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TECHNICAL REPORT

Computer Simulation of General and Flag Officer Management

Model Description and Results

Peter Schirmer

Sponsored by the Office of the Secretary of Defense

NATIONAL DEFENSE RESEARCH INSTITUTE

The research described in this report was prepared for the Office of the Secretary of Defense (OSD). The research was conducted in the RAND National Defense Research Institute, a federally funded research and development center sponsored by the OSD, the Joint Staff, the Unified Combatant Commands, the Department of the Navy, the Marine Corps, the defense agencies, and the defense Intelligence Community under Contract W74V8H-06-C-0002.

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Preface

The RAND Corporation analyzes military manpower and personnel issues for the Department of Defense using a variety of methods, including computer modeling. The models provide insights regarding the promotion, assignment, retention, and development of military officers; they also provide insights into systemwide issues, such as end-strength management and bench strength for key positions.

In recent years, the RAND National Defense Research Institute has developed a simulation model that is capable of managing hundreds or thousands of officers individually according to complex laws, policies, and practices. The model can address very detailed questions that are not easily answered using spreadsheet models, stock-and-flow models, or linear-programming models. The simulation model has been applied to research sponsored by the Office of the Secretary of Defense, the Army, the Navy, and the Air Force.

This technical report describes the design of a version of the simulation model that has been adapted specifically to address general and flag officer management subject to provisions of the Duncan Hunter National Defense Authorization Act for Fiscal Year 2009. The report also provides results requested by the Office of the Secretary of Defense, which has sponsored most of the work using different versions of the simulation model.

This research was sponsored by the Office of the Secretary of Defense and conducted within the Forces and Resources Policy Center of the RAND National Defense Research Institute, a federally funded research and development center sponsored by the Office of the Secretary of Defense, the Joint Staff, the Unified Combatant Commands, the Department of the Navy, the Marine Corps, the defense agencies, and the defense intelligence community.
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The Duncan Hunter National Defense Authorization Act for Fiscal Year 2009 introduced the joint pool rubric, which provides for the designation of up to 324 general and flag officer (GFO) positions by the Secretary of Defense. Once designated, the services will be allocated a number of these joint officer requirements as their fair share. These positions will not be counted against service GFO grade- and end-strength ceilings. The revised strength accounting rules were designed to increase competition for joint positions and to encourage greater use of reserve component (RC) GFOs in joint positions, but they will add to the complexity of managing active component (AC) and RC end and grade strengths. The RAND National Defense Research Institute (NDRI) was asked to apply its computer simulation models to assess the complexity and feasibility of managing the new grade- and end-strength accounting rules.

The modeling results presented in this report support the conclusion that GFO end-strength management is a tractable challenge. There is no single number or result that leads to this conclusion; it is based on an examination of the frequency, magnitude, and duration of end-strength violations. The simulation model schedules assignments, holds positions open when needed, forecasts retirements, forecasts promotions, and generally operates under a fairly sophisticated set of business rules and model procedures similar to real-world processes. With these processes, the model manages end strength, grade pyramids, and limitations on officers serving in external positions. End-strength violations do occur, but they appear to fall within the admittedly amorphous standard of "acceptable." The active and reserve components will have to work closely with one another to manage end strength, and they will have to work closely with the Joint Staff Office of General/Flag Officer Matters as well.

Acknowledgments

The author is indebted to the individuals from the service offices that manage general and flag officers: Lieutenant Colonels William Redman and Arthur Stovall, United States Marine Corps; Commander David Dillensnyder, United States Navy; Colonel Thomas Seamands, United States Army, and Bill Atkinson, Army General Officer Management Office; Colonel Tammy Smith, United States Army Reserve; Colonel William Stoppel, Army National Guard, and John Ellington, National Guard Bureau; Master Sergeant David Clark, United States Air Force; and Colonel Stephanie Gass and Lieutenant Colonel Heather Capella, Air Force Reserve. The staff of the Deputy Under Secretary of Defense for Military Personnel Policy, especially Lernes Hebert, provided critical support and assistance. Special thanks go to RAND colleagues Meg Harrell, who was co-leader of this project; Ian Cook, who did some coding of the model; Michael Tseng, who worked on an earlier version of the model; Jessica Hart, who assisted with GFO databases; and Lawrence Hanser and Louis Miller, who provided excellent reviews of the document.

Acronyms and Abbreviations

AC	active component
AF	Air Force
AFR	Air Force Reserve
ANG	Air National Guard
AR	Army Reserve
ARNG	Army National Guard
CENTCOM	Central Command
GFO	general and flag officer
GOMO	general officer management office
IMA	individual mobilization augmentee
NDAA 09	Duncan Hunter National Defense Authorization Act for Fiscal Year 2009
MR	Marine Reserve
NDRI	National Defense Research Institute
NR	Navy Reserve
RC	reserve component
USAFE	United States Air Forces in Europe

CHAPTER ONE

Background

The Duncan Hunter National Defense Authorization Act for Fiscal Year 2009 (NDAA 09) made significant changes to general and flag officer (GFO) management by the military services. The Act changed the rules for GFO end-strength accounting, with the goal of encouraging greater utilization of reserve component (RC) GFOs in joint positions. Under the old accounting rules (found in Title 10 of the United States Code), the Army, Navy, Air Force, and Marine Corps each had a specified end-strength limit for their GFOs, with additional limitations on the grade distribution of those GFOs. Title 10 also allowed some exceptions to these limitations, but by and large, each service had a fixed number of GFOs to fill in-service positions as well as "external"—typically joint—positions. This principle applied to both active component (AC) and RC GFOs, with the complicating fact that some of the RC GFOs counted against AC end strength, while most counted against RC end strength.

NDAA 09 introduced the joint pool rubric, which provides for the designation of up to 324 GFO positions by the Secretary of Defense. Once designated, the services will be allocated a number of these joint GFO requirements as their fair share. These positions will not be counted against service GFO grade- and end-strength ceilings. The revised strength accounting rules were designed to increase competition for joint positions and to encourage greater use of RC GFOs in joint positions. An RC officer in a joint pool position counts as a credit toward in-service, active duty end strength. For example, the Army is authorized to have 90 O-7s on active duty in Army positions and is allocated a certain number of joint pool positions it is expected to fill, in addition to the 90 Army positions. If one of those joint pool positions is filled by an Army Reservist or National Guardsman, the Army may have 91 O-7s on active duty in Army positions; if 10 joint pool positions are filled by Army RC officers, the Army may have 100 O-7s on active duty in Army positions.

Additionally, there are other jobs that have not been designated as part of the joint pool but are nonetheless external to the services. Although these are external positions (they are mostly individual mobilization augmentees (IMAs)), they do potentially count against end strength. Under the new law, each RC element may have up to 20 percent of its authorized end strength in external positions—both joint pool and non–joint pool. So the Army Reserve could have 23 officers in external positions (115×0.2); those in joint pool positions would not count against Army Reserve or Army active duty end strength, while those in external non–joint pool positions would count against either one or the other.

Although these provisions of NDAA 09 may encourage greater use of RC GFOs in joint positions, they may also complicate management of both AC and RC end strength. Each service and service component will have to keep track of how many GFOs count against end strength, how many are in the joint pool and will likely return to in-service positions, how

many additional in-service O-7 positions can be filled by virtue of having counterpart RC GFOs in joint pool positions, when those RC GFOs will be leaving the joint pool (therefore eliminating the credits), and when and how many new RC GFOs will be moving into the joint pool. On top of this, the reserve components will have to limit the percentage of GFOs serving in external positions (whether those positions are part of the joint pool or not). Each service will have to ensure that it fills its fair share of the joint pool so that a certain number of GFOs will be assured over time.

The RAND National Defense Research Institute (NDRI) was asked to apply its computer simulation models to assess the complexity and feasibility of managing these and other end-strength accounting rules under NDAA 09. The modeling results presented in this report support the conclusion that GFO end-strength management is a tractable challenge. Understanding how RAND NDRI reached that conclusion requires some understanding of how the model used in this study functions, the assumptions it is based on, and the inputs it uses.

The model is described in Chapter Two. Chapter Three presents modeling findings, with insights into the cause, magnitude, and frequency of end-strength violations. Chapter Four provides the conclusions drawn from this work.

CHAPTER TWO

Model Description

The computer simulation model described in this chapter was developed and used in several earlier RAND studies.[1] It functions somewhat like the popular computer strategy game *SimCity*, in which a human player designs and builds a city that simulated people live and work in. The RAND model includes hundreds of simulated officers who are individually assigned, promoted, and retired. The GFO version of the model deals only with officers in grades O-6 (assumed to be an unlimited source of GFOs) through O-10. As in commercial computer simulation games, time is compressed in the model. Each time step represents a three-month period, and for the analysis reported here, the model was run for a simulated duration of 100 years, or 400 quarters. With the model, it is possible to analyze the records of simulated officers just as one would analyze the records of real officers, enabling calculation of various metrics of interest, such as career length, types of assignments, and so forth. It is also possible to measure systemwide outcomes, such as the ability of each service to manage its personnel within end-strength limitations. This analysis focuses on the systemwide outcomes.

Entity Characteristics

In the model, each military officer, position, grade, and service[2] is defined by a unique array of information. Some characteristics, especially those related to positions, grades, and services, do not change in the course of the simulation; others, especially those related to officers, change extensively. Tables 2.1 through 2.3 list the entity characteristics for military officers, services, and positions. The tables also indicate which characteristics are fixed throughout the simulation and which change.

The model also keeps a record of some of the officers' characteristics over time. Specifically, it records each assignment an officer has, the duration of each assignment, performance in each assignment, and the date an officer is promoted to each grade.

[1] The model was the basis for the analysis and recommendations in Peter Schirmer, Harry J. Thie, Margaret C. Harrell, and Michael S. Tseng, *Challenging Time in DOPMA: Flexible and Contemporary Military Officer Management*, Santa Monica, Calif., RAND Corporation, MG-451-OSD, 2006. The model was also used extensively in unpublished work for the Office of the Chief of Naval Personnel and for the Army Human Resources Command, as well as in unpublished work for the Office of the Secretary of Defense.

[2] The term "service" in this model description actually refers to individual service components for each branch of the Armed Forces. The ten "services" separately modeled are the AC Army, Navy, Air Force, and Marine Corps, as well as the Army Reserve (AR), the Army National Guard (ARNG), the Navy Reserve (NR), the Air Force Reserve (AFR), the Air National Guard (ANG), and the Marine Reserve (MR).

Table 2.1
Military Officer Characteristics in the Model

Characteristic	Description
Name	Unique alphanumeric combination
Ability	Uniformly distributed integer from 1 to 10
Branch	A, F, N, M
Service community	Combination of branch characteristic with component Example: Air National Guard
Grade	6 through 10
Promotion eligible	Boolean
Selected for promotion	Boolean
Promotion date	Period in the simulation when the officer will be promoted to the next grade
Separation date	Last period the officer will be in the simulation unless first promoted
Time in service	Number of periods since becoming an O-6
Time in grade	Number of periods in current grade
Time in job	Number of periods in current position
Job	Number of the position the officer currently fills
Next job	Number of the position the officer is slated to fill next
Next job date	Period in the simulation when the officer will go to the next position
Assignment eligible	Boolean indicating the officer should be assigned to another position
Early assignment eligible	Boolean indicating the officer can be assigned to another position if it makes sense to do so
Job score	Real number indicating how well the officer is performing in current position
On active duty this period	Boolean indicating that the officer counts against active duty end strength (for RC officers only)
On active duty next period	Boolean indicating that the officer is expected to count against active duty end strength in the next period (for RC officers only)

NOTES: Italicized characteristics are fixed throughout the simulation; others vary. A = Army; F = Air Force; N = Navy; M = Marine Corps.

