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Transforming the Assignment System: Will Incentives Reduce Critical Shortages?

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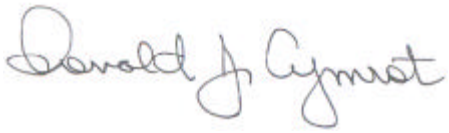

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Contents

Summary

The Navy has long faced difficulties in manning billets in certain locations. To keep sea manning high, the Navy has relied on sea pay and sea/shore rotation. For key shore assignments, it has used a patchwork of assignment incentives, such as offering sea duty credit or promising sailors they can choose their next assignment. Then, if all else fails, the Navy orders sailors involuntarily into hard-to-fill billets. Solving manning problems in this way, however, has unintended and potentially costly consequences.

Because of the negative consequences of the current assignment system, the Chief of Naval Operations (CNO) wants to increase sailors' choice and job satisfaction while improving the efficiency of the distribution system. To do this, the Navy plans to use pay as the primary means to encourage sailors to volunteer for hard-to-fill billets. Specifically, Assignment Incentive Pay (AIP), which was first authorized and funded for FY 2003, can provide extra pay to sailors serving in hard-to-fill billets.

Before the Navy fully implements AIP or any other incentives, however, it requires better information about the costs and benefits of moving toward a more voluntary assignment system. To that end, the Assistant Deputy Chief of Naval Operations, Manpower and Personnel (N1B) asked CNA to consider the costs of the current system and determine how the Navy might encourage sailors to volunteer for hard-to-fill billets in a cost-efficient way. The main questions we look at are:

- What are the largest costs of the current assignment system?
- What incentives would best encourage sailors to volunteer for hard-to-fill billets?
- Is an assignment incentive pay cost-effective compared to the current system?

Findings

Overall, we find that AIP is a promising way of moving the Navy toward a more voluntary, efficient assignment system if it is designed as a flexible, market-based incentive pay, as planned. For overseas shore billets that use sea-duty credit as an incentive, an AIP will almost certainly be cost-effective. For continental United States (CONUS) shore billets, AIP may not be cost-effective. Specifically, our analysis led to three findings.

First, the cost of the current assignment system is substantial. The cost of using sea duty credit to compensate sailors for overseas shore duty is the largest cost component. The expense associated with using sea duty credit can be thought of as either:

1. The cost of higher endstrength to maintain sea/shore balance. In this case, we estimate that the higher endstrength needed to support sea duty credit to overseas shore billets costs the Navy at least $195 million annually.
2. The loss in fleet readiness of having fewer sailors available for sea duty. In this case, the Navy would have to pay over $83 million in sea pay annually to offset the fleet readiness loss of the sea duty credit.

We also find that retention is lower for sailors ordered into undesirable billets under the current assignment system. Using statistical analyses, we estimate that careerists who receive orders for less desirable CONUS locations have a continuation rate about 1 percentage point lower than that of sailors ordered to highly desired locations. Both initial enlistees and careerists who are, or are likely to be, involuntarily assigned are more apt to leave the Navy—with continuation rates 2.1 and 0.8 percentage points lower, respectively. The implicit cost of the lower retention is the cost of offsetting it using bonuses. Although our estimates are sensitive to the definition of *hard to fill*, our best estimate of this cost, applied to CONUS sea and shore billets, is about $33 million per year, or about 20 percent of the Selective Reenlistment Bonus budget.

Combining the retention costs and lower bound cost of sea duty credit, we estimate that the costs of the current assignment system and incentives exceed $116 million annually.

Second, the Navy can transform its current system through the use of incentives. Using our survey data, we find that, given adequate incentives, sailors will volunteer for billets that are traditionally difficult to fill. Nonmonetary incentives, however, often do not have the broad appeal that pay does, and the value of some nonmonetary benefits appears low compared to additional pay.

The incentive required, however, differs depending on sailors' assignment options and personal circumstances. Our survey shows that the less preferred the location, the higher the compensation required to induce volunteers. For example, the "typical" sailor requires pay ranging from $96 to $651 to choose Japan (the least preferred location) depending on the sailor's alternative. In contrast, it would take from nothing to $262 to get the typical sailor to the Pacific Northwest (a somewhat more preferred location). We also find that sailors with dependents favor staying in their current locations, whereas sailors without dependents have less of a home-basing preference. This implies that single sailors may be more willing, at a lower pay, to go to traditionally difficult-to-fill locations, such as certain overseas shore duty.

Third, cost/benefit analysis shows that AIP should be more cost-effective than the current system, although, for some billets, it may not be. Although there is uncertainty about how AIP will be designed and, consequently, how targeted and effective it will be, our estimates show that the Navy will likely reap benefits from at least a partial implementation. Again, we analyzed the costs of outside-CONUS (OCONUS) shore duty, which receives sea duty credit separately from CONUS duty.

On the basis of our survey results, we make the following estimate: Using an efficient market system in which AIP is targeted by billet, the cost of getting volunteers for OCONUS billets would probably be below $25 million annually. The sea duty credit (costing $83 million annually at a minimum) is *at least* three times more costly than AIP. Even under a worst case scenario, assuming all OCONUS shore billets

that receive sea duty credit were paid AIP of $750 per month (a current maximum), AIP should be cost-effective.

AIP is not clearly advantageous for CONUS shore billets. Our best estimate based on survey data is that, under an efficient AIP system, sailors may volunteer for traditionally difficult-to-fill billets for about $125 per month on average. Translating the retention cost of the existing system into a cost per hard-to-fill billet, we find that the retention cost also equals about $125 per month. Looking only at retention costs, it may not be cost-effective to offer AIP to CONUS shore billets, and certainly great care would have to be taken in designing a bonus that is cost-effective.

Risks of adopting AIP

As the Navy proceeds, it must keep in mind some possible consequences to adopting AIP:

- *The design and implementation of AIP combined with the responsiveness of sailors will ultimately determine its costs.* The cost-effectiveness of AIP will be undermined if it cannot be targeted to billets (i.e., it becomes an across-the-board location pay). If AIP is paid at the billet level, however, there could be large variations in pay at a location or even within a paygrade/skill/location combination. If the Navy applies decision rules to lessen the differences in pay, the efficiency of AIP will diminish.
- *AIP may not succeed in filling all priority billets.* Without the flexibility to set rates sufficiently high or substantial sailor participation, AIP may not solve all the Navy's manning problems in key shore billets. For some billets, detailers may need to revert to ordering sailors involuntarily or using other, nonmonetary, incentives.
- *AIP may alter the demographic composition of sailors in fleet concentration areas and overseas.* Our survey suggests that single sailors are more likely to volunteer for overseas duty, and that sailors with dependents who want to home-base would then have more opportunities to do. If so, the Navy will likely reap additional savings from reduced permanent-change-of-station expendi-

tures. The Navy, however, must ask whether it is willing to accept these changes in demographics, particularly in light of concern about sailors representing U.S. interests abroad.

Recommendations

We believe that using AIP is a promising way of moving the Navy toward a more voluntary, efficient assignment system if it is designed as a flexible, market-based incentive pay, as planned. Such a design would allow the Navy to alleviate manning shortages as they emerge and to adjust pay as sailors are more or less willing to volunteer for priority billets. In addition, pay has a broader appeal than many nonmonetary incentives, which are targeted to small segments of the sailor population. In the long run, AIP will allow for better resource allocation by making more visible the costs of keeping hard-to-fill billets manned versus moving or outsourcing them.

Our cost/benefit analyses suggest that the costs of manning shore billets by using sea duty credit for rotational purposes is so large that the Navy should offer AIP for those billets. Even if AIP ends up less targeted and pays sailors more than we estimate they require to volunteer for these billets, AIP should still be cost-effective. For CONUS shore billets, however, the costs of the current system are much lower. The Navy should consider whether the risks of designing an effective AIP program make it worth proceeding because the policy will be cost-effective only if the AIP can be efficiently designed and targeted. We recommend that AIP be adopted gradually for CONUS billets, with careful design of the incentives and study of interim results.

Introduction

The Navy has long faced difficulties in manning billets in certain locations. To alleviate these shortages, the Navy selectively offers several, primarily nonmonetary, incentives to encourage sailors to fill and to stay at those billets. They include the promise of a preferred follow-on tour, shortened tour obligations, and sea duty credit for rotational purposes. These incentives, however, have not been attached to all priority difficult-to-fill billets or have not been large enough to induce sailors to volunteer for many of the undesirable billets. Gapped billets and chronic shortages at some units would result if not for the Navy ordering sailors into these hard-to-fill billets.

Consequences of the current assignment system[1]

Solving manning problems with a patchwork of nonmonetary incentives and involuntary fills has unintended consequences. Nonmonetary incentives can constrain the distribution system and are potentially costly. For example, the Navy gives sea duty credit for rotational purposes for many overseas shore duty billets (about 9,000 billets in FY01). As a result, fewer sailors are available for sea duty billets. The Navy may have to fill sea billets with lesser qualified sailors or allow fleet manning to slip. The result is a degradation in readiness. As another example, overseas tour obligations are often shortened—with unaccompanied tour obligations generally between 12 and 24 months and accompanied tours lasting 24 to 36 months. At the most extreme, this policy over the long term could increase permanent-change-of-station (PCS) costs for these billets by a factor of three. An additional problem with the existing incentives is that they are not flexible. They are usually not adjusted as undermanning/overmanning occurs. For example, the shore locations receiving sea duty credit last changed in

1. See [1] for a discussion of the problems the Navy faces with its current compensation system in meeting various manning goals, including distribution challenges.

1997 and before that in 1993. Thus, it does not address emerging problems.

Even with existing incentives, the Navy cannot be sure of getting the right sailor into the right job at the right time. Sailors being ordered to jobs they do not want are likely to be less satisfied—with their jobs and with Navy life. The Navy does attempt to alleviate dissatisfaction with the assignment system by rotating sailors frequently between good and bad locations to "share the pain." This policy, however, leads to higher PCS costs and exacerbates detailing complexity.[2] Furthermore, the geographic instability of the existing system is not desirable to many sailors,[3] and the expectation of moving to a new billet may not be sufficient to assuage their dislike of their current billet.

