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AN ALTERNATIVE APPROACH FOR MEASURING BLACK REPRESENTATION IN NAVY ENLISTED OCCUPATIONS

by

Gary B. Dye

June 1994

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This thesis examines the possible outcomes of U.S. Navy policies to achieve proportional representation of blacks in enlisted occupations. This thesis employs two models to analyze the distribution of black enlisted men in the Navy's occupational specialties. The first model uses FY1979, FY1982, FY1985, and FY1988 cohort data to examine black male occupational representation during the fifth year of service. This study introduces a new approach to control for the influence of aptitude test scores on the occupational placement process. Black male representation in 14 occupational categories comprising 109 Navy ratings is graphically summarized using difference indicators. The study analyzes the trend in black male representation by comparing difference indicators for four enlisted cohorts spanning a 14-year period. The second model uses data on the 1991 Navy enlisted population and the 1992 census to compare the distribution of black men in Navy ratings with the distribution of black men in civilian occupations. The results of the study reveal that disproportionate representation persists in certain Navy ratings. However, when the influence of aptitude is controlled, results indicate that the Navy has made progress toward minority placement goals. The study suggests that U.S. Navy equal opportunity and affirmative action policies have been effective in achieving a more representative distributions of black men in Navy occupations.

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An Alternative Approach for Measuring Black Representation in Navy Enlisted Occupations

by

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ABSTRACT

This thesis examines the possible outcomes of U.S. Navy policies to achieve proportional representation of blacks in enlisted occupations. This thesis employs two models to analyze the distribution of black enlisted men in the Navy's occupational specialties. The first model uses FY1979, FY1982, FY1985, and FY1988 cohort data to examine black male occupational representation during the fifth year of service. This study introduces a new approach to control for the influence of aptitude test scores on the occupational placement process. Black male representation in 14 occupational categories comprising 109 Navy ratings is graphically summarized using difference indicators. The study analyzes the trend in black male representation by comparing difference indicators for four enlisted cohorts spanning a 14-year period. The second model uses data on the 1991 Navy enlisted population and the 1992 census to compare the distribution of black men in Navy ratings with the distribution of black men in civilian occupations. The results of the study reveal that disproportionate representation persists in certain Navy ratings. However, when the influence of aptitude is controlled, results indicate that the Navy has made progress toward minority placement goals. The study suggests that U.S. Navy policies have been effective in achieving a more representative distribution of black men in Navy occupations.

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I. INTRODUCTION

A. BACKGROUND

If the Navy is to attain its goals for military readiness in an era of voluntary service, it is important that it make the most effective use of its personnel. National population projections of draft-age youth through the year 2000 indicate that, while the military age population (18-26) is declining, the percentage of African-Americans, or blacks, in the population is increasing [Ref. 1:p. 82-100]. If the Navy is to successfully recruit and employ its share of qualified draft-age youth, it is important that it be perceived as an equal opportunity, nondiscriminatory organization.

The Navy Affirmative Action Plan (NAAP) is the foundation of the Navy's program to ensure equal opportunity. A primary goal of the NAAP is to "... attain a minority enlisted population that as a minimum reflects the percentages of minorities in the general population." [Ref. 2:p. 8] Since the inception of the All-Volunteer Force (AVF) in 1973, black representation in the armed forces has grown steadily. By 1983, the Navy achieved its overall representation goal for blacks and has exceeded the goal every year since.

Another goal of the NAAP, closely related to the first and more relevant to this thesis, mandates that, "... within legal constraints, minorities and women participate equitably in all occupational areas and warfare specialties." [Ref. 2:p. 1] This study examines the degree to which this goal has been achieved for the enlisted force. The study focuses on the appropriate methods to measure "equitable participation," pertinent factors affecting attainment of the goal of equitable representation across occupational specialties, and the relevant implications for the Navy of alternative policies to achieve this goal.

Despite the Navy's relative "success" in attaining and exceeding its goals for overall representation of blacks, it is well-documented that blacks are not proportionately represented across the military's occupational specialties. For example, the 1992 Navy

Equal Opportunity Assessment listed the ten most overrepresented and underrepresented Department of Defense (DoD) occupational groupings for minorities over several years. Representation was determined using overall minority percentages (in the Navy) as a basis. Fiscal 1990 information, converted to Navy rating equivalents, is displayed in Table 1 [Ref. 3]. Despite the report's aggregation of all racial and ethnic groups into a single

TABLE 1. MINORITY REPRESENTATION IN SELECTED NAVY ENLISTED RATINGS: T FIVE MOST OVER-REPRESENTED RATINGS AND THE FIVE MOST UNDERREPRESEN 0 RATINGS, FISCAL 1990

DoD Occupational Group Description	Representative Navy Rating	Percent Minority†	Percent Over-represented
84 Personal Service	SH	60.6	106.7
54 Accounting, Finance & Disbursing	DK	52.4	78.7
80 Food Service	MS	51.1	74.2
33 Dental Care	DT	47.9	63.4
55 Other Functional Support	AK, SK	47.9	63.4

DoD Occupational Group Description	Representative Navy Rating	Percent Minority	Percent Under-represented
21 Sonar	ST	8.5	-71.1
45 Musician	MU	10.1	-65.6
11 Fire Contol Technician	FT, FTG, FC	11.7	-60.1
19 Other Electronics Equipment	ET	12.3	-58.1
10 Radio/Radar	AT, ET, FC	12.9	-56.0

Source: [Ref. 4].
†"Minority" is defined as any non-white.
Percent overrepresented and percent underrepresented is determined using the Minority Representation Index (MRI): MRI = [(Actual Number + Expected Number) x 100] - 100. Where Expected Number is equal to the total in the occupation multiplied times the overall percentage of minorities in the population [Ref. 4].

minority category and the difficulties of converting DoD occupational codes to Navy ratings, one can readily conclude that significant differences in representation exist across these ratings.

In 1988, the Chief of Naval Operations (CNO) commissioned a special Study Group on Equal Opportunity in the Navy. In its first report to CNO, the group stated that one goal

of the Navy's Affirmative Action Plan should be to optimize minority upward mobility through an equitable distribution of minority enlisted personnel among all ratings and occupational field. The fiscal 1992 Equal Opportunity Assessment reported that minority representation remains unevenly distributed across the Navy rating structure and that minorities continue to be underrepresented in the more technical ratings [Ref.3].

Although to date the Navy has established no specific minority representation goals for individual ratings, the Equal Opportunity Assessment evaluates "equitable representation" on the basis of each racial or ethnic group within the Navy at the end of a particular fiscal year. For example, at the end of fiscal 1991 blacks accounted for 17.6 percent of the total Navy enlisted force [Ref.5]. Therefore, the expectation implied by the Equal Opportunity Assessment is that the proportion of blacks within each individual rating should also approximate 17.6 percent. The implied assumption appears to be that the distribution of racial/ethnic groups would be equal in the absence of some form of institutional bias acting against a particular minority. This assumption, however, is somewhat naive because it appears to give little or no weight to important factors such as qualifications and personal preferences. Thus far, little research has been conducted that measures racial differences in occupational preferences. However, differences in occupational qualification rates are easily quantified and well-documented.

B. RESEARCH OBJECTIVES

This thesis examines the effectiveness of the U.S. Navy's affirmative action program in achieving a proportional distribution of black men in the enlisted ranks. This study uses two models to analyze the expected distribution of black enlisted men among the Navy's occupational specialties. The first model examines the influence of aptitude test scores on representation in enlisted occupations at the fifth year of military service for non-prior service (NPS) black and non-black[1] male enlistees within a particular cohort. To establish

trends in representation, the model is applied to four separate cohorts consisting of enlisted personnel who entered the Navy in fiscal 1979, 1982, 1985, and 1988, respectively. A procedure to control for the influence of aptitude tests scores is introduced and explained. Graphical depiction of black male representation in Navy enlisted occupations is shown by cohort and enlisted community. This model draws on data resources from the Navy's Active-Duty Master files, Active-Duty Accession files, and standardized tests scores from the Armed Services Vocational Aptitude Battery (ASVAB). The study explores the relationship of disproportionate occupational representation and black advancement rates by examining cohort data over the course of several years.

The second model compares the distribution of black men by occupation in the Navy with the distribution of black men in comparable civilian occupations. This calculation uses 1991 data from Current Population Surveys and a 1992 cross-sectional file of all Navy enlisted personnel.

C. ORGANIZATION OF THE STUDY

This study is organized into five chapters. The next chapter reviews pertinent studies and other literature that relate to occupational placement of minorities in the armed forces. Chapter III addresses occupational representation when the influence of aptitude is controlled. It begins with an examination and assessment of the methodology used in a previous study that evaluates occupational representation after attempting to control for the influence of aptitude. Chapter III also describes the contents of the data files and the research methodology used by an alternative approach introduced in this study as the "Assignment Model." Chapter III concludes with the results of the Assignment Model. Chapter IV describes the contents of the data files, explains the research methodology, and

[1]The term "non-black" refers to all racial/ethnic groups in the population, including "whites" and all other minorities not categorized as black.

provides the results from this study's second model, which compares civilian and Navy occupational distributions. Chapter V summarizes the results, offers conclusions drawn from the findings, and provides recommendations derived from the research effort.

II. BACKGROUND AND LITERATURE REVIEW

This chapter reviews literature related to the occupational placement of minorities in the armed services. To gain a perspective on present issues, Section A provides a brief history of black representation in the Navy. Section B examines the occupational assignment process and describes the Armed Services Vocational Aptitude Battery (ASVAB). Section C reviews literature that explores differences in the performance of blacks and non-blacks on aptitude tests and the fairness of aptitude tests in determining occupational placement. Section D examines affirmative action programs and policies in the Navy. The final section (E) looks at the literature on the occupational placement of minorities in the armed services.

A. BLACKS IN THE U.S. NAVY: A HISTORICAL PERSPECTIVE

1. Days of Sail

Black Americans have been members of the nation's Navy since its inception. During the colonial era, when ships were propelled by wind, the ideal sailor was agile, quick to obey, willing to endure danger and discomfort, and experienced in the ways of the sea. Few qualified for service, so any able-bodied man who came close to fulfilling this ideal was welcome in the Navy. Race was secondary to manpower requirements. Although black Americans often received lower wages than their white counterparts, they nevertheless shared the same mess, hung their hammocks side-by-side, and worked alongside each other on board seagoing warships [Ref. 6].

Following the Civil War, white attitudes toward blacks changed in society and in the Navy. This shift in attitudes is captured by the following passage from Bernard C. Nalty's history of black Americans in the military, *Strength for the Fight* (1986):

> ...the relationship between conservative whites and the black populace now changed. Instead of treating the black as a ward, dependent upon their good will for protection

against the white rabble, the conservatives allied themselves with a class they despised to disenfranchise all blacks (and the poorest of whites who might become their economic and political allies), isolating the black race from the mainstream of political, cultural, and social life. A series of statutes, the so-called Jim Crow laws, enforced racial segregation, at first in the old Confederacy but later throughout the nation, thanks in part to a series of Supreme Court decisions dealing with voting rights and public accommodations [Ref. 6:p. 61].

Racism had become so deeply ingrained in American life that whites would rarely work with blacks. Nor would whites bunk with and eat with blacks in the close confines of a warship. Over time, the status of blacks in the Navy came to reflect the diminished condition of their civilian brethren.

2. The Steam Age

The steam age ushered in a new fleet of ships that were larger and more numerous than their wooden predecessors. With these new ships came new manpower requirements. The Navy needed a new type of enlisted man, possessing skills and abilities very different from those demanded of wooden-ship sailors. The Navy preferred volunteers with an aptitude for operating machinery rather than the talents to work aloft in foul weather. Experience at sea was less important and gave way to comprehensive training at recruit depots and on ships. The Navy not only needed a different kind of volunteer, it needed more of these people than before. Whereas 130 men crewed *Andrew Doria*, the Navy's first warship, it took 827 to man Admiral Perry's flagship, *Connecticut*. The steam-age Navy came to depend upon young, white volunteers who possessed the aptitude to function on steam ships but whose attitudes reflected the Jim Crow legislation that was emerging throughout the country. The realities of recruiting persuaded naval leaders to turn their backs on the black sailor. Few, if any, were accepted; and those who were accepted were segregated from their white shipmates. Except for a few men in the engine rooms, most black sailors were relegated to the messman rating [Ref. 6].

The demands of World War I did little to affect the racial composition of the Navy. Of 238,000 enlisted men on active duty in 1919 (just prior to demobilization), only 6,000 (less than 3 percent) were black. This compared with 5 percent in 1907, when Admiral Perry sailed around the world [Ref. 6].

Restrictions on the enlistment and assignment of blacks continued after the conclusion of World War I. By 1919, the Navy refused to accept any more black recruits. Those already in service might reenlist, but many of the veterans who had become petty officers were attaining retirement age and leaving the service. As a result, by the end of 1941, the Navy had just 29 blacks who were not part of the steward branch [Ref. 6].

Like the Army, the Navy entered World War II as a racially-segregated service. However, blacks and whites were kept separate in a different manner. The Army maintained units manned entirely by blacks (but commanded by whites). They were housed and employed in a fashion that would minimize their contact with white soldiers. By contrast, the Navy enforced segregation by occupation. Black sailors might serve with whites in a large ship, but with few exceptions, blacks prepared and served food or waited upon the ship's officers. Because all blacks performed essentially the same duties, they were easily segregated. They worked, ate, and slept apart from the rest of the crew [Ref. 6].

3. After World War II

On July 26, 1948, just three months before the presidential election, President Harry S. Truman issued Executive Order 9981, which "declared to be the policy of the President that there shall be equality of treatment and opportunity for all persons in the armed services without regard to race, color, religion, or national origin." Additionally, promotions were to be based "solely on merit and fitness."[2] The order also established the

[2]Note that Executive Order 9981 did not specifically promise integration; it promised "equality of treatment and opportunity." Since the policy of the armed forces was "separate but equal" treatment of the races, the order was the subject of some controversy and confusion [Ref. 7].

President's Committee on Equality of Treatment and Opportunity, which was expected to work with the Secretary of Defense and the Service Secretaries in implementing the new policy [Ref. 7].

Executive Order 9981 did not, however, result in the immediate desegregation or equal opportunity for blacks in the armed forces. None of the Services fully embraced the Executive Order until 1950, when events on the Korean peninsula forced a rapid build-up of all the Services. The Navy's expansion for the Korean War attracted more black recruits than could be fully absorbed by the steward branch, leading the service to broaden opportunities for training in other specialities. From 18,000 in 1948, the total number of blacks in the naval service dropped below 15,000 in 1950, and then expanded to 24,000 once the War began. By 1956, three-fourths of the 37,000 blacks in the Navy were assigned to positions other than in the steward branch [Ref. 6].

In the 1960s, the Navy continued to broaden opportunities for blacks, which subsequently benefited all minorities. However, prejudicial attitudes persisted, and a period of racial tension marked by episodes of violence followed. These incidents were a reflection of the social forces operating in the 1960s. It was the collision of the civil rights movement, the antiwar movement, the "War on Poverty," federal legislation to create a "balanced society," and the "channeling" policies of the Selective Service that aroused public awareness of equity issues in the military. Like their civilian counterparts, blacks in the Navy became more vocal and, in some cases, violent in their demands for equal opportunities and fair treatment [Ref. 7:p.37].

By 1970, Admiral Elmo Zumwalt was Chief of Naval Operations and blacks represented 5.5 percent of the Navy's enlisted force. This compared with about 11.6 percent in the general population. Zumwalt attempted to encourage the recruitment of blacks by relaxing aptitude standards for enlistment. However, occupational assignment continued to be made primarily on the basis of aptitude tests. Zumwalt's decision to lower

standards to attract more black recruits proved somewhat self-defeating, because a majority of blacks could not score high enough on the aptitude tests to qualify for many of the more desirable ratings. Consequently, blacks continued to gravitate to the lower skill occupations [Ref. 6].

In the early 1970s, American participation in Vietnam diminished and draft calls declined. The declining pool of draft-induced volunteers available to the Navy forced the Service to establish lower entry standards for aptitude and education. Many of the new recruits who entered because of the lower standards were black. But, as before, the new, lower-qualified sailors could not qualify for technical training and were relegated to the least desirable jobs in the Navy [Ref. 6].

By 1974, one year after the draft ended, the proportion of black enlisted men in the Navy had increased from 5.5 to 8.1 percent. In that year, blacks represented 11.7 percent of first-term volunteers in the Navy, marking the first time in history that the proportion of black recruits matched or exceeded the level of black representation in the general population [Ref. 8].

Despite the progress in overall force composition, inequities in promotions, occupational selection, and administration of justice persisted. In response, the Navy, for the first time, recognized the possibility that systemic institutional discrimination could exist in many personnel areas. Equal opportunity and affirmative action programs were inaugurated throughout the 1970s to address these problems. The effect was to focus attention annually on issues of equal opportunity. Sailors received racial awareness training, and commanding officers were required to annually assess the equal opportunity climate in their commands. Commanders were required to identify deficiencies and establish actions to address these deficiencies.

In summary, the long history of blacks in the Navy is replete with personnel policies and practices that have been less than fair. For many years, segregation was carried

out in the Navy by policies that restricted access to occupations. Despite this tainted past, the plight of minorities in the Navy has significantly, albeit gradually, improved since World War II. Manpower needs were often the impetus for the greatest improvements. Today, there are no policies that discriminate directly against minorities. Affirmative action and equal opportunity programs have been in place to monitor and eradicate discrimination, both direct and indirect, for nearly two decades. Still the question remains: how effective have past policies been, and what new policies, if any, are needed?

B. APTITUDE TESTING FOR SELECTION, CLASSIFICATION, AND ASSIGNMENT

The accession process for new recruits includes three stages:

- The first is *selection* in or out of the Service, depending on whether or not a person meets the minimum qualification standards.
- The second is *classification*, or the determination of an individual's qualifications for specific occupational specialties.
- The third is *assignment* to training for a specific occupational speciality.

Assignment to training for a specific occupational specialty is based in part on qualification standards and on the needs of the Service. It is important to note that qualification standards for the Navy include more than just passing scores on the enlistment test; they also include educational, medical, physical, and moral standards.

1. Evolution of the Selection Process

The U.S. military has been a leader in the field of personnel testing and selection. The fundamental purpose for using selection criteria is to eliminate "bad risks" and those who cannot meet the "severe demands of war" as well as to select people who can be trained most effectively and efficiently [Ref. 9].

The issue of military selection based on aptitude was first raised in World War I. The weapons used in this war were significantly more lethal and sophisticated than in previous conflicts. To ensure soldiers were equal to the task, military leaders sought a screening technique. The Army Alpha and Army Beta tests were subsequently developed to provide military commanders an index of the learning of their men. Additionally, these tests were designed to give manpower and personnel planners an objective basis to make personnel assignments by separating slow and fast learners into different categories [Ref. 8:p. 22].

After World War I, the purpose of the military's screening process shifted from preparing men for war to limiting the number of potential pensioners. During the post-war period, the military was concerned that unfit men might enter the military and then later be discharged for an injury received supposedly while on active duty, thereby securing a pension through contrivance [Ref. 8:p. 20].

During World War II, the Army replaced the Army Alpha test with the Army General Classification Test (AGCT). The AGCT was used to determine general learning ability. It also separated soldiers into five grades (I-V). The test was standardized to ensure that scores were representative of the age, education, and geographic distributions in the civilian manpower pool. The rapid learners (those who scored above 130) were place in grade I, while the slower learners (those who scored below 69) were placed in grade V [Ref. 8:p. 22]. The military has always had members who range the entire spectrum of learning abilities. A 1965 study by the Department of the Army, *Marginal Man and Military Service*, describes how the Army has utilized soldiers who have been classified as "marginal." The study points out that everyone is marginal, at least in some area, and that "marginality is a relative concept which can be meaningful only in a defined context." [Ref. 10]

After World War II, the Departments of the Army, Navy, and Air Force jointly developed a test to screen enlisted personnel. The Armed Forces Qualification Test (AFQT) was introduced in 1950; and, although it has been revised over time, the AFQT remains in use today. In the years following World War II, each service employed its own test to classify recruits for training in an occupation. In 1976, the Department of Defense (DoD) introduced the Armed Services Vocational Aptitude Battery (ASVAB) as a service-wide instrument for selecting and classifying all military recruits [Ref. 11].

2. Norming and Scaling

Before a military aptitude test is introduced, its scores are calibrated to an existing score scale that can be interpreted in terms of expected performance. Qualification standards require a score scale that indicates the level of expected performance and does not change the meaning when new forms of a test are introduced. The initial AFQT and Service classification batteries were calibrated to the distribution of the Army General Classification Test and the Navy General Classification Test score of men who served during World War II (a standard commonly referred to as the "44 metric"). As new forms of the ASVAB were introduced, they too were calibrated to the World War II population so that the meaning of qualifying standards remained relatively constant [Ref. 11].

3. The Infamous Misnorming Incident

Three years after introduction of the new ASVAB in 1976, problems with the new exam developed. Allegations surfaced that the quality of new accessions was well below that of previous years. After intense investigation, the Department of Defense discovered errors in the method used to convert raw scores to percentile scores. In February 1980, the Assistant Secretary of Defense for Manpower, Reserve Affairs, and Logistics informed Congress "... that the Services might be enlisting a higher percentage of low scoring individuals than was previously thought to be the case." [Ref. 8]

Although the misnorming problem with ASVAB Forms 5, 6, and 7 was corrected very quickly, with the introduction of ASVAB Forms 8, 9, and 10 in October 1980, tremendous damage had already been done. Hundreds of thousands of people qualified for enlistment and assignment to technically demanding occupational specialties who would not have qualified if the scores had been accurately scaled [Ref. 8].

4. Classification and Assignment using ASVAB

Various forms of the ASVAB have been developed since the original version was introduced as part of the Department of Defense High School Testing Program in 1968. Forms 5, 6, and 7 were the first versions to be used under the Joint-Service testing program that began in 1976. Forms 5, 6, and 7 consisted of 12 subtests designed to examine a recruit's abilities in areas considered important to military jobs. In October 1980, DoD overhauled the ASVAB, replacing Forms 5, 6, and 7 with Forms 8, 9, and 10. The new versions consisted of only ten subtests. Some previous subtests were combined, new subtests were created, and some old subtests were eliminated. Subsequently, DoD has introduced new versions comprised of the same subtests: Forms 11, 12, and 13 in October 1984; Form 14 in July 1984; Forms 15, 16, and 17 in January 1989; and Forms 18 and 19 in July 1992 [Ref. 11:p. 89-93].

Forms 8 through 19 test skills in the following areas: Word Knowledge, Paragraph Comprehension, Arithmetic Reasoning, Numerical Operations, Coding Speed, General Science, Mathematics Knowledge, Mechanical Comprehension, Electronics Information, and Auto/Shop Information. The first four measure general trainability, and the second six measure more specialized knowledge considered relevant to technical vocations. Tables 2 and 3 list the ASVAB subtests with a brief description, the number of questions, and testing time in minutes for Forms 5, 6, and 7, and Forms 8 through 19, respectively. The subtests are combined in different combinations to form composites.

TABLE 2. ASVAB SUBTESTS: DESCRIPTION, NUMBER OF QUESTIONS, AND TESTING TIME FOR FORMS 5 THROUGH 7

Content Area	Description	Items	Time (Minutes)
Arithmetic Reasoning (AR)	Word problems that emphasize reasoning rather than mathematical knowledge.	20	20
Attention to Detail (AD)	A speeded test to count the number of "C's" embedded in series of "O's".	30	5
Automotive Information (AI)	Knowledge of automobiles.	20	10
Electronics Information (EI)	Knowledge of electricity, radio principles and electronics.	30	15
General Information (GI)	Information on Geography, sports, history, automobiles.	15	7
General Science (GS)	Knowledge of physical and biological sciences.	20	10
Math Knowledge (MK)	Knowledge and skills in algebra, geometry, and fractions.	20	20
Mechanical Comprehension (MC)	Understanding of mechanical principles, such as gears, pulleys, and hydraulics.	20	15
Numerical Operations (NO)	A speeded test of the four arithmetic operations-addition, subtraction, multiplication, division.	50	3
Shop Information (SI)	Knowledge of shop practices and use of tools.	20	8
Space Perception (SP)	Identifying a three-dimensional figure obtained from folding a flat pattern.	20	12
Word Knowledge (WK)	Understanding the meaning of words.	30	10

Source: Department of Defense, *Test Manual for the Armed Services Vocational Aptitude Battery*, July 1984.

Each service applies minimum test standards referred to as "cut scores" to establish the minimum aptitude requirement for entry into the military and qualification for training in a specific occupation or rating. The choice of subtests used to create a composite is based on the ability of the subtests to predict performance in training and later, performance in the occupation. A report by the Defense Manpower Commission in 1976 describes the principle applied to determining composites:

> Eligibility for assignment to jobs involving, for instance, mechanical work was determined by the score a person achieved on a test purportedly predictive of mechanical aptitude. Thus the qualification of individuals for assignment to all occupations in which mechanical work predominated was governed by the score attained on the

TABLE 3. ASVAB SUBTESTS: DESCRIPTION, NUMBER OF QUESTIONS, AND TESTING TIME FOR FORMS 8 THROUGH 19

Content Area	Description	Items	Time (Minutes)
Arithmetic Reasoning (AR)	Word problems that emphasize reasoning rather than mathematical knowledge.	30	36
Auto/Shop Information (AS)	Knowledge of automobiles, shop practices and use of tools.	25	11
Coding Speed (CS)	A speeded test to match words and numbers.	84	7
Electronics Information (EI)	Knowledge of electricity, radio principles and electronics.	20	19
General Science (GS)	Knowledge of physical and biological sciences.	25	11
Math Knowledge (MK)	Knowledge and skills in algebra, geometry, and fractions.	25	24
Mechanical Comprehension (MC)	Understanding of mechanical principles, such as gears, pulleys, and hydraulics.	25	19
Numerical Operations (NO)	A speeded test of the four arithmetic operations-addition, subtraction, multiplication, division.	50	3
Paragraph Comprehension (PC)	Understanding the meaning of paragraphs.	15	13
Word Knowledge (WK)	Understanding the meaning of words.	35	11
Verbal (VE)	Summation of PC and WK.	n/a	n/a

Source: Department of Defense, *Test Manual for the Armed Services Vocational Aptitude Battery*, July 1984.

mechanical aptitude test. Similarly, other occupations characterized by another common and essential type of work such as clerical activities, were grouped together in occupational "clusters" corresponding to the common aptitude required. This practice continues today, although the various aptitude tests have been periodically refined over the years [Ref. 8:p. 69], [Ref. 12:p. C-3].