Table 2.2
Service Community Characteristics in the Model

Characteristic	Description
Authorizations	Authorized in-service end strength, by grade
Joint pool fair share	Fair share of joint pool positions based on relative size of in-service authorization (for active components only)
End strength	Total number of officers, by grade
Joint pool size	Total number of officers in the joint pool
Average joint pool credit	Average number of officers in counterpart RC services serving in the joint pool each period (for active components only)
Exemptions	Total number of officers who do not count against that service's end strength (In the case of RC services, officers could count against the AC service counterpart)
Retirement forecast	Expected number of officer retirements in each of the next 12 periods
RC on end strength	Total number of officers in counterpart RC services who count against AC end strength (for active components only)
RC on next end strength	Total number of officers in counterpart RC services who will count against AC end strength in the next period (for active components only)
Minimum time in grade	Minimum amount of time officers must spend in a grade before they are considered for promotion to the next grade
Promotion list	List of officers selected for promotion to O-7 and to O-8, sorted by officer seniority

NOTE: Italicized characteristics are fixed throughout the simulation.

The service community characteristics are almost entirely accounting-related and therefore change constantly, not only from period to period, but as individual assignments are made. These characteristics are the very things that real-world service general officer management offices (GOMOs) will have to track to minimize end-strength violations.

In contrast to the officer characteristics, almost all of the position characteristics are fixed throughout the simulation; only vacancies and the candidates change. The minimum, preferred, and maximum times in job are based on assignment lengths found in law, in the joint blue book maintained by the Joint Staff Office of General/Flag Officer Matters, and in practice. The default setting for O-7 and O-8 assignments is four periods (one simulated year) for the minimum and eight periods (two simulated years) for the preferred and the maximum. Some positions are typically three-year assignments; for these, the preferred and maximum assignment lengths are set to 12 periods. The position priorities determine the order in which positions are filled, and they are also used to determine whether officers in some assignments can leave those assignments early for other assignments. Neither the law nor the joint blue book specifies the order in which positions must be filled. Instead, some commonsense rules of thumb can be applied. Most joint pool positions are priority 1, and the rest are priority 2; other

Table 2.3
Position Characteristics in the Model

Characteristic	Description
Number	Unique integer
Title	Job title from GFO position databases Example: Commander
Organization	Organization from GFO position databases Example: Combatant Command
Minimum time in job	Minimum number of periods an officer must be in the position before being considered for early reassignment
Preferred time in job	Number of periods the officer must be in the position before being considered for regular reassignment
Maximum time in job	Maximum number of periods the officer can be in the position before either being reassigned or retiring
Number of positions	Total number of officers who can fill the position at the same time Example: 10 Army Division Commanders
Vacancies	Number of positions that are currently vacant and should be filled
Grade	Desired grade of the officer(s) filling the position: 6 through 10
Priority	Number from 1 through 4 determining the order in which vacancies are filled
Service	Service of the officer(s) filling the position: A, F, N, M, or some combination if the position is a joint one
Rotation	Boolean indicating whether position is filled on a rotational or nominative basis (for external positions only)
Reserve position	Boolean indicating whether the position is normally filled by an officer in the Army, Air Force, Navy, or Marine Reserves
Guard position	Boolean indicating whether the position is normally filled by an officer in the Army or Air National Guard
External position	Boolean indicating whether the position is considered external to the services
Joint pool RC can fill	Boolean indicating whether an RC officer can fill the position (for joint pool positions only)
Candidates	List of officers eligible to be assigned to the position, sorted by past job performance

NOTES: Italicized characteristics are fixed throughout the simulation. A = Army; F = Air Force; N = Navy; M = Marine Corps.

external positions not in the joint pool are priority 2; some in-service positions are priority 1, most are priority 2, and some are priority 3; "hold" positions, used when officers are awaiting a vacancy as they transition from one position to another, are priority 4. The position priorities can have small modeling consequences, mainly for RC assignments to external positions. Since external, non–joint pool positions are priority 2, the same priority as some of the joint pool positions, RC officers assigned outside their service have ended up in a mix of joint and other external positions.

Model Inputs

Congress, the Department of Defense (DoD), the services, statutory boards, the GOMOs, and individual officers all make decisions or set policies that shape career paths. Although no individual actor or collective actors have exclusive control over all aspects of officer career management, generally speaking, Congress and DoD set basic career parameters, such as the number of officers that serve in each grade and how long they serve; the Joint Staff Office of General/Flag Officer Matters and the service GOMOs determine how officer careers are managed within those parameters; and officers themselves determine their individual behavior (for the purposes of this model, that behavior consists of decisions to retire or stay in service).

Translating these decisions, laws, and policies into a computer model requires numerous inputs. These inputs provide values for the fixed characteristics of officers, positions, and service communities. Some inputs, such as authorized grade strength, the length and number of assignments, and mandatory retirement dates, are strictly quantitative. Other inputs, sometimes called "business rules," govern processes. The business rules determine which officers get selected for promotion, when officers have key assignments, what the prerequisites for those assignments are, when officers choose to retire, and so forth. Just about any quantitative input or business rule can be changed to yield a different set of results from the model.

For the version of the model used here, the key quantitative inputs include

- grade and end-strength limitations for the active components established in NDAA 09;
- grade and end-strength limitations for the reserve components (including the National Guard) established in existing law and policy;
- the number of in-service, joint pool, and external but non–joint pool positions, by grade and by service, as appropriate;
- the percentage of RC officers who can serve in external positions, including positions that are not part of the joint pool; and
- the minimum number of joint pool positions each service branch will fill, as established in NDAA 09.

The key business-rule inputs relate to retirement and assignment practices. The retirement rules allow officers to serve at least three years in grade (for O-7 and above) before retiring, and all must retire after five years in grade. If not selected for promotion, most GFOs retire during their fourth year in grade (i.e., after three full years). The assignment-rule inputs relate to how positions are prioritized and filled.

Once the model identifies the best officer to fill a vacancy, it looks at whether he has served the minimum amount of time in his current position and whether he is in a lower-

priority position and then determines whether he can move to the new position.[3] The procedures for determining the best officer are discussed below.

Model Procedures

Business-rule inputs are easily altered; model procedures are not. Model procedures address things such as how the model is seeded with simulated officers, when an officer selected for promotion actually pins on a new rank, how end strength is managed, and how upcoming assignments are scheduled.

Model Initialization

Even when all of the quantitative and business-rule inputs are established, there are still no officers in any grades. In the first period of a model run, officers are "accessed" as junior O-6s and are assigned O-6 positions. In subsequent periods, those O-6s will become more senior and will eventually reach the minimum-time-in-grade milestone for promotion to the next grade. All O-7 positions at this point are vacant, so the vacancy-driven promotion system will promote O-6s en masse to fill O-7 vacancies.[4] Officers selected for promotion will be assigned to O-7 positions and will remain in that grade for a while; eventually some will be selected for promotion to O-8; and so on. Over time, all of the grades will be fully populated.

The model runs for an extended period and tracks the average number of GFOs in each grade, in each time-in-service step, and in each time-in-grade step. For example, the model records the average number of O-7s who are in their 28th year of service and their second year in grade (technically, because it calculates by quarters, the model tracks the average number of O-7s in their 109th quarter of service and their fifth quarter in grade). At the end of this initial run, the model generates a series of matrices for each grade and each service. One dimension of the matrix is time in service, the other is time in grade. The model then runs a second time, this time initialized with a simulated GFO corps whose time in grade and time in service match the matrices. Table 2.4 reproduces a portion of one of the matrices, showing the average number of AC Army O-7s in their 27th and 28th years of service, and in their first through fifth years in grade, after an initializing run. When the model is run a second time using these matrices as inputs, it rounds real numbers to whole numbers, adjusting the largest rounding errors up or down in order to completely fill the authorized end strength for each grade and service (see Table 2.5). Continuing with the same example, the second model run will be initialized with two (rounded down from 2.11) AC Army O-7s in the first quarter of their 27th year of service and the first quarter of their second year in grade, and with three (rounded up from 2.70) O-7s in the first quarter of their 27th year of service and the second quarter of their second year in grade, and so forth.

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[3] For ease of exposition, a simulated officer is referred to as "he," but obviously, the GFOs could be of either gender.

[4] Note that without a minimum-time-in-grade requirement, a vacancy-driven model without any officers at initialization would immediately promote new officers all the way up to the grade of O-10.

Table 2.4
Portion of Time in Grade/Time in Service Input Matrix for Seeding Model with Officers

	Y27Q1	Y27Q2	Y27Q3	Y27Q4	Y28Q1	Y28Q2	Y28Q3	Y28Q4
Y1Q1	0.06	0.055	0.067	0.033	0.017	0.031	0.014	—
Y1Q2	0.06	0.061	0.055	0.067	0.033	0.017	0.031	0.014
Y1Q3	0.16	0.055	0.055	0.050	0.067	0.033	0.017	0.031
Y1Q4	0.82	0.158	0.053	0.055	0.050	0.058	0.028	0.017
Y2Q1	2.11	0.821	0.161	0.053	0.055	0.044	0.058	0.028
Y2Q2	2.70	2.102	0.818	0.161	0.053	0.055	0.042	0.058
Y2Q3	1.07	2.701	2.088	0.807	0.161	0.050	0.053	0.042
Y2Q4	0.27	1.076	2.709	2.085	0.810	0.164	0.050	0.050
Y3Q1	0.16	0.269	1.079	2.693	2.077	0.813	0.166	0.050
Y3Q2	—	0.144	0.263	1.076	2.659	2.027	0.807	0.164
Y3Q3	—	—	0.100	0.225	0.990	2.243	1.764	0.763
Y3Q4	—	—	—	0.050	0.128	0.624	1.534	1.375
Y4Q1	—	—	—	—	0.031	0.072	0.169	0.477
Y4Q2	—	—	—	—	—	0.017	0.053	0.078
Y4Q3	—	—	—	—	—	—	0.008	0.036
Y4Q4	—	—	—	—	—	—	—	—
Y5Q1	—	—	—	—	—	—	—	—
Y5Q2	—	—	—	—	—	—	—	—
Y5Q3	—	—	—	—	—	—	—	—
Y5Q4	—	—	—	—	—	—	—	—

Table 2.5
Portion of Time in Grade/Time in Service Input Matrix Transformed to Show Whole Numbers of Officers

	Y27Q1	Y27Q2	Y27Q3	Y27Q4	Y28Q1	Y28Q2	Y28Q3	Y28Q4
Y1Q1	—	—	—	—	—	—	—	—
Y1Q2	—	—	—	—	—	—	—	—
Y1Q3	—	—	—	—	—	—	—	—
Y1Q4	1	—	—	—	—	—	—	—
Y2Q1	2	1	—	—	—	—	—	—
Y2Q2	3	2	1	—	—	—	—	—
Y2Q3	1	3	2	1	—	—	—	—
Y2Q4	—	1	3	2	1	—	—	—
Y3Q1	—	—	1	3	2	1	—	—
Y3Q2	—	—	—	1	3	2	1	—
Y3Q3	—	—	—	—	1	2	2	1
Y3Q4	—	—	—	—	—	1	2	1
Y4Q1	—	—	—	—	—	—	—	—
Y4Q2	—	—	—	—	—	—	—	—
Y4Q3	—	—	—	—	—	—	—	—
Y4Q4	—	—	—	—	—	—	—	—
Y5Q1	—	—	—	—	—	—	—	—
Y5Q2	—	—	—	—	—	—	—	—
Y5Q3	—	—	—	—	—	—	—	—
Y5Q4	—	—	—	—	—	—	—	—

The key points are that the final modeling results are from this second run, and the second run is not initialized with a real-world inventory. Instead, it begins with a simulated inventory ("ghosts," so-named because they lack a complete career history) and then manages from there. As the ghosts retire, new O-6s enter the model until eventually no ghosts remain. If a project sponsor is interested in individual-level outcomes, such as promotion opportunity, career paths, or levels of individual joint experience, the analysis can examine outcomes only for the cohorts that enter the system after the last ghost has retired. Because questions about the feasibility and tractability of new end-strength accounting rules are answered with systemwide outcomes, the analysis presented in this report includes periods that have ghosts. However, some odd results occur in the first few periods with a ghost run, because the model relies on vacancy and assignment forecasts (discussed below) to run smoothly, and in the first few periods of the model run, no such forecasts exist. Therefore, to be on the safe side, this analysis ignores the first five years of results.

