A SYSTEM APPROACH TO REDESIGNING A CANADIAN MILITARY FOOD SERVICE FACILITY

By

Jean B. Liberty

A PROBLEM

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

MASTER OF SCIENCE

Department of Institution Administration

1969

ACKNOWLEDGMENTS

The author is deeply grateful to Professor Gladys Knight for her enthusiasm, encouragement and willing assistance during the preparation and formulation of this study. The writer also expresses appreciation to Professor Katherine Hart and Dr. Grace Miller for their support and advice.

Appreciation is also expressed to the Canadian Armed Forces for the appointment to the postgraduate program.

* * * * *

PREFACE

This study is an attempt to illustrate that the planning or redesigning of food facilities involves more than shifting equipment, renovating departments or re-training personnel. Certain fundamental information and analysis are pertinent to successful planning.

The author, a Canadian Forces Food Service Officer, elected to analyse the layout of an existing Canadian Forces kitchen. The motivating factor was simply a desire to apply principles and procedures to structure a more efficient lay-out both in terms of present needs and speculative future growth.

The study, generated from personal interest and concern, has been meaningful and far exceeded expectations. The author recognizes definite limitations in the scope and conclusiveness of this particular study yet feels that it represents a reference tool if and when the organization contemplates new construction or facility renovations.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF PLATES

PLATE

INTRODUCTION

The ultimate goal of this redesign system is to achieve maximum internal operating efficiency. The end product takes shape as a new or modified kitchen layout. The approach demands logical and systematic identification of the variables involved, decisions as to entity relationships and integration of the numerous parts into a final efficient plan.

This redesign program, set up to accomplish specific objectives, is composed of several elements. For the program to be maximally effective all the isolated elements must be integrated into a SYSTEM which will accomplish the intended objectives in a manner that is most efficient and economical. Webster defines a system as "an organized or established procedure; a group of components organized to accomplish a given purpose". The systems approach as applied to this redesign program means focussing upon the elements or components, then the evaluation of each and finally synthesizing the decisions into a complete whole.

This redesign system moves through four major processes. These are as follows:

Stage 1:

The preplanning and decision making phase. In this stage the purpose of the system is defined, objectives are clarified and requirements are analysed.

Stage 2:

The research phase during which the components or entities are isolated and analysed in terms of inter-relationships and contribution to each other as well as to the whole or overall scheme.

Stage 3:

The synthesis (redesign) of the kitchen layout.

Stage 4:

The assessment of the effectiveness of the redesign.

The first and most critical stage in the redesign system is a factual, objective operational analysis. Decisions here must be based upon actual and/or forecasted requirements then translated into a planning prospectus to guide and control the system formation. If requirement analysis is not completed, there is a risk of excluding relevant operational functions, equipment or procedures.

The next step in the redesign system is the isolation of entities requiring detailed analysis. In this program the elements under study include an assessment of the kitchen areas or departments, an analysis of the menu pattern, an estimate of equipment requirements, and estimate of space requirements and a structuring of an efficient flow

pattern. The thorough evaluation of each component provides the basis for decisions relative to efficient utilization of facilities. In stage three the numerous separate decisions are incorporated or synthesized, resulting in the completed renovated layout.

The evaluation process in the redesign system is concerned with an assessment of operational effectiveness and efficiency. Evaluation in this particular study can be considered as having two parts. First, the redesigned layout can be assessed in terms of its ability to meet the stated objectives. Secondly, the renovated plan can be evaluated in terms of its degree of efficiency as compared with the original layout.

CHAPTER I

PLANNING FOOD SERVICE FACILITIES

The food service industry is a large and growing segment of the nation's economy. Among service industries, that of food service is approaching a total annual volume of thirty billion dollars (11). Concurrent with industrial growth a steady increase in labor and other costs has been recognized. Formerly, raw food costs represented the largest single expense in food service operations but outlay for labor in recent years demands a growing percentage of the total operating budget. As the wage-cost spiral continues to develop, food service managers must encourage reduction of the food preparation, cooking and serving costs. Labor-saving techniques and devices, mechanization and changes in operational procedures are being evaluated for their ability to offset higher costs.

In this regard emphasis logically rests upon the design and construction of highly efficient production and service facilities. The quantity food service kitchen must be designed to cope with its highly specialized functions. But the success with which these functions are accomplished will be effected by the layout in which the facility

operates (9). An improved production layout promotes effective work performance to a high standard and at minimum cost.

Management Involvement in Facility Design

The commitment to create and present an efficient food service facility demands the services of an analytical management team. Whether the decision is to rehabilitate an existing establishment or to design a new facility, it is desirable to assemble qualified planning personnel. The team approach is recognized as an intelligent manoeuvre and the starting point for detailed facility design (5). The dietitian or food service administrator, the architect, engineer and financial administrator should unite their efforts and interests in planning the food service enterprise. A committee with knowledgeable representation of each aspect of facility planning is more likely to produce a satisfactory plant (9).

Regardless of the type or size of the food service facility, initial research into the important and influencing factors reduces the risk of overlooking essential and costly details. During this preliminary planning stage, discussion and development of principal objectives is crucial to the ultimate success of the operation. A thoroughly detailed planning guide and master prospectus for the overall project represent the first responsibility for the planning team (3). As discussions and meetings continue, it is

possible and beneficial to compile an organized checklist of the principal ideas or factors to be considered throughout the systematic planning process.

While still in the initial stages of planning it is particularly important to consider long-term or future endeavors. The primary principle in today's design for tomorrow's food facility is that of flexibility (6). Planning committee failure to anticipate and allow for future development restricts the ability of the operation to respond to change. Flexibility implies mobility, adaptability and modification. In food facilities design flexibility in terms of methods, equipment, materials and space govern the potential of the operation to accommodate tomorrow's activity. In general, the basic plan must be thorough enough to encompass immediate requirements and flexible enough to cope with continuing technological advancement.

In summary, planning the food service operation to be efficient from the outset and well into the future requires the creative thought and pooled interests of top-management, food administrators, architects and construction engineers.

Planning Procedures

While there is no universal approach to the task of facility planning, several knowledgeable individuals (9,3,2, 8) have promulgated their general strategy and offer guidelines for the less experienced administrators. The informative presentations highlight identical basic concepts and processes involved in facility planning. The systems approach provides the opportunity to sequentially analyse the concepts and processes, the interrelationships and finally to synthesize the component elements into an appropriate, meaningful plan. The following section identifies common objects or elements in the facility design system and directs attention to the influence each entity bears with regard to the total system.

Define objectives

It is a rational and intelligent approach to establish objectives or goals very early in the planning program. These statements of intended terminal structure guide the efforts of the management team toward an orderly and effective conclusion of the project within the prescribed framework. Nebulous, ill-defined objectives erode the foundation of the total design system and curtail the ability to accurately identify and analyse the interrelated factors. The immediate and long-term policies, budgets and programs of the entire operation should be reflected in the goals

established at this time (5). In addition to giving direction to team efforts, objectives further provide a tool to measure the effectiveness of the final, consolidated design.

The primary goal of food service facility planning is the efficient housing and placement of required functions, personnel, equipment and materials to minimize production costs and maintain high quality standards (1).

Determine operations

Having established realistic objectives, the subsequent procedure is to decide upon the activities necessary to accomplish the goals. Since food service facilities are individual and vary considerably even within a type classification, the decisions made at this stage will reflect such individuality. Operations common to most settings include menu planning, commodity purchasing, cost accounting, food preparation, method of service, sanitation and dishwashing procedures. Additional operations peculiar to a specific establishment, such as hospital tray service, should also be clearly identified and analysed at this stage.

As well as present needs, the planning committee should be concerned with future trends and growth potential. New food products, new cooking methods, equipment developments and policy changes could impose a requirement for facility adjustment (9). Forethought in listing the present operations and in determining the possible future adaptations places the facility in a better position for survival.

Analyze menu pattern

Before the sketching of the actual kitchen is undertaken, the scope of the menu to be served must be determined and subjected to minute analysis. This step is undoubtedly the most tedious and time-consuming but nonetheless represents a critical stage in the design system and must not be ignored. Because of the interrelatedness of menu pattern with other significant elements in the system, the time devoted to a critical investigation is highly justified. The menu format and subsequent content analysis enlighten the planners, for during this procedure the profile of the facility begins to unfold. It is the menu which describes the size, design and layout and production procedures. It is the menu which determines the type, number of pieces, size and location of equipment. It is the menu which governs labor requirements. Menu analysis is therefore an imperative procedure in the design system and limited attention to its influence can be detrimental to the envisioned efficient plan.

