Improving Enlisted Fleet Manning

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DRM-2014-U-007586-Final
July 2014

140506-N-IU636-037 PEARL HARBOR (May 6, 2014) Sailors assigned to the guided-missile destroyer USS Hopper (DDG 70) man the rails as the ship returns to homeport at Joint Base Pearl Harbor-Hickam from an independent deployment to the U.S. 5th and 7th Fleet areas of responsibility. The ship and its crew of nearly 280 Sailors conducted theater security cooperation and maritime presence operations with partner nations. (U.S. Navy photo by Mass Communication Specialist 3rd Class Johans Chavarro/Released)

Approved for distribution: July 2014

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Contents

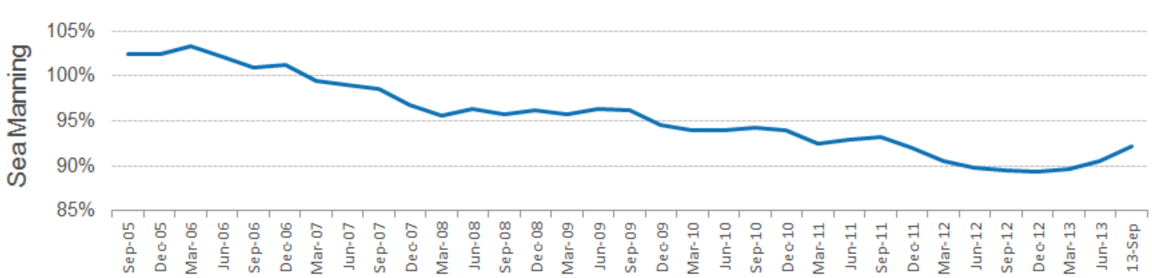
Executive summary

Background and tasking

The primary objective of the Navy's Manpower, Personnel, Training & Education (MPT&E) system is to "man the fleet" with sailors whose skills and experience levels match those of the job (i.e., billet) requirements. Achieving fleet manning levels that are deemed sufficient by Navy leadership, however, has proved to be a perennial challenge. Providing the right number and mix of sailors to the fleet is a complicated process. Many underlying issues combine and interact in complex ways to produce persistent inventory shortfalls and skill/experience misalignments, which impede the MPT&E system's ability to meet fleet manning goals.

Over the past eight years, enlisted sea duty manning levels have steadily dropped (see figure 1). During the first three quarters of FY 2013, aggregate sea manning levels hovered around 90 percent, meaning that about 15,000 funded sea-duty billets were not filled. Furthermore, the primary fleet manning metric—Fit, which accounts for how well sailors' skills and experience levels match those required by billets—showed even lower levels, meaning that even more billets were not filled with the right types of sailors.

Figure 1. Fleet (sea-duty) manning levels (personnel on board over billets authorized)



Given the current state of fleet manning, N81 asked CNA to examine the issues affecting fleet manning and to provide recommendations for changes to the MPT&E policies, processes, procedures, and funding that will lead to improved manning levels.[1]

Findings

In response to this tasking, we conducted a broad analysis of fleet manning.[2] We examined the current set of metrics that are used to assess fleet manning, analyzed trends in manning levels, and identified issues, imbalances, and misalignments that affect manning levels. Integrating the key findings from this work, we also identified strategic goals for improved MPT&E management. A summary of our findings follows.

Major factors affecting fleet manning

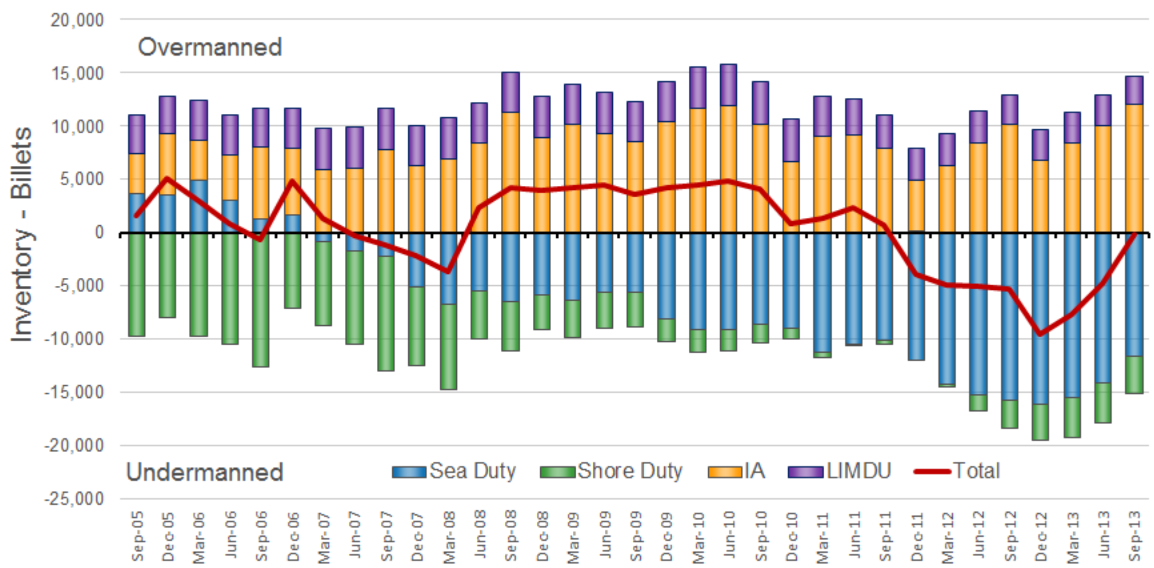
At the highest level, fleet manning depends on the size of the distributable inventory (i.e., sailors available for full-duty assignment) and the allotment of these sailors between sea and shore assignments. The size of the distributable inventory is governed by total endstrength (relative to authorizations) and overhead execution (i.e., students, transients, prisoners, patients, and holdees (TPPH), and sailors in limited duty status (LIMDU)). Figure 2 shows how these factors combined to produce the manning levels shown in figure 1. Total endstrength (red line) has fluctuated between periods of shortfalls and excess. Excess in overhead execution (orange and purple portions of the columns) has reduced the distributable inventory, causing shortfalls at sea (blue columns) and ashore (green columns). Sea-shore

1. The Navy's MPT&E system may be considered in two parts: (1) policy, process, and budget establishment (e.g., recruiting plans, training plans, sea-shore flow policies, and billet funding) and (2) implementation and execution (e.g., distribution, detailing, and reclassification). While both parts affect fleet manning, this study focused on the former.

2. To provide recommendations in time for Program Objective Memorandum (POM) deliberations, we had roughly six months to complete our investigation. Consequently, our analysis, while extensive, was tailored (and restricted in depth) to the time available.

flow affects how the shortfalls are distributed between sea and shore. Note that, over the past eight years, shortfalls have migrated from shore to sea.

Figure 2. Major imbalances affecting fleet manning



Fleet manning metrics: Fit and Fill

Fit and Fill are the primary metrics Navy leadership uses to evaluate fleet manning. On one hand, Fill compares total personnel with authorizations without regard for skill or seniority (similar to the manning metric in figure 1). Fit, on the other hand, compares personnel inventories with authorizations, but takes skills and paygrades into account. The Navy uses two sets of these metrics to assess enlisted manning—Rating Control Number (RCN) Fit and Fill and Navy Enlisted Classification (NEC) Fit and Fill.[3] (This study focuses on RCN Fit and Fill.)

3. RCNs represent enlisted distribution communities. Most RCNs are defined by ratings, but some are defined by one or more NECs.

Fit was developed to measure unit manning, but it is also used to measure manning at more aggregate levels. At the unit level, Fit measures how well the unit is manned. At aggregate levels, Fit measures the ability of the MPT&E system to properly fill authorized billets.

Fleet RCN Fit gaps

Decrements to RCN Fit are caused by Fit billet gaps. A Fit gap can result from too few sailors in total or from having the wrong mix (rating and paygrade) of sailors. In our analysis of fleet Fit, we identified three levels of gaps that affect RCN Fit: aggregate Fill gaps, aggregate Fit gaps, and Fit gaps at the Unit Identification Code (UIC) level.

Aggregate Fill gaps result from an imbalance between the number of sailors in full-duty status (i.e., the distributable inventory) and the number of full-duty authorized billets. Most of the aggregate Fill gaps at sea have been caused by a persistent excess of personnel in the overhead accounts. In 2012 and 2013, Fill gaps were exacerbated by a significant shortage in total force inventory. Aggregate Fill gaps at sea also depend on sea-shore flow. Over the past eight years, Fill gaps at sea have ranged from about 2,000 to 15,000, causing a decrement to RCN Fit of 1.3 to 10.7 percentage points.

Aggregate Fit gaps stem from additional imbalances in the distributable inventory at the community and payband levels. Community imbalances, which account for most of these gaps, result from having some communities that are overmanned and some that are undermanned. Excesses in overmanned communities do not contribute to Fit; however, any excess is usually offset by shortages in other communities that do affect Fit. Aggregate Fit gaps at sea also depend on sea-shore flow. Since 2006, Fit gaps at sea have varied from 850 to 9,200, causing a 0.6- to 6.3-percentage-point decrement to RCN Fit.

UIC-level gaps occur at the unit/activity level and stem from distribution friction that cause some units/activities to be overmanned and others to be undermanned. They depend on the number of sailors assigned to each UIC and their payband distribution relative to requirements. Since 2006, the level of UIC level gaps at sea due to distribution friction has fluctuated between 6,000 to 10,000, causing a 4.0- to 6.0-percentage-point decrement to sea RCN Fit.

Each of these gap levels is distinct in that the overall decrement to RCN Fit is the sum over all three levels. For example, since 2006 the combined decrements to RCN sea Fit from aggregate Fill and aggregate Fit gaps have ranged from 4.4 to 12.0 percentage points. These gap levels, however, are not independent of one another. Increases in aggregate Fill gaps have been accompanied by decreases in aggregate Fit gaps because more of the shortfalls were caused by insufficient total inventory as opposed to imbalances among communities. In other words, the likelihood of overmanned communities decreases as total distributable inventory shortfalls increase.

Underlying causes of manning problems

Part of our tasking was to identify the underlying issues that cause or contribute to the imbalances and misalignments that decrease fleet Fit levels. Our investigation uncovered several of these issues:

- *Interyear whipsaw behavior in A-school throughput:* We found exceedingly large year-to-year changes in the number of students that attend A-school for a given rating. Large changes in student throughput stress the enlisted supply chain process. Large increases are likely to result in longer training times as bottlenecks and backlogs occur in the training pipelines. Large decreases, however, can lead to wasted resources as funded training capacity may go unused.

- *Intrayear fluctuations in accessions:* Variations in the flow of personnel, whether caused by changes in annual throughput or by the spread of accessions during the year, disrupt the supply chain. School schedules need to adjust to the extent possible, and typically there are increases in the time students spend either awaiting instruction or transfer.

- *Execution-year changes to accession plans:* In-year changes mostly arise from accessions being used as a force-shaping lever to align inventory to end-of-year endstrength requirements Rating adjustments are also made to address the health of individual communities. These are all laudable objectives, but cuts or increases during execution usually affect some communities more than others, which disrupts the flow of sailors to the fleet.

- *Misalignment of tour lengths and personnel obligations:* The Navy sets sea and shore tour lengths to align personnel with billets. Tour lengths are prescribed for sea and shore tours 1, 2, 3, etc. If actual tour lengths differ, the alignment of personnel between sea and shore duty to match inventory and billets will suffer, causing decrements to fleet manning.
- *Complexity of training pipelines:* The efficient flow of personnel through initial training to the fleet is affected by the complexity of training pipelines, some of which have many courses and branches/alternatives. As the complexity increases, so does the difficulty of synchronizing the course convenings to minimize bottlenecks and gaps in training, which results in student not-under-instruction (NUI) time.
- *Billet churn:* Authorized billets provide the demand signal that the Navy MPT&E enterprise endeavors to meet. Authorizations do evolve over time, and personnel management reacts accordingly through changes to recruiting, community management, sea-shore flow, distribution, etc. Time is required to implement such changes. Changes on short notice have a disruptive effect, as the personnel system aims toward an out-of-date target.
- *Unexecutable billet structures:* Military manpower is a closed labor market, which places many constraints on MPT&E. One major constraint is the concept of an executable billet structure. The limits of what is executable or unexecutable are difficult to establish and depend on various MPT&E policies (such as advancement rules and sea-shore flow policies) and retention. Unexecutable billet structures have a negative impact on fleet manning because they inevitably result in not attaining the authorized mix of personnel.

Strategic goals

It is difficult to form a coherent response to all of the above issues that can have a negative impact on fleet manning without an overall viewpoint/strategic perspective that channels ideas and initiatives. Therefore, we have identified a strategy for addressing fleet manning problems.

We infer from our analysis the need for four strategic goals for Navy MPT&E management:

- ***Stability*** in MPT&E planning and execution from one year to the next
- ***Alignment*** of MPT&E processes and procedures
- ***Flexibility*** as a primary means of attaining stability
- ***Executable*** goals

All the actions that we explored to improve fleet manning were developed in the context of this strategy.

Recommendations

Based on our findings, we developed and analyzed actions to improve fleet manning. Our recommendations include a holistic management process for evaluating MPT&E requirements, plans, and policies, as well as individual solutions to address the issues, imbalances, and misalignments that decrease fleet Fit. We also estimate the combined effects of these actions in terms of attainable fleet RCN Fit.

Holistic MPT&E management process

We recommend that the Navy adopt a holistic and coordinated MPT&E management process, in which it asks and addresses each of the following four questions for each enlisted community:

1. Can the inventory attain and maintain the authorizations' paygrade structure? That is, is the billet structure ***executable***?
2. Can the inventory attain and maintain the authorizations' paygrade distribution at sea? That is, is the billet structure ***aligned*** with sea/shore flow policies and practice?
3. How quickly can we transition from today's inventory to the sustainable target inventory, while limiting accession fluctuations? That is, will there be ***stability*** during the transition?
4. Do we have the policies and procedures available to implement the above steps? This requires ***flexibility*** in execution.

"Solutions" that support the goals of *stability, alignment, flexibility* and *executability*

We recommend that the Navy pursue the following so-called solutions to improve fleet manning:

- *Fix the billet base where it lacks junior billets.* Too few junior (E-1 to E-3) billets can lead to shortages of E-4 sailors. This problem usually occurs when the number of junior billets is less than 19 percent of the total billets for that community. The fix could be to buy more E-1–E-3 billets or roll down the paygrades of existing billets.

- *Fully fund the student and TPPH accounts.* We support the Navy plans to buy over 2,500 additional student billets by FY 2015. This buy, coupled with N12's forecasts that student execution will decrease by 3,000 man-years by FY 2015 (based on lower accession numbers), should align student execution and funding. Similarly, the Navy plans to buy 1,125 additional TPPH billets by FY 2015; based on TPPH execution forecasts, this buy will align this account as well.

- *Buy billets to account for sailors in LIMDU status.* Sailors in LIMDU status are not able to serve on sea duty. Assuming that about two-thirds of LIMDU sailors come from sea duty, we estimate that about 1,700 billets would need to be bought to account for these losses.

- *Align tours, obligations, and paygrades.* The Navy could improve alignment by lengthening some first sea tours (to align with longer initial obligations) and shortening others (to get sailors back to their second sea tours sooner). This initiative should provide better alignment between tour lengths and obligations, leading to a better alignment of personnel between sea and shore duty. It should also improve sea manning by providing a better paygrade/experience mix at sea.

- *Fix sea/shore imbalances in the senior paygrades.* We identified 27 communities in which greater than 50 percent of the E-8–E-9 billets were at sea (totaling 922 sea billets and 991 shore billets). To address this issue, we propose rolling down 465 E-8-billets to

E-7 and adding 465 E-8 shore billets. The additional shore billets could be new billets or conversions of civilian billets to military billets.

- *Shorten shore tours for geographic stability.* To improve sea manning, we propose giving shorter shore tours to sailors who are receiving the benefit of geographic stability.

- *Align sea pays with other pays.* Since 2001 (the date of the last increase), sea pays have lost 24 percent of their purchasing to inflation. We support the Navy's decision to increase sea pays to better align growth in sea pays with growth in other pays.

- *Reduce billet churn.* Billet churn contributes to manning friction. We support the current Navy proposal to delay billet change requests (BCRs) that affect sea duty Fit by 10 months. This will better allow the distribution process to respond to these new demand signals.

- *Reduce the complexity of training pipelines.* We propose that the Navy take action to examine its initial training pipelines with the goal of reducing their complexity. It should also review the process used in acquisition to develop training for new and upgraded systems and platforms.

- *Level-load accessions.* Seasonal fluctuations in recruiting cause inefficient flows of accessions to the fleet. We propose that the Navy level-load recruits. We estimate the cost of level loading to be about $25 million per year for enlistment bonuses and roughly $67 million per year for additional MPN man-years.

- *Minimize year-to-year fluctuations.* MPT&E plans look three-plus years into the future (e.g., TRM). Plans are updated in a deliberative process (e.g., quarterly demand planning). End-strength/budget constraints cause plans to change during execution. We propose that the Navy "lock" plans after a certain date, thereby limiting year-to-year fluctuations. This is an explicit goal of the Business Improvement Team (BIT) as outlined in its Navy Accession Master Production Planning concept (specifically, the Rolling Production Plan during the POM and budget years and the Firm Production Plan during the execution year).

- *Use Professional Apprentice Career Track (PACT) sailors as a relief valve.* The use of PACTs as a relief valve can help smooth out changes in A-school flow, removing (or partially removing) instability. Although the Navy already treats PACTs as a relief valve to some extent, we believe that they could be used to achieve more stability in accession levels for rated communities.
- *Seek endstrength relief.* Execution-year actions taken to meet monetary and endstrength constraints are frequently at odds with long-term plans. The Navy has limited authority from Congress to miss endstrength targets. We recommend that the Navy seek authorization for endstrength variance in support of long-term community management objectives.

Attainable RCN Fit

Our analysis indicates that 90-percent Fit levels are about the best the Navy can achieve without systemic changes to MPT&E processes. Many of the required systemic changes are described in this report; to the extent that they are implemented, attainable Fit levels would rise.

There is a level of friction that derives from issues not addressed in this report (personnel that are not worldwide assignable, assignments for pregnant women, lack of funding for contact relief, etc.). So, even if all of our recommendations were implemented, we estimate 94 percent as an upper bound on attainable Fit levels.

The above limits address aggregate levels of attainable Fit. It is possible to attain higher levels of Fit on individual units if they are given sufficient distribution priority.

Introduction

Background

The primary objective of Navy personnel management is to “man the fleet”—that is, ensure that sea duty units have the appropriate number and skill mix of trained personnel on board. Fleet manning is a perennial complicated problem, and fleet manning levels are almost invariably deemed insufficient by Navy leadership. Many underlying issues cause fleet manning decrements. These issues are complex (schoolhouse capacity, LIMDU rates, student billet funding, etc.), and they combine and interact to produce persistent shortfalls in fleet manning.

Over the past eight years, enlisted sea duty manning levels—defined as the ratio of onboard inventory to authorized billets—have steadily dropped. During the first three quarters of FY 2013, aggregate sea manning levels hovered around 90 percent, which means that about 15,000 funded sea-duty billets were not filled. Furthermore, current fleet manning metrics, **Fit** and **Fill** (which not only measure the number of sailors on board but also account for how well their skills and experience levels match those required by the billets), show even lower levels.

In July 2013, the Strategic Actions Group (N00Z) provided the Chief of Naval Operations (CNO) an extensive point paper on fleet manning [1] that identified a range of issues affecting the ability of Navy personnel managers to provide sufficient sailors to the fleet with the right skills and experience levels. In response, the CNO asked for recommendations on how to address these issues and improve fleet manning. The Director, Assessment Division (N81), in turn, asked CNA to analyze these issues and provide such recommendations.

Tasking

Our tasking was to provide recommendations for changes to Navy Manpower, Personnel, Training & Education (MPT&E) policies, processes, procedures, and funding, that will lead to improvements in fleet manning.[4] Although our focus was on the enlisted street-to-fleet supply chain and personnel management processes, we also explored actions to reduce the complexity of these processes and ensure that their end goals are executable. In making recommendations, we were asked to consider the backdrop of declining Navy budgets and search for overall efficiencies in spending.

To provide recommendations in time for POM deliberations, we had six months to complete our investigation. Consequently, our analysis, while extensive, was tailored (and restricted in depth) to the time available.

The work was structured in two phases:

- Phase 1 established a baseline of the current situation by defining the "AS-IS" model, which has the following goals:
  - — Develop a comprehensive list of issues that affect the street-to-fleet supply chain.
  - — Quantify the impacts/relative importance of each of the foregoing issues to the street-to-fleet supply chain.
  - — Describe the interactions between the above issues, showing their cumulative impact.
  - — Evaluate and critique the current set of fleet manning measures and determine currently attainable Fit and Fill levels.
  - — Identify issues that need to be addressed to improve fleet manning.

4. Our analysis addressed all enlisted personnel except for nuclear trained and health-care-related personnel.

- Phase 2 built on the baseline to develop recommended actions that would define the "TO-BE" model—specifically, two types of potential improvements:
  - — Efficiencies in the current processes (e.g., better alignment of training plans with fleet manning demands)
  - — Changes to these processes (e.g., streamlining training to reduce the numbers of accession pipelines)

We also conducted case studies on enlisted communities to identify and understand fleet manning problems and test potential solutions.

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Understanding fleet manning: The "AS IS" model

In this section, we describe the current state of fleet manning and the issues that affect its levels.

The Navy's MPT&E framework

Fleet manning is the end product of the Navy's MPT&E process, and it's fair to say that every MPT&E management action has an impact—direct or indirect—on fleet manning. Consequently, there are many issues to explore when trying to understand why fleet manning is less than 100 percent. It is necessary, therefore, to have a framework and overall perspective of Navy MPT&E in order to bring consideration of the many issues into a coherent whole. We start by describing such a framework; it provided the focus and organizational principles to our analysis, and it provides a perspective from which to view the analysis results.

Overall structure of MPT&E management

Navy MPT&E management may be considered in two parts:

- Establishment of policy, process, budget, etc., which are the purview of N1
- Implementation of Navy MPT&E, which is the focus of the Navy Personnel Command, the detailers, etc.

For three reasons, we focused on the higher level functions of policy, process, and budget establishment—that is, consideration of recruiting plans, training plans, sea-shore flow policies, billet funding, etc.:

- If policies and so forth are incorrect, implementation is almost sure to have significant problems.

- A belief that MPT&E policies and procedures have a larger effect on overall Navy manning, whence fleet manning, than implementation procedures.
- The time available for this study was not sufficient to analyze issues pertaining to the efficiency of the distribution process.

Key MPT&E processes

Our analysis focuses mainly on two key processes that support Navy MPT&E management: the enlisted street-to-fleet supply chain and community personnel management.

The primary function of the supply chain is to train and prepare new recruits for their first fleet assignment. This process involves long- and short-term planning and resourcing, and execution year management functions.

Community management focuses on the short- and long-term health of each enlisted community by determining accession requirements and managing retention and advancement. It also oversees career path and development issues, such as advanced training, sea-shore flow, and assignment opportunities. Both these processes play key roles in producing the right number and mix of sailors to fill fleet manpower requirements.

Perspective regarding Navy MPT&E and fleet manning

Our tasking was very broad, and we did not have much time to address the many underlying issues. However, the issues addressed in this study are mostly not new, and we were able to draw on our knowledge of Navy MPT&E issues to guide and assist our work. A crucial benefit of our background in Navy MPT&E issues is that it provided a backdrop, which helped to guide and focus the analysis. The following observations regarding Navy MPT&E form this backdrop.

- **Military manpower is a closed labor market**. The Navy mostly hires its all-volunteer force at entry levels, and trains and develops them for future senior positions. Consequently, the Navy needs to consider requirements for senior personnel 10+ years in the future when hiring personnel today. Such long-term planning, which is uncommon in the civilian sector, imposes numerous constraints on personnel management decisions.

- **Tensions exist between long-term planning and short-term priorities.** MPT&E managers produce many plans several years in advance of execution. For example, A-school plans are produced three years in advance of when the students will attend. The Navy is also subject to many short-term, execution-year considerations, most of which are budget driven. These short-term considerations are frequently in conflict with long-term plans, and decisions are made that undercut one or the other.

- **Forecasts are uncertain**. Navy MPT&E managers need and make use of forecasts all the time. For example, one cannot produce a school plan three years out without making some forecasts regarding authorizations, continuation behavior, etc. These forecasts are inherently uncertain and have large confidence intervals/margins of error due to unanticipated events.

- **The Navy uses paygrade structure as a compensation tool**. The Navy has one pay table that applies to all enlisted personnel. So, an E-5 in a high-tech community (e.g., a nuclear-trained petty officer) receives the same basic pay as an E-5 in a low-tech community (e.g., boatswain mate). The Navy needs to pay high-tech/highly skilled personnel considerably more than lower skilled personnel in order to retain them. It is true that there are incentive pays and reenlistment bonuses that vary between skills, but the pay table is the basis of all compensation, and working with one pay table causes problems for personnel management. The Navy gets around this problem by having a much more senior paygrade distribution in highly skilled communities in comparison to lower skilled communities. This causes highly skilled personnel to be advanced faster and, hence, receive higher compensation.

- **Navy MPT&E is complex**. There are many MPT&E policies and procedures and they interact with each other in many ways. Consequently, it is very difficult to understand all of the impacts of any personnel policy or procedure on Navy personnel; there always seem to be unintended consequences.

- **Fleet manning issues have persisted for many years**. The extent of problems with fleet manning may have increased in the past few years but the underlying issues have existed and have been scrutinized repeatedly over many years. It's reasonable to hypothesize that easy answers were found a long time ago, and long-term improvements in fleet manning will require significant change.

Fleet manning metrics: Fill and Fit

We start the analysis by providing a detailed description of the state of fleet manning. There are many ways to measure fleet manning; each measure provides different insights. We analyze data over many years to discern long-term behavior/performance levels and shorter term behavior. After establishing this foundation, we address the causes of fleet manning shortfalls. Initially, we consider the metrics that are widely used to measure fleet manning, *Fill* and *Fit,* and the development of a new metric, *quality of alignment,* and we provide a critique of the idiosyncrasies, strengths, and weaknesses of the metrics.

In 2005, the Navy developed new metrics, known as Fill and Fit, to better measure fleet manning. Two sets of these metrics were developed to measure enlisted manning—Rating Control Number (RCN) Fill and Fit and Navy Enlisted Classification (NEC) Fill and Fit—and one set to measure officer manning—Officer Fill and Fit. Since then, these metrics have evolved under the collaborative efforts of Navy Personnel Command (NPC), Fleet Forces Command (FFC), Naval Education and Training Command (NETC), and Commander, Pacific Fleet (PACFLT).

RCN Fill and Fit

RCNs represent enlisted distribution communities. Most are defined by a rating, but some are defined by one or more NECs (mostly closed-loop NECs that define a distribution community). Reference [2] defines RCN Fill and Fit and describes the data and business rules used to calculate these metrics.

RCN Fill

RCN Fill is defined as the number of Current on Board (COB) personnel divided by the count of Billets Authorized (BA) projected for nine months out (P9BA) for each community. The Fill measure counts all COB and BA, including those for the unrated Professional Apprentice Career Track (PACT) sailors (i.e., airmen (AN), fire controlmen (FN), seamen (SN), and construction men (CN)). Fill is calculated for each community (RCN) and for the unit as a whole. In calculating Fill for the unit, Fill counts excess personnel, meaning that COB personnel above the BA requirements for that community and payband contribute to the overall Fill score.[5]

RCN Fit

RCN Fit equals the count of COB personnel for the selected month for each rating and Supervisor/Journeyman/Apprentice (SJA) payband divided by P9BA for each rating and SJA payband. Not all COB personnel or BA are included in Fit calculations. Specifically, Fit excludes PACT sailors and billets.

Unlike RCN Fill, RCN Fit does not count excess. That is, any portion of a rating/SJA payband manned above 100 percent is not included in the computation. The one exception to this rule is that excess supervisor (E-7–E-9) personnel may fill journeyman (E-5–E-6) gaps, and excess journeyman personnel may fill apprentice (E-1–E-4) gaps. Excess supervisor personnel may also fill apprentice gaps. In other words, bodies may "trickle down" to fill gaps, but not up.[6,7]

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5. For example, assume that a unit has 20 BA, 10 for community A and 10 for community B. If this unit has 8 COB in community A and 12 in community B, Fill would be 80 percent for community A and 120 percent for community B. However, Fill for the unit would be 100 percent.

6. There are a few other rules in the RCN Fit calculations that apply to individual communities.

7. To illustrate the effect of not counting excess in Fit, recall our earlier Fill example. In this scenario, the Fit score for that unit would be 90 percent because the two excess COB personnel in community B do not count to the unit's Fit score. Fit (and Fill) use a sailor's prospective paygrade in determining his/her payband.

Assessment

We continue with an assessment of the strengths and weaknesses of the measures. First, we need to address the objectives of Fit and Fill.

Metric objectives. To understand the objectives of these metrics, we asked the following questions:

- Who are the primary users/customers of the metrics?
- What are the metrics supposed to measure?
- For what level are the metrics intended?

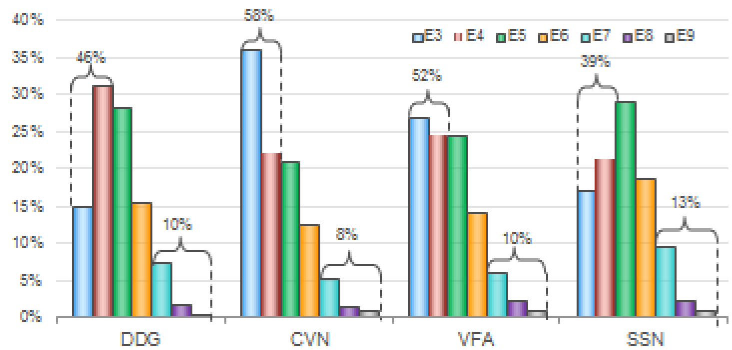
Fit and Fill were developed for fleet leadership. Fit and Fill measure two things: At the aggregate level, they measure the ability of the MPT&E system to properly fill authorized billets. At the unit level, they measure how well the unit is manned.

Fit and Fill are unit-level fleet metrics. Aggregating these metrics above this level is equivalent to computing an average Fit score, which can be misleading. For example, aggregating Fit across a class of ships will reflect the average Fit score but will not reveal how many, if any, units are below a minimum Fit threshold.

Issues and limitations. One limitation of the current Fit measure is that all billets used in the Fit calculations are weighted equally. For example, a gapped E-8 billet decrements Fit the same as a gapped E-3 billet.[8] One consequence of this rule is that apprentice billets contribute the most toward Fit. To illustrate this point, figure 3 shows the paygrade distribution of billets on four classes of operational units: DDG-51 guided missile destroyers (DDGs), nuclear aircraft carriers (CVNs), F/A-18 squadrons (VFAs), and attack submarines (SSNs). The data show that supervisor billets account for a small portion of total billets (8 to 13 percent)—hence, a small portion of RCN Fit scores. In fact, a CVN could achieve a 92-percent Fit score without any E-7–E-9 sailors on board.

8. Allowing excess supervisors to fill gapped journeyman and apprentice billets does add value to senior personnel.

Figure 3. Paygrade distribution of billets on four classes of operational units



The portions of apprentice and journeyman billets vary by unit class. CVNs have 58 percent of their billets in the apprentice payband, and 34 percent are in the journeyman payband. SSNs, however, have 39 percent apprentices and 48 percent journeyman billets.

Another issue involves the SJA paybands. Fit uses the same paygrade rules to divide personnel and billets into the three paybands across all communities, but the distribution of billets by paygrade varies by community: highly technical communities, such as nuclear communities or advanced electronic computer field communities, have a more senior paygrade distribution than the so-called lower technical communities (e.g., boatswain mates). Thus, the experience levels of apprentices and journeymen, can differ between the communities. In some communities, many E-5s and some E-6s are first-term/first-tour sailors, and these sailors are considered journeyman even though they may lack journeyman training and leadership experience. Recently, the Navy embarked on an initiative to define first-term billets for each community. Perhaps, the results of this effort could be used to redefine the SJA paybands for each community.

NEC Fill and Fit

Enlisted manpower requirements extend beyond rate and rating. Specialized skills are defined by NECs, and metrics are needed to assess the extent to which NEC requirements are met in a UIC. NEC Fill and Fit are measures of how well the specialized skill sets (NECs) of a unit's crew match those required by the unit's authorized billets. Not all NECs are included in these metrics. Specifically, NECs that define a distribution community are excluded because they are accounted for in RCN Fit and Fill. The Navy reports two sets of NEC Fit and Fill: one for all NECs and one for just the critical NECs. Critical NECs represent those skills that are deemed essential for a unit to perform its mission.[9]

NEC Fill

NEC Fill is simply the number of NECs on board (i.e., in the crew's inventory) that are not in excess of the number of authorized NEC requirements. Fill does not count NECs on board that are in excess of each NEC requirement. For example, if a ship required four sailors with an NEC but has six sailors on board with that NEC, only four count in the NEC Fill score.

NEC Fit

Whereas NEC Fill measures the aggregate skill set of the crew, NEC Fit is far more restrictive in that it accounts for whether the sailor or sailors who hold the NEC are assigned to a job that requires the specialized skill set. It uses the distribution NEC (DNEC) to determine this assignment. For some NECs, there is an additional constraint that the sailor belongs to the source rating for that NEC.[10] Other rules used in NEC Fit calculations that pertain to certain NECs are listed in appendix A.

NEC Fit equals the number of COB sailors who are both distributed to and hold the NEC (or senior NEC) in their inventory for each

9. Subject matter experts (SMEs) within each community have identified which NECs are critical.

10. If an NEC has multiple source ratings (as identified in the NEC manual [3]), a sailor-to-billet rating match is not a criterion in determining Fit. A sailor will count as a NEC Fit match if he or she is DNEC'd to that NEC, holds the NEC, and is in the correct payband. The sailor can be from any of the source ratings and does not have to match the rating of the billet to which the NEC is attached. For all other NECs, a sailor of one rating may not be substituted for another rating, even though they hold the same NEC.

