



Creating an OSD Retention Dashboard

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with Cathy Hiatt and Tanya Saloom

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Abstract

The services commit a considerable amount of resources to retention policy levers, including a variety of reenlistment bonuses for both officers and enlisted personnel. To oversee the resources supporting these levers, the services must understand the current retention environment, both in aggregate and for specific subsets of servicemembers, since retention incentives can target certain communities. This paper discusses the retention dashboard that CNA developed for the Office of the Undersecretary of Defense (OSD) Personnel and Readiness (P&R) that allows users to view recent active component enlisted retention trends in each of the services. We discuss our choice of retention metrics, identify the data that we used, and provide guidance on using the dashboard. We conclude with a discussion of a potential future extension of the dashboard that incorporates predictive capabilities. Future extensions also could add the reserve component and/or the officer corps.

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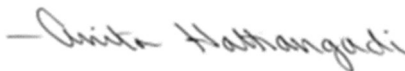
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Cover image credit: Members of a joint color guard march onto the field during the National POW/MIA Recognition Day ceremony at the Pentagon, Sept. 18, 2009. Courtesy of defense.gov.

Approved by:

April 2020



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Executive Summary

The past two decades have reflected constantly changing retention environments, driven by factors including the post-9/11 increase in willingness to serve, the strong civilian economies of the mid-2000s, and the Great Recession and its lingering aftermaths. These changes have resulted in changes to retention policy and retention incentive requirements. Oversight of these policies by the Office of the Secretary of Defense (OSD) Personnel and Readiness (P&R) has been complicated by the services' use of different retention measures, making direct comparisons across services difficult.

In this report, CNA facilitates OSD's efforts to oversee retention policies in two ways:

- We define several retention measures that are consistently measured across the services
- We calculate and display these metrics in an interactive retention dashboard

We define four retention measures:

- The *continuation rate* measures the share of servicemembers who remain in the military from one year to the next. Those who fail to retain encompass all types of losses, including servicemembers who leave while still under contract with the military and those who leave at the end of their contract.
- The *cumulative continuation rate* measures the share of servicemembers who have retained from accession to a particular year of service; this is essentially an aggregation of continuation rates for each year from accession to present.
- The *reenlistment rate* contrasts the number of servicemembers who reenlisted¹ with the number of servicemembers who were eligible to reenlist but left at the end of their contracts.
- The *end-of-contract (EOC) cohort reenlistment rate* measures reenlistment behavior for servicemembers with contracts ending in a particular fiscal year.

We illustrate these rates in the retention dashboard that accompanies this document. This document serves as a basic “user guide” for that dashboard and describes some of its limitations (and the limitations of other, similar, dashboards). Chief among these limitations

¹ Including those who choose to reenlist before the end of their service contracts.

are constraints due to privacy concerns related to the use of personally-identifiable individual-level data. These concerns forced us to compute predetermined measures of interest in aggregate to not risk exposing individual level data. Although we chose a large set of precomputed measures to allow for user flexibility, this and similar dashboards cannot offer the same level of flexibility as dashboards that have “live” access to databases that contain personally identifiable information (PII).

Finally, we highlight some considerations for future dashboard iterations, focusing on predictive capabilities. Although the current dashboard has no predictive component, we note the effect of using aggregated versus PII data on (likely) forecast accuracy. Previous work has shown that the national unemployment rate is an insufficient summary of civilian economic conditions, and we show that even using unemployment rates that seem more suitable for the population in question (e.g., high school graduates age 25 and older) does not overcome this insufficiency. Instead, we suggest using one or more broader (but still forecastable) measures of economic conditions.

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Introduction

The services commit a considerable amount of resources to retention policy levers, including a variety of reenlistment bonuses for both officers and enlisted personnel. To oversee the resources supporting these levers, the Office of the Secretary of Defense (OSD) and the services must understand the current retention environment, both in aggregate and for specific subsets of servicemembers, since retention incentives can target certain communities. However, OSD oversight has been hindered by the different measures the services use to summarize retention. For example, the Air Force uses continuation rates to track the proportion of servicemembers staying in service from one time period to the next. On the other hand, during their yearly reenlistment campaign, the Marine Corps tracks the proportion of Marines who have reenlisted out of the eligible population for that fiscal year (FY). Each of these measures provide useful information, but they do not allow for a cross-service comparison.

In order to assist with the oversight of retention policies, OSD Personnel and Readiness (P&R) asked CNA to develop a retention dashboard that allows users to view recent active component enlisted retention trends in each of the services and to drill-down into specific areas of interest (e.g., zone, occupation, etc.). In this paper, we discuss our choice of retention metrics, identify the data that we used, and provide guidance on using the retention dashboard that we developed. We conclude with a discussion of a potential future extension of the dashboard that incorporates predictive capabilities. Predictive capabilities would show the potential effects of changing policies or changing economic conditions on retention in the future. This would be a useful tool for OSD and the services when making retention policy and resourcing decisions. Finally, future extensions of the retention dashboard also could add the reserve component and/or the officer corps.

Retention Metrics

The retention dashboard, created by CNA for OSD-P&R, allows users to track active component enlisted retention rates across all four Department of Defense (DOD) military branches and “drill down” into demographic categories specific to a user’s interest, such as retirement zone, gender, paygrade, or occupation. In this section, we discuss different types of stay and leave behaviors. We then define the specific retention rates that we used in the retention dashboard.

Stay behaviors include a servicemember choosing to reenlist or extend before the end of an existing contract. A *reenlistment* is considered a new contract (new begin and end date), while an *extension* simply extends the end date of the existing contract.

There are multiple types of leave behaviors, called losses. An *unplanned loss* occurs when a servicemember leaves service before the end of his or her existing contract. An *end of contract (EOC) loss* occurs when a servicemember leaves upon the completion of his or her current contract. EOC losses can be eligible or ineligible to reenlist, depending on whether the servicemember was designated eligible to reenlist by his or her respective service.

Because there are many types of stay and leave behavior, there are also many ways that retention can be defined. Based on OSD working groups, we decided to include four retention metrics in the dashboard: the *continuation rate*, the *cumulative continuation rate*, the *reenlistment rate*, and the *EOC-cohort reenlistment rate*. As we show below, these rates use different forms of stay and leave behaviors in their definitions and one may be more useful than another, depending on the dashboard user.

Continuation rate

The *continuation rate* measures the percentage of servicemembers who stay in service from one month to the next. This is the most comprehensive retention metric because it encompasses all of the stay and leave behaviors. However, it does not distinguish between reenlistments vs. extensions or unplanned losses vs. EOC losses. It simply measures the percentage of servicemembers who stay in service. The continuation rate in a particular month is given by:

$$\frac{\# \text{ of Servicemembers Present in Both the Current and Previous Month}}{\# \text{ of Servicemembers Present in the Previous Month}} \times 100$$

Although we used a monthly time period in our definitions and in the retention dashboard, continuation rates could be computed by quarter or year. Depending on the time interval, continuation rates may be systematically high or low. For example, month-to-month there will

be very few separations out of all the servicemembers present, so continuation rates will be higher than year-to-year continuation rates.

Cumulative continuation rate

The *cumulative continuation rate* for an FY accession cohort is the percentage of an FY accession cohort that is still in service as of a particular month. An *accession cohort* is defined as those who accessed in a particular FY. The cumulative continuation rate for an FY accession cohort in a particular month is given by:

$$\frac{\# \text{ of Servicemembers in the FYXX Accession Cohort in Service in the Current Month}}{\# \text{ of Servicemembers in the FYXX Accession Cohort}} \times 100$$

The cumulative continuation rate for an FY accession cohort is linked to the continuation rate because it is based on the percentage of servicemembers still in service.² In this way, it still reflects all stay and leave behaviors but is restricted to a particular cohort of servicemembers.

Reenlistment rate

The *reenlistment rate* measures the percentage of reenlistments out of reenlistments and eligible EOC losses. Recall that eligible EOC losses are losses from servicemembers who were designated as eligible to reenlist by their respective services. The reenlistment rate in a particular month is given by:

$$\frac{\# \text{ of Reenlistments in the Current Month}}{(\# \text{ of Reenlistments in the Current Month}) + (\# \text{ of Eligible EOC Losses in the Current Month})} \times 100$$

The reenlistment rate is much more specific in scope than the continuation or cumulative continuation rates because it reflects only reenlistments and eligible EOC losses. It does not include information about the percentage of servicemembers who extend, were ineligible to reenlist, or were unplanned losses.

² The cumulative continuation rate for an accession cohort from time 1 to time t is simply the product of the continuation rates for that accession cohort from time 2 to time t . For example, if the continuation rate of an accession cohort from period 1 to period 2 is 97 percent and from period 2 to period 3 is 95 percent, then the cumulative continuation rate in period 3 is 92 percent (97 percent x 95 percent).

EOC-cohort reenlistment rate

The *EOC-cohort reenlistment rate* is the ratio of the cumulative number of reenlistments from a particular EOC cohort and the size of the EOC cohort times 100. An *FY EOC cohort* is defined as the number of servicemembers who had a contract ending in a particular FY. The denominator in the EOC-cohort reenlistment rate is constant over time for a particular FY cohort and includes everyone, regardless of whether they were eligible to reenlist. The EOC-cohort reenlistment rate for FYXX is given by:

$$\frac{\text{Cumulative \# of Reenlistments from FYXX EOC Cohort as of the Current Month}}{\text{\# of Servicemembers in the FYXX EOC Cohort}} \times 100$$

The EOC-cohort reenlistment rate is similar to the reenlistment rate in that the numerator is based on only reenlistment transactions. However, the denominator is constant and includes ineligible EOC losses, while the reenlistment rate includes only eligible EOC losses. The EOC-cohort reenlistment rate also is similar to the cumulative continuation rate in that it reflects the cumulative behavior over time for a particular cohort, while cumulative continuation rates are based on accession cohorts and EOC-cohort reenlistment rates are based on EOC cohorts.

Data

We used Defense Manpower Data Center (DMDC) to build the retention dashboard. These data include stay, leave, and demographic information for each servicemember in each month. We restricted the population to active component enlisted personnel. We also restricted our attention to servicemembers present in the data between FY 2013 and FY 2019. This is partially because there was a shift in FY 2013 in the structure of the compensation files. In addition, because we used the monthly files, the dataset was extremely large, so including additional FYs would significantly increase computational time.

Relevant variables

DMDC retention-related variables include begin contract date, end contract date, reenlistment transaction, loss transaction, and eligibility to reenlist. Loss information includes both the date of the transaction and the reason. We used this information to calculate the various metrics discussed in the previous section.

We can examine the retention metrics along several demographic and career-related dimensions using information from DMDC including gender, race, ethnicity, marital status, dependent status, education tier, Armed Forces Qualification Test (AFQT) category, zone, paygrade, occupation, and initial contract length. We also can examine retention across several dimensions simultaneously (e.g., occupation by gender).

Issues and limitations

Transaction dates

When we calculated the number of reenlistments, we used the transaction date attached to each reenlistment. An alternative would have been to identify reenlistments by when the begin contract date and end contract date both changed. Because we used monthly data, we often found small discrepancies between reenlistment transaction dates and when the contract dates changed (often only one or two month differences). For example, a reenlistment transaction occurred in January, but we observed the change in contract dates in February or March.

Similarly, we did not rely on when a servicemember disappeared from the data to determine EOC losses; we used loss transaction dates. For example, a loss transaction may have occurred in January, but a servicemember appeared in the DMDC data until February or March. We

counted this as a loss in January. If OSD or the services use similar data but rely on changes in contract dates or when servicemembers are no longer in the data to determine reenlistments and losses, their numbers will differ from ours.

It is rare, but sometimes a servicemember disappeared from the data but did not have a loss code. We did not count these as losses in the calculation of the reenlistment rate because we did not know their reenlistment eligibility status. However, the continuation and cumulative continuation rates still reflect these losses.

Changes in contract dates

Before a reenlistment or a loss, we sometimes observed small changes in contract end dates in the data. For losses, it was not uncommon to see a contract end date pull back or forward a few months to match the loss transaction date. For reenlistments, it was not uncommon to see the end of contract date switch for one or two months before the reenlistment transaction date. In both cases, it was not clear whether the change in contract dates was related to an official extension or was some sort of internal adjustment.

Changes in contract end dates created a unique problem for the EOC-cohort reenlistment rate. These changes do not cause problems for the other retention rates because we did not rely on contract dates in constructing those metrics. However, the denominator in the EOC-cohort reenlistment rate relies on correctly determining which servicemembers belong to an FY EOC-cohort. If someone made a reenlistment or loss transaction near the beginning or end of an FY, and there were small changes in contract end dates like those described above, we might count that person in multiple EOC cohorts when they should not be. To partially alleviate this problem, if we observed a change in contract end dates before a loss or reenlistment and the change lasted for three months or less, we assigned that transaction to the original contract end date and counted that servicemember in only the FY cohort that corresponded to the original contract end date.