Instead, because of the risk of receiving bad assignments, the Navy may either have to increase sailors' total compensation to keep them in the Navy or potentially risk decreases in retention. Lower retention and higher crew turnover increase recruiting, training, and PCS costs. CNA research shows that higher crew turnover affects readiness in the areas of personnel, training, equipment, and supply on ships [2].

Although the current assignment system entails costs, they are, for the most part, not visible to the Navy. The costs are either not easily quantified or not attributed to the assignment system. For example, PCS costs are considered a part of doing business, and any retention costs from not meeting sailors' assignment preferences have not been measured. With costs not readily apparent, there had been little impetus to move toward a more cost-efficient assignment allocation system.

2. PCS costs in FY02 were over $650 million, or 3 percent of the Navy's compensation budget.

3. The Navy Homebasing Survey indicates that the majority of sailors with dependents would prefer to stay for several tours in one location and indeed are willing to give up pay to do so.

Transforming the assignment system

Moving toward a more voluntary system can potentially improve manning, readiness, and retention and lower costs. Recognizing this, the CNO wants to expand sailors' choice of assignments while better encouraging them to volunteer for undesirable, high priority billets. Indeed, the Navy took steps in the 1990s toward incorporating sailors' preferences into the assignment system with the Job Advertising and Selection System (JASS). Through JASS, sailors may apply for jobs they find interesting or acceptable. The continuing problems, however, are (1) how to encourage sailors to volunteer for billets that they never show any interest in accepting and (2) how to encourage qualified volunteers at the lowest possible cost.

Expansion of the currently used incentives may not be the best way to fill undesirable billets. Instead, designing incentives that can be adjusted quickly based on demand signals while not constraining the distribution system should theoretically alleviate shortages more effectively. The Navy is implementing two targeted, market-based pays that it anticipates will encourage sailors to volunteer for and remain in difficult-to-fill billets: the Location Selective Reenlistment Bonus (LSRB) and Assignment Incentive Pay (AIP). The LSRB, piloted in FY02, is offered to sailors with particular skills willing to reenlist to selected billets/locations. AIP is a monthly award to be paid to sailors for the duration of their tours in certain hard-to-fill billets and will be introduced in a limited fashion over the coming year. Both are market-based in that they will be adjusted in response to sailors' willingness to accept the undesirable jobs. Because sailors have a range of preferences for jobs, AIP and LSRB would allow the Navy to pay only what it costs to get the sailor who is least averse to the hard-to-fill billet to volunteer for that billet. These pays should (a) improve sailors' satisfaction with their assignments and with the Navy, (b) lower turnover in undesirable billets, and (c) increase retention and readiness. Consequently, these incentives could be more cost-efficient than current assignment incentives.

Before fully implementing these pays, however, policy-makers must gain information on sailors' job and incentive preferences as well as the costs and benefits of incentive pays.

Our role

In this study, we address the following questions:

- What are the largest costs of the current assignment system?
- What incentives would best encourage sailors to volunteer for and stay in hard-to-fill billets?
- Is an assignment incentive pay cost-effective compared to the current system?
- What are the guidelines for designing and implementing a new distribution pay?

We begin with a brief discussion of the aspects of a job that may make it hard to fill and of sailors' job preferences. Then, we quantify the retention effects of not aligning sailors' assignments to their preferences. Next, we consider how the Navy might move toward a more voluntary system of assignments. Based on a conjoint survey we developed and administered, we identify sailors' preferences for various incentives and the costs of getting sailors to volunteer for the more difficult-to-fill jobs. We also consider how well compensation works at keeping sailors in hard-to-fill billets by analyzing the effect of the Navy's largest distribution pay—sea pay—on completing sea tours. We then make some broad assumptions to derive bounds on the cost-effectiveness of using compensation as an incentive. Specifically, we consider the costs of OCONUS billets receiving sea duty credit versus an assignment pay and then separately calculate the retention costs of CONUS shore billets versus pay. Finally, we consider AIP's implementation strategy and highlight some implications for the Navy.

Hard-to-fill billets[4]

Dimensions of hard-to-fill billets

One difficulty in determining the costs of the current system and in designing assignment incentives is the lack of agreement on a clear definition of a hard-to-fill billet. Many factors determine how difficult or easy a billet is to fill. In broad terms, these reasons can be categorized as career, location, or family considerations. We surveyed Navy enlisted personnel and found that, for those sailors rotating to shore duty, 41 percent stated that family considerations were the most important aspects of choosing assignments, followed by career and location considerations (33 and 26 percent, respectively). For those rotating to sea duty, family considerations were again the most important (55 percent), followed by location (23 percent) and career considerations (22 percent).

Typically, the Navy thinks of hard-to-fill billets in terms of location. Population density, climate, and other geographic characteristics factor into which locations are hard to fill. In addition, family or career considerations underlying a sailor's assignment preference often are essentially incorporated into the sailor's location preference. Family considerations, for example, mainly involve the sailor's proximity to family and employment opportunities for spouses. Both are clearly location issues and suggest that overseas duty may be the least preferred duty for many sailors. Similarly, sailors' career considerations point to certain locations. If a sailor wants a certain type of work, that may drive the location preference because not all work is done in all Navy locations. For example, if a sailor wants to work as a detailer, he/she must locate in Millington, TN.

4. Two companion papers in this study examine in detail the issues surrounding hard-to-fill billets [3, 4]. This section summarizes some of their findings.

By internalizing and weighing the importance of the range of factors influencing sailors' preferences, sailors decide which billets and, by default, which units and locations best match their desires.

Identifying hard-to-fill billets by location

The importance of family, career, and location considerations varies among sailors. Despite this, the degree to which a location is preferred by most sailors is one reasonable measure of billet desirability and the relative difficulty in filling it. We grouped hard-to-fill billets by location preferences[5] using two data sources: a CNA administered choice-based conjoint (CBC) survey and the Job Advertising Selection System (JASS).[6, 7]

Sailors' locational preferences—survey data

The advantage of the CBC survey is that it revealed information about how sailors would make tradeoffs between various assignment packages—with location as one of the characteristics that could be considered. Based on the survey, we ranked the eight shore and eight sea duty locations from most to least preferred based on sailors' choices among the assignment packages.[8]

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5. Two additional potential measures of hard-to-fill billets are average manning levels and average time in station. However, as we discussed in [3], we believe these would not give accurate estimates of hard-to-fill billets. We also used in [3] alternative job characteristics (e.g., working in rate) as measures of hard-to-fill billets.

6. The Navy posts available, priority jobs in JASS. Sailors are then able to view these jobs based on rank, rating, and location and can apply for up to five jobs in order of their preferences during the requisition cycle. For more information on JASS, see [3] and [5].

7. The Navy Homebasing Survey [6] and [7], which shows how length of stay varies by location and rating, provide useful comparisons.

8. We did not consider more locations because we wanted to ensure that we would have statistical reliability given the number of respondents and number of questions we asked.

Table 1 shows the average preference ranking among these locations for sailors rotating to shore duty and to sea duty. For those rotating to shore duty, San Diego was the most preferred location among those currently stationed in San Diego; for sailors currently in Norfolk, however, Norfolk was the most preferred location.

Table 1. Location ranks by sample and rotation to shore or sea duty

	Rotating to shore duty			Rotating to sea duty		
Rank	Full sample	Norfolk subsample	San Diego subsample	Full sample	Norfolk subsample	San Diego subsample
1	San Diego	Norfolk	San Diego	FL/GA	Norfolk	San Diego
2	Hawaii	Hawaii	Hawaii	San Diego	FL/GA	FL/GA
3	Norfolk	ME/CT/RI	Pacific NW	Hawaii	Hawaii	Hawaii
4	Pacific NW	San Diego	ME/CT/RI	Norfolk	ME/CT/RI	Pacific NW
5	ME/CT/RI	Great Lakes	Italy	Pacific NW	San Diego	Italy
6	Italy	Pacific NW	Norfolk	ME/CT/RI	Pacific NW	ME/CT/RI
7	Great Lakes	Italy	Great Lakes	Italy	Italy	Norfolk
8	Japan	Japan	Japan	Japan	Japan	Japan

For those rotating to sea duty, we also see that those in San Diego rank San Diego highest and those in Norfolk rank Norfolk highest. Overall, Florida / Georgia (FL / GA) is the most preferred location for those rotating to sea duty, and Japan is ranked lowest in either sample for those rotating to shore duty or sea duty. Italy also ranks in the bottom half regardless of the sample. In addition, for the Norfolk and San Diego samples, locations near the sailors' current billet locations were more attractive than locations farther away. The Pacific Northwest area was relatively preferred more by San Diego respondents than Norfolk respondents, whereas the Maine / Connecticut / Rhode Island (ME / CT / RI) area was preferred more by Norfolk respondents than San Diego respondents. This suggests that, on average, Sailors prefer to stay at their current locations or, if they have to move, to go somewhere geographically close.

Sailors' locational preferences—JASS data

The benefit of JASS data is that they provide information on which jobs sailors actually wanted, assuming sailors would not have applied for jobs that were unacceptable.

Using JASS data, we computed the number of applications sailors submitted per shore job for 18 CONUS locations as our measure of location preference.[9] We have considered only CONUS shore jobs because incentives the Navy currently offers in certain locations and assignments (e.g., giving sea duty rotation credit for overseas shore duty or shortened tour lengths) affect the overall desirability of the location.

Figure 1 shows our JASS-based location rankings. Specifically, we found that the most preferred locations are Jacksonville and Norfolk and the least preferred are Lemoore and inland California.

When we integrated our two location rankings, a fuller, more complex representation of sailors' preferences emerged. Our data indicate that, although overseas duty is generally less preferred, other CONUS locations also are ranked low and should not be ignored for assignment incentives.