Determine equipment requirements

The selection of kitchen and service equipment should begin only after the planning team has made a careful analysis of the needs of the installation (10). The factors to influence the decision include type of menu, volume and turnover of diners, type of service, type of fuel, budget and available space.

Thomas (12) describes a systematic approach for the determination of equipment requirements firmly based upon menu content analysis. Each product on the menu is studied to ascertain quantity, type and size of equipment required to process that item. The time period over which each machine is needed, the time of day for its use and the maximum load factors on each item of equipment are integral considerations in the calculations. By estimating the maximum production demands placed on single equipment items, it is then possible to calculate the total equipment needs.

In order to correctly select and size the equipment, the committee must depend upon both the menu analysis and decisions concerning operation tendencies. Extensive use of convenience food products such as soup and sauce bases, frozen vegetables, pre-fabricated meats or pre-prepared vegetables reduces both the requirement for and size of certain types of equipment.

Determine areas

Kitchen design is characterized by a highly departmentalized layout. The activities begin with materials at receiving which are subjected to storage, transportation, processing, assembly and distribution. With this insight it is possible to identify the following departments or functions:

1. Receiving and storage
2. Meat processing
3. Vegetable pre-preparation
4. Salad preparation
5. Main cooking
6. Bakeshop
7. Service and dining room
8. Pot and pan washing
9. Dishwashing
10. Garbage storage.

The existence of some areas in a specific installation solely depends upon the decisions reached during the initial survey and preliminary planning stage. The changing attitudes in food procurement and preparation are reflected in the departmental structure. For example, the requirement for meat processing and on-site baking could be greatly reduced or completely eliminated. When area requirements are under review, decisions should be based upon present and future intentions for the facility, plus the affect of current and projected trends. The following illustrations draw attention to the need for critical thought in determining departmental structure:

1. Pre-fabricated and portion cut meats are becoming widely accepted. Fully equipped meat processing rooms and abundant refrigeration for carcass meats are being eliminated or modified.

2. Vegetable peelers and cutters are disappearing from the kitchens as food administrators purchase pre-peeled and cut raw vegetables.
3. Bakeshops are eliminated or modified through the utilization of commercially prepared products, cake and cookie mixes, prepared pie fillings, packaged puddings or frozen pastries.
4. The extensive variety in and general acceptance of frozen food items is increasing the demand on low temperature storage.
5. The use of mechanical garbage disposals at point of use replaces the need for refrigerated garbage rooms.

A study is required within this dimension to clarify the direction of the operation and its immediate and future needs in food production and service. If enlargement, modification and adaptation are probable, surveys made before the design is implemented would be helpful and less expensive in the long-term view.

Allocate space

Each square foot of space in a food service operation can be considered a fixed cost. Profitable operation, therefore, demands that space be carefully calculated in the design system. Too little space results in a cluttered, inefficient operation; conversely, space beyond actual requirement is costly (10). Space allowances should be

balanced in terms of: (a) proposed permanence and future expansion of the facility, (b) acuteness of the need for a specific function, (c) essentials for operating efficiency, (d) desirable standards in terms of appearance, sanitation and high quality production and service, and (e) immediate and future costs, depreciation, upkeep and maintenance (9).

There is no panacea for the determination of space needs. However, Laschober (10), Frolich (7), Kotschevar and Terrell (9) and Dana (4) each offer assistance with the use and interpretation of formulas developed for space calculations. The formulas are presented as guides and must be treated as such. It is doubtful that any one formula for space allowance meets the needs of all installations. To reach a decision in this matter the committee must be influenced by the type and size of departmental equipment, the frequency of supply deliveries, the kind of food used, whether fresh, frozen or canned, and the completeness of processing to be done. Planners must use logic and judgment throughout their analysis of space requirements.

Construct flow pattern

Essentially, an efficient food service layout is one in which food travels the shortest possible distance from receiving to service and the labour performed involves a minimum of walking and unproductive effort. The use of area and equipment templates will aid in determining the best

relationships for effective flow of work. The intent is to construct an overall and individual work center flow in which the route taken by the worker or materials is both direct and in proper sequence with a minimum of criss-crossing and back-tracking.

The flow most suitable for a specific operation is not necessarily suited to a second operation. Once again individual facility needs must be surveyed. Nonetheless, common principles are significant in establishing the flow pattern regardless of the type and complexity of the plant. The flow should be planned so that delay, storage and handling of materials in processing and serving has been eliminated as much as possible. Proper flow dictates minimum spacing between machines, maximum utilization of equipment and economical expenditure of space. The most effective and efficient flow pattern constructed limits the travel distances for both the worker and materials and promotes production and service within the shortest possible time.

Analysis of route charts at this time enables the planners to visualize the work center interrelationships and aids in the final association or contact of one with the other. Bottlenecks and excess backtracking can be avoided before the proposed design is consolidated. Decisions related to department and equipment location become much more confident when supported by work flow evaluations.

Application phase

Canadian military food service staff officers are required to monitor the efficiency of food service operations for bases and units within their command and ensure that high standards are attained with the greatest possible economy in manpower and supplies. Staff officer responsibility further involves a requirement to monitor and provide direction on all unit kitchen and dining area designs.

To gain the theoretical and practical knowledge related to kitchen layout the best experience is that of actual involvement and concern with the creating of a new or a rehabilitated facility. Chapter 2 details the programming and sketching experiences encountered with the renovation of an existing military facility.

CHAPTER II

THE REDESIGN OF A MILITARY FOOD SERVICE FACILITY

In creating a food service establishment one of three methods is normally selected. First, a new building is erected; second, an existing facility is substantially altered, or third, an existing structure is slightly modified. The first method is the most practical in terms of functional use of space and often is the least expensive in terms of long range investment. In food service planning the desire for straight line flow patterns also makes the first method the most desirable. In contrast, both the second and third method introduce a need for financial stability to offset the renovation costs. Additionally, the ability to establish efficient, factory-type production flow can be seriously hindered.

Despite the stated and implied advantages to method number one, the remaining two approaches offer a dynamic challenge to explore and improve upon a facility while subject to actual restrictions and limitations. For this study either of the three methods might have been selected, the first encouraging the creation of a totally new facility

and the second and third method presenting the opportunity to redevelop a site. Method number two, substantial alteration to an existing facility, was selected.

This report is concerned with the redesign of an existing Canadian Forces Junior Ranks dining area. The food service operation selected is a permanent accommodation responsible for the preparation and serving of daily meals to one thousand active military personnel. This operation is neither a profit-making establishment nor a hospital. Emphasis throughout the study rests within the kitchen and back-of-the-house area and no attempt has been made at this time to remodel the dining rooms, the dishwashing area, nor the serving line. Foremost in the planner's mind was functionalism of redesign, efficiency of the kitchen, effectiveness of the labour force and the possibility of future expansion or additional alterations.

Redesigning Procedures

The task was to remodel the present kitchen wherein large quantity food preparation and cooking activities continue thirteen hours per day, seven days each week. The operation is in the form of two cafeteria lines and dining rooms and is maintained for the purpose of providing meals for the one thousand, or more, younger military personnel. Appendix A provides summarized background information related to the operation and represents the preliminary

planning guide established as the initial step in the exploration. Through application of the planning principles expressed throughout Chapter I it was possible to systematically develop a renovated site. In this section, the essential steps involved in planning the redesigned facility, the current trends of the industry and the newer ideas of kitchen planning consultants are presented.

Objectives identified

The goal of any efficient food service kitchen is to prepare, cook and serve food meeting the highest possible standards with a minimum of labour, effort and exertion. The physical layout of the plant in which the operation is housed plays a most critical role in achieving this goal.

The objective of this specific project was to improve the operation of the facility by:

a. increasing functionalism of the over-all kitchen operation
b. encouraging faster and more efficient production
c. encouraging more effective manpower utilization
d. minimizing unproductive effort, and
e. encouraging operational mobility, flexibility and growth.

In essence, the envisioned improvement was to eliminate wasteful application of human effort, materials, equipment and facilities and gain maximum return for each unit of effort, money and time expended.

To meet the stated objectives and subsequently attempt to create an adequate and efficient kitchen layout, a research pattern was established and considerable preliminary investigation completed before the renovated kitchen appeared on the drawing board.