Eligibility to reenlist

Why do we not restrict the EOC-cohort reenlistment rate to those eligible to reenlist? In the DMDC data, we observed a servicemember's eligibility status when a loss transaction occurred. This means that at the end of an FY, we observed who were eligible to reenlist and had a contract ending in that FY. Then we could construct an EOC-cohort reenlistment rate for that EOC cohort that was restricted to those eligible to reenlist. However, we would not be able to show the progress of a particular FY EOC cohort throughout the FY because we would not know the size of the eligible EOC cohort until the end of the FY (by which point everyone in the EOC-cohort had made a reenlistment decision). The EOC-cohort reenlistment rate is most useful to track an EOC cohort's progress during the FY, so we chose to include those ineligible to reenlist.

Missing data

The DMDC data for this project included the compensation files, which include special pay and bonus information for each servicemember. Because this is a retention dashboard, reenlistment bonus information was the most relevant piece of data from the compensation files. Unfortunately, by FY 2018, all services, except the Marine Corps, were missing values for the date variable that corresponds to the bonus amount. If a servicemember had only one reenlistment, this is not a problem because the bonus obviously corresponds to that reenlistment. However, if a servicemember had reenlisted more than once, we did not know whether one of the reenlistments or both received a bonus. At this time, there is no clear solution to this problem. However, the services indicated that they may have this information in their service-specific data files, in which case we could supplement the DMDC data with service data.

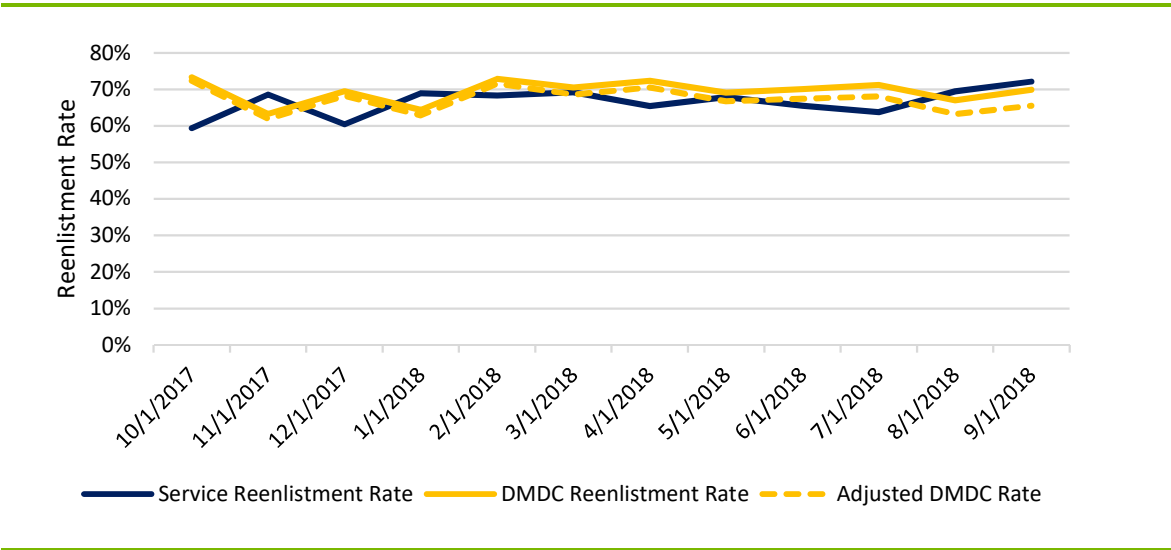
Validation

As part of the working groups, we asked the services to provide the number of reenlistments and losses by month in FY 2018 so that we could compare them to the numbers we generated using DMDC data. Reenlistment rates for the Air Force, Marine Corps, and Navy are shown in Figure 1 through Figure 3 (service-provided data are in blue and DMDC data are in yellow). We did not receive data from the Army to validate.

For the Air Force, we also show an adjusted DMDC rate, which is calculated by excluding servicemembers who reenlisted more than one year before their end of contract. Based on Air Force inputs, we believe its data pull may have excluded these servicemembers because, by policy, Airmen should not reenlist more than one year before their end of contract. However, based on DMDC data, we did sometimes observe Airmen reenlisting more than one year before their EOC because of an extension (which moved the EOC date forward). We show the adjusted DMDC rate to demonstrate that we came close to the Air Force-provided numbers; however, the dashboard uses the unadjusted rate.

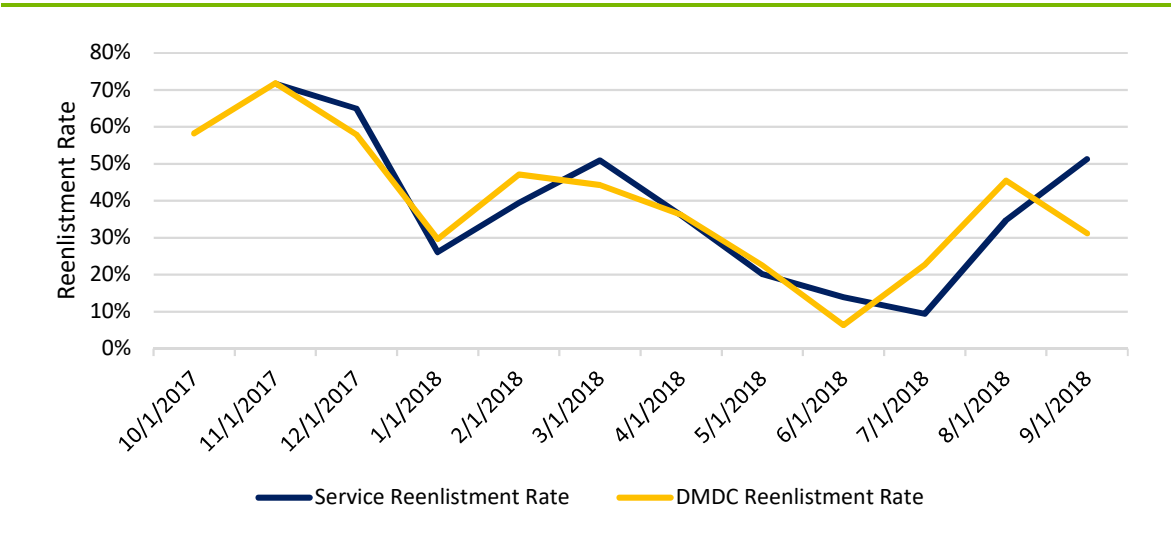
Over time, the reenlistment rate from the service-provided data and DMDC data track closely, although, there are some differences. For example, DMDC reenlistment rates generally are higher than service-reported rates for the Navy. Additionally, it appears that the Marine Corps data lags the DMDC data from June through August. This could be because the Marine Corps used changes in contract end dates rather than the transaction date in identifying reenlistments.

Figure 1. Air Force reenlistment rate validation



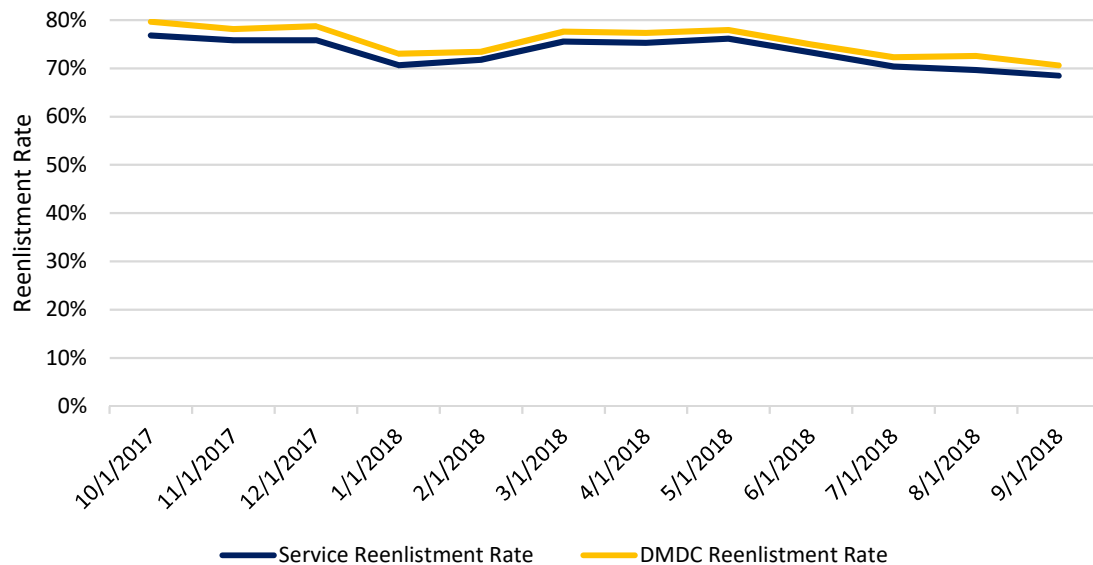
Source: DMDC and service-provided data.

Figure 2. Marine Corps reenlistment rate validation



Source: DMDC and service-provided data.

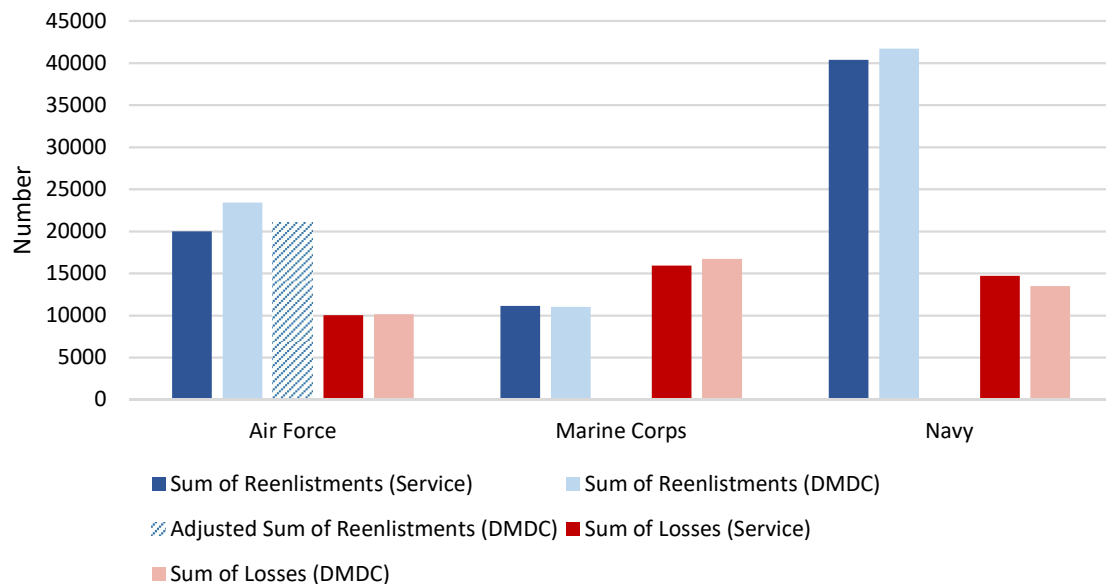
Figure 3. Navy reenlistment rate validation



Source: DMDC and service-provided data.

Reenlistment rates reflect both reenlistments and eligible EOC losses, so Figure 4 shows the total number of reenlistments and losses in FY 2018 for each service. This allows us to better pinpoint whether differences in reenlistment rates are due to differences in the number of reenlistments or the number of losses. We report a higher number of reenlistments for both the Air Force and Navy using DMDC data and a lower number of losses for the Navy, compared to service-provided data. However, using the adjusted number of reenlistments by excluding those who reenlisted more than one year before their EOC brings the Air Force numbers more in line.

Figure 4. Reenlistment and loss counts by service, FY18



Source: DMDC and service-provided data.

Note: The sums for the Marine Corps exclude October.

There are several possible explanations for the small differences observed in the previous figures, and these explanations largely stem from the limitations previously noted.

- *Transaction dates:* Some reenlistments and losses may be off by a month or two. As previously noted, when we generated reenlistment rates using DMDC data, we relied on the reenlistment and loss transaction dates—not when EOC dates changed. This may create slight differences when a reenlistment or loss is counted.
- *No loss transaction:* Sometimes a servicemember disappeared from the DMDC data without a loss transaction. We did not count these losses in the reenlistment rate calculations using DMDC data.
- *Changes in contract dates:* In the DMDC data, we often see small changes in contract dates before a reenlistment or loss that may just be noise in the data. If the services rely on changes in contract dates to identify stay behavior, it may account for the differences we observe in the number of reenlistments or losses.

- *Eligibility to reenlist:* Each service has different reenlistment eligibility codes with many possible values. In most cases, the code clearly implies whether a servicemember is eligible or ineligible to reenlist, but there are some codes that are ambiguous. Differences in how we counted eligibility could account for differences in the number of losses.

