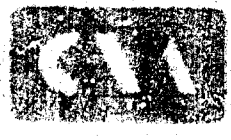
CNSR 9 / September 1981

FINAL REPORT OF THE MANPOWER AVAILABILITY STUDY

Robert F. Lockman
Jean W. Fletcher
Philip M. Lurie
Alan J. Marcus
James S. Thomason



CENTER FOR NAVAL ANALYSES

Work conducted under contract N00014-76-C-0001

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER CNSR 9	2. GOVT ACCESSION NO. AD-A 1	3. RECIPIENT'S CATALOG NUMBER 09699
4. TITLE (and Subtitle) Final Report of the Manpower Availability Study		5. TYPE OF REPORT & PERIOD COVERED 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Robert F. Lockman, Jean W. Fletcher, Philip M. Lurie, Alan J. Marcus, James S. Thomason		8. CONTRACT OR GRANT NUMBER(s) N00014-76-C-0001
9. PERFORMING ORGANIZATION NAME AND ADDRESS Center for Naval Analyses 2000 No. Beauregard Street Alexandria, Virginia 22311		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Office of Naval Research Department of the Navy Arlington, Virginia 22217		12. REPORT DATE Sep 1981 13. NUMBER OF PAGES 27
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office) Office of the Chief of Naval Operations (Op96) Department of the Navy Arlington, Virginia 22217		15. SECURITY CLASS. (of this report) Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

The work reported here was conducted under the direction of the Center for Naval Analyses and represents the opinion of the Center for Naval Analyses at the time of issue. It does not necessarily represent the opinion of the Department of the Navy except to the extent indicated by the comments of the Chief of Naval Operations.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

AFQT, ASVAB, attitudes (psychology), enlisted personnel, enlistment, manpower utilization, naval personnel, personnel retention, personnel selection, ratings, recruits, reenlistment, SCREEN, survival (personnel)

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

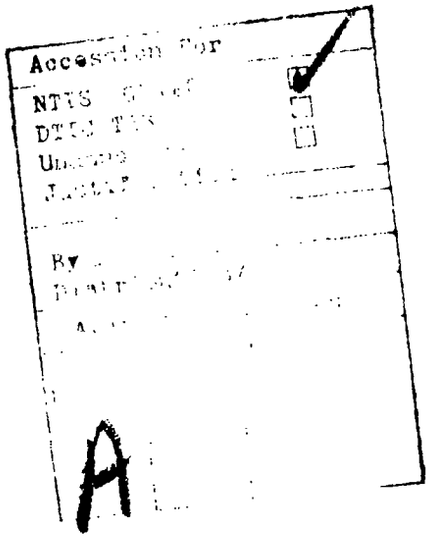
Ways to expand the Navy manpower pool by qualifying more applicants for enlistment and retaining them longer were explored. They include (1) alternative enlistment standards, (2) separate recruit screening procedures for Class A school and apprenticeship trainees, and (3) rating assignments to increase retention. Attitudes toward Navy jobs and military life that affect first-term and career enlistment decisions differently also were identified.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE
S/N 0102-LF-014-6601

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

0772 70

[7]Contributors: Kurt L. Giesler and Kathye D. Rutledge



DEPARTMENT OF THE NAVY
OFFICE OF THE CHIEF OF NAVAL OPERATIONS
WASHINGTON, DC 20350

IN REPLY REFER TO
Ser 964/333833
19 NOV 1981

From: Chief of Naval Operations
To: Distribution List

Subj: Manpower Availability Study (MAST) Summary report; promulgation of

Encl: (1) CNA, Summary Report 9, "Final Report of the Manpower Availability Study," Unclassified, September 1981

1. The Center for Naval Analyses was requested to examine ways of expanding the Navy manpower pool by qualifying more applicants for enlistment and improving retention of those who enlist. Specifically, the tasks were to study enlistment standards, Class A school and apprenticeship trainee screening procedures, rating assignments, and the relationship of attitudes toward pay, Navy jobs, and military life to first-term and career reenlistment decisions.

2. The variety and volume of material addressed in each task report prohibited publication of one all-inclusive study. Consequently, enclosure (1) highlights the findings of each study task. Requests for copies of the individual reports referenced in this study should be forwarded to the Center for Naval Analyses. The MAST study contributed to the Navy's understanding of alternative screening, placement, and retention programs for use in effective personnel management.

3. Enclosure (1) is forwarded.

C. A. H. Trost

C. A. H. TROST
VICE ADMIRAL, U.S. NAVY
DIRECTOR, NAVY [illegible] PLANNING

Distribution list:

SNDL

A1	Immediate Office of the Secretary (ASSTSECNAV MRA) (only)
A2A	Department of the Navy Staff Offices (OPA) (CNR, Codes 431, 450, 452, 458) (only)
A5	Bureaus (CHBUMED, Code: NM&S-33) (only)
A6	Headquarters Marine Corps (DC/S Manpower) (only)
B3	College and University (NDU, AFSC) (only)
B5	U.S. Coast Guard (COMDT COGARD) (only)
FF38	Naval Academy (Nimitz Library)
FF44	Naval War College
FF48	Human Resource Management Center

(Distribution List continued on next page)

(Distribution list cont.)

FH7	Medical Research Institute
FH20	Health Research Center
FJ18	Military Personnel Command
FJ76	Recruiting Command
FJ89	Manpower and Material Analysis Center
FKA6A16	Personnel Research and Development Center (2 copies)
FT1	Chief of Naval Education and Training
FT5	Chief of Naval Technical Training
FT73	School Postgraduate
OPNAV	Op-00K, Op-00X, Op-09BH, Op-09R, Op-90, Op-96, Op-964 (2 copies), Op-01, Op-11, Op-12, Op-13 (2 copies), Op-15, Op-29, Op-39, Op-04, Op-59

OTHER

Ass't Sec'y of Defense, Manpower, Reserve Affairs and Logistics
Director, Program Analysis and Evaluation (2 copies)
Defense Technical Information Center (12 copies)
Principal Ass't Sec'y of the Navy, Manpower and Reserve Affairs
Deputy Ass't Sec'y of the Navy (Manpower)
Department of the Army (Attn: Adj Gen'l)(6 copies)
Department of the Air Force (SAMI)
Institute for Defense Analyses
Human Resource Research Organization
The Rand Corporation
System Development Corporation

CNSR 9 / September 1981

FINAL REPORT OF THE MANPOWER AVAILABILITY STUDY

Robert F. Lockman
Jean W. Fletcher
Philip M. Lurie
Alan J. Marcus
James S. Thomason

Enclosure (1) to CNO ltr Ser 964/333833 dated 19 November 1981.