NEC, rating, and SJA payband divided by the count of P9BA for each NEC, rating, and SJA payband. Any portion of an NEC/SJA payband manned above 100 percent is not included in the computation. As was the case with RCN Fit, NEC Fit excess supervisor personnel (E-7 to E-9) may fill journeyman (E-5 to E-6) gaps, and excess journeyman personnel may fill apprentice (E-1 to E-4) gaps. Excess supervisor personnel may also fill apprentice gaps.[11]

Assessment

In assessing NEC Fit as a fleet manning metric, we address the following two questions:

1. What is the relative importance of NEC Fit to RCN Fit as a measure of unit manning?
2. How well does NEC Fit capture NEC manning levels? In other words, is NEC Fit a good metric?

The importance of NEC Fit for a unit depends, in part, on the ratio of Fit NECs to total billets. Figure 4 shows the ratio of Fit NECs to billets on DDGs, CVNs, VFA squadrons, and SSNs. The ratios range from a low of 0.3 for CVNs to a high of 0.8 for VFA squadrons. This suggests that NEC Fit is a less important manning measure for carriers than for the other units.

NEC requirements are not evenly distributed across all ratings. They tend to be concentrated in the more technical ratings (e.g., Electronic Technician (ET)). Figure 5 shows the number of billets (blue columns) and NEC requirements (red columns) by division on DDG-51 class ships. We include only billets that are used in Fit calculations. The chart shows that NEC requirements (and, therefore, the NEC Fit metric) are dominated by the combat systems division. This implies that NEC Fit may be an important measure of personnel readiness in the warfare mission areas (e.g., antiair warfare mission).

11. The NEC working group, which oversees these metrics, is debating whether to remove the payband criterion. If implemented, a sailor in any paygrade could fill an NEC requirement in any payband as long as the other rules are met.

Figure 4. Ratio of Fit NECs to RCN billets on four classes of operational units

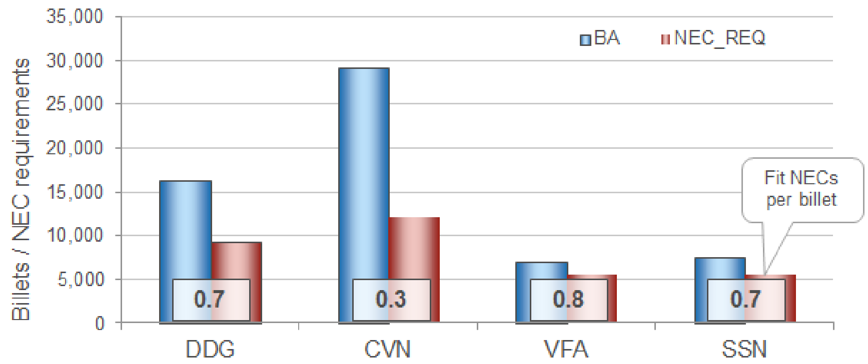
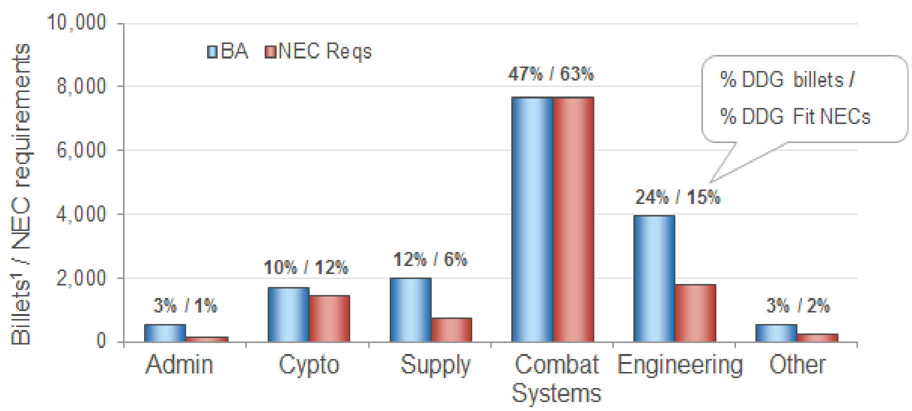


Figure 5. Number of billets and NECs by division on DDG-51 ships



Quality of alignment

The Navy is moving toward a new process for distributing enlisted personnel known as Billet Based Distribution (BBD). Under BBD, the Navy will distribute sailors to individual billets.[12] The Navy believes that BBD will enable better enlisted personnel management and a clearer demand signal of the fleet's need by matching sailors' unique skills with individual billet requirements.

12. The current enlisted distribution process is based on matching enlisted personnel to manpower requirements at an aggregate (unit) level, not on a billet-by-billet basis.

Quality of Alignment (QOA) is a new metric being developed to support BBD. QOA will provide a quantitative value of an individual unit's alignment of billets and personnel. It uses a detailed set of rules to provide a score that shows how well each crew member matches the billet to which he/she is assigned, with a value of 1 being the best possible match and a value of 6 being the worst possible match. Table 1 shows proposed alignment rules and corresponding scores.

Table 1. Proposed QOA rules and scores

Alignment	Rating	Primary NEC (PNEC)	Secondary NEC (SNEC)	Paygrade	QOA
Dual NEC/Paygrade	Match	Match	Match	Match Paygrade	1
Dual NEC/Payband	Match	Match	Match	Match Payband	2
Critical Single NEC/Paygrade	Match	Match Critical	N/A	Match Paygrade	1
Critical Single NEC/Paygrade	Match	N/A	Match Critical	Match Paygrade	1
Critical PNEC/Paygrade	Match	Match Critical	No Match	Match Paygrade	2
Critical SNEC/Paygrade	Match	No Match	Match Critical	Match Paygrade	2
Critical Single NEC/Payband	Match	Match Critical	N/A	Match Payband	2
Critical Single NEC/Payband	Match	N/A	Match Critical	Match Payband	2
Critical PNEC/Payband	Match	Match Critical	No Match	Match Payband	3
Critical SNEC/Payband	Match	No Match	Match Critical	Match Payband	3
Essential Single NEC/Paygrade	Match	Match	N/A	Match Paygrade	1
Essential Single NEC/Paygrade	Match	N/A	Match	Match Paygrade	1
Essential PNEC/Paygrade	Match	Match	No Match	Match Paygrade	2
Essential SNEC/Paygrade	Match	No Match	Match	Match Paygrade	2
0000/Paygrade	Match	Blank	Blank	Match Paygrade	1
Essential Single NEC/Payband	Match	Match	N/A	Match Payband	2
Essential Single NEC/Payband	Match	N/A	Match	Match Payband	2
Essential PNEC/Payband	Match	Match	No Match	Match Payband	3
Essential SNEC/Payband	Match	No Match	Match	Match Payband	3
0000/Payband	Match	Blank	Blank	Match Payband	2
Dual NEC/Next Lower Payband	Match	Match	Match	Match Next Lower Payband	3
Critical Single NEC/Next Lower Payband	Match	Match Critical	N/A	Match Next Lower Payband	3
Critical Single NEC/Next Lower Payband	Match	N/A	Match Critical	Match Next Lower Payband	3
Critical PNEC/Next Lower Payband	Match	Match Critical	No Match	Match Next Lower Payband	4
Critical SNEC/Next Lower Payband	Match	No Match	Match Critical	Match Next Lower Payband	4
Essential Single NEC/Next Lower Payband	Match	Match	N/A	Match Next Lower Payband	3
Essential Single NEC/Next Lower Payband	Match	N/A	Match	Match Next Lower Payband	3
Essential PNEC/Next Lower Payband	Match	Match	No Match	Match Next Lower Payband	4
Essential SNEC/Next Lower Payband	Match	No Match	Match	Match Next Lower Payband	4
0000/Next Lower Payband	Match	Blank	Blank	Match Next Lower Payband	3
No NEC Match/Paygrade	Match	N/A	N/A	Match Paygrade	5
No NEC Match/Payband	Match	N/A	N/A	Match Payband	5

QOA also allows a user to assign weights to paygrades, ratings, and NECs, providing a capability to articulate and account for some billets being more important than others. QOA could potentially replace the existing enlisted manning metrics (Fit, Fill, and NEC Fit).

Decrements to ALNAV RCN Fit

We continue with an analysis of Fit levels from 2005 to 2013. We have organized the data to provide an understanding of the nature and extent of undermanning/Fit decrements. Fit is designed to measure unit manning, but it is also used to measure manning levels at a more aggregate level. Our analysis follows a hierarchical structure: we start by considering manning levels for the Navy as a whole (ALNAV RCN Fit) and gradually drill down to lower levels of detail.[13]

To better understand the issues that decrement ALNAV RCN Fit, we decomposed the billet gaps that cause these decrements into three levels: Fill gaps, aggregate Fit gaps, and UIC-level Fit gaps. We then identified and analyzed the imbalances and misalignments that give rise to each level of gaps. Figure 6 conceptually illustrates these levels and their relationships to ALNAV Fit. It also shows the imbalances that contribute to each gap level.

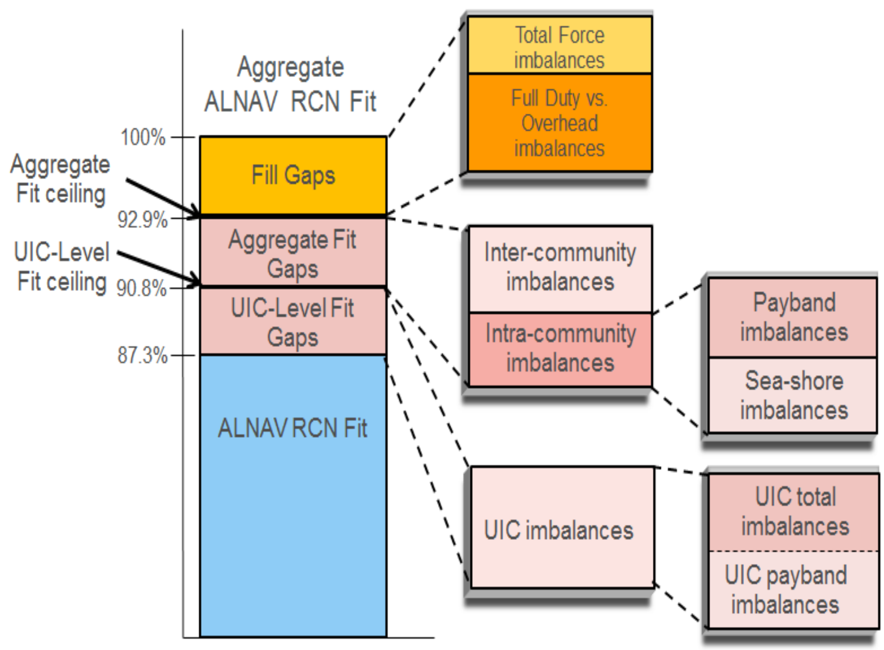
Fill gaps result from an imbalance between the number of sailors in full-duty status (i.e., the distributable inventory) and the number of full-duty authorized billets. These gaps depend on the total number of sailors (across all communities) in the fleet and reflect shortfalls in the size of the distributable inventory relative to requirements. ALNAV RCN Fit gaps stem from imbalances in the distributable inventory at the community and payband levels.[14] They depend on the number of sailors in each community and their payband distribution

13. ALNAV Fit is an aggregation of unit manning data, where we are aggregating over full-duty units, both sea and shore duty. So, ALNAV Fit is a measure of full duty manning: individuals account personnel and billets are excluded from and are not part of these computations.

14. Aggregate Sea RCN Fit gaps (and aggregate RCN Shore Fit gaps) also stem from sea vs. shore imbalances.

relative to requirements. UIC level imbalances occur at the unit/activity level and stem from distribution friction that causes some units/activities to be overmanned and others to be undermanned. They depend on the number of sailors assigned to each UIC and their payband distribution relative to requirements.

Figure 6. Gap levels affecting RCN Fit



Although we describe each gap level separately, these levels are not independent of one another. As illustrated in figure 6, there is a hierarchical order to these levels. Fill gaps define the ceiling for aggregate Fit. Likewise, aggregate Fit gaps (plus Fill gaps) define the ceiling for UIC-level Fit. Furthermore, the magnitude of a higher level can affect the size of a lower level. For example, reducing Fill gaps provides opportunity for increases in aggregate- and/or UIC-level Fit gaps.

Next, we examine the Fill and aggregate Fit gap levels and imbalances in more detail. We also show examples of the complex relationships between these levels.

Fill gaps

Fill gaps result from imbalances at two levels: total force and full-duty versus overhead. Total force imbalances stem from a difference between total enlisted endstrength (inventory) and authorized enlisted endstrength (billets). Being under total authorized endstrength contributes to shortfalls in the distributable inventory, which lead to RCN Fill gaps. Overhead imbalances result from having more (or fewer) sailors in an overhead status than authorized endstrength. For our analysis, overhead comprises the Individuals Account (IA)—students and transients, patients, prisoners, and holdees (TPPH)—and sailors in Limited Duty (LIMDU) status.[15] Excesses in the overhead account result in shortfalls in the distributable inventory, which lead to RCN Fill gaps.

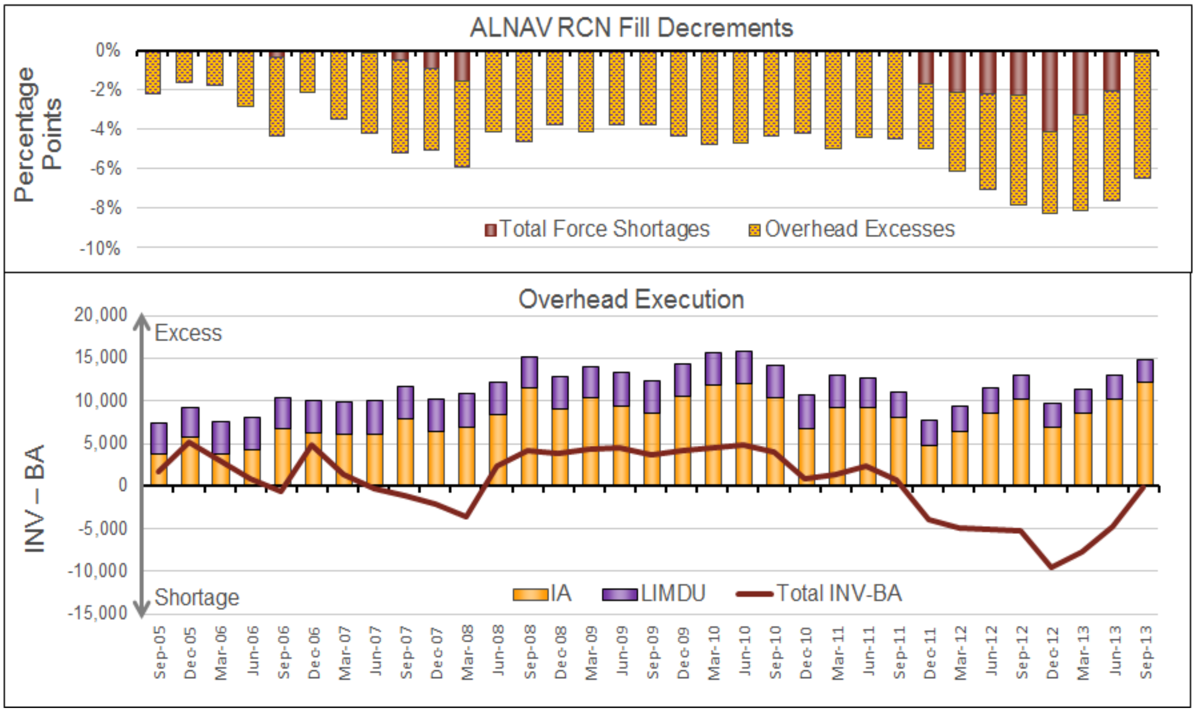
Figure 7 shows the level of Fill gaps over the past eight years (FY 2006 through FY 2013).[16] The bottom chart shows the two levels of imbalances. The dark red line represents total force imbalance—the difference between actual and authorized total endstrength. Positive values indicate excess; negative values indicate shortages. The columns show excess overhead, defined as inventory minus BA. The orange portion of each column represents IA excess, and purple represents LIMDU sailors. Because the Navy does not buy billets for LIMDUs, the difference for this category is simply the number of LIMDU sailors.

Total force imbalances have fluctuated between periods of excess and shortages. For example, endstrength exceeded authorizations from January 2008 through September 2011 but fell well below authorizations in 2012 and 2013. With the exception of a short period in 2012, the total force has stayed within plus or minus 5,000 of authorizations (less than a 2-percent variation). Full duty versus overhead imbalances, however, show only overhead excess during this timeframe. The level of IA excess ranged from 3,754 to 12,186, whereas the number of LIMDU sailors varied from 2,662 to 3,930.

15. The Navy buys endstrength (i.e., billets) to account for sailors in an IA status, but it does not buy endstrength to account for LIMDU sailors.

16. We pulled billet authorizations, by quarter, from the Navy's Total Force Manpower Management System (TFMMS); we compiled quarterly inventory data from the Navy's Enlisted Master Record (EMR) files.

Figure 7. Fill gaps and their effects on fleet RCN Fill



The top chart in figure 7 shows the effects of these gaps on fleet RCN Fill. The dark red portion of each column shows Fill decrements due to shortages in total endstrength, and the orange dotted portions shows decrements due to shortages caused by excess in the overhead accounts.[17] In FY 2012, Fill decrements reached 8 percent—due, in large part, to shortages in total force. In September 2013, total endstrength equaled authorizations; thus, all Fill decrements (6.1 percent) stemmed from overhead excesses.

Aggregate ALNAV Fit gaps

We just showed how RCN Fill gaps were a reflection of the total number of full-duty sailors in the Navy. RCN Fit, however, measures

17. Excess in the total force offsets shortages due to excess in overhead. However, because we cannot distinguish how this excess affects shortages due to IA excess from those due to LIMDU excess, we show only the combined effects.

more than quantity; it also measures quality in terms of community skill match. Accordingly, ALNAV RCN Fit gaps are a reflection of the number of full-duty sailors in each enlisted management community.

Aggregate RCN Fit gaps stem from imbalances in the distributable inventory at the community and payband levels. We can divide these imbalances into two types: intercommunity and intracommunity imbalances. Intercommunity imbalances result from having some communities that are overmanned and some that are undermanned. Excesses in overmanned communities do not contribute to Fit; however, any excess is usually offset by shortages in other communities, which do affect Fit. This is a zero-sum game in which there is a limit to the total number of personnel in the Navy. Hence, overmanning in one area will lead to undermanning in another.

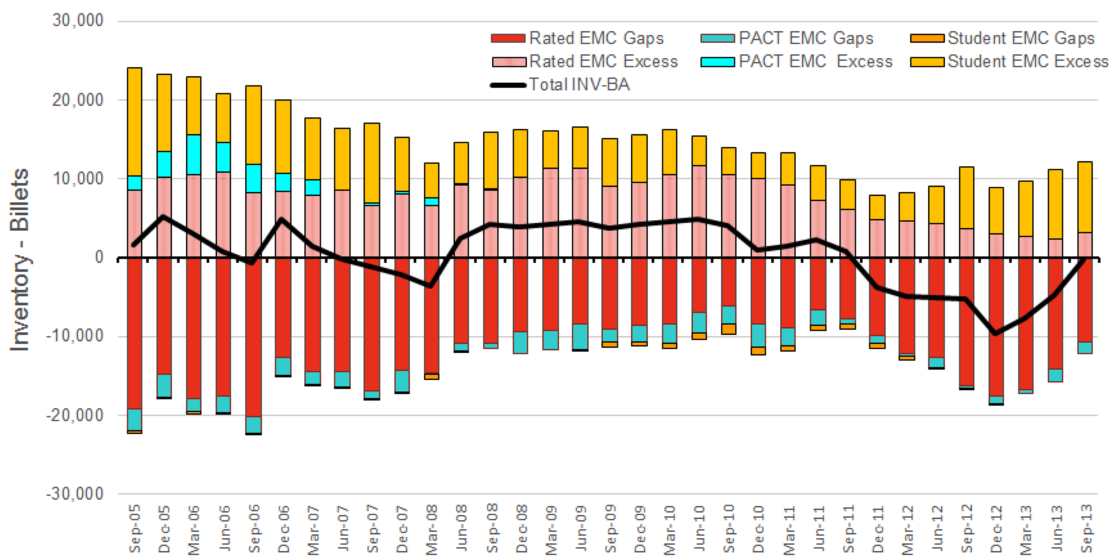
From an ALNAV RCN Fit perspective, intracommunity imbalances entail payband imbalances (i.e., excesses or shortages of sailors in one or more paybands). If we divide ALNAV RCN Fit into its two components, aggregate Sea RCN Fit and aggregate RCN Shore Fit, we introduce another intracommunity imbalance: sea versus shore assignments. Understandably, the Navy is more concerned with manning levels on its operational forces (i.e., Sea RCN Fit), so this imbalance takes on greater importance.

Intercommunity imbalances

Types of imbalances. To analyze intercommunity imbalances, we first grouped communities, defined by enlisted management community (EMC) codes, into three categories: rated EMCs, PACT EMCs, and unrated student EMCs. We then determined excesses (inventory greater than BA) and shortages (inventory less than BA) for each community and summed these across all communities within each category. Figure 8 shows the results. For the rated communities, the dark red columns show shortages (gaps), and the light red columns show excess. Likewise, the dark and light teal columns show shortages (below the baseline) and excess (above the line) for the PACT category. The dark and light tan columns shows the same for the unrated student category. For reference, the black line shows the total force imbalance.

The rated EMC group includes all inventory and billets (sea, shore, and individuals account). The data show both shortages and excesses, indicating overmanned and undermanned communities. The level of imbalances has varied. In 2006, imbalances approach 30,000. Since then, it has declined except for FY 2012 when shortfalls in total force increased total imbalances.

Figure 8. Intercommunity imbalances



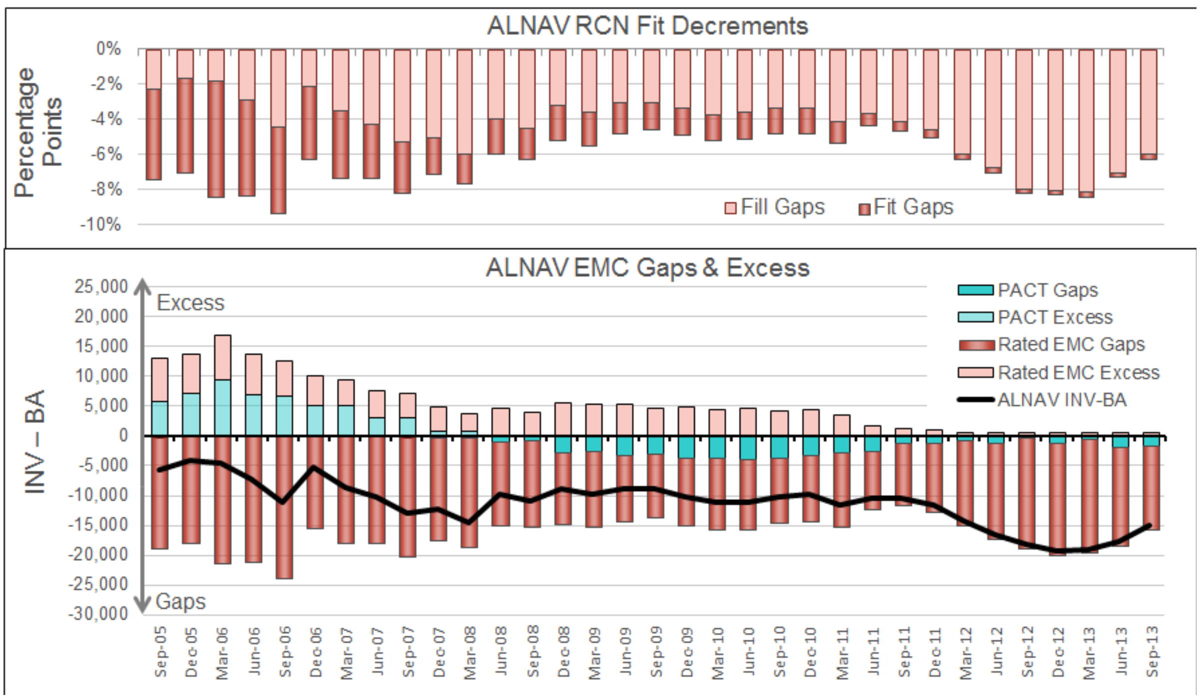
The PACT groups had both excesses and shortages in FY 2006 and FY 2007, but only shortages since then. Unrated student EMCs, however, have had excess over this entire period. Unrated student EMCs represent new recruits in their initial training before they become part of a rated community (which usually occurs during their A-school training).

How do these imbalances affect aggregate RCN Fit? To answer this question, we first examined decrements to aggregate ALNAV RCN Fit.

There are two types of intercommunity imbalances that affect fleet Fit. One is the imbalance between rated EMCs and PACTs. This is important because RCN Fit is based only on rated EMC sailors and billet authorizations (i.e., PACTs are not included in Fit). The other is the imbalance among rated EMCs due to overmanned and undermanned communities.

Figure 9 shows the levels of these imbalances and their effects on ALNAV Fit. The bottom chart shows total excess and gaps across all rated communities (red portion of the columns) and PACT communities (teal portion). It also shows the imbalance between total fleet inventory and authorizations (black line).

Figure 9. Intercommunity imbalances and their effects on ALNAV RCN Fit



Rated EMC gaps—which are key because they cause Fit decrements—result from (1) excess (or overmanning) in some rated communities, (2) excess in PACT communities, and (3) shortfalls in total distributable inventory. The contribution of each of these factors has varied over the past eight years.

The primary cause of rated EMC gaps has been the shortfall in total distributable inventory. This was particularly true in 2012 when nearly all rated EMC gaps can be attributed to total shortfalls. At other times when the total shortfall was not as large, the other factors contributed much more. For example, in FY 2006 and FY 2007, the number of

PACT sailors exceeded authorizations by over 5,000 sailors. In addition, excess in overmanned rated communities exceeded 5,000 sailors. This excess, coupled with total shortfalls of 5,000 to 10,000 sailors, results in 17,000 to 25,000 rated EMC gaps. Starting in 2008, the imbalance between PACTs and rated EMCs changed from excess to shortfalls. The shortfalls helped to offset the other two factors and reduce rated EMC gaps. Starting in 2012, shortfalls in the distributable inventory grew so large that most of the excess in rated communities disappeared.

The chart at the top of figure 9 shows the effects of these intercommunity imbalances on ALNAV RCN Fit. The light red portion of the columns represents Fill gaps (i.e., gaps caused by insufficient total inventory). The dark red portion represents Fit gaps caused by intercommunity imbalances (both rated-community vs. PACT community and among rated communities). The primary cause of ALNAV Fit decrements has transitioned from mostly intercommunity imbalances to mostly Fill gaps. This transition is due to the decrease in total inventory. As total inventory decreases, the opportunity for excess to occur in a community decreases.

Intracommunity imbalances

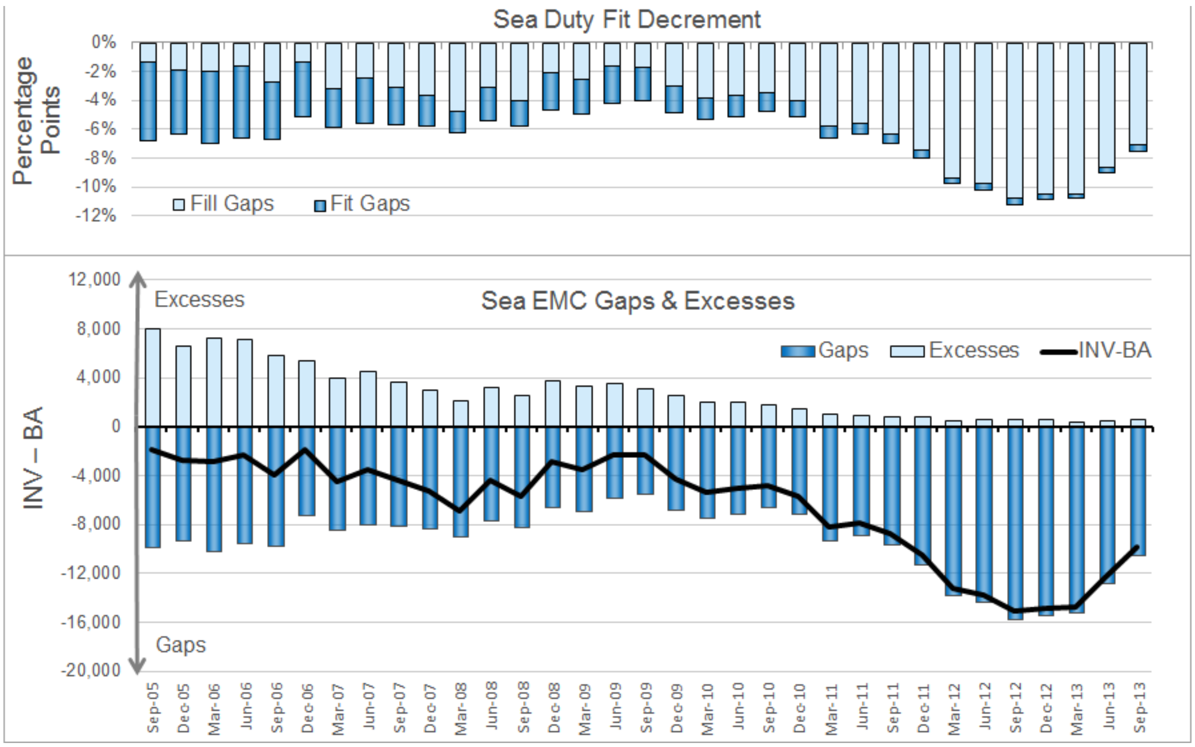
Sea-shore imbalances. So far, we have been looking at ALNAV RCN Fit. Although manning at shore activities is important, the focus of Navy leadership is Sea Fit. In this subsection, we examine aggregate Sea Fit and how intercommunity and intracommunity imbalances affect these levels. We address the sea-shore component of intracommunity imbalances, which measures the alignment of the distributable inventory between sea and shore UICs.

Figure 10 shows intercommunity imbalances (excess and shortages) for sea duty units over the past eight years.[18] It also shows the shortfall in total sea manning (black line), which is a product of both total distributable inventory and the allocation of the inventory between sea and shore. The imbalances follow a trend similar to those for ALNAV Fit (figure 9). Early in this timeframe, there were high levels of both

18. In figure 10, we include only rated communities (i.e., we excluded PACT communities).

excess and shortages, even though the total imbalance was relatively small. Over time, as the shortages in the total inventory grew, excesses decreased.

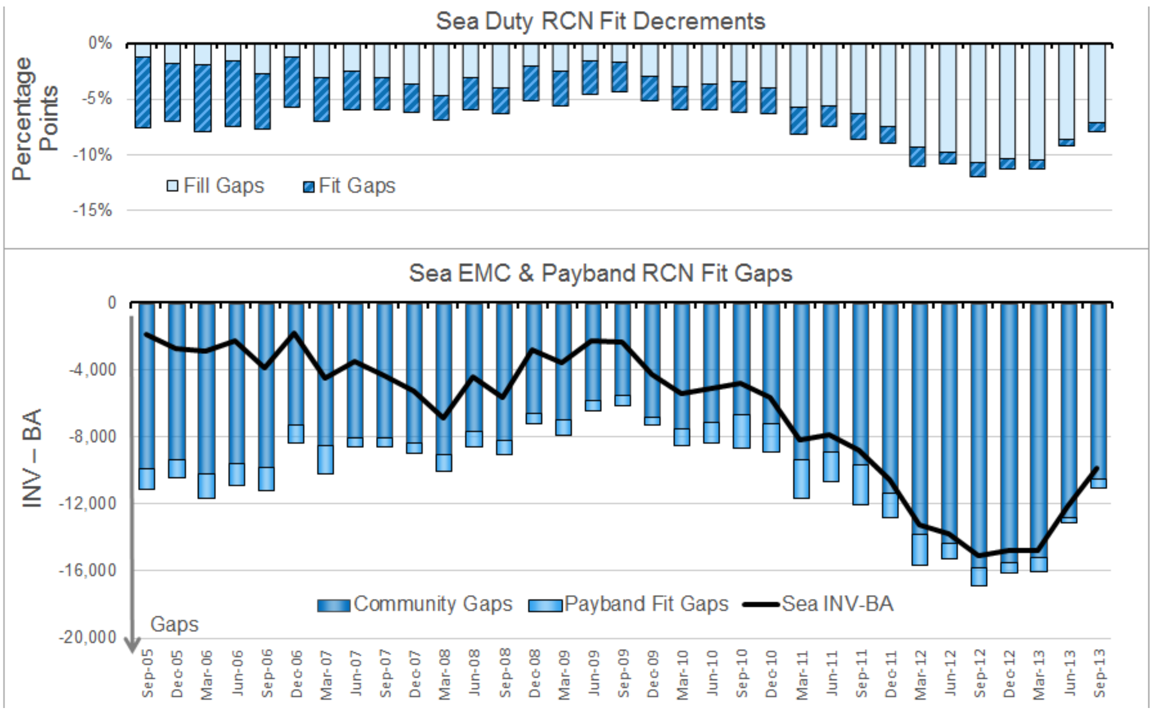
Figure 10. Intercommunity and intracommunity (sea-shore) imbalances for rated EMC Sea Fit



The top chart in figure 10 shows decrements to aggregate Sea RCN Fit due to total inventory shortfalls and intercommunity imbalances. Once again, we see that the primary cause of Fit decrements changed from mostly intercommunity imbalances (dark blue portion of the columns) to mostly Fill gaps (i.e., insufficient number of sailors at sea).