In summary, due to a variety of factors, we found some differences in reenlistments and losses using the DMDC vs service-provided data. However, the differences are relatively small, and this dashboard is not intended as a comparison against service-reported numbers. Rather, it provides a uniform set of retention metrics and a uniform process for generating these metrics so that dashboard users may compare retention metrics across time and service.

From Data to Dashboard

This section discusses PII concerns and how we address these concerns by restructuring and collapsing the individual-level DMDC data to feed the retention dashboard.

Privacy protection

One potential concern for the retention dashboard is inadvertent leaks of Personally Identifiable Information (PII) or other sensitive information. These leaks could take the form of either accessible individual information or the ability to combine multiple dashboard views to identify an individual servicemember and then learn additional information about that servicemember. Here, we briefly discuss our methods to address these concerns and identify the limitations that these concerns place on the final form of the dashboard.

First, the retention dashboard displays information based on data in an underlying spreadsheet. These spreadsheets mean that any of the data that are aggregated and displayed in the dashboard can be accessed in raw form by opening the spreadsheets in Excel (or a similar viewer). While the data do not include direct identifiers (e.g., names or Social Security Numbers), elements of the data included in the dashboard theoretically could be combined to uniquely identify servicemembers. For instance, there may only be one Hispanic woman in some of the three-digit occupation codes. This would allow for the creation of a pseudo-identifier that would allow users to track the servicemember across time as well as allow for discovery of information that potentially could be harmful if traced back to the servicemember in question.

Our data use agreements with DMDC and our standard Statements of Work prevent us from removing PII from our secure servers and from sharing individual-level DMDC data with non-authorized individuals. If we were to include individual-level data in the dashboard spreadsheets, we would be violating both of these agreements. Instead, the dashboard data must be aggregated on CNA's secure servers before exporting it to the dashboard environment. Furthermore, this aggregation must ensure that PII cannot be recovered from the data.³ As a result of using aggregated data, the dashboard can only select among pre-computed averages across pre-determined groups. It cannot calculate retention metrics for groups for which we have not already created aggregate statistics.

³ For instance, if ten men and one woman are in an occupation, reporting aggregate statistics on the total and on the ten men would allow for a user to "back out" the characteristics of the one woman.

Distribution tables

Figure 5 provides an example distribution table using part of the service/month/zone distribution table. It is an aggregate of counts for zone A enlisted Air Force personnel over time. “Cont” gives the numerator for the continuation rate metric and “S_Cont” gives the denominator. The same applies for the reenlistment rate using “Reen” and “S_Reen”. These counts are taken outside the SCO environment and fed into the retention dashboard for OSD use. The retention dashboard itself then uses this information to calculate the various retention metrics.

Because of the PII limitations, we created distribution tables for each group in which we were interested. Each distribution table then feeds an individual dashboard page. For example, we created a distribution table with the counts for continuation and reenlistment rates by service/month. We also created distribution tables by service/month/zone, service/month/occupation, etc.

Figure 5. Example Air Force Zone A distribution table

Service	Zone	Date	Cont	S_Cont	Reen	S_Reen
Air Force	A	12/1/2012	130003	131108	439	866
Air Force	A	1/1/2013	130202	131171	626	1021
Air Force	A	2/1/2013	131160	132153	814	1131
Air Force	A	3/1/2013	131082	132263	172	467
Air Force	A	4/1/2013	130954	132134	650	953
Air Force	A	5/1/2013	129876	132073	743	1054
Air Force	A	6/1/2013	130409	131527	565	883

Source: DMDC data.

Note: Zone A includes servicemembers with 0 to 6 years of service.

The major limitation with using PII is that, for a particular group, we cannot report counts fewer than 10 (zeros can be reported) or summary statistics based on counts fewer than 10. For example, there are very few female pilots in the Air Force and even fewer making reenlistment decisions in a particular month. If we were interested in the reenlistment rate of Black female pilots in the Air Force, there likely would be fewer than 10 comprising that group in some months. Breaking the data down into further increments only exacerbates this problem. For example, consider trying to report the reenlistment rate for zone A Black female Air Force pilots.

In terms of Figure 5, a problem occurs when “S_Cont” or “S_Reen” is between 0 and 10. In other words, the restriction applies to the denominator of the various retention metrics. If a

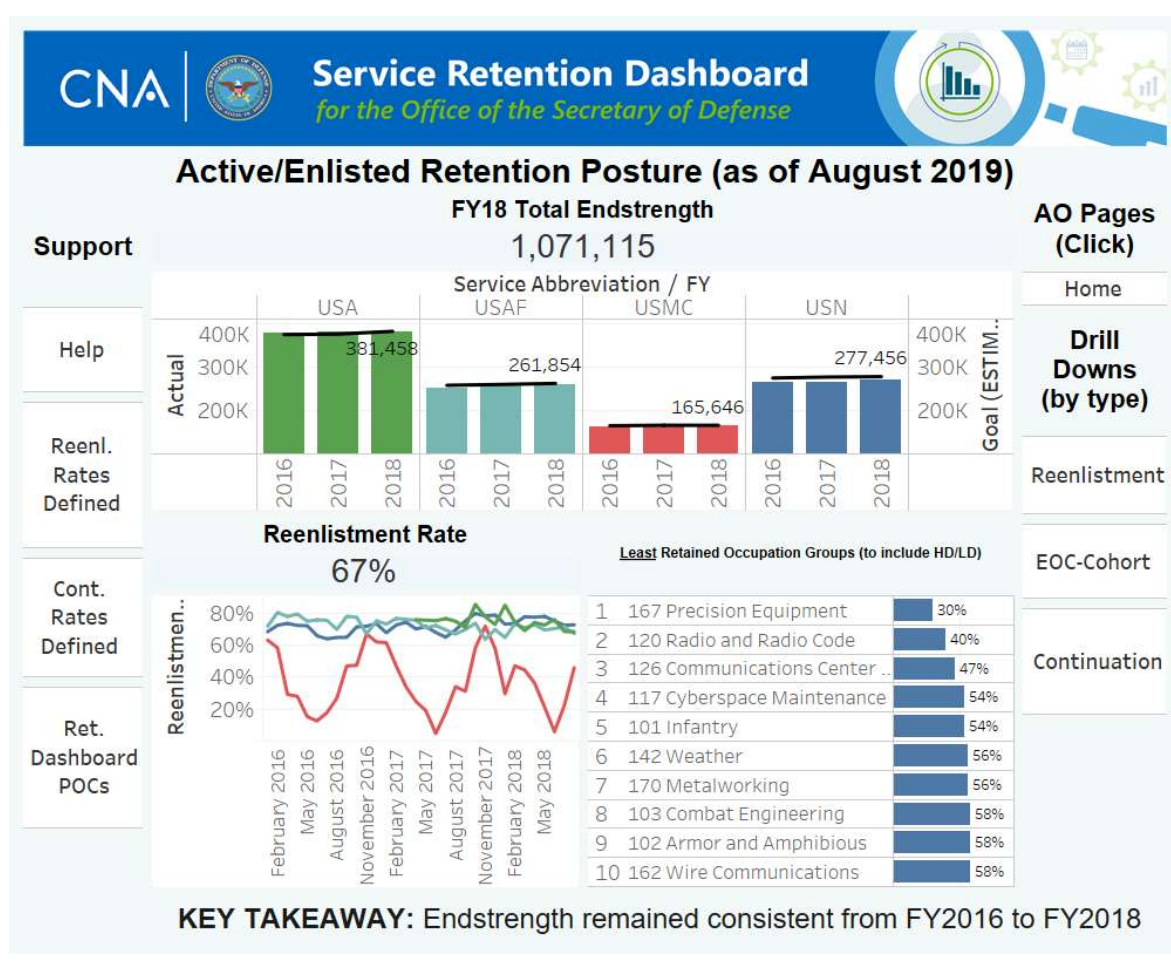
grouping resulted in some cells with fewer than 10 observations but greater than zero, we suppressed those cells. In addition, in some cases a suppressed cell may be backed out from addition or subtraction of other groups. For example, if we suppressed “S_Reen” for Asians, but we knew “S_Reen” for white, black, other, and overall, we could back out the value of “S_Reen” for Asians. In these cases, we also suppressed the next smallest cell (in this example, it is likely to be the “other” ethnicity category).

For these reasons, the counts in a more disaggregated distribution table do not necessarily sum to those in a more aggregate table. For example, the service/month/zone/male distribution table cannot be used to get the service/month/zone distribution table, if the service/month/zone/male table contains suppressed cells.

Using the OSD Dashboard

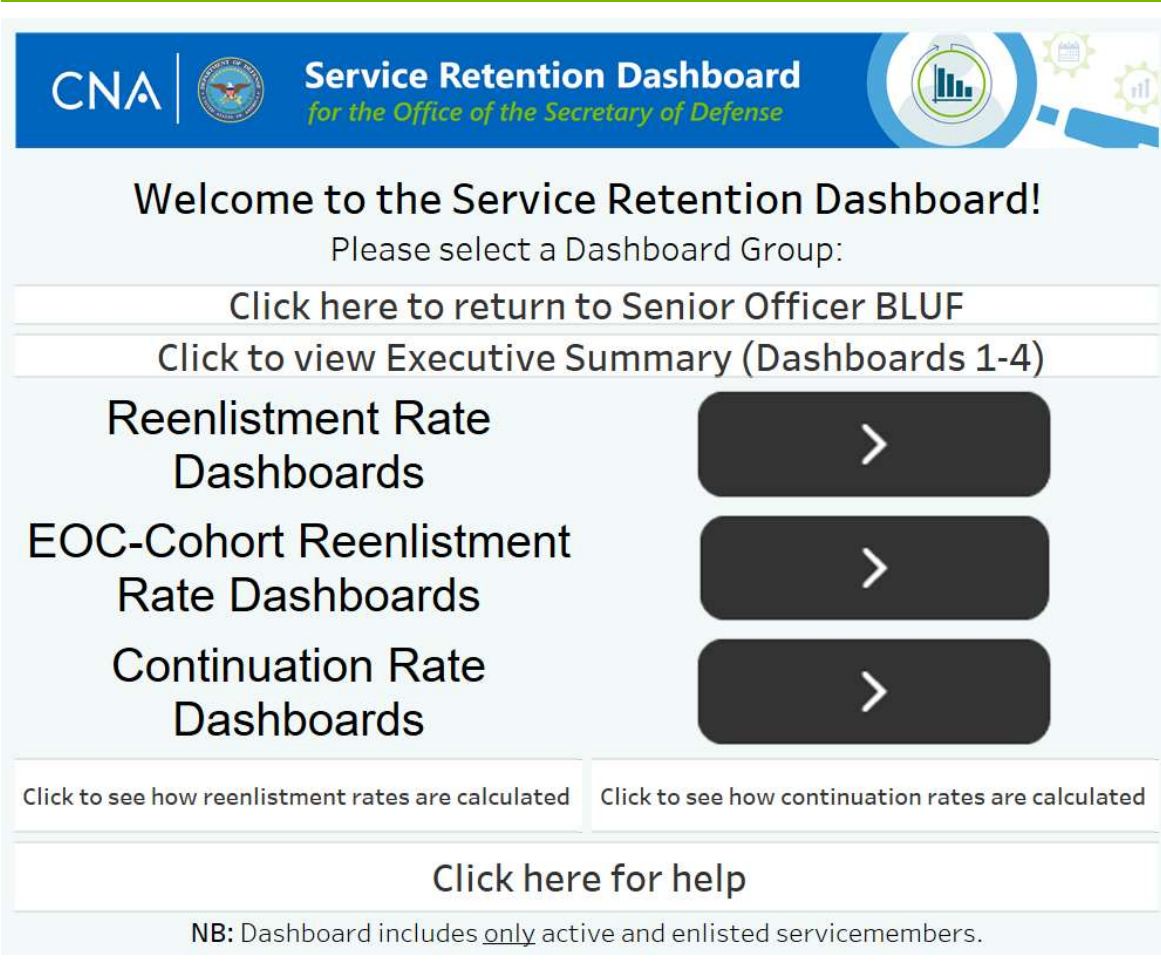
On opening, the OSD Retention Dashboard will display the senior officer BLUF page (shown in Figure 6), which contains information about endstrength by service over the past three fiscal years, the reenlistment rate by service and month over the past two years, and the least retained DoD three-digit occupation groups across all services.


Figure 6. Senior officer BLUF page



For more detailed information, users can navigate to the action officer home page, as shown in Figure 7.

Figure 7. Action officer home page



CNA |  **Service Retention Dashboard**
for the Office of the Secretary of Defense

Welcome to the Service Retention Dashboard!
Please select a Dashboard Group:

[Click here to return to Senior Officer BLUF](#)

[Click to view Executive Summary \(Dashboards 1-4\)](#)

Reenlistment Rate Dashboards [>](#)

EOC-Cohort Reenlistment Rate Dashboards [>](#)

Continuation Rate Dashboards [>](#)

[Click to see how reenlistment rates are calculated](#) [Click to see how continuation rates are calculated](#)

[Click here for help](#)

NB: Dashboard includes only active and enlisted servicemembers.