Institute of Naval Studies

CENTER FOR NAVAL ANALYSES

2000 North Beauregard Street, Alexandria, Virginia 22311

ABSTRACT

Ways to expand the Navy manpower pool by qualifying more applicants for enlistment and retaining them longer were explored. They include (1) alternative enlistment standards, (2) separate recruit screening procedures for Class A school and apprenticeship trainees, and (3) rating assignments to increase retention. Attitudes toward Navy jobs and military life that affect first-term and career enlistment decisions differently also were identified.

EXECUTIVE SUMMARY

The Manpower Availability Study sought ways to expand the enlisted manpower pool by qualifying more applicants for enlistment and retaining personnel longer. It dealt with alternative enlistment standards, recruit screening, rating assignment, and quality of life factors.

Enlistment waivers for other than unlawful behavior were found to be justified for recruits who will go to apprenticeship training. At the end of the first year of service, their disciplinary and desertion records are similar to those of recruits who did not require waivers, and their survival rate is slightly higher.

New SCREEN tables were developed for recruits who will go to Class A schools and apprenticeship training. These tables improve upon the single table now used to predict survival during the first year of service. They are based on months of service during the first enlistment, reflect current recruit survival patterns, and clearly show differences between the two kinds of recruits.

A rating assignment guide was devised to improve first-term survival. It applies to recruits who are 17 years old, who are not high school graduates, and who have no strong preferences among Navy ratings. The guide can easily be incorporated into the current recruit classification and assignment system.

In addition to pay, attitudes toward Navy jobs and military life were found to be important in reenlistment decisions. These attitudes are very similar over a variety of Navy ratings, but they affect reenlistment decisions in different ways. Job-related factors are more important in first-term reenlistments, while quality of life factors are more important in subsequent reenlistments. Accordingly, improvements in personnel management should increase first-term reenlistments, while improvements in military life should increase career reenlistments.

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

PURPOSE OF THE STUDY

The Manpower Availability Study (MAST) was aimed at helping the Navy expand the enlisted manpower pool by qualifying more applicants for service and retaining them longer. This goal is particularly important in the 1980s in the face of a decline in young males eligible for military service and an increase in manpower requirements.

MAST contained four tasks, each representing a first in Navy manpower studies:

1. The task on alternative enlistment standards examined the effects of enlistment waivers, not only on recruit survival, but also on disciplinary and deserter status (25 percent of recruits enter the Navy on waivers). It also evaluated various combinations of entrance tests and different state standards on the General Educational Development (GED) test for high school equivalency.

2. The recruit screening task related recruit background characteristics to months of survival over the first and second terms of service for recruits who went to Class A schools and for recruits who did not (about 30 percent of annual accessions).

3. The rating assignment task verified and extended a procedure for assigning recruits to Class A schools to improve first-term survival. It was the culmination of earlier CNA work.

4. The quality of life task related attitudes toward pay, Navy jobs, and military life to first-term and career reenlistment decisions for a variety of ratings.

ALTERNATIVE ENLISTMENT STANDARDS

The effects of recruit selection measures on survival were analyzed [1]. The measures examined were mental ability tests, educational quality, waivers, and prospective Navy training. Other measures — age at enlistment, participation in the Delayed Entry Program (D.E.P.), and dependency status — were controlled for. The data came from the Enlisted Master Record of non-prior-service males who joined the regular Navy in CY 1977. These men were followed for two years to determine their training and survival experience. Because this cohort contains a wider than normal range of quality, it is particularly useful for studying availability as a function of background measures under different selection standards. The more highly selected cohorts since 1977 are less like the applicant pool and therefore less likely to reveal the effects of changes in enlistment standards.

The mean values of the variables analyzed are shown in table 1 for recruits who had Class A school guarantees for specialized training and for those who did not. The latter group received two weeks of apprenticeship training as seamen, airmen, or firemen before being assigned to the fleet. Because the two groups differ in many respects, the effects of recruit selection measures on survival were estimated separately for them.

AFQT-ASVAB Tests

The relation between survival and mental ability was examined using four different measures of mental ability:

- FY 1981 mental groups derived from the Armed Forces Qualification Test (AFQT)
- Actual AFQT percentile score
- Scores on the three tests that constituted the AFQT in ASVAB forms 5, 6, and 7
- Scores on the six tests not included in the AFQT that are still contained in ASVAB forms 8, 9, and 10.

Mental groups do predict survival. The higher groups have higher survival rates than the lower ones. For high school graduates, table 2 shows differences in survival rates from the top to the bottom mental group of 11 percentage points for school guarantees and 15 percentage points for non-guarantees. Non-graduates display somewhat larger differences, but their base rate is lower than that of graduates.

Higher AFQT scores are also associated with higher survival rates. Table 2 shows gradually increasing chances of survival as AFQT score increases for high school graduates with school guarantees. The effect for non-guarantees is even greater, although again they have a lower base rate.

The AFQT score is derived from the sum of three tests (Word Knowledge, Arithmetic Reasoning, Space Perception). Estimated survival using the three tests separately increased with higher test scores, to about the same extent that it did with the AFQT score.

Finally, six tests from the ASVAB that were not included in the AFQT score were examined: Mathematical Knowledge, General Science, Mechanical Comprehension, and Electronic, Shop, and Automotive Information. They could be useful as additional or alternative predictors of survival in recruit screening, but the improvements would be slight.