Payband imbalances. The other intracommunity imbalances affecting aggregate Sea RCN Fit are payband imbalances (i.e., misalignments that occur within a community at the payband level). Figure 11 shows the level of these imbalances and their effects on aggregate Sea RCN Fit. The bottom chart shows the additional gaps that result from payband imbalances within each rated community (medium blue portion of each column). Payband imbalances are much smaller than intercommunity imbalances, ranging from a low of 307 gaps in June 2013 to a high of 2,332 in March 2011. In addition, the levels of these imbalance do not show any long-term trends but have risen and fallen several times over this period.[19]

Figure 11. Intercommunity and intracommunity gaps and their effects on Sea RCN Fit



The top graph in figure 11 shows total decrements to aggregate Sea RCN Fit. It also differentiates how much of each decrement is due to Fill gaps and how much is due to Fit gaps. Because we cannot determine how Fill gaps affect intercommunity and payband gaps individually, we show only the combined effects of these imbalances. For the

19. The business rules for RCN Fit, which allow excesses in higher paybands to fill gaps in lower paybands, decrease the magnitude of payband imbalances.

past eight years, aggregate Sea RCN Fit has varied from a high of 96 percent in September 2009 to a low of 88 percent in September 2012. In addition, the primary cause of Fit decrements changed from Fit gaps (due to intercommunity and intracommunity imbalances) to Fill gaps. An important analytical question that were we unable to address in this study is, "If the Fill gaps were eliminated, what is achievable in terms of reducing the level of aggregate Fit gaps due to intercommunity and intracommunity imbalances?"

UIC-level Fit gaps

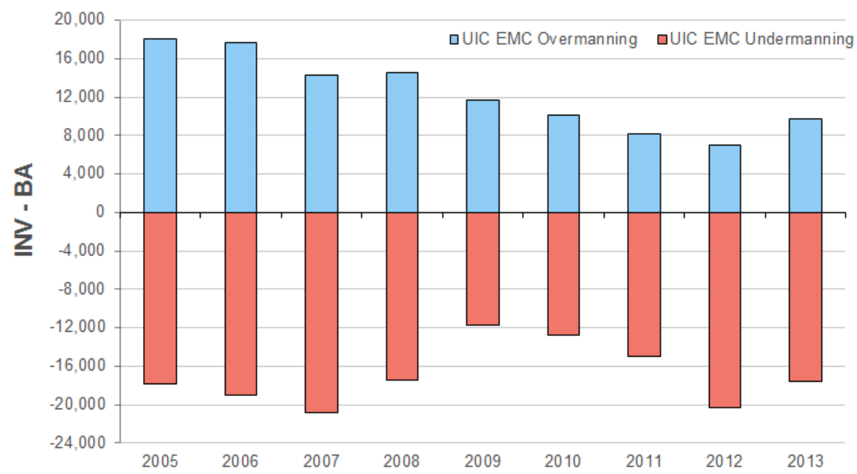
All of the aforementioned metrics address a macro-level matching of the supply of personnel with billets authorized (i.e., whether the Navy has sufficient personnel at sea). There is another level of imbalances that occur at a UIC level, where the inventory may not precisely align with the billets. In this subsection, we examine whether these personnel are in the right places.

UIC-level imbalances stem from distribution friction that causes some units/activities to be overmanned and others to be undermanned. Distribution friction arises for a variety of reasons, including policy decisions to man unfunded billets and imperfections in the distribution process. As before, we need to consider imbalances for each EMC in order to account for all Fit decrements.

We computed manning of each EMC for each sea UIC and summed up all the overmanned UIC/EMC combinations. Similarly, we summed all the undermanned UIC/EMC combinations. We display the results in figure 12.

Figure 12 shows total EMC imbalances at sea and is the end result of all the types of friction described earlier (i.e., the macro-level imbalances plus the distribution-level imbalances). We can see that EMC overmanning in sea duty UICs has declined from roughly 18,000 to a little under 10,000 during the 2005–2013 timeframe. Conversely, EMC undermanning in sea duty UICs was roughly 18,000 in 2005, declined to 12,000 in 2009, and increased again to roughly 18,000 in 2013.

Figure 12. Sea UIC-level EMC imbalances



If we subtract the macro-level imbalances, as described in figure 10, from the imbalances shown in figure 12, we attain the level of imbalances due to distribution friction. We display these data in figure 13.

Figure 13. Distribution imbalances

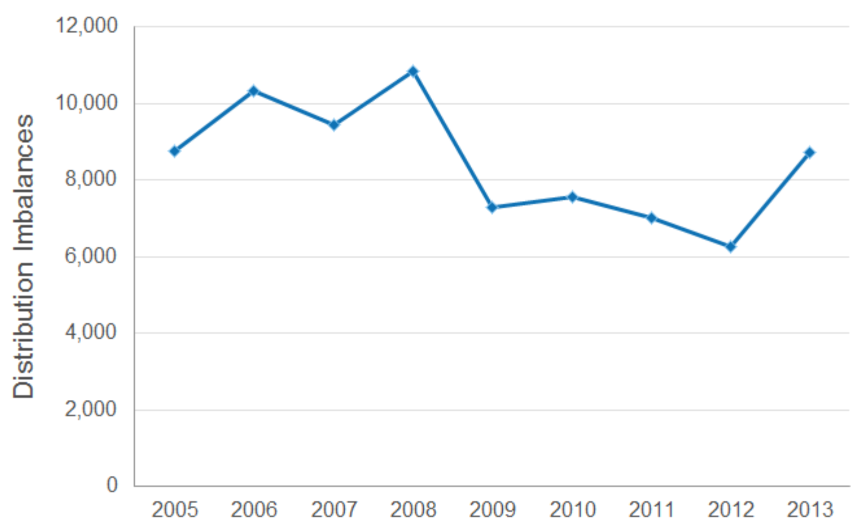


Figure 13 shows that distribution imbalances have fluctuated between 6,000 and 10,000 from 2005 to 2013. Such imbalances give rise to an aggregate Fit decrement of 4 to 6 percentage points.

Distribution friction can also cause additional payband imbalances at individual UICs; that is, some paybands may be overmanned while others are undermanned. We did not have time to fully explore UIC-level imbalances during the study, including payband imbalances. Much more analysis could be performed here, leading to better insights into the extent and causes of distribution imbalances and how to address them.

Factors that influence fleet manning

Contributing issues

Earlier, we examined the types of imbalances that affect fleet manning. Here, we investigate the following key issues that cause or contribute to these imbalances:

- Interyear whipsaw behavior in A-school throughput
- Intrayear fluctuations in accessions, whence A-school input
- Execution-year changes to accession plans
- Misalignment of tour lengths and personnel obligations
- Complexity of training pipelines
- Billet churn
- Unexecutable billet structures

Misalignments in billet funding, most notable in underfunding/over-execution of the individuals account, and decisions to man unfunded requirements, such as several cruisers planned for decommissioning, are also a major cause of losses in fleet manning. We have already described these misalignments, so we do not address them here.

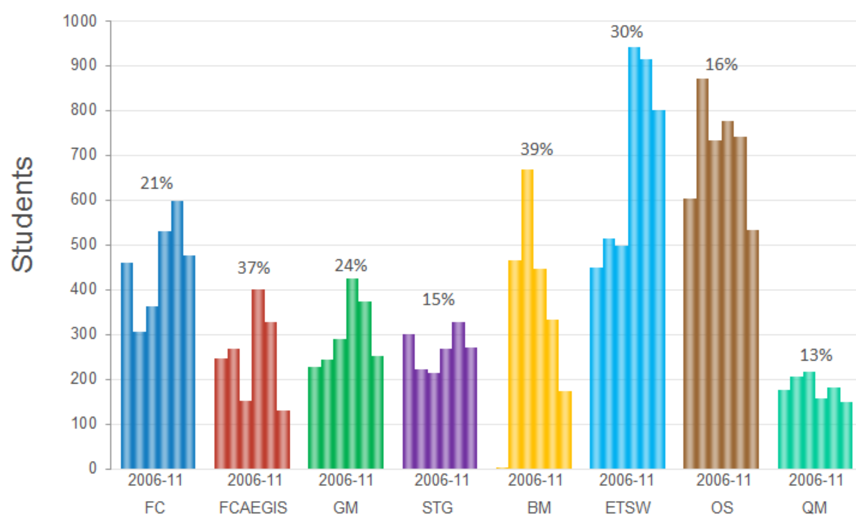
Whipsaw behavior in A-school throughput

One type of the instability that hinders the enlisted supply chain and community management processes is the large year-to-year fluctuation in the number of sailors that start A-school for a given rating/community. To illustrate this issue, we examined the surface combat systems/operations ratings over the past six years. The ratings/communities in this group are Fire Controlman (FC), Fire Controlman—Aegis Weapons System (FC-Aegis), Gunner's Mate (GM), Sonar Technicians—Surface (STG), Boatswain's Mate (BM), Electronics

Technician—Surface Warfare (ETSW), Operations Specialist (OS), and Quartermaster—Surface Warfare (QMSW).

Figure 14 shows for each of these ratings the number of students who started A-school training each year from FY 2006 to FY 2011.[20] We were struck by how much these numbers changed from year to year. The percentage figures in the chart represent the coefficient of variation, which is a measure of the yearly change in students.[21] Coefficient-of-variation values range from 13 percent for QMs to 39 percent for BMs.

Figure 14. Annual number of students attending A-school FY 2006 through FY 2011



20. In this analysis, we counted only those sailors who started A-school, successfully completed all prefleet training, and reach the fleet in that community. We excluded sailors who started A-school training but did not complete the entire training pipeline (i.e., nongraduates).

21. The coefficient of variation is the standard deviation divided by the mean.

Large changes in student throughput stress the enlisted supply chain process. Training resources are programmed three years in advance. While there is some ability to change training capacity in response to changes in requirements, this ability is limited. Large fluctuations are difficult to handle. Large *increases* in students are likely to result in longer training times as bottlenecks and backlogs occur in the training pipelines. Large *decreases,* however, can lead to wasted resources because funded training capacity may go unused.

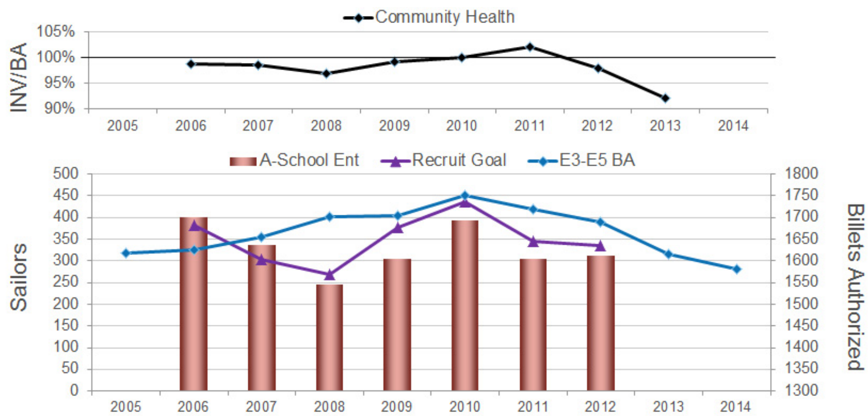
Next, we address the following question: What causes these fluctuations?

A-school plans are developed three years in advance and are regularly updated by the quarterly demand planning (QDP) process. The number of gains depends on sailor behavior (retention) and future requirements (defined by enlisted program authorizations). The QDP involves community managers, who determine the gains for each community, and the production management officer, who factors in attrition and determines how much of the goals will come from PACTs and laterals and how much will come from accessions. A-school input is mostly new recruits who have completed bootcamp.

Fluctuations can be in response to changes in retention, requirements, or other factors, such as execution-year budget constraints. The question is whether the changes we see in A-school throughput can be explained by changes in community health, retention, and requirements.

Figure 15 shows the A-school throughput from 2006 to 2011 for STGs and the number of authorized fleet billets for E-3 through E-5. The upper chart shows community health as measured by inventory over billets authorized. Requirements have changed very little over this timeframe, while A-school input has varied widely—far in excess of changes in retention. Community health levels follow a trend similar to accessions and A-school students. We conclude that changes to accessions occur for reasons beyond changes in requirements and retention.

Figure 15. STG A-school entrants, recruiting goals, E-3–E-5 fleet billets, and community health



Intrayear fluctuations in accessions

Navy recruiting has long-standing annual seasonal patterns, with peak accessions occurring during the summer months. These seasonal patterns are motivated by two factors: (1) synchronization with graduation of students from high school and (2) saving money by delaying accessions until later in the fiscal year. The extent of seasonal fluctuations is described in figures 16 and 17.

Figure 16. Share of monthly accessions for selected year

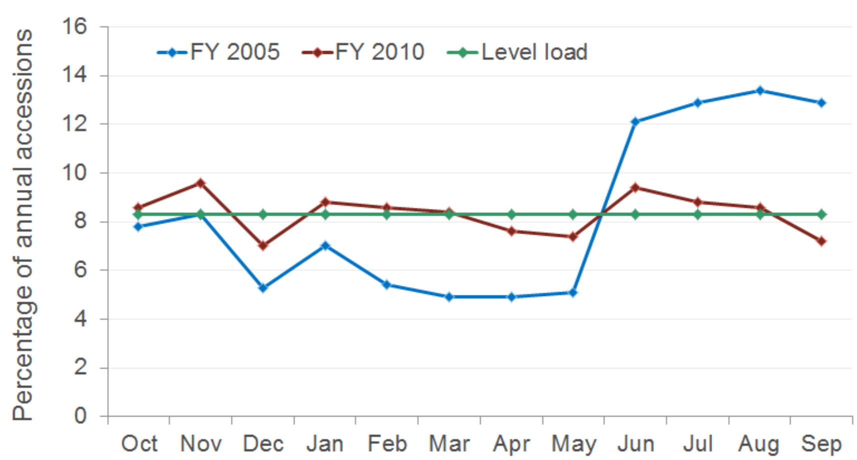


Figure 16 displays the monthly spread of accessions that entered the Navy in two different fiscal years, 2005 and 2010. 2005 was a year in which accessions were heavily loaded into the summer months, whereas 2010 was a relatively level-loaded year. For comparison, a perfectly level-loaded distribution of 8.3 percent of accessions in each month is also displayed.

One can quantify the degree to which a year is not level loaded by calculating the deviation of monthly accessions from level loading. By summing the total deviations—both positive and negative—we get a score for each year. For example, in 2005, 35.8 percent of the accessions over the year would need to be moved to achieve level loading; in 2010, only 8.4 percent would need to be changed.

Figure 17. Percentage of accessions not level loaded

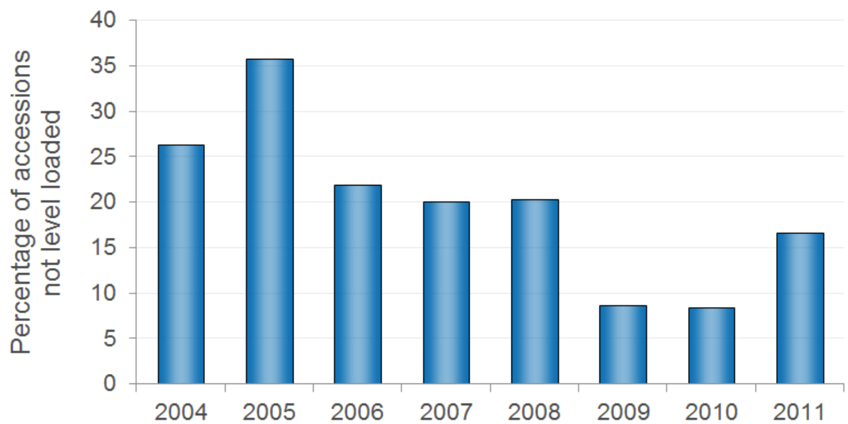


Figure 17 provides the percentage of accessions that would need to be changed in each year from 2004 through 2011 to achieve level loading. We observe large variations in the extent of level loading, and these variations have an impact on fleet manning. The supply chain for the initial training pipeline works most efficiently when there is a steady and predictable flow of personnel. Variations in the flow of personnel, whether caused by changes in annual throughput or by the spread of accessions during the year, disrupt the supply chain. School schedules need to adjust, to the extent possible, and typically there are increases in the amount of time students spend either awaiting instruction or transfer. The flow of personnel to the fleet will also vary, as the supply of A-school graduates fluctuates. It is difficult to quantify the impact of variations in the supply of accessions on fleet manning. References [4] and [5] describe simulations of the flows of personnel through parts of the initial accession supply chain and provide some insights into the disruptive effect of uneven accession patterns. Additional, similar modeling is required to obtain a detailed and comprehensive understanding of this issue.

Execution-year changes to accession plan

The Navy publishes the *Enlisted Recruiting Goals and Policies* letter for a fiscal year about two years in advance. For example, the initial letter for FY 2011 was released on September 29, 2009. Included in this letter is the Rating Phase Matrix, which lists the monthly recruiting goals (and FY totals) by rating, program, and gender for active and reserve accessions.

Each quarter, the Navy holds a quarterly demand planning conference in which it reviews accession requirements for each fiscal year. If the QDP authorizes changes (e.g., based on changes in endstrength targets or community manning levels), the Navy publishes a revision to the recruit goaling letter.[22]

Changes to accession requirements happen quite often. They occur both before the fiscal year starts and during that year. Table 2 shows the number of revisions and the magnitude of changes for FY 2009 through FY 2011.

The second and third columns of table 2 show the total number of revisions and the number of revisions that occurred during the execution year. The next three columns show the goals for rating accessions: original total goal, end total goal, and the difference. The last column under "rating accessions" presents the total number of changes that occur at the rating/program level. Then we provide the same information for PACT accessions.

22. A change could entail an increase or decrease in total requirements or just adjustments to individual ratings/programs.

Table 2. Accession plan revisions

	Plan revisions		Rating accessions				PACT accessions			
FY	Total	In-year	Original goal	End goal	Change	Rating/program-level changes	Original goal	End goal	Change	Rating/program-level changes
2009	7	6	36,965	34,903	-2,062	15,786[a]	2,985	503	-2,482	5,428
2010	7	4	36,398	29,271	-3,609	12,825	2,352	1,351	-1,001	2,753
2011	5	3	33,943	29,271	-4,672	12,922[b]	1,157	4,129	2,972	3,134

a. Elimination of Job Occupational Group (JOG) programs (EL4 and EL6) in Revision 1 accounts for up to 3,546 rating/program changes.

b. Elimination of JOG programs (ADEK, ADSP, AMEK, and SENG) in Revision 1 accounts for up to 3,688 rating/program changes.

For example, table 2 shows that, for FY 2009, the Navy issued seven revisions, six of which occur in that year. Total goal for rating accessions and PACTs dropped by 2,062 and 2,482, respectively. Total changes at the rating/program level numbered 15,786 for rating accessions and 5,428 for PACTs.

In-year changes mostly arise from accessions being used as a force-shaping lever to align inventory to end-of-year endstrength requirements. If the Navy is above endstrength and projected retention is not enough to lower inventory levels, the Navy can cut back on accessions. Alternately, if the Navy is below endstrength targets, it can increase accessions to grow inventory. Rating adjustments are also made to address the health of individual communities: undermanned communities may get accession increases, while overmanned communities receive cuts. These are all laudable objectives, but making the cuts during execution has a disruptive effect because the training establishment frequently has little flexibility to adjust accessions in an efficient way. For example, an accession cut during execution may have a disproportionate effect on some communities because other communities may have already reached accession goals and “sold” their school seats. Such disproportional accession cuts may lead to the large variations in A-school throughput that were shown in figure 14.

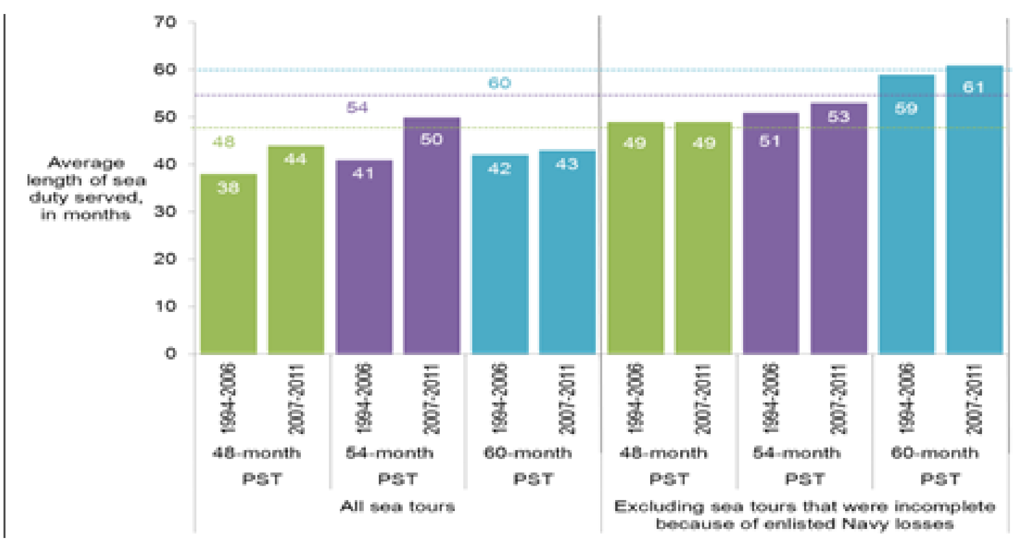
Misalignment of tour lengths and personnel obligations

The Navy sets sea and shore tour lengths to align personnel with billets. Tour lengths are prescribed for sea tours 1, 2, 3, and so on. If actual tour lengths are not as prescribed by policy, the alignment of personnel between sea and shore duty to match inventory and billets will suffer, eventually leading to decrements to fleet manning.

There are many reasons for the large differences between actual tour lengths and prescribed tour lengths. Reference [6] explores this issue in depth. A primary reason for the discrepancies is that personnel reach their end of active obligation (EAOS) before serving their tour length and leave the Navy. Figure 18, taken from [6], displays pertinent data for first sea tours.

Figure 18 shows that increasing sea tour lengths does not increase sea duty served because personnel leave the Navy. The Navy is pursuing a policy solution to this problem by aligning prescribed sea tours and EAOS dates. This initiative, called T+X, sets obligations equal to tour lengths plus the length of the training pipeline. A pilot T+X program has been under way for several years in numerous communities.

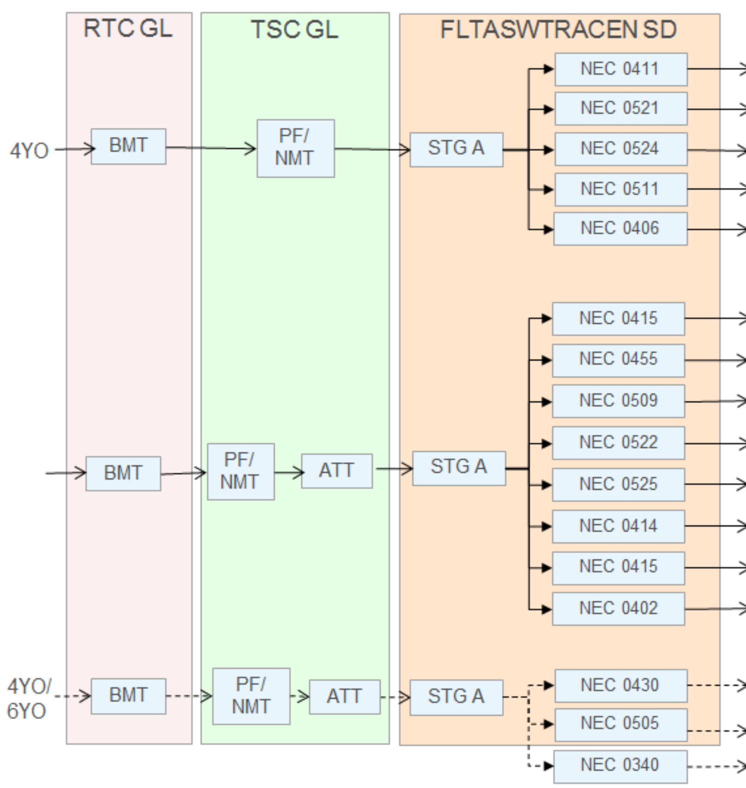
Figure 18. First-term men: Average sea duty served



Complexity of training pipelines

The efficient flow of personnel through initial training to the fleet is also affected by the complexity of training pipelines. Some pipelines have many courses and branches/alternatives. As the complexity of the pipeline increases, so does the difficulty of synchronizing the courses to minimize bottlenecks and gaps in training, which result in student not-under-instruction (NUI) time. Figure 19 shows the initial training pipelines for the surface sonar technician rating (STG).[23] The STG training pipeline has multiple paths, depending on (1) whether the trainee is studying to be an operator or a maintainer and (2) the specific equipment for which the sailor requires NEC training. Coordination of this many paths and courses is no simple task.

Figure 19. STG accession training pipelines



Job	Unit	NEC	E3	E4	E5	Tot
Sensor Operator	DDG	0411	68	14		82
		0521	30	30		60
		0524	69	90		159
	CG	0411	22	2		24
		0511	35	4		39
		0524	3	3		6
	FFG	0406	6	52		58
Level II Technician /Operator	DDG	0415		26	24	50
		0455		50	25	75
		0509		25	25	50
		0522		10	20	30
		0525		31	54	85
	CG	0414		6	3	9
		0415		2	39	41
		0509		9	31	40
		0510		27	12	39
		0455		10	5	15
		0525		2	1	3
	FFG	0402		26	23	49
		0415		45	31	76
		0509		25	25	40
ASWCS	DDG	0430		1	71	72
	CG	0430		51	15	66
IUSS Analyst	IUSS	0505		47	42	89
GCCS COP	IUSS	0340		47	5	52

23. Training tracks were derived from data provided by the Production Management Office (PMO) in Millington, TN.

It is difficult to precisely quantify the impact of training pipeline complexity on NUI time, whence fleet manning. Table 3 presents data that suggest there is growth in NUI time as the number of training tracks (and the number of courses in each track) increases.[24] Although more analysis is required to fully understand this relationship, we do know that NUI time increases total time to train, which, in turn, increases overhead execution. And we previously showed that excess overhead execution reduces fleet manning levels.

Table 3. Training complexity and NUI days

Rating	No. of training tracks	No. of NECs	No. of courses[a]	No. of school locations	Average UI days per sailor (2012)	Average NUI days per sailor (2012)
ABE	1	0	2-A	1	39.7	25
ABF	1	0	2-A	1	41.3	24.9
ABH	1	0	2-A	1	38.2	22.9
AD	31	20	NEC 0000 3-A	1	67.7	32.3
			Other NECs 3-A, 1 or 2-C	2		
AM	29	16	NEC 0000 3-A	1	86.6	39.6
			Other NECs 3-A, 1 or 2-C	2		
AME	10	6	NEC 0000 2-A	1	91.4	55.1
			Other NECs 2-A, 1-C	2		
AE	46	21	NEC 0000 3-A	1	136.5	77.6
			Other NECs 3-A, 1 or 2-C	2		
AT	79	42	NEC 0000 3-A	1	163.4	77.1
			Other NECs 3-A, 1 to 6-C	2		

a. Excludes administrative types of courses (i.e., NMT, PFT, INDOC); A = A-school course, C = NEC training course.

Billet churn

Authorized billets provide the demand signal that the Navy MPT&E enterprise endeavors to meet. Authorizations do change and evolve over time, and personnel management reacts accordingly through

24. Any break in a sailor's training pipeline, whether it's between courses in a multicourse pipeline or a juncture where a pipeline splits into multiple paths, provides an opportunity for delays. Training paths that include courses at more than one location have an added opportunity for longer delays.

changes to recruiting, community management, sea-shore flow, distribution, and so on. Time is required to implement such changes. Changes on short notice have a disruptive effect because the personnel system aims toward an out-of-date target.

The billet file experiences thousands of changes each year. This billet churn has been a persistent issue for many years. Recently, OPNAV N1 established a working group to address billet churn. Reference [7], a November 2013 working group briefing, provides a variety of information regarding billet churn, including:

- Billet churn is identified as a contributor to manning friction.
- Billet changes can adversely affect Fit metrics by increasing the likelihood of billet-to-sailor mismatch. Coordination of changes with the distribution system could mitigate this impact.
- Many factors contribute to billet churn, including programming changes, manpower document updates, and billet change requests (BCRs).
- Some BCRs contribute to Fit decrements, including positions added/deleted, UIC changes, and rating/paygrade/NEC changes.
  - — From April 2011 to April 2012, 5.1 percent of all enlisted active-duty billet churn affected Fit.
  - — Total BCR transactions affecting enlisted sea duty Fit in FY 2013 was 7,852 of 269,038 BCRs.

The billet churn working group is pursuing its objective of reducing billet churn.

Unexecutable billet structures

Military manpower is a closed labor market, where personnel join the services at a young age, and the services train them and incrementally prepare them for more senior positions. The Navy does not place advertisements in the *New York Times* for a ship's captain: prospective COs joined the Navy many years earlier.

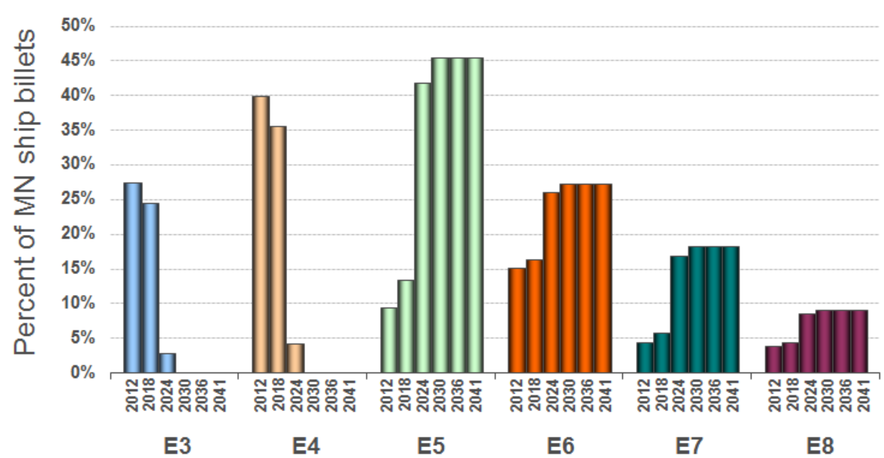
This closed labor market places many constraints on MPT&E. One major constraint is the concept of an executable billet structure. Consider a hypothetical rating in which there is no requirement for anyone below the E-6 paygrade. This is obviously unworkable, or *unexecutable,* because the Navy needs to train and develop personnel in lower paygrades before they become E-6s. This was an easy example, but the underlying problem is a lot more complex. The limits of what is executable or unexecutable are difficult to establish and depend on various MPT&E policies (advancement rules, sea-shore flow policies, etc.) and retention. Unexecutable billet structures have a negative impact on fleet manning because they inevitably result in not attaining the authorized mix of personnel.

Figure 20 and table 4 provide examples of unexecutable billet structures. The figure shows mineman (MN) at-sea billets, and table 4 shows billet requirements for two Aegis ashore sites.

Mineman at-sea billets

Mine-countermeasure (MCM) ships are due to decommission in the future, and mine warfare missions will transition to Littoral Combat Ships. When this happens (in 2024), there will be no mineman billets at sea below E-5. This is clearly unexecutable.

Figure 20. Paygrade distribution of Mineman ship billets



Aegis ashore billets

In Aegis ashore sites, all the requirements for technical ratings are at E-5 and above (for FC Aegis, they start at E-6). Again, there is a need for more junior personnel who will be trained and prepared for these positions.

Table 4. Manpower requirements for two Aegis ashore sites

EMC	E4	E5	E6	E7	E8	Total
CMC					2	2
CTT		18				18
FC Aegis			**54**	**36**		**90**
GM		18				18
IT			18			18
OS		36				36
ETSW		2				2
HM	2					2
LS	4	4	2	2		12
MA	86	6	8	2		102

The foregoing examples are part of a long-term trend toward more senior billet structures with a declining number of junior billets. Current force structure units require fewer junior personnel to operate them than past force structures. However, this trend is inconsistent with the need to provide junior sailors with the training and experience to be ready for more senior positions. The end result of this situation is personnel inventories that do not match authorizations, leading to Fit decrements. We explore this situation further in later sections of this report.

Subject matter expert (SME) input

Many organizations have a major impact on fleet manning. We held discussions with representatives of the following organizations to obtain their insights:

- OPNAV N1
- OPNAV N9 (Resource Sponsors)

- The detailers (PERS-4)
- Community managers (BUPERS-3)
- NETC
- USFF N1
- Acquisition community
- PMO

We were looking for major issues/problems, underlying causes of fleet manning difficulties, and potential remedies. The SMEs' insights were valuable and provided many perspectives on fleet manning. We summarize the discussions below.

What we heard from OPNAV N1

OPNAV N1 SMEs offered the following comments:

- Many actions and trends have caused large changes in personnel management.
  - — The Navy is more sea centric.
  - — Shore billets have been civilianized and outsourced.
  - — Policies are more attuned to personnel wishes.
  - — There is a move toward high-tech ships requiring a multiplicity of skills in crew members.
  - — There is a reduced demand for junior personnel.
- Level-loading accessions will benefit training, but it's hard for recruiting.
- Year-to-year variations in A-school throughput have many causes, including:
  - — Execution-year adjustments to accessions
  - — Billet churn
  - — Inaccurate and inconsistent planning tools
  - — Retention variations

- Too many NECs
- The fact that the individuals account is subject to a lot of scrutiny from Congress and the Office of the Secretary of Defense
  - Preference is to slightly underfund.
  - There are large student buys in FY 2014 and FY 2015.

What we heard from OPNAV N9

In discussions at OPNAV N9, we collected the following information:

- "Ownership" issues were fixed with the move from N1 to N9 resource sponsors.
  - N9 has the incentives and resources to act.
- N9 is willing to invest in training pipelines but concerned about lack of execution.
- It will take several years to see the impacts of the OPNAV reorganization.
- There are two stages to attaining fleet manning:
  - Buying appropriate resources—programming issues
  - Executing the program—personnel management issues
- Metrics
  - Fit and Fill are good metrics, but they are too aggregated.
  - The Navy needs a Fit/Fill predictive model.
  - Metrics need to compare distributable inventory to requirements in ship and squadron manpower documents.
- Moving training to the waterfront
  - A lot of training already occurs on the waterfront, and it is increasing.
  - It passes a bill from N1/N9 to the fleet.
  - Onboard training is already onerous.
- Concerned with the proliferation of training pipelines

What we heard from PERS-4

The detailers made a number of comments worth noting:

- We are manning 2,700 unfunded billets on ships.
- LIMDU personnel are a problem.
  - — They are unfunded and a serious drain on fleet manning.
  - — The Navy lacks an instruction regarding how to manage them, though they are preparing one.
  - — The Navy needs better methods to track them and project their status.
- Changing billets every day causes an ever-changing demand signal for distribution. Why not make changes twice a year?
- The Navy lacks a process for determining shore manpower requirements.
  - — Navy Manpower Analysis Center (NAVMAC) does a good job of determining manpower requirements at sea.
  - — Why is there not a similar organization/process for shore requirements?
- The individuals account fluctuates with accessions.
  - — There were many accessions at the end of FY 2012, and at the start and end of FY 2013.
  - — Training pipelines are expected to stabilize by mid FY 2014.
- LCS-class ships pose numerous challenges.
  - — There are many manning inefficiencies from having two variants.
  - — Sailors may get one tour on an LCS-class ship—zero NEC reutilization.
  - — If LCS-class ships were centralized in one location, it would be easier to provide waterfront training.

