Steady-State Accession Requirements
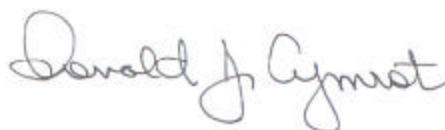
Michael L. Hansen • Henry S. Griffis
Deena Ackerman

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Donald J. Cymrot, Director
Workforce, Education and Training Team
Resource Analysis Division

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Background

Higher than anticipated retention caused the Navy to finish FY02 above planned endstrength. Despite cuts in the FY03 accession goal, there is a concern that the Navy strength might continue above planned levels. Even if the Navy stays below the congressionally mandated endstrength ceiling, remaining above planned strength will result in higher military personnel costs than expected. At the same time, there is a concern that accessions not drop too far below steady-state levels because too large a cut would leave the Navy with long-term manning problems.

In support of this effort, the Director, Programming Division (N80) asked CNA to analyze the Navy's steady-state, non-prior-service (NPS) accession requirements to see if further cuts in accessions would result in a cohort that is too severely undersized. The two central questions are:

1. What are reasonable expectations about continuation behavior in the steady state?

2. What risks are associated with temporarily dropping accessions below steady-state levels?

This analysis will help the Navy to better understand the determinants of steady-state accession requirements and to respond more effectively to fluctuations in both recruiting and retention environments.

Methodology and data

Accession requirements are a function of *continuation rates*, the proportion of existing servicemembers remaining in the Navy from one year to the next. For a given endstrength, the higher the continuation rate, the lower the number of accessions needed to replace

servicemembers who leave the Navy. Estimates of the steady-state accession requirement, then, depend heavily on assumptions about steady-state continuation rates.

We begin with an examination of continuation rates of enlisted personnel since the end of the drawdown, with a focus on notable changes in the behavior of servicemembers. We also analyze the sensitivity of steady-state, NPS accession requirements to different assumptions about continuation rates in the steady state. The section after that considers impending and potential changes in the environment faced by Sailors. Next, we assess the risk associated with lower than expected continuation behavior and how this risk influences the decision of whether to cut current accession goals. The final section presents our conclusions.

Our data come from CNA's holdings of the Enlisted Master Record data. In order to focus on post-drawdown retention behavior, our data span the FY97–02 time period. We also use data on the distribution of enlisted personnel at the end of FY02 to compare current cohorts with steady-state requirements.

Findings

Continuation rates have risen dramatically since the end of the drawdown. These sizable differences in continuation rates imply a wide range of estimates of the number of accessions needed to meet end-strength targets. Unfortunately, these differences also make it difficult to precisely estimate steady-state continuation behavior. Furthermore, it is not possible to predict changes in any unobservable determinants of retention.

As a baseline estimate, we assume that FY01 continuation rates are sustainable. This assumption implies an NPS accession requirement of about 46,000, or a total accession requirement of about 48,700. As an alternative, we consider an environment in which FY00 continuation rates are sustainable. FY00 retention implies an NPS accession requirement of about 54,300.

This range of estimates assumes that all determinants of continuation behavior remain at their FY01 (FY00) levels in the steady state. We

anticipate some changes, however, that will affect steady-state continuation rates. First, the relatively large pre-drawdown cohort is approaching the point at which many servicemembers choose to retire. Second, the Navy plans to increase the proportion of servicemembers in the top six enlisted paygrades. These two events will affect both advancement opportunities and continuation rates of enlisted personnel.

Other changes are more uncertain but reflect reasonable expectations about the steady state. CNO initiatives to reduce boot camp and first-term attrition have been very successful, and we expect these efforts to continue. Also, it is likely that steady-state unemployment will be higher than FY01 or FY00 levels. Accounting for all these adjustments produces a range of estimates of steady-state, NPS accession requirements, from 42,300 to 46,000 (i.e., total accession requirements ranging from 45,000 to 48,700).

Implications and recommendations

If steady-state requirements are at the lower end of our range of estimates, the data suggest that the Navy could temporarily lower accessions *below* steady-state levels. In this scenario, the cohort currently in its first term of service is larger than needed in the steady state. Of course, it is not possible to perfectly predict steady-state continuation behavior, so this conclusion carries some risk. If steady-state requirements are at the higher end of our range of estimates, this cohort is appropriately sized and does not support a cut in accessions.

There are two sources of uncertainty responsible for the risk in these estimates. First, steady-state economic conditions are not known and must be estimated; if the steady-state economic environment is different, steady-state accession requirements will differ as well. Second, we cannot completely explain all year-to-year differences in retention. If these unmeasurable conditions are substantively different than we assume, accession requirements will be different as well.

Both underestimating and overestimating steady-state accession requirements carry real consequences. On one hand, the risk of bringing in too few accessions is that the Navy could create a cohort

that is undersized for the next 20 years. On the other hand, the risk of bringing in too many accessions is that the Navy devotes scarce resources to people when the long-term needs of the Navy would dictate that the resources be directed elsewhere.

Given the risks of bringing in fewer accessions than are needed in the steady state, the Navy must exercise caution if it chooses to cut its accession goal. Lowering accessions creates a disproportionately small cohort and increases the Navy's reliance on its estimates of continuation behavior for that cohort. It is imperative, then, that the Navy carefully monitor the retention of any undersized cohorts.

Any changes in early attrition can be offset by adjustments to the level of accessions; if attrition rises above steady-state rates, increases in accessions will be necessary so that adjoining cohorts offset the unexpectedly high attrition. Furthermore, the Navy *must* be committed to aggressively protecting reenlistment of these smaller cohorts. If reenlistment rates fall below steady-state rates, increases in reenlistment incentives are mandatory to ensure that an already-small cohort does not shrink through lower than anticipated retention.

Finally, we want to stress that too large a cut in accessions, or more than one or two years of lower accessions, will leave the Navy with significant manning problems in the future. Furthermore, cuts in the recruiting infrastructure below steady-state levels reduce the Navy's ability to quickly respond to any unexpected increases in accession requirements. Any deviations from steady-state accession levels should be temporary and in direct response to changes in the continuation behavior of enlisted personnel.

Continuation rates and steady-state accession requirements[1]

Continuation rates

Accession requirements are a function of *continuation rates*, the proportion of existing servicemembers remaining in the Navy from one year to the next. For a given endstrength, the higher the continuation rate, the lower the number of accessions needed to replace servicemembers who leave the Navy. Estimates of the steady-state accession requirement, then, depend heavily on assumptions about the continuation rates the Navy will experience.

