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FINAL REPORT OF THE ENLISTED MANPOWER, PERSONNEL AND TRAINING STUDY

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1. The Center for Naval Analyses (CNA) was asked to address the question of how the Navy can attract and retain enlisted personnel to man the growing 600 ship Navy while facing stronger competition from the civilian sector and the other military services. Results of the CNA analysis are contained in enclosure (1).

2. CNA examined specific related accession and retention issues. In the accession area, factors affecting recruit procurement and survival were examined. In the retention area, geographic stability, retirement, and sea duty/pay issues were investigated. Major recommendations for obtaining sufficient numbers of quality recruits in a difficult recruiting environment include rephasing more accessions into the summer months, increasing the percentage of accessions from the Delayed Entry Program, and raising the number of production recruiters.

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CNR 126 / September 1986

FINAL REPORT OF THE ENLISTED MANPOWER, PERSONNEL AND TRAINING STUDY

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INTRODUCTION

How can the Navy most cost effectively attract and retain the enlisted personnel it needs when it is growing and when faced with stronger competition from the civilian sector and other services? This was the central question addressed in the Enlisted Manpower, Personnel and Training (EMPT) study conducted by a team of analysts at the Center for Naval Analyses (CNA).

Detailed descriptions of the analysis have already been published in a series of CNA Research Memoranda [1 through 12]. This report summarizes the work and highlights the main findings that are relevant to manpower policy.

Before proceeding to the analysis itself, it is worthwhile to review the developments and concerns that prompted the study and that underlie the topics it covered.

THE CURRENT ENVIRONMENT FOR NAVY MANPOWER

So far, the Navy has been able to meet its recruiting goals and maintain high retention, in spite of more intense competition from the civilian sector and from the other services. The quality of recruits, however, has declined, and the cache from which most accessions come—the Delayed Entry Program—has shrunk. There are two problems in manpower today—one is shared by all services and one is more specifically a Navy problem. First, all services face competition from a strong civilian economy offering attractive alternatives to military service. But even if the civilian economy should weaken, the number of young males is declining throughout the mid-1990s (figure 1)—a fact that will make procurement increasingly difficult for all military services.

These procurement pressures affect the Navy more sharply than the other services because it is the only service projected to grow. The Navy's problem is compounded by the fact that attractive enlistment bonuses and educational benefits for Army recruits appear to have switched the service choice of many young males toward the Army.

The fact that the Navy is no longer perceived to be as attractive an alternative to the other services as it once was is reflected in attitudinal data. The Youth Attitude Tracking Study (YATS) done yearly by the Defense

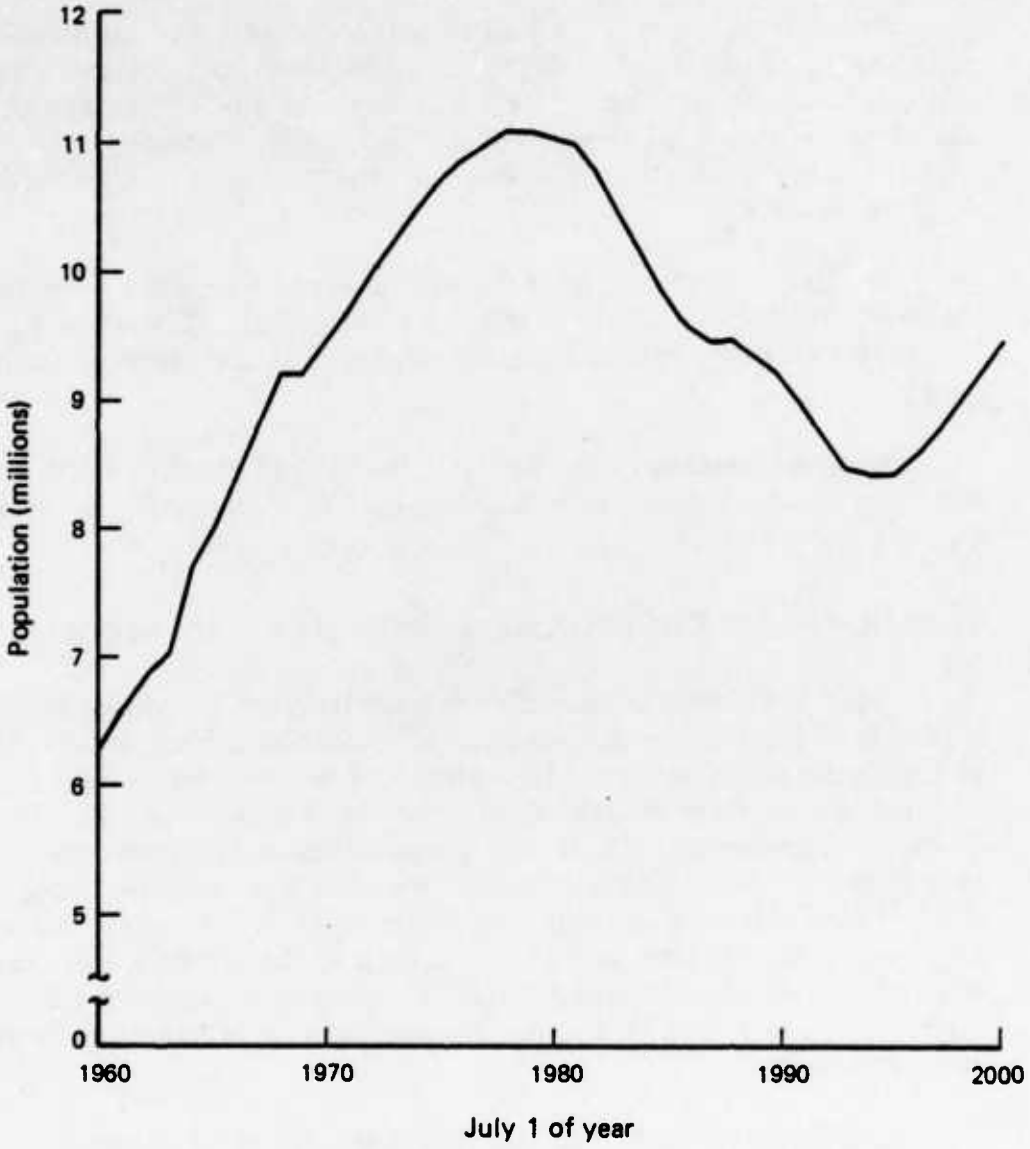


FIG. 1: POPULATION OF 17- TO 21-YEAR-OLD MALES, 1960-2000

SOURCE: The numbers in all figures are calculated from the United States Bureau of the Census, *Current Population Reports,* Series P-25, Report Numbers 917, 952, and 965.

Manpower Data Center monitors the service preferences of young men who say they will "definitely" or "probably" serve on active duty. The fraction of these young men who choose the Navy has declined steadily since 1981 [13, 14]. Figure 2 illustrates how the Navy fell from a strong second place in these service preferences to a weak third. In 1986, planned Navy accessions were 26.9 percent of all planned military accessions, yet only 16.7 percent of young males expecting to join the military prefered the Navy.