Specific functions isolated

An examination of the preliminary planning guide and the blueprint of the existing facility emphasized the requirement to plan for the following functions or areas in the kitchen and back of the house:

1. Receiving
2. Bulk storage
3. Refrigeration and low temperature storage
4. Meat processing
5. Vegetable and salad preparation
6. Main cooking
7. Bakeshop
8. Potwashing
9. Sanitation--aervoids, mop truck storage, dry and refrigerated garbage storage
10. Miscellaneous areas
    a. offices
    b. employee facilities
    c. miscellaneous storage.

The next step was to estimate space allotments for each of the functions or areas identified.

Calculation of space requirements

Decisions pertaining to space allowance for kitchen and back of the house operations were made relative to the functions that had been identified. Since the project involved renovation to an existing facility, the outline of the external walls provided the skeletal structure and automatically restricted the total area for redevelopment. A measurement of the kitchen yielded an area allowance of approximately 7,047 square feet which became the base from which the remaining space calculations were determined. Thereafter it was possible to estimate square footage requirements for bulk storage, refrigeration, meat processing, vegetable and salad preparation, main cooking, baking and potwashing.

Published articles and texts provide useful percentage figures for determining space allocations. Laschober (10) cautions, however, that percentage figures are averages drawn from many test groups and designers. In using the figures, suitable allowances must be made according to the needs of the specific operation. The foremost determining factor will be the complexity of the menu pattern which establishes the equipment requirements and work center activities. Each operation has its unique concerns and

should be treated as an individual entity. Kotschevar and Terrell (9) suggest that space allowances should be calculated in terms of volume and type of service, size and amount of equipment, number of workers required, space for needed supplies and space for adequate traffic and work aisles. Authors are in agreement that the amount of space required must be influenced by individual operational characteristics and there is no rule of thumb. Accordingly, planners have access to recommended allowances but judgment based upon specific demands must be applied in the final analysis.

At this stage percentage figures and formula are introduced since they did provide this planner with convenient criteria for space allocation decisions.

1. Bulk storage. The volume and type of items received, the accessibility to the market, the frequencies of deliveries and the expected amount of food to be stored will influence the size of the storage area. Laschober (10) grants 10 percent from the back of the house for dry storage. He further suggests that the store room area should be calculated to hold a maximum thirty day supply of goods. Laschober proposes a rule of thumb which is to calculate the meal load for the heaviest day anticipated and divide by two, thus obtaining the square footage required for a thirty day storage period. Two week and one week storage requirements can be calculated as fractions of the thirty day total.

For the food service facility under study, bulk storage space estimate obtained was 750 square feet. Laschober's conclusions, frequency of deliveries to the facility, size of containers, variety in the nature of the stored food and non-food items and volume of meals served were all interrelated in reaching the decision.

2. Refrigerated and low temperature storage. The space needed for refrigerated and low temperature storage once again varies with each individual facility. Frolich (7) stipulates that one to two cubic feet per person served would be a starting point for refrigeration estimates. Planners, however, must consult the preliminary planning guide and interrelate such factors as frequency of deliveries, extent of frozen food usage, type of menu and preparation procedures.

The American Gas Association (1) offers volume of storage guidelines for each of the three types of refrigerated storage required per typical meal when the use of fresh items is at a peak. The factors proposed, however, vary quite significantly between institutions and much depends upon the interpretation of the phrase "typical meal". Typical volumes discussed by the Association are as follows:

Meat and poultry	. . . 0.010-0.030*
Dairy	. . . 0.007-0.015*
Vegetables and fruit	. . . 0.020-0.040*

*Cubic feet per meal.

The formula published by American Gas takes into account the useful refrigerator storage height, the factor of usable space and the factor of lost space of the exterior walls and walls between compartments.

Kotschevar and Terrell (9) estimate that space allocation during preliminary planning may be as follows:

Meat and poultry . . .	20 to 35%
Vegetable and fruit . . .	30 to 35%
Dairy products . . .	20 to 25%
Frozen foods . . .	10 to 25%
Carry over foods . . .	5 to 10%

They further advise that some planners may find it desirable to work in terms of fifteen to twenty cubic feet of refrigeration per one hundred complete meals served. Or, alternately, an allowance of one to one and one-half cubic feet of usable refrigerator space for every three meals served could be considered. While drawing attention to three methods of estimating refrigeration and low temperature storage, Kotschevar and Terrel stress the need to apply the percentage or factors given in direct relation to specific needs of the installation.

Laschober (10) bases calculations upon the meal load for the heaviest day of operation. With his formula, the meal load is first multiplied by the average weight of food served per person each meal (two pounds). The result of this computation is multiplied by three to give the total weight of food served during the heaviest day. At this point the planner must decide how many days of supplies will be

under refrigeration. The total weight of food served during the heaviest day, multiplied by the number of days of storage gives an estimate of the maximum weight of food to be stored. The weight calculation can then be divided by the shelf space factor thus providing a fairly accurate estimate of the total amount of shelf space needed.

The total space allowance can then be broken down as follows:

Meat and poultry	35%
Vegetable	35%
Dairy	20%
Frozen foods	10%

Each of the foregoing methods was used in determining refrigeration and low temperature storage required in the renovated facility. The resulting calculations were not significantly different one from the other and final decisions were based upon a judgment of actual needs of the facility, both immediate and future. While applying the percentages published by Kotschevar and Terrell and Laschober, the planner elected 35 percent for meat and poultry refrigeration, 30 percent for vegetable and fruit, 20 percent for dairy products and 15 percent for frozen food storage. Translated into square footage estimates, the refrigeration and low temperature storage requirements for the renovated facility were as follows:

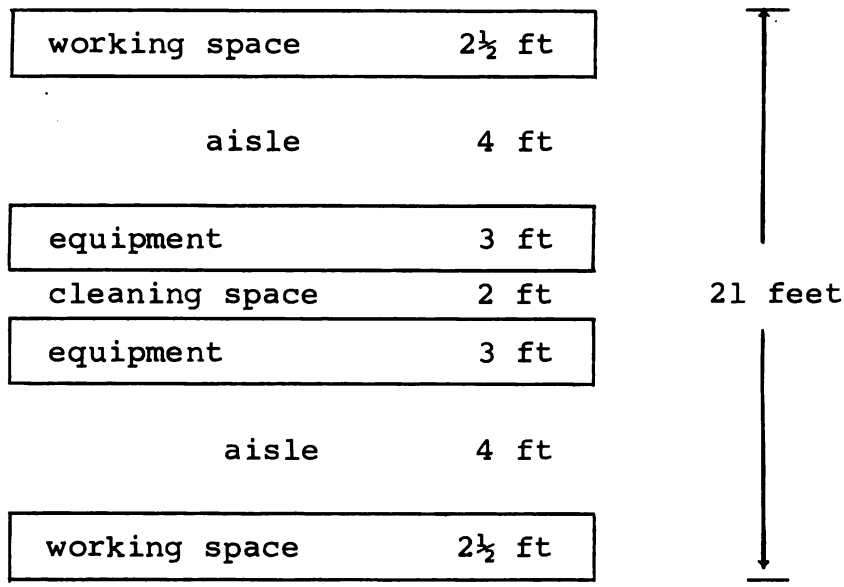
Meat and poultry	161.7 square feet
Vegetable and fruit	138.6 square feet
Dairy products	92.4 square feet
Frozen foods	69.3 square feet

3. Meat processing. Many military installations continue to process carcass meat into usable portions. To meet the requirements of this operation it is necessary to provide the space and equipment common to the traditional butcher shop. Within the pages of current journals and texts it is difficult to find convenient criteria for establishing butcher shop perimeters. Therefore, total space estimates for this department were based upon the quantity and size of work center equipment, allowances for sinks and work tables and allowances for adequate work and traffic aisles. The literature was researched for the dimensions of the needed machinery and support elements and aisles. Once all calculations had been made it was apparent that a minimum area of 300 square feet must be allocated to meat processing.

4. Vegetable and salad preparation. As with the meat preparation area, the space allocation in relation to vegetable and salad preparation was determined by internal department analysis. The total area was arbitrarily viewed as having three distinct components: a peeling center, a cleaning and trimming center and a cutting, shredding, chopping and salad assembly center. The performance and workload within each center was carefully reviewed to guide the decisions related to equipment demands, work surfaces, sinks and aisle allowances. An area of 300 square feet

minimum was the estimated requirement to house the vegetable and salad preparation function.

5. Main cooking. Within this segment of the redesigning process it was only possible to allocate the area of twenty-one feet in depth to accommodate the main cooking battery. The estimate of the battery length was deferred until a menu analysis had been completed. The calculated depth of twenty-one feet is illustrated in the following diagram:



Detailed planning of the main cooking area was carried out in conjunction with the data made available from the menu analysis.

