to meet U. S. Army time requirements for ordering, initial planning must begin months prior to the actual service date. Initial orders for meats and frozen foods may be reviewed and revised until the deadline date for the issuing of procurement documents for a specific delivery date. Once issued however, the procurement documents may not be readily revised; procurement documents for dry goods may not be revised under any conditions. Perishable items such as produce and dairy products (except milk), are reviewed and procurement orders issued twice weekly. Milk and bread, which are ordered on a five (5) times weekly basis, are ordered according to a par inventory procedure. However, extraordinary use of these products is noted on the recipes so that provision for their use as an ingredient may be made.

The steps of the procurement procedure are as follows:

1. Review and, if necessary, revise menu for a specific service date
2. Project a census
3. Project the service requirements

4. Assign a production date
5. Identify quantities to be produced
6. Identify quantities to be procured
7. Assign delivery dates
8. Issue procurement documents

Non-food supplies are also a part of this system, and are ordered according to prior experience.

All of the steps are repeated for the initial planning and whenever any revision to the original plan is being considered. These steps are detailed in the following pages:

1. REVIEWING THE MENU

The WRAMC menu is cyclic. It is fully described in sub-section 5. Each section of the menu cycle is rotated in order and assigned to a calendar date. Any menu under discussion will have been assigned specific service dates. The menu may be revised to reflect holidays, seasonality, cost constraints, unsuitably paired selections, etc. A major revision to a day's menu, for instance for Christmas Day, may well entail changes to several others. This type of change is reviewed on a printed copy of the menu.

## 2. PROJECTING THE CENSUS

The DR census and patient censuses, by diet category, are projected on an historical basis of the same date in previous years and the same day in preceding weeks.

## 3. PROJECTING SERVICE REQUIREMENTS

The number of servings of each menu item in each diet category that will be required is projected on an historical basis that is expressed as a percentage of the census projection for each category, DR and patient. The historical basis of these figures are developed from actual use figures obtained from the tray assembly's load sheets, described in sub-system 6, and from cafeteria sales. The serving requirements thus established are used for tempering frozen foods for tray line assembly and preparing/tempering foods for dining room service.

## 4. ASSIGNING A PRODUCTION DATE

In order to facilitate procurement, each menu item is assigned a production date. Even items such as canned fruit whose only preparation consists of opening the can, are assigned a "production" date. Although these items need only be opened, their

assignment to a production date insures that they are available. The Chief, Food Production or his representative then plans the production of the menu items requiring detailed work steps. This planning must be slated between the earliest available scheduled delivery date and the date of service. Planning may be done on a hard cover copy of the previously established production schedule. The following parameters, in addition to scheduled delivery and service dates, are considered: product shelf life, frozen storage space availability and labor and equipment availability on a given production day. If it becomes necessary to alter previously established production runs, they are altered in these terms as well as the already established delivery dates for their ingredients. Personnel may be assigned to produce this item at a specific time on an historical basis. Major equipment usage and estimated time of production are established on the same basis.

## 5. ESTABLISHING THE AMOUNTS TO BE PRODUCED

Once the number of servings required and the service date have been decided, the inventory requirements are calculated. This calculation is:

Servings in Inventory
+ Servings to be produced between now and new production date
- Safety level
= Available servings

Servings required
± Available servings
= Production requirements

The safety level referred to in this formula is applied only to items to be produced for low temperature storage. These levels are established by the Chief, Food Production. It is the level below which rotating inventory of the product should not fall. These "reserve servings" are used for patients who do not care for the menu items being offered, or have highly qualified diet requirements.

## 6. IDENTIFYING THE QUANTITIES TO BE PROCURED

Once the date of production and the quantities to be produced of each item have been determined, the ingredient amounts that need to be purchased for each item to be served are calculated. Each service item's production guide or recipe, is computer calculated to yield the number of servings required. Then the amounts for identical ingredients are totalled and converted to the nearest available

purchase unit amount that is most economically bought by WRAMC. It must be noted that some production guides will only contain one (1) ingredient, i.e., chilled peach slices will contain only canned peach slices in heavy syrup.

The calculation for each ingredient is as follows:

Quantity in inventory
+ Quantity to be delivered between now and new production date
- Reserve level
= Available quantity

Quantity needed for service
± Available quantity
= Quantity to procure (converted to purchase units)

The reserve level in this calculation is applied to basic items that occur frequently as ingredients in many recipes, such as flour, sugar, salt, canned tomatoes, etc. An available supply of these items assures a certain degree of production and menu flexibility.

It has been essential to establish the edible (usable) portion weights of purchased units, such as cases, boxes, etc. so that the conversion from ingredient amount to purchase unit can be made. Additionally, it has been necessary to convert volumes to weight since recipes are frequently written in volumes of items that are purchased by weight.

## 7. ASSIGNING DELIVERY DATES

Once the quantities to be procured and the production dates have been established, the delivery dates of each required recipe ingredient may be assigned to regularly scheduled deliveries of that category of items (produce, dry goods, meat, etc.). It may well be that a new procurement requirement for a given date is in addition to already established needs for the same ingredient. This is true of basic items such as flour, sugar, salt, cheese, etc.

Like items assigned for delivery on the same date but needed for different production dates, will be totalled and appear as one (1) item on procurement documents.

8. ISSUING PROCUREMENT DOCUMENTS

Procurement documents are issued in timely fashion to meet U. S. Army requirements; they include required purchase order documentation, number of purchase units, the purchase unit, name and specification of the item, delivery date, time and location of delivery and all other information required by U. S. Army procurement documents.

TIMING OF THE PROCUREMENT PROCEDURES

All of the steps for the procurement procedure must be done at the time of initial planning and at the procurement time deadline.

As the time for production nears, steps 1, 2, 3, 4, 5 and 6 (through the first part of the calculation, "available quantities") are reviewed. If the original planning quantities must be revised downward, the product, if it lends itself to this, may be prepared and kept in low temperature storage or the unneeded raw ingredients, if used on a continuing basis, may be held in rotating inventory; they will be adjusted out by the next revision of the procurement process. If the ingredients are not used on a continuing basis and are perishable, they may be frozen. If the product or ingredient

cannot be frozen, they must be added as a meal revision. If the original planning quantities must be revised upward, a special procurement may have to be obtained or the menu revised; this depends heavily on the "safety and reserve" levels of items held in low temperature or dry storage and on items which were produced even though not immediately needed when initial planning quantities were reduced.

As the time of service nears, steps 1, 2, 3, 4 and 5 (through the first step of the calculation, "available servings") are reviewed. Upward and downward revisions of service needs are handled as designated in the previous paragraph for production revisions.

INVENTORY

The inventory, or goods on hand, control system at WRAMC is a perpetual one. It monitors raw or purchased goods (raw inventory) as well as goods produced on premises and held in low temperature storage (finished inventory). Since the entire procurement system depends on the accuracy of the inventory record system, it must be closely controlled. Goods, when received, are accurately weighed and/ or counted and this information recorded. There is provision on the receiving dock for entering such information directly into inventory records.

Goods, when issued, are accurately weighed and/or counted. In order to assure the accuracy of the inventory information, all raw ingredients issue orders are forwarded to the ingredient room where they are revised upward or downward, according to its stock of goods on hand, and then sent to the stores area so that actual issue amounts may be recorded. This is mandatory because of variation in procurement vs. recipe ingredient amounts and because of the way ingredients are quantified in recipes vs. the way they are issued.

A slot inventory system is used to house raw and finished goods. Information regarding this movement of goods within slots is forwarded to inventory records.

An actual physical inventory is done monthly to comply with U. S. Army requirements.

INTERFACE WITH OTHER SUB-SYSTEMS

The procurement system, is integrally dependent on the receipt/inventory, issue, ingredient processing and production sub-systems. It interfaces with these systems, providing and receiving information.

The procurement system provides the receiving dock with a copy of procurement orders, so that deliveries may be anticipated

and checked for accuracy of quality and quantity. It receives information regarding actual delivery date and quantities from the receipt area.

The procurement system provides the inventory/issue area with a daily requisition. This requisition is divided into five (5) sections, by delivery areas:

1. Production area's portion/seal/label areas
2. Production
3. Dining Room/Servery
4. Tray assembly
5. Ingredient rooms

Each part of the requisition contains the delivery address, delivery day/date and time, slot address, names of the items and the amount requisitioned. The goods delivered to all areas are in unopened unit use packages. While broken cases are handled by the issue area, broken packages, cans, etc., are not. The ingredient room requisition, due to its particular functions, has additional information described in sub-system 3.

The daily requisition includes finished goods to be tempered for patient tray service. This notifies issue of the items to be removed from low temperature storage to normal temperature storage. The orders list the day/date and time tempering is

to begin, the menu item and diet type and the number to be issued, and the intended date of service.

The procurement system receives from inventory/issue any movement of goods within the slot inventory system. Additionally, it receives back the daily requisition that has been adjusted by both issuing and ingredient room personnel so that the perpetual inventory may be updated.

The procurement system provides the ingredient processing area with the following information:

1. Daily requisition and ingredient processing orders
2. Production guide check list labels
3. Ingredient labels
4. Production schedule

Items 1 through 3 are described in sub-system 3. Item 4 is described in sub-system 4.

The procurement system provides the production area with a production schedule and production guides for each item to be processed.

The production schedule lists items to be produced in chronological order according to the scheduled production time. It contains the following information:

1. The production day and date

2. Time of production for each item, which has been correlated with the time of delivery from storage or ingredient processing areas
3. Each item, by diet type, to be produced in chronological order
4. Number of servings of each item to be produced
5. The major piece or pieces of equipment required for production
6. Estimated time of production
7. Personnel assigned to the task
8. The intended service dates
9. Whether the product will be frozen, refrigerated or served immediately

This form is revised by the Chief, Food Production as required and as dictated by factors such as storage life, frozen storage space, personnel and equipment availability as well as delivery schedules.

The production guides include all directions and information required by the cook to prepare the product and the information already noted as a part of the production schedule. The cook receives a list of ingredients and their amounts as a cross control on the ingredient processing area.

The portion/seal/label area of the production area receives a separate schedule, correlated with delivery from and to issue, production, ingredient room, tray assembly and dining room. It shows the following:

1. Production day and date
2. Expiration
3. Delivery time to and from this area
4. Each item by diet type to be processed in chronological order
5. Size of portions or amounts to be placed in each container
6. Size of container
7. Total number of containers to be filled
8. Sealing method
9. Destination

Procurement receives from the portion/seal/label area of production the actual number of servings of each item placed in low temperature storage on a given production date by patient diet type and dining room bulk pack. This information is also provided to the quality assurance section.

## SUB-SYSTEM 2 - RECEIPT, STORAGE AND ISSUE

This sub-system describes how goods are received, stored and issued at WRAMC.

### RECEIPT

Receipt of all products to be used by the WRAMC Food Service Division is via it's own covered dock. The dock has seven parking positions with space for three to six trucks, depending on their size. Trucks and delivery vehicles ramp up to the third floor level, where the Food Service Division supplies; non-food and dry, refrigerated and frozen foods, are stored. Meats and fresh produce are received and processed at Forest Glen; they are then racked on ACTS (Automatic Cart Transport System) vehicles and trucked to the hospital.

Purveyor procured and off-premise procured supplies are off loaded onto platform or ACTS carts. The Food Service Division counts and weighs all products and supplies in the appropriate manner. Large shipments are weighed on the 7' x 7' platform scale, flush with the floor, located on the dock; the remote dial of this scale is located in the receiving room. Small individual packages may be weighed on a mobile scale. After weighing, the goods are wheeled into the receiving corridor and inspected by Food Service personnel for condition.

Goods not meeting specifications are held for disposition. Approved goods are received by the Food Service Division; they are identified as belonging to Food Service Division, marked as to date of receipt, and entered into inventory records.

On-premise procurred foods processed at Forest Glen need only be checked against requisitions as all other steps in the receipt processing will have been done at the time of delivery to the base.

Accepted products are transferred to various areas:

1. Manually via platform truck to paper, central detergent, or non-food storage areas
2. Manually, via platform truck to the dry storage area
3. Via the ACTS to refrigerated storage
4. Via the ACTS to direct use areas such as the dining room and tray line.

The ACTS (Automated Cart Transport System) circles throughout the third floor Food Service Division and loops through the various storage areas. It is a motor driven belt containing

grasping hooks. Specially designed carts that accept these grasping hooks are used. There are call stations scattered throughout the third floor where an empty hook or an empty cart may be requested.

Carts are sent to their destination by dialing the appropriate code. These codes are posted at all ACTS call stations.