The standard approach when modeling accession requirements is to use recent continuation rates of enlisted personnel as proxies for continuation behavior in the steady state.[2] Table 1 presents, for each year of service, continuation rates for FY97–02.[3] As table 1 indicates, each fiscal year follows a similar pattern across the year-of-service (YOS) distribution. Continuation rates are usually between 85 and 90 percent for YOS 0–2 and drop noticeably in YOS 3–6 as servicemembers reach their first reenlistment decision point. After YOS 6, continuation rates rise as years of service increase until YOS 19, when many servicemembers choose to retire.

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1. We are grateful to David Gregory and Katrine Wills for their timely efforts in preparing these data for our analysis.

2. For examples, see [1] and [2].

3. For year of service *y* and fiscal year *t*, we calculate continuation rates by dividing the number of enlisted personnel at year of service *y+1* at the end of fiscal year *t* by the number of enlisted personnel at year of service *y* at the end of fiscal year *t-1*. For accessions, we calculate continuation rates as the proportion of non-prior-service accessions during the fiscal year remaining in the Navy at the end of the fiscal year.

Table 1.   Continuation rates of enlisted personnel: FY97-02

Years of service	FY97	FY98	FY99	FY00	FY01	FY02
Accessions	84.5	84.9	85.3	86.1	86.6	89.8
0	85.8	88.3	87.3	85.6	88.8	91.8
1	87.9	89.1	89.8	91.5	90.6	91.5
2	74.9	80.2	85.3	89.5	91.8	93.0
3	59.7	66.1	66.8	70.0	73.2	78.3
4	83.1	81.7	78.1	78.2	83.9	87.3
5	77.9	78.4	78.8	81.1	83.8	87.1
6	87.7	88.9	87.7	88.5	90.9	93.2
7	86.2	86.3	85.5	85.1	87.7	91.5
8	86.3	86.8	86.3	88.2	90.0	92.1
9	83.5	81.9	80.9	83.2	86.5	91.4
10	90.8	90.2	89.6	91.2	93.1	94.3
11	93.9	93.1	92.4	93.3	94.1	94.9
12	95.7	95.3	94.7	95.1	95.3	96.7
13	96.2	96.1	95.6	95.9	95.9	97.1
14	96.4	96.8	95.0	96.5	97.3	98.1
15	94.5	95.5	93.1	97.3	97.7	97.9
16	95.5	96.1	93.8	98.2	98.4	98.5
17	96.1	96.2	95.0	98.9	99.0	99.2
18	96.9	96.6	94.6	98.9	98.9	99.0
19	45.0	43.0	37.1	39.1	46.2	55.5
20	65.7	61.9	58.9	66.5	69.7	75.1
21	74.2	73.1	72.2	74.0	75.4	75.6
22	79.0	75.7	73.3	76.7	75.8	80.3
23	63.5	59.3	53.5	61.8	62.5	65.6
24	81.1	76.4	77.2	80.9	80.6	80.7
25	62.5	56.0	57.1	58.8	57.3	73.1
26	81.3	77.2	73.1	76.9	76.6	84.3
27	84.0	80.2	80.3	82.0	87.4	86.5
28	86.6	84.9	79.0	84.7	85.7	89.6
29	20.6	17.6	13.0	16.2	18.7	19.0
30	36.8	31.3	24.2	45.5	24.0	25.8

The patterns are similar for each fiscal year that we examine, but table1 reveals notable differences in continuation rates from one year to the next. In general, continuation rates have increased over time for accessions and for enlisted personnel in YOS 0–10. These

increases are most dramatic for those with 3 years of service or less. In FY97, for example, the continuation rate of people with 2 years of service was 74.9 percent; by FY02, this rate increased to 93 percent. Enlisted personnel with 3 years of service had a similar increase in continuation rates, from 59.7 to 78.3 percent. Because a relatively large proportion of the enlisted force is at YOS 0–3, these sizable differences in continuation rates will generate significantly different predictions of steady-state accession requirements.

Sensitivity of requirements

Given the dramatic improvement in retention since the drawdown, we explore the sensitivity of steady-state accession requirements to the use of different fiscal years' continuation rates. When using continuation rates from a given fiscal year, the implicit assumption is that all determinants of continuation behavior in the steady state will resemble their levels in that fiscal year.

Table 2 displays the number of non-prior-service accessions needed to achieve steady-state endstrength, assuming that different fiscal years' continuation rates prevail in the steady state. We follow the FY02 Operations Plan and assume a steady-state enlisted endstrength of 316,440.[4] Furthermore, our model assumes 1,500 prior-service and 1,200 TAR accessions during each year. The total steady-state accession requirement, then, is 2,700 larger than that listed in table 2.

Column 2 of table 2 lists steady-state accession requirements if continuation behavior were identical to that realized in FY97-02. Clearly, the number of accessions depends heavily on the assumptions one makes about continuation rates. At one extreme, steady-state continuation behavior like that experienced in FY97 would require 67,459 NPS accessions to meet endstrength; at the other end of the spectrum, the relatively high continuation rates in FY02 would imply only 36,099 NPS accessions.

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4. An enlisted endstrength of 316,440 is consistent with a total force of 378,000.

Table 2. Sensitivity of NPS accession
requirement to continuation rates

Continuation rates from	NPS accession requirements[a]
FY97	67,459
FY98	60,154
FY99	60,127
FY00	54,300
FY01	45,994
FY02	36,099

a. Assumes enlisted endstrength of 316,440 with
1,500 prior-service and 1,200 TAR accessions.

Given this wide variation in estimates, the choice of a fiscal year's continuation rates as proxies for steady-state behavior is not a trivial one. Though there is no objective, analytical framework to help choose one set of continuation rates over another, we can rule out some fiscal years because of the unique environment faced by the Navy at the time. For example, it is likely that steady-state continuation behavior will not resemble retention patterns shortly after the drawdown. The Navy's downsizing required dramatic declines in continuation rates of enlisted personnel; retention during this transition period, however, is not sustainable in a steady-state environment. Therefore, we expect that continuation rates in the steady state will be higher than those observed immediately after the drawdown. Consequently, it is probable that steady-state accession requirements are lower than are implied by FY97-99 continuation rates.

