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Effectiveness of the U.S. Navy's Basic Skills
Enhancement Program Entitled
Functional Applied Skills Training (FAST)

by

John K. Spendley

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Thesis Advisor: James Suchan

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This thesis explores the effectiveness of the U.S. Navy's basic skills enhancement program entitled Functional Applied Skills Training (FAST) in providing the basic reading skills necessary for enlisted personnel to more ably perform their jobs in the U.S. Navy fleet during the first three years of their enlistment. Current FAST program mission, FAST's impact on fleet job performance, and future U.S. Navy enlisted manpower requirements are examined to identify mission areas where program improvements can be made.

Enlisted advancement probabilities, which reflect enlisted job performance, for FAST program participants and non-participants were calculated using a statistical regression model. The results of these calculations indicate that a recruit's participation in the FAST program significantly increases his or her probability of advancing to grade E-4 within the first three years of his or her enlistment.

However, considering the anticipated defense drawdown and the need to enlist a cadre of high-quality service-members, the mission of the FAST program will require redefinition to avoid the ax that will be used to accomplish future budget cutbacks.

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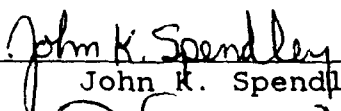B.S., University of Notre Dame, 1985

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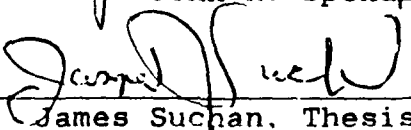
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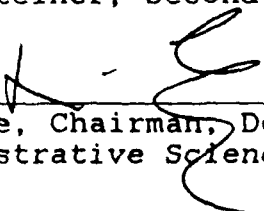
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ABSTRACT

This thesis explores the effectiveness of the U.S. Navy's basic skills enhancement program entitled Functional Applied Skills Training (FAST) in providing the basic reading skills necessary for enlisted personnel to more ably perform their jobs in the U.S. Navy fleet during the first three years of their enlistment. Current FAST program mission, FAST's impact on fleet job performance, and future U.S. Navy enlisted manpower requirements are examined to identify mission areas where program improvements can be made.

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I.   INTRODUCTION

A. BACKGROUND

In the civilian employment community, as well as the military, there is growing concern about workers' poor reading skills. Research conducted both in the civilian sector and in the military convincingly demonstrates that low basic reading skill levels of workers causes a significant loss in employee productivity (Mikulecky, 1982, p.453).

This problem has been the subject of increased attention during the past decade because of the drastic escalation in the demands on employees to process printed instructions. The 1790 U.S. Census results indicated less than ten percent of U.S. jobs required any reading skills; today, it is estimated over 95 percent of jobs in the U.S. require at least a basic reading skill level (Mikulecky, 1982, p.453). Mikulecky has also discovered that the heaviest job related reading is performed by new workers learning new jobs. This fact is significant for the U.S. Navy because all U.S. Navy recruits, which comprise approximately 20 percent of the U.S. Naval force, are new workers learning new jobs. In addition, new workers (Navy recruits) entering the work force with poor basic reading skill levels are less productive and cause more accidents and mistakes than entry-level workers who exhibit average or above average basic reading skill levels (Mikulecky, 1982, p.402).

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While many civilian companies have developed programs designed to combat the problem of low basic reading skill levels, the Navy, as yet, has not implemented a program specifically directed at combatting the problem of low basic reading skill levels. The Navy does, however, have a basic skills enhancement program entitled Functional Applied Skills Training (FAST), which is completed by 4,000 to 4,500 recruits per year prior to enrollment in basic recruit training (boot camp). This program was formulated in the early 1980s to increase the number of Qualified Military Accessions (QMA) available for recruitment in the face of a declining, post-baby boom, 17-21 year old population.

B. NAVY RECRUITING TARGETS

The U.S. Navy, which has operated since 1973 with an all-volunteer force, targets 17-21 year old, morally sound[1], Mental Category (CAT) I-IIIA individuals in its recruiting effort. The Navy considers these individuals to be the most desirable potential recruits. It should be noted that a potential recruit's Mental Category (CAT) is determined by his or her score on the Armed Forces Qualification Test (AFQT). This standardized test is

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[1]An individual is considered by the Navy to be morally sound if he or she has no past record of felony convictions, no previous drug use, and has no conscientious objection to serving in the military.

administered to every individual who seeks enlistment in the military. The following are the Mental Category designations derived from this test and the criteria establishing these designations:

1. CAT I is the designation given to a potential recruit who scores in the top 10 percent, as measured against his or her peers.

2. CAT II represents the eleventh through fortieth percentiles,

3. CAT IIIA the forty-first through fiftieth percentiles,

4. CAT IIIB the fifty-first through sixty-ninth percentiles, and

5. CAT IVA the seventieth through seventy-ninth percentiles.

It is because of these scores that CAT IIIB and CAT IVA individuals are considered by the Navy to be less desirable recruits than their CAT I-IIIA counterparts.

The accession goals established by the Navy in the Mid-1980s for some of its recruiting regions, however, far exceeded the number of people available from the desirable potential recruit population when considering the additional constraining variable of propensity to enlist in the Navy[2]. The strong U.S. economy and a relatively low civilian unemployment rate in the 1980s were the two most significant

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[2]An individual's propensity to enlist in the U.S. Navy must be evaluated when predicting the number of people that can be considered potential recruits. Not every CAT I-IIIA, morally sound, 17-21 year old individual that is interested in pursuing an enlistment into the Navy will ultimately decide to enlist.

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factors contributing to the overall low propensity to enlist in the Navy throughout many regions of the U.S.. Also, during the 1980s many desirable potential Navy recruits were attracted to other services. The higher propensity to enlist in the Army was most likely due to the Army's intensive advertising campaign, and the higher Air Force enlistment preference resulted from the Air Force's commitment to provide highly technical training and advanced educational opportunities for its enlisted personnel.