STORAGE

There are five distinct storage areas at WRAMC: Non-Food, Paper, Dry, Low Temperature Refrigeration, Normal Temperature Refrigeration, and Detergent. The Detergent Storage will be discussed in conjunction with Sub-System 8, Warewashing.

PAPER STORAGE: Paper is stored in the non-food area and, as requisitioned, transferred to a paper storage room in the production area, close to use areas.

DRY STORAGE: Dry storage is accomplished at WRAMC in a single room employing the following types of storage:

1. Pallets - Pallets are used for case or packaged goods moved in relatively large quantities, such as canned fruits in syrup, canned vegetables, sugar, flour, etc.

2. Mobile Shelving - These are hand loaded and off loaded. The mobile shelving is used for the storage of low volume and infrequently used items such as spices, flavorings and special diet products (other than calorie and sodium restricted), etc.

3. Gravity Flow Shelving - This shelving is manually loaded from the back, like items only behind each other, and manually off loaded from the front directly onto a skate wheel gravity conveyor. Thus, items will accumulate at the low end of the conveyor and be ready for ACTS delivery to use areas with a minimum of effort. One conveyor serves both banks of shelving. The gravity flow shelving is used for the storage of moderate use items in case or unit lots such as calorie and sodium restricted products, tomato paste, soup bases, etc.

Products in dry storage are removed from storage location on a first-in/first-out basis and collected on ACTS vehicles according to intended use and distribution. Broken unit use packages, but no broken packages, are handled.

All cartons are labeled as to the intended usage area except those for the ingredient room. Direct use foods such as crackers and condiments that require no processing, will be sent directly to the dining room, the tray line, or to the portion/seal/label area. All other products are sent to the ingredient room for package breakdown and pre-processing in the amount and at the time specified by the computerized production planning system, described in Sub-System I.

LOW TEMPERATURE REFRIGERATION STORAGE: Products requiring low temperature storage are moved from the receiving corridor via the ACTS to the freezer, maintained at -10 degrees. The freezer contains an ACTS station. Prepared patient and dining room meals (finished goods) are stored here. These finished goods are received in baskets directly from the nitrogen freezing system via a skate wheel gravity conveyor. Patient portions of finished foods are stored in baskets; a basket contains only one type of food. Finished foods for the dining room are held in baskets in standard size half-pans; a basket contains only one type of food. The baskets are removed from the conveyor, accumulated on mobile carts in the freezer and then taken to appropriate shelving. The freezer contains the following types of shelving:

Gravity Flow Shelving - There are two banks of this shelving in the center of the freezer.

These shelves are used primarily for the storage of raw food products (in covered clean containers), high volume dining room foods, and regular and some special diet patient foods. These sections are manually loaded from the back, like items only behind each other, and manually off loaded from the front directly onto a skate wheel gravity conveyor. Products accumulate around the corner, staging at the end of another conveyor: one such conveyor located at the ACTS station and another at the entrance to the normal temperature refrigerators.

Mobile Shelving - These shelves are hand loaded and off loaded. They are used primarily for the storage of low volume raw foods and modified diet patient finished foods.

Products are unloaded from storage shelves or conveyors to ACTS vehicles. They proceed via the ACTS to service or processing areas or to normal temperature refrigeration; carts may be manually delivered to the adjacent normal temperature refrigeration.

NORMAL TEMPERATURE REFRIGERATION STORAGE: The walk-in refrigerated areas at WRAMC are maintained at 36 degrees. Products are removed from all refrigerated storage in a

first-in/first-out basis; this necessitates the identifying of foods that appear on the menu on a daily basis, with the date and time that they were produced or removed from the freezer. If not used within 72 hours of production or removal from the freezer, they are discarded.

There are 5 walk-in refrigerated areas:

1. The main normal temperature storage box is located between the freezer and ingredient rooms. Products are moved here via the ACTS from the receiving corridor, the chilled ingredient room, low temperature refrigeration or manually from low temperature refrigeration and the ingredient room. The room contains two ACTS stations, and the following types of shelving:

   a. Mobile Pallets - Pallets are hand or machine loaded and off-loaded. They are used for case packaged goods moved in relatively large quantities, such as milk, butter, produce and frozen raw products to be thawed.

   b. Mobile Shelving Racks - These are hand loaded and off-loaded. They are used for low volume

or infrequently used items such as bulk product produced in the ingredient rooms but not yet portioned.

c. Gravity Flow Shelving - These are two (2) banks of this shelving, manually loaded from the back, like items only behind each other, and manually off-loaded from the front, directly onto skate wheel conveyors. Items accumulate at the far end of the conveyor and are ready for transfer to use areas with a minimum of effort. This shelving is used for moderate use products in case or unit distribution such as pre-portioned juices and processed foods that technically cannot be frozen. Products are collected in ACTS vehicles and moved via the ACTS to the ingredient rooms, production or patient tray line. They may also be moved manually to the ingredient room. ACTS carts filled in the ingredient rooms according to production guides are staged here until their delivery time arrives.

2. The normal temperature storage box in the production area is maintained at 36 degrees. Product is moved here via the ACTS from the ingredient rooms

where it has been assembled into production guide requirements and where each cart has been properly marked as to usage, and from the production area awaiting further processing. Thus, this area will house ACTS vehicles containing covered raw and finished goods.

3. The normal temperature storage box in the tray line area. Products are moved here via the ACTS from receiving and from low and normal temperature refrigeration or manually from low temperature refrigeration and production/portioning. Items to be served at all meals arrive on a daily basis. Items for a specific meal are sent at a scheduled time before that meal. Thus, the area will house ACTS vehicles.

4. The dining room servery has two normal temperature rooms. Products will be moved near here via the ACTS from receiving, and low and normal temperature refrigeration. These areas will house ACTS vehicles.

ISSUE

The issuance of goods to the various use areas at WRAMC is activated by computer generated requisition. Finished goods

are requisitioned in sufficient time to allow them to thaw before reheating and service. These products are labeled with the date, meal, and place of service as they are moved from the freezer to normal temperature refrigeration. They must be used within 72 hours. Raw goods are requisitioned three days in advance of production and/or service.

Before issuance, the daily requisition is sent to the ingredient room. At the end of the processing day, the supervisor notes unassigned goods applicable to the new order. These are placed on a shelf (rack) labeled "for _____ day's use only". The adjusted requisition is then forwarded to the issue area two days in advance. The issue area assembles the requisitioned items and stores them in appropriate areas: dry, low, or normal temperature refrigeration.

One day in advance of production, requisitioned goods are sent to ingredient processing according to schedule. The issue area then makes the final adjustments in the daily requisition and forwards it to Automatic Data Processing so that the perpetual inventory may be updated.

They are thawed in the normal temperature refrigerator and appropriately labeled.

## SUB-SYSTEM 3 - INGREDIENT PREPARATION AND ASSEMBLY

This section describes the flow of goods to the Ingredient Room, their processing there, and the delivery of processed goods to use areas.

The Ingredient Room receives goods from storage areas: dry, normal and low temperature refrigeration and from Forest Glen, where meats and produce have already been partially processed. Ingredient Room personnel weigh or measure and process all foods as directed by computer-generated requisitions. They properly label and store all products, then send the products to use areas: production, tray assembly and the Dining Room, at the appointed times.

The Ingredient Room distributes all foods, with the exception of direct use items such as crackers and condiments. These are sent directly to the tray assembly or dining room areas.

With the exception of flour, sugar and spices all undistributed goods received from dry stores, both opened and unopened, are stored in the normal or low temperature refrigerators which are contiguous with the ingredient processing area. The normal and low temperature refrigerators are an important adjutant to the ingredient area. Each has a specific area

set aside in it for staging processed ingredients. These refrigerated areas have open spaces which are used to store ACTS vehicles during loading and unloading.

To minimize the refrigerated storage requirement and prevent dual inventories from being established, one in dry stores and one in the refrigerator, the ingredient processing function receives broken cases from dry storage. To preserve the integrity of its function, it does not receive broken unit use items from dry storage. The ingredient processing function is separate from that of storage.

Ingredient room personnel manually adjust computer generated daily requisitions in order to control the usage of goods that have been opened or are on hand, but were not fully required for use in a given production guide or guides. The adjusted daily requisition is returned to ADP for on-going reconciliation of the perpetual inventory.

The Ingredient Room receives the following computer print outs to assist its operation:

1. Daily Requisition and Ingredient Processing Order: A list of each item required for the day, its package weight (or as purchased and edible portion weights) and

the product for which it is intended. An average waste factor for each item requiring it has been applied. The form in which the item is required (chopped, sliced, etc.) and its edible portion weights appear as sub-headings. This order is adjusted to actual needs and returned to ADP for use in updating the perpetual inventory. Items are grouped by delivery times to the ingredient room.

Items in dry storage are assembled in scheduled amounts according to the adjusted daily requisition and placed on ACTS vehicles; they are automatically sent to the Ingredient Room. Items to be processed in the normal temperature Ingredient Room are manually taken to it from the ACTS station in the chilled ingredient room. Items in low and normal refrigeration storage are automatically and/or manually brought to the normal temperature refrigerator aisle space adjacent to the ingredient processing area or directly to the ingredient room. Produce and meat items which suffer rapid quality deterioration after processing are delivered to the area last. Items that do not do so are delivered to the area first.

2. Production Guide And Production Guide Label:
A self-sticking label that withstands refrigeration, for each production guide item to be prepared on that day. It lists the name of the production guide for which ingredients need to be processed and/or grouped, the delivery destination and schedules of delivery date and time. The label also provides an ACTS destination address such as B2 or A9, so that carts on which ingredients are to be placed can be arranged and located easily; this address is based on production schedules.

The labels are placed on ACTS vehicles in the ingredient processing area of the normal temperature refrigerator. As each ingredient and cooking utensil are placed on the vehicle it is checked off on the Production Guide. A supervisor checks for completion, makes corrections as required, certifies for delivery and then places the guide in the ACTS vehicle so that it may be used for production. The Production Guide contains all of the information contained on the label, but further lists each ingredient and its required amount.

3. Ingredient Label:
A self-sticking label that withstands refrigeration is

provided for each ingredient and is placed on the container as it is prepared. This lists name of the ingredient, edible portion weight, desired form, Production Guide for which it is intended and the delivery date and time. As required, ingredient room personnel correct the actual poundage of foods issued if it differs from the pre-printed amount; this is particularly true of meats.

Items requiring tempering before processing will have a one to three day lead time, but normally the Ingredient Room works to the day of production and service.

All processing for a raw food is done at a single time. For instance, the ingredient processing order lists a total requirement of 95 lbs. (AP) of Celery for Tuesday's production and service: 50 lbs. (EP) as hearts for the dining room, 34 lbs. (EP) julienned for Chow Mein in the production area: a total of 84 lbs. edible portion. When the 95 lbs. of Celery is delivered, it is washed, processed and the appropriate quantities of each form processed as requested.

There are two (2) distinct Ingredient Room sections: a chilled room used primarily for the processing of raw meat

products and a normal temperature room used for the processing of all other products. The chilled room, maintained at 50 degrees, contains a breading machine, a patty machine, a bacon slicer, a mixer, and a tenderizer. Each is used as the name implies except the bacon slicer, will be used to slice processed meat. The patty machine is used to form items such as ovals for salisbury steak and meat balls, which are mixed in this area. The breading machine is used for the coating of chicken to be fried and for cutlets, fish, etc., when the product is partially frozen.

The normal temperature ingredient room is a processing and preparation area for produce and all canned and dry goods.

Canned goods are opened, drained if required, and weighed or measured.

Spices, flour, sugar, salt and other dry goods are measured or weighed and may be combined for delivery to the preparation area.

Fresh produce is washed, dried and prepared as requested. If necessary, produce is manually, or automatically peeled. It is then processed to the required size and shape in the appropriate machine.

Salads and desserts that did not require cooking but do require blending are mixed here.

As each ingredient is processed and/or weighed and measured, it is containerized and covered. Each container is marked with the pre-printed ingredient label. ACTS vehicles or a section of an ACTS vehicle are addressed by production guide label and stationed in the normal temperature refrigerator.

Each food is assigned to an employee. This of course, varies accordingly to needs. The Celery requirement may be so high as to be assigned to two men, two hours each. Spices, flour, sugar and other dry goods may require only one hour.

As the weighing, measuring, containerization and labeling of each type of food, (or foods) proceeds, the various containers are collected on an ACTS cart. When that item is complete, or the group of items is complete (if they are not perishable), they are taken to the refrigerator and staged temporarily or immediately placed on the appropriate cart, addressed with a checklist label. The ingredient is then checked off the cart label. After the last ingredient has been placed on the carts, a supervisor or group of supervisors checks for completion and initials the checklist label.

The carts leave the normal temperature refrigerator via the ACTS at the scheduled time on the delivery date. A computer printed delivery schedule is provided for this purpose.