It is also probable, however, that steady-state retention will be lower than FY02 retention. A number of factors make FY02 a unique retention environment. The terrorist attacks against the United States, the conflict in Afghanistan, a relatively large military pay raise, and a sagging domestic economy all combined to generate record retention levels for the Navy. These rates are probably not sustainable in a steady-state environment. Therefore, it is reasonable to expect that, in general, continuation rates in the steady state will be lower than those in FY02, resulting in a higher accession requirement.

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Our baseline estimate of steady-state accession requirements assumes that FY01 continuation rates are sustainable in the steady state. FY01 reenlistment rates are close to the Chief of Naval Personnel's (N1's) steady-state goals [3], and the recruiting and retention environment lies somewhere between the extremes of the drawdown and the War on Terrorism. These continuation rates imply a steady-state NPS accession requirement of about 46,000.

As an alternative, we also consider an environment in which FY00 continuation rates are sustainable. FY00 retention implies an NPS accession requirement of about 54,300. Because FY01 reenlistment levels reflect N1's goals, much of our analysis will focus on FY01 continuation behavior. However, accession requirements based on FY00 retention are presented as a reasonable alternative that provides us with a range of estimates.

Adjustments to the steady-state environment

These estimates of steady-state accession requirements assume that either FY01 or FY00 continuation rates are sustainable in the steady state. They also implicitly assume that all determinants of continuation behavior remain constant at their FY01 (FY00) levels. In reality, however, it is likely that the environment faced by Sailors will be different from that observed during either fiscal year. In this section, we discuss impending changes in the years of service and paygrade distributions of enlisted personnel, as well as three areas in which we see the potential for change: first-term attrition, the selective reenlistment bonus (SRB) budget, and the civilian economy. Each of these affects determinants of continuation behavior and therefore directly affects estimates of steady-state accession requirements.

Modeling the determinants of continuation behavior

To estimate the effect of changes in the determinants of continuation behavior on steady-state accession requirements, it is necessary to model the relationship between a Sailor's characteristics and whether he or she chooses to remain in the Navy. It is well known, for example, that advancement opportunities affect continuation rates of enlisted personnel.[5] Similarly, a Sailor's environment is known to influence the decision to remain in the Navy [5]. Civilian employment opportunities, spousal and family preferences, and even an increase in patriotism all affect continuation rates of enlisted personnel.

To estimate the effect of a Sailor's characteristics on the probability of staying in the Navy, we estimate separate logistic regressions for each

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5. References [4] and [5] present evidence that continuation rates of enlisted personnel vary by paygrade. Similarly, [6] shows a positive relationship between paygrade and zone A reenlistment rates.

year of service.[6] In each regression, we control for several factors that potentially affect continuation behavior: paygrade, demographic characteristics (e.g., marital status, gender, age, number of children, race/ethnicity), educational attainment, characteristics of Navy service (e.g., rating group, sea/shore duty, geographic location), and economic conditions (e.g., reenlistment bonus levels, state-specific unemployment rates).[7] Despite this rich set of characteristics on which we have data, some differences in continuation rates from one year to the next are the result of other factors, such as changes in patriotism. To quantify these differences over time, we also include a set of fiscal year controls.

The coefficients from these regressions give us the predicted relationship between each observable characteristic and the probability of continuation, holding all other factors constant. Using this model, we estimate a steady-state, NPS accession requirement of 46,000 if FY01 conditions persist into the steady state. This estimate matches the requirement listed in table 2. This equality of predicted and actual continuation rates is an attractive property of regression models.

To calculate accession requirements under FY00 conditions, we hold all measurable characteristics constant at their FY01 levels, but assume unmeasurable conditions are at FY00 levels. Intuitively, this approach measures the continuation rates that would prevail if the individuals making retention decisions in FY01 faced the general retention climate of FY00. This approach lowers the upper bound of our range of estimates from 54,300 to 52,100. Consequently, our estimates of steady-state, NPS accession requirements range from 46,000 to 52,100.

In the remainder of this section, we consider how determinants of continuation behavior might differ in the steady state. To simulate the effect on steady-state accession requirements, we modify observable characteristics from their FY01 levels and use the coefficients from our model to predict changes in steady-state continuation rates.

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6. For a detailed explanation of the logistic model, see [7]. For a Navy application of this model, see [6].

7. Complete regression results are available on request. Appendix A contains results for two representative regressions.
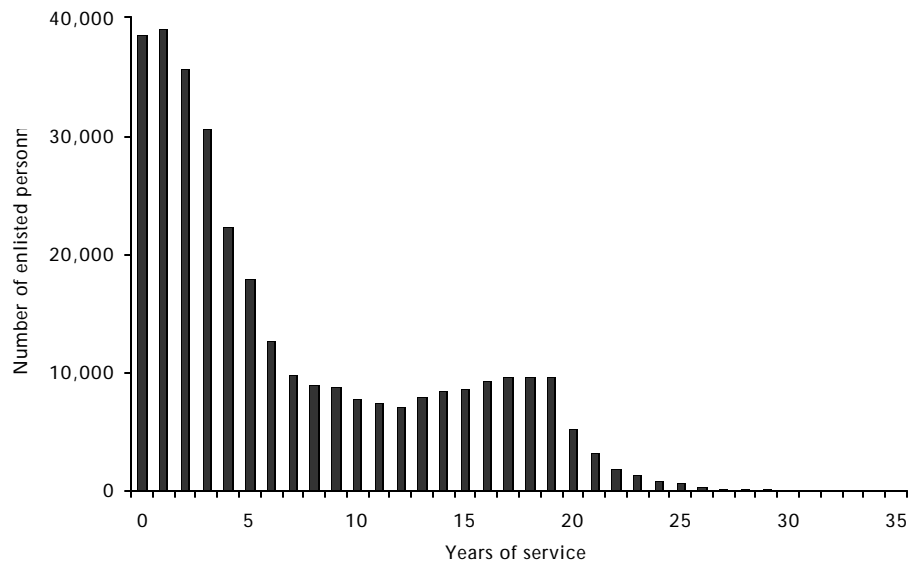
Future changes in advancement opportunities

Many steady-state conditions are uncertain, but two characteristics of the current environment are very likely to change:

- Retirement of the pre-drawdown cohort

- Expansion of the "Top 6" paygrades.

First, the year-of-service distribution of enlisted personnel does not resemble a steady-state distribution. To illustrate this, figure 1 presents the YOS distribution as of 30 September 2002. As figure 1 indicates, the cohort at YOS 13–19 is relatively larger than the adjoining, younger cohort. These personnel joined the Navy in FY83–89, before the Navy began to aggressively reduce the size of the enlisted force (i.e., the drawdown). Because the Navy chose to downsize by taking disproportionate accession cuts rather than forced attrition of the career force, these cohorts are larger than the steady-state requirement. Consequently, the succeeding cohorts are smaller than steady-state requirements.