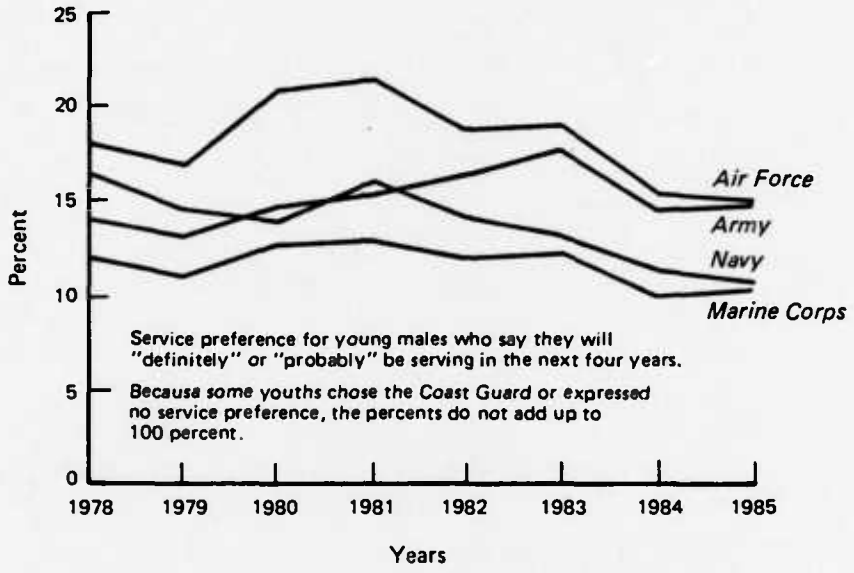


FIG. 2: RESULTS OF YOUTH ATTITUDE TRACKING SURVEY

What caused this sharp attitudinal change was not directly addressed in the EMPT study. Indeed, because of the lag in reporting the YATS data, the extent of the change was not perceived until the study was almost completed. Still, some of the study findings, combined with information from Army manpower analysis, suggest reasons for the shift. Since 1981, the Army has been able to give two-thirds of its high-quality recruits (high-school-diploma graduates in the upper mental groups) either an enlistment bonus or Army College Fund money [15]. Navy recruits have had no such inducements, although in FY 1987 the Navy will be able to give college-fund money to about 8 percent of its high-quality recruits under the Navy Sea/College Program (NSCP).

Figure 3 illustrates the proportion of high-quality recruits procured by each service in the FY 1977 through FY 1984 period. A sharp increase in the quality of Army recruits is evident. Since 1982 or 1983, all the services have

been able to get a richer mix of these high-quality recruits than that found in the general population. But since 1983 or 1984, the quality of Air Force and Navy recruits has declined.

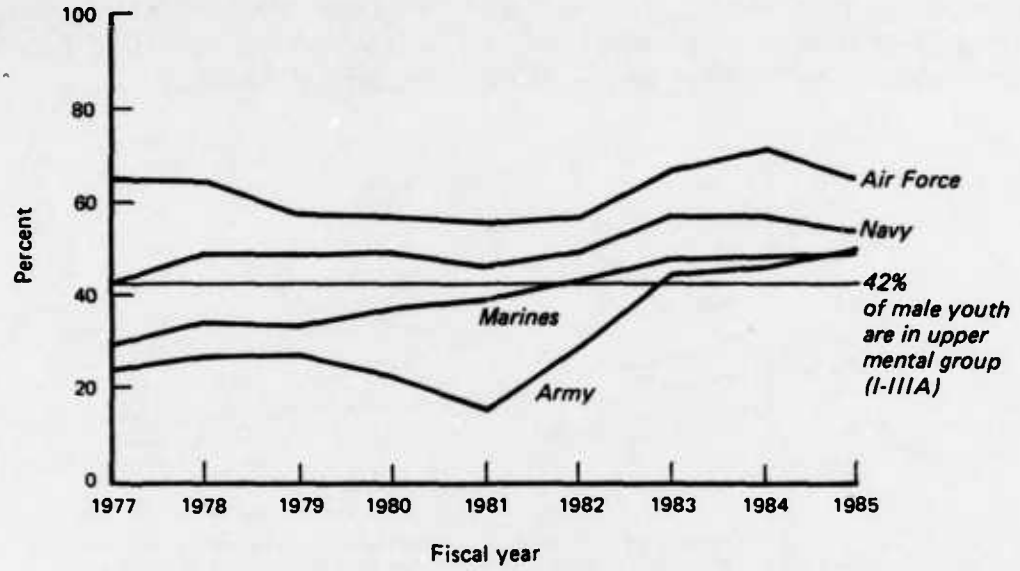


FIG. 3: PERCENT OF NON-PRIOR-SERVICE MALE ACCESSIONS IN UPPER MENTAL GROUP

SOURCE: U.S. Army Recruiting Command

Navy data show a substantial drop in the quality of recruits since January 1984. Although there is seasonal variation, the number of recruits in the Delayed Entry Program (DEP) has fallen about 30 percent. The percentage of recruits who are high-school-diploma graduates (the characteristic most closely associated with first-term survival) has also dropped. The first 6 months of FY 1986 saw 10 percent fewer diploma graduates among non-prior-service male recruits than the first 6 months of FY 1985 (79 percent versus 89 percent). Finally, the fraction of recruits in the upper mental group has also declined, although some of this decline reflects a definitional change in what constitutes the upper-mental-group population.

It is against this backdrop of a more difficult recruiting environment for the Navy that the EMPT study findings should be evaluated. If it is more difficult to procure recruits, it is important to understand why and what can be done about it. It is also important to focus on keeping recruits once they enlist. This review of the study's findings will begin with retention issues and then work backward to first-term survival and recruit procurement.

RETENTION

Two factors the study team addressed concerning the retention were (1) sea duty and sea pay and (2) geographic stability.

Sea Duty and Sea Pay

Manning a growing fleet adequately when endstrength growth is limited will likely require enlisted personnel to spend more time at sea. Thus, the relationship of sea duty and sea pay to retention is a subject of continuing concern to Navy manpower planners. A number of studies, reviewed in [3], have sought to quantify this relationship. The results indicate that individuals are quite willing to accept real pay increases in exchange for additional sea duty. However, there are several measurement issues associated with these variables that potentially affect the interpretation of these results.

Navy manpower analysts use two measures of the extent of sea duty for sailors. The first measure constitutes "sea duty for rotation." It is determined by the sea/shore code assigned to the billet in which the sailor is serving. This definition is used when ratios of sea duty to shore duty by skill type and experience level are specified. For example, the prescribed sea/shore rotation for an operations specialist, first class, is 60 months' sea duty followed by 24 months' shore duty. This schedule results in 7.5 years of sea duty for every 3 years of shore duty, a 7.5 to 3 sea/shore rotation. These prescribed rotations are used in various planning functions within the Navy.

The second measure of the extent of sea duty is "sea duty for pay." Qualification for sea pay is determined by criteria that are much more stringent than those for sea duty for rotation. All billets eligible for sea pay also qualify as sea duty for rotation. However, many billets that count toward sea duty for rotation do not pass the requirements for sea-pay eligibility. Examples of the latter are some overseas shore duty and billets associated with certain ships, including submarine tenders.

A brief history of enlisted sea pay may be found in the references of [3]. At present, sea pay consists of Career Sea Pay (CSP) and Career Sea Pay Premium (CSPP). Individuals in eligible billets earn CSP at a monthly rate determined by their paygrade and cumulative time in these billets. The CSP rates increase more quickly with paygrade than with cumulative sea duty. Since FY 1985, these rates have ranged from $50 to $410 per month. In addition, members serving in eligible billets for more than 36 months

continuously earn the CSPP of $100 per month for each month beyond the first 36. An unexpected complication in the analysis of sea pay is the fact that many individuals lose their eligibility for shore allowances when serving in billets that are designated for sea duty.

How a Proposed Change in Sea Pay Affects Retention

The study team analyzed the effects on retention of a proposed revision in sea-pay rates for FY 1987 (see [5]). Enlisted sea pay has undergone a number of such revisions since 1978, when it was less than 2 percent of basic pay. The result has been to increase sea-pay rates to a significant fraction of basic pay. For example, in FY 1985, for an E5 with ten years of service and five years of cumulative sea duty, monthly sea pay was 17 percent of basic pay.[1]

Because Congress retains control over the amounts of sea pay, proposed revisions in the rates require Congressional legislation. The primary purpose of the proposed FY 1987 CSP legislation is "to improve retention in the mission-critical, sea-intensive ratings." The proposal indirectly targets sea pay by rating depending on the sea intensity of the rating. The proposed sea-pay rates would substantially increase the CSP rates for those with more than 5 years' cumulative sea duty and reduce the rates for those with less than 5 years. The largest rate reductions would be for paygrades E7 to E9 with less than 5 years' cumulative sea duty. Table 1 presents the proposed changes to the sea pay table.