What we heard from BUPERS-3

Community managers reported the following:

- Planning is now a “push” process.
- We need a better “pull” (i.e., demand) signal.
  - — Obtaining a definition of first-term billets will facilitate a more accurate demand signal.
- Long- and short-term planing needs to be aligned.
  - — Misalignment is not inevitable.
  - — There are many changes in the demand signal during execution.
    - – It does not matter how good long-term plans are; we need to be able to react.
  - — Don’t make large changes to community plans in execution.
  - — We need a deliberative planning process and a flexible system with “valves” that can react quickly.
    - – For example, use PACTs as a valve.
- Supply chain management takes time to implement.
  - — It took the aviation community 7 years to obtain and use the right metrics.

What we heard from NETC

SMEs at the Naval Education and Training Command had the following comments and queries:

- We plan 3 years ahead and try to adjust as we move ahead, but there is not enough flexibility.
- We manage an excess supply of students better than a shortage.
- C-school plans are managed by community managers.

— They provide sufficient supply, which is not the same as fleet demand. It lacks details.

- The timing of training is complicated and needs to consider varying obligations, advancements, sea/shore flow, and costs/return on investment (ROI).
- What are the rules for moving from an apprentice to a journeyman in first sea tour?
- It probably only makes sense to move C-school training to the waterfront.
  — Factors include costs, course length, and sailor availability.
- Configuration management problems are mostly with the Surface Navy.
- How will we develop sailors as requirements below E-5 decline?
- We need to address and attain in-rate shore duty to maintain sailor proficiency.
- Student overexecution does not generate a bill—hence, it receives little attention.
- It's not a training problem, it's an MPT&E management problem.

What we heard from USFF N1

Discussions with United States Fleet Forces N1 yielded a number of remarks, which are summarized below:

- Chief of Naval Personnel (CNP) focuses on health of the force, whereas USFF focuses on employment.
- N9 resource sponsors do not have a fleet execution perspective.
- Fit, Fill, and NEC Fit are fleet metrics, designed to answer two questions:
  — How well is the distribution system responding to fleet demand?
  — How well are ships manned?

- Billet-based distribution is an interesting concept that needs analysis.
- The benefits of level loading accessions outweigh the costs.
- Modularize training (Training 2020 initiative).
- The Surface Navy is starting to address configuration management; it will take years.
- In terms of schoolhouse training, there is a lack of flexibility to update deliberate planning.
- Individuals account overexecution causes gaps in the fleet, but remedies may cause more problems.
  - USFF prefers fleet gaps to ensure that personnel receive the proper training.
- There are inefficiencies caused by an inability to move MPN billets across resource sponsor boundaries in execution.

What we heard from the Acquisition community

Acquisition community SMEs made the following observations:

- NAVSEA puts a lot of effort into training; it used to be performed by community managers.
- Plans for upgrades show detailed training requirements.
- Regarding why the Surface Navy has the most problems with configuration management:
  - Aviation—planes come off production lines from manufacturers.
  - Ships are built to latest standards and become "one-offs."
    - Many changes/upgrades can only occur in the yard (5-year cycle).
- Analyses of alternatives consider costs of new training.
  - Inputs regarding the need for new training may cause delays in buying equipment.

- Factory training is frequently the most effective solution.
- NAVSEA leadership has helped get back on track with the Navy Training Systems Plan (NTSP) process.
- We believe it's best for personnel to train on their own gear aboard ships, but we understand the practical impediments (can't use while under way, maintenance while in port, etc.).

What we heard from PMO

The following bullets summarize opinions expressed by SMEs at the Production Management Office in Millington, TN:

- The initial street-to-fleet supply chain is currently a push system with a demand signal.
- MPT&E is an endstrength-driven system.
  - Accession numbers, fleet endstrength, and rating planning goals are frequently not aligned.
  - NETC was not prepared for the FY13 40K accession mission.
- Fleet manning metrics
  - Leadership understands Fit and Fill (it would be a mistake to do away with them).
  - Fit and Fill measure personnel input, not readiness.
  - We lack a decent target for NEC Fit.
- There are 921 paths from street to fleet, with 643 different NECs.
  - This is not necessarily bad, but it's very difficult to forecast.
- Aviation is much better than the Surface Navy in training management.
  - Squadron training officers are knowledgeable.
  - Aviation centralizes planes in a type/model/series.
  - Aviation has less proliferation of NECs than the Surface Warfare Enterprise.

- Tracking experience on platforms is a good idea.
  - P-3s used to do this.
- We believe the split of STG accessions who enter the Navy under four- and six-year obligation programs is wrong.
  - It is driven by community management concerns, not fleet demand.

Synthesis of results

The foregoing analysis describes a variety of problems with Navy MPT&E management that have a negative impact on fleet manning. It's difficult to form a coherent response to all of the issues we have explored without an overall viewpoint/strategic perspective that channels ideas and initiatives. So, we have pursued and identified a strategy for addressing fleet manning problems, and all initiatives to improve fleet manning will be developed in the context of this strategy.

We infer from the analysis in earlier sections of this report the need for four strategic goals for Navy MPT&E management: **S**tability, **A**lignment, **F**lexibility, and **E**xecutable targets (SAFE).

A little more detail on the SAFE concept follows:

- ***Stability*** *in MPT&E planning and execution from one year to the next.* Instability causes inefficiencies in personnel management, leading to gaps at sea.
- ***Alignment*** *of MPT&E processes and procedures.* Policies and procedures frequently have conflicting goals, leading to disruptions and inefficiencies, whence gaps at sea.
- ***Flexibility*** *as a primary means of attaining stability.* The Navy can't stop emergent requirements, but it can institute better policies to address them and minimize disruptions.
- ***Executable*** *targets.* Nonexecutable goals inevitably lead to manning mismatches and gaps at sea.

In the next section, where we develop a "TO BE" model for improved fleet manning, we build on these strategic goals, develop a holistic Navy MPT&E management process around them, and identify and analyze specific individual solutions that further the strategic goals of **S**tability, **A**lignment, **F**lexibility, and **E**xecutable targets.

"TO BE" model for improved fleet manning

Analytic framework

Improved fleet manning is the motivation behind many MPT&E management actions. However, it is difficult to discern an overall structure/pattern for such actions, and some actions may be in apparent conflict with others. The Navy needs an analytic framework for consideration of fleet manning. Such a framework will provide the Navy a perspective from which to evaluate all actions and an ability to determine the effectiveness and any inconsistencies of MPT&E policies and procedures. This framework will also help to identify areas where policy actions are missing and needed.

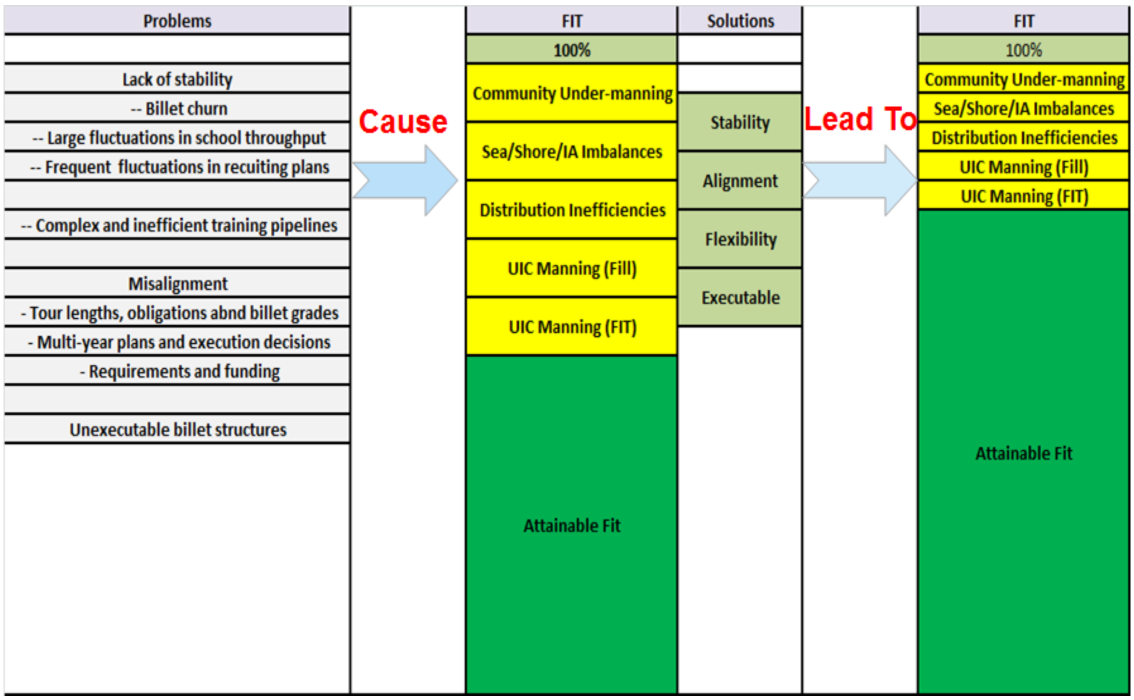
We start our description of an analytic framework by consideration of figure 21, which shows the following sequence:

- A wide variety of problems lead to decrements in fleet manning.
- Decrements in fleet manning may occur in various, cumulative ways.
- Solutions cause decreases in the various decrements to fleet manning.
- Increased fleet manning (Fit) is attained.

The types of problems that cause fleet manning problems were described earlier in the report. They include problems with stability, misalignment, and unexecutable billet structures.

The nature of decrements to fleet manning requires an explanation. In summary, Fit decrements have two causes: (1) there are not enough personnel and (2) personnel are in the wrong places.

Figure 21. Analytic framework



Insufficient personnel

There may be insufficient personnel for two reasons:

- There are fewer personnel than authorizations in an enlisted community.[25]
- The alignment of personnel within a community between sea and shore duty may not match the billet structure. This occurs when sea-shore flow policies and execution do not lead to the required disposition of personnel between sea and shore duty.

Macro-level MPT&E management policy decisions (regarding community management, sea-shore flow, etc.) determine whether personnel are sufficient or insufficient. These decisions are within the purview of OPNAV N1 and the community managers (BUPERS 3).

25. Overmanning in one rating does not compensate for undermanning in another. One must consider manning one community at a time.

Personnel are in the wrong places

Fit is a measure of unit manning. So, it is necessary to consider manning levels of individual UICs and compare them with requirements. Shortages in unit-level manning may result from shortages of personnel, as described in the previous paragraphs. However, they can also be the result of imperfect personnel distribution, in which available personnel are not "ideally" matched to UICs; ideally, inventory matches authorizations for each community and paygrade within a community.[26]

Unit-level manning imbalances can occur in two ways:

- There are insufficient personnel on board in a community, when compared with authorizations.
- The paygrade distribution of personnel on board does not match authorizations.

If we disregard the imbalances caused by macro-level shortages of personnel, remaining imbalances may be thought of as inefficiencies in personnel distribution. They have many potential causes, including the following:

- Personnel are assigned in excess of authorizations—a zero-sum game in which overmanning in one UIC will inevitably result in undermanning in another UIC.
- Personnel have left the unit and have not, as yet, been replaced.
- Authorizations have grown and have not, as yet, been filled.

Personnel are in the wrong paygrades. This is a cyclical persistent issue, where personnel paygrades will change with every advancement cycle.

26. We are not considering NEC manning issues in this document, which adds another layer of detail to the matching of personnel to authorizations.

Holistic solution—MPT&E process to improve fleet manning

We propose a holistic management process to improve fleet manning. Our rationale for a holistic approach follows. Although much, if not all, of what we propose is currently undertaken by MPT&E management, it is frequently the case that initiatives are undertaken in an uncoordinated fashion, very much lessening their impact.

We propose that the Navy ask and address each of the following four questions for each enlisted community:

1. Can the inventory attain and maintain the authorizations' paygrade structure? That is, is the billet structure ***executable?***
2. Can the inventory attain and maintain the authorizations' paygrade distribution at sea? That is, is the billet structure ***aligned*** with sea/shore flow policies and practice?
3. How quickly can we transition from today's inventory to the sustainable target inventory, while limiting accession fluctuations? That is, will there be ***stability*** during the transition?
4. Do we have the policies and procedures available to implement the above steps? This requires ***flexibility*** in execution.

Attain and maintain

The first two questions include the phrase "attain and maintain." That's because it is not sufficient to obtain these goals on an ad hoc basis, which can be (and frequently is) accomplished by heroic and transitory measures. It is necessary to maintain these goals indefinitely, which places considerable constraints on billet structures, personnel policies, and so on. We analyze such constraints in detail in the next section, when we describe several case studies.

Transition and stability

The third question focuses on the issue that inventory targets are typically long-term, steady-state targets, which may take several/many years to attain, but MPT&E management is primarily focused on shorter time horizons. So, it is also necessary to consider how long it will take the current inventory to transition to a long-term goal and the path it takes to get there.

The path taken to transition to the long-term goal needs to maintain stability. Suppose, for example, that a community is undermanned and/or authorizations are growing by 20 percent. It is possible to make this increase in one year by means of a large increase in accessions. However, such a large accession cohort will lead to bottlenecks in training pipelines, uneven flows of personnel to the fleet, and an "echo" in recruiting requirements several years in the future when this cohort reaches reenlistment decisions and many personnel leave. Consequently, it is desirable to aim for a steady-state sustaining level of accessions each year, and limit fluctuations in annual accessions, around the steady-state targets. Under these guidelines, one needs to consider how quickly the current inventory can transition toward the target inventory.

Flexibility

Among the numerous impediments to attaining improved fleet manning are conflicts that often exist between execution-year considerations and long-term plans. For example, budget considerations frequently lead to changes in accession plans during the execution year. Such changes have a disruptive effect on training pipelines and, therefore, on fleet manning. Navy personnel management would benefit from more flexibility in the response to execution-year emergent issues, allowing for variations from execution-year goals/constraints in order to attain longer term stability in community management.

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Case studies

We have established a strategic framework from which we can identify individual "tactical" solutions for improving fleet manning. We want our solutions to be empirically based and practical. Hence, we conducted numerous case studies of individual EMCs to better identify the nature and extent of fleet manning problems and proposed solutions to ameliorate these problems.

We built a model to facilitate this analysis. This model simulates personnel inventories, how they evolve over time, problems they experience regarding supporting fleet manning requirements, and how they respond to potential initiatives, such as changing sea-shore flow policy. The model is called ESS-Sim (for **E**nlisted **S**teady-**S**tate **Sim**ulation) and is documented in [8]. We begin with an overview of ESS-Sim before describing the individual case studies.

Overview of ESS-Sim

We built ESS-Sim to obtain insights into enlisted fleet manning. Fleet manning is addressed and managed one community at a time; overmanning in one rating does not offset undermanning in another. Consequently, we developed a model that simulates one enlisted management community at a time.

Navy personnel inventories are dynamic: they change substantially from one time period to another. When analyzing trends in Navy manning, it is difficult to distinguish between long-term trends and seemingly random fluctuations from one time period to the next. It is also difficult to discern limits in what is attainable due to policy and behavioral constraints (i.e., the fluctuations mask underlying structural dynamics of personnel inventories). We built the simulation model to address these concerns.

ESS-Sim works in two phases:

1. A simulation of long-term, *steady-state* behavior that shows how inventories will evolve over time in response to a set of policies and procedures and obtain a stable *steady-state* inventory
2. A simulation of the transition from a current inventory toward the steady state

The steady-state inventory identifies what is attainable and sustainable. The simulation of the transition from a current inventory toward the steady state addresses situations that may arise today or in the near future due to the idiosyncrasies of current inventories.[27]

The model simulates the aging of personnel inventories, by repetitively applying the following annual processes:

- We apply continuation rates to estimate how many personnel remain in the community from one year to the next.
- We advance personnel to fill vacancies, following time-in-rate policies.
- We "bring in" accessions to sustain the community size.
- We flow personnel between sea and shore duty.

Users have the ability to alter associated policies, authorizations, and continuation rates and to observe the impact on future inventories. Details regarding how we simulate these personnel dynamics are provided in [8].

In the case studies that follow, we use EMC-specific continuation rates from FY 2005 to FY 2007. We chose these years because we are analyzing long-term trends; more recent rates reflect the effects of the recent recession and the Perform-to-Serve program and may not be reflective of long-term behavior.

27. We developed the model in Excel. We did not make use of Visual Basic macros but instead choose to show all intermediate calculations. This makes the spreadsheet rather voluminous but adds some transparency to the calculations.

Overview of the case studies

We conducted case studies for seven EMCs from the surface and aviation communities:

- B121, Gas Turbine Systems Technician, Electrical (GSE)
- A101, Aviation Boatswain's Mate–Launch/Recovery (ABE)
- A420, Aviation Ordnanceman (AO)
- B650, Culinary Specialist (CS)
- B110, Engineman, Surface, Main Propulsion (ENSW)
- B440, Operations Specialist (OS)
- A103, Aviation Boatswain's Mate–Aircraft Handling (ABH)

We chose these communities to provide a cross-section of behavior and primarily focus on sea-intensive communities.

In the case studies, we address both overall and paygrade-specific sea manning issues. Our recommendations, based on the simulation results, include changes to the initial obligation and first sea tour length, changing sea and shore tour lengths, and changing student individuals account billet authorizations (IA BA). For initial obligation and first sea tour lengths, we consider three options:

- "T+X": T+X is a pilot program that aligns obligation with the completion of the first sea tour. The program has been rolled out over the course of multiple years and was fully implemented in FY13. In T+X, selected communities have their initial obligations changed to five years and their first sea tours are set equal to the difference between initial obligation and the length of initial training. For instance, if initial training is 9 months long, the first sea tour would be 51 months long under T+X.
- "4YO/60": A 4-year initial obligation and a 60-month initial sea tour.
- "5YO/60": A 5-year initial obligation and a 60-month initial sea tour.

Table 5 summarizes the results of our case study simulations. For three of the seven case studies (AO, CS, and OS), we recommend staying with the current initial obligation and sea tour length. For another three case studies (GSE, ABE, and ABH), we recommend leaving the initial obligation length unchanged and lengthening the first sea tour to 60 months. For one case study (ENSW), we recommend lengthening the initial obligation to 5YO and leaving the first sea tour length unchanged at 60 months.

Table 5. Summary of case study results

EMC	Sea manning issues addressed in case studies	Recommendations
GSE	Sea manning gaps overall and at E-5, E-6, and E-7	Change from T+X/51 to 5YO/60 Shorten third shore tour to 24 months Increase student IA BA from 18 to 62
ABE	Sea manning gaps overall and at E-5, E-7, and E-8	Change from T+X/55 to 5YO/60 Shorten first shore tour to 30 months Lengthen third sea tour to 48 months Increase student IA BA from 29 to 63
AO	Sea manning gaps overall and at E-6, E-8, and E-9	Stay at T+X/53 Lengthen third sea tour to 48 months Shorten third shore tour to 30 months Increase student IA BA from 236 to 316
CS	Sea manning overage overall and at E-5; sea manning gaps at E-8 and E-9	Stay at 4YO/54 Lengthen first shore tour to 48 months Lengthen third sea tour to 42 months Increase student IA BA from 82 to 138
ENSW	Sea manning gap at E-5, E-7, and E-9	Change from 4YO/60 to 5YO/60 Shorten first shore tour to 26 months Lengthen second shore tour to 48 months Lengthen third sea tour to 48 months Increase student IA BA from 59 to 84
OS	Sea manning gaps at E-5 and E-9	Stay at T+X/53 Shorten first shore tour to 28 months Increase student IA BA from 155 to 235
ABH	Sea manning gaps at E-7 and E-8	Change from T+X/55 to 5YO/60 Lengthen third sea tour to 48 months Increase student IA BA from 71 to 122

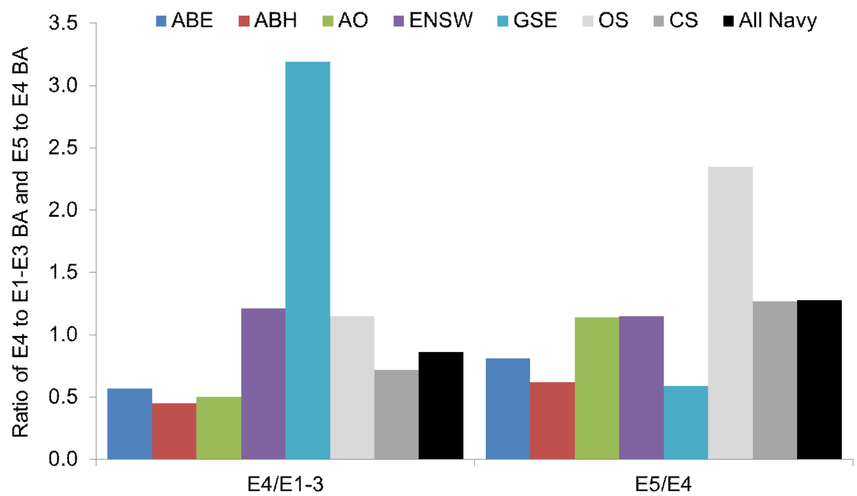
Across the board, we identify considerable shortages in student IA BA. Table 5 shows our estimate of the number of student IA BA required in steady state. In many cases, the gap in student IA BA is sizable. Note that, in each case study, we assume that the Navy purchases sufficient student IA billets to close this gap. Thus, this assumption is built into the resulting steady-state sea manning projections.

The simulation model is designed to reach full EMC manning (sea and shore combined) overall and by paygrade, if feasible, in a steady state. We find that full EMC manning is feasible overall and by paygrade for four of the case studies: ABE, AO, CS, and ABH. For these EMCs, then, getting sea manning right is a matter of getting the right number of sailors at sea at the right time. However, for the other three case studies—GSE, ENSW, and OS—we find that steady-state full EMC manning is feasible overall but not by paygrade, due to a structural BA paygrade imbalance. For these EMCs, sea manning gaps can be closed partially by changing obligation lengths and sea and shore tour lengths. But, closing these communities' sea manning gaps completely will require changes in the underlying billet structure.

To illustrate paygrade imbalances, we consider the following example. Figure 22 shows the ratio of BA in consecutive paygrades—that is, the ratio between E-4 and E-1–E-3 BA and the ratio between E-5 and E-4 BA. For GSE, there are many E-4 billets relative to E-1–E-3 billets, by a ratio of more than 3:1. For OS, there are many E-5 billets relative to E-4 billets, by a ratio of more than 2:1. These communities may find it very difficult or impossible to grow inventories to match their current billet structures.

Of course, even when an EMC is manned fully overall and at sea, sea manning gaps can still exist by paygrade, and we find that the senior paygrade gaps at sea are considerably harder to fill. As is described in more detail in the individual case studies, we find that changing initial obligations, first-sea-tour lengths, and the number of student IA billets is effective, by and large, at eliminating the gaps at sea in the junior paygrades. However, the policy changes we simulate are less effective for the senior paygrades. Changing sea and shore tour lengths and incentivizing more sailors to stay at sea close some, but not all, of the senior paygrade gaps at sea. In all but one case study, the simulation model revealed structural problems with BA at the senior paygrades that, if left unaddressed, will prevent the EMC from reaching full manning at sea in the senior paygrades.

Figure 22. Total BA ratios for case study EMCs: E-4/E-1–E-3 BA and E-5/E-4 BA



Our final point is that current sea manning may be very different from what the model predicts would exist in steady state, even when simulating no change to policy. The steady-state inventory shows what happens in the long term when there are no "shocks" to community management, such as changes in BA, accessions, or retention. Yet these very same shocks might have been responsible for current community manning. The steady state shows whether full manning at sea is even feasible. If not, the model helps us determine what adjustments are needed to achieve full manning at sea in a steady state.

In the remainder of this section, we describe our case studies for the GSE, AO, and OS communities.[28] For each case study, we begin by documenting historical trends in the sea manning rate, defined as the ratio between inventory at sea and BA at sea. A value of 1.0 means that

28. Appendix B contains the case studies for the other four communities.

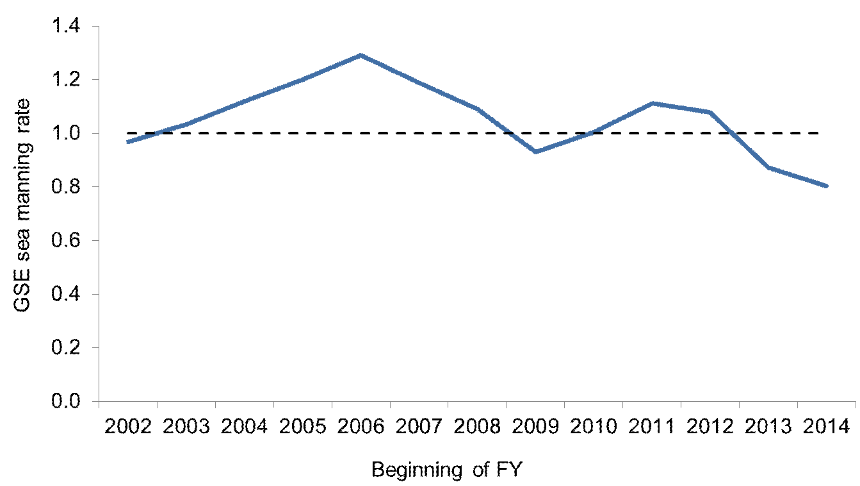
sea inventory equals sea BA; therefore, the EMC is fully manned at sea. A value greater than 1.0 corresponds to overmanning at sea, and a value less than 1.0 corresponds to undermanning at sea. Then, we examine current sea manning rates by paygrade and explore what policies can be used to address undermanning and overmanning.

Case study: GSE

Historical trends in GSE sea manning

As figure 23 shows, until recently, GSE was well manned at sea; the GSE sea manning rate generally hovered near or above 1.0. Starting in FY 2013, however, the GSE sea manning rate began falling, and now the EMC is undermanned at sea.

Figure 23. GSE sea manning rate



Moreover, GSE sea manning rates vary considerably by paygrade (see figures 24 to 27). Since early FY 2002, GSE has been overmanned in paygrades E-1–E-3 and E-5 and undermanned in E-4, E-6, and E-7.[29]

29. GSE (along with GSM) compresses and merges into GS at E-8.

Figure 24. GSE sea manning rate, overall and for E-1–E-3

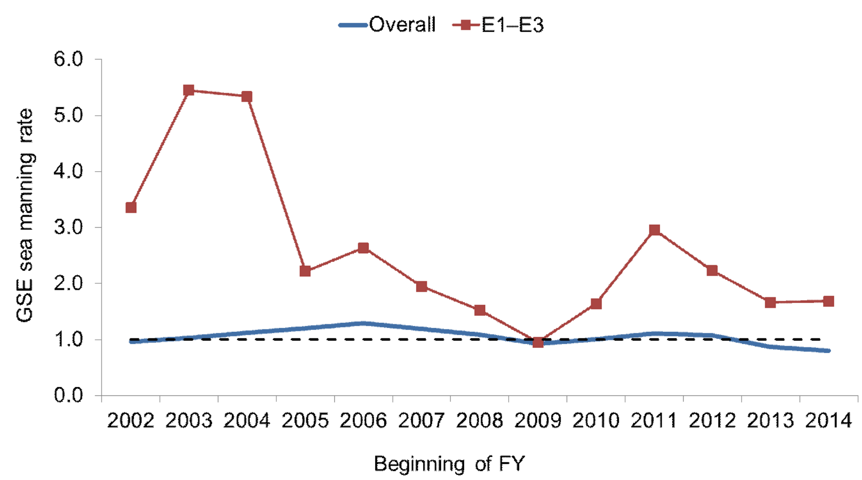


Figure 25. GSE sea manning rate, overall and for E-4

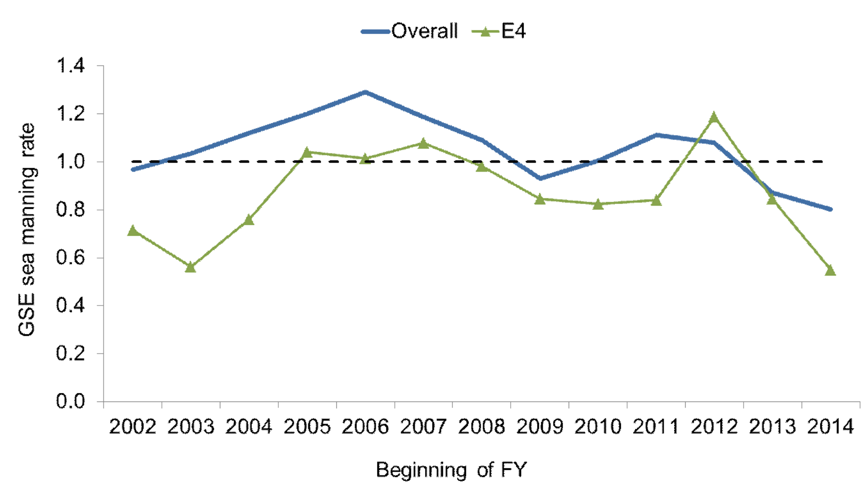


Figure 26. GSE sea manning rate, overall and for E-5 and E-6

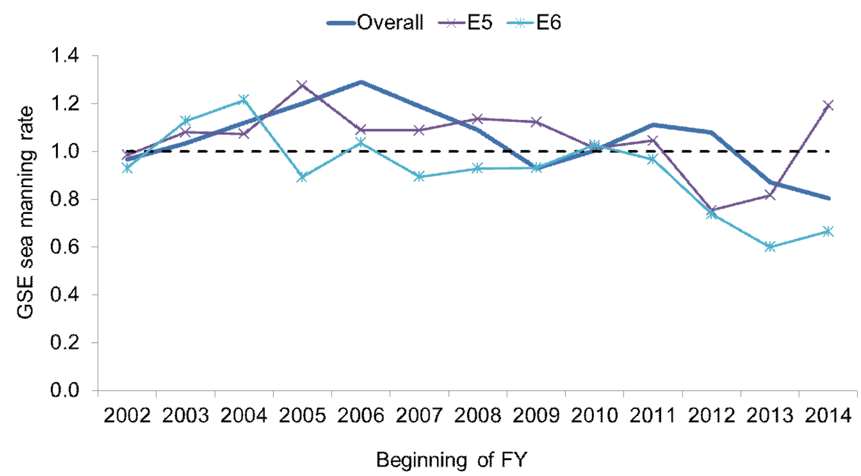
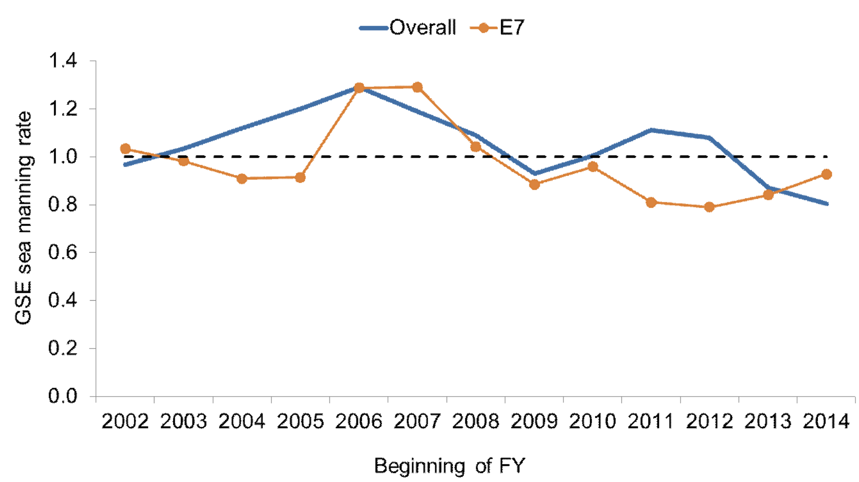


Figure 27. GSE sea manning rate, overall and for E-7



Policies that address current GSE overmanning and undermanning at sea

Now we turn our attention to current GSE sea manning rates and the policies that will address overmanning and undermanning at sea. When considering policy options, we start at the lowest paygrades and work our way up the pyramid, and we use ESS-Sim to estimate the impact on GSE sea manning rates in steady state. A bottom-up approach is appealing for two reasons. First, it replicates the way inventory flows through the pipeline. The Navy rarely permits lateral entry into EMCs. Instead, new recruits are trained and advanced from within the Navy and, generally, from within the EMC. Second, it enables us to chip away at the sea manning mismatch where it is often the most problematic—at the lower paygrades.

Initial obligation and first-sea-tour length

Starting at the bottom of the pyramid, we begin by simulating the effect on steady-state sea manning of different combinations of initial obligation and first-sea-tour length.[30] We simulate three alternatives. First is T+X/51, where the GSE first-sea-tour length is set to 51 months (the difference between the T+X 5-year initial obligation and GSE initial training of 9 months). T+X/51 is the combination currently being used by the GSE community. The other two alternatives we simulate are 4YO/60 and 5YO/60, as defined earlier.

As figure 28 shows, under all three alternatives, the steady-state overall sea manning rate is higher than the current overall sea manning rate. Also, in each of the alternatives, the GSE E-1–E-3 paygrades are overmanned at sea in steady state and the GSE E-4 paygrade is undermanned at sea in steady state. This is because the overall (sea and shore combined) BA is out of balance (figure 29). There are three times as many E-4 BA as E-1–E-3 BA, and E-1–E-3 BA are overmanned while E-4 BA are undermanned. This imbalance is caused by two things. First, minimum time in rate (TIR) requirements for advancement mean that GSE sailors cannot advance fast enough to E-4 to fill those requirements. Second, to fill E-5 and higher BA, GSE E-4 sailors advance too quickly to keep the E-4 inventory in line with the E-4 BA.