Figure 1.   YOS distribution of enlisted personnel: 30 September 2002

As these cohorts retire from the Navy, advancement opportunities will change; consequently, advancement opportunities will be different in the steady state than they were in FY01. Because advancement opportunities directly affect continuation rates, this implies that steady-state continuation rates will also be different.

Second, the Navy plans to increase the proportion of servicemembers in paygrades E-4 through E-9 (known as the Top 6). As table 3 indicates, about 70 percent of enlisted personnel are in the six highest paygrades;[8] the Navy plans to increase this proportion to 75.5 percent by FY09. Expanding Top 6 will also affect advancement opportunities in the steady state because a higher proportion of enlisted personnel will be at a higher rank than in FY01.

Table 3.   Paygrade distribution of enlisted personnel: 30 September 2002

Paygrade	Percentage
E-1 to E-3	29.7
E-4	20.2
E-5	22.7
E-6	16.7
E-7	7.5
E-8	2.2
E-9	1.0
Current Top 6:	**70.3**
Steady-state Top 6:	**75.5**

Table 4 displays our predictions of steady-state NPS accession requirements, given these changes in advancement opportunities.[9] As a reference, the first row of table 4 reproduces our estimate of steady-state NPS accession requirements, assuming that FY01 continuation

8. The paygrade distribution of enlisted personnel at the beginning of FY01 is extremely similar to the current distribution.

9. See appendix B for a brief discussion of the framework we use to model these future changes in advancement opportunities; reference [8] provides more detail.

rates are sustainable and that all determinants of continuation behavior remain at their FY01 levels. In rows 2 and 3, we present the steady-state requirement given each change in advancement opportunities; all other characteristics remain held at FY01 levels.

Table 4.   Changes in advancement opportunities
          and steady-state accession requirements

Model	NPS accession requirements
FY01 baseline	45,994
Pre-drawdown cohorts retire, force levels out in steady state	47,085
In addition, Navy increases Top 6 to 75.5%	45,177

As table 4 shows, incorporating the change in advancement opportunities due to the "leveling out" of the force *raises* estimates of the NPS accession requirement to about 47,100. In contrast, adding the change in advancement due to expansion of Top 6 to 75.5 percent *decreases* steady-state requirements to about 45,200.

Intuitively, the leveling out of the force in the steady state increases advancement opportunities for some and decreases them for others; the net result is slightly lower average continuation rates than those observed in FY01. In contrast, the expansion of Top 6 generally improves advancement opportunities. Incorporating both of these changes in advancement opportunities results in higher continuation rates in the steady state than in FY01. Consequently, our revised estimate of steady-state NPS accession requirements is about 800 lower than our estimate using FY01 continuation behavior.

These changes in advancement opportunities have a larger effect on our FY00 estimates of accession requirements, with a reduction in accessions of about 2,000. Intuitively, the change in accession requirements is larger for FY00 because of a more dramatic change in advancement opportunities. Consequently, incorporating these changes in advancements results in a range of steady-state, NPS accession requirements of 45,200 to 50,100.

Further adjustments to continuation rates

Although the years of service and paygrade distributions imply that advancement opportunities will be different in the steady state, other differences are less certain. Nevertheless, it is likely that the environment faced by Sailors will be different from that observed during either FY01 or FY00. We discuss three areas in which we anticipate the potential for change: first-term attrition, the SRB budget, and the civilian economy.

Lower first-term attrition

As table 1 showed, continuation rates for accessions and enlisted personnel in YOS 0–1 have risen steadily in recent years. The civilian economy has undoubtedly played a role in this lower attrition, but these improvements also coincide with a Chief of Naval Operations (CNO) initiative to decrease boot camp and first-term attrition. Because this lower attrition has been leadership driven, it is reasonable to assume that these early continuation rates are sustainable.

Furthermore, from a cost-effective perspective, these rates *should* be sustained. Trading off higher first-term attrition for higher accession levels is not internally consistent. For first-term enlisted personnel, the Navy has already invested substantial recruiting and training resources. Allowing higher attrition from a group in which the Navy has already made a significant investment generates additional costs and no benefits.

Finally, a change in first-term attrition is something to which the Navy can react and make a commensurate change in accession requirements.[10] For example, if first-term attrition is unexpectedly high, an increase in the accession goal can offset this lower continuation behavior with a larger adjoining cohort. Therefore, the most recent (i.e., FY02) first-term attrition levels represent a reasonable goal for a steady-state environment, and a target to which the Navy can easily react.

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10. CNA provides quarterly attrition and reenlistment reports to the CNO.

Our model of the determinants of continuation behavior suggests a sizable relationship between changes in first-term attrition and accession requirements. Specifically, we estimate that a 1-percentage-point decrease in zone A attrition would reduce steady-state, NPS accession requirements by 2,000 to 2,600. The level of accessions is extremely sensitive to changes in first-term attrition, since a large number of enlisted personnel are at these years of service.

Table 5 incorporates FY02 first-term attrition levels into our calculations of steady-state accession requirements. In each scenario, continuation rates for accessions and enlisted personnel in YOS 0–1 are taken from FY02 and combined with the rest of the continuation rate profile for FY01. In each scenario, accession requirements are uniformly lower than the estimates presented in table 4, reflecting the higher first-term continuation rates from FY02. Incorporating FY02 first-term continuation rates into our model lowers steady-state accession requirements by about 2,300 for each scenario.

Table 5. Accession requirements with FY02
first-term attrition levels

Model	NPS accession requirements
FY01 baseline	43,805
Pre-drawdown cohorts retire, force levels out in steady state	44,728
In addition, Navy increases Top 6 to 75.5%	42,903

Combining FY02 first-term attrition with FY00 continuation rates results in an even larger decrease in accession requirements. This disparity exists because FY00 first-term attrition was higher than in FY01. Consequently, our revised estimate of the range of steady-state NPS accession requirements is about 42,900 to 46,600.[11]

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11. For the remainder of this analysis, we focus only on estimates of the steady-state accession requirement that incorporate future changes in advancement opportunities.

