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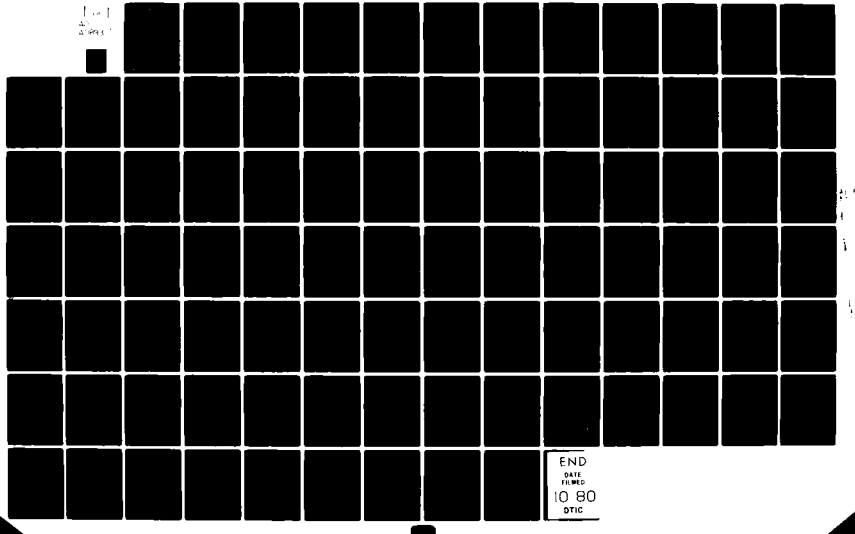

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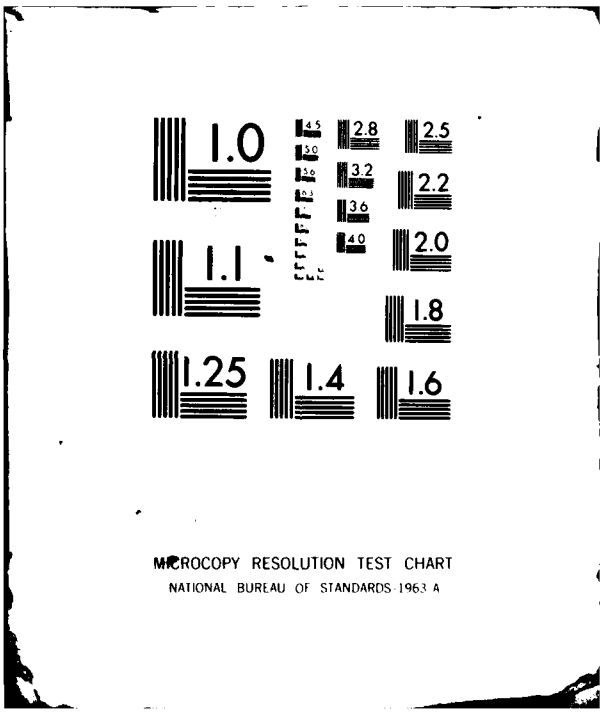
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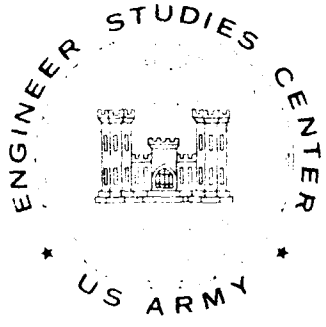

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This study analyzes the Corps of Engineers work force requirements for the 1980's and identifies specific actions which will enable the work force to meet these needs. It was undertaken to determine the investments in employee development and management that must be made today to assure that the Corps will have the personnel resources to meet the challenge in the next decade.

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FOR

FUTURE MISSIONS

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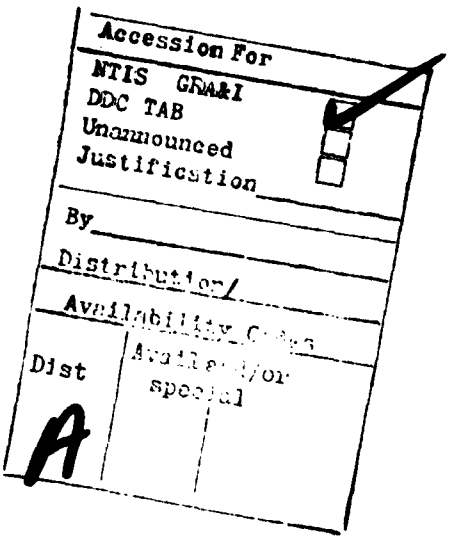

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CONTENTS

ABSTRACT

This study analyzes the Corps of Engineers work force requirements for the 1980's and identifies specific actions which will develop the work force to meet these needs. It was undertaken to determine the investments in employee development and management that must be made today to assure that the Corps will have the personnel resources to meet the challenges of the next decade.

DEVELOPING AND MANAGING THE CORPS WORK FORCE FOR FUTURE MISSIONS

I. INTRODUCTION

1. Purpose. This study analyzes the Corps of Engineers work force requirements for the 1980's and identifies specific actions which will develop the Corps work force to meet those needs.

2. Organization of the Study. Although this analysis represents over a year of effort by the Engineer Studies Center (ESC), the key study issues and findings are presented in this rather brief Main Report. The report is written in such a way as to present the problem and results of analysis early in the text. More specific details on process, data supporting the analysis, and recommended actions fill out the remainder. To be more specific, Section I presents the purpose, scope, background, analytic approach, and significant findings. Section II discusses development of the Corps' historical work force trends for the 1961-1971 period and then explains how those traditional mission trends were projected to 1990. Section III investigates new mission opportunities for the Corps (both foreign and domestic) and determines their potential impact on the work force. Section IV gets more specific and identifies key skill needs for the future and suggests actions for meeting those needs. Section V addresses personnel management implications of the evolving work force. Section VI contains the study recommendations. Included as Annex A is a discussion of economic, political, and demographic trends that will influence future Corps missions. The bibliography is at Annex B. In addition to this Main Report, five monographs, listed below, are being published separately to treat specific topics in greater detail.

a. Corps Work Force Mobility.

b. Management Implications of the Civil Service Reform Act (CSRA).

c. The Corps Work Force in Transition.

d. Managing the Corps Work Force.

e. Work Force Training and Development for the 1980's.

3. Background. This study is an outgrowth of the October 1977 Division Engineers (DE) Conference. Quality of the Corps work force was one of several issues addressed by task groups at that conference. One recommendation of the work force quality task group was to have the Corps study several problem areas, particularly employee mobility and development. ESC was subsequently tasked to study the broader problem of the future Corps work force needs. The Resource Management Office, Office of the Chief of Engineers (RMO, OCE) has served as study sponsor.

4. The Problem in Perspective.

a. Simply stated, the work force needs problem is: What investments in people development and management must be started now to assure that the Corps will have people sufficient in number and with the skills and capabilities needed to do the job in the next decade? The following specific questions face corporate planners as they try to grapple with this problem:

(1) What are the future Corps missions?

(2) How will the Corps accomplish this work?

(3) What is the impact on the business process?

(4) What changes are needed--how should the Corps change?

b. As if these questions are not difficult enough in their own right, the Corps' corporate planning situation was especially complex at the time the study was commissioned. Several social, political, and demographic

influences had combined to make fundamental changes in the laws and institutions of the United States relevant to the Corps' operations. These changing values were reflected in the National Environmental Protection Act (NEPA) and similar legislation and court decisions. The Corps was markedly influenced by societal attitudes toward environment and growth. The 1976 Presidential campaign even raised the issue of whether or not the Corps should continue to pursue its traditional civil works (CW) mission. Proposed government reorganization plans and Corps mission changes kept the Corps' future uncertain over the ensuing 3 years.

c. From a long-term planning viewpoint, the Corps faced several possible mission combinations. It was clear that regardless of the type missions, successful accomplishment would depend on the Corps' ability to get the right people into positions of opportunity. The work force had to be flexible, and the Corps' human resource management system had to nurture that flexibility. One goal of this study was to recommend ways to achieve that flexibility. Given the impracticality of trying to project the size and mix of skills needed for all possible combinations of future missions, the problem was narrowed to one of identifying problem areas and skill shortages for only those missions considered most likely.

5. Analysis Procedures.

a. The initial approach, illustrated in Figure 1, was to simultaneously conduct labor demand and labor supply analyses. The labor demand analysis concentrated on the business process for ongoing missions and the impact of new missions on the process. The emphasis was on those job skill needs initially affected by new missions. The labor supply analysis examined work force composition and demographics to determine employee career and

STUDY APPROACH : LOGIC

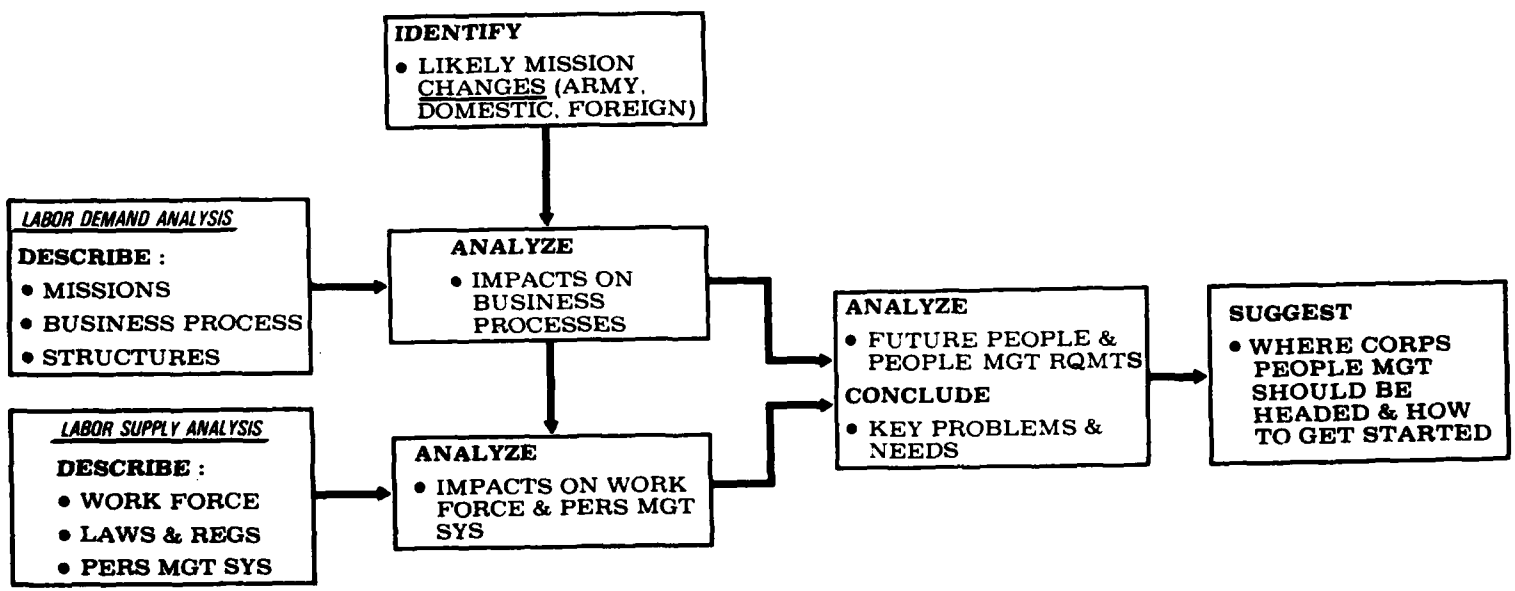

Figure 1

mobility trends. Personnel management systems, policies, and practices were scrutinized in search of ways to improve the labor supply in key areas. Demand and supply analysis streams were brought together to identify key shortages and needed systems improvements. This initial investigation was briefed to the DE Conference in May 1979.

b. When it was resolved that the Corps' traditional CW missions would not significantly change, the short-term future work force needs took on a much more stable form. The study approach of dealing with innumerable uncertainties was adjusted somewhat to one of accepting certain established functional balances and projecting them to the future based on recent trends. The ensuing historic and projected balance of planning, engineering, construction, operations, and real estate provided a baseline for steering and measuring Corps progress into the 1980's.

c. In addition to the historical and statistical data accumulated in building the picture of functional interrelationships and dynamics, ESC realized that certain aspects of Corps activities do not lend themselves to mathematical description and solution. ESC personnel visited many field organizations and OCE staff elements and interviewed both management and staff to record opinions and observations on relevant issues. Figure 2 shows the places visited.

d. Throughout the study process, there was an off-line effort to quantify and describe the work force. This effort consisted of using a computer terminal to access the Civilian Personnel Management Information System (CIVPERSINS) data bank and extract and re-array data relevant to Corps composition. By researching nationwide and Corps demographic trends, the Corps composition was then projected to the future. By comparing the internally

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Sacramento District

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Waterways Experiment Station

Institute for Water Resources

Construction Engineering Research Laboratory (CERL)

Hydrologic Engineering Center

Water Resource Support Center

Civilian Personnel Office (CPO) Conference (Galveston, March 1979)

Figure 2

generated Corps management information system (MIS) data with the DA CIVPERSINS data bank, certain MIS inadequacies came to light along with the required refinements in training, recruitment, and general management policy. By revealing the impact of an aging work force on recruitment and selection policies, the analysis suggests a more insightful way of planning for the future. The availability of work force descriptors also enabled the team to compare actual composition with the perceived composition as revealed through Corps-wide interviews. This check and balance approach was essential to keeping the analysis on track.

6. Insights on the Future. After almost 2 years of analytic effort following the process just outlined, ESC has developed a perception of the Corps' future which is much more optimistic than anticipated at the outset. The Corps has undergone what might be considered the organizational equivalent of a complete physical examination. ESC checked the future national environment, the Corps business process, new mission opportunities, composition of the work force, personnel management policies and practices, and other relevant considerations. The vital signs are healthy. The traditional Corps missions are necessarily changing because traditional demands are being exhausted; however, new mission opportunities abound. The organization and its people will have to adapt to the new requirements. Fortunately, the Corps' previous farsighted investments in its people, its structure, and its training capabilities have put it in a good posture to meet these requirements. All indications are that there will be plenty of work, both foreign and domestic. The character of that work and the processes and procedures by which it is accomplished are changing subtly and can be expected to continue

to change. Several broad study findings are briefly discussed below and will be examined in more detail in the following sections of this report.

a. Work force functional mix. Today's work force is evolving toward a significantly different functional mix. Over the next decade, the portion of the work force engaged in planning is expected to increase 60 percent, operations are expected to increase 16 percent, and engineering and construction are expected to decrease about 10 percent. These changes reflect only manpower shifts for traditional missions and do not reflect such considerations as mobilization requirements and new domestic and foreign missions which will impact on the future work force. Sound agency planning is essential to ensure that necessary actions are taken to accommodate these changes.

b. New missions. Future Corps missions represent the key to molding the functional balance of skills desired in the future work force. Potential missions, both foreign and domestic, should be evaluated to ensure that the Corps exploits all opportunities afforded by these new missions.

c. Key skill needs. Future skill needs identified in this study correspond closely to current skill shortages in the Corps work force. These shortages occur in managerial, technical, and mission support fields. They can be substantially reduced with a modest commitment of resources through additional in-house training, improved recruitment efforts, and through providing better career opportunities for certain positions.

d. Personnel management considerations. The Corps has made significant strides in human management awareness and activities. Furthermore, in CSRA the Corps now has the opportune vehicle for adapting the work force to future requirements. Efforts should be made to revise recruiting policies, continue contract work to develop aid for selection in filling vacancies,

describe and define job activities and work climate, and enhance the Corps MIS to provide accurate information for use by management. Recruitment, utilization, and development of subordinates should be considered critical job elements for all Corps managers and supervisors and should be so stated in their performance standards required by CSRA.

II. WORK FORCE TRENDS AND PROJECTIONS

7. General. This section summarizes Corps work force trends for 1961-1979 and projects requirements to 1990. Eighteen years of historical work force and workload data for traditional Corps missions were analyzed to provide a base for long-term projections. The functional composition of the Corps work force was then projected to 1990 without regard to the impact of any new missions that might be undertaken in the future. This projected posture provided a basis for evaluating which forthcoming opportunities, employee development, training, and recruitment investments best promote continued Corps support to the Nation in civil and military programs. Findings of this analysis were then compared to more subjective data developed during field visits. Combined results of these two investigations provided the work force implications of future Corps traditional missions. The work force implications for new missions are discussed later in the report.