TABLE 1

MEANS OF VARIABLES FOR SCHOOL GUARANTEE AND SEAMAN/AIRMAN/FIREMAN RECRUITS

	School guarantees (percent)	S/A/F - no guarantees (percent)
Number	42,235	24,955
First-year survival	87.2	75.8
Caucasian	88.9	80.4
Black	8.7	14.2
Other minorities	2.4	5.4
Delayed Enlistment Program	88.0	52.6
D.E.P. months[a]	4.3	2.1
Married	3.9	3.2
Enlistment guarantee:		
School guarantee	44.5	—
Occupational speciality	21.1	—
Programmed school input	7.0	—
6-year obligor	27.3	—
Completed Class A school	78.6	21.8
Waiver total	22.8[b]	28.4[b]
Minor misdemeanor	3.2	2.8
Non-minor misdemeanor	3.8	4.9
Felony	0.6	0.9
Drug abuse	10.0	11.0
Other waivers	4.8	8.3
H.S. diploma	76.9	50.1
GED	7.5	7.1
Post-high-school	2.8	1.0
Age 17	15.8	24.5
Age 18	40.2	34.8
Age 19	19.0	19.6
Age 20+	25.0	21.1
AFQT (percentile mean)	67.1	41.0
MG1	2.5	0.2
MG2	24.7	4.7
MG3U	18.5	6.6
MG3L	37.0	34.3
MG4	17.2	54.1

[a]Mean months for those who participated in the Delayed Entry Program.
[b]Due to coding errors, the five subcategories of waivers do not add exactly to total waivers.

TABLE 2

CHANGES IN FIRST-YEAR SURVIVAL PROBABILITIES
OF HSDG BY MENTAL GROUP AND AFQT SCORE

Mental group	School guarantee	Non-guarantee	AFQT score	School guarantee	Non-guarantee
1	11	15	70	7	13
2	10	10	60	6	10
3U	8	9	50	4	7
3L	6	6	40	2	4
4A	3	3	30	0	0
4B-5	0	0			

Enlistment Waivers

About 25 percent of all recruits enter the Navy on one of five types of waivers. The first three types involve unlawful behavior of varying severity: minor misdemeanors, non-minor misdemeanors, and felonies. The fourth waiver category involves minor drug or alcohol abuse (largely admitted experimental use of marijuana, not drug convictions). The fifth category includes physical waivers, mental test score waivers, and waivers not elsewhere classified.

If waivered recruits have survival rates as high and disciplinary records as good as non-waivered recruits, then expanding the waiver policy might be an attractive way of increasing the pool of eligible recruits.

Table 3 shows that recruits with waivers for misdemeanors and felonies have more disciplinary problems than non-waivered recruits. Their first-year survival chances, however, are about the same. Recruits with physical/mental/other and substance abuse waivers who received school guarantees at enlistment also have first-year survival rates as high as non-waivered recruits. For non-guarantees, however, waivered recruits have higher survival rates than non-waivered recruits (higher by 2 percentage points), and their disciplinary/desertion rates are no worse (8 percent for both groups).

Given these favorable results for physical/mental/other and substance abuse waivers, plus the fact that 70 percent of all waivers are of these types, increasing these waivers might be an attractive option. The Navy already grants waivers to applicants who have "experimented" with drugs, but the physical/mental/other category of waivers is a potential area for expansion. Other studies have shown the positive advantages of reducing the physical standards for military

service.* Our work does not produce specific recommendations about what further allowances could usefully be made, but it does confirm the potential for expansion of such waivers. Waiver expansion is preferable to changing enlistment standards, because it allows more flexibility in the management of recruiting policy.

TABLE 3

CHANGES IN FIRST-YEAR SURVIVAL PROBABILITIES AND DISCIPLINARY PROBLEMS BY WAIVER TYPES

	% change in survival chances		% disciplinary problems	
Type waiver	School guarantee	Non-guarantee	School guarantee	Non-guarantee
None	-	-	4	8
Physical/mental and substance abuse	0	2	5	8
Misdemeanors and felonies	0	-1	7	12

GED and Other High School Equivalents

The impact of different state standards for Graduate Education Development (GED) test certificates on applicant selection was assessed. We divided states into four categories. Category 1 includes four states with the most difficult requirements, and category 4 includes six states with the easiest requirements. Category 2, containing 33 states, encompasses the majority of recruits.

For school guarantees, all four GED categories are related significantly to survival, as are the top two for non-guarantees. Table 4 shows a consistent pattern of increased survival with increased requirements for a passing score on the GED. For school guarantees, group 1 displays a survival rate comparable to that of high school graduates. Among non-guarantees, there is a much wider range of survival rates. Groups 3 and 4 have rates about the same as those of non-graduates.

* RAND, Report R-1347-ARPA/DDPAE, "Physical Standards in an All-Volunteer Force," by David S.C. Chu and Eva Norrblom, Unclassified, Apr 1974.

There may be small gains to the Navy by treating GEDs from different states differently in recruit screening. For example, GEDs from category 1 states could be treated as if they had a diploma, or non-guarantee GEDs from categories 3 and 4 could be treated as non-graduates. The Navy also could obtain actual GED test scores and set its own pass/fail standard. In either case, the number of potential recruits affected would be small, and the administrative and political costs could outweigh the benefits of the policy change.

TABLE 4

CHANGES IN FIRST-YEAR
SURVIVAL CHANCES FOR GED QUALITY

	School guarantee	Non-guarantee
Post-HSG	12	11
HSG	14	12
GED 1	14	8
GED 2	9	5
GED 3	6	2
GED 4	9	-2
Non-HSG	0	0

Class A School Attendance

The survival chances of recruits are clearly improved if they attend Class A school. Not all recruits who attend A-school actually complete it, but results using school attendance instead of school completion were very similar.

The survival effect of attending an A-school is more dramatic for recruits who were guaranteed a school before, rather than after, they enlisted. In the CY 1977 cohort, completing an A-school increased recruits' first-year survival chances by 17 percentage points for school guarantees, compared to 7 percentage points for non-guarantees. Consequently, any improvements in administration that lead to a better match between guarantees and attendance would improve survival.