From the AO Home Page, users can access executive summary dashboards and dashboards for the different retention metrics.

Once a particular retention metric is selected, users then can access the specific dashboards for the various drill-down areas (e.g., zone, occupation, etc.) shown in Figure 8.⁴

⁴ See Appendix A for a list of the possible drill-down areas.

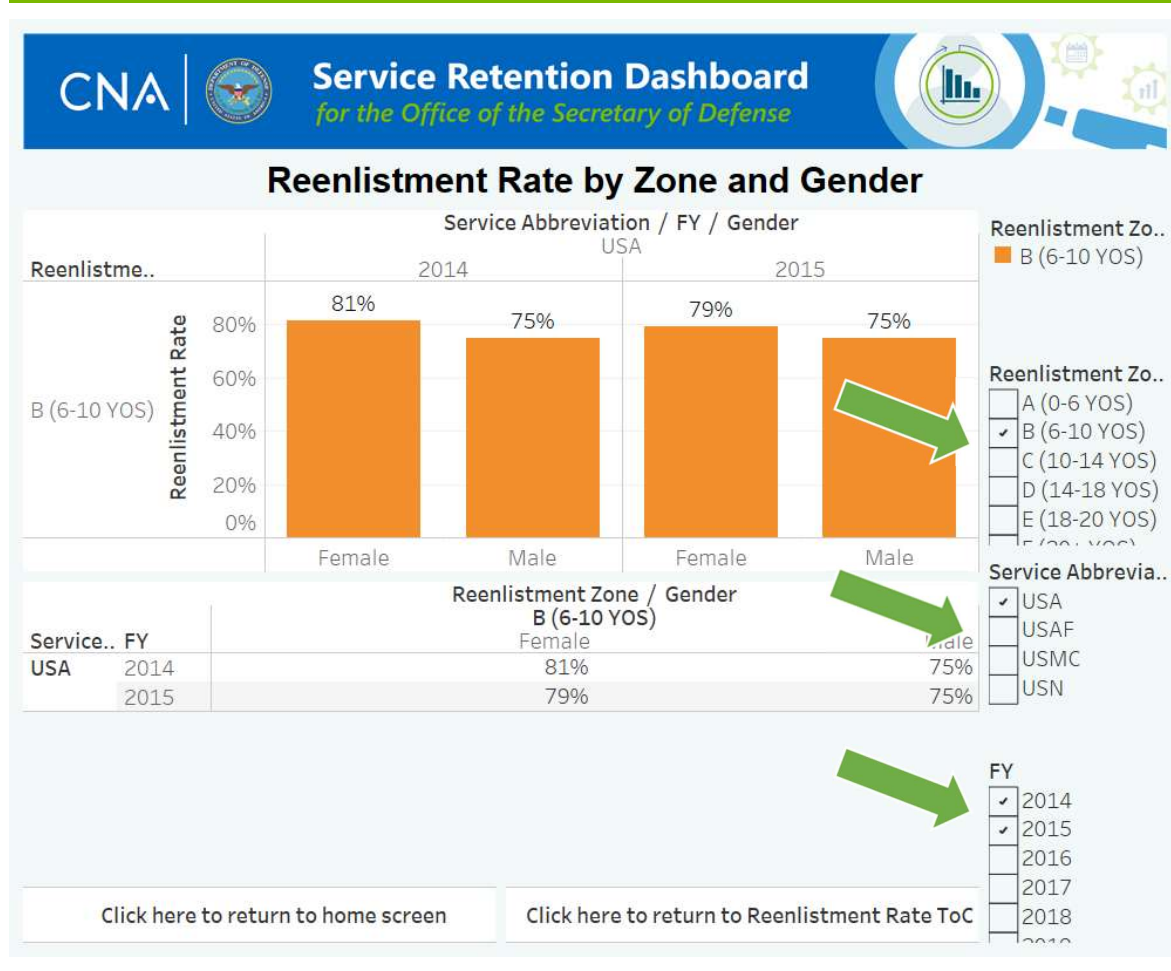
Figure 8. Reenlistment table of contents

Dashboard 4: Reenlistment Rate	>
Dashboard 5: Reenlistment Rate by Zone	>
Dashboard 6: Reenlistment Rate by Zone and Gender	>
Dashboard 7: Reenlistment Rate by Zone and Race	>
Dashboard 8: Reenlistment Rate by Race	>
Dashboard 9: Reenlistment Rate by Zone, Gender, a..	>
Dashboard 10: Reenlistment Rate by Zone and Occ..	>
Dashboard 11: Reenlistment Rate by Zone, Occupati..	>
Dashboard 12: Reenlistment Rate by Zone, Occcupa..	>
Dashboard 13: Reenlistment Rate by Zone and Occ..	>
Dashboard 14: Reenlistment Rate by Zone, Occupati..	>
Dashboard 15: Reenlistment Rate by Paygrade	>
Dashboard 16: Reenlistment Rate by Paygrade and ..	>
Dashboard 17: Reenlistment Rate by Paygrade and ..	>
Dashboard 18: Reenlistment Rate by Paygrade and ..	>
Dashboard 19: Reenlistment Rate by Paygrade and ..	>
Dashboard 20: Reenlistment Rate by Ethnicity	>
Dashboard 21: Reenlistment Rate Rate by Marital St..	>
Dashboard 22: Reenlistment Rate by Parental Status	>
Dashboard 23: Reenlistment Rate by Education Tier	>
Dashboard 24: Reenlistment Rate by Initial Contract	>
Dashboard 25: Reenlistment Rate by Years of Service	>

[Click here to return to home screen](#)

When examining a particular dashboard, users will use the checkboxes at the right of the screen to select different options, as shown in Figure 9 (e.g., service, FY, etc.).

Figure 9. Reenlistment rate by zone and gender menu options



The data containing the selected options (represented by a checkmark) should be reflected in the graph/table within the dashboard. Depending on how the options on the dashboard are organized, the figure will adjust in different ways. For example, one dashboard may be organized by zone and then by year. If a user selects an additional zone, it will add that additional zone to the below the figure with all of the previous years already selected for that zone, as shown in Figure 10 and Figure 11.

Figure 10. Reenlistment rate by zone and gender zone comparison (Zone A)

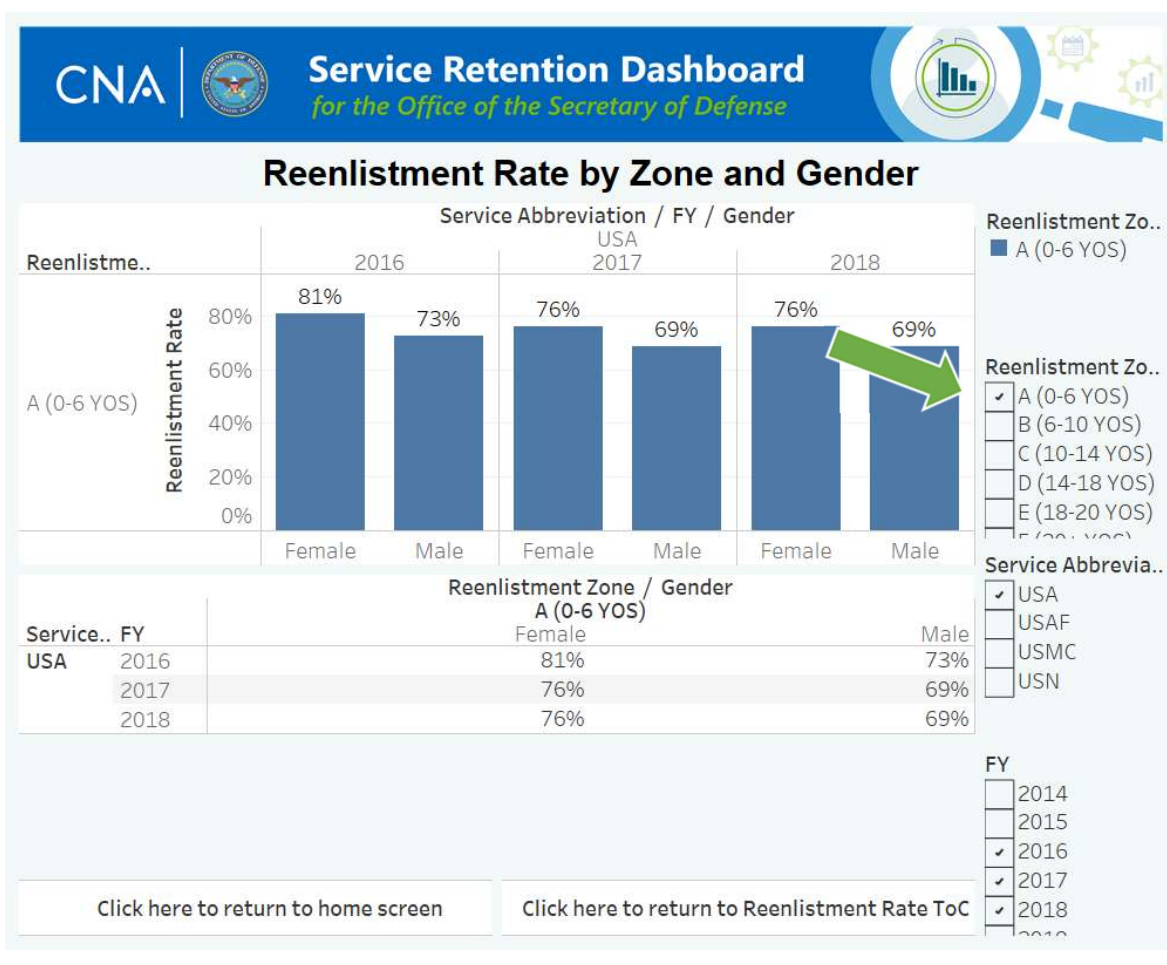
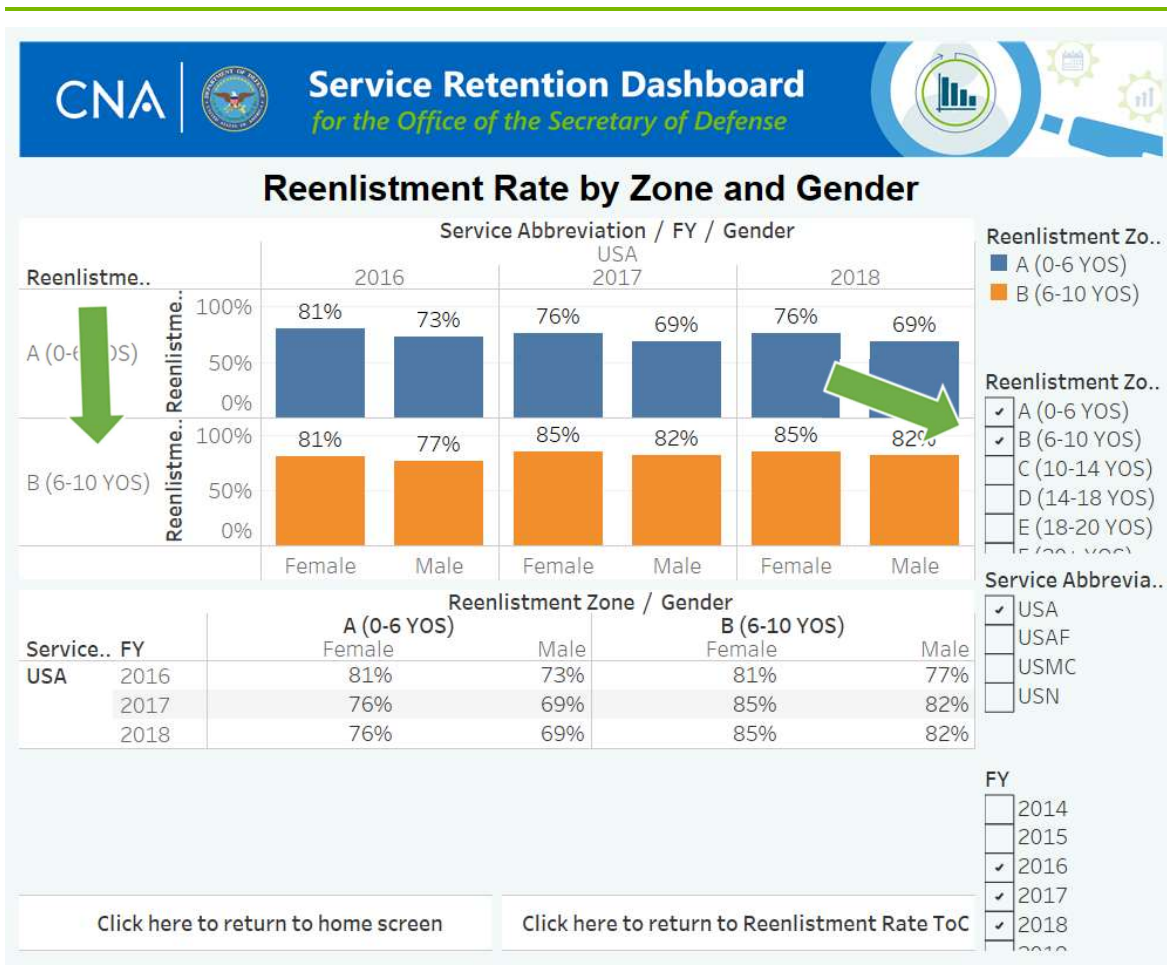