Tradeoffs between recruiting and retention

Although we assume that continuation rates can be influenced by leadership-driven initiatives, it is well established that Sailors' retention is strongly driven by financial incentives [9]. Because changes in reenlistment rates have an immediate effect on continuation rates, financial incentives offered to Sailors have a direct impact on accession requirements. In other words, the Navy can directly affect the steady state with changes in enlisted compensation.

Our model of continuation behavior illustrates this point. Our analysis suggest that a 1-percentage-point increase in the zone A reenlistment rate would reduce, steady-state, NPS accession requirements by 400 to 500. For perspective, an increase in zone A reenlistment rates from FY01 levels (about 57 percent) to 65 percent would lower accession requirements by about 3,100.

Compensation and retention

In addition to the direct effect on reenlistments, financial incentives (e.g., selective reenlistment bonuses) increase continuation rates by slightly reducing attrition. For example, an increase in SRBs that raises reenlistments by 1 percentage point also lowers attrition; the combined effect of higher reenlistment and lower attrition reduces accessions by 450 to 550. Higher bonuses increase both current compensation for those at a decision point and expected future compensation for those who have not yet reached their first reenlistment point. This increase in expected earnings tends to reduce attrition.

Increases in basic pay also increase retention; previous CNA research suggests that a 1-percent, across-the-board increase in basic pay raises zone A reenlistment by about 1 percentage point [6]. Therefore, our model of continuation behavior predicts that a 1-percent increase in basic pay would reduce steady-state, NPS accession requirements by 450 to 550. Similarly, a 1-level, across-the-board increase in zone A SRB multipliers increases reenlistment by 2.5 percentage points [6]; these higher SRBs reduce accession requirements by 1,100 to 1,400.

There are two important caveats to these estimates. First our estimates are based on *real* (i.e., adjusted for inflation) and not nominal pay

raises. Second, this analysis holds all other factors constant, including civilian earnings opportunities. Thus, an increase in basic pay that merely keeps pace with inflation will have no impact on reenlistments or accession requirements.

Increases in basic pay affect all zones, not just zone A; similarly, increases in zone B and C SRBs also affect retention in those zones. In this respect, these estimates can be thought of as lower-bound estimates of the change in accession requirements. However, a large body of research concludes that Sailors in zones B and C are significantly less responsive to changes in compensation than Sailors in zone A [9]. Furthermore, all but the most dramatic changes in retention at higher years of service have relatively little impact on accession requirements because most personnel are at low years of service. Changes in zone A continuation rates, then, dominate any effect due to changes in the retention behavior of more senior personnel.

Steady-state reenlistment goals

Each year, the Navy sets selective reenlistment bonus levels to ensure that the number of reenlistments continues to meet its skill requirements. Given the strong civilian economy, the Navy has become increasingly aggressive in its use of SRBs; for example, the Navy's budget for zone A reenlistment bonuses jumped from $69 million in FY98 to $165 million in FY01 [10]. Reenlistment bonus levels were scaled back in FY02, however, because of an exceptionally strong retention environment.[12]

Given this dramatic fluctuation in the reenlistment bonus budget over the past few years, it is not clear what the size of the SRB budget will be like in the steady state, or whether it will resemble FY01 levels. However, any changes in reenlistment bonuses that alter retention rates will require an adjustment to accession goals. Furthermore, this relationship gives the Navy some ability to affect reenlistment and to set steady-state reenlistment goals that are substantively different

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12. In addition, while changes in basic pay are beyond the direct control of the Navy, increases in the past few years have undoubtedly contributed to the higher retention reflected in table 1.

from current rates. Even though FY01 reenlistment rates are close to N1's steady-state goals [3], the Navy could decide to set new goals in the future.

Given this ability to affect reenlistment levels, it is important to note that trading off accessions for higher retention is not always a cost-effective option. When comparing the higher SRB and seniority costs with the savings in recruiting and training costs, reference [11] shows that the costs of increasing retention outweigh the benefits.[13] When incorporating the productivity gains associated with greater seniority, trading off accessions for higher retention is cost-effective in high- and mid-tech ratings, but not in low-tech ratings. The implication is that trading off accessions for higher across-the-board retention is not a cost-effective option. Even for technical ratings, the positive return on investment depends on the productivity benefit, so it does not generate dollar savings that can be used to fund the SRB expenditures.

Without direct evidence of how N1's steady-state reenlistment goals will change in the future, we make *no* adjustments in our model to the SRB budget or the level of basic pay from their FY01 levels.[14] Consequently, our estimates of steady-state, NPS accession requirements remained unchanged and range from 42,900 to 46,600. However, any changes in reenlistment goals, and in the financial incentives offered to Sailors to achieve these goals, will require an adjustment to accession requirements.

Changes in the civilian economy

The Navy can influence continuation behavior through compensation, quality-of-life programs, and working conditions, but external changes in a Sailor's environment also influence the decision to remain in the Navy [5]. Civilian employment opportunities, spousal and family preferences, and even an increase in patriotism all affect

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13. Seniority costs include greater housing allowances, medical costs, and moving costs associated with Sailors who are more likely to have dependents and greater lengths of service.

14. Our model implicitly assumes that these budgets remain constant when adjusted for inflation.

continuation rates of enlisted personnel. These external influences require that the Navy respond and adjust in order to sustain manning levels.

To illustrate the effect of a Sailor's environment on continuation behavior, we focus on changes in unemployment rates. Higher civilian unemployment increases retention because civilian jobs become relatively scarce and the Navy is perceived as a more attractive career. The civilian unemployment rate, then, is a useful metric with which to assess recruiting and retention climates. Using our model of continuation behavior, we estimate that a 1-percentage-point increase in civilian unemployment rates decreases steady-state, NPS accession requirements by about 600.

It is important to point out that we estimate the relationship between unemployment and accessions, *holding all other factors constant.* As table 2 notes, estimates of accession requirements fell at the same time that unemployment rates were falling. Our model of continuation behavior reveals that other factors were responsible for this decline; holding all else constant, lower unemployment *raises* accession requirements. Regardless of the steady-state level of unemployment, cutting (raising) accession goals in response to uncharacteristically high (low) unemployment would allow the Navy to compensate for the change in continuation rates due to changes in the civilian economy.

Our estimates of accession requirements reflect data from FY00 and FY01, a time when unemployment rates were at a record low.[15] It is probable that unemployment in the steady state will be higher than FY00 or FY01 rates; over the past decade, for example, unemployment has been as high as 7.3 percent. If unemployment is higher in the steady state, accession requirements will be lower than our range of estimates.