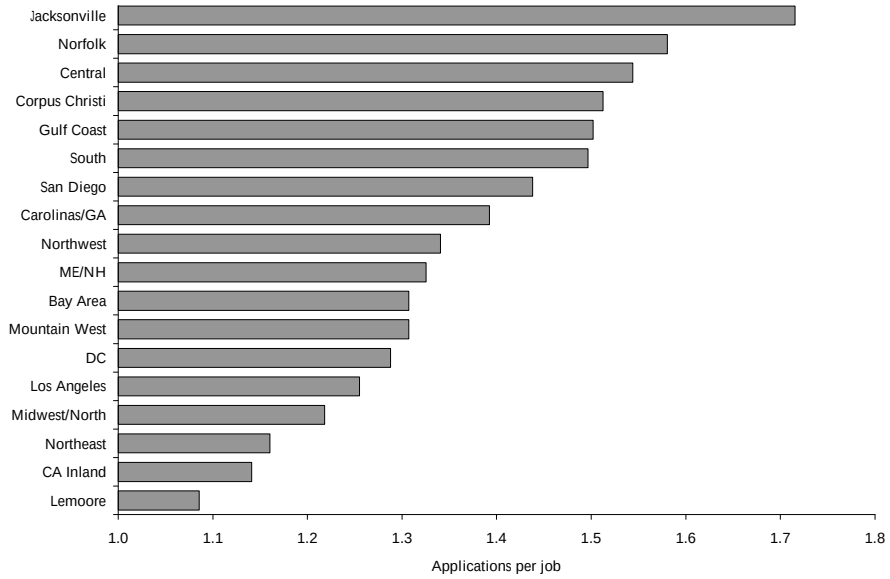
Also, an apparent discrepancy appears to have important implications. We found that Norfolk ranks higher than San Diego in the JASS-based ranking, with the opposite true in the CBC-based ranking overall.[10] However, if we look at the Norfolk subsample in the CBC survey data, Norfolk ranks higher than San Diego does. This suggests that either (1) current location has a lot to do with preferences for the next assignment or (2) sailors currently in Norfolk, for example,

9. We have aggregated CONUS shore duty billets into 18 locations because the data are insufficient to judge the relative desirability of more narrowly defined locations. See [3] for locations included in each of these 18 groups.

10. The CBC survey reveals the preferences of sailors serving at the three locations where it was fielded, whereas the JASS data reflect preference information across all Navy sites.

are there because that is their preference. Sailors may already be able, to a certain extent at least, to select their preferred locations.[11]

Figure 1. Applications per job by CONUS location (shore jobs only)



11. Although the Navy Homebasing Survey didn't order locations by preference, its findings about locations are generally consistent with our rankings.

Retention and the current assignment system

Forcing sailors into undesirable assignments may result in greater dissatisfaction among sailors with the Navy and in lower retention. This, in turn, would lead to higher recruiting and training costs or higher Selective Reenlistment Bonus (SRB) costs. As a first step in documenting the costs of the current system, we examined the impact of assignment preferences on continuation.[12] Specifically, we looked at the relationship between being assigned to undesirable locations and continuation. Then, we measured the relationship between serving in a billet of *the sailor's choice* and continuation.

To test our hypothesis, we relied on statistical analysis of several data sets: the Enlisted Master Record, the Ship Employment History, and JASS applications and job listings.[13] We merged the data sets and conducted several regression analyses with individual sailors as the unit of analysis. We included all sailors who had received shore-duty orders to CONUS in the first half of FY 2000 and then followed their retention in the Navy through most of the first year of their assignment. The advantage of using regression analysis is that we could determine the effect of a specific assignment on a sailor's continuation behavior while controlling for the effects of other factors (e.g., civilian opportunities) on his or her decision to stay in the Navy.

12. We summarize our findings in this section. For the full report, see [3].

13. We relied on JASS data for data on sailors' billet preferences. With only about 25 percent of sailors applying for billets through JASS, sailors who use JASS may not be similar to the rest of the population. As we discuss in [3], we construct several measures of billet preferences and data samples to alleviate this problem.

Navy-wide hard-to-fill billets and continuation

Because, as discussed earlier, there is no standard definition of a hard-to-fill billet, we used different aspects of jobs as alternative definitions. In this section, we concentrate on the effect of receiving orders to hard-to-fill billets as defined by location preferences. We do so for two reasons: (1) anecdotal evidence suggests that location is a strong predictor of whether a billet will be hard to fill, and (2) JASS data indicate that sailors typically apply more often to a specific location than the availability of assignments would suggest (indicating that location is a consistently important and determining factor in what billets are hard to fill).

To examine the effect of sailors' location preferences on continuation, we used two measures of location preference. The first was the average number of JASS applications per job in a given CONUS location (refer to figure 1).[14] We also partitioned the locations more broadly into "good," "mediocre," and "bad" locations because our first measure probably does not perfectly order the spectrum of locations. We based these categories on applications per job but then aggregated the distribution of locations into thirds. For example, "good" locations include such places as Norfolk and Jacksonville, whereas "bad" locations include the Northeast and Lemoore.

Our statistical tests confirmed that the desirability of the location has a significant impact on sailors' continuation, but only for careerists. We found that the difference in careerists' continuation rates for those sailors ordered to the "best" versus the "worst" locations (or between the top and bottom thirds) is 1.2 percentage points. In other words, if the locations in the bottom third of the ranking are "hard to fill" and that those in the top third are "preferred," hard-to-fill locations increase the annual loss rate (1 minus the continuation rate) of careerists about 1.2 percentage points or 25 percent (see figure 2).[15]

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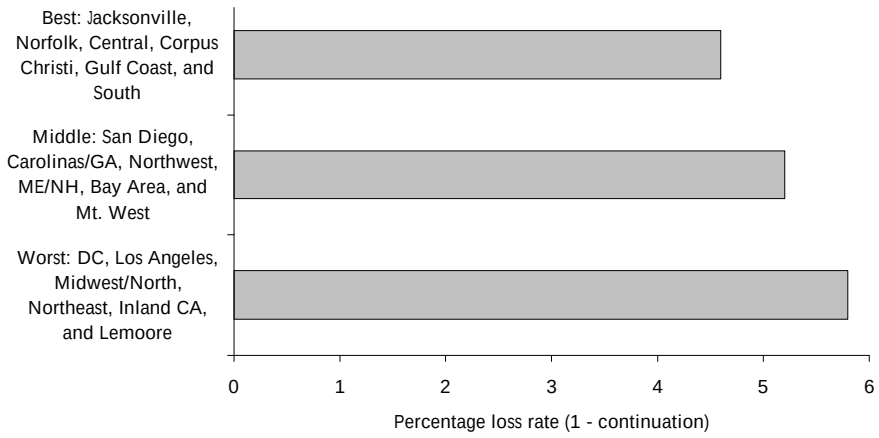
14. OCONUS shore jobs (typically considered hard-to-fill billets) usually have special incentives attached to them, such as shorter tour lengths or sea duty credit; consequently, our measured effects of undesirable locations on continuation would have been understated by their inclusion.

15. If sailors in the hard-to-fill billets are receiving promises of a preferred next billet, the incentive partially counteracts the disutility from the current billet. Our results are then subsequently understated.

Figure 2. Predicted annual percentage loss rate of career sailors by location



In contrast, we did not find a location effect for first-term sailors. This result is not unexpected. First-term sailors are still learning about different Navy jobs and gaining information as to which are good and bad locations. In addition, sailors early in their careers repeatedly say they want to "see the world." Aggregate-level location measures may not reflect first-term sailors' assignment preferences well. It does not mean they don't have assignment preferences or that their preferences don't affect continuation. That is why we investigate, in the next section, individual sailors' preferences.

Sailors' assignment preferences and continuation

By definition, most sailors do not desire Navy-wide, hard-to-fill billets; however, for every hard-to-fill billet, some sailors are less averse than others to that billet. In fact, some billets we considered hard to fill are preferred billets for some sailors. Therefore, recognizing that sailors' assignment preferences differ, we also need to examine the individual-level relationship between continuation and serving in a billet of *the sailor's choice*. We did this by constructing several measures of individual sailors' preferences and estimating the relationship that these measures have with continuation.

First, we considered how long sailors take to find new assignments, or the time to selection, as a measure of billet preference to indirectly capture billet preferences. The *potential* number of requisition cycles that sailors could have participated in before being selected for a billet should reveal information about sailors' satisfaction with their ultimate assignments. It is likely that sailors applying one month into the detailing window will be more discriminating about the billets they apply for than those sailors close to PRD. Sailors who are close to PRD may apply for billets that are not their ideal assignment rather than take a chance on being ordered into a billet that they see as undesirable. In other words, they might take almost any billet so that they are not "slammed" into an assignment. Sailors with shorter time to assignment selection should be more likely to have received their preferred billet. Thus, shorter time to selection should translate into higher continuation.

Comparing the difference in continuation between sailors selected 9 months before PRD versus those selected 6 months from PRD is a rough measure of the effect of an "involuntary assignment." Figure 3 shows the magnitude of this measure on the annual loss rate. We find that the continuation rate of those first-term sailors selected early in their detailing window is 2.1 percentage points higher than those selected at the end.[16,17] For careerists, the continuation rate difference is 0.84 percentage point.

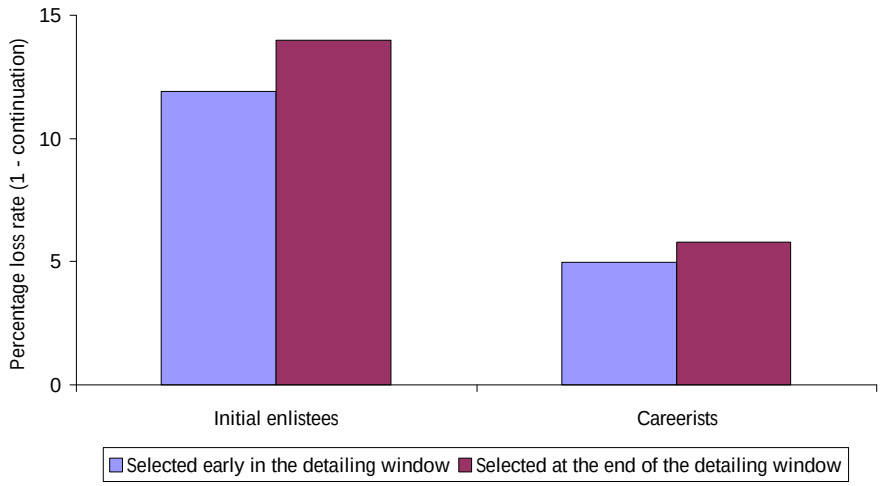
The lower effect for careerists is understandable for two reasons. First, careerists' continuation rates are much higher—94 percent versus 86 percent for first-term sailors. With continuation rates for careerists so high, it would be difficult to believe that any one factor could explain much more of why senior sailors leave. In addition, the detailing system may work somewhat differently for more experienced sailors.