In analyzing these proposed changes, the study team used the Annualized Cost of Leaving (ACOL) simulation model [16 and 17], which was recently modified [18] to analyze force-structure effects of various manpower policies by groups of ratings. ACOL is concerned primarily with modeling the stay/leave decision of individuals who have reached the end of their contracted service. It does not try to explain continuation rates not associated with the expiration of a contract. The model is founded on the assumption that sailors will reenlist if the present value of future income with one or more terms of reenlistment exceeds the present value of future income if the individual leaves immediately. The model is made operational by ascribing future income streams to the stay/leave decisions at each point in time and using observed stay/leave decisions to estimate the responsiveness of such decisions

1. This rate increases to 26 percent if the individual has more than three years of consecutive sea duty on his current tour and thus qualifies for the sea-pay premium.

TABLE 1

MONTHLY CAREER SEA PAY: FY 1985 AND PROPOSED CHANGES FOR FY 1987[a]

	Cumulative sea duty (years)																	
Paygrade	⟨1	1	2	3	4	5	6	7	8	9	10	11	12	13	⟩14	⟩16	⟩18
E4	50	60	125	160	175	175	175	175	175	175	175	175	175	175	175	175	175
Δ	(0)	(0)	(−5)	(−10)	(−15)	(−15)	(−15)	(−15)	(−15)	(−15)	(−15)	(−15)	(−175)	(−175)	(−175)	(−175)	(−175)
E5	60	70	140	175	185	190	205	220	220	220	220	220	220	220	220	220	220
Δ	(−10)	(−10)	(−20)	(−25)	(−15)	(125)	(120)	(130)	(130)	(130)	(130)	(130)	(130)	(130)	(130)	(130)	(130)
E6	125	135	170	190	210	215	225	235	245	255	265	265	280	290	310	325	340
Δ	(−25)	(−35)	(−50)	(−40)	(−40)	(100)	(100)	(115)	(105)	(110)	(100)	(100)	(100)	(100)	(100)	(100)	(110)
E7	135	145	215	235	255	260	265	265	270	275	280	300	310	330	350	3703	90
Δ	(−35)	(−45)	(−95)	(−60)	(−65)	(90)	(85)	(85)	(120)	(125)	(120)	(110)	(110)	(120)	(125)	(130)	(110)
E8	165	180	225	255	265	270	280	285	290	300	310	310	320	340	360	380	400
Δ	(−65)	(−80)	(−105)	(−80)	(−75)	(80)	(70)	(65)	(100)	(100)	(90)	(100)	(100)	(110)	(115)	(120)	(120)
E9	175	195	235	265	280	290	310	310	310	310	320	320	350	370	390	410	410
Δ	(−75)	(−95)	(−115)	(−90)	(−90)	(60)	(40)	(40)	(80)	(90)	(80)	(90)	(70)	(80)	(85)	(110)	(110)

a. The Δ values in parentheses are changes associated with the FY 1987 proposal. Under the proposal, only those with less than five years' cumulative sea duty would be eligible for the career sea-pay premium awarded for more than three years' continuous sea duty. The sea-pay premium is presently awarded to all individuals at sea with more than three years' continuous sea duty.

to relative changes in Navy compensation. Empirical implementation of the model involves a statistical analysis of stay/leave decisions as a function of the maximum imputed difference in future paystreams (see [16]). The sensitivity of reenlistment and extension decisions to changes in relative military compensation are summarized by the coefficient of the ACOL variable in the statistical procedure. The other major empirical determinant of the stay/leave decision is the unemployment rate in the civilian economy. An increase in the unemployment rate is found to increase the fraction of members choosing to stay.

To analyze the effect of changes in relative military compensation on retention, the study team performed and compared two ACOL simulations. The team used current pay tables for the first simulation. In the second simulation, they substituted the proposed sea-pay changes. The difference in force structure between the simulations is the estimated effect of the pay change on retention. Because the FY 1987 sea-pay proposal involves a change in the entitlement to the sea-pay premium, as well as changes in the existing rate structure, a minor modification of the sea-pay calculation was required. The new sea-pay matrix was substituted in the calculation of military pay, and the premium for those with more than five years' cumulative sea duty was eliminated.

Two points about these calculations should be noted. First, the sea-pay calculations for the rating-specific version of the simulation are based on observed September 1984 distributions of individuals by length of service, cumulative sea time, and pay grade. This modification is believed to be a substantial improvement in the calculation of sea pay relative to earlier versions of the simulation. Second, the responsiveness of ratings to pay changes is based on ten DOD occupational codes applied to specific rating groups as in [18]. Different groups of ratings thus have different estimated retention responses associated with the same compensation change (table 1). ACOL makes no distinction, however, between different types of pay; i.e., sea pay and basic pay are assumed to have the same per-dollar effect on retention.

The rating groups analyzed include (1) mission-critical, sea-intensive; (2) other, sea-intensive; (3) mission-critical, some sea duty; and (4) mission-critical, no sea duty, as well as the group consisting of all Navy ratings.

To increase retention in a cost-effective manner in the sea-intensive ratings that are mission-critical (group 1), the substantial increases for those with more than 5 years' cumulative sea duty should be targeted to that mission-critical group. Individuals in the small number of sea-intensive

ratings that are not defined as mission-critical, however, tend to reach five years of cumulative sea duty even more quickly than those in the mission-critical, sea-intensive ratings (see [4]). The proposed CSP table can thus be expected to improve retention in all sea-intensive ratings.

Estimated changes in retention associated with the proposed changes in sea pay are summarized in table 2. The proposed FY 1987 sea-pay table would increase retention in sea-intensive ratings and leave the other large ratings groups virtually unaffected. In particular, mission critical ratings that are not sea-intensive (groups 3 and 4) would not be affected significantly. This result is due to the fact that higher sea pay would go only to those with more than five years of cumulative sea duty, whereas those with less than five years would receive slightly lower rates than they now get. On the other hand, sea-intensive ratings that are not mission-critical (group 2) would have an estimated retention increase that is proportionally slightly higher than that of the mission-critical, sea-intensive group. This result reflects the fact that a larger percentage of this group would be eligible for the higher sea-pay rates.

TABLE 2

ACOL ESTIMATES OF ADDITIONAL PERSONNEL RETAINED BY FY 1987 SEA-PAY PROPOSAL: 1987 – 1992[a]

Length of service (years)	Rating group[b]				
	1	2	3	4	All Navy
5-10	83 (.002)	114 (.007)	– 73 (– .001)	– 2 (.000)	98 (.001)
10-20	266 (.009)	68 (.006)	29 (.001)	– 1 (.000)	471 (.004)
20-30	63 (.017)	40 (.016)	31 (.006)	0 (.000)	167 (.010)
5-30	412 (.005)	222 (.007)	– 13 (.000)	– 3 (.000)	736 (.003)

a. Numbers in parentheses indicate approximate size of change relative to initial population of the cell.

b. 1 = mission-critical, sea-intensive; 2 = other, sea-intensive; 3 = mission critical, some sea billets; 4 = mission-critical, no sea billets.