6. Bakeshop. The bakeshop total space allocation of five hundred and twenty-five square feet was obtained from a menu analysis for equipment needs detailed in subsequent discussions.

7. Potwashing. The space required for the potwashing operation depends upon the method used and equipment needed and is, therefore, subject to wide variation between different food service facilities. For the facility under review, potwashing is a manual rather than a mechanized process.

Frolich (7) recommends that approximately three-tenths of a square foot per person fed be allowed for this unit. Kotschevar and Terrell (9) relate space requirements to volume of soiled pots, size of triple sink drainboard, allowance for soiled and clean pot storage and adequacy of worker aisle. Dana (4) calculates the potwashing area in a manner similar to Kotschevar and Terrell. Aided by the published guidelines an area of three hundred square feet was reserved for the potwashing function.

8. Employee facilities. The allowance for employee facilities is given as eight square feet per employee (7). This space includes area for lockers, showers, toilets and restrooms. With an employee population of forty-nine, the total area required for employee use was calculated to be three hundred and ninety-two square feet.

Menu analysis for equipment needs

Menu preparation for the military installation follows a master menu pattern (Figure 1). The meals provided vary from a light lunch to a heavy meal, according to the desire of the diner. The military facility under study uses a six week cycle menu which details all items to be prepared and served at breakfast, lunch and dinner, Monday to Sunday for the six week period. For purposes of the menu analysis, random selection of several complete daily menus was encouraged and during the preliminary planning stages these selected menus were systematically studied. However, since the procedures for the determination of equipment requirements are identical for each menu, the intent here is to illustrate the process using one sample menu (Figure 2).

The initial step in the procedure was to list each product on the menu and the anticipated number of servings. Then a column listing of each piece of equipment required for the production of the item was compiled. The amount of time required for the use of the equipment and the time of day for usage were then determined. The final step was to calculate the quantity of each piece of equipment required, relative to the volume of production. This data was organized in chart format (Figures 3, 4 and 5) for ease of reference. A final overall consolidation of total department equipment requirements, to meet the maximum demand at any one time, was then compiled (Figures 6, 7 and 8).

A. BREAKFAST

Choice of fruit or fruit and vegetable juices

Choice of cooked and dry cereals

Choice of breakfast egg dishes

Hot cakes

Bacon or ham or sausage

Toast, butter, jams etc.

Beverages--milk, tea or coffee

B. LUNCH AND DINNER MEALS

Choice of soup or appetizer

Choice of two freshly prepared meat or fish dishes

One casserole type or egg dish

Choice of two potatoes

Choice of two other vegetables

Salad table

Choice of at least three desserts

Bread, butter, jam, cheese etc.

Beverages--milk, tea or coffee

Figure 1. The master menu pattern.

BREAKFAST

½ grapefruit
Cream of wheat; assorted dry cereals
Poached, fried or scrambled eggs
Soft or hard cooked eggs
Grilled back bacon
French toast with maple syrup
Apricot muffins
Toast, butter, jams
Beverages

LUNCH

Pepper pot soup
Virginia baked ham with orange and raisin sauce
Hamburger deluxe
Chili con carne
Au gratin or baked potato
Boiled shredded cabbage
Vegetable macedoine
Garden green salad
Potato salad
Chefs salad
Assorted meat trays
Apple pie
Lime jello with toppit
Chilled plums, caraway cookies

DINNER

Split pea soup
Baked salmon loaf with egg sauce
French meat pie with brown gravy
Veal chop suey on steamed rice
Parslied boiled or roast potato
Buttered carrot pennies
Frozen green beans
Club salad
Combination salad
Potato salad
Assorted cheese tray, assorted crackers
Assorted meat tray
Raspberry jelly roll
Queens pudding with light custard sauce
Chilled fruit cocktail, cocoanut cookies
Beverages

Figure 2. A sample daily menu.

Product	Number of Servings	Equipment Needed	Time of Day Required	Duration Required	Estimate of Total Equipment Needs
cream of wheat	100	range/stm kettle or counter kettle sink work table	6:40-7:00	20 mins	1 range/stm kettle or 1 counter kettle 1 sink 1 work table
assorted egg dishes	700	refrigerator range griddle steam kettle work table	staggered 6:30-8:00	1½ hrs	1 refrigerator 1 range 1-2 griddles 1 steam kettle 1 work table
grilled bacon	700	refrigerator griddle work table	staggered 6:30-8:00	1½ hrs	1 refrigerator 1-2 griddles 1 work table
French toast	300	refrigerator mixer griddle work table	staggered 6:30-8:00	1½ hrs	1 refrigerator 1 mixer 1 griddle 1 work table
pepper pot soup (30 gals)	500 8 oz srvgs	work table refrigerator sink veg chopper steam kettle	10:00-11:30	30 mins briefly briefly 4-5 mins 1 hr 15	1 work table 1 refrigerator 1 sink 1 veg chopper 1 steam kettle
Virginia ham (110 lbs) 10 hams/15 lbs	300 6 oz srvgs	work table roast oven sink	6:30-12:30	15 mins 6 hrs briefly	1 work table 2 ovens access
orange-raisin sauce (2½ gals)	150 2 oz srvgs	sink work table counter kettle	11:00-11:20	20 mins	access 1 work table 1 counter kettle
grilled beef patties (250 lbs)	1,000 3 oz srvgs	refrigerator work table mixer grill thermotainer	11:00-1:00	2 hrs	access 1 work table 1 mixer 2 griddles
Chili con carne (10 gals)	200 6 oz srvgs	refrigerator work table steam kettle	8:00-8:30	briefly 30 mins 3 hrs	access 1 work table 1 steam kettle
Au gratin potato	500 5 oz srvgs	work table steamer steam kettle oven	10:30-10:45 10:30-11:00 11:00-11:30	15 mins 30 mins 30 mins	1 work table 1 steamer 1 counter kettle 1 oven
baked potato	500	work table oven	10:15-10:30 10:30-11:30	15 mins 1 hr	1 work table 1 oven
shredded cabbage	400 3 oz srvgs	cutting board steam kettle	staggered 11:15-1:00	2 hrs 45	1 work table 1 steam kettle
vegetable macedoine	600 3 oz srvgs	work table steam kettle	staggered 11:15-1:00	2 hrs 45	1 work table 1 steam kettle

Figure 3. Cook's battery: equipment required to process menu.

Product	Number of Servings	Equipment Needed	Time of Day Required	Duration Required	Estimate of Total Equipment Needs
split pea soup (30 gals)	500 8 oz srvgs	refrigerator work table steam kettle	 2:45-3:00 3:00-4:30	access 15 mins 1 hr 30	1 refrigerator 1 work table 1 steam kettle
salmon loaf (12 gals)	450 6 oz srvgs	can opener refrigerator mixer work table oven	 3:00-3:15 3:15-3:30 3:30-4:30	access access 15 mins 15 mins 1 hr	1 can opener 1 refrigerator 1 mixer 1 work table 1 oven
egg sauce (2 gals)		refrigerator work table kettle	 4:00-4:10 4:10-4:30	access 10 mins 20 mins	1 refrigerator 1 work table 1 counter kettle
meat pies (112 lbs-- 15 gals)	450 6 oz srvgs	refrigerator work table mixer steam kettle oven	 2:50-3:10 3:10-3:30 3:30-4:10 4:10-4:30	access 20 mins 20 mins 40 mins 20 mins	 1 work table 1 mixer 1 steam kettle 1 oven
brown gravy (3 gals)		refrigerator work table counter kettle	 3:50-4:00 4:00-4:20	access 10 mins 20 mins	 1 work table 1 counter kettle
veal chop suey (10 gals)	100 6 oz srvgs	refrigerator work table sink steam kettle	 2:00-2:30 3:00-4:30	access 30 mins access 1 hr 30	1 refrigerator 1 work table 1 sink 1 steam kettle
steamed rice	100	sink steam kettle	 4:10-4:30	access 20 mins	1 sink 1 steam kettle
boiled potato	400 5 oz srvgs	work table steam kettle	staggered 4:10-5:40	 1 hr 30	1 work table 1 steam kettle
roast potato	600 5 oz srvgs	work table oven	3:15-3:30 3:30-4:30	15 mins 1 hr	1 work table 1 oven
carrot pennies	500 3 oz srvgs	work table steam kettle	staggered 4:15-5:40	 1 hr 25	1 work table 1 steam kettle
frozen green beans	500 3 oz srvgs	counter kettle	staggered 4:15-5:40	 1 hr 25	1 counter kettle