O-6 "Accessions"

Once the model has been initialized and has read all the inputs, it begins looping through the specified number of periods. The first procedure in each loop creates new O-6s, based on upcoming O-6 vacancies in each service. The procedure tabulates the number of O-6s who are about to be promoted to O-7 or to retire and generates enough O-6s to replace the losses. When a new O-6 is created, he is assigned to a particular service, his time in service at promotion to O-6 is set at 85 quarters (or 21 years), and he is given an ability score, which is a randomly generated, uniformly distributed integer between 1 and 10. The new O-6s are given assignments and expected attrition dates (both processes are described below).[5]

Officer Information Updates

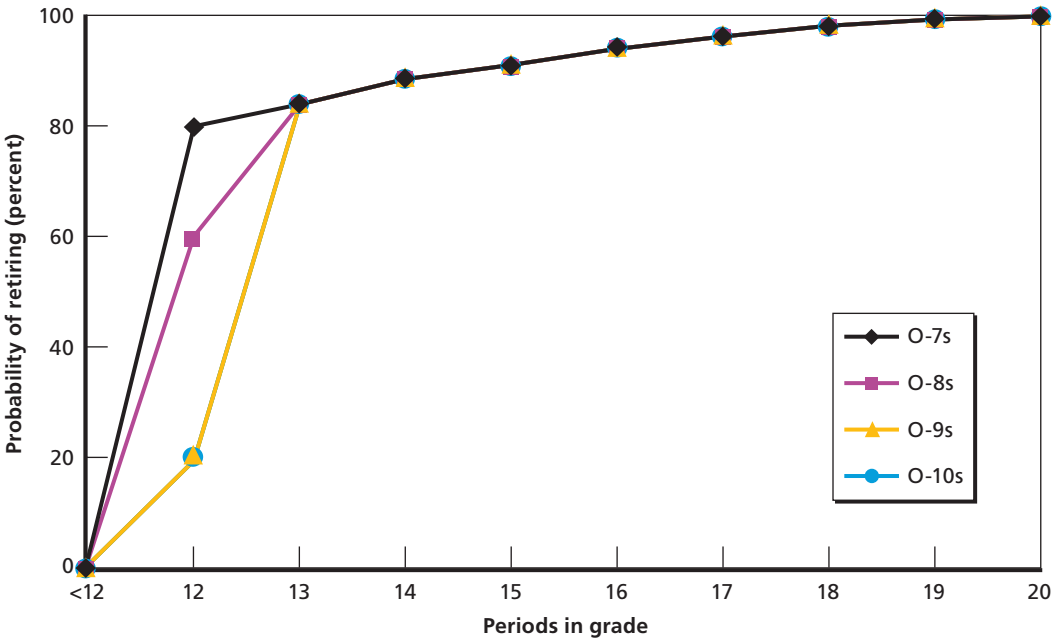
The next step is to update data for all officers. If an officer is scheduled to retire after the previous period, he is deleted from the model. If an officer is scheduled to be promoted, his grade is augmented and he is given a new retirement date, which is the last period in which he will serve if he is not selected for further promotion. If an officer is scheduled to change assignments, that information is updated and a job performance score is calculated for his new assignment (in the real world, job performance obviously cannot be determined until completion of the assignment, but in the modeling world, it can be calculated at the beginning of the assignment). The job performance score is a real, random, normally distributed number whose mean is the officer's underlying ability and standard deviation is 1. So if the officer's ability score is 8, his performance in a job will usually range from about 6.5 to 9.5. For any officer not retiring, assignment eligibility is determined. The updates involve considerable service-level and systemwide accounting. The model tracks the number of officers in each grade and service, in the joint pool, in other external positions, and in each end-strength accounting category. As officers change jobs, retire, or get promoted, all of those numbers change.

Retirement Dates

Figure 2.1 shows the cumulative probability of retiring from each grade after the specified number of periods. For example, there is an 80 percent probability that an O-7 will retire after

[5] Incidentally, each new O-6 is given a unique identification, which makes it much easier to manage promotion lists, job-candidate lists, and debugging.

Figure 2.1
Probability of Retiring, by Time in Grade



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12 periods (i.e., three full years) in grade if he has not been selected for promotion by that time.[6] Subsequently, if an officer is selected for promotion, his retirement date is set to zero; once he is actually promoted to the next grade, his retirement date is reset.

When an officer is being promoted, a random number between 0 and 1 is generated, the value of which corresponds to the probability of retiring after a certain number of periods in grade (unless the officer is first promoted to the next grade). Continuing with the O-7 example above, if the random number is less than or equal to 0.8, the officer will retire after 12 periods in grade; if the random number is between 0.8 and 0.84, he will retire after 13 periods in grade; and so forth.

Assignment Availability

In each period, officers are given one of three assignment statuses: (1) cannot be assigned to a new position, (2) can be assigned to a new position (*AssignEarly*), or (3) must be assigned to a new position (*AssignEssential*).[7] Officers who have not served at least the minimum time in their current assignment fall into the first category. Officers who have served the maximum allowable time in their current assignment fall into the third category. Also in the third category are newly promoted O-7s who are still in an O-6 position and have served the minimum

[6] Modeling experience has shown that if each grade has the identical cumulative probability of separating over the specified number of periods, over time the model begins to develop big peaks and valleys in inventory. There are periods when large numbers of officers retire from one grade and are promoted in the grades below, and there are periods when almost nobody retires or is promoted. This problem is fixed by assuming small differences between grades in the cumulative retirement probability.

[7] When the simulation is run to examine career paths, even officers in the first category can be assigned under certain circumstances, but they are not eligible to be assigned in the current version of the model.

amount of time in that position, and newly promoted O-8s who are still in an O-7 position and have served the minimum amount of time in that position. All others fall into the second category.

Job-Score Calculation

After the officer information has been updated, the model calculates officers' suitability for each upcoming job vacancy. For each officer classified as *AssignEssential* or *AssignEarly*, the model determines whether he is eligible for each position. To be eligible, an officer must be in the service and grade appropriate for the position. Some officers are eligible not only for positions in their current grade, but also for some positions in the next-higher grade. Such officers are O-6s and O-7s on a promotion selection list and O-8s, O-9s, and RC officers who have been in their current grade at least the minimum amount of time before promotion. This, in fact, also serves as the promotion mechanism for RC officers as well as for O-8s and O-9s from the active component. If an officer is classified as *AssignEarly*, he is eligible only for higher-priority positions.

Once the entire list of eligible officers has been generated for each position, the officers are sorted on the basis of past job performance, then seniority.[8] Thus if two officers are being compared, the officer with the better past performance is ranked higher; if past performance is the same, the one with greater seniority is ranked higher.[9]

Job Assignments

Once the list of eligible officers for each job has been generated and sorted, the model begins to fill positions. The assignment process fills positions beginning with the highest-priority positions in the highest grade and ending with the lowest-priority positions in the lowest grade. For reasons that will be explained later, in most periods, assignments are made only in grades O-8 and below.

The model randomly selects a position from among the highest-priority positions with a vacancy and tries to fill it with the best-available officer by taking the first officer off the sorted eligible officer list. If that officer already has a new assignment, it deletes him from the list and looks at the next officer. An officer without a new assignment does not necessarily get assigned to the position in question; he must also satisfy several quantitative constraints. If the position is for an O-9 or an O-10, the model must check to see whether the officer would need to be promoted to fill the position, whether the position is exempt from grade-strength limitations, and whether the officer—if promoted—would exceed those limitations. If the officer is in the reserve component, the model must check to see whether he would violate end-strength limitations if he were assigned to the position. If the officer is in the reserve component and the position is external to his service, the model must verify that his assignment to that position would not result in more than 20 percent of authorized end strength for his service (e.g., Air Force Reserve, Air National Guard) being in an external position. If the position is in the joint pool, the model must try to meet the floors for shares of the joint pool established by NDAA 09. Those floors assure at least 85 joint pool positions for the Army, 76 for the Air Force, 61 for the

[8] Past job performance is an average of job performance scores in the officer's previous assignments.

[9] When the simulation is run to examine career paths, the model uses a much more complicated algorithm for ranking officers. That algorithm uses officers' career fields and assignment histories to identify those who are best suited for the positions and then ranks the officers by past job performance and seniority.

Navy, and 21 for the Marine Corps. At the same time, the model tries not to exceed a service's fair share of the joint pool by more than 10 percent.[10] If all of those criteria are met, the officer is assigned the position and is scheduled to begin the new assignment in the following period. The model follows the same procedures as it fills progressively lower-priority positions.

Involuntary Retirements for Lack of Assignment

After the assignments have been made, any officer who is classified as *AssignEssential* and does not have an assignment must retire. This will occur only for officers who have served at least 12 periods in their current grade, because service practice usually allows officers at least three years in grade; those with less than 12 periods in grade can fill temporary, one-period holding assignments.

Promotion Numbers and Timing

Promotion selection for RC officers and AC O-8s and O-9s occurs when they are selected for a position in the next-higher grade. Their promotion date is commensurate with their assignment to the new position. Active component O-6s and O-7s are selected for promotion by a statutory board and are promoted when their lineal number comes up to fill a vacancy. For each period, the model calculates the number of vacancies for the active component in grades O-7 and O-8 and promotes the appropriate number of officers from each service's promotion selection lists.

Calculating the number of vacancies is tricky, because the basic authorizations for O-7 and O-8 are adjusted by two factors. The first is what could be called the "joint pool credit." Under NDAA 09, the Army, Navy, Air Force, and Marine Corps are allowed to have a certain number of officers on active duty in in-service positions. But every RC officer who is in a joint pool position can be credited toward an additional active duty in-service position. The Army, for example, is allowed 225 general officers serving on active duty in Army positions, but if there are 10 Army Reserve or Army National Guard officers in joint pool positions, the Army can have 235 (225 + 10) on active duty in Army positions. Those additional officers can serve only in O-7 positions, even if some of the RC officers are in O-8 joint pool positions. The second factor affecting O-7 and O-8 vacancies is the number of RC officers *not* in the joint pool but on active duty nonetheless. That number *reduces* the number of AC GFOs who can serve in in-service positions.