To offset this demand/supply imbalance, the U.S. Navy was compelled, in the Mid-1980s, to recruit Mental Category (CAT) IIIB and CAT IVA individuals. This policy, however, still did not produce the number of accessions required to meet the Navy's recruiting goals. The FAST program was, therefore, implemented by the Navy to help produce more qualified accessions. The following excerpt from a speech given in June 1990 by Dr. Imelda Idar of the Navy Training Command describes the mission of the FAST program:

> The mission of the Functional Applied Skills Training (FAST) program is to provide CAT IIIB and CAT IVA recruits, who would otherwise not qualify for enlistment, based on a score of 45 or below on the verbal (VE) portion of the Armed Services Vocational

Aptitude Battery (ASVAB) test[3], the specific skills identified as necessary to successfully complete the Recruit Training curriculum (boot camp). (Idar, 1990)

Basically, the FAST program was developed to provide those individuals identified as reading deficient, the reading skills necessary to enable them to successfully complete the academic challenges of boot camp. The measure of effectiveness (MOE) used in evaluating the success of the FAST program is, therefore, the boot camp graduation rate for FAST-educated recruits. This graduation rate has been reported to be 100 percent over the past five years (Idar, 1990). Therefore, the program has been judged to be highly effective and has enabled the U.S. Navy to meet its accession targets.

C. OBJECTIVES AND RESEARCH QUESTIONS

The Navy's FAST program is seemingly successful in accomplishing its stated mission. However, spill-over effects of the program, which are the indirect effects of program participation, such as the job performance of the graduates it produces and their contribution to the mission effectiveness of the U.S. Navy fleet, have never been

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[3]The Armed Services Vocational Aptitude Battery test is another standardized test that is administered to all potential military recruits to determine specific academic proficiency, including, but not limited to, mathematics and verbal abilities. The Navy has determined, based on Recruit Training academic attrition, that it is not cost-effective to enlist a person with a verbal ASVAB score of 45 or less.

evaluated. The following research questions, which will be answered in this thesis, will provide the information necessary to determine not only the value of the FAST program originating from the accomplishment of its stated mission but the value of the program derived from its spill-over effects:

1. Is the FAST course curriculum effective in increasing a recruit's ability to perform required job tasks in the U.S. Navy fleet by increasing the probability that he or she is promoted to E-4 within three years of his or her initial enlistment?

2. Is the FAST program cost-effective?

D. SCOPE AND LIMITATIONS

The scope of the research in this thesis will focus on the determination of the FAST program's effect on its participants' job performance. It will also include a preliminary cost/benefit analysis of the program and evaluate the possible need for program expansion.

Research into projected future U.S. Navy manpower requirements and their impact on the need for the FAST program will be conducted. Statistical analysis will be limited to the use of a category modeling (CATMOD) logistic regression (LOGIT) model, with maximum likelihood techniques, utilized to determine whether the FAST program is effective in increasing a recruit's ability to perform his or her assigned tasks in the U.S. Navy fleet.

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Since individual FAST course completion data were not recorded until 1987, the calculation of first-term attrition rates for FAST-educated sailors can not be completed until 1992, which limits the research effort in this thesis. The preliminary cost/benefit analysis in this thesis, therefore, will lack an analysis of the attrition behavior of FAST-educated recruits, which may be an important factor in the determination of FAST program cost-effectiveness.

E. ORGANIZATION OF STUDY

The next chapter of this thesis will address the previous literature written that is pertinent to this study. The third chapter will be a discussion of the statistical methodology used in determining whether the FAST program increases a recruit's ability to perform in the Navy fleet, and the fourth chapter will evaluate the results of this methodology. Finally, the conclusions and recommendations arising from this study will be presented.

II. LITERATURE REVIEW AND THEORETICAL FRAMEWORK

While no study has ever been completed on the spill-over effects of the FAST program, there have been some studies conducted on the adverse effects of low basic reading skill levels in the work force. Dr. Larry Mikulecky of Indiana University has done extensive work on the effects of low basic reading skill levels by workers in the U.S. work force. He has found, as was described earlier, that low basic reading skill levels by workers correlate to an increase in job performance errors and industrial accidents (Mikulecky, 1982, p.411). Mikulecky has also discovered that most of these errors and accidents are not due to misunderstandings of complex written directions, but the worker's inability to process (read) simple basic written instructions (Mikulecky, 1982, p.415).

These findings are supported by the research of Joseph Henry and Steven Raymond (Henry and Raymond, 1982, p.16). By surveying 184 businesses from the finance, manufacturing, services, and insurance industries, Henry and Raymond discovered that many workers have been killed simply because of the inability to read safety communications and warning signs (Henry and Raymond, 1982, p.6). The survey respondents also indicated that basic skills difficulties has become the

number one problem for businesses and the main factor slowing growth in industry (Henry and Raymond, 1982, p.12).

The civilian sector has launched a campaign to fight basic skills problems and many U.S. companies have implemented basic skills enhancement programs for their workers. In How to Gather and Develop Job Literacy Materials For Basic Skills Instruction, Drew and Mikulecky state that developing these basic skills enhancement programs is time consuming but necessary if these programs are expected to be successful (Drew and Mikulecky, 1988, p.1). They also suggest that many companies realize the need for providing their workers with basic skills instruction and that these companies are willing to invest the time and manpower necessary to ensure the success of the basic skills enhancement programs that they are implementing (Drew and Mikulecky, 1988, p.19). The verdict on their success has not yet been reached, but most companies seem to be encouraged by the initial results.