Sea Duty and Sea Pay

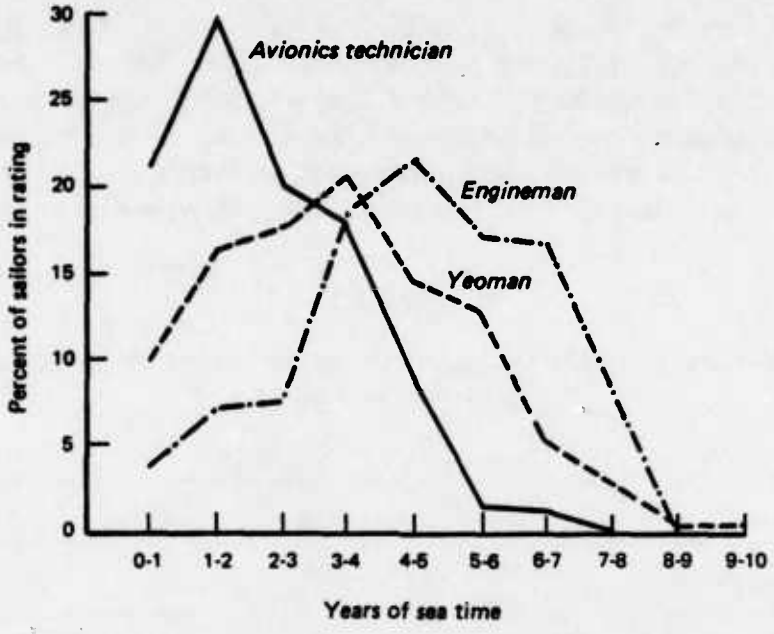
Existing retention studies, including those that ACOL relies upon, have employed measures of sea duty for rotation; they have not attempted to measure sea duty for pay or sea pay. In the studies reviewed in [3], sea pay either is not included in the analysis or is imputed on the basis of prescribed sea duty for rotation. Recent acquisition of individual data on sea duty for pay and sea pay from the Navy Finance Center (NFC) allowed the study team to explicitly analyze the link between sea duty and sea pay. The availability of these data supports, for the first time, the analysis of within-rating differences in sea duty and sea pay.

The analysis of these measurement issues was conducted for groups of individuals classified by ratings (occupations) or rating groups, paygrades, and lengths of service. The major findings are that:

- Variations in sea duty within ratings are as large as differences in mean sea duty across ratings.
- Loss of shore allowances significantly offsets sea pay, especially for single petty officers in shore-intensive ratings.
- Even very sea-intensive ratings have cumulative sea/shore rotations (for pay rather than rotation) that closely approximate a 3:3 ratio for sailors with a length of service (LOS) between 9 and 11 years.

The variation of sea duty within ratings for six selected ratings is illustrated in figure 4. A significant overlap in sea-duty intensity across these ratings is readily apparent. If greater dispersion in sea duty is partly due to the ability of individuals to influence their relative positions in the sea-duty distributions, then it should be associated with greater retention, other things being equal. Since sea-pay rates depend on cumulative sea duty, the dispersion of sea duty within a rating-LOS category implies the possibility of reducing sea-pay expenditures by substituting those ashore who have less-than-average sea duty for those at sea who have had above-average sea duty. However, such a policy may have the effect of reducing retention.

Many sailors receiving sea pay do not qualify for shore allowances associated with housing and other subsistence expenditures that are available to those on shore duty. Previous analysis of the effect of sea pay on retention



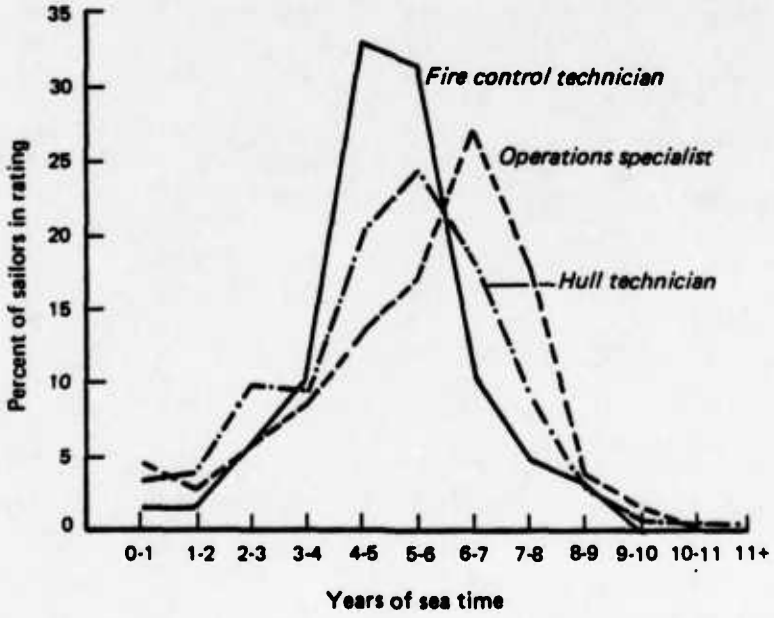


FIG. 4: VARIATION OF SEA DUTY WITHIN RATINGS FOR SAILORS WITH 11 YEARS OF SERVICE

has not examined the relative magnitudes of sea pay and shore allowances for sailors with different characteristics.

Table 3 presents the net "at-sea" pay differentials (designated as Δ) between those receiving sea pay (defined to be "at sea") and those not receiving sea pay in October 1982 by rating and paygrade for individuals with no dependents in six selected ratings.[1] Paygrades E4 through E6 generally receive much smaller shore allowances when receiving sea pay than when not. E7s continue to collect shore allowances while getting sea pay.

TABLE 3

MEAN SEA PAY AND "AT-SEA" PAY DIFFERENTIALS, NO DEPENDENTS
(Dollars per month)

Paygrade		Rating					
		AT	YN	EN	FTG	OS	HT
E4	Sea pay	55	83	85	65	89	85
	Δ	14	-14	45	44	43	66
	Number	440	536	772	410	1,082	1,307
E5	Sea pay	73	133	126	119	168	130
	Δ	-35	-22	34	58	49	81
	Number	223	123	164	430	476	384
E6	Sea pay	157	179	196	233	224	197
	Δ	5	27	97	93	107	107
	Number	32	51	33	41	82	54
E7	Sea pay	233	261	318	259	299	264
	Δ	189	235	284	202	223	198
	Number	7	9	6	14	25	18

It is clear that the shore-intensive ratings (AT, YN) have lower differentials in "at-sea" pay and allowances than the sea-intensive ratings

1. The net "at-sea" pay differentials are the differences between (1) the sum of mean sea pay and shore allowances for those at sea and (2) the shore allowances of those on shore in the same rating and paygrade. They do not include the tax advantage associated with allowances. See [4] for a description of the ratings.

(OS, HT). For the YN ratings in pay grades E4 and E5 and for the AT rating in pay grade E5, the loss of shore allowances while at sea more than offsets, on average, the gain in sea pay. These differentials, like the previous ones, should be interpreted as lower-bound estimates of the net monetary impact of sea duty. They implicitly assume that each dollar of in-kind allowance (without tax advantage) is valued as a dollar of income and that shipboard quarters and subsistence have no compensating value for lost allowances. On the other hand, upper-bound estimates of the monetary impact of sea duty are the average sea-pay amounts themselves, with perceived value of shore-based allowances being exactly balanced by shipboard services.[1] The differences in average sea pay across ratings reflect differences in cumulative sea duty and the fact that sea-pay rates increase with cumulative sea duty.

Sea duty for pay is much less intensive than prescribed sea duty for rotation. Sailors in the most sea-intensive ratings among the six studied (OS and HT) spent, on average, about half of their first ten years of service at sea for sea pay (see [4], p. 17). For comparison, the prescribed sea/shore rotation stipulates 71 percent sea duty for these ratings up through E6. Subsequent work should examine the relations between sea duty for pay and sea duty for rotation within and across ratings. The findings should be useful for Navy planners as well as for future retention studies.