Once the number of vacancies has been calculated, the next step is to designate officers on the promotion selection list for promotion in the next period. The number of AC promotions to O-8 each period depends on how many O-8s are being promoted to O-9, how many are retiring, how many do not count against end strength by virtue of being in the joint pool, and how many RC O-8s count against end strength. Complicating this calculation is the fact that some of the O-7s on the promotion selection list are in the joint pool and will not count against O-8 end strength when promoted to O-8. To use a specific example from the model, in one modeling quarter, the Army had a total of 102 AC O-8s. Of those 102, two were going

[10] This limitation is not specified by either law or policy; it is a constraint introduced in the modeling to reduce the volatility of each service's share of the joint pool. It is probably a reasonable approximation of how the joint pool will actually be managed in the future, with positions likely to be very carefully meted out to the services and any disproportionate assignments to one service likely to raise the ire of the others. This makes end-strength management more predictable and therefore easier.

to be promoted to O-9 in the next quarter, six were going to retire, and 11 were expected to be assigned to joint pool positions. With one O-8 active duty position expected to be filled by an RC officer, the model calculated that it could promote six officers without exceeding an authorized end strength of 90 O-8s in Army positions. In this same example, the Army promoted the first six officers on the promotion selection list, as shown in Table 2.6.

As shown in Table 2.7, three of the six officers at the top of the list (sorted by lineal number) were in joint pool assignments (either O-7 or O-8 positions) at the time of the promotion. In other words, three of the six officers would not count against Army O-8 end strength in the next period, so the Army could promote more officers and still not be in violation of authorized end strength. Two of the next three officers on the list were also in the joint pool and they, too, would not count against Army O-8 end strength. Ultimately, the model ended up promoting 12 officers although there were six in-service O-8 vacancies.

Violations can occur when an officer in the joint pool gets reassigned to an in-service position in the same period in which he is promoted. If the first officer on the list, for example,

Table 2.6
Active Duty Army O-8 Inventory in an Illustrative Modeling Period

AC O-8 end strength this quarter	102
Subtract: being promoted next quarter	2
Subtract: retiring next quarter	6
Subtract: joint pool next quarter	11
Add: RC O-8 on active duty (non–joint pool)	1
Net AC O-8 end strength next quarter	84
Authorized end strength	90
Number that can be promoted	6

Table 2.7
Active Duty Army O-7s (Promotable) in an Illustrative Modeling Period

Relative Rank	Officer Name	In Joint Pool?
1	99bcgh	Yes
2	99bche	No
3	99bcid	No
4	99bcig	No
5	99bcjc	Yes
6	99bcjf	Yes
7	99bdaa	Yes
8	99bdac	No
9	99bdaf	Yes
10	99bdfb	No
11	99bdgc	Yes
12	99bdha	No

moves to an in-service position at roughly the same time that he is promoted, then seven—not six—of those O-7s being promoted to O-8 in the next quarter will count against Army O-8 end strength.

Assignment and Vacancy Forecasts

Every fourth period (i.e., once a model year), the model selects AC officers for promotion to O-7 and O-8. This requires forecasting assignments and vacancies in the higher grades.

As noted earlier, in most periods, assignments are made only in grades O-8 and below. Assignments in O-9 and O-10 are made annually, in conjunction with the forecasts necessary for promotion selection. The same eligibility and assignment processes described above generally apply to O-9 and O-10 assignments. However, instead of making assignment decisions just one period in advance, the forecast makes assignment decisions up to six periods in advance. Thus it may identify the next CENTCOM commander while he is still only an O-9, or the next Senior Military Assistant to the Secretary of Defense while he is still only an O-8. Furthermore, the model records when the assignment is scheduled to occur. At the appropriate time, rather than going through the procedure to select the appropriate officer for the position again, the model will simply assign the person to whatever job he was selected for during the previous forecast. Sometimes this requires holding a position open for a period of time. The model might have determined that the next USAFE commander will assume his duties in period 128, but if the incumbent is scheduled to leave after period 126, the position will be vacant for a quarter.

As O-10s are projected to retire, O-9s are projected to replace them, and as those O-9s are promoted and others retire, O-8s are projected to replace them. The forecasts end there (i.e., promotions to O-8 and O-7 are not forecast, nor are assignments for any officer not already in the grade of O-8 or higher). This results in fewer and fewer O-8s in the forecast periods. After the final forecast period, the difference between the inventory of O-8s and the authorized end strength of O-8s (net of some adjustments) tells the model how many O-7s must be selected for promotion to O-8, and that in turn determines how many O-6s must be selected for promotion to O-7.

Although the forecasts are conducted once every four periods, the forecasts themselves cover six periods. This is because in the real world there is a gap of about 18 months between the time the results of a promotion board are announced and the time that the last officer on the list has been promoted. For example, in the real world, the Navy holds its O-7 promotion board each November. The results of the November 2009 board will be announced in spring 2010, officers will begin being promoted off that list around October 2010, and the list will be exhausted by September 2011. Thus in order for the November 2009 board to know how many O-6s to select for O-7, it must know how many O-7s it will need to promote by September 2011. The model does not require a gap between the timing of the board itself and the announcement of the results, so it does not need to forecast as far in advance as a real statutory board does, but it needs to forecast about six periods (equivalent to 18 months) nonetheless.

Forecasting how many O-7s should be selected each year for promotion to O-8 is complicated by the fact that each AC service has to select not only enough officers to fill in-service positions, but also enough to fill some of the joint pool positions. Each service is assured of filling a minimum number of joint pool positions, but the total share of the joint pool may fluctuate from period to period, especially when the reserve components are factored in. The model addresses this by selecting a few more officers for promotion than it calculates will be needed.

The calculation considers the number of officers still waiting to be promoted from the previous selection list, so if the last board selected too many officers, the current board will select relatively fewer. This prevents the selection lists from growing longer and longer over time. The drawback, however, is that it results in some officers being on the promotion selection lists longer than six periods (i.e., 18 months in the real world). Title 10 currently allows GFOs to be on a promotion selection list no more than 18 months from the date of the announcement of the list. This section of law may have to be repealed, or some other way of managing the uncertainty in vacancy requirements will have to be identified.

RC Officers on Active Duty

The current law allows RC officers to be on orders up to 179 days without counting against active duty end strength, and up to 10 percent of authorized RC end strength can be on 365-day orders without counting against active duty headspace. RC officers on active duty can be in either RC or AC positions. In the model, the probability that an RC officer assigned to one of the positions external to the services but not in the joint pool (i.e., one that would count against the end strength of one component or the other) was set at 50 percent. The percentage was selected not to reflect reality but to stretch the model by adding to the uncertainty about RC officers moving into and out of active duty end-strength accounting.

Caveats and Concerns

This is an entity model, meaning that it does not allow for fractions of people or positions, nor does it manage homogeneous blocks of people or groups of positions; everybody and everything is managed individually. This allows for very complicated assignment, selection, and promotion rules. Very similar to processes in the real world, the assignment rules forecast vacancies, hold positions open for particular officers, move officers out of one position and into another if the new position is a better fit, prioritize assignments, rank officers according to ability, and do other things that give the model verisimilitude.

However, this modeling approach presents some risks. For one thing, any rule by itself, such as *find the best available person for the highest-priority job with a vacancy*, is easy to understand. But when several are put together, it can be difficult to attribute a particular outcome of interest to any single business rule or input. That makes the model difficult to audit. A second risk is that the verisimilitude could give false assurance that the model is forecasting or predicting particular outcomes, or that it is a better representation of reality than it really is. For example, although the services plan ahead for vacancies and submit qualified officers in advance for consideration for key positions, the last-minute creation of a temporary position, dual-hatting, elimination of positions, or some other change could either cause or avoid an outcome of interest, such as an end-strength violation.

CHAPTER THREE

Model Results

One of the key management challenges for the GOMOs will be to ensure that they manage the accounting of officers flowing back and forth from the joint pool. The return from the joint pool is particularly problematic. If the Army, for example, has all 90 of its in-service O-7 positions filled and there is an O-7 leaving a joint pool job before another job opens up, there will be 91 officers but an authorization of 90. Another challenge is knowing when to promote an officer. If an O-7 has been selected for promotion and is frocked for an O-8 joint pool position, when should he actually become an O-8? He does not count against end strength, so there is no vacancy he can be promoted to fill.

The modeling results presented in this chapter support the conclusion that end-strength management will be feasible and tractable under the NDAA 09 rules, although it is likely that greater scrutiny and effort will be required. There is no single number or result that leads to this conclusion; instead, the conclusion is based on an examination of the frequency, magnitude, and duration of end-strength violations. The simulation model schedules assignments, holds positions open when needed, forecasts retirements, forecasts promotions, and generally operates under a fairly sophisticated set of business rules and model procedures similar to real-world processes. With these processes, the model can manage end strength, grade pyramids, and limitations on officers serving in external positions. Violations do occur, but they appear to fall within the admittedly amorphous standard of "acceptable."[1]

One factor working in favor of the new system is the process by which RC GFOs are promoted: There must be specific vacancies for them to fill, much like the process for promotion to O-9 and O-10 in the active component. This facilitates forecasting of RC end strength, which in turn gives the active components more information about upcoming changes in O-7 end-strength limitations (the changes, recall, are due to the credits received for RC officers in joint pool positions). The modeling results presented below show that the National Guard and Reserves are only occasionally in violation of end-strength limits, and never by more than one or two officers for more than one or two quarters. There are no end-strength violations for O-9s and O-10s because of their promotion process.

End-strength violation does occur, however, for active duty O-7s and O-8s, more frequently for the former. The O-7s are harder to manage because of the accounting rules. Even though RC GFOs can be assigned to O-7 or O-8 joint pool positions, the in-service credit accrues only to O-7s. For example, the Navy Reserve might have two O-7s and two O-8s in

[1] The fact that the simulation model allows for violations of accounting rules is a prime reason why this modeling approach is preferred—in this situation—over spreadsheet models or linear-programming models that operate within a set of constraints.

joint pool positions, but the Navy may have the four additional in-service positions only at O-7. Despite these challenges, the model does a reasonably good job of managing O-7 and O-8 end strength.

Why Do End-Strength Violations Occur?

End-strength violations occur fairly routinely for the active components in grades O-7 and O-8, but not in large numbers and not for extended periods. The simpler case is the O-8s. As explained in Chapter Two, an end-strength violation can occur if an officer leaves the joint pool and returns to an in-service position shortly after promotion to O-8. The accounting for end strength is more complicated for O-7s, because the active components receive a credit for RC officers of the same service in joint pool positions. Interestingly, there is still uncertainty about future end strength in the O-7 grade, but for a different reason. In the case of the O-8s, it was possible that an O-7 on a promotion selection list was serving in an O-7 joint pool position and would leave that for an in-service O-8 position at about the same time as his promotion. This would not happen with an O-6 promoted to O-7, because the joint pool applies only to positions in grade O-7 and above. Although an O-6 might be frocked for an O-7 joint pool position, it is highly unlikely that he would already be leaving that position and moving to another at the time of his promotion to O-7. In fact, that does not happen in the model. Uncertainty about O-7 end strength is related to RC joint pool assignments. If the service GOMOs anticipate filling 10 joint pool positions with RC officers in the next period and the reserve component ends up filling only five, the active component will have too many O-7s counting against end strength.