8. Corps Business Process. An understanding of the Corps business process is essential to the effort of projecting future work force needs. Figure 3 graphically depicts this process, illustrating the interrelationships among the basic functions for both civil and military missions. Funnel-shaped portions of the diagram represent work acquisition activities for each function. These are generally, but not exclusively, programming and budgeting activities. In the military programs area, the planning function is not shown separately because the Corps installation and master planning functions are carried out as part of and in support of the programming process. Rectangular portions of the diagram represent execution activities resulting in products and services. Army real property operations and maintenance are shown outside of the dashed outline because the Corps only has staff and technical support

BUSINESS PROCESS: CONCEPTUAL MODEL

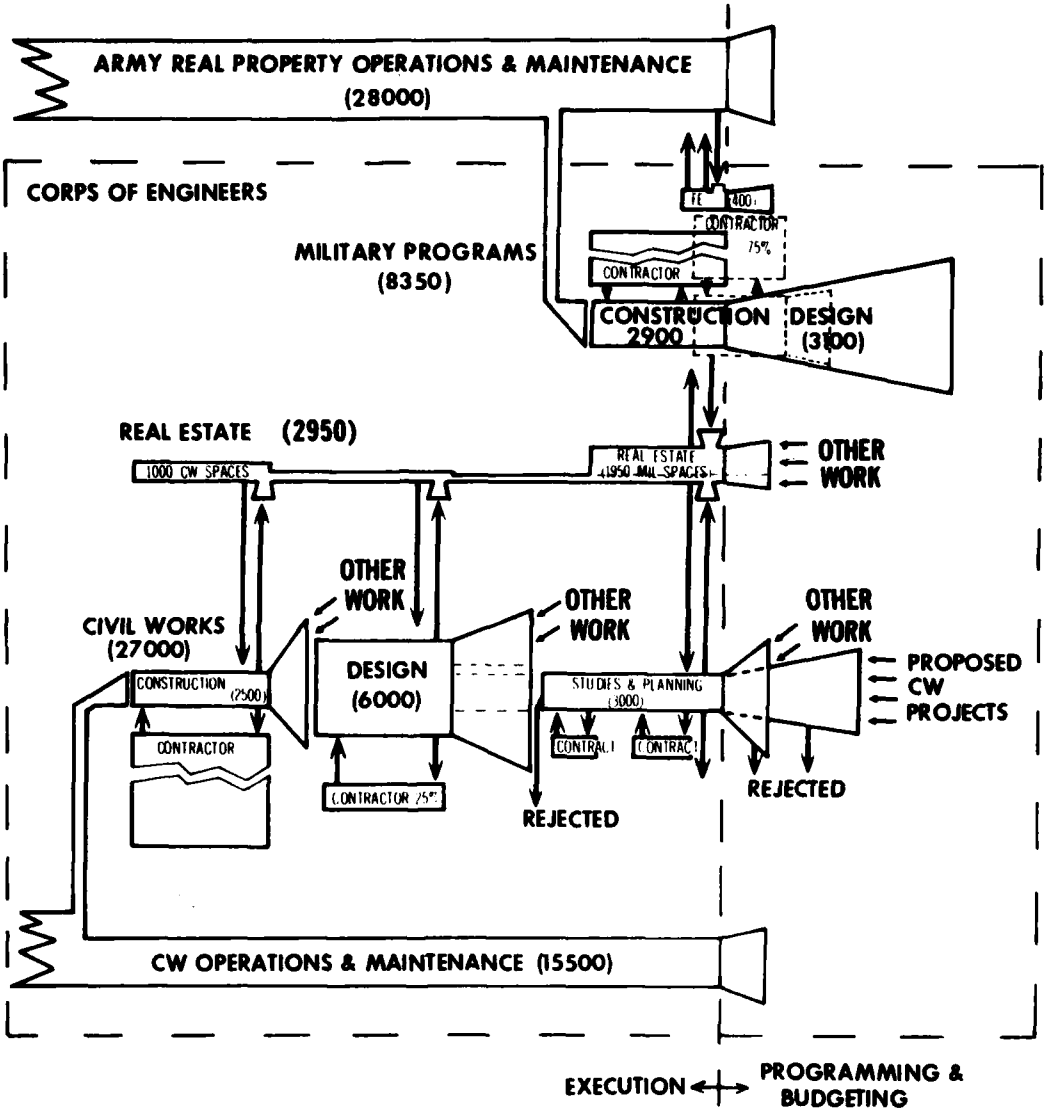


Figure 3

responsibilities for that function. Execution responsibilities rest with the other major Army commands. Horizontal dimensions of each "tube" are scaled to represent the normal duration a project requires to pass through the production process. Vertical dimensions are proportional to the number of people, including allocated support, currently involved in the function, so that the area of the rectangles depicts the proportion of the work force engaged in each function. Approximate numbers of people are shown in parentheses.

9. Contracting. An issue bearing on the Corps' business process and work force requirements is the policy on contract work. In recent years, the Corps has turned to contracting more work in response to the government policy[1/] of relying on private enterprise to supply products and services wherever possible. The Chief of Engineers recently indicated that the need to contract out additional functions continues and that the objective should be to adjust our resources so that essential, primarily professional work is either performed in-house or at an appropriate contract-to-in-house ratio, while functions most suitable for industry are performed by contract. As a matter of good business principle in this regard, the Corps should strive to maintain a balance between contract and in-house capability in each key functional area. This balance is needed to provide visible competition for the in-house work force, to meet Corps requirements, and to prevent any contractor from gaining an inordinate leverage that could preclude Corps "takeover" if a major project failure is threatened.

1/ Exec Ofc of the President, OMB, Circular No. A-76, Policies for Acquiring Commercial or Industrial Products and Services Needed by the Government.

10. The Corps Work Force: 1961-1979.

a. Data sources. The civil- and military-funded manpower levels for the 38 districts and 10 divisions in CONUS provided the historical basis for the work force analysis. Specifically, the analysis was based primarily on program review and analysis (PR&A) reports for 1961 through 1975 and Corps of Engineers Performance Measurement System (CEPMS) reports for 1975 through 1979. The Corps Stratification System (CORPSTRAT) was used for comparison and verification of 1975-1979 data. Personnel data on Corps employees used for demographic analyses were obtained from the CIVPERSINS data bank and selected 201 files.

b. Work force distribution. Figure 4 shows the Corps work force size and distribution by function for the 1961-1979 period. Unfortunately, the standard PR&A manpower report was not published in 1968. Consequently, it was not possible to ascertain whether the Corps reached peak manpower in 1967 or 1968. A manpower low was reached in 1971 that was second only to the current low in 1979. Planning and engineering functions are aggregated because they were not separately reported until recently at district level.

11. Work Force Trends Projected to 1990.

a. Procedure. In order to determine the trend for each functional area, manpower dedicated to each function was represented as a percentage of total Corps manpower by year. Least-squares linear regression was applied to project a straight-line trend to 1990. Two trend lines were projected for each functional area. One was based on the period 1961-1979 to determine the long-term trend, and the second on the period 1970-1979 to indicate the post-NEPA trend. Results are shown in Figure 5.

MANPOWER DISTRIBUTION FOR MAJOR FUNCTIONAL AREAS--1961-1979

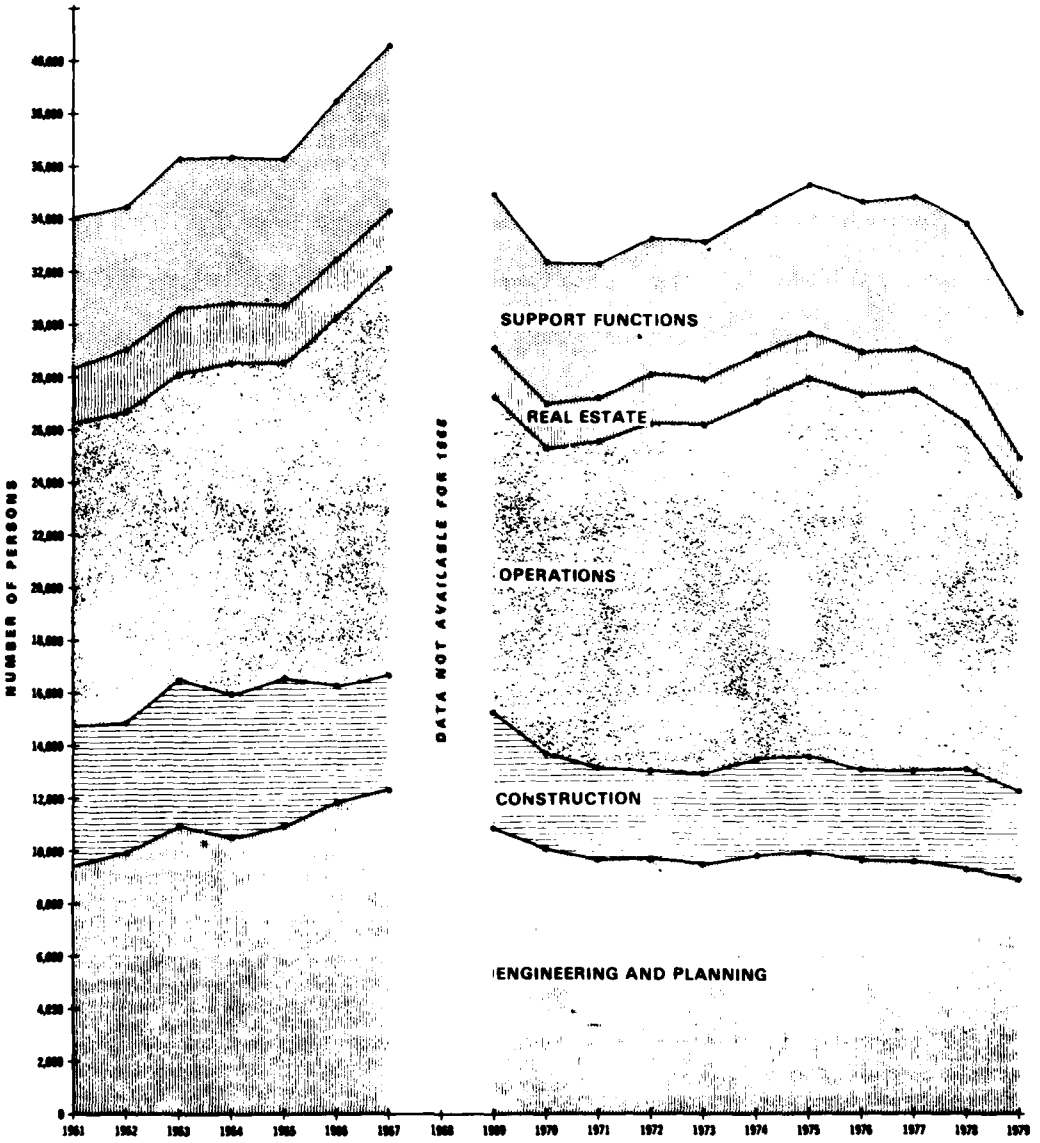
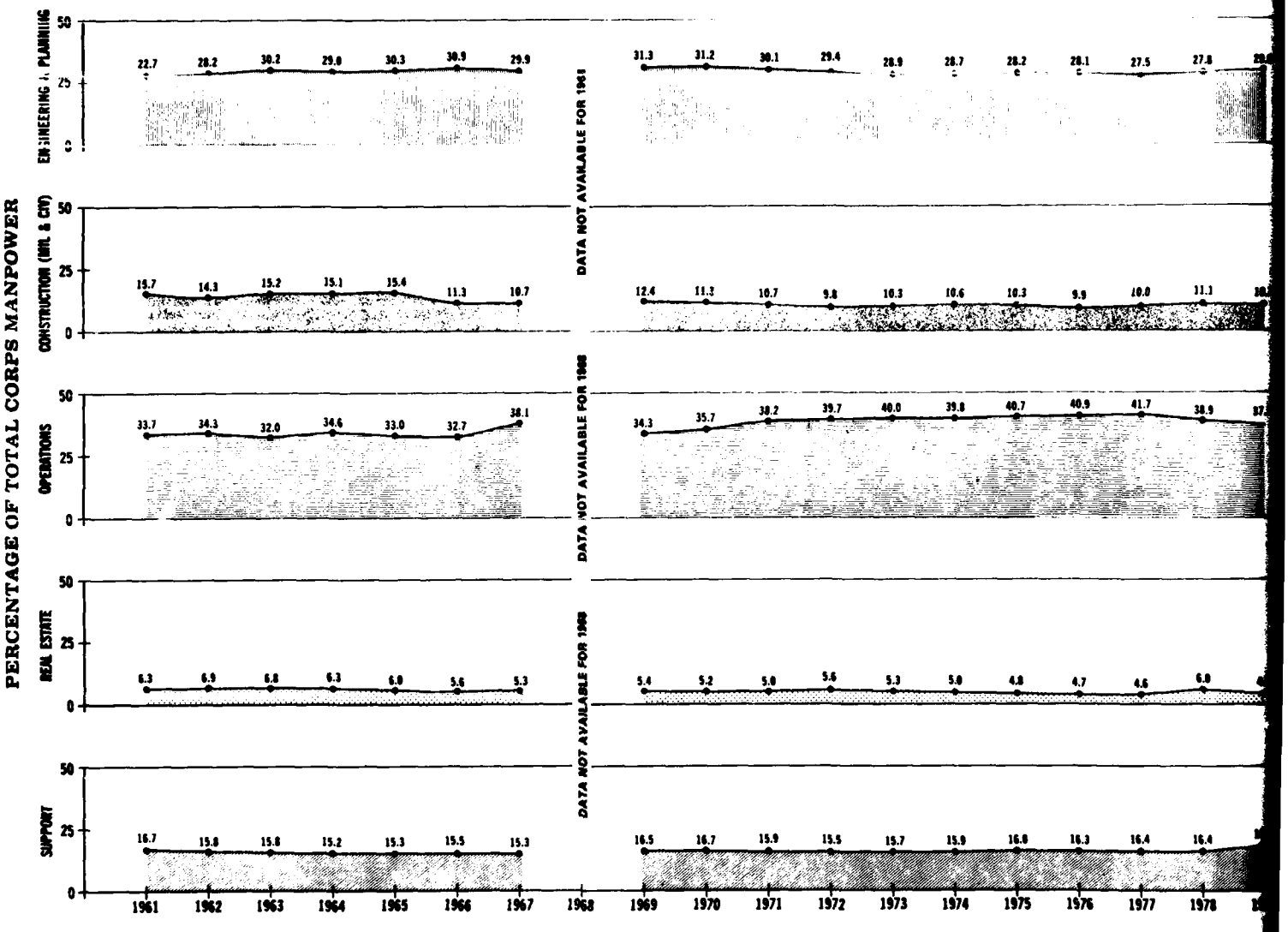


Figure 4

FUNCTIONAL MANPOWER TRENDS AND PR



MANPOWER TRENDS AND PROJECTIONS TO 1990

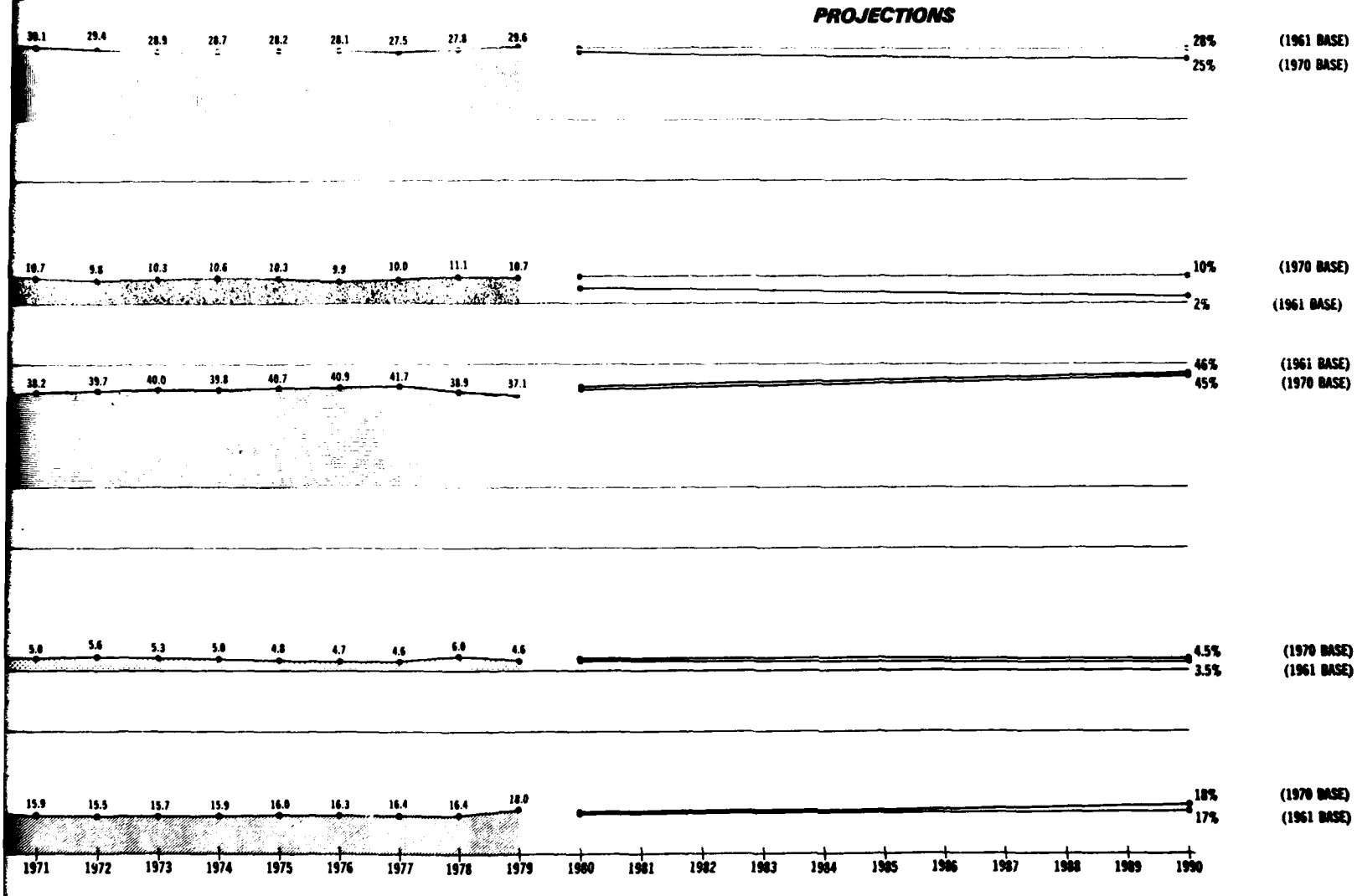


Figure 5

b. Planning-engineering ratio. As indicated earlier, planning and engineering functions are aggregated because they were not reported separately until recently at district level. Findings from field visits indicate that there has been a rapid increase in planning and a slow decline in engineering. Presently, all divisions and 11 of 38 districts have separate planning divisions. In view of this change, separate manpower projections were made for the engineering and planning functions using field reports available for the last 5 years and total dollar workload trends. Results of these projections are shown in Figure 6.