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15. To estimate the relationship between Sailor characteristics and continuation behavior, we measure characteristics in October—the beginning of the fiscal year. In 2000, the U.S. unemployment rate stood at 3.9 percent, in contrast to 5.2 percent in 1996 and 5.7 percent in 2002.

Although higher than FY01 levels, unemployment in FY97 was still appreciably lower than unemployment during the previous recession. Therefore, FY97 unemployment rates appear to be a conservative estimate of economic conditions in the steady state. Consequently, we incorporate these higher unemployment rates into our estimates of steady-state, NPS accession requirements; this generates a range from about 42,300 to 46,000.[16]

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16. Unemployment rates rose throughout FY01, and unemployment at the end of FY01 was almost as high as FY97 levels. If we were to measure unemployment at the end of the fiscal year, we would make virtually no adjustment to FY01 levels. It is reasonable to expect that unemployment rates affect continuation rates with some lag [12]; however, our estimate of the decrease in steady-state accession requirements can be viewed as an upper bound.

Assessing the risk of cutting accessions

As we have demonstrated, estimates of steady-state accession requirements are extremely sensitive to the assumptions one makes about steady-state conditions. Even with an accurate prediction of steady-state accession requirements, however, this will rarely be the *desired* number of accessions in a given year. Temporary deviations from the steady-state accession goal would provide the Navy with the flexibility to respond to an environment that differs from the steady state.

However, deviating from steady-state accession levels runs the risk of bringing in too few or too many accessions. The risk of bringing in too few accessions is that the Navy could create a cohort that is under-sized for the next 20 years, whereas the risk of bringing in too many accessions is that the Navy devotes scarce resources to people when the long-term needs of the Navy would dictate that the resources be directed elsewhere.

Furthermore, we cannot perfectly predict steady-state continuation behavior. Consequently, relying on any estimate of steady-state accession requirements carries some risk. Models of continuation behavior cannot completely explain all year-to-year differences in retention; if unmeasurable conditions are substantively different than we assume, steady-state accession requirements will be different as well.

In this section, we examine the risk to the Navy of dropping accessions below the steady-state level. We compare the current YOS distribution of enlisted personnel with our estimates of the steady-state distribution. We also discuss the sensitivity of our conclusions to changes in unobservable factors affecting retention and the implications for current accession goals.

Temporary deviations from steady-state accession goals

Given a relatively strong retention environment and concerns that the Navy might continue to be above planned strength, it is reason-

able to ask whether accessions can safely be dropped below the steady-state level. Figure 2 displays the YOS distribution of enlisted personnel, as well as our estimate of the steady-state distribution. For this comparison, the steady-state distribution assumes continuation rates for accessions and personnel in YOS 0–1 from FY02, combined with the rest of the continuation rate profile for FY01, and FY97 unemployment rates. This steady-state estimate carries with it an NPS accession requirement of 42,345.[17]

Figure 2.   Current and baseline steady-state distributions of enlisted personnel[a]
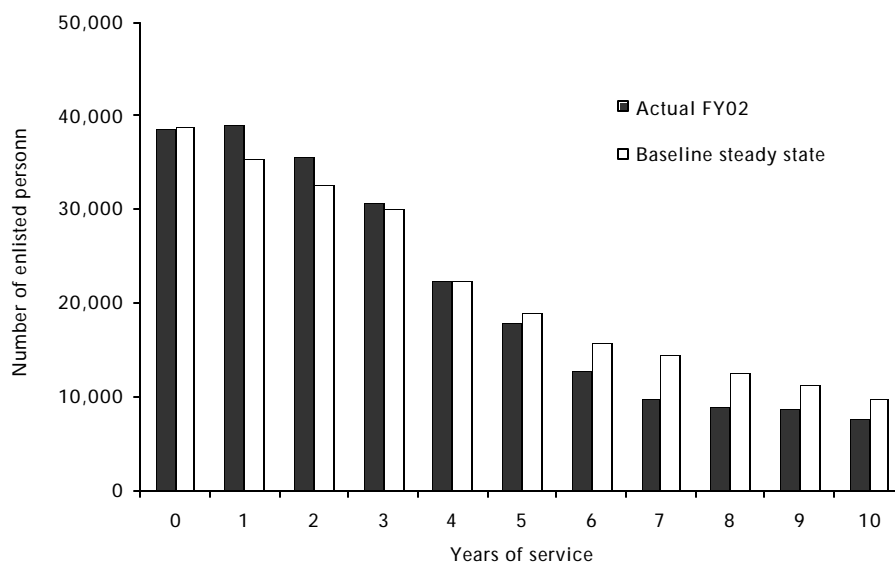
a. Steady-state distribution assumes FY01 continuation rates, with FY02 first-term attrition levels and FY97 unemployment levels.

As figure 2 shows, there are more personnel at YOS 1–3 than in the steady state; this differential is particularly large for YOS 1–2. Specifically, there are about 3,800 more Sailors at YOS 1 than in the steady state, and about 3,100 additional Sailors at YOS 2. Assuming that

17. Comparisons of these YOS distributions are qualitatively similar for any of the steady-state distributions based on FY01 continuation behavior.

these people exhibit steady-state continuation behavior, these data imply that the cohort currently in its first term of service will always be oversized. With an additional 7,000 Sailors in an adjoining cohort, NPS accessions could temporarily drop *below* the steady-state level of 42,300.

This conclusion, however, is heavily dependent on the assumption that steady-state behavior will resemble FY01 continuation behavior. If continuation rates are lower than we have assumed, a cut in accessions runs the risk of creating a cohort that is substantially smaller than desired. To assess the risk of overestimating continuation behavior, we now turn to an alternative steady state based on FY00 continuation rates.

## Sensitivity analysis with an alternative steady state

Our estimate of steady-state accession requirements incorporates future changes in advancement opportunities and likely changes in the environment faced by Sailors. Despite these refinements to our estimate, it still relies heavily on the assumption that all other determinants of retention resemble their FY01 levels in the steady state. However, table 3 showed the sizable variation in accession requirements if continuation rates resemble any of the rates experienced in the last 6 years, from 36,100 to 67,500. Although much of this variation can be explained by differences in observable factors, some variation from one year to the next is still unexplained. If these unmeasured conditions are substantively different from FY01 levels, steady-state requirements will be different as well.

Figure 3 displays an alternative estimate of the steady-state distribution. The only difference between this steady state and the distribution presented in figure 2 is that we now assume that the unmeasured determinants of continuation resemble their FY00 levels. The alternative steady state carries an NPS accession requirement of 46,004.