End-strength violations might also occur for O-7s if there is a precipitous decline in the number of AC officers in the joint pool. For example, in one period of a modeling run, the Navy had 33 O-7s in joint pool positions, which was slightly more than its long-term average of 26, and just a year later the number had declined to only nine. The Navy could not reabsorb so many officers back into in-service end strength and had an excess of 12 officers for two consecutive periods. The Navy eventually got back within end-strength limitations through promotions, retirements, and an increase in the number of officers in joint pool positions. The model allows a significant amount of volatility in joint pool assignments in order to stretch the system, but it is doubtful that in the real world there would be so large a change in joint pool share over such a short period of time.

Scenarios and Results

There are 294 joint pool positions for grades O-7 through O-10. Assuming that RC GFOs would not serve in the O-9 and O-10 joint pool positions, there are still 239 positions for O-7s and O-8s that RC GFOs might fill. But a recent data call from the service GOMOs and the Joint Staff Office of General/Flag Officer Matters identified only 15 joint pool positions that RC GFOs could fill. Arguably, there are actually more such positions. The high number (239) and the low number (15) represented the upper and lower bounds for modeling scenarios. The project sponsor asked RAND NDRI to run a third modeling scenario in which the number

of joint pool positions open to RC GFOs is midway between the two extremes. Thus, RAND NDRI modeled three separate scenarios based on RC access to joint pool positions:

- Scenario 1: Only 15 joint pool O-7 and O-8 positions are open to RC GFOs.
- Scenario 2: Roughly half (125) of the joint pool O-7 and O-8 positions are open to RC GFOs.
- Scenario 3: All 239 joint pool O-7 and O-8 positions are open to RC GFOs.

In every scenario, there are 294 joint pool positions for grades O-7 through O-10, and there are 59 other positions that are external to the services but are not part of the joint pool. Of the 59, 53 are IMA positions for RC officers, and there is a 50/50 chance that an RC officer in an IMA position is on active duty. The odds are not based on service inputs but are intended to maximize the uncertainty of how an RC officer would be counted if he were assigned to one of those positions.

Each service and service component attempts to manage its end strength within statutory limits. The active components are allowed a "credit" of additional officers serving in in-service positions based on the number of RC officers from each service branch serving in joint pool positions. This results in fluctuation in the number of officers serving in in-service positions and in the total number of officers from all components in a single service branch. Increases in the numbers do not necessarily correspond to end-strength violations, nor do decreases in the numbers necessarily correspond to end-strength shortages.

Model results are presented in tables and figures. Each scenario has two associated tables and eight associated figures (two figures per service branch). This chapter presents the tables and figures for Scenario 1 (Tables 3.1 and 3.2, and Figures 3.1 through 3.8), and the appendix contains the tables and figures for the other scenarios. The conclusions for all of the scenarios are the same: The model does a good job of managing end-strength limitations, and the violations are modest. The model also had no difficulty staying within the limitation of 20 percent of RC authorized end strength in external positions. In Scenario 1, very few joint pool positions are open to RC GFOs, so those officers are more likely to end up in other external positions—ones that count against either active or reserve end strength. In Scenario 3, which has many joint pool positions open to RC GFOs, they are likely to fill those positions rather than the other external positions. The number of joint pool positions in Scenario 2 was between the two extremes. Regardless, the 20 percent limitation was not a challenge.

The figures show that the system is stable over time, but the model was designed to allow some ebb and flow in the share of joint assignments that the services have, so there is some visible variability in the time series. Because of the variability, the charts show five-year moving averages (e.g., the numbers shown in period 100 are an average of the numbers in periods 81 through 100). One technical consideration is that the smaller services look more variable than the bigger services because of the scale of the figures. The figures also indicate where the active components (and in just a handful of cases, the reserve components) exceed end-strength limitations. Those are illustrated as white dots whose height above the related time series indicates the magnitude of the violation; each dot represents a violation in a single period of the model (in this case, a three-month period). The dots can represent either O-7 or O-8 end-strength violations the same way; there were no O-9 or O-10 violations.

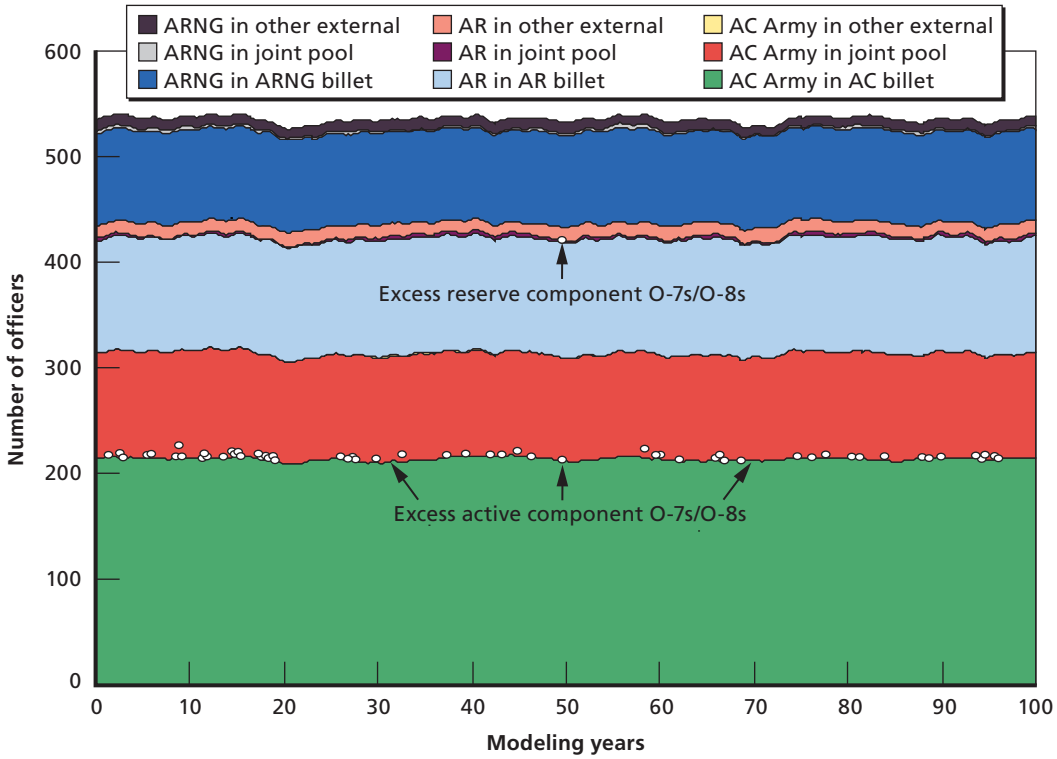
Table 3.1
Active Component End-Strength Analysis for Scenario 1

	Army	Air Force	Navy	Marine Corps
Active Component O-7s				
Average size of end-strength violation	3.07	3.19	3.52	1.76
Largest end-strength violation	11	9	11	6
Number of quarters with end-strength violations (out of 400 modeling quarters)	41	47	64	66
Number of times end-strength violations occurred in consecutive quarters	8	13	17	13
Number of times end-strength violations lasted 4 quarters or more (i.e., 1 year or more)	0	0	5	2
Most consecutive quarters with end-strength violations	3	3	5	4
Estimated rate of end-strength violations	1 every 3.2 quarters	1 every 2.7 quarters	1 every 1.8 quarters	1 every 3.4 quarters
Active Component O-8s				
Average size of end-strength violation	1.36	1.44	1.75	1.00
Largest end-strength violation	4	6	3	1
Number of quarters with end-strength violations (out of 400 modeling quarters)	25	25	16	7
Number of times end-strength violations occurred in consecutive quarters	3	2	2	0
Number of times end-strength violations lasted 4 quarters or more (i.e., 1 year or more)	0	0	0	0
Most consecutive quarters with end-strength violations	3	2	2	1
Estimated rate of end-strength violations	1 every 11.8 quarters	1 every 11.1 quarters	1 every 14.3 quarters	1 every 57.1 quarters

Table 3.2
Reserve Component End-Strength Analysis and Officers in External Positions for Scenario 1

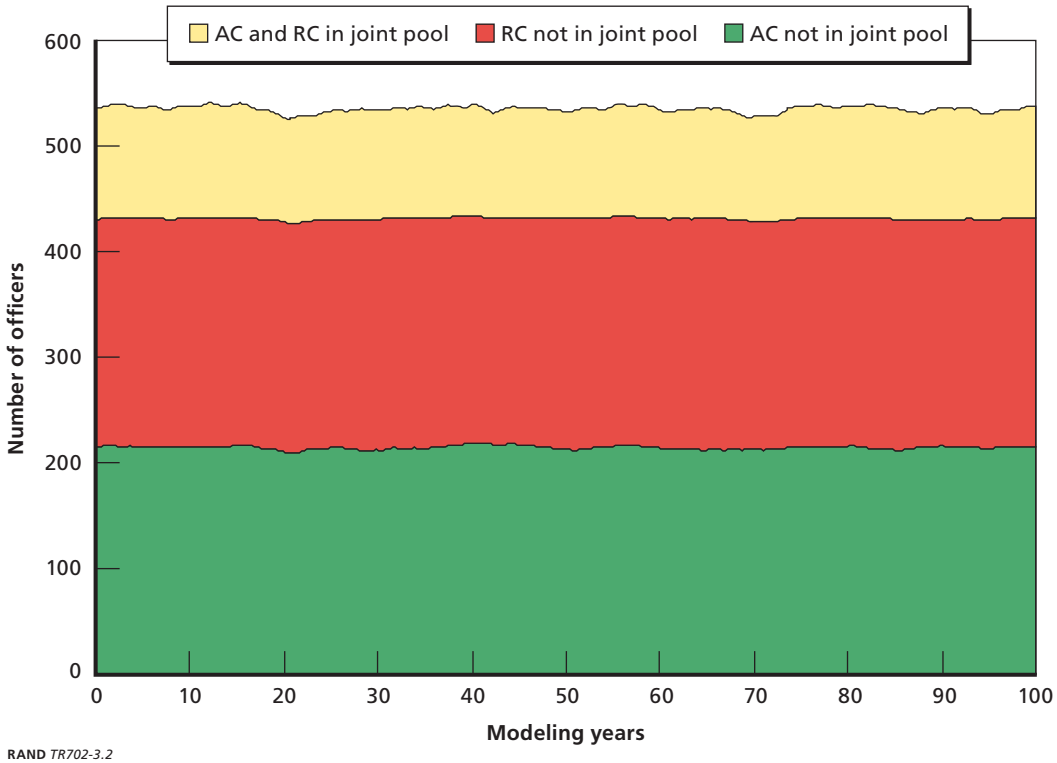
	Army Reserve	Army National Guard	Air Force Reserve	Air National Guard	Navy Reserve	Marine Reserve
Average number of O-7s and O-8s above statutory limits	0.005	0.0	0.0	0.0	0.005	0.0
Average number of officers in joint pool	2.4	2.0	1.6	1.7	1.4	0.3
Average number of officers in other external positions	12.2	9.4	8.2	8.4	4.4	1.2
Average number of officers in all external positions	14.5	11.4	9.8	10.1	5.8	1.5
Maximum allowed number of officers in all external positions	23	18	15	16	9	2