Taken together, this means that there are far too few E-1–E-3 BA to grow enough sailors to satisfy the E-4 and higher BA, leading to an inventory-BA paygrade imbalance and problems with manning at sea. Indeed, the model predicts problems with steady-state overall manning (sea and shore combined) for the E-1–E-3 and E-4 paygrades. In steady

30. Across all simulations, we set the second GSE sea tour length at 60 months, in accordance with sea-shore flow policy.

state, the GSE E-1–E-3 overall manning rate will be 2.45 under 4YO and 2.27 under 5YO, whereas the GSE E-4 overall manning rate will be 0.68 under 4YO and 0.72 under 5YO.

Figure 28. Current and steady state GSE sea manning rates under alternative initial obligation and first-sea-tour length assumptions

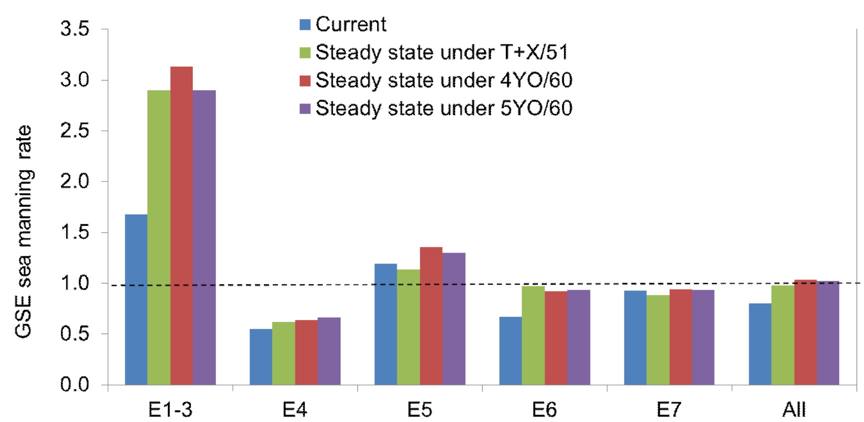
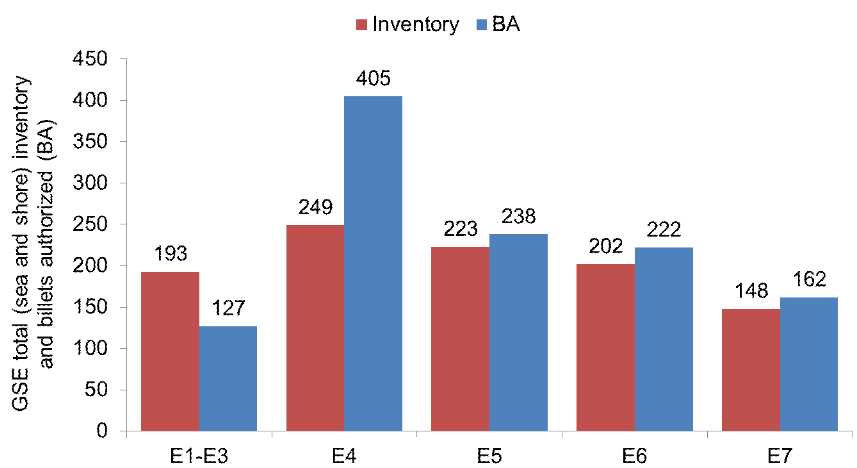


Figure 29. Current GSE total (sea and shore combined) inventory and BA by paygrade



Fixing the sea manning mismatches for the GSE E-1–E-3 and E-4 paygrades can only be done by changing the underlying BA (and not by sea-tour-related policies we can simulate with ESS-Sim) because E-1–E-3 and E-4 sailors are already at sea and there is no other place to send them. Therefore, when choosing between the three combinations of initial obligation and first-sea-tour lengths, we choose the combination that produces the least distortion for E-1–E-3 and E-4 sea manning: 5YO/60.

Under 5YO/60, we estimate that 123 GSE sailors are required to reach the fleet each year. Since the GSE training pipeline is nine months long, but the first three months are spent in bootcamp, GSE sailors spend six months (or one-half) of their first year of service in GSE student IA billets. Therefore, we estimate that 62 GSE student IA billets are required (i.e., 123/2). Currently, however, there are only 18 GSE student IA billets.

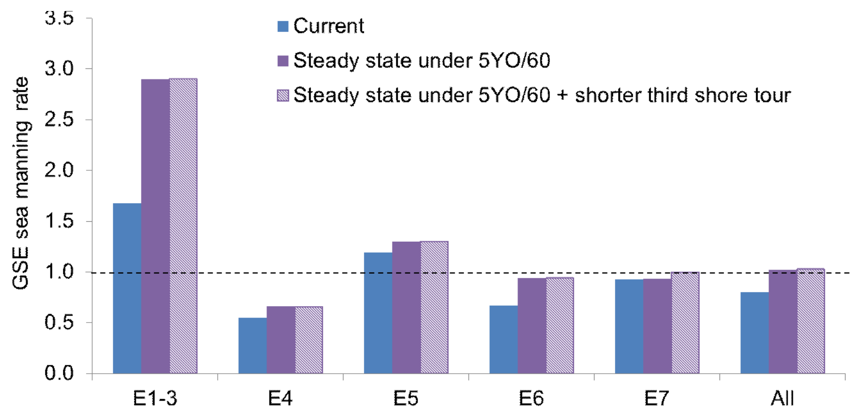
Shorter third shore tour

The main sea manning problem for GSE is the overmanning at sea for E-1–E-3 and the undermanning at sea for GSE E-4; however, the only way to fix this is to shift around BA, and this is not something we simulate in ESS-Sim. So, next we shift our focus to the other paygrade-specific GSE sea manning problem: undermanning at sea for GSE E-6 and E-7. To address this, we simulate the effect of shortening the third GSE shore tour from 36 months to 24 months. This causes sailors to return to sea sooner for their fourth sea tours, increasing manning at sea in the E-6 and E-7 paygrades.

Simulated effect on sea manning rates

Figure 30 shows the steady-state sea manning rates under 5YO/60 and shorter third shore tours. First, switching from T+X/51 to 5YO/60 without yet changing the length of the third shore tour, the steady-state GSE overall sea manning rate rises from the current value of 0.80 to 1.02. The GSE E-1–E-3 sea manning rate triples, leading to even more overmanning at sea (an excess of 127 sailors) in those paygrades. GSE E-4 sea manning increases slightly, but the paygrade remains undermanned at sea. Again, the only way to address this mismatch is to change sea BA. Relative to current GSE sea manning rates, under 5YO/60 the GSE E-5 paygrade is overmanned at sea by 36 sailors and the GSE E-4 paygrade is undermanned at sea by 130 billets in steady state. So, some of the excess GSE E-5 sailors at sea could be used to fill gapped GSE E-4 sea billets.

Figure 30. Current and steady-state GSE sea manning rates: 5YO/60 plus shorter third shore tour



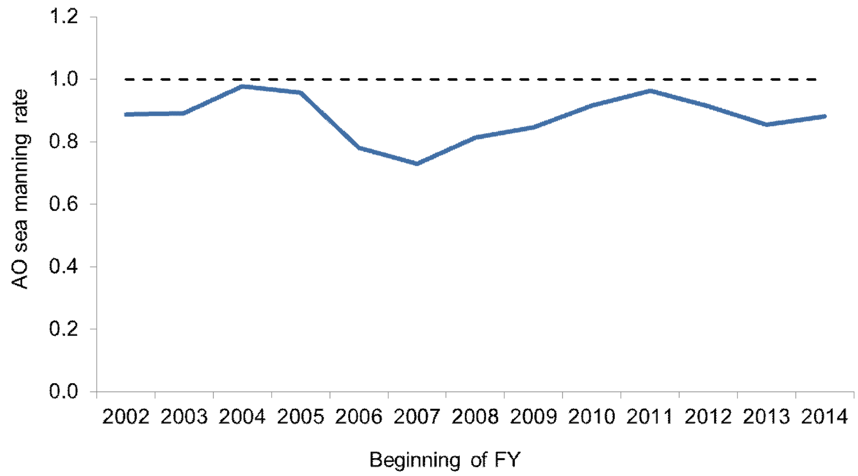
Most of the E-6 sea manning gap is closed in steady state under 5YO/60. Relative to the current sea manning rate, the GSE E-6 sea manning rate increases from 0.67 to 0.94 in steady state under 5YO/60. Still, the small gap in GSE sea manning persists for paygrades E-6 and E-7. After shortening the third shore tour to get sailors back to their fourth sea tours sooner, the GSE E-6 sea manning rate increases ever so slightly (remaining short at sea by 8 sailors), and the GSE E-7 sea manning gap closes completely.

Case study: AO

Historical trends in AO sea manning

As figure 31 shows, historically, AO has been undermanned at sea. The AO overall sea manning rate improved steadily between FY 2007 and FY 2011, at which point it started to decline again.

Figure 31. AO sea manning rate



AO sea manning rates vary by paygrade (see figures 32 through 34). In the early 2000s, AO was overmanned at sea in the E-1–E-3 paygrades and undermanned at sea in the E-4 paygrade. This pattern reversed in the middle to late 2000s. In FY 2011, the AO E-1–E-3 and E-4 paygrades reached full sea manning. Since then, E-1–E-3 sea manning has fallen and E-4 sea manning has risen. AO E-5, E-8, and E-9 paygrades have historically been undermanned. AO E-6 and E-7 paygrades also have been historically undermanned, but less so; in FY 2014, the paygrades were fully manned or slightly overmanned.

Figure 32. AO sea manning rate, overall and for E-1–E-3 and E-4

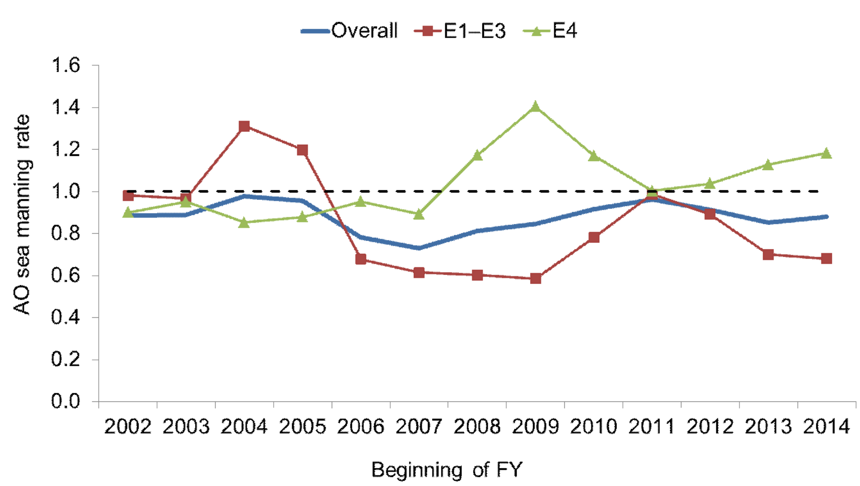


Figure 33. AO sea manning rate, overall and for E-5 and E-6

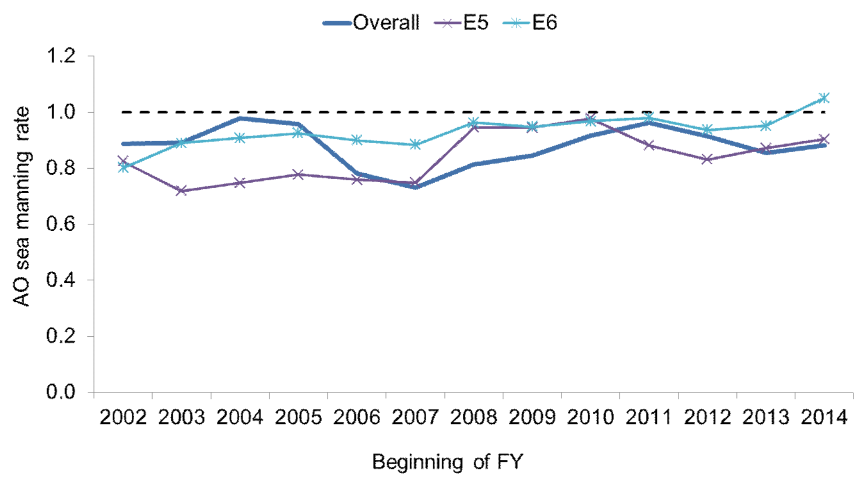
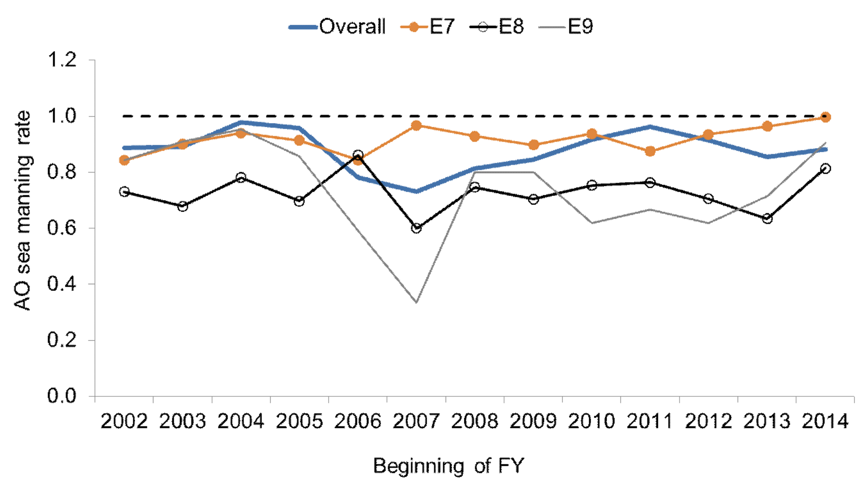


Figure 34. AO sea manning rate, overall and for E-7, E-8, and E-9



Policies that address current AO overmanning and undermanning at sea

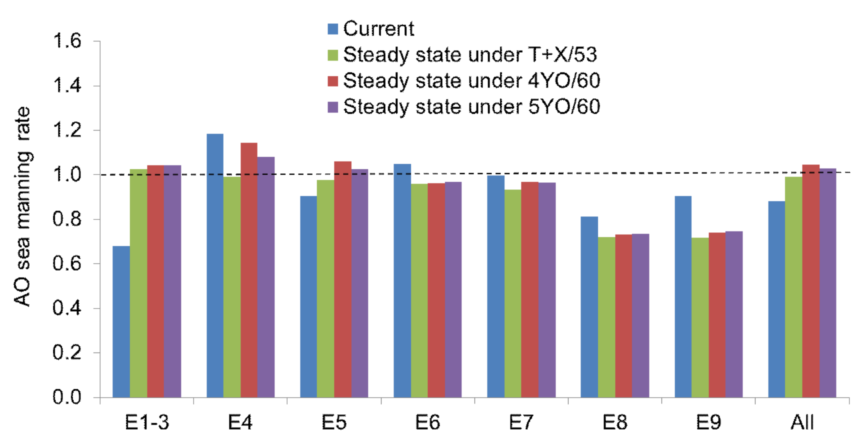
We now turn to current AO sea manning rates and consider policies that will address AO overmanning and undermanning at sea. Again, we begin by evaluating different combinations of initial obligation and sea tour lengths. Then, we discuss the effect of lengthening specific sea tours and shortening specific shore tours.

Initial obligation and first-sea-tour length

To begin, we simulate the effect on sea manning rates of three different combinations of initial obligation and first-sea-tour length. First is T+X/53, where the AO first sea tour length is set to 53 months (the difference between the T+X 5-year initial obligation and AO initial training of 7 months). T+X/53 is the combination currently being used by the AO community. The other two alternatives we simulate are 4YO/60 and 5YO/60.

As figure 35 shows, T+X/53 is preferred over 4YO/60 or 5YO/60. T+X/53 achieves a slightly lower overall steady-state sea manning rate compared with 4YO/60 and 5YO/60. But, T+X/53 achieves an overall sea manning rate of 0.99 and does not result in overmanning at sea in the E-4 and E-5 paygrades as the other two alternatives do. Moreover, for all other paygrades, T+X/53 performs just about as well as the other alternatives.

Figure 35. Current and steady-state AO sea manning rates under alternative initial obligation and first-sea-tour length assumptions



Under T+X/53, we estimate that 948 AO sailors are required to reach the fleet each year. Since the AO training pipeline is seven months long, and the first three months are spent in bootcamp, AO sailors spend four months (or one-third) of their first year of service in AO student IA billets. Therefore, we estimate that 316 AO student IA billets are required (e.g., 948/3). Currently, however, there are only 236 AO student IA billets.

Longer third sea tour, shorter third shore tour

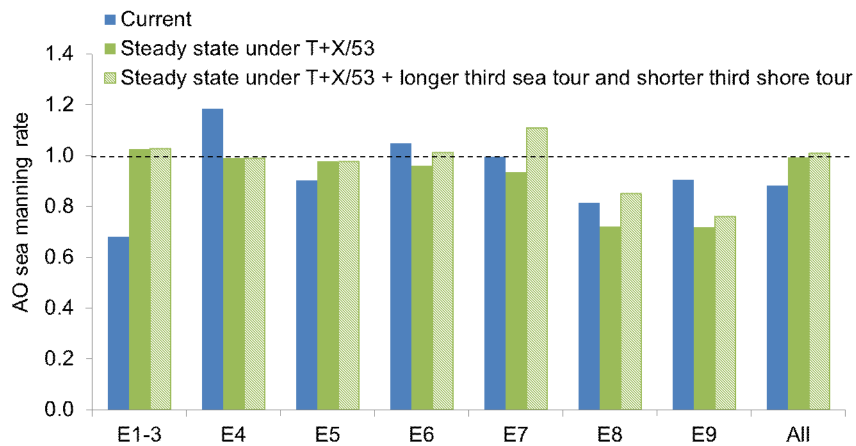
To increase AO E-6 and above sea manning rates, we simulate the effect of lengthening the third sea tour to 48 months and shortening the third shore tour to 30 months. According to Sea Shore Flow policy, AO sailors' third sea tours are meant to be 48 months long. But, the empirical evidence suggests that sailors are not staying at sea for longer than 36 months on their third and higher sea tours, so as a baseline we assume that third and higher sea tours are 36 months long. Getting sailors to serve 48 months at sea on their third sea tours will likely take some extra incentives.

Simulated effect on sea manning rates

Figure 36 shows the effect on steady-state AO sea manning rates of staying with the T+X/53 initial obligation and first-sea-tour length combination, lengthening third sea tours, and shortening third shore tours. Under T+X/53 alone in steady state, the AO overall sea manning rate rises to 0.99, compared with the current value of 0.88. The AO E-1–E-3 sea manning rate also rises from the current value of 0.68 to 1.03 under T+X/53 in steady state. The AO E-4 sea manning rate falls from the currently overmanned value of 1.18 to 0.99 in steady state. The AO E-5 sea manning rate rises as well, from 0.90 to 0.98 in steady state. The AO E-6 and above sea manning rates fall under T+X/53 in steady state, relative to their current values.

The lengthening of the third sea tour and the shortening of the third shore tour address the worsening in AO E-6 and above sea manning. With this addition, the AO E-6 and E-7 paygrades become slightly overmanned at sea. The AO E-8 and E-9 paygrades see an improvement in sea manning rates, to 0.85 and 0.76, respectively, compared with T+X/53 alone, but the gaps at sea persist. In steady state and with these policy changes, there will still be a shortage of 13 E-8 and 3 E-9 AO sailors at sea. Some options for addressing this problem are to increase E-9 BA or move some E-8 BA to E-7.

Figure 36. Current and steady-state AO sea manning rates: T+X/53 plus increasing percentage at sea and more shore BA

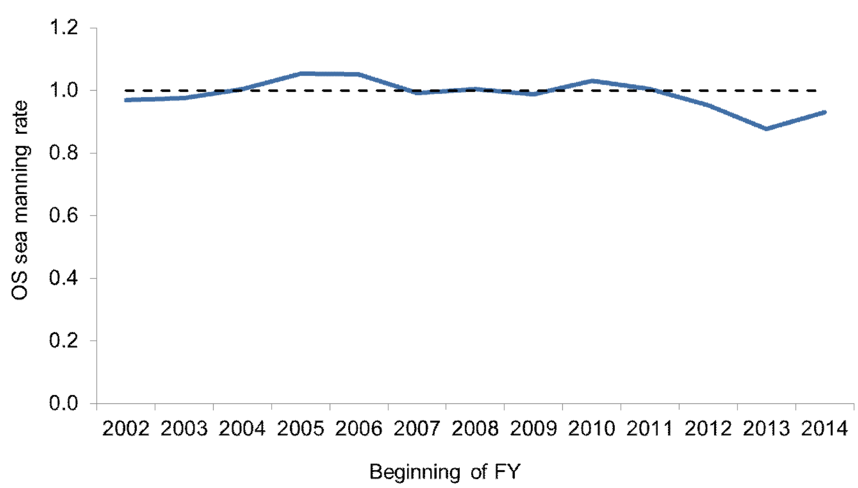


Case study: OS

Historical trends in OS sea manning

As figure 37 shows, similar to ENSW, the OS overall sea manning rate has oscillated around perfect manning at sea until recently, when the manning at sea rate fell below 1.0 in FY 2012 to FY 2014.

Figure 37. OS sea manning rate



Turning to OS sea manning rates by paygrade (figures 38 through 40), we see that the only paygrade-specific sea manning rate that follows the same pattern as the OS overall sea manning rate is E-4. The OS E-1–E-3 paygrade historically has been overmanned at sea, though it reached a sea manning rate of just above 1.0 in FY 2014.

Figure 38. OS sea manning rate, overall and for E-1–E-3 and E-4

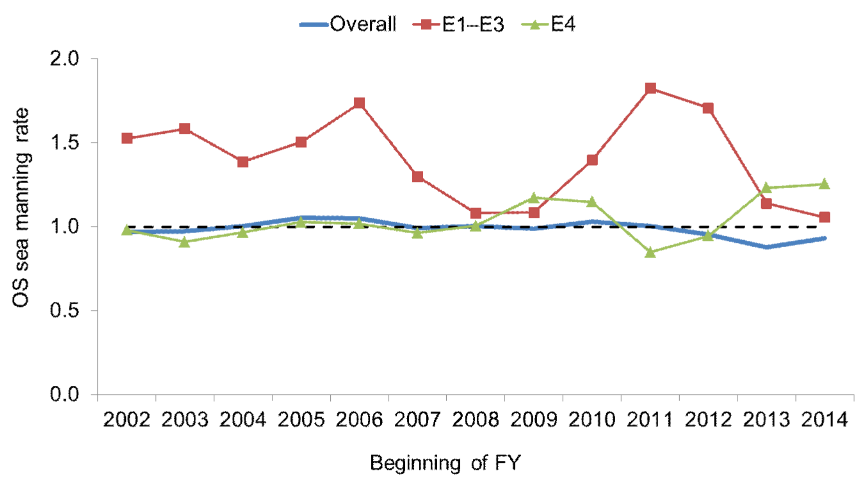


Figure 39. OS sea manning rate, overall and for E-5 and E-6

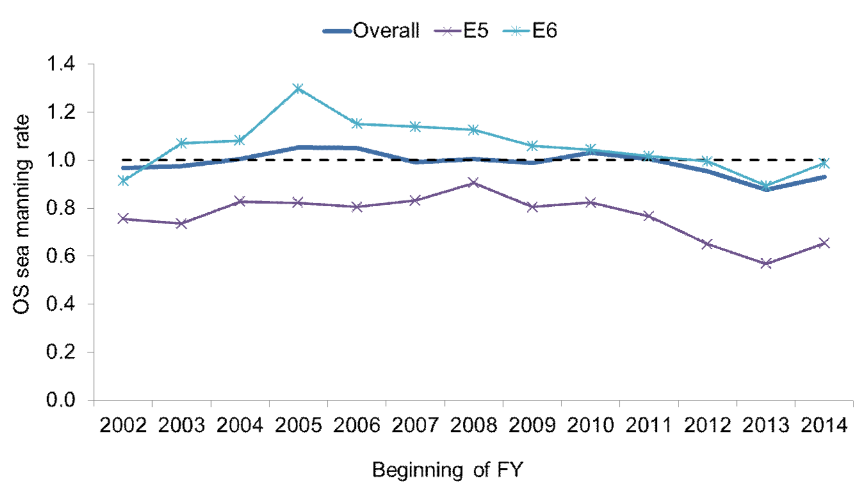
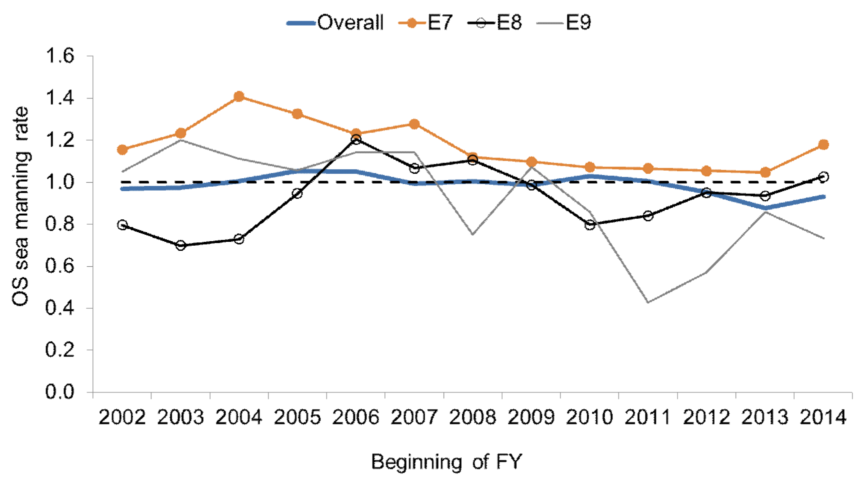


Figure 40. OS sea manning rate, overall and for E-7, E-8, and E-9



The OS E-5 paygrade consistently has been undermanned at sea historically, while the OS E-6 paygrade generally was overmanned at sea until recently. Historically, the OS E-7 paygrade consistently has been overmanned at sea, and the OS E-8 and E-9 paygrades have oscillated between being overmanned and undermanned at sea.

Policies that address current OS overmanning and undermanning at sea

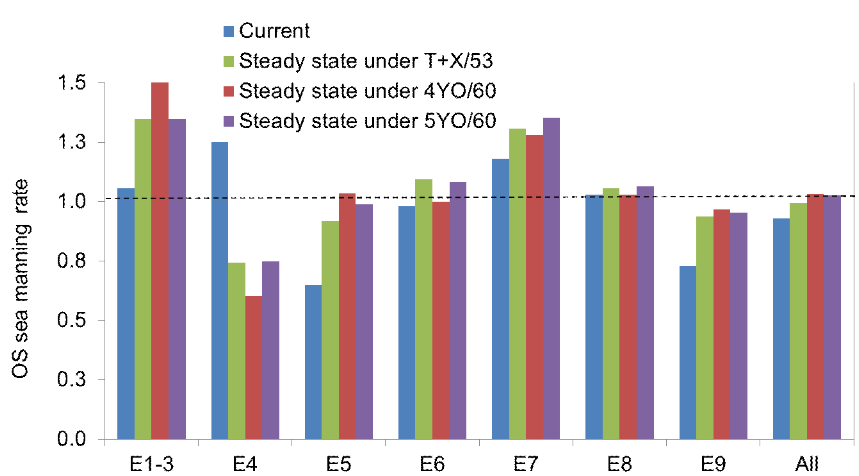
Turning to current OS sea manning rates, we consider policies that will address OS overmanning and undermanning at sea. First, we evaluate different combinations of initial obligation and sea tour lengths. Then, we discuss another policy option to consider: shortening the first sea tour.

Initial obligation and first-sea-tour length

We simulate the effect on sea manning rates of three different combinations of initial obligation and first-sea-tour length. First is T+X/53, where the OS first sea tour length is 53 months under the T+X program (53 months is the difference between the T+X 5-year initial obligation and CS initial training of 7 months). T+X/53 is the combination currently being used by the OS community. The other two alternatives we simulate are 4YO/60 and 5YO/60.

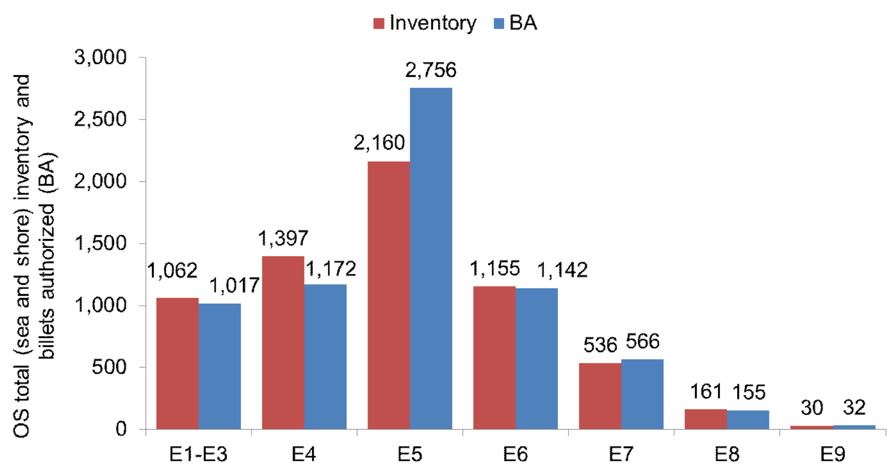
As figure 41 shows, all three alternatives produce fairly high rates of sea manning overall in steady state. In each of the alternatives, the OS E-1–E-3 paygrades are overmanned at sea in steady state and the OS E-4 paygrade is undermanned at sea in steady state. This is due to the fact that the overall (sea and shore combined) BA is out of balance (figure 42). There are more than twice as many OS E-5 BA as OS E-4 BA. E-4 sailors are advanced as quickly as possible to meet the E-5 requirement, but TIR restrictions stall the advancement of E-4 sailors into E-5 BA, leading to undermanning at E-5. Moreover, TIR restrictions stall the advancement of E-3 sailors to backfill the E-4 vacancies, leading to overmanning among the E-1–E-3 paygrades. This causes a BA paygrade imbalance and creates problems with manning at sea. Our simulations confirm this: the steady-state OS E-1–E-3 sea manning rate will be 1.48 under 4YO and 1.27 under 5YO, whereas the steady-state OS E-4 sea manning rate will be 0.68 under 4YO and 0.80 under 5YO.

Figure 41. Current and steady-state OS sea manning rates under alternative initial obligation and first-sea-tour length assumptions



As we've seen before, fixing the sea manning mismatches for the OS E-1–E-3 and E-4 paygrades can only be fixed by changing the underlying BA and not through our simulated sea-tour-related policy changes. Comparing the three combinations for initial obligation and first-sea-tour lengths, we think that T+X/53 outperforms the other alternatives. T+X/53 does just as well as the other combinations in most paygrades, but it outperforms the others in the E-7 paygrade. (It underperforms slightly in the E-5 paygrade, but this can and will be addressed in the policy scenario discussed next.)

Figure 42. Current OS total (sea and shore combined) inventory and BA by paygrade



Under T+X/53, we estimate that 705 OS sailors are required to reach the fleet each year. Since the OS training pipeline is seven months long, and the first three months are spent in bootcamp, OS sailors spend four months (or one-third) of their first year of service in OS student IA billets. Therefore, we estimate that 235 OS student IA billets are required (e.g., 705/3). Currently, however, there are only 155 OS student IA billets.

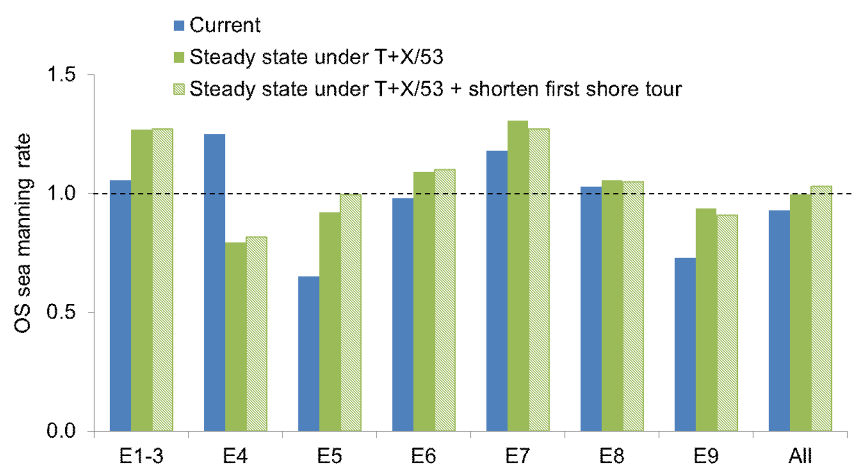
Shortening the first shore tour

To improve OS E-5 manning at sea, we simulate shortening the first shore tour to 28 months. This will result in sailors getting back to sea on their second tours while still in the E-5 paygrade.

Simulated effect on sea manning rates

Figure 43 shows the effect of staying with T+X/53 and shortening first shore tours on OS steady-state manning at sea. Staying with T+X/53 alone takes the OS overall sea manning rate from a current value of 0.93 to 1.00 in steady state, but this also results in overmanning in the E-1–E-3 paygrades (an excess of 200 sailors) and undermanning in the E-4 paygrade (a shortage of 182 sailors). As previously discussed, this can only be addressed by changing the underlying BA. T+X/53 also increases the OS E-5 sea manning rate from a current value of 0.65 to 0.92 in steady state. Shortening the first shore tour raises the OS E-5 sea manning rate by another 8 points to a value of 1.0 in steady state. The OS E-9 paygrade remains short at sea in steady state under T+X/53 and a shorter first shore tour, but the difference amounts to just one sailor.

