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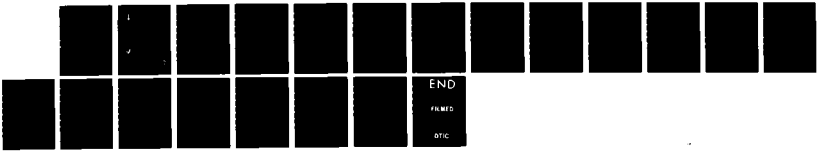

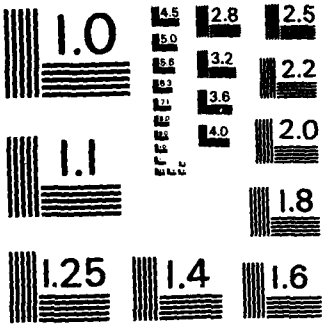

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TECHNICAL REPORT CPO-85-4

INTRODUCTION OF A CENTRALIZED COLLEGE RECRUITMENT PROGRAM TO ATTRACT MORE FEMALE ENGINEERS

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September 1985

U.S. ARMY MISSILE COMMAND
Redstone Arsenal, Alabama 35898-5000

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In an effort to alleviate large numbers of engineering vacancies and to provide a systematic input of new engineers, a centralized college recruitment program was initiated at the U.S. Army Missile Command at the beginning of Fiscal Year (FY) 1982. Review of traditional government recruitment procedures and increased demand for research personnel leading to the establishment of the centralized college recruitment program and equal employment opportunity for females are discussed. Recruitment results are compared for the first 3 years of the recruitment program and the 3 years immediately prior to its establishment. The comparison indicates the increased number of female engineers recruited during the 3 years of the centralized program was significant. For purposes of this study, significant increase was defined as doubling the number of female engineers recruited. A discussion of the possibility that the results may have been confounded by factors other than the recruitment intervention is provided.

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I. INTRODUCTION

In organizations, personnel costs are often primary drivers in total expenditure of money. While most organizations have equipment and buildings, the recruitment, training, retention, and proper utilization of employees often takes the greater part of a budget, and how well an organization manages the work force often predicts its success or failure. According to Blau and Scott (1), individuals live in organizations, and their organizations may be as simple as the family or as complex as an organization structured to explore outer space. Most students of organizations and organizational effectiveness would agree that large highly technical organizations require an array of personnel management skills in order to recruit, train, and retain a viable work force.

Recruitment programs within the United States, compared to those of other industrialized nations, generally contain broader areas of concern such as fairness, equality, and nondiscrimination. According to Hatvany and Pucik (2), Japanese companies develop an internal labor market whereby male employees will be hired just after graduation from high school or university with the expectation of retaining him for the rest of his working life, whereas the female work force is considered as temporary. Under this concept, the use of female and part-time workers gives employers flexibility in adjusting the size of their work force to current economic conditions while maintaining employment for full-time male workers.

The purpose of this paper is to document the effectiveness of a centralized college recruitment program in attracting engineers, grades GS-5 and GS-7, into the work force at the U.S. Army Missile Command with specific attention on the recruitment of white female engineers. As previously indicated, some highly industrialized countries do not place as much emphasis in the area of equal employment opportunity for females as does the United States.

Research into Federal recruitment practices is given impetus by the fact that the Federal Government, when considered as one employer, is by far the Nation's largest employer. According to the U.S. Office of Personnel Management Central Personnel Data File (3), the Federal Government employed 2,068,334 persons as of March 31, 1983.

The Department of Defense (DOD) is but one of many agencies within the Government that comprises the Federal Employee work force. Occupational categories within the Federal Government often mirror non-Government occupational categories. The lack of available candidates for positions within the larger society will likely reflect as shortages to Federal recruiters. The sweeping technological changes that have come about in the world since 1900 have brought about subsequent changes to the DOD. Today's Federal recruiter must compete with the top industrial concerns in order to attract engineers and scientists.

United States citizens have supported large outlays of money for the DOD budget each year. A significant part of the budget has been in the form of support to allied countries to both develop their own military strength and in some cases to provide U.S. soldiers in country for defense purposes. As

society and the world have become more highly technical, society's expectations of what is required of the Federal work force, especially in the area of the DOD, have greatly changed and expanded.