Figure 3--Continued

Product	Number of Servings	Equipment Needed	Time of Day Required	Duration Required	Estimate of Total Equipment Needs
muffins	20 doz	refrigerator		briefly	1 refrigerator
		work table	5:00-6:30	1 hr 30	1 work table
		mixer	5:15-5:30	15 mins	1 food mixer
		bake oven	5:30-6:30	1 hr	1 oven
apple pie (pastry and filling)	1000 srvgs	scales	(4 hrs)	briefly	1 scales
		work table	8:00-9:30	1 hr 30	1 work table
		mixer	8:30-9:30	1 hr	1 food mixer
		steam kettle	8:30-9:00	30 mins	1 steam kettle
		oven	10:30-11:30	1 hr	1 oven
		cooling rack	11:15-11:30	15 mins	1 cooking rack
lime jello with toppit	500 srvgs	sink		briefly	1 sink
		mixer	5 mins	day	2 mixers
		work table	15 mins	previous	1 work table
		mixer	10 mins		
chilled plums	300 srvgs	can opener	9:20-9:30	10 mins	1 can opener
		work table			1 work table
		refrigerator		2 hrs	1 refrigerator
caraway cookies (90 doz)	serve with jello and fruit	scales		briefly	1 scales
		mixer	8:00-8:30	30 mins	1 mixer
		work table	8:30-9:30	1 hr	1 work table
		oven	9:30-10:30	1 hr	1 oven
		cooling rack	10:30-11:30	1 hr	1 cooking rack
raspberry jello roll (25 rolls)	600 srvgs (16"x26" pans)	scales	12:00-12:15	15 mins	1 scale
		sink		briefly	1 sink
		mixer	12:15-12:30	15 mins	1 work table
		work table	12:30-12:45	15 mins	1 work table
		oven	12:45-2:30	1 hr 45	1 oven
		cooling rack	2:30-3:00	30 min	1 cooling rack
		work table	3:45-4:10	25 min	1 work table
		refrigerator			
queens pudding (15 gals)	500500 5 oz srvgs	refrigerator		briefly	1 refrigerator
		scales	1:30-1:45	15 mins	1 scales
		mixer	1:45-2:00	15 mins	1 mixer
		work table	2:00-2:30	30 mins	1 work table
		oven	2:30-4:00	30 mins	1 oven
		cooling rack	4:00-4:30	30 mins	1 cooling rack
custard sauce (4-5 gals)	1 oz srvg	refrigerator		briefly	1 refrigerator
		scales	3:00-3:05	5 mins	1 scales
		mixer	3:05-3:15	10 mins	1 mixer
		counter kettle	3:15-3:35	20 mins	1 counter kettle
		work table	3:00-4:00	1 hr	1 work table
chilled fruit cocktail	300	can opener			1 can opener
		work table	3:20-3:30	10 mins	1 work table
		refrigerator		2 hrs	1 refrigerator
cocoanut cookies	90 doz	refrigerator		briefly	1 refrigerator
		scales	11:00-11:10	10 mins	1 scales
		mixer	11:10-11:25	15 mins	1 mixer
		work table	11:00-12:45	1 hr 45	1 work table
		oven	11:30-12:45	1 hr 15	1 oven
		cooling rack	12:45-1:15	30 mins	1 cooling rack

Figure 4. Bakeshop: equipment required to process menu.

Product	Number of Servings	Equipment Needed	Time of Day Required	Duration Required	Estimate of Total Equipment Needs
garden green salad	25 gals	sinks work table refrigerator	9:30-11:30	2 hrs	double sinks 1 work table 1 refrigerator
potato salad	25 gals	veg peeler sinks work table	8:00-10:00	2 hrs	1 veg peeler double sinks 1 work table
chefs salad	25 gals	sinks work table refrigerator	9:00-11:00	2 hrs	double sinks 1 work table 1 refrigerator
assorted meat tray relish tray	variable	refrigerator meat slicer work table	10:30-11:30	1 hr	1 refrigerator 1 meat slicer 1 work table
club salad	15 gals	work table steam kettle sink refrigerator	12:30-2:30	2 hrs	1 work table 1 steam kettle sinks 1 refrigerator
combination salad	25 gals	refrigerator sinks work table	1:00-3:00	2 hrs	1 refrigerator double sinks 1 work table
potato salad	25 gals	veg peeler sinks work table refrigerator	1:30-3:30	2 hrs	1 veg peeler double sinks 1 work table 1 refrigerator
assorted meat tray	10-15 lbs	refrigerator work table meat slicer	3:30-4:30	1 hr	1 refrigerator 1 work table 1 meat slicer
assorted cheese tray	variable	refrigerator work table	3:30-4:30	1 hr	1 refrigerator 1 work table

Figure 5. Salad preparation: equipment required to process menu.

Item	Quantity	Size
Refrigerator	2	48" x 29"
Work Tables	6	30" wide; 4,6,8 ft long
Upright Steamer	1	21½" x 29½" x 32"
Steam Kettles	2	30 gals
Steam Kettles	2	40 gals
Steam Kettles	2	Counter Kettles
Food Mixers	2	1--60 quart stationary
		1--20 quart portable
Ovens, Deck, Roasting	3	54-3/8" x 36"
Range	1	36" x 38"
Griddles	3	1--6 ft x 3 ft
		2--36" x 38"
Fry Kettles	3	20-1/8" x 36-1/8"
Meat Slicer		21" x 26" x 34"
Sinks	2	Variable

Figure 6. Cook's battery: consolidated equipment needs.

Equipment Needed	Quantity	Size
Oven--Deck, Baking	1	54" x 38"
Food Mixer and Attachments	1 1	60 quart--stationary 20 quart--portable
Steam Kettle (Tilting)	1	20 gals
Steam Kettle (Counter)	1	5-6 gals
Work Tables	3	6 ft x 2½ ft
Scales--Large, Mobile	1	2 ft x 2½ ft
Scales--Small, Counter	1	1 ft x 1 ft
Sink--Single Compartment	1	2 ft x 2½ ft
Cooling Racks--Mobile	2	5½ ft x 2½ ft
Proofing Cabinet	1	2½ ft x 2½ ft
Fry Kettles	2 Bskt	20" x 36"
Refrigerator	1	48" x 29"

Figure 7. Bakeshop consolidated equipment needs.

Equipment Required	Quantity	Size
Work Tables	3-4	8 ft x 2½ ft
Vegetable Peeler	1	2 ft x 2 ft
Meat Slicer--Mobile	1	2½ ft x 2½ ft
Counter Steam Kettle	1-2	5 gals
Food Mixer and Attachments	1	20 qt portable
Double Sinks and Drainboards	2	8 ft x 2 ft
Refrigerator	1	Walk-In and Pass Through

Figure 8. Salad preparation: consolidated equipment needs.

The individual equipment size was also influenced by maximum demand upon the item. In the majority of instances, equipment size compares favorably with that equipment in place within the existing facility.

Development of the flow pattern

To plot the location of the various areas within the kitchen, cut-outs representing each total space allocation were manipulated to ascertain the most efficient production flow. The various departments were arranged such that work and materials moved in a reasonably straight, direct line. The goal was to minimize manpower and material movement and to maximize operational efficiency.

Bulk storage has been placed in close proximity to the receiving dock, yet is directly accessible to food preparation areas so that deliveries can be made quickly when required. Refrigeration and low temperature storage, coordinated as a bank of installations, have been assigned an area close to the preparation departments they support.

The meat processing area and vegetable pre-preparation have been placed adjacent to the main cooking battery; the salad preparation area occupies a space convenient to each of the dining rooms.

The main cooking department has been logically situated within a short distance of each of the serving

lines. The bakeshop and potwashing area have been assigned floor space on a route convenient to the functions each supports.

Development of the renovated layout

Once the production flow pattern was established and the area locations firmly resolved, action then proceeded toward development of the renovated facility. Equipment templates were designed to scale, in the size and quantity determined from the menu analysis. Work centers were planned in harmony with the principles of good flow and motion economy. Mobility characterized by portable equipment was highlighted within performance centers. The preliminary planning guide was reviewed frequently to ensure that important factors and features had not been overlooked. One by one the preparation departments were constructed until eventually the total remodelling task was completed (Plate 2). The completed plan was remarkably different in character to the former plan.

In Chapter Three both the original plan and the proposed arrangement are discussed to bring to light the resulting outstanding differences.

