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Estimating high tech Army recruiting markets

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This thesis presents exploratory model-building for identifying and analyzing the recruiting market for highly technical occupations for the Army of the future. The "high-tech" ratings were defined based upon their technical characteristics, qualification rates of the youth labor market, and the Army force structure. Using data from the National Longitudinal Survey of Youth (NLSY), three regression equations were developed to estimate mental eligibility for high-tech ratings as well as interest in joining the military and actual joining behavior, so that recruiting commands can allocate recruiting resources more accurately and efficiently. These prototypical equations and this method of measuring the recruiting market for high-tech ratings provide a good beginning for estimating the recruiting market for any specific occupation.

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Estimating High Tech Army Recruiting Markets

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I. INTRODUCTION

U.S. forces in future regional conflicts should be committed in such a way that the fighting is terminated swiftly, decisively and with minimum loss of life, as in the Gulf War. A commitment to this goal requires that formations have the overmatch capabilities to quickly win in combat. Overmatch, from the institutional Army perspective, is contingent on quality training, competent leaders, sufficient resources and funds to equip the force[1]. In order to maximize the quality of training, recruiting success is essential because the capabilities of a recruit affect training progress. This is why the Department of Defense and its subdepartments adjust their training policies to current conditions in the 'educational training market'.

Recruiting success is highly dependent on the nature of the civilian labor market, the level of military requirements, the quality mix of requirements, the availability of recruiting resources, and competition from colleges and civilian employers. As the budget pressure from the Congress increases in order to reduce military spending, and the size and quality of youth population in the 1990s declines[2], the need for efficient recruiting operations is

[1]Wolf-Dietrich Kutter, Army Weapons Edge Threatened by Budget Crunch, Army, Jan. 1992, pp.15-16.

[2]George W. Thomas and Kathryn M. Kocher, Youth Labor Force In The 21st Century, Oct. 1991.

inevitable. Moreover, the need for highly technical, qualified personnel will be increasing in order to keep up with technical change in the military.

Since World War II, technological change has profoundly affected the military community. The evolution of thermonuclear weapons, developments in aircraft and ballistic missile systems, and advances in computer-based command, control, and communications have enabled the United States to field armed forces with a technological edge designed to offset the Soviet Union's numerical superiority. There is a feeling that the cold war is over because of the dramatic changes in the Soviet Union and Eastern Europe since late 1989 and a reduction of 25 percent of the total force size is planned by 1995. However, the military will keep investing in technology in order to increase productivity as labor input is reduced. If the trend toward more complicated weaponry continues, the armed forces could be caught between a growing need for skilled technicians and specialists to handle sophisticated systems and a diminishing supply of recruits able to absorb complex training.

This thesis presents exploratory model-building for identifying and analyzing the recruiting market for highly technical military occupations in the U.S. Army. The research question asked in this theses is "what proportion of the youth labor market nationally and in geographic regions can be expected to qualify for highly technical Army occupations?" Selected ratings for highly technical occupations are based on technical characteristics of the occupations and on their associated entry scores on the Armed Services Vocational Aptitude Battery(ASVAB). Additional questions include (1) how should the term high tech be defined for the Army?, (2) what model specification is most appropriate?, (3) what variables might be useful in predicting high tech qualification scores?, and (4) what are the specific equations that best predict whether an individual will score well enough on the ASVAB to be assigned to a high tech rating? Models and procedures are also developed to estimate interest in military employment for each race/gender market segments given the likelihood of being qualified for high-tech occupations and to estimate the actual joining behavior of each market segment given the level of interest in the military.

II. LITERATURE REVIEW

The need for efficient recruiting operations for highly technical occupations will be driven by two factors; the increasing proportion of skilled positions in the military, and the decreasing size and the ability of the youth population to fill these skilled positions.

A. TECHNICAL CHANGE IN THE MILITARY

During most of the nineteenth century U.S. military forces consisted mainly of Army and Marine Corps infantrymen and Navy seamen performing routine tasks. For example, fully 95 percent of Union Army soldiers were basic riflemen or were in associated combat units[3] ;the few who were engaged in support activities were involved with repairing guns, weapons, and saddles.

World War II marked the first extensive use of armor and tactical aircraft in land warfare, expanding the fields of battle and the scope of military maneuvers. Aircraft and submarines replaced the ships of the line as key naval weapons. Tactical aircraft were employed in a variety of roles: as interceptors, fighter-bombers, and long-range fighter escorts to accompany bombers. These new weapon systems greatly altered the military's occupational structure. By the end of the war only 39 percent of Army and

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[3] Martin Binkin, Military technology And Defense Manpower, Washington, D.C. : The Brookings Institute, 1986, p.3.

34 percent of Marine Corps enlisted troops held jobs classified as "ground combat" and fewer than half of these were infantry billets.[4] The changes of the military's occupational structure during 1865 to 1984 time period are shown in Table 1.

A relatively great shift in military occupational functions took place within the two decades preceding World War I, as the proportion of the "white collar" force tripled to almost 12 percent and the proportion of personnel in general military skills fell from 87 percent to just over 40 percent. By the end of the Second World War, one out of four enlistees was serving in a white collar job and one out of three was assigned to a general (or combat) skill.

Military occupations continued to change following World War II urged on by the Korean Conflict. Thus at the start of the 1960s, fewer than 19 percent of all enlistees were serving in a combat-related or general specialty -a proportion which, for the first time, was exceeded by that of Craftsmen (30 percent), Technical Workers (20 percent), and Clerical Workers (19 percent). Changes in the distribution of military occupations since 1960 have been relatively minor, at least when compared with what occurred over the earlier part of this century. Nonetheless, moderate growth in the share of white collar jobs took place during the Vietnam era,

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[4] Ibid., p.5.

TABLE 1

PERCENTAGE DISTRIBUTION OF MALE ENLISTED PERSONNEL, ALL SERVICES, BY MAJOR OCCUPATIONAL CATEGORY, SELECTED YEARS, 1865-1984

Major Occupational Category	White Collar	Technical Workers[c]	Clerical Workers[d]	Blue Collar	Crafts-men[e]	Service and Supply Workers	General military skills, including combat	TOTAL
Civil War [a] (1865)	0.9	0.2	0.7	99.1	0.6	5.3	93.2	100.0
Spanish-American War(1898)	3.6	0.5	3.1	96.4	1.0	8.7	86.7	100.0
World War I [b] (1918)	11.9	6.8	5.1	88.1	21.6	24.7	41.8	100.0
World War II (1945)	25.2	11.6	13.6	74.7	25.9	14.8	34.0	100.0
Peace-time Draft(1960)	39.4	20.0	19.4	60.6	30.3	11.6	18.7	100.0
Vietnam War (1967)	40.8	22.4	18.4	59.2	33.1	12.0	14.1	100.0
Draft-Vollunteer Transition (1971)	45.1	25.7	19.4	54.9	28.6	12.1	14.2	100.0
All-Vollunteer Force(1975)	44.7	25.8	18.9	55.3	28.6	12.2	14.5	100.0
All-Vollunteer Force(1980)	43.0	26.8	16.2	57.0	29.2	10.3	17.5	100.0
All-Vollunteer Force(1984)	44.0	28.9	15.1	56.0	28.1	10.5	17.4	100.0

Source: Mark J. Eitelberg, Manpower For Military Occupations, Office of the Assistant Secretary of Defense (Force Management and Personnel), 1988 p.13.

Note: Percentage distributions for 1967 and earlier years may include female personnel(accounting for less than 2 percent of all personnel in 1945 and less than 1 percent in 1960 and 1967).

[a]Based on the Union Army only.

[b]Includes Army and regular Navy personnel only.

[c]Percentages for 1945, 1960, and 1967 include Electronics and Other Technical categories. Percentages for later years included Electronic Equipment Repairers; Communications and Intelligence Specialists; Medical and Dental Specialists; and Other Technical and Allied Specialists categories.

[d]Percentages for 1945, 1960, and 1967 include Administrative and Clerical Personnel. Percentages for later years are for the Functional Support and Administration category.

[e]Percentages for 1945, 1960, and 1967 include Mechanics and Repairers and Craftsmen categories. Percentages for later years include Electrical and Mechanical Equipment Repairers and Craftsmen category.

accompanied by an increase in Technical Workers and a decline in the proportion of both Craftsmen and those in General skills. Since the start of all-volunteer recruiting, the growth in Technical Workers has continued to a point where this category of personnel is the largest of the five separate groupings , that is, as of fiscal 1984, more male enlisted personnel were serving in Technical positions (29 percent) than in either Clerical (15 percent), Craftsmen (28 percent), Service and Supply (11 percent), or General Skills (17 percent) positions.

Service-specific differences in occupational distribution can be seen in Table 2, which separates the military's occupational groups into three skill categories; unskilled, semiskilled, and skilled. The "skilled" category is similar to "Technical Workers" in Table 1. As shown in Table 2, the greatest shift in the distribution of skill categories occurred in the Army during the 1972 to 1984 time period. The proportion of skilled positions climbed from 16 percent in 1972 to over 21 percent in 1984. There were modest increases in the proportion of skilled positions in the Navy and Air Force as well, whereas the Marine Corps experienced a decline.

Binkin(1986) noticed that common to all the services, however, has been the relative growth in the requirement for people trained to operate and maintain electronic equipment.[5]

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[5] Martin Binkin, Military technology And Defense Manpower, Washington, D.C. : The Brookings Institute, 1986, p.8.

TABLE 2

PERCENTAGE DISTRIBUTION OF ENLISTED PERSONNEL BY OCCUPATIONAL SKILL CATEGORY AND SERVICE:1972, 1978, 1984

Occupational Skill Category and Service[a]	FY 1972	FY 1978	FY 1984
Unskilled[b]			
Army	40.8	42.9	40.6
Navy	20.6	18.9	18.6
Marine corps	44.4	48.6	44.6
Air Force	22.9	22.0	24.0
All Services	30.2	31.8	31.0
Semiskilled			
Army	43.1	39.2	38.2
Navy	52.3	52.0	51.7
Marine corps	35.6	34.9	37.1
Air Force	53.5	51.8	50.3
All Services	48.2	45.4	44.7
Skilled[d]			
Army	16.1	17.9	21.2
Navy	27.1	29.1	29.7
Marine corps	20.0	16.5	18.3
Air Force	23.6	26.2	25.7
All Services	21.6	22.8	24.3

Source: Mark J. Eitelberg, Manpower For Military Occupations, Office of the Assistant Secretary of Defense (Force Management and Personnel), 1988 p.16.

Note: Derived from data provided by the Defense Manpower Data Center

[a]Distribution by skill category does not include enlisted personnel in "nonoccupational" Status (e.g., officer candidates, students, patients, prisoners, and persons in undesignated occupations).

[b]Includes the following categories: Infantry, Gun Crews, and Seamanship Specialists; Craftsmen; and Service and Supply Handlers.

[c]Includes the following categories: Medical and Dental Specialists; Functional Support and Administration; and Electrical/Mechanical Equipment Repairers.

[d]Includes the following categories: Electronic Equipment Repairers; Communications and Intelligence Specialists; and Other Technical and Allied Specialists.

The Navy and Air Force exploited electronics technology soon after World War II, and by 1957 electronics jobs accounted for 18 percent and 15 percent of their respective work forces. Although the rate of increase slowed thereafter, by 1985 electronics skills constituted 28 percent of the Navy's enlisted work force and 19 percent of the Air Force's. Electronics-related jobs in the Army and Marine Corps, meanwhile, which made up less than 10 percent of each service's enlisted billets as late as 1957, have grown to 19 percent and 15 percent respectively in 1985.