16. Our estimate may understate the effect of being involuntarily assigned because sailors at the end of the detailing window may or may not have been slammed into a billet. Discussions with Navy personnel confirm that some sailors who did not intend to stay in the Navy do, in fact, remain because they find desirable jobs at the end of their PRD.

17. Additional regressions reported in [3] show the effects could be somewhat larger.

They know the system and their billet options and may be more able to work with their detailer until closer to PRD to get a preferred billet.

Figure 3. Effect on the annual loss rate of being involuntarily assigned



JASS applications also contain a direct indicator of sailors' preferences. Sailors rank the applications they submit by preference order; we incorporated this preference ranking into our analysis. We found, however, that the stated preference ordering of jobs doesn't have much impact on continuation; time to selection drives the effect on continuation.[18] This is because each job a sailor applies for must be, if not the sailor's most desired billet, at least acceptable. Consequently, even if the billet the sailor received is not ranked as his or her first preference, it does not affect the sailor's continuation behavior.

18. We conducted individual sensitivity tests for each measure of being hard to fill. We found that, although some control variables were not as stable as expected, the estimates for the individual hard-to-fill measures did not vary substantially.

Sailors' responsiveness to incentives

Not only has there been little quantifiable information on the repercussions of the current assignment system on retention, there has been little information on how well assignment incentives get sailors to volunteer for and stay in less preferred billets. In this section, we use survey and historical data to shed light on these issues.

What incentives best encourage sailors to volunteer?[19]

Although many possible assignment incentives exist, not all have been implemented. To gather information on sailors' preferences for existing and potential assignment incentives, we fielded a Choice-Based Conjoint (CBC) survey in which sailors chose between hypothetical assignment packages. The data collected do not indicate what sailors will do necessarily; however, they do show how incentives that are currently offered, as well as ones that aren't, would be perceived. Because the Navy has difficulty filling selected sea and shore assignments, we developed and administered two versions of the survey—one for sailors rotating to shore duty, the other for sailors rotating to sea duty.[20]

Table 2 shows an example of the type of assignment choices seen by sailors taking the Rotating to Sea survey version. Each sailor was presented with 18 CBC questions. For each question, the sailor was

19. A companion paper from this study [4] describes the CBC survey methodology and examines the findings and implications of the Assignment Incentive Survey in detail.

20. In February and March 2002, CNA fielded the CBC survey at Norfolk, San Diego, and Pearl Harbor to about 1,000 sailors who participated voluntarily. Sailors within 18 months of their next projected rotation date (PRD) were encouraged to participate because they were close to or in the process of making their next assignment decision.

shown three assignment packages, each of which included a location and potential incentives. Sailors selected their most preferred assignment assuming they had only those three options available for their next rotation. In all, the CBC survey collected sailors' preferences on the eight shore and eight sea duty locations shown in table 1. Here, again, location is used an indicator of the billet's difficulty to fill. We also included six potential assignment incentives to gain insights into the perceived cost or benefit to the sailor of an assignment location and to estimate which incentives are most valued. We included a monetary assignment incentive, similar to AIP, that sailors could receive each month while stationed at that location. The nonmonetary incentives we incorporated were a one-time bonus leave, more (guaranteed) time to study, a reduction in the current sea tour or next sea tour length, an increased chance of getting the next billet of their choice, and being eligible for promotion sooner. For the rotating to shore survey, we added time spent working in rating and type of rotational credit to the assignment characteristics.

Table 2. A potential CBC question from the Rotating to Sea survey

Assignment 1	Assignment 2	Assignment 3
Japan	San Diego	Hawaii
Extra $200 per month	Extra $800 per month	No extra pay
Extra 40 days of leave	Extra 10 days of leave	No extra leave
No time for study	4 hours/wk. for study	7 hours/wk. for study
9-month reduction in sea tour length	18-month reduction in sea tour length	6-month reduction in sea tour length
Promotion on expected date	Promotion 3 months earlier than expected	Promotion 12 months earlier than expected
50% chance of next preferred billet	Little chance of next preferred billet	25% chance of next preferred billet

Sailors' assignment incentive preferences

To compare sailors' preferences between assignment incentives, we estimated the level of assignment pay needed to make the "typical" sailor as likely to select a package with a monthly assignment pay as one with various nonmonetary incentives. The highest valued nonmonetary incentive is having a 99-percent chance of getting the next

assignment of choice—at $291 per month. For the typical sailor rotating to shore duty, as shown in table 3, rotational sea credit is estimated to be as attractive as $60 in monthly bonus pay. This may be an underestimate because it is based on the preferences of sailors currently on sea duty. Sailors with a strong aversion to sea duty, and a high valuation of sea duty credit, may be less likely to be on sea duty at any one time and less likely to be included in our sample.

Table 4 lists the results for the Rotating to Sea sample. Having a 99-percent chance of picking one's next billet makes a hypothetical assignment as attractive as $316 per month in special pay. This is $25 higher than for the other sample, implying that Sailors are more interested in being able to pick their next assignment if rotating to a shore duty assignment.

Effect of pay on willingness to volunteer for different locations

Here, we discuss the tradeoffs between pay and hard-to-fill locations. We focus on pay because it is feasible, and indeed expected, that the Navy will offer it. In contrast, some of the other incentives (such as guaranteeing time to study) would be difficult for the Navy to implement fully. We also expect that, in general, nonmonetary incentives interest smaller subsections of sailors.

Overall, we find that sailors' willingness to choose a less preferred location can be influenced by the incentives attached to that location. Table 5 shows our calculated pay thresholds for those locations included in the survey. It answers the question: If offered only two assignments, how much bonus money, holding all else equal, would it take to make the "typical" respondent just as likely to choose a less preferred location (top locations) as a more preferred location (side locations)?

Because Japan is the least preferred location in the survey, when offered a highly preferred location (such as San Diego), a higher pay differential is required. For the Rotating to Shore sample, the pay range for a typical sailor to choose Japan is $96 to $651 per month depending on the sailor's alternative. If offered two relatively unattractive assignment locations, the pay required is lower. For example, it would take $88 per month to get the typical sailor to Great Lakes if

Table 3. Rotating to Shore: Estimated monetary equivalent of nonmonetary incentives[a]

Nonmonetary incentive and level	Estimated monthly special pay equivalent ($)
Rotational credit	
Shore credit	0.00
Neutral credit	0.00[b]
Sea credit	58.85
One-time basket leave	
10 days	45.18
20 days	104.12
40 days	160.33
Expected promotion	
3 months earlier	66.30
6 months earlier	101.74
12 months earlier	163.05
Reduction in next sea tour length	
6-month reduction	69.96
9-month reduction	74.91
18-month reduction	176.61
Guaranteed time to study and attend classes	
4 hours per week	98.44
7 hours per week	148.07
12 hours per week	188.55
Time spent working or training in rating[c]	
25 % time	111.99
50 % time	193.53
All time spent in rating	272.07
Chance of picking next assignment	
25% chance	56.46
50% chance	153.94
99% chance	291.42

a. The estimates of this table can be interpreted as the level where the "typical" respondent would be equally likely to choose the nonmonetary incentive as the corresponding monetary amount, holding all else equal.

b. The estimate for neutral credit was -$11; however, we don't expect the Navy would ever make sailors pay to avoid having neutral credit.

c. Although time spent in rating is not an incentive that necessarily could be implemented, the "value" of doing work or training within rating provides information about what makes an assignment attractive.

Table 4. Rotating to Shore: Estimated monetary equivalent of nonmonetary incentives[a]

Nonmonetary incentive and level	Estimated monthly special pay equivalent ($)
Expected promotion	
3 months earlier	63.62
6 months earlier	83.21
12 months earlier	125.04
One-time basket leave	
10 days	78.44
20 days	81.77
40 days	139.38
Guaranteed time to study and attend classes	
4 hours per week	63.62
7 hours per week	122.43
12 hours per week	157.79
Reduction in expected sea tour length	
6-month reduction	80.69
9-month reduction	116.12
18-month reduction	174.87
Chance of picking next assignment	
25% chance	108.03
50% chance	187.67
99% chance	316.14

a. The estimates of this table can be interpreted as the level where the "typical" respondent would be equally likely to choose the nonmonetary incentive as the corresponding monetary amount, holding all else equal.

Table 5. Rotating to Shore sample: Assignment location versus monthly bonus

	Hawaii	Norfolk	Pacific NW	ME/CT/RI	Italy	Great Lakes	Japan
San Diego	$124	$193	$262	$302	$330	$483	$651
Hawaii	–	$69	$112	$135	$152	$267	$433
Norfolk	–	–	$44	$67	$84	$171	$315
Pacific NW	–	–	–	$24	$40	$127	$241
ME/CT/RI	–	–	–	–	$17	$104	$201
Italy	–	–	–	–	–	$88	$184
Great Lakes	–	–	–	–	–	–	$96

the only other assignment option was Italy. Of the locations included in the survey, Italy is the only location where Sailors on shore duty currently receive sea duty credit for rotational purposes. On the Rotationg to Shore survey, we allowed shore assignment packages to vary by rotational credit (shore, sea, or neutral rotational credit). This should have prevented any bias toward a relative preference for Italy due to Italy's current shore assignment rotational sea duty credit.

For the Rotating to Sea sample (table 6), the estimates for comparable locations are lower. For example, to get sailors to volunteer for Japan typically requires monthly pay between $122 and $397. The difference may be the result of sea jobs not being as distinguishable as shore assignments.