The AFQT is an ASVAB composite used by all Services for enlistment screening. The AFQT is used to predict an applicant's overall "trainability." With Forms 5, 6, and 7, the AFQT consisted of the Word Knowledge, Space Perception, and Arithmetic Reasoning subtests. With Forms 8 through 14, the AFQT consisted of Word Knowledge, Paragraph Comprehension, Arithmetic Reasoning, and one-half the value of Numerical Operations. In January 1989, the AFQT was revised so that it consisted of twice the combined value of Word Knowledge and Paragraph Comprehension, plus Arithmetic Reasoning and

Mathematics Knowledge. Tables 4, 5, and 6 show the ASVAB composites and their component subtests for Forms 5 through 7, Forms 8 through 13, and Forms 14 through 19, respectively [Ref. 11:p. 90].

TABLE 4. COMPOSITES AND COMPONENT SUBTESTS: ASVAB FORMS 5 THROUGH 7

Description	Composite	Component Subtests
Armed Forces Qualification Test	AFQT	WK + AR + SP
Clerical	CLER	WK + AD + NO
Electronics	ELEC	AR + MK + GS + EI
General Technical	GT	WK + AR
Mechanical	MECH	WK + MC + SI

Source: Department of Defense, *Armed Services Vocational Aptitude Battery (ASVAB) Test Manual*, 1984.

TABLE 5. NAVY COMPOSITES AND COMPONENT SUBTESTS: ASVAB FORMS 8 THROUGH 13

Description	Composite	Component Subtests*
Armed Forces Qualification Test	AFQT	VE + AR + 1/2NO
Mechanical	MECH	VE + MC + AS
Clerical	CLER	NO + CS + VE
General Technical	GT	VE + AR
Electronics	ELEC	AR + MK + EI + GS
Basic Electricity/Electronics	BE/E	AR + GS + 2MK
Boiler Tech/Engineman/Machinist Mate	BT/EN/MM	MK + AS
Submarine	SUB	VE + AR + MC
Machinery Repair	MR	AR + MC + AS
Hospitalman	HM	VE + MK + GS
Communications Technician	CT	VE + AR + NO + CS
Aviation Structural Mechanic	AM	MC + VE

Source: Department of Defense, *Armed Services Vocational Aptitude Battery (ASVAB) Test Manual*, 1984.

See Table 3 for the full name of each subtest.

*VE is an abbreviation for Verbal composite and includes the Word Knowledge and Paragraph Comprehension subtests.

Every Service uses minimum AFQT scores in their enlistment standards. None of the Services uses AFQT specifically for job assignment. Certain Navy ratings (e.g., Basic Seaman) have no specific aptitude composite requirement.

TABLE 6. NAVY COMPOSITES AND COMPONENT SUBTESTS: ASVAB FORMS 14 THROUGH 17

Description	Composite	Component Subtests*
Armed Forces Qualification	AFQT	2VE + AR + MK
Mechanical	ME	VE + MC + AS
Clerical	CL	NO + CS + VE
General Technical	GT	VE + AR
Electronics	EL	AR + MK + EI + GS
Basic Electricity	E	AR + GS + 2MK
Engineering	EG	MK + AS
Submarine	ST	VE + AR + MC
Machinery Repair	MR	AR + MC + AS
Hospitalman	HM	VE + MK + GS
Communications Technician	CT	VE + AR + NO + CS
Business and Clerical	BC	VE + MK + CS

Source: Milton H. Maier, Defense Manpower Data Center Technical Report 93-007.
See Table 3 for the full name of each subtest.
*VE is an abbreviation for Verbal composite and includes the Word Knowledge and Paragraph Comprehension subtests.

The Department of Defense and Congress require that the AFQT scores of new recruits be reported in percentiles, grouped according to traditional AFQT categories. Percentile scores reflect a person's "trainability" relative to that of the general youth population. A percentile score of 50 is the mean score for the general youth population. A percentile score of 70 indicates a standing at or above 70 percent of all persons in the norming population. Those who score in category V (a percentile score of 9 or below) are considered "well below average" in trainability and are legally barred from military service. Traditional AFQT categories, percentile scores, and levels of trainability are listed in Table 7 [Ref. 8:p. 73].

The Services may increase their minimum AFQT standards to reduce the eligible pool of recruits and concentrate recruiting efforts on persons with higher test scores. For example, during a good recruiting year, the Services may find that the pool of applicants in the above-average range is large enough so that standards can be tightened for persons

TABLE 7. ARMED FORCES QUALIFICATION TEST (AFQT) CATEGORIES BY CORRESPONDING PERCENTILE SCORES AND LEVEL OF "TRAINABILITY"

AFQT Category	AFQT Percentile Score	Level of Trainability
I	93-99	Well above average
II	65-92	Above average
IIIa	50-64	Average
IIIb	31-49	Average
IV	10-30	Below average
V	1-9	Well below average

Source: Department of Defense, *Defense Manpower Quality: Volume I* (Washington DC: Office of the Assistant Secretary of Defense for Manpower, Installations, and Logistics, May 1985).

scoring at lower levels, perhaps restricting admission to high school graduates who score in the "average" and above levels.

As previously noted, each Service uses its own composites for assigning personnel to occupational training. The Services also choose the minimum acceptable score that will allow a person to qualify for training in a particular occupation. Previous studies have noted that there are differences between the scores of minorities and others on the ASVAB [Ref. 13]. These differences have raised questions about the fairness of the test and, more generally, about fundamental disparities in the abilities of particular minority groups. Are blacks, for example, inherently less qualified than whites for technical occupations; is the ASVAB somehow biased; or, is there some other explanation or combination of reasons to account for the test score differences?

C. TEST FAIRNESS FOR MINORITIES

The fairness of tests for minorities is a great concern of the Services. Beginning during the Vietnam era and continuing with the AVF, the Services became more sensitive to the impact of testing on all individuals, noting especially the impact on members of racial/ethnic subgroups and women. The concern remains that personnel decisions in terms of

both selection and classification may not be fair for all groups. A number of studies have examined race-related differences that occur in aptitude testing. Some of these efforts have specifically addressed the fairness of the military's enlistment test. This section reviews some of these studies and examines what those differences are.

One of the most comprehensive studies to examine the correlation between individual differences and ASVAB scores is *Demographic Influences on ASVAB Test Performance* (1984) by Darrell Bock and Elsie Moore. This 1984 study reports the results of the 1980 *"Profile of American Youth"* in which the ASVAB was administered to a representative sample of 12,000 young people between the ages of 15 and 23. The Profile study was undertaken in part to establish new national norms for the ASVAB. The study by Bock and Moore found that average test scores for blacks are almost always lower than those for whites and Hispanics, and in some cases by as much as 100 scale points. Bock and Moore found evidence of a small group of blacks, amounting to perhaps 10 percent of the black population, whose scores are comparable to those of whites. They concluded that these blacks were participating more fully in the majority culture as represented in the content of the vocational test [Ref. 13].

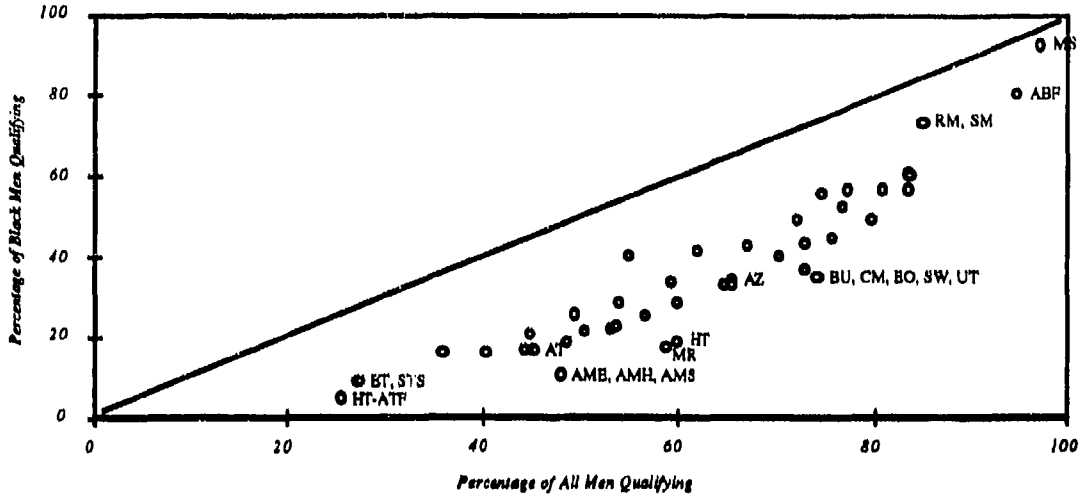
In a highly detailed and thoroughly researched book on the subject of bias in standardized testing, Arthur R. Jensen's *Bias in Mental Testing* (1980) examines psychometric methods for detecting bias and for applying standardized tests fairly in education, personnel management, and other areas. Jenson, a controversial figure in the field of testing, concluded that the most widely used standardized tests are not biased against any of the native-born English speaking minority groups for whom sufficient data exist. Jensen further concluded: "The observed mean differences in test scores between various groups are generally not an artifact of the tests themselves, but are attributable to factors that are causally independent of the tests." [Ref. 14].

As previously mentioned, racial/ethnic minorities, as a group, score lower than whites on aptitude tests in both civilian and military testing programs. Consequently, this means lower qualification rates for these minority groups. As such, aptitude tests continue to receive great scrutiny with respect to their fairness as predictors of performance in training and on the job.

Beginning in the 1970s, the Services started to evaluate the predictive validity of the ASVAB for blacks. A consistent finding is that the mean score for blacks is about one standard deviation below that of whites. This fact by itself shows an adverse impact on, but not necessarily a bias against, blacks. Test fairness is usually evaluated on the basis of how accurately it predicts the performance of minorities as compared to that of whites. In a Department of Defense report entitled *Sensitivity and Fairness of the Armed Services Vocational Aptitude Battery (ASVAB) Technical Composites* (1992), findings suggest that the ASVAB is equally accurate in predicting training grades for racial/ethnic minorities. If discrepancies existed, it was because the tests tended to predict higher than the actual performance of minorities [Ref. 15].

Figure 1 provides a graphical indication of the differences in qualification rates for black men and for the entire population of new male accessions during fiscal 1994. Each circle represents a rating with an ASVAB qualification requirement. Qualification rates for the overall population are located on the diagonal line. Only selected ratings are identified by name. Figure 1 demonstrates that black men qualify at lower rates for all ratings that have ASVAB qualification requirements when compared with the entire Navy male enlisted population.

FIGURE 1. A-school Qualification Rates for New Accession in the Navy, Fiscal 1994



Source: Derived from data provided by the Center for Naval Analyses.
Only selected ratings are labeled.

D. AFFIRMATIVE ACTION

1. Federal Affirmative Action

The nation experienced a resurgence in consciousness concerning inequality of minorities in the United States in the 1960s. The term "institutional racism" or "institutional discrimination" was first popularized in the literature in 1967 [Ref. 16]. Activists and social scientists adjusted their focus from personal forms of discrimination to institutional forms, particularly those in the work place. Many came to believe that passive non-discrimination would not adequately address institutional forms of discrimination. The federal government required government contractors to take positive steps to ensure that minorities were employed and treated without regard to race, creed, color, religion, or national origin. Executive Order 10925 of 1961 directed positive measures for the elimination of any discrimination, direct or indirect, in the federal government [Ref. 17]. The Civil Rights Act of 1964 prohibited discrimination in programs receiving federal

assistance and established the Equal Employment Opportunity Commission. By 1972, Executive Order 11246 required affirmative action programs of government agencies including the armed forces and all federal contractors.

For DoD activities, heads of organizations are responsible for equal opportunity in their respective jurisdictions. DoD requires the Armed Services to formulate, maintain, and carry out affirmative action plans that establish quantifiable good faith goals, timetables, and accountability in personnel management [Ref. 18].

2. Navy Affirmative Action Plan

a. Description

Prior to 1971, the Navy had no service-wide program specifically designed to address racial discrimination. In response to the DoD requirement, the Navy began its first efforts at increasing racial awareness in January 1972 with Navy-wide race relations training. By 1978, the Navy had instituted the Navy Affirmative Action Plan (NAAP), a comprehensive equal opportunity program still in effect today. The NAAP identifies specific categories in which the Navy will take positive, affirmative steps to achieve a demographically-balanced composition of personnel, ensuring fair treatment and freedom from discrimination. Accessions, assignments, promotions, and utilization of skills (occupational placement) are among the categories monitored.

The NAAP is intended to be a continuing program of goals and actions with realistic milestones. Goals are reassessed on an annual basis, and milestones are revised and updated by comparing statistical trends within each of the identified categories [Ref. 2].

Many of the Navy's own studies provide evidence of a skewed distribution of minorities along the spectrum of occupational specialties [Ref. 5]. When compared with their overall percentages in the Navy, minorities tend to be underrepresented in the more technical ratings. This finding, in and of itself, would not necessarily justify an affirmative

action. The Navy's definition of affirmative action is "the taking of positive steps to correct or eliminate present or future institutional discrimination that decreases equal opportunity due to race, color, national origin, religion, or gender, and all traces of past discriminatory policies or practices." [Ref. 2] To merit consideration for affirmative action, the unequal occupational distribution of minorities must be shown to be the result of institutional bias.

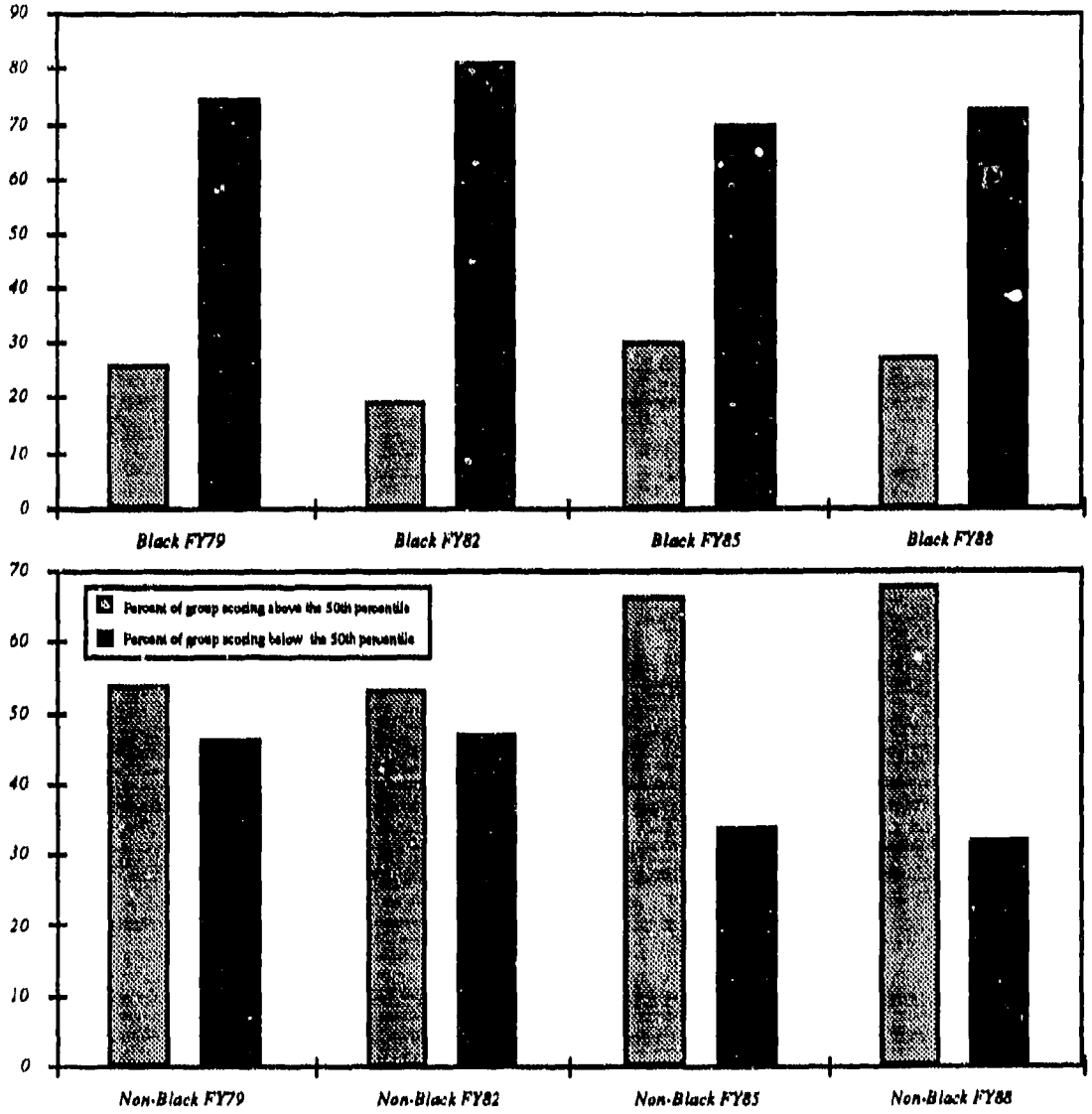
As previously discussed, the history of the Navy is replete with personnel policies and practices that have discriminated against racial/ethnic minorities particularly blacks. It is open to debate whether remnants of these policies and practices still exist. Nevertheless, by identifying occupational placement for minorities as one of the twelve major points in NAAP, the Navy has ensured that this issue will receive continual focus.

b. Program Application

The Job-Oriented Basic Skills (JOBS) program represents a potentially powerful tool of the Navy to combat disproportionate minority representation. JOBS is an intensive course of basic and remedial instruction. It is provided to a select group of new recruits (of all races) who show promise but lack the formal education to score high enough on the ASVAB to qualify for the more technical training programs. The effectiveness of JOBS as a key element in an ethnic/occupational balancing strategy arises from acknowledgment that minorities constitute a significant number of the population unable to qualify for technical programs.

Figure 2 shows the percentage of new recruits, both black and non-black, who score above and below the 50th percentile on the AFQT. Although the AFQT is not used directly for job assignment, it is an indicator of overall "trainability." As seen in Figure 2, there has been some improvement in the proportion of non-blacks scoring above the 50th percentile between 1982 and 1985. During that same period, the proportion of blacks scoring above the 50th percentile actually declined.

FIGURE 2. Distribution of AFQT Scores Above and Below the 50 Percentile for Black and Non-Black Male New Recruits in FY1979, FY1982, FY1985, and FY1988



Source: Derived from data provided by the Defense Manpower Data Center.
FY79 Test Results are "renormed" to the 1944 metric.

If the minority aptitude deficiencies depicted above could be overcome in sufficient numbers through the JOBS program, then proportional attendance at the A-schools (the Navy's occupational training schools) might eventually be achieved and

occupational specialties would eventually become racially balanced. However, JOBS is an expensive program in terms of both dollars and manpower. It is also dependent upon volunteers who perceive benefit from spending an additional period of time undergoing classroom training. It is unlikely that this program by itself could ever grow to the size that would be needed to achieve racially balanced occupational specialties.

Through early 1978, Commander, Navy Recruiting Command (CNRC) managed assignment to A-schools with an archaic system of card files called "RACS." Increasing demands to meet monthly accession goals while paying closer attention to minority recruiting and placement soon rendered the manual methods ineffective. The answer was a computer program designed by Dr. Len Kroeker of the Navy Personnel Research and Development Center (NPRDC), implemented by the Navy in 1981 under a system named Personalized Recruiting for Immediate and Delayed Entry (PRIDE). It provides the Navy with an orderly and efficient mechanism for the management and control of the recruiting process by performing several crucial recruiting functions. PRIDE automates the process of matching an applicant's personal preference and qualifications. Access to PRIDE is available to all of the Navy's recruiters and classifiers via personal computer and modem. CLASP (Classification and Assignment within Pride) is the software model or algorithm that matches available training programs with applicant information and generates a list of programs that the applicant is offered. It takes various inputs such as ASVAB scores, physical qualifications, fill rates for given A-schools, historical attrition factors, Navy needs, and individual preferences and computes an "optimality index." The index is rank-ordered on the basis of the value of "optimalities" for each applicant, for each month. The list is automatically edited with respect to ratings for which the applicant is not qualified on the basis of physical standards or ASVAB score. A final edit removes all ratings for which there is no school quota or for which the applicant does not meet the "minimum optimality requirements." [Ref. 19:p. 1-30]

It is important to note that, regardless of how qualified an applicant might be, CLASP will automatically generate only A-school quotas that are available during a three-month window. A-school quotas are determined by start dates, seat loading, and projected manpower requirements for a particular rating. If the applicant desires an A-school without a current quota, then the Navy classifier must manually query the program to determine when in the future a desired quota will become available. The obvious requirement to "sell" current A-school quotas usually means that approval from a higher authority is required to assign an applicant to a future quota. The PRIDE/CLASP classification and assignment process represents another powerful weapon to combat disproportionate minority representation because it offers an automated method to ensure Service goals are directly conveyed to the classifier.

ASVAB scores are far and away the most important determinant in the A-school assignment process. Poor performance on the ASVAB prevents many minorities from attending the most desirable A-schools. This circumstance no doubt accounts for a portion of the disparity in racial or ethnic representation with Navy occupations. Exactly how much of the disparity can be attributed to "lack of skills" is not known.

E. PREVIOUS RESEARCH ON THE OCCUPATIONAL PLACEMENT OF MINORITIES IN THE MILITARY

Relatively little research has addressed occupational placement of various racial/ethnic minorities in the military. Studies in this area are those done by Butler (1976), Nordlie et al. (1975), Zucca (1984), Eitelberg (1988), and Barnhill (1991).

In a 1976 study of trends in correlations between race and rank in the military from 1962 to 1973, John Sibley Butler found negative correlation between the percentage of blacks and enlisted rank. Specifically, the higher the rank, the lower the percentage of blacks in the rank. Butler also found that, in the Army, blacks were overrepresented in non-

technical occupations, and he found that there was no change in the trend of this distribution between 1966 and 1972. When the effects of mental ability (as measured by the AFQT) were controlled, the inequities in rank and occupational specialty distributions remained, as did the trend of representation between 1966 and 1973 [Ref. 20:p. 558-556].

In a second study, Butler (1976) examined black and white promotion in Army technical and non-technical occupational specialities. When he controlled for aptitude, as measured by AFQT, he discovered that blacks in both categories were promoted more slowly than were whites and that whites attained a given rank faster than blacks. When the variable of education was controlled, Butler found that, with few exceptions, whites were promoted faster than blacks. Butler also controlled for type of occupational specialty and found, as one might expect, that both blacks and whites in technical occupations were promoted faster than blacks and whites in non-technical occupations [Ref. 21:p. 807-818].

In a 1975 study of Army occupational placement and promotion from 1962 to 1973, Nordlie et al. found that blacks were progressively underrepresented in higher enlisted ranks, particularly E8 and E9. The authors also found that blacks were overrepresented in infantry, gun crews, supply, service, administrative, and medical specialities and underrepresented in electronics, craftsman, communication, intelligence, and other technical specialties [Ref. 22]. Nordlie and his coauthors lacked data to control for qualifications required for various occupational specialties. As a result, they were unable to determine to what extent the racial differences found in occupational placement were due to the inability of blacks to qualify for high-skill occupations and to what extent the differences were due to racial discrimination.

In 1986, Gary J. Zucca, a former Naval Officer, examined the effectiveness of the Navy's Affirmative Action Plan with respect to occupational placement and advancement

of blacks and Hispanics. A significant portion of his work was dedicated to an assessment of minority representation in occupational specialties [Ref. 23].

Zucca hypothesized that complex organizations tend to protect their "core technology" from change. As applied to the Navy, core technology specialties include those involving the operation of weapons and propulsion systems aboard ships and aircraft. Peripheral specialties are those involved with support and administration. If such a phenomenon were occurring with regard to minority inclusion in the Navy, then all other factors being equal, minority representation should be greater in occupational specialties that represent peripheral technology rather than in those representing core technology. Alternatively, if all other factors were equal, the distribution of minorities among core and peripheral occupational specialties should move toward equality [Ref. 23].

Zucca discovered that, after attempting to control for aptitude, blacks and Hispanics were overrepresented in less-technical ratings and underrepresented in more technical ones. Less expected was Zucca's conclusion that black and Hispanic overrepresentation actually increased in non-technical ratings in direct relation to the degree of qualification required for entrance into those ratings. This contradicts the notion that disproportionate minority representation can be attributed solely to lower aptitude levels. He contends that many highly qualified minorities are being directed by the Navy into support, rather than technical ratings. Zucca asserts that racial inequalities in representation with regard to occupational placement are not explainable by the differences in the human capital (formal education, training, experience) of Navy recruits [Ref. 23]. In Chapter III, I will examine and assess the validity of Zucca's methodology in controlling for aptitude and evaluating the Navy's occupational placement process [Ref. 23].

In 1991, Jon T. Barnhill, a student at Naval Postgraduate School in Monterey, California, replicated Zucca's methodology using 1982, 1986, and 1990 data. He obtained results that reinforced those of Zucca [Ref. 24].

Chapter III of this thesis reviews the methodology used in, and the results of, the earlier studies. The chapter also discusses weaknesses of the earlier studies and presents a new approach that attempts to overcome those weaknesses.

III. CONTROLLING FOR THE INFLUENCE OF APTITUDE: METHODOLOGIES AND RESULTS

This chapter is divided into three sections. Section A begins with an examination of Zucca's "Core Technology Model" and an assessment of the methodology employed by Zucca (1984) and Barnhill (1991) to control for the influences of aptitude. Section B introduces the "Assignment Model," a new methodology to control for the influence of aptitude. Subsections provide a full description of the "Assignment Model," including the data sources used, the population to which the model is applied, the computation of the model, occupational group definitions, and a discussion of "difference indicators." Section C provides a full analysis of the results derived from the "Assignment Model."

A. THE CORE TECHNOLOGY MODEL

Zucca (1984) actually proposed three models to analyze the representation of minorities in Navy occupational specialties. They were the Cohort Model, the Self-Interest Model, and the Core Technology Model. He hoped his models would explain the occupational distribution of ethnic groups in a complex organization (in this case, the Navy) after the implementation of an affirmative action policy. Of the three, Zucca seemed most satisfied with the results of the Core Technology Model. This model examines an organization in terms of its "core" and "peripheral technologies." As applied to the Navy, core technology specialties include those involving the operation of weapons and propulsion systems aboard ships and aircraft. Peripheral specialties are those involved with support and administration. Examples of peripheral specialties include Yeoman, Mess Specialist, and Corpsman. [Ref. 23, 24:p. 19].