For future technological change, electronics technologies are expected to have the most pervasive effect. A study group established by the Defense Science Board to assess technologies "critical to future (1990 - 2000) defense capabilities" highlighted the growing importance of electronics. In the process of rank-ordering technologies that it considered most worthy of vigorous pursuit, and that would make order-of-magnitude improvements in deployable operational capability, the panel noted that "the vast majority of the 'order-of-magnitude' technologies lie in the electronics area".[6] The impact of these technological changes will not fall equally on the individual services. The Air Force and the Navy, both of which have a long association with complex weapon systems, should be the least affected during the transition from one generation of technology to the next. On the other hand, the Army and, to a lesser extent, the Marine Corps are likely to encounter substantial challenges as they convert from systems that are largely electromechanical to systems incorporating advanced integrated electronics.

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[6] Defense Science Board, Report of the Defense Science Board 1981 Summer Study Panel on Technology Base (DoD; distributed by Defense Technical Information Center, Alexander, Va., 1981), pp. 1-3.

The shift toward technical sophistication should have implications for the qualitative profile of the military work force: as jobs become more technical, the tasks seemingly become more complex and the people performing them, more highly qualified.[7]

B. THE CHANGING YOUTH POPULATION

A commission of the National Science Board concluded that the quality of education has become one of the principal issues in contemporary America:

> Across the United States, there is escalating awareness that our educational systems are facing inordinate difficulties in trying to meet the needs of the Nation in our changing and increasingly technical society. We appear to be raising a generation of Americans, many of whom lack the understanding and the skills necessary to participate fully in the technological world in which they live and work.[8]

The major assault on the educational system was by declining student achievement. The most widely cited evidence has been the drop-off in Scholastic Aptitude Test(SAT) scores

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[7] There is some debate on this issue. If the technologists are correct, the next generation of hardware, albeit more complex than the current one, will also be more reliable and easier to maintain, and thus the services will not need as many as highly qualified people to keep it in working condition. However, if the historical experience with high-performance systems is any guide, these promises warrant a healthy measure of skepticism. The weight of the evidence is that both new and replacement weapon systems will demand ever-more-skillful operators and maintainers, especially if the capabilities of new systems are to be fully exploited. For a further discussion, see ,Martin Binkin, Military technology And Defense Manpower, Washington, D.C. : The Brookings Institute, 1986, capture 4.

[8] National Science Board Commission on Precollege Education in Mathematics, Science and Technology, Today's Problems, Tomorrow's Crises (National Science Foundation, 1982),p.1.

since 1963. Table 3 shows trends in SAT scores, a measure of proficiency on an examination testing verbal and mathematics skills of college bound high school students. The SAT scores

TABLE 3

SCHOLASTIC APTITUDE TEST (SAT) SCORES: 1963-1988

School Year Ending	Total	Verbal	Math	School Year Ending	Total	Verbal	Math
1963	980	478	502	1976	903	431	472
1964	973	475	498	1977	899	429	470
1965	969	473	496	1978	897	429	468
1966	967	471	496	1979	894	427	467
1967	958	466	492	1980	890	424	466
1968	958	466	492	1981	890	424	466
1969	948	463	493	1982	893	426	467
1970	948	460	488	1983	893	425	468
1971	943	455	488	1984	897	426	471
1972	937	453	484	1985	906	431	475
1973	926	445	481	1986	906	431	475
1974	924	444	480	1987	906	430	476
1975	906	434	472	1988	904	428	476

Source: Thomas and Kocher, Youth Labor Force in the 21st Century, Monterey, CA:Naval Postgraduate School, 1991, p.56.

Note: Averages for 1972 through 1988 are based on college-bound seniors. Averages for 1963 through 1971 are estimates provided by the College Board; background information needed for specific identification of college-bound seniors was not collected before 1972.

for 1991 show a further decline. The verbal score declined to 422, the lowest, national average score on record, and the mathematics score fell to 474, the lowest score since 1983.[9] Similarly, a general downward trend was recorded in average

[9] Thomas and Kocher, Youth Labor Force in the 21st Century, Monterey, CA:Naval Postgraduate School, 1991, p.57.

scores attained by college-bound students on tests administered by the American College Testing Program, with the largest drop occurring in the mathematics portion of the test, as seen in Table 4.

TABLE 4

AVERAGE AMERICAN COLLEGE TESTING (ACT) SCORES

1970-1988

Year	Composite	English	Mathematics	Social Studies	Natural Science
1970	19.9	18.5	20.0	19.7	20.8
1971	19.2	18.0	19.1	18.7	20.5
1972	19.1	17.9	18.8	18.6	20.6
1973	19.2	18.1	19.1	18.3	20.8
1974	18.9	17.9	18.3	18.1	20.8
1975	18.6	17.7	17.6	17.4	21.1
1976	18.3	17.5	17.5	17.0	20.8
1977	18.4	17.7	17.4	17.3	20.9
1978	18.5	17.9	17.5	17.1	20.9
1979	18.6	17.9	17.5	17.2	21.1
1980	18.5	17.9	17.4	17.2	21.1
1981	18.5	17.8	17.3	17.2	21.0
1982	18.4	17.9	17.2	17.3	20.8
1983	18.3	17.8	16.9	17.1	20.9
1984	18.5	18.1	17.3	17.3	21.0
1985	18.6	18.1	17.2	17.4	21.2
1986	18.8	18.5	17.3	17.6	21.4
1987	18.7	18.4	17.2	17.5	21.4
1988	18.8	18.5	17.2	17.4	21.4

Source: Thomas and Kocher, Youth Labor Force in the 21st Century, Monterey, CA:Naval Postgraduate School, 1991, p.58.

Thomas and Kocher(1991) noticed that mathematical skills particularly have been linked to on the job productivity, as reflecting the ability to follow sequential sets of directions and the capacity to learn cumulatively. Better educated workers are likely to be at an advantage in implementing new technology.[10]

The implications of the decline in the abilities of the youth population for the nation's armed forces are clear: it means that a smaller proportion of the pool of prospective volunteers possess the background to be trained in technical skills that are becoming increasingly desirable for a range of military jobs. On top of this, the youth pool will be shrinking in size as the "baby boom"[11] runs its course, and its composition will be changing as disadvantaged social groups, traditionally with lower aptitude scores for technical training, constitute a larger proportion of the youth population.

The youth population is projected to be declining relative to other age groups. Figure 1 shows the trend in the number of 18 to 21 year old males, the traditional target group for military recruiters. The impact of the baby boom was still evident in the latter half of the 1970s as the youth population continued to grow, although at a decreasing pace. In 1981, the trend reversed and the size of the youth cohort started a decline that will continue through the mid-1990s. Cohort sizes will begin to increase again after 1995,

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[10] Ibid., p. 59.
[11]Dwindling birthrates in the United States,a trend started in the late 1950s and brought the baby boom to an end in the mid-1960s.

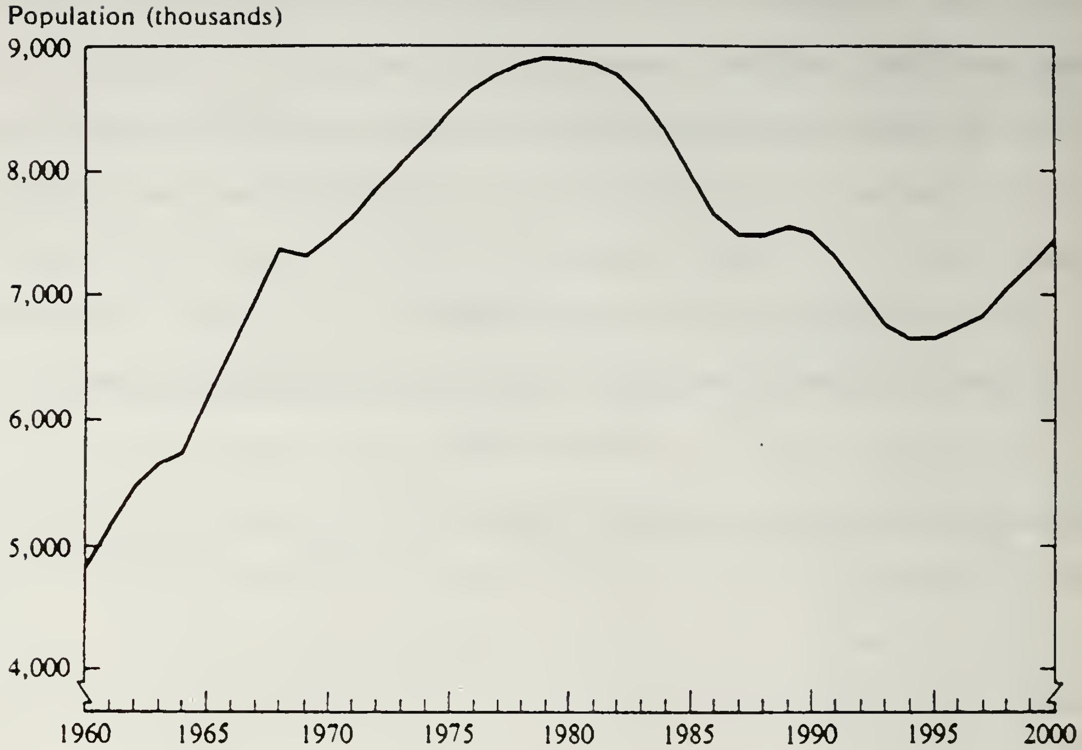

Figure 1. Projected U.S. Male Population Aged 18 tO 21, 1960-2000[a]

Sources: Martin Binkin, Military technology And Defense Manpower, Washington, D.C. : The Brookings Institute, 1986, p.75.
[a]Figures are as of July 1 of each year

an upturn that can be expected to last at least at until 2010.

Also relevant is the anticipated shift in the social composition of the American population. Minority groups will constitute an increasing proportion of the youth population, a consequence of higher fertility rates among minority women in the resident population and the concentration of nonwhites among new immigrants to the United States.[12]

The race/ethnic group distribution of the labor force of the future will reflect a growth in minority group participation rates as well as their more rapidly growing populations. Blacks will make up 12 percent of the labor force in 2000, up 1 percent from 1988. Hispanics will constitute 10 percent of the labor force, an increase of 3 percent over 1988. Asian and other work force is expected to grow by 1 percent to account for 4 percent of the total work force.[13]

The connections between military technology, the occupational structure, and the changing youth population suggest that if advances in technology over the next decade result in a heavier concentration of technical jobs in the armed forces, a smaller proportion of the youth population will be qualified for military service, and the recruitment task will become more difficult.

C. PREVIOUS RESEARCH

Several studies have examined the relationship between test score on the Armed Forces Qualification Test(AFQT) and social and economic characteristics. Bock and Moore (1984) analyzed the effects of various socioeconomic characteristics

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[12]Martin Binkin, Military technology And Defense Manpower, Washington, D.C. : The Brookings Institute, 1986, p.77.