Geographic Stability

The lack of geographic stability for Navy personnel, particularly when it is combined with long tours at sea, has been a subject of continuing concern. Questionnaires given to sailors when they leave the Navy routinely show that frequent moves and long sea tours (particularly if they involve family separations) are two of the most important reasons for leaving. While being in the Navy means being at sea for at least part of one's career, there have been proposals, such as Project Sea Horse in the early 1980s and more recently TETHER, to increase geographic stability for enlisted personnel.

The problem is complicated, however, because increasing geographic stability for some Navy personnel may decrease the stability for others. Mandatory permanent-change-of-station (PCS) moves are required for accessions and separations. Additionally, the need to shift personnel to

1. The possibility that sailors might prefer shipboard accommodations to shore accommodations is discounted here.

different locations for training, for operational needs, and for sea/shore rotation necessitates PCS moves.

There are hints that the frustration of sailors over geographic instability is growing. At least some of this frustration relates to the increased propensity of couples to be dual earners. While military wives participate less in the labor force than civilian wives do, the difference seems to be narrowing. To the extent that these trends continue, one can expect more voluntary separations (as employed wives do not accompany their military spouses, particularly for short-term moves) as well as lower retention as more couples decide that family income will be higher if they both pursue civilian employment.

Increased geographic stability would probably increase retention, as well as decreasing the PCS budget. But whether overall it would be cost effective is a difficult question. Indeed, until the EMPT study was done, the Navy did not even know how long enlisted personnel stay in one geographic area.

The study team was asked to examine the current length of stay in eight locations for five combat-system/propulsion ratings. One primary interest was the proportion of these personnel who remain in one location at least six years. The answer was—not many. Only in 9 of the 40 rating/location combinations do at least 20 percent of the enlisted personnel remain for six years. While for these locations a proposal to "tether" about 20 percent of the billets might not involve a sharp change in detailing practices, for most of the other locations, detailing practices would have to change significantly. (The complete results of the analysis are in [1].) Figure 5 illustrates the findings for boiler technicians in Hawaii. In the 1978 through 1985 time period, a little over 36 percent remained in Hawaii over four years and 17 percent remained over six years.[1]

1. The analysis of the current length of stay required the construction of longitudinal histories for enlisted personnel. Although CNA had a complete collection of Enlisted Master Record (EMR) extracts from December 1973 to the present, permanent longitudinal records had not been created. After longitudinal files were created, information for 1973 through 1977 was put into one data set and information for 1978 to the present time was put into another. The longitudinal file is updated every quarter and is now part of the CNA computer tape library.

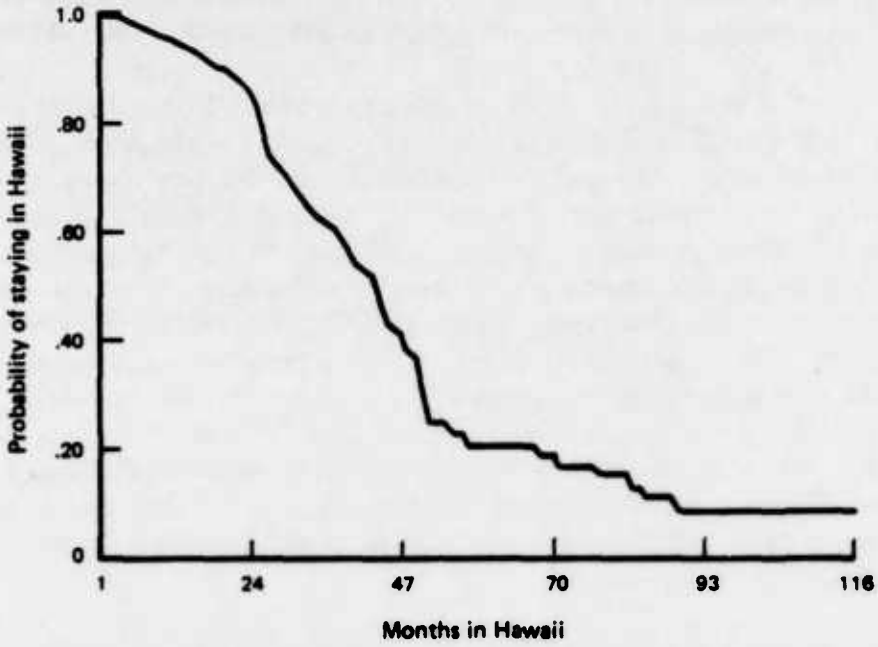


FIG. 5: BOILER TECHNICIAN TIME IN HAWAII

ACCESSIONS

Study topics for accessions fall into two categories: recruit survival and recruit procurement.

Recruit Survival

With the advent of the All-Volunteer Force, new interest emerged in the question of how the characteristics of recruits relate to the probability that they will complete their enlistment contracts. CNA was a prime contributor to the Navy's understanding of this relationship. In work with the FY 1973 cohort and later with the FY 1977 cohort, CNA developed a scoring method labeled "Success Chances for Recruits Entering the Navy" (SCREEN) [19 through 22]. A recruit's SCREEN score, which takes into account personal characteristics like gender, race, educational status, age, and mental group, provide an estimate of the probability that the recruit will successfully complete (survive) a specified period of service. Currently the Navy uses SCREEN scores only for male recruits. Derived from experience with the

FY 1977 recruit cohort, these scores provide an estimate of the probability that males with specified characteristics will complete one year of service.

As part of the EMPT study, the Navy wanted to check the continuing validity of the SCREEN scores currently used. Additionally, there was interest in whether survival rates are affected by the overall recruiting climate for a particular recruit cohort. The late 1970s, for example, were extremely difficult recruiting years. Low civilian unemployment rates and small (or nonexistent) military pay increases combined to create an environment in which military service was not popular, and recruiting goals were not always met. 1982 and 1983 stand in sharp contrast: substantial military pay increases and high civilian unemployment rates created an environment in which the Navy met its accession goals and improved the quality of its recruits.[1] Finally, the Navy was interested because of administrative concerns. Could a SCREEN-type database be created that would be easy to access, up to date, and responsive to user queries? Here the primary goal was a quick-response capability.

Earlier work at CNA had built a data set on non-prior-service accessions in the FY 1978 to FY 1984 time period.[2] Composed of 546,569 observations, this file contained recruits' history from the dates they signed their initial enlistment contracts to the dates they left the Navy (or to June 1985 if they were still in the Navy in June 1985). The problem here was how to organize these data so that survival rates for the different subgroups of recruits could be tabulated quickly and displayed clearly. Because previous work had generally displayed survival rates by educational status, mental group, and age, it was decided to continue this format.[3] Tables would organize survival rates by these three characteristics.

The next decisions involved what characteristics users of the SCREEN tables would be able to specify. The ones selected were fiscal year of recruit cohort (or a combination of years), program enlisted for (or a combination of programs), gender (or both genders), and whether shipment occurred within the contract month or in a later month (DEP).[4] Additionally, the users could

1. Recruit quality started to decline again in 1985. Survival data for the FY 1985 and FY 1986 recruit cohorts were not available when this analysis was done.
2. See [6] for a more complete description of these data.
3. Mental group categorizations are by the World War II reference population.
4. There are at least two definitions of the DEP – shipment three days or more after the initial contract is signed, and shipment in a future month. The latter definition is the one used in this study.

specify the number of months for which they want to compute the survival rate. Access to this SCREEN data base on the CNA computer is available in Op-13.

Analysis of these attrition data both validated earlier findings and provided new insights into first-term attrition. First, the finding that high-school-diploma graduation is the most important predictor of first-term survival was demonstrated for every recruit cohort and every accession program. At 33 months, nearly all the survival rates for high-school-diploma graduates (HSDGs) are over 20 percentage points higher than those with general equivalency diplomas (GEDs) and nongraduates. No systematic differences in survival between GEDs and nongraduates was found. (This finding differs from the results of the earlier SCREEN work. The older SCREEN table currently used by the Navy indicatates that GEDs have slightly higher survival rates than nongraduates.) Given that GEDs are supposed to have absorbed the same amount of formal schooling as diploma graduates, the finding appears to be that a diploma signals something else about the recruit other than formal learning – perhaps simply that the recruit is more likely to finish what he starts.