United States military and civilian leaders have been strongly committed to insure the freedom and independence of the U.S. and its allies. Each new administration and congress have been supportive of an adequate up-to-date defense establishment.

Almost simultaneous with the end of the shooting war in 1945, was the birth of the cold war which brought with it an increasing awareness of a continuing requirement of a strong defense establishment. Since 1945, the U.S. has committed considerable effort and large sums of money for the research, development, and production of new and highly sophisticated weapons. Large expenditures of money for defense purposes have been viewed as being necessary because of the world-wide rapid advancement of technology, increased military and industrial buildup of potential adversaries, political instability in many parts of the world, and the emergence of third world countries.

During much of the same time frame, 1960 to the present, private industry in the U.S. has faced increasing competition from foreign industry. This increased competition has caused U.S. companies to expand their research capabilities and monetary outlays for modernization to remain competitive both at home and in the world market. An increased need for scientific and technical personnel from within the defense establishment as well as the larger society have combined to create a shortage of engineers that at times approaches the critical level. A review of scientific history reveals that many innovative ideas and inventions were products of small, individually owned laboratories or shops. The present emphasis by industry for research in highly specialized areas, usually requiring complex and costly facilities combined with monetary incentives offered to research engineers and scientists, has practically eliminated the small, independent researcher (Kennedy, 1985) (4).

Lower pay scales and less attractive fringe benefits have long proved serious hurdles for Federal recruiters in search of engineers and scientists. In an attempt to place the Federal Government in a more competitive position, the Office of Personnel Management (OPM) approved an increased rate of pay, grades GS-5 through GS-12, for engineers and scientists. Even with the increased rate of pay, positions often went unfilled for long periods of time. In an attempt to further improve the Federal Government's recruitment position and to speed up recruitment actions, Federal agencies were delegated direct hire authority in the appointment of engineers and scientists. Direct hire authority enables Federal agencies to bypass OPM registers and deal directly with applicants in filling certain hard-to-fill engineering and scientific positions. Even though the advanced pay rate and the direct hire authority greatly improved recruitment for these positions, the problem of attracting a sufficient number of highly qualified engineers was not eliminated.

In an attempt to further alleviate the problem of recruiting engineers, a decision was reached by the U.S. Army Missile Command's Civilian Personnel Office to initiate a centralized recruitment program by visiting certain colleges to attract engineering graduates. Technical Report CPO-85-2 measured the overall effectiveness of the centralized recruitment program at U.S.

Army Missile Command. Technical Report CPO-85-3, reported on the effectiveness of the centralized college recruitment program in recruiting both male and female engineers for the first 3 years of the program compared to the 3 years prior to its implementation. This research measures the success of the centralized college recruitment program in attracting white female engineers, grades GS-5 and GS-7.

Recruitment of white female engineers grades GS-5 and GS-7 was analyzed for the first 3 years of the centralized college recruitment program and compared to the same series (grades GS-5 and GS-7) for the 3 years prior to the program's implementation. For purposes of this study, recruitment of twice as many white female engineers, grades GS-5 and GS-7, is considered significant.

II. ARMY MISSILE COMMAND

The U.S. Army Missile Command (MICOM), located on Redstone Arsenal, is a 39,000 acre military reservation in Madison County, Alabama, responsible for the total life cycle management of all Army missile systems. Total life cycle management includes research, development, production management, procurement, quality assurance, maintenance, and logistics support to U.S. troops and foreign governments that have purchased Army missile systems. According to Kennedy (4) $4,834 billion were appropriated in Fiscal Year 83 for procurement of supplies, missile hardware, and services needed to perform MICOM's mission. In excess of 8,000 civilian and approximately 1,000 military employees are assigned to MICOM.

III. OVERVIEW OF PERSONNEL MANAGEMENT IN THE FEDERAL SECTOR

It appears that the founding fathers saw the need for a military establishment as soon as they perceived that a new nation was possible. From the very beginning, civilians have worked with the military. According to Baker (5), civilians were employed as riflemakers, quartermasters, and physicians as early as 1775. The military recruited civilians directly from the population by the use of contract terms.