[13]Thomas and Kocher, Youth Labor Force in the 21st Century, Monterey, CA:Naval Postgraduate School, 1991, p.118.

on individual ASVAB subtest performance, using the National Longitudinal Survey of Youth(NLSY) data. The results suggest that variation in ASVAB performance can be found with respect to gender, race/ethnicity, geographic region, poverty status, age, educational attainment and mother's education. Another study was done by Department of Defense to look specifically at the effects of socioeconomic variables on AFQT scores. The study used the same data and the same variables as Bock and Moore (1984) with the exception of poverty status. These studies showed that: (1) the mean AFQT scores for Whites exceeds that of Hispanics, which, in turn, exceeds that of Blacks; (2) AFQT scores for young adults are positively related to age and educational attainment; (3) mother's education and AFQT score are positively related; (4) people from the Northeast census region have the highest mean AFQT score while those from the South have the lowest.

Curtis, Borack and Wax(1987) made one of the first attempts to estimate regional Qualified Military Available(QMA) estimation. They produced estimates of QMA for the years 1984 through 1990 for each Marine Corps recruiting district and station and for each U.S. county. Using data from the NLSY, they clustered counties based on socioeconomic attributes that were correlated with AFQT score. An AFQT score distribution was then computed for each cluster and each county in the cluster was assumed to have that distribution of AFQT scores. While they were able to produce county estimates, they advised against relying on them because of insufficient sample sizes and unavailability of some county level data.

Peterson (1990) developed models for forecasting the proportions of the youth population in a given area that would score above the 50th percentile on the AFQT, using data from the NLSY. The results suggest that parent's education, poverty status and urban residence are good predictors of mental ability.

Thomas and Gorman (1991) developed models and procedures for estimating the QMA population as well as the subset of QMA interested in joining the military (QMJ) at the county level, using data from the NLSY with the set of explanatory variables for which the data are available at the county level such as parent's education, poverty status, and age. The QMA model measures the number of those morally and medically qualified to join who are high school graduates and likely to score in categories I-IIIA on AFQT. The QMJ model measures the number of qualified military available who are also interested in joining the military. Estimates of QMA and QMJ was made for 17 to 21 and 22 to 29 year old men and women for each county in the continental United States for the years 1990, 1991, 1992, 1995, 2000, 2005, and 2010.

Using data from the NLSY, Moreau (1991) did preliminary work on developing equations for technical ratings of the U.S. Navy. Regression equations were developed to estimate the probability that a 17 to 21 year old high school graduate will score high enough on the ASVAB to be classified into a highly technical rating. This could allow the Navy to predict where the best markets are for these high quality individuals.

Uslar (1991), using the same data, extended Moreau's study by developing measures of qualification, interest, and actual enlistment behavior for high-tech occupations in the Navy.

The basic model used in this thesis extends in large part from that of Uslar (1991). This work, however, presents exploratory model-building for identifying and analyzing the recruiting market potential as well as capturing regional variability both in interest in joining the military and in actual enlistment behavior for high-tech rating in the U.S. Army.

III DATA AND METHODOLOGY

This thesis models the achievement of the minimum test score required for entry into training for highly technical Army ratings. The data used in this research were obtained from the NLSY. The NLSY is a nationally representative sample of 12,686 young men and young women who were ages 14 to 21 in 1979 when they were first interviewed. In 1980, the ASVAB was administered to a total of 11,914 civilian and military NLSY respondents, representing a completion rate of approximately 94 percent, by the U.S. Department of Defense and the military services to update national norms for the ASVAB. A NLSY respondent's scores on specific subsets of the ASVAB were used as criteria for qualification for highly technical occupational fields.

A. THE NLSY DATA

From 1979 the NLSY collected data nationwide annually about education, training, labor force experience, financial characteristics, and other characteristics for a representative sample of the U.S. population. The NLSY is an extension of the National Longitudinal Surveys of Labor Market Experience which was initiated by the office of Manpower Policy, Evaluation, and Research of the United States Department of Labor in the mid-1960s to conduct longitudinal studies of the labor market experience of four groups in the United States population: men 45 to 59 years of age, women 30 to 44 years of age, young men 14 to 24 years of age, and young women 14 to 24 years of age. In 1977, the Department of labor decided to begin the NLSY. This was initiated to permit a replication of the analysis of earlier cohorts of Youth and also to help evaluate the expanded employment and training programs for youth legislated by the 1977 amendments to the Comprehensive Employment and Training Act.[14]

To these ends, a national probability sample was drawn consisting of three groups: (1) a cross-section national sample of the American Youth, aged 14 to 21 as of January 1, 1979 in their proper population proportions; (2) a sample designed to overrepresent civilian Hispanics, Blacks, and economically disadvantaged Whites; and (3) a military sample designed to represent the population aged 17 to 21 as of January 1, 1979 and serving in the military as of September 30, 1978.

Table 5 shows the distribution of NLSY Respondents interviewed in 1979 by sample type, race, and sex. The NLSY is weighted in order to compensate for the unequal probability of selection.

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[14]NLS Handbook 1991,p.29.

TABLE 5
DISTRIBUTION OF THE NLSY SAMPLE BY GENDER AND RACE

Cross-Section Sample 6,111	Supplemental sample 5,295	Military Sample 1,280	**Total** **12,686**
Males White 2,439 Black 346 Hispanic 218	Males Poor White 742 Black 1,105 Hispanic 729	Males White 609 Black 162 Hispanic 53	Males White 3,790 Black 1,613 Hisp. 1,000
Females White 2,477 Black 405 Hispanic 226	Females Poor White 901 Black 1,067 Hispanic 751	Females White 342 Black 89 Hisp. 25	Females White 3,720 Black 1,561 Hisp. 1,002

Source: NLS Handbook 1991,p.29.

B. ASVAB

The ASVAB is given to all applicants for enlistment in the military services. It was introduced in January 1976 as a single DoD test to replace various aptitude test batteries then in use by each service. The ASVAB serves two important purposes in the enlistment process. First, it is used to determine eligibility for enlistment. Second, it is used to establish qualifications for assignment to specific occupations.[15] The standards for entry into a specific occupation are set by each service based with its experience of how people with different test scores perform in training.

Since the ASVAB is used to determine qualifications for a large number of skill training courses, the battery

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[15]Office of the Assistant Secretary of Defense(Manpower, Reserve Affairs, and logistics), A Report to the House committee on Armed Services Aptitude Testing of Recruits, July 1980, p.2.

consists of ten subtests which measure a variety of abilities. These subtests are shown in Table 6.

The Armed Forces Qualification Test, or AFQT, is used by all the services as their primary screening device for mental qualification for entrance into the military. AFQT is a specific aptitude composite based on four ASVAB subtests: Arithmetic reasoning, word knowledge, paragraph comprehension, and mathematics knowledge.[16]

For convenience, AFQT scores are grouped into five broad categories and sometimes into finer subcategories based upon percentile scores, ranging form 1 to 99, which reflect a person's trainability relative to that of the general youth population. Those in Categories I and II are above average in trainability; those in Category III are average; those in category IV are below average; and those in category V are markedly below average. Over the past decade, the military has been trying to improve the quality of the force by stressing the need for recruiting volunteers who fall in the upper 50th percentile(I to IIIA) of the AFQT. Table 7 shows the AFQT Categories by corresponding percentile scores and level of "trainability".

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[16]Department of Defense, Conversion Tables, Armed Services Vocational Aptitude Battery(DOD 1304.12-L-IOTE-CT),February 1992, p.1.

TABLE 6
ARMED SERVICES VOCATIONAL APTITUDE BATTERY (ASVAB) SUBTESTS: DESCRIPTION, NUMBER OF QUESTIONS, AND TESTING TIME

ASVAB Subtest Titles and Abbreviations	Description	Number of questions	Testing time (minutes)
General Science (GS)	Measure knowledge of physical and biological sciences	25	11
Arithmetic Reasoning (AR)	Measure ability to solve arithmetic word problems	30	36
Word Knowledge (WK)	Measure ability to select the correct meanings of words presented in context and to identify the best synonym for a given word	35	11
Paragraph comprehension (PC)	Measures the ability to obtain information from written passages	15	13
Numerical Operations (NO)	Measures ability to perform arithmetic computations in a speeded context	50	3
Coding Speed (CS)	Measures ability to use a key on assigning numbers to words in a speeded context	84	7
Auto and Shop Information (AS)	Measures knowledge of automobiles, tools, and shop terminology and practices	25	11
Mathematics Knowledge (MK)	Measures knowledge of high school mathematics principles	25	24
Mechanical Comprehension (MC)	Measures knowledge of mechanical and physical principles and ability to visualize how illustrated objects work	25	19
Electronics Information (EI)	Measures knowledge of electricity and electronics	20	9
All Subtests		334	144[a]

Source: Mark J. Eitelberg, Manpower For Military Occupations, Office or the Assistant Secretary of Defense (Force Management and Personnel), 1988 p.68.
Note : Subtests are in ASVAB Forms 8, 9, 10. Information also applies to ASVAB Forms 11, 12, and 13, as well as 14 (used in the DoD student testing program). ASVAB subtests appear here in the order in which they are administered. [a]Administrative time is approximately 36 minutes, for a total testing and administrative time of 3 hours.

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: Mark J. Eitelberg, Manpower For Military Occupations, Office or the Assistant Secretary of Defense (Force Management and Personnel), 1988 p.74.

The services use the ASVAB subtests to form aptitude composites that are useful predictors of success in job training. The Army uses ten ASVAB aptitude composites to supplement the AFQT in determining enlistment eligibility and to classify enlistees for job training in various occupational fields. The title and abbreviations of ten Army aptitude composites and their component subtests are presented in Table 8.

In 1980, the ASVAB was administered to NLSY participants in order to establish new test norms. To encourage maximum participation in the testing effort, an honorarium of $50 was paid to each NLSY respondent who took the ASVAB. Of the initial 12,686 respondents, 11,914, or about 94%, actually took the test.

TABLE 8
THE ARMY APTITUDE COMPOSITES AND THEIR COMPONENT SUBTESTS

ASVAB Composite	Abbreviation	Component Subtests
General Technical	GT	VE + AR
General Maintenance	GM	MK + EI + AS + GS
Electronics	EL	AR + MK + EI + GS
Clerical	CL	AR + MK + VE
Mechanical Maintenance	MM	NO + AS + MC + EI
Surveillance/communications	SC	AR + AS + MC + VE
Combat	CO	CS + AR + MC + AS
Field Artillery	FA	AR + CS + MC + MK
Operators/Foods	OF	NO + AS + MC + VE
Skilled Technical	ST	VE + MK + MC + GS

Source: Department of Defense, Conversion Tables, Armed Services Vocational Aptitude Battery(DOD 1304.12-L-IOTE-CT),February 1992, p.1.

The data used to model the achievement of the minimum test score required for entry into training for highly technical Army ratings were from a subset of NLSY, 1979-1987 respondents. The subset was created by discarding those who were in the active military or reported prior service as of 1980, those who were less than 17 or more than 21 years old in 1980, and those of the remainder who had not graduated from high school as of their 1987 interview.

C. DEFINITION OF ARMY HIGH-TECH

There is no formal list of highly technical occupations in the Army. To define "high-tech" occupation, several Army occupations were selected based upon their technical characteristics, qualification rates of the youth labor market, and the Army force structure.

The staff of the President's Commission on an All-Volunteer Armed Force grouped DoD occupational areas into three categories based on skill level to compare military and civilian labor forces. These three skill level categories and their associated DoD occupational areas are presented in Table 9.[17] Based on these skill level grouping of occupations, Electronic Equipment Repairers, Communications and Intelligence Specialists, and Other Technical and Allied Specialists were selected as skilled occupational areas.