Basic skills enhancement programs, such as FAST, have also been implemented in the U.S. military; however, the focus of the basic skills enhancement programs, more specifically, the FAST program, seems to be different than that of similar civilian programs. The goal of the FAST program is to provide reading deficient recruits the skills necessary to complete boot camp training, not to provide

recruits the skills necessary to prevent on-the-job accidents and mistakes. In her evaluation of the U.S. Army's basic skills programs, which have similar goals as FAST, Joan Harman of the U.S. Army Research Institute for the Behavioral and Social Sciences suggests that basic skills programs in the military be evaluated for their effect on job performance and the prevention of accidents and mistakes, which are of greater value to the military than the academic preparation these programs provide (Harman, 1986, p.3). In <u>Characteristics of Effective Occupational Literacy Programs</u>, Thomas Cornell also stresses that before a basic literacy program is implemented it must include an extensive analysis of the anticipated job performance enhancement effects expected from the program (Cornell, 1988, p.2). This author agrees, and this thesis will, therefore, provide an analysis of FAST that measures the program's effect on job performance in the Navy fleet.

III. METHODOLOGY

A. DETERMINING WHETHER THE FAST PROGRAM EFFECTIVELY INCREASES A RECRUIT'S ABILITY TO PERFORM HIS OR HER ASSIGNED DUTIES IN THE U.S. NAVY FLEET--THE MODEL DESIGN

A category modeling (CATMOD) logistic regression (LOGIT) model with maximum likelihood estimation techniques was used to determine whether the FAST program effectively reduced the impact of the problem of low basic reading skill levels and their adverse effect on a recruit's ability to perform assigned duties in the fleet.[4]

A logistic regression (LOGIT) model was appropriate for this study because it allows for the use of an observable binary proxy variable (advanced, or not advanced, to E-4) in place of an unobservable, underlying response variable (the ability to successfully perform assigned duties in the fleet). Similarly, the SAS CATMOD LOGIT software procedure was appropriate because it represents the data in two-dimensional contingency tables, with the rows corresponding to samples formed on the basis of the independent variables: FAST course completion, education level, and AFQT percentile.

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[4]The category modeling (CATMOD) logistic regression (LOGIT) software procedure in SAS release 5.18, developed by the SAS Institute, Inc., Cary, North Carolina, was used.

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The data are represented in a contingency table to formulate an accurate evaluation of the effects of the FAST course completion variable which must be considered autonomously, free from any of the effects of the other variables that impact advancement to E-4. The specific similarities and differences between individuals in the sample group are summarized by the multivariate contingency table (Table 1). This table groups individuals sharing the same independent variable attributes. A CATMOD LOGIT procedure evaluates each of these groups and determines the probability of an individual's advancement to E-4 given that he or she meets the education level, FAST participation, and AFQT percentile criteria specified for a given group. The educational criteria used are whether an individual is not a high school graduate, a recipient of a general education diploma, a high school graduate, or has completed some college course-work are the education level criteria. Similarly, whether an individual has no FAST course participation or FAST course participation are the FAST participation criteria. Finally, whether an individual's AFQT percentile is less than 30, between 30 and 40, or greater than 40 are the AFQT percentile criteria. For example, the two following groups are among the twenty-four groups represented in the two-dimensional contingency table (Table 1):

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1. Group 7 - All individuals with a General Education Diploma (GED), who did not participate in the FAST program, and had an AFQT percentile score less than 30.

2. Group 8 - All individuals with a General Education Diploma (GED), who participated in the FAST program, and had an AFQT percentile score less than 30.

The model, therefore, allows for the effects of FAST course participation on advancement to E-4 to be isolated from the effects of education level and AFQT percentile which are also significant determiners of advancement to E-4. By comparing the advancement probabilities of, for example, groups 7 and 8 whose characteristics were described earlier, it can be determined how FAST course participation affects advancement to E-4[5], with all other contributing factors remaining equal. In the next chapter this comparison will be made among all of the twenty-four sample groups derived in this study.

The other factors (independent variables) were selected based on a two-step procedure:

1. All of the factors (intervening variables) that could be reasonably expected to effect promotion to E-4 which existed in computer data tape format were listed by the author. They are: race, primary occupational specialty, sex, home state, education level, ethnic group, AFQT percentile, and FAST course participation.

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[5]Advancement to E-4 is used to measure a recruit's ability to perform his or her assigned duties in the Navy fleet. The specific reasoning for using this performance measure will be explained later in this chapter.

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2. Principal component analysis (PROC PRINCOMP) was performed to derive linear combinations of these intervening variables that retain as much of the information, related to the dependent variable, as possible. The results of this analysis are included in Table 2 and indicate three significant determining factors of promotion to E-4: education level, AFQT percentile, and FAST course participation.

B. SAMPLE GROUP

The sample group used for the study was selected from recruits who entered the Navy in fiscal year (FY) 1987. Originally, this thesis intended to investigate not only the performance of FAST-educated recruits but also their first-term attrition rate, which is the rate at which sailors leave the Navy after completing their first term of enlistment.

A difference in attrition rates for FAST-educated recruits versus other CAT IIIB and CAT IVA recruits could provide useful information when determining the value of the FAST program. If the attrition rate was found to be greater, the FAST program could be considered detrimental to the cost-effectiveness of recruiting CAT IIIB and CAT IVA personnel. Conversely, if this rate was found to be smaller, the FAST program could be considered valuable to the retention of experienced sailors. However, individual FAST course completion data were not recorded until 1987 which prevents any calculation of attrition rates for FAST-educated sailors until 1992.

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C. DATA SET

The data set used in developing this model was derived
by merging the Defense Manpower Data Center's (DMDC)
Enlisted Master File (EMF) and the Navy Personnel Research
and Development Center's (NPRDC) Training Tracking
(TrainTrak) file. The EMF contains the necessary individual
education level, AFQT percentile, and advancement to E-4
information, while the TrainTrak file contains the requisite
individual FAST course completion data.

The model's cohort includes those who participated in
the four week FAST course and all other mental category
(CAT) IIIB and CAT IVA recruits. To measure a recruit's
ability to perform assigned duties in the fleet (binomial
dependent variable), individuals from the sample group were
classified as advanced to grade E-4 within three years of
their initial enlistment or not advanced to grade E-4.