Figure 11. Reenlistment rate by zone and gender zone comparison (Zones A and B)



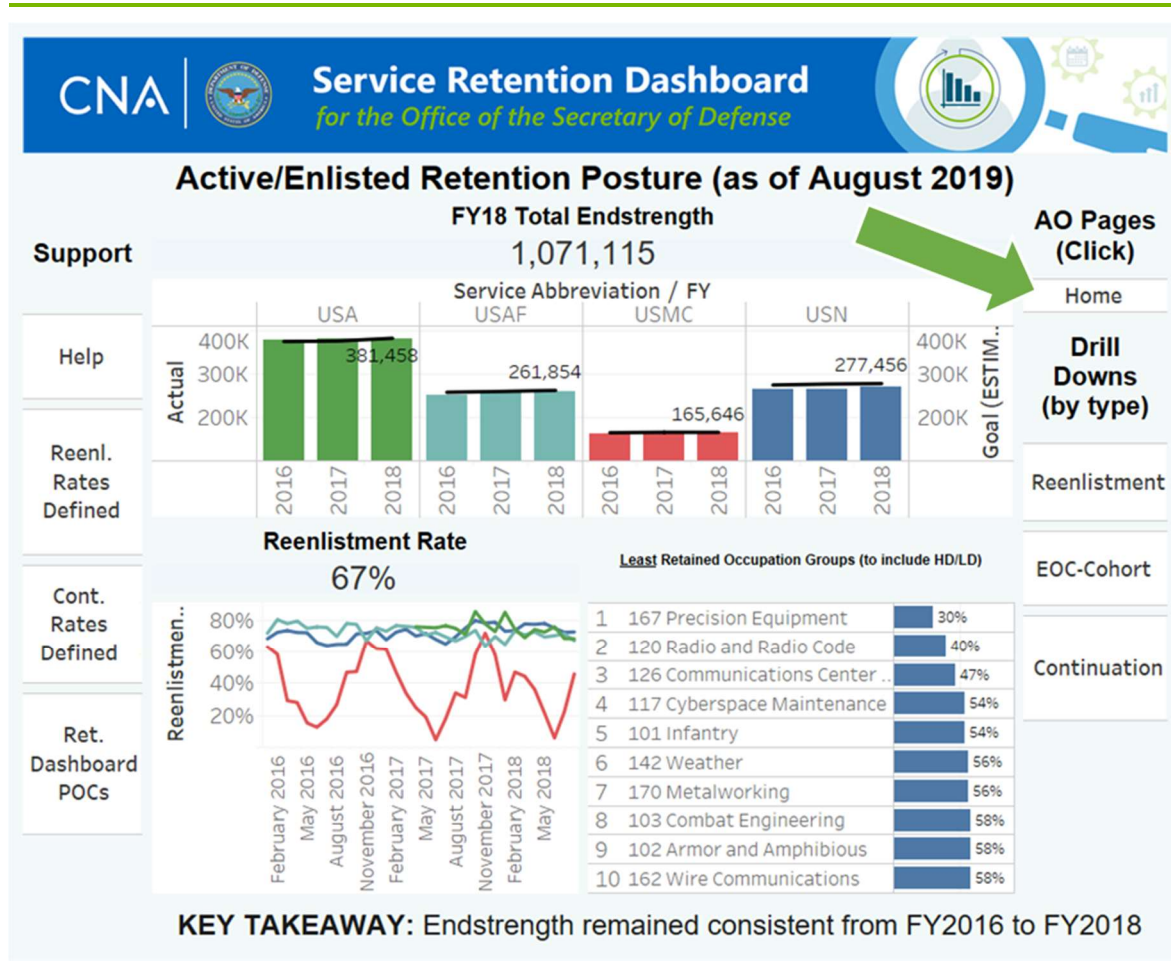
Certain options also may extend the graph horizontally. Experimenting with each of the options and observing the changes to any given dashboard is the best way to learn how these dashboards function.

Example: Comparing reenlistment rates for E3 sailors over time

An individual requests for the user to pull information comparing the reenlistment rate of sailors at the E3 paygrade from 2014 to 2018.


STEP 1: From the Senior Officer BLUF page, as shown in Figure 12, the user navigates to the Action Officer Home Page.

Figure 12. Senior officer BLUF page



STEP 2: From the Action Officer Home Page, as shown in Figure 13, the user clicks the button for the “Reenlistment Rate Dashboards.”


Figure 13. Action officer home page


CNA |  **Service Retention Dashboard**
for the Office of the Secretary of Defense


Welcome to the Service Retention Dashboard!
Please select a Dashboard Group:

[Click here to return to Senior Officer BLUF](#)

[Click to view Executive Summary \(Dashboards 1-4\)](#)

Reenlistment Rate Dashboards 

EOC-Cohort Reenlistment Rate Dashboards 

Continuation Rate Dashboards 

[Click to see how reenlistment rates are calculated](#) [Click to see how continuation rates are calculated](#)

[Click here for help](#)

NB: Dashboard includes only active and enlisted servicemembers.

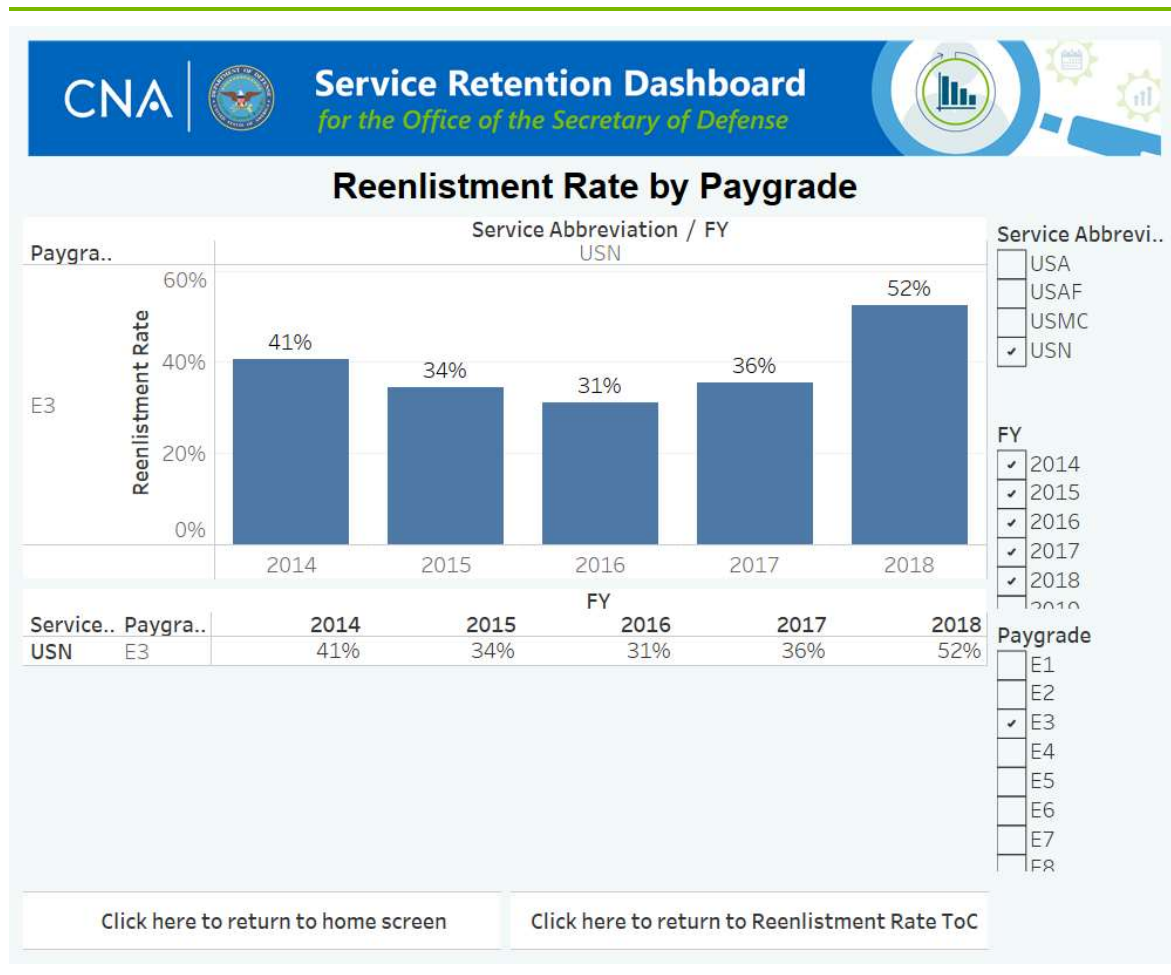
STEP 3: From the Reenlistment Rate Dashboard Table of Contents, as shown in Figure 14, the user clicks the button for “Dashboard 15.”

Figure 14. Reenlistment rate dashboard table of contents



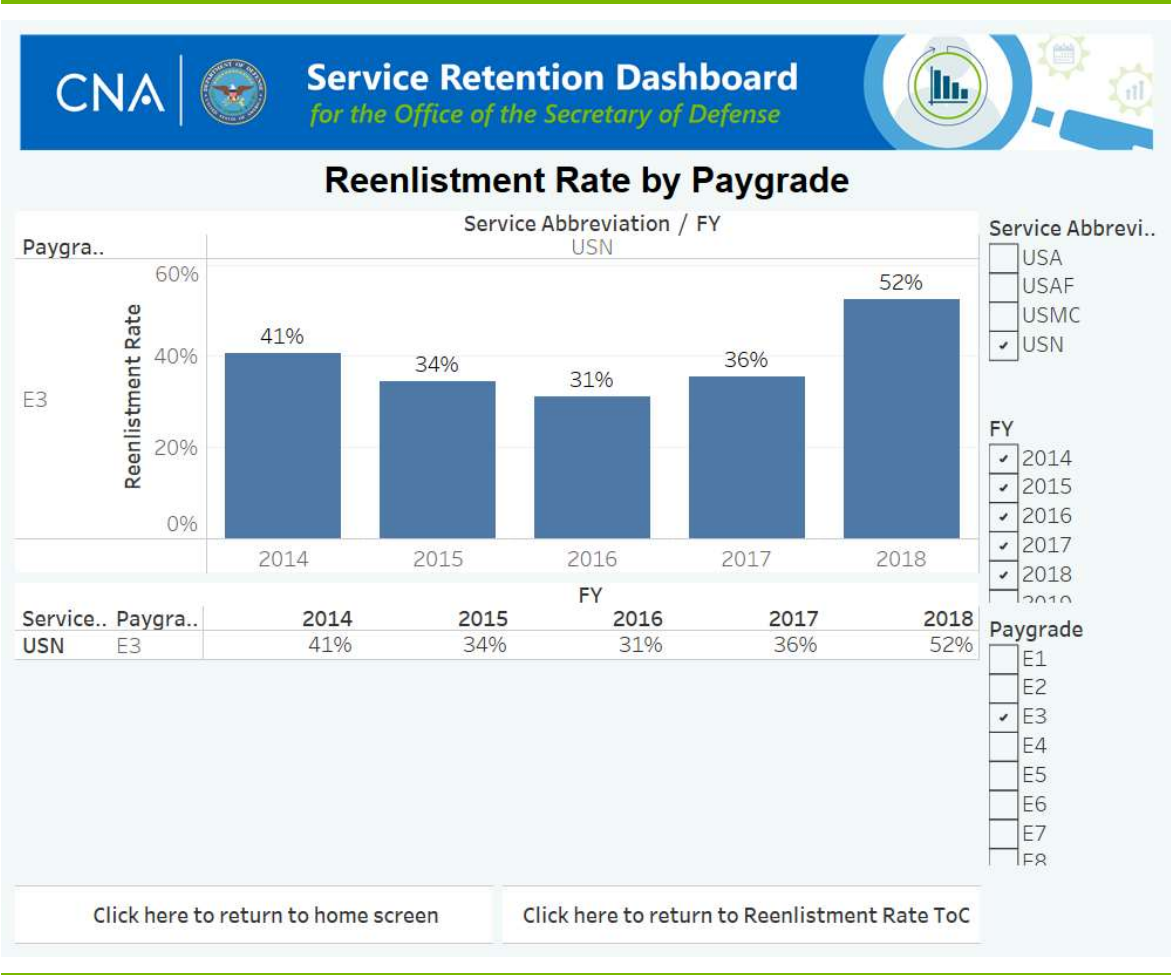
STEP 4: The user makes the selections on the dashboard that correspond with the request: “USN” (as the request is for sailors), as shown in Figure 15, all of the years from 2014–2018 in “FY” (these dates were specified by the requestor), and “E3” for “Paygrade.”