Table 9
OCCUPATIONAL SKILL CATEGORY

Skill Category[a]	DoD One-Digit Occupation code	Title
Unskilled	0	Infantry, Gun Crews, and Seamanship Specialists
	7	Craftsmen
	8	Service and Supply Handlers
Semiskilled	3	Medical and Dental Specialists
	5	Functional Support and Administration
	6	Electrical/Mechanical Equipment Repairers
Skilled	1	Electronic Equipment Repairers
	2	Communications and Intelligence Specialists
	4	Other Technical and Allied Specialists

Source: Mark J. Eitelberg, Manpower For Military Occupations, Office or the Assistant Secretary of Defense (Force Management and Personnel), 1988 p.16.

[a]Distribution by skill category does not include enlisted personnel in "nonoccupational" status (e.g., officer candidates, students, patients, prisoners, and persons in undesignated occupations).

These three skilled occupational areas have rather high average AFQT scores relative to other occupational areas.

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[17]Based upon DoD occupation coding system, occupational area is made by 1-digit grouping, occupational group is made by 2-digit grouping, occupational subgroup is made by 3-digit grouping

Table 10 presents a more detailed view of quality trends in major occupational areas. In all services, the preeminence of Electronic Equipment Repairers is clearly visible. The average AFQT scores of male enlistees in this area have topped the 70th percentile; in sharp contrast, the average AFQT scores of men serving as Service and Supply Handlers have remained below the 50th percentile.

In the Army, the field of Electronic Equipment Repairers also stands well above the other occupational areas, in terms of AFQT scores of its personnel. Grouped below Electronic Equipment Repairers are Other Technical and Allied Specialists, Communications and Intelligence Specialists, and Medical and Dental Specialists. Personnel in these areas achieved an average AFQT score under the 60th percentile and above the 50th. Grouped below these occupational areas are Nonoccupational, Infantry/Gun crews/Seamanship specialists, Functional Support and Administration, Service and Supply Handlers, Electrical/Mechanical Equipment Repairers, and Craftsmen. Personnel in these areas achieved an average AFQT score under the 50th percentile. Thus, in view of AFQT mean score, the Electronic Equipment Repairer occupational area in the DoD occupation coding system has the highest quality personnel in all services and in the Army.

TABLE 10
MEAN AFQT PERCENTILE SCORES OF MALE ENLISTED PERSONNEL IN THE ARMY AND IN THE ALL SERVICES BY OCCUPATIONAL AREA, SELECTED YEARS, 1972-1984

(in All Services)

Occupational Area[a]	Fiscal Year			
	1972	1975	1980	1984
0 - Infantry, Gun Crews, and Seamanship Specialists	49.7 (48.7)	51.6 (52.2)	40.6 (43.8)	49.2 (50.9)
1 - Electronic Equipment Repairers	64.6 (75.9)	64.1 (75.3)	57.6 (72.4)	61.0 (72.1)
2 - Communications and Intelligence Specialists	59.5 (65.5)	59.8 (64.0)	50.1 (57.2)	56.1 (60.4)
3 - Medical and Dental Specialists	59.6 (63.5)	61.2 (63.5)	54.2 (59.0)	55.9 (60.0)
4 - Other Technical and Allied Specialists	67.9 (69.6)	65.8 (67.7)	56.9 (61.0)	57.8 (62.1)
5 - Functional Support and Administration	52.2 (55.7)	52.1 (55.1)	47.2 (52.2)	48.6 (53.9)
6 - Electrical/Mechanical Equipment Repairers	48.8 (59.6)	49.4 (58.4)	41.1 (53.1)	46.5 (55.1)
7 - Craftsmen	47.8 (53.7)	51.1 (55.5)	42.0 (50.9)	44.2 (51.9)
8 - Service and Supply Handlers	45.4 (46.8)	49.3 (49.5)	42.2 (45.4)	47.0 (48.7)
9 - Nonoccupational[b]	53.2 (50.3)	55.2 (54.2)	41.4 (48.1)	57.3 (57.3)

Source: Mark J. Eitelberg, Manpower For Military Occupations, Office or the Assistant Secretary of Defense (Force Management and Personnel), 1988 pp.46-47.

[a]Based on the Department of Defense occupational classification system. One-digit code precedes titles of the 10 occupational areas shown here.

[b]Includes patients, prisoners, officer candidates and students, persons serving in undesignated or special occupations, and persons who are not yet occupationally qualified (service members who are in basic or occupational training). Scores for 1972 and 1975 also include persons with "unknown" occupational assignments.

For the reasons given above, this thesis focusses on qualification rates and the Army force structure for occupations that use the EL composite as a criteria to screen recruits. First, qualification rates were inspected. Four groups of occupations were constructed among those that use the EL composite for screening. Group I refers to the occupations that require a score above 120, Group II refers to the occupations that require a score above 115, Group III refers to the occupations that require a score above 110, and Group IV refers to the occupations that require a score above 105 to enter.[18] The titles of these occupations, their appropriate cutscores, and their Army codes as of 1 October 1989 are shown in Table 11. Table 12-1 shows the qualification rates of 17 to 21 years old personnel who had graduated from high school for the selected four groups by six race/gender segments; White males(WM), White females(WF), Black males(BM), Black females(BF), Hispanic males(HM), and Hispanic females(HF). Table 12-2 also shows the qualification rates for the selected groups but samples are retained for those of 17 to 21 years old who had graduated from high school and who are in AFQT category I to IIIA.

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[18] Army uses composite standard scores derived from the sum of standard subtest scores. For equivalent sum of standard subtest scores, see Department of Defense, *Conversion Tables: Armed Services Vocational Aptitude Battery*(DOD 1304.12-L-IOTE-CT), February 1992, pp.58-70. The formula to transform a raw subtest score into a standard subtest score is shown in Appendix A.

TABLE 11
MOS GROUPINGS OF ARMY HIGH-TECH RATINGS
IN EL COMPOSITE

MOS GROUP I (EL ≥ 120)

- 29Y SATELLITE COMMUNICATIONS SYSTEMS REPRR
- 35H TMDE MAINTENANCE SUPPORT SPECIALIST

MOS GROUP II (EL ≥ 115)

Group I +

- 39C TARGET ACQ/SURVEILLANCE RADAR REPAIRER

MOS GROUP III (EL ≥ 110)

Group II +

- 21L PERSHING ELECTRONICS REPAIRER
- 24C HAWK FIRING SECTION MECHANIC
- 24G HAWK INFORMATION COORDINATION CTR MECH
- 24H HAWK FIRE CONTROL REPAIRER
- 24K HAWK CONTINUOUS WAVE RADAR REPAIRER
- 24M VULCAN SYSTEM MECHANIC
- 24N CHAPARRAL SYSTEM MECHANIC
- 24U NIKE-HERCULES CUSTODIAL MECHANIC
- 27B LAND COMBAT SUPPORT SYS TEST SPEC
- 27F VULCAN REPAIRER
- 27J HAWK FIELD MAINT EQ/PULSE ACQ REPRR
- 27K HAWK FIRE CONTROL/CONT WAVE RADAR REPRR
- 27N FOREWORD AREA ALERTING RADAR (FAAR) REPRR
- 29E RADIO REPAIRER
- 29H AUTOMATIC DIGITAL MESS SWITCH EQUIP REPRR
- 29J TELECOMMUNICATIONS TERMINAL DEVICE REPRR
- 29V STRATEGIC MICROWAVE SYSTEMS REPAIRER
- 34T TACTICAL COMPUTER SYSTEMS REPAIRER
- 35G MEDICAL EQUIPMENT REPAIRER, UNIT LEVEL
- 36L TRANSPORTABLE AUTO SWITCH SYS OP/MAINT
- 39B AUTOMATIC TEST EQUIPMENT OPERATOR/MAINT
- 39G AUTOMTD COMMUNICATIONS COMPUTER SYS REPRR
- 39L FA DIGITAL SYSTEMS REPAIRER
- 39Y FA TACTICAL FIRE DIRECTION SYS SPECIALIST

MOS GROUP IV (EL ≥ 105)

Group III +

- 29F FIXED COMMUNICATIONS SECURITY EQUIP REPRR
- 29S FIELD COMMUNICATIONS SECTION EQUIP REPRR
- 31F MOBILE SUBSCRIBER EQ NETWORK SWITCH SYS OP
- 46N PERSHING ELECTRICAL MECHANICAL REPAIRER
- 93D ATC SYS, SUBSYSTEMS AND EQUIP REPRR

Source: Data was provided by the Army Research Institute, 5001 Eisenhower Avenue Alexandria, VA. 22333-5600.

TABLE 12-1
QUALIFICATION RATES FOR MOS GROUPINGS IN EL COMPOSITE BY RACE/GENDER SEGMENTS OF 17-21 years old, HSG, (N=4836)

	GROUP I (EL≥120)	GROUP II (EL≥115)	GROUP III (EL≥110)	GROUP IV (EL≥105)
WM (n=1438)	24.1%	38.0%	52.3%	65.7%
WF (n=1654)	1.6%	6.6%	14.3%	26.4%
BM (n=538)	1.7%	3.7%	7.3%	11.5%
BF (n=644)	NONE	0.6%	0.9%	2.6%
HM (n=267)	7.1%	14.2%	21.4%	31.5%
HF (n=295)	0.7%	1.4%	2.4%	4.1%

TABLE 12-2
QUALIFICATION RATES FOR MOS GROUPINGS IN EL COMPOSITE BY RACE/GENDER SEGMENTS OF 17-21 years old, HSG, AFQT I-IIIA, (N=2259)

	GROUP I (EL≥120)	GROUP II (EL≥115)	GROUP III (EL≥110)	GROUP IV (EL≥105)
WM (n=944)	36.8%	56.9%	75.4%	88.5%
WF (n=961)	2.8%	11.3%	24.5%	44.8%
BM (n=98)	9.2%	19.4%	36.7%	53.1%
BF (n=102)	NONE	3.9%	4.9%	14.7%
HM (n=95)	20.0%	40.0%	57.9%	76.8%
HF (n=59)	3.4%	6.8%	11.9%	20.3%

Six race gender/segments are constructed because they are substantially different in their qualification for entry into the selected high-tech groups. Females and minorities are much less likely to qualify than are males and Whites. For example, in a market of 17 to 21 year old white males who graduated from high school and are in AFQT category I to IIIA, 36.8 percent will qualify for Group I rating in the EL composite, 88.4 percent for Group IV, as compared to zero percent of Black females for Group I and 14.7 percent for Group IV.

To compare selectivity of these four groups, qualification rates for the AFQT category I to IIIA were used. Table 13 shows the qualification rates of 17 to 21 year olds who graduated from high school for the AFQT category I to IIIA.

TABLE 13
QUALIFICATION RATES FOR AFQT I-IIIA
BY RACE/GENDER SEGMENTS
OF 17-21 years old, HSG, (N=4836)

	Percent
WM (n=1438)	65.7%
WF (n=1654)	58.1%
BM (n=538)	18.2%
BF (n=644)	15.8%
HM (n=267)	35.6%
HF (n=295)	20.0%

Compared with qualification rates for AFQT category I to IIIA and for MOS groupings in the EL composite, Group I is too selective, Group II is very selective, Group III is selective, and Group IV is comparatively selective than AFQT category I to IIIA.

Second, the Army force structure was reviewed in order to find how many recruits are actually assigned to these four groups. Table 14 shows the distribution of recruits among the four high-tech groups in the EL composite in FY 1990.

About three percent of recruits have jobs which require a score above 110 on the EL composite, and around four percent of recruits have jobs which require a score above 105 on the EL composite.