12. The Corps Work Force: 1980-1990. The following functional projections cover only trends for the work force for Corps traditional civil and military missions in CONUS. Projections are based on the previously described straight-line trends as modified by insights collected from field discussions and other considerations.

a. Planning and engineering. The straight-line projections indicate that the combined planning and engineering functions will continue to account for between 25 and 28 percent of the Corps work force through the next decade. This is slightly lower than the current 29.6 percent, but generally consistent with percentages for 1976, 1977, and 1978. More dramatic is the projected distribution between planning and engineering.

(1) Planning. The straight-line trend shown in Figure 6 indicates nearly a 60 percent increase in the planning work force between 1978 and 1990. This projection is based on only 5 years of actual data, and should not be viewed as conclusive. The intent is to present a general quantitative measure of the magnitude of the projected increase. It is reasonable to expect an acceleration in the rate of growth of the planning function, considering

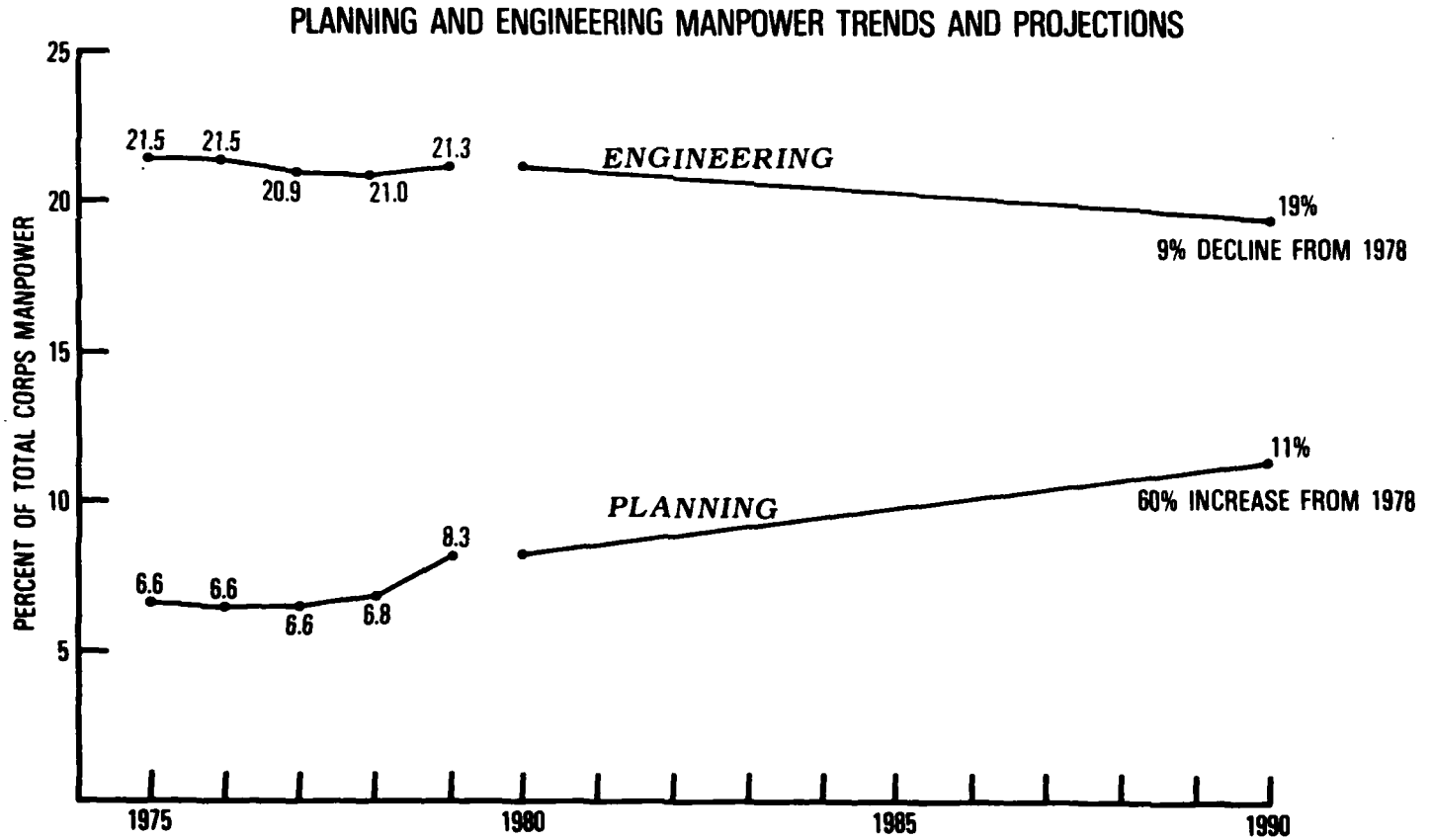

PLANNING AND ENGINEERING MANPOWER TRENDS AND PROJECTIONS
PERCENT OF TOTAL CORPS MANPOWER
25
20
15
10
5
21.5
21.5
20.9
21.0
21.3
ENGINEERING
19%
9% DECLINE FROM 1978
6.6
6.6
6.6
6.8
8.3
PLANNING
11%
60% INCREASE FROM 1978
1975
1980
1985
1990

Figure 6

factors such as increasing public involvement in planning for public capital investment projects, an increasing range of software services provided by the Corps, greater coordination requirements among State and Federal agencies, and broadening environmental and historical preservation considerations for proposed projects. All of these factors increase the labor intensity and duration of the planning process. Thus, by 1990 the planning function is projected to represent 11 percent of the Corps total work force--an increase of about 60 percent above the 1978 level.

(2) Engineering. Both the straight-line projections and the more subjective evidence from the field visits indicate that the proportion of the work force allocated to the engineering function will continue the slow decline it began in 1970. A number of factors are influencing this decline. First, it is primarily influenced by CW since the military construction workload has remained relatively constant. Considering the history of the Corps' CW missions, this should not be surprising. Prior to World War II, when the current era of flood control and navigation missions started, the number of Corps opportunities for projects was great and geographically widespread. Now, with over 3,400 projects completed and 200-plus underway, fewer viable opportunities remain. Another reason is that the public's desires are changing. The public has been opting more in recent times for nonstructural solutions such as flood plain management. These solutions result in diminishing follow-on engineering, design, and construction work. Third, an increase in contracting has had a greater influence on the engineering portion of the work force than on the planning work force. The reason is that studies and the planning function serve to facilitate decisions on how and where to invest the public's money, fundamentally a government responsibility. Design,

on the other hand, is not necessarily a governmental function; there are ample nongovernment sources of this service available. (This is not to say that the public investment process cannot be assisted by contracting or that selecting and accepting designs is not a governmental function.) In-house government design work forces must be justified either on the basis of their efficiency and effectiveness to the public or the need for them to meet mobilization requirements. Both functions involve engineering, but the basic role being served is different. Considering the general trend to reduce government employment, the pressure on the in-house design force is likely to continue. For these reasons, it is projected that the engineering proportion of the Corps work force will continue to decline slowly to about 19 percent in 1990. The analysis also indicated a significant internal change in the composition of the engineering work force. The engineering field force has declined 50 percent since 1970 while the office force has declined only 9 percent.

b. Construction. The long-term (1961-1979) straight-line projection shown in Figure 5 indicated a decline in construction manpower from the 1978 level of 11 percent of the work force to only 2 percent in 1990. However, this projection is heavily influenced by the years 1961 through 1965 when construction averaged slightly above 15 percent of the work force. The projection based on the past 10 years shows the construction work force declining about 10 percent to a level of 10 percent by 1990. This projection is reasonable since a decline in construction work can be expected to follow the decline in design work. If the decline in design work accelerates, a corresponding decline in construction can be expected to follow 2 to 3 years later. It is significant to note that there is also a changing mix between the office

and field construction work forces. The construction office force has grown 21 percent since 1970 while the field force has declined 13 percent.

c. Operations. The portion of the total work force engaged in operations increased from 34 percent in 1961 to 42 percent in 1977. Concentrated efforts to contract more operations activities have offset that growth in the last 2 years. Currently, operations account for 37 percent of the work force. Projections for the 1980's, however, indicate that the operations work force can be expected to increase to a level where it will account for approximately 45 percent of the Corps work force by 1990. The operations area actually includes such different activities as operation of facilities, maintenance, dredging, and regulatory functions. Unfortunately, historical manpower records do not contain data on individual activities, so a trend analysis was not conducted for each activity. It is believed that the projected growth in the operations work force is reasonable, although the distribution of the work force within the operations area could shift between activities.

d. Real estate. The proportion of the work force dedicated to Corps real estate activities has been in a slow decline since 1961, a trend that is projected to continue. Real estate accounted for 6.3 percent of the work force in 1961, reached its high of 6.9 percent in 1962 and 1963 during the ICBM construction program, and has declined almost steadily to its current 4.6 percent level except in 1978 when it increased to 6 percent for 1 year. The projection based on the 1970-1979 data indicates further slight decline by 1990 to 4.5 percent, whereas the projection based on 1961-1979 data shows a decline to only 3.5 percent. Considering that the level of military real estate work is likely to remain relatively constant (disregarding the MX ICBM program for the moment) and that opportunities for new CW projects are

dwindling, a small decline in the real estate proportion of the work force appears realistic.

e. Support. The proportion of the Corps work force allocated to activities aggregated as support has remained relatively constant. It accounted for 16.7 percent of the work force in 1961, dropped to 15.2 percent during the mid-1960's, and increased to 18 percent in 1979. Both of the projections based on 1961-1979 data indicate a 17 to 18 percent level in 1990. The growth trend of recent years seems to be driven by the increasing demand for information, public relations, legal services, and technological advances in automatic data processing (ADP), word processing, and other office equipment. Key changes that have occurred in the 1960-1979 period are described below.

(1) Legal services. The legal services proportion of the total work force has grown 37 percent since 1961, reaching 1.1 percent of the work force in 1979. However, this is an increase of only 68 people Corps-wide, a modest number considering the increasing complexity of the Corps activities and the adverse consequences which can result from inadequate legal services.

(2) Public affairs. That portion of the work force identified with public relations has grown 108 percent since 1961. Approximately 80 percent of this growth has occurred since enactment of the NEPA. In 1979, public affairs accounted for less than 1 percent of the total work force. Of course, that is not fully representative of the Corps' public relations workload since public relations activities are actually part of the duties of a wide segment of the work force.

(3) ADP. ADP first appears as a separate identifiable element in historical manpower records in 1966. Since that time, it has grown 111

percent and now accounts for 1.8 percent of the total work force. It is significant to note that during this same period, the reduction in manpower devoted to finance activities was twice the increase in ADP manpower. Since the financial area is the principal user of automation, it appears the ADP investment has paid off in manpower savings without even considering all other functions receiving ADP services.

(4) Administrative services. The administrative services portion of the work force has remained relatively constant at about 0.3 percent. There was a 10 percent increase in 1979 over 1978, but that is attributable to the sharp decline in the Corps' 1979 population.

(5) Personnel. The personnel proportion of the work force rose 60 percent between 1961 and 1979. This growth can be explained in terms of the ratio of personnel manpower to the population served, the standard used in the DA Staffing Guide.[2/] From 1961 to 1966, that ratio ranged between 66.4 and 64.3 persons served per personnel worker serving. Between 1968 and 1978, the ratio ranged between 46.2 and 47.6--just slightly lower than the DA Staffing Guide standard. The ratio dropped in 1979 to 41.8 but that again can be attributed to the drop in Corps population and insufficient time for the personnel structure to adjust.

(6) Financial functions. The financial area, comptroller and programming, is the only area to show a significant decline in its proportion of the total work force. It is currently down 20 percent from its 1961 level. There was a long period of decline from 1961 to 1974 when it reached a low of 3.9 percent of the work force--29 percent lower than the 1961 level. The proportion has been increasing since 1974 to its present level of 4.5 percent.

2/ DA, HQ, DA PAM 570-551, Staffing Guide for US Army Garrisons. (Hereafter referred to as DA Staffing Guide.)

13. Conclusions. Figure 7 summarizes the work force projections for the Corps' traditional civil and military missions. The sum of the 1990 projections, each independently determined, is greater than 100 percent. This is due to rounding and the softness of the projections. It can also be considered as a vague measure of the competitive pressure for resources that will exist in the future (i.e., a shortage in the vicinity of 6 percent).

SUMMARY OF WORK FORCE PROJECTIONS: 1980-1990
(Traditional Missions Only)

Function	Proportion of Work Force 1978 (%)	1990 (%)	Trend
Planning	6.8	11.0	Up 60%. Broader range of studies, more complex planning processes with more nonstructural solutions.
Engineering	21.0	19.0	Down 10%. Project opportunities declining, less design follow-on from studies, more contracting, smaller field force.
Construction	11.1	10.0	Down 10%. Fewer and smaller projects, declining field force.
Operations	38.9	45.0	Up 16%. Increasing maintenance and rehabilitation of existing facilities.
Real Estate	4.6[a/]	4.5	Down 2%. Long decline, will bottom out at level needed to provide effective coverage.
Support	16.4	17.0	Up 4%. Increasing need for legal, public relations, and other specialized support.

a/ The 1978 proportion of 6 percent was not representative, so the 1979 figure was used.

Figure 7

a. Collectively, the trends show a pattern of which aspects of the Corps' business are growing and which are losing ground. If it is assumed that the occurring shifts are in response to and reflect a genuine change in the market's need for the Corps' various services, then all would seem well and the Corps should only follow where the market is taking it. However, neither the problem nor the solution is quite that simple. The organization must be balanced to meet, in peacetime, both its civil and military missions, new and old, in such a manner that it can meet both its civil and military missions during mobilization and wartime. It is the peacetime market for the Corps' services which has molded the work force trends. The work force so molded may not have the capabilities required for the Corps' major mission to serve the Nation in mobilization and war. Thus, a major question implied by the analysis is: If these trends continue, will the Corps have the capabilities it needs to accomplish its mobilization and wartime missions?3/

b. Engineering and construction are the major areas of decline. These are the hard skill areas normally associated with a military buildup. Planning and operations, both civil functions, are the major areas of growth and are usually thought of only as peacetime activities. Yet, they certainly include activities which are needed and will continue in war, such as waterways operation and power generation. As indicated earlier, the Corps' mobilization requirements are under study and decisions on the functional balance the Corps will need to meet these requirements will depend on the results of that study. If the pattern of the projected trends does not fit the Corps mobilization needs, the alternative is to adjust the peacetime work force

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3/ DA, OCE, USAESC, Corps Mobilization Capabilities, Requirements, and Planning.

balance. Accordingly, the problem may be reducible to seeking additional peacetime missions which will provide the work force capabilities the Corps needs for mobilization and war. The decline in engineering and construction has other significant management implications for the Corps concerning the attitudes and values of the organization and the individuals in it who have a strong self-identity with engineering and construction roles and see these roles as the Corps' only reason for existence.