D. PERFORMANCE MEASURE JUSTIFICATION

There were two reasons for using advancement to grade
E-4 as the performance measure for this model. First, the
Navy promotion boards use job performance as the primary
criterion for promotion decisions and specify that a
service-member demonstrates a specific level of knowledge in
his or her rating, coupled with the proven ability to
consistently and effectively complete his or her assigned

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tasks. Therefore, those individuals promoted to E-4 can be considered better fleet performers than those not promoted. Secondly, the enlisted advancement system in the U.S. Navy virtually guarantees universal advancement of E-1s to grades E-2, and E-3 at pre-specified length of service (LOS) points. Therefore, these promotions do not reflect fleet performance and are invalid performance predictors.

Two alternative performance measures, enlisted evaluations and A-school performance, were considered in the development of this model, but proved to be ineffective. Enlisted evaluation data were not used because they are only recorded in document form. Compiling the data for use in a computer generated model would have been unnecessarily laborious given the fact that enlisted advancement data were so readily available on computer data tapes. Secondly, Navy A-school (an occupational specific schooling system) performance was considered as a job performance measure, but recent research has indicated that satisfactory training performance does not necessarily reflect satisfactory job performance (Livingston, 1987). This is not to say that the 1987 study by Dr. Livingston indicates that the completion of training courses did not provide individuals an important base of information necessary to perform certain jobs; however, it did find that exemplary performance by individuals in training curricula does not necessarily

correlate to exemplary job performance by these individuals. Basically, many of the skills needed to perform well in an academic environment were found to be different from those required to perform well in an employment-oriented environment. Additionally, after further investigation, only a small percentage of CAT IIIB and CAT IVA personnel are selected to attend a Navy A-school. This would, consequently, reduce the model sample size to a statistically insignificant level.

All of these independent variables, as well as the dependent variable (promoted to E-4 or not promoted), were contained in the data set mentioned earlier that was formulated by merging the DMDC's EMF and NPRDC's TrainTrak files. The merged data set contained 15,409 observations; that is, 15,409 CAT IIIB and CAT IVA recruits from 1987 comprised the data set used for analysis in this model.

E. INDEPENDENT VARIABLE ASSIGNMENTS

The procedure used for assigning values to the dependent variable has already been discussed; however, the procedure for assigning values to the independent variables should be addressed before confronting the specifics of the model's calculation techniques and the significance of these techniques. The independent variable FAST course completion was assigned a value of 1 for individuals in the sample

group who completed the FAST course and 0 for those who did not. The independent variable education level was assigned a value of 3 for individuals who completed some college course work or even obtained a college degree, 2 for individuals who obtained a high school diploma, 1 for individuals who obtained a General Education Diploma (GED), and 0 for individuals who did not obtain a high school diploma. The independent variable, AFQT percentile, was assigned the value of 2 for individuals with AFQT percentile scores greater than 40, 1 for individuals with scores between 30 and 40, and 0 for individuals with scores less than 30.

These independent variables, therefore, describe the characteristics of each individual in the data set. If an individual participated in the FAST program, was a high school graduate, and had an AFQT percentile score less than 30, the independent variables FAST completion, education level, and AFQT percentile would be assigned the values 1,2,0, respectively. Also, this individual would be grouped in a category (described earlier in this chapter) with all other individuals whose independent variable assignments were 1,2,0 (respectively) for the independent variables FAST completion, education level, and AFQT percentile.

The model results will, therefore, describe the behavior of each group (or category) of individuals. For example, the statistical analysis results will indicate a probability of

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advancement for the group of individuals having the

independent variable assignments 1,2,0 (respectively) for

the independent variables FAST completion, education level,

and AFQT percentile. It will also indicate a probability of

advancement for the other twenty-three groups in the model.

These results are summarized and described in the following

chapter.

F. VALIDATING THE STATISTICAL SIGNIFICANCE OF THE RESULTS

Before discussing the results of this model, the tests

used to validate the statistical significance of this model

should be addressed. Verification of the statistical

significance of a logistic regression model is accomplished

through the use of three generally accepted statistical

validity verification tests.

The first test involves an evaluation of the

significance level of the parameter estimates for the

logistic regression equation. Before the CATMOD LOGIT

procedure calculates probabilities for each of the

categories (found in Table 5) described earlier in this

chapter, it derives estimates for each independent

variable's impact on the dependent variable--advancement to

E-4. These results can be found in Table 3. The reason that

these estimates were not previously discussed is because

they are expressed in a confusing mathematical form (as a

natural log) that is ultimately converted into the easily understandable probability calculations that are shown in Table 5.

These parameter estimates are important because they describe the statistical significance of each independent variable in the model, which is also shown in Table 3. The significance level of these parameter estimates are interpreted as the probability that the results obtained from each independent variable were derived by chance alone. For example, Table 3 indicates that the significance level of the variable, AFQT percentile (less than 30), is .0001. This means that the probability that the results in the model, involving the categories that include an AFQT percentile less than 30, were obtained by chance alone is one-one-hundredth of one percent. The significance level, for each independent variable in a statistical model, that is generally accepted as an indicator of a valid model is five percent or less. As Table 3 indicates, all of the independent variables meet this criterion. Therefore, this model, based on the calculations derived from these independent variables, appears to be valid.

The second test used for statistical significance verification in a CATMOD LOGIT procedure involves a model goodness-of-fit test, which evaluates whether the model adequately explains the variance that exists in the data. A

chi-square, which is the type of statistical distribution pattern that the variance of a logistic regression model imitates, value is computed. This value is specifically calculated for the likelihood ratio test statistic, which is the statistic that determines the likelihood that the model explains the variance in the data. It is then transformed into a probability calculation (Barr, 1987, p.138). This calculation does not allow for the conclusion that the model does, in fact, conclusively explain the variance in the data; however, it is used to verify that the following conclusion can not be made: the model does not explain the variance in the data. Basically, the statistical importance of this calculation is interpreted in the following manner: if the probability calculation for the likelihood ratio statistic is greater than .05, the hypothesis that the model explains the variance in the data can not be rejected.