TABLE 14
DISTRIBUTION OF GROUP I TO IV IN EL COMPOSITE
(N=36,376)

Group	Number of Enlisted Personnel	percentage
Group I(EL≥120)	127	0.35%
Group II(EL≥115)	153	0.42%
Group III(EL≥110)	1103	3.03%
Group IV(EL≥105)	1467	4.03%

Source: Data were provided by the Defense Manpower Data Center, East.

Note : Of the all recruits, 17 to 21 years old males who graduated high school and in AFQT category I to IIIA were retained.

Based on above observations of qualification rates, Group III was initially selected as the high-tech group for this thesis. It is more selective than the other groups and it has a large counterpart in the youth population. However, based on the Army's accession structure, it includes only three percent of all recruits. Thus it is too narrow for use as a high-tech category. It was necessary to expand the definition of high-tech occupations.

While the Electronics(EL) composite is widely regarded as an appropriate criterion for screening recruits for highly technical occupations, the Surveillance/Communications(SC) and Skilled Technical(ST) ASVAB composites are also often used for this purpose.[19] Thus, the SC and ST composites were reviewed in terms of their qualification rates and their role in the Army accession structure reviewed in EL.

First, the qualification rates were investigated. Four groups of occupations were constructed among occupations that use the SC composite to screen recruits. Group I refers to the occupations that require a score above 105 on the SC composite, Group II refers to the occupations that require a score above 100, Group III refers to the occupations that require a score above 95, and Group IV refers to the occupations that require a score above 90 to enter. The titles of those occupations, their appropriate cutscores, and their Army codes as of 1 October 1989 are shown in Table 15. Also, four groups of occupations were constructed among occupations that use the ST composite to screen recruits. Group I refers to the occupations that require a score above 115 on the ST composite, Group II refers to the occupations that require a score above 110, Group III refers to the occupations that require a score above 105, and Group IV refers to the occupations that require a score above 100 to enter. The titles of those occupations, their appropriate cutscores, and their Army codes as of 1 October 1989 are shown in Table 16.

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[19] Robert Brandewie, Deputy Director, and Bruce Broxom, Quality Control Chief of the Defense Manpower Data Center, East suggested that SC and ST composite to be used if high-tech occupations are to be expanded.

TABLE 15
MOS GROUPINGS OF ARMY HIGH-TECH RATINGS IN SC COMPOSITE

MOS GROUP I (SC ≥ 105)

- 13T REMOTELY PILOTED VEHICLE CREWMEMBER
- 31F MOBILE SUBCRIBER EQ NETWORK SWITCH SYS OPER.

MOS GROUP II (SC ≥ 100)

Group I +

- 13R FA FIREFINDER RADAR OPERATOR
- 17B FIELD ARTILLERY(FA) RADAR CREWMEMBER
- 18E SPECIAL OPERATIONS COMMUNICATIONS SERGEANT
- 31C SINGLE CHANNEL RADIO OPERATOR
- 31D MOBILE SUBSCRIBER EQ TRANSMISSION SYS OPER.
- 36M SWITCHING SYSTEMS OPERATOR

MOS GROUP III (SC ≥ 95)

Group II +

- 31M MULTICHANNEL COMMUNICATIONS SYSTEMS OPERATOR
- 31N COMMUNICATIONS SYSTEMS/CIRCUIT CONTROLLER
- 31Q TACTICAL SATELLITE/MICROWAVE SYSTEM OPERATOR
- 31V UNIT LEVEL COMMUNICATIONS MAINTAINER
- 96H AERIAL INTELLIGENCE SPECIALIST
- 96R GROUND SURVEILLANCE SYSTEMS OPERATOR
- 97G COUNTER SIGNALS INTELLIGENCE SPECIALIST

MOS GROUP IV (SC ≥ 90)

Group III +

- 31K COMBAT SIGNALER
- 31L WIRE SYSTEMS INSTALLER
- 72E TACTICAL TELECOMMUNICATIONS CENTER OPERATOR
- 72G AUTOMATIC DATA TELECOMMUNICATIONS CENTER OPERATOR

Source: Data was provided by the Army Research Institute, 5001 Eisenhower Avenue Alexandria, VA. 22333-5600.

TABLE 16
MOS GROUPINGS OF ARMY HIGH-TECH RATINGS IN ST COMPOSITE

MOS GROUP I (ST ≥ 115)

- 33P EW/I RECEIVER EQUIPMENT REPAIRER
- 33Q EW/I PROCESSING/STORAGE EQUIPMENT REPAIRER
- 33R EW/I AVIATION SYSTEMS REPAIRER
- 33T EW/I TACTICAL SYSTEMS REPAIRER

MOS GROUP II (ST ≥ 110)

Group I +

- 33V EW/I AERIAL SENSOR REPAIRER
- 81Q TERRAIN ANALYSTS

MOS GROUP III (ST ≥ 105)

Group II +

- 71C EXECUTIVE ADMINISTRATIVE ASSISTANT
- 91G BEHAVIORAL SCIENCE SPECIALIST
- 93B AEROSCOUT OBSERVER
- 96B INTELLIGENCE ANALYST
- 96F PSYCHOLOGICAL OPERATIONS SPECIALIST
- 97B COUNTERINTELLIGENCE AGENT
- 98C SIGNALS INTELLIGENCE ANALYST
- 98J NONCOMMUNICATIONS INTERCEPTOR/ANALYST

MOS GROUP IV (ST ≥ 100)

Group III +

- 01H BIOLOGICAL SCIENCES ASSISTANT
- 18D SPECIAL OPERATIONS MEDICAL SERGEANT
- 55R AMMUNITION STOCK CONTROL/ACCOUNTING SPECIALIST
- 74D COMPUTER/MACHINE OPERATOR
- 74F PROGRAMMER/ANALYST
- 91P X-RAY SPECIALIST
- 91R VETERINARY FOOD INSPECTION SPECIALIST
- 93C AIR TRAFFIC CONTROL(ATC) OPERATOR

Source: Data was provided by the Army Research Institute, 5001 Eisenhower Avenue Alexandria, VA. 22333-5600.

Tables 17-1 and 17-2 show the qualification rates for MOS groupings in the SC composite, while Tables 18-1 and 18-2 show the qualification rates for MOS groupings in the ST composite by six race/gender segments.

TABLE 17-1
QUALIFICATION RATES FOR MOS GROUPINGS IN SC COMPOSITE BY RACE/GENDER SEGMENTS OF 17-21 years old, HSG, (N=4836)

	GROUP I (SC≥105)	GROUP II (SC≥100)	GROUP III (SC≥95)	GROUP IV (SC≥90)
WM (n=1438)	69.8%	78.7%	85.7%	90.1%
WF (n=1654)	19.2%	35.0%	56.7%	70.9%
BM (n=538)	10.6%	16.5%	26.0%	37.0%
BF (n=644)	1.4%	3.6%	8.1%	16.9%
HM (n=267)	34.8	44.9%	52.8%	62.9%
HF (n=295)	4.1%	8.8%	17.6%	27.5%

TABLE 17-2
QUALIFICATION RATES FOR MOS GROUPINGS IN SC COMPOSITE BY RACE/GENDER SEGMENTS OF 17-21 years old, HSG, AFQT I-IIIA, (N=2259)

	GROUP I (SC≥105)	GROUP II (SC≥100)	GROUP III (SC≥95)	GROUP IV (SC≥90)
WM (n=944)	87.0%	93.9%	97.4%	99.4%
WF (n=961)	32.0%	55.1%	79.0%	91.9%
BM (n=98)	44.9%	65.3%	81.6%	92.9%
BF (n=102)	7.8%	19.6%	41.2%	70.6%
HM (n=95)	72.6%	85.3%	89.5%	99.0%
HF (n=59)	20.3%	39.0%	67.8%	84.8%

TABLE 18-1
QUALIFICATION RATES FOR MOS GROUPINGS IN ST COMPOSITE
BY RACE/GENDER SEGMENTS
OF 17-21 years old, HSG, (N=4836)

	GROUP I (ST≥115)	GROUP II (ST≥110)	GROUP III (ST≥105)	GROUP IV (ST≥100)
WM (n=1438)	40.4%	54.7%	67.9%	77.6%
WF (n=1654)	20.2%	34.3%	50.5%	63.2%
BM (n=538)	5.6%	9.5%	16.7%	23.2%
BF (n=644)	2.8%	5.8%	11.8%	19.7%
HM (n=267)	14.2%	25.1%	35.2%	46.1%
HF (n=295)	3.4%	8.8%	13.6%	24.1%

TABLE 18-2
QUALIFICATION RATES FOR MOS GROUPINGS IN ST COMPOSITE
BY RACE/GENDER SEGMENTS
OF 17-21 years old, HSG, AFQT I-IIIA, (N=2259)

	GROUP I (ST≥115)	GROUP II (ST≥110)	GROUP III (ST≥105)	GROUP IV (ST≥100)
WM (n=944)	61.6%	81.5%	95.0%	99.5%
WF (n=961)	34.8%	58.5%	83.0%	95.2%
BM (n=98)	29.6%	49.0%	78.6%	93.9%
BF (n=102)	17.7%	35.3%	68.6%	92.2%
HM (n=95)	40.0%	66.3%	88.4%	97.9%
HF (n=59)	17.0%	44.1%	61.0%	88.1%

These tables show that, generally speaking, occupations that use the SC composite as a criteria to screen recruits are less selective than those which use the ST composite. Occupations that use the ST composite are less selective than those which use the EL composite.

Compared to qualification rates for AFQT category I to IIIA, occupations that require a score above 100 on the SC composite are regarded as high-tech occupations based on selectivity and the size of the youth labor market. Also, occupations that require a score above 105 on the ST composite are regarded as high-tech.

Table 19 shows the distribution of recruits among the selected four groups in the SC composite. Table 20 shows the distribution of recruits among the selected four groups in the ST composite.

TABLE 19
DISTRIBUTION OF GROUP I TO IV IN SC COMPOSITE
(N=36,376)

Group	Number of Enlisted Personnel	percentage
Group I(SC≥105)	192	0.5%
Group II(SC≥100)	996	2.7%
Group III(SC≥95)	2,089	5.7%
Group IV(SC≥90)	3,046	8.4%

Source: Data were provided by the Defense Manpower Data Center, East.

Note : Of the all recruits, 17 to 21 years old males who graduated high school and in AFQT category I to IIIA were retained.

TABLE 20
DISTRIBUTION OF GROUP I TO IV IN ST COMPOSITE
(N=36,376)

Group	Number of Enlisted Personnel	percentage
Group I(ST≥115)	171	0.5%
Group II(ST≥110)	205	0.6%
Group III(ST≥105)	1,101	3.0%
Group IV(ST≥100)	1,359	3.7%

Source: Data were provided by the Defense Manpower Data Center, East.

Note : Of the all recruits, 17 to 21 years old males who graduated high school and in AFQT category I to IIIA were retained.

In occupations that use the SC composite to screen recruits, around three percent of recruits are in occupations which require a score above 100 on the SC composite. In occupations that use the ST composite, around three percent of recruits are in occupations which require a score above 105 on the ST composite.