As figure 3 shows, the cohort currently in its first term of service is more appropriately sized if the unobservable conditions in the steady state mirror those present in FY00. The number of Sailors at YOS 1–2 is slightly larger than that required in the steady state, but YOS 0 and

YOS 3–4 are too small. In this scenario, cutting accessions below 42,300 would result in an undersized cohort that is not balanced by a relatively large adjoining cohort. Indeed, if steady-state conditions are similar to those represented in figure 3, NPS accessions should not drop very far below 46,000.

Figure 3.   Current and alternative steady-state distributions of enlisted personnel[a]
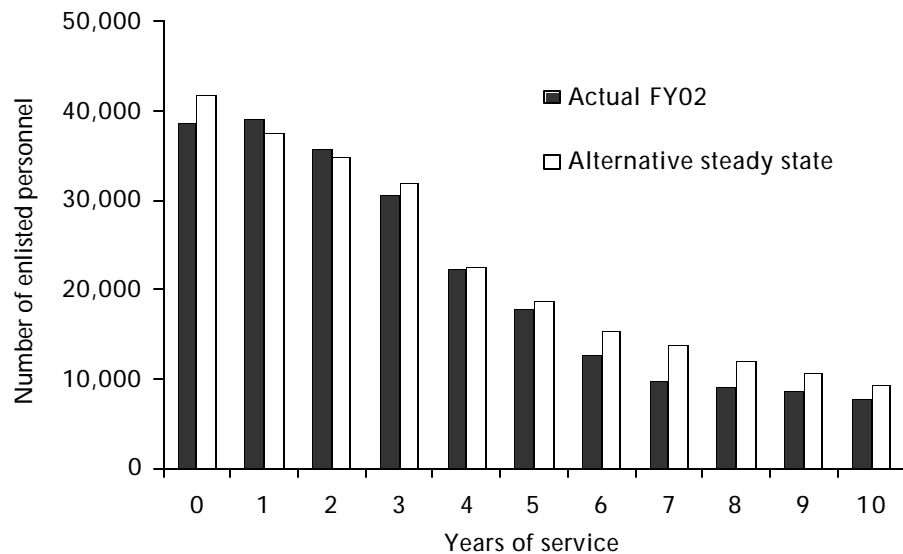
a. Steady-state distribution assumes FY00 continuation rates, with FY02 first-term attrition levels and FY97 unemployment levels.

Figure 4 displays the difference between the current YOS distribution and these two different steady-state distributions. The degree to which the Navy can cut current accessions clearly depends on assumptions about steady-state continuation rates. Indeed, whether the Navy should cut accessions *at all* depends on one's estimate of steady-state accession requirements. Unfortunately, the dramatic differences in post-drawdown continuation rates from one year to the next make it difficult to precisely estimate steady-state continuation behavior. Cutting accessions below estimates of steady-state requirements, therefore, involves some risk. If retention is substantively different in the

steady state than one assumes, estimates of accession requirements will not be accurate.

Figure 4. Difference between current and steady-state YOS distributions
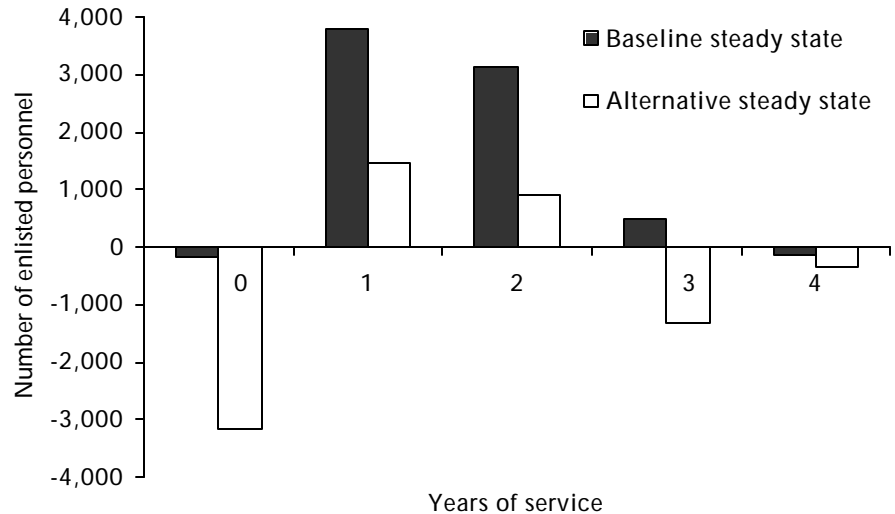
Implications for current accession goals

If steady-state requirements are at the lower end of our range of estimates, the data suggest that the Navy could temporarily lower accessions *below* steady-state levels. In this scenario, the cohort currently in its first term of service is larger than needed in the steady state. Of course, it is not possible to perfectly predict steady-state continuation behavior, so this conclusion carries some risk. If steady-state requirements are at the higher end of our range of estimates, this cohort is appropriately sized and does not support a cut in accessions.

Given the risk associated with cutting accession goals, however, the Navy must exercise caution if it chooses to bring in fewer accessions than are needed in the steady state. Lowering accession goals requires that the Navy carefully monitor continuation behavior to ensure that the level of accessions is consistent with effectively manning the force.

Any changes in early attrition can be offset by changes in accessions; if attrition rises above steady-state rates, increases in accessions will be necessary so that adjoining cohorts offset the unexpectedly high attrition. Furthermore, the Navy *must* be committed to aggressively protecting reenlistment of these smaller cohorts. If reenlistment rates fall below steady-state rates, increases in reenlistment incentives are mandatory to ensure that an already-small cohort does not shrink through lower than anticipated retention. If changes in reenlistment are too severe, it is possible that the Navy will need to consider *raising* its accession requirements to offset unexpectedly low retention.

Finally, we want to stress that too large a cut in accessions, or more than 1 or 2 years of lower accessions, will leave the Navy with significant manning problems in the future. Any deviations from steady-state accession levels should be temporary and in direct response to changes in the continuation behavior of enlisted personnel.

Conclusions

Continuation rates have changed dramatically since the end of the drawdown. These sizable differences in continuation rates imply a wide range of estimates of the number of accessions needed to meet endstrength targets. Unfortunately, these differences also make it difficult to precisely estimate steady-state continuation behavior. Furthermore, it is not possible to predict changes in any unobservable determinants of retention. Though it seems reasonable to expect that FY01 continuation rates are sustainable, different rates in the steady state would lead to very different accession requirements.