The likelihood ratio statistic for this model is found in Table 4. Since the probability calculation for this statistic is .8210, the hypothesis that the model explains the variance in the data can not be rejected.

The third and final procedure used to verify the statistical significance of the results of a CATMOD LOGIT regression procedure is a Wald test. A Wald test evaluates whether the parameter estimates, described earlier in this chapter, are significantly different from 0. Chi-square

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values are used in conducting this test, as they were for the goodness-of-fit test. A chi-square value is calculated for each of the independent variables in the model and is subsequently converted into probability calculations (Table 4), which describe the level of significance of each independent variable in the following manner: the independent variables level of education, FAST completion, and AFQT percentile, are all different from 0 at the .0001 level of significance.

In statistical analysis, significance level is inversely proportional to the significance of a statistic (i.e. a .0001 level of significance is more significant than a .001 level of significance). The standard significance level used to determine statistical significance is .05. Therefore, all three independent variables in this model are considered significantly different from 0.

The following chapter will be a presentation and analysis of these statistically significant results.

IV. PRESENTATIᴏᴺ ᴵ OF DATA COLLECTED AND DATA ANALYSIS

A. DETERMINING WHETHER THE FAST PROGRAM EFFECTIVELY INCREASES A RECRUIT'S ABILITY TO PERFORM HIS OR HER ASSIGNED DUTIES IN THE U.S. NAVY FLEET--THE MODEL RESULTS

As was discussed in Chapter **III**, The CATMOD LOGIT procedure evaluated all 15,409 individuals in the data set, and, based on the values assigned to the independent variables, grouped all individuals with similar independent variable characteristics. These groupings allow for the analysis of advancement to E-4 probabilities to be conducted for each group.

Groups with a different FAST course completion characteristic, but similar education level and AFQT percentile characteristics, can be compared to determine the effect of FAST course completion on advancement to E-4. For example, the following extract from Table 5 compares advancement probabilities for individuals in the first two groups of the model:

Group	Probability of Advancing to E-4
No HS diploma,	
No FAST participation,	.06
AFQT percentile < 30	

No HS diploma,

FAST participation,   .17

AFQT percentile < 30

Therefore, it can be concluded that an individual
without a high school diploma, who has an AFQT percentile
score less than 30, and participated in the FAST program, is
2.83 times more likely to be advanced to E-4 than an
individual, with similar education level and AFQT percentile
characteristics, who did not participate in the FAST
program. In fact, FAST participation increases the
probability of advancement to E-4 in all the categories
derived by the model.

B. ADVANCEMENT LIKELIHOODS

The following describes the difference in the likelihood
of advancement to E-4 between each pairs of groups that have
similar education level and AFQT percentile characteristics
but a different FAST completion characteristic:

Group x is ? times more likely to be advanced than Group y

No HS diploma FAST AFQT < 30	is 2.83 times more likely to be advanced to E-4 than	No HS diploma No FAST AFQT < 30
No HS diploma FAST 30 < AFQT < 40	is 2.86 times more likely to be advanced to E-4 than	No HS diploma No FAST 30 < AFQT < 40
No HS diploma FAST AFQT > 40	is 2.56 times more likely to be advanced to E-4 than	No HS diploma No FAST AFQT > 40

Group x is ? times more likely to be advanced than Group y.

GED		GED
FAST	is 1.91 times more likely	No FAST
AFQT < 30	to be advanced to E-4 than	AFQT < 30

GED		GED
FAST	is 2.88 times more likely	NO FAST
30 < AFQT < 40	to be advanced to E-4 than	30 < AFQT < 40

GED		GED
FAST	is 2.55 times more likely	No FAST
AFQT > 40	to be advanced to E-4 than	AFQT > 40

HS diploma		HS diploma
FAST	is 2.32 times more likely	No FAST
AFQT < 30	to be advanced to E-4 than	AFQT < 30

HS diploma		HS diploma
FAST	is 2.18 times more likely	No FAST
30 < AFQT < 40	to be advanced to E-4 than	30 < AFQT < 40

HS diploma		HS diploma
FAST	is 2.07 times more likely	No FAST
AFQT > 40	to be advanced to E-4 than	AFQT > 40

Some college		Some college
FAST	is 2.26 times more likely	No FAST
AFQT < 30	to be advanced to E-4 than	AFQT < 30

Some college		Some college
FAST	is 2.23 times more likely	No FAST
30 < AFQT < 40	to be advanced to E-4 than	30 < AFQT < 40

Some college		Some college
FAST	is 2.04 times more likely	No FAST
AFQT > 40	to be advanced to E-4 than	AFQT > 40

The above data indicate that, on the average, those individuals who participated in the FAST course, holding all other contributing factors equal, are 2.40 times more likely to be promoted to E-4 than their counterparts who did not participate in the FAST program. The model describes, then,

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that the FAST program increases a recruit's ability to perform his or her assigned tasks in the U.S. Navy fleet by a factor greater than two.

C. ADDITIONAL ANALYSIS OF THE RESULTS

While this is the most important result derived in this statistical model, there are other interesting interpretations of the statistical probability results presented in Table 5. First, the advancement probabilities indicate that FAST is overall most effective with those individuals without a high school diploma. Those individuals without a high school diploma who participate in FAST are 2.75 times more likely to be promoted to E-4, within the first three years of their enlistment, than those without a high school diploma who do not participate in FAST. Also, the advancement probabilities indicate that FAST is overall least effective with those individuals who have completed some college course work. Those individuals who have completed some college course work and participated in FAST are 2.18 times more likely to be promoted to E-4 than those who have completed some college course work and did not participate in FAST.

These results are reassuring because they conform with logically sound intuitive reasoning. It makes sense that the FAST program is more effective for non-high school graduates

than those who have completed some college course work because it seems that non-high school graduates would have a greater need for, and could therefore make better use of, any concepts and skills learned in a basic reading skills education program like FAST.