For the purpose of high-tech definition in this thesis, Group II in the SC composite(occupations that require score above 100 on the SC composite test to enter) and Group III in the ST composite(occupations that require a score above 105 on the ST composite test to enter) are added to Group III in the EL composite(occupations that require a score above 110 on the EL composite to enter). Table 21-1 shows the qualification rates for this new high-tech group by six race/gender segments for 17 to 21 year olds who have graduated from high school. As shown in this Table, 81.8 percent of the White males are qualified to enter the high-tech ratings. This means that 81.8 percent of the White males are qualified either for the occupations that require a score above 110 on the EL composite or a score above 100 on the SC composite or a score above 105 on the ST composite. In comparison, only 65.7 percent of White males are qualified by AFQT score as category I to IIIA.

However, even though an individual might not qualify as category I to IIIA, he/she could be qualified to enter the high-tech ratings. Of Black males, 18.2 percent are qualified as category I to IIIA, but 21.8 percent are qualified to enter the high-tech rating. This means that if the Army focuses on specific occupations rather mental group categories I to IIIA when recruiting, it is possible for the Army to draw from a larger pool of qualified recruits. Tables 21-1 and 21-2 also shows that women have a lower likelihood of entering the high-tech ratings. This is because their scores on the EL, SC, and ST composites are lower of the ten

TABLE 21-1
QUALIFICATION RATES FOR HIGH-TECH RATING BY RACE/GENDER SEGMENTS OF 17-21 years old, HSG, (N=4836)

	EL≥110 or SC≥100 or ST≥105
WM (n=1438)	81.8%
WF (n=1654)	54.2%
BM (n=538)	21.8%
BF (n=644)	12.4%
HM (n=267)	49.1%
HF (n=295)	15.6%

TABLE 21-2
QUALIFICATION RATES FOR HIGH-TECH RATING BY RACE/GENDER SEGMENTS OF 17-21 years old, HSG, AFQT I-IIIA (N=2259)

	EL≥110 or SC≥100 or ST≥105
WM (n=944)	97.9%
WF (n=961)	85.9%
BM (n=98)	86.7%
BF (n=102)	71.6%
HM (n=95)	95.8%
HF (n=59)	66.1%

ASVAB subtests, GS, AR, AS, MK, MC, and EI which are mostly included in the EL, SC, and ST composites show higher scores for men. PC, NO, CS show higher scores for women. WK shows no sex-related performance difference.[20] Table 21-2 shows the qualification rates for high-tech rating for 17 to 21 year olds who have graduated from high school and are in AFQT category I to IIIA. As shown in this Table, around 98 percent of White males are qualified for the high-tech rating, while two percent are not qualified but are in AFQT category I to IIIA. Of Black males, around 72 percent are qualified and 28 percent are not qualified but are in AFQT category I to IIIA.

In the Army accession structure this high-tech rating included about nine percent of recruits in FY 1990.[21]

D. SELECTION OF EXPLANATORY VARIABLES

The selection of explanatory variables was based on their availability in the NLSY data set and the availability of similar variables at the county level. Previous research indicates that there is a strong positive relationship between mother's education, as well as parent's education, and performance on the ASVAB. The model developed here uses highest parent's education (PED) because it reduces the large number of missing values for mother's education, and because

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[20] Mark J. Eitelberg, Manpower For Military Occupations, Office or the Assistant Secretary of Defense (Force Management and Personnel), 1988 p.95.

[21] 3.03 percent in Group III in EL composite + 3.03 percent in Group III in ST composite + 2.74 percent in Group II in SC composite = 8.8 percent in high-tech rating.

mother's and father's educations are highly correlated. Mother's education has been shown to affect certain ASVAB subtests such as Word Knowledge, Mathematics Knowledge, General Science, Arithmetic Reasoning, and Paragraph Comprehension.[22] If one parent's education was missing the educational attainment of the other was used in order to maintain sample size.

The socioeconomic status of the respondents was accounted for by a variable indicating whether or not the individual's family was in poverty. This variable, called socioeconomic status(SES; 1=in poverty status, 0=not in poverty status), is expected to have a negative effect on high-tech criterion performance. Two special transformed variables were used to account for the possible effect of a race and poverty interaction. These interaction variables were constructed by multiplying the poverty status variable by the race variable. These variables are BLSES, and HISSES.

Previous research also shows that the region in which the respondent lives influences ASVAB performance. Generally, average scores on the subtests are the lowest in the South and highest in the Northeast.[23] In order to capture this effect the fifty states were grouped into region variables called Northeast, Southeast, Midwest and West, and a variable SOUTH-WEST was constructed. This variable indicates whether

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[22]Uslar, A Prototypical Model for Estimating High-Tech Navy Recruiting Markets, Naval Postgraduate School, Monterey, CA., 1991, p. 26.
[23]PROFILE OF AMERICAN YOUTH, 1982, PP. 42-43.

or not an individual resides in the Southeast or the West(1=resides in the southeast or the west, 0=else).

To capture such effects as the quality of schools and educational opportunities the individual may have experienced, a dummy variable for living in an urban area is included. This variable, URBAN(1=live in an urban area, 0=else), is expected to have a negative effect for minorities since such individuals are more likely to attend inner-city schools with marginal educational opportunities.

For estimating the probability that an individual will score above high-tech cut score, the logit model shown below was specified.

$$\ln[P_i/1-P_i] = a + \underline{b}\cdot\underline{X}i + Ui$$

where,

P_i = the probability that individual i scores above high-tech cut score

1-Pi = the probability that individual i does not score above the high-tech cut score

$\underline{Xi}$ = a vector of individual i's sociodemographic characteristics

$\underline{b}$ = a vector of coefficients for the effect of sociodemographic characteristics

Ui = a random error term

The logit functional form has several attractive properties. Unlike the linear probability model, the logit functional form constrains the probability to the range from zero to one and does not assume that the effects of the explanatory variables on the probability of scoring above the high-tech cut score are constant.

IV. MODELS ESTIMATION

A priori expectations of the composition of each race/gender subgroup were confirmed by comparisons of the means of the sociodemographic variables among the subgroups as seen in table 22. It shows that there are large differences among the six race/gender subgroups and also that the mean of the each variable is strongly affected by poverty status.

TABLE 22
SAMPLE MEANS FOR EACH SUBGROUP BY SOCIODEMOGRAPHIC VARIABLE AND POVERTY STATUS

NOT IN POVERTY (IN POVERTY)

	WM N=1235 (N=179)	WF N=1420 (N=231)	BM N=351 (N=162)	BF N=410 (N=226)	HM N=214 (N=51)	HF N=215 (N=79)
In Poverty	14.5	16.3	46.2%	55.1%	23.8%	36.7%
In Urban	77.3% (69.3)	74.4% (68.8)	86.3% (75.3)	85.9% (77.4)	93.9% (100.0)	96.74% (93.7)
In southwest	42.2% (45.3)	44.8% (44.6)	61.5% (67.3)	65.1% (73.5)	79.0% (58.9)	82.3% (70.9)
Parents' ed.	13.2yr (12.7)	13.0yr (12.3)	12.0yr (11.0)	12.1yr (10.8)	10.0yr (8.1)	9.5yr (8.1)
Qualified for Hitech	83.2% (71.0)	55.8% (44.6)	26.8% (11.1)	15.1% (8.0)	52.3% (35.3)	17.7% (10.1)

The percentage of sample Blacks in poverty was highest with approximately 50 percent followed by Hispanics with approximately 30 percent and then Whites with approximately 15 percent. The percentage of Hispanics living in urban areas and in the southwest area was the highest followed by Blacks and then Whites. Of the sample who were not in poverty status, above 90 percent of Hispanics, 80 percent of Blacks, and 70 percent of Whites were living in urban areas. But of the sample who were in poverty status, the percentage living in urban areas was lower with five to ten percent than those who were not in poverty status with the exception of Hispanic males.

Of the people who were not in poverty, the percentage living in the southwest area was highest for Hispanics with about 80 percent followed by Blacks with about 60 percent and Whites with about 40 percent. Table 22 shows that people who live in poverty are more likely to live in the southwest area except for Hispanics. Of the sample not in poverty, the average parents' education for Whites exceeded the 13 year level followed by Blacks with approximately 12 years and finally Hispanics with approximately 10 years. However, of the sample in poverty, the average parents' education was about one year below the level for the sample not in poverty for all six subgroups.

The percentage of sample White males passing the high-tech cutscore(83.3%) was highest followed by White females(55.8%), then Hispanic males(52.3%), then Black males(26.8), then Hispanic females(17.7%), and finally Black females(15.1%). People in poverty are much less likely to qualify for high-tech occupations.

Three models are specified in this thesis; a 'HIGHTECH' model, an 'INTEREST' model, and a 'JOIN' model. The 'HIGHTECH' model estimates the eligibility of six market segments for high-tech occupations in the U.S. Army. The 'INTEREST' model estimates four different interest levels in military employment for each market segment given the likelihood of being qualified for high-tech occupations. The 'JOIN' model estimates the actual joining behavior of each market segment given the level of interest in the military.

A. 'HIGHTECH' MODEL ESTIMATION

Logit regression equations for males and females were calculated using the LOGIST procedure contained in release 6.06 SAS. The dependent variable, HITEC, was a dichotomous variable indicating whether or not the respondent achieved the minimum score for the high-tech rating specified in this thesis. Table 23 presents the estimated binominal logit coefficients by gender for achiving a high-tech rating as a function of race, socioeconomic status, parents' education and region.

TABLE 23

ESTIMATED COEFFICIENTS FOR 'HITEC' MODEL

MALES

Variables	Parameter Estimate	Pr > Chi-square
INTERCEPT	0.78 (0.49)	0.11
BLACK	-2.47 (0.15)	0.00
HISPANIC	-1.09 (0.18)	0.00
SES	-0.63 (0.19)	0.00
PED	-0.09 (0.08)	0.27
PED2	0.01 (0.00)	0.00
SOUTH-WEST	-0.09 (0.11)	0.43
URBAN	0.00025 (0.14)	0.99
BLSES	-0.31 (0.34)	0.36
HISSES	0.11 (0.39)	0.78

-2 LOG L : 762.49 with 9 DF (p=0.0001)
C Statistic : 0.83
Percent Correctly Predicted : 78.6%

FEMALES

Variables	Parameter Estimate	Pr > Chi-square
INTERCEPT	-2.98 (0.72)	0.00
BLACK	-2.01 (0.16)	0.00
HISPANIC	-1.30 (0.21)	0.00
SES	-0.30 (0.15)	0.05
PED	0.19 (0.11)	0.09
PED2	0.0036 (0.00)	0.40
SOUTH-WEST	0.09 (0.10)	0.37
URBAN	0.23 (0.12)	0.05
BLSES	-0.06 (0.33)	0.86
HISSES	-0.09 (0.46)	0.85

-2 LOG L : 742.44 with 9 DF (p=0.0001)
C Statistic : 0.80
Percent Correctly Predicted : 65.7%

(Standard errors in parentheses)

The signs of the coefficient for Blacks and Hispanics are negative for both models and the effects are both significant. This confirms the a priori expectation that non-whites have historically had a more difficult time meeting the criterion for classification to a high-tech rating. The model results for Blacks, whether they are male or female, indicate that their likelihood of qualifying for high-tech ratings is lower than that of Hispanics or Whites. Socioeconomic status(SES,poverty status) had a negative effect in each model as expected, and the effects were significant in both models. The coefficient of parents' education was expected to be positive, but this was only true in the female model. The negative effect expected from the SOUTH-WEST variable was present in only the male model. Living in an urban area had a positive effect in both models, however the effects were not significant in either model.