An ingredient processing supervisor, acting against the delivery schedule, is responsible to see that vehicles are placed on the ACTS at the required time; if production is not ready for handling of an item at the scheduled time, or it is needed sooner, ingredient processing is so notified and an estimated time of production identified.

## SUB-SYSTEM 4 - PRODUCTION, PACKAGING, LABELING AND FREEZING

This sub-system describes the cooking, portioning, packaging and freezing of products..

All hot foods except selected potatoes, vegetables and short order items served in the cafeteria are cooked in the central production area of the Food Service Division. All hot and cold foods, except cold foods served in bulk in the cafeteria, are portioned and packaged here. All patient foods technically capable of being frozen are so treated here. The majority of food for the dining room is prepared and put into serving pans and immediately served. Selected foods for the dining room are frozen. Grilled and fried short order items and vegetables to be served for the dining hall are prepared in the dining room servery. Foods are cooked in the central production unit under the aegis of a supervisor who may centrally control all pieces of production equipment: heat turn-on/turn-off times, mixing times and rates of speed, proper functioning of equipment, monitoring of cool-down times, etc.

Flow of Goods: Ingredients are delivered to the central production area and the dining room servery via the ACTS from the ingredient room, or normal and low temperature refrigeration where they have been temporarily staged and

are deposited at one of six stations. Transport within the production area is basically manual, using mobile foodveyors or hand carts.

The actual cooking of foods is accomplished on medium volume, semi-automatic equipment. For the most part this means that cooking devices must be hand loaded and off loaded but that processing within the cooking device and delivery to an off-loading area are done automatically.

After preparation foods are:

1. Put directly into bulk pans for immediate service in the dining room.

2. Portioned but not packaged at the portioning line for immediate service in the dining room.

3. Portioned and packaged at the portioning line for freezer or chilled storage.

PORTIONING AND PACKAGING

There are two (2) portioning and packaging areas in which foods are portioned, containerized and labeled. One line is used for entree and all small dishes, and the other for 12" x 10" dining room pans.

Each portioning line consists of:

1. Automatic Conveyor - The conveyor may be set to a maximum rate of 40/minute: It may be adjusted to less. During filling, the surface is continuously self-cleaned to avoid soiling the bottom of dishes if spillage should occur. All other parts of the system must be manually cleaned.

2. Automatic dispenser that places containers onto the conveyor line for filling.

3. Automatic Fillers - these dispense gravies, sauces and similar items. Many foods because of their size, shape and fragility are hand portioned.

4. Packaging - The lidding devices at the end of each line apply a cover to each container. The lidding devices may be disconnected and the rest of the system operated without it; however, all patient foods are sealed to prevent surface dehydration in the tray cart, spillage in the semi-automatic tray assembly and during ACTS delivery, and to permit proper thermalizing in the carts, if they are to be served hot. If they are to be used immediately, baked goods and desserts portioned for the dining room are not sealed; if there is to be any delay in service, such items are sealed after portioning.

5. Labeling - The labeler applies a code-dated, computer generated contact label to the top of each sealed package. The label preprinting shows the name of the item, its' diet-type, portion size, expiration date, the inventory number and the coded production date and method of storage. For bulk items, the number of portions per container are also noted.

6. Off-Loading: After containers are sealed and labeled, they are manually removed from the conveyor to trays which are compatible with the nitrogen freezing system. These trays are placed in ACTS carts.

After foods are processed on the portioning line, they are manually taken to the dining room and tray line, or sent via the ACTS to the nitrogen freezing system, after initial cool down to 32-40° Fahrenheit in the production unit's blast freezer.

Nitrogen Freezing System: Nitrogen freezing is the most rapid means of freezing food and results in the highest quality product because few cells are ruptured and little essential fluid is lost. Foods have already been placed on trays which are compatible with the freezer. These trays

are manually removed from ACTS vehicles and placed in the tunnel at the tray pre-loading area, one at a time. They are automatically conveyed through and out of the nitrogen atmosphere system at a pre-set rate; the trays of food are then placed onto a skate wheel gravity conveyor that delivers them directly into the main low temperature storage box. They are then placed in inventory.

## SUB-SYSTEM 5 - MENU AND PATIENT MENU SELECTION

This sub-system describes the menu offered at WRAMC to patients and staff. It further describes the present method used to record patients selections and discusses a number of more sophisticated methods. one of which may be used in the near future.

### MENU

The choice of foods offered to the patients and staff at WRAMC is presented in the form of a menu. The menu consists of appetizers, entrees, starch accompaniment, vegetables, salads, rolls and bread, desserts, and beverages. The dining room menu for breakfast is standard, although selective items are regularly rotated; the patient breakfast menu is standard. The lunch and dinner menus at WRAMC are cyclic: Daily menus have been written to cover a selected number of days. The menus are served daily for that number of days, and,then prepared and served again until a new cycle menu is prepared. In order to avoid familiarity lunch and dinner are exchanged each time the menu cycle is begun.

The daily hot food menus are not the same nor are the number of days in the cycle the same for the dining room and patients. These need not be tied together since the patient food is not served immediately following preparation but chilled or

frozen for service. To increase production efficiency each item that appears on the patient menu is also offered in the dining room menu. Thus, when an item is prepared for the dining room it may be chilled or frozen for patient service.

Soups and cereals, for instance, which are served the same day of preparation in the dining room, are chilled for the next day's patient service.

The dining room hot food cycle consists of nine days; four Sundays, and five Ethnic days. The Sunday and Ethnic days are inserted into the cycle, in rotation, on Sundays and Tuesdays.

The patient hot food cycle consists of eleven days and five Ethnic days. The Ethnic days are inserted into the cycle on Wednesdays, so that the foods can be prepared and chilled Tuesdays, when the Ethnic day foods are prepared for the dining room.

The daily cold food menus and the number of days in the cycle are the same for the dining room and patients, since these foods are best served quickly following preparation. This cycle is thirteen days long and they are referred to as Days A through M. The ways in which the hot and cold sections of the menu combined are shown in Chart I.

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CHART I

DAILY MENUS

| | SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|---|
| HOT FOOD | | | | | | | |
| Dining Room Sun. | 1 | 1 | Eth. | 2 | 3 | 4 | 5 |
| Patient | 1 | 2 | 3 | Eth. | 4 | 5 | 6 |
| COLD FOOD | | | | | | | |
| Dining Room | A | B | Eth.-C* | D | E | F | G |
| Patient | A | B | C | Eth.-D** | E | F | G |
| HOT FOOD | | | | | | | |
| Dining Room Sun. | 2 | 6 | Eth. | 7 | 8 | 9 | 1 |
| Patient | 7 | 8 | 9 | Eth. | 10 | 11 | 1 |
| COLD FOOD | | | | | | | |
| Dining Room | H | 1 | Eth.-J* | K | L | M | A |
| Patient | H | 1 | J | Eth.-K** | L | M | A |
| h FOOD | | | | | | | |
| Dining Room Sun. | 3 | 2 | Eth. | 3 | 4 | 5 | 6 |
| Patient | 2 | 3 | 4 | Eth. | 5 | 6 | 7 |
| COLD FOOD | | | | | | | |
| Dining Room | B | C | Eth.-D* | E | F | G | H |
| Patient | B | C | D | Eth.-E** | F | G | H |
| HOT FOOD | | | | | | | |
| Dining Room Sun. | 4 | 1 | Eth. | 8 | 9 | 1 | 2 |
| Patient | 8 | 9 | 10 | Eth. | 11 | 1 | 2 |
| COLD FOOD | | | | | | | |
| Dining Room | 1 | J | Eth.-K* | L | M | A | B |
| Patient | 1 | J | K | Eth.-L** | M | A | B |

* Supper
** Modified Diet Dinner and All Patients' Supper

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In addition to a regular diet patient menu, there are four therapeutic menus: Bland, Type II HLP, Sodium-Calorie Restricted, and Low Sodium-Diabetic, and Sodium Restricted.

In addition to breakfast, lunch and dinner menus, each patient has a selection of items from which to choose a bedtime nourishment. These items are basically limited to cold beverage and snack items, although selected patients have a more extensive selection for therapeutic purposes.

## MENU SELECTIONS

A consideration of the alternate methods by which the patient physically receives the menu and makes his selection, and how this information is physically relayed back to a computer is as follows. The description of the patient menu selection is divided into two phases: the first which describes the present system on which there is computer support for the menu development process, but there is no direct electronic communication between patient areas and a computer; the second in which there will be both computer support and electronic communication between patient areas and the computer.

In both of these phases a computer is used for tallying individual patient requests and preparing the information required for automatic tray assembly, described in Subsystem 6.

## PHASE I

Presently, since there is computer support for the menu development, but no direct electronic communication between patient floors and a computer, a paper menu for breakfast, lunch, dinner and bedtime nourishment is delivered to and collected from each patient by the Dietetic Attendant. This

paper menu is printed for each specific diet by the computer from the menu written by WRAMC staff members and modified by procurement, production and service demands. The day and date of service, and the selective menu for his diet are listed on each meal of the day. Spaces are provided for the patient to fill in his name, ward and bed number.

The Dietetic Attendant gives out the paper menus and he, the Dietitian, or Dietetic Technician, assist patients in filling them out, if necessary, and the Dietetic Attendant collects them. He sees that all are correctly filled out, and that all are present.

The current method used to circulate the paper menu is:

Each type of diet in general use at WRAMC (Regular, Diabetic, Low Sodium, Bland, Diabetic Bland, Low Fat, etc.) is computer printed and duplicated. A suitable variety and number of each type of menu is delivered to each ward.

The Dietetic Attendant gives out the menus and he, the Dietitian or the Dietetic Technician assists with the filling out of the menu, if necessary, and then collects them. They are checked to see that all are present, correctly filled out and are

according to the patient's most recent diet prescription. If some change occurs late in the day and there is sufficient time before menus are due in Room 29, the Dietetic Attendant can fill in a new diet sheet and the Dietetic Attendant, the Dietitian or the Dietetic Technician can take it to the patient. Since menus for the next day are not required until late in the preceding day, many patients have the opportunity of selecting the next day's meals. Any changes not taken care of on the ward level are corrected by the Master Patient Diet File described in this sub-system.

DIET CHANGES

The monitoring of patient's diet changes is best done at the ward, or pantry level, so the Dietetic Attendant obtains a list of patient's diet changes at a prescribed time before lunch and dinner tray assembly and before bedtime nourishment service. A list of all patients currently prescribed diets (which may include changes made during the night by physicians) are collected by a Dietetic Technician and delivered to Room 29 before breakfast, in time to make suitable changes to the breakfast trays.

To facilitate the paper work involved in making diet changes, each morning the Dietetic Technician receives three (3)

copies of the Diet Roster for the ward or wards for which he is responsible, for use in the pantry. It is manually updated by the Dietetic Technician according to changes received and one (1) copy taken to Room 29's mailbox before lunch tray assembly document preparation, and one copy before dinner assembly document preparation. Then the computer's Master Patient Diet File is updated before each meal so the actual menus can be compared with it and corrected. The third and final copy of the ward's Dietary Roster is continuously updated by the Dietetic Attendant and is used for the service of the bedtime nourishment; since these are normally relatively simple, changes can be made from food supplies kept in the pantry. If they cannot be, the Dietetic Attendant is responsible to call for the items required. They are delivered on the bedtime nourishment cart or by a special runner. The third copy is then left at the Nurse's Station so that it can be corrected during the night and collected by dietary before the breakfast tray assembly documents are prepared.

If diet changes are not received in time to follow these normal procedures, the Dietetic Attendant is responsible to call them to the tray assembly office. If the changes can be made in time to be delivered on the patient tray cart they will be; if not, they will be made up of supplies kept in the wards or delivered by a special runner.

The tray assembly computer develops a Master Patient Diet File of each patient, his address and his historically prescribed diet, from the information obtained from the Diet Roster before each meal and from the Diet Roster of each ward picked up before breakfast. This computer File is updated according to changes in diet and address, admissions and discharges and then the menus for the next meal will be compared to the master file. The computer activates any invalid menus and displays a list of patients with incomplete selections. A dietitian or Dietetic Technician then makes all necessary corrections before the tray assembly documents (described in Sub-system 6) are compiled.