CHAPTER III

A CRITIQUE OF THE TWO LAYOUTS

The Original Layout (Plate 1)

The receiving dock, upper extremity in the layout, is constructed to encompass two entrances and is accessible to the building interior by way of two main corridors. Foodstuffs received are inspected and checked then routed to the various refrigeration and storage areas at points within the kitchen and/or back of the house. The administrators office is located some distance from the entrance making it necessary for him to re-position himself at the entrance during delivery proceedings. The same office must be shared by the shift supervisor since additional office space is not identified on the plan. This office is suitably located for the shift supervisor to oversee the preparation and serving line activities but critically limits the supervision of the important and costly function of receiving.

The butcher shop, meat refrigerator, dry garbage storage, garbage refrigerator, vegetable preparation and vegetable refrigerator are congregated in locations adjacent to the two main corridors leading from the receiving dock.

A linen room, a bread room, the dairy refrigerator and bulk stores are given a mid-kitchen site bordering the main preparation area, but their doors open into the incoming passageway. They are more readily accessible from the receiving dock than to the main cooking area. This is an awkward arrangement since the movement from receiving to storage might occur once in a day but the movement patterns between these areas and the preparation areas could occur several times each shift.

Surplus bulk storage is accommodated on the basement level, routed down the stairs which appear to the left of the meat refrigerator. Such movements must be manually completed since there is no evidence of an elevator or conveyor belt facility in the plan.

The scullery occupies a prime site, centrally located in the kitchen immediately bordering the cook's battery which it strenuously supports.

All departments within the original layout are surrounded by walls, either floor to ceiling as with the meat processing department, or by a partial wall similar to that isolating the scullery. To be aware of conditions and activities within any one department the supervisor must find his way to the area and step inside its boundaries. Workers, on the move between departments, are forced to dodge walls and frequently take a zig-zag avenue to make contact with an area. Because each preparation area is

isolated by the walls it becomes an impractical feat to share equipment, to communicate and to maintain a direct, unrestricted production flow.

To comprehend a very few of the difficulties within the original layout, it may be advisable to look more closely at one or two activities occurring in this facility. Foodstuffs delivered to the receiving dock are loaded onto hand trucks and routed to appropriate areas within the kitchen. All meat items would be delivered to the butcher-shop, and placed under refrigeration. Fresh vegetables and fruits would be delivered to the vegetable preparation area and placed under refrigeration. However, it is unknown which door would be used to gain access to the building. It appears that regardless of which entrance is selected, one of the departments is directly attainable, while access to the second department is on a route cutting through the dry garbage area. Failure to acknowledge the short cut through the garbage area gives rise to a lengthy movement down one main corridor, around the cook's refrigerator and zero room, then up the second main corridor to the department in question. Perhaps, on the other hand, both doors are used; one to gain access to the meat refrigerator, dairy refrigerator and dry storage, the second to gain access to the vegetable refrigerator and zero room. If such is the case, either commodities are separated on the dock or the

delivery truck and personnel shift positions to make use of the two doors and delivery routes.

Frozen foods would travel from receiving dock to the zero room. It is necessary to enter the cook's refrigerator to reach the zero room. Canned goods, flour, sugars, spices, cereals, pickles and the many other items destined for dry storage are transported the length of a main corridor from the receiving dock to the storeroom on the kitchen level or carried to basement storage. Personnel from the main preparation, the bakeshop and the vegetable preparation area journey to the storeroom to acquire needed supplies.

The meat, once delivered to the butcher shop, is thereafter handled by the butcher until utilized in the main cooking domain. The butcher walks to the meat refrigerator, removes the carcass for processing and returns to his work center. Throughout the day he may make numerous trips between the work center and refrigerator, storing cuts or removing other specific meat demands. At the same time a cook from the main preparation area may be in the butcher shop to load a cart with the meat cuts to be used for the meal. Both the butcher and the cook could make several trips between the heart of the refrigerator and the cart or work center, hand carrying the meat. The high refrigerator door ledges preclude the pushing of carts into the refrigerator. From the layout of the kitchen it appears that the relationship of the main cooking area and the butcher shop

is costly in terms of time and labour dollar expenditure on non-productive hours. Someone, either the butcher or the cook, is walking the distance between the two departments to make the necessary contact. The relationship is so distant that a large percentage of the time involved is contributed more to walking and a very small percentage recorded as productive effort.

Vegetables that are trimmed and cleaned within the vegetable preparation room are transported to the cook's battery where the steam kettles, steamer, ovens and fryers are located. Potatoes, cabbage, carrots and other numerous fresh vegetables travel the extensive distance between the two areas either on carts or hand carried. Salads, also originating from the vegetable preparation area must be distributed to buffet tables situated in each of the dining rooms. Salads are held in and replenished from the vegetable refrigerator since there is no contact refrigeration situated near the buffet tables. Workers expend considerable time and walk extensive distances both in setting up the buffet tables and in replenishing salads throughout the meal period.

The basic incoming flow and distance relationship chart (Figure 9) gives some indication of the problems inherent in this operation. It is apparent that two quite active departments, the butcher shop and the vegetable and salad preparation, are not ideally located in relation to

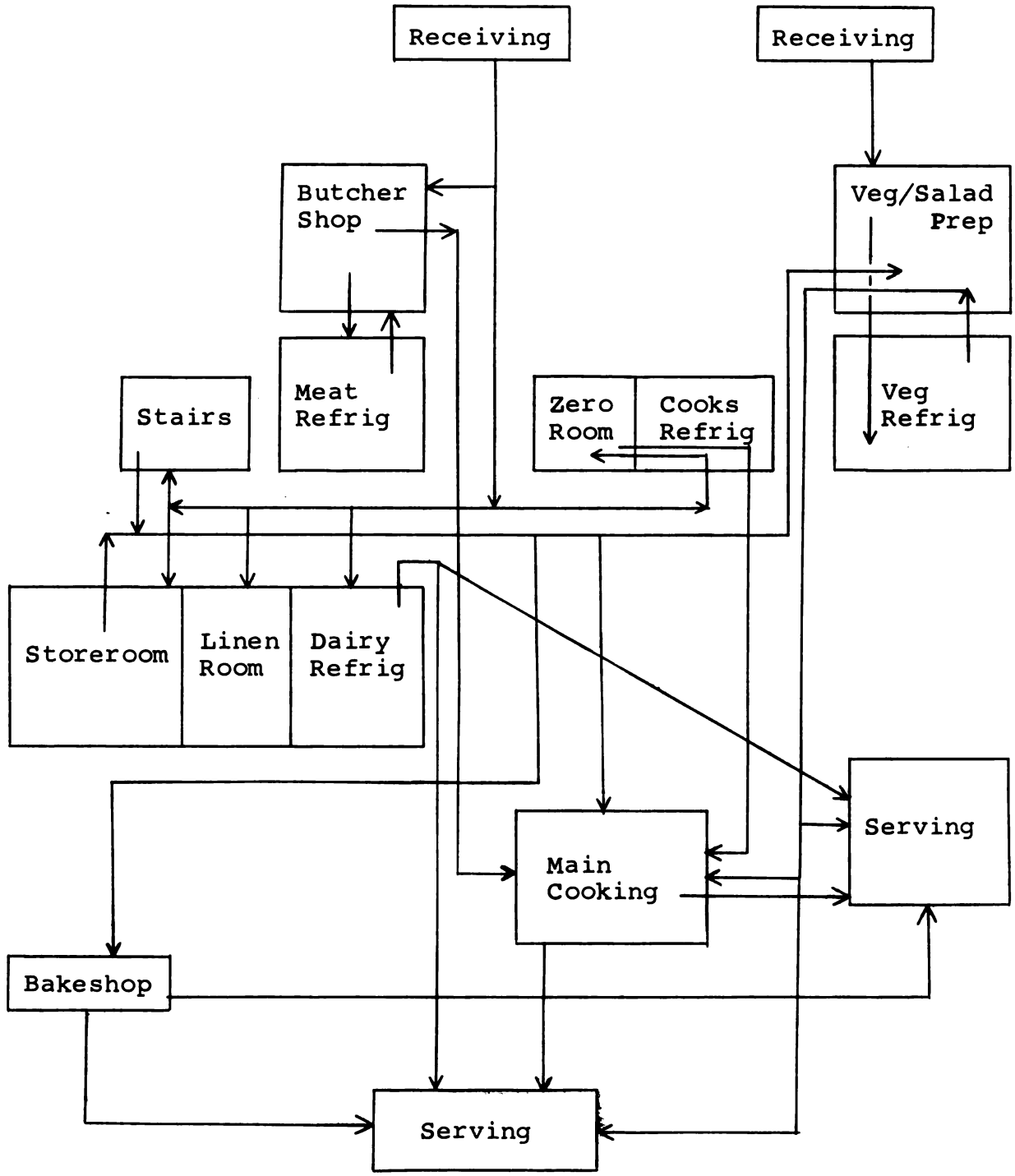


Figure 9. Incoming flow and distance relationship chart: the original layout.

the third and fourth active centers, main cooking and serving. Cooks and kitchen helpers expend a significant portion of the labour dollar just walking between departments. The contact is necessary but the time and individual effort required to achieve the relationship results in an extremely high tally of non-productive hours. Establishing more efficient departmental relationships could substantially reduce the non-productive hours now experienced, reduce labour costs and possibly lower manpower requirements.