There was some difference in overall survival by recruit year. In FY 1979, when the civilian unemployment rate was low and military pay relative to civilian pay was also relatively low, the Navy experienced both difficulties in recruiting and relatively low nine-month survival rates (86 percent). In contrast, in the peak recruiting year of 1983, nine-month survival was 90 percent. This 4-percent increase in nine-month survival rates translates into a retention of about 3,000 more sailors. Some of this variance is explained by the different mixes of recruits (primarily a higher percentage of diploma graduates in 1983), but there were still differences in survival for the two years for otherwise identical recruits.

An interesting observation is that one- and two-year survival rates over the FY 1983 through FY 1984 period tended to be higher for those in the longer enlistment programs (the five- and six-year obligors) than for those with shorter initial enlistments.

1. There are at least two definitions of the DEP – shipment three days or more after the initial contract is signed and shipment in a future month. The latter definition is the one used in this study.

The overall survival rates for males and females were generally similar. The totals, however, are somewhat misleading, because females were overwhelmingly diploma graduates; within educational- and mental-group categories, males had slightly higher survival rates than females.

As was observed in earlier work on first-term survival, survival rates vary more by educational category than by mental group. For example, six-month survival rates for male recruits with school guarantees in FY 1983 and FY 1984 ranged from 84 percent for non-high-school graduates to 91 percent for high-school-diploma graduates. By mental group (MG), the survival rates ranged from 91 percent (MG-1) to 87 percent (MG-4A). Within the upper mental group (MG-1 through MG-3U), survival rates were identical—91 percent.

Another finding that emerged from the survival analysis was the difference in behavior for recruits who entered the Navy within the month of their initial enlistment contract and those who entered in a future month (1 to 12 months later). These latter recruits went into the Delayed Entry Program. Even within educational categories, recruits who entered from the DEP had higher survival rates. For example, for FY 1982 recruits who were HSDGs and had school guarantees, the 30-month survival rate for those who entered within a month was 72 percent; for recruits who entered from the DEP, the survival rate was 80 percent.

This finding was evident in all fiscal years and in all recruit programs. It suggests that individuals who have had more time to think about their decision to enter the Navy are more likely to adapt to Navy life. Moreover, the finding reinforces a concern to be discussed more fully later in this report. As the Navy's DEP shrinks and more recruits enter the Navy within the month they sign their contract, the Navy can expect higher first-term attrition *even if the recruit quality mix does not change.*

Recruit Procurement

The study team addressed three recruit procurement topics. The first concerned a special procurement program the Navy used in 1983 and 1984; the second concerned the efficacy of enlistment bonuses; and the third was enlistment contract abrogation.

Programmed School Inputs (PSIs)

Enlisted recruits come into the Navy in two general patterns. About two-thirds enter with the promise of formal schooling after completing two months of recruit training. This period of formal schooling (A-school) varies from six weeks for semitechnical ratings to over two years for recruits in the nuclear field and culminates in occupational qualification (a rating). About one-third of the recruits, however, get no promise of A-school. These general-detail recruits (Gendets) may attend A-school later or, alternatively, become occupationally qualified through on-the-job training (OJT). In the meantime, these recruits will perform the many general-detail tasks required in the Navy. After recruit training, Gendets attend a month-long apprenticeship school before going to the fleet. Congressional direction currently requires completion of basic training before recruits can be assigned outside the U.S., except in time of war or national emergency when a minimum of 12 weeks is required.

Because school attendance patterns are tied to accession patterns (lagging accessions by the two months of recruit training), school loadings have tended to vary more than Navy planners desire. The heaviest demands on the A-schools are in the fall, because of the large number of accessions following high school graduation; in the spring there tend to be unfilled school seats.

Partly in response to school-loading issues and partly in response to attrition issues, the Navy implemented an accession program called Programmed School Inputs (PSIs). Recruits entering the Navy as PSIs were guaranteed A-school, but they would first go to the fleet. Sometime during their first year in the Navy, they would be sent to school to train for the rating they had been promised. In addition to providing Navy school planners with more flexibility for scheduling school inputs, the program offered the prospect of saving training dollars by allowing recruits who were not going to be satisfactory to leave the Navy before the Navy had spent training dollars on them. Additionally, the program was expected to save recruiting dollars (because of the attraction of guaranteed training and of the popular summer entry) and to provide extra Gendet manning for the fleet.

The Navy accessed 3,142 PSI recruits in FY 1982 and 1,704 in FY 1983. The program then stopped, primarily because the new Sea and Air Mariner Program filled the training facilities that had been used for the PSIs. The General Accounting Office (GAO) then directed the Navy to evaluate the program, and this task was added to the EMPT study.

PSI recruits were promised schooling for many of the ratings that require four-year obligations. (The only PSI five-year obligors were in the air traffic controller rating.) Most PSI recruits were brought in for ratings at the lower end of the technical spectrum and most of them received the ratings they were promised.

Overall, the program worked as it was intended. Recruits went to the fleet and later returned to A-school. Not surprisingly, there were exceptions. About 5 percent of the recruits went to A-school immediately after recruit training, and some recruits never made it to A-school. Slightly over half of the PSI recruits who did not make it to A-school left the Navy before 12 months, and before they were to attend A-school. For these recruits, the Navy presumably saved training dollars. (It is reasonable to assume that many of them would also have left the Navy if they had gone directly to A-school after recruit training.) Of the 547 PSI recruits who did not attend A-school but remained in the Navy at least 12 months, 212 got rated on the job. The vast majority of the 343 PSI recruits who stayed in the Navy long enough to attend A-school, but who neither attended A-school nor got rated through OJT, left the Navy in their second year of service.[1]

To evaluate the PSI program, it is necessary to first outline its benefits and costs. Ideally, both would be expressed in dollars, so that subtracting the costs from the benefits would show, unambiguously, whether the program was cost effective. Not surprisingly, some of the parameters necessary for the calculation are more sharply delineated than others. For example, while one can calculate quite precisely how permanent-change-of-station (PCS) costs differ between school-guarantee and PSI recruits, one has considerably more difficulty putting a dollar value on the increased Gendet manning that PSI recruits provide while spending four to ten months in the fleet. Similarly, it is hard to quantify the benefits to the Navy of recruiting with the promise of future school (versus recruiting Gendets) or of recruiting in the more popular summer months and sending these recruits to school in the spring. The CNA study team made tentative cost-effectiveness calculations, but additional Navy input has been sought before these calculations become final.

1. See [8] for a more complete description of the program as well as more detail on its effectiveness.

Enlistment Bonus Program

Enlistment bonuses are promised to some potential recruits to induce them to join the Navy. They have been limited to skill areas characterized by chronically inadequate volunteer levels. The EMPT study detailed the history of the Navy's Enlistment Bonus (NEB) program and then addressed the question of whether it has been successful in prompting additional enlistments. The focus was on recruits in the nuclear field.[1]

The Navy's use of enlistment bonuses has been flexible; eligible ratings and bonus amounts are subject to change based on the Navy's current manpower requirements and are reviewed semiannually. For ratings in which the active-duty enlistment period is six years, the bonus is given to all recruits. If, however, the enlistment term for the rating is four years, recruits are given the choice of a four-year enlistment without the bonus or a five-year enlistment with the bonus. (No ratings with an initial enlistment period of five years have received a bonus.) The enlistment bonus is contracted when an individual enlists and is paid upon completion of A-school. For accessions in the nuclear field, this training period is approximately two years.

Although the Navy has used the enlistment bonuses extensively since 1980, CNA has never conducted a systematic analysis of their efficacy. The analysis done in this study for nuclear-field recruits provides a first step in that direction. No attempts were made, however, to evaluate the cost-effectiveness of the program.