PHASE 2

The second phase of the menu Sub-System will begin when both computer support and electronic communication between patient areas and the computer are available. The selection of the electronic equipment used to interface the computer and patient areas will be based upon its ability to meet the following criteria:

1. Transmit his prescribed menu to a patient at any reasonable time directly from the computer
2. Display the entire day's menu in a clearly legible size
3. Display back to the patient the selections he has chosen
4. Enable the Dietary Department to return the patient's marked menu back to him on his tray

5. Interface the patient's selections directly back to a computer storage area without additional steps
6. Be flexible enough to allow changes in diet to enter the system readily and allow the patient to make selections from his new diet without undue delay
7. Easy to train each user to work the system
8. Terminal and data entry equipment must be reliable and easily replaceable in case of failure
9. Economical to operate
10. Require little, if any, monitoring of the equipment

Each of the systems evaluated, except the last one, will require communication with a computer capable of developing individualized menus for each patient and maintaining the Master Patient Dietary File described in Phase I, but with the ability to be updated on-line. Additionally, this computer will need to develop the basic updated menu information required to support the tray assembly system described in Sub-system 6.

All of the systems except the last two will have the ability to note prepared trays that have had a diet change. After delivery, the pantry can be notified of those trays not to be served as is.

Out of the whole range of possible systems of communications, the following have been selected as meeting a majority of these criteria:

Modified television set with a light pencil or a telephone
Portable cathode ray tube with a keyboard
Telecopier with a telephone
Remote printer with a data entry keyboard
Talking computer with a telephone
TV with a telephone

MODIFIED TELEVISION SET WITH A LIGHT PENCIL OR TELEPHONE

The television set is converted to a cathode ray tube terminal and interfaced with a computer by means of an electronic chip. It will, when interfaced with a computer programmed on-line, display a day's menu of the patient's currently prescribed diet to him at any time. The CRT will display the entire day's menu in a clearly legible size if the display screen is sufficiently large. On a "personal size" TV, it will probably need to be displayed to him one meal at a time. The TV set will display back to the patient the selections he has chosen if it is further modified by another electronic chip, instructing it to remember the selections.

A CRT is a computer terminal system so it may be interfaced

directly with a computer storage area. Diet changes may be made instantly and be available to the patient by any data entry terminal; it would probably be located in the pantry. The TV-turned CRT equipment is reliable, easy to maintain, economical to operate and requires little monitoring; it will not return a patient's marked menu back to him. It requires little training to receive the menu, as most Americans know how to dial a TV channel and dialing the correct channel will automatically get him his own menu. The amount of training required to actually select the items depends on the data entry system chosen: light pencil or telephone. The light pencil is not in general use and would therefore require more extensive training than the telephone. The telephone is reliable and historically proven, everyone knows how to use it. A dial or touch tone telephone may be used. Each must be modified to interface with the computer but the dial phone's interface is a more sophisticated device. There are very few procedures needed on the floor for this system. There will be no requirement for the passing and collecting of menus, but it would be wise for the Pantry Assistant to remind each patient of the need to choose his selections from the available menu. If he fails to do so by the deadline, selections will be computer selected for him. Patients who require assistance in choosing their foods may only be keyed into their menus when the Dietic

Technician or Dietitian is present; this program may be done with Dietitian and patient communicating via closed TV circuit.

In order to make diet changes, the pantry would be supplied with a CRT and a data entry keyboard. Dietetic Attendants, who will of course require training, will make the diet changes directly into the computer on a continuing basis. Immediately before tray service the Dietetic Attendant will request from the computer and receive a CRT display of any errors in the tray as delivered, due to changes received too late for the tray assembly system to be responsive to them. The Dietetic Attendant may then make required tray changes or, if necessary, call for a new tray.

PORTABLE CATHODE RAY TUBE WITH A DATA ENTRY KEYBOARD

The type of interface between the patient and the computer is similar to the TV set described above and meets the criteria in the same manner, but it is a true data entry terminal combined with a keyboard. The Dietetic Attendant will take the CRT to the patient's bedside and plug it into a wall outlet. The Dietetic Attendant will, via the keyboard, request a display of that patient's menu, according to the most recently prescribed diet. As the patient indicates them, the aide will "type" his selections to the computer.

The Dietetic Attendant will transmit diet changes in the same manner, "typing" them directly. It is obvious that this CRT may be used with a light pencil or a telephone, in the same manner as the TV CRT, but since the Dietetic Attendant will necessarily be required to move it from patient to patient and room to room, he might as well remain and eliminate the need for this equipment, as well as the need to train patients to use it. Patients on special diets may be taught by Dietitians during the selection process.

TELECOPIER WITH A TELEPHONE

This interface system is similar to Phase I with individualized menu printing, in that a paper copy of the menu is delivered to the patient. In practice, the only difference is that the menus, instead of being hand or cart carried to and from patient areas, will be forwarded by telecopier from the computer development area to the patient floors. Additionally, any changes could be forwarded by telephone or data entry keyboard from the floor so that a corrected menu transmittal could be issued. It involves the printout, at the computer level, of individualized menus which are then placed on the telecopier for transmittal to the appropriate ward, where they are automatically received at the ward's telecopier. The menus are then given out, marked by the patient, corrected for legibility as required and replaced in the ward's telecopier

where they are transmitted and automatically received at the computer level; receipt is automatically held and an available telephone searched if any transmittals are received simultaneously. The resultant menus must then be translated to machine language. These copies require a specially treated paper and require two to four minutes per page of transmittal. They meet all other criteria.

REMOTE PRINTER WITH A DATA ENTRY KEYBOARD

This interface system is similar to that of the telecopier except that this printout from and the entry into the computer are done on the ward level. It meets all criteria, except that the personnel using the entry equipment must be highly trained.

TALKING COMPUTER WITH A TELEPHONE

This interface system will require the patient to dial the computer. The computer will state the menu to him, a few items at a time, (probably no more than four) and verbalize a number with each item. The patient will make his selection by punching or dialing the number assigned to that item. The patient will go through each group of items and make his selections; the computer will then "repeat" his selections to him. Any changes must be made via the telephone system

and a special correct code. This obviously will require considerable training of the patient and advanced technology computer design. It meets all criteria except that of a display and the ability to return the patient's marked menu to him.

TV WITH A TELEPHONE

An ordinary TV set can, via closed circuit, telecast menus. This system will not individualize the menu to the patient and have it available at any reasonable time; it will not display back the menu choices he has made and will not return a patient marked menu back to him. Thus a low fat diet must be telecast, then a regular, then a diabetic, etc., according to an established schedule. The patient will make his selections via a dial or touch-tone telephone, as described in the TV-CRT section. The patient will have to be kept currently informed of his menu and the times during which it will be broadcast. It will not be necessary for the Dietetic Technician to up-date the Master Patient Menu File on-line. This will be done in a written form at prescribed times and verbally by telephone to computer personnel, if required. If there has been a change after a menu was chosen, it may be telephone "scratched" by the Dietetic Technician and selections from his new diet chosen

by the patient when it is telecast. If there is an error by the patient, the Master Patient Diet File will note it so that it may be corrected. The legibility of the menu depends on the size of the TV screen. This interface system meets all other criteria.

It is evident that the final decision as to the computer interface system will be made in terms of the total hospital's systems and needs, and the use which other departments can make of each type of equipment.

## SUB-SYSTEM 6 - PATIENT TRAY ASSEMBLY

This sub-system describes the mechanical and computer system used to assemble patient's trays, and the loading of those trays onto service carts.

The patient tray assembly sub-system consists of fully integrated, computer controlled, manual, semi-automatic and automatic load stations adjacent to an intermittent motion conveyor.

The tray assembly line and its controls may be categorized into the following major steps:

1. Tray placement and travel
2. Loading
   a) automatic (common loaders)
   b) Semi-automatic
   c) Manual
3. Tray addressing
4. Tray resolution
5. Tray disbursement and off-loading

All of these processes are linked by a large TV screen or CRT visible from all areas of the tray assembly room, that indicates the number of the tray currently at the end of the tray assembly line. This number is used to re-load dispensers

and other activities. Additionally, the CRT displays error and other messages.

A functional description of each of these steps follows:

1. Tray placement and travel. To begin the process, a self leveling dispenser of patient trays is manually placed at the end of the conveyor. The last leg of the conveyor and the tray off-loader are then manually switched to accept the size of the tray being assembled, two (2) sizes are used: 12" x 20" for breakfast, lunch and dinner and 6" x 20" for nourishments. The manual start button is activated and the computer confirms that the correct size of tray has been placed in position and the vertical conveyor switched to the proper size. If this cannot be confirmed, the computer so indicates by a message on the CRT and the system does not start. After corrections have been made, the manual start button is pushed again; the computer again attempts to confirm and if all is correct, the tray is placed in process. Since the tray was delivered by the tray washer to the self leveling dispenser in the upside down position it is automatically picked up by a suction device, revolved 180 degrees to place it right side up, and placed on the conveyor so that it travels forward along the direction of its shortest size, 6" or 12".

The tray is automatically moved forward until it is a pre-determined distance from the tray off-loader and after each stop. There must be a tray in each available space in order for the system to operate properly. An appropriate sensor confirms this; when the end of the run is signalled, this sensor is deactivated. If a space is not filled, a message so advises.

As it is placed on the conveyor each tray is assigned a number internally by the computer that corresponds to a number pre-assigned to a specific patient's menu displayed on the CRT. This is a reference number; at the check point, the physical contents of this tray may be compared to the menu items actually ordered by the patient assigned this tray reference number.

If any error occurs and the processing order of trays is changed after the run has started, the tray counter must be manually re-set to maintain the orderliness of the automatic checking and tray labeling process.

The trays are grouped by wards and then by serving order for the tray assembly process. They are then computer divided into ward carts to alert tray loading personnel to the need to change carts when the trays for a new ward are being assembled. A blank tray

that holds cart separator menu and a Transport Module Pack (TMP) for the cart are computer integrated into the conveyor line to divide the ward carts.

The conveyor moves along in an intermittent manner. The speed of the conveyor may be manually adjusted; it is designed to handle up to fifteen (15) trays per minute. At that rate the conveyor will accelerate to its maximum speed and decelerate to a complete stop in one (1) second; it remains stopped for three (3) seconds. All of the horizontal conveyors for the system are continuously and automatically self-cleaning at specific locations.

After being automatically placed on the conveyor and assigned a reference number, the trays move along to the loading stations.

2. Loading - Trays move along the conveyor to be filled at automatic dispense and load, automatic dispense - manual load, and manual dispense and load stations. All of the products dispensed are in sealed packages.

The assignment of food to each type of machine is a computer function. There are specific limitations to

this: they are noted below. But, unless it is specifically noted as being outside its functional parameter, any machine can be assigned any food item. These parameters are the total number of each item to be used, according to diet type, and the usage rate. These loads are totally independent, thus assignment of an item to a specific machine for the first part of the run does not necessarily preclude its assignment to another machine in the later portions.

a) Automatic dispense-and-load machines: There are twenty-three (23) such machines. Each dispenses a single type of dished food onto a specific tray location. The location of each item on the tray is established by a computer analysis for each tray based on total number of items to be placed on that tray and their individual re-thermalizing requirements. These machines are well insulated and will hold food at proper storage temperature up to two (2) hours. The computer activates each machine that is required for each specific serving tray and confirms that the item is available for pickup from the machine. To prevent complete product depletion, a light atop the machine, indicating its address, flashes when the storage

cart is empty, and a buzzing sound when the delivery conveyor has been emptied, unless the end of the run has been signalled. If an item is not available, the entire tray assembly system shuts down and there is a print-out of the unavailable item at the resolution station.

A mechanical failure within the automatic machine or the dispensing arm is computer noted. It is then possible to advise the computer of the break-down location. The computer devises corrective action, i.e., relocates the product to another loading station. When the correction action has been completed, the computer is so notified and makes its own necessary program corrections.

It is not possible to automatically dispense and load two (2) servings of any one (1) item onto a single tray from one (1) common loader. This must be done manually.

Fifteen (15) of the common loaders accept the single serving dish. They are used for the loading of soups, diet entrees, salads, desserts

and vegetables. Five (5) of the common loaders accept the 5" x 3" entree platters and are used for the loading of entree-starch combinations.

The remaining three (3) common loaders are specific for milk, juice and bread. They too are activated and off-loaded to a specific location by computer activation, but since these products are applied to virtually every tray and their capacity is limited, they must be continuously reloaded. There is, therefore, no warning device signalling their depletion. Corrective action in case of machine failure is the same as for the other common loaders. The milk dispenser handles up to four (4) varieties of product in standard containers. The juice dispenser handles up to six (6) varieties of product in containers. The bread dispenser handles up to eight (8) varieties of product in dishes.

b. Automatic dispense - manual load machines. These machines gravity feed a tray of items to an opening. There are eight (8) such openings per machine and six (6) of these machines. The operator is alerted that one of the eight (8) products at his station is required by the flashing of a computer-controlled

signal light. There are three (3) such lights at the dispenser opening of each product; the light that is flashing indicates the tray position, as well as the item. The computer verifies that the product has been dispensed, not that it has been placed on the tray, and turns out the signal light and the tray continues. If the computer cannot verify that an item has been dispensed, for any reason, the entire system shuts down; there is a print-out of the missing item at the resolution station. When the correction is made the line may start again. These machines are well insulated and will hold food at proper storage temperature up to two (2) hours.