As time passed, political and personal connections gained more and more influence in the recruitment and selection process. Each Presidential election would bring about a large scale turnover in Federal employees. This system of personnel management became known as the spoils system and created an unhealthly environment for employees and job applicants which led to a less efficient government. The spoils system was also adopted by state governments. The interplay and exchange of ideas and practices between the Federal and state governments seemed to give additional impetus to the growth of the spoils system. Lacking strong or well organized opposition at the national level, the spoils system became accepted by the major political parties.

When Thomas Jefferson was inaugurated President in 1801, he found himself in control of a system staffed almost entirely by the opposition party who had lifetime tenure in Government positions. In an effort to reward his own supporters and to gain control of the Government he moved to eliminate

many of the office holders. According to Baker (5), Jefferson is credited with initiating the spoils system in the Federal sector, but the Jackson administration is credited with making the system an art.

While there had been some opposition to the spoils system in the early 1800's in the form of pamphlets and newspaper articles, no organized serious opposition emerged until after the Civil War. As a result of corruption and mismanagement in President Grant's administration, civil service reform became a visible national political issue. In August 1881, a National Civil Service Reform League was organized. A propaganda effort was waged through the use of monographs and pamphlets. This early opposition primarily addressed ethical and moral principles rather than economy and efficiency.

The history of mankind often reveals that it requires an extreme act to bring about drastic change. Such an act occurred in 1881 when Charles J. Guiteau, a disappointed office seeker, assassinated President James Garfield. As a result of the assassination, public opinion solidified against the spoils system and magazines and newspapers began to attack its practices.

In 1883, Congress passed the Civil Service Act which among other things established the Civil Service Commission (the name was changed in 1978 to Office of Personnel Management). The Civil Service Commission was empowered to administer and systematize Federal hiring on the basis of merit and fitness. The commission was not immediately effective and some political scientists blame this early ineffectiveness on the fact that the commission was created from a negative standpoint. The commission was charged with insuring that Government agencies refrain from certain practices rather than applying effective personnel management practices. Scholars who have made a study of the early effectiveness of the Civil Service Commission are often highly critical of the lack of effective administration.

The Office of Personnel Management is charged with assisting Federal agencies in administering the Federal personnel program and in so doing administers provisions of the Civil Service Act of 1883, the Veteran's Preference Act of 1944, the Civil Service Reform Act of 1978, and various executive orders and laws. The Office of Personnel Management is headquartered in Washington, D.C., has 10 regional offices and area offices in various states. According to the Comptroller General's Report to the Congress (6), during FY 78 the Office of Personnel Management spent approximately $35.4 million on examination and referral of applicants, processed 1.6 million applications, and referred 1.1 million applicants to Federal agencies from which 152,771 selections were made.

IV. EQUAL EMPLOYMENT OPPORTUNITY

Women in public service actually antedated the U.S. Government. While there were isolated cases of the appointment of women to Federal positions from the earliest time, there was no general employment of women until the period between 1862 and 1868 when the Treasury Department hired a number of lady clerks. The Civil Service Act of 1883 allowed women to compete in civil service examinations on the same basis as men. Generally speaking, women received less pay for the same work that males were doing. The Classification Act of 1923 established the concept of equal pay for equal work and pay for each position was determined solely on the basis of the duties and re-

sponsibilities of the position. In 1934, the Attorney General ruled that an 1870 law gave agencies the option of requesting men only or women only for filling positions. Men were requested for most professional and executive positions when travel was involved, were hazardous, had contact with the public, involved rotating assignments, or had exposure to weather. Women were requested for a few occupations (such as nursing or social work), but the majority were employed in positions for which sex was not specified, generally lower graded clerical jobs with limited advancement opportunity.

In 1962, at the request of the President's Commission on the Status of Women, the Attorney General reviewed the former opinion and reversed it. The Civil Service Commission revised the civil service regulations to require specifically that all appointments be made without regard to sex unless exceptions were granted by the Commission. Conditions justifying general exceptions were limited to certain kinds of institutional and custodial employment and law enforcement positions requiring the bearing of firearms. In 1965, Congress repealed the 1870 law to preclude any possibility of reversion to the previous policy. In 1971, the firearms exception was cancelled.