Figure 3.1
Detailed Army Inventory, Scenario 1



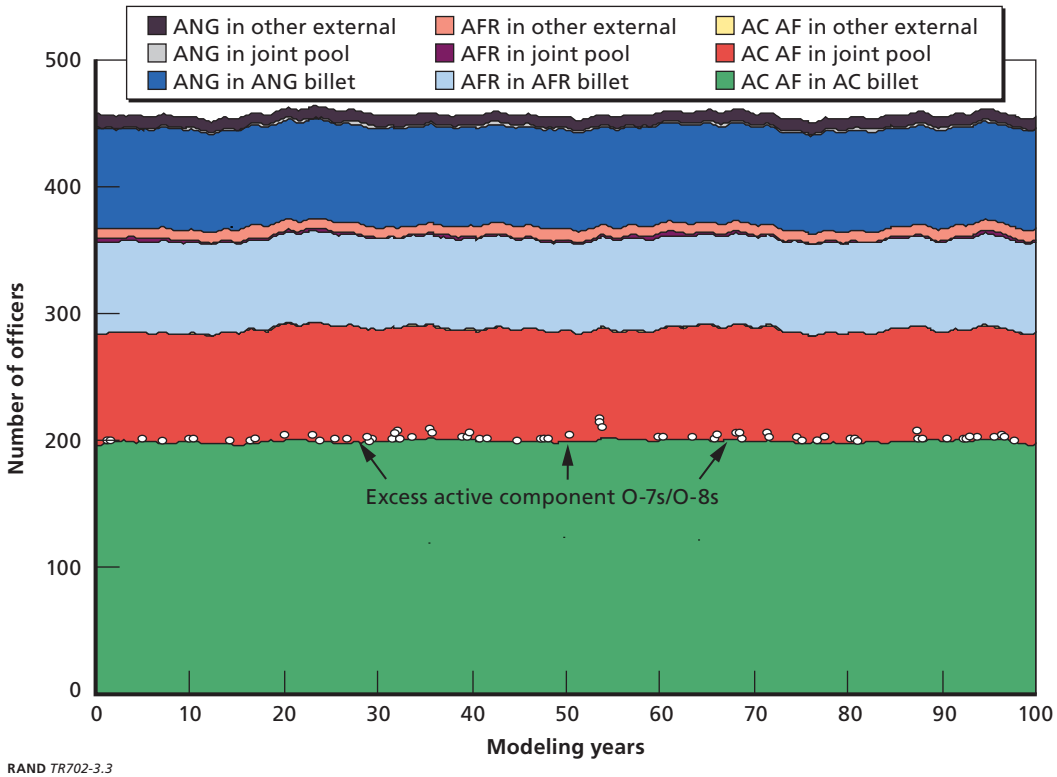
RAND *TR702-3.1*

Figure 3.2
Aggregated Army Inventory, Scenario 1



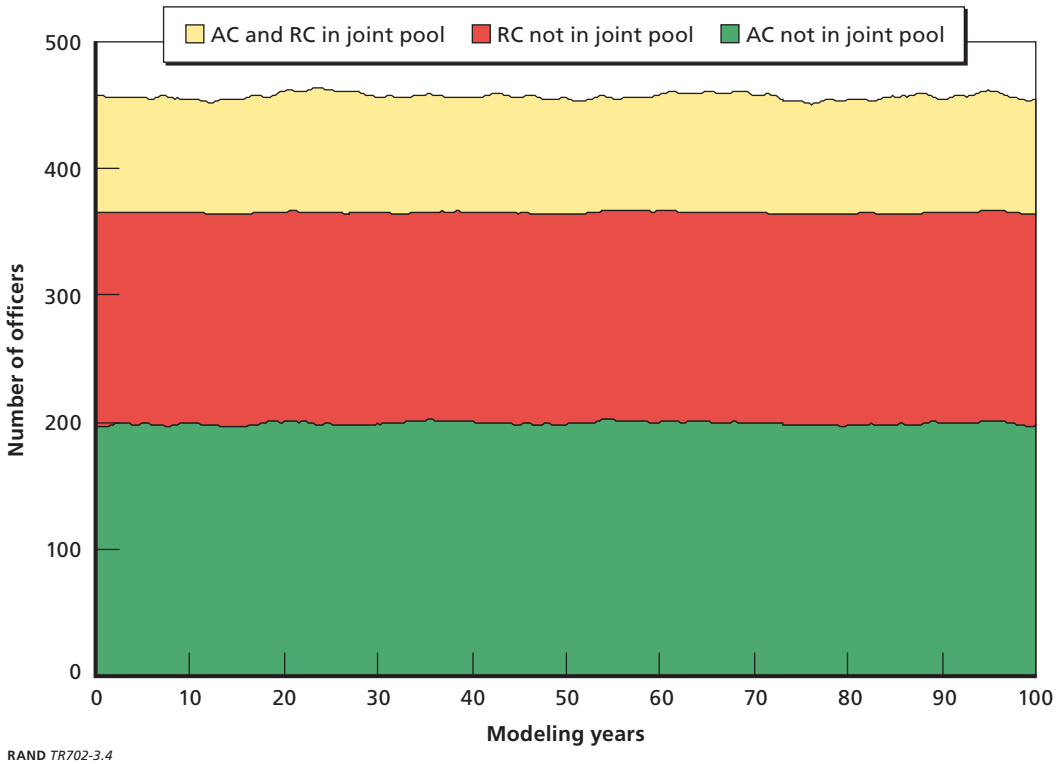
RAND *TR702-3.2*

Figure 3.3
Detailed Air Force Inventory, Scenario 1



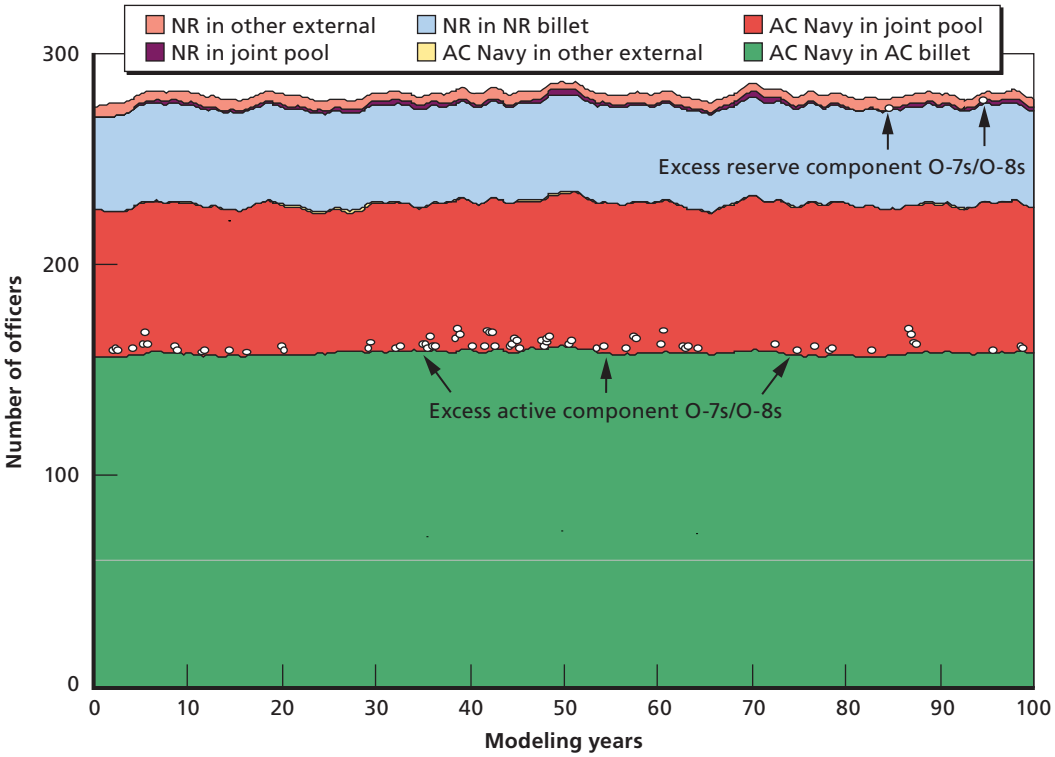
RAND *TR702-3.3*

Figure 3.4
Aggregated Air Force Inventory, Scenario 1



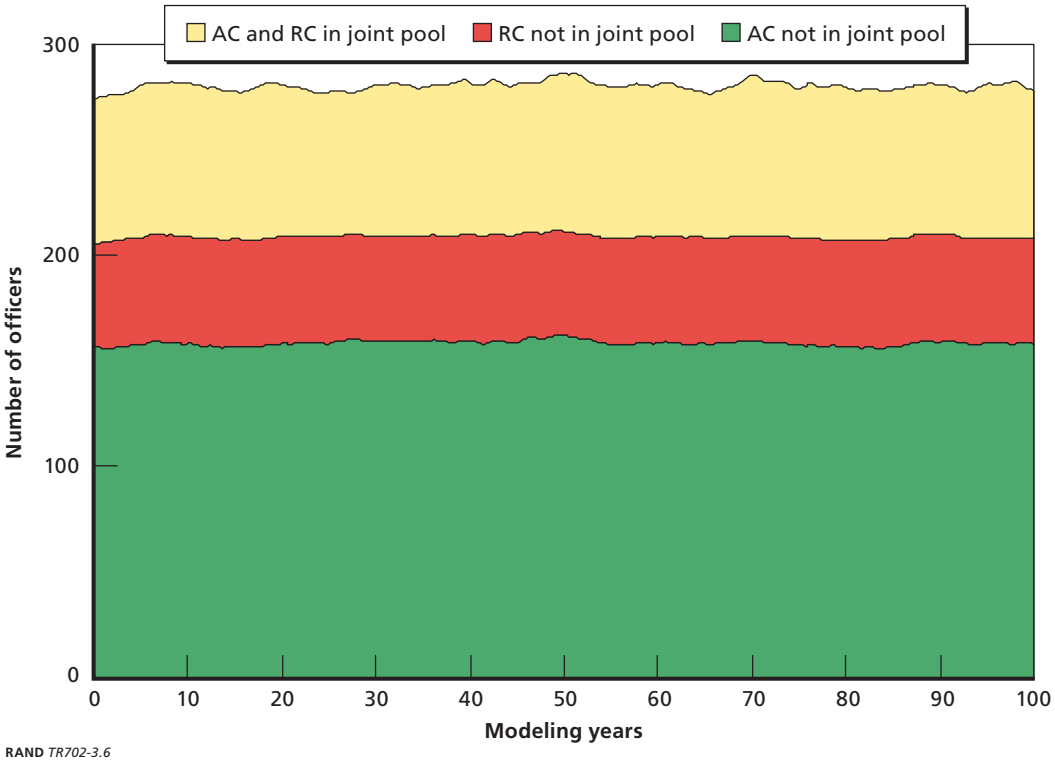
RAND *TR702-3.4*

Figure 3.5
Detailed Navy Inventory, Scenario 1



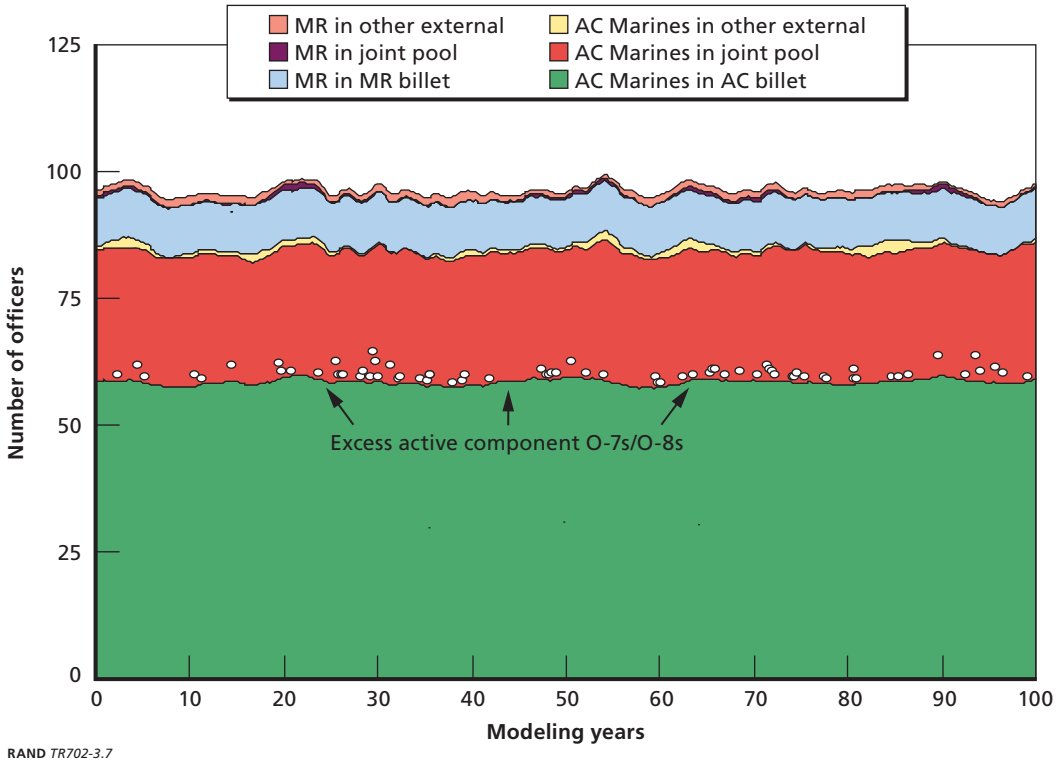
RAND *TR702-3.5*

Figure 3.6
Aggregated Navy Inventory, Scenario 1



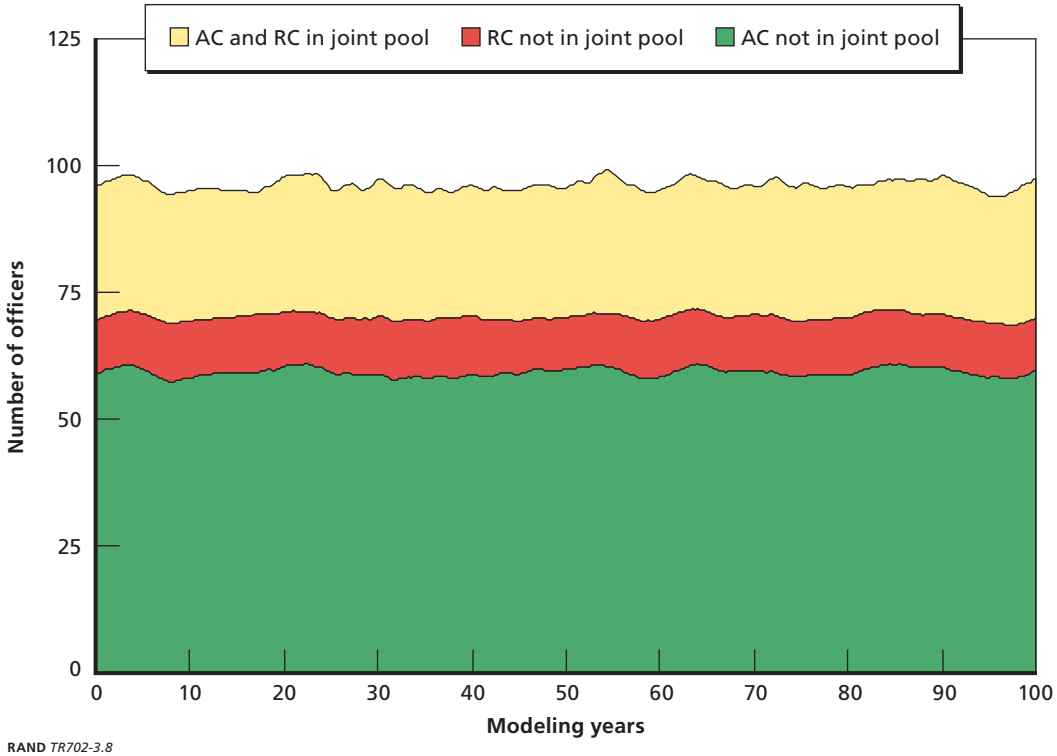
RAND *TR702-3.6*

Figure 3.7
Detailed Marine Corps Inventory, Scenario 1



RAND *TR702-3.7*

Figure 3.8
Aggregated Marine Corps Inventory, Scenario 1



RAND *TR702-3.8*

The O-7 violations are caused by uncertainty about the size of the joint pool credit. The modeling suggests that if the active components choose not to utilize their entire joint pool credit, they can reduce the magnitude, frequency, and duration of O-7 end-strength violations. Using the Navy as an example, if it is initially allowed 78 O-7s on active duty, but there are five Navy RC O-7s in joint pool positions, the active component could have up to 83 O-7s on active duty and not be in violation of the law. As a matter of practice, the Navy may want to have, say, only 80 or 81 on active duty in order to be able to absorb officers returning from the joint pool who come back onto in-service end-strength rolls, as well as to prepare for the possibility that some of those RC O-7s may leave the joint pool soon, thereby reducing the Navy's permissible number of officers over the 78 baseline. One modeling excursion did implement a rule whereby the active components utilized only half of the available joint pool credit. Table 3.3 compares the O-7 results from that excursion with those presented in Table 3.1. Both implemented Scenario 1 joint pool access for the reserve component.

Table 3.3
Active Component End-Strength Analysis for Scenario 1 When Services Do and Do Not Use Their Entire Joint Pool Credit

	Army	Air Force	Navy	Marine Corps
Active Component O-7s Using Entire Joint Pool Credit				
Average size of end-strength violation	3.07	3.19	3.52	1.76
Largest end-strength violation	11	9	11	6
Number of quarters with end-strength violations (out of 400 modeling quarters)	41	47	64	66
Number of times end-strength violations occurred in consecutive quarters	8	13	17	13
Number of times end-strength violations lasted 4 quarters or more (i.e., 1 year or more)	0	0	5	2
Most consecutive quarters with end-strength violations	3	2	5	4
Estimated rate of end-strength violations	1 every 3.2 quarters	1 every 2.7 quarters	1 every 1.8 quarters	1 every 3.4 quarters
Active Component O-7s Using Half of Joint Pool Credit				
Average size of end-strength violation	3.57	3.36	3.76	1.86
Largest end-strength violation	9	12	12	6
Number of quarters with end-strength violations (out of 400 modeling quarters)	23	33	46	43
Number of times end-strength violations occurred in consecutive quarters	7	8	11	8
Number of times end-strength violations lasted 4 quarters or more (i.e., 1 year or more)	0	2	1	0
Most consecutive quarters with end-strength violations	2	4	4	3
Estimated rate of end-strength violations	1 every 4.9 quarters	1 every 3.6 quarters	1 every 2.3 quarters	1 every 5.0 quarters