Under the assumption that organizations desire to protect the core technology from outside influence [Ref. 24], Zucca argues that occupational specialities that represent the core technologies of the Navy are traditionally white and male, and that personnel in power

positions within the organization, who are also primarily white and male, tend to maintain them as such. Hence, Zucca's "Core Technology Hypothesis" states that, all factors being equal, minority groups will be overrepresented in peripheral occupational specialties and, conversely, underrepresented in core technology specialties [Ref. 23; 24:p. 20].

1. Zucca's Data Sources

Data for Zucca's study were obtained primarily from the Navy-wide Demographic Data Base. His data identify the occupational specialty, rank, sex, and ethnic identity of the entire active duty enlisted population for the years 1976,1979, and 1982. He selected these particular years for the following reasons: (1) they contained data on Hispanics; (2) they offered the most recent data available; and (3) 1979 provided a midpoint reference for the other two years. His data were aggregated as of the end of the fiscal year (September 30th) [Ref. 23:p. 34].

His second source of data was the *Navy Enlisted Career Guide 1980-1981*. This publication provides job descriptions for each of the Navy occupational specialties and was used to determine whether an occupation represented core or peripheral technologies [Ref. 23:p. 34].

His third source of data was the *Navy Recruiter's Manual* (COMNAVCRUITCOM, 1979). The data from the manual provided aptitude test composites and corresponding "cut scores" required for acceptance into the A-schools for each occupation that requires A-school training [Ref. 23:p. 35].

2. Identification of the Population

Zucca's data represented the total male enlisted population of the Navy for the years 1976, 1979, and 1982. From this population, only white, black and Hispanic ethnic groups were selected for study. Zucca considered the treatment of women beyond the scope of his study. Additionally, seven construction occupational specialties (Sea Bees) and three

Petty Officer occupational specialties were deleted from the population. Zucca deleted the Sea Bees because they were considered organizationally autonomous and, therefore, did not represent traditional Navy occupations. Zucca deleted the Petty Officer occupational specialties of Legalman, Master-at-Arms, and Navy Counselor because they are not open to incoming recruits, but rather obtain personnel via transfer from other occupations.

3. Controlling For Aptitude

To determine the degree to which aptitude influences the occupational distribution, Zucca (1984) attempted to isolate aptitude from other possible factors. To accomplish this, he needed a variable or proxy for aptitude that possessed the proper attributes. The variable had to be common to all members in the data set, it had to be easily quantifiable, and it had to be readily accessible. ASVAB scores fit all three criteria [Ref. 23].

Zucca (1984) realized the need to find a common basis by which to compare the many diverse occupations of the Navy. He believed no direct method existed to judge the differences in aptitude levels required for each of the Navy's ratings. The aptitude composites used to screen recruits for each rating are generally unique and contain no subtest common to all composites. The author attempted to standardize each composite score using the following methodology [Ref. 23].

To control for the aptitude variable (ASVAB scores), Zucca (1984) first ranked each rating in descending order by the minimum score required for entrance into that rating's A-school. He then grouped individual ratings in the order of their ranking. Because each subtest making up a composite is standardized to 50, average standardized scores for each rating were computed by dividing the composite minimum score by the number of subtests forming the composite. Based on this average score, Zucca ranked all occupational specialties into one of three "aptitude" categories (Low, Medium, or High), with roughly

one-third of enlisted petty officers falling into each category. Table 8 provides the range of computed average standardized scores and their breakdown into aptitude groups [Ref. 23].

TABLE 8. APTITUDE GROUPS (BY SCORE RANGE) AS DEFINED IN THE "CORE TECHNOLOGY" MODEL"

Aptitude Group	Score Range†
Low	45.0 - 49.0
Medium	49.1 - 51.6
High	51.7 - 55.0

Source: [Ref. 23:p. 38].

† Scores were calculated by dividing the composite minimum score for each rating's A-school by the number of subtests forming the composite.

Looking at the Medium aptitude group in Table 8, the scores making up this category fall into a relatively narrow range on either side of the mean (50). Zucca indicated that the small variance associated with this "bunching" effect precipitated rather inconsistent and confusing results. Consequently, Barnhill (1991) discounted findings emanating from the Medium aptitude group. Both Zucca and Barnhill felt the occupational ratings falling on the extremes of the aptitude spectrum—the High and Low aptitude groups—offered the greatest potential for overrepresentation or underrepresentation of minorities [Ref. 24].

4. Difference Indicators

Zucca (1984) used difference indicators to summarize and describe the occupational distribution of minorities [Ref. 23:p. 40]. Difference indicators were first introduced for military use by Nordlie et al. (1975). This method for summarizing differences in racial/ethnic composition assumes that all ethnic groups are randomly distributed throughout the population. For instance, if blacks constituted 18 percent of the Navy's population, under this assumption, one would also expect blacks to account for 18 percent of each occupational speciality. Any difference between the actual minority

composition of the particular rating and the expected composition based on the population as a whole is reflected in the difference indicator. The formula for calculating the difference indicator is displayed in equation (1).

$$DI = \left[\left(\frac{Actual}{Expected} \right) \times 100 \right] - 100 \tag{1}$$

Where:

DI	=	Difference Indicator
Actual	=	The actual number of members of a particular racial/ethnic group i in the category of interest j
Expected	=	The number of members of the racial/ethnic group of interest one would expect to find if members of that group were randomly distributed throughout the population.

The expected number is derived by multiplying the percent of the minority group in the aptitude group by the total population in that category. For example, suppose that within the highest aptitude group 18 percent are black. It follows that the expected number (of blacks) of any subset of that group would be the total number of members of that group times (.18).

The expected number is divided into the actual number to form a ratio. This ratio is multiplied by 100 so it can be expressed as a percentage. Finally, 100 is subtracted from the result so that, when the actual and expected numbers are equal, the difference indicator equals zero. Thus, any overrepresentation of the minority group appears as a positive number, and any underrepresentation appears as a negative number.

Continuing with the example, suppose the subset of interest forming the highest aptitude group contains 1,000 members and that 110 are black. The expected number (of blacks) would be 180 (from 1,000 x.18). Equation (2) solves for the difference indicator (DI):

$$DI = \left[\left(\frac{110}{180}\right) \times 100\right] - 100$$

$$DI = -38.9 \tag{2}$$

The negative sign denotes underrepresentation, and the 38.9 indicates that, for this particular subset of ratings, at this particular aptitude level, blacks are 38.9 percent underrepresented.

The selection of the expected population is crucial to the determination of the difference indicator. This is where Zucca's model deviates from Nordlie et al. (1975). Nordlie used the entire enlisted population of the Army as the basis for computing the expected percentage of each ethnic group. This, of course, assumes that minorities are distributed evenly without regard to their individual qualifications. In Zucca's model, the expected percentage used as a base are those enlisted personnel with the level of qualification required for the particular set of specialties being evaluated (i.e., those corresponding to High, Medium, or Low aptitude). In this way, Zucca attempted to control for aptitude.

The Navy Equal Opportunity Office, in its annual assessment of equal opportunity and affirmative action programs, uses the same equation for calculating difference indicators as does Nordlie et al. (1975) and Zucca (1984). However, the Navy's version, called the Minority Representation Index (MRI), like Nordlie et al. (1975), incorporates the entire enlisted force as the base for relating expected percentages of minorities [Ref. 5].

5. Occupational Categories

In his Core Technology Model, Zucca categorized occupations according to the job description of each occupational specialty. Each Navy rating was assigned to either

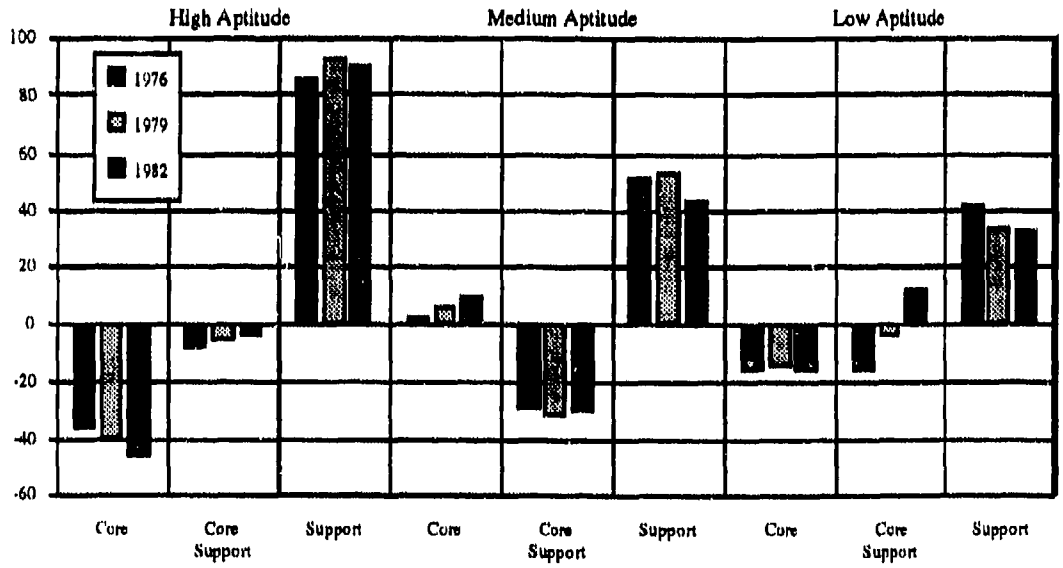
"Core," "Core-Support," or "Support Technology" based on the following criteria [Ref. 22, 23]:

- *Core Technology:* Ratings involved in the operation of propulsion, detection, or weapons systems aboard ships and aircraft. (Example: Sonar Technician, ST)
- *Core-Support Technology:* Ratings whose primary job functions are to maintain and repair equipment directly associated with the operation of ships and aircraft. (Example: Aviation Structural Mechanic, AMS)
- *Support Technology:* Ratings that provide logistic, medical, and administrative support to the operating forces. (Example: Disbursing Clerk, DK)

6. Results from the Core Technology Model

Figures 3 and 4 present the results from the application of Zucca's Core Technology Model. Zucca found that blacks, with the exception of those in ranks E4-E6 in

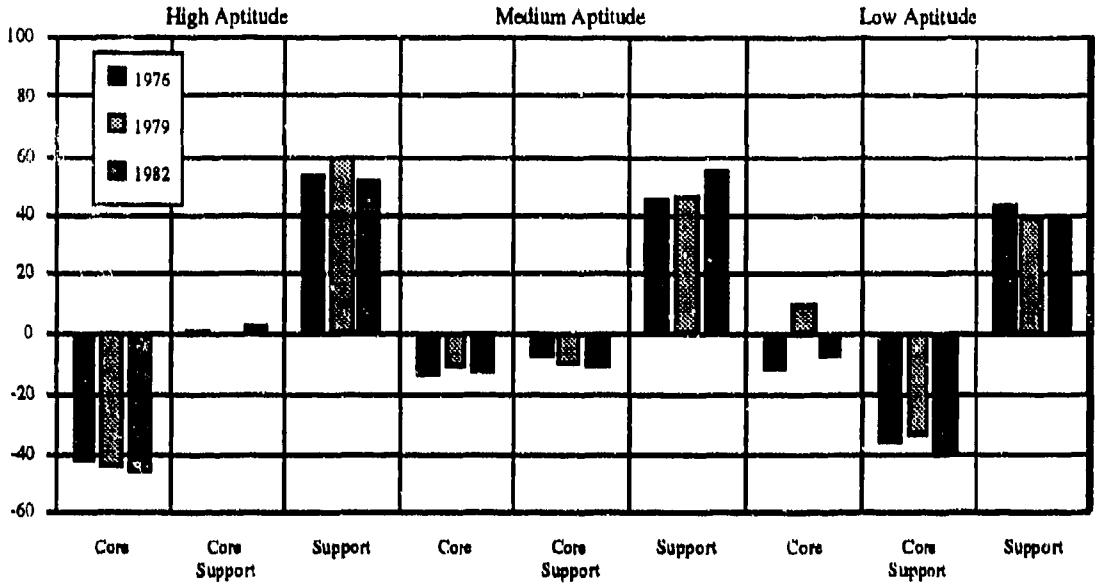
FIGURE 3. Results From the Core Technology Model: Difference Indicators for Blacks, E4-E6



Source: Gary J. Zucca, "Ethnic Distribution Among U.S. Navy Occupation Specialties and Ranks: Organizational Implications," Ph.D. Dissertation, University of Florida, 1984.

the medium aptitude group, were underrepresented in core technology and core support technology occupations and overrepresented in support technology occupations in all

FIGURE 4. Results From the Core Technology Model: Difference Indicators for Blacks, E7-E9



Source: Gary J. Zucca, "Ethnic Distribution Among U.S. Navy Occupation Specialties and Ranks: Organizational Implications," Ph.D. Dissertation, University of Florida, 1984.

categories of aptitude. He concluded that many highly qualified minorities were being directed by the Navy into support, rather than technical ratings. Because the greatest over representation of blacks occurred in "High aptitude" ratings rather than the "Medium aptitude" or "Low aptitude" ratings, the author asserted that racial inequalities in representation with regard to occupational placement are not explainable by the differences in the human capital (formal education, training, experience) of Navy recruits alone [Ref. 23].

7. Cohort Effect

Studies, such as those by Zucca (1984) and Barnhill (1991), that analyze cross-sections of the entire enlisted force to evaluate personnel policies over time will inevitably suffer from a cohort effect. Specifically, if there were a disproportionate representation of a particular minority among a given cohort of qualified entrants into a certain occupational

specialty in the past, this same disproportion will likely remain with the cohort as it progresses through the years of service and the paygrade structure. Since the Navy accepts virtually all of its recruits at the entry level, it would take a considerable period of time after the implementation of an affirmative action plan for the results to be seen. Consequently, there is a considerable delay (perhaps as great as twenty years) between conception, implementation, and accomplishment of specified affirmative action and equal opportunity goals throughout the entire paygrade structure. Thus, with studies, such as those by Zucca (1984) and Barnhill (1991), that analyze changes in occupational distributions using cross-sectional data over periods of only six to eight years, it is entirely possible for the results of significant policy changes to appear imperceptibly small or to be masked altogether by the residual influence of prior policies or exogenous elements.

8. An Assessment of Zucca's Methodology for Controlling for the Influence of Aptitude

The procedure employed by Zucca (1984) to control for the influence of aptitude cannot be mathematically verified or even assigned a statistical degree of significance. Any assessment of Zucca's model must therefore be made on the basis of its theoretical assumptions. The following are some of the weaknesses in Zucca's approach:

The author assumes that because all ASVAB subtests are standardized to a mean of 50, it is possible to make direct comparisons of various subtest averages. This may not be accurate. If two particular composites to be compared had several subtests common to both, a certain amount of validity could be assigned to this procedure. However, comparing two composites with no subtest in common is a somewhat dubious procedure.

The author categorizes aptitude groups based on a single score range. However, composite score minimums or "cut scores" are flexible over time. They are often raised or lowered based on changes in manpower requirements or space availability in the training

pipeline. Further, with the introduction of new ASVAB forms over time, composites that determine qualification for some ratings have changed. By establishing aptitude group criteria for the entire cross-section, Zucca assumes that qualification standards in 1959, for example, are equivalent to those in 1982. This, of course, is not the case.

The most serious misspecification arises from the method Zucca uses to determine aptitude distributions. By categorizing aptitude groups on the basis of the number of personnel *in* a given rating, Zucca assumes that the selection, classification and assignment process places individuals in occupations strictly on the basis of aptitude. As we know from the description of this process in Chapter II, several other factors also determine placement. These include education; personal preferences; physical, medical and moral qualifications; timing; and the needs of the Navy. Any methodology that determines aptitude distributions on the basis of where personnel are actually assigned will also capture the influences of these other factors.

The work done by Zucca to analyze ethnic distributions among Navy occupational specialties is the most comprehensive to date. Although there are several weaknesses in his methodology, his efforts to control for aptitude, without the benefit of individual ASVAB subtest data, are nonetheless commendable.

B. THE ASSIGNMENT MODEL

This section describes an approach for evaluating occupational placement using an alternative methodology to control for the influence of aptitude. This section discusses data sources, the population of interest, and the details of this alternative approach.

1. Data Sources

The primary data for this study were provided by the Defense Manpower Data Center (DMDC) in Monterey, California. The data consist of four distinct cohort files created from the Navy enlisted Active-duty Master and Loss Edit File merged with selected

data from the MEPCOM (Military Examination Processing Command) Edit file. The four cohorts represent persons who entered Naval Service in fiscal years 1979, 1982, 1985, and 1988, respectively. The file includes the demographic variables for: sex, race, age, and education, among others. The cohort data files also include status of prior service, raw and standardized ASVAB subtest scores,[3] ASVAB test form, and ASVAB test version.[4] The occupational specialty (rating) and paygrade (as of the end of each fiscal year) are provided in annual increments for each record through the end of fiscal 1992. This study focuses on the occupational distribution in the fifth year of service for each cohort.

The data represent the entire male enlisted Navy population in a particular cohort in a given year of service and therefore require no statistical procedure involving the estimation of population parameters. Thus, whatever differences are found between blacks and non-blacks will be significant because they are based on the population.

A second source of data is the *Navy Recruiters' Manual* (COMNAVCRUITCOMINST 1130 series) for fiscal years 1979, 1982, 1985, and 1988, respectively. This manual provides information regarding the qualifications required for entrance into the various Navy enlistment programs. The data from the *Navy Recruiters' Manual* used for this study are the ASVAB subtest combinations (composites) and their minimum respective "cut scores" required for entrance into the A-school for each occupational specialty. Although subtest combinations are relatively stable throughout a recruiting year, "cut scores" are often raised or lowered based on manpower requirements or space availability in the training pipeline. This study uses the "cut scores" in effect at the end of the fiscal year of accession.

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[3]Subtest from ASVAB Forms 5, 6, and 7 have been "renormed" to the 1944 metric.

[4]ASVAB raw scores were converted to ASVAB standardized scores by Mr. Robert Hamilton of the Defense Manpower Data Center, Monterey, California. This author is indebted to Mr. Hamilton for his assistance on this project.

2. Identification of the Population

As stated previously, this study focuses on the male enlisted population in the regular Navy during the fifth year of service for each of four cohorts. Cohort data were chosen because each cohort offers for analysis a relatively homogeneous group of personnel whose occupational placement and career opportunities have been guided by essentially the same personnel policies. Additionally, by focusing on individual cohorts, we are able to more easily discern the impact of affirmative action and equal opportunity programs as they evolve over the period of analysis—in this case, from 1979 through 1993 (the fifth year of service for the 1988 cohort). The use of cohort data eliminates one of the major weaknesses (the cohort effect) present in the Zucca study.

The fifth year of service was chosen because this approximates the beginning of the "career force." By the fifth year, most of the remaining members of a cohort will have "found their calling" and will be assigned to their career rating. Although the racial/ethnic distributions among occupations will shift somewhat as a particular cohort works its way toward retirement, these shifts are less the result of the occupational placement process, and are more related to advancement policies.

This study is limited to male active-duty enlistees in the regular Navy. An examination of the treatment of women, although an important and relevant topic, requires a different theoretical approach and is beyond the scope of this study. Accordingly, women are deleted from the study population.

Prior service personnel are not included because many of the policies affecting their occupational placement differ from those affecting other members of a cohort. Additionally, the inclusion of prior service personnel would introduce inconsistencies in paygrade analysis because prior service personnel often enter at a higher paygrade than a normal non-prior service accession.

After deleting women and men with prior service, and accounting for the normal attrition associated with five years of service, the remaining populations in each cohort are provided in Table 9. A total of 109 different occupational ratings were represented in the data.

TABLE 9. SUMMARY OF DATA SET POPULATIONS FOR SELECTED COHORTS IN THE FIFTH YEAR OF SERVICE

Cohort Accession Year	Non-blacks In the 5th Year of Service	Blacks In the 5th Year of Service	Missing Data Non-blacks	Missing Data Blacks	Total In the 5th Year of Service
FY1979	20,998	4,654	119	31	25,802
FY1982	22,620	3,781	97	25	26,523
FY1985	22,524	3,948	153	34	26,659
FY1988	22,551	5,541	96	30	28,218

Source: Derived from data provided by the Defense Manpower Data Center.
Missing Data are the result of incomplete ASVAB or rating information in an individual record.

3. Assignment Model

The purpose of the Assignment Model is to determine racial distributions across ratings after controlling for the influence of aptitude. Like the Core Technology Model specified by Zucca (1984), the Assignment Model uses ASVAB scores as the proxy for aptitude. As previously discussed in Chapter II, ASVAB scores are not the only factor that influence the selection, classification, and assignment process. While other factors (such as education, personal preferences, physical, medical and moral qualifications, timing, and the needs of the Navy)

influence ultimate assignment, ASVAB scores are the only component representing aptitude. To effectively control for the influence of aptitude, it is crucial that the model capture only the effects of aptitude. The Assignment Model accomplishes this by determining racial distributions solely on the basis of ASVAB scores. The Assignment Model does not attempt to replicate the results of the actual selection, classification, and

assignment process because to do so would introduce the unwanted influences of numerous factors other than aptitude.

The Assignment Model uses a five-step process to determine racial distributions by occupation after controlling for the influence of aptitude.[5] The first step is to determine the total *actual* number in each occupational specialty at the fifth year of service for a particular cohort. For example, from the data set, there were 460 Aviation Electrician's Mates (AEs) in the fifth year of service in the FY1985 cohort (not including women or men with prior service).

The second step is to evaluate each record in the data set on the basis of ASVAB qualification requirements for each of the 109 ratings to determine overall qualification rates. For example, in FY1985, to qualify for the AE rating it was necessary to score a minimum of 196 on the sum of the standardized subtest scores for Arithmetic Reasoning (AR), General Science (GS), and twice the score for Math Knowledge (MK).[6] In 1985, 75.77 percent of the entire population remaining after five years of service qualified for the AE rating.[7]

The third step rank-orders each rating on qualification "selectivity." Once qualification rates for the entire 109 ratings are determined, then the 109 ratings are rank-ordered on the "selectivity" of qualification For the FY1985 cohort, the Journalist (JO) rating was the most "selective" for which to qualify (only 51.74 percent of the total population qualified for JO). Conversely, each rating without a specific ASVAB requirement was the "easiest" with 100 percent of the cohort qualifying.

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[5]Although this five-step process could be completed manually, it is recommended that it be accomplished using the capabilities of a computer. This study employed the SAS® statistical program on an Amdahl® 5995 mainframe computer to complete the five-step process.

[6]Because a service member may have taken any number of different ASVAB Test Forms, each record must be screened for test form and the appropriate combination of subtests and "cut scores" applied.

[7]Excluding all women and men with prior service.

The fourth step is to randomly sort each record in the data file. While this can be accomplished in a number of different ways, for this study it was accomplished by sorting on the last four digits of the social security number, which was provided by DMDC.

The fifth and final step employs an assignment algorithm that assigns each individual record to the most "selective" rating for which an individual is qualified. This process is continued until the total number of individuals assigned to each rating is equal to the actual population of the rating, as based on the *actual* distribution (determined in step one). Once a rating is filled, the algorithm ceases to assign individuals to that particular rating and considers only the unfilled ratings. This process is continued until every individual is assigned a rating. Once every individual is assigned a rating, then the new distribution of blacks and non-blacks within each rating represents the original distribution after controlling for the influence of aptitude. Unlike Zucca's (1984) approach, High, Medium, and Low aptitude categories are not required because representation within each rating reflects a new distribution after controlling for aptitude.

4. Occupational Groups

Table 10 defines 14 broad Navy occupational groups. First used by Shiells and McMahon (1993) to examine the patterns of retention, advancement, and sea/shore ratios across ratings, these rating groups categorize ratings by functional groups [Ref. 26:p. 19]. Each of the 109 Navy ratings is assigned to one of the 14 categories. Occupational groups serve two purposes. First, they aggregate ratings into a smaller number of categories (with larger populations) thus smoothing the misleading effects arising from a small number of personnel in any single rating. For example, in the fifth year of service, the FY1985 cohort had a total of only eight Opticalman (OM). Given this small total number of personnel, it would be possible for the FY1985 cohort to have perfectly proportional representation (based entirely on random assignment) and still have no black OMs. Second, categorizing

TABLE 10. OCCUPATIONAL GROUP DEFINITIONS

Occupational Group	Name	Abbreviation	Ratings
1	Surface engineering	Surf eng	BT, EN, GSE, GSE GSM, MM
2	Hull, mechanical, electrical	HME	DC, EM, HT, IC, IM, ML, MR, OM, PI, PM
3	Aviation Maintenance	Av maint	AD, AE, AF, AM, AME, AMH, AMS, AQ, AS, ASE, ASH, ASM, AT, AV, AX, TD
4	Aviation operations	Av ops	AB, ABE, ABF, ABH, AC, AG, AO, AW, PH
5	Avintion supply	Av supply	AK, AZ, PR
6	Administrative	Admin	DM, DP, JO, LI, LN, MA, NC, PC, PN, RP, YN
7	Deck	Deck	BM, QM, SM
8	Supply	Supply	DK, MS, SH, SK
9	Medical	Med	DA, DN, DR, DT, HA, HM, HN, HR
10	Cryptology	Crypt	CTA, CTI, CTM, CTO, CTR, CTT, IS
11	Surface operations (combat systems)	Surf ops-cs	DS, EW, FC, FTM, GM GMG, GMM, GMT, OT, OTA, OTM, OTM, ST, STG, WT,
12	Surface operations	Surf ops	ET, ETN, ETR, OS, RM
13	Submarine	Sub	FT, FTB, FTG. MN. MT. STS, TM
14	Other	Other	all other ratings

Source: Shiells, Martha E. and Joyce S. McMahon, *Effects of Sea Duty and Advancement on First-Term Retention*, Center for Naval Analyses, 1993, p.19.

ratings into occupational groups allows representation data to be analyzed for functional groups and for enlisted communities.

5. Difference Indicators

Like Nordlie et al. (1975) and Zucca (1984), this study uses difference indicators to summarize and describe the distribution of blacks across occupational categories. Difference indicators are based on equation (2) above, but with the changes identified in equation (3):

$$DI = \left[\left(\frac{Actual}{Expected^{*}}\right) \times 100\right] - 100 \qquad (3)$$

Where:

DI	=	Difference Indicator
Actual	=	The *actual* number of blacks in a rating group i
*Expected**	=	The number of blacks one would expect to find in a rating group i as determined by the Assignment Model's percentage multiplied times the total *actual* number in the rating group i.