Figure 43. Current and steady state OS sea manning rates: T+X/53 plus shorter first sea tour



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Individual tactical solutions

Our previous analysis (data analysis of historical trends, case studies, what we learned from our SME discussions, etc.) highlighted many of the problems facing enlisted community management and fleet manning. Drawing on all of this analysis, we provide numerous tactical solutions in support of the four strategic objectives for improving the enlisted supply chain and personnel management systems, leading to enhanced fleet manning—namely, enhance *stability*, *alignment*, *flexibility*, and *executability* (SAFE). For example, to enhance stability, we recommend that the Navy reduce billet churn, simplify initial training pipelines, level-load accessions, and minimize year-to-year fluctuations in community accessions. To enhance alignment, we recommend that the Navy fully fund overhead requirements (i.e., student and TPPH accounts), realign senior sea and shore billets to make them executable, trade shorter shore tours for geographic stability, align sea pay with other pays, and align tour lengths, obligations, and paygrades. Where applicable and feasible, we estimated the cost and ROI in terms of RCN Fit improvement for each of these actions.

Enhance *executability*

Ensure that billet structure is executable

Fix the billet base where it lacks junior billets

Issue. Having too few junior billets (E-1 through E-3) can lead to shortages of E-4 sailors. Our analysis shows that problems occur when the number of E-1–E-3 billets in a community is less than 19 percent of the total billets for that community. (For reference, 26 percent of all enlisted billets (including nonrated billets) are E-1–E-3; if we exclude the nonrated billets, this portion drops to 21 percent.) To identify the extent of this problem, we first excluded communities whose fleet requirements essentially start at E-4 (nukes, etc.). We then found 32 communities with the percentage of E-1–E-3 billets below the 19-percent threshold. These communities total 78,221 billets, of which 10,919 are E-1 through E-3.

Action. To address this problem, we could buy more E-1–E-3 billets or roll down the paygrades of existing billets. If we solve the problem solely by buying billets, we would need an additional 4,868 E-1–E-3 billets (that's an upper limit on the resources needs). However, having too many E-1–E-3s and too few E-4s does not cause Fit decrements (since all these paygrades are in the apprentice payband). Therefore, we do not recommend paying to fix this problem, unless the Navy decides that it is unacceptable to consistently have an excess of E-1–E-3s and a shortage of E-4s.

Enhance *alignment*

Align requirements and funding

Fully fund the individuals account

Issue. Both the student account and the Transient, Patient, Prisoner, and Holdee (TPPH) account have been underfunded relative to execution for the past eight years. This has resulted in fewer sailors in the distributable inventory, which leads to unfilled fleet billets and lower fleet Fill and Fit scores.

Action. Fully fund the student and TPPH accounts. Based on data from N12, the Navy plans to buy 2,537 additional student billets by FY 2015. This buy, coupled with N12's forecasts that student execution will decrease by 3,000 man-years by FY 2015 (based on lower accession numbers), will fully fund the student account. Similarly, the Navy plans to buy 1,125 additional TPPH billets by FY 2015, which, based on TPPH execution forecasts, will fully fund this account.

Cost. Most of the unfunded student execution occurs in initial skill training. Assuming this represents about a 50-50 split of E-2 and E-3 student billets, the cost of these 2,537 additional billets is about $133,000,000 per year. The cost to buy 1,125 additional TPPH billets (using the average cost of an enlisted sailor) is about $87,000 per year.

ROI. In September 2013, aggregate RCN sea-duty Fill was about 93 percent. We estimate that fully funding the individuals account will improve sea Fill by 6 percentage points. Improvements in Fill will likely lead to improvements in Fit, but the relationship is not one-for-one. Thus, we estimate that fully funding the IA account will likely increase RCN sea Fit by 3 to 5 percentage points.

Buy billets to account for sailors in LIMDU status

Issue. Sailors in LIMDU status are not able to serve on sea duty. Last year, the Navy had over 2,600 sailors in LIMDU status. Most of these sailors came from sea duty, which results in fewer sailors in the distributable inventory who are available for sea assignments. This, in turn, leads to more gapped sea billets.

Action. Buy billets to account for LIMDU sailors. These billets could be included in the TPPH account.

Cost. Assuming about two-thirds of LIMDU sailors come from sea duty, about 1,700 billets would need to be bought to account for these losses. The cost to buy these billets (using the average cost of an enlisted sailor) is about $147,000 per year.

ROI. Buying billets to account for LIMDU sailors would increase sea Fill by 1.2 percentage points. Following the same rationale we used with IA funding, we would expect this to increase Fit by about 1 percentage point.

Align tours, obligations, and paygrades

Issue. Obligations, tour lengths, and billet paygrades are not aligned. The adverse consequences are gaps at sea and/or paygrade and experience mismatches at sea.

Action. Either set longer first sea tours (aligned with longer initial obligations) or set shorter first sea tours (get sailors to second sea tours sooner).

Costs and considerations. There will be compensation implications relating to recruiting, retention, and sea duty.

ROI. This initiative should provide better alignment between tour lengths and obligations, leading to a better alignment of personnel between sea and shore duty. This should provide improved sea manning, and a better paygrade/experience mix at sea.

A limiting factor is that multiple Navy and DOD policies affect sea tours, and these policies are frequently at odds with sailors completing a prescribed sea tour (PST).

The impact needs to be estimated one community at a time.

Fix sea/shore imbalances in the senior paygrades

Align E-8–E-9 sea billets and inventory

Issue. Sea/shore billet imbalances in the senior paygrades can lead to gapped sea billets. We looked at communities where greater than 50 percent of the E-8 and E-9 billets, when considered together, are for sea duty. We identified 27 such communities with a total of 1,922 sea billets and 991 shore billets (an imbalance, assuming equal-length sea and shore tours, of 931).

Action. To address this issue, we propose rolling down 465 E-8-billets to E-7 and adding 465 E-8 shore billets. The additional shore billets could be new billets or conversions of civilian billets to military billets.

Cost. This is the cost of closing a 100-billet gap in E-9/E-8 sea vs. shore. It assumes adding 50 more shore billets: one-third E-9 billets (17) and two-thirds E-8 billets (33). The rest of the gap is closed by rolling down sea billets. This keeps the total number of E-9 and E-8 constant, so we don't violate legislative limits on E-8s and E-9s.

We can add the 50 shore billets by either buying them outright or changing over civilian billets, assuming that civilian billets are 30 percent less expensive than military billets:

- Buying outright—the cost of closing 100 billet gaps is $5.4 million ($6.5 million to buy the 50 billets and $1.1 million in savings from the billet roll-downs).

- Changing over civilian billets—the cost of closing the gap is \$0.9 million (\$2.0 million to have 50 billets military instead of civilian, and \$1.1 million in savings from the roll-downs).

If we multiply the foregoing numbers by 9.31, we attain two cost estimates for fixing E-8/E-9 sea/shore imbalances:

- Creating new civilian billets and rolling down some billets—\$50.3 million per year
- Changing over civilian billets and rolling down some billets—\$8.4 million per year

ROI. We would expect these actions to result in 465 additional E-8s and E-9s at sea. This is a modest increase in Fit (< 1 percentage point) but an important increase in senior enlisted leadership.

Shorten shore tours for geographic stability

In this subsection, we discuss two ideas—shorter shore tours and geographic stability. We propose that, by combining these two ideas, the Navy can overcome problems that would exist if it tried to adopt either one in isolation.

Shorter shore tours

When the Navy provides sea/shore flow (also known as sea/shore rotation) for its sailors, shore tours break up sea tours, filling the time between them. Just as there are requirements for sailors to fill sea billets, there are also requirements for sailors to fill shore billets. With sea/shore flow, the Navy can use these shore billets to provide sailors with a break from the arduous working conditions involved with sea duty. Historically, the Navy has set shore tour lengths to be at least 3 years.

Shorter shore tours could potentially generate more sailor time at sea and improve sea manning, especially for sea-intensive ratings. However, shortening shore tours would be expected to have a negative retention effect, and the negative retention effect might well negate the benefits from shortening shore tours.

Geographic stability

Geographic stability occurs when sailors can stay in the same location for a sea tour and a subsequent shore tour (or for a shore tour and a subsequent sea tour). Geographic stability is popular with sailors, but the geographic distribution of billets makes it impossible to provide geographic stability to all sailors. This creates a situation in which some sailors benefit from geographic stability while others do not. One would expect a negative retention effect among sailors who would like to have geographic stability but are unable to get it.

Analysis in [9] found that the potential for geographic stability is about 50 percent; about as many sea tours have to be followed by a geographic move as can be followed by geographic stability. The 2008 study examined sea tours in the Navy's top eight fleet concentration areas, and found that 40 percent of the subsequent shore tours were in the same location, while 60 percent were in a different location. The study then found that the potential to increase geographic stability existed with only an additional 10 percent of tours.

Action. Combine shorter shore tours with geographic stability.

Taken alone, shortening shore tours creates a retention problem. Some positive benefit is needed to offset the negatives associated with a shorter shore tour.

Taken alone, geographic stability can only be given to 40 to 50 percent of sailors. This is a benefit that is provided to some sailors yet not to others. This presumably creates a negative retention effect among sailors who do not receive the benefit. And there is no mechanism in place to provide this benefit to the sailors who value it the most.

Our proposed solution is to combine the two. Apply shorter shore tours when sailors are receiving the benefit of geographic stability, but not when sailors are relocating to a new area for their shore tours. The benefit of geographic stability will help offset the negatives associated with shorter shore tours. And imposing a shorter shore tour on those receiving the geographic stability benefit will help "equalize" benefits across sailors who get and do not get geographic stability.

Another advantage of this proposal is the sorting mechanism that it will provide. Sailors range in tastes from those who resent a shorter shore tour a great deal to those who don't mind a shorter shore tour very much. Those who mind it a great deal will sort themselves in the 3-year shore tours, helping to fill shore tours outside fleet concentration areas. Also, sailors range in tastes from those who really want geographic stability to those for whom it doesn't matter as much. Those who really want geographic stability will sort themselves into the 2-year shore tours, helping generate more sailor time at sea and improving sea manning in the process. Targeting sailor preferences in this way should mitigate or neutralize both the negative retention effects from shorter shore tours and the negative retention effects from not receiving geographic stability.

ROI. Consider the impact on RCN Fit. Not all communities have the potential to offer large amounts of geographic stability, but the 2008 study found that communities with high levels of existing or potential geographic stability include GSM and many of the Surface Warfare EMCs [9]. For this analysis, we base our estimates of the impact on RCN Fit on the overall average of 40 percent of shore tours having geographic stability.

We used the ESS-Sim model to estimate the impact of shortening 40 percent of shore tours in a given EMC. We find that shortening 40 percent of shore tours by 12 months—from 36 to 24 months—would increase RCN fit by 2 to 2.5 percent for that community, depending on the community. We find that shortening 40 percent of shore tours by 6 months—from 36 to 30 months—would increase RCN Fit by about half as much. Because first sea tours are unaffected, this increase is focused on journeyman and supervisor sea manning.

Align sea pay with other pays

The Navy's sea pays have historically been used to compensate sailors for the arduous working conditions involved with sea duty. More recently, there has been an increasing awareness that sea pays also act as an incentive to serve on sea duty—getting more sailors to rotate to sea duty, complete their sea tours, and/or extend on sea duty beyond their notional sea tour lengths.

The Navy's sea pays include Career Sea Pay (CSP) and Career Sea Pay Premium (CSPP). Sailors serving on qualified sea duty receive monthly CSP, based on their paygrades and their cumulative years of sea duty served to date. Careerist sailors can also qualify for CSPP if they serve consecutively on qualified sea duty for more than 36 months. CSPP for these sailors has been a fixed $100-per-month amount. However, sailors with 8 or more years of cumulative sea duty have had their CSPP embedded into their CSP, effectively removing the requirement to exceed 36 months of consecutive sea duty to receive CSPP.

Previous research has found that increases in these sea pays can be correlated with measurable increases in the amount of sea pay served by sailors [10]. Yet, between 2001 and 2014, the Navy did not increase its sea pays. From 2001 (the date of the last increase) to 2013, sea pays lost 24 percent of their purchasing to inflation. In contrast, regular compensation (Basic Pay plus allowances) has grown by 61 percent in nominal terms. Thus the growth in regular compensation has far exceeded inflation during this same time period.

Accordingly, the Navy has decided to increase its sea pays to better align growth in sea pays to growth in other pays. Effective May 1, 2014, CSP will increase by 25 percent for all sailors with 3 or more years of cumulative sea duty, and CSPP will increase from $100 to $200 per month. The 25-percent increase will also apply to officers and warrant officers with 3 or more years of cumulative sea duty. A recent Navy estimate of the enlisted portion of the increase is that CSP will increase by $44 million and CSPP will increase by $17 million.

We can extrapolate from the analysis in [10] to estimate the effect of this increase on enlisted sea manning. That analysis estimated that a $24-million increase in CSP (in 2001 dollars) would generate an additional 750 work-years of sea duty. This increase was driven by extra completions of sea tours and extra extensions of sea duty. Adjusting for inflation, a $30-million increase in CSP (in 2013 dollars) would be required to generate the same 750 work-years of sea duty, which translates into about a 0.5-percent increase in overall sea manning. Thus, the projected $44-million increase in CSP would be estimated to generate about a 0.75-percent increase in overall sea manning.

Because the effect on sea manning is driven by completions and extensions, we would expect that CSPP would be much more targeted than CSP. Because CSPP is not paid for at least the entire first half of any notional sea tour, we would expect CSPP to be at least twice as effective as CSP at generating completions of sea tours and extensions of sea duty. This would suggest that an additional $17 million in CSPP would increase sea manning by at least another 0.5 percent. Taken together, we can conservatively estimate that these increases in the Navy's sea pays will increase overall sea manning by more than 1 percent.

Enhance *stability*

Reduce billet churn

Issue. Billet churn contributes to manning friction.

Out-of-cycle billet changes cause problems for the distribution system and contribute to Fit gaps. Types of billet churn include:

- Programming changes and manpower document updates
- Billet Change Requests (BCRs)

BCRs affecting sea duty Fit include changes to UIC, rating, paygrade, Primary NEC, or Secondary NEC. In FY 2013, there were approximately 7,300 such changes. The proposed solution is to delay BCRs and update TFMMS less frequently.

Current initiatives. N12 led a working group addressing billet churn and proposed a solution to delay BCRs that affect sea duty Fit for 10 months.

- The proposed solutions allows the distribution process to respond to new demand signal.
- The fleet would still able to get immediate changes for emergent needs with justification.

Impact. Based on the FY 2013 totals, there is a potential 1- to 2-percentage-point increase in Fit.

Reduce complexity of training pipelines

Issue. Complexity of initial training pipelines leads to inefficiencies in training and gaps at sea for apprentice sailors.

The main measure of inefficiency is time Not Under Instruction (NUI).

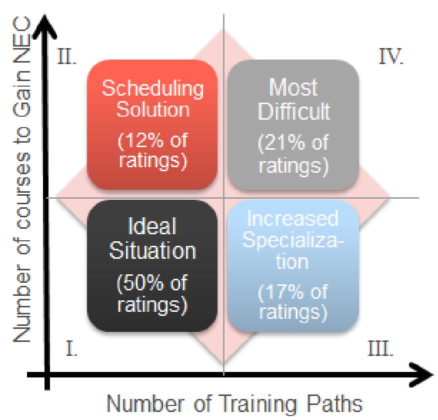
Action. Reduce number of training pipelines.

Considerations. There are three questions to consider:

1. Are courses used for multiple training paths?
2. Is there sufficient course capacity in other training paths to absorb the demand from compressed training paths?
3. Are multiple paths in place for proximity to fleet concentration areas?

Complexity of training is a combination of the number of training paths and the number of courses required to gain an NEC. Figure 44 displays how ratings are distributed within these categories. The "'most difficult" ratings, those with many paths and many courses, are the prime candidates for reducing training complexity.

Figure 44. Training pipeline complexity



Impact. Each enlisted community must be analyzed:

- Each training path that is compressed reduces NUI by about 8 percent.
- Based on training paths compressed, the decrement is not always linear.

Level-load accessions

Issue. Seasonal fluctuations in recruiting cause inefficient flows of accessions to the fleet.

Action. Carry out level-loading of accessions.

Costs. There are two costs associated with level-loading accessions:

- Paying for enlistment bonuses—roughly $25 million per year
- Additional MPN man-years—roughly $67 million per year

ROI. A detailed analysis of each community would be required, and this was beyond the scope of this study.

Minimize year-to-year fluctuations

Issue. Three issues arise:

- MPT&E plans look 3+ years into the future (e.g., Training Requirements Manager (TRM)).
- Plans are updated in a deliberative process (e.g., Quarterly Demand Planning (QDP)).
- Plans change during execution because of endstrength/budget constraints.

Adverse consequences. Unstable multiple-year execution of the MPT&E supply chain is possible, such as wide fluctuations in A-school throughput.

Action. Possible actions follow:

- "Lock" plans after a certain date.
- Limit year-to-year fluctuations.

Considerations. There are barriers to implementation:

- Institutional stovepipes and lack of integrated plans
- Endstrength/budget pressures

Current initiatives. This is an explicit goal of the BIT *(Rolling Production Plan* during POM and budget years, *Firm Production Plan* during execution year).

Potential benefits. Flows of personnel to the fleet will be stable.

ROI. Return on investment must be estimated one community at a time.

Enhance *flexibility*

Use PACTs as a relief valve

Issue. Earlier in this report, we showed how school flow in various enlisted communities whipsawed up and down, and we discussed several causes for this. One cause is that accession goals change—both from year to year and during the year of execution—as the Navy makes adjustments to meet endstrength. Such instability in school flow, however, creates inefficiencies in the supply chain that hamper getting sailors into the fleet and filling sea billets.

In this subsection, we discuss using PACTs as a relief valve to help smooth out changes in school flow, removing (or partially removing) instability in school flow. In discussing this idea with N132 staff, we discovered that the Navy already treats PACTs as a relief valve to some extent. However, our analysis of the data from FY 2006 through FY 2012 shows that more stability could have been achieved.

What the FY 2006–2012 data show

The Navy had a relatively stable number of total active enlisted accessions from FY 2006 through FY 2012. Accessions across this time period averaged about 35,500 and ranged from just under 34,000 to just over 37,000, with a standard deviation of about 1,200.

During this time period, however, enlisted accessions that were promised a school seat varied more than overall accessions did. This suggests that PACTs were not effectively used as a relief valve, at least not in a way that smoothed school flow.

Accessions promised a school seat averaged around 32,500 and ranged from about 29,500 to about 35,000, with a standard deviation of roughly 2,000. Figure 45 shows the total active accessions, the number of accessions promised a school seat, and the number of PACT and National Call to Service (NCS) accessions.[31]

How much stability in school flow could have been achieved in this time period by using the PACT/NCS accessions as a relief valve? As figure 46 shows, the Navy could have completely stabilized school flow across these seven years by using PACTs and NCS accessions as a relief valve. Furthermore, figure 46 shows that the PACT/NCS accessions would have been more stable as well.

How do we reconcile these data with the Navy assertion that PACTs are already used as a relief valve? We believe that, as requirements change within a given enlisted community, the Navy has aggressively used accessions to try to address the overage and/or underage right away, rather than taking a more stable, phased approach. Perhaps the Navy is letting the number of PACT accessions vary to help support these actions, instead of to create more stability in accessions.

31. Most of the PACT/NCS accessions were PACTs. Although many NCS accessions attend school, they are destined for the reserves rather than a full sea tour in the active Navy, so we did not group them together with the active-duty accessions promised a school seat. The last year of NCS accessions was FY 2009. There were 2,147 NCS accessions in FY 2006, 1,253 NCS accessions in FY 2007, 871 NCS accessions in FY 2008, and 94 NCS accessions in FY 2009.

Figure 45. FY 2006 through FY 2012 accessions, by school and PACT/NCS

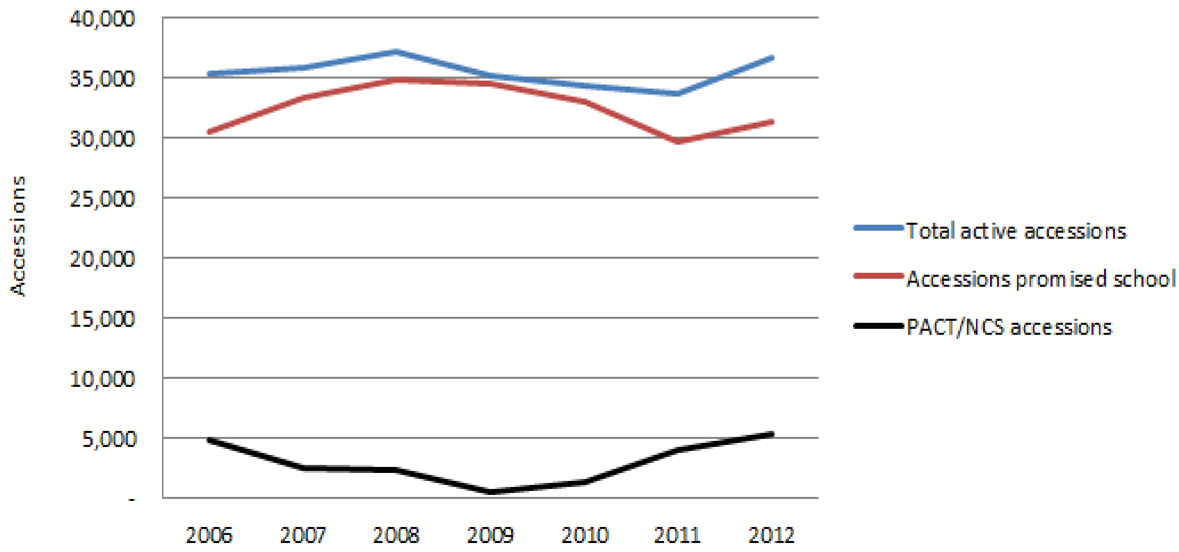
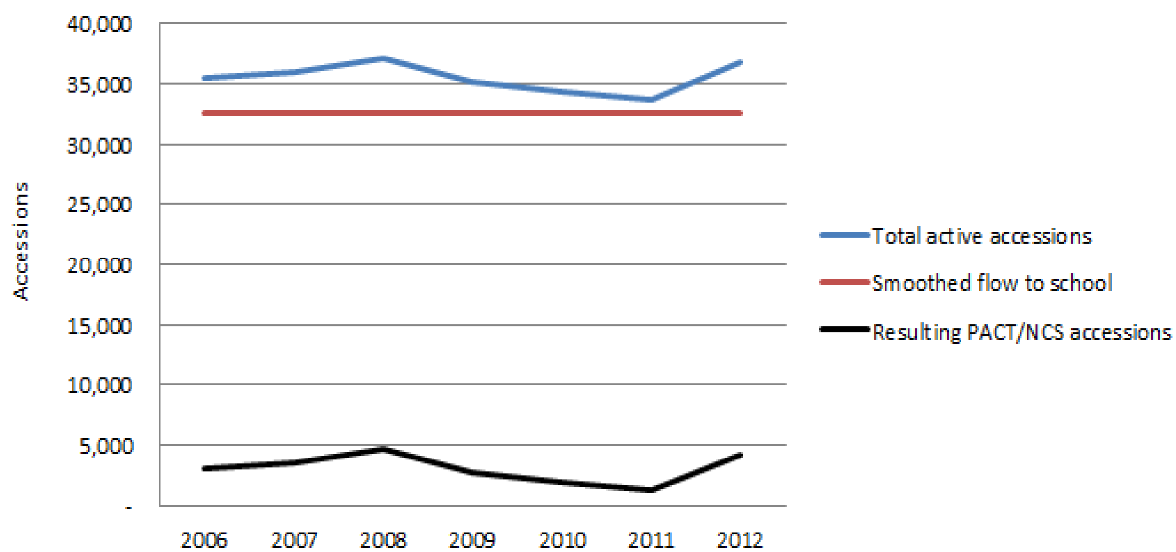


Figure 46. FY 2006 through FY 2012 accessions, with smoothed flow to school



So, the real lesson to be learned from this analysis is not that the Navy needs to allow the number of PACT accessions to vary to help address issues with other enlisted communities. Rather, it is that the Navy needs to establish more stability in the year-to-year accession requirements for its enlisted communities, and it can use PACTs as a relief valve to help achieve that stability (instead of using PACTs as a relief valve to help them dial individual community accessions up and down and to repeat that process in successive years).

Seek endstrength relief

Issue. Execution-year actions taken to meet monetary and endstrength constraints are frequently at odds with long-term plans.

Action. Seek endstrength variance. This should facilitate stabilizing interyear school throughput.

Cost. If we consider an authority to allow 1-percent variance of 265,776 endstrength, we estimate that it would cost $42 million per year. Our estimates are based on the following chain of reasoning:[32]

- Assumes extra 2,658 E-1s at end of year (average of 2 person-months for each of the extra recruits) priced at the E-1 rate.
- Assumes extra 2,658 E-2s at beginning of year (average of 2 person-months for each before strength line settles back down to where it would have been).

ROI. This initiative could have a ripple effect throughout the Navy MPT&E enterprise: accessions would be more stable, hence school throughput would be more stable, reducing training bottlenecks and providing a more consistent and predictable flow of personnel to the fleet. Precise estimates would require detailed analysis, one community at a time, and this was beyond the scope of this study.

32. The premise is that Navy retention is running high, and the Navy would have to take an end-year cut in accessions to meet strength. So, there is extra cost, probably significant, of the higher retention/more senior personnel. The Navy faces this cost whether it slashes end-year accessions or not. Thus, the cost of the extra strength is just the few months of very junior personnel.

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Attainable Fit

Previously, we examined fleet manning levels over the past eight years, which is about the length of time that the Navy has tracked Fit and Fill measures.

To get a better sense of what are achievable Fill and Fit levels, we examined fleet manning levels over a much longer time period. Using our historical billet and personnel data, we compiled estimates of aggregate RCN Fill and Fit rates going back to 1990. Our estimates are similar (but not identical) to the Navy's RCN Fill and Fit measures. For example, we based our Fit rates on enlisted management communities that closely approximate the RCN groups. We then estimated yearly aggregate RCN Fill and Fit levels for three types of operational forces: surface ships, submarines, and aviation squadrons. Figures 47, 48, and 49 show the results.

By definition, Fill levels should be higher than Fit,[33] and this is indeed the case. In general, Fit levels are more stable (less fluctuation) than Fill levels. For surface ships, Fill rates varied between 90 and 100 percent, whereas Fit rates varied between 80 and 90 percent. The two rates follow a parallel track, except for the period from December 2003 to December 2009, when these rates trended in opposite directions.

The Fit rates for submarines have been much more stable than those for surface ships, tracking close to 90 percent for most of this period. The same holds true for Fit rates for aviation squadrons. They have hovered around 90 percent, independent of the Fill rate, which has varied between 95 and 110 percent.

33. Because Fill includes unrated sailors and billets, and Fit does not, the only circumstance that would cause Fill to be lower than Fit is if the manning levels for unrated communities were exceedingly low.

Figure 47. Historical Fill and Fit rates for surface ships

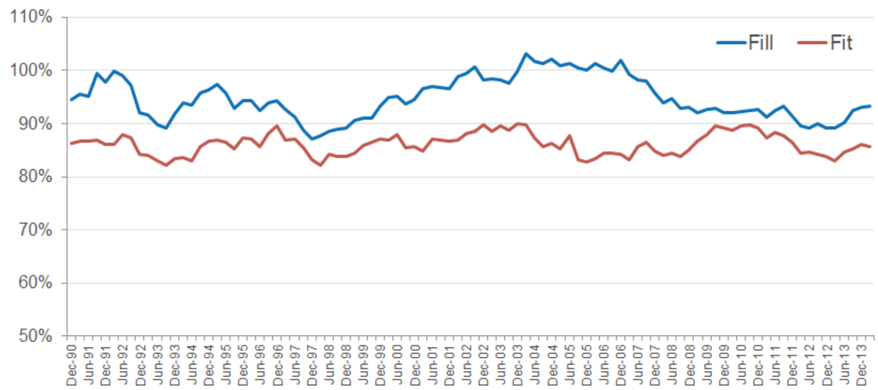


Figure 48. Historical Fill and Fit rates for submarines

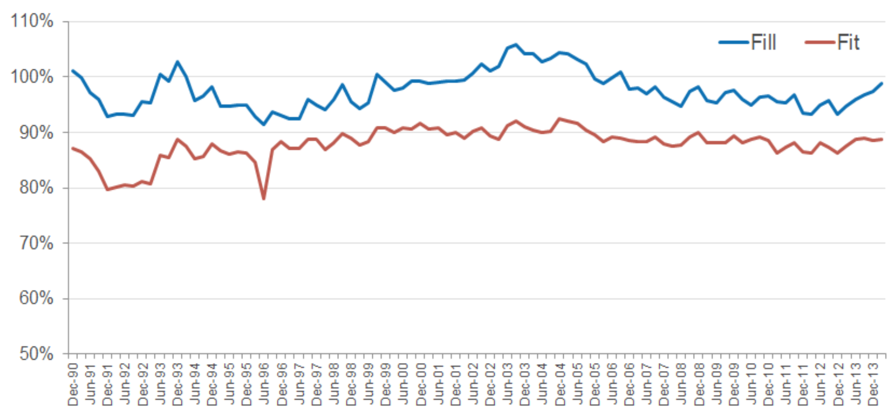
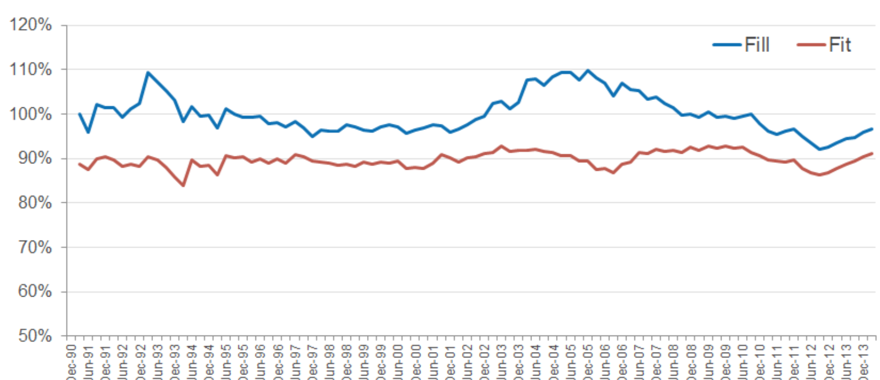


Figure 49. Historical Fill and Fit rates for aviation squadrons



These data suggest (1) that Fit levels are independent of Fill and (2) that 90-percent Fit levels are about the best the Navy can achieve without systemic changes to MPT&E processes. Many of the required systemic changes are described earlier in this report and, to the extent that they are implemented, attainable Fit levels would rise.[34]

There is a level of friction that derives from issues not addressed in this report. Such issues include the large numbers of personnel that are not worldwide assignable, assignments for pregnant women, lack of funding for contact relief, and other aspects of personnel distribution. So, even if all of our recommendations were implemented, we estimate 94 percent as an upper bound on attainable Fit levels.

34. In this analysis, we are addressing aggregate levels of Fit. We are not addressing unit manning. It is quite possible to attain higher levels of Fit on individual units if they are given sufficient distribution priority. However, it's a zero-sum game, and these personnel come from somewhere, lowering Fit levels on other units.

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Future work

Numerous issues spanning many areas have an impact on fleet manning levels. In this study, we focused on the high-level issues that degrade aggregate RCN Fit. Although we identified many issues that cause imbalances and misalignments, the scope and timeframe of this study did not allow us to fully analyze many of them. These issues, however, do warrant further investigation. Here, we describe the most important areas for future work.

NEC Fit

Table 6 shows NEC Fit, Fill, and aggregate levels on February 4, 2014, for the entire Navy and for DDG-51-class ships. Current NEC Fit levels are in the middle 60-percent range for all NECs and in the lower 70-percent range for critical NECs. In other words, according to the NEC Fit metric, about one-third of all NEC requirements are gapped and little more than a quarter of critical NECs are gapped.

Table 6. Current NEC Fit, Fill, and aggregate levels for entire Navy and for DDG-51-class ships

	NEC Rqmt.	NECs on board	NEC Fit	NEC Fill	Fit Gaps	Fit	Fill	Aggregate
All Navy								
All NECs	133,627	137,790	84,581	102,777	49,271	63.3%	76.9%	103.1%
Critical NECs	35,964	36,927	26,296	30,408	9,669	73.1%	84.6%	102.7%
DDG-51-class ships								
All NECs	12,283	12,994	8,214	10,140	4,069	66.9%	82.6%	105.8%
Critical NECs	7,799	7,980	5,643	6,668	2,156	72.4%	85.5%	102.3%

These levels reveal two important issues. The first is that current NEC Fit levels are low. Of particular concern are the low levels for critical NECs which, by definition, have a greater effect on unit readiness. The Navy needs to identify actions to improve NEC Fit levels.

The second issue stems from the large differences between the NEC aggregate, Fill, and Fit values. These differences suggest that the NEC Fit metric may not accurately reflect the crew's specialized skill sets. It raises the question of whether the rules used to determine NEC Fit matches are too restrictive and, ultimately, whether there is a better way to measure NEC Fit. One aspect of NEC Fit, in particular, that warrants study is the role of the distribution NEC because it plays an important role in determining an NEC Fit match.

Other issues affecting NEC Fit that warrant investigation follow:

- *NEC executability:* The issue here is whether NEC requirements are executable under the current training model. Most NECs are earned by attending training en route to the unit. But NECs have paygrade restrictions, which sometimes limit the training opportunities. For example, an NEC may be restricted to E-5s and above, but the E-5 billet requiring the NEC may be filled by sailors on their first sea tours. These sailors were not able to earn the NEC during initial training because, at that time, they did not meet the paygrade requirement. So the only option is to earn the NEC while assigned to the unit; however, this is not feasible in most cases because of travel and per diem costs and the time sailors would be away from the unit.

- *C-school planning, capacity, and scheduling:* Another limitation in filling NEC requirements is the availability of NEC schools (i.e., C-schools). Unavailability can be caused by poor C-school planning, which results in insufficient training capacity and restricts the number of sailors who can earn the NEC. Course scheduling is another concern, especially for NECs with a low number of billet requirements. Low annual throughput leads to infrequent course convenings, so the timing of NEC requisitions relative to the course schedule determines whether there is an opportunity to send a sailor to school to get the required NEC.

- *NEC reutilization:* How are career paths and NEC requirements defined to support reutilization of previously earned NECs? In other words, are there opportunities to use NECs on more than one tour and, if so, does the Navy take advantage of them?

- *Impact of system upgrades:* New system installations and upgrades may bring with them new NEC requirements. How do these changes affect NEC Fit and how does the Navy train current crew members to earn these new NECs?