The Government was not included in the Civil Rights Act of 1964, but the statute did state that the U.S. policy was to insure nondiscrimination in Federal employment based on race, color, religion, sex, or national orgin. Executive Order 11246, issued by President Lyndon B. Johnson on September 24, 1965 (7), transferred Federal equal employment enforcement to the Civil Service Commission.

Executive Order 11375, dated October 13, 1967 (8), prohibited discrimination on the basis of sex. The Civil Service Commission established the Federal Women's Program to enhance the employment and advancement of women as a follow-on of Executive Order 11375. On August 8, 1969, President Nixon issued Executive Order 11478 (9) which stated that "equal employment opportunity must be an integral part of every aspect of personnel policy and practice in the employment, development, advancement, and treatment of civilian employees of the Federal Government" (p.1). Executive Order 11478 set forth a new direction for the Equal Employment Opportunity program and emphasized that each Federal agency was responsible for developing an affirmative action program.

According to the Comptroller General's Report September 9, 1977 (10), the order stated that the government policy was to:

A. provide equal opportunity in Federal employment for all persons,

B. prohibit discrimination in employment because of race, color, religion, sex, or national origin,

C. promote full equal employment opportunity through a continuing affirmative action program of each executive department and agency.

This equal opportunity policy was to apply to and be an integral part of every aspect of personnel policy and practice in the employment, development, advancement, and treatment of civilian employees of the government.

Under Executive Order 11478 (9), the Civil Service Commission was directed to:

--Review and evaluate program operations.

--Obtain necessary data and report to the President on overall progress.

--Issue appropriate regulations, orders, and instructions, with which agencies must comply.

--Provide prompt, fair, and impartial consideration of all complaints involving Federal Employment discrimination.

--Provide counseling for employees who believe they have been discriminated against and encourage informal resolution of these matters.

--Provide for appeals of decisions to the Civil Service Commission following impartial review by the Federal agency involved.

The Equal Employment Opportunity Act of 1972 (11) was the legal basis for assuring equal employment opportunities for females and minorities. The Civil Service Commission was assigned responsibility for leadership and enforcement. Under terms of this act, each Federal agency was directed to establish an Equal Employment Opportunity program as a part of the personnel policy. A major thrust of the act was to provide affirmative action for increasing representation of minorities and females in the Federal work force. Agencies were required to continuously report progress made toward Equal Employment Opportunity actions.

Additionally the Civil Service Commission was required to:

--Annually approve national and regional Equal Employment Opportunity plans (commonly referred to as affirmative action plans) submitted by each agency.

--Review and evaluate the operation of agencies' Equal Employment Opportunity programs.

--Publish periodic reports reflecting the Government's progress in providing Equal Employment Opportunity.

The Civil Service Reform Act enacted on October 13, 1978 (12), stated that in order to have a competent, honest, and productive work force personnel management should be implemented consistent with the merit system principles.

One of the primary principles as defined by the act was that: Recruitment should be from qualified individuals from appropriate sources in an endeavor to achieve a work force from all segments of society, and selection and advancement should be determined solely on the basis of relative ability, knowledge, and skills after fair and open competition which assures all receive equal opportunity (Public Law 95-454 Civil Service Reform Act, 1978).

Public policy, as defined by Congress in the above paragraph and by passage of the Civil Service Reform Act, is to recruit and attract a Federal work force that mirrors the larger society as to race, sex, and ethnic group. Each Federal agency is required to analyze their work force regarding composition of females and minorities and, accordingly, design an affirmative action program that will allow the agency an opportunity to achieve a work force that mirrors the civilian labor force of the recruitment area.

The following selected court cases relating to the status of women were developed by the RAND Corporation (13);

SELECTED COURT CASES RELATED TO THE STATUS OF WOMEN[1]

Reed v. Reed, 404 U.S. 71 (1971).[2]

Idaho statute giving preference to men over women in administering estates was held to be invalid by the Supreme Court on the ground that the classification was unrelated to any purpose to be achieved by the statute administrative convenience in determining who should be appointed administrator without the necessity to hold a hearing was considered insufficient justification by the court.