III. MISSION OPPORTUNITIES

14. General. This section addresses opportunities afforded to the Corps by future missions. Interest in new missions peaked during the period of the President's proposed reorganization of the Federal Government, when modification of the Corps' CW missions was under consideration. Investigations disclosed that both new international and domestic program opportunities existed. In addition, the energy shortage accelerated priority for nonpetroleum forms of energy production and energy support projects resulting in requests for Corps assistance. Currently, there are bills pending in Congress enabling broader Corps roles in water supply and hydropower. In addition, there were requests for support to foreign nations. In order to review the increasing number of these requests, a Special Assistant to the Chief of Engineers for Foreign Programs was established in October 1978. Since that time, project proposals have come from 25 nations. Future military program opportunities include facilities construction for the proposed MX ICBM program and a broader role in management of Army real property. All in all, there is a wide range of opportunities in the Corps' future to serve the national interest. To the extent available information allows, this section describes the Corps' new opportunities and their potential impact on the work force.

15. Military Mission Opportunities. There are two major military mission opportunities--facilities construction for the MX ICBM program and management of the Army's real property maintenance activities (RPMA).

a. The MX ICBM program could involve the construction of about 4,600 missile shelters, road and rail facilities, and operational and life support facilities in the western part of the US. This project is expected to extend over an 8-year period--1981 through 1989. The SPD is currently developing a

management plan for Corps participation in this program. A personnel plan for program execution addressing manpower requirements will be included in the SPD report. The MX program is expected to impact heaviest on engineering- and construction-related skills with a moderate requirement for highly specialized engineer-, procurement-, and real estate-oriented employees.

b. The RPMA mission consists of the Corps accepting CONUS-wide responsibility for execution of the RPMA program. This mission would involve using the Corps' current field office structure to incorporate the facilities engineering activities. Facilities engineering activities would probably be accomplished primarily by contract. The proposal would add approximately 1,300 jobs to the Corps structure by 1984. The likelihood of this mission materializing in the near future is low since it was rejected by the Army Select Committee (SELCOM) meeting in September 1979. However, as a result of that meeting, the Corps has been given execution responsibility for RPMA for Army facilities in the National Capital Region (NCR). This limited mission is considered a test of the broader RPMA mission. Manpower impact of the NCR mission will not be clear until management details and the degree of contracting involved are determined. Major functional areas impacted will be procurement and contract administration and the obvious facilities engineering skills.

16. Domestic Mission Opportunities. Domestic mission opportunities for the Corps addressed in this study are grouped into three separate categories: water supply, hydropower expansion, and support for other Federal agencies.

a. Water supply. There are several water supply bills presently before Congress. Current forms of the bills provide for both urban and rural water supply. Passage of a major bill that could lead to a long-term Corps

program is likely to occur within the next few years. Such a program could give the Corps almost total water management responsibility, except water rights, acquisition, and facility operations. The basis of the program is low-interest Federal loans to localities to develop needed water supply systems. Since the program involves geographically widespread project opportunities and fits very well with current civil missions, it will also fit well into the Corps' division/district structure. The program could impact heavily on planning, engineering, and construction. It would have a modest impact on real estate activities and on the Corps permits program.

b. Hydropower expansion. The Corps is conducting a National Hydropower Study to identify the unused energy potential of existing heads of water which can be harnessed to increase production of electric power. It identifies where new and additional power-generating capacity can be installed at both existing Federal and non-Federal facilities. The forthcoming program will include technical assistance for planning, design, and construction for non-Federal projects. Currently, there are bills before Congress that would provide the Corps discretionary authority to install small power-generating systems and larger systems with Congressional authorization. These programs are likely to involve both in-house and contract operations. They would impact most heavily on the Corps planning, engineering, and construction functions. There would also be some impact in the operations functional area for permits and inspection. The Corps' present large power design capability, centered in the Northwest, is limited. It is estimated that just making additions to existing Federal facilities would stress that capacity so that centers of competence for power design and construction would be required to carry out the programs.

c. Other Federal agency support. Other domestic mission opportunities are provided by supporting other Federal agencies which do not have an engineering or construction capability. Potential projects involve support to the Department of Energy (DOE), Department of Transportation (DOT), Environmental Protection Agency (EPA), and Housing and Urban Development (HUD).

(1) DOE support. Proposed DOE support falls into three areas: the Strategic Petroleum Reserve Program, Coal Conversion, and Interstate Energy Transport.

(a) The Strategic Petroleum Reserve Program is aimed at the purchase and storage of oil in underground salt domes as a reserve to cushion the US from the impact of an oil embargo by the oil exporting nations. Under a memorandum of understanding between the Corps and DOE defining the extent of support, the program would involve between 50 and 100 planning, engineering, construction, and operations personnel.

(b) The Corps is engaged in design, construction, and demonstrative operation of a coal conversion pilot plant. The $150 million project is half designed. Construction time is estimated at 3 years and scheduled for a 1981 start. There are 32 people involved in the design and 18 projected for construction management. The operations turnover phase will require four to five people, double that if two sites are built.

(c) Interstate energy transport now consists of two pipeline projects. One is a pipeline between California and Texas for the distribution of petroleum products. This project is in the preliminary planning stage. The second is a 4,700-mile natural gas pipeline extending from Alaska, across Canada to the Midwest, with branches to Chicago and San Francisco. The cost is projected at $10 to $15 billion. This line will enable the distribution

of 26 trillion cubic feet of known gas supply--an amount equal to 10 percent of current US annual consumption. Based on the knowledge that the $6 billion cost overrun on the first Alaskan pipeline was due in part to poor communication between government agencies, a Presidential-level project management office, Office of the Federal Inspector, was created to handle the project. The Federal agencies and the Federal Energy Resource Commission with statutory permit-issuing responsibilities will still be responsible for their permit-issuing actions, but all inspection and enforcement activities will be the responsibility of the Federal Inspector. This office is reportedly considering Corps expertise for assistance, particularly in the area of cold-weather engineering, along with that of the Academies of Science of Canada and the USSR. The southern leg of the project is scheduled to begin in September 1980 with completion by 1985.

(2) DOT support. The possibility of the Corps being assigned to rebuild the railbeds, trackage, and operating facilities of US railroads has been discussed for years. Such a program could be initiated within the next 10 years. It would involve design and construction and be handled primarily by contract.

(3) EPA and HUD support.

(a) It has been proposed that the Corps do the quality assurance for design and construction for HUD's grant program and EPA's grant work. There are significant differences between these programs and the Corps' normal business operations. The Corps normally operates with direct Federal expenditures; i.e., the Corps is given the money, the product responsibility, and frequently does the work itself. In the case of HUD grants, HUD provides funds to recipients who meet program qualifications, but HUD has no

responsibility for the quality of the products for which the money is being used. EPA, on the other hand, funds its projects through grants but retains responsibility for the quality of the products. It is unclear whether and how these piecemeal responsibilities would fit into the Corps' manner of conducting business. The Corps prides itself on a long history of quality work which was accomplished in large measure because it had both responsibility and authority for direct management. Involvement in grant work, particularly the HUD type, would undoubtedly bring discomfiture to many Corps elements and individuals.

(b) The Governor of New Jersey and the Mayor of New York City have made direct requests to the President for Corps assistance in rebuilding inner cities. An interesting implication of these proposals is that local governments have not been able to solve the inner city problem even though they have had available grants. The fact that they are now turning to the Federal Government for help may be signaling the end of the grant program approach. These programs would involve demolition, planning, design, and construction functions. Current Corps thinking is that they would be accomplished primarily by contract.

17. International Mission Opportunities. The Corps' history in foreign programs dates back to the immediate post-World War II period. During this period, most of the work was military, authorized by the Mutual Defense Assistance Act of 1949 which consolidated Marshall Plan support with a comprehensive loan and grant program. The Foreign Assistance Act of 1961 established the Agency for International Development (AID) and, of importance to the Corps' current opportunities, authorized the furnishing of services to foreign nations on a reimbursable basis. In the late 1960's and early 1970's, the

Corps did extensive work in the Middle East. In addition to work in Saudi Arabia, there were also programs in Iran, Jordan, Kuwait, and Libya. Since its establishment, the Special Assistant for Foreign Programs Office has coordinated requests from many nations seeking Corps assistance.

a. Corps foreign activities are outlined in Figure 8. Activities include ongoing missions, potential missions, and other possible missions. The latter category includes activities where contacts have been made by foreign governments seeking Corps assistance but have not been followed up with formal requests. It will be noted that most of the projects listed are water-related. Planning and engineering design are also involved in most of the ongoing projects.

b. Corps involvement in international programs is well accepted by DOD, DA, State Department, AID, Congress, the news media, and the architects and engineering community, but reservations exist within the Corps itself. Some engineering employees are concerned that international programs could drain resources from their activities and conceivably reduce Congressional support for the CW program. A specific matter of concern is the impact on manpower. Thus far there have been a number of pre-feasibility actions funded by the US under Section 661, but there are no programs underway that are funded by foreign government reimbursement. Pre-feasibility activities take people away from their jobs for 1 to 2 months on short notice. For local managers trying to keep up with their work programs, these disruptions are significant. From the corporate perspective, the manpower commitment to foreign work, except for Saudi Arabia, is small. The international programs, except Saudi Arabia, have a short-term manpower potential of less than 400, a small commitment from an organization of over 30,000 considering the potential

FOREIGN ACTIVITIES

Country	Activity
Ongoing and Potential Program	
Korea	Development of Han River
Saudi Arabia	Construction and design management
Nigeria	Navigation--Niger River
Gabon	Port, roads, forestry
Sudan	Red Sea mining--environment
Somalia	Ports and roads
Oman	Water supply
Brazil	Navigable waterways
Peoples Republic of China	Hydro-electric power, water resource
Swaziland	Water resource
Israel	Air base construction
Awaiting Formal Request--Possible Programs	
Indonesia	Transportation systems
Pakistan	Flood protection
Mexico	Dam safety training, port
Hong Kong	Solid waste disposal
Macau	Water supply
Yemen	Construction and design management
Peru	Waterway and land development
Egypt	Dredging of Suez Canal
Malta	Port and water resource development
Venezuela	Water-crossing alternatives
Sudan	Navigation--White Nile River
Columbia	Development of Magdalena River

Figure 8

importance to the national welfare and the American engineering and construction industry. This is particularly true since the Corps receives additional manpower spaces when programs materialize.

c. An additional international program, now underway, has not been mentioned. It is the building of two air bases in Israel. Accomplishment of this job within the 3 years allowed will be a major construction achievement. The NAD, following prudent contingency planning, has let both the cost-plus design and construction contract and a project management contract. Corps offices have been established at Tel Aviv, Ramon, and Ovda.

18. Conclusions. The foregoing review of domestic and foreign missions indicates that numerous opportunities are available for the Corps to take on new and varied projects. A number of these projects involve extensive planning, engineering, design, and construction and can provide the Corps with ample opportunities to rebalance functional capabilities. Collectively, these new missions will provide the Corps with more work than present manpower can accommodate. Since it is likely that manpower restrictions will continue, future missions should be selected with care. New missions which offer the greatest payoff are those that are mainstream to long-term national interests--namely water supply and conservation, energy, and national defense. Foreign program opportunities can provide a high payoff with a relatively small Corps investment. It would appear prudent to pursue programs which support this Nation's security, energy, and mineral interest.

IV. KEY SKILL NEEDS

19. General. Thus far, this study has addressed the question of future work force demand in terms of current mission trends and future opportunities and their effect on the functional balance of the organization. The primary purpose of the study, however, is to project future key skill requirements and identify actions the Corps should take to meet these requirements. Information for this part of the analysis was collected from interviews and discussions with more than 300 Corps field and staff managers. Largely it consisted of reports of actual experiences, although in some cases it was termed as "considered opinion." While this information was largely subjective in nature, interviews revealed an obvious consensus as to where skill shortages existed. Projections of key skill requirements for new missions, collected from those individuals most knowledgeable on these prospects, are combined and reported in this section.

20. Current Management Skill Shortages. The strongest point of consensus on current skill shortages was the need for managers. Two specific types of managers were identified--study/project managers and general managers.

a. Study/project managers were almost unanimously identified as the skill shortage of greatest concern. These are individuals who must be adept at handling all phases of a project to include planning the project schedule and budget, negotiating task commitments with functional support elements, monitoring progress to assure commitments are met, and handling customer relations. Ideally, a single project manager would carry a project through its entire life cycle from the study/planning phase through design and construction to completion. However, the lengthy duration of many Corps projects does not permit this, and major phases of the life cycle are usually treated as

separate projects. While splitting of the life cycle creates hand-off and continuity problems, it has the advantage of enabling selection of managers with skills that match special needs of different phases. For example, the study/planning phase requires individuals talented in public relations who can deal with widely differing segments of the community, providing them objective information to facilitate reaching decisions on a particular project solution. In the design/construction phase, the project manager deals more with professionals and staff within the Corps and industry at large where one-on-one interpersonal skills and professional reputation have more bearing. In the Corps, there appears to be fewer personnel with potential to manage the study/planning phase of project management than those with the potential to manage the design/construction phase. Fortunately, a wider range of disciplines, such as urban planning, engineering, environmental sciences, and economics provide suitable backgrounds from which to develop study/planning managers than is true for design/construction project managers where an engineering background is essential.

b. The other management category shortage identified during field visits was that of general managers. (Shortage is not really the correct description since there are presently no civilian positions of general managership in the Corps organization structure.) Discussions usually identified the need for a position of authority with a broad understanding of all major aspects of the business process at district and division level. An individual in this position should have the ability to arbitrate among the functions and set priorities to achieve the resource balance necessary to obtain effective results in all areas of production. Fortunately, a new force has entered the picture which supports the philosophy of a general manager cadre and can

facilitate implementation of this concept if the Corps chooses. This force is the CSRA of 1978. Provisions of the CSRA and their importance to the Corps are discussed in more depth in a separate ESC monograph prepared as an adjunct to this study, titled, Management Implications of the Civil Service Reform Act (CSRA), dated September 1979. Since implementation of this Act will require redefining and analyzing a wide range of Corps positions, the opportunity is provided for the Corps to assess establishment of general manager positions.

21. Current Technical Skill Shortages. The consensus gained from field discussions is that there is a need for hydrologists, engineers with hydrologic skills, mechanical engineers, electrical engineers, and construction inspectors.

a. Hydrologic engineering skills go to the heart of the Corps' mainline business--water management--and were the most commonly cited technical shortages. The complaint most commonly heard was a lack of experienced people. Since a major portion of the Nation's share of these skills are Corps employees, a shortage is a matter for considerable concern, particularly in view of probable expansion of both domestic and foreign missions requiring hydrological skills. These skills are not readily available in the private labor market, making it difficult to recruit or to expand Corps capability through contracting. Moreover, a marked increase in contracting could conceivably lead to contractors "raiding" Corps personnel and selling their expertise back at a higher price. Many individuals involved in hydrologic engineering work in the Corps are trained at the Corps Hydrologic Engineering Center (HEC) in Davis, California. By and large, these people entered the Corps as civil engineers and then later specialized in hydrology. The CORPSTRAT shows 1,158 persons actually used in hydrologic fields. An

interesting aside is that, of this number, only 57 are identified in the hydrology engineering occupational series. Essentially, all of the remainder are in the civil engineering occupational series and reportedly resist changing their occupational series, presumably to preserve what they perceive as greater promotability. ESC decided to find out if there was any basis for the perception that advancement opportunities are better for individuals not in the hydrologic occupational series. The study team compared, by grade, 57 employees in the hydrology series, with the remaining 825 persons being used in the series but not identified as such. Results are shown in Figure 9. This comparison provides an approximation of promotion opportunities for persons desiring to remain in the hydrologic field under two different personal identification strategies. In the early grades, GS-5 through GS-11, the strategy of maintaining the specialized occupational identification gives slightly better upward mobility. Mobility shifts dramatically at the GS-12 level when the "other series" becomes the better strategy and remains so for reaching all upper grades. Thus, the general perception that limited opportunities exist for reaching the upper grades within the hydrologic functional area coincides with the facts. This comparison suggests that the best personal strategy is to "fast track" in hydrology until you reach senior journeyman and then change occupational identification. It also suggests that the shortage of these skills is due more to the Corps' limited opportunity structure than to an unwillingness of people to enter this field. HEC has the potential to increase substantially its training capacity with a modest investment in people and money. Although this increase is needed, it will be of little consequence if talent is drained from the Corps as it reaches the maturity and experience level where the greatest payoff from the training

investment is normally expected. Additional training investment and revision of the opportunity structure are both necessary to solve this skill shortage.

GRADE DISTRIBUTION OF EMPLOYEES SERVING IN THE HYDROLOGIC FIELD

Identified in Hydrologic Occupational Series			Identified in Other Occupational Series[a/]		
GS Grade	No.	Percent	GS Grade	No.	Percent
15-16	0	0.0	15-16	6	0.7
14	2	3.5	14	31	3.8
13	1	1.8	13	117	14.2
12	11	19.3	12	200	24.2
11	24	42.1	11	253	30.7
9	7	12.3	9	91	11.0
7	7	12.3	7	77	9.3
5	5	8.7	5	50	6.1
Total	57	100.0		825	100.0

a/ Does not include 276 persons in other grades and temporary/part-time positions.