Attainable community heath and fleet Fit

In our investigation of intercommunity imbalances, we identified two types of imbalances that affect fleet Fit. First are the imbalances between rated EMCs and PACTs. This is important because fleet Fit is based only on rated EMC billet requirements (i.e., PACTs are not included in Fit). Second are the imbalances among rated EMCs (i.e., overmanned and undermanned communities).

Over the past eight years, the primary cause of fleet Fit decrements has transitioned from mostly intercommunity imbalances to mostly Fill gaps—primarily due to the large decrease in total inventory. (As total inventory decreases, so does the likelihood that some communities will be overmanned.)

Of more concern to Fit is what occurred earlier in this time period when the size of the distributable inventory more closely aligned with requirements. Fit decrements were just as large, but most were due to intercommunity imbalances. In 2006, for example, there were on the order of 12,000 Fit gaps at the community level. As the Navy works to increase the size of its distributable inventory, a key issue with regard to fleet Fit is whether intercommunity imbalances will increase, causing Fit gaps and thus limiting any improvements to Fit.

We believe that a study is needed to determine an achievable level of intercommunity imbalances. Because these imbalances reflect community heath, it becomes a matter of identifying achievable and sustainable levels of community health. For example, should the Navy expect communities to be within plus or minus some percentage of authorizations? The study would also quantify the effects of community health on fleet manning, specifically fleet Fit. For example, if the goal for community health is plus or minus 1 percent of authorizations, what does this translate to in terms of achievable aggregate fleet RCN Fit?

Impact of assignment-limited personnel on fleet manning

The Navy's sea-shore flow model determines the length of sea and shore tours for each community required to achieve optimal manning. The model takes into account a variety of important factors that affect community manning, including current inventory by paygrade, retention, and advancement.

Not all sailors are available for sea or shore duty when required, however. Numerous requirements for certain assignments or exceptions to policy exist that have an impact on where sailors may be assigned and for how long, especially concerning sea duty. Measuring the impact that each contributes to sea manning is important in understanding how gaps can be reduced.

For instance, members with Exceptional Family Members (EFMs), currently numbering about 14,000, may have limited overseas or remote CONUS[35] assignment options, or they may have to return early if their family members' needs exceed the capability of the facility overseas. Sailors married to other servicemembers can serve a maximum of 36 months at sea to prevent a situation in which both spouses are away from home at the same time. Some sailors leave sea duty early for medical reasons, while some sailors fail to screen for OCONUS assignments. Other policies place limits on the number of moves that first-term sailors may have beyond initial training, provide exceptions to minimum time on station requirements when sailors lose eligibility to remain in their billets (such as loss of security clearance), or require that permanent-change-of-station moves for members who have school-age dependents occur at times that avoid disruption of the school schedule.

A study is needed to identify and estimate the impact of various sources of personnel considerations on sea manning. It would explore options for reducing the impact of those considerations that have the greatest impact.

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35. CONUS stands for continental United States; OCONUS is the abbreviation for outside the continental United States.

Summary and recommendations

We have conducted a broad analysis of fleet manning, addressing the metrics that are used, trends, causes of problems, strategic goals for improved MPT&E management, a holistic management process that will improve fleet manning, and estimates of attainable Fit. A summary of our results and recommendations follows.

Results

Navy MPT&E management may be considered in two parts:

- Policy, process, and budget establishment
- Navy MPT&E implementation

This study addressed the higher level functions of policy, process, and budget establishment—consideration of recruiting plans, training plans, sea-shore flow policies, billet funding, and so on.

Metrics

Fit and Fill are the primary metrics used to evaluate fleet manning. Fit and Fill are defined for both RCNs and NECs. (This study addressed RCN Fit and Fill.)

Fit and Fill were developed for fleet leadership. Fit and Fill measure two things. At the aggregate level, they measure the ability of the MPT&E system to properly fill authorized billets. At the unit level, they measure how well the unit is manned.

Fit and Fill are unit-level fleet metrics. Aggregating these metrics above this level is equivalent to computing an average Fit score, which can be misleading. For example, aggregating Fit across a class of ships will reflect the average Fit score but will not reveal how many, if any, units are below a minimum Fit threshold.

One limitation of the current Fit measure is that all billets used in the Fit calculations are weighted equally. For example, a gapped E-8 billet decrements Fit the same as a gapped E-3 billet. One consequence of this rule is that apprentice billets contribute the most toward Fit because apprentice billets are the most plentiful.

Fleet manning trends

We analyzed trends in fleet manning from 2006 through 2013. We decomposed the billet gaps into the following three levels:

1. *Aggregate Fill gaps at sea.* Most of the aggregate Fill gaps at sea have been caused by a persistent excess of personnel in the overhead accounts. In 2012 and 2013, Fill gaps were exacerbated by a significant shortage in total force inventory. Over the past eight years, Fill gaps at sea have ranged from about 2,000 to 15,000, causing a decrement to RCN Fit of 1.3 to 10.7 percentage points.

2. *Aggregate Fit gaps at sea.* These gaps stem from additional imbalances in the distributable inventory at the community and payband levels. Community imbalances, which account for most of these gaps, result from having some communities that are overmanned and some that are undermanned. Since 2006, aggregate Fit gaps at sea have varied from 850 to 9,200, causing a 0.6- to 6.3-percentage-point decrement to RCN Fit.

3. *UIC-level gaps.* These gaps stem from distribution friction that causes some units/activities to be overmanned and others to be undermanned. Since 2006, the level of UIC level gaps at sea due to distribution friction has fluctuated between 6,000 to 10,000, causing a 4.0- to 6.0-percentage-point decrement to sea RCN Fit.

Causes of manning problems

We identified the following causes of fleet manning problems:

- Interyear whipsaw behavior in A-school throughput
- Intrayear fluctuations in accessions, whence A-school input

- Execution-year changes to accession plans
- Misalignment of tour lengths and personnel obligations
- Complexity of training pipelines
- Billet churn
- Unexecutable billet structures

Strategic goals for MPT&E to improve fleet manning

We identified the need for four strategic goals for Navy MPT&E management:

- ***Stability*** in MPT&E planning and execution from one year to the next
- ***Alignment*** of MPT&E processes and procedures
- ***Flexibility*** as a primary means of attaining stability
- ***Executable*** goals

Holistic MPT&E management process

We identified the need for a holistic and coordinated MPT&E management process, and we propose that the Navy address each of the following four questions for each enlisted community:

1. Can the inventory attain and maintain the authorizations' pay grade structure? That is, is the billet structure ***executable***?
2. Can the inventory attain and maintain the authorizations' pay grade distribution at sea? In other words, is the billet structure ***aligned*** with sea/shore flow policies and practice?
3. How quickly can we transition from today's inventory to the sustainable target inventory, while limiting accession fluctuations? Will there be ***stability*** during the transition?
4. Do we have the policies and procedures available to implement the above steps? This requires ***flexibility*** in execution.

Individual “solutions” for improved fleet manning

We identified the following so-called solutions that would lead to improved fleet manning:

1. Ensure that billet structure is executable.
2. Align requirements and funding.
3. Align tours, obligations, and paygrades.
4. Fix sea/shore imbalances in the senior paygrades.
5. Shorten shore tours for geographic stability.
6. Align sea pays with other pays.
7. Reduce billet churn.
8. Reduce complexity of training pipeline.
9. Level-load accessions.
10. Minimize year-to-year fluctuations.
11. Use PACTs as a relief valve.
12. Seek endstrength relief.

Attainable Fit

Our analysis indicates that 90-percent Fit levels are about the best the Navy can achieve without systemic changes to MPT&E processes. Many of the required systemic changes are described in this report, and, to the extent that they are implemented, attainable Fit levels would rise.

There is a level of friction that derives from issues not addressed in this report (personnel that are not worldwide assignable, assignments for pregnant women, lack of funding for contact relief, etc.). So, even if all of our recommendations were implemented, we estimate 94 percent as an upper bound on attainable Fit levels.

The above limits address aggregate levels of attainable Fit. It is possible to attain higher levels of Fit on individual units if they are given sufficient distribution priority.

Recommendations

We have two recommendations, each of which was described earlier in detail and was summarized on the previous page:

- Implement a holistic MPT&E management process.
- Implement the 12 so-called solutions that support the goals of *Stability*, *Alignment Flexibility* and *Executability*.

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Appendix A: Additional rules for NEC Fit

Reference [2] includes the following additional rules and caveats for calculating NEC Fit:

- 336X and 339X NEC Fit are forced to Supervisor payband, and 335X and 338X are forced to Journeyman payband. This rule is coded but not visible to the user because these NECs are specifically excluded from NEC Fit due to their presence in RCN Fit.
- 95XX series NECs – If NEC manual does not identify a source rating, rating match is not a criterion in determining Fit. Sailor will count as Fit if DNEC'd and NEC held and is in the correct payband. Sailor can be from any rating and does not have to match the billet rating.
- 0170 Surface Rescue Swimmer and 5345 Scuba Diver do not need to be DNEC'd by BUPERS, do not require a rating match (rating is set to NA), and are forced to the Journeyman payband.
- Multiple source rating NECs – If NEC manual identifies multiple source ratings, rating match is not a criterion in determining Fit. A sailor will count as Fit if DNEC'd and NEC held and is in the correct payband. Sailor can be from any rating in the NEC manual and does not have to match the billet rating. Exceptions include the following NECs: 8206, 8208, 8209, 8210, 8216, 8220, 8227, 8228, 8235, 8241, 8245, 8250, 8251, 8252, 8278, 8279, 8284, 8289, 8295, 8296, 8303, 8305, 8306, 8307, 8310, 8311, 8312, 8313, 8314, 8316, 8318, 8319, 8332, 8341, 8342, 8343, 8351, 8361, 8362, 8363, 8364, 8373, 8378, 8379, 8380, 8388, 8389, 8391, 8392, 8805, 8806, 8807, 8808, 8819, 8832, 8841, 8842, 8843, and 8878.
- For all other NECs, a person of one rating may not be substituted for another rating even though he or she holds the same NEC.

- Any portion of an NEC/rating/SJA payband manned above 100 percent is not included in the computation.
- NEC 2781 is excluded from NEC Fit for SUBFOR units.
- The following closed-loop NECs are excluded from all enlisted NEC Fit computations: 0054, 0167, 0215, 0304, 2005, 2006, 2186, 2514, 3353, 3354, 3355, 3356, 3363, 3364, 3365, 3366, 3383, 3384, 3385, 3386, 3393, 3394, 3395, 3396, 4131, 5323, 5326, 5333, 5335, 5337, 5341, 5342, 5343, 5352, 5633, 5931, 5932, 5933, 7805, 7807, 7815, 7835, 7836, 7841, 7842, 7861, 7862, 7873, 7875, 7876, 7886, 8202, 8209, 8220, 8227, 8228, 8229, 8235, 8241, 8245, 8250, 8251, 8252, 8265, 8278, 8279, 8284, 8289, 8300, 8402, 8403, 8406, 8407, 8408, 8410, 8416, 8425, 8427, 8432, 8434, 8452, 8454, 8463, 8466, 8467, 8482, 8483, 8485, 8486, 8489, 8493, 8494, 8496, 8503, 8506, 8541, 8701, 8702, 8708, 8752, 8753, 8765, 90GS, 9401, 9402, 9508, 9515, 9517, 9518, 9519, 9520, 9522, 9575, 9578, 9579, 9580, 9585, 9586, 9587, 9800, 9999. These NECs are included in enlisted RCN Fit.
- The following NECs are also excluded from all enlisted NEC Fit computations: 0053, 0055, 2612, 2735, 4140, 4340, 4342, 4343, 4344, 4346, 4540, 4541, 4542, 4651, 4911, 4952, 5339, 7846, 8012, 8288, 8401, 8409, 9203, 9209, 9211, 9216, and 9545.
- The following RCNs are excluded from all enlisted NEC Fit computations: 0051, 0052, 0053, 0054, 0072, 0092, 3353, 3354, 3355, 3356, 3363, 3364, 3365, 3366, 3383, 3384, 3385, 3386, 3393, 3394, 3395, 3396, 3600, 5000, 7800, and 6000.
- NECs held where no BA at the UIC/payband level are excluded from NEC Fit regardless of DNEC.
- NEC 8404 Fit is computed as the count of held/DNEC for NEC and rating divided by the count of P9BA for NEC and rating. Any portion of an NEC/rating manned above 100 percent is not included in the computation.

Appendix B: Other community case studies

In this appendix, we describe the other four case studies: Aviation Boatswain's Mate–Launch/Recovery (ABE), Culinary Specialist (CS), Engineman, Surface, Main Propulsion (ENSW), and Aviation Boatswain's Mate–Aircraft Handling (ABH).

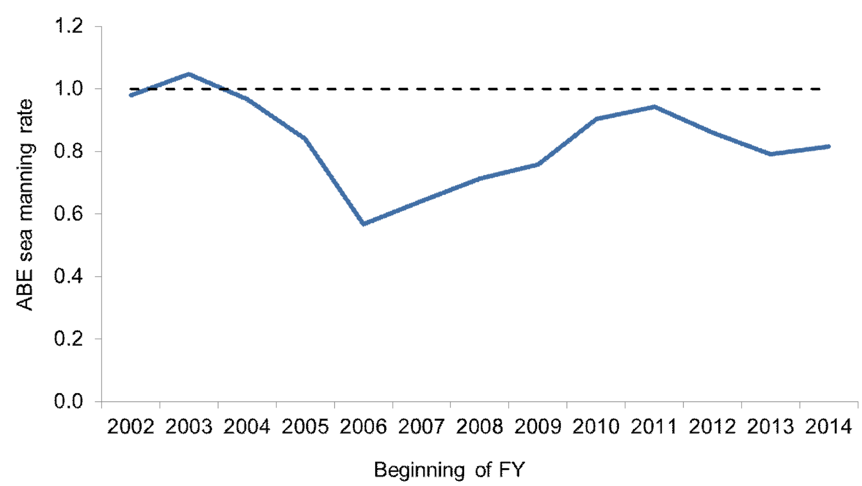
As in the main text, we begin each case study by documenting historical trends in the sea manning rate, defined as the ratio between inventory at sea and BA at sea. Then, we examine current sea manning rates by paygrade and explore what policies can be used to address undermanning and overmanning.

Case study: ABE

Historical trends in ABE sea manning

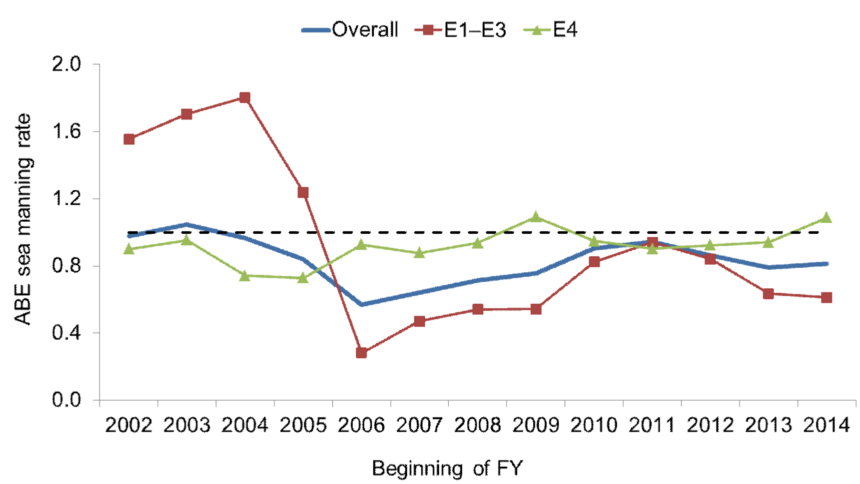
Figure 50 shows that the ABE has been consistently undermanned at sea. Since FY 2006, however, the ABE sea manning rate has steadily increased. Still, as of the start of FY 2014, ABE remains undermanned at sea.

Figure 50. ABE sea manning rate



ABE sea manning rates vary considerably by paygrade (see figures 51 to 53). Most notably, the ABE E-1–E-3 paygrades were overmanned in the early 2000s, until the sea manning rate plummeted starting in FY 2005.[36] The ABE E-1–E-3 sea manning rate bottomed out in FY 2006, recovered to nearly full manning at sea by FY 2011, only to fall starting in FY 2012. The sea manning rate for the ABE E-4 paygrade has been relatively stable over time, hovering near full manning at sea. The ABE E-5, E-7, and E-8 paygrades generally have been undermanned historically, whereas the ABE E-6 paygrade generally has been overmanned historically.[37]

Figure 51. ABE sea manning rate, overall and for E-1–E-3 and E-4



36. The precipitous decline in the ABE E-1–E-3 sea manning rate is due, in large part, to the reclassification of Airmen GENDET (AN) BA to such EMCs as ABE and ABH.

37. ABE (along with ABF and ABH) compresses and merges into AB at E-9.

Figure 52. ABE sea manning rate, overall and for E-5 and E-6

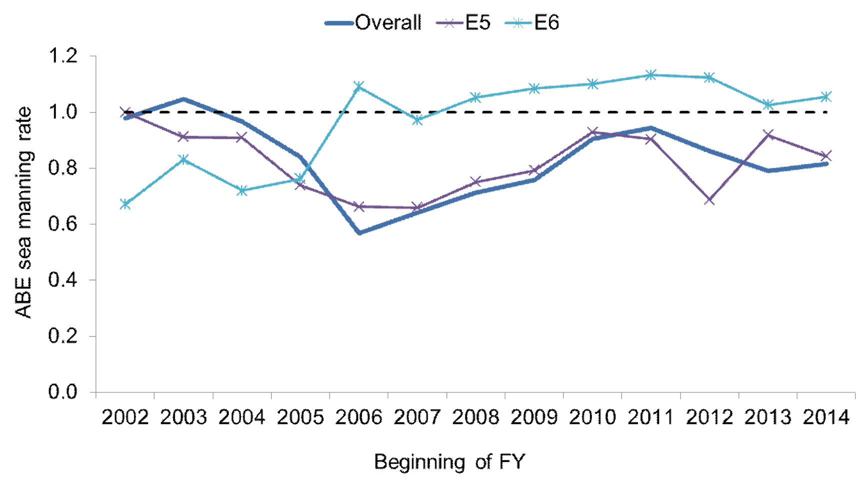
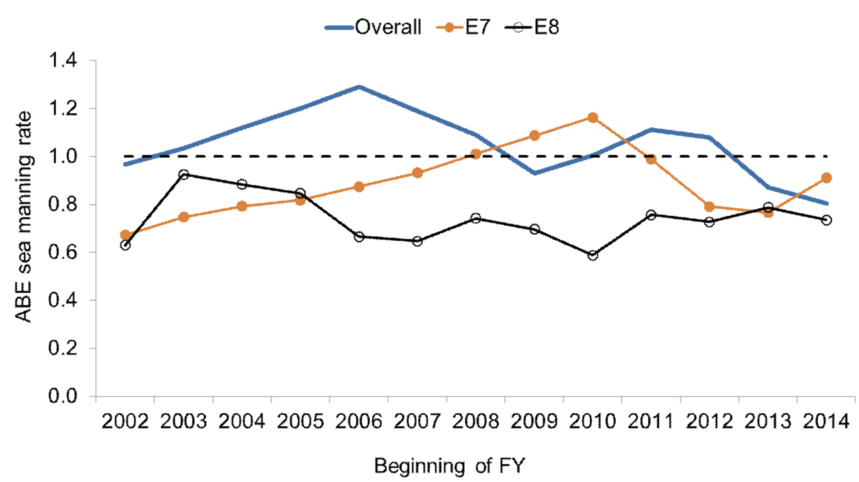


Figure 53. ABE sea manning rate, overall and for E-7 and E-8



Policies that address current ABE overmanning and undermanning at sea

Shifting our focus to current ABE sea manning rates, we now consider policies that will address ABE overmanning and undermanning at sea. Consistent with our bottom-up approach, we begin by evaluating different combinations of initial obligation and sea tour lengths.

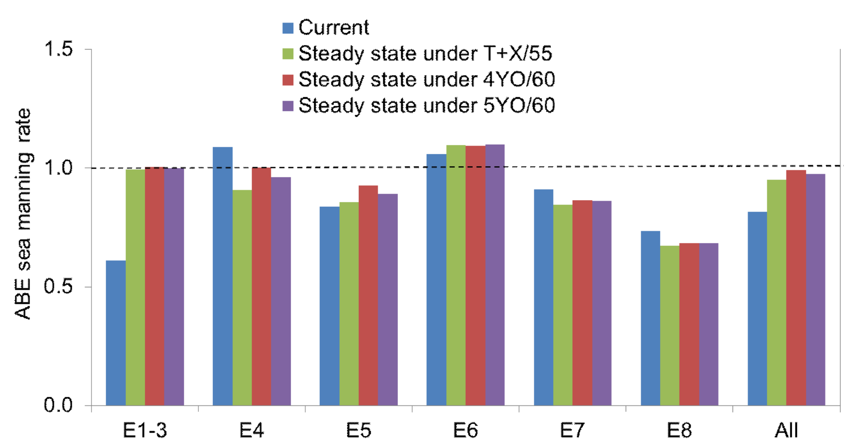
Then, we discuss other policy options to consider, including an agricultural fix, shorter shore tours, and adding shore BA.

Initial obligation and first-sea-tour length

First, we simulate the effect on sea manning rates of different combinations of initial obligation and first sea tour length. We simulate three alternatives. First is T+X/55, where the ABE first-sea-tour length is set to 55 months (the difference between the T+X 5-year initial obligation and ABE initial training of 5 months). T+X/55 is the combination currently being used by the ABE community. The other two alternatives we simulate are 4YO/60 and 5YO/60.

While the steady-state overall sea manning rate is higher than the current overall sea manning rate under all three alternatives, 5YO/60 is preferable to T+X/55 or 4YO/60 (figure 54). 5YO/60 achieves higher sea manning rates in steady state, both overall and by paygrade, than T+X/55. Moreover, 5YO/60 will require less recruiting (and therefore less training) costs than 4YO/60 while still achieving sizable sea manning gains in steady state.

Figure 54. Current and steady-state ABE sea manning rates under alternative initial obligation and first-sea-tour-length assumptions



As a 5YO program, we estimate that 376 ABE sailors are required to reach the fleet each year. Since the ABE training pipeline is five months long, but the first three months are spent in bootcamp, ABE sailors spend two months (or one-sixth) of their first year of service in ABE student IA billets. Therefore, we estimate that 63 ABE student IA billets are required (e.g., 376/6). Currently, however, there are only 29 ABE student IA billets.

Shorter first shore tours, longer third shore tours

To address undermanning at sea in the ABE E-5 paygrade, we simulate the effect of shortening the first shore tour to 30 months. By doing so, ABE sailors will return to sea sooner for their second sea tours, increasing manning at sea in the E-5 paygrade. Next, to address undermanning at sea in the ABE E-7 and E-8 paygrades, we simulate the effect of lengthening the third sea tour to 48 months.

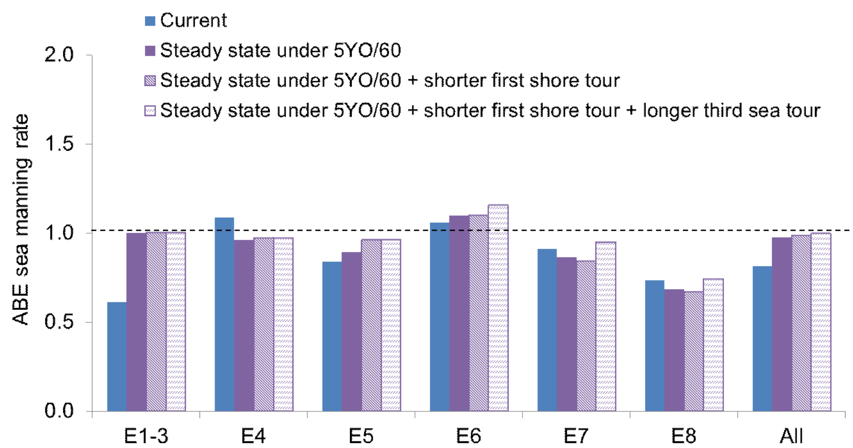
Simulated effect on sea manning rates

Figure 55 shows the effect of 5YO/60 plus shorter first shore tours and longer third sea tours on steady-state ABE sea manning. Relative to the current ABE overall sea manning rate of 0.82, shifting from the current T+X/55 to 5YO/60 increases the ABE overall sea manning rate to 0.98 in steady state. The effect is primarily concentrated in the ABE E-1–E-3 sea manning rate, which increases from its current value of 0.61 to 1.00 under 5YO/60 in steady state.

Adding shorter ABE first shore tours improves manning at sea overall by 1 additional point to 0.99, and it drives sea manning for the E-5 paygrade from 0.89 under 5YO/60 alone to 0.96. The ABE E-6 paygrade is slightly overmanned in steady state under these policies, and the overage among E-6s at sea (an excess of 20 sailors) can compensate for the remaining gap at sea for E-5 (a shortage of 11 sailors).

Lengthening the third shore tour drives the overall ABE sea manning rate to 1.00. The ABE E-7 sea manning rate increases from 0.85 to 0.95 (a remaining gap of 4 sailors). The ABE E-8 sea manning rate increases from 0.67 to 0.74 (a remaining gap of 9 sailors). There are various options for closing the E-7 and E-8 sea manning gaps further, including buying additional E-8 BA, moving some E-7 BA to E-6 BA, incentivizing sailors to go back to their fourth and fifth sea tours earlier or to stay on their third sea tours longer, or lengthening fourth and fifth sea tours. Because of the potential retention implications, it may be most cost-effective to buy additional E-8 BA.

Figure 55. Current and steady-state ABE sea manning rates: 5YO/60 plus shorter first shore tours and longer third sea tours



Case study: CS

Historical trends in CS sea manning

As figure 56 shows, CS was undermanned at sea in the early 2000s, overmanned or manned at nearly 100 percent at sea in the middle to late 2000s, and has been undermanned at sea again since FY 2011.

Examining CS sea manning rates by paygrade (see figures 57 to 59), we see that the E-1–E-3 sea manning rate follows a similar pattern to the overall sea manning rate. The CS E-1–E-3 paygrades were undermanned at sea in the early-2000s, overmanned at sea in the middle to late 2000s, and then undermanned at sea again from FY 2008 through today (with the exception of FY 2011). The CS E-4 sea manning rate followed nearly the exact opposite pattern. The CS E-5 and E-6 paygrades generally have been undermanned at sea since FY 2002 (with the exception of the late 2000s for E-5). The CS E-7, E-8, and E-9 historically have been undermanned at sea, but in FY 2014 the CS E-7 sea manning rate reached parity.

Figure 56. CS sea manning rate

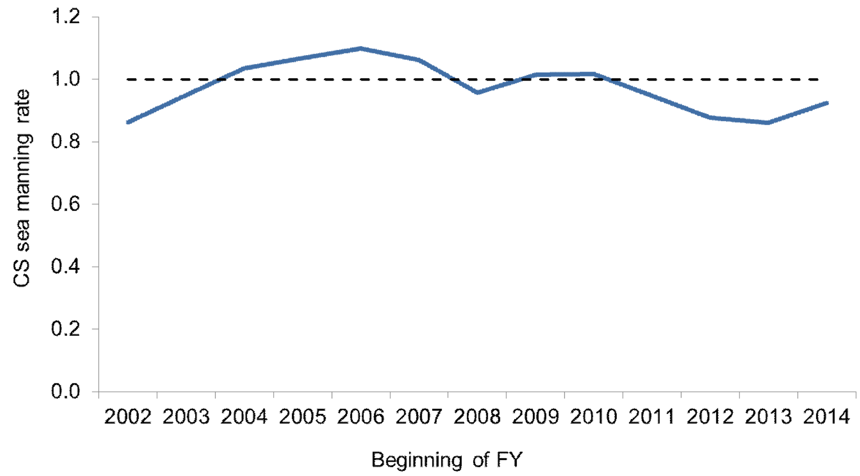


Figure 57. CS sea manning rate, overall and for E-1–E-3, and E-4

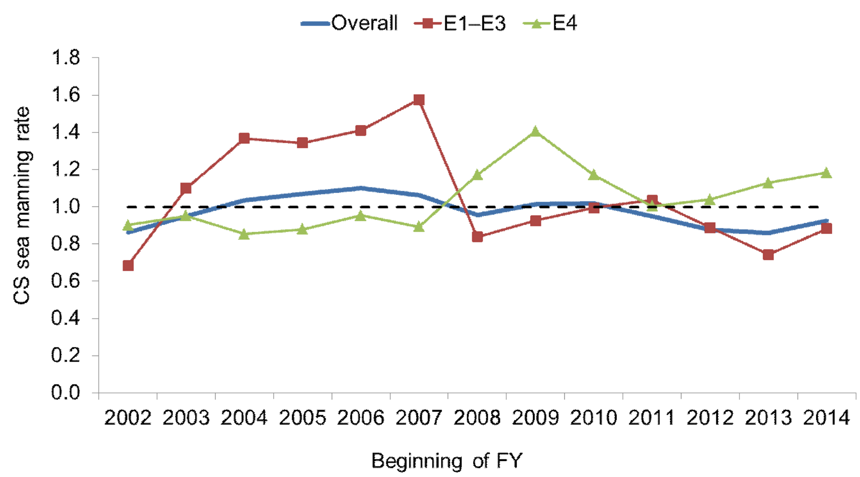


Figure 58. CS sea manning rate, overall and for E-5 and E-6

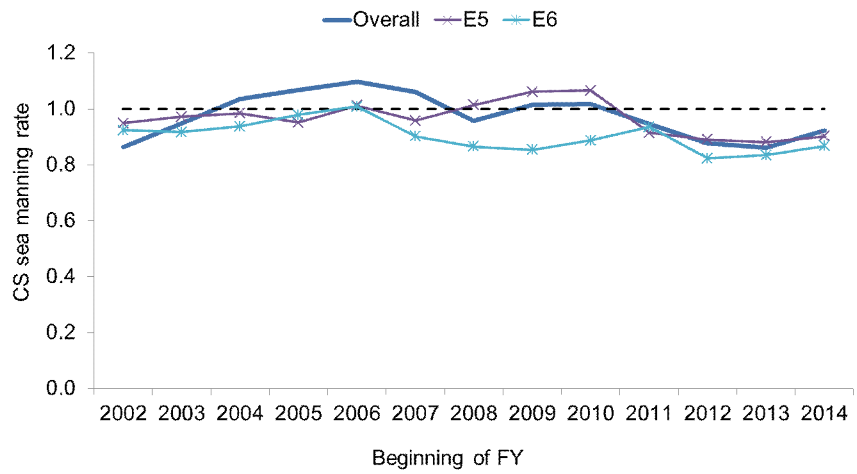
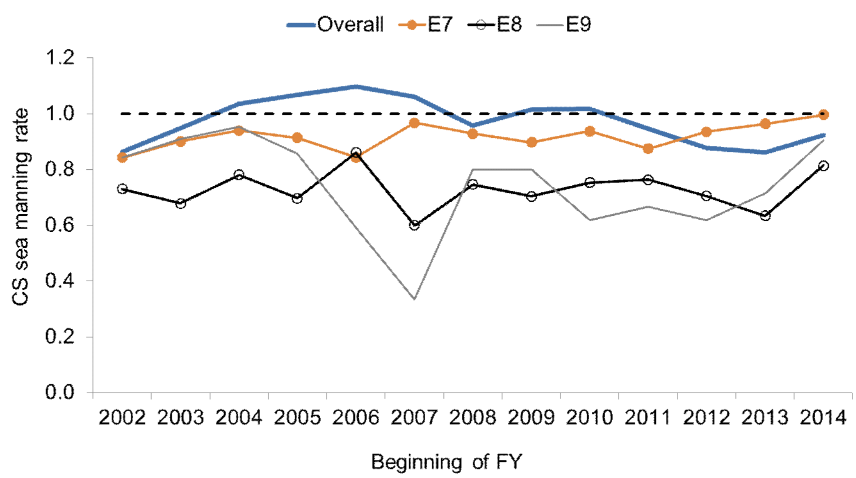


Figure 59. CS sea manning rate, overall and for E-7, E-8, and E-9



Policies that address current CS overmanning and undermanning at sea

Turning to current CS sea manning rates, we consider policies that will address CS overmanning and undermanning at sea. Unlike the other case studies, we do not begin by evaluating different combinations of initial obligation and sea tour lengths for CS. CS is, and always has been, a 4YO, non-sea-intensive community. As our model simulations show, sticking with the current 4YO/54 combination does not produce a sea manning problem in steady state. So, we assume that the EMC will keep 4YO/54, and then we discuss another policy option to consider: lengthening both the first shore tour and the third sea tour.

Under 4YO/54, we estimate that 828 CS sailors are required to reach the fleet each year. Since the CS training pipeline is five months long, and the first three months are spent in bootcamp, CS sailors spend two months (or one-sixth) of their first year of service in CS student IA billets. Therefore, we estimate that 138 CS student IA billets are required (e.g., 828/6). Currently, however, there are only 82 CS student IA billets.

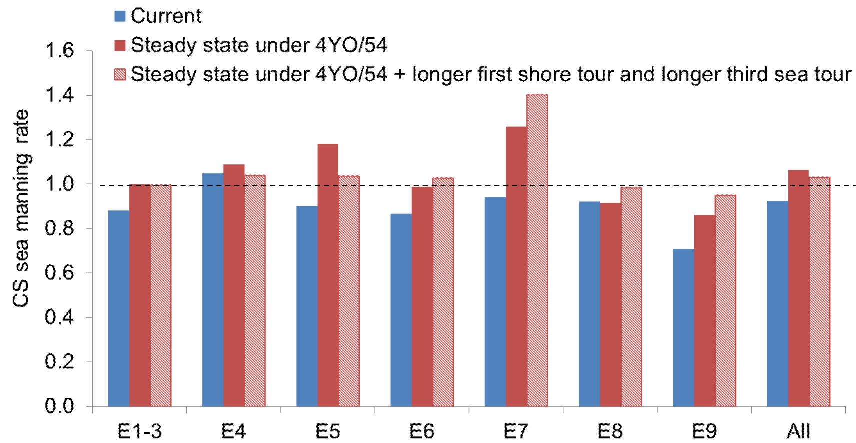
Lengthening the first shore tour, lengthening the third sea tour

We begin by addressing overmanning at sea among CS E-5 sailors by simulating a longer first shore tour. This should cause CS sailors to go back to sea on their second sea tour later, driving down the E-5 sea manning rate. Next, we simulate a lengthening of the third CS sea tour to ramp up the E-8 and E-9 sea manning rates.