Additionally, evaluation of the impact of FAST on different AFQT percentile groups yields consistent multiplicative impact factors. Those individuals with an AFQT percentile score less than thirty who participated in the FAST program are 2.33 times more likely to be advanced to E-4 than those with an AFQT percentile score less than thirty who did not participate in FAST. Similarly, those with an AFQT percentile score between thirty and forty are 2.43 times more likely to be advanced to E-4 than those with an AFQT percentile score between thirty and forty who did not participate in FAST. Finally, those with an AFQT percentile score greater than forty who participated in FAST are 2.30 times more likely to be advanced to E-4 than those with an AFQT percentile score greater than forty who did not participate in FAST.

Again, these results make sense. Since AFQT percentiles are derived from a combination of all of the scores on various sections of the AFQT (verbal or reading ability being only one section of the test), an individual with an AFQT percentile less than thirty is not necessarily more

reading deficient than an individual with an AFQT percentile between thirty and forty or an individual with an AFQT percentile greater than forty. In fact, an individual with an AFQT percentile less than thirty may even be less reading deficient than an individual with an AFQT percentile score between thirty and forty or an individual with an AFQT percentile greater than forty. Therefore, similar multiplicative factors were reasonably expected for all AFQT percentile groups.

Therefore, while the results of this model show that FAST contributes significantly in increasing the probability that a recruit is advanced to E-4, which reflects an increased ability to perform in the fleet, the results can also be considered intuitively logical. Basically, the results make sense.

V. PRELIMINARY COST/BENEFIT ANALYSIS OF THE FAST PROGRAM

While the FAST program has been shown to be highly effective in helping recruits get promoted to E-4, defining the true effectiveness of the program must include an evaluation of the costs of the program compared to the benefits realized from program implementation.

A. THE COSTS

The cost of the FAST program is easily calculated. The operating budget outlay for the FAST program in fiscal year (FY) 1987 was approximately $660,000 (Idar, 1990). The FAST curriculum was completed by 4,231 CAT IIIB and CAT IVA recruits who received E-1 pay during the four-week course, which equates to a foregone Navy labor cost of $4,518,708 (see Appendix A). Therefore, the variable cost of the FAST program is estimated to be $5,178,708 for FY 1987.

The benefits of the FAST program, however, are not as easily quantified. FAST program advocates insist that because the boot camp graduation rate for FAST-educated recruits is 100 percent, while the graduation rate of those who did not participate in FAST is 94 percent, the program is highly effective and justifies to the "holders of the Navy purse strings" that the program should receive continued funding. But the budget decision-makers need to

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become convinced that this qualitative measure of effectiveness correlates to an actual cost-effectiveness, not an impossible, but a seemingly difficult task.

While all the data do not exist to fully evaluate the cost-effectiveness of the FAST program (the first-term attrition data, which is an important factor in the determination of FAST program cost-effectiveness, will be unavailable until 1992), the remainder of this chapter will provide a shell for a complete cost/benefit analysis of the FAST program. This thesis will evaluate the boot camp attrition savings due to FAST, the savings from a decrease in job related accidents and mistakes due to FAST, and the savings from maintaining an over-all better cadre of enlisted personnel in the Navy due to the FAST program.

B. THE BENEFITS

First, the average boot camp, academic-related, attrition rate is approximately 6 percent (Idar, 1990). Because FAST-educated recruits have a 0 percent boot camp attrition rate, these statistics can be converted into an annual attrition dollar savings, directly related to FAST program participation, by using the equation:

$$(.06 - 0) \times 4,231 \times 2 \times \$1068 = \$542,244.96$$

Where,

.06   is the academic attrition rate for recruits in boot camp.

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0   is the academic attrition rate for FAST-educated
        recruits in boot camp.

4,321   is the number of FAST-educated recruits attending
        boot camp in 1987.

2   is the average number of months that an academically
        unsuccessful recruit participates in boot camp before
        he or she is separated from the Navy.

$1068   is the average 1987 monthly E-1 compensation wage.

Therefore, the Navy recuperates almost ten percent of

its investment in the FAST program merely from the decreased

boot camp attrition rate for FAST-educated recruits.

The other benefits of the FAST program are very

difficult to quantify. Those accepted into the FAST program

have reading skill levels below the acceptable Navy limit.

One of the reasons that this limit has been established is

because of convincing research showing that low basic

reading skill levels of entry-level workers (recruits) can

cause not only an increase in accidents and mistakes but

also a significant loss in employee productivity (Mikulecky,

1982, p.411). Therefore, if a FAST education was not

provided to these otherwise unqualified recruits, who, by

earlier evidence, are needed to meet Navy recruiting quotas,

the U.S. Navy might experience an increase in accidents and

mistakes.

Quantifying the cost savings gained from preventing

these possible accidents and mistakes can only be

speculated. However, given the extremely high cost of Navy

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equipment, even a series of minor accidents due to poor reading ability would cost the Navy far more than the the $4.6 million necessary to deem the FAST course a cost-effective program.

Another benefit of the FAST program that is difficult to quantify is the FAST-educated recruit's increased ability to perform required job tasks after assuming his or her duties in the U.S. Navy fleet. Calculating this benefit is once again extremely difficult. However, given the fact that the FAST program contributes positively to the mission performance of the U.S. Navy can only strengthen the acceptance of the hypothesis that FAST is a cost-effective program. Any Navy program that is developed and proven to increase the Navy's mission effectiveness, for example the Navy's F-14 program, will be considered cost-effective even if the quantifiable benefits (in dollars saved) are less than the total cost of the program (within reasonable limits).

Finally, the social and political benefits of the FAST program must also be considered. The FAST program provides CAT IIIB and CAT IVA individuals, who would otherwise not qualify for military service and who are considered to be socially disadvantaged youth, the opportunity for productive employment. These individuals also receive extensive training which provides them with skills that are marketable

in the civilian work force. Many of these individuals could

eventually find themselves as a part of the U.S. welfare or

correctional systems. However, in most cases the FAST

program can prevent this from happening, thereby relieving

some of the stress placed on these two social institutions.