Frontiero v. Richardson, 93 S. Ct. 1764 (1973).

The Supreme Court determined that a regulation permitting men in the armed service to declare their wives as dependent whether or not they actually achieved that status, while requiring women in the armed services to prove actual dependency by their husbands in order to receive a dependency allowance as well as other benefits, was invalid. The basis for the invalidation of this regulation was that "classification on the basis of sex, like classification based upon race, alienage, or national origin . . . are indirectly suspect, and must therefore be subjected to strict judical scrutiny."[2]

Phillips v. Martin-Marietta Corp., 91 S. Ct. 496 (1971).

The case involved a company policy rejecting applications for employment from women with preschool-age children. The same employment barrier did not apply to males with preschool-age children. The court determined that the proper test to be applied was whether the decision to hire men with preschool-age children, but excluding women with the same age children, was a bona fide occupational qualification. The court ruled:

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[1]Two journals, the Bureau of National Affair Fair Employment Practices series and the Civil Service Journal, Vol. 14, No., 2 October-December, 1973, U.S. Civil Service Commission, P. 30, were among the primary sources for the summaries of the cases.

[2]The majority opinion was signed by only four of the nine justices of the Supreme Court. A fifth concurred but on the basis of findings of the Reed v. Reed cases. It would therefore appear that the majority of the Supreme Court judges are not yet prepared to find classification on the basis of sex inherently suspect.

The existence of such conflicting family obligations, if demonstrably more relevant to job performance for a woman than for a man, could arguably be a basis for distinction. . . . But that is a matter of evidence tending to show that the condition in question "is a bona fida occupational qualification reasonably necessary to the normal operation of that particular business or enterprise."

Thus the case upheld the principle that motherhood by itself was not a rational basis for exclusion.

Griggs v. Duke Power Co., 401 U.S. 424 (1971).

This case has direct relevance to the questions of job-related qualifications and of test (education, experience, etc.) used as criteria for hiring. The court has said:

The facts of this case demonstrate the inadequacy of broad and general testing devices as well as the infirmity of using diplomas or degrees as fixed measure of capability. History is filled by examples of men and women who rendered highly effective performance without the conventional badges of accomplishment in terms of certificates, diplomas, or degrees. Diplomas and tests are useful servants, but Congress has mandated the common-sense proposition that they are not to become master of reality . . . . What Congress has commanded is that any tests used must measure the person for the job and not the person in the abstract.

Additionally, the Supreme Court said at 431:

The (1964 Civil Rights) Act proscribes not only overt discrimination but also practices which are fair in form, but discriminating in operation . . . . Further, any specification which operates to exclude any segment of society and which cannot be shown to be job-related is prohibited.

Schattman v. Texas Employment Commission, 330 F. Supp. 328 (W.D. Tex. 1971).

The EEOC appeared as amicus curiae arguing that an employer's policy of compelling female employees to resign after reaching a certain month of pregnancy constitutes a violation of Title VII of the Civil Rights Act of 1964. The commission took the position that this policy was only acceptable under Title VII if it could be shown that substantially all women were unable to perform safely and efficiently the duties of their particular job upon reaching the time established by the employer.

Pittsburgh Press Co. v. Pittsburgh Human Relations Commission, 413 U.S. 376 (1973).

Order of Pittsburgh, Pennsylvania, Commission on Human Relations prohibiting newspaper from placing in sex designated columns help-wanted advertisments for job opportunities that are not exempt under City Human Relations Ordinance doesn't infringe on the newspaper's rights under the First Amendment to the Constitution.

Court cases and positive actions by both the executive and legislative branches of the Federal Government have helped to make equal employment

opportunity a reality for females seeking Federal positions. In spite of progress made in many occupational categories within the Federal work force, many problems remain in the recruitment of female engineers.