SURVIVAL CURVES FOR RECRUIT SCREENING

CNA developed SCREEN (an acronym for "Success Chances of Recruits Entering the Navy"), a table of first-year survival probabilities, to aid recruiters in selecting applicants for enlistment. The latest version of SCREEN is based on educational level, AFQT percentile score, and age at enlistment. Other CNA studies have related pre-service and in-service personnel characteristics to the probability of surviving to

a given point in time. All these studies had to follow recruits from enlistment to either attrition or completion of obligated service.

To avoid this sometimes lengthy follow-up process, we used a new statistical technique, called the Cox regression model, that operates on cross-sectional data to obtain estimates of survival [2]. It requires only a relatively short period of follow-up and exhibits the most recent survival patterns. The Cox model also generates a continuous survival curve, not just a point-in-time estimate of survival, e.g., at the end of one year.

The cross-sectional data base consisted of all non-prior-service (NPS) male enlistees in the Navy on 31 December 1978. They were followed until the end of calendar 1979. Then all NPS male accessions during 1979 were added to the data base. The total population contains approximately half a million men. Since each man in the data base can be tracked back to his date of enlistment, entire career survival patterns through 30 years of service could be estimated. For this study, however, we generated survival curves through eight years of service.

The survival curves would be of little practical help to recruiters in screening applicants for enlistment. Therefore, we summarized them by measuring the mean survival time (the area under the survival curve) in months. If mean survival time is multiplied by the number of recruits entering the Navy in a given year, the expected man-months of survival for that cohort can be obtained.

Survival curves were calculated for each combination of educational level (high school graduate, GED, or non-graduate), mental group (1-4), and age at enlistment (17-24, 25 or older). Since the men in the data base entered the Navy over a 30-year period, different tests and norms were used to compute mental groups. To make these test results comparable, we converted them to mental groups defined by FY 1981 AFQT norms [3].

First-Term Survival

Cross-sectional data yield biased estimates of survival because the longer a recruit's survival time, the greater his chances are of being included in the data base. The procedure for correcting the bias is simple. First, using only the 1979 cohort, we obtain an unbiased estimate of the first year of survival. Next, using only recruits with a 1978 active duty service date and a survival time of at least one year, we obtain an unbiased estimate of the second year of survival conditional on having survived the first year. Multiplying the two estimates together then gives an unbiased estimate of survival over two years of service. By successively selecting unbiased subsets of the data, we can calculate estimates of survival for any number of years of service. Thus, by applying the Cox model one year at a time, the yearly

impact of pre-service characteristics on recruit survival can be estimated.

Separate survival analyses were performed for Class A school attendees and non-attendees who had completed recruit training. Once recruits completed this training, we determined the effects of pre-service characteristics on survival. The only clear pattern across time is that pre-service characteristics become less important as time passes.

For each combination of recruit characteristics, we estimated survival curves through eight years of service with the Cox regression model. Some curves are shown in figures 1 and 2. The first-term mean survival times, obtained as the area under the curves up to four years of service, are shown in table 5 for A-school attendees and non-attendees.

The variable with the greatest impact on survival is educational level. A consistent relationship between mental group and survival is harder to see, except for high school graduates. For A-school attendees, survival is relatively constant across mental groups, even down to the lowest mental group. For non-attendees, there is a general upward trend in survival as mental test scores decrease, a relationship previously observed in the 1973 recruit cohort. There is no clear relationship between mental group and survival for non-graduates and GEDs, but the survival behavior of GEDs is much more like that of non-graduates than that of graduates.

Qualifying Scores

Qualifying scores or cut-off points for mean survival times were determined for use in recruit screening. A cost-benefit analysis considered the cheapest way of selecting recruits who survive longer but cost more. The effects of possible qualifying scores compared to the lowest score that would let in an entire cohort were examined.

If the only objective is to maintain the same endstrength at the end of recruit training, it always costs more to be more selective than simply to allow all prospective recruits to enlist. The reason is that the cost of recruiting higher quality individuals more than offsets the savings realized by putting fewer recruits through recruit training. Of course, the Navy is concerned with survival beyond completion of recruit training, and a better screening policy will be achieved by taking this into account.

The effects of possible qualifying scores on the relative costs of maintaining the same total man-months of service were calculated. The optimal qualifying score is 35 for A-school attendees, and 28 for non-attendees (non-qualifying scores are boxed in table 5). All high school graduates qualify with these scores, regardless of mental group.