Table 6. Rotating to Sea sample: Assignment location versus monthly bonus

	San Diego	Hawaii	Norfolk	Pacific NW	ME/CT/RI	Italy	Japan
FL/GA	$7	$52	$60	$140	$182	$211	$397
San Diego	–	$45	$53	$133	$175	$200	$386
Hawaii	–	–	$8	$90	$131	$155	$319
Norfolk	–	–	–	$82	$123	$147	$307
Pacific NW	–	–	–	–	$42	$67	$188
ME/CT/RI	–	–	–	–	–	$25	$147
Italy	–	–	–	–	–	–	$122

Marital status

To see whether sailor assignment preferences differ by dependent status, we compared sailors with and without dependents (spouse or child).[21] Sailors with dependents stated more of a concern with having a permanent residence and with spouses' employment opportunities. Single sailors without children don't consider family considerations to the same extent. When they do, they are more concerned with being close to siblings and parents.

21. Fifty percent and 62 percent in the Rotating to Shore and the Rotating to Sea survey sample, respectively, listed being married or having children.

The special concerns of sailors with dependents translate into somewhat different location preferences, as shown in table 7. For respondents with dependents rotating to shore, Italy, Japan, and Great Lakes were the least preferred locations. These three sites were also less preferred among sailors without dependents but with Norfolk added to the less desirable list. San Diego, Norfolk, and Hawaii, respectively, were the most preferred assignment locations for sailors with dependents. These locations are also the survey fielding sites. Overall, although both groups have largely the same dislikes, this suggests that sailors with dependents have a stronger preference for staying at their current location.[22]

Table 7. Location preference by dependent status

	Rotating to Shore sample		Rotating to Sea sample	
Rank	Dependent subsample	No-dependent subsample	Dependent subsample	No-dependent subsample
1	San Diego	San Diego	FL/GA	Hawaii
2	Norfolk	Hawaii	San Diego	San Diego
3	Hawaii	ME/CT/RI	Norfolk	Italy
4	Pacific NW	Pacific NW	Hawaii	FL/GA
5	ME/CT/RI	Italy	Pacific NW	ME/CT/RI
6	Italy	Norfolk	ME/CT/RI	Norfolk
7	Great Lakes	Great Lakes	Italy	Pacific NW
8	Japan	Japan	Japan	Japan

The same conclusions apply to the Rotating to Sea samples. Norfolk was more preferred than Hawaii among sailors with dependents—possibly because of the potential to home-base and differences in the public school systems. Among sailors without dependents, Italy is relatively more attractive, perhaps reflecting a preference for a range of locations.

The differences in preferences among sailors with and without dependents translate into dissimilar pay/location tradeoffs. Typically,

22. Our results support an earlier finding that sailors with civilian spouses and children typically stay at a location longer than single sailors [8].

sailors without dependents will volunteer for traditionally hard-to-fill billets for about the same or less pay than sailors with dependents. For example, it would require only $133 per month to get the "typical" unattached respondent to be as likely to choose an assignment at either Norfolk or Japan versus $466 per month for the typical respondent with dependents. This suggests that sailors without dependents may be more likely to accept hard-to-fill, overseas billets should an assignment pay be offered at those locations.

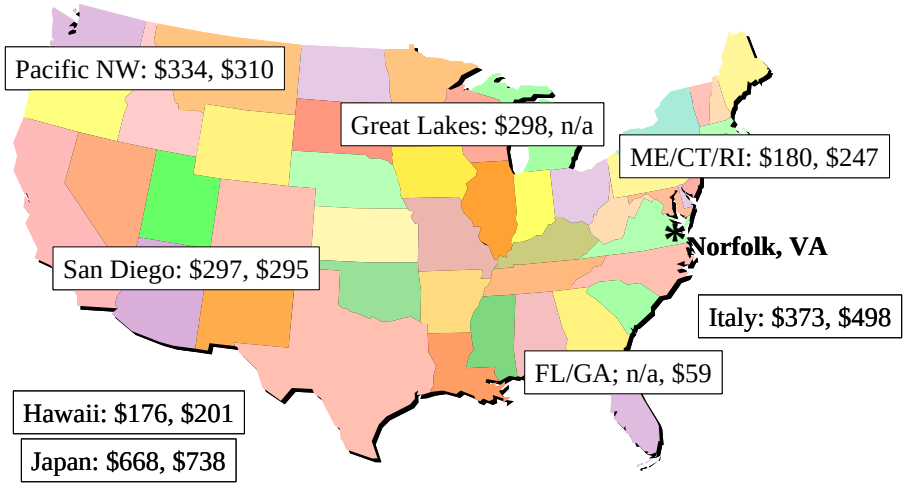
Current location versus next assignment

As discussed earlier, sailors in Norfolk and San Diego prefer those locations over all the other locations we included on the survey. This may mean that, on average, at least for these locations, sailors prefer to stay in their current locations. The survey fielding concentrations in Norfolk and San Diego let us examine whether that is true. In our study, a home-basing preference would be reflected in a location preference toward the three survey fielding locations by respondents *at* those sites; however, our sample size is only large enough to allow for examination of the Norfolk and San Diego subsamples.

And, we do see a desire to stay in a location for multiple assignments. For example, an estimated 13 percent of sailors in the *full* Rotating to Shore sample would select an assignment at Norfolk over any other location offered. In contrast, among the Rotating to Shore *Norfolk subsample*, an estimated 22 percent of the sailors would select Norfolk.

Figure 4 shows the amount of money necessary to make the "typical" Norfolk respondent just as likely to pick Norfolk as another location. If offered a next assignment that includes that sailor's current location, more pay is needed to make the sailor just as likely to pick the non-home-basing location. For example, in this case, the amount of money required to choose Japan over Norfolk is $668 per month, compared with $315 per month for the full sample. Also, locations geographically nearer Norfolk, such as Great Lakes and Maine, are preferred to areas farther away, such as the Pacific Northwest, in comparison to the full sample.

Figure 4. Norfolk subsample: Norfolk versus other locations with Assignment Pay (for Rotating to Shore duty, Rotating to Sea duty)[a]



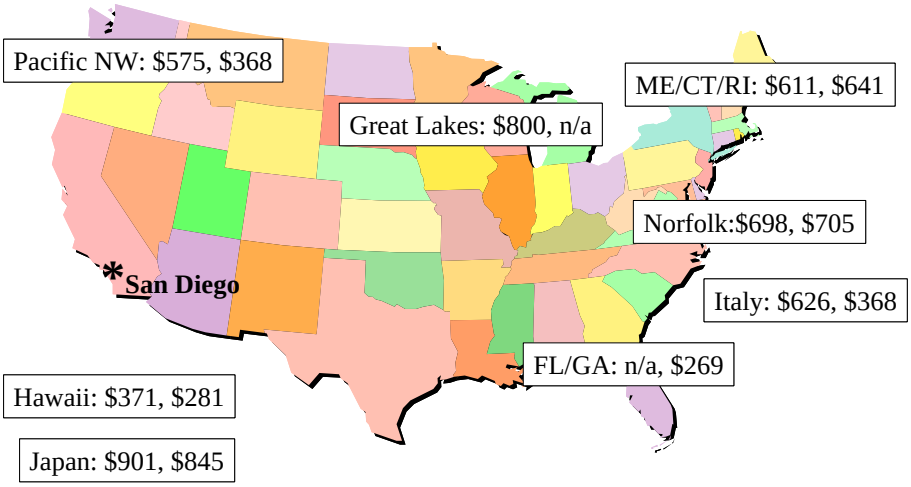
a. The amount of money it would take to make the "typical" Norfolk respondent just as likely to choose Norfolk as his or her next assignment as these other location options.

We find similar results for San Diego (figure 5). Sailors currently at San Diego prefer to stay there. The estimated probability of an assignment in San Diego being chosen is 7 percentage points higher than with the full sample. It is more expensive to persuade the typical San Diego sailor if offered an assignment in San Diego to accept a different location, up to $901 per month (for Japan). Finally, sailors in San Diego also preferred Hawaii and Pacific Northwest over locations farther away from San Diego, such as Norfolk and Great Lakes.

Overall, we consistently see that monetary and nonmonetary incentives will influence the assignment choices sailors make. The amount of the incentive, however, differs depending on the sailors' assignment options and characteristics. Most tradeoffs in pay and location range between $100 and $500 per month. Once the Navy implements an assignment pay, the actual minimum pay needed for sailors to choose hard-to-fill billets may be less than our calculated amounts. Our estimates are based on the aggregate survey sample and reflect the typical sailor taking the survey. Consequently, the rates reflect the levels of assignment pay necessary to fill a large number of billets at a

location. If each billet were to get a different level of bonus or if there are only a few billets to be filled, these estimates are upper bounds. Some sailors do have lower aversion levels to the undesirable billets than others and would be willing to serve in them at lower incentive levels.

Figure 5. San Diego subsample: San Diego versus other locations with Assignment Pay (for Rotating to Shore duty, Rotating to Sea duty)



Do incentives keep sailors in hard-to-fill billets?

Although the primary purpose of these incentives is to encourage sailors to volunteer for difficult-to-fill billets, an additional benefit for the Navy is that sailors should remain in these billets longer.

Little information exists, however, on how effective incentives are in keeping sailors in traditionally hard-to-fill billets. What historical data there are relate to sea pay's effect on distribution. Of course, an assignment pay would differ from sea pay, and, consequently, its efficiency may also vary. But, the goals of sea pay and an assignment pay are ultimately the same—to increase manning in hard to fill billets. The mechanism is also the same—using money to encourage sailors to accept, and remain in, jobs that are difficult to fill. Therefore, to

gain insights into the effectiveness of pay at keeping sailors in hard-to-fill billets, we investigated the willingness of sailors to remain or extend on sea duty for additional sea pay.[23]

Patterns in sea pay and time at sea

To examine whether sea pay affects sailors' time on sea duty, we first looked at changes in sea pay and corresponding patterns in the time spent on sea duty.