The Proposed Layout (Plate 2)

In this layout there is a single back entrance and exit to the building interior, opening into a wide main corridor. This arrangement shortens distances from receiving to storage, allows material handling to be as convenient as possible and minimizes traffic lines during the unloading process. The route taken by the worker to the major storage areas is the most direct one and eliminates the criss-cross and back-track motions previously encountered. The receiving dock provides space for each shipment received, the personnel who check, inspect and unload deliveries and the equipment required to transport items to the interior storage areas. The large double door opening and wide entrance corridor permit easy passage of supplies, workers and equipment. The administrator's office has been positioned to allow him to verify that purchasing standards and quantities are acceptable. Additionally, the administrator can oversee

employee and non-employee activities as they occur at the back of the kitchen. Salesmen, delivery personnel, party committee members and other visiting persons no longer trespass the heart of the production areas to confer with the manager.

Storage facilities, ample for all storage needs of food and non-food items, have been consolidated into one large room located on the same level as the receiving and preparation functions. The central bulk storeroom is intended for long term, dry, non-perishable items, linen supplies, paper goods and other non-food items, that, for economical use of space, can be divided later and issued to work centers or to individuals. An issuing clerk, positioned in the supply area, assumes central responsibility for the issuing, control and inventory of the commodities. Storage facilities for daily and recurring needs have been provided within the main cooking, bakery and salad preparation areas. Back and forth movement between the general storeroom and the preparation areas is reduced to an absolute minimum.

Refrigerated storage occurs at several points from receiving to service. The production processes in the kitchen are characterized by relatively few receipts of refrigerated supplies compared to the movements between the refrigerated storage area and the preparation departments. For this reason, the bank of walk-in refrigerators is positioned close to the preparation areas but within a direct,

straight line of the receiving activity. Separate storage refrigerators are available for meat, vegetables and fruits and dairy products; low temperature storage is provided for frozen food items delivered to the facility. Refrigerator floors are intended to be level with the surrounding floor space to enable more effective use of carts and other mobile trucks or portable shelving. Walk-in freezer storage is provided adjacent to the meat refrigerator; a second walk-in freezer, located near the main cooking area, minimizes the distance travelled by cooks in obtaining food which is available in the ready to cook state.

Area reach-in refrigerators are located in the various preparation and production departments to accommodate storage needs within the work center. Pass through refrigerators have been installed between the preparation and service areas.

The location of refrigeration was based upon an estimate of the concentration of use. Analysis of the movements portrayed that it was more economical to roll deliveries a foot or more further than to have workers make several lengthy trips to get foods from locations nearer to receiving than to preparation. The use of mobile carts and portable shelves also substantially reduces the overall number of trips and effectively lowers the cost of transporting foods. Refrigeration located at point of use results in few production delays, greater utilization of

labour, less confusion and congestion and, most important, a reduction of the risk of food spoilage.

Within the proposed kitchen layout, the core production sections have been integrated in a central area (Figure 10). Thus, production proceeds from one department to the next in a continuing efficient flow. Worker inter-departmental movements can be conducted with relative ease and in less time than previously recognized. The close association of the departments eliminates the prospect of lengthy walks, curtails the accumulation of non-productive hours and upgrades the productive potential of each work center.

In the event that military policy directs implementation of a whole or partial convenience food system, the proposed layout has the greatest flexibility to incorporate the changes. The space saved, for example, in converting to pre-portioned or prefabricated meat can be used for additional cold storage areas and/or freezers. Similarly, space availability in the bakeshop and vegetable preparation area place both departments in a position to readily convert to the new system. Since the use of convenience foods will probably increase in the next five to ten years, the proposed layout appears flexible enough to use available convenience foods in conjunction with conventional foods. It renders the transition to a convenience foods system much easier to cope with and to program.

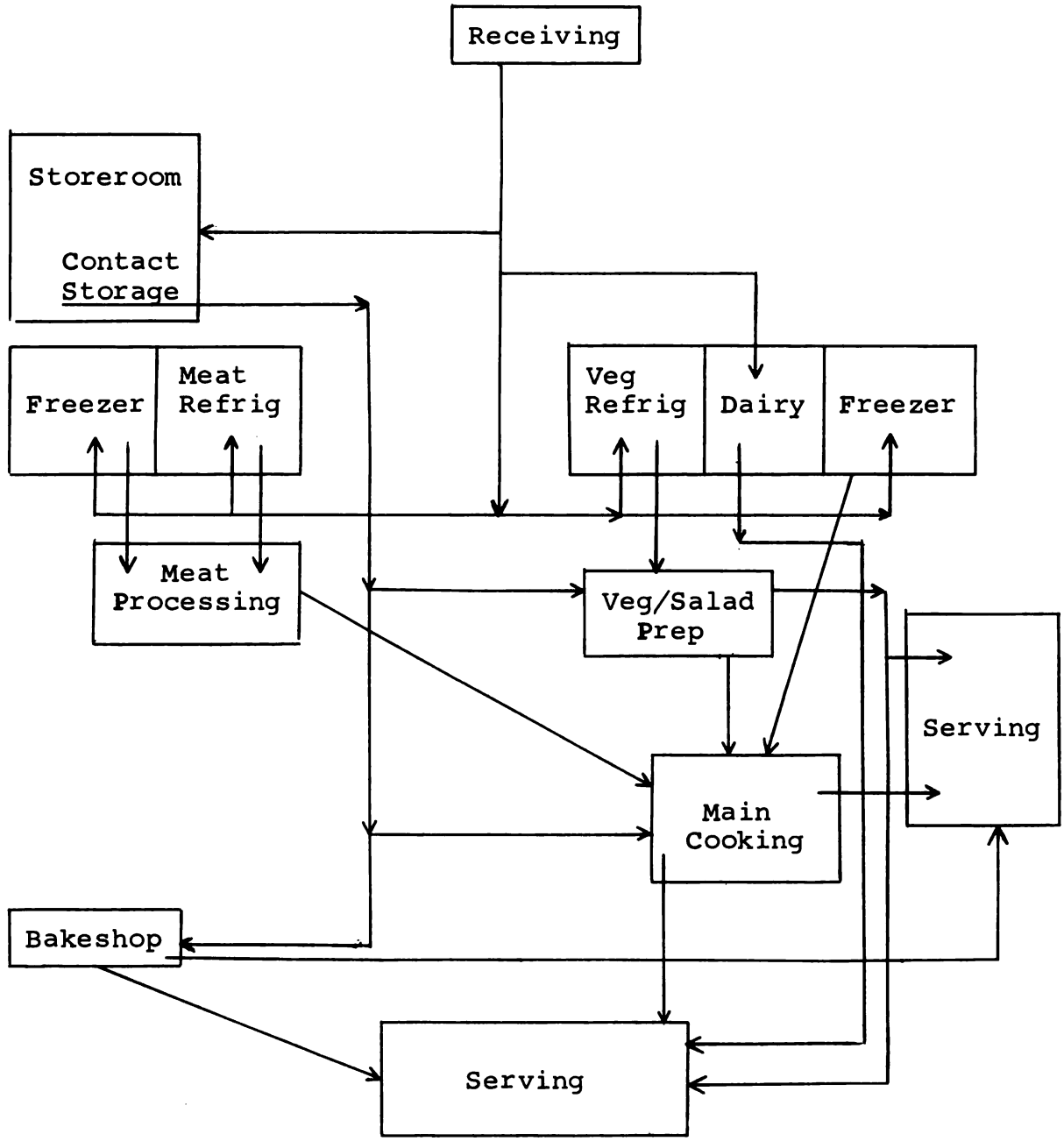


Figure 10. Incoming flow and distance relationship chart: the proposed layout.