If there is insufficient space to load a dispenser with a total meal requirement, the product load sheet pin points at which tray number the supply of critical items will be exhausted. There is no warning device on these machines. If a visual inspection shows that the last of a product is about to be, or has been used, the operator alerts the runner by pushing a button, causing a flashing address light atop the dispenser to light up; the runner consults his run list and determines which product requires replenishing by checking the tray

number currently being dispensed on the CRT.

The computer determines the distribution of products among all available machines. The dispensing of more than two (2) products by any one (1) operator is minimal. These machines accommodate dished or containerized foods. They are used to manually dispense second helpings of automatically loaded items ordered by a patient, as well as low volume items.

c. Manual dispense - manual load stations. There are three (3) such stations. They are small aligned storage bins of individual portion packs of condiments, butter, etc. These are filled to supervisor determined levels before each meal, since it is impractical and unnecessary to actually count them according to need. The computer, to guide the supervisor, prints-out the total meal requirement of each condiment on the product run list. Proper rotation must be assured: because of the long time periods that are involved, the bins containing perishable products are provided refrigerated packs.

The condiments at each station are computer planned by meal to facilitate station set-up. The individual normal temperature bins are usable for a variety of products.

The operator is alerted that up to six (6) of the products at his station are required by the lighting up of signal lights atop the bin of each required product.

Included in the items that are dispensed at the first condiment station is a dish that holds all of the products loaded at these stations. These are held in self leveling dispensers at this station. There is no computer verification of the dispensing of these products.

After leaving all of the various loading stations, the trays are complete except for silverware, napkins, addressing and checking. To reach these stations, the trays must be automatically transferred onto another intermittent motion conveyor by mechanical pushers. The trays then travel along the direction of their largest dimension, 20". An

appropriate computer read sensor confirms that the tray has been pushed off the original conveyor and if it has not, the CRT displays that information and the entire line stops. If this transfer malfunctions and cannot be readily repaired, the trays can be manually pushed from one conveyor to the other.

3. Tray Addressing - This is a manual station with minimal computer support. A computer printed patient menu that was prepared as close to actual assembly time as possible is torn from a roll and placed on the tray. This menu contains, in printed English: the reference tray number, the ward cart and cart slide number, meal being served, the patient's name, diet, ward and bed numbers and all the menu items ordered. If the tray is a beginning of a "new ward cart" indicator, the printed address label states "Ward Cart _____". If the tray is an indicator signalling the "end of meal" the printed cart separator menu so states. The menu and cart separator menu labels are necessarily printed in correct and integrated order. New patients orders, diet changes, etc., received after the labels have been printed are assembled as a separate manual run if the corrections cannot be made at the pantry level.

Once the patient menu has been placed on the tray, the operator places a package of silverware on it to keep it in place; this simple procedure is also being used to keep the cart separator menu in place.

Lastly, the operator at this station places one of seven available diet packs, each containing a napkin, on the tray. A computer controlled signal light indicates the correct diet pack for that tray. The tray then moves to the final check point or resolution station.

4. Tray Resolution - As each tray arrives at this station, its tray reference number, shown on the CRT, is compared with the menu placed on the tray and the actual tray contents may be compared to the patient order. If the tray contents are incorrect, the line is stopped to allow any necessary corrections of machine loading, which is the only reason for an error. A computer print-out will note the discrepancies.

The checking of tray contents is done at the beginning of a run and randomly during it. The checking of condiments and affirmation of correct diet pack and silverware are routinely done on floor pantries.

5. Tray disbursement and loading - As the first tray arrives at the end of the second intermittent conveyor, the entire system stops. The next conveyor, a vertical one, and the output conveyor on the second floor are automatically started by the arrival at their entrance of the first tray for the meal. When a shelf on the continuous motion vertical conveyor is aligned for transfer of the tray, a mechanical transfer pusher places it on the vertical conveyor. A computer connected sensor confirms that each tray has left the end of the intermittent motion conveyor and automatically re-start the entire system; if this confirmation cannot be made, a computer message on the CRT so indicates and the entire tray assembly process stops. If the problem can be immediately corrected, the manual re-start is activated. If it cannot be, the trays must be manually loaded onto the vertical conveyor.

The tray assembly system's intermittent motion conveyor and the continuous motion vertical conveyor are separated by an automatic fire door. In case of fire, this automatic door will close slowly enough to allow the transfer of a tray in process to be completed, but once the fire door begins to move it will not allow the

initiation of a new transfer. There is another fire door, that operates in the same manner, at the end of the vertical conveyor that closes around the output conveyor on the second floor.

The vertical conveyor consists of two parallel chain belts containing supports that are wide enough to form an open shelf under both 6" and 12" trays. As each tray lands at the second floor ward cart storage level it does so onto a horizontal, continuous motion conveyor that propels it forward, off the vertical conveyor angles via the open space under its middle. Guides retain the tray on the conveyor. As each tray, empty or full, arrives at the end of the horizontal output conveyor it will have a cup placed on it and will thus be manually placed on the ward carts in the order received and as indicated by the ward cart and slide numbers. As each cart is filled, the doors will be left open and it will be manually moved on the ACTS system and automatically placed in refrigerated storage.

The cart separator trays are not placed on carts; they have the message and silver removed. The tray is then placed on an empty self leveling dispenser stationed at

the onput conveyor for this purpose and the silver placed in a bin attached to the side of the dispenser. The cart separator menu stating "Ward Cart _____" will be attached to a special holder on the front of the empty cart next in line for filling.

The cart separator tray containing the message "end of run" is noted and discarded, the tray is then placed on the self leveling dispenser lowerator and the last ward cart is placed in storage. The vertical assembly and output conveyor automatically shut down when the tray containing this message is removed from the vertical conveyor.

If the tray assembly system is outputting trays more rapidly than they can be loaded onto ward carts and a tray reaches the last position on the onput conveyor, a computer connected sensor stops the entire tray assembly system and displays this information on the CRT screen. As soon as the tray in the last position in the output conveyor is removed, the sensor notes the action and the entire tray assembly automatically re-starts.

If the vertical conveyor is not functioning, the tray carts must be brought up by elevator to the end of the

intermittent conveyor for loading. If the output conveyor on the second floor is not functioning, trays must be manually removed from the vertical conveyor. The vertical conveyor is provided with a sensor capable of determining that a tray has in fact been removed from the shaft. If the tray sensing device determines the tray has not been removed at the output end, either by the output conveyor or manually, the entire system stops until the sensor can determine that the tray has cleared the opening; the system then re-starts automatically.

When the "end of run" separator tray leaves the intermittent motion conveyor, the resolution station operator manually stops all of the tray assembly systems on the third floor; the vertical and output systems are automatically shut down by the computer, as noted, when the "end of run" separator tray reaches the end of the vertical conveyor.

After all of the trays included in the computer run for a given meal have been assembled and the dispensing equipment and conveyors shut down, any new, special or changed trays may be manually assembled. The intermittent motion conveyor may be re-set to a manual load rate of approximately eight (8) per minute; the menu is placed

on the tray and it is referred to for manual loading. The only dispensers that can be used for this processing are the condiment, silver and napkin stations, all other foods must be obtained from carts or racks. When these trays have been loaded and checked, they are racked and manually sent to the floors at meal time. Nourishments and bulk supplies for each pantry are assembled manually, using the conveyors for support. They go to the second floor and are loaded onto nourishment carts; these are handled in the same manner as tray carts.

After all of the assembly and transport systems have been shut down the loaders, carts and conveyors are emptied of food as desired and routinely sanitized, with the exception of the vertical conveyor. The vertical conveyor is automatically cleaned on a preset timer sequence.

## COMPUTER SUPPORT

The tray assembly is supported, in an extensive manner, by computerized information derived from patient and/or dietitian ordered menus and bulk delivery sheets.

All activities related to data processing of the menus are done by a computer and attendant equipment. Data will be entered by CRT with light pencils and keyboards which communicate directly with the computer memory. Such data is entered far enough in advance of actual tray assembly to allow processing to be completed and food requirements loaded into appropriate machines; it may be updated to a pre-determined time and then any subsequent changes must be handled manually. After the menu update has been completed the computer develops a hard copy print-out of the product load report for the next meal to be assembled. The product load report contains three (3) parts. The first is the refrigerator load sheet and it contains:

1. Each item that is required for tray assembly
2. The exact number of servings of each item. If an insufficient number of portions has been tempered, the underage will be noted as -10 on the refrigerator load sheet. The loader then obtains the required number by requesting a supply from freezer personnel and affixes a red "frozen" tag to each of these items before properly placing them on the tray assembly supply carts. After the trays have been assembled, unused products will be noted in the refrigerator load sheets as +10.

These sheets containing the information on shortages and overages will be turned over to the Chief, Food Production or his representative so that arrangements can be made for their service next meal, and popularity factors adjusted, if they indicate a persistant trend.

3. The address and load factors: Refrigerator cart number, refrigerator shelf number and how many portions of the item are to be placed on that shelf. This is repeated for each item, cart by cart and shelf by shelf.

Parking spaces in the tray assembly refrigerators and storage areas are numbered to indicate the cart to be parked there. To assure that a cart has been properly loaded for parking in this space, removable tags (so that carts can be interchanged) are used to indicate the cart number when it is taken for loading. The shelves of each cart are permanently numbered in order to address them.

The second part of the product load report is the runner's load sheet. It lists the loading required for tray assembling that meal and is grouped by runner assignment. It tells the

runner the "time" that each machine requires loading, because it is near empty of the required product. This "time" is referenced by the tray number on the CRT. The computer adjusts the reference tray number on the CRT to that tray beginning the assembly process that will exhaust a particular product. The reference tray number on the CRT is displayed so that it can be seen from all areas of the tray assembly room. Each employee is assured a space of thirty (30) trays between reloading assignments.

The runner's load sheet begins with the original "start" load requirement, and lists their refrigerator address, the dispensing machine address, name of the item and diet type. It then lists, by consecutive tray reference number, the same information for all of the re-loading situations for which that employee is responsible. To facilitate this, each machine or station on the tray assembly line will be addressed by a permanently assigned letter.

The third part of the product run report is a composite of the runner's load sheet for the supervisor; it also includes the runner assigned to each re-loading situation and the serving tray size to which the conveyor must be adjusted.

The computer will also provide a printed address for each tray. The address label is described on p. 65. The menu is

printed on a tear-off roll and the computer prints and correctly intersperses the cart separator menus: Begin Cart, End of Meal, etc.

Computer assistance to the tray assembly line in the form of machine activation, the confirmation of various procedures and checking have already been described. The mini-computer also supplies assistance for the re-thermalizing of food in patient carts, described in Sub-System 7.

If a major power or equipment failure exists and the tray assembly cannot be run as intended, a simplified version of the menu is manually assembled.

OPERATIONAL TIME SEQUENCE

The sequence of the tray assembly operations is timed to obtain maximum employee efficiency within system time frames. The sequence is:

1. Menu selection completed and information delivered
2. Menu information compiled
3. Product load report printed
4. Refrigerator and other storage carts for tray assembly according to the refrigerator load sheet.

The amount of product to be pulled from the freezer to temper or to be freshly prepared is not a part of this system, but a part of the inventory control system described in Sub-System I.

5. Refrigerator and other carts stored in assigned parking spaces
6. Tray assembly stations set up according to "start" requirements
7. Conveyor adjusted to receive proper tray size
8. Tray assembly started
9. Dispensing machine re-loading accomplished based on tray reference numbers according to runner load sheets
10. Computer-assisted tray assembly completed at "end of meal" indicator
11. Any late admissions or corrected trays that could not be included in automatically assembled part of run are manually assembled
12. Late admission or changed trays are manually delivered

## SUB-SYSTEM 7 - PATIENT TRAY DISTRIBUTION SUB-SYSTEM

This sub-system describes the rethermalization and distribution of patient meal trays and nourishments from the pantries located on patient floor.

After the tray carts are loaded as described in sub-system 6, they are stored in the second floor refrigerator with the doors open. At a predetermined time they will begin to move on the ACTS to assigned patient floors. Before they exit the refrigerator, the doors will be shut, the tray delivery guide correct for that cart will be slipped into a holder on top of the cart and the cart will be dialed to its' destination. After the meals have been heated, the patients served and the soiled trays collected, the carts are returned to the ACTS system. They stop at the third floor dishwashing area for unloading and sanitizing and return to the second floor parking area.