6. Assessing Annual Overall Trends in Black Representation Using the Annual Representation Index (ARI)

The Annual Representation Index (ARI) provides a comprehensive annual measure of representation of a particular group (in this case, blacks) for all occupational groups. When ARIs are compared over time, they provide an indication of the effectiveness of policies and programs intended to improve representation. ARIs are obtained from the summation of the absolute value of difference indicators in a particular year. The greater the ARI, the more disproportionate is the representation. An ARI of zero would indicate no disproportionate representation. The Annual Representation Index (ARI) is defined by equation (4) below.

$$ARI = \sum_{j=1}^{J} |DI_j| \qquad j = 1, 2, \ldots, J \tag{4}$$

Where:

ARI	=	Annual Representation Index
DI_j	=	the difference indicator for occupational group j.

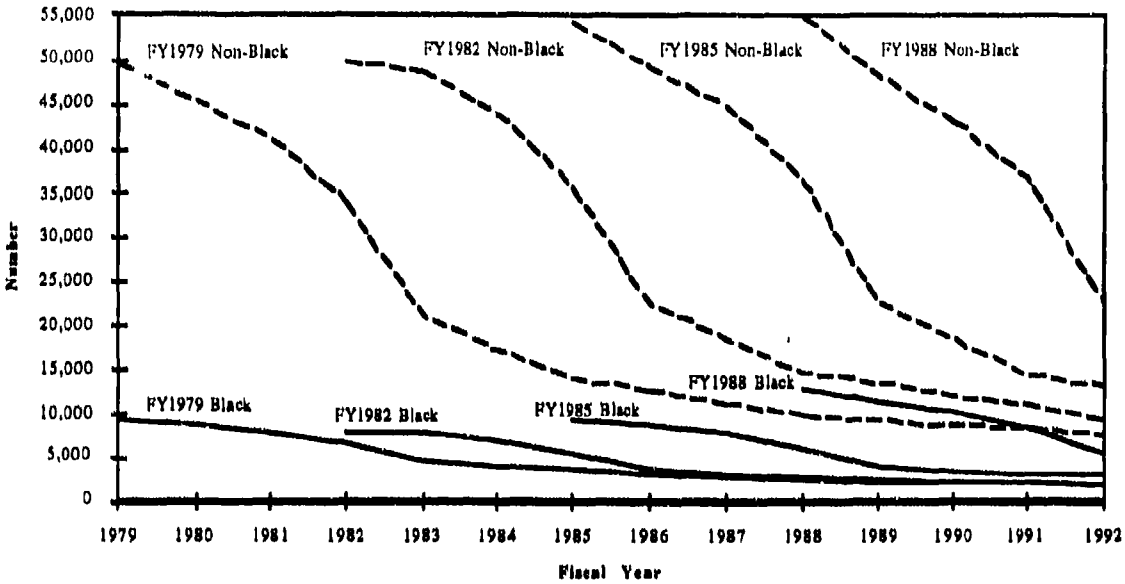
C. RESULTS

1. Cohort Demographics

Figure 5 charts the pattern of change in each cohort from the end of the first year through the end of fiscal 1992. The vertical axis denotes the number of personnel and the horizontal axis denotes fiscal year. Dashed lines chart the number of non-blacks and solid lines chart the number of blacks over time. From Figure 5, the reader can see the rapid attrition of each cohort over the first four years of service followed by a dramatic "leveling" by the end of the fifth year of service. By the end of the fifth year of service, the population in each cohort represents the "career forces." From Figure 5, the reader can also see the significantly higher rates of attrition as depicted by the slope of each line for non-blacks as compared to the line for blacks particularly during the first four years of service.

Table 11 shows the number of black and non-black, non-prior service (NPS) enlisted men in selected cohorts for each year from accession through fiscal 1992. Table 12 summarizes the total number of NPS men at selected years of service. From Table 11, we can see steady growth in accessions with each succeeding cohort except the FY1982 cohort which declined slightly. Remarkably, by the fifth, eighth, and eleventh year of service, the difference in the size of each cohort was relatively small, suggesting that for these particular cohorts, the growth in accessions from fiscal 1979 though fiscal 1988 did not translate into a significantly larger "career force."[8]

FIGURE 5. The Distribution of Male Non-prior Service (NPS) Blacks and Non-Blacks for Selected Cohorts From Accession Year Through 1992



Source: Derived from data provided by the Defense Manpower Data Center.
Information as of the end of the respective fiscal year.

Table 13 shows the percentage of black and non-black NPS men in selected enlisted cohorts for each year from the end of the accession year through fiscal 1992.[9] Interestingly, the percentage of blacks (as measured at the end of the accession year) grew steadily (from 13.5 percent to 19.2 percent) between the FY1982 and FY1988 cohorts. However, the percentage of blacks (as measured at the end of the accession year) declined (from 16.0 percent to 13.5 percent) between the FY1979 and the FY1982 cohorts. The decline in blacks (as measured at the end of the accession year) between the FY1979 cohort and the FY1982 cohort can largely be attributed to the introduction of ASVAB Form 8 in October 1980 which corrected the misnorming problem that had plagued earlier ASVAB

[8]"Career force" is defined here as personnel remaining at the end of the cohort's fifth year.

[9]Note that the number at the end of accession year is not the same as the total number of accessions in a particular year. The former will always be larger than the latter because of attrition throughout the cohort's first year.

TABLE 11. THE DISTRIBUTION OF BLACK AND NON-BLACK NPS MALES FOR SELECTED COHORTS FROM THE END OF THE ACCESSION YEAR THROUGH 1992

Fiscal	FY1979 Cohort		FY1982 Cohort		FY1985 Cohort		FY1988 Cohort	
Year	Non-Black	Black	Non-Black	Black	Non-Black	Black	Non-Black	Black
1979	49,679	9,485						
1980	45,434	8,821						
1981	41,314	8,016						
1982	33,822	6,670	49,983	7,793				
1983	21,117	4,685	48,872	7,718				
1984	17,316	4,014	44,048	6,947				
1985	13,934	3,596	35,584	5,567	54,331	9,347		
1986	12,823	3,245	22,727	3,800	49,206	8,540		
1987	11,135	2,824	18,653	3,277	44,904	7,818		
1988	9,971	2,525	14,784	2,833	36,390	6,192	54,917	13,013
1989	9,192	2,296	13,584	2,584	22,677	3,982	48,465	11,472
1990	8,676	2,164	12,094	2,318	18,552	3,503	43,257	10,364
1991	8,302	2,085	10,992	2,123	14,557	3,176	36,720	8,502
1992	7,613	1,931	9,516	1,860	13,256	2,906	22,647	5,571

Source: Derived from data provided by the Defense Manpower Data Center.
Information as of the end of the respective fiscal year.

TABLE 12. THE TOTAL NUMBER OF NPS MALES FOR EACH COHORT AT THE END OF SELECTED YEARS OF SERVICE

Cohort	End of 1st Year	End of 5th Year	End of 8th Year	End of 11th Year
FY1979	59,164	25,802	16,068	11,488
FY1982	57,776	26,527	16,168	11,376
FY1985	63,678	26,659	16,162	
FY1988	67,930	28,218		

Source: Derived from data provided by the Defense Manpower Data Center.
Information as of the end of the respective fiscal year.

forms. By correcting the misnorming problem, the Services reestablished intended aptitude screening standards, thereby excluding the population with aptitudes corresponding to AFQT Category V (on a properly normed test).[10] Figure 2 suggests that a disproportionate number in this population are black.

[10]AFQT Categories were defined above in Table 7.

TABLE 13. THE PERCENTAGE DISTRIBUTION OF BLACK AND NON-BLACK NPS MALES FOR SELECTED COHORT FROM ACCESSION YEAR THROUGH 1992

Fiscal	FY1979 Cohort		FY1982 Cohort		FY1985 Cohort		FY1988 Cohort	
Year	Non-Black	Black	Non-Black	Black	Non-Black	Black	Non-Black	Black
1979	84.0	16.0						
1980	83.7	16.3						
1981	83.8	16.2						
1982	83.5	16.5	86.5	13.5				
1983	81.8	18.2	86.4	13.6				
1984	81.2	18.8	86.4	13.6				
1985	79.5	20.5	86.5	13.5	85.3	14.7		
1986	79.8	20.2	85.7	14.3	85.2	14.8		
1987	79.8	20.2	85.1	14.9	85.2	14.8		
1988	79.8	20.2	83.9	16.1	85.5	14.5	80.8	19.2
1989	80.0	20.0	84.0	16.0	85.1	14.9	80.9	19.1
1990	80.0	20.0	83.9	16.1	84.1	15.9	80.7	19.3
1991	79.9	20.1	83.8	16.2	82.1	17.9	81.2	18.8
1992	79.8	20.2	83.6	16.4	82.0	18.0	80.3	19.7

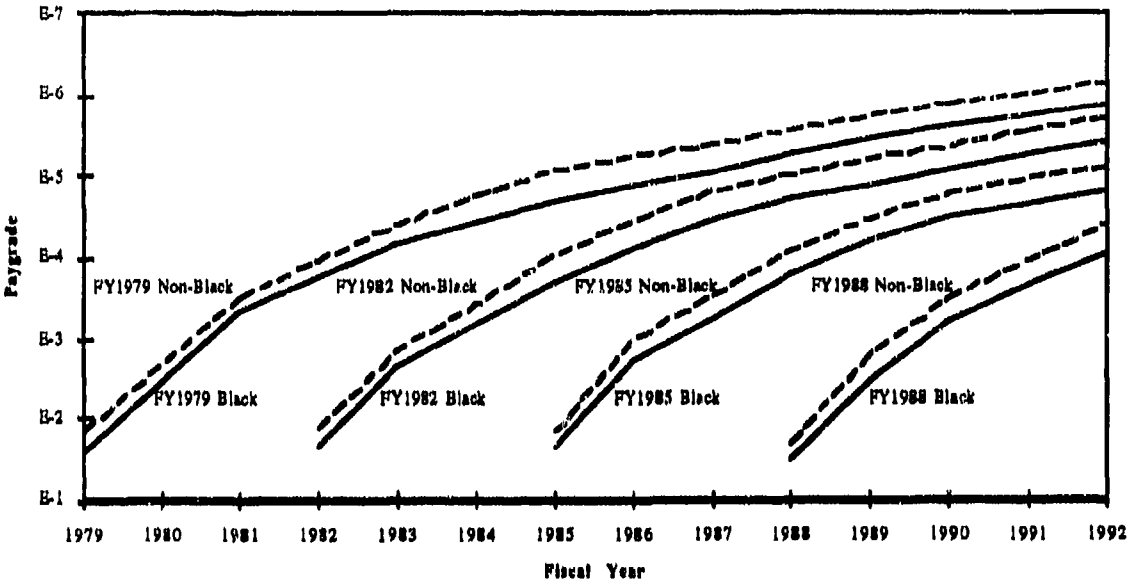
Source: Derived from data provided by the Defense Manpower Data Center.
Information as of the end of the respective fiscal year.

Table 13 also depicts the steady increase in the percentage of blacks within each cohort over time. This increase reflects the well-known fact that blacks are more likely to reenlist than non-blacks and are less likely to leave the Navy through attrition than non-blacks.

2. Differences In Average Paygrade between Blacks and Non-Blacks

Figure 6 graphically depicts the difference over time in average paygrade between black and non-black NPS men for selected cohorts. The vertical axis denotes paygrade and the horizontal axis denotes fiscal year. Dashed lines chart the average paygrade for enlisted non-black NPS men. Solid lines chart the average paygrade for enlisted black NPS men. The vertical difference in dashed and solid lines represents the difference in average paygrade between non-blacks and blacks. From Figure 6, it is clear that for every year of service, blacks have a lower average paygrade when compared with non-blacks.

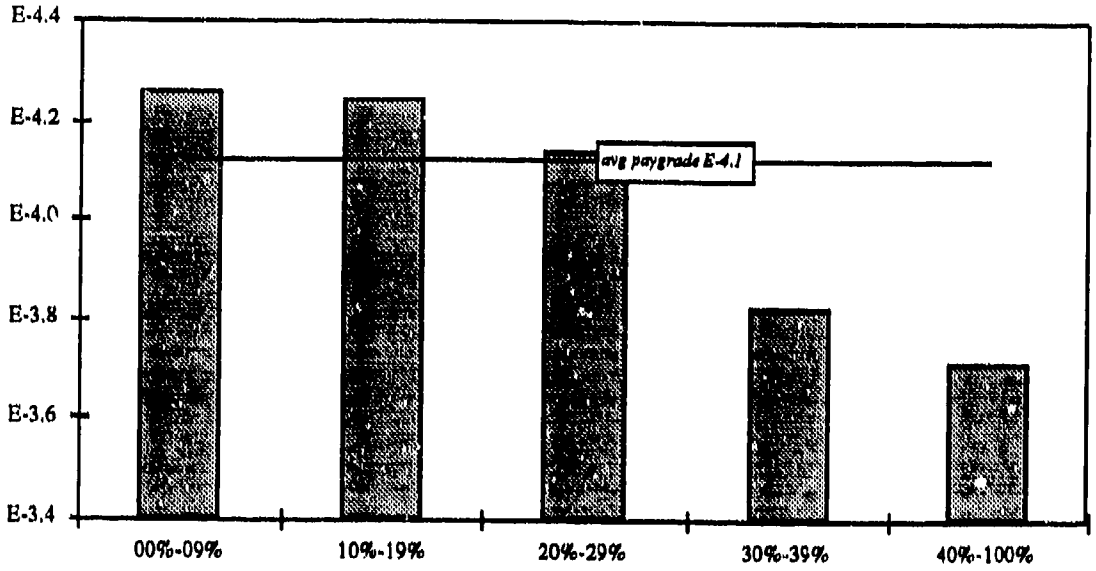
FIGURE 6. The Difference in Average Paygrade Between Black and Non-Black NPS Males For Selected Cohorts From Accession Year Through 1992



Source: Derived from data provided by the Defense Manpower Data Center.
Information as of the end of the respective fiscal year.

Not unexpectedly, in addition to the differences in average paygrade between blacks and non-blacks, there are differences in average paygrade among blacks depending upon occupation. Less expected, however, are the differences in average paygrade among blacks depending on the percentage of black representation in a particular occupation. Figure 7 presents the average paygrade of blacks based on the percentage of black representation within an occupation. The vertical axis denotes average paygrade and is displayed in tenths. The horizontal axis aggregates Navy ratings by their percentage of black representation. For example, the first column represents blacks whose rating composition is between zero and nine percent black. The height of this column corresponds to the average paygrade of blacks within these ratings. The information in Figure 7 relates only to black NPS men from the FY1982 cohort in their fifth year of service. This difference in average paygrade is consistent between cohorts and is relatively consistent

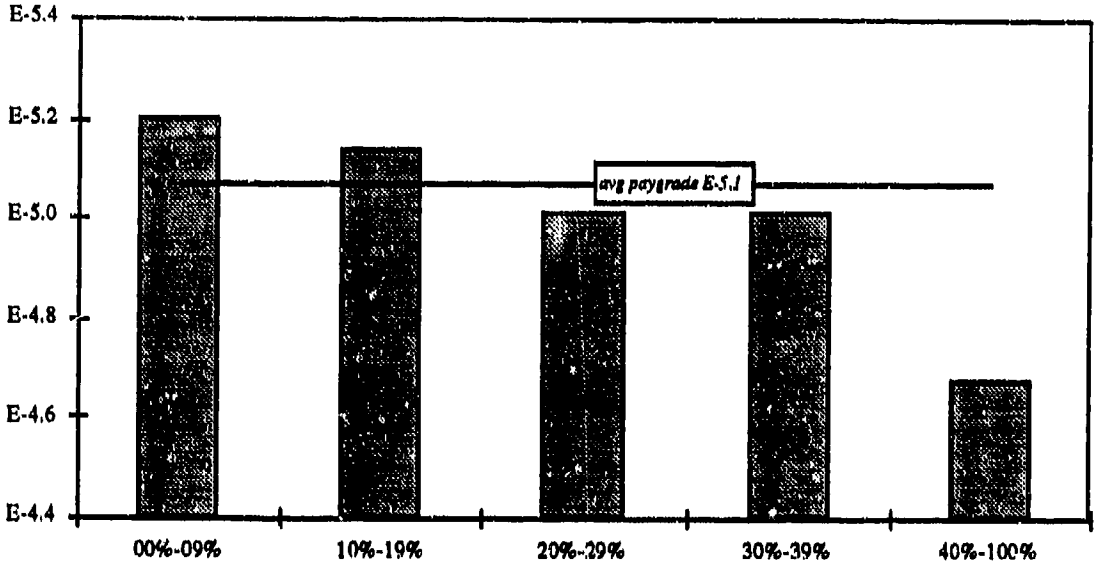
FIGURE 7. The Average Paygrade by Percentage of Black Representation of Occupation—FY1982 Cohort in Fifth Year of Service



Source: Derived from data provided by the Defense Manpower Data Center.
Average paygrade is provided in tenths to facilitate scale.

over time. This suggests that moving an average black sailor from a rating in which blacks are heavily overrepresented (40%-100%) to a rating in which they are underrepresented (00%-09%) would improve the sailor's rank by almost one-half of a paygrade (E-3.7 to E-4.3). Figure 8 displays similar information for blacks from the FY1982 cohort in their ninth year of service. The implication from Figures 7 and 8 is that occupations historically "underrepresented" by blacks may offer greater advancement opportunity for blacks when compared with occupations historically "overrepresented" by blacks. The data, however, are inconclusive concerning the cause and effect of this relationship. It is not clear how much of the improved advancement opportunity is attributable to the rating, how much is attributable to the greater ability of the personnel in those ratings, or how much is attributable to unobserved factors.

FIGURE 8. The Average Paygrade by Percentage of Black Representation of Occupation—FY1982 Cohort in Ninth Year of Service

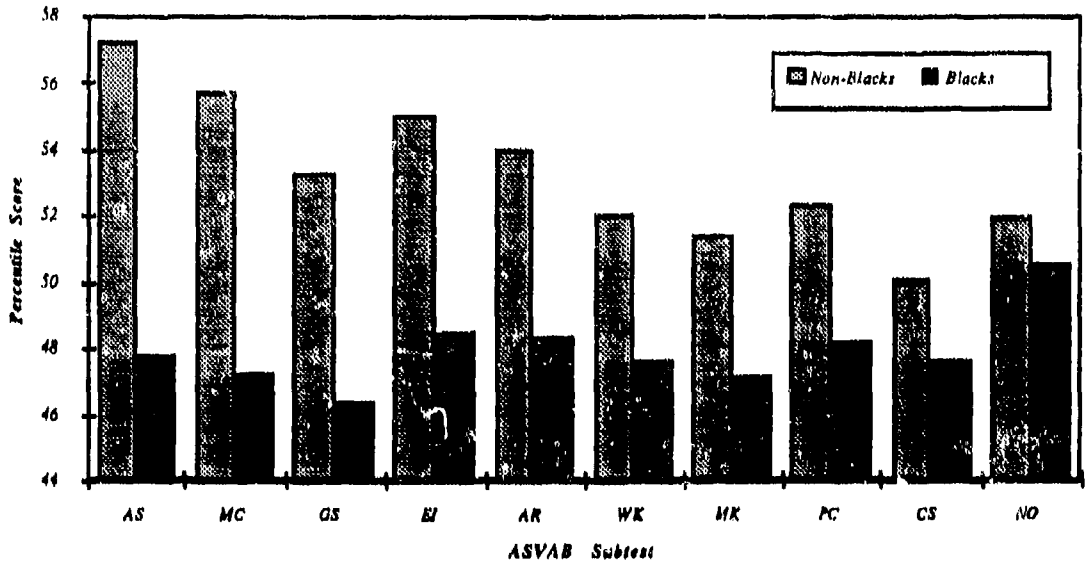


Source: Derived from data provided by the Defense Manpower Data Center.
Average paygrade is provided in tenths to facilitate scale.

3. Differences In ASVAB Scores Between Blacks and Non-Blacks

As mentioned in Chapter II, a significant portion of the assignment process is based on ASVAB composite scores. Composites are composed of two to six subtests. Figure 9 displays the difference in the relative performance of blacks and non-blacks on each of these subtests for the FY1982 cohort. Subtests are arranged along the horizontal axis from the greatest difference to the least difference between racial groups. Auto/Shop Information, Mechanical Comprehension and General Science are the three subtests for which the greatest disparity exists. Assuming that aptitude has the strongest influence on occupational placement, one would expect that occupations whose entry qualifications are based on subtests with the greatest difference between black and non-black groups would have the lowest black representation and, conversely, those with the least difference would have the highest black representation.

FIGURE 9. Mean ASVAB Standardized Test Scores for Black and Non-Black NPS Males from the FY1982 Cohort



Source: Derived from data provided by the Defense Manpower Data Center.
Comparisons reflect ASVAB forms 8, 9, and 10.

4. Results Of The Assignment Model

To compare actual representation with "expected" representation, the difference indicators (DIs) are graphed in Figure 10 which presents DIs for black enlisted NPS men in the fifth year of service from the FY1979 cohort. The horizontal axis denotes the 14 occupational groups into which all Navy ratings have been aggregated (see Table 10). The vertical axis shows the percent of overrepresentation (positive values) and underrepresentation (negative values) of blacks in each occupational group. The DI in the first column are based on expected values that control for aptitude and are derived from the Assignment Model. The DIs in the second column are based on the overall percent of blacks in a selected Navy cohort, and offer a reference point against which to compare the first DI. For example, black NPS men constitute 18.2 percent of the FY1979 cohort population in the fifth year of service. Within the Hull, Mechanical, and Electrical (HME) occupational group, the expected black proportion is 7.5 percent when the influence of

aptitude is controlled. Consequently, all else being equal, blacks should theoretically constitute 7.5 percent of the personnel in HME. The degree to which actual percentages (in this example, 11.9 percent) in each occupational category differ from the expected percentage (in this example, 7.5 percent) is indicated by the graph of the difference indicators in Figure 10.[11] Continuing with the example, blacks in HME are shown to be 58.6 percent overrepresented. This means that black representation in the ratings making up the HME occupational group is 58.6 percent greater than would be expected if occupational placement were made strictly on the basis of aptitude. If occupational placement were made without regard to possible influences (aptitude, personal preferences; physical, medical and moral qualifications; timing, the needs of the Navy, or any other factor other than random assignment), then HME would be underrepresented by 17.6 percent (as indicated by the second column).

It is apparent from Figures 10, 11, 12, and 13 that even when the influence of aptitude is controlled, blacks are predominantly overrepresented in Administrative and Supply occupational groups.[12] Conversely, blacks are predominantly underrepresented in the Aviation Maintenance, Surface Operations, and the Other category.

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[11] If the actual percentages were equal to 7.5%, then the DI would equal zero and the first column (which depicts representation after controlling for the influence of aptitude) would have neither positive nor negative displacement.