Figure 9

b. Electrical and mechanical engineering were the next most widely named technical skill shortages. These shortages are due partly to a general shortage in the labor market and partly to a perception that the Corps offers a restricted career for noncivil engineers. Current labor market demand for electrical and mechanical engineers is exceeding supply, and competition is keen for new graduates. The situation for the Corps is particularly severe for electrical engineers since a large share of these graduates have opted to

specialize in small-scale electronics rather than architecture and power systems. At the recruiting level, the Corps is not competitive. This noncompetitiveness is usually attributed to lower government salaries at the entry levels. But this is also true for other engineering specialties, including civil engineers. Another aspect of the problem which is of equal or greater importance is the unfortunate perception that the young electrical and mechanical engineer graduates have of their career opportunities in the Corps. The Corps is perceived by many as being for "civil engineers only." The shortages of electrical and mechanical engineers are primarily a recruiting problem since retraining is time-consuming and expensive. One solution is to make the Corps a more attractive employer to people with these special skills. To do so, the Corps should be able to demonstrate good career opportunities for these specialties. Electrical engineers working in that occupational series comprise 4.4 percent of the Corps' professional work force,[4/] and mechanical engineers comprise 4.7 percent. Figure 10 provides a breakdown of these percentages by GS grade. The entries in Figure 10 reflect the shortages that exist at lower entry levels; however, a favorable percentage is shown for GS-13, the normal management entry level. Representation at the higher grades is less favorable, but at those grade levels the job opportunities are mainly managerial, defined as multidisciplinary or general engineering positions. In short, the Corps can demonstrate that it does, in fact, provide good career opportunities for these specialties and that it certainly needs personnel with these skills. This approach of demonstrating opportunities for growth to overcome the "civil engineer only" image should be made a basic part of the Corps' recruitment activities for these specialties.

4/ The professional work force is defined to be the 12,500 personnel classified as scientists, engineers, and other professionals.

DISTRIBUTION OF ELECTRICAL AND MECHANICAL ENGINEERS
IN THE PROFESSIONAL WORK FORCE

GS Grade	Electrical Engineers[a/]	Mechanical Engineers[a/]
16	—	—
15	0.7	0.7
14	2.4	2.2
13	4.5	4.5
12	5.6	5.8
11	5.0	6.0
9	2.7	1.9
7	2.8	3.1
5	1.6	1.6
All Grades	4.4	4.7

a/ Percentage of total professional work force.

Figure 10

22. Current Support Skill Shortages.

a. Accountants and auditors. During the field discussions, two skill shortages frequently mentioned were accountants and auditors. One reason cited for these shortages was the increase in Corps contracting activity. In some discussions, concern was expressed that the Corps was not able to attract and retain high-quality graduates in this field. In subsequent discussions, RMO personnel indicated that the problem was not inability to recruit people but in not being able to keep them because of grade plateaus at the GS-11 level, mainly in the districts. The top accountant at a district is usually a GS-12 with section supervisors at the GS-11 level. Young

accountants often enter, move up to the GS-9 level, and then transfer to another agency. Those who reach GS-11 tend to stay in the Corps. This opportunity structure is unlikely to attract the top graduates; however, it has been suggested that with a stable, well institutionalized accounting system, the Corps does not need to pay a premium for these top graduates. In the case of auditors, the problem is somewhat different. In the past few years, there has been an almost exponential increase in auditing workload driven primarily by increased contracting. In the Corps, the journeyman auditor is a GS-11 and there are ample people available at that level. The problem is not a shortage of qualified people, but rather a shortage of positions. Under the continuing pressure of manpower space limitations, there has been a hesitancy to increase the number of auditor manpower spaces. To date, Corps auditors have been able to make all required audits; however, the scope and depth of those audits have been reduced. In the case of CW contracting, the Corps' audit is the only one performed on the contracts.

b. Computer specialists and real estate specialists. In discussions with the field, shortages were mentioned in computer science specialists and real estate specialists. However, shortages in these skills were generally localized or were cited as indirect critiques of other issues.

(1) In the case of computer personnel, the real issue appeared to be a perceived conflict in Corps guidance created when the Corps announced a policy of contracting for ADP services, accompanied with manpower cuts, followed later by instructions that the Corps was installing a new generation of computers.

(2) In the case of real estate specialists, the real complaint was not that people with the needed skills are not available, but rather that

it takes an inordinate amount of time for the personnel system to bring them on board once needed individuals are identified. Delays of 12 to 14 months were cited.

23. Employment Competition. The situation described above (i.e., understrength auditing and loss of accounting talent to other agencies) is characteristic of many Corps districts. This situation adversely affects Corps competitiveness as an employer vis-a-vis other Federal agencies. There are several aspects to the problem. In many cases the Corps grade structure is more austere than other agencies for similar jobs. Another aspect is that Corps employees are not well informed of Corps opportunities. The Corps relies primarily on its centralized employment referral system while other agencies also use open advertising. As a result, Corps employees are frequently better informed about employment opportunities outside the Corps than within the Corps, and too frequently respond by transferring to other agencies. Several major city districts were characterized as "training grounds" for other agencies. Still another part of the overall problem is a general increase in stress and frustration in the Corps work places due to manpower cuts. This results in the growing perception that the volume of the work forces employees to do less than the thorough, professional, high-quality work to which they have become historically accustomed.

24. New Mission Skill Needs. Skill requirements associated with new mission opportunities were discussed in Section III. A few additional observations follow:

a. Management skills.

(1) The majority of new missions will require study/project managers. As indicated previously, this group of management skills is already

in short supply in the Corps. Availability of capable, experienced project managers could be the single most critical element determining the Corps' flexibility and the success or failure of future projects. The Corps needs to identify those individuals with the highest potential and then develop them so they will be available when needed. Considering current and future needs for management skills, the goal should be to establish a project management training facility.

(2) Contract management is the next most commonly required management skill for future missions. As Corps missions expand, the portion of the work contracted will also expand. As contracting expands, the proportion of the work force devoted to contract administration and management will also expand beyond its current level of 5 percent of the work force. Currently, there is no recognized career pattern series specifically for contract management in the Corps. In light of the expanding need for this set of skills, the occupation should be formally recognized, job criteria defined, and a career development pattern established specifically to fit Corps contracting methods.

b. Technical skills.

(1) Unfortunately, the key technical skills most commonly required by the largest and most likely new missions are those currently in short supply in the Corps--hydrologic engineering skills, electrical engineers, and mechanical engineers. As discussed earlier, the Corps has the capability to overcome the need for most hydrologic engineering skills within its own control by improving the opportunity structure and expanding HEC training capacity. The electrical and mechanical engineer shortages are problems of recruitment rather than training. Since it is likely that the Corps' demand for these skills will increase in the future, the Corps should

emphasize recruitment in this area, including carefully mentored pre-graduation internships. Electrical and mechanical engineer students should be informed that the Corps does provide a good, meaningful, and fulfilling career. Renewed emphasis on hydropower in the Corps programs will create demand for both large and small hydropower systems design specialists in excess of the Corps' current capacity. The volume and geographic distribution of work could lead to a requirement for establishing engineering centers of competence for these specialties within 2 to 4 years. Capable manpower for these centers will be difficult to find. The situation can be alleviated somewhat by informing electrical engineering schools of the situation. It was found in previous periods, particularly during times of projected low employment, that college students will respond to projections of future demand for engineers by shifting their majors. The critical lead time for the first wave is about 2 years, so they have time to make the shift without loss of credits. Successive waves will follow as long as it is perceived that the demand will continue. Engineering schools can be approached directly or through engineering societies.

(2) Construction management and inspection are also key skills common to a number of the new mission categories which, though not yet mentioned, are likely to quickly become a critical shortage area if combinations of new programs materialize and reach the construction phase simultaneously. It was brought out earlier in this study that the Corps' construction function has been declining, particularly the field force. Thus, the new MX ICBM program, while a welcome means to rejuvenate the force, will present a special manpower problem by its magnitude, even if construction management is contracted. Phasing down the Saudi program will provide some capability as

experienced Corps people return. Undoubtedly, other experienced Corps people will accept this challenge to form a leadership cadre. Still, a large number of additional people will be needed and will require training. Since the Corps has an excellent construction program, it should be able to handle the MX ICBM program during the projected buildup--FY 1981 through FY 1984. A serious problem could result if one of the other large new missions, such as hydropower or water supply, accelerates into a large construction program during the same period. Fortunately, that is unlikely considering the normal time requirements for planning and design. Given the current estimates for passage of the water supply and hydropower legislation and normal Corps planning design times, these programs will probably not be moving into a construction buildup until the MX program phases down in the late 1980's. Thus, a relatively orderly redistribution of the MX manpower bulge may be possible if the Corps is able to control the timing among the programs.

25. Conclusions. Investigations indicated that future key skill needs correspond closely to current skill shortages in the Corps work force. These shortages occur in managerial, technical, and mission support fields.

a. Management. There is a shortage of project managers for planning studies and design/construction. There is also a need for general managers in districts and divisions to improve continuity and balance. Anticipated increases in contracting activities will intensify the need for contract management skills.

b. Technical. There is a need in the Corps for hydrologists and engineers with hydrologic skills, mechanical engineers, and electrical engineers. A need was also cited for additional construction inspectors. The shortage of hydrologic engineering skills is due in part to a perception of

limited promotional opportunities in this field. Shortages of electrical and mechanical engineers are due partly to a general shortage in the labor market and partly to a perception that the Corps offers a restricted career for non-civil engineers. The need for construction inspectors can be expected to increase once the MX ICBM program is underway.

c. Mission support. Skill shortages identified in the mission support area were accountants and auditors. These shortages are being brought on by the increase in contracting activity and the accompanying need for accounting and auditing work. The accountant shortage stems from a grade plateau resulting in many employees leaving the Corps for better opportunities. The problem with auditors is one of not having enough spaces in the Corps organizational structure.

V. PERSONNEL MANAGEMENT CONSIDERATIONS

26. General. Previous sections of this report have addressed work force trends and projections, the future demand for Corps work, the nature of that work, and the skills required to do the work. This section briefly addresses those aspects of the analysis which deal with describing and managing employees doing the work. Topics discussed in the following paragraphs are the salient concepts and facts featured in the separate monographs developed concurrently with the preparation of this Main Report. These monographs address the following subjects. The Corps Work Force in Transition monograph describes the Corps work force as it exists today and projects it to 1990. The Corps Work Force Mobility monograph describes Corps employee behavior as concerns mobility (geographically and functionally) and suggests its relevance to Corps management policy. The Management Implications of the Civil Service Reform Act (CSRA) monograph describes the management opportunities inherent in the CSRA. The monograph, Managing the Corps Work Force, assesses the Corps' human resources management posture today and recommends actions and policies for further improvements. And finally, the monograph Work Force Training and Development for the 1980's, addresses specific needs in the Corps' training and development program.

27. Work Force Mobility.

a. At the October 1977 DE Conference, it was suggested that work force mobility could be a major Corps personnel management problem and should be examined. It was therefore addressed as one of the early issues in this study. The measure used to evaluate mobility was the number of moves that exceeded normal commuting distance, defined as 50 miles. The data base was obtained by selecting a random sample of 638 personnel 201 files of Corps

employees at grades GS-11 and above. Using this data base, the following mobility statistics were determined:

(1) Number of employees with at least one career move. The results, shown in Figure 11, indicate that 45 percent of GS-11's have made at least one career move. This number increases to 80 percent for GS-16's and above. The analysis disclosed that for GS-13's and above, the major reason for moving was promotion, whereas for GS-12's and below the most frequent move was a lateral for career development.

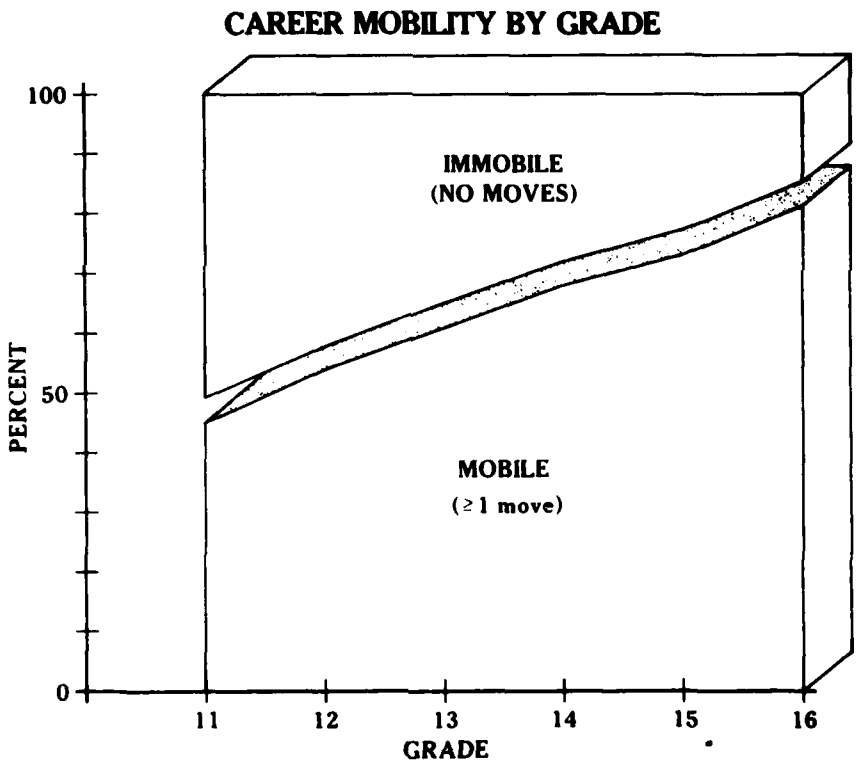

Figure 11

(2) Number of career moves an employee can be expected to make. Figure 12 was plotted using only those files reflecting at least one career move; so it shows the expected number of moves only for those personnel that

moved at least once. As indicated, the average GS-16 makes 4.2 moves during their career and can expect to make about 1.4 additional moves. It was found also that mobility increases with grade for all grades except GS-13. This is believed due to many personnel entering the Corps at this grade who have not had previous opportunities to make moves within the Corps.

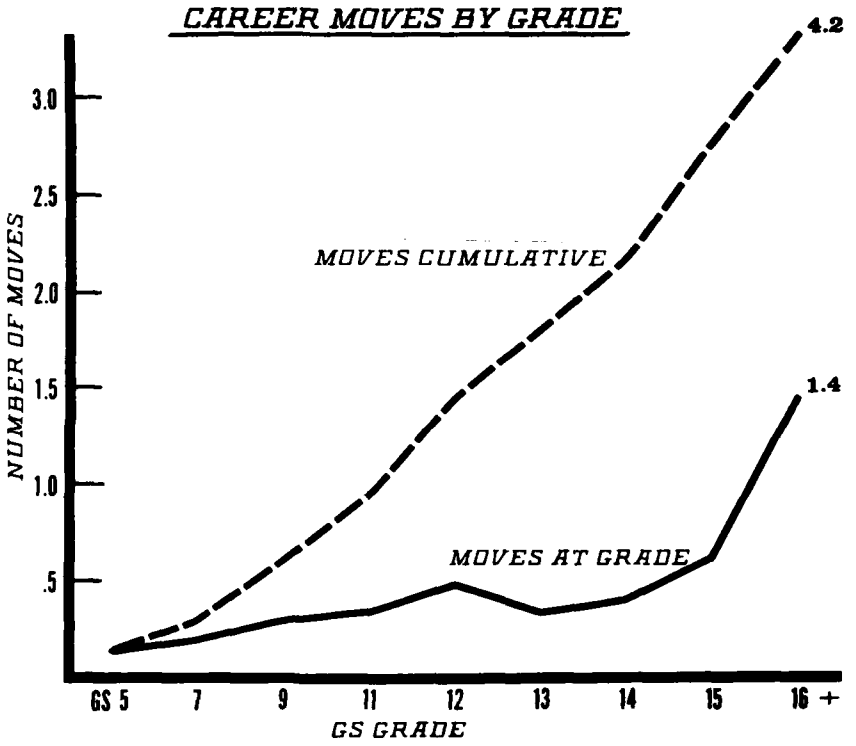

Figure 12

b. Based on the historical sample analyzed, employee mobility does not appear to be a significant management problem. However, this situation is expected to change in the future. Recent national predictions are that within the next 10 years inflation will reduce the standard of living for the average American to that prevalent in the mid-1950's. This, plus other pressures,

could result in reduced willingness to make costly moves and heightened demand for increased and different incentives.