According to the Woman Engineer (14), females received 9,566 of the total 72,471 bachelors degrees in engineering that were awarded in 1983 which equates to 13.2 percent. This represents an increase of 17.5 percent over 1982. Data from the National Science Foundation in 1970 revealed that there were only 34,800 experienced women engineers. Women accounted for 15 percent of the baccalaureate engineering degrees in the spring of 1982.

Federal recruiters seeking female engineers must face up to the fact that recruiters from private industry can and do offer higher salaries, but they must also face up to the fact that not enough female engineers are graduating to fill the many new engineering positions. As economic conditions expand, college recruitment activity continues to expand. Out of approximately two million American engineers only 3.5 percent, or 70,000 are female.

The most popular engineering field for women at the bachelor's level in 1983 was electrical, in which 1,786 degrees were earned. Chemical was next with 1,703 degrees earned. Mechanical with 1,503 degrees and civil with 1,315 degrees were third and forth.

According to the Woman Engineer (15), women's share of bachelor's degrees in engineering have grown from less than one percent in 1970 to 13.2 percent in 1983. At the master's level, the percentage of females has grown from less than 1 percent to 9 percent. At the doctoral level, female representation grew from 0.9 percent to 4.7 percent. Even with a large increase in the number of female engineering students, recruitment of engineers, and especially female engineers, still remains a problem. Despite a 21 percent increase of females in engineering from 1974 to 1983, the total number of bachelor's degrees grew less than 1 percent. The total number of engineering and scientists doctoral degrees dropped slightly from 1973 to 1983. This change resulted from a decrease of 15.4 percent in the number awarded to men and an increase of 97.8 percent in the number awarded to women. By 1983, women had increased their proportion of doctoral degrees from 12.9 percent in 1973 to 25.7 percent. While there has been a steady and somewhat dramatic increase in the number of female engineering graduates, recruitment of these graduates into the Government work force still faces considerable difficulty due to the overall increasing demand for engineering graduates.

V. RECRUITMENT OF ENGINEERS AT THE U.S. ARMY MISSILE COMMAND

As a result of research and development being the primary mission at the U.S. Army Missile Command, the engineer and scientist career program with 1,491 members, as of December 1984, is the Command's largest career program. Most Department of Army career programs are represented at MICOM e.g., procurement, supply, safety, equipment specialist, etc.; however, chronic recruitment problems have most often arose in the engineer and scientist program. Emphasis on the recruitment of engineers and scientists became more pronounced during the late 1970's because of an aging work force. The increased demand by private industry for engineers and scientists, during this time frame, further complicated the Government's recruitment of personnel for these career fields.

According to the Department of Defense Laboratory Management Task Force (16), numerous National studies to identify shortages of Engineers and Scientists have been conducted, but their findings and conclusions are often in conflict. Some studies claim present shortages exist throughout the country while other studies indicate that there is no present shortage and very little evidence to predict shortages in the future. Kennedy conducted an analysis of a centralized college recruitment program for attracting engineers and scientists (Grades GS-5 through GS-7) into the MICOM work force (4), also an analysis of the program's effectiveness in recruiting blacks for these professions (17). No studies were found that analyze the programs effectiveness in recruiting white females.

VI. DISCUSSION

Very little debate would be generated among knowledgeable people that the OPM approval of an increased rate of pay for engineers and scientists and the granting of direct hire authority had not had a positive effect on attracting and retaining engineers. Even with the introduction of these two very positive recruitment interventions, MICOM continued to experience difficulty in attracting sufficient numbers of young engineers. In periods of recruitment crises during the 70's, sporadic visits were made to various colleges in an effort to attract young engineers; however, a formalized college recruitment program had not yet been developed and utilized.

After a thorough review and assessment of the overall recruitment program with particular emphasis on the recruitment of engineers, a decision was reached in the Spring of 1981 to initiate a formal college recrutiment program for engineers and scientists. This recruitment effort was to be coordinated by the Recruitment and Placement Division of the Civilian Personnel Office with technical recruitment assistance from the Army Missile Laboratory at MICOM. A decision was reached to concentrate recruitment efforts at engineering schools located primarily in the Southeastern United States. Visits on an as needed basis to engineering schools located in other parts of the country were also included as part of the overall recruitment plan.