When the carts arrive on the patient floor, they are taken to the pantries and plugged into refrigeration. At the same time a small device called a TMP, (Transport Memory Pack) is plugged into the cart housing. This TMP will activate the rethermalizing of foods to be served warm or hot while a refrigerated atmosphere for all other foods is maintained in the cart.

There are two (2) types of patient tray carts: One (1) to be used for meals (breakfast, lunch and dinner) and another to be used only for nourishments and bulk deliveries of pantry supplies. The meal patient tray cart holds twenty (20" x 12") trays; it will refrigerate and upon TMP command will re-heat foods to be served warm or hot while maintaining a refrigerated atmosphere for all others. There is a double set of these carts so that the next meal may be loaded before a set of carts is returned from being unloaded and sanitized.

Each tray has five (5) heating elements and four (4) openings for heating. They are intended for:

Double Element Opening - An entree casserole platter containing the entree and a starch accompaniment, which may be heated independently. This opening may also be used for smaller dishes which contain an entree and another item. They may also be heated independently.

Single Element Opening - These will contain dishes of the same size that will be of three varying depths. They are used for vegetables, soups, hot rolls, desserts or any other product. Foods to be served cold will be in these same size dishes.

If an item intended to be served cold has been placed in one of the openings capable of heating, or the space is empty, the TMP will control that element so that it does not come on.

## CART DISPATCHING



All carts will begin a cycle by being unloaded and sanitized on the third floor, as described in Sub-System 8. They will return to the second floor refrigerated storage area with the doors open. They will remain there until signal-activated to enter the loading area, one at a time. The loading area is not refrigerated but since the tray assembly process is geared to fifteen trays per minute and each cart holds twenty trays, carts should not remain here for more than two (2) to three (3) minutes. The carts will be continuously available, with little delay, for loading.

As the loading of each cart is begun, it is addressed with the cart separator menu describing its destination (see Sub-System 6) by placing this menu in a special holder on the front of the cart.
The cart is dialed to this location when it is loaded, as it re-enters the refrigerated parking garage.

Each cart is then loaded as described in Sub-System 6 and is returned to the refrigerated pantry area with the doors still open; they remain until they are ready to move to patient areas.

Approximately 1-3/4 hours before a meal serving, the carts

begin their journey to the patient areas. They are electronically signalled and before they exit the garage the doors are closed and secured; they are then automatically taken via interfloor tracks to the patient area to which it was previously dialed.

MEAL SERVICE

The cart travel time from the second floor to its destination requires from ten to forty-five minutes; during this time carts are not refrigerated but refrigerated air has been closed into them and they are well insulated. Carts are automatically ejected from the ACTS into a dispatch area when they reach their destination; they will be manually taken to the patient area pantry by transport personnel, who will attach the cart to refrigeration.

In the pantry, the attendant will check to see that all the required trays are present according to the ward dietary roster, make any necessary corrections and insert the TMP that controls each heating element individually. The TMP's programming is established after all trays on that cart have been assembled and addressed within that cart, so that each tray delivered on that cart will be properly heated.

The TMP will have stored in its memory the position of each

food on each tray on that cart, its rethermalizing time requirements and the temperature to which that food is to be heated; food positioning on each tray will have been computer guaranteed during the tray assembly process (see Sub-System 6). Thus each of five (5) heating elements will be automatically and independently activated at the appropriate time; they will be turned off and maintained at the selected serving temperature at the appropriate time. Sensors at each heating element will note that the food has reached the selected serving temperature of 145 degrees, 165 degrees or 185 degrees and cut the heating element on and off to maintain it at that temperature. Items which are only to be warmed, such as rolls, will be rethermalized only briefly.

Some changes may be made on the TMP's at the floor pantry. Trays may be held for later reheating, the heating pattern for the elements on a given shelf changed if the meal has been changed, the serving temperatures maintained for a patient who is unavailable but whose tray has been rethermalized and a meal served early for an entire ward. Instructions to affect these changes are given in the Pantry Procedures.

If for any reason there is a TMP or cart breakdown, the foods will be thermalized in the microwave oven, one at a time and served as each of the trays is ready.

Late meals held for service after the tray carts have left the floor will be stored in the pantry refrigerator or nourishment cart until they are required for service and then thermalized in the microwave oven.

Any foods that have a "frozen" sticker affixed to them indicates that the foods were not tempered before being placed on the tray (see Sub-System 6) and therefore must be boost heated before service. Boost heating will be done in the microwave oven.

Dietetic attendant receives a comprehensive list of the "buttons to push" and temperature to be reached for each food that might require microwave heating as well as general instructions regarding the handling of this type of thermalizing.

When the cart signals that each food has reached its pre-selected serving temperature, a "ready" light signals its preparedness for serving. At this time, the dietetic attendant will have prepared the hot beverages to be placed on the trays. The trays will be distributed according to the specific instructions in the Pantry Procedures.

Of course there must be excellent communication between nursing and dietary regarding the order in which trays are to be served, requirements for hold trays, etc.

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TRAY RETRIEVAL

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After all meals have been served at the normal meal time, the dietetic attendant will thermalize any late meals in the cart or the microwave oven, as determined by the time frame. When the meal period is over, any trays that have not been heated are placed in the pantry refrigerator to be heated in the microwave oven when called for. The pantry attendant wheels the cart down the hall, picking up soiled trays and making notes on the patient's intake as she goes. When this task is complete, the doors are closed and the cart returned to the pantry where it is picked up by Transport personnel for its trip to warewashing.

NOURISHMENTS AND BULK GOODS DELIVERY

Nourishment carts hold up to forty 20" x 6" trays; it refrigerates only. There is a single set of these carts. These carts will be loaded as described and dispatched in the same manner as tray carts, at least one hour before scheduled nourishment service. They are connected to the refrigeration units only when they reach the pantry since they have no heating capabilities. Between meal and bedtime nourishments are delivered to the patient by the dietetic attendant.

Bedtime nourishments for each ward are delivered on individual patient trays.

When the nourishment cart has been delivered and is connected to refrigeration, the pantry attendant checks the list against the trays received to insure the accuracy of the delivery. She checks to see that all persons who ordered a nourishment or whose diet requires one are listed on the delivery guide by checking the diet rosters, and plans any necessary corrections.

At nourishment time, the dietetic attendant will heat in the microwave oven, any items requiring hot service and serve all of the trays. After service, the dietetic attendant will retrieve the soiled trays and replace them on the cart.

Bulk goods, both food and non-food items, (except cleaning supplies) are delivered on this cart. When the cart is delivered, the aide checks those received against those ordered and then stores them in appropriate locations. These goods are ordered by the dietetic attendant to bring stock up to pre-established par levels. They include any items needed for between meal nourishments, diet changes, condiments, diet packs, coffee, tea, glasses, hot beverage cups, silverware packs and other items pre-established as a requirement in each individual pantry.

## CART SANITIZING AND RETRIEVAL

After being taken to the dispatch room by Transport personnel, each cart will be dialed to return to the second floor garage area and be placed on the ACTS. It automatically goes to the interfloor holding area above the third floor dishwashing area and is held until it is its turn for sanitizing. The doors are opened, the cart is revolved, manually stripped, returned to its original position and then manually restarted on the ACTS with the doors still open; it goes through the cart sanitizing station on the third floor while on its return journey to the second floor refrigerated parking garage to begin the cycle anew.

Mealtime and nourishment carts will follow this same procedure.

## SUB-SYSTEM 8 - WAREWASHING

This sub-system describes the sanitizing of dishes, utensil and trays from patients and dining room services.

The warewashing system at WRAMC is semi-automatic, fully integrated, and supported by a series of conveyors, automatic detergent injection and a control system. The area is U-shaped with the clean end of the dish machine at the open end of the U. According to U.S. Army sanitary codes clean and soiled wares must be separated, therefore, soiled items will be confined to the closed end of the U and soiled dollies will be rolled under, rather than around, conveyors.

The warewashing system may be categorized into the following continuous major steps:

1. Entrance into the system
2. Cup and glass removal, washing, and distribution
3. Paper trash removal
4. Tray dumping, washing, and distribution
5. Silver soaking, washing, and distribution
6. Dishwashing and distribution
7. Cart washing

A functional description of each of these steps follows:

1. Entrance into the system - All soiled wares from patient and staff enter the warewashing system on trays via two

(2) separate conveyors, which may not operate at the same time. Dining room patrons place their trays onto a power conveyor. Dining room trays move along the conveyor to the trash remover.

The dining room conveyor acts as an accumulator during the time that patient trays are being unloaded; there is no limiting switch, but a bar placed in position manually at the desired time holds the trays in position while allowing the conveyor to move. The conveyor may be shut down with a button switch if it becomes filled and trays from the dining room are then collected onto racks.

Patient trays are returned to the warewashing area via the ACTS. Carts are loaded onto the ACTS on patient floors and transported at a pre-programmed time to an inter-floor stacking area above warewashing.

As programmed, carts are positioned on the ACTS track at the unloading station, parallel to the patient tray conveyor, and revolved on a turntable so that the doors are in position for unloading. The carts are unloaded and turned again so that the doors are in the original position. They then automatically travel along the ACTS to a cart washing area; another cart moves into

the unloading position. Patient trays are manually oriented on the belt so that they fit into pegged compartments and the holes cut in the trays are on the far side of the conveyor. Patient trays move along the conveyor to the manual cup and glass removing station. All tray carrying conveyor belts move at a rate not to exceed fifteen trays per minute; this speed is dictated by the tray washing machine. All conveyor belts are continuously and automatically self-cleaning at specific locations. There is a drainage pipe, piped directly through the floor, on each conveyor. None of the conveyors has a scraping trough inasmuch as these are not necessary under this system.

2. China cup and glass removal, washing and distribution - Since the dining room uses paper cups for hot and cold beverages, this station is operated only on the patient tray side. As the trays move along the patient tray conveyor, they reach the manual cup and glass removal station. Cups and glasses must be removed before the tray reaches the automatic paper blower because empty cups and glasses might otherwise be blown off the tray. Cups and glasses are emptied onto the tray line or the tray and placed upside down in racks positioned on overhead racks. Each cup station will have two racks positioned there, with a space between them; one for

glasses and the other for cups. When an empty rack is required, it is taken from staging under the conveyor line. The supply is replenished from a supply of clean racks on a flat dolly kept on the periphery of the system. Racked cups and glasses developed by the patient tray system and staged at the periphery of the dishwashing system will be returned, at a convenient time, to the removal station and placed, one rack at a time, on a low, flat, flanged platform located there. Each rack will be removed and walked to the dishwasher's manual load station. Glasses and cups will be washed after all dishes have been processed by placing them in the dishmachine at the manual load station. The racks of clean cups and glasses are then placed in appropriate self leveling dispensers and manually taken to the tray assembly area.

All <u>empty</u> carts, self leveling dispensers, dollies, racks, etc. in the center of the U or under its conveyor belts, will be considered dirty; all those on the outer periphery, clean. Therefore, any empty dollies pushed underneath the conveyor belts for reuse <u>must</u> be sanitized at the hose and detergent station at the tray dumping area. The employees at the dump station is responsible for sanitizing these.

3. Paper trash removal - As patient and dining room trays move along their respective conveyors, a continuous directional stream of compressed air blows paper into a receptacle. Empty or partially empty milk cartons, paper cups, straws and their wrappings, plastic utensils, small paper bags, paper dishes, plastic creamers, paper cups, napkins, etc. are therefore removed. Half-full paper cups and containers are not blown off, and must be removed at the manual station at the tray dumping area.

Paper trash is blown into a trash container with a coved splashback that is perforated to prevent the trash from bouncing off it and blowing back on the tray. The trash container has a plastic lining. It must be randomly visually inspected and changed, as required, by personnel. When it is being changed the filled trash container is pushed aside, which automatically turns off the stream of compressed air; when a new cart with plastic liner is pushed into position, the stream of compressed air is automatically turned on again. To minimize the off time, two trash containers are provided for each station. On the dining room line, the soiled cart is pushed under the conveyor. The clean cart is pushed under the conveyor and placed in position. When the dining room and patient trays have passed through

the trash removal stations on their respective conveyors, they are transferred to the tray dumping conveyor. Dining room trays turn a corner guided by a flange and under the momentum supplied by their own entrance conveyor, onto the pegged tray dumping conveyor. Each patient tray is pushed onto the pegged tray dumping conveyor by two mechanical arms; these trays have been fitted into pegged compartments so that the arms are in the correct pushing position. Since the dining room and patient tray lines are run at different times, there is no need to monitor the dining room and patient tray lines as they converge at the tray dumping conveyor. During the time that soiled patient trays are being processed, the dining room conveyor acts as an accumulator; should it become full, dining room trays must be manually racked for storage.