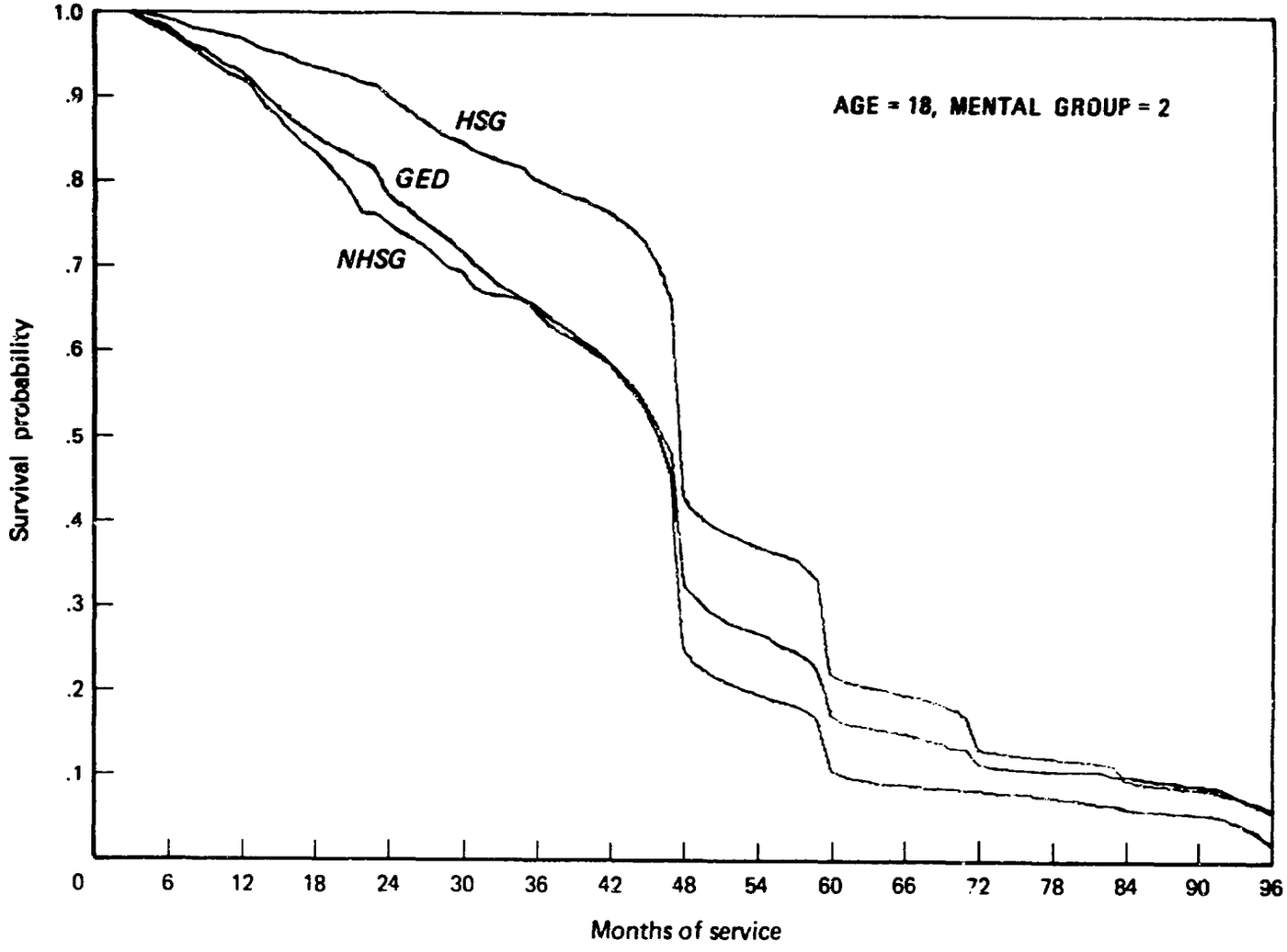


FIG. 1: SURVIVAL CURVES FOR CLASS A SCHOOL ATTENDEES

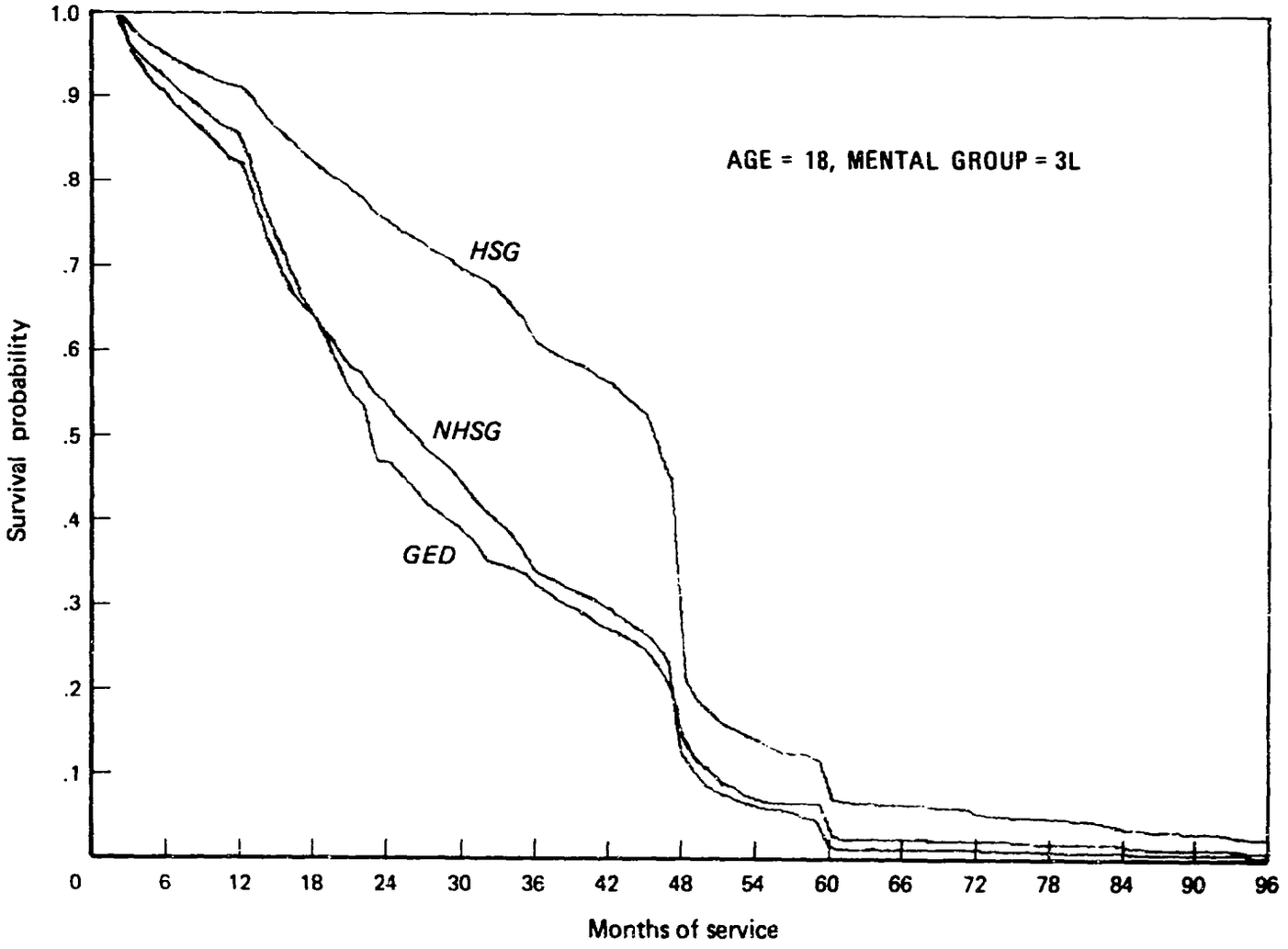


FIG. 2: SURVIVAL CURVES FOR CLASS A SCHOOL NON-ATTENDEES

TABLE 5

FIRST-TERM MEAN SURVIVAL TIMES

(Months of service)

For Class A School Attendees

Mental Group	Age 17-22			Age 23+		
	HSG	GED	NHSG	HSG	GED	NHSG
1	40	36	35	39	32	31
2	42	37	36	40	34	33
3U	42	36	35	41	33	32
3L	42	36	34	40	32	31
4A	42	37	34	40	34	32
4B-C	42	36	34	39	33	29

For Non-Attendees

	Age 17-21			Age 22+		
1	35	28	28	31	23	23
2	35	29	28	32	24	24
3U	37	28	29	35	24	26
3L	36	28	28	33	22	24
4A	37	28	27	34	23	22
4B-C	37	28	27	34	26	26

Non-graduates and GEDs over 22 or 23 years of age do not qualify, but excluding them from the recruiting market poses no problem. The projected four-year endstrength using the qualifying scores is greater than that observed with no screening.

New SCREEN Tables for A-School Attendees and Non-Attendees

Since the survival curves were estimated using the entire active male force (3-, 4-, and 6-year obligors), it would probably be better from a recruiter's standpoint to express the SCREEN tables in proportions, i.e., the mean survival times divided by 48 months. The qualifying scores then become 73 for A-school attendees and 58 for non-attendees. The resulting SCREEN tables are shown in table 6.

The present SCREEN table that gives first-year survival chances can be replaced with these new ones that give expected proportions of service completed over four years.

AFQT, Advancement, and Survival

A subsidiary task of the study related AFQT score and other recruit background characteristics to a combination of advancement and survival for Ship's Serviceman (SH) and Electronics Technician (ETN) ratings [4]. It is a prototype for validating selection test scores against job performance measures.

The advancement/survival model required the estimation of two components of a recruit's service history: first, the probabilities of subsequent transitions (advancement, reduction, or attrition) from any paygrade; then, conditional on being in a particular paygrade, the distribution of time (a survival curve) spent in that paygrade until the next transition. Each of these quantities was estimated holding constant the effects of AFQT score, primary dependents, age, and years of education. Given a recruit's initial paygrade, these characteristics enabled the model to estimate the probabilities of his being in any paygrade or of survival as a function of time. The model assumed that the transition probabilities and time in grade were independent of the time at which the paygrade was attained. This assumption was necessary to make the model mathematically tractable.

The recruit background characteristics were related to transition probabilities by means of a logit model. They were related to time in grade through the Cox regression model.

In the SH rating, non-high-school-graduate recruits with lower AFQT scores advanced more rapidly than those with higher scores. However, AFQT score had no impact on survival. AFQT score was of little value in predicting advancement or survival for recruits in the ETN rating, perhaps because their scores varied so little.

TABLE 6

FINAL FIRST-TERM SCREEN SCORES

For Class A School Attendees

Mental Group	Age 17-22			Age 23+		
	HSG	GED	NHSG	HSG	GED	NHSG
1	83	75	73	81	67	65
2	88	77	75	83	71	69
3U	88	75	73	85	69	67
3L	88	75	71	83	67	65
4A	88	77	71	83	71	67
4B-C	88	75	71	81	69	60

For Non-Attendees

	Age 17-21			Age 22+		
1	73	58	58	65	48	48
2	73	60	58	67	50	50
3U	77	58	60	73	50	54
3L	75	58	58	69	46	50
4A	77	58	56	71	48	46
4B-C	77	58	56	71	54	54

If this prototype analysis is extended to other ratings, groups of similar ratings should be used to gain sample size. Also, ASVAB test scores used in qualifying recruits for ratings should be included.

RATING ASSIGNMENTS TO IMPROVE SURVIVAL

This task [5] was the culmination of earlier CNA work on exploiting the rating assignment process to increase first-term survival.

Assignment Strategies

If new recruits can be matched better with their Navy jobs, overall survival could be improved. One way to improve that match would be to focus on a recruit's preferences and find him a job that he believes suits him best -- consistent of course with his skills and the Navy's requirements. We used a complementary strategy.

Whether our strategy will work hinges on the answer to the question, does a recruit characteristic (say age 17) affect first-term survival chances differently in different ratings? If it does, and if the recruit and the Navy do not care which rating he enters, then he would be encouraged to enter the rating where the historical survival rate of his type is hurt least (or helped most) relative to other candidates for the rating. Following a strategy of this sort could enhance overall first-term survival inexpensively.

Ground Work

Two earlier CNA reports led to this work. In the first [6], the four-year, first-term survival effects of pre-service and in-service recruit characteristics for major Navy ratings were estimated. The objective was to find out if there is variation across ratings in the effects on survival of recruit characteristics. There was. In particular, there were significant differences across ratings in the effects on survival of age 17 at enlistment (relative to age 18), education less than 12 years (relative to 12 years), and participation in the Delayed Entry Program (D.E.P.). Age 17 and education less than 12 years hurt little in some ratings but a lot in others. Participation in the D.E.P. helped a little in some ratings and a lot in others.

To assess the potential gains in survival from using these three variables, the reassignment of recruits who joined the Navy in CY 1973 was simulated under the same conditions faced in their original assignment [7]. The simulation confirmed the potential of the procedure, showing a 10 percent gain in first-term survival for the recruits involved.

Verifying and Extending the Assignment Technique

Before recommending that the Navy adopt the rating survival estimates derived from one year's entering cohort, it was necessary to determine whether the relations between recruit characteristics and survival chances, by rating, remain stable over time. This check was made, and estimates for additional Navy ratings also were obtained.

The original estimates were based on the four-year survival behavior of some 28 thousand recruits who entered the Navy in CY 1973 and trained for one of 37 major Navy ratings. The stability check involved two separate but comparable looks at recruits who entered in CY 1974 and in CY 1976. We then had three independent sets of estimates for the original 37 ratings, and two sets of estimates (from CY 1974 and CY 1976) for 23 additional ratings: 60 ratings in all.

The relations among the rank-orders over time for each of the three key effects - age, education, and D.E.P. - were generally positive. Thus, the averaged key effects shown in table 7 indicate the ratings that a recruit should be encouraged to enter or avoid. For example, a 17-year-old recruit with less than 12 years of education who was not in the D.E.P. should enter EM, IC, or aviation weapons ratings, but avoid MT, BT, logistics, and sensor ratings. If this recruit were in the D.E.P., he could also enter media and administrative ratings.

Thus, because (1) there is an increase in survival rates from employing this technique, (2) the chances of badly misgauging the true rank-order appear low, and (3) the technique is inexpensive to implement, we recommend that our average set of the three key survival effects be incorporated in the Navy's rating assignment procedure.

QUALITY OF LIFE AND REENLISTMENT

The quality of life (QOL) task was initiated to search for alternatives to compensation as reenlistment incentives. To do this, we modelled the effects of attitudes towards characteristics of Navy jobs and Navy life on the reenlistment decisions of enlisted personnel [8].

Relating attitudes to reenlistment will provide insight into the reenlistment decision. However, to compare the reenlistment benefit of QOL programs to pay increases, we would have to know the cost of changing attitudes. The value of our analysis will lie in identifying areas where dissatisfaction affects reenlistment. This will provide a focus for future efforts to quantify the relationship between reenlistment and the Navy environment.

Data Base

Attitude data were obtained from the Navy Occupational Task Analysis Program (NOTAP) Survey, which is administered in six-year

TABLE 7

AVERAGE EFFECTS OF KEY VARIABLES ON FOUR-YEAR SURVIVAL CHANCES
(In Percentage Points)

Age 17	
AVWEP	0
ABASPR	0
ADMIN	0
OPS	0
MEDIA	0
EM/IC	0
RM/CT	-2
CONST	-2
EN	-3
SENSOR	-3
HT	-4
LOG	-4
ORD	-4
BT	-4
DT/HM	-5
ET/FT	-5
MM	-6
AVMT	-6
SHPMT	-12

Non-D.E.P.	
CONST	-3
RM/CT	-3
DT/HM	-4
EM/IC	-4
SHPMT	-5
ABASPR	-5
AVMT	-5
AVWEP	-5
ET/FT	-6
BT	-7
ORD	-8
HT	-8
MM	-8
ADMIN	-9
SENSOR	-9
OPS	-10
LOG	-10
EN	-10
MEDIA	-17

Less than 12 years education	
SHPMT	7
MEDIA	0
EN	-2
AVWEP	-3
EM/IC	-4
ADMIN	-4
ET/FT	-5
ORD	-5
DT/HM	-6
MM	-6
AVMT	-7
CONST	-8
ABASPR	-9
RM/CT	-9
OPS	-9
LOG	-11
SENSOR	-10
HT	-13
BT	-13

Abbrev.	Major Rating/Group	Ratings
BT	Boiler technicians	BT
MM	Machinists mates	MM
EM/IC	Electricians	EM,IC
EN	Enginemen	EN
HT	Hull technicians	HT
ET/FT	Weapons control	ET,FT
SENSOR	Sensor systems	ST,EW,OT
RM/CT	Radiomen/communications	RM,CT
AVWEP	Aviation weapons	AT,AW,AQ,AC,AX
AVM	Aviation maintenance	AM,AD,AE,AO
ABASPR	Aviation support	AS,PR,AB
DT/HM	Health care	DT,HM
LOG	Logistics	MS,SK,AK,DK,SH
ADMIN	Administration	PN,YN,AZ,PC,AG
SHPMT	Ship maintenance	MR,ML,PM,IM,OM
ORD	Ordnance	MN,MT,TM,GM
CONST	Construction	BU,CE,CM,EA,EO,SW,UT
OPS	Ship operations	QM,BM,SM
MEDIA	Media	PH,DM,JO,LI

cycles to representative samples of personnel working in Navy ratings.The job satisfaction section of NOTAP elicits evaluations of satisfaction with a large number of characteristics of living and working conditions. By merging NOTAP data records with Enlisted Master Records (EMRs), we could relate job satisfaction as measured by NOTAP to actual reenlistment decisions.

The six ratings selected for analysis were: hospital corpsman (HM), electricians mate (AE), structural mechanic (AM), electronics technician (AT), antisubmarine warfare operator (AW), and mess management specialist (MS). These ratings were chosen because they had relatively recent NOTAP surveys, the sample size of each was adequate, and their NOTAP records included the information necessary for us to extract EMR data. They cover a range of technical and non-technical jobs. AEs and AMs were considered a single sub-population. Also, ATs and AWs (who generally score higher on AFQT tests, are better educated, and receive large reenlistment bonuses) composed a separate group. Thus, we looked at four, rather than six, sets of ratings.

Constructing Job-Related and QOL Factors

Factor analysis was employed to reduce the data to manageable proportions.* It is a statistical technique for identifying underlying patterns of relationships among many data items, and grouping these items into a smaller number of sets, or factors. We were able to discern three categories of factors from the NOTAP survey data. They were pay satisfaction, quality of job, and quality of military life. The job-specific and military-specific factors are listed in table 8.

Each factor represents a weighted linear combination of groups of data items. These composite factor scores, rather than raw satisfaction data, were incorporated in a reenlistment model. The composite factors were constructed separately for each rating. These factors have intuitive appeal and are consistent across ratings.

Reenlistment Model

Two aspects of reenlistment patterns that influenced our choice of reenlistment model are illustrated in table 9. First, as expected, reenlistment behavior differs dramatically between first-term and career personnel. For each rating except MS (whose sample size was too small), we performed separate analyses of first-term and career reenlistments. A second striking fact was the large numbers of extenders, especially among career aviation personnel. Since it is unclear if extending expresses a career commitment, we maintained a separate decision category for extenders and compared their behavior and characteristics

* NOTAP contained 39 job satisfaction questions for HMs, and close to 70 for the other ratings.

TABLE 8

NOTAP SATISFACTION FACTORS

Job- specific	Military-specific
Training Opportunities	Military Housing
Physical Work Environment	Deployment Time
Meaningful Work	Present Duty Station
Team Effort	Work Schedule (Home)
Relations with Co-Workers	Work Schedule (Deployed)
Relations with Subordinates	Medical Services
Faith in the Organization	Family Services
Adequate Tools	Career Support Services
Skill Utilization	Military Quarters/Ship Habitability
Autonomy	
Personnel Management	
Recognition/Prestige	

to those of leavers and reenlistees. We modelled the probabilities ofmaking each of three choices (leave, extend, reenlist) as functions of our quality of job, military life, and pay composites.

TABLE 9

REENLISTMENT DECISION FREQUENCIES

Rating (Cases)		% Leave	% Extend	% Reenlist
HM	First (2,042)	79	8	13
	Subsequent (726	39	20	42
AE/AM	First (949)	82	9	9
	Subsequent (464)	35	40	25
AT/AW	First (536)	72	11	17
	Subsequent (308)	30	59	11
MS	All terms (417)	44	18	38

Results for First-Term Decisions

The first-term results are shown in table 10. Pay proved consistently important in retaining first-term personnel. The job factors, which generally can be improved by effective leadership and personnel management, are also important. The significant factors vary by rating, but this is not surprising given the diversity of job content across ratings. With few exceptions, the quality of military life factors are not significant determinants of first-term reenlistment. NOTAP survey data confirms that many enlisted personnel are dissatisfied with these items. This dissatisfaction does not differ substantially for those who leave and those who reenlist or extend. Correcting these items might increase reenlistments as well as have a beneficial effect on those who stayed despite their dissatisfaction with them.

Results for Careerists

However, we see a very different picture for career personnel in table 11. There are still some significant job factors, but there is a striking increase in the number of significant quality of military life factors. Duty station choice is important across ratings, housing is

TABLE 10

FACTORS THAT MAKE FIRST-TERM
EXTENSION OR REENLISTMENT MORE LIKELY

	HM	AT/AW	AE/AM
Pay and advancement	X	X	X
Quality of job factors:			
Training opportunities			
Physical work environment			
Meaningful work		X	X
Team effort			
Relations with co-workers	X		
Relations with subordinates			
Faith in the organization	X		
Adequate tools			
Skill utilization			
Autonomy	X		X
Personnel utilization		X	X
Recognition/prestige	X		X
Quality of military life factors:			
Military housing			
Duty assignments/station			
Deployment time			
Work schedule (home)			
Work schedule (deployed)			
Medical services		X	X
Family services			X
Career support services			
Barracks/ship habitability		X	

TABLE 11

FACTORS THAT MAKE EXTENSION OR
REENLISTMENT BEYOND THE FIRST TERM MORE LIKELY

	HM	AT/AW	AE/AM	MS
Pay and advancement	X	X	X	
Quality of job factors:				
Training opportunities		X	X	
Physical work environment				
Meaningful work	X			X
Team effort	X			
Relations with co-workers				
Relations with subordinates				
Faith in the organization		X		X
Adequate tools				
Skill utilization				X
Autonomy		X		
Personnel utilization		X		
Recognition/prestige	X	X		X
Quality of military life factors:				
Military housing		X	X	
Duty assignments/station	X	X	X	X
Deployment time	X			X
Work schedule (home)				
Work schedule (deployed)				
Medical services			X	X
Family services				
Career support services				
Barracks/ship habitability		X		

important for aviation ratings, and medical services for two of the ratings. The Navy has been spending money in these areas, and our findings indicate that, where possible, it should be targeted toward career personnel.

QOL Summary

The use of pay in the past to affect reenlistments appears to be justified. Beyond that, improvements in personnel management training should improve retention for first-termers, while quality of military life improvements and expenditures will have the biggest retention payoff if targeted on career personnel.

FINDINGS AND CONCLUSIONS

There is justification for maintaining, if not carefully increasing, enlistment waivers, -- other than for felonies and misdemeanors — for recruits who do not get Navy school guarantees. By the end of the first year of service, their disciplinary and desertion records are no worse than those of recruits who were not granted waivers, and their survival rate is slightly higher.

New SCREEN tables for A-schoolers and non-A-schoolers are worth implementing. They are based on months of service during the first enlistment, reflect current survival patterns, and clearly show the differences in survival between the two kinds of recruits.

Rating assignment guides can improve first-term survival of 17-year-olds and non-high-school-graduates who have no strong rating preferences. The guides can easily be appended to the Navy's recruit classification and assignment system. The Delayed Entry Program consistently enhances first-term survival for A-schoolers and deserves judicious expansion.

Finally, pay is important in reenlistment decisions - not surprisingly. Attitudes toward Navy jobs and military life, which are remarkably similar across a variety of ratings, relate to reenlistment decisions, too, though in different ways. Job-related factors are important in first-term reenlistments, while quality of military life factors are important in subsequent reenlistments. Consequently, improved personnel management should increase first-term reenlistments, while improvements in the quality of military life should increase career reenlistments.

REFERENCES

[1] CNA, Research Contribution 448, "Alternative Enlistment Standards," by Alan J. Marcus and Robert F. Lockman, Unclassified, Apr 1981

[2] CNA, Research Contribution 450, "Continuous Estimates of Survival Through Eight Years of Service Using FY 1979 Cross-Sectional Data," by Philip M. Lurie, Unclassified, Jul 1981

[3] CNA, Memorandum 81-0151, "AFQTease," by Robert F. Lockman and Kathye D. Rutledge, Unclassified, 5 Feb 1981

[4] CNA, Memorandum 81-0048, "Relating Enlistment Standards to Job Performance: A Pilot Study for Two Navy Ratings," by Philip M. Lurie, Unclassified, 15 Jan 1981

[5] CNA, Research Contribution 453,"A Rating Assignment Procedure To Increase First-Term Retention," by James S. Thomason and Kathye D. Rutledge, Unclassified, Aug 1981

[6] CNA, Research Contribution 382, "First-Term Survival and Reenlistment Chances for Navy Ratings and a Strategy for Their Use," by James S. Thomason, Unclassified, May 1979

[7] CNA, Research Contribution 426, "Rating Assignments To Enhance Retention," by James S. Thomason, Unclassified, Feb 1980

[8] CNA, Research Contribution 454, "Relating Attitudes Toward Navy Life to Reenlistment Decisions," by Jean W. Fletcher and Kurt L. Giesler, Unclassified, Sep 1981