Fifty to eighty entry level positions (GS-5 and GS-7) were set aside each fiscal year to be utilized for the recruitment, placement, and training of engineering graduates. A decision was made that the command should continue to visit colleges and conduct a public relations campaign even during periods of recruitment austerity in order to familiarize faculty and students with MICOM and its mission. Predominately black engineering colleges were on the recruitment schedule for at least one and possibly two visits per year, e.g., Tennessee State University, Tuskegee Institute.

To determine the effectiveness of the centralized college recruitment program in recruiting white female engineers, data were gathered from MICOM's automated data bank. The data relects a 6-year recruitment period (Table). The first 3 years of the program included data from October 1981 through September 1984, and the 3 years prior to the implementation of the centralized college recruitment program covered the period from Septebmer 1978 through September 1981.

TABLE. Female Engineers Recruited in Grades GS-5 and GS-7
FY 79 through FY 84

U.S. Army Missile Command Appointments

FY 79	FY 80	FY 81	TOTAL
1	1	3	5
FY 82	FY 83	FY 84	TOTAL
7	9	14	30

As the above figures depict, the total number of white female engineers, grades GS-5 and GS-7, increased from 5 for the 3 years prior to implementation of the centralized college recruitment program to 30 for the first 3 years of the program. This increase of 25 appointments equates to a plus 500 percent. Earlier in the technical report, significant increase was defined as an increase of twice as many white females recruited. According to the definition stated earlier, the centralized college recruitment program resulted in a significant increase in the number of white females recruited. Special Note: Black female engineers were not reported in this report as they were previously reported under total black engineers recruited in Technical Report CPO-85-3. One Asian American female was reported in FY 83 and one in FY 84.

VII. RESEARCH SIGNIFICANCE

Government officials and the public in general are requiring more and more program evaluations to determine which programs are effective. Social Science researchers who conduct research concerning individuals and organizations must conduct their research under more uncertain conditions than natural scientists. Pure scientific research is conducted under laboratory conditions that can be duplicated and re-checked. Conditions can be altered and varied to suit research requirements and needs.

Proponents of pure scientific research often criticize social science research as being ineffective and unreliable. In direct opposition to this criticism are those who maintain that more effective and in-depth program evaluation is a must in order to arrive at meaningful decisions on which programs to continue and which to abolish. Social Science researchers have long been aware of certain inherent problems in their research that are not present in pure scientific research. Ambiquity, lack of truly comparable comparison bases, and lack of concrete results all contribute to a lack of certainty. Some critics charge that public administrators often avoid meaningful research out of fear that it will not produce favorable results.

Campbell (18) addresses the various threats to internal and external validity that may confound studies of the nature addressed in this technical report. Since the data used in this report is archival in nature, history, one of the threats to internal validity, is the only one addressed. While some of the other threats could possibly have a confounding influence, their effect is viewed as minimal. Historical occurrences which may have influenced results of the 6-year period studied are:

- o A slow-down of recruitment of all Engineers and Scientists by private industry.
- o Larger number of Engineering and Scientist graduates.
- o Change in Engineering and Scientist graduates'attitude toward Department of Defense.
- o Set aside of spaces (50 to 80) may have caused additional management focus on the filling of these particular vacancies.
- o Larger number of female Engineering and Scientist graduates.
- o Increased emphasis on Equal Employment Opportunity.

VIII. IMPLICATIONS FOR THE FUTURE

As discussed earlier in this report, it is not possible to evaluate individual and organizational behavior utilizing the pure scientific method under laboratory conditions. There is a continuing call for improved program evaluation from both within and without government circles. Much of the evaluation that is conducted fails to utilize appropriate methods and does not attempt to control outside influences. Public administrators are often so committed to a particular program that there may be a tendency to avoid any form of evaluation that may cause a reflection on their particular program. It is the opinion of this researcher that public administrators of the future will have to rely on meaningful program evaluations in order to ensure continued support.

The movement of females into nontraditional occupations such as engineering will help to alleviate serious shortages. This movement will also provide a completely different type of occupation role model for female children.

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