4. Tray dumping, washing, and distribution - All trays move in pegged positions along the dumping conveyor and at the "dumping point" one side of the tray is elevated and angled by a stationary stainless steel guide, similar to a roller coaster. While it is being elevated, the tray continues to be moved along by the conveyor. In order to control the rate of ascent, which climaxes at 105 degrees, the tray gradually slides forward onto a parallel stabilizing conveyor which operates in

tandem with the first conveyor. This controlled gradual ascent insures that all dishes and flatware, whether loose or in cut-outs, fall onto the appropriate station. When the tray reaches its apex and is emptied, it descends in a similar fashion. The side that was elevated is guided downward and gradually returns to its original position. It is simultaneously guided off the stabilizing conveyor so that it returns to the original tray dumping conveyor, where it continues along to the tray washing machine.

The trays descend until one end is caught in a special device. Trays proceed through the power prerinse, wash, rinse and blow dry tanks of the traywasher. Trays are conveyed out of the machine and accumulated upside down on self leveling tray dispensers. When the dispenser has reached its maximum weight limit, an alarm sounds and the entire dishwashing system automatically shuts down. After the filled rack is moved out for staging or distribution, and an empty rack moved into position, the system restarts automatically. Since dining room and patient trays are processed at different times, these two types of trays are separated without further processing. It is necessary to change the tray dispenser, even if it is not full, at the end of each type (dining room or patient) of processing run to

avoid intermingling of the two types of trays.

5. Silver soaking, washing and distribution - As the trays are dumped, all of their contents (except cups, glasses and paper that have been previously removed) are deposited onto a power roller section with spaces between the rollers. An employee is stationed here to monitor its smooth operation. Dishes, by virtue of their size and depth, continue on to the next station. Silver, food and paper waste not previously removed falls, or is pushed, by the roller's rotary motion through the spaces in the rollers and falls 6" below to a vibrating belt. This belt vibrates trash and silverware sideways to a sink next to the dishmachine. The removal of waste material from this belt is also aided by a continuous water/detergent solution spray.

The silverware collecting is automatically filled with a detergent solution and maintained by the vibrator conveyor spray nozzle. This sink contains a plastic basket for collecting the silver. A pump that circulates water at the rate of 300 gallons per minute is located on one side of the sink, and a 7-1/2 horsepower waste disposal is located on the other side, under the dishmachine. Only the upper 6" of the sink are connected by means of an upward angled trough to the waste disposal. The

circulating water enters at the same level, therefore all solid wastes are pumped along this trough and disposed of in the waste disposal; 80% of the water is recirculated.

The silverware, due to its weight, falls directly to the bottom of the sink where it remains until 30 lbs. of silver have been collected. When 30 lbs. have been collected, a bell automatically triggers and the vibrator, pump and waste disposal system shut down. While the 6" of space between the vibrator belt and the power rollers act as a stationary collecting device, the basket of silver is manually removed and an empty basket, taken from staging under the conveyor, and placed in the sink. This supply is replenished from a supply of clean racks in a flat dolly kept on the periphery of the system. The restart button for the vibrator, waste disposal and pump system is then pushed and all the things that have been temporarily held in the vibrating belt are moved into the sink.

The full basket of soiled silver is placed on a flat dolly and kept in the aisle space adjacent to the dish-machine. When five racks have been accumulated on the dolly, it is rolled under the conveyor and staged at

the periphery of the dishwashing system. After all the dishes have been processed, the dollies are rolled back and the baskets manually lifted onto the dishmachine at the manual load station.

After it has been washed, the silverware is automatically sorted in the silver sorter into flat pans. Dining room silver is then placed, handles up, in cylinders. Some of these cylinders are placed directly on a self-service device and taken to the dining room. The remainder is stored on 3-tiered carts for refill of the dining room cart during service periods. Patient silver is machine bagged and sealed, placed on clean racks and manually wheeled or automatically sent, via the ACTS, to the tray assembly area.

6. Dishwashing and distribution - Dishes move along the power roller section and are transferred to an ascending fabreeka belt. They are then guided onto the pegged conveyor of the flight-type machine. A Food Service Division employee is stationed here to correct any errors. Dishes may be washed in a horizontal, rather than the usual vertical, position.

Food and paper waste that escapes the several removal points is sprayed off by the dishwashing pre-wash tank

and caught on the dishwasher filter screens; these are cleaned at designated intervals.

All dishes, glasses and flatware, racked and unracked, go through a power prewash, wash, rinse and blow dry cycle in the flight-type pegged conveyor dishwasher. The detergent and drying agent are part of an automatic system pumped from a remote storage room. A visual and audial warning system alert personnel when a storage container of these is nearly empty.

Racks of cups, glasses and silverware are assembled and transported as described in Steps 2 and 5. All other dishes are removed directly from the machine belt and stacked on flat, working height trucks; as convenient, they are transferred to enclosed mobile dish carts. They are manually taken to portioning and packaging or to the tray assembly loading areas. The only exception is a predetermined number of self leveling dispensers filled with dishes for use at the self-service salad bar in the dining room. They are manually taken, as required, to the dining room, where they fit into this service area.

7. Cart Washing - After unloading, patient tray carts remain on the ACTS; they then pass through an automatic washer and continue to the second floor cart parking area.

The patient tray carts are controlled by the ACTS programming; they enter and leave the dishwashing area at a predetermined time slot. All other carts, dollies, etc. are manually sanitized in the dishwashing area at any of the stations provided for that purpose.

The control system for the dishwashing area is quite simple. Any stop, for any reason, of any conveyor, machine, or device, shuts down the entire system. The only exceptions are the compressed air blower on the paper remover and the silverware vibrator, waste disposal and pump circuit. Failure to manually remove glasses as instructed does not shut down the system, but it must be corrected at the manual inspection station at the dumping area.

There are three auditory warning signals, all with different sounds, that shut down part of the system or the entire system. One is at the silverware collecting basket; the silver system shuts down, but continues to act as an accumulator, until the full basket is replaced with an empty one. Another is the detergents and drying agent system; it will eventually shut the entire system down if unheeded, but there is sufficient warning time before this happens. The last signal is the tray collecting self leveling dispenser; the entire system

shuts down until the filled dispenser is replaced with an empty one.

There are general manual shut-down buttons at each manual inspection station. Once the system is shut down by preplanning or by choice, it must be restarted by pushing the restart button at the station where it was turned off; the only exceptions are the trash bins and the tray dispenser. If the reason for the shutdown has not been corrected, the entire system may immediately shut down again.

If it becomes necessary to bypass any area of the system for a period of time, individual conveyors, machines and devices may be restarted by manually pushing individual restart buttons.

The system is provided with a visual board indicating the location of mechanical problems when can then be corrected as required. Each element of the system is capable of working independently of the other, if necessary, while corrections are made to any one item.

The system components are sanitized manually in the usual manner.

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## SUB-SYSTEM 9 - DINING ROOM AND SERVERY

This sub-system describes customer self-service activity in the Dining Room, and preparation and service activities in the Servery.

The Dining Room serves authorized Military and Civilian personnel, ambulatory patients, and authorized visitors.

A variety of foods are available for self-service at breakfast, lunch, dinner and an evening meal at prescribed hours. A limited short order menu is available continuously from after breakfast to dinner time.

Patrons enter the Dining Room unit and show proper identification to the cashier, paying if necessary.

They proceed to one of two revolving food counters, each of which has a selection of hot foods, breads and desserts displayed. There are six (6) customer positions at each revolving food counter. After picking up a tray from stations beneath the revolving counter and making their selections, they go to the beverage counter, then to the salad bar, and finally to the silver dispenser. After dining, the patron carries his tray of soiled dishes to a conveyor. The soiled tray is then conveyed to the dishwashing area described in sub-system 8.

The entire area is signed with appropriate menus and graphics in such a manner as to expedite the flow of traffic.

The Dining Room unit consists of a finishing and serving kitchen (servery), and a dining area.

The servery contains both a finishing kitchen and serving equipment. The kitchen equipment consists of two (2) high-speed convection ovens, a double-deck high pressure steamer, a 90-pound fryer and two (2) 2-foot griddles. This equipment is supported by two (2) reach-in freezers, two (2) walk-in refrigerators and refrigerated drawers.

The servery, for the most part, receives hot, fully cooked entrees, soups, sauces, potatoes and potato substitutes, and cereals from the main production facility. On week-ends it may reheat frozen, tempered foods. All steamed vegetables, short order grilled items, and grilled breakfast foods are cooked in the servery.

During peak serving periods, the servery is supported by the main production kitchen for the cooking and re-heating of foods. During slower serving periods, the servery re-heats and/or cooks the foods that can be prepared on its own equipment.

Desserts have been portioned in the packaging area, and salads come in bulk from the ingredient and production areas. Before service, a supply of these items is stored on racks in the servery's walk-in refrigerators.

The serving equipment consists of mobile thermal cabinets, mobile soup kettles, two (2) steam tables to which ferris wheels are attached, and two (2) revolving hot food display counters, with access from both the servery and customer area.

In the servery, a food service employee stands behind each serving table, alongside which a soup kettle has been placed. This employee portions hot foods and soup onto dishes and places the dishes on the ferris wheel. Another employee removes the dishes, as required, and places them on the appropriate places on the revolving display counter, which then revolves to the customer access area. The employee assigned to the carousel also places desserts and other items on it which are obtained from a rack alongside the station or from a reach-in door to the walk-in refrigerators.

The revolving display counters are each 3-tiers high. They rotate at a rate of one revolution per minute. The bottom tier is heated by means of two (2) infra-red units.

At lunch and dinner, foods are placed on the revolving

counters according to a written plan drawn up and posted at each station by the supervisor before each meal. These plans are based on the following principles:

A specific type of food (i.e. entrees) is placed on the bottom or largest tier. The next tier is assigned to desserts, etc.

Each tier is divided into twice as many sections as there are items to be displayed in it. Thus, an item is displayed in two (2) sections, directly opposite each other. This affords each patron a look at all selections every 30-seconds.

The sections for each type of food may differ in size: thus, if Grilled Loin Steak and Roast Duckling with Orange Sauce appear at the same meal, the sections displaying Steak may be larger.

The two customer pick-up stations nearest the short order window at each counter are designated as short-order service and these items are obtained directly from the cook while allowing the customer to pick up other items to complete his meal.

The two salad bars display bulk salad makings and dressings

in refrigerated, open-pan units. They are refilled from bulk supplies in the walk-in refrigerators in the servery. Customers obtain salad plates from dish carts adjacent to the salad bar.

Breakfast is handled somewhat differently from the preceding description. One revolving counter is set up with cold items (fruit, breads, cheese, etc.), and the other with hot foods. Customers make their own toast.

The two beverage counters display dispensing heads of a variety of hot and cold beverages (except milk), as well as display cream and butter. Additionally, one offers juice and the other self-service, soft ice cream.

All of the hot and cold beverages displayed on dispensing heads are stored in pre-mix tanks in a remote refrigerated room. If they are to be served hot, they are automatically heated at the point of service. The creamers, butter banks, juice and soft ice cream machines are manually filled. Customers obtain appropriate single serviceware for beverages, and soft ice cream from servers built into the beverage counter.

Milk (in cartons) and individual ice cream novelties are available in self-leveling mobile, refrigerated cabinets adjacent to the beverage island. They are manually refilled.

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## SUB-SYSTEM 10 - FOOD QUALITY STANDARDS SUB-SYSTEM

This sub-system describes the testing procedures and data review established to insure the service of the highest possible quality of food to patients and staff at Walter Reed Army Medical Center.

The Food Quality Standards Laboratory is responsible for the testing of food products for microbial, nutritional and aesthetic quality; additionally, optimum shelf life is established. It is also responsible for checking the microbial load on all equipment and utensils used in food processing and service, as well as adherence to established control standards.

All cooked foods processed in the nitrogen freezing system and used in patient or dining room service and reference products are tested here. All uncooked foods or those not freezer processed are not tested as they meet standards and are stored and served in accordance with these standards.

Foods are tested in order to assure that they are microbially safe, and to determine which processing methods and storage periods give maximum nutrient retention and aesthetic quality.

Food processing equipment and utensils are tested to insure

proper sanitation in the food processing and service areas so that this equipment does not add to the microbial content of foods processed.

All raw ingredients and packaging materials used in the processing operations meet strict U.S. Army standards. They are free of microbial contamination, toxic substances, extraneous matter and defects. These materials are inspected at time of delivery and stored under appropriate conditions, according to U. S. Army standards. These products are not reinspected by the quality control laboratory before entering the processing operations.