The -2 Log Likelihood(-2 Log L) statistics indicate that the combined effect of the explanatory variables was significant in both models, with p=0.0001. The C statistic measures the model's predictive ability based on whether an observation with a specific mental group outcome would be predicted to score in that same mental group outcome. The C statistics indicate good model fit with 0.83 for the male model and 0.80 for the female model.[24]

To check the models for within sample consistency, the estimated distributions of the six market subgroups for high-tech rating are presented in Table 24. The probabilities were calculated using the 'HIGHTECH' model results from Table 23.[25] The pattern in this Table matches quite well the sample distribution for high-tech rating in Table 22.

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[24] SAS/STAT User's Guide, Version 6, Fourth Edition, Volume 2, Cary, N.C., 1990, pp. 1074-1075, pp. 1090-1091.
[25] The procedure used is described in: SAS/STAT User's Guide, Version 6, Fourth Edition, Volume 2, Cary, N.C., 1990, p. 1087.

TABLE 24

ESTIMATED GENDER/RACE DISTRIBUTIONS FOR HIGH-TECH RATING BY POVERTY STATUS

	WM	WF	BM	BF	HM	HF
Not in Poverty	83.6%	56.3%	24.5%	12.5%	47.8%	13.1%
In Poverty	70.5%	43.5%	9.6%	6.4%	30.3%	8.7%

As shown in Table 24, almost 84 percent of White males not in poverty qualify for high-tech ratings. White females (56.3%) are more likely to qualify for high-tech ratings than Hispanics and Blacks. Minority females are much less likely to qualify for high-tech ratings than White females. Poverty status decreases the likelihood of qualifying for high-tech ratings for all market segments, particularly for Blacks and Hispanic females.

B. 'INTEREST' MODEL ESTIMATION

The 'INTEREST' model estimates four different interest levels in military employment for each market segment given the likelihood of being qualified for high-tech ratings. The dependent multinominal variable, INTEREST, was measured by responses to the NLSY question; "Do you think, in the future, that you will (1) definitely try to enlist, (2) probably try to enlist, (3) probably not try to enlist, and (4) definitely not try to enlist?" Explanatory variables include the high-tech qualification variable as well as the socioeconomic variables which were used in the 'HIGHTECH' model. Table 25 presents the sample distribution for interest by high-tech category and poverty status.

TABLE 25

SAMPLE DISTRIBUTION OF 'INTEREST' BY HIGH-TECH AND POVERTY STATUS

NOT IN POVERTY (IN POVERTY)

	Def. Yes	Prob. Yes	Prob. No	Def. No
IN HIGH-TECH				
WM, N=996 (N=123)	1.4% (4.1)	12.5% (15.5)	48.1% (40.7)	38.1% (39.8)
WF, N=788 (N=99)	0.3% (NONE)	4.3% (5.1)	38.1% (34.3)	57.4% (60.6)
BM, N=93 (N=17)	1.1% (5.9)	17.2% (17.7)	35.5% (52.9)	46.2% (23.5)
BF, N=60 (N=18)	1.7% (5.6)	13.3% (11.1)	26.7% (38.9)	58.3% (44.4)
HM, N=108 (N=18)	NONE (5.6)	16.7% (22.2)	60.1% (55.6)	23.2% (16.7)
HF, N=38 (N=8)	NONE (NONE)	10.5% (37.5)	39.5% (25.0)	50.0% (37.5)
NOT IN HIGH-TECH				
WM, N=199 (N=46)	4.5% (2.2)	23.6% (39.1)	32.7% (30.4)	39.2% (28.3)
WF, N=625 (N=128)	0.3% (3.1)	8.2% (10.2)	29.1% (29.7)	62.4% (57.0)
BM, N=243 (N=136)	6.6% (11.8)	26.3% (38.2)	30.9% (25.0)	36.2% (25.0)
BF, N=345 (N=205)	2.0% (3.9)	16.8% (17.6)	27.0% (29.8)	54.2% (48.8)
HM, N=95 (N=30)	5.3% (10.0)	35.8% (36.7)	26.3% (30.0)	32.6% (23.3)
HF, N=176 (N=70)	2.8% (NONE)	15.9% (24.3)	32.4% (30.0)	48.9% (45.7)

The table shows that people who are eligible for high-tech occupations generally are less interested in enlistment than those who are not eligible for high-tech occupations. Also, people not in poverty status generally are less interested in enlistment than those in poverty status. Among the six race/gender subgroups, males are much more interested in enlistment than females, and Whites are generally less interested in enlistment than Blacks and Hispanics. The 'HIGHTECH' model suggested that Whites are more qualified than Blacks and Hispanics for the high-tech occupations. This indicates that interest in the military decreases as mental test score increases.

The multinominal logistic regressions for males and females were conducted for interest in the military. Table 26 presents the estimated coefficients for the four different interest categories as a function of the HITEC and the socioeconomic variables of the 'HIGHTECH' model.The estimated coefficients in Table 26 show substantial differences in significance of the explanatory variables between the male and female models. A gender difference can be seen in the significance level for the 'HITEC' coefficients. Only the male model shows that the high-tech variable had a negative effect on interest in joining the military as expected, and the effect was significant. Another difference between the male and the female models is in the race variables for Blacks and Hispanics. Only the female model shows that the race variables for Blacks and Hispanics had a positive effect as expected, and the effect was significant. The signs of the coefficients for socioeconomic status variable (SES) were positive as expected in both models, however the effect was not significant in either model. Only the male model shows

TABLE 26

ESTIMATED COEFFICIENTS FOR 'INTEREST' MODEL

MALES

Variables	Parameter Estimate	Pr > Chi-square
INTERCEPT 1	-3.33 (0.41)	0.00
INTERCEPT 2	-1.13 (0.40)	0.00
INTERCEPT 3	0.74 (0.40)	0.06
HITEC	-0.37 (0.10)	0.00
BLACK	-0.05 (0.13)	0.72
HISPANIC	0.25 (0.16)	0.10
SES	0.18 (0.15)	0.24
PED	0.04 (0.06)	0.50
PED2	-0.003 (0.00)	0.16
SOUTH-WEST	0.25 (0.08)	0.00
URBAN	-0.05 (0.10)	0.60
BLSES	0.62 (0.24)	0.01
HISSES	0.28 (0.34)	0.40
-2 LOG L :	**107.12 with 10 DF (p=0.0001)**	
C Statistic :	**0.60**	

FEMALES

Variables	Parameter Estimate	Pr > Chi-square
INTERCEPT 1	-3.71 (0.41)	0.00
INTERCEPT 2	-1.31 (0.37)	0.00
INTERCEPT 3	0.52 (0.37)	0.16
HITEC	0.11 (0.09)	0.25
BLACK	0.44 (0.12)	0.00
HISPANIC	0.55 (0.16)	0.00
SES	0.05 (0.14)	0.71
PED	-0.09 (0.06)	0.11
PED2	0.003 (0.00)	0.25
SOUTH-WEST	-0.01 (0.08)	0.93
URBAN	-0.40 (0.10)	0.00
BLSES	0.15 (0.21)	0.48
HISSES	0.15 (0.29)	0.59
-2 LOG L :	**69.73 with 10 DF (p=0.0001)**	
C Statistic :	**0.58**	

(Standard errors in parentheses)

that the SOUTH-WEST variable had a positive effect as expected, and the effect was significant. The coefficient signs for the URBAN variable are negative for both models, but were significant only in the female model. The interaction variables, 'BLSES' and 'HISSES' were not significant in either model with the exception of 'BLSES' in the male model.

The -2 Log Likelihood(-2 Log L) statistics indicate that the combined effects of the explanatory variables are significant in both models, with p=0.0001. The C statistics indicate good model fit with 0.60 for the male and 0.58 for the female model.

To check the model for within sample consistency the estimated interest distribution of the six race/gender subgroups given one's the eligibility for a high-tech occupation are presented in Table 27. The probabilities were calculated using the 'INTEREST' model results from Table 26.[26] The pattern in this table matches quite well the sample distributions in Table 25.

Table 27 indicates that there are different relative levels of interest for the six race/gender subgroups based on their mental eligibility and their poverty status. It shows that poverty status increases interest in joining the military for all race/gender subgroups whether they are eligible for high-tech occupations or not. females show slightly more interest when they are in poverty status, however, males show a big shift in interest in joining the military when they are in poverty status. Among males, Whites

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[26] The procedure used is described in: SAS/STAT User's Guide, Version 6, Fourth Edition, Volume 2, Cary, N.C., 1990, p. 1087.

TABLE 27

ESTIMATED DISTRIBUTION OF 'INTEREST'
BY HIGH-TECH AND POVERTY STATUS

NOT IN POVERTY (IN POVERTY)

	Def. Yes	Prob. Yes	Prob. No	Def. No
IN HIGH-TECH				
WM	2.4% (2.9)	15.8% (18.4)	40.8% (42.4)	41.0% (36.2)
WF	0.9% (1.0)	8.2% (9.0)	29.6% (31.2)	61.2% (58.8)
BM	2.4% (5.5)	15.5% (28.9)	40.7% (42.9)	41.5% (22.7)
BF	1.4% (1.7)	11.9% (14.1)	35.8% (38.3)	50.9% (45.9)
HM	3.7% (5.8)	22.1% (29.8)	43.5% (42.6)	30.8% (21.8)
HF	1.5% (1.9)	12.9 (15.7)	37.0% (39.7)	48.7% (42.7)
NOT IN HIGH-TECH				
WM	3.7% (4.6)	21.8% (25.5)	43.4% (43.5)	31.1% (26.4)
WF	0.9% (1.0)	8.1% (8.6)	29.3% (30.4)	61.7% (60.1)
BM	3.8% (8.5)	22.3% (37.0)	43.5% (38.9)	30.4% (15.6)
BF	1.3% (1.7)	11.3% (14.3)	34.9% (38.5)	52.6% (45.6)
HM	5.5% (8.3)	29.0% (36.5)	42.8% (39.2)	22.7% (16.0)
HF	1.5% (2.0)	13.0% (16.3)	37.1% (40.1)	48.4% (41.6)

show a relatively smaller shift in interest in the military than Blacks and Hispanics. For example, of the people who are not eligible for high-tech occupations, 25.5 percent(3.7% + 21.8%) of White males not in poverty are positively interested in the military. But, for those in poverty status, the percentage is slightly increased to 30.1 percent(4.6% + 25.5%). However, for Black males the percentage is greately increased from 26.1 percent(3.8% + 22.3%) when they are not in poverty to 45.5 percent(8.5% + 37.0%). For Hispanic males, the percentage is also greatly increased from 34.5 percent(5.5% + 29.0%) to 44.8 percent(8.3% + 36.5%).

Differences in interest in joining the military based on one's eligibility for high-tech occupations can be mainly seen among males. Males who are not eligible for high-tech occupations generally are more interested in joining the military than those who are eligible. However, females do not show much difference in interest based on their mental eligibility. Table 27 shows that White females and Black females who are eligible for high-tech occupations are slightly more interested in the military than those who are not eligible. Hispanic females do not show much difference in interest based on their eligibility for high-tech occupations. Generally, Whites show less interest in joining the military than Blacks or Hispanics.

C. 'JOIN' MODEL ESTIMATION

The 'JOIN' model estimates the actual enlistment behavior of the market segments given their level of interest in the military. Only the male proportion of the sample was retained for this model estimation, because of a limited female sample. The dependent binominal variable, JOIN, was constructed from the respondent's answer to a question about his membership in the Armed Forces between 1979 and 1987. A dichotomous explanatory variable for interest, DINT(1 = Def.