Although the study lacks conclusive evidence that manpower requirements within the proposed layout could be reduced, it is nonetheless conceivable that such could be the case. The creation of this more efficient, more flexible and more versatile operational structure should significantly reduce manpower costs. However, as a continuation of this study, manpower costs for each layout should be determined by estimating both the payroll for personnel actually employed and payroll for the recommended kitchen layout. The present study is unsatisfactory since it offers nothing more than an opinion with regard to lowered manpower expenditures.

Summary and Conclusions

The objectives established for this redesign system have been achieved. The following speculations serve to justify the proposed layout configuration.

Increased functionalism

The total available space for the kitchen and back of the house has been effectively utilized. All functions are conveniently and efficiently located on a single level. A comparative summary of space allocations illustrates the value of thorough needs analysis to obtain economic space expenditures.

	Space Allotted to	Original Layout	Proposed Layout
1.	bulk storage	488 sq. ft scattered two levels	750 sq. ft. consolidated one level
2.	refrigeration:		
	meat-poultry	182 sq. ft.	161 sq. ft.
	veg-fruit	143 sq. ft.	138 sq. ft.
	dairy	121 sq. ft.	92 sq. ft.
	frozen foods	52 sq. ft. (one)	112 sq. ft. (two)
3.	meat processing	240 sq. ft	300 sq. ft.
4.	veg-salad prep	255 sq. ft.	300 sq. ft.
5.	main cooking	850 sq. ft.	850 sq. ft.
6.	bakeshop	500 sq. ft.	525 sq. ft.
7.	potwashing	225 sq. ft.	300 sq. ft.
8.	employee facilities	700 sq. ft.	392 sq. ft.

With regard to available refrigeration, the proposed layout is far superior than the original arrangement. In addition to walk-in refrigerators and freezers, reach-in refrigerators at points of use have been provided. Further, three banks of pass-through refrigerators were placed between main preparation areas and the serving function. In effect, therefore, the total square footage and cubic area assigned to refrigeration is significantly greater within the redesigned facility.

Ample work spaces appropriately related to needs and functions, correctly located according to purpose and degree of importance minimizes the overall cost of materials

handling and work production. The proposed layout makes effective use of cubic space.

Increased production potential

Centralization of food preparation areas tends to increase general efficiency. Extraneous worker movements are decreased and non-productive hours are minimized. The concentrated arrangement of food preparation areas eliminates delays and contributes to a smoother flow of materials into, through and from the preparation departments.

Increased manpower utilization

The proposed layout integrates worker with material and equipment. The kitchen is planned to handle food and supplies with a minimum of backtracking and cross travel. Aisles allow free movement throughout the kitchen area and the elimination of the complete walls improves departmental unity. The promotion of labour-saving devices, the provision of contact storage facilities and the structuring of efficient work flow should reduce direct labour costs.

Increased flexibility

The proposed kitchen design offers a high degree of flexibility for future changes. The arrangement has the capability of meeting both present operational demands and possible future developments.

In the opinion of the author, for this report to be conclusive in certain respects, it is necessary to incorporate the results of several other studies. With both the original and proposed layout as the foundation, it would be advisable to compile comprehensive man and material process charts, distance charts, cross charts and time studies. Further, a cost analysis and realistic estimate of manpower requirements related to each design would provide invaluable comparative and supportive data.

APPENDIX

THE PRELIMINARY PLANNING GUIDE FOR THE MILITARY FOOD SERVICE OPERATION

APPENDIX

THE PRELIMINARY PLANNING GUIDE FOR THE MILITARY FOOD SERVICE OPERATION

1. Project

    a. Renovation to existing facility

2. Type of installation

    a. Military controlled and administered
    b. Normal military feeding operation
    c. Double cafeteria line; two dining rooms
    d. Military subsistence

3. Service

    a. Cafeteria
    b. Hot food line; cold food service; buffet table
    c. Uses self-selection cutlery system
    d. Tables arranged with napkins, sugar, salt, pepper
    e. Uses melmac and china plates

4. Menu

    a. Prepare three meals per day, seven days per week
    b. Operates to accommodate 1,000 military personnel
    c. Extensive menu, many choices
    d. Conventional food system; no convenience foods
    e. Uses fresh, frozen, canned food items
    f. Uses fresh, frozen meats, fish, poultry
    g. Uses fresh, frozen vegetables and fruits
    h. Prepare all baked goods and dessert items

5. Preparation areas

    a. Meat processing
    b. Vegetable and salad preparation
    c. Baking
    d. Main cooking--includes soups, sauces, meat and vegetable cooking

6. Food supply

    a. Twice per week authorized ration deliveries
    b. Daily milk deliveries
    c. Daily bread deliveries
    d. Twice per week market purchasing and deliveries
    e. Issues to preparation areas twice per day
    f. Inventory stored for two weeks to thirty days
    g. Public and non-public food supplies separated for storage

7. Meal service

    a. 7:00 a.m. to 8:00 a.m.
    b. 11:30 a.m. to 1:00 p.m.
    c. 4:30 p.m. to 6:00 p.m.
    d. Special catering after normal meal hours

8. Sanitation requirements

    a. Dishwashing
    b. Pot and pan washing
    c. Garbage refrigerator
    d. Dry garbage storage
    e. Locate area garbage cans; place on dollies
    f. Plan for mop truck storage; garbage and milk can sterilization

9. Utilities

    a. Gas
    b. Electricity
    c. Steam
    d. Compressors; locate on basement level or external to preparation areas

10. Personnel

    a. Military cooks and stewards
    b. Civilian cooks and kitchen helpers

11. Special notes for planning

    a. Develop layout to provide good work flow from receiving of raw produce to the final prepared menu items served to personnel
    b. Develop layout so that crossing of paths and back-tracking of personnel is minimized
    c. Plan layout to allow for efficient receiving and stock control

d. Plan walk-in refrigerators and freezers that have door base at the same level as kitchen floors. Trucks, carts, portable shelving wheeled in and out
e. Provide adequate freezer space to meet immediate needs as well as increasing use of prepared frozen food items.
f. Plan equipment needs to keep hot foods hot, cold foods cold.
g. For the planning of each department take into account work simplification procedures to increase productivity and reduce labour costs.
h. Plan arrangement of pick-up stations in the serving area to minimize steps of personnel. Plan pass-through refrigerators and food warmers.
i. Plan work centers to allow adequate work space, contact storage, contact refrigeration and suitable aisle space.
j. Plan work centers to allow adequate work space, contact storage, contact refrigeration and suitable aisle space.
k. Locate each department to afford efficient supervision, efficient communication and effective utilization of personnel.
l. Locate each department to encourage direct and smooth flow of the menu item in production.

BIBLIOGRAPHY

BIBLIOGRAPHY

1. American Gas Association, Inc. Commercial Kitchens. New York, 1962.

2. Avery, A. C. "Traffic Flow: Good Layout Cuts Costs," The Cornell Hotel and Restaurant Administration Quarterly, II (May, 1961), 51-60.

3. Bangs, E. O. "Ideas Are Food for Thought in Food Service Planning," The Cornell Hotel and Restaurant Administration Quarterly, II (May, 1961), 8-9.

4. Dana, A. W. Kitchen Planning for Quantity Food Service. New York: Harper and Brothers, 1949.

5. Fisk, M. L., Hart, K. M., and Miller, G. A. "Long-Range Planning for Food Service Layouts," Journal of the American Dietetic Association, XLII (June, 1963), 489-95.

6. Flambert, R. "To-day's Design for To-morrow's Food Facility," The Cornell Hotel and Restaurant Administration Quarterly, VI (May, 1965), 54-64.

7. Frolich, L. A. K. Planning and Equipping a Hospital Food Service Facility. Koch Refrigerators Inc., Publication, undated.

8. Kotschevar, L. H. "Food Service Equipment and Jobs," The Cornell Hotel and Restaurant Administration Quarterly, VI (May, 1965), 70-73.

9. Kotschevar, L. H., and Terrell, M. E. Food Service Planning. New York: John Wiley and Sons, Inc., 1967.

10. Laschober, J. A. A Short Course in Kitchen Design. Reprint from Institutions Magazine, Chicago, 1960.

11. Parks, R. "Professionalism, Pride and Profits," The Cornell Hotel and Restaurant Administration Quarterly, IX (May, 1968), 2-5.

12. Thomas, O. M. A Scientific Basis for the Design of Institution Kitchens. Teacher's College, Columbia University, New York, 1947.

Pocket he

A PROBLEM 1969

LIBERTY, Jean B.

A System Approach to Redesigning
A Canadian Military Food Service
Facility