The study team began by assembling a data set for nuclear-field recruits that includes information from January 1974 to April 1985. Data were collected on the unemployment rate, the levels of military and civilian pay, and the number of recruiters. During this period there were four bonus levels for new recruits in the nuclear field:

- No bonus from January 1974 to November 1979
- A $2,000 bonus from December 1979 to July 1984
- A $4,000 bonus from August 1984 to December 1984

1. See [9] for a more complete description of the NEB program and for the empirical analyses of the efficacy of the program for procuring nuclear- field personnel.

- A $5,000 bonus from January 1985 to April 1985.

These bonus levels provide enough variation to permit estimation of the efficacy of the bonus for attracting recruits.

Three measures of enlistment supply for the nuclear field were constructed: total shipments, additions to the DEP, and the difference between the monthly shipment goals and the actual shipments. These measures were regressed against variables that reflect the economic climate (pay and unemployment), the number of production recruiters, the amount of the enlistment bonus, and variables that control for seasonality. There was an additional variable in the equations for total shipments and for the additions to DEP: for total shipments it was the shipment goal, and for additions to DEP it was the number of recruits who were not added to the DEP but instead were immediately accessed into the Navy.

The coefficient estimates, as well as the general explanatory power of the equations, were similar across the different specifications for measures of the economic climate. Navy policy variables—the bonus and the number of recruiters—were positive and significant: more recruiters and higher bonuses stimulate nuclear-field enlistments. The recruiter elasticity suggested by these estimates is 2.22; that is, increasing recruiters by 10 percent increases the number of recruits added to the DEP by 22.2 percent. While these estimates may seem high, it should be remembered that recruiters first fulfill their shipment goal with recruits going directly to active duty and only then add individuals to the DEP. Additions to the DEP are a residual and, as such, respond much more sharply to the addition (or subtraction) of Navy resources. The elasticity of the total number of nuclear-field recruits entering the Navy in relation to the number of recruiters is 0.60, suggesting that if the number of recruiters is increased by 10 percent accessions increase by 6 percent.

The efficacy of the NEB program is clearly established by its significance for all three measures of recruit procurement and across the different specifications of the economic climate. Increasing the bonus by $1,000 adds about 40 new obligors monthly to the DEP, increases total shipments by about 25 recruits each month, and reduces the shortage of nuclear-field recruits by about 25 each month.[1]

1. The estimates in [9] measured the nuclear-field bonus in nominal dollars. The equations were later reestimated with the bonus deflated by the Consumer Price Index (base is March 1981). The numbers in this report refer to those later estimates.

Since September 1985, the NEB program for recruits in the nuclear field has been based upon the shipment month. The new bonus structure attempts to even the accession flow, which has historically been seasonal. Differential enlistment bonuses are set to give individuals an incentive to delay entry until historically poor accession months. The hoped-for result is a level-loaded accession flow to match training capacity. These bonuses vary from $3,750 in the historically high-accession summer months to $6,000 in the spring (March-May).

The findings from this work justify some optimism for the success of the new program, although whether the bonuses will provide sufficient incentive to change historical accession patterns and shift recruits into less popular shipment months is still unknown. CNA is monitoring the results of the new program in a new study, the Targeted Enlistment Bonus Study.

Enlistment Contract Attrition

While much research has been done on the determinants of Navy active-duty attrition, virtually no research has been done on pre-active-duty (enlistment contract) attrition. One explanation for the paucity of research in this area is the presumed low cost of such attrition.[1] Another reason arises from the way the Navy organizes its data on enlistment contracts: information is retained only for contracts that result in accessions. Even for aggregate summary statistics, information is not available on the number of abrogated contracts.

To investigate the magnitude of this attrition, the study team constructed a data set for individual non-prior-service recruit contracts in FY 1983 to FY 1984.[2] These data showed that 12.2 percent of the contracts were abrogated during this period. The study team then tried to identify individual characteristics associated with high rates of contract attrition, hoping to match the success of its effort to identify the characteristics associated with high active-duty attrition.

Recruits either abrogate their contracts or they ship. Such dichotomous decisions are appropriately estimated as probabilities, with a specification

1. The cost includes the cost of obtaining the contract and the cost of any additional time the recruiter spends with the individual while he is in the DEP.
2. See [10] for a discussion of the construction of this data set and more detail on the analysis.

that does not allow the values to fall below 0 or above 1. For this analysis, the logistic distribution, which estimates an S-shaped curve, was selected. The contract abrogation equation controlled for personal characteristics (gender, education, age, and AFQT score), enlistment program, recruit area, length of time in the DEP, and the month.

Although the explanatory power of this equation was statistically significant at the 1-percent level, it did not exhibit the powerful discrimination between contract abrogators and nonabrogators that is characteristic of equations estimating active-duty attrition. The variables differentiate attrition rates in the directions expected by casual observation. The predicted differences among males are not very large: estimated probabilities for those least likely to abrogate their contracts are 8 percent, while the estimated probability for those most likely to abrogate is 13 percent. The only characteristic that sharply delineated abrogation rates was gender: contract abrogation rates estimated for females were almost double those for otherwise identical males.

These results are not surprising. Young adults are prone to change their minds, but predicting which young adults will change their minds is difficult. Also, the "cost" to a recruit of abrogating a contract is undoubtedly less than the "cost" to an active-duty sailor of leaving the Navy before his term is up. The decision to abrogate, therefore, may be more subject to whim.

Recruiting Issues

As indicated in the introduction, Navy recruiting statistics for the period since 1984 reflect competitive pressures in the youth labor market that pose the most serious challenge to Navy recruiting since the experience of 1978 and 1979. These statistics were the catalytic factor inducing a study of recruiting as part of the EMPT project. The analysis focused first on the observation that much of the month-to-month variation has been seasonal. An understanding of the quantitative significance of this seasonal variation was needed. Remaining fluctuations in recruiting flows could then be examined for systematic relationships with indicators from the youth labor market and with the level of Navy recruiting resources. If robust relationships could be identified, they might be exploited in future planning for recruiting resources.

The following questions were addressed:

- To what extent are recent changes in enlistment contracts and accession flows normal seasonal changes?
- Is there a relation between seasonal recruiting and accession patterns and the relative difficulty of the recruiting environment?
- What are the effects of youth population, unemployment, and military pay (relative to civilian pay) on recruiting performance?
- What are the effects of changes in the number of Navy recruiters and advertising expenditures on enlistment contracts and accessions of high-mental-group recruits?

Understanding the relation between economic conditions, Navy recruiting resources, and recruiting performance is important in planning allocations of recruiting resources. The primary cohort from which the Navy recruits active-duty, non-prior-service males consists of 17- to 21-year-olds who are in the early stages of their careers. Their choice between military and civilian occupations is assumed to be determined by four considerations: military compensation relative to civilian sector alternatives, employment prospects, demographic factors, and recruiting resources, particularly recruiters and advertising. Indicators of recruiting performance to be explained by the analysis include total enlistment contracts, which are the sum of contracts that have shipment dates in the same month (direct shipments), and contracts that have shipment dates in future months (additions to the DEP). Other things being equal, enlistment contracts are expected to increase with military pay increases, unemployment rate increases, and with additional recruiters and advertising.

A variable measuring the pressure on recruiters to produce direct-shipment contracts was constructed. It is the number of contracts that must be written in the current month to meet the monthly accession goal, assuming that the number reported as scheduled to ship from the DEP actually do so. An increase in this measure of recruiting pressure would be expected to increase direct shipments of recruits and reduce additions to the DEP. Improved efficiency in estimating these relationships can be obtained by exploiting the fact that more direct shipments, as a percentage of total contracts, tend to reflect an increased competitiveness in the recruiting market.