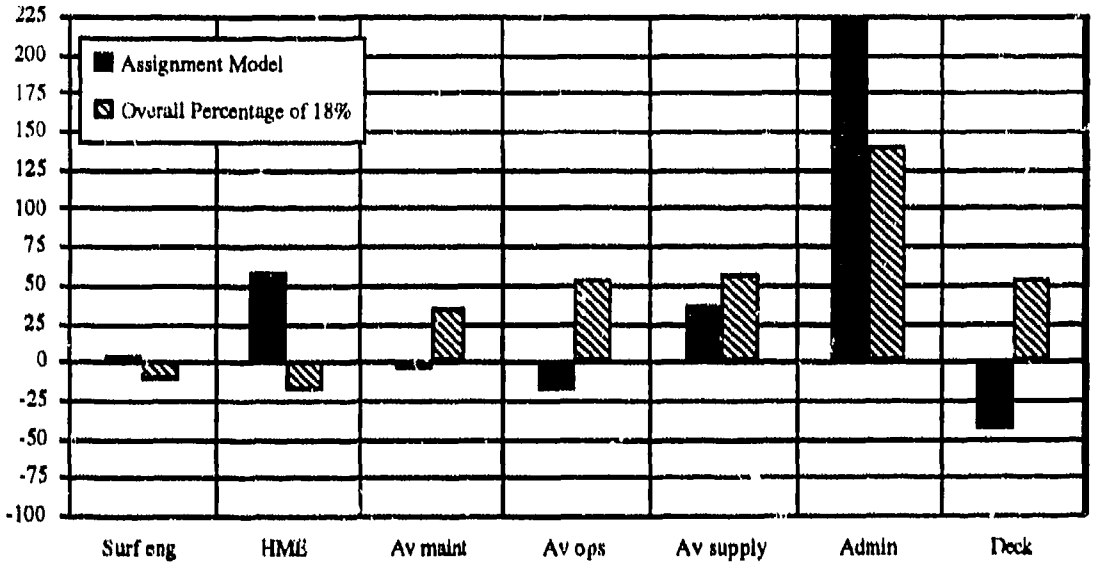
[12] "Predominantly overrepresented" is defined as three consecutive difference indicators which reflect overrepresentation and are statistically significant. "Predominantly underrepresented" is defined as three consecutive difference indicators which reflect underrepresentation and are statistically significant. Statistical significance is determined by calculating the population proportion and using the $\alpha = 0.05$ level of significance. The population proportion formula is as follows:

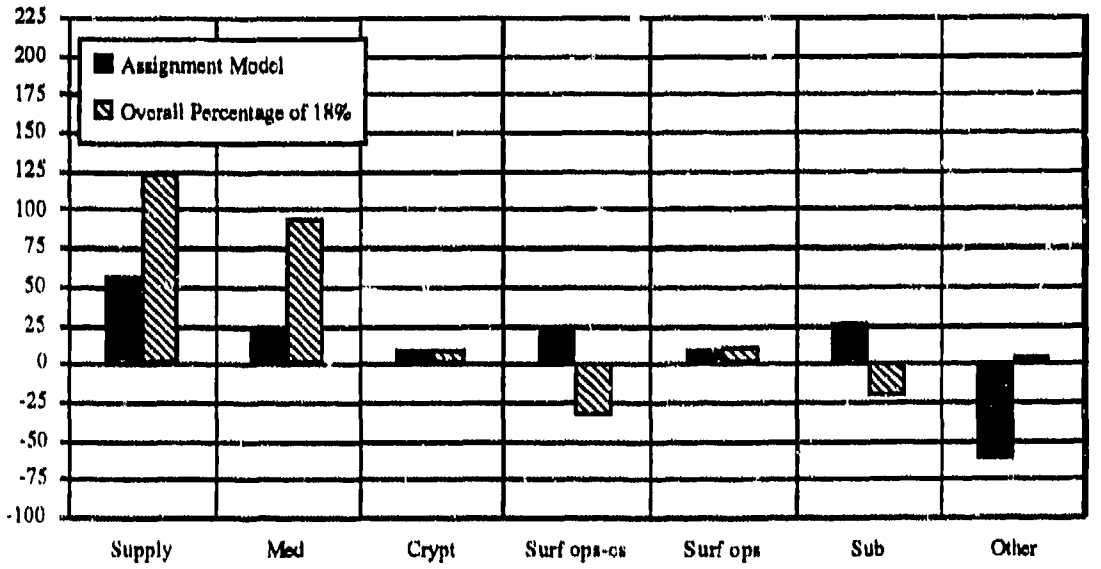
$$p = \frac{x}{n} \qquad z = \frac{p - p_0}{\sqrt{p \times (1 - p_0)/n}} \qquad \mp z_{\alpha/2} = 1.96$$

Where:

p	=	the population proportion
p_0	=	the "expected" number of blacks in rating group i from the Assignment Model
x	=	the number of blacks in rating group i
n	=	the total number in rating group i
z	=	the test statistic

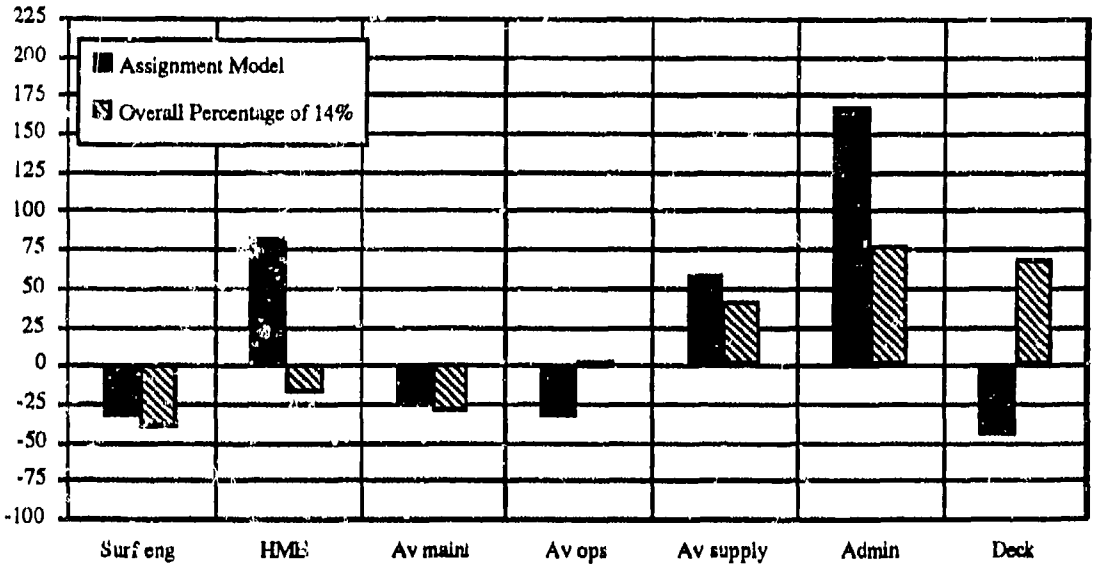
FIGURE 10. Black Representation: Difference Indicators for 14 Occupational Categories for the FY1979 Cohort

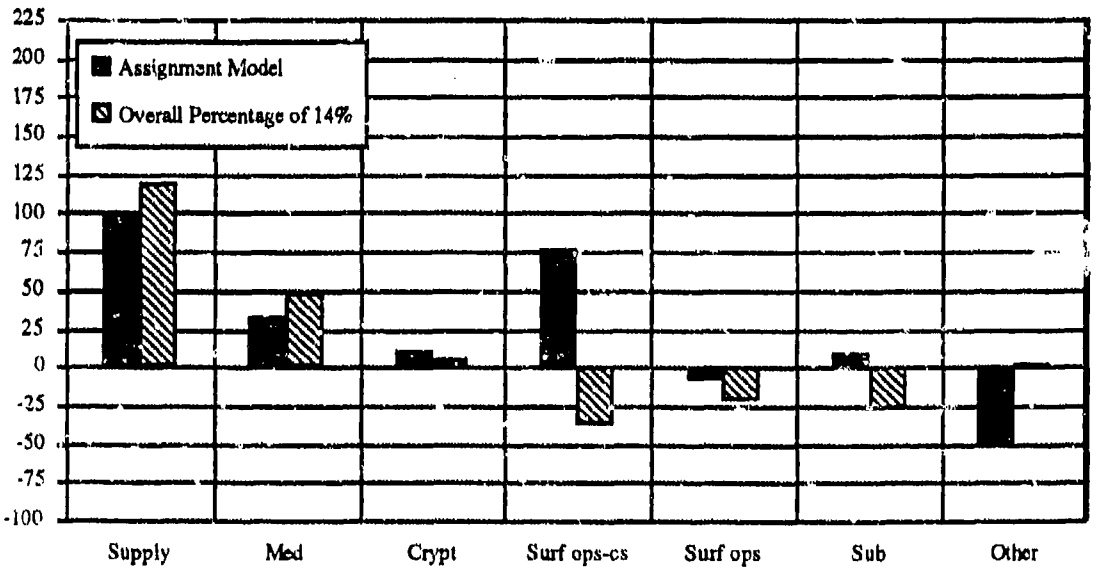




Source: Derived from data provided by the Defense Manpower Data Center.
Representation percentages are summarized by difference indicators (DIs).
Assignment Model DIs employ expected percentages that control for aptitude.
"Overall Percentage" DIs reflect expected percentages equal to the overall black NPS male representation in the fifth year of service for the selected cohort.
Table 10 defines occupational categories.
FY1979 data based on "renormed" ASVAB scores.

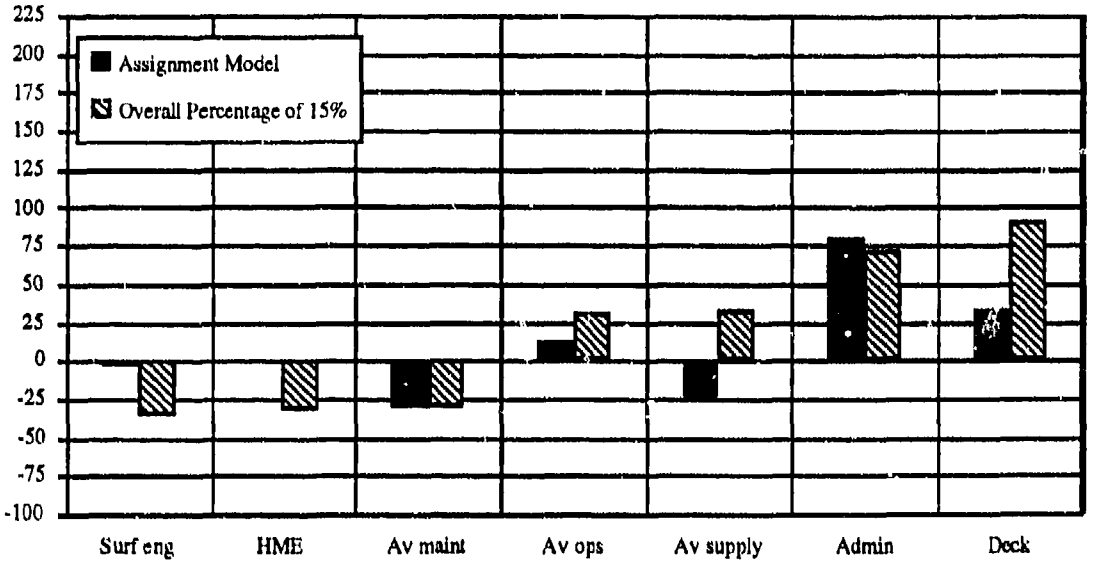
FIGURE 11. Black Representation: Difference Indicators for 14 Occupational Categories for the FY1982 Cohort

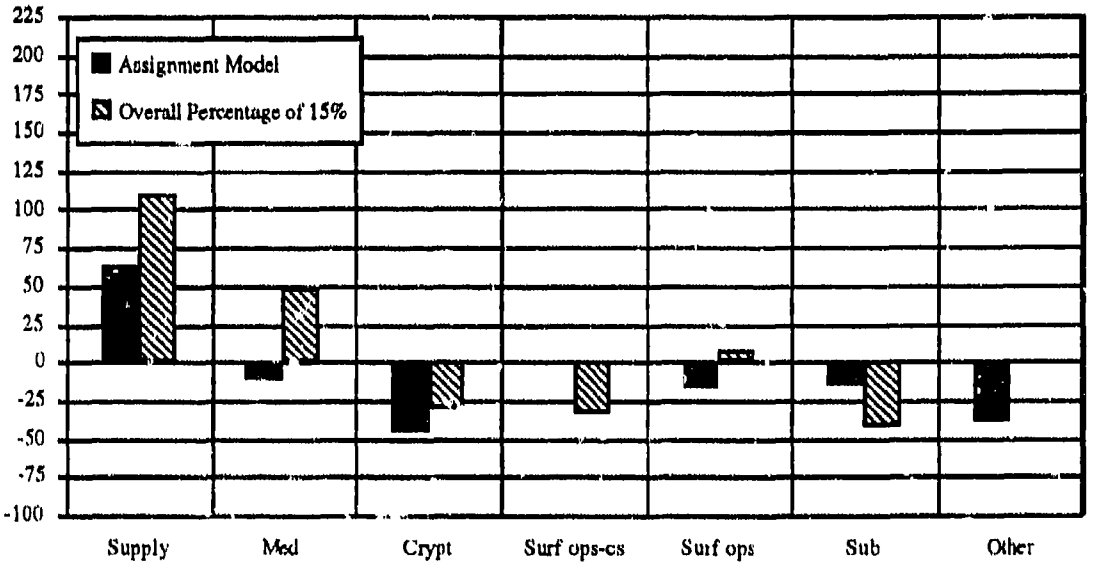




Source: Derived from data provided by the Defense Manpower Data Center.
Representation percentages are summarized by difference indicators (DIs).
Assignment Model DIs employ expected percentages that control for aptitude.
"Overall Percentage" DIs reflect expected percentages equal to the overall black NPS male representation in the fifth year of service for the selected cohort.
Table 10 defines occupational categories.

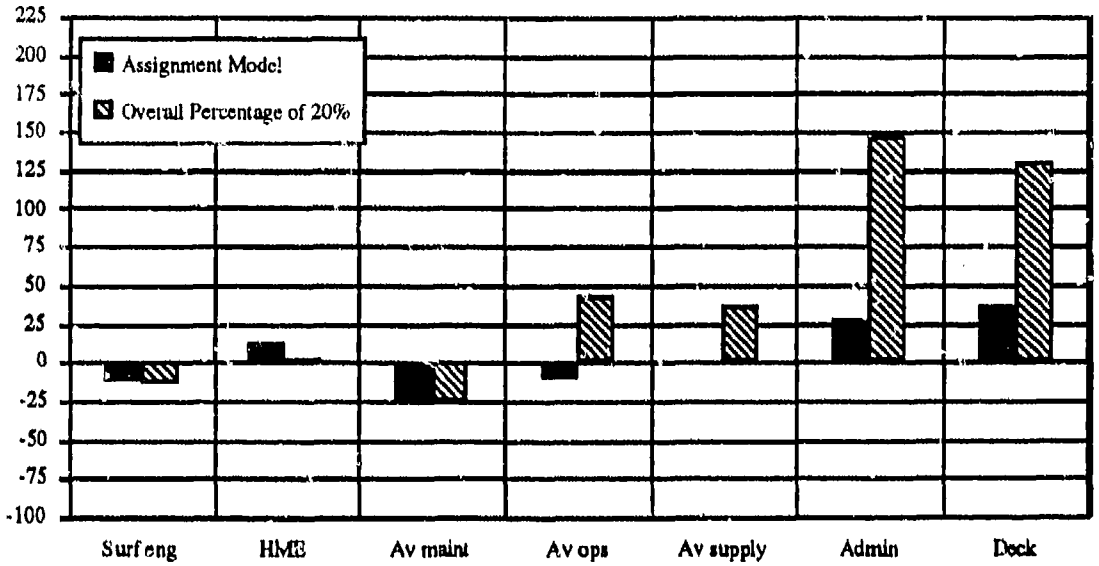
FIGURE 12. Black Representation: Difference Indicators for 14 Occupational Categories for the FY1985 Cohort

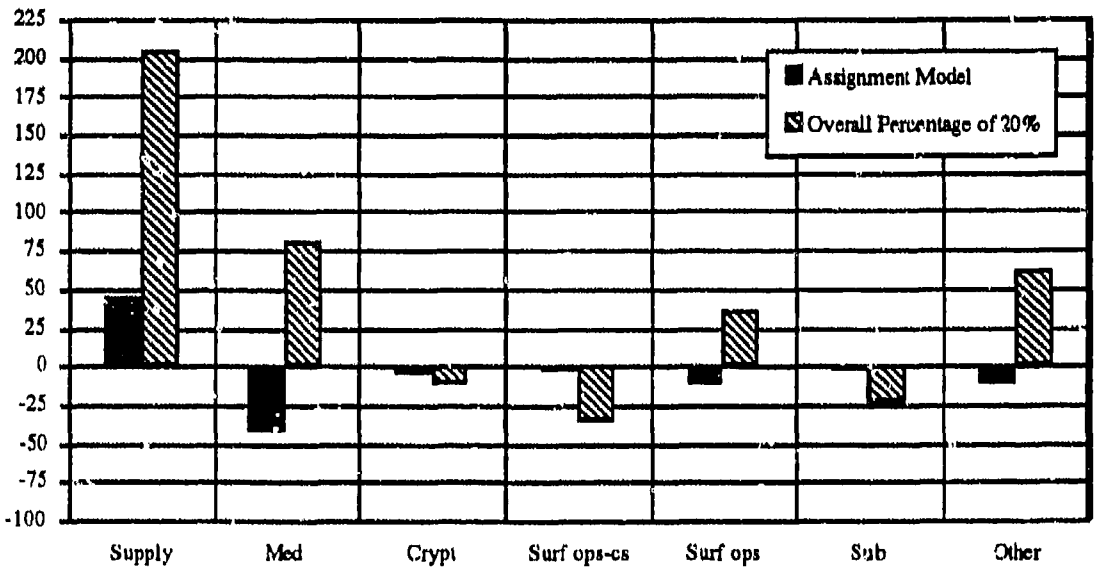




Source: Derived from data provided by the Defense Manpower Data Center.
Representation percentages are summarized by difference indicators (DIs).
Assignment Model DIs employ expected percentages that control for aptitude.
"Overall Percentage" DIs reflect expected percentages equal to the overall black NPS male representation in the fifth year of service for the selected cohort.
Table 10 defines occupational categories.

FIGURE 13. Black Representation: Difference Indicators for 14 Occupational Categories for the FY1988 Cohort





Source: Derived from data provided by the Defense Manpower Data Center.
Representation percentages are summarized by difference indicators (DIs).
Assignment Model DIs employ expected percentages that control for aptitude.
"Overall Percentage" DIs reflect expected percentages equal to the overall black NPS male representation in the fifth year of service for the selected cohort.
Table 10 defines occupational categories.

The Administrative and Supply occupational categories in Figures 10, 11, 12, and 13 illustrate the striking difference in representation when the influences of aptitude are controlled versus when they are not. If representation were evaluated strictly on the basis of the overall black percentage in the cohort (i.e., not controlled for aptitude), these two categories would appear to be dramatically increasing in overrepresentation when considering the results from the FY1985 and FY1988 cohorts. When the influences of aptitude are considered, these occupational categories are still overrepresented; however, this overrepresentation is dramatically decreasing over the same period of time.

5. Trends In Representation

Figure 14 charts the trend over time in difference indicators. Difference indicators from Figures 10, 11, 12, and 13 are consolidated in Figure 14. An examination of the trend over time of DIs derived from the Assignment Model (depicted in solid black) offers an indication of the effectiveness of personnel policies intended to address disparities in occupational placement. If the Equal Opportunity/Navy Affirmative Action programs inaugurated in the seventies and eighties have been effective, one would expect a trend in representation toward the baseline. If the Equal Opportunity/Navy Affirmative Action programs have not been effective, one would expect a trend in representation parallel to or away from the baseline. Difference indicators that reflect no control for aptitude are provided as a point of reference (depicted in gray). When examining the results from the four selected cohorts for the 14 occupational groups, by the FY1988 cohort, 11 of the occupational groups (Surface Engineering, HME, Aviation Operations, Aviation Supply, Administrative, Supply, Cryptology, Surface Operations—Combat Systems, Surface Operations, Submarine and the Other category) are, in fact, converging on the zero baseline; two (Deck and Medical) have dramatically moved through the zero baseline; and one (Aviation Maintenance) is holding parallel with the zero baseline.

FIGURE 14. The Trend in Difference Indicators in Occupational Categories for Selected Cohorts

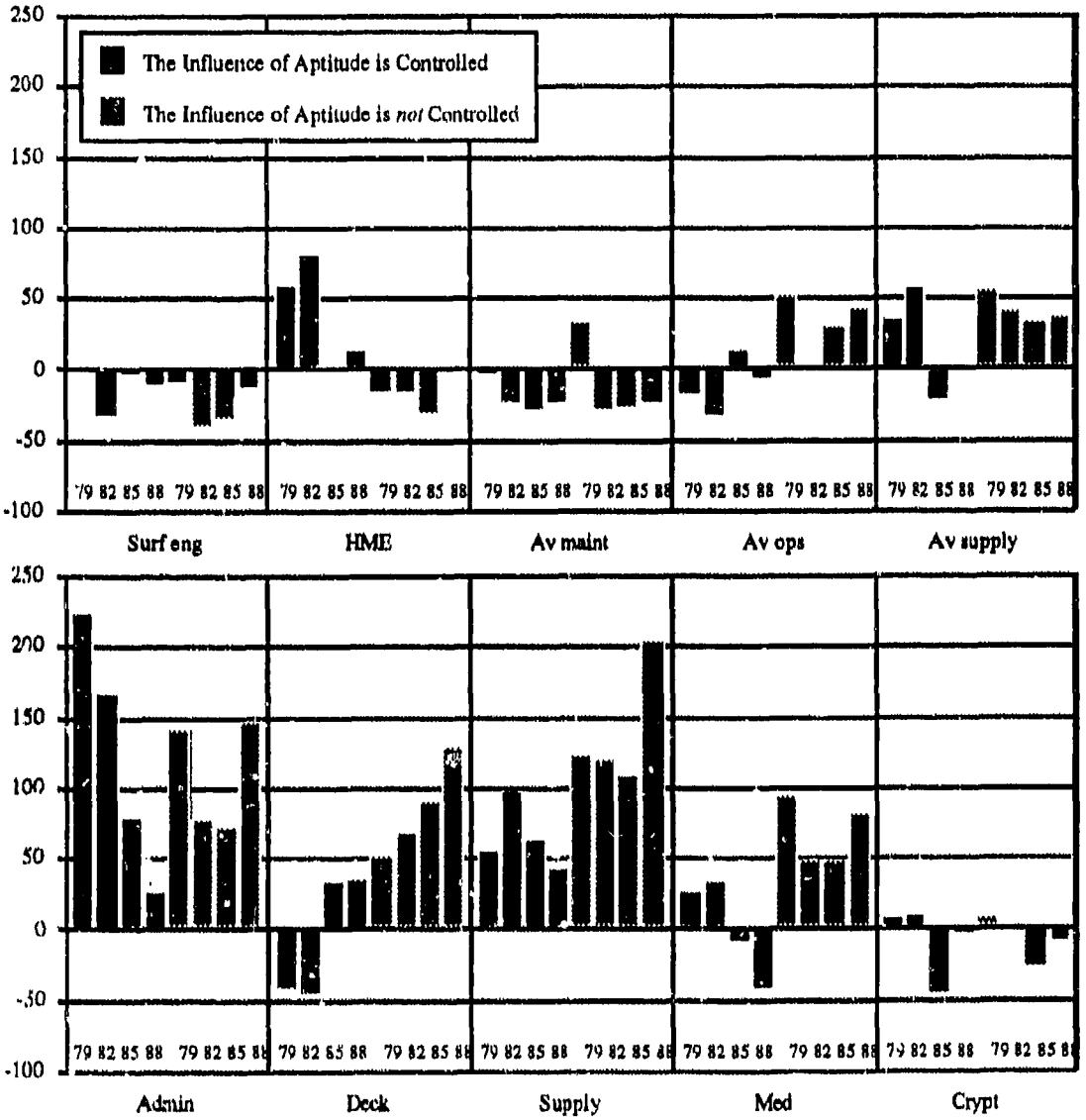
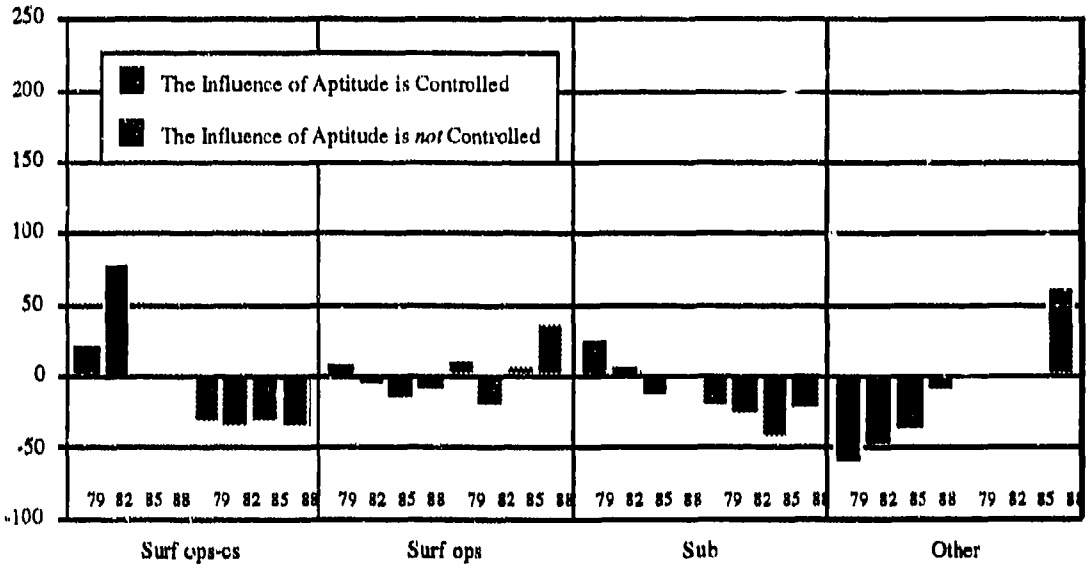


FIGURE 14 is continued on the next page.

Another method of measuring the overall trend in representation over time is to compare the Annual Representation Index (ARI) from the fifth year of service for each cohort.[13] Table 16 provides ARIs for selected cohorts. When the influence of aptitude is

[13]Equation (4) above defines the Annual Representation Index (ARI).

FIGURE 14. (Continued)



Source: Derived from data provided by the Defense Manpower Data Center.
Representation percentages are summarized by difference indicators (DIs).
DIs that reflect controlling for the influence of aptitude use "expected values" derived from the Assignment Model.
DIs that reflect no control for the influence of aptitude use "expected values" equal to the overall black NPS male representation in the fifth year of service for the selected cohort.
Table 10 defines occupational categories.

TABLE 14. ANNUAL REPRESENTATION INDEX (ARI) FOR BLACK NPS MEN IN THE FIFTH YEAR OF SERVICE OF SELECTED COHORTS

Cohort	After Controlling for Aptitude	Not Controlling for Aptitude
FY1979	599.0	659.2
FY1982	732.4	531.6
FY1985	376.7	597.5
FY1988	243.5	848.3

Source: Derived from data provided by the Defense Manpower Data Center.

controlled, and with the exception of the FY1982 cohort, ARIs dramatically decline over the period of analysis. This suggests that policies and programs introduced during this period to address minority representation are indeed working to decrease the

disproportionate representation of blacks. When the influence of aptitude is not controlled, the message is quite the opposite.

6. Factors Influencing Difference Indicators Over Time

As noted above, difference indicators that are adjusted for the influence of aptitude may "behave" differently over time when compared with difference indicators for the same rating group that are unadjusted for the influence of aptitude. For example, from Figure 14, looking at the Administrative rating group, FY1985 and FY1988 difference indicators adjusted for the influence of aptitude (black columns), are "moving" in an opposite direction from the difference indicators (from the same cohorts and rating group) that are unadjusted for the influence of aptitude (gray columns). What are the forces that may be causing these difference indicators to move in opposite directions? The section below provides some insight into possible cause.[14]

Equation (5) below defines an unadjusted difference indicator and is derived from equation (1). Equation (6) below defines a difference indicator which is adjusted for the influence of aptitude and is derived from equation (3).

[14]I am grateful to Dr. Martha Shiells of the Center for Naval Analysis for assistance on this section.

Define

DI	=	Difference Indicator unadjusted for the influence of aptitude
DI'	=	Difference Indicator adjusted for the influence of aptitude
B_i	=	the actual number of blacks in rating group i
B_i'	=	the number of blacks in rating group i as determined by multiplying the percentage of blacks assigned by the Assignment Model times the total number in rating group i.
r	=	the percentage of blacks in all ratings
T_i	=	the total number (black and non-black) in rating group i.