We anticipate some fundamental changes to the environment faced by Sailors. First, the relatively large pre-drawdown cohort is approaching the point at which many servicemembers choose to retire. Second, the Navy plans to increase the proportion of servicemembers in the Top 6 enlisted paygrades. Both of these changes imply that advancement opportunities will be different in the steady state; our analysis suggests that steady-state accession requirements are lower than those implied by FY01 advancement opportunities.

Other changes to steady-state continuation behavior are more uncertain, but would also directly affect accession requirements. First, CNO initiatives to reduce boot camp and first-term attrition have been very successful, and we expect these efforts to continue. Second, unemployment in FY01 was at a record low, and it is not likely that this rate is sustainable in the steady state. Our analysis suggests that both of these changes would lower steady-state accession requirements.

Finally, the Navy could temporarily lower accessions below steady-state levels if steady-state requirements are at the lower end of our range of estimates. The sensitivity of requirements to continuation rates, however, requires that the Navy exercise caution when lowering its accession goals. If continuation behavior does not continue to track with estimates of steady-state rates, too large a cut in accessions will leave the Navy with significant manning problems in the future.

Appendix A: Regression results

Table 6 lists the coefficients from our models of continuation behavior of enlisted personnel with 3 and 7 years of service. These models are estimated using standard logistic regression. Complete regression results for all years of service are available on request.

Table 6.   Models of continuation behavior—logistic regression results[a]

Independent variable	YOS 3	YOS 7
Fiscal year		
1998	0.036	0.033
1999	0.028	0.069
2000	0.034	0.080
2001	0.285***	0.239***
2002	0.444***	0.563***
Paygrade		
E-4	0.286***	n/a
E-5	0.546***	0.394***
E-6	n/a	0.574***
Rating group		
Non-SEABEE Construction	0.079	-0.249
Marine Engineering	-0.804***	0.120
Ship Maintenance	-0.879***	0.077
Aviation Maintenance	-0.498***	-0.067
Aviation Ground Support	-0.590***	0.082
Media	-0.022	0.588***
Logistics	-0.356***	0.013
Administration	-0.202***	0.263***
Data Systems	-0.719***	-0.342***
General Seamanship	-0.653***	0.010
Health Care	0.292***	0.337***
Cryptology	-0.330***	-0.236**
Ordnance Systems	-0.598***	0.130

Table 6.   Models of continuation behavior—logistic regression results[a] (continued)

Independent variable	YOS 3	YOS 7
Communications/Sensor	-0.692 ***	0.431 ***
Weapons Systems/Control	-0.318 ***	-0.113
GENDET	-0.647 ***	n/a
Geographic location		
Hawaii	0.226 ***	0.197 ***
California	-0.028	0.073 **
Virginia	0.048 **	0.158 ***
Non-U.S.	-0.187 *	0.469 ***
Other characteristics of military service		
EAOS within 12 months	-2.587 ***	-2.783 ***
Sea duty	0.352 ***	0.474 ***
Training	0.917 ***	0.426 ***
Other duty (not shore duty)	-0.855 ***	-1.030 ***
Nuclear field	0.214 ***	-1.175 ***
Educational attainment		
No high school diploma	0.046	-0.246 ***
Some college education	-0.204 ***	-0.122 *
Other education (not high school diploma)	0.056	-1.147 ***
Race/ethnicity		
Black, non-Hispanic	0.669 ***	0.377 ***
Hispanic	0.225 ***	0.095 **
Other (non-White)	0.507 ***	0.486 ***
Other demographic characteristics		
Married	0.266 ***	0.074 **
Male	-0.041 **	0.231 ***
Age (years)	0.019 ***	0.016 ***
Has children	0.176 ***	0.048 *
AFQT	-0.007 ***	-0.010 ***
Economic data		
SRB	0.085 ***	0.032 **
Home-state unemployment rate	0.035 ***	0.017
UIC unemployment rate	-0.019 *	-0.007
Constant	1.767 ***	2.365 ***

a. Asterisks denote statistical significance at the *10%, **5%, and ***1% levels.

Appendix B: Modeling the impact of the drawdown and changes in Top 6 on steady-state continuation behavior

In this appendix, we briefly describe the model we use to estimate the impact of drawdown effects and changes in Top 6 on continuation behavior.[18] This model estimates the steady-state distribution of Sailors by paygrade and year of service, incorporating estimates of advancement opportunities and the relationship between advancements and continuation behavior.

Beginning with the actual FY01 distribution of Sailors, the model "ages" the force by a year, taking into account four parameters for each combination of paygrade/year of service:

1. Proportion that leaves the Navy

2. Proportion that stays in the Navy and advances to the next paygrade

3. Proportion that stays in the Navy and remains in the same paygrade

4. Number of accessions that enter the Navy.[19]

Our estimates of continuation rates are described in detail in the main body of this research memorandum. Intuitively, our model assumes that continuation rates for each paygrade/year of service combination do not change over time; continuation rates for each year of service, however, do change over time, as the distribution of Sailors across paygrades changes from one year to the next.

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18. For more detail, see [8].

19. Our model holds endstrength constant through all iterations.

Our estimates of steady-state advancement rates are an average of FY89–91 advancement rates. These rates were chosen because this time period is the farthest from the days of the "hollow force," when advancements were relatively frequent and early, but before the draw-down, when advancement opportunities were limited. Over the FY89–91 time period, advancement opportunities were relatively stable.

Once this "aging" of the force by a year has occurred, the process is repeated for another year. In this step, we use the distribution of Sailors that is generated by the previous step. Our model continues this process indefinitely, until the distribution of Sailors does not change from one year to the next. By this time, the relatively large pre-draw-down cohorts, and the relatively small adjoining cohort, have both retired from the Navy. At this point, each new cohort is the same size and shape as its predecessor; consequently, continuation and advancement rates are not different from one cohort to the next. This is the steady-state distribution of Sailors; for each year of service, we calculate steady-state continuation rates by multiplying the proportion of Sailors in each paygrade by that paygrade's continuation rate.

To estimate the effect of changes in Top 6, we begin with the steady-state distribution of Sailors that we have just described. Intuitively, the model works the same way as it did when finding the original steady-state distribution of Sailors. The only difference is that advancement opportunities by paygrade/year of service are adjusted to reflect the higher proportion of Sailors that are needed in the six highest enlisted paygrades.

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