28. Work Force Turnover. Personnel turnover was examined to gain insights into the management implications of turbulence in the Corps work force. The analysis examined the total work force but focused primarily on turnover in the so-called "professional work force" (i.e., the 12,500 personnel classified as scientists, engineers, and other professionals). Figure 13 shows this work force distribution by grade.

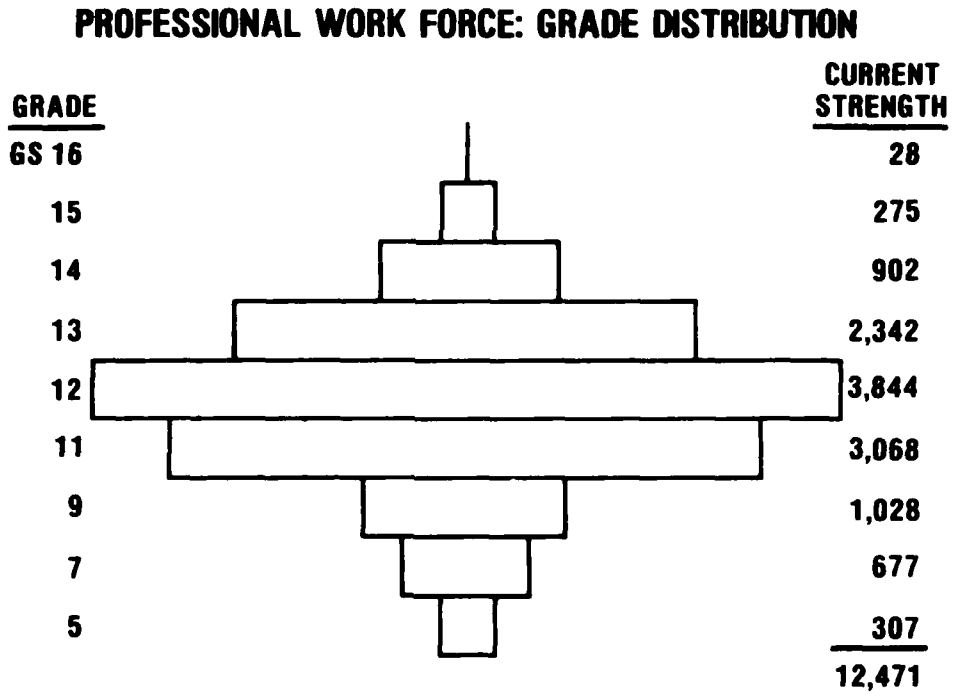

Figure 13

a. Each GS grade level was analyzed to determine the average number of vacancies being created annually due to promotions, retirements, and other reasons. Lateral job changes within grade were not examined. Figure 14 shows

the results for a 1-year period. This figure shows the demand on the next lower grade as vacancies occur at each higher grade level. The extent of the demand for a 1-year period is shown in the right column and by the shaded portions of the bars. As indicated, the 1-year turnover is expected to be low to moderate. The vacancies at the upper grades can generally be filled with the top 10 percent of the next lower grades. However, at the lower grades, a substantial excess demand occurs totaling over 400 persons, which must be satisfied by recruiting.

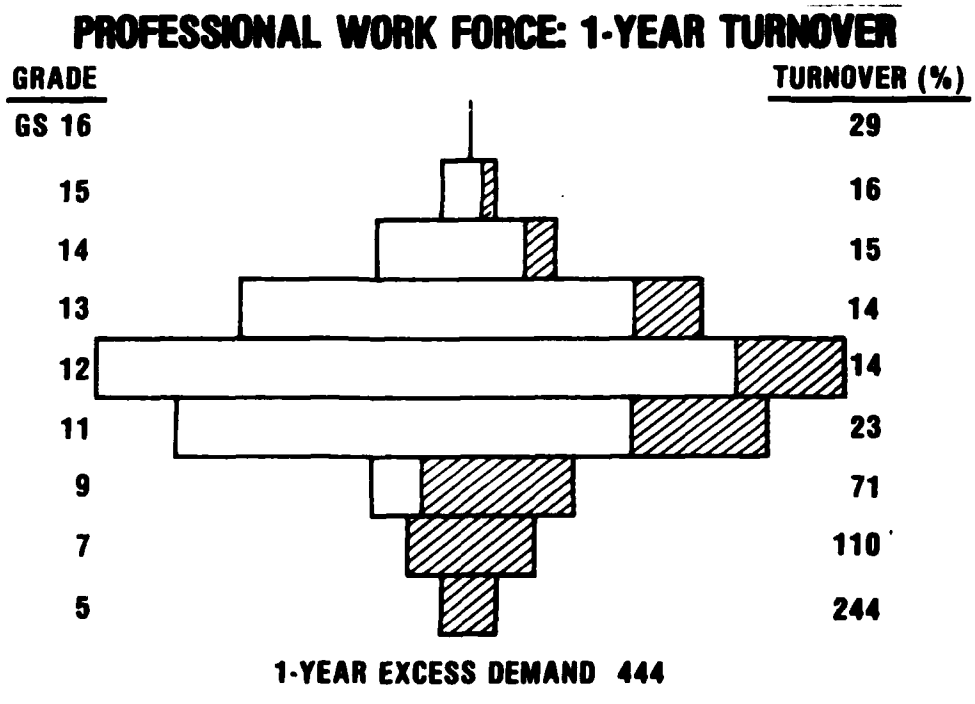

Figure 14

b. The investigation was extended to cover a 5-year period. Figure 15 shows the 5-year cumulative turnover to be much more severe than the turnover for a single year. During the longer period, over 65 percent of the personnel at each grade level will become new in their positions. Moreover, the excess demand at the lower grade levels will total over 3,400 persons. While this turnover imposes a significant employee development requirement, it also provides the opportunity to mold the future work force to meet the changing demands that the Corps will face.

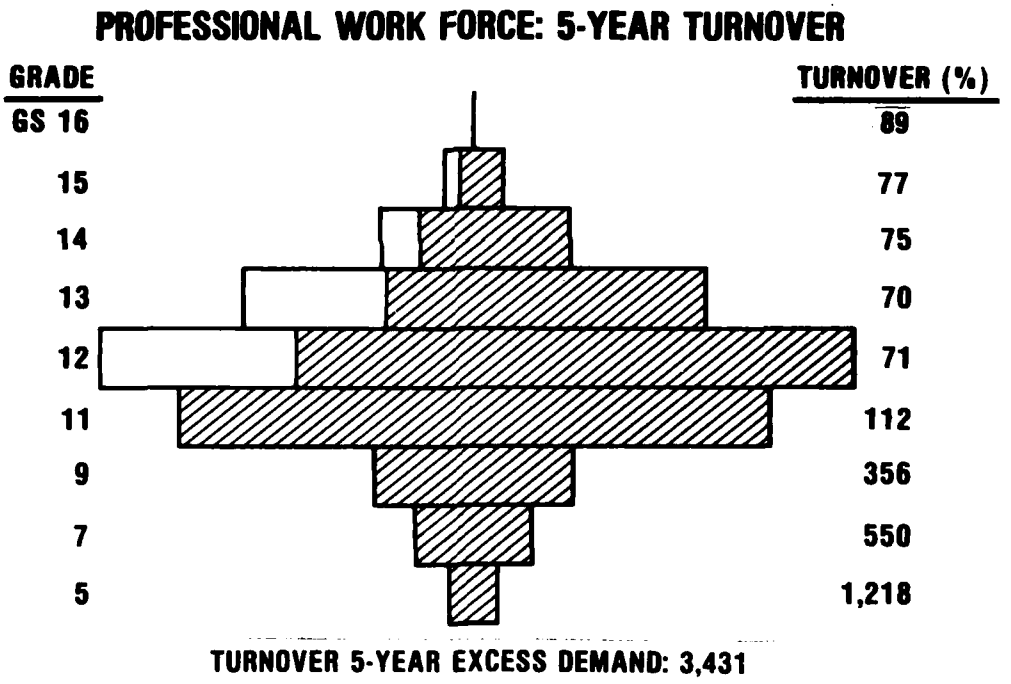

Figure 15

29. Management Implications of the CSRA. The overall philosophy of the CSRA is to put "people management" responsibility on the line manager where it belongs. The key mechanism CSRA provides for doing this is the requirement to

define organizational objectives in terms of major elements and tasks for every job, making the performance standards for those elements and tasks clear to the employees, and then measuring employee performance based on achievement of those standards. These elements and tasks should be succinctly stated in all job descriptions.

a. CSRA provides the manager the authority to reward employees based on and proportional to the quality of their performance--even to the extent of termination. It also provides impetus and an umbrella for implementing a number of personnel management changes recognized as needed in the Corps. It fosters decentralized personnel administration which is appropriate to the Corps' general management style and consistent with the expressed wishes of its field organizations. The Corps has started implementation. The goal is to implement not just the specific provisions of the Act, but to infuse creatively the spirit and philosophy of the Act throughout the Corps personnel management system. Success will depend on the continued personal attention of top-level Corps management.

b. Abuse of the CSRA concept and philosophy could create greater management problems than those existing with the present system. Some critics of CSRA are concerned about the "punishment" aspects espoused in the Act (e.g., the annual awarding/withholding of comparability pay and the annual decision on promotion/demotion). Care must be taken during the implementation of CSRA in the Corps to be fully considerate of such concerns and to not sacrifice personnel morale (presently high and climbing) in an attempt to satisfy the perceived intent of the law.

30. <u>People Management--Today and Tomorrow</u>. The ESC analysis took a broad look at the Corps work force management processes and policies and

analyzed their appropriateness in preparing the organization for a healthy future. The focus was on recruitment, training, career development, MIS, and organizational work climate. Recommendations resulted concerning policies and actions to enable the Corps to shape the current and future work force to meet expected future mission requirements. Each of these areas is addressed in detail in the monograph, Managing the Corps Work Force. Three of the areas are highlighted below.

a. Effective filling of vacancies. One key to being ready for the future is to consider all position vacancies as opportunities for growth and improvement. To do this, the Corps must have the capability to select and promote the best qualified candidates. CERL and the Institute for Behavior Research in Creativity (IBRIC) have done some important and promising pioneer work in developing tools to facilitate the selection process. For example, these organizations have developed a biographical inventory form, an inventory manual and guide, a validated system of peer rankings, and a system for supplementing the skills, knowledge, ability, and personal characteristics (SKAP) supervisory ratings with second-level supervisory ratings. The Corps should seriously consider adopting such tools.

b. MIS. During the data-gathering phase of the project, it became evident that it is entirely too difficult to account for Corps employees and their activities. In order to acquire the necessary data, the study team had many dealings with those aspects of the Corps' MIS which are dedicated to quantifying the human resources of the Corps in ways that describe their current activities, previous experience, and future traits (e.g., projected demographics). The evidence indicates that the Corps undertook an ambitious project when it set out to accumulate, synthesize, and disseminate human

resources data of relevance to a highly decentralized organization such as the Corps. Incomplete location and occupational series data proved a great source of confusion. The lack of historical records was also a problem and caused a great deal of necessary but costly investigative work. Perhaps most alarming was the impression that much of the data being processed is never used by a decision maker and, conversely, that relevant data are not being kept routinely.

c. Human resources management. The essence of the Corps' human resources management problems is the need to develop an organization which meshes its operational activities and objectives with the skills and objectives of its individual employees. For example, one Corps challenge is to offset a current shortage of managers. Complementary individual objectives of Corps employees would involve actions to prepare them to become effective managers. This situation is exaggerated in its complexity by the Corps commitment to decentralized management and creating an environment of regional commitment and effectiveness. It is thus difficult to generalize when describing the Corps, its employees, or its activities. Some recent research, however, has focused effectively on common aspects/attributes of Corps operations.

(1) CERL's Job Activities Description (JAD) questionnaire resulted in a quantitative statement of the Corps' need to make sure that its managers spend their time on managerial tasks. The JAD questionnaire revealed that current Corps management personnel (from a random sample of personnel in grades GS-11 through GS-16) devote the bulk of their time to activities not managerial in character and which they rate as less important than their management tasks. This questionnaire also revealed that the preponderance of

Corps civilian engineer managers, at all levels, do not see the management of change as an important part of their jobs.

(2) In conjunction with IBRIC, CERL has also developed a management tool which measures the work climate of an organization in relation to other organizations and its own component elements. This tool, the Management Audit Survey (MAS), has been designed to fit Corps operations and was administered to three[5/] Corps elements to ascertain its effectiveness in diagnosing and improving the management climate. MAS measures 19 score areas encompassing a broad spectrum of management interests. The resultant scores enable assessment of organizational climate today with an implied plan for future improvements. These data are then dealt with through the interaction of a trained "facilitator" and the supervisors of the work elements being surveyed. Because a high level of confidentiality is maintained, the resultant scores form a nonthreatening stimulus which energizes each individual to strive to improve his/her own scoring in subsequent MAS administrations. To give some idea of the nature of information collected and its appropriate usage:

(a) The MAS scores for Corps organizations indicated a high "climate of innovation." This would seem to contradict the JAD data which indicated that "no one considered managing change their responsibility." One presumption or inference would be that the Corps employees believe that change occurs <u>despite</u> managerial influence rather than as a result of it.

(b) Three of the Corps organizations surveyed in developmental testing situations scored the poorest employee performance feedback ratings of all private and governmental organizations audited (over 40,000

5/ Two more installations (Los Angeles District and ESC) have conducted the MAS as separate parts of organizational development and training needs identification initiatives.

individuals to date). The strong implication is that Corps managers are not seen by their subordinates as being concerned with employee development, or at least as being ineffective at it.

(c) Similar complaints were repeatedly voiced during the field visits for the study. This subjective indicator, plus the MAS's more quantitative measures, signal a need for management training and emphasis. The expected large turnover in the Corps work force strongly suggests a large and continuing requirement for employee development. A large part of this development should be in managerial techniques and policies. Supervisors need to be more aware that effective feedback to employees is an important part of their jobs.

31. Training and Development Needs. A comprehensive training and development program is essential to developing the future Corps work force. To appraise the consistency of this program with respect to organizational needs, an analysis was made to determine where improvements could be made to enhance responsiveness to work force needs. This analysis focused on three areas: specific courses that need to be established, organizational changes that need to be made, and funds-related initiatives that need to be undertaken.

a. New course requirements. Figure 16 summarizes new courses which should be established to accommodate Corps training needs over the next 5 years. These courses fall into four general categories--mobilization support, management, RPMA, and CSRA implementation--with the major needs being in the management area. These additional courses are considered to be the minimum necessary to ensure continued Corps effectiveness in carrying out future missions.

NEW COURSES--1980-1985

Description	Student Potential	Frequency	Length (Hrs)	Location
Mobilization Orientation	40,000	One-time	1	Div/Dist/FOA
Mobilization Management	200	6 per year	80	HND
Mobilization Planner	100	4 per year	80	HND
Mobilization Cross Training	20,000	115 per year	40-80	HND[a/]
Management, General	650	4 per year	160	HND
Management, Project/Program	2,200	12 per year	80	HND[a/]
Management, Contract	Unknown	27 per year	40-80	HND
RPMA Orientation[b/]	5,000	One-time	8	Div/Dist/FOA
RPMA Management	500	3 per year	40	HND
CSRA Implementation	3,600	One-time	8	Div/Dist/FOA

a/ Could be presented at division/district/field operating agency (FOA).
b/ Contingent on Corps acceptance of expanded RPMA mission.

Figure 16

b. Organizational changes. Analysis disclosed that the continuity of the training and development program can be improved through minor realignments in program responsibilities. These alignments, outlined in the training and development monograph, consist of organizational changes to improve communication, increasing the breadth of managerial involvement in the program, and raising the priority of training and development considerations in the decision-making process. It was also found that the program could be improved further if training officers were given a larger role in organizational management and were better prepared to carry out their functions as an interactive member of the organizational staff.

c. Funding initiatives. The Corps needs to increase its level of funding for training and development activities. Our analysis revealed that

while funding levels have been growing in recent years, the growth has not been keeping pace with inflation. As a result, the number of training incidences has been decreasing at a time when an increase is needed. To offset this trend, training and development should be funded as a percentage of the operational budget to ensure that the future program is more consistent with operational needs. At present, Corps training and development expenditures amount to approximately 0.5 percent of the annual operating budget. This should be considered the absolute minimum proportion of the budget committed to training. Since the Corps is revitalizing its capabilities for mobilization support, this commitment should be increased incrementally to meet additional requirements. Moving toward allocating 1 percent of budget to training over the next 5 years will enable the Corps to keep pace with its increased responsibilities. Also, "fencing" these funds would ensure maximum coherence in the training and development program and consistency from year to year.

32. Conclusion. Human resources management is a relatively new field which abounds with opportunities for the forward-looking manager. The Corps of Engineers has earned wide recognition for some of the strides it has made in this area.[6/] Development of the RMO, insightful guidance by the Chief of Engineers, innovative research and testing through the auspices of CERL contracts with IBRIC, and concentration on improving in-house training and career development have all combined to give the Corps a head start in better human resources management. The Corps cannot afford to lose the initiative.