Figure 15. Dashboard selection options



Once the selections have been made, a graph should appear that looks like Figure 16.

Figure 16. Example retention dashboard graph

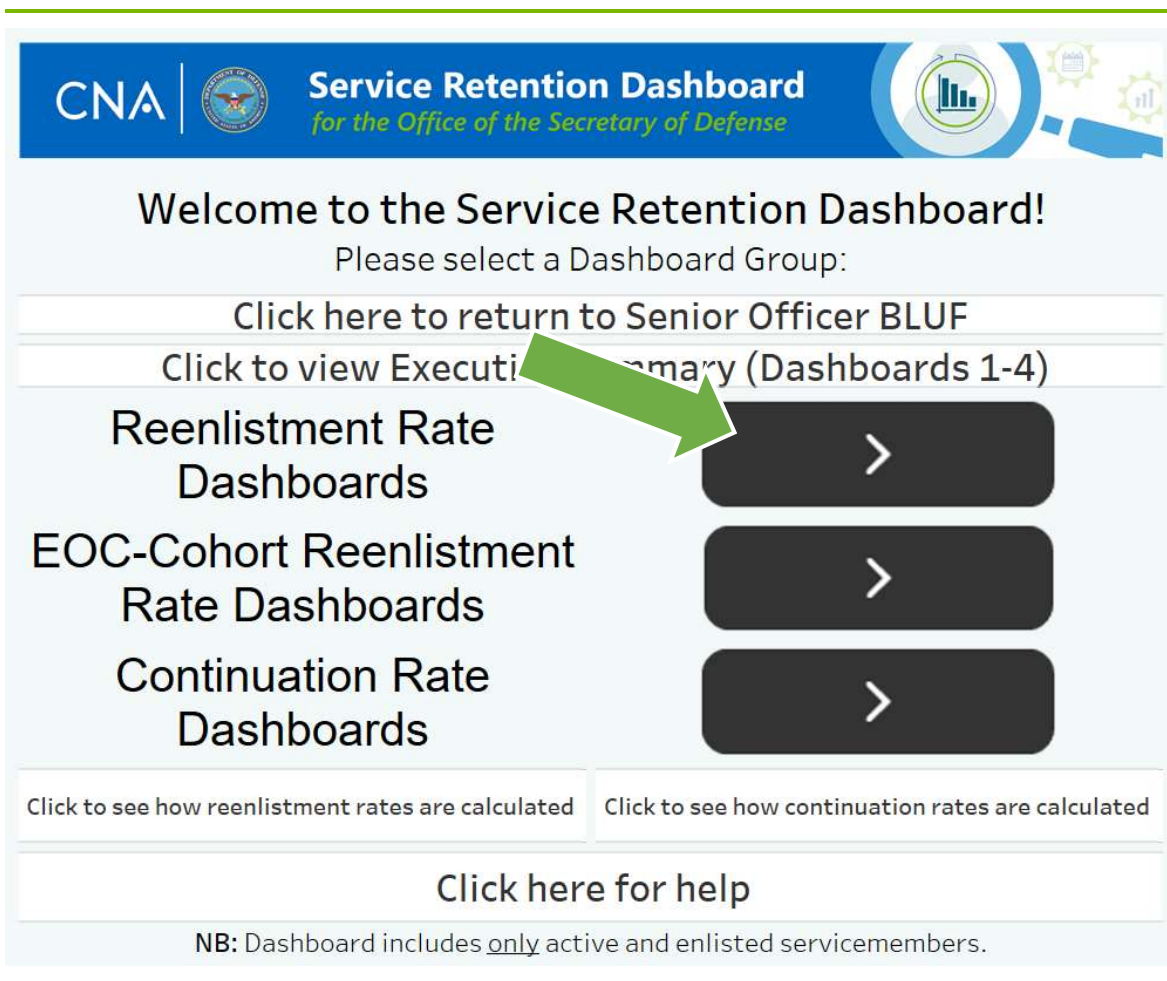


How to export to share results with colleagues

If a colleague requests a visualization based on a specific retention rate definition and drill-down option, the user will perform the following actions:

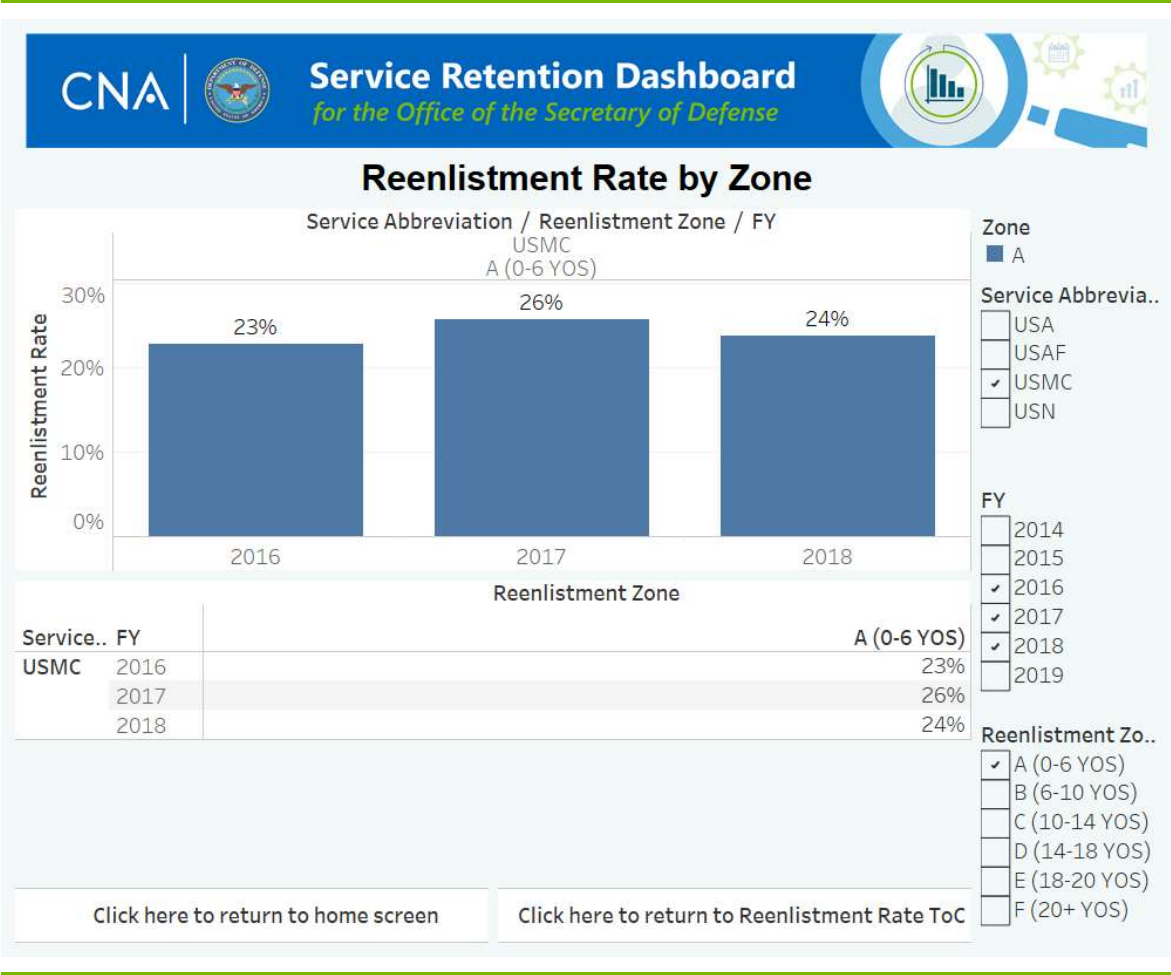
STEP 1: The user selects the appropriate dashboard using the table of contents, as shown in Figure 17.

Figure 17. Action officer home page



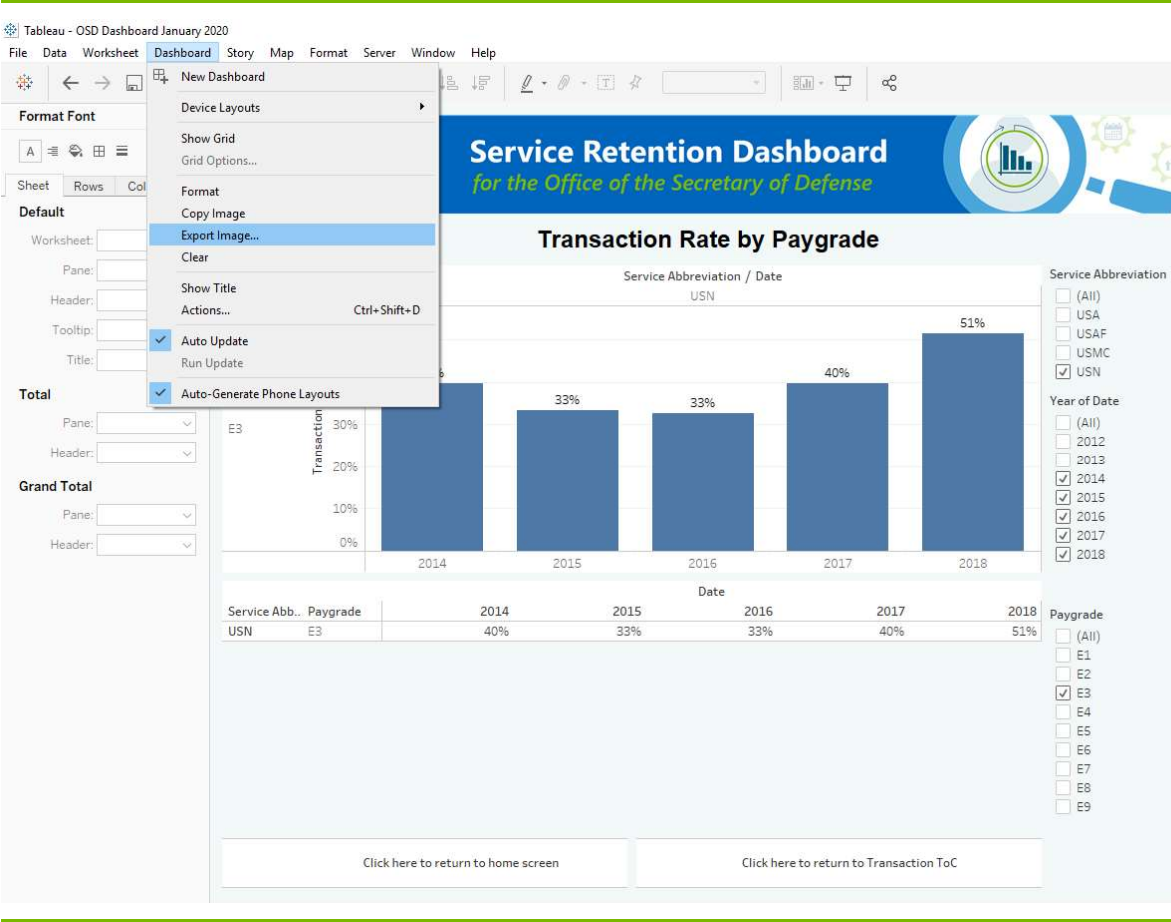
STEP 2: The user drills down by clicking the desired demographic category options (represented by a checkmark) at the right of the screen, as shown in Figure 18.