Then the unadjusted difference indicator can be written as

$$DI = \left(\frac{\frac{B_i}{T_i} \times 100}{r} \right) - 100 \ , \tag{5}$$

and the adjusted difference indicator can be written as

$$DI' = \left(\frac{\frac{B_i}{T_i} \times 100}{\frac{B_i'}{T_i} \times 100} \times 100 \right) - 100$$

or

$$DI' = \left(\frac{B_i}{B_i'} \times 100 \right) - 100 \ . \tag{6}$$

If we let

$$\tilde{D}I = \frac{DI + 100}{100}$$

$$\tilde{D}I' = \frac{DI' + 100}{100} \quad ,$$

then

$$\tilde{D}I = \left(\frac{\frac{B_i}{T_i} \times 100}{r} \right) \Rightarrow r \times \tilde{D}I = \frac{B_i}{T_i} \times 100 \Rightarrow B_i = \frac{r \times \tilde{D}I \times T_i}{100} \quad .$$

And since

$$\tilde{D}I' = \frac{B_i}{B_i'} \quad ,$$

it follows that

$$\tilde{D}I' = \frac{r \times \tilde{D}I \times T_i}{100 \times B_i'} \quad . \tag{7}$$

From equation (6) the reader can see that the adjusted difference indicator will decrease whenever: (a) the actual number of blacks in rating group i (B_i) decreases; or (b) the number of blacks assigned by the Assignment Model to rating group i (B_i') increases.

Equation (7) above defines the relationship between the adjusted difference indicator and the unadjusted difference indicator. The adjusted difference indicator will decrease whenever: (a) the percentage of blacks in all ratings (r) decreases; (b) the unadjusted difference indicator decreases; (c) the total number in rating group i (T_i) decreases; or (d) the number of blacks assigned to rating group i by the assignment model (B_i') increases. With respect to (a), the data in Table 13 indicate that the percentage of blacks in all ratings (r) decreased only in the FY1982 cohort and thereafter the percentage of blacks increased in the FY1985 cohort and the FY1988 cohort.[15]

Under what circumstances might the adjusted difference indicator decrease and the unadjusted difference indicator increase (or remain unchanged) as in the case of the Administrative rating group previously discussed? This could occur whenever: (a) the ASVAB cut scores leading to A-school training for ratings within rating group i are lowered (or ASVAB cut scores leading to A-school training for ratings from other rating groups are increased), thereby pushing more blacks into rating group i; (b) the ASVAB component subtests which define aptitude qualification for A-school training for ratings within rating group i are redefined to include subtests for which the mean differential between blacks and non-blacks is greater (or the ASVAB component subtests which define aptitude qualification for A-school training for ratings from other rating groups are redefined to include subtests for which the mean differential between blacks and non-blacks is smaller) thereby pushing more blacks into rating group i; or (c) the average differential in aptitude (as measured by the ASVAB) between blacks and non-blacks is different in selected cohorts. In the case of (c) above, if the particular rating group i was composed of ratings requiring predominantly lower skill, and the differential in aptitude between blacks and non-blacks was greater in a selected cohort when compared to previous cohorts, then the number of blacks assigned to rating group i (B_i') would increase, thereby causing the adjusted difference indicator to decrease. Similarly, if the particular rating group i were composed of ratings requiring predominantly higher skill, and the differential in aptitude between blacks and non-blacks were smaller in a selected cohort when compared to previous cohorts, then the number of blacks assigned to rating group i (B_i') would increase also causing the adjusted difference indicator to decrease. Data from Figure 2 suggest that the differential in aptitude between blacks and non-blacks has increased slightly over time.

---

[15]The percentage of blacks referred to here is as of the end of the cohort's fifth year.

The relative difference in the movement over time between adjusted and unadjusted difference indicators does not appear to be explained by any single factor discussed above. Instead, such movement is the result of the combined influence of all these factors.

IV. A COMPARISON OF RACIAL/ETHNIC DISTRIBUTIONS IN NAVY RATINGS WITH RACIAL/ETHNIC DISTRIBUTIONS IN CIVILIAN OCCUPATIONS: METHODOLOGIES AND RESULTS

Until now, the focus of this study has been an examination of racial/ethnic occupational distributions in the Navy. Navy distributions from selected cohorts have been compared over time to assess the magnitude and persistence of disproportionate representation in various Navy occupational groups. As one attempts to assess the different occupational distributions in the Navy, several questions arise: (1) How do racial/ethnic distributions in Navy ratings compare with racial/ethnic distributions in the general population? (2) Given the significant differences in respective populations and occupational placement processes, are comparisons between Navy occupational distributions and civilian distributions possible? (3) And, if so, are comparisons between Navy occupational distributions and civilian distributions useful? This chapter addresses these questions.

Chapter IV is divided into three sections. Section A discusses the relative differences between the occupational selection processes used by the Navy and those found in the civilian sector. Section B describes data sources, the civilian and Navy populations used for comparison, and the methods employed to enable comparison of civilian and Navy occupational distributions by race. Section C provides the results of that comparison.

A. DISCUSSION

The processes leading to occupational placement differ significantly between the Services and the civilian population. As explained in Chapter II, occupational placement in the Services is a multi-stage process requiring selection, classification, and assignment to training, and completion of training for the occupation. Research has shown that most military recruits make their occupational choice first on the basis of Service (i.e., Army, Navy, Air Force, or Marine Corps) and second, on the basis of occupational specialty [Ref.

8]. Armed with this knowledge, Navy recruiters normally "sell" the Navy first then they negotiate A-school training (which normally determines occupational assignment). Recruits receive normal pay while attending school.

Conversely, most job aspirants in the civilian sector must obtain their occupational training at their own expense and prior to securing a job. This alone may cause any group that has a lower economic status to be dissuaded from seeking training-intensive occupations. Most entry level workers in the civilian sector make occupational choices first, on the basis of occupational preferences and second on the basis of employer. Although federal law prohibits discrimination on the basis of race, color, national origin, creed, or religion, employers in the civilian sector rarely face the same level of scrutiny or pressure (both within and outside of the organization) to adhere to these laws as does the military. These obvious differences in the occupational placement process are likely to result in differences in racial/ethnic occupational distributions. The next section describes a methodology for comparing Navy racial/ethnic occupational distributions with civilian racial/ethnic occupational distributions.

B. METHODOLOGY

1. Data Sources

This portion of the study relies on data from three sources: the 1992 Active-Duty Master file, the 1991 Current Population Survey (CPS), and the Department of Defense Master Crosswalk file. Data on the 1992 enlisted Navy cross-section were extracted from the Active-Duty Enlisted Master file. These data were provided by DMDC and they include, among other demographic variables, Navy rating, sex, age, and racial/ethnic identity. Data on the 1991 civilian cross-section were extracted from the Current Population Survey. These data were provided by the National Bureau of Economic Research to Professor Stephen L. Mehay, Naval Postgraduate School, Monterey,

California. Annual data were obtained by consolidating data from four monthly surveys. Data from the monthly survey were adjusted for seasonal activity and weighted for rotational schedule in accordance with procedures recommended by the Bureau of Labor Statistics. These monthly surveys of the population are conducted through a scientifically selected sample designed to represent the civilian noninstitutional population. Respondents are interviewed to obtain information about the employment status of each member of a household 16 years of age and over. The inquiry relates to activity of status during the calendar week, Sunday through Saturday, which includes the 12th day of the month. Actual field interviewing is conducted the following week. Inmates of institutions and persons under 16 years of age are not covered in the regular monthly surveys. Each month, about 60,000 occupied units are eligible for interview. About 2,600 of these households are contacted, but are unavailable for interview. This results in a noninterview rate of between 4 and 5 percent. In addition to the 60,000 occupied units, there are 11,500 sample units in an average month that are visited but are found to be vacant. Part of the sample is changed each month. The rotation plan provides for three-fourths of the sample to be common from one month to the next, and one half to be common with the same month a year earlier [Ref. 27].

The survey defines persons as *employed* if they are civilian and they (1) did any work at all as paid employees, in their own business, profession, or on their own farm, or who worked 15 hours or more as unpaid workers in an enterprise operated by a member of the family; and (2) all those who were not working but who had jobs or businesses from which they were temporarily absent because of illness, bad weather, vacation, labor-management disputes, or personal reasons, whether they were paid for the time off or were seeking other jobs. These CPS data include among other demographic variables, civilian occupation, sex, age, and racial/ethnic identity.

The Department of Defense Master Crosswalk Data file provides a listing of military occupations and Census of Population codes that define civilian occupations closely matched to the military occupations. The DoD Master Crosswalk file provides a link between the 1992 military cross-section and the 1991 civilian cross-section that allows comparison of occupational distributions. The DoD Master Crosswalk file was provided by DMDC.

2. Identification of the Population

Consistent with the other portions of this study, the 1992 Navy cross-section is limited to male active-duty enlistees in the regular Navy. To ensure a demographically comparable civilian population, the civilian cross-section is limited to males who are employed full time and are ages 18 to 38. The DoD Master Crosswalk data file matched 95 Navy ratings with civilian rating equivalents. Table 15 summarizes the black and non-black percentages in the two populations. Note the significant difference in the percentage of

TABLE 15. SUMMARY OF BLACK AND NON-BLACK POPULATION PERCENTAGES

Population	Black	Non-Black
1992 Navy Cross-Section	18.0	82.0
1991 Civilian Cross-Section	6.9	93.1

Source: Derived from data provided by the Defense Manpower Data Center and the U.S. Department of Labor, Bureau of Labor Statistics.

black men in the general population (fully employed in occupations closely matched to Navy ratings) as compared to those in the Navy (6.9 percent versus 18.0 percent). If data were available to screen the civilian population for educational, physical, medical and moral qualifications, the disparity in these percentages would be even greater. The fact that the percentage of black men fully employed in civilian occupations closely matched to Navy ratings is less than half the percentage of black men in the Navy attests to the greater

opportunities in these occupations available to qualified minorities in the Navy, when compared with the general population.

3. Occupational Groups

To facilitate an analysis of representation by functional groups, each of the 95 ratings was assigned to one of 14 occupational groups defined in Table 10. Table 12 summarizes the black and non-black percentages within each of the 14 rating categories.

TABLE 16. SUMMARY OF BLACK AND NON-BLACK PERCENTAGES BY OCCUPATIONAL

Occupational Group	Navy Percentages		Civilian Percentages	
	Black	Non-Black	Black	Non-Black
Surf eng	14.0	86.0	7.3	92.7
HME	14.4	85.6	8.3	91.7
Av maint	12.0	88.0	5.9	94.1
Av ops	20.6	79.4	8.8	91.2
Av supply	20.7	79.3	5.9	94.1
Admin	25.9	74.1	6.7	93.3
Deck	23.9	76.1	10.7	89.3
Supply	31.2	68.8	7.1	92.9
Med	19.2	80.8	7.5	92.5
Crypt	14.7	85.3	5.9	94.1
Surf ops-cs	10.4	89.6	7.3	92.7
Surf ops	18.1	81.9	6.9	93.1
Sub	11.4	88.6	8.8	91.2
Other	21.0	79.0	6.4	93.6

Source: Derived from data provided by the Defense Manpower Data Center and the U.S. Department of Labor Bureau of Labor Statistics.

4. Representation Comparisons Using Difference Indicators

In the same manner first introduced by Nordlie et al. (1975), difference indicators are used to summarize and describe the distribution of blacks across occupational categories within the civilian and Navy populations. When difference indicators from the two populations are charted on the same graph, they provide a basis for comparing black

occupational representation. Difference indicators are based on equation (2) above, but with the changes identified in equation (8), as shown below.

$$DI = \left[\left(\frac{Actual}{Expected^{\dagger}} \right) \times 100 \right] - 100 \tag{8}$$

Where:

DI	=	Difference Indicator
Actual	=	The *actual* percentage of blacks in rating group i
Expected†	=	The percentage of blacks in the population. For the 1992 Navy cross-section, "expected" = 18.0 percent. For the 1991 civilian cross-section, "expected" = 6.9 percent.

5. Segregation Index

Assuming that "equitable representation" in occupations was defined strictly on the basis of the representative minority percentages in the population, and assuming it is the goal of the Navy to balance occupational representation on the basis of these percentages, then the segregation index provides a measure of the magnitude of movement required to equalize the distribution of two groups (in this case, blacks and non-blacks). The index is based on the absolute deviation in the percentage employed in each occupation and indicates the percentage of minority workers that would have to shift between jobs to equalize the occupational distributions of the two groups. The segregation index is defined in equation (9) [Ref. 28].

$$D = \left(\frac{1}{2} \right) \sum_{j=1}^{j} \left| F_{nj} - F_{bj} \right| \tag{9}$$

Where:

D	=	Segregation Index
F_{nj}	=	is the percentage of the non-black work force in occupation j
F_{bj}	=	is the percentage of the black work force in occupation j.

C. RESULTS

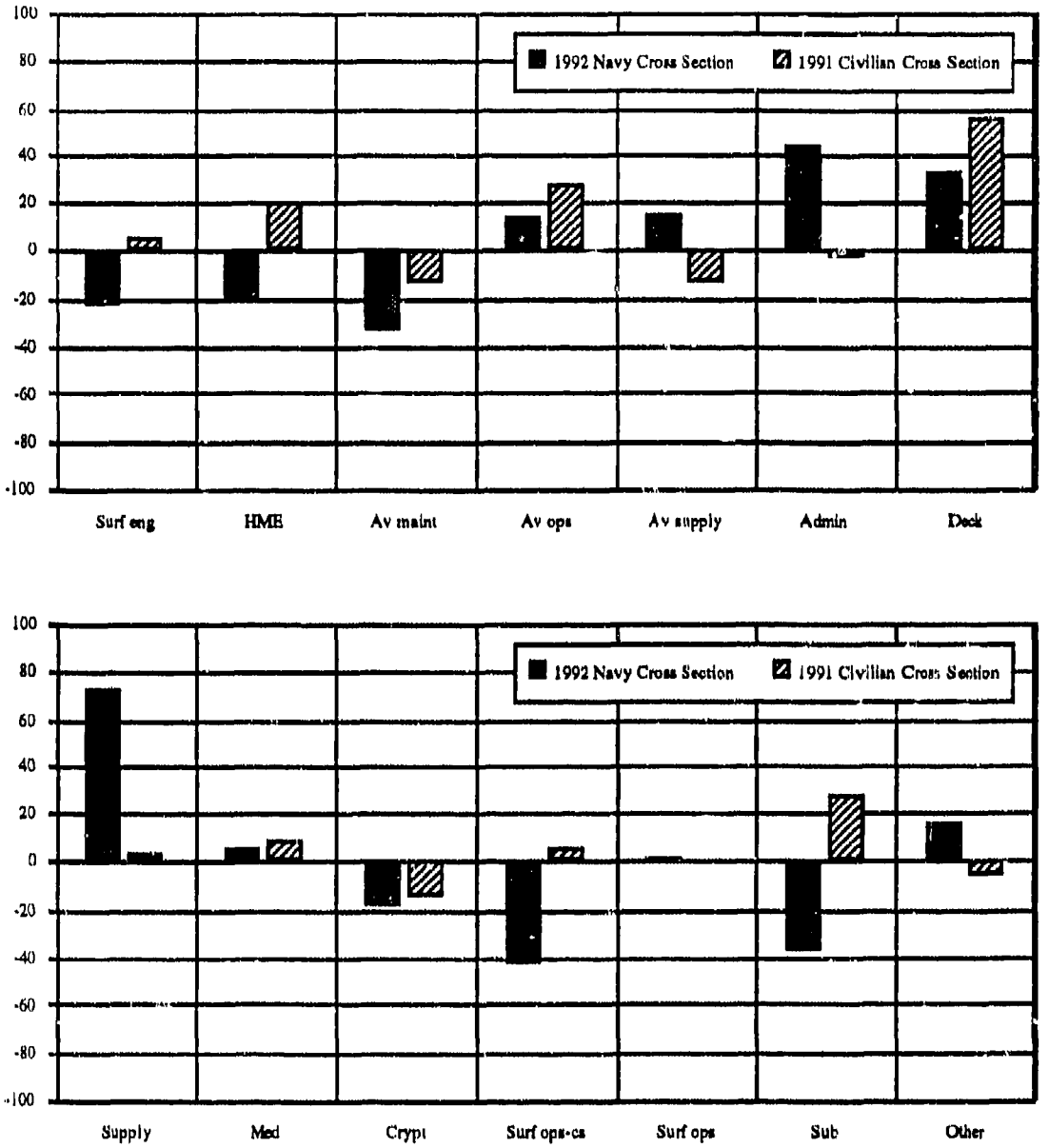
1. Black Representation as Measured by Difference Indicators

Figure 16 provides a comparison of difference indicators reflecting black representation in Navy ratings versus similar civilian occupations. Difference indicators are computed using equation (6). Figure 16 graphically demonstrates the dramatic differences between the Navy distribution and the civilian distribution. Of the 14 occupational categories, six (Aviation Maintenance, Aviation Operations, Deck, Supply, Medical, and Cryptology) have representation in the same direction, seven (Surface Engineering, HME, Aviation Supply, Administrative, Surface Operations-Combat Systems, and Submarine) have representation in the opposite direction, and one (Surface Operations) has actual representation equal to expected representation in both the Navy and civilian distributions.

Of interest, the persistent overrepresentation of blacks in the Navy Administrative and Supply categories is not duplicated in the civilian labor force. However, the underrepresentation of blacks in Navy Aviation Maintenance occupations is duplicated in the civilian labor force. One explanation relates to the type of training required to enter these respective occupations. The Aviation Maintenance occupations, in general, require very expensive, highly technical, extremely specialized training. The training and the job experience received by military personnel in this occupational category are quite often directly transferable to the civilian labor force. Civilian employers, no doubt, seek out these veterans for their military training and, more importantly, their valuable job experience. It is not surprising that many in the civilian Aviation Maintenance occupations received their initial training in the Armed Forces. Thus, any disproportionate representation present in the military population would likely be transferred to the civilian population.

On the other hand, the Administrative and Supply occupations involve less expensive and less specialized training. The experience gained in these occupations is less

FIGURE 15. A Comparison of Black Representation in Navy Ratings versus Similar Civilian Occupations



Source: Derived from data provided by the Defense Manpower Data Center and the U.S. Department of Labor, Bureau of Labor Statistics.
Representation percentages are summarized by difference indicators (DIs).

transferable and therefore less valued by civilian employers. A smaller percentage of the civilian work force in these occupations received their initial training in the Armed Forces.

Thus, civilian distributions in these occupations are less likely to be influenced by military distributions and are more likely to be the result of the dissimilar occupational placement processes.

As noted above, the process leading to occupational placement differs significantly between the Services and the civilian population. And despite the rigorous approach employed here to match civilian occupations with Navy ratings, it is doubtful, given the unique characteristics of military service, that civilian occupations could ever be precisely matched with Navy ratings. Ultimately, these significant differences in respective occupational placement processes and populations indicate that comparisons of civilian occupational distributions with Navy distributions are of limited value.

2. Segregation Index

The segregation index is based on the absolute deviation in the percentage employed in each occupational distribution and indicates the percentage of minority workers that would have to shift between jobs to equalize the occupational distributions of the two groups. Equation (9) defines the segregation index. For the 1992 Navy cross-section, the segregation index is 22.7 percent which means that 106,101 enlisted personnel would have to change occupations to achieve an equal distribution.

V. CONCLUSIONS AND RECOMMENDATIONS

This chapter briefly summarizes the study and presents the conclusions drawn from the results. It also offers some recommendations and suggests areas for further research.

A. GENERAL

A primary purpose of this study is to examine outcomes of the U.S. Navy's policies and programs to achieve equitable occupational placement of black men in the enlisted ranks. The long history of blacks in the Navy is replete with personnel policies and practices that have been less than fair. For many years, racial segregation was carried out in the Navy by policies that restricted access to occupations by blacks. Despite this tainted past, the opportunities for blacks in the Navy have significantly, albeit gradually, improved since World War II. Manpower needs were often the impetus for the greatest improvements [Ref. 6]. Today, there are no policies that discriminate directly against minorities. Affirmative action and equal opportunity programs have been in place to monitor and eradicate discrimination, both direct and indirect, for nearly two decades. This study endeavors to determine how effective they have been by looking at the distribution of blacks in Navy occupations.

It is well-documented that black men, on the basis of their overall percentage of the force, continue to be underrepresented in the Navy's more technical ratings and overrepresented in the less technical support and administrative ratings [Ref. 4]. It is also well-documented, and proven by the data in this study, that black men have lower scores than non-black men, on average, on every subtest of the Armed Services Vocational Aptitude Battery (ASVAB)—a test designed to measure aptitude for occupational training assignments. The ASVAB has been shown to accurately predict performance in occupational training, and later, "on the job." [Ref. 15] Despite consistent differences in

ASVAB scores between blacks and non-blacks, studies have consistently found that the ASVAB is not biased against native-born English speaking minorities [Ref. 14].

Few studies, however, have documented how much of the disparity in black occupational representation can be attributed to ASVAB scores and how much is attributable to other factors acting upon the occupational placement process. Other important factors include: education; personal preferences; physical, medical and moral qualifications; timing; and the needs of the Navy. The possibility that personal and institutional bias may play some role in the placement process cannot be discounted. Although the Navy devotes significant resources to ensure equal opportunity education and awareness of all Navy personnel, there are situations in which personal bias might affect the occupational distribution of minorities [Ref. 24:p. 64]:

- A well-intentioned recruiter may unknowingly press personal stereotypes of minorities and jobs onto an eager, yet ill-informed, recruit candidate.
- Similarly, the "classifier," or career counselor at the Military Examination and Processing Station (MEPS), whose job it is to match recruit preferences and qualifications with available training openings, has a similar opportunity to interject personal bias.
- During occupational training, instructors might grade minorities differently than non-minorities or apply different standards to the two groups.
- Once on the job, supervisors and managers evaluate an individual's performance. Their evaluations greatly influence the retention and advancement of all subordinates. Again, there exists the possibility that a supervisor could interject personal bias into the evaluation process.

Clearly though, of all the factors that influence occupational placement, probably none have a greater influence than differences in aptitude as measured by the ASVAB. This study addresses how much of the disparity in black occupational representation can be attributed to ASVAB scores and how much is attributable to other factors acting upon the occupational placement process. This is accomplished with a new methodology that

enables an examination of black occupational distributions after controlling for the influence of aptitude. Any disproportionate black representation that persists after controlling for the influence of aptitude is likely the result of the other factors previously mentioned or some factor or factors presently unknown.

B. CONCLUSIONS

After controlling for the influence of aptitude, it was discovered that disproportionate black representation occurred in several occupational categories. Blacks are predominantly overrepresented in the Administrative and Supply categories. Conversely, blacks are predominantly underrepresented in the Aviation Maintenance, Surface Operations, and the Other categories:[16]

Determination of disproportionate representation by itself does not provide an indication of the effectiveness of equal opportunity/affirmative action policies and programs. Rather, the existence of disproportionate representation tends to only validate the need for such programs. To measure the effectiveness or outcomes of these programs, it is necessary to evaluate the persistence of disproportionate representation over time. For example, if disproportionate representation were decreasing over time, then one could conclude that equal opportunity/affirmative action policies and programs were probably effective (in a comprehensive fashion) in addressing the issue of equitable representation in Navy occupations. Conversely, if disproportionate representation were increasing or remaining constant, one can conclude that equal opportunity/affirmative action policies and programs may be ineffective in addressing the issue of equitable representation in Navy occupations. After controlling for the influence of aptitude, and examining data over a nine-year period, it was found that of the 14 occupational categories examined, 11 demonstrated a trend of decreasing disproportionate black representation (i.e., converging toward

[16]Occupational categories are defined in Table 10.

balanced representation). Two categories had reversed their relative disproportionate representation: Deck from underrepresented to overrepresented and Medical from overrepresented to underrepresented. One category, Aviation Maintenance, was holding constant at a moderate level of underrepresentation. These findings support the conclusion that, in general, the disproportionate representation of blacks in U.S. Navy ratings is decreasing. One cannot point to a specific relationship between these improvements in black representation and causal factors; but it is likely that the Navy's affirmative action and equal opportunity policies have contributed to the change.

C. RECOMMENDATIONS

1. *The Services should establish representation goals and indicators based on distributions derived by a method that controls for the influence of aptitude.*

As equal opportunity and affirmative action programs evolve, it is important that occupational representation goals are attainable within the framework of legitimate standards. Any large organization such as the Navy, with a great diversity of jobs, must manage the complex task of providing a continuous supply of new personnel to fill job vacancies. Applicants have different characteristics and experiences that may qualify them for one type of occupation but not another. To maximize production and efficiency, the Navy must screen the applicant pool to determine each applicant's suitability for a particular occupation and to make an effective person-job match. This process is complicated by the fact that the available manpower pool is composed predominantly of young men and women who have limited job histories. Given the extraordinary expense of A-school training (particularly in the highly technical ratings), and the even greater potential expense, in terms injury or death, of an over-matched sailor failing on the job, it is critically important that the Navy be able to effectively match applicants with jobs. Aptitude testing offers a systematic and cost effective method to assess an applicant's

potential for success in training and success on the job. Establishing minority occupational representation goals that have not considered the influence of aptitude is naive, because such goals may not be attainable given existing ASVAB standards. Lowering ASVAB standards for every occupation in which minorities are underrepresented would likely prove to be prohibitively expensive in human as well as training costs. Establishing separate ASVAB standards for minorities would violate the Civil Rights Act of 1991 which prohibits the establishment of separate employment standards on the basis of race, color, religion, or creed.

In the past, the absence of an appropriate methodology may have hindered the establishment of minority occupational representation goals that considered the influence of aptitude. This need not be an obstacle today. The Assignment Model, introduced in this study, could certainly be adapted to this role as follows:

- assuming that the previous year's distribution of applicants is somewhat representative (in terms of its racial/ethnic makeup and aptitude) of the next year's distribution; and
- assuming that the goals for the number of personnel desired for each rating next year are known; and
- given established attrition rates by racial/ethnic groups; and
- given expected ASVAB composite and cut scores, then

an assignment algorithm similar to the one introduced in Chapter III could be employed to determine an "expected" racial/ethnic distribution for each rating. The minority percentages in these distributions would represent both equitable and attainable representation goals.

2. *The Services must continue to validate the capability of future ASVAB forms and versions to predict both training performance and job performance.*

The ASVAB has been shown to accurately predict performance in occupational training and, later, "on the job." [Ref. 15] Future ASVAB forms and versions must also be capable of predicting job performance. Only when it can be demonstrated that the ASVAB specifically predicts job performance with greater accuracy than other available methods, can its use in occupational placement overcome allegations that it discriminates with respect to socioeconomic status far more than justified by the requirement to support the Navy mission [Ref. 8,p. 81].