Yes or Prob. Yes, 0 = Prob. No or Def. No), was added to the HITEC, race/ethnic variables and the geographic variable of the previous models. The relation between the actual joining behavior and interest level is shown in Table 28.

TABLE 28

SAMPLE DISTRIBUTION OF ACTUAL JOINING BEHAVIOR BY INTEREST LEVEL

	JOIN	NOT JOIN	TOTAL
Def. Yes			
WM (n=29)	31.0%	69.0%	100.0%
BM (n=34)	32.4%	67.6%	
HM (n=9)	22.2%	77.8%	
Prob. Yes			
WM (n=208)	17.8%	82.2%	100.0%
BM (n=135)	21.5%	78.5%	
HM (n=67)	13.4%	86.6$	
Prob. No			
WM (n=608)	5.1%	94.9%	100.0%
BM (n=151)	11.3%	88.8%	
HM (n=109)	3.7%	96.3%	
Def.No			
WM (n=519)	3.3%	96.7%	100.0%
BM (n=169)	8.3%	91.7%	
HM (n=66)	1.5%	98.5%	

As explained in the discussion of the 'INTEREST' model, Hispanics are generally more interested in joining the military regardless of their poverty status or their eligibility for high-tech occupations, followed by Blacks and then Whites. However, the sample distribution shows that Hispanics had the smallest proportion who actually joined the military for all levels of interest.

Table 29 presents the sample distribution for actual joining behavior by mental eligibility for high-tech occupations.

TABLE 29

SAMPLE DISTRIBUTION OF ACTUAL JOINING BEHAVIOR BY MENTAL ELIGIBILITY

	JOIN	NOT JOIN	TOTAL
IN HITEC			
WM (n=1155)	7.5%	92.5%	100.0%
BM (n=112)	15.2	84.8%	
HM (n=130)	1.5%	98.5%	
NOT IN HITEC			
WM (n=259)	8.9%	91.1%	100.0%
BM (n=401)	14.7%	85.3%	
HM n=135)	12.6%	87.4%	

The proportion of White males who joined the military was slightly greater for those not eligible for high-tech ratings (from 7.5% to 8.9%). Hispanic males showed a greater tendency to join the military when they were not eligible for high-tech ratings (from 1.5% to 12.6%). However the proportion of Black males who joined the military was slightly lower for those not eligible for high-tech ratings (from 15.2% to 14.7%).

Table 30 presents the estimated binominal logit coefficients for actual joining behavior as a function of high-tech category, race/ethnic group, region, and interest level.

TABLE 30

ESTIMATED COEFFICIENTS FOR 'JOIN' MODEL

Variables	Parameter Estimate	Pr > Chi-square
INTERCEPT	-3.17 (0.23)	0.00
HITEC	0.11 (0.20)	0.57
BLACK	0.60 (0.21)	0.00
HISPANIC	-0.33 (0.30)	0.26
SOUTH-WEST	0.14 (0.17)	0.39
DINT	1.47 (0.17)	0.00

-2 LOG L : 104.37 with 5 DF (p=0.0001)
C Statistic : 0.72
Percent Correctly Predicted : 91.4%

Out of sample size of 2,104 males, 181 (8.6%) actually joined the military. The predictive ability of the 'JOIN' model may be substantially influenced by the small number joining the military. The positive coefficient sign for Black indicates that Black males are the most likely to join the military. However, Hispanics are less likely to join the military than Blacks or Whites. The greater the expressed interest, the greater is the likelihood of joining the military. SOUTH-WEST had a positive effect as expected, but the effect was not significant. The HITEC variable had a positive effect on joining the military, however the effect was not significant.

The -2 Log Likelihood(-2 Log L) statistic indicates that the combined effects of explanatory variables are significant , with p=0.0001. The C statistics indicate good model fit at 0.72.

To check the model for within sample consistency the estimated join distributions of the six race/gender subgroups are presented in Tables 31 and 32. The probabilities were calculated using the 'JOIN' model results from Table 30.[27] The pattern in these tables matches quite well the sample distributions in Tables 28 and 29.

TABLE 31

ESTIMATED DISTRIBUTION OF ACTUAL JOINING BEHAVIOR BY INTEREST LEVEL

	JOIN	NOT JOIN	TOTAL
Def. Yes			
WM (n=29)	17.5%	82.5%	100.0%
BM (n=34)	27.0%	73.0%	
HM (n=9)	12.8%	87.2%	
Prob. Yes			
WM (n=208)	17.4%	82.6%	100.0%
BM (n=135)	27.1%	72.9%	
HM (n=67)	13.1%	86.9%	
Prob. No			
WM (n=608)	4.7%	95.3%	100.0%
BM (n=151)	7.9%	92.1%	
HM (n=109)	3.5%	96.5%	
Def.No			
WM (n=519)	4.7%	95.3%	100.0%
BM (n=169)	7.8%	92.2%	
HM (n=66)	3.4%	96.6%	

TABLE 32

ESTIMATED DISTRIBUTION OF ACTUAL JOINING BEHAVIOR BY MENTAL ELIGIBILITY

	JOIN	NOT JOIN	TOTAL
IN HITEC			
WM (n=1155)	5.8%	94.2%	100.0%
BM (n=112)	10.8%	89.2%	
HM (n=130)	4.7%	95.3%	
NOT IN HITEC			
WM (n=259)	6.5%	93.5%	100.0%
BM (n=401)	12.9%	87.1%	
HM n=135)	5.8%	94.2%	

[27] The procedure used is described in: SAS/STAT User's Guide, Version 6, Fourth Edition, Volume 2, Cary, N.C., 1990, p. 1087.

As shown in Tables 31 and 32, Black males show the highest likelihood of joining the military at each interest level and in each mental category followed by White males and then Hispanic males. The greater the expressed interest, the greater is the likelihood of joining the military. Also, those who are not eligible for high-tech ratings show a greater likelihood of joining the military.

V. CONCLUSIONS

The primary goal of this research was to provide better measures of the target recruiting market for the Army of the future. Previous measures of market have focused on either 17-21 year old high school graduate military available population or on ASVAB I to IIIA mental quality population. This thesis indicates how a more targeted metric can be developed to provide a better measure of the market qualified for technical occupations which is an essential target recruiting market for the Army of the future. Mental eligibility for high-tech occupations as well as interest in joining the military and actual joining behavior should be taken into account, so that the recruiting commands can allocate recruiting resources more accurately and efficiently.

To define 'high-tech' occupation, several Army occupations were selected based upon their technical characteristics, the qualification rates of the youth labor market, and the Army force structure. Initially, the occupations that require a score above 110 on the electronic (EL) ASVAB composite to enter were selected as the high-tech group, because of their eminent technical characteristics and of a large counterpart in the youth population. However, based on the Army's accession structure, only three percent of all recruits were assigned to occupations requiring this level of achievement on the EL composite. Thus this definition was too narrow for use as a high-tech category. For this reason, the SC and ST composites, which have often been used as appropriate criteria for screening recruits for highly technical occupations, were reviewed in terms of their related qualification rates and their role in the Army accession structure. As a result, occupations that require a score above 100 on the SC composite and occupations that require a score above 105 on the ST composite were added to the initially selected occupations which required a score above 110 on the EL composite. In the Army accession structure these high-tech ratings included about nine percent of recruits in FY 1990.

Three models were estimated in this thesis. A 'HIGHTECH' model estimated the likelihood of an individual being qualified for high-tech ratings as a function of race, gender, parents' education, poverty status, and geographic location. An 'INTEREST' model estimated the likelihood of being interested in the military as a function of eligibility for high-tech ratings, race, gender, parents' education, poverty status, and geographic location. A 'JOIN' model estimated the likelihood of enlisting in the military for males as a function of eligibility for high-tech ratings, level of interest, race, and geographic location.

The results of the three equations indicate that (1) these equations can be specified and estimated, (2) that market composition (i.e., race, gender, socioeconomic variables, high-tech eligibility, and interest level) systematically affect the model outcome for each model, and (3) that acceptable regional socioeconomic measures can be used to capture regional variation in the HIGHTECH market. These prototypical equations and this method of measuring the recruiting market for high-tech rating provide a good beginning for estimating the recruiting market for any specific occupation.

Further research should be done on the development of measures of high-tech qualification and interest for the gender specific differences which were shown in the 'HIGHTECH' and 'INTEREST' models.

APPENDIX A

CONVERSION OF RAW ASVAB DATA TO STANDARDIZED SCORES[1]

ASVAB standardized scores are computed through a conversion process using a linear transformation using a mean of 50 and a standard deviation of 10. The formula to transform a raw subtest score into a standard subtest score (SSS) is as follows:

$$SSS = (10/S)\ (NC-X) + 50,$$

where

SSS = the standardized subtest score (round this result to the nearest integer: if it is less than 20 raise it to 20 and if it is greater than 80 then lower it to 80)

S = the standard deviation of the subtest raw scores[2]

NC = the number of questions answered correctly for the given subtest (for Verbal this is the sum of the number answered correctly for Word Knowledge and Paragraph Comprehension)

X = the mean of the subtest raw scores[3]

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[1] See also Peterson, Jeff, ibid, 1990.
[2] Moreau, Ellen, ibid, 1991.
[3] Moreau, Ellen, ibid, 1991.

APPENDIX B

TABLE B-1. YOUTH NATIONAL LONGITUDINAL SURVEY (NLSY) VARIABLES USED IN DATA ANALYSIS

Variable Number	Variable Description and Survey Year
R 65	Highest Grade Attended by Mother (1979)
R 79	Highest Grade Attended by Father (1979)
R 96	Racial/Ethnic Origin (1979)
R 183	Which does Respondent Have, High School Diploma or GED (1979)
R 2148	Sex of Respondents (1979)
R 2149	Employment Status Record (1979)
R 2202	Age of Respondent (1980)
R 2300	Which does Respondent Have, High School Diploma or GED (1980)
R 2357	Interest in Military Enlistment (1980)
R 3935.10	Is Respondents Residence Urban/Rural (1980)
R 4063	Employment Status Record (1980)
R 4182	Which does Respondent Have, High School Diploma or GED (1981)
R 6150	ASVAB Subtest Raw Score; General Science (1980)
R 6151	ASVAB Subtest Raw Score; Arithmetic Reasoning (1980)
R 6152	ASVAB Subtest Raw Score; Word Knowledge (1980)
R 6153	ASVAB Subtest Raw Score; Paragraph Comprehension (1980)
R 6154	ASVAB Subtest Raw Score; Numerical Operations (1980)
R 6155	ASVAB Subtest Raw Score; Coding Speed (1980)
R 6156	ASVAB Subtest Raw Score; Auto and Shop Information (1980)
R 6157	ASVAB Subtest Raw Score; Mathematics Knowledge (1980)
R 6158	ASVAB Subtest Raw Score; Mechanical Comprehension (1980)
R 6159	ASVAB Subtest Raw Score; Electronics Information (1980)
R 6185	Family Poverty Status in 1980 (1981)
R 6457	Employment Status Record (1981)
R 6653	Which does Respondent Have, High School Diploma or GED (1982)
R 8977	Employment Status Record (1982)
R 9067	Which does Respondent Have, High School Diploma or GED (1983)
R 11463	Employment Status Record (1983)
R 15215	Employment Status Record (1984)
R 18922	Employment Status Record (1985)
R 22593	Employment Status Record (1986)
R 24467	Employment Status Record (1987)

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