Again, quantifying this benefit is very difficult, but the

social cost savings do exist.

The political benefit of FAST further supports its

usefulness. Because FAST provides educational opportunities

for disadvantaged youth and eventually aids in improving the

Navy's mission effectiveness, FAST enhances the image of the

Navy as it is viewed by Congressional and Department of

Defense (funding) decision-makers--a very important benefit

when considering the unavoidable future DOD budget cuts.

The following chart summarizes the preliminary

cost/benefit analysis of FAST:

<u>COST</u>	<u>BENEFITS</u>
$5,178,708 per annum.	1. Boot camp attrition savings - $542,244
	2. Cost savings gained from preventing accidents and mistakes
	3. Recruit's increased ability to perform required job tasks
	4. Possible savings by the U.S. welfare and correctional systems
	5. The value of FAST as a public relations tool

While many of the benefits of FAST are difficult to quantify, the evidence in this chapter suggests that the cost savings gained from the benefits of FAST are probably greater than the actual cost of the program, thereby indicating that FAST is a cost-effective program.

VI. CONCLUSIONS AND RECOMMENDATIONS

A. FAST RECOMMENDATION

The FAST program has been shown to more than double the probability that a recruit will be advanced to E-4 within the first three years of his or her enlistment. Also, a preliminary cost/benefit analysis of FAST indicates that the FAST program is cost-effective. However, with the recent events in Eastern Europe and the Soviet Union, U.S. military force reductions are imminent and could possibly eliminate the need to enlist CAT IIIB and CAT IVA personnel, thereby maintaining a cadre of high quality service members and abolishing the need for the FAST program. A June 1990 Congressional Budget Office (CBO) report on the future military personnel reductions suggested that a military force drawdown be accomplished by an across-the-board reduction in force, including a 20,000 person annual reduction in Navy accession over the next five years. Mr. David Rodney of the Center For Naval Analyses proposes a similar across-the-board reduction in force in his 1990 study, Managing a Decline in Enlisted Endstrength (Rodney, 1990, p.42).

Since approximately 15,000 CAT IIIB and CAT IVA recruits during the past four years annually enlist in the Navy, it

may seem logical that the impending reduction in accessions target this population. However, there are two significant reasons that this will probably not happen. First, as recruiting goals are cut, it is likely that funding for recruiting will be cut proportio..ally, which will adversely affect the Navy's ability to attract the number of CAT I-IIIA personnel required to meet its recruiting goals. Additionally, the military has received increasing political pressure from Congress to provide disadvantaged youth, most of whom are CAT IIIB and CAT IVA potential recruits, with an opportunity to enlist in the military so that they may achieve upward social mobility, thereby relieving pressure on the U.S. welfare system (Mehay, 1990).

This is not to say the population of CAT IIIB and CAT IVA recruits will not decline. However, this population will not be eliminated or even reduced at a higher proportion than the population of CAT I-IIIA recruits. Because the population of CAT IIIB and CAT IVA recruits will most likely experience a marginal decline, though, over the next five years, it appears the requirements for FAST program services will also decline. But does this mean that funding for this FAST program should be reduced?

No. However, the FAST program requires expansion and redefinition to maximize its benefits to the U.S. Navy. First, the FAST mission should be changed. The current FAST

mission is to provide certain reading deficient recruits the skills necessary to complete the academic challenges of boot camp. But FAST program's value is rooted in its ability to train recruits to be better job performers. Therefore, the mission should focus on this important benefit of the program. A 1986 U.S. Army Research Institute report on the effectiveness of U.S. Army basic skills enhancement programs emphasizes the benefit of improved job performance (Harman, 1986, p.1).

It states:

> The ultimate value of basic skills education lies in the extent to which program components increase the proficiency with which soldiers carry out carry out their job tasks, not on increases in test scores and general academic school performance. None of these programs have ever attempted to measure effects on job task proficiency or job performance. (Harman, 1986)

It seems as though the Navy is "putting the cart before the horse" in its current FAST program mission. The Navy should instead "put the horse in front of the cart" and change the mission of the FAST program to focus on training recruits to be better job performers, the FAST program's true value.

While changing the mission of the FAST program is the first step necessary in expanding the scope of the benefits the program provides, it is also recommended that participation in the program be increased. The FAST program

has been shown to increase the job performance of reading deficient recruits which ultimately aids in increasing the mission effectiveness of the Navy. Currently, 25 percent of U.S. Navy recruits (or approximately 20,000 Navy enlistees annually), most of whom are high school graduates, read below the ninth-grade level (Idar, 1990). Because this reading inadequacy is only captured in the verbal section of the ASVAB and AFQT tests, these reading deficient individuals are not necessarily designated CAT IIIB and CAT IVA recruits; many of them are designated CAT II and CAT IIIA because their scores on the other, non-verbal sections (for example, mathematical ability) of the tests may be very high resulting in an average over-all score that is considered to meet the criteria of a higher category designation. The model developed in this thesis suggests that if these reading deficient recruits were enrolled in the FAST program, their probability of being promoted to E-4 would increase, thereby indicating that their ability to perform their job tasks would increase, which would aid in maximizing Navy personnel effectiveness. Therefore, the FAST program should include participation by, not only the 4,000 to 4,500 CAT IIIB and CAT IVA personnel annually enrolled in the program, but the 20,000 people enlisting in the U.S. Navy annually who read below the ninth-grade level.

The Navy, as well as the other armed service branches, is becoming more and more technically oriented; consequently, there will be a greater need to ensure personnel have adequate reading and comprehension skills to understand the technical manuals and instructions necessary to operate and repair equipment and machinery. Continued funding of the FAST program will ensure that Navy personnel are provided with the reading skills necessary to perform as competent technicians in this highly technical environment.