Figure 18. Reenlistment rate by zone dashboard for export example



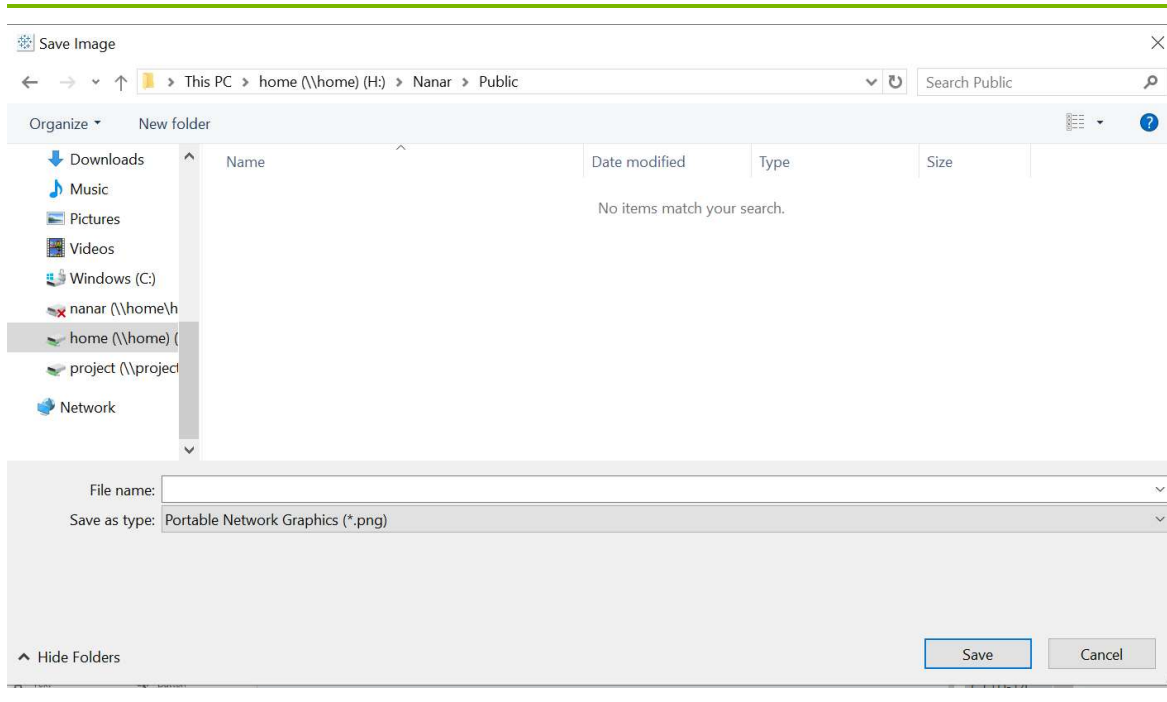
STEP 3: When the dashboard displays the desired figure, the user clicks “Dashboard” in the top menu and then clicks “Export Image” in the dropdown menu, as shown in Figure 19.

Figure 19. Exporting dashboard graph



STEP 4: A “Save Image” window will pop up. The user selects a desired file path in the left portion of the “Save Image” window and a desired file type in the bottom portion of the “Save Image” window, which includes the following options: Portable Network Graphics (.png), Windows Bitmap (.bmp), Enhanced Metafile (.emf), and Joint Photographic Experts Group (JPEG) image (.jpg, .jpeg, .jpe, .jfif). The resulting image will capture a screenshot of all the figures on a particular dashboard, including the items selected on the dashboards. Users may wish to crop out unwanted portions of this image, either in a photo editor or by copy-pasting it into Word and using the crop feature in the “Format” tab under the “Picture Tools” menu that appears when the image is clicked, as shown in Figure 20.

Figure 20. Save image window



Potential issues

Delays when opening the dashboard

If there is a connection error, it may take a few moments to resolve. If the problem does not resolve, please contact CNA at the above email address.

Items on the dashboard are highlighted in blue

If a box is highlighted in blue, try clicking the far left corner of the container (the part of the item with a gray border) to remove the highlight.

Crowded dashboard display

If you are unable to view the figures, attempt to make fewer selections.

Support

If any of the above issues are encountered, please contact Rikesh Nana at nanar@cna.org, Jared Huff at huffj@cna.org, or Josh Horvath at horvathj@cna.org.

Future Extension: Predictive Modeling

We conclude this paper with thoughts on dashboard extensions. One future extension of the dashboard is a predictive component that would provide oversight of how changes in policy, servicemember characteristics, and external factors could affect retention. In this section, we summarize some of the major concerns that must be addressed when a predictive component is incorporated. In particular, we discuss the differences between voluntary and involuntary losses and briefly identify how that might affect retention predictions, offer insight on modeling civilian economic conditions, and discuss the costs and benefits of individual versus aggregated retention predictions.

Differences between voluntary and involuntary retention decisions

Retention statistics encompass three types of losses:

- Losses before the end of obligated service (unplanned losses)
- Involuntary losses at the end of obligated service (ineligible EOC losses)
- Voluntary losses at the end of obligated service (eligible EOC losses)

Although some causes of these losses are similar, some are unique. These losses are concentrated at different YOS across servicemembers' careers; therefore, understanding what drives the different types of losses is important for accurately forecasting total losses, and, thus, retention. In this section, we discuss the differences between these types of losses, how these differences affect forecasting, and how the data requirements differ for each.

Unplanned losses can occur for a variety of reasons, including injury, misconduct, and failure in a training pipeline. Various studies have shown that servicemember characteristics such as education attainment, aptitude test scores, and demographic characteristics are strongly correlated with these types of losses—especially in the first-term. Likewise, first-term unplanned losses can be driven by changes in policy, such as weight and body fat restrictions, permissibility of waivers, and the extent to which servicemembers who suffer training setbacks are released from service.

Unplanned losses tend to be viewed as involuntary; much of the literature focuses almost exclusively on policy and servicemember characteristics when estimating unplanned loss models (See, for example, [1]). This need not be the case; servicemembers face both incentives and disincentives to leave. A stronger civilian job market should make leaving the military

more attractive, while the required (partial) repayment of any enlistment bonuses should make leaving less attractive. However, recent research has shown minimal correlation between incentives and unplanned losses, supporting the assumption that first-term unplanned losses are generally involuntary.

Likewise, some losses at the end of obligated service are not voluntary. These losses represent servicemembers who would have remained in the military after their contracted obligations were served but were prohibited from doing so. For example, sometimes there is a limit on the number of servicemembers who can reenlist to maintain the relevant service's preferred force size and grade structure.⁵ Involuntary losses also can be due to indirect factors. High Year Tenure (HYT), for instance, limits the permissible length of service for servicemembers by paygrade. Servicemembers who reach HYT for their paygrade must separate even if they wish to remain in service.

As with unplanned losses, servicemember characteristics are correlated with servicemembers' voluntary reenlistment decisions (See, for example, [2-4]). However, incentives and disincentives have been widely shown to affect servicemembers' voluntary reenlistment decisions and frequently are the focus of reenlistment studies. Reenlistment bonuses, which offer servicemembers monetary incentives in return for additional obligation, are common policy tools that the services use to increase or decrease reenlistments. Strong civilian economic conditions can make leaving more attractive (and vice versa). Servicemembers who face unappealing career conditions in the near future (lower advancement opportunities or higher chances of deployment) may be more likely to leave at the end of their contracts.

These different types of losses, concentrated at different points in servicemembers' careers, should affect retention predictions. Very early retention should primarily be based on servicemember characteristics and service policies. At (and after) the first reenlistment decision, accounting for each type of potential loss should result in more accurate long-term predictions.

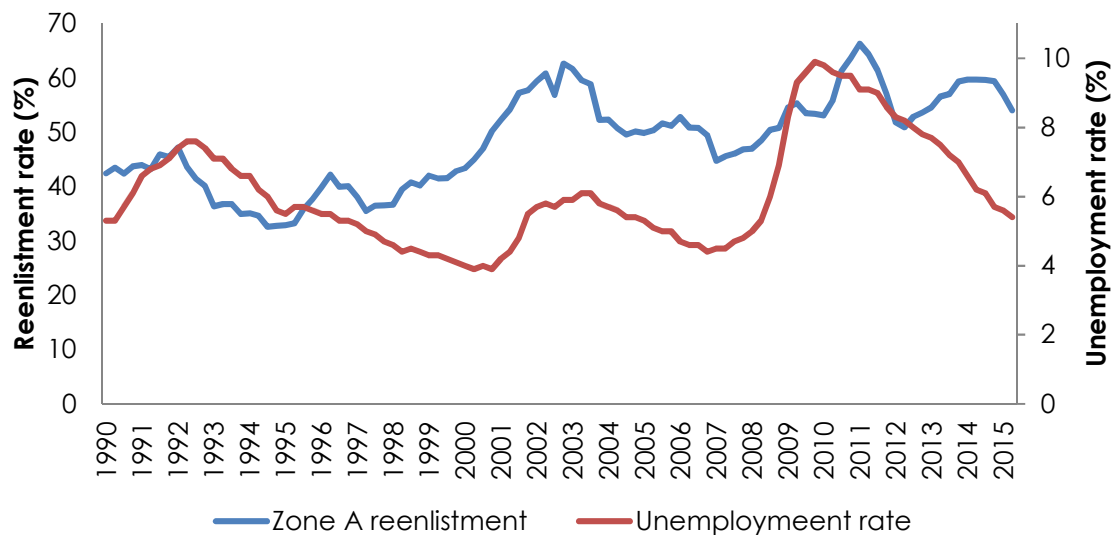
Modeling civilian economic conditions

Civilian economic conditions commonly are accepted drivers of military reenlistment. Economic conditions traditionally have been measured with some form of the unemployment rate. Here, we briefly discuss the implications of some of our previous work showing that improvements in the unemployment rate have outpaced improvements in military retention.

⁵ The Marine Corps is well known for limiting its first-term reenlistments, but the Navy also limited reenlistment in the aftermath of the recession of the late 2000s.

Recent CNA work for the Navy focused on explaining why improvements in civilian economic conditions in the early 2010s (as measured by the unemployment rate) seemed to have diverged from Navy retention. As Figure 21 shows, improvements in the national unemployment rate outpaced improvements in the Navy reenlistment rate throughout the first half of the 2010s. As [5] notes, this is not evidence that the relationship between economic conditions and reenlistment rates has weakened; instead, it suggests that the unemployment rate has become a less accurate measure of economic conditions.

Figure 21. The Navy reenlistment rate diverged from the unemployment rate in the early 2010s



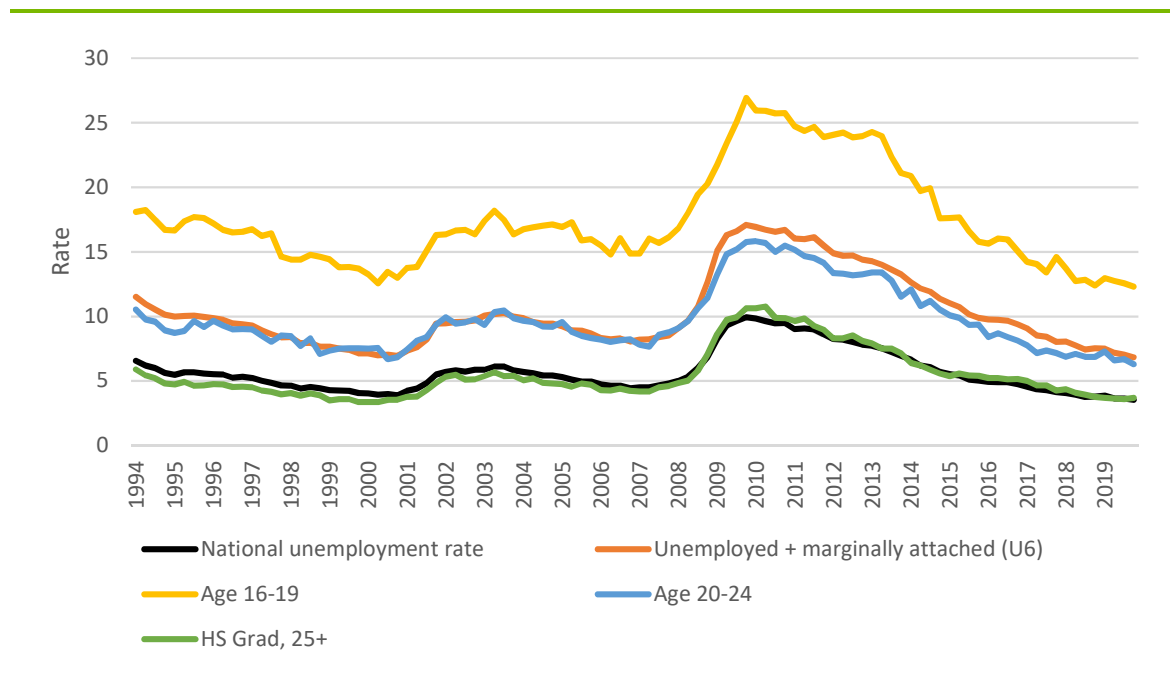
Source: Previous (unpublished) CNA tabulations.

This issue is not limited to the national unemployment rate. Different parts of DOD may use different unemployment rates to capture economic conditions for their relevant markets. Our previous discussions with recruiting establishments, for instance, showed that the youth unemployment rate is favored in some cases. For retention, a focus on the unemployment rate for slightly older populations seems more appropriate. In addition, given our concerns about the national unemployment rate, a rate that includes some accounting for people who decide to work part time instead of full time, go to school instead of enter the labor market, or remain without employment until economic conditions improve may seem more valuable.

We show several plausible unemployment rates in Figure 22. These include the national unemployment rate, multiple age- and education-specific unemployment rates, and “U6”—an unemployment rate that includes the formally unemployed, discouraged workers who have

temporarily stopped looking for work, people who work part time but want full-time employment, and those who remained in school to avoid the labor market. The calculated unemployment rates vary substantially: the highs in the national unemployment rate for those age 16 to 19 range from around 10 percent to more than 25 percent.