CHAPTER FOUR

Conclusions

All in all, the simulation results showed only very modest numbers of end-strength violations, and it is possible that the model overstates the actual violations. Because the model calculates by quarters, it must make three months' worth of assignment and promotion decisions in a single modeling step. If the services set promotion dates on a monthly, rather than a quarterly, basis, unanticipated movement into or out of the joint pool is less likely. In addition, there are limits on how many assignment and promotion rules the model can incorporate before it becomes intractable. The real world can accommodate far more complex decision rules, last-minute changes, contingencies, swaps between services and components, temporary dual-hattings, and so forth, that could help the services stay within authorized end strength. The model results may thus overstate the magnitude, frequency, and duration of end-strength violations.

But the model may understate the practical challenges of simultaneously managing promotions, assignments, and end strength in real time by different offices. The AC and RC GOMOs will have to work closely with one another to manage end strength, and both will have to work closely with the Joint Staff Office of General/Flag Officer Matters as well. At the heart of the process are joint pool assignments. The greater the visibility and predictability of planned joint pool assignments, the more easily the services can manage their GFOs.

When making promotion and assignment decisions, the AC GOMOs need to know which of their officers are going into, serving in, or coming out of joint pool positions; they must also have the same information on their RC counterparts. The RC GOMOs need advance notice about upcoming joint pool vacancies they can compete for. This not only will serve the interests of the RC GOMOs by giving them time to identify qualified and available officers but will also serve the interests of the AC GOMOs by enabling them to plan for the joint pool credit. Friction may arise if both the Army and the Air Force want the National Guard to nominate somebody for a joint pool position.

It may be advisable to carefully monitor information sharing, assignment predictability, and promotion forecasting after the new rules take effect. This information can be tied to end-strength violations to determine how real-world processes can be improved. If these processes do not work well—if there is miscommunication, gamesmanship for particular positions, or other complicating factors—the management of end strength may not run smoothly. It is important to bring to light the hidden assumption that information will flow freely and promptly between offices. The model knows all; humans might not.

APPENDIX

Model Results for Scenarios 2 and 3

Chapter Three presented modeling results for Scenario 1, in which very few joint pool positions are open to RC GFOs. This appendix presents the modeling results for Scenario 2, in which half of the joint pool positions are open to RC GFOs (Tables A.1 and A.2, Figures A.1 through A.8), and Scenario 3, in which all of the joint pool positions are open to RC GFOs (Tables A.3 and A.4, Figures A.9 through A.16). The results from all scenarios support the same conclusion: GFO end strength may require closer attention, but it is manageable.