3. *The Navy must ensure "cut scores" are determined on the basis of appropriate-qualification and not over-qualification.*

Each Service creates and applies its own aptitude composites and "cut scores." Cut scores are flexible over time. They are often raised or lowered based on changes in manpower requirements or space availability in the training pipeline. When a cut score, which establishes minimum qualification for occupational training, is adjusted upward independently of any change in the skills and abilities required by the job, the result is to deny less qualified persons (on the basis of aptitude) the opportunity to serve in the respective rating. However, the resultant redistribution affects not only the rating in question but the distributions of all other ratings with similar or lesser ASVAB requirements. Given the differentials in ASVAB performance, these changes have a particularly adverse effect on minorities. The Navy must ensure that cut scores are established on the basis of empirically justified qualification criteria.

4. *The Navy should maximize the PRIDE/CLASP system to direct qualified minorities into underrepresented ratings.*

The PRIDE/CLASP automated classification and assignment program represents a powerful weapon to combat disproportionate minority representation in ratings. The CLASP model is particularly valuable because it was designed to be "policy-capturing," in the sense that it is able to integrate certain Navy policies and goals under an "optimization procedure." One of several policy elements that influences an "optimality index" is balanced minority fill rates within all ratings [Ref. 8]. The system is particularly effective at conveying Navy policies because it reaches each classifier directly (through the personal computer on their desk) and it virtually "dictates" (via the classifier) information on available training opportunities to the applicant. As effective as this program is, its full potential for directing minorities into disproportionately represented ratings may not be fully realized. For example, the current CLASP program provides the classifier with only a three-month listing of available A-school training seats for which the applicant qualifies. It is possible that a minority may qualify (on the basis of aptitude) for A-school training in a historically underrepresented rating; yet, because of gaps in start dates and limited quotas, he or she may not be offered the A-school. If the applicant were to request the particular A-school, the classifier can manually search future months until a quota is found. However, this takes some time and it requires overt action on the part of the classifier. If, in the case of minorities, the CLASP program automatically displayed A-school training dates for all historically underrepresented ratings for which the applicant qualifies, independent of time, there is a greater probability that the individual would choose one of these ratings. Another innovation involves "fencing" a number of A-school seats (corresponding to "fair share" on the basis of aptitude distributions) each training cycle for minorities.[17]

[17]Discussions with staff members at the Bureau of Personnel (PERS 22) on May 24, 1994 indicate that both recommendations are under consideration and may soon to be implemented.

D. RECOMMENDATIONS FOR FUTURE RESEARCH

A considerable portion of this thesis was devoted to examining the influence of aptitude on the distribution of black men within Navy ratings. Although blacks represent the largest minority population in the Navy, the factors affecting their occupational representation may be significantly different for other racial/ethnic groups. Accordingly, it is recommended that similar research be conducted to examine the influence of aptitude on the occupational placement of other prominent minority groups.

As has been often noted in this study, aptitude is not the only factor exercising influence on occupational placement. Personal preference no doubt plays a major role in occupational selections by members of all racial/ethnic groups. It may well be that personal preference outweighs all other considerations when a recruit selects a career field. To date, little research has addressed the role of personal preference in the determination of occupational distributions in the Navy. Meaningful research in this area would greatly contribute to the body of knowledge concerning minority occupational placement.

E. A FINAL NOTE ON MINORITY REPRESENTATION IN U.S. NAVY RATINGS

Today, military personnel managers face a formidable task as they seek solutions to the challenging issue of equitable representation for all members in Naval Service. Often, the Services are criticized for allowing minorities to be underrepresented in the more selective, highly-technical ratings and overrepresented in less-selective, least technical ones. Some proponents of equal opportunity correctly argue that minorities—despite tangible gains in past 20 years—are "forced to travel an especially rough road to complete job parity in the military because of the various institutional obstacles put before them." [Ref. 8:p. 164] These same proponents further argue that a major obstacle is, in fact, the aptitude test, since it is the factor upon which occupational opportunities are primarily

APPENDIX A: Fifth Year Demographic Data By Rating Group

TABLE 17. DEMOGRAPHIC DATA FOR FY1979

Rating Group	Actual Non-Black	Actual Black	Total	Actual Non-Black	Actual Black	Assignment Model Non-Black	Assignment Model Black	DIs Actual	DIs Model	
Surf eng	3522	518	4040	87.2	12.8	87.6	12.4	-11	3	*
HME	2124	286	2410	88.1	11.9	92.5	7.5	-18	59	
Av maint	3045	729	3774	80.7	19.3	79.6	20.4	34	-5	*
Av ops	1150	324	1474	78.0	22.0	72.7	27.3	53	-20	
Av supply	367	107	474	77.4	22.6	83.3	16.7	57	35	
Admin	844	448	1292	65.3	34.7	89.3	10.7	141	225	
Deck	694	195	889	78.1	21.9	61.0	39.0	52	-44	
Supply	957	451	1408	68.0	32.0	79.5	20.5	122	56	
Med	1193	461	1654	72.1	27.9	77.7	22.3	94	25	
Crypt	477	88	565	84.4	15.6	85.7	14.3	8	9	*
Surf ops-cs	1475	157	1632	90.4	9.6	92.1	7.9	-33	22	
Surf ops	2519	479	2998	84.0	16.0	85.4	14.6	11	9	
Sub	1035	131	1166	88.8	11.2	91.1	8.9	-22	26	
Other	1596	280	1876	85.1	14.9	60.9	39.1	4	-62	

Source: Derived from data provided by the Defense Manpower Data Center.

* not statistically significant (see footnote 12).

TABLE 18. DEMOGRAPHIC DATA FOR FY1982

Rating Group	Actual Non-Black	Actual Black	Total	Actual Non-Black	Actual Black	Assignment Model Non-Black	Assignment Model Black	DIs Actual	DIs Model	
Surf eng	3740	347	4087	91.5	8.5	87.3	12.7	-41	-33	
HME	2297	313	2610	88.0	12.0	93.4	6.6	-18	82	
Av maint	2785	311	3096	90.0	10.0	86.6	13.4	-30	-25	
Av ops	1108	187	1295	85.6	14.4	78.1	21.9	0	-34	
Av supply	426	109	535	79.6	20.4	87.1	12.9	41	58	
Admin	961	327	1288	74.6	25.4	90.5	9.5	76	168	
Deck	969	308	1277	75.9	24.1	54.7	45.3	67	-47	
Supply	1206	554	1760	68.5	31.5	84.1	15.9	119	99	
Med	1007	274	1281	78.6	21.4	83.9	16.1	49	33	
Crypt	587	105	692	84.8	15.2	86.3	13.7	5	11	*
Surf ops-cs	2139	215	2354	90.9	9.1	94.9	5.1	-37	78	
Surf ops	3352	428	3780	88.7	11.3	87.6	12.4	-21	-8	
Sub	804	95	899	89.4	10.6	90.2	9.8	-27	8	*
Other	1239	208	1447	85.6	14.4	71.5	28.5	0	-50	

Source: Derived from data provided by the Defense Manpower Data Center.

* not statistically significant (see footnote 12).

TABLE 19. DEMOGRAPHIC DATA FOR FY1985

Rating Group	Actual Non-Black	Actual Black	Total	Actual Non-Black	Actual Black	Assignment Model Non-Black	Assignment Model Black	DIs Actual	DIs Model	
Surf eng	3791	383	4174	90.8	9.2	90.4	9.6	-36	-4	*
HME	2056	221	2277	90.3	9.7	90.2	9.8	-33	-1	*
Av maint	2703	306	3009	89.8	10.2	85.3	14.7	-29	-31	
Av ops	1078	249	1327	81.2	18.8	83.3	16.7	30	12	*
Av supply	484	115	599	80.8	19.2	75.0	25.0	33	-23	
Admin	844	277	1121	75.3	24.7	86.3	13.8	72	80	
Deck	1061	402	1463	72.5	27.5	79.4	20.6	91	33	
Supply	1153	498	1651	69.8	30.2	81.5	18.5	109	63	
Med	1344	365	1709	78.6	21.4	76.2	23.8	48	-10	
Crypt	623	70	693	89.9	10.1	81.2	18.8	-30	-46	
Surf ops-cs	2417	258	2675	90.4	9.6	90.2	9.8	-33	-1	*
Surf ops	3073	563	3636	84.5	15.5	81.3	18.7	8	-17	
Sub	946	84	1030	91.8	8.2	90.3	9.7	-43	-16	*
Other	951	157	1108	85.8	14.2	76.9	23.1	-2	-39	

Source: Derived from data provided by the Defense Manpower Data Center.

* not statistically significant (see footnote 12).

TABLE 20. DEMOGRAPHIC DATA FOR FY1988

Rating Group	Actual Non-Black	Actual Black	Total	Actual Non-Black	Actual Black	Assignment Model Non-Black	Assignment Model Black	DIs Actual	DIs Model	
Surf eng	3644	518	4162	87.6	12.4	85.9	14.1	-14	-12	
HME	2128	361	2489	85.4	14.6	87.0	13.0	1	12	
Av maint	2764	337	3101	89.1	10.9	85.3	14.7	-25	-26	
Av ops	1484	384	1868	79.4	20.6	77.3	22.7	43	-9	
Av supply	498	122	620	80.3	19.7	80.0	20.0	37	-2	*
Admin	771	428	1199	64.3	35.7	71.9	28.1	148	27	
Deck	936	462	1398	67.0	33.0	75.8	24.2	129	36	
Supply	1286	1009	2295	56.0	44.0	69.5	30.5	205	44	
Med	1458	511	1969	74.0	26.0	54.4	45.6	80	-43	
Crypt	623	92	715	87.1	12.9	86.4	13.6	-11	-5	*
Surf ops-cs	2357	241	2598	90.7	9.3	90.5	9.5	-36	-2	*
Surf ops	2731	662	3393	80.5	19.5	78.0	22.0	35	-11	
Sub	847	104	951	89.1	10.9	88.7	11.3	-24	-3	*
Other	1024	310	1334	76.8	23.2	74.0	26.0	61	-10	

Source: Derived from data provided by the Defense Manpower Data Center.

* not statistically significant (see footnote 12).

APPENDIX B: Fifth Year Demographic Data By Rating

TABLE 21. FIFTH YEAR DEMOGRAPHIC DATA: FY1979

Rating	Actual Number in Rating			Actual Percentage in Rating		Assignment Model Percentage in Rating	
	Non-Black	Black	Total	Non-Black	Black	Non-Black	Black
AA	27	6	33	81.8	18.2	57.6	42.4
ABE	70	63	133	52.6	47.4	50.4	49.6
ABF	62	43	105	59.0	41.0	51.4	48.6
ABH	149	73	222	67.1	32.9	46.8	53.2
AC	183	24	207	88.4	11.6	69.1	30.9
AD	650	213	863	75.3	24.7	75.6	24.4
AE	457	90	547	83.5	16.5	65.6	34.4
AG	74	3	77	96.1	3.9	98.7	1.3
AK	148	67	215	68.8	31.2	81.4	18.6
AME	142	49	191	74.3	25.7	51.8	48.2
AMH	224	114	338	66.3	33.7	65.4	34.6
AMS	431	163	594	72.6	27.4	83.5	16.5
AN	81	32	113	71.7	28.3	35.4	64.6
AO	243	105	348	69.8	30.2	88.8	11.2
AQ	220	16	236	93.2	6.8	96.2	3.8
AR	60	9	69	87.0	13.0	10.1	89.9
AS	0	0	0	0.0	0.0	0.0	0.0
ASE	25	6	31	80.6	19.4	61.3	38.7
ASM	89	8	97	91.8	8.2	91.8	8.2
AT	635	58	693	91.6	8.4	97.1	2.9
AW	143	3	146	97.9	2.1	81.5	18.5
AX	136	8	144	94.4	5.6	97.2	2.8
AZ	122	38	160	76.3	23.8	79.4	20.6
BM	406	139	545	74.5	25.5	56.1	43.9
BT	786	192	978	80.4	19.6	81.3	18.7
BU	219	14	233	94.0	6.0	81.5	18.5
CE	102	11	113	90.3	9.7	95.6	4.4
CM	143	9	152	94.1	5.9	79.6	20.4
CN	1	1	2	50.0	50.0	100.0	0.0
CTA	16	14	30	53.3	46.7	100.0	0.0
CTI	45	2	47	95.7	4.3	80.9	19.1
CTM	183	15	198	92.4	7.6	96.5	3.5
CTO	44	14	58	75.9	24.1	81.0	19.0
CTR	52	11	63	82.5	17.5	60.3	39.7
CTT	81	26	107	75.7	24.3	75.7	24.3
DA	3	3	6	50.0	50.0	50.0	50.0
DC	0	0	0	0.0	0.0	0.0	0.0
DK	75	41	116	64.7	35.3	95.7	4.3
DM	11	6	17	64.7	35.3	64.7	35.3
DN	58	36	94	61.7	38.3	50.0	50.0
DP	236	71	307	76.9	23.1	87.9	12.1
DR	2	0	2	100.0	0.0	50.0	50.0
DS	304	27	331	91.8	8.2	96.7	3.3

Rating	Actual Number in Rating			Actual Percentage in Rating		Assignment Model Percentage in Rating	
	Non-Black	Black	Total	Non-Black	Black	Non-Black	Black
DT	112	88	200	56.0	44.0	81.0	19.0
EA	34	2	36	94.4	5.6	100.0	0.0
EM	890	115	1,005	88.6	11.4	93.3	6.7
EN	432	88	520	83.1	16.9	89.6	10.4
EO	198	2	200	99.0	1.0	90.0	10.0
ET	1,683	113	1,796	93.7	6.3	96.6	3.4
EW	182	20	202	90.1	9.9	95.5	4.5
FA	42	9	51	82.4	17.6	68.6	31.4
FC	0	0	0	0.0	0.0	0.0	0.0
FN	60	26	86	69.8	30.2	46.5	53.5
FR	71	11	82	86.6	13.4	61.0	39.0
FTB	81	3	84	96.4	3.6	89.3	10.7
FTG	312	30	342	91.2	8.8	92.1	7.9
FTM	237	15	252	94.0	6.0	96.0	4.0
GMG	162	33	195	83.1	16.9	76.4	23.6
GMM	59	10	69	85.5	14.5	91.3	8.7
GMT	88	11	99	88.9	11.1	81.8	18.2
GSE	74	1	75	98.7	1.3	88.0	12.0
GSM	120	2	122	98.4	1.6	97.5	2.5
HA	9	3	12	75.0	25.0	41.7	58.3
HM	937	280	1,217	77.0	23.0	82.7	17.3
HN	67	52	119	56.3	43.7	50.4	49.6
HR	8	2	10	80.0	20.0	30.0	70.0
HT	646	75	721	89.6	10.4	90.8	9.2
IC	433	78	511	84.7	15.3	93.7	6.3
IM	10	5	15	66.7	33.3	93.3	6.7
IS	56	6	62	90.3	9.7	95.2	4.8
JO	45	7	52	86.5	13.5	100.0	0.0
LI	20	21	41	48.8	51.2	58.5	41.5
LN	9	1	10	90.0	10.0	70.0	30.0
MA	2	1	3	66.7	33.3	33.3	66.7
ML	9	1	10	90.0	10.0	100.0	0.0
MM	2,110	235	2,345	90.0	10.0	89.2	10.8
MN	21	0	21	100.0	0.0	100.0	0.0
MR	123	12	135	91.1	8.9	89.6	10.4
MS	508	132	640	79.4	20.6	50.6	49.4
MT	210	7	217	96.8	3.2	86.6	13.4
MU	12	1	13	92.3	7.7	84.6	15.4
NC	0	0	0	0.0	0.0	0.0	0.0
OM	9	0	9	100.0	0.0	88.9	11.1
OS	318	78	396	80.3	19.7	86.6	13.4
OT	56	8	64	87.5	12.5	82.8	17.2
OTA	0	0	0	0.0	0.0	0.0	0.0
OTM	0	0	0	0.0	0.0	0.0	0.0
PC	43	19	62	69.4	30.6	95.2	4.8
PH	226	10	236	95.8	4.2	84.3	15.7
PM	4	0	4	100.0	0.0	100.0	0.0
PN	203	113	316	64.2	35.8	91.5	8.5

Rating	Actual Number in Rating			Actual Percentage in Rating		Assignment Model Percentage in Rating	
	Non-Black	Black	Total	Non-Black	Black	Non-Black	Black
PR	97	2	99	98.0	2.0	93.9	6.1
QM	207	38	245	84.5	15.5	58.8	41.2
RM	518	288	806	64.3	35.7	59.7	40.3
RP	31	6	37	83.8	16.2	100.0	0.0
SA	73	29	102	71.6	28.4	46.1	53.9
SH	129	136	265	48.7	51.3	86.0	14.0
SK	245	142	387	63.3	36.7	88.1	11.9
SM	81	18	99	81.8	18.2	92.9	7.1
SN	151	59	210	71.9	28.1	40.0	60.0
SR	108	44	152	71.1	28.9	46.7	53.3
STG	387	33	420	92.1	7.9	95.7	4.3
STS	245	11	256	95.7	4.3	96.5	3.5
SW	110	4	114	96.5	3.5	94.7	5.3
TD	36	4	40	90.0	10.0	95.0	5.0
TM	166	80	246	67.5	32.5	87.8	12.2
UT	101	8	109	92.7	7.3	93.6	6.4
WT	0	0	0	0.0	0.0	0.0	0.0
YN	244	203	447	54.6	45.4	90.4	9.6
Total	20,998	4,654	25,652				

Source: Derived from data provided by the Defense Manpower Data Center.

TABLE 22. FIFTH YEAR DEMOGRAPHIC DATA: FY1982

Rating	Actual Number in Rating			Actual Percentage in Rating		Assignment Model Percentage in Rating	
	Non-Black	Black	Total	Non-Black	Black	Non-Black	Black
AA	7	2	9	77.8	22.2	11.1	88.9
ABE	95	36	131	72.5	27.5	38.2	61.8
ABF	57	32	89	64.0	36.0	55.1	44.9
ABH	109	30	139	78.4	21.6	61.9	38.1
AC	160	10	170	94.1	5.9	81.2	18.8
AD	415	51	466	89.1	10.9	82.2	17.8
AE	414	43	457	90.6	9.4	78.6	21.4
AG	34	3	37	91.9	8.1	78.4	21.6
AK	175	52	227	77.1	22.9	87.2	12.8
AME	114	21	135	84.4	15.6	50.4	49.6
AMH	185	33	218	84.9	15.1	90.8	9.2
AMS	407	58	465	87.5	12.5	89.9	10.1
AN	66	29	95	69.5	30.5	38.9	61.1
AO	366	63	429	85.3	14.7	93.5	6.5
AQ	157	21	178	88.2	11.8	94.9	5.1
AR	22	6	28	78.6	21.4	42.9	57.1
AS	0	0	0	0.0	0.0	0.0	0.0
ASE	41	19	60	68.3	31.7	78.3	21.7
ASM	102	15	117	87.2	12.8	82.1	17.9
AT	810	47	857	94.5	5.5	94.6	5.4
AW	190	3	193	98.4	1.6	81.9	18.1
AX	128	3	131	97.7	2.3	91.6	8.4
AZ	127	49	176	72.2	27.8	85.2	14.8
BM	574	204	778	73.8	26.2	36.6	63.4
BT	658	82	740	88.9	11.1	77.8	22.2
BU	200	6	206	97.1	2.9	58.3	41.7
CE	166	4	170	97.6	2.4	94.1	5.9
CM	108	1	109	99.1	0.9	94.5	5.5
CN	0	0	0	0.0	0.0	0.0	0.0
CTA	22	4	26	84.6	15.4	88.5	11.5
CTI	53	3	56	94.6	5.4	87.5	12.5
CTM	138	11	149	92.6	7.4	89.3	10.7
CTO	88	15	103	85.4	14.6	92.2	7.8
CTR	96	40	136	70.6	29.4	68.4	31.6
CTT	117	29	146	80.1	19.9	94.5	5.5
DA	1	1	2	50.0	50.0	50.0	50.0
DC	0	0	0	0.0	0.0	0.0	0.0
DK	114	66	180	63.3	36.7	81.7	18.3
DM	9	4	13	69.2	30.8	23.1	76.9
DN	28	15	43	65.1	34.9	37.2	62.8
DP	234	24	258	90.7	9.3	91.1	8.9
DR	0	1	1	0.0	100.0	0.0	100.0
DS	273	9	282	96.8	3.2	93.6	6.4
DT	73	18	91	80.2	19.8	93.4	6.6
EA	21	2	23	91.3	8.7	87.0	13.0
EM	1187	110	1297	91.5	8.5	94.2	5.8

Rating	Actual Number in Rating			Actual Percentage in Rating		Assignment Model Percentage in Rating	
	Non-Black	Black	Total	Non-Black	Black	Non-Black	Black
EN	423	89	512	82.6	17.4	90.0	10.0
EO	162	8	170	95.3	4.7	75.3	24.7
ET	2048	84	2132	96.1	3.9	95.4	4.6
EW	239	21	260	91.9	8.1	96.2	3.8
FA	10	1	11	90.9	9.1	27.3	72.7
FC	751	53	804	93.4	6.6	96.4	3.6
FN	52	14	66	78.8	21.2	43.9	56.1
FR	18	6	24	75.0	25.0	20.8	79.2
FTB	54	4	58	93.1	6.9	81.0	19.0
FTG	145	5	150	96.7	3.3	95.3	4.7
FTM	0	0	0	0.0	0.0	0.0	0.0
GMG	241	50	291	82.8	17.2	91.1	8.9
GMM	134	10	144	93.1	6.9	94.4	5.6
GMT	45	9	54	83.3	16.7	96.3	3.7
GSE	101	3	104	97.1	2.9	95.2	4.8
GSM	186	4	190	97.9	2.1	94.2	5.8
HA	5	2	7	71.4	28.6	28.6	71.4
HM	799	189	988	80.9	19.1	91.0	9.0
HN	95	45	140	67.9	32.1	47.1	52.9
HR	7	4	11	63.6	36.4	63.6	36.4
HT	537	70	607	88.5	11.5	90.0	10.0
IC	352	98	450	78.2	21.8	94.9	5.1
IM	38	6	44	86.4	13.6	93.2	6.8
IS	73	3	76	96.1	3.9	86.8	13.2
JO	35	4	39	89.7	10.3	84.6	15.4
LI	20	8	28	71.4	28.6	46.4	53.6
LN	12	10	22	54.5	45.5	68.2	31.8
MA	5	2	7	71.4	28.6	85.7	14.3
ML	13	2	15	86.7	13.3	86.7	13.3
MM	2372	169	2541	93.3	6.7	88.7	11.3
MN	20	5	25	80.0	20.0	92.0	8.0
MR	145	22	167	86.8	13.2	95.8	4.2
MS	621	241	862	72.0	28.0	76.8	23.2
MT	117	10	127	92.1	7.9	94.5	5.5
MU	49	2	51	96.1	3.9	74.5	25.5
NC	0	0	0	0.0	0.0	0.0	0.0
OM	21	3	24	87.5	12.5	95.8	4.2
OS	681	110	791	86.1	13.9	90.0	10.0
OT	0	0	0	0.0	0.0	0.0	0.0
OTA	61	5	66	92.4	7.6	81.8	18.2
OTM	5	2	7	71.4	28.6	85.7	14.3
PC	36	19	55	65.5	34.5	96.4	3.6
PH	97	10	107	90.7	9.3	94.4	5.6
PM	4	2	6	66.7	33.3	100.0	0.0
PN	220	69	289	76.1	23.9	91.7	8.3
PR	124	8	132	93.9	6.1	89.4	10.6
QM	253	66	319	79.3	20.7	74.9	25.1
RM	623	234	857	72.7	27.3	66.3	33.7

Rating	Actual Number in Rating			Actual Percentage in Rating		Assignment Model Percentage in Rating	
	Non-Black	Black	Total	Non-Black	Black	Non-Black	Black
RP	35	8	43	81.4	18.6	97.7	2.3
SA	23	19	42	54.8	45.2	71.4	28.6
SH	104	81	185	56.2	43.8	91.4	8.6
SK	367	166	533	68.9	31.1	94.4	5.6
SM	142	38	180	78.9	21.1	96.7	3.3
SN	137	82	219	62.6	37.4	78.8	21.2
SR	33	12	45	73.3	26.7	0.0	0.0
STG	344	43	387	88.9	11.1	97.9	2.1
STS	282	17	299	94.3	5.7	93.6	6.4
SW	66	5	71	93.0	7.0	80.3	19.7
TD	12	0	12	100.0	0.0	100.0	0.0
TM	186	54	240	77.5	22.5	82.5	17.5
UT	98	8	106	92.5	7.5	84.9	15.1
WT	46	13	59	78.0	22.0	88.1	11.9
YN	355	179	534	66.5	33.5	93.8	6.2
Total	22,620	3,781	26,401				

Source: Derived from data provided by the Defense Manpower Data Center.