6/ For example, see Brookings Institute, Can Organizations Change?

VI. RECOMMENDATIONS

33. Exploiting Opportunities. Advantage should be taken of opportunities afforded by new domestic and foreign missions during the next decade to mold the future work force to meet changing demands the Corps will face and to apply the Corps' many talented resources to solving a wider spectrum of the Nation's problems. This goal can be achieved by seeking missions that are mainstream to long-term national interests--water supply, energy, and national defense. Since it is likely that manpower restrictions will continue, the Corps should be highly selective in the missions it seeks to ensure that maximum advantage is taken of these opportunities.

34. Developing the Work Force. Increased emphasis should be accorded to developing the future Corps work force to ensure that needed skills are acquired and maintained. New missions, changing technology, and normal attrition will all serve to create future skill shortages which must be filled through recruitment and/or training and development programs. Steps should be taken to strengthen recruitment and employee development programs. Recruitment responsibilities should be further decentralized to reduce current time required to fill vacancies. Corps in-house training capacities should be increased and required resources committed to accommodate skill needs identified in this study. Career development should receive greater emphasis. The Corps should take action to create coordinated training and developmental assignments which will provide the proper mix of skills and managers and give individual employees clearly defined opportunities and milestones.

35. Managing the Work Force. The Corps should extend the strides it has made in the human resources management area. Now is the time to progress as

rapidly as possible along the routes already being probed. Specifically, the Corps should:

a. Place heavy reliance on local civilian personnel offices for aggressive recruitment action. This recommendation includes open advertising of vacancies and conducting job analyses and writing job sheets to allow the widest possible range of candidates to qualify for consideration.

b. Continue developing tools which will lead to better selections among applicants for vacancies, especially for managerial positions.

c. Take advantage of the work done by CERL and IBRIC as the basis for a vocabulary of job tasks and quantification criteria. The impetus for such an effort is provided by the CSRA requirements to conduct a job analysis and rewrite job descriptions and develop a new performance appraisal system.

d. Conduct an initial administration of the MAS for as many Corps elements as possible prior to implementation of the CSRA provisions pertaining to performance appraisals, merit pay, and revised job descriptions. The resultant data should provide a pre-CSRA baseline.

e. Vigorously revise the Corps MIS to enable accurate headcounting and quantification of organizational elements and to make sure that the data being processed have decision-making relevance.

36. Filling Key Skill Needs. The following specific actions should be taken to fill skill needs identified in this study.

a. Management. Establish appropriate project management courses to fill the need for study/project managers, assess the need for general manager positions at division and district levels, and initiate actions to recognize contract management as a recognized career series.

b. Technical. Increase promotional opportunities and enlarge training capacity at HEC to fill the need for hydrologic engineering skills, intensify recruitment efforts to acquire mechanical and electrical engineers, and expand the throughput of training facilities for construction inspectors.

c. Mission support. Provide better career opportunities and eliminate present grade plateaus for accountants, and establish more positions in the structure for auditors.

37. Implementing CSRA. The Corps should vigorously implement the provisions of CSRA as a priority matter. It should be implemented through the line managers with the support of the civilian personnel offices. Every Corps position should be reviewed, job standards established, and critical job elements identified. The latter should serve as the basis for measuring individual performance. Recruitment, utilization, and development of people should be made a mandatory critical job element for all managers and supervisors to ensure future strength of the Corps.

38. Continued Attention. As a final recommendation, ESC believes the importance of acquiring and maintaining a responsive work force warrants the need for periodic review of Corps requirements. RMO should conduct this review at least every other year.

LAST PAGE OF MAIN PAPER

ANNEX A

ECONOMIC, POLITICAL, DEMOGRAPHIC, AND SOCIAL TRENDS

ANNEX A

ECONOMIC, POLITICAL, DEMOGRAPHIC, AND SOCIAL TRENDS

1. Historic Overview. National economic, political, demographic, and social trends will play an integral part in determining the Corps' future. Though the impacts of change are worldwide in scope, they are nowhere more clearly evident than in the US. During the first 50 years, the application of science and technology resulted in major achievements in industrial production, transportation, medicine, and agriculture. By mid-century, many Americans envisioned that this progress would continue indefinitely. Yet, by the early 1970's, optimism for the remainder of the century had significantly declined. During the late 1960's and early 1970's, fundamental changes in values and attitudes altered the fabric of American life. The media labels for the most visible of these changes have become household words: "Civil Rights," "Black Revolution," "Women's Equal Rights," "Peaceniks," "Environmentalists," "War on Poverty," "Generation Gap," "Watergate," "Inflation," "Recession," "Stagflation," "Worker Discontent," "Sexual Revolution," "Energy Shortage," and many others. While the Nation is adjusting to the new economic realities of shortages in energy, minerals, and capital; new mores, values, and attitudes are emerging and becoming institutionalized.

2. Major Trends. The following environmental areas are especially susceptible to trends which will impact on the Corps and influence its future.

a. The economy.

(1) Foods, goods, and services. As Third World areas continue to develop, their needs will fuel the productive capacity of the industrialized nations. Population growth in these areas is greater than the growth of food production; thus, there will be increasing demand for US agricultural products.

(2) Competition for US markets abroad. International markets long enjoyed by US business are being successfully invaded by French, German, and Japanese enterprises. Even the preeminent US construction industry—steeped in Yankee "know how"--is feeling the sting of outside competition.

(3) US productivity down and unit costs increasing. The growth of "bureaucratization" is affecting not only government, but is sapping the vigor of US industry as well. Figure A-1 depicts trends for the US non-government service sector for 1967 through 1977. The figure shows that productivity has leveled off while real costs have risen sharply.

(4) Energy available for growth is down. Kilocalories are becoming the actual currency of world economics. Contemporary Western society is intrinsically dependent on petroleum and its byproducts. As the world's available supply of oil diminished relative to demand, it provided the Organization of Petroleum Exporting Countries (OPEC) the opportunity for price control. Rapidly increasing oil prices have directly affected the balance of payment flows, the stability of the US dollar in the international money markets, and the US standard of living. Less widely understood is the indirect effect on the national economy. As the primary supply source of oil

SERVICE EMPLOYMENT SECTOR–US ECONOMY NON-GOVERNMENT

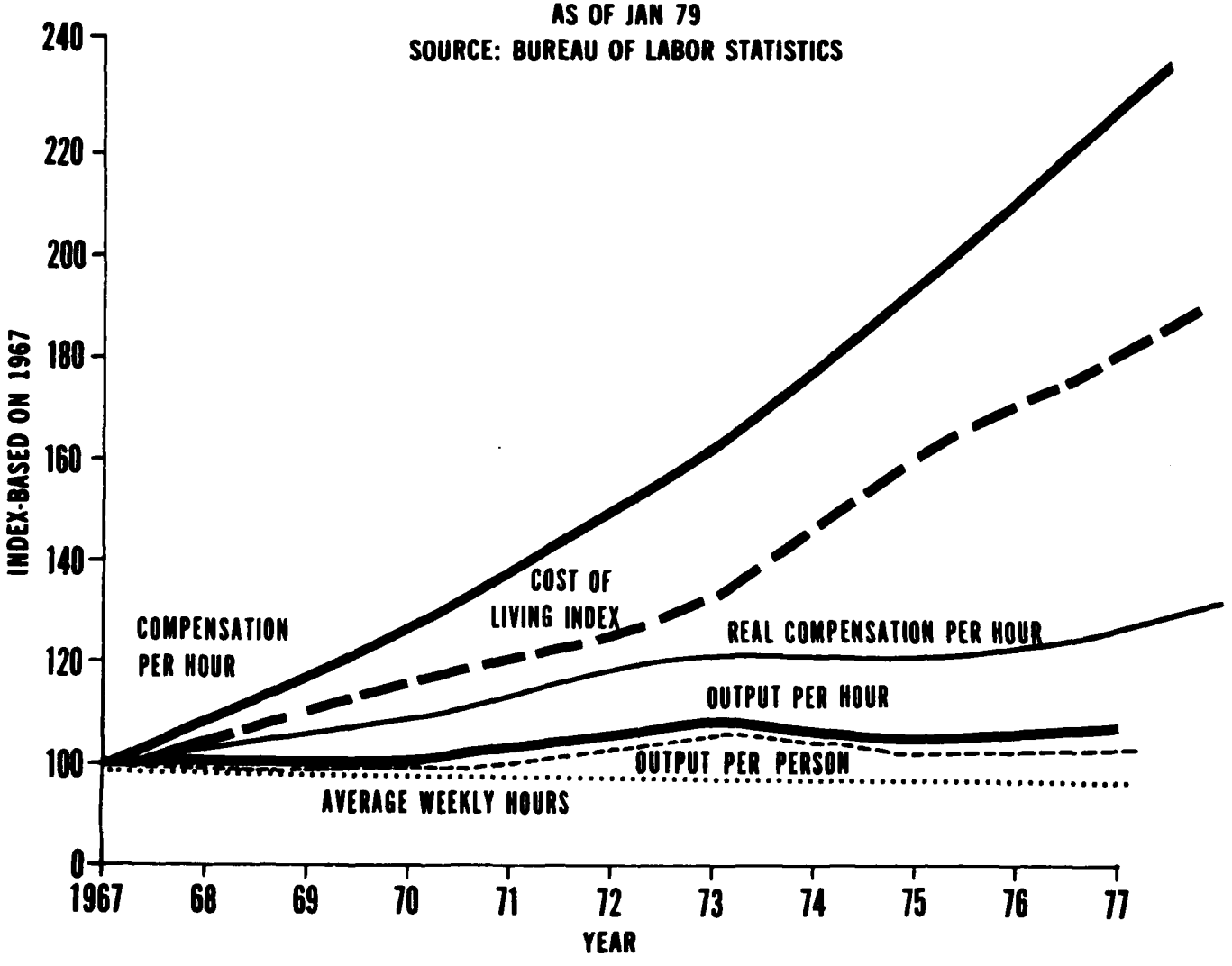

Figure A-1

decreases, substitute sources are sought. These activities themselves consume energy; therefore, the net proportion of energy available for consumption is growing more slowly than the proportion being plowed back to get additional energy. A growing proportion of every barrel of oil is being invested to get more oil. This plowback is paid for inevitably by the consumer in higher costs for end-product goods and services. To appreciate fully the extent to which this affects the cost of living, one need only consider the degree to which products dependent on petroleum hydrocarbons (e.g., plastics, manmade fibers, and fertilizers) touch our lives. Direct and indirect energy costs will continue to drive inflation for at least the next decade. In the US, the most visible impacts of this will be in transportation, housing, and agriculture. Since real growth requires an availability of excess energy to sustain it, energy availability and distribution will be the primary constraint on future development.

(5) Investment capital scarce and cost increasing. The US prime-interest rate is fluctuating at a relatively high level. Many events have contributed to a critical shortage of investment capital. Postponement of industrial plant modernization has resulted in many American industries falling behind the unit cost of production of foreign competitors. Large investments are needed to remain viable in both international and domestic markets. The strategic balance between the US and the Soviet Union is shifting, and the US must make heavy capital investment to assure the survivability of its strategic nuclear capability. Energy demand will require immense investments in future petroleum exploration and transport systems, in fossil fuel conversion and support systems, and in developing other alternative energy sources. Current trends indicate that traditional growth of US markets

and industrial efficiency can no longer be taken for granted. The US will be forced to make substantial capital investments in energy systems to sustain a standard of living acceptable to the public.

b. Political. The Civil Rights Movement and Anti-war Movement demonstrated the effectiveness of prolonged organized protest in changing both governmental policy and the societal value structure. The Environmental Movement met with equal success against long entrenched special interests and governments at all levels. The process of active public participation is becoming an institution and can be expected to grow in the future. A number of legislative actions such as the Environmental Impact Statements required by NEPA, access to government action, and decision papers under the Freedom of Information Act ensure continued public involvement. Currently, agricultural interests, energy interests, and the Federal and State Governments are positioning for a confrontation over how the water resources of the upper Midwest (Colorado, Montana, and Wyoming) shall be shared in the future. The outcome of this struggle may well determine the Nation's future for the rest of the century.

c. Demography.

(1) Population distribution by age. The US population by year of birth, illustrated in Figure A-2, clearly shows the cyclic birth pattern and the bulging "baby boom" cohorts following the close of World War II (1946-64). The largest group, 1957, is now 23 years old, has completed college, and is entering the labor force. This group will be at the prime of their working lives at the close of the century. The last of the large groups (1964), now 15, will be 36 at the turn of the century, matured and ready to move up in organizational responsibility. Following the 1964 group, there are 13 smaller

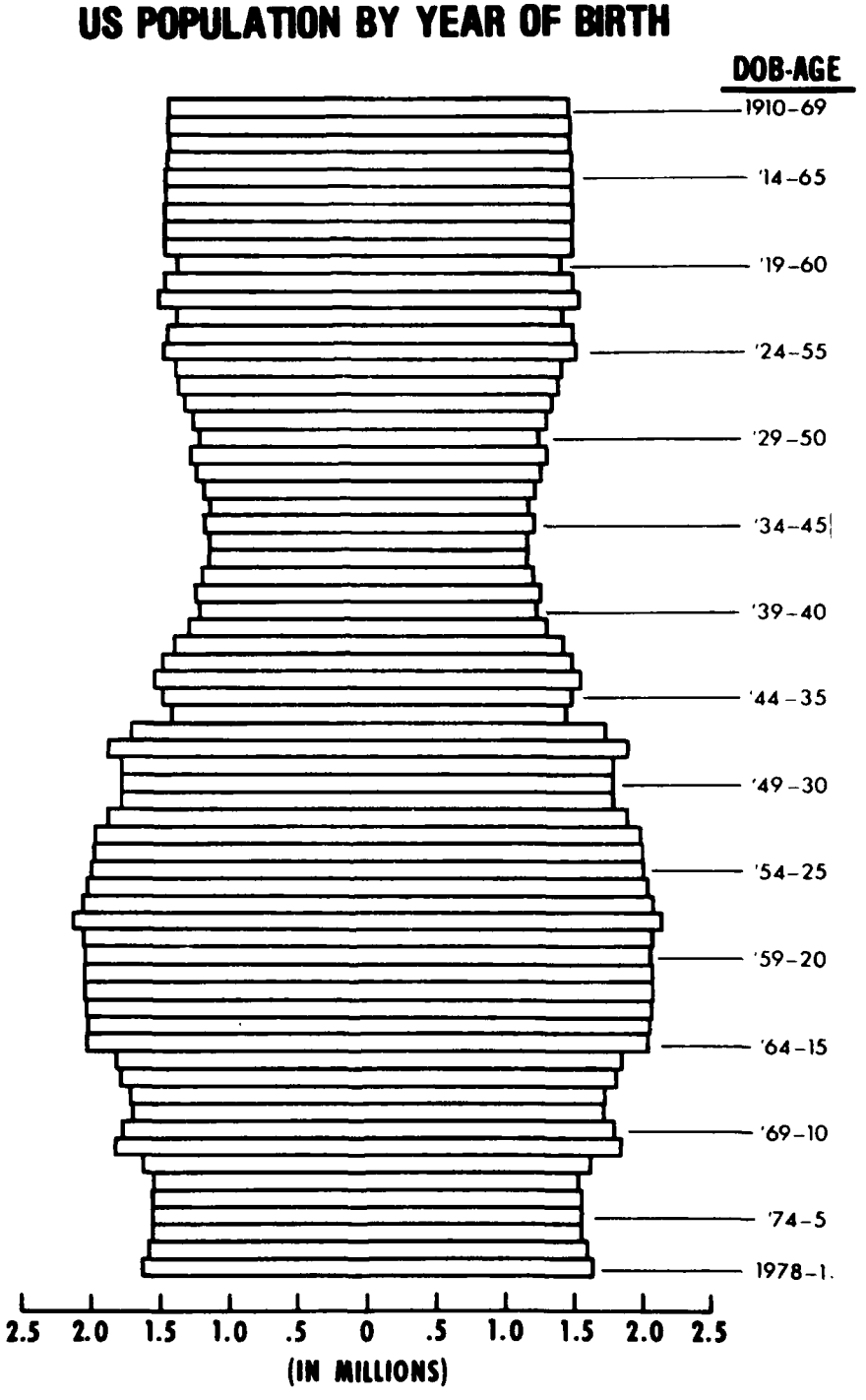
US POPULATION BY YEAR OF BIRTH
DOB-AGE
1910-69
'14-65
'19-60
'24-55
'29-50
'34-45
'39-40
'44-35
'49-30
'54-25
'59-20
'64-15
'69-10
'74-5
1978-1
2.5 2.0 1.5 1.0 .5 0 .5 1.0 1.5 2.0 2.5
(IN MILLIONS)

Figure A-2

cohorts that will start entering the labor force between 1985 and 1990. Starting in this period and continuing for 20 or more years, there may be a shortage and keen competition for high-quality, entry-level people. Trends helping to offset the problem are individuals staying longer in the work force, minorities and women entering into a wider range of jobs, and increased immigration. The birth rate is dropping, but another grouping of larger cohorts is expected to be born during the 1980's and 1990's as the "baby boom" group moves through its child-bearing years. There is a current shortage of members in the work force (in the 40 to 50 age groups) for upper management positions. Competition for capable managers is already being reported and will continue for the next 5 to 10 years. As a consequence, the younger employees are being moved faster to upper management positions.