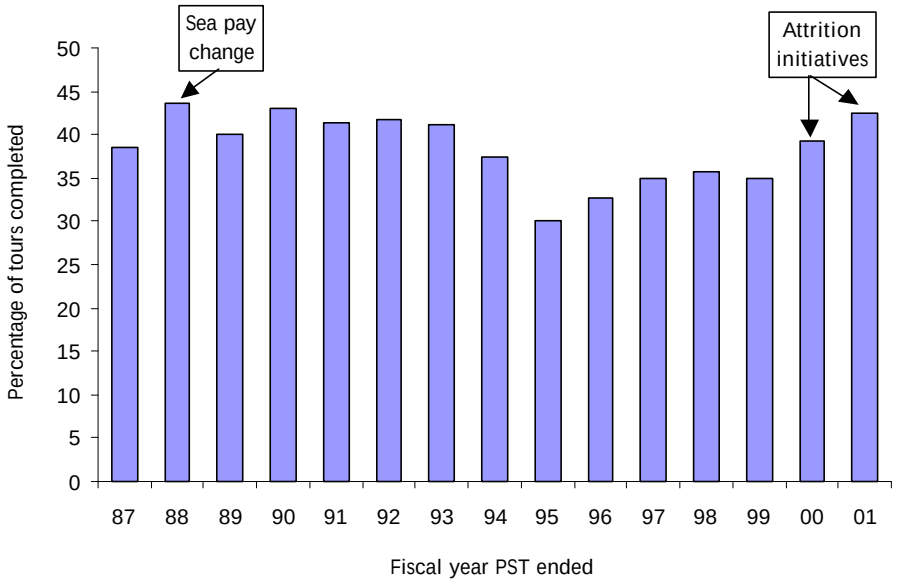
Until recently, career sea pay (CSP) rates were specified in U.S. Code, so changes to the sea pay table have required congressional legislation. As a result, few major modifications have been made since the inception of the CSP program. The most sweeping transformation occurred in 1981, and those rates remained largely unchanged until 1988. The FY88 NDAA legislation revised sea pay rates upward for careerists. For some careerists, the CSP table was increased by up to $130. There was a small decline in rates for the most junior sailors. Rates then remained at the same nominal levels until October 2001 when the Navy increased rates in targeted areas of the career sea pay table and began paying sea pay to the most junior sailors (E-1s to E-3s). Between the most recent rate changes, sea pay had lost more than 40 percent of its value to inflation.

Turning to sailors' time at sea, we wanted to see whether pay matters—whether the changing value of sea pay corresponds to changes in time at sea. We analyzed sea tour completions and extensions separately. Because the Navy sets obligated sea tour lengths, if sailors regard their obligations as binding, completion rates could be unaffected by sea pay. However, as seen in figure 6, completion rates vary over time. Despite the use of sea pay as a distribution incentive, we do not see a clear correspondence between sea pay and completions. The trough in sea tour completions occurred at the end of the drawdown, while a large uptick in completions has occurred in recent years—before an improvement in sea pay rates. Although the highest completion rates occurred in the years around the 1989 sea pay rate change, it is not clear whether sea pay or other factors (e.g., relatively

23. We summarize our findings in this section. For the full report, see [9].

high quality of service at sea) drove the high completion rates—particularly in light of the more recent increases in completions.

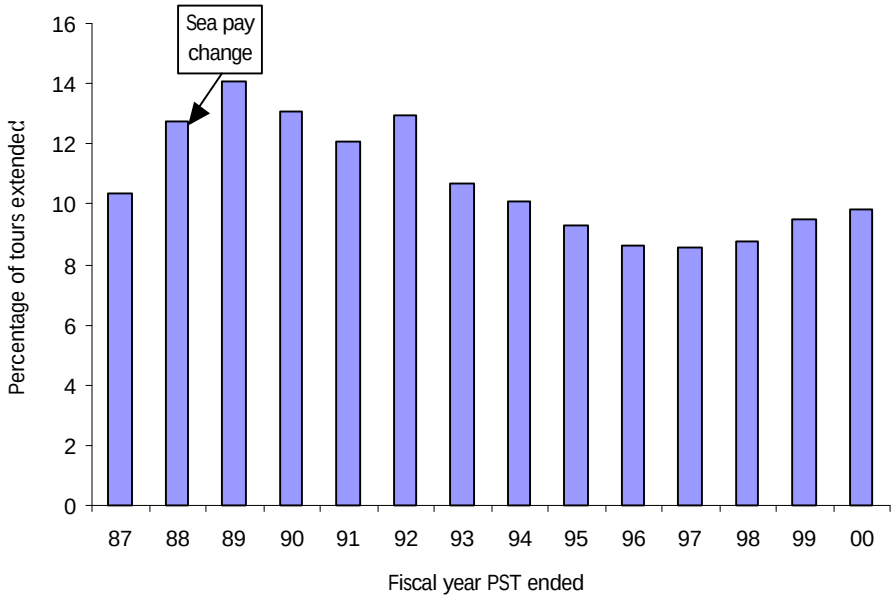
Figure 6. Percentage of 4-year sea tours completed



Next, as shown in figure 7, we looked at sea pay changes and extensions of sea duty, which represent the only measure of truly voluntary behavior we have. Like completions, extensions increased in recent years—before the FY 2002 sea pay increase. Overall, however, extensions of sea duty show a clearer correspondence with sea pay, as one might expect because extensions do not reflect obligated service at sea.[24] Extensions of sea duty peaked at 14 percent in FY89—the year following a sea pay table change. As the value of sea pay deteriorated over the 1990s, the percentage of voluntary extensions also dropped—by almost 40 percent.

24. The sample here is of sea tours with initial prescribed sea tours (PSTs) of 48 months, as used previously. If we look at sea tours that remained at 48 months, we find the same pattern, although the recent increase in extensions is more pronounced.

Figure 7. Voluntary extensions of sea duty over time, 4-year tours



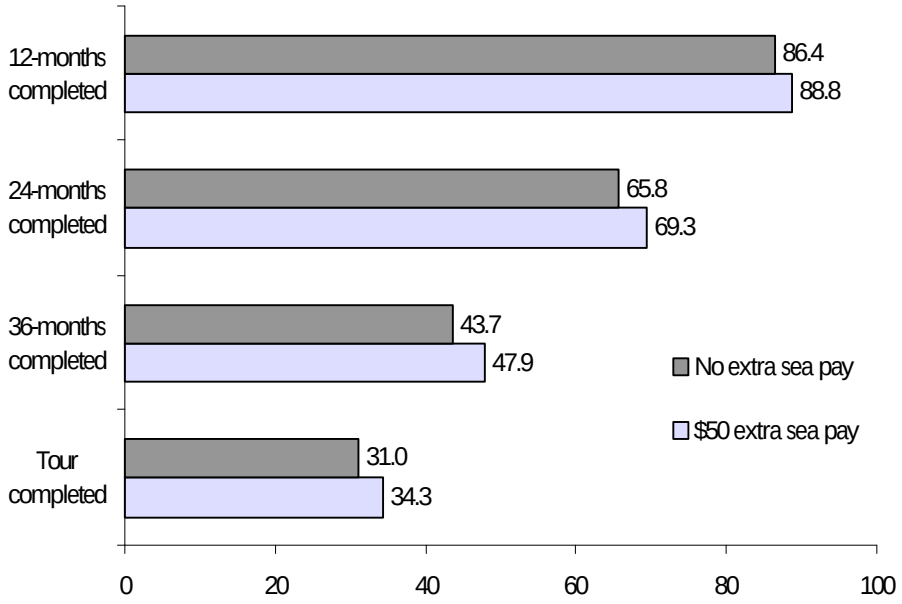
Effect of pay on completions and extensions of duty

Because of the apparent link between sailors' time on arduous duty and pay, we wanted to establish whether there is a direct link between sailors' behavior and pay. We relied on statistical analysis of several data sets: the Enlisted Master Record, historical sea pay tables, civilian employment and earnings data, and published data on obligated sea tour lengths. We merged the data sets and conducted several regression analyses with individual sailors as the unit of analysis. We included sailors who started sea tours in FY83 or later and related their completion of sea tours through their first and subsequent years to the levels of sea pay received. Only sailors eligible for sea pay for the duration of their sea tours (e.g., most sailors assigned to deploying ships and some ship-based staffs) are included in the sample. As sea pay levels vary, these sailors face the largest changes in annual compensation and in incentives. Consequently, they should exhibit the biggest fluctuations in sea tour completion and extension rates.

We find that sailors respond to additional sea pay both by completing their sea tours and by extending those tours. Because the Navy plans to pay an assignment pay in increments of $50, we show, in figure 8,

the cumulative effect on sea duty served for an additional $50 per month in career sea pay (for sailors serving 48-month tours). The cumulative effect of an increase in sea pay is a 3.3 percentage point, or 11 percent increase, in completions of sea duty.[25] Yearly completion rates rise between 0.8 (in the second year) and 2.5 percentage points (in the last year of a sea tour). To the extent that completions reflect obligations, not choice, our measured effects are dampened.[26]

Figure 8. Sea pay's effect on cumulative time served on a sea tour

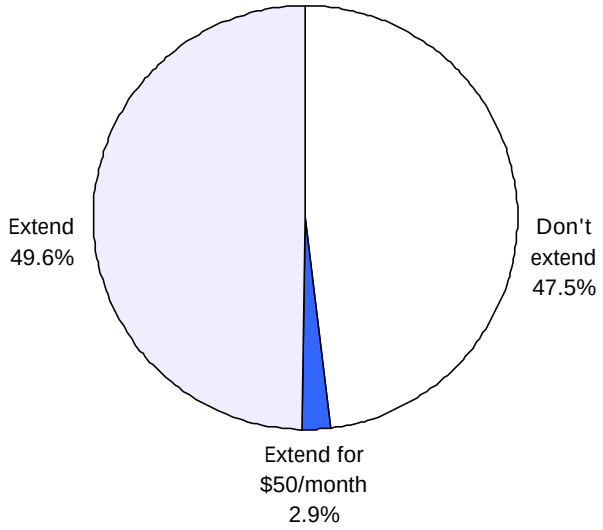


25. A $50-per-month increase is quite large for this sample when examining the first and second years of sea duty because the sample is made up of primarily junior sailors receiving little or no sea pay. Consequently, the calculated effects for the first years are more tenuous but are consistent with our estimated effects for sailors later in their sea tours.

26. It is possible that the sea pay variable is capturing a time trend—that sea duty simply worsened over the time period. Assuming this is the case, we obtained lower bound estimates on the effect of sea pay. Under the most stringent assumptions, 48 and 29 percent, respectively, of the sea pay effect on completions and extensions dissipates.