TABLE 23. FIFTH YEAR DEMOGRAPHIC DATA: FY1985

Rating	Actual			Actual		Assignment Model	
	Number in Rating			Percentage in Rating		Percentage in Rating	
	Non-Black	Black	Total	Non-Black	Black	Non-Black	Black
AA	5	3	8	62.5	37.5	0.0	100.0
ABE	100	38	138	72.5	27.5	47.1	52.9
ABF	81	25	106	76.4	23.6	77.4	22.6
ABH	127	61	188	67.6	32.4	88.8	11.2
AC	104	13	117	88.9	11.1	62.4	37.6
AD	591	111	702	84.2	15.8	78.9	21.1
AE	388	72	460	84.3	15.7	67.6	32.4
AG	47	5	52	90.4	9.6	86.5	13.5
AK	215	55	270	79.6	20.4	65.9	34.1
AME	102	5	107	95.3	4.7	87.9	12.1
AMH	203	27	230	88.3	11.7	93.5	6.5
AMS	352	37	389	90.5	9.5	91.8	8.2
AN	79	29	108	73.1	26.9	41.7	58.3
AO	331	94	425	77.9	22.1	92.7	7.3
AQ	165	5	170	97.1	2.9	93.5	6.5
AR	5	1	6	83.3	16.7	0.0	100.0
AS	0	0	0	0.0	0.0	0.0	0.0
ASE	36	5	41	87.8	12.2	95.1	4.9
ASM	70	1	71	98.6	1.4	66.2	33.8
AT	701	41	742	94.5	5.5	94.1	5.9
AW	186	4	190	97.9	2.1	91.1	8.9
AX	95	2	97	97.9	2.1	96.9	3.1
AZ	175	56	231	75.8	24.2	77.1	22.9
BM	680	289	969	70.2	29.8	82.9	17.1
BT	587	112	699	84.0	16.0	75.8	24.2
BU	145	13	158	91.8	8.2	77.2	22.8
CE	91	10	101	90.1	9.9	94.1	5.9
CM	115	9	124	92.7	7.3	78.2	21.8
CN	0	0	0	0.0	0.0	0.0	0.0
CTA	39	5	44	88.6	11.4	61.4	38.6
CTI	115	5	120	95.8	4.2	57.5	42.5
CTM	91	6	97	93.8	6.2	92.8	7.2
CTO	69	3	72	95.8	4.2	81.9	18.1
CTR	97	24	121	80.2	19.8	87.6	12.4
CTT	123	22	145	84.8	15.2	85.5	14.5
DA	2	2	4	50.0	50.0	75.0	25.0
DC	131	23	154	0.0	0.0	0.0	0.0
DK	104	37	141	73.8	26.2	92.9	7.1
DM	5	1	6	83.3	16.7	100.0	0.0
DN	50	27	77	64.9	35.1	87.0	13.0
DP	104	17	121	86.0	14.0	82.6	17.4
DR	0	1	1	0.0	100.0	100.0	0.0
DS	144	10	154	93.5	6.5	92.2	7.8
DT	165	46	211	78.2	21.8	57.3	42.7
EA	21	0	21	100.0	0.0	90.5	9.5
EM	1007	88	1095	92.0	8.0	94.4	5.6
EN	389	84	473	82.2	17.8	94.3	5.7
EO	151	10	161	93.8	6.2	78.3	21.7
ET	1941	94	2035	95.4	4.6	93.9	6.1
EW	239	15	254	94.1	5.9	96.5	3.5

Rating	Actual Number in Rating			Actual Percentage in Rating		Assignment Model Percentage in Rating	
	Non-Black	Black	Total	Non-Black	Black	Non-Black	Black
FA	5	1	6	83.3	16.7	100.0	0.0
FC	980	46	1026	95.5	4.5	93.9	6.1
FN	23	14	37	62.2	37.8	91.9	8.1
FR	0	0	0	0.0	0.0	0.0	0.0
FTB	88	5	93	94.6	5.4	96.8	3.2
FTG	95	9	104	91.3	8.7	96.2	3.8
FTM	0	0	0	0.0	0.0	0.0	0.0
GMG	270	73	343	78.7	21.3	72.3	27.7
GMM	159	40	199	79.9	20.1	84.4	15.6
GMT	0	0	0	0.0	0.0	0.0	0.0
GSE	127	4	131	96.9	3.1	95.4	4.6
GSM	116	12	128	90.6	9.4	93.0	7.0
HA	2	1	3	66.7	33.3	66.7	33.3
HM	1068	256	1324	80.7	19.3	78.3	21.7
HN	56	32	88	63.6	36.4	80.7	19.3
HR	3	2	5	60.0	40.0	60.0	40.0
HT	392	36	428	91.6	8.4	89.5	10.5
IC	354	61	415	85.3	14.7	84.3	15.7
IM	14	2	16	87.5	12.5	87.5	12.5
IS	89	5	94	94.7	5.3	93.6	6.4
JO	59	1	60	98.3	1.7	81.7	18.3
LI	13	5	18	72.2	27.8	55.6	44.4
LN	7	2	9	77.8	22.2	66.7	33.3
MA	14	2	16	87.5	12.5	75.0	25.0
ML	12	1	13	92.3	7.7	92.3	7.7
MM	2572	171	2743	93.8	6.2	93.1	6.9
MN	32	1	33	97.0	3.0	97.0	3.0
MR	132	10	142	93.0	7.0	79.6	20.4
MS	552	243	795	69.4	30.6	67.0	33.0
MT	206	19	225	91.6	8.4	92.4	7.6
MU	34	2	36	94.4	5.6	61.4	38.6
NC	1	0	1	0.0	0.0	0.0	0.0
OM	8	0	8	100.0	0.0	100.0	0.0
OS	497	146	643	77.3	22.7	95.5	4.5
OT	0	0	0	0.0	0.0	0.0	0.0
OTA	38	6	44	86.4	13.6	84.1	15.9
OTM	18	1	19	94.7	5.3	78.9	21.1
PC	42	22	64	65.6	34.4	90.6	9.4
PH	102	9	111	91.9	8.1	95.5	4.5
PM	6	0	6	100.0	0.0	83.3	16.7
PN	225	55	280	80.4	19.6	85.7	14.3
PR	94	4	98	95.9	4.1	94.9	5.1
QM	202	56	258	78.3	21.7	49.6	50.4
RM	635	323	958	66.3	33.7	45.1	54.9
RP	27	13	40	67.5	32.5	77.5	22.5
SA	17	6	23	73.9	26.1	0.0	100.0
SH	119	118	237	50.2	49.8	92.8	7.2
SK	378	100	478	79.1	20.9	96.7	3.3
SM	179	57	236	75.8	24.2	97.5	2.5
SN	99	46	145	68.3	31.7	0.0	100.0
SR	10	4	14	71.4	28.6	0.0	100.0
STG	505	60	565	89.4	10.6	94.0	6.0

Rating	Actual Number in Rating			Actual Percentage in Rating		Assignment Model Percentage in Rating	
	Non-Black	Black	Total	Non-Black	Black	Non-Black	Black
STS	406	26	432	94.0	6.0	93.3	6.7
SW	63	2	65	96.9	3.1	92.3	7.7
TD	0	0	0	0.0	0.0	0.0	0.0
TM	119	24	143	83.2	16.8	67.8	32.2
UT	86	5	91	94.5	5.5	84.6	15.4
WT	64	7	71	90.1	9.9	91.5	8.5
YN	347	159	506	68.6	31.4	89.7	10.3
Total	22,524	3,948	26,472				

Source: Derived from data provided by the Defense Manpower Data Center.

TABLE 24. FIFTH YEAR DEMOGRAPHIC DATA: FY1988

Rating	Actual Number in Rating			Actual Percentage in Rating		Assignment Model Percentage in Rating	
	Non-Black	Black	Total	Non-Black	Black	Non-Black	Black
AA	5	5	10	50.0	50.0	100.0	0.0
ABE	121	63	184	65.8	34.2	41.3	58.7
ABF	80	45	125	64.0	36.0	44.9	55.1
ABH	175	94	269	65.1	34.9	0.0	0.0
AC	202	30	232	87.1	12.9	62.5	37.5
AD	468	97	565	82.8	17.2	74.5	25.5
AE	419	94	513	81.7	18.3	58.7	41.3
AG	69	7	76	90.8	9.2	86.8	13.2
AK	205	55	260	78.8	21.2	66.2	33.8
AME	107	4	111	96.4	3.6	96.4	3.6
AMH	214	18	232	92.2	7.8	97.4	2.6
AMS	504	23	527	95.6	4.4	95.4	4.6
AN	79	48	127	62.2	37.8	69.3	30.7
AO	415	115	530	78.3	21.7	88.5	11.5
AQ	0	0	0	0.0	0.0	0.0	0.0
AR	1	2	3	33.3	66.7	66.7	33.3
AS	142	38	180	78.9	21.1	90.6	9.4
ASE	0	0	0	0.0	0.0	0.0	0.0
ASM	0	0	0	0.0	0.0	0.0	0.0
AT	910	63	973	93.5	6.5	95.0	5.0
AW	285	11	296	96.3	3.7	93.2	6.8
AX	0	0	0	0.0	0.0	0.0	0.0
AZ	182	60	242	75.2	24.8	88.4	11.6
BM	557	356	913	61.0	39.0	80.6	19.4
BT	345	113	458	75.3	24.7	59.6	40.4
BU	243	19	262	92.7	7.3	72.9	27.1
CE	99	22	121	81.8	18.2	95.0	5.0
CM	103	11	114	90.4	9.6	78.9	21.1
CN	0	0	0	0.0	0.0	0.0	0.0
CTA	20	19	39	51.3	48.7	51.3	48.7
CTI	111	5	116	95.7	4.3	53.4	46.6
CTM	168	13	181	92.8	7.2	97.2	2.8
CTO	90	11	101	89.1	10.9	93.1	6.9
CTR	110	34	144	76.4	23.6	95.8	4.2
CTT	49	6	55	89.1	10.9	94.5	5.5
DA	0	0	0	0.0	0.0	0.0	0.0
DC	280	63	343	81.6	18.4	87.5	12.5
DK	94	44	138	68.1	31.9	95.7	4.3
DM	1	2	3	33.3	66.7	66.7	33.3
DN	34	35	69	49.3	50.7	76.8	23.2
DP	211	47	258	81.8	18.2	86.4	13.6
DR	1	0	1	100.0	0.0	100.0	0.0
DS	316	19	335	94.3	5.7	95.8	4.2
DT	64	37	101	63.4	36.6	43.6	56.4
EA	28	0	28	100.0	0.0	96.4	3.6
EM	987	147	1134	87.0	13.0	85.0	15.0
EN	378	116	494	76.5	23.5	84.2	15.8
EO	138	17	155	89.0	11.0	85.8	14.2
ET	1585	114	1699	93.3	6.7	95.1	4.9
EW	319	24	343	93.0	7.0	96.2	3.8

Rating	Actual Number in Rating			Actual Percentage in Rating		Assignment Model Percentage in Rating	
	Non-Black	Black	Total	Non-Black	Black	Non-Black	Black
FA	4	0	4	100.0	0.0	50.0	50.0
FC	776	39	815	95.2	4.8	93.5	6.5
FN	28	19	47	59.6	40.4	74.5	25.5
FR	2	2	4	50.0	50.0	100.0	0.0
FTB	65	3	68	95.6	4.4	92.6	7.4
FTG	154	11	165	93.3	6.7	91.5	8.5
FTM	0	0	0	0.0	0.0	0.0	0.0
GMG	218	61	279	78.1	21.9	67.7	[illegible]
GMM	95	36	131	72.5	27.5	77.9	[illegible]
GMT	0	0	0	0.0	0.0	0.0	[illegible]
GSE	157	20	177	88.7	11.3	97.2	2.8
GSM	311	50	361	86.1	13.9	96.1	3.9
HA	8	8	16	50.0	50.0	75.0	25.0
HM	1168	282	1450	80.6	19.4	42.8	57.2
HN	182	146	328	55.5	44.5	75.3	24.7
HR	1	3	4	25.0	75.0	75.0	25.0
HT	371	43	414	89.6	10.4	94.7	5.3
IC	343	93	436	78.7	21.3	83.3	16.7
IM	12	3	15	80.0	20.0	86.7	13.3
IS	75	4	79	94.9	5.1	96.2	3.8
JO	39	1	40	97.5	2.5	90.0	10.0
LI	11	12	23	47.8	52.2	100.0	0.0
LN	10	1	11	90.9	9.1	54.5	45.5
MA	16	3	19	84.2	15.8	57.9	42.1
ML	10	1	11	90.9	9.1	100.0	0.0
MM	2453	219	2672	91.8	8.2	88.8	11.2
MN	17	0	17	100.0	0.0	94.1	5.9
MR	111	11	122	91.0	9.0	90.2	9.8
MS	650	635	1285	50.6	49.4	33.9	66.1
MT	101	8	109	92.7	7.3	98.2	1.8
MU	24	7	31	77.4	22.6	71.0	29.0
NC	0	0	0	0.0	0.0	0.0	0.0
OM	12	0	12	100.0	0.0	91.7	8.3
OS	597	167	764	78.1	21.9	92.5	7.5
OT	0	0	0	0.0	0.0	0.0	0.0
OTA	65	6	71	91.5	8.5	63.4	36.6
OTM	22	0	22	100.0	0.0	95.5	4.5
PC	38	18	56	67.9	32.1	89.3	10.7
PH	137	19	156	87.8	12.2	93.6	6.4
PM	2	0	2	100.0	0.0	100.0	0.0
PN	163	43	206	79.1	20.9	85.9	14.1
PR	111	7	118	94.1	5.9	93.2	6.8
QM	198	53	251	78.9	21.1	49.8	50.2
RM	549	381	930	59.0	41.0	34.7	65.3
RP	23	28	51	45.1	54.9	37.3	62.7
SA	12	14	26	46.2	53.8	65.4	34.6
SH	125	141	266	47.0	53.0	78.2	21.8
SK	417	189	606	68.8	31.2	94.7	5.3
SM	181	53	234	77.4	22.6	84.6	15.4
SN	85	107	192	44.3	55.7	80.7	19.3
SR	2	8	10	20.0	80.0	70.0	30.0
STG	471	48	519	90.8	9.2	97.3	2.7

Rating	Actual Number in Rating			Actual Percentage in Rating		Assignment Model Percentage in Rating	
	Non-Black	Black	Total	Non-Black	Black	Non-Black	Black
STS	362	33	395	91.6	8.4	94.4	5.6
SW	99	15	114	86.8	13.2	86.8	13.2
TD	0	0	0	0.0	0.0	0.0	0.0
TM	148	49	197	75.1	24.9	68.0	32.0
UT	72	14	86	83.7	16.3	93.0	7.0
WT	75	8	83	90.4	9.6	92.8	7.2
YN	259	273	532	48.7	51.3	59.2	40.8
Total	22,551	5,541	28,092				

Source: Derived from data provided by the Defense Manpower Data Center.

APPENDIX C: 1992 Navy Cross-Section and 1991 Civilian Equivalent

TABLE 25. DEMOGRAPHIC DATA BY RATING: 1991 NAVY CROSS-SECTION AND 1991 CIVILIAN EQUIVALENT

	1992 Navy Cross-Section					1991 Civilian Cross-Section						
Rating	Non-Blacks	Blacks	Total	%Non-Blacks	%Blacks	Non-Blacks	Blacks	Total	%Non-Blacks	%Blacks	Navy DI	Civ DI
AB	60	14	74	81.1	18.9	138,855	13,825	152,680	90.9	9.1	5	32
ABE	1,636	616	2,252	72.6	27.4	14,630	1,788	16,418	89.1	10.9	52	58
ABF	1,301	526	1,827	71.2	28.8	86,152	6,118	92,271	93.4	6.6	60	-4
ABH	2,339	840	3,179	73.6	26.4	101,006	11,642	112,648	89.7	10.3	47	50
AC	2,405	412	2,817	85.4	14.6	201,127	30,961	232,088	86.7	13.3	-19	94
AD	7,940	1,572	9,512	83.5	16.5	2,678,751	157,769	2,836,520	94.4	5.6	-8	-19
AE	6,262	1,314	7,576	82.7	17.3	41,918	3,573	45,491	92.1	7.9	-4	14
AF	260	22	282	92.2	7.8	2,026,198	105,609	2,131,807	95.0	5.0	-57	-28
AG	1,295	142	1,437	90.1	9.9	53,865	2,183	56,048	96.1	3.9	-45	-43
AK	3,501	1,042	4,543	77.1	22.9	1,287,358	91,986	1,379,345	93.3	6.7	27	-3
AM	244	17	261	93.5	6.5	2,446,446	141,309	2,587,756	94.5	5.5	-64	-21
AME	2,068	211	2,279	90.7	9.3	413,187	32,873	446,060	92.6	7.4	-49	7
AMH	3,588	493	4,081	87.9	12.1	466,718	40,967	507,685	91.9	8.1	-33	17
AMS	6,327	763	7,090	89.2	10.8	413,187	32,873	446,060	92.6	7.4	-40	7
AO	5,600	1,406	7,006	79.9	20.1	211,581	18,470	230,051	92.0	8.0	11	17
AS	2,284	414	2,698	84.7	15.3	853,292	59,525	912,817	93.5	6.5	-15	-5
AT	13,382	1,028	14,410	92.9	7.1	445,229	36,242	481,471	92.5	7.5	-60	9
AV	316	9	325	97.2	2.8	84,353	11,026	95,379	88.4	11.6	-85	68
AZ	2,749	936	3,685	74.6	25.4	2,057,529	112,921	2,170,450	94.8	5.2	41	-24
BM	7,939	2,905	10,844	73.2	26.8	1,085,762	130,877	1,216,639	89.2	10.8	49	56
BT	6,289	1,475	7,764	81.0	19.0	836,657	66,685	903,342	92.6	7.4	5	7
BU	2,684	227	2,911	92.2	7.8	3,742,139	224,427	3,966,567	94.3	5.7	-57	-18
CA	80	12	92	87.0	13.0	534,273	54,348	588,620	90.8	9.2	-28	34
CE	1,192	242	1,434	83.1	16.9	3,310,585	213,682	3,524,268	93.9	6.1	-6	-12
CM	1,447	155	1,602	90.3	9.7	1,369,909	90,066	1,459,976	93.8	6.2	-46	-10
CN	37	11	48	77.1	22.9	534,273	54,348	588,620	90.8	9.2	27	34
CTA	930	349	1,279	72.7	27.3	2,114,843	131,056	2,245,899	94.2	5.8	52	-15
CTM	2,347	203	2,550	92.0	8.0	160,624	16,749	177,374	90.6	9.4	-56	37
CTO	1,694	257	1,951	86.8	13.2	2,068,160	116,536	2,184,696	94.7	5.3	-27	-22
CTR	2,946	659	3,605	81.7	18.3	12,024	470	12,494	96.2	3.8	1	-45
CTT	885	149	1,034	85.6	14.4	334,371	30,383	364,754	91.7	8.3	-20	21
DC	4,118	723	4,841	85.1	14.9	643,955	56,554	700,509	91.9	8.1	-17	17
DK	1,853	583	2,436	76.1	23.9	724,532	73,248	797,780	90.8	9.2	33	34
DM	181	59	240	75.4	24.6	178,387	10,183	188,570	94.6	5.4	36	-21
DP	2,661	703	3,364	79.1	20.9	2,778,026	175,732	2,953,758	94.1	5.9	16	-13
DS	2,586	218	2,804	92.2	7.8	160,624	16,749	177,374	90.6	9.4	-57	37
DT	1,516	579	2,095	72.4	27.6	2,727,478	164,580	2,892,058	94.3	5.7	53	-17
EA	382	25	407	93.9	6.1	189,299	8,436	197,736	95.7	4.3	-66	-38
EM	13,139	2,368	15,507	84.7	15.3	527,064	42,191	569,256	92.6	7.4	-15	8
EN	7,610	1,924	9,534	79.8	20.2	533,63[illegible]	39,932	573,564	93.0	7.0	12	1
EO	1,700	163	1,863	91.3	8.7	3,667,245	314,397	3,981,642	92.1	7.9	-51	15
EQ	26	1	27	96.3	3.7	2,129,322	117,012	2,246,334	94.8	5.2	-79	-24
ET	18,971	1,407	20,378	93.1	6.9	698,921	90,844	789,765	88.5	11.5	-62	67
EW	2,479	251	2,730	90.8	9.2	172,648	17,219	189,867	90.9	9.1	-49	32
FA	3,444	859	4,303	80.0	20.0	48,061	3,468	51,529	93.3	6.7	11	-2

	1992 Navy Cross-Section					1991 Civilian Cross-Section						
Rating	Non-Blacks	Blacks	Total	%Non-Blacks	%Blacks	Non-Blacks	Blacks	Total	%Non-Blacks	%Blacks	Navy DI	Civ DI
FC	8,273	632	8,905	92.9	7.1	372,205	35,219	407,424	91.4	8.6	-61	26
FN	4,968	1,579	6,547	75.9	24.1	48,061	3,468	51,529	93.3	6.7	34	-2
FT	201	9	210	95.7	4.3	372,205	35,219	407,424	91.4	8.6	-76	26
FTB	673	44	717	93.9	6.1	372,205	35,219	407,424	91.4	8.6	-66	26
FTG	1,616	129	1,745	92.6	7.4	372,205	35,219	407,424	91.4	8.6	-59	26
GM	959	79	1,038	92.4	7.6	2,227,898	123,684	2,351,582	94.7	5.3	-58	-24
GMG	3,209	733	3,942	81.4	18.6	601,478	68,358	669,836	89.8	10.2	3	48
GMM	1,443	338	1,781	81.0	19.0	255,952	24,256	280,207	91.3	8.7	5	26
GS	138	9	147	93.9	6.1	477,946	40,970	518,917	92.1	7.9	-66	15
GSE	1,462	191	1,653	88.4	11.6	303,615	22,903	326,517	93.0	7.0	-36	2
GSM	2,589	383	2,972	87.1	12.9	303,615	22,903	326,517	93.0	7.0	-28	2
HM	15,460	3,390	18,850	82.0	18.0	1,286,650	153,599	1,440,249	89.3	10.7	0	55
HN	4,918	1,225	6,143	80.1	19.9	45,570	10,078	55,648	81.9	18.1	11	163
HT	7,687	867	8,554	89.9	10.1	1,590,116	141,157	1,731,273	91.8	8.2	-44	19
IC	4,755	1,335	6,090	78.1	21.9	286,150	31,866	318,016	90.0	10.0	22	46
IM	580	81	661	87.7	12.3	859,345	96,186	955,531	89.9	10.1	-32	46
IS	1,485	156	1,641	90.5	9.5	87,653	3,489	91,143	96.2	3.8	-47	-44
JO	624	60	684	91.2	8.8	2,191,488	121,349	2,312,837	94.8	5.2	-51	-24
LI	367	134	501	73.3	26.7	798,276	62,853	861,129	92.7	7.3	49	6
LN	449	159	608	73.8	26.2	2,177,564	133,490	2,311,054	94.2	5.8	45	-16
MA	1,464	197	1,661	88.1	11.9	616,066	147,422	763,487	80.7	19.3	-34	181
ML	241	25	266	90.6	9.4	409,663	35,055	444,718	92.1	7.9	-48	15
MM	25,075	3,063	28,138	89.1	10.9	1,161,566	89,671	1,251,236	92.8	7.2	-40	4
MN	468	34	502	93.2	6.8	432,347	42,833	475,180	91.0	9.0	-62	31
MR	2,765	235	3,000	92.2	7.8	646,158	50,296	696,453	92.8	7.2	-57	5
MS	10,638	5,239	15,877	67.0	33.0	3,875,026	305,152	4,180,177	92.7	7.3	83	6
MT	1,483	96	1,579	93.9	6.1	295,934	29,496	325,430	90.9	9.1	-66	32
MU	659	50	709	92.9	7.1	55,390	12,853	68,243	81.2	18.8	-61	174
NC	1,038	200	1,238	83.8	16.2	172,240	27,208	199,448	86.4	13.6	-10	98
OM	355	44	399	89.0	11.0	461,777	39,166	500,943	92.2	7.8	-39	14
OTM	379	32	411	92.2	7.8	160,624	16,749	177,374	90.6	9.4	-57	37
PC	697	369	1,066	65.4	34.6	91,335	21,010	112,344	81.3	18.7	92	172
PH	1,171	145	1,316	89.0	11.0	1,130,541	100,882	1,231,423	91.8	8.2	-39	19
PM	186	26	212	87.7	12.3	411,103	32,644	443,748	92.6	7.4	-32	7
PN	4,088	989	5,077	80.5	19.5	2,202,657	136,560	2,339,217	94.2	5.8	8	-15
PR	1,844	135	1,979	93.2	6.8	458,489	35,650	494,139	92.8	7.2	-62	5
QM	3,684	741	4,425	83.3	16.7	24,224	2,811	27,035	89.6	10.4	-7	51
RM	11,701	5,368	17,069	68.6	31.4	2,112,694	116,710	2,229,404	94.8	5.2	75	-24
RP	557	285	842	66.2	33.8	2,127,543	131,151	2,258,694	94.2	5.8	88	-16
SA	7,993	2,166	10,159	78.7	21.3	8,744	1,980	10,724	81.5	18.5	18	168
SH	2,658	1,782	4,440	59.9	40.1	1,678,283	127,458	1,805,741	92.9	7.1	123	3
SK	6,994	2,419	9,413	74.3	25.7	3,676,545	256,036	3,932,581	93.5	6.5	43	-5
SN	9,446	3,807	13,253	71.3	28.7	8,744	1,980	10,724	81.5	18.5	59	168
STG	4,674	531	5,205	89.8	10.2	295,934	29,496	325,430	90.9	9.1	-43	32
STS	3,528	243	3,771	93.6	6.4	295,934	29,496	325,430	90.9	9.1	-64	32
SW	811	78	889	91.2	8.8	3,110,543	179,803	3,290,346	94.5	5.5	-51	-21
TM	2,813	828	3,641	77.3	22.7	333,893	30,905	364,798	91.5	8.5	26	23
UT	1,057	148	1,205	87.7	12.3	1,154,603	87,901	1,242,504	92.9	7.1	-32	3
WT	938	95	1,033	90.8	9.2	211,581	18,470	230,051	92.0	8.0	-49	17
YN	6,764	3,462	10,226	66.1	33.9	2,238,905	149,333	2,388,238	93.7	6.3	88	-9
Total	330,718	72,649	403,367			90,193,477	6,659,499	96,852,976				

Source: Derived from data provided by the Defense Manpower Data Center and the U.S. Department of Labor, Bureau of Labor Statistics. Note: Civilians may be counted in more than one equivalent rating.

TABLE 26. DEMOGRAPHIC DATA BY RATING GROUP: 1991 NAVY CROSS-SECTION AND 1991 CIVILIAN EQUIVALENT

Enslisted	Navy		Civilian		Percent Black		DIs	
Community	Black	Total	Black	Total	Navy	Civilian	Navy	Civilian
Surf eng	7,045	50,208	283,064	3,900,094	0.14	0.07	-22	6
HME	5,704	39,530	525,115	6,360,446	0.14	0.08	-20	20
Av maint	5,843	48,514	621,767	10,491,047	0.12	0.06	-33	-14
Av ops	4,101	19,908	185,868	2,123,626	0.21	0.09	14	27
Av supply	2,113	10,207	240,557	4,043,934	0.21	0.06	15	-13
Admin	6,617	25,507	1,116,290	16,688,776	0.26	0.07	44	-3
Deck	3,646	15,269	133,688	1,243,674	0.24	0.11	33	56
Supply	10,023	32,166	761,894	10,716,279	0.31	0.07	73	3
Med	5,194	27,088	328,257	4,387,955	0.19	0.07	6	9
Crypt	1,773	12,060	298,683	5,076,359	0.15	0.06	-18	-14
Surf ops-cs	2,909	27,849	350,201	4,809,145	0.10	0.07	-42	6
Surf ops	6,775	37,447	207,554	3,019,169	0.18	0.07	0	0
Sub	1,383	12,165	238,389	2,713,112	0.11	0.09	-37	28
Other	9,523	45,449	1,368,171	21,279,361	0.21	0.06	16	-6

Source: Derived from data provided by the Defense Manpower Data Center and the U.S. Department of Labor, Bureau of Labor Statistics.

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