B. RECOMMENDATION FOR FURTHER RESEARCH

While this thesis has shown that there are many benefits derived from the spill-over effects of the FAST program, there are areas in which further research should be conducted. When sufficient data become available in 1992, a study of the first-term attrition behavior of FAST-educated recruits should be conducted. This study should ask the following questions:

1. Does participation in the FAST program result in a decreased first-term attrition rate, thereby furtner supporting the argument that the FAST program is a cost-effective Navy program? or

2. Does FAST participation result in an increased first-term attrition rate and detract from the program support that has been shown, in this thesis, to be justifiable support?

Also, as information becomes available in the future, an analysis of E-5 and E-6 advancement probabilities should be

performed, comparing advancement rates for FAST-educated and non-FAST-educated, CAT IIIB and CAT IVA personnel. It will be interesting to find out whether the increased probability of advancement to E-4 for FAST-educated personnel yields similar results when considering E-5 and E-6 advancement data.

Finally, quantifying the social cost savings and the savings due to a possible decrease in the accident rate for FAST-educated personnel was beyond the scope of this thesis. It is recommended that a future thesis focus on completing a comprehensive cost/benefit analysis of the FAST program which includes a study of the average individual accident rate (in dollar cost per person) for all Navy personnel versus the accident rate for FAST educated personnel. In addition, an estimate of the social cost savings due to participation in the FAST program should be examined.

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TABLE 1

MULTIVARIATE CONTINGENCY TABLE

Sample	Education Level	FAST Completed?	AFQT Percentile
1	No HS Diploma	No	Less than 30
2	No HS diploma	Yes	Less than 30
3	No HS diploma	No	Between 30 and 40
4	No HS diploma	Yes	Between 30 and 40
5	No HS diploma	No	Greater than 40
6	No HS diploma	Yes	Greater than 40
7	GED	No	Less than 30
8	GED	Yes	Less than 30
9	GED	No	Between 30 and 40
10	GED	Yes	Between 30 and 40
11	GED	No	Greater than 40
12	GED	Yes	Greater than 40
13	HS diploma	No	Less than 30
14	HS diploma	Yes	Less than 30
15	HS diploma	No	Between 30 and 40
16	HS diploma	Yes	Between 30 and 40
17	HS diploma	No	Greater than 40
18	HS diploma	Yes	Greater than 40

Sample	Education Level	FAST Completed?	AFQT Percentile
19	Some college	No	Less than 30
20	Some college	Yes	Less than 30
21	Some college	No	Between 30 and 40
22	Some college	Yes	Between 30 and 40
23	Some college	No	Greater than 40
24	Some college	Yes	Greater than 40

TABLE 2

PRINCIPAL COMPONENT ANALYSIS RESULTS

Correlations

	EL	HS	RC	SX	FC	E	AP
PG	.07*	.02	-.00	.00	-.06*	-.02	.10*

Where:

PG represents advancement to E-4

EL represents education level

HS represents home state

RC represents race

SX represents sex

FC represents FAST course completion

E represents ethnic group

AP represents AFQT score percentile

*These correlation statistics are the largest, indicating the intervening variables (education level, FAST course completion, and AFQT percentile) retain more information, related to the dependent variable (advancement to E-4), than the other variables (home state, race, sex, and ethnic group) proposed for use in the model.

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TABLE 3

PARAMETER ESTIMATES FOR THE LOGISTIC REGRESSION EQUATION

	ESTIMATE	Significance Level
Intercept	1.26	.0001
Level of education (No HS degree)	.69	.0016
Level of education (GED)	.53	.0001
Level of education (HS degree)	-.64	.0001
Level of education (Some college)	-.58	.0001
FAST course completion (Not completed)	.61	.0001
FAST course completion (Completed)	-.61	.0001
AFQT percentile (Less than 30)	.21	.0001
AFQT percentile (Between 30 and 40)	.05	.0296
AFQT percentile (Greater than 40)	-.26	.0001

TABLE 4

ANALYSIS OF VARIANCE

Source	Degrees of Freedom	Chi-Square	Probability
Intercept	1	110.84	.0001
Level of education	3	119.04	.0001
FAST completion	1	50.79	.0001
AFQT percentile	2	154.52	.0001
Likelihood Ratio	15	9.98	.8210

TABLE 5

PROBABILITY ESTIMATES

Sample	Probability of Advancing to E-4	Probability of Not Advancing to E-4
No HS diploma, No FAST, AFQT < 30	.06	.94
No HS diploma, FAST, AFQT < 30	.17	.83
No HS diploma, No FAST, 30 < AFQT < 40	.07	.93
No HS diploma, FAST, 30 < AFQT < 40	.20	.80
No HS diploma, No FAST, AFQT > 40	.09	.91
No HS diploma, FAST AFQT > 40	.23	.77
GED, No FAST, AFQT < 30	.11	.89
GED, FAST AFQT < 30	.21	.79

GED, No FAST, 30 < AFQT < 40	.08	.92
GED, FAST, 30 < AFQT < 40	.23	.77
GED, No FAST, AFQT > 40	.11	.89
GED, FAST, AFQT > 40	.28	.72
HS diploma, No FAST, AFQT < 30	.19	.81
HS diploma, FAST, AFQT < 30	.44	.56
HS diploma, No FAST, 30 < AFQT < 40	.22	.78
HS diploma, FAST, 30 < AFQT < 40	.48	.52
HS diploma, No FAST, AFQT > 40	.27	.73
HS diploma, FAST, AFQT > 40	.56	.44

Some college, No FAST, AFQT < 30	.19	.81
Some college, FAST, AFQT < 30	.43	.57
Some college, No FAST, 30 < AFQT < 40	.21	.79
Some college, FAST, 30 < AFQT < 40	.47	.53
Some college, No FAST, AFQT > 40	.27	.73
Some college, FAST, AFQT > 40	.55	.45

APPENDIX A

In Chapter V, Foregone labor cost was calculated by the
following equation :   4,231 x $1068 = $4,518,708

Where,

        4,231 is the number of recruits completing the FAST

        program in 1987.

                     --and--

        $1068 is the average 1987 monthly E-1 compensation
        wage.

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