(2) Changing urban patterns. Suburban growth will continue to the end of the century as the "baby boom" generation seeks housing. Energy availability will have an important impact on urban growth. Increasing transportation costs will continue to make rehabilitation of inner-city areas both desirable and economically feasible to small private investors. This rehabilitation process will to a lesser degree continue to need public subsidy. Rising cost of heating fuels and water and sewage services will tend to increase the cost of new residences, making rehabilitation of older residences with established services a more economical alternative. The pace of outlying urban development, with attendant heavy energy subsidy, will slacken. While uncontrolled growth will also continue in many areas, general land use planning will come into wide application, with greater emphasis on the environmental and energy consequences of development and with a greater degree of public

participation in the planning. Water supply, quality, and conservation will become an increasingly important constraint on urban development.

d. Sociology. Social attitudes and values are changing rapidly in the US. Increasing tolerance of a multitude of life styles and living arrangements, dual (male-female) careers, and changing sexual mores are modifying traditional concepts of marriage and family. Emphasis of values is shifting from material acquisition toward the "quality" of life. Although the traditional work ethic has not diminished, it is tempered by a broader set of values for self-fulfillment. More and more employers are finding that employees are demanding a greater degree of control over their lives, including work. This trend can be expected to continue and employers must accommodate it to remain competitive in the labor market.

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ANNEX B

BIBLIOGRAPHY

ANNEX B

BIBLIOGRAPHY

1. Brookings Institute, Can Organizations Change? By D. A. Mazmanian and J. Nienaber. Washington, D. C., 1979.

2. Collins, Glenn, "The Good News About 1984," Psychology Today. January 1979.

3. Congress of the United States, 95th Congress, Public Law 95-454, An Act to Reform the Civil Service Laws. Washington, D. C., 13 October 1978.

4. Cooper, M. R., et. al., "Changing Employee Values: Deepening Discontent?" Harvard Business Review. January-February 1979.

5. Department of Defense, Defense Intelligence Agency, DIA Review and Analysis of General Intelligence Career Development Program Annual Status Report for 1978. Washington, D. C., 1978.

6. Department of Defense, Defense Mapping Agency Hydrographic/Topographic Center, Civil Service Reform Act of 1978. Washington, D. C., 15 November 1978.

7. _____, "Merit Pay Provisions," Surf 'n Turf. 20 July 1979.

8. Department of the Army, Headquarters, AR 5-1, Management--Army Management Doctrine. Washington, D. C., 6 August 1973.

9. _____, AR 18-1, MIS Policies and Objectives, Procedures and Responsibilities. Washington, D. C., March 1976.

10. _____, AR 18-7, Army Automation, Data Processing, Activity Management, Procedures, and Standards. Washington, D. C., July 1978.

11. _____, AR 680-3330, Reporting Requirements Under the Civilian Personnel Information System. Washington, D. C., July 1975.

12. _____, DA Pamphlet 570-551, Staffing Guide for US Army Garrisons. Washington, D. C., January 1972 with Change 6 dated 15 October 1978.

13. _____, DA Pamphlet 690-10, A Candidate Evaluation System. Washington, D. C., September 1979.

14. _____, DA Pamphlet 690-11, Guide to Civilian Personnel Management for Key Military Personnel. Washington, D. C., September 1979.

15. Department of the Army, Headquarters, Civilian Personnel Center, CPR 950-1, Career Management. Washington, D. C., November 1977.

16. Department of the Army, Headquarters, Civilian Personnel Center, CPR 950-18, Army Civilian Career Programs for Engineers and Scientists. Washington, D. C., April 1965.

17. _____, CSGPA-1103, CIVPERSINS Profile Report. Washington, D. C., January-March 1979.

18. Department of the Army, Office of the Chief of Engineers, Careers. Washington, D. C., Undated.

19. _____, Corps of Engineers Performance Measurement System (CEPMS). Washington, D. C., Reports from 1975 through 1979.

20. _____, EC 690-1-218, Civilian Personnel Program Evaluation. Washington, D. C., Quarterly Reports, Dates Unknown.

21. _____, EP 18-1-13, Resource Allocation/Project Management Analysts Guide. Draft. Washington, D. C., Unpublished.

22. _____, EP 335-1-1, Reports and Statistics--Register of Management Information Requirements. Washington, D. C., 29 December 1978.

23. _____, EP 350-1-5, Managers and Supervisors Training Handbook. (Also known as the Purple Book.) Washington, D. C., 15 February 1977 and July 1977.

24. _____, EP 350-1-6, Employee Development in the Corps of Engineers--A District Engineer's Primer. Washington, D. C., 28 April 1977.

25. _____, EP 360-1-15, The Corps of Engineers and the American Environment--Past, Present, and Future. Washington, D. C., August 1978.

26. _____, ER 350-1-414, Training--Corps of Engineers Training Program. Washington, D. C., 31 January 1980.

27. _____, ER 690-1-2, Equal Employment Opportunity Policy Statement by Chief of Engineers. Washington, D. C., 1 October 1978.

28. _____, ER 690-1-291, Civilian Personnel Reports. Washington, D. C., 1 November 1977.

29. _____, ER 690-1-300, Civilian Personnel--Employment. Washington, D. C., 12 August 1975.

30. _____, ER 690-1-958, Army Civilian Career Program for Engineers and Scientists. Washington, D. C., June 1972.

31. _____, Manpower Survey. Washington, D. C., Surveys dated 1960 through 1978.

32. _____, Memorandum to Multiple Addressees, Personal Objectives. Washington, D. C., 3 July 1979.

33. Department of the Army, Office of the Chief of Engineers, DF, Philosophy of Management for Civil Works Directorate. Washington, D. C., 4 January 1973.

34. _____, Program Review and Analysis. Washington, D. C., Reports dated 1961 through 1975.

35. _____, Resume of Chief of Engineers' Personal Program for Period 1 July 76-30 June 80. Washington, D. C., 1 June 1979.

36. _____, 638 data sheets containing information extracted from civilian personnel 201 files. Washington, D. C., Dates Unknown (CONFIDENTIAL-HISTORICAL).

37. Department of the Army, Office of the Chief of Engineers, Directorate of Civil Works, Resource Analysis Tables (RAT). Washington, D. C., Quarterly Reports, Dates Unknown.

38. Department of the Army, Office of the Chief of Engineers, Directorate of Military Programs, Military Organization Utilization System (MOUS). Washington, D. C., Annual Reports, Dates Unknown.

39. Department of the Army, Office of the Chief of Engineers, Division and District Offices, Career Program Interns (Intake). Completed DA Forms 4472-1R. Washington, D. C., Forms dated 1976 through 1978.

40. Department of the Army, Office of the Chief of Engineers, Engineer Automation Management Office (formerly Engineer Information and Data Systems Office), COEMIS F&A Subsystem. Washington, D. C., February 1972.

41. Department of the Army, Office of the Chief of Engineers, Engineering Automation Support Activity (formerly Engineer Data Processing Center), Corps of Engineers Performance Measurement Systems (CEPMS). Washington, D. C., Reports dated 1975 through 1979.

42. _____, Corps Stratification. Washington, D. C., Reports dated 1975 through 1979.

43. _____, CE Strength as of 31 Dec 75. Washington, D. C., 1975.

44. _____, CE Strength as of 31 Dec 76. Washington, D. C., 1976.

45. _____, CE Strength as of 31 Dec 77. Washington, D. C., 1977.

46. _____, CE Strength as of 30 Nov 78. Washington, D. C., 1978.

47. _____, Printout of select entries from automated files containing information recorded on DA Forms 2302. Washington, D. C., January 1979.

48. Department of the Army, Office of the Chief of Engineers, Office of the Special Assistant for Foreign Affairs, Special Report to the Chief of Engineers. Washington, D. C., May 1979.

49. Department of the Army, Office of the Chief of Engineers, Omaha District, Public Affairs Office, "Management Audit Survey," The Omaha District Newsletter. Omaha, Nebraska, January 1979.

50. Department of the Army, Office of the Chief of Engineers, Resource Management Office, Manpower Programs Allocation and Utilization Branch, Manpower Status, 31 Mar 79. Washington, D. C., 1979.

51. Department of the Army, Office of the Chief of Engineers, United States Army Engineer Studies Center (formerly Engineer Studies Group), An Evaluation of CE Civilian Training. Washington, D. C., January 1977.

52. _____, Corps Mobilization Capabilities, Requirements, and Planning. Washington, D. C., March 1980.

53. _____, Corps Mobilization Posture. Washington, D. C., February 1980.

54. _____, Corps Stratification (CORPSTRAT). Washington, D. C., Reports dated 1975 through 1979.

55. _____, Corps Work Force Mobility. Washington, D. C., August 1979.

56. _____, Engineer After Action Report, Exercise Prize Gauntlet (U). Washington, D. C., April 1980 (SECRET).

57. _____, Field Review of Corps Organization and Resources. Washington, D. C., July 1977.

58. _____, Management Implications of the Civil Service Reform Act (CSRA). Washington, D. C., September 1979.

59. _____, Managing the Corps Work Force. Washington, D. C., July 1980.

60. _____, National Security Aspects of the Federal Dredge Fleet. Washington, D. C., September 1978.

61. _____, New Missions--Functional Impacts. Interview between Mr. James Kirkpatrick, ESC and Mr. D. Duncan, OCE, Civil Works Directorate, Office of Policy. Washington, D. C., September 1979.

62. _____, OCE Organizational Realignment. Washington, D. C., May 1977.

63. _____, Review of Computer Applications and Programs. Washington, D. C., March 1974.

64. _____, The Corps Work Force in Transition. Washington, D. C., July 1980.

65. _____, Work Force Training and Development for the 1980's. Washington, D. C., July 1980.

66. Department of the Army, Office of the Deputy Chief of Staff for Personnel, DCSPER 322, Monthly Command Strength Report. Washington, D. C., January, February, March 1979.

67. Department of the Army, United States Army Audit Agency, Report of Audit: Selected Aspects of DA Civilian Career Management. Washington, D. C., April 1979 (FOR OFFICIAL USE ONLY).

68. Drucker, Peter F., "The Relevance of Management Education," Perspectives in Defense Management. 1969.

69. Engineering Manpower Commission of Engineers Joint Council, Measuring and Forecasting Engineering Personnel Requirements. New York, New York, August 1978.

70. Executive Office of the President, Office of Management and Budget, Circular No. A-76, Policies for Acquiring Commercial or Industrial Projects and Services Needed by the Government. Washington, D. C., 29 March 1979.

71. General Accounting Office, Comptroller General of the United States, Report by the Comptroller General--Administrative Weaknesses in St. Louis' Comprehensive Employment and Training Act Program. HRD-79-15. Washington, D. C., 2 March 1979.

72. _____, Report by the Comptroller General--More Effective Management is Needed to Improve the Quality of the Summer Youth Employment Program. HRD-79-45. Washington, D. C., 20 February 1979.

73. _____, Report by the Comptroller General of the United States--Major Federal Equal Employment Opportunity Programs for the Private Sector Should be Consolidated. HRD-78-72. Washington, D. C., 9 June 1978.

74. _____, Report by the Comptroller General of the United States--Much More Could be Done for Veterans in Employment and Training Programs. HRD-78-166. Washington, D. C., 29 December 1978.

75. _____, Report by the Comptroller General to the Congress of the United States--Job Training Programs Need More Effective Management. HRD-78-96. Washington, D. C., 7 July 1978.

76. _____, Report to the Congress of the United States by the Comptroller General--A Management Concern: How to Deal With the Nonproductive Federal Employee. FPCD-78-71. Washington, D. C., 10 August 1978.

77. _____, Report to the Congress--Personnel Restrictions and Cutbacks in Executive Agencies: Need for Caution. FPCD-77-85. Washington, D. C., 9 February 1978.

78. _____, Report to the Congress--Problems with Federal Equal Employment Opportunity Guidelines on Employee Selection Procedures: Need to be Resolved. FPCD-77-54. Washington, D. C., 2 February 1978.

79. Honeywell Information System, Inc., Management Data Query System IV. Order No. DD92. Waltham, Massachusetts, August 1976.

80. _____, Programming Management Data Query System II. Order No. A437. Waltham, Massachusetts, March 1977.

81. "How PRI Helps Locate Talent," Business Week. 18 September 1978.

82. Institute for Behavioral Research in Creativity, Applications of the Management Audit Survey (MAS) to the U.S. Army Corps of Engineers--Final Report. By Robert L. Ellison, et. al. CERL Contract DACA 88-78-C-0010. Salt Lake City, Utah, July 1979.

83. _____, The Development of Preliminary Performance Indicators for the Selection of Managerial Talent in the U.S. Army Corps of Engineers. By Robert L. Ellison, et. al. CERL Contract No. DACA 88-77-C-0004. Salt Lake City, Utah, September 1977.

84. _____, The Job Activities Description (JAD) Questionnaire: An Analysis of Time Spent on and Importance of Managerial Duties. By Robert L. Ellison, et. al. for CERL. Salt Lake City, Utah, November 1978.

85. Institute for Behavioral Research in Creativity and Department of the Army, Office of the Chief of Engineers, Construction Engineering Research Laboratory, jointly, The Job Activities Description (JAD) *Questionnaire: An Analysis of Time Spent on and Importance of Managerial Duties*. Interim Report E157 by Robert L. Ellison, et. al. Champaign, Illinois, September 1978.

86. Lawler, Edward E., "Performance Appraisal and Merit Pay," Civil Service Journal. April-June 1979.

87. Levinson, Harry, "On Being a Middle-Aged Manager," Harvard Business Review. July-August 1969.

88. Mintzberg, Henry, The Nature of Managerial Work. New York: Harper and Row Publishers, Date Unknown.

89. Office of Personnel Management (formerly Civil Service Commission), CPR 950-1, Career Management. Washington, D. C., November 1977.

90. _____, CPR 950-18, Army Civilian Career Program for Engineers and Scientists. Washington, D. C., April 1965 with Change 1 dated 10 October 1975.

91. _____, FPM Bulletin 540-4, Guidance on Implementing Performance Appraisal for Merit Pay. Washington, D. C., 23 July 1979.

92. _____, FPM Supplement 512-1, Alphabetical Listing for Published Job Grading Standards. Washington, D. C., June 1974.

93. Office of Personnel Management (formerly Civil Service Commission), Introducing the Civil Service Reform Act. Washington, D. C., November 1978.

94. _____, OPM Handbook of Occupation Groups and Series of Classes. Washington, D. C., 1977.

95. Office of Personnel Management, Office of Work Force and Development, Employee Training in the Federal Service, FY 1978. Washington, D. C., 1980.

96. Planning Research Corporation, Memorandum to Engineer Studies Center, Training Budget for the Army Corps of Engineers. Washington, D. C., March 1980.

97. Rank Xerox Limited, International Headquarters, The Identification of Management Potential: A Contingency Approach. By V. Stanic. London, Circa 1975.

98. Ross, Stephen S., "Engineering: Liberal Arts of the 80's," The Washington Post. 29 April 1979.

99. Schoderbek, Peter P., Management Systems. New York: John Wiley and Sons, Inc., 1971.

100. Sherwin, Douglas S., "Management of Objectives," Harvard Business Review. May-June 1976.

101. Snedecor, George W. and William G. Cochran, Statistical Methods. Ames, Iowa: The Iowa State University Press, 1969.

102. Sonnenfeld, Jeffrey, "Dealing With the Aging Work Force," Harvard Business Review. November-December 1978.

103. Staats, Elmer B., "Accountability for Career Development--A Must for Improved Program Management," The Bureaucrat. Fall 1979.

104. Stimson, Richard A., "Performance Pay--Will it Work?" Defense Management Journal. July-August 1979.

105. Tucker, W. T., "A Behavioral Ethic for Organizations," Human Resource Management. Volume 11, No. 4. Winter 1972.

106. Walfish, Beatrice, "Job Satisfaction Declines in Major Aspects of Work, Says Michigan Study; All Occupational Groups Included," World of Work Report. Volume 4, No. 2. February 1979.

107. Wells, Richard M., Letter to Chief of Engineers on productive use of engineering talent. Portland, Oregon, 7 November 1978.

LAST PAGE OF MONOGRAPH