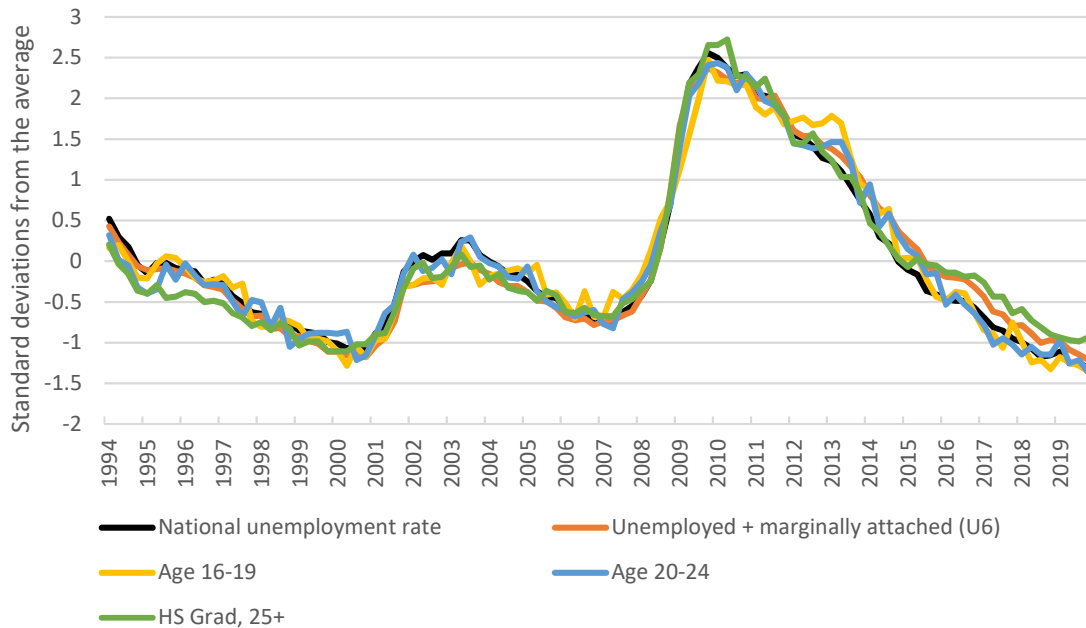
Figure 22. Different unemployment rates appear to show different information



Source: CNA tabulations from data obtained from the Federal Reserve website.

Despite the differences in the measured level of unemployment, from a forecasting standpoint, the unemployment rates contain very similar information: the correlation between the national unemployment rate and the others exceeds 0.97. We show this similarity graphically in Figure 23, in which we have normalized each of the unemployment rates. There, the extent to which the unemployment rates typically move at the same time in the same direction is clear. Substituting these other unemployment rates into Figure 21 will not solve the divide between changes in the unemployment rate and changes in reenlistment rates throughout the first half of the previous decade.

Figure 23. Different unemployment rates offer nearly identical information when forecasting



Source: CNA tabulations from data obtained from the Federal Reserve website.

There are a variety of potential solutions to this problem, with a range of associated data requirements. Over the past several years, CNA has combined the unemployment rate with other variables in a statistical model that distills the information into an index. Similar solutions have been proposed by others (e.g., the Federal Reserve [6]). An index of this type has several benefits:

- It is easier to interpret than several variables reported independently, since it builds in appropriate interpretation when the variables seem to signal different economic conditions.
- The data requirements are low: a limited series of variables can be applied to all servicemembers.
- Forecasts of broad economic variables are available from several sources. The current version of the CNA Economic Index uses publically available forecasts from the Federal Reserve that are available four quarters into the future. Longer forecasts are available from proprietary sources (e.g., the Blue Chip Economic Indicators), but face the tradeoff that distribution is severely limited.

More sophisticated solutions are available as well. A variety of DOD-related organizations (including CNA, RAND, and some of the services) have developed crosswalks that link military occupations and experience to civilian occupations or expected wages.⁶ A benefit to this approach is that it offers much more fidelity into the economic conditions faced by individual servicemembers or specialties than is offered by an index based on national-level variables. There are two distinct downsides to this type of solution. First, occupation-specific civilian wages typically do not have professional forecasts available. Second, the data requirements are substantially larger because the dashboard would need to include updates on the wages for all of the relevant civilian occupations, incorporate new projections as relevant, and periodically update the civilian crosswalks as the share of people who work in different occupations shifts across time.

Individual or aggregated predictions?

The predictive modeling element of a retention dashboard will face tradeoffs across three major considerations: flexibility in user choice, modeling sophistication (and, thus, presumably, accuracy), and barriers due to practical limitations (notably, data security and computational power requirements). These tradeoffs are illustrated in three major options for forecasting in the dashboard:

1. Predictions of aggregate rates (flexible user choice, unsophisticated modeling, and few barriers)
2. Predictions of individual decisions that then are aggregated before being incorporated into the dashboard (inflexible user choice, sophisticated modeling, and few barriers)
3. Predictions of individual decisions that then are then aggregated on-the-fly based on user requirements (flexible user choice, sophisticated modeling, and several barriers)

The first option does not estimate retention at the individual level. Instead, the retention of one or more groups of servicemembers is treated as the outcome of interest in statistical or machine learning models, with changes in policies, average characteristics, or other circumstances correlated with historical retention rates for the groups of interest. Policy changes are scoped accordingly: changes in reenlistment bonuses may be represented through the average change for the group or the total budget allocated for that kind of bonus. Changes in economic conditions are, by necessity, focused on broader measures (such as the CNA Economic Index discussed above) instead of personalized predictions of civilian job opportunities. This scope represents another advantage: predictions of aggregate rates do not need to link policies (such as reenlistment bonuses) to individual servicemembers. Finally, the

⁶ Previous CNA research suggests that industry-level unemployment rates tend to suffer from the same limitations as the unemployment rates discussed earlier.

focus on aggregated rates would allow users to change policies within the dashboard and receive new predictions.

The second option estimates retention at the individual level and then aggregates the results (on servers approved for PII) before including aggregated projections in dashboard updates. An immediate consequence is that this option requires more data than aggregated predictions. This is not due to the retention data itself; individual-level data is used in the creation of the dashboard regardless of whether the dashboard stores the individual-level data or instead stores aggregated tables based on the individual data. Instead, the additional data requirements result from the need to trace the applicability of specific policies to individual servicemembers. In an aggregated model, for instance, changing reenlistment bonuses could be modeled as changes to the overall budget. Modeling the impact of bonuses at an individual level requires identifying which bonuses each servicemember is likely to be eligible for when making his or her reenlistment decision.⁷ The user also would have less flexibility in this case. Much like the current version of the dashboard, both the level of aggregation and the policy choices driving the projections would need to be specified in time for the aggregated projections to be incorporated in the next update.

The third option offers both flexibility and accuracy but also the greatest cost: individual projections based on policy choices that the user makes in real time. This would require an overhaul of the dashboard. Instead of a dashboard that is delivered to OSD via DOD SAFE and that can be shared among DOD entities, this option would require a computational environment that is approved to hold PII data and that interested parties could access. The environment also would need to have the computational power needed to generate new estimates from whatever statistical or machine learning model is chosen for retention predictions.

⁷ Technically, service-level information (such as bonuses) could be used in an individual-level model, but this essentially defeats the purpose of having an individual-level model and certainly would seem to limit the model's ability to accurately forecast retention.

Conclusion

In this paper, we have discussed the retention dashboard that we have developed for OSD. The creation of a dashboard included identification of retention metrics that are both measurable and meaningful across services and transforming individual-level data from DMDC into aggregate statistics that can be reported without risking (direct or indirect) disclosure of PII. We then offered a brief guide to using the dashboard. Finally, we offered some thoughts on considerations for a predictive component of the dashboard. Such a predictive element is a natural extension for the dashboard and could serve to not only identify forthcoming changes in retention but also predict the ability of various policy levers to mitigate these changes.

Appendix A: Overview of Servicemember Characteristics

When reviewing retention rates, the user is able to view a “drill down” of the results based on servicemember characteristics. In addition to straightforward variables, such as race, ethnicity, gender, marital status, and paygrade, we allow for drill-downs based on the following:

Zone

Servicemembers are grouped into reenlistment zones based on years of service (YOS). These zone categories are

- Zone A (0 YOS–6 YOS)
- Zone B (6–10 YOS)
- Zone C (10–14 YOS)
- Zone D (14–18 YOS)
- Zone E (18–20 YOS)
- Zone F (20+ YOS)

Occupation code (two digit)

We were unable to find a formal definition of DMDC two-digit occupation codes. However, the code represents the occupation of a servicemember’s military job. We also include a cross-walk in the dashboard that matches service-specific occupation codes into these broader categories. The two-digit occupation codes represent broad categories of similar occupations, while the three-digit occupation codes contain groupings of more specific occupations. The relevant two-digit occupation codes are

- 10 Infantry, Gun Crews, and Seamanship Specialists
- 11 Electronic Equipment Repairers
- 12 Communications and Intelligence Specialists
- 13 Health Care Specialists
- 14 Other Technical and Allied Specialists
- 15 Functional Support and Administration

- 16 Electrical/Mechanical Equipment Repairers
- 17 Craftworkers
- 18 Service and Supply Handlers
- 19 Non-occupational

Occupation code (three digit)

- 101 Infantry
- 102 Armor and Amphibious
- 103 Combat Engineering
- 104 Artillery/Gunnery, Rockets, and Missiles
- 105 Air Crew
- 106 Seamanship
- 108 Unmanned Vehicle System (UVS) Operation
- 110 Radio/Radar
- 111 Fire Control Electronic Systems (Non-missile)
- 112 Missile Guidance, Control, and Checkout
- 113 Sonar Equipment
- 114 Nuclear Weapons Equipment
- 115 ADP Computers
- 116 Teletype and Cryptographic Equipment
- 117 Cyberspace Maintenance
- 119 Other Electronic Equipment
- 120 Radio and Radio Code
- 122 Radar and Air Traffic Control
- 123 Signal Intelligence/Electronic Warfare
- 124 Intelligence
- 125 Combat Operations Control
- 126 Communications Center Operations
- 127 Cyberspace Operations
- 130 Medical Care
- 131 Ancillary Medical Support

- 132 Biomedical Sciences and Allied Health
- 133 Dental Care
- 134 Medical Administration and Logistics
- 140 Photography
- 141 Mapping, Surveying, Drafting, and Illustrating
- 142 Weather
- 143 Ordnance Disposal and Diving
- 145 Musicians
- 149 Technical Specialists, NEC
- 150 Personnel
- 151 Administration
- 152 Clerical/Personnel
- 153 Data Processing
- 154 Accounting, Finance, and Disbursing
- 155 Other Functional Support
- 156 Religious, Morale, and Welfare
- 157 Information and Education
- 160 Aircraft and Aircraft Related
- 161 Automotive
- 162 Wire Communications
- 163 Missile Mechanical and Electrical
- 164 Armament and Munitions
- 165 Shipboard Propulsion
- 166 Power Generating Equipment
- 167 Precision Equipment
- 169 Other Mechanical and Electrical Equipment
- 170 Metalworking
- 171 Construction
- 172 Utilities
- 174 Lithography
- 175 Industrial Gas and Fuel Production
- 176 Fabric, Leather, and Rubber

- 179 Other Craftworkers, NEC
- 180 Food Service
- 181 Motor Transport
- 182 Material Receipt, Storage, and Issue
- 183 Law Enforcement
- 184 Personal Service
- 185 Auxiliary Labor
- 186 Forward Area Equipment Support
- 187 Other Services, NEC
- 190 Patients and Prisoners
- 191 Officer Candidates and Students
- 192 Undesignated Occupations
- 195 Not Occupationally Qualified

Dependents

The DMDC Data Dictionary defines this demographic category as “the number of persons for whom a military sponsor provides support” [7].

Education tier

The DMDC Data Dictionary defines this demographic category as “the code that represents a classification of educational attainment for military enlistment purposes” [7].

- HS Diploma or Approved Alt Credential
- Alternate Credential or No Diploma or Certificate

Initial contract

We define this demographic category as the number of months for which a servicemember signs his or her initial contract during accession.

- 36 months
- 48 months
- 60 months
- 72 months

Cohort

As noted above, we define *cohort* as a group of servicemembers who had a contract start or end in a particular FY.

- 2014
- 2015
- 2016
- 2017
- 2018
- 2019

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Abbreviations

AFQT	Armed Forces Qualification Test
DOD	Department of Defense
DMDC	Defense Manpower Data Center
EOC	End of Contract
FY	Fiscal Year
OSD	Office of the Secretary of Defense
P&R	Personnel & Readiness
PII	Personally Identifiable Information
SCO	Secure Computing Environment
YOS	Years of Service

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