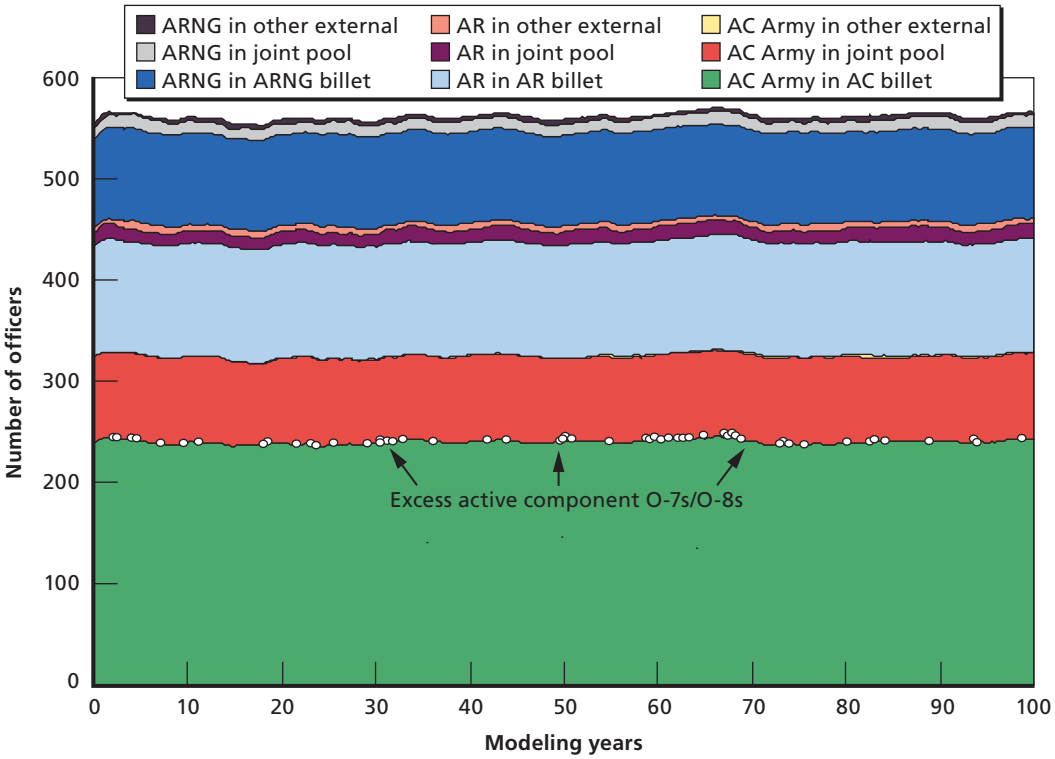
Table A.1
Active Component End-Strength Analysis for Scenario 2

	Army	Air Force	Navy	Marine Corps
Active Component O-7s				
Average size of end-strength violation	1.67	2.07	2.04	1.67
Largest end-strength violation	4	7	6	8
Number of quarters with end-strength violations (out of 400 modeling quarters)	15	14	26	57
Number of times end-strength violations occurred in consecutive quarters	2	3	4	15
Number of times end-strength violations lasted 4 quarters or more (i.e., 1 year or more)	0	0	0	2
Most consecutive quarters with end-strength violations	2	2	3	4
Estimated rate of end-strength violations	1 every 16 quarters	1 every 13.8 quarters	1 every 7.5 quarters	1 every 4.2 quarters
Active Component O-8s				
Average size of end-strength violation	1.30	1.08	1.33	1.29
Largest end-strength violation	4	2	2	2
Number of quarters with end-strength violations (out of 400 modeling quarters)	40	37	6	14
Number of times end-strength violations occurred in consecutive quarters	2	4	1	4
Number of times end-strength violations lasted 4 quarters or more (i.e., 1 year or more)	0	0	0	0
Most consecutive quarters with end-strength violations	3	2	2	3
Estimated rate of end-strength violations	1 every 7.7 quarters	1 every 10 quarters	1 every 50 quarters	1 every 22.2 quarters

Table A.2
Reserve Component End-Strength Analysis and Officers in External Positions for Scenario 2

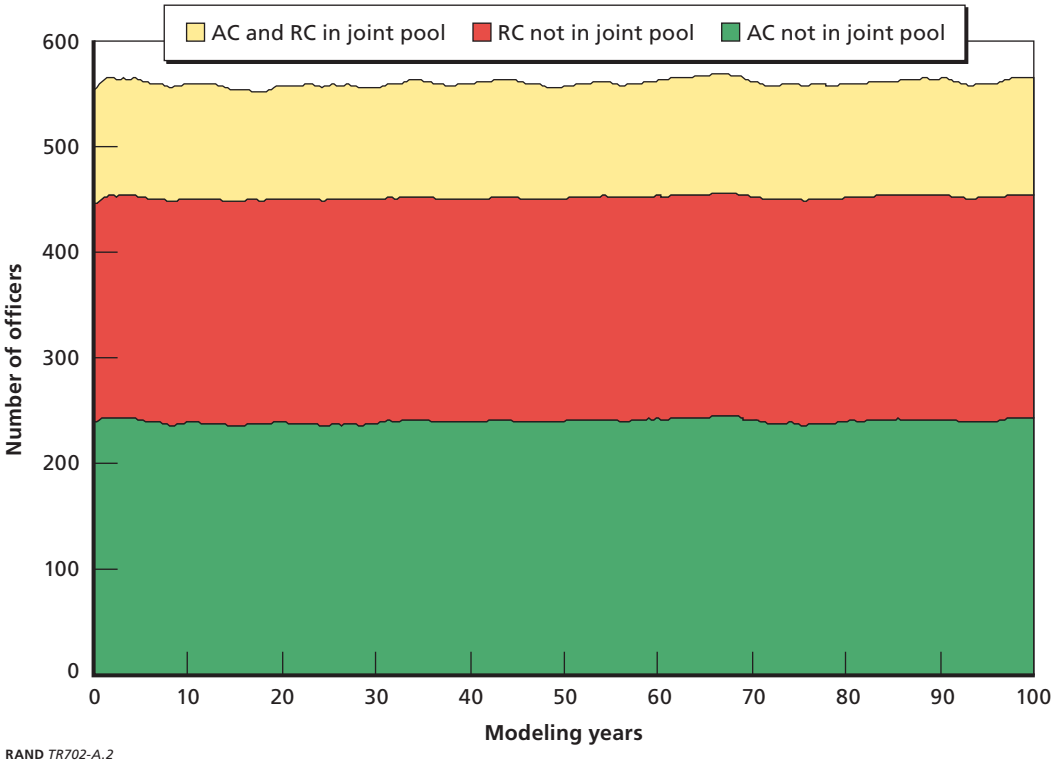
	Army Reserve	Army National Guard	Air Force Reserve	Air National Guard	Navy Reserve	Marine Reserve
Average number of O-7s and O-8s above statutory limits	0.0	0.0	0.0	0.0	0.0	0.0
Average number of officers in joint pool	13.1	11.4	8.8	9.7	5.8	1.4
Average number of officers in other external positions	6.0	3.8	3.8	3.7	1.2	0.0
Average number of officers in all external positions	19.1	15.3	12.6	13.3	7.0	1.5
Maximum allowed number of officers in all external positions	23	18	15	16	9	2

Figure A.1
Detailed Army Inventory, Scenario 2



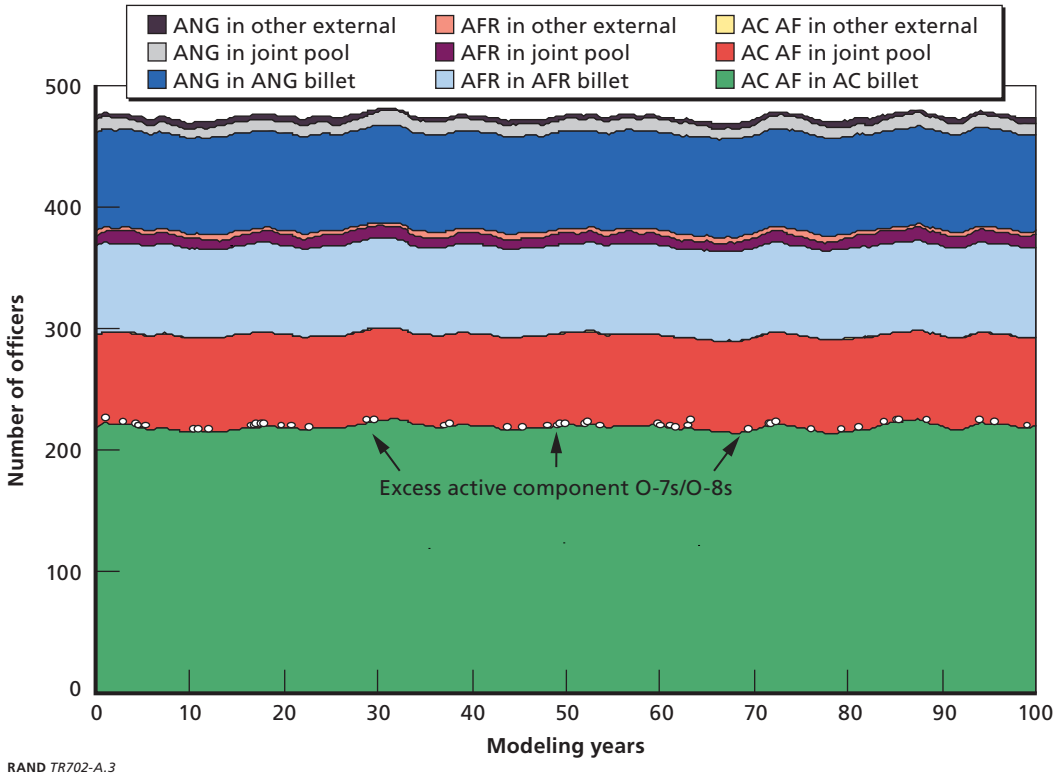
RAND *TR702-A.1*

Figure A.2
Aggregated Army Inventory, Scenario 2



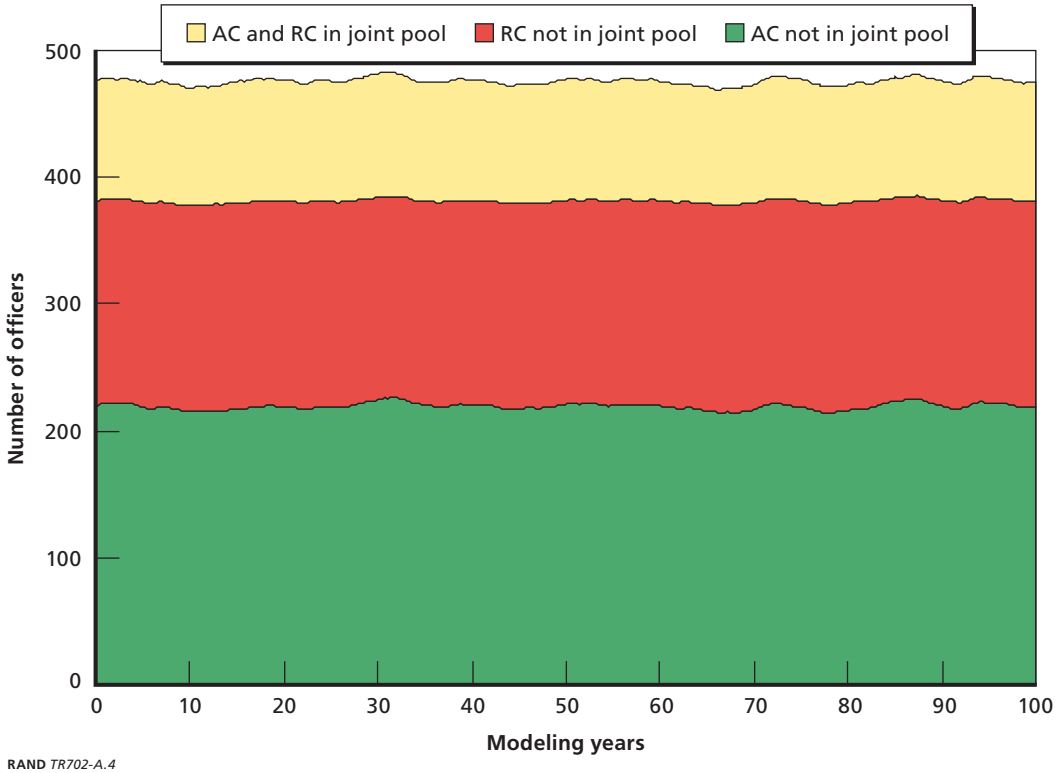
RAND *TR702-A.2*

Figure A.3
Detailed Air Force Inventory, Scenario 2