Figure 9 shows that a $50-per-month increase in sea pay boosts extensions by 2.9 percentage points, or about 6 percent. Compared with the rises in yearly completion rates, extensions are, as expected, more responsive to changes in sea pay.

Figure 9. Extensions among sailors who complete their PSTs



If we assume the *same* responsiveness to AIP as to sea pay, we can calculate the extra work-years the Navy would gain in hard-to-fill CONUS shore billets given that each sailor in those billets receives an additional $50 per month for the duration of their tours. Using our location-based measure of hard-to-fill billets, up to 8,000 CONUS shore requisitions per year might be designated as hard to fill. We estimate that the Navy would gain a modest 300 extra work-years annually at a cost of about $15 million per year, or $50,000 per additional work-year generated.

Based on both our survey and historical data, it appears sailors respond to incentives. Sailors will volunteer for and stay in less preferred duty for longer if given a pay incentive.

Assignment Incentive Pay (AIP) pilot program

As noted earlier, to encourage an adequate number of volunteers for hard-to-fill billets, the Navy plans to implement Assignment Incentive Pay (AIP). This section describes in greater detail the Navy's plans, how AIP might be structured, and some issues in its implementation.

Description

AIP is envisioned as a flexible, market-based pay, where the specific award would be adjusted to balance the supply and demand of qualified volunteers for service at certain locations or billets. AIP would be paid monthly for the duration of the assignment. The maximum monthly AIP allowed by Congress is $1,500; however, the Navy will set lower monetary caps on AIP eligible billets.

The AIP pilot program will include billets from a limited number of type-3 overseas shore duty locations. The Navy plans to use AIP to replace the sea duty credit for rotational purposes offered to those sailors. The pilot will begin in FY03 at a projected cost of $1.0 million. Over the longer term, the AIP program is expected to be expanded to CONUS shore billets and, potentially, to sea billets. The projected costs for AIP are over $54 million annually by FY08.

Goals and benefits of AIP

The ultimate goal of the assignment system is to fulfill the readiness needs of the Navy—fill the billets the fleet needs filled and fill these priority billets quickly. In practice, detailers are also tasked with matching the qualifications of sailors to the jobs, considering sailors' preferences to keep them in the Navy, and minimizing moving and training costs. Thus, the current system is complex and cumbersome, and assignment decisions may seem arbitrary to the sailor.

The aim of AIP is to improve readiness and sailor satisfaction in a cost-effective manner. The goals of AIP are to:

- Mitigate emerging manning problems and reduce costs by targeting only specific shortages and by introducing flexibility to respond to market conditions. Unlike the current system in which a sailor with a high aversion to a billet may be ordered into it anyway, sailors with the lowest aversion to a billet would volunteer for hard-to-fill billets and do so, it is hoped, for a relatively modest cost.
- Increase the availability of sailors for sea duty and improve fleet manning with the elimination of sea duty credit for shore billets.
- Improve cost visibility of filling undesirable billets since the level of AIP will be tracked billet by billet. This will aid the Navy in improving resource allocation (e.g., how many and which billets are bought).
- Potentially allow for longer obligated tours as sailors' satisfaction with their sea and shore assignments improves. Consequently, the Navy should experience reduced moving and training costs, a more geographically stable force, and higher readiness.

Implementation strategy

For the first limited testing, the Navy had been considering paying AIP in one of two ways: as a location pay or as a billet-specific pay. The primary advantage of the first method is that it's potentially simple to administer and understand. It could be structured so that all sailors in a location or in a paygrade/skill/location combination would receive the same monthly additional pay. If there were no volunteers or not enough volunteers, a central board would increase the level of AIP. The disadvantage is that it may not be as cost-effective as a billet-specific pay. Sailors who do not find the location undesirable and require no AIP would still receive the incentive. The latter method for paying AIP—billet by billet—would involve a bidding system for individual billets. That system could take many forms:

- *Ascending bid system.* The Navy offers a successively higher AIP until one qualified sailor volunteers for the assignment.
- *Descending bid system.* The Navy offers a maximum AIP and successively lowers the rate until only one qualified sailor remains.
- *Sealed bid system.* A sailor puts in a bid that no one, not even the detailer, can see until the bidding period (the requisition cycle) is closed.

The advantage of a bidding system in which each billet may or may not receive AIP is that is it extremely targeted. Only if there were no volunteers for a job would AIP need to be paid. And, even then, because preferences differ over sailors, sailors who have less dislike for a billet ideally would accept it at a lower cost than other sailors. Eventually, if not initially, the Navy would like to target AIP to only those billets the detailing system cannot fill voluntarily without an incentive.

Design and implementation issues

In determining whether to adopt a bidding system and the attributes of any AIP system, the Navy must consider several issues:

- Will the Navy permit any involuntary assignments?
- How can a bidding system be structured to minimize sailors gaming it? In other words, how can it be structured so that sailors bid the billet's true value (or disutility)? How much more in AIP will the Navy pay if gaming occurs?
- Is it acceptable to Navy leadership and sailors if AIP varies in a location by skill or even within skill/paygrade combination? If not, would setting both maximum and minimum rates of pay on billets amelioriate equity concerns under a bidding system?
- How can the Navy incorporate other factors detailers consider in matching sailors to billets into an assignment bidding system? These factors include the training and moving costs of a sailor, the quality of the sailor, and the priority of the billet.

- What should be the upper limit the Navy will pay in AIP for an assignment? Should it be based on the amount of pay required to get a sailor to accept the billet, the requisition priority, or other considerations? Or, should all billets have the same cap?
- What measures of effectiveness are pertinent, and will they be possible to collect?

Cost-effectiveness of incentives

Given that the Navy plans to implement AIP, we examine in this section its potential cost-effectiveness. First, we evaluate the cost and benefits of converting overseas shore billets that qualify for sea duty credit (type-3 duty) to AIP-eligible billets (without sea duty credit). We focus on this comparison of incentives for two reasons. Sea duty credit is possibly the largest nonmonetary incentive the Navy currently offers—with about 9,000 sailors in overseas shore billets receiving it in FY01. In addition, Navy manpower experts believe that replacing sea duty credit with AIP may be an effective way to increase fleet manning and readiness.

Following this assessment of AIP for overseas type-3 billets, we examine separately the benefits of AIP versus its likely cost for hard-to-fill CONUS shore billets.[27] Because of the uncertainty surrounding AIP's design and sailors' responsiveness, these estimates should be interpreted only as a rough guide to AIP's cost-effectiveness.

Overseas shore billets: AIP or sea duty credit?

Both AIP and sea duty credit should improve manning in hard-to-fill overseas shore billets. They should also increase retention and lower turnover. Both, however, entail costs. To determine which is more cost-effective, we first estimate the direct costs for AIP. The uncertainty in how AIP will be implemented necessitates making several assumptions

27. Although we surveyed sailors' preferences for other incentives, such as guaranteed time to study or the promise of a preferred next billet, we do not present their cost-effectiveness for two reasons. First, difficulties in guaranteeing those incentives make it unlikely that they could be fully and effectively implemented, and second, sailors generally value them lower than compensation. See [4] for a comparison between AIP and guaranteed time to study.

to derive bounds on its costs. Assuming that AIP can vary by billet, we calculate two cost scenarios:

- The costs if all OCONUS shore locations were as undesirable as the *least* preferred OCONUS shore location
- The costs if all OCONUS shore locations were as desirable as a *preferred* OCONUS shore location.

We also derive an upper bound on AIP costs assuming that all hard-to-fill billets are paid the same rate.

Following the AIP calculations, we consider the cost of the sea duty credit for type-3 duty. This expense can be thought of as either (1) the cost to higher endstrength to maintain sea/shore balance, or (2) the loss in fleet readiness by having fewer sailors available for sea duty. We calculate the cost of sea duty credit using both approaches, and then compare the costs of AIP and sea duty credit.

Costs of AIP for overseas shore billets

Method 1—assuming that AIP rates can vary across billets

Our first approach relies on the CBC survey's estimated tradeoffs between locations and pay. We first consider how many sailors might decide between a billet at a satisfactory CONUS shore location and an overseas shore billet.[28] Next, we assume the the Navy will first rely on sailors with the least aversion to overseas duty who, consequently, require the lowest AIP—these are disproportionately single sailors. Only if there were not enough willing single sailors would the Navy more heavily tap sailors with dependents for the vacancies.[29] Based on our survey pay estimates, we determined separately how many single and married sailors would *accept* an OCONUS billet. Then we

28. We consider the AIP tradeoff between an adequate billet and the overseas billets for two reasons. First, sailors who have an option to accept a most preferred location are more expensive. Second, sailors choosing between the least preferred CONUS locations and overseas may not be retained because both options are still undesirable.

29. If more single sailors accept these billets than currently do, the Navy can expect PCS savings, too.

calculated the average monthly and annual AIP cost. This approach assumes that sailors could receive different AIP levels for jobs in the same location.[30]

Not all OCONUS locations are equally undesirable, so we estimate a range in costs. To derive a lower bound, we use the estimated monetary tradeoffs between a CONUS survey location in the middle of the preference range and Italy. We use Italy for the comparison because analysis of EMR data reveals that Italy is one of the more preferred type-3 duty locations. Likewise, we derive an upper bound by using the estimated CONUS-to-Japan AIP requirements. Our survey shows Japan as the least preferred duty.

Using our location preferences derived from JASS data and matching sailors to locations using the EMR, we find that about 8,300 sailors annually leave satisfactory shore billets in CONUS. We assume that at least this many sailors may choose between CONUS and the 3,800 type-3 OCONUS shore duty billets open each year. Given this pool of sailors, table 8 shows the pay necessary to get the typical sailor to volunteer for the OCONUS location, and the number of sailors accepting OCONUS type-3 duty at that pay rate.[31] Using this method, sailors would require payments of $25 to $300 per month. Sailors would need, on average, a payment of $40 if all overseas locations were similar to Italy versus an average payment of $240 per month if the OCONUS jobs were similar to Japan.

Based on 8,800 sailors in type-3 billets receiving the average monthly payment instead of sea duty credit, we estimate that the cost of AIP could range from $4 million (if all overseas type-3 billets are similar to Italy) to $25 million annually (if they are as undesirable as Japan).