Simulated effect on sea manning rates

Figure 60 shows the effect on steady-state CS sea manning rates of lengthening the first shore tour and third sea tour. CS is an excellent example of how an EMC's current sea manning rate may be very different from the model's steady-state prediction, even in the absence of any policy changes. Since we do not model a change in the initial obligation and first sea tour length for CS, the difference between the first and second set of bars in figure 60 arises because the simulation model assumes there are no shocks, such as changes in BA, accessions, or retention, in steady state. For CS, this means that the overall sea manning rate rises from the current value of 0.92 to 1.06 in steady state with no change in policy. Moreover, the CS E-5 and E-7 paygrades go from currently being undermanned at sea (with values of 0.90 and 0.94, respectively) to being overmanned at sea in steady state (with values of 1.18 and 1.26, respectively) with no change in policy.

Figure 60. Current and steady-state CS sea manning rates: 4YO/54 plus longer first shore tour and longer third sea tour



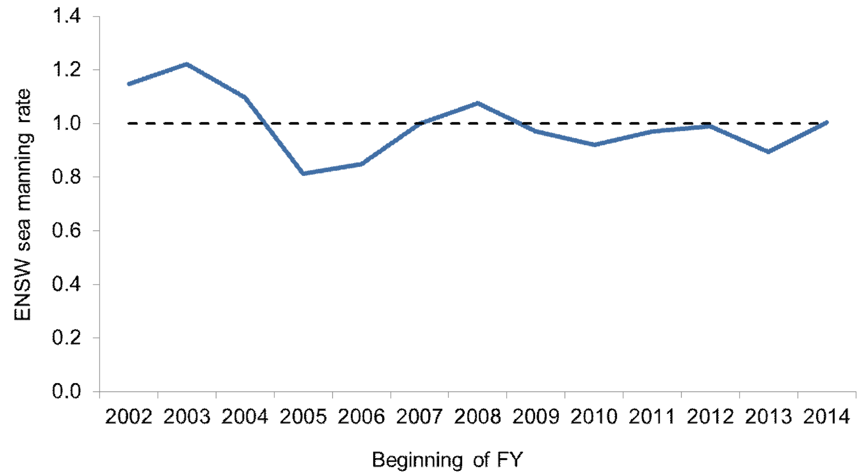
The policy changes we simulate are aimed at driving down the CS E-5 overmanning at sea and the CS E-8 and E-9 undermanning at sea that would arise in steady state with no change in policy. Lengthening the first shore tour drives down the CS E-5 sea manning rate from 1.18 to 1.04 in steady state. Lengthening the first shore tour and third sea tour drives up the CS E-8 and E-9 sea manning rates, from 0.92 and 0.96, respectively, to 0.98 and 0.95. Perhaps the easiest and most cost-effective way of closing the remaining CS E-8 and E-9 sea manning gaps (a shortage of two E-8 and one E-9 CS sailors at sea) is to use incentive pays to elicit slightly more sea duty out of these senior sailors. One final note: These policy changes do lead to overmanning at sea at the E-7 paygrade, which could be mitigated by assigning fewer E-7s to sea duty.

Case study: ENSW

Historical trends in ENSW sea manning

As figure 61 shows, the ENSW overall sea manning rate jumped around in the early 2000s, and has stayed near perfect manning at sea since then.

Figure 61. ENSW sea manning rate



The pattern in the ENSW E-1–E-3, E-5, E-6, and E-7 paygrades is very similar to the overall pattern, with the exception of the considerable overmanning at sea in the early 2000s (see figures 62 to 65). However, the sea manning rates for E8s and E9s have seen much larger swings historically.

Figure 62. ENSW sea manning rate, overall and for E-1–E-3

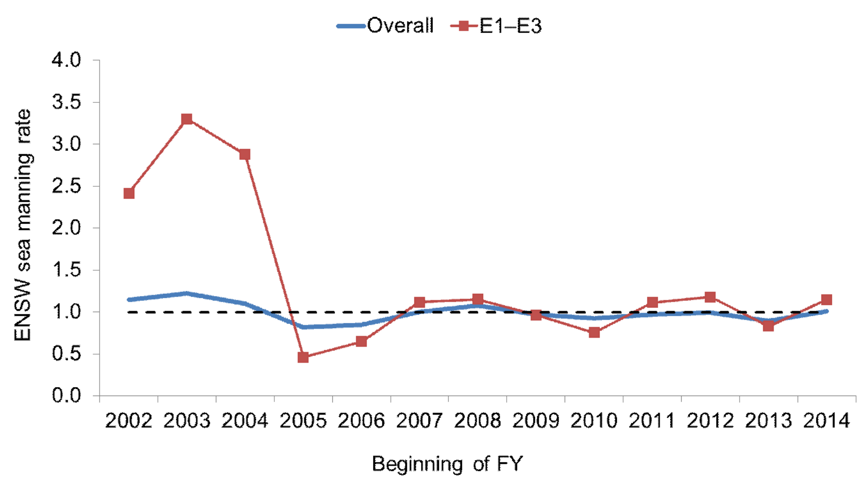


Figure 63. ENSW sea manning rate, overall and for E-4

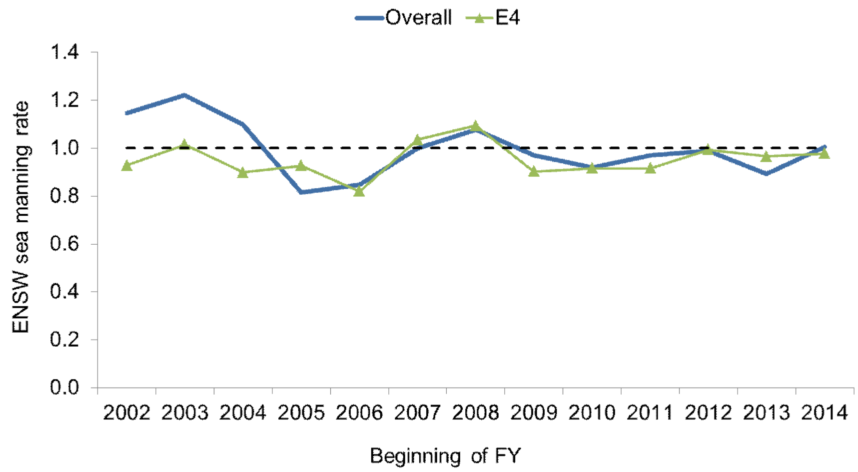


Figure 64. ENSW sea manning rate, overall and for E-5 and E-6

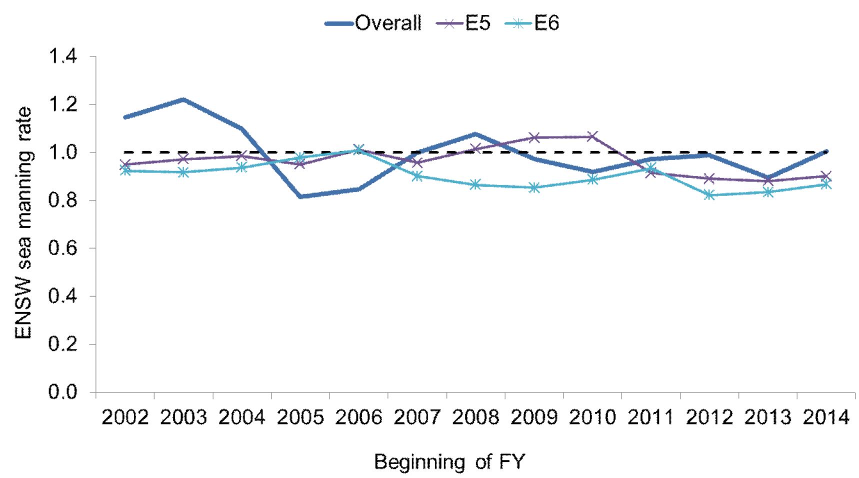
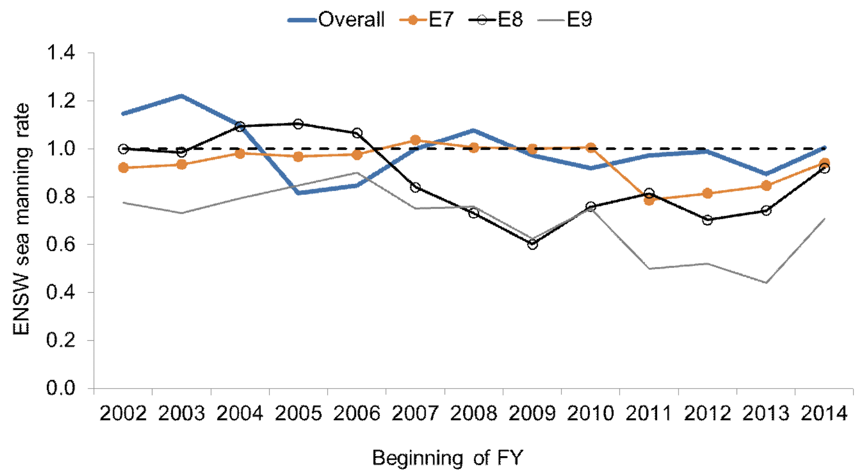


Figure 65. ENSW sea manning rate, overall and for E-7, E-8, and E-9



Policies that address current ENSW overmanning and undermanning at sea

Turning to current ENSW sea manning rates, we consider policies that will address ENSW overmanning and undermanning at sea. First, we evaluate different combinations of initial obligation and sea tour lengths. Then, we discuss another policy option to consider: shortening the first shore tour, lengthening the second shore tour, and lengthening the third sea tour.

Initial obligation and first-sea-tour length

We simulate the effect on sea manning rates of three different combinations of initial obligation and first-sea-tour length. First is T+X/54, where the ENSW first-sea-tour length would be set to 54 months if it entered the T+X program (54 months is the difference between the T+X 5-year initial obligation and ENSW initial training of 6 months). The other two alternatives we simulate are 4YO/60 (the combination currently in use for ENSW) and 5YO/60.[38]

38. ENSW is the only sea-intensive EMC we studied that currently has a four-year initial obligation (with a 60-month first sea tour).

As figure 66 shows, all three alternatives produce fairly high rates of sea manning overall in steady state. As was the case for GSE, though to a much lesser extent here, in each alternative, the ENSW E-1–E-3 paygrades are overmanned at sea in steady state and the ENSW E-4 paygrade is undermanned at sea in steady state. This is because the overall (sea and shore combined) BA is out of balance (figure 67). There are 20 percent more E-4 BA than E-1–E-3 BA, and 15 percent more E-5 BA than E-4 BA. E-4 sailors are advanced as quickly as possible to meet the E-5 requirement, but TIR requirements stall the advancement of E-3 sailors to fill the E-4 vacancies. Therefore, there are far too few E-1–E-3 BA to grow enough sailors to satisfy the E-4 and E-5 BA, leading to an inventory-BA paygrade imbalance and problems with manning at sea. Indeed, our simulations show there will be issues with steady state overall manning (sea and shore combined) for the ENSW E-1–E-3 and E-4 paygrades. In steady state, the ENSW E-1–E-3 overall manning rate will be 1.18 under 4YO and 1.05 under 5YO, whereas the E-4 overall manning rate will be 0.87 under 4YO and 0.96 under 5YO.

Figure 66. Current and steady-state ENSW sea manning rates under alternative initial obligation and first-sea-tour-length assumptions

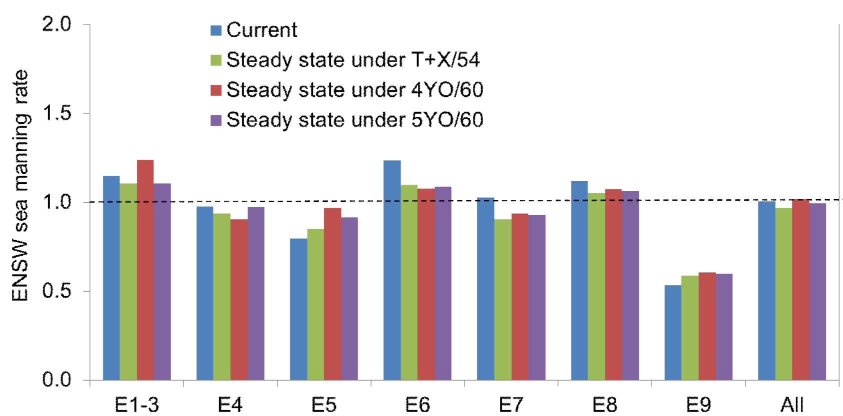
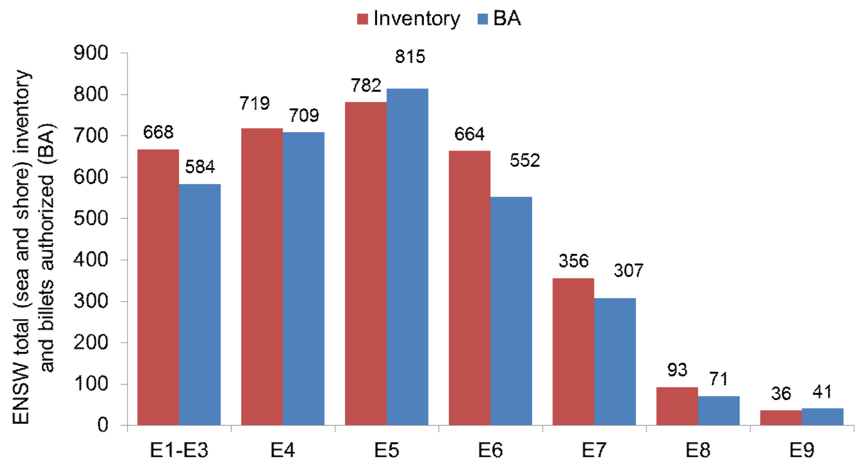


Figure 67. Current ENSW total (sea and shore combined) inventory and BA by paygrade



As was the case for GSE, fixing the sea manning mismatches for the ENSW E-1–E-3 and E-4 paygrades can only be fixed by changing the underlying BA and not through our simulated sea-tour-related policy changes. Therefore, when choosing between the three combinations of initial obligation and first sea tour lengths, we choose the combination that performs the best for E-1–E-3 and E-4: 5YO/60. Next, we address the other paygrade-specific sea manning problems with additional policy changes.

Under 5YO/60, we estimate that 335 ENSW sailors are required to reach the fleet each year. Since the ENSW training pipeline is six months long, and the first three months are spent in bootcamp, ENSW sailors spend three months (or one-fourth) of their first year of service in ENSW student IA billets. Therefore, we estimate that 84 ENSW student IA billets are required (e.g., 335/4). Currently, however, there are only 59 ENSW student IA billets. If ENSW stays at 4YO/60, the problem is more severe. Under 4YO/60, 378 ENSW sailors are required to reach the fleet each year, translating into a requirement of 95 ENSW student IA billets.

Shortening the first shore tour, lengthening the second shore tour, and lengthening third sea tour

The mismatch in sea manning for E-1–E-3 and E-4 is small; under 5YO/60, E-1–E-3 is overmanned at sea in steady state by 50 sailors, whereas E-4 is undermanned at sea in steady state by 18 sailors. If this mismatch needs to be addressed, it could be accomplished by shifting a small number of E-4 BA to E-3 BA.

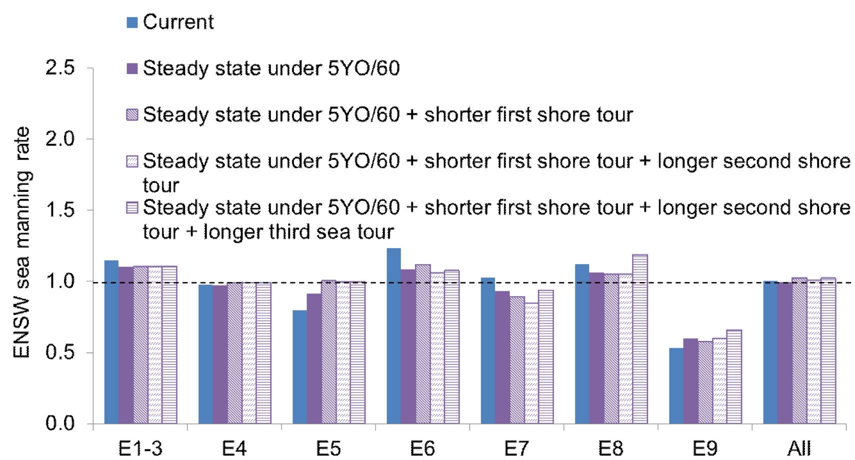
The bigger ENSW sea manning issues exist at the higher paygrades. To address ENSW E-5, E-7, and E-9 undermanning at sea and E-6 and E-8 overmanning at sea, we simulate the effect of shortening the first shore tour to 26 months, lengthening the second shore tour to 48 months, and lengthening the third sea tour to 48 months. Shortening the first shore tour is meant to address E-5 undermanning at sea by getting sailors back to sea in their second sea tours sooner. Lengthening the second shore tour is meant to reduce the E-6 sea manning rate by delaying the time when sailors return to sea for their third sea tours. Finally, lengthening the third sea tour is aimed at closing some of the E-9 sea manning gap. As was the case with AO, per Sea Shore Flow policy, ENSW sailors' third sea tours are meant to be 48 months long, but data suggest that sailors stay for only 36 months at sea. So, in the model, we assume that third and higher sea tours are 36 months long as a baseline, and it will likely take extra incentives to get these sailors to serve longer at sea.

Simulated effect on sea manning rates

Figure 68 shows the implications of a shift to 5YO/60 and the changes to sea and shore tour lengths listed earlier on steady-state sea manning rates. In all cases, overall ENSW sea manning rates are right near 1.0. The main improvements in sea manning brought about by the policy changes are seen for the E-5, E-7, and E-9 paygrades.

The ENSW E-5 paygrade sea manning rate increases from the current value of 0.80 to 0.92 in steady state with 5YO/60. Moreover, the ENSW E-5 paygrade sea manning rate rises another 9 points, to 1.01, with shorter first shore tours. The ENSW E-7 paygrade sea manning rate falls from the current value of 1.03 to 0.93 in steady state under 5YO/60, and falls further to 0.89 in steady state with the addition of shorter first shore tours and to 0.85 with the addition of the longer second shore tours. It is only with the addition of longer third sea tours that the ENSW E-7 sea manning rate begins to rise, to 0.94 (a shortage of 11 sailors) in steady state.

Figure 68. Current and steady state ENSW sea manning rates: 5YO/60 plus shorter first sea tours, longer second shore tours, and longer third shore tours



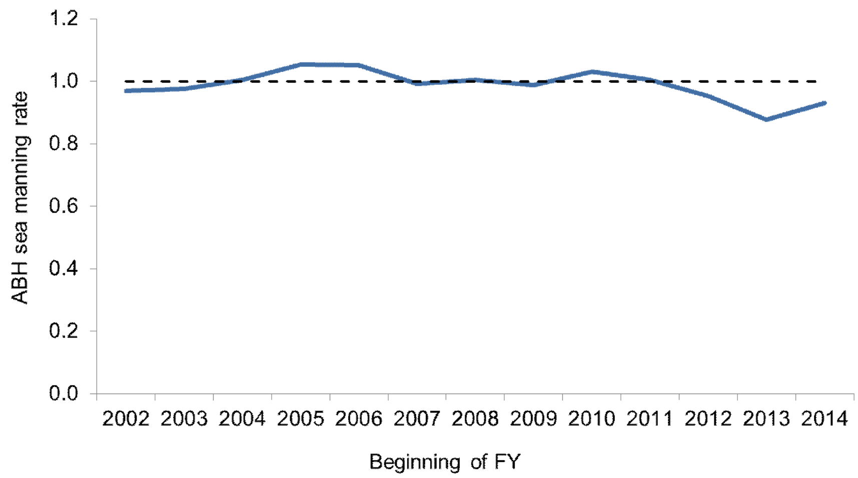
For the ENSW E-9 sea manning rate, small increases arise with each of the policy alternatives, but altogether the rate only increases from the current value of 0.53 to 0.66 (a shortage of 10 sailors) in steady state with all of the simulated policies in place. Options for closing the remaining ENSW E-9 sea manning gap (which amounts to a shortage of 10 ENSW E-9 sailors at sea) include increasing E-9 BA and/or shifting some E-9 sea BA to E-8.

Case study: ABH

Historical trends in ABH sea manning

As figure 69 shows, similar to ENSW and OS, the ABH overall sea manning rate has hovered around perfect manning at sea until recently. The ABH overall sea manning rate fell below 1.0 in FY 2012, declined again in FY 2013, then started to recover in FY 2014.

Figure 69. ABH sea manning rate



Looking at ABH sea manning rates by paygrade (figures 70 to 72), we see that the ABH E-1–E-3 paygrades were overmanned at sea in the early 2000s. But, the ABH E-1–E-3 sea manning rate fell precipitously in the middle 2000s and the paygrade group has been undermanned at sea ever since.[39] The ABH E-4, E-5, E-6, and E-7 sea manning rates have hovered near perfect manning since the early 2000s. The ABH E-8 paygrade consistently has been undermanned historically.[40]

Policies that address current ABH overmanning and undermanning at sea

Turning to current ABH sea manning rates, we consider policies that will address ABH overmanning and undermanning at sea. First, we evaluate different combinations of initial obligation and sea tour lengths. Then, we discuss another policy option to consider: lengthening the third sea tour.

39. Recall that the precipitous decline in the ABH (and ABE) E-1–E-3 sea manning rate is due, in large part, to the reclassification of Airmen GENDET (AN) BA, to such EMCS as ABE and ABH.

40. Recall that ABH (along with ABE and ABF) compresses into AB at E-9.

Figure 70. ABH sea manning rate, overall and for E-1–E-3 and E-4

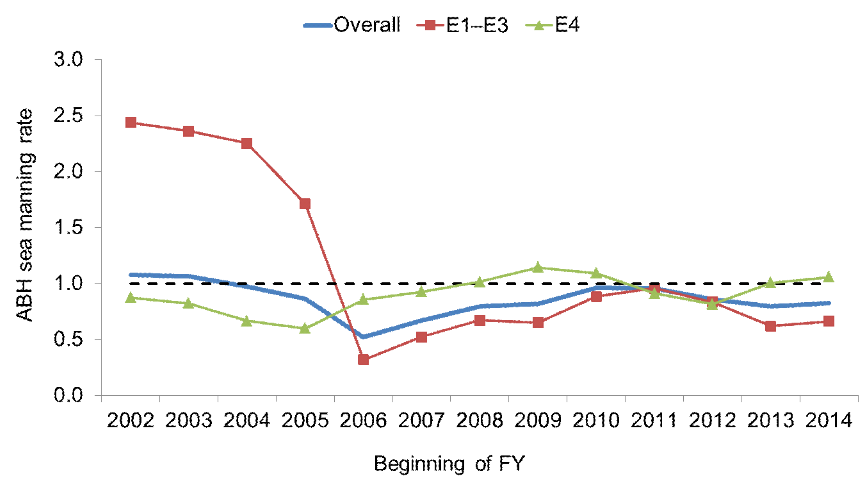


Figure 71. ABH sea manning rate, overall and for E-5 and E-6

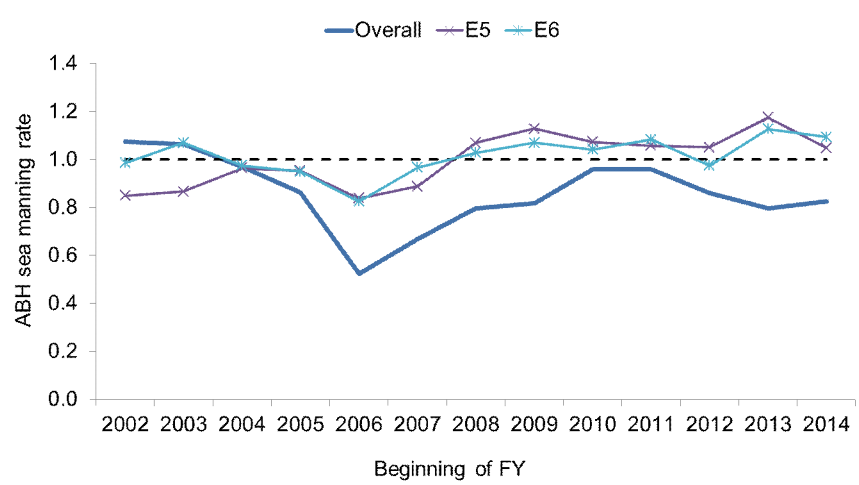
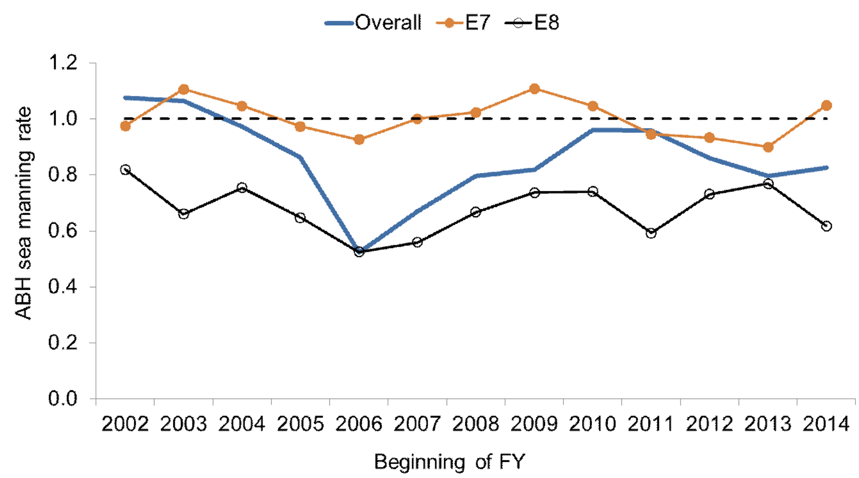


Figure 72. ABH sea manning rate, overall and for E-7 and E-8



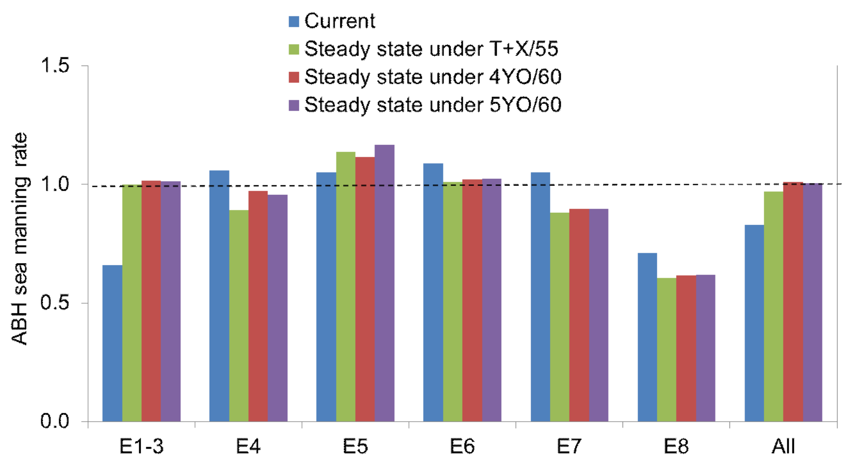
Initial obligation and first-sea-tour length

We simulate the effect on sea manning rates of three different combinations of initial obligation and first sea tour length. First is T+X/55, where the ABH first sea tour length is 55 months under the T+X program (55 months is the difference between the T+X 5-year initial obligation and ABH initial training of 5 months). T+X/55 is the combination currently being used by the ABH community. The other two alternatives we simulate are 4YO/60 and 5YO/60.

As figure 73 shows, 5YO/60 is preferable over 4YO/60 or T+X/55. Overall sea manning is closest to 1.00 under 5YO/60, and 5YO/60 closes a good portion of the E-4 gaps at sea.

Under 5YO/60, we estimate that 730 ABH sailors are required to reach the fleet each year. Since the ABH training pipeline is five months long, and the first three months are spent in bootcamp, ABH sailors spend two months (or one-sixth) of their first year of service in ABH student IA billets. Therefore, we estimate that 122 ABH student IA billets are required (e.g., 730/6). Currently, however, there are only 71 ABH student IA billets.

Figure 73. Current and steady-state ABH sea manning rates under alternative initial obligation and first-sea-tour-length assumptions



Lengthening the third sea tour

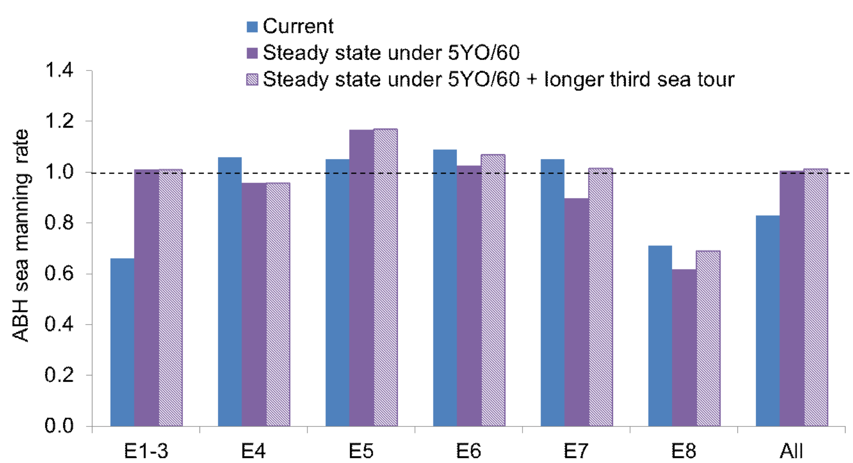
We focus next on the other paygrades where sea manning is low: ABH E-4, E-7, and E-8. In steady state, under 5YO/60 the overage in ABH E-5 sailors at sea will compensate for the shortage in ABH E-4 sailors at sea—there are 51 excess ABH E-5 sailors at sea and 36 ABH E-4 gapped sea billets. So, we consider policies that will address undermanning among ABH E-7 and E-8. Specifically, we simulate lengthening the third sea tour to 48 months. Again, per Sea Shore Flow policy, ABH sailors are expected to serve for 48 months on their third sea tours. But, the data show that these sailors stay only 36 months at sea. So, in the model we assume that third (and higher) sea tours are only 36 months long. As noted above, getting sailors to serve the full 48-month third sea tours likely will require some extra incentives.

Simulated effect on sea manning rates

Figure 74 shows the effect of shifting to 5YO/60 and lengthening third sea tours on steady-state ABH sea manning. Under 5YO/60 alone, the ABH overall sea manning rate rises from the current value of 0.83 to 1.01 in steady state. The greatest improvement is seen the ABH E-1–E-3 paygrades, where the sea manning rate rises from the current value of 0.66 to 1.01 in steady state.

In addition, lengthening the third sea tour raises the steady-state ABH E-7 sea manning rate from 0.90 under 5YO/60 alone to 1.01. The steady-state ABH E-8 sea manning rate rises as well, from 0.62 under 5YO/60 alone to 0.69 with a longer third sea tour. The remaining steady-state ABH E-8 sea manning gap (a shortage of 17 sailors) could be closed further in a variety of ways, such as adding more E-8 BA, pulling in any excess AB E-9 sailors at sea, and incentivizing ABH sailors to stay at sea longer at the end of their careers.

Figure 74. Current and steady-state ABH sea manning rates: 5YO/60 plus longer third sea tours



Glossary

ABE	Aviation Boatswain's Mate–Launch/Recovery
ABH	Aviation Boatswain's Mate–Aircraft Handling
AD	Aviation Machinist’s Mate
BA	Billets Authorized
BBD	Billet Based Distribution
BCR	Billet Change Request
BIT	Business Improvement Team
BM	Boatswain’s Mate
CNP	Chief of Naval Personnel
COB	Current On Board
CONUS	Continental United States
CS	Culinary Specialist
CSP	Career Sea Pay
CSPP	Career Sea Pay Premium
CVN	Nuclear Aircraft Carrier
DDG	Guided Missile Destroyer
DNEC	Distribution NEC
EAOS	End of Active Obligated Service
EFM	Exceptional Family Member
EMC	Enlisted Management Community
EMR	Enlisted Master Record
ENSW	Engineman, Surface, Main Propulsion
ESS-Sim	Enlisted Steady-State Simulation
FC-Aegis	Fire Controlman—Aegis
FFC	Fleet Forces Command
GM	Gunner’s Mate

GSE	Gas Turbine Systems Technician, Electrical
IA	Individuals Account
JOG	Job Occupational Group
LCS	Littoral Combat Ship
LIMDU	Limited Duty
MCM	Mine Countermeasure
MN	Mineman
MPT&E	Manpower, Personnel, Training & Education
NAVMAC	Navy Manpower Analysis Center
NCS	National Call to Service
NEC	Navy Enlisted Classification
NETC	Naval Education and Training Command
NPC	Navy Personnel Command
NTSP	Navy Training Systems Plan
NUI	Not Under Instruction
OCONUS	Outside the Continental United States
OS	Operations Specialist
OSD	Office of the Secretary of Defense
P9BA	Billets Authorized Project for 9 Months Out
PACFLT	Pacific Fleet
PACT	Professional Apprentice Career Track
PMO	Production Management Office
POM	Program Objective Memorandum
QDP	Quarterly Demand Planning
QMSW	Quartermaster–Surface Warfare
QOA	Quality of Alignment
RCN	Rating Control Number
ROI	Return on Investment

SAFE	Stability, Alignment, Flexibility, Executable
SJA	Supervisor/Journeyman/Apprentice
SME	Subject Matter Expert
SSN	Attack Submarine
STG	Sonar Technician–Surface
TFMMS	Total Force Manpower Management System
TIR	Time in Rate
TPHH	Transient, Patient, Prisoner, and Holdee
TRM	Training Requirements Manager
UIC	Unit Identification Code
VFA	F/A-18 Squadrons

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List of figures

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List of tables

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ANALYSIS & SOLUTIONS

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