All foods processed through the nitrogen freezing system is labeled with the product name, diet type, finishing time and a coded processing date to facilitate testing by the Food Quality Standards Laboratory. Foods are labeled during processing by production personnel. Batch numbers are the coded production date; if more than one run of an item is produced on any given date, they are labeled with this date code and A, B, C to indicate the batch; this is noted on the production schedule for identification.

Additionally, each product produced at WRAMC is accompanied by a "Time in Transit" chart. Each time the completed product is removed from refrigeration for transit, packaging,

service, etc., the time of withdrawal will be charted and initialled. When it is replaced under refrigeration, the time will be charted and initialled. The Food Quality Standards section will review the summary of the times out of refrigeration for each portion served and take appropriate action to uphold U. S. Army standards.

MICROBIAL TESTING

A suitable number of samples (according to U. S. Army standards) are taken from each batch of every food processed. Samples are taken after processing but before entering the nitrogen freezing system, after normal temperature thawing, after tray assembly, from an extra patient tray before and after reheating in the tray cart during patient service, and directly from the cafeteria line. When foods show consistantly low counts after refrigerated thawing, this sampling is eliminated. Sampling at this stage is reinstated if any changes occur in raw ingredients, formula content, or processing procedures, or, if high counts, according to developed standards, occur in samples taken during patient service.

The following procedures, based on accepted scientific standards and proposed methods of the Frozen Food Standards Sub-Committee of the Association of Food and Drug Officials of the U. S. (AFDOUS) are used:

1. Total Plate Count - The total number of viable organisms

is determined by standard procedures on plate count agar. Plates are incubated at 35 degrees Centigrade for 48 hours.

2. Coliform Count - Coliform numbers are determined by a 3-tube Most Probable Number series using lauryl sulfate lactose (LST) broth. Tubes are incubated at 35 degrees Centigrade and examined at 24 and 48 hours. Interpretation of results is obtained from "Standard Methods for the Examination of Water and Wastewater", 12th Edition, American Public Health Association (APHA).

3. Coagulase Positive Staphylococcus - For enumeration of coagulase positive staphylococcus, tubes of trypticase soy broth with 10% NaCl, or another appropriate selective media, are inoculated with suitable dilutions of food samples and incubated at 35 degrees Centigrade for 48 hours. A loopful of material from growth positive tubes is streaked on Staphylococcus Media and the plates are incubated at 35 degrees Centigrade for 48 hours. Gram stains are done on representative colonies and coagulase tests using plasma are performed on all coccoids.

4. Yeast and Mold Count - Suitable dilutions of food are inoculated on potato dextrose agar, acidified; dextrose

agar, acidified; or, malt agar. Plates are incubated at 21 degrees Centigrade, or room temperature, for 5 days. They are checked for spreading mold growth after 3 days.

5. Clostridum Perfringins - Suitable dilutions of food are innoculated on SPS (Sulfite Polymixin Sulfadiazine). Plates are incubated under suitable anderobid conditions at 37 degrees Centigrade. Plates are examined after twenty-four (24) hours and black colonies counted and enumerated according to standard procedures. If no black colonies appear after twenty-four (24) hours, plates are again incubated and re-examined after a total incubation of forty-eight (48) hours.

Products require different procedures for these tests: Vegetables - 50 ml. samples are taken and blended in 450 ml. sterile water for two minutes. If an individual portion weighs less than 50 gm., one half of the portion is taken and mixed with enough water to yield a 1:10 dilution. Samples are blended for two minutes and allowed to rest for two to three minutes. The following tests are then performed on suitable dilutions: Total Plate Count, Coliform Count, and Coagulase Positive Staphylococcus.

Entrees - Individual whole portions or representative

portions from large samples are taken and blended with enough sterile water to yield a 1:10 suspension. If an individual portion exceeds 50 gm. a 1:2 or 1:5 suspension is prepared in the blender and a 1:10 suspension prepared by dilution. Samples are blended for two minutes and allowed to rest for two to three minutes. The following tests are then performed on suitable dilutions; Total Plate Count, Coagulase Positive Staphylococcus, Coliform Count, Mold and Yeast Count, and Clostridum Perfringins.

Fruits and Fruit Desserts - 50 ml. samples are taken and blended in 450 ml. sterile water for two minutes. If an individual portion weighs less than 50 gm., one half of the portion is taken and mixed with enough water to yield a 1:10 dilution. Samples are blended for two minutes and allowed to rest for two to three minutes. The following tests are then performed on suitable dilutions: Total Plate Count, Coliform Count, Coagulase Positive Staphylococcus, and Mold and Yeast Count.

Custards, Cream and Cheese Filled Desserts - 50 ml samples are taken and blended with 450 ml sterile water for two minutes. After two to three minutes resting, the following tests are performed on suitable dilutions: Total Plate Count, Coliform Count, and Coagulase Positive Staphylococcus.

Soups, Sauces and Gravies - 50 ml samples are taken and blended with 450 ml sterile water for two minutes. After two to three minutes resting, the following tests are performed on suitable dilutions: Total Plate Count, Coagulase Positive Staphylococcus, Coliform Count and Clostridium Perfringens.

If microbial counts exceeding those allowable by U. S. Army standards occur in samples taken after processing, but before freezing, all food in the batch from which the samples were taken are destroyed.

If excessive microbial counts occur in samples taken after low temperature thawing, a sample of any food from that batch remaining in the freezer is tested. If these show high counts, all food processed in the batch are destroyed. If foods still in the freezer give acceptable counts, the length of time food is allowed to thaw is decreased. Freezers and refrigerators are continuously monitored to assure appropriate storage temperatures.

If excessive counts occur after tray assembly, the length of time foods are held on the tray assembly line is reduced. If excessive counts occur in samples taken at the time of patient service, procedures for patient service are reviewed

and time and temperature of storage on the tray cart and the tray cart refrigerator before service are revised.

Processing Equipment - Twice weekly, microbial examinations are made on all equipment used for peeling, slicing, grating, chopping, mixing, portioning, cleaning, transporting, and storing of foods. These tests are performed before the first run is completed, six hours after the first run and after cleaning at the end of the production day. Periodic tests are also performed in low and normal temperature refrigerators and tray assembly and warewashing surface areas.

RODAC plates are used on all flat surfaces such as cutting boards, cutting blades, refrigerator and freezer surfaces. Sterile calcium alginate swabs are used on curved or hard to reach surfaces. Samples taken with the swabs are plated on trypticase soy extract with an added neutralizer or a similar medium. Plates are incubated at 35 degrees Centigrade for 48 hours. A similar procedure is used to test dishes and utensils after they are run through the dishwashing machine and are dried.

If counts exceeding those acceptable by the U. S. Army standards occur on any production equipment or utensils, cleaning methods are reviewed; stronger sanitizing agents

may be used. The equipment showing unacceptable counts are tested daily until acceptable counts are recorded for one week. Twice-weekly inspections are then resumed.

Nutrient Testing

A suitable number of representative samples, as determined by U. S. Army standards, are taken for nutrient testing of each new food processed. This is done before low temperature storage, from the extra tray on the reheating cart during patient service and directly from the cafeteria line. After a food has been tested, further tests are run only after changes in ingredient, formula content, or processing methods. All products are tested for the following:

1. Protein - Protein content is determined using the Kjeldahl method for determination of total nitrogen as described in the AOAC official methods of analysis (11th Edition), or by standard U. S. Army methods.

2. Lipids - Lipid content of foods is determined by the solvent extraction method. AOAC methods for individual foods are followed.

3. Vitamin C (ascorbic acid) - Determination of ascorbic acid is carried out using the 2, 6 Dichloroindophenol

method as described in AOAC Official Methods of Analysis (11th Edition).

4. Vitamin B (thiamine) - Determination of thiamine is carried out using the colorimetric test described by Kennerosly and Peters, Biochem. J.28, 667-670.

If a product's nutrient level is unacceptable or there is considerable loss of nutrients, the recipe, production procedure, storage times and temperature, and reheating times and temperatures are reviewed and changed to give a more acceptable product.

Shelf Life

The purpose of the following tests is to determine optimum of maximum shelf life of processed foods:

1. Vitamin C (ascorbic acid) and Vitamin $B_1$ (thiamine) - Ascorbic acid and thiamine are the two nutrients most sensitive to heat processing, oxidation and light exposure. They are determined in all batches of foods after processing, those in the freezer longer than one month at 2-week intervals, and on selected samples during patient tray and cafeteria service. The method will be as described on Page 112.

2. Enzyme Inactivation - Enzyme activity can lead to development of off-flavor and discoloration in fruits and vegetables. Peroxidase is recognized as one of the most heat-resistant plant tissue enzymes. The rate and extent of thermal inactivation of peroxidase parallels that of enzymes responsible for off flavor formation in vegetables and oxidative discoloration of fruit products. Tests for catalase and peroxidase activity are performed per standard U. S. Army methods after cooking, to insure adequate cooking time for enzyme deactivation. If the enzyme has not been deactivated, the cooking or temperature time is increased. If this is not possible, the food is frozen and served within two weeks.

3. Oxidative Rancidity - Oxidation of unsaturated fatty acids by molecular oxygen is a major source of off flavor in foods containing edible fats and oils. Oxidative rancidity may be determined by the 2 - thiobarbituric acid colorimetric test for malonaldehyde, or standard U. S. Army methods. Each batch is tested at the time of removal from the freezer, and those that remain in the freezer longer than one month at 2-week intervals. Any batch judged to be unacceptable by these standards is subjectively tested. If subjective tests agree, that the food is of poor quality, the batch is destroyed and the shelf life established at the last acceptable

set of tests. If the subjective tests do not agree, the product is served as soon as possible, but all preparation and storage conditions are reviewed for possible mishandling.

Aesthetic Testing

Tests to insure palatability will be primarily subjective and are not a responsibility of this Laboratory. The Food Quality Standards Laboratory, can, however, alert the Division to possible aesthetic deterioration by the shelf life tests already described, and the following aesthetic tests:

1. A visual examination is made on a suitable number of samples from each batch of food upon the removal from the freezer, but not more than every two (2) weeks. Samples are taken from each batch of food removed from low temperature refrigeration and those that remain in the freezer longer than 1-month, at 2-week intervals. The samples are opened while frozen and their condition noted. They are checked for large crystals or sheets of ice, freezer burn, shriveled or unnatural appearance, off odor, poor color or discoloration, and yeast or mold growth. This gross examination insures products were quickly frozen and not exposed to thawing and refreezing temperatures in storage. The adequacy of

packaging materials can be checked through this test for freezer burn.

Foods that show a visual off color or noticable off odor can be assumed to have had excessive enzyme or microbial activity during storage; this should be confirmed in the Shelf Life Tests.

Chart 2 summarizes the various tests to be carried out and their scheduled times.

The Food Quality Standards Laboratory establishes and maintains its own records. It is, however, supported by a perpetual inventory record showing products on hand and their code dates, (the production date), by tray assembly data and by thawing, production, packaging and portioning schedules.

Food Quality Standards Laboratory personnel continually add their requirements, in writing, to schedules and tray assembly data; they collect required samples at the appropriate time and place. Reports are sent to the Infection's Control Committee, WRAMC, and to the following personnel in the Food Service Division:

Chief, Food Service Division

Chief, Food Production

Chief, Clinical Services

| | MICROBIAL | | | | | |
|---|---|---|---|---|---|---|
| | TOTAL PLATE COUNT | COLIFORM | MOLDS AND YEAST* | COAGULASE AND STAPHY-LOCOCCUS | CLOSTRIDIUM PERFRINGENS | RODAC OR TSE PL COUNT |
| 4. Each batch of products after packaging and sealing but before freezing | X | X | X | X | X | |
| . Foods in the freezer longer than 1 month at 2-week intervals | | | | | | |
| . Each batch of products at time of removal from freezer but not more than every 2-weeks | | | | | | |
| . Each batch of products after normal temperature thawing and immediately before tray assembly or reheating | X | X | X | X | X | |
| 5. Each batch of products after tray assembly | X | X | X | X | X | |
| 6. Each batch of products after reheating at time of service | X | X | X | X | X | |
| 7. Gravies, sauces, custards, puddings and pureed foods on production line after cooking | | | | | | |
| 8. Fresh fruits and vegetables after cooking but before portioning | | | | | | |
| 9. Processing and serving equipment, twice weekly | | | | | | |

*Entrees, Fruits & Fruit Desserts ONLY

| UTR | IONAL AND SHELF LIFE | | | | AESTHET.I |
|---|---|---|---|---|---|
| ITAMIN C | VITAMIN $B_1$ | LIPIDS | CATALASE OR PEROXIDASE | OXIDATIVE RANCIDITY | VISUAL |
| X | X | X | | | |
| X | X | | | | |
| | | | | X | X |
| | | | | X | X |
| X | X | X | | | |
| | | | X | | |

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