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30. The calculated cost is sensitive to the number of sailors facing the choice between a satisfactory CONUS location and overseas shore duty. If there are more sailors than we estimate making this decision, costs are overstated because more willing sailors would be available to fill the overseas billets. Costs may also be overstated because sailors with less of an aversion for an undesirable billet than the "typical" sailor should volunteer for a lower AIP than the estimated pay required.

31. Our pay estimates for the "typical" respondent can be interpreted as the pay at which one-half of those sailors offered the less desirable location would choose it and the other one-half would not.

Table 8. AIP cost assuming sailors choose between CONUS and overseas shore billets

AIP based on estimated tradeoff between	Monthly AIP required[a]	Sailors accepting OCONUS billet
Italy		
Pacific Northwest (Single sailors)	25	1,370
Pacific Northwest (Sailors with dependents)	50	2,430
Average AIP required	40	
Japan		
Norfolk (Single sailors)	125	1,370
Pacific Northwest (Sailors with dependents)	300	2,430
Average AIP required	240	

a. Survey pay estimates are rounded to the nearest $25.

Method 2—assuming that AIP rates are equal for all sailors

Another approach to calculating AIP costs is to assume that AIP will be a location pay and that every sailor will be paid the same. An upper bound on AIP is the Secretariat maximum of $750 per month—which, given sailors' stated preferences, we think is unlikely. The total annual AIP cost for overseas shore duty could range anywhere from $32 million (based on $300 per month) to $79 million (based on $750 per month).

Cost of sea duty credit

Cost scenario 1

If the Navy is keeping endstrength high to provide shore rotation opportunities for the 8,800 sailors assigned to overseas shore billets, the cost of providing sea duty credit is the savings the Navy does not realize by cutting endstrength and outsourcing shore billets. By converting 8,800 billets to shore duty for rotational purposes, the equivalent number of shore billets could be outsourced and the (E-1 to E-9)

sea/shore ratio would still improve from the current 4.9:3 to 4.6:3. In total, 14,250 shore billets could be outsourced without any deterioration in sea/shore rotation. The cost of the additional 14,250 endstrength is about $650 million annually.[32] Based on an outsourcing savings of 30 percent [10, 11], the Navy, by offering sea duty credit, cannot realize outsourcing savings of $195 million annually.

Cost scenario 2

Alternatively, the Navy may have been sacrificing fleet manning and readiness to fill overseas shore billets. The cost of the sea duty credit then equals the expenditures required to buy higher fleet manning. Instead of increasing endstrength to improve fleet manning, the Navy can use an incentive pay, such as sea pay, to encourage sailors to remain on or extend on sea duty. Based on previous CNA research [12], we calculate that an additional $83 million in sea pay annually would be required to generate 8,800 extra work-years.

Cost-effectiveness of AIP for overseas shore duty

AIP compares very favorably to sea duty credit. Because it appears that the Navy will allow AIP to vary by billet, we expect that the AIP cost will likely be $25 million annually or less. The cost of sea duty credit ($83 million annually at a minumum) is *at least* three times more costly than AIP. Even under a worst case scenario, assuming that all OCONUS shore billets that receive sea duty credit currently were paid AIP of $750 per month instead, AIP should still be the better tool to use.

CONUS shore billets: Is AIP cost-effective?

Here, we consider whether the Navy should use AIP for hard-to-fill CONUS billets. Using the methodology we employed earlier, we compare the AIP cost of an adequate location to the least preferred CONUS location from our survey. Then, we estimate the savings AIP would generate in retention as hard-to-fill billets with no incentive switch to being AIP-eligible. The retention savings equal the amount

32. We assume the FY02 fully loaded annual manpower cost (i.e., the composite rate) of an E-5 of $45,800.

in Selective Reenlistment Bonuses (SRBs) the Navy needed to offer to keep retention constant when no assignment incentives were provided. In [3], we calculated several scenarios using two indicators of sailors receiving less preferred assignments to derive a range of retention costs for using SRBs. These avoided costs would, consequently, be the savings of using AIP. Here, we simply present our best cost estimates based on sailors being involuntarily assigned to CONUS shore billets.

Costs of AIP for CONUS shore billets

Our survey showed that, under most scenarios, the "typical" respondent would be just as likely to choose any CONUS shore assignment for $0 to $175 per month.[33] Table 9 shows the pay necessary to get the typical sailor to volunteer for Great Lakes (the least preferred CONUS shore location) versus the Pacific Northwest, and the number of sailors accepting hard-to-fill CONUS billets at that pay rate. We anticipate that filling the most undesirable CONUS billets[34] would cost about $125 per month, given the number of sailors likely to be offered the two alternatives.

Savings from offering AIP to CONUS billets[35]

We calculated a retention cost estimate for sailors involuntarily assigned to CONUS shore billets under the current system. As before, we assume that all sailors selected for billets at 6 months or less before PRD—23 percent of sailors—are getting assignments they do not

33. Of our surveyed location tradeoffs, only sailors choosing between San Diego and other CONUS locations or between Hawaii and Great Lakes required pay higher than $175 per month. These estimates assume that the sailors are not offered their current location. Because of sailors' desire to home-base, the costs to AIP would be higher if they were offered their current location.

34. Based on EMR and JASS data, about 3,100 sailors in zones B and C are assigned to undesirable locations annually.

35. For greater detail on our estimation of the retention costs to the involuntary system, see [3].

want.[36] The SRB cost to alleviate their retention problems would be approximately $21.8 million annually, or about $125 per month of tour,[37] for each sailor involuntarily assigned. This estimate is highly sensitive to the magnitude of the continuation effect among first-term sailors and to the definition of hard to fill.[38] If we expand our estimate to both sea and shore CONUS billets, the total cost is $33 million annually.

Table 9. AIP cost assuming sailors choose between CONUS billets

AIP based on estimated tradeoff between Great Lakes and	Monthly AIP required[a]	Sailors accepting less preferred CONUS billet
Pacific Northwest (Single sailors)	100	1,370
Pacific Northwest (Sailors with dependents)	150	1,730
Average AIP required	125	

a. Survey pay estimates are rounded to the nearest $25.

Cost-effectiveness of AIP for CONUS shore duty

Although there is uncertainty regarding the AIP rates sailors will require, our best estimate is that sailors may volunteer for traditionally difficult-to-fill CONUS shore billets for about $125 per month, on average. The retention cost of the existing system, however, also

36. Based on this definition, approximately 5,000 sailors in zones A through C are involuntarily assigned to CONUS billets each year while, at any point in time, about 15,000 sailors are serving in billets they were involuntarily assigned.

37. Per billet cost is based upon the 15,000 sailors serving in less-preferred billets.

38. To the extent we are not capturing preferences perfectly in our measures and cannot control for the effects of existing assignment incentives, our estimated retention effects may be too low. Consequently, the retention costs of the existing distribution system we've estimated are probably lower bounds.

equals about $125 per month. Based on retention costs alone, it may not be cost-effective to offer AIP to CONUS shore billets, particularly in light of the perturbations AIP will create in the distribution system.

That said, one added benefit to AIP to keep in mind, however, is that AIP keeps sailors in difficult-to-fill billets longer. Based on our estimates, an additional $100 per month to difficult-to-fill CONUS shore billets should increase work-years by 600. The PCS savings from the lower turnover is minor, but the increased stability of staffing shore billets should make the Navy more efficient. The Navy would also benefits from AIP by making costs to filling billets more visible and increasing the experience levels of sailors within jobs.

Implications and conclusions

In this study, we found substantial costs to the current assignment system, but those costs can be mitigated through carefully crafted incentive packages. Sailors will volunteer for hard-to-fill billets and stay in them longer given the right incentives.

We believe that using AIP is a promising way of moving the Navy toward a more voluntary, efficient assignment system if it is designed as a flexible, market-based incentive pay, as planned. Such a design would allow the Navy to alleviate manning shortages as they emerge and adjust pay as sailors are more or less willing to volunteer for priority billets. In addition, pay has a broader appeal than many nonmonetary incentives, which are targeted to small segments of the sailor population. In the long run, AIP will allow for better resource allocation by making more visible the costs of keeping hard-to-fill billets manned. The Navy can then decide under what conditions it is cost-effective to pay AIP, address the underlying problems of an undesirable location (e.g., through quality-of-life enhancements), or move or outsource the billets.

Our cost/benefit analyses suggest that the costs of manning shore billets by using sea duty credit for rotational purposes is so large that the Navy should make those billets AIP-eligible. Even if AIP ends up less targeted and pays sailors more than we estimate they require to volunteer for these billets, AIP should still cost less. For CONUS shore billets, however, the costs of the current system are much lower. The Navy should consider whether the risks make it worth proceeding. AIP only makes sense if it can be efficiently targeted. It is particularly important, therefore, to carefully monitor the outcomes of the first limited implementation of AIP to overseas billets and then expand implementation to selected CONUS shore billets if it appears that the design of the system and responsiveness of sailors will make it cost-effective.

As the Navy proceeds, it must, however, keep in mind some possible consequences to adopting AIP:

- *The design and implementation of AIP combined with the responsiveness of sailors will ultimately determine its costs.* For example, the cost-effectiveness of AIP will be undermined if it cannot be targeted to billets (i.e., it becomes an across-the-board location pay). If AIP is paid at the billet level, however, there could be large variations in pay at a location or even within a paygrade/skill/location combination. The Navy can apply decision rules to lessen the differences in pay, but the efficiency of AIP will diminish.
- *AIP may not succeed in filling all priority billets.* If there is not enough participation or the system is not flexible enough to set high enough rates, AIP may not solve all the Navy's manning problems in key shore billets. For some billets, detailers may need to revert to ordering sailors involuntarily or using other, nonmonetary, incentives.
- *AIP may alter the demographic composition of sailors in fleet concentration areas and overseas.* Our survey suggests that single sailors are more likely to volunteer for overseas duty, and that sailors with dependents who want to home-base will have more opportunities to do. If so, the Navy will likely reduce its PCS expenditures. The Navy, however, must ask whether it is willing to accept these changes in demographics, particularly in light of concern about sailors representing U.S. interests abroad.

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