A decline in the average quality of new recruits is to be expected in more difficult recruiting periods. The EMPT study used the percentage of recruits in mental groups 1 and 2 as an indicator of the aggregate quality of new recruits. The study team also looked for systematic relationships between the percentage of recruits in these mental groups and the indicators of economic conditions and recruiting effort discussed above.

Most of the results of the statistical analyses were as expected, but there were exceptions. Among the troublesome findings, the most surprising result was that Navy advertising, measured as expenditures (deseasonalized) on all types of advertising by month in which the advertising appears, had no significant effect on either the number or the percentage of accessions in the high mental groups. Although this finding was unanticipated, it is in accord with results obtained by other researchers.

Several possible explanations for this result were considered. First, it may be that advertising expenditures are efficiently adjusted so that they fall as changes in the economy improve the recruiting market, and vice-versa. If they were perfectly programmed, one should observe a strong negative correlation between advertising and unemployment. In fact, this correlation is essentially zero over the period for which advertising data were available. Alternatively, some other definition of advertising effort—such as television advertising expenditures, joint-services advertising expenditures, or a measure of advertising effectiveness—may be more appropriate.

On the positive side, unemployment and recruiters were identified as important variables associated with the number of contracts and additions to the DEP. With respect to total contracts, a typical ratio of unemployment elasticity to recruiter elasticity is 0.6; that is, a 10-percent decrease in youth unemployment requires a 6-percent increase in recruiters to hold the number of recruit contracts constant, other things being equal.[1] Both elasticities are larger for additions to the DEP. Using the total sample results, the ratio of elasticities is about 0.8 for additions to the DEP, requiring a larger increase in recruiters to hold additions to the DEP constant in the face of declining youth unemployment.

With respect to mental group 1 and 2 accessions, no robust relationship was identified between the number of recruiters and the percentage of high-

1. The elasticity ratio is 0.5 when estimated over the FY 1980 through FY 1985 period. It is thus relatively robust despite the misnorming of the ASVAB in the late 1970s.

quality recruits accessed. Mental group 1 and 2 accessions, however, are sensitive to unemployment fluctuations. A 10-percent decline in youth unemployment rate (for example, from 15 percent to 13.5 percent) was associated with a 5-percent decline in the quantity of recruits and a 3-percent decline in the percent of enlistment contracts that are in mental groups 1 and 2. The combined effect indicates that high-quality accessions are more sensitive to changes in the unemployment rate than are total enlistment contracts. Relative military pay (in the supply-constrained sample as defined in [12]) is also both positively and significantly related to the percentage of high-mental-group accessions.

Overall, this study's estimates of the elasticities of contracts with respect to unemployment (0.4–0.5) and recruiters (0.7–0.8) are similar to those reported in the previous literature, though some cross-section estimates are smaller. A relatively high (greater than 1) recruiter elasticity was estimated for additions to the DEP. Since additions to the DEP are a residual (falling sharply in difficult recruiting months and increasing sharply in good months), this result is perhaps not surprising. Moreover, additions to the DEP will increase if higher retention reduces the accession goal (other things being equal); thus the large elasticity estimate implicitly includes a measure of the responsiveness of the accession goal to economic conditions as they affect retention. There are, however, no other estimates to compare it with.

At this point, it is worth noting that Navy policy has been at least partially responsible for the drop in the size of the DEP. Between April 1983 and April 1984, the Navy reduced the number of production recruiters by about 20 percent. Unfortunately, this cost-saving measure coincided with the beginning of the more competitive recruiting period. The difficulty of timing such changes argues against such activist policies of making large changes in recruiting resources based on current or imperfectly foreseen economic conditions. Had the recruiting force not been cut at that time, the current DEP size would be considerably larger than it is.

Seasonal patterns in recruiting reflect recruit preferences concerning the timing both of decisions about employment choice and of entrance into military service. The Delayed Entry Program allows recruits to separate these decisions by signing an enlistment contract in January, for example, and entering military service the following June. Seasonal patterns are also influenced by Navy policies and goals concerning the number of enlistment contracts and accessions for each month of the year.

Seasonal adjustment is important to an understanding of cycles in the recruiting market, which are believed to be related to business cycles in general. Accounting for seasonal variation associated with seasonal preferences of recruits is necessary to properly interpret whether the recruiting cycle is currently on an upward swing, on a downward swing, or at a turning point.

The seasonality evident in Navy recruiting data is systematically explored in [11], a methodological paper that uses several alternative techniques for determining the quantitative significance of seasonal fluctuations in time-series data. Estimates of the extent of seasonal variation in enlistment contracts and accession flows are obtained. The main results are the following:

- There was a significant decline in the extent of seasonality in recruiting and accession between 1979 and 1984. But the most recent evidence indicates a reversal of this trend that is probably caused by the growing competitiveness in the recruiting market.
- Additions to the Delayed Entry Program and accessions of high-mental-group recruits have been subject to greater cyclical fluctuations (related to the business cycle) than have net enlistment contracts or the percent of high-school-diploma graduates recruited.

In the absence of seasonal adjustment, month-to-month comparisons of recruiting performance provide little information on recruiting conditions. Because of the importance of seasonality in recruiting, decision makers who have little experience with the nature and quantitative significance of seasonal influences must be careful in evaluating arguments based on unadjusted data.

POLICY IMPLICATIONS OF EMPT STUDY

The importance of high-school-diploma graduation as a predictor of first-term survival has important implications for current Navy recruiting. In the first six months of FY 1986, 79 percent of the recruits entering service had high school diplomas, compared with 89 percent during the same period of FY 1985. The SCREEN results show that, after 33 months, 77 percent of high-school-diploma graduates are still in the Navy, but only 53 percent of nondiploma recruits are. If the 10-percentage-point drop in accessions of high-school-diploma graduates continues for the rest of FY 1986, approximately 2,300 fewer recruits will survive 33 months. To the extent that this additional

attrition is not planned for, some personnel shortages may occur. The cost of this additional attrition justifies additional recruiting resources.

A rough magnitude of reduced recruit survival associated with higher percentages of direct shipments can also be derived from the SCREEN work. Based on the FY 1984 cohort, even if direct shipments have the same quality characteristics as shipments from the DEP, there is a decrease of 0.7 percentage point in nine-month survival when direct shipments increase from 10 percent of accessions to 35 percent of accessions. This amounts to about 650 additional losses in the first nine months (for 95,000 total accessions).

Because diploma graduates prefer to enter the Navy in the summer, a rephasing of the accession plan into these months, along with a heavier reliance on the DEP as a screening device, would increase recruit survival and quality. The problems with rephasing are that apprenticeship training facilities are already operating at near capacity and Sea/Air Mariners (SAMs) must be trained in the summer. But there are several possible ways to alleviate this constraint. Gendets could be assigned to shore billets, rather than going immediately to apprenticeship training. That would fulfill the Congressional requirement of 90 days' service before leaving CONUS. The result would be to allow more of them to access in the summer. In the meantime, the Navy could petition Congress for a waiver of this requirement. In the absence of more training facilities, other options would require the more intensive use of training facilities in the late summer and fall months, or scaling back the summertime use of training facilities by SAMs.

Alternatively, recruiters could devote more effort to combating recruit preferences for summer and early fall accession. Seasonal accession bonuses are being experimented with in the nuclear field, and such bonuses could be expanded to other fields. The current seasonal accession bonus for the nuclear field is not tied to the DEP, however, and may need to be modified to have its most desirable effect.

The most cost effective of the above alternatives appears to be a rephasing of the accession plan to shift more accessions into the summer months and to free up training space for them by reducing the number of SAM shipments in the summer. Increasing the percentage of DEP accessions would increase the survival of the higher quality recruits obtained, since DEP experience is an inexpensive and valuable screening mechanism. Increasing the number of production recruiters would be consistent with increasing accession goals and a difficult recruiting environment that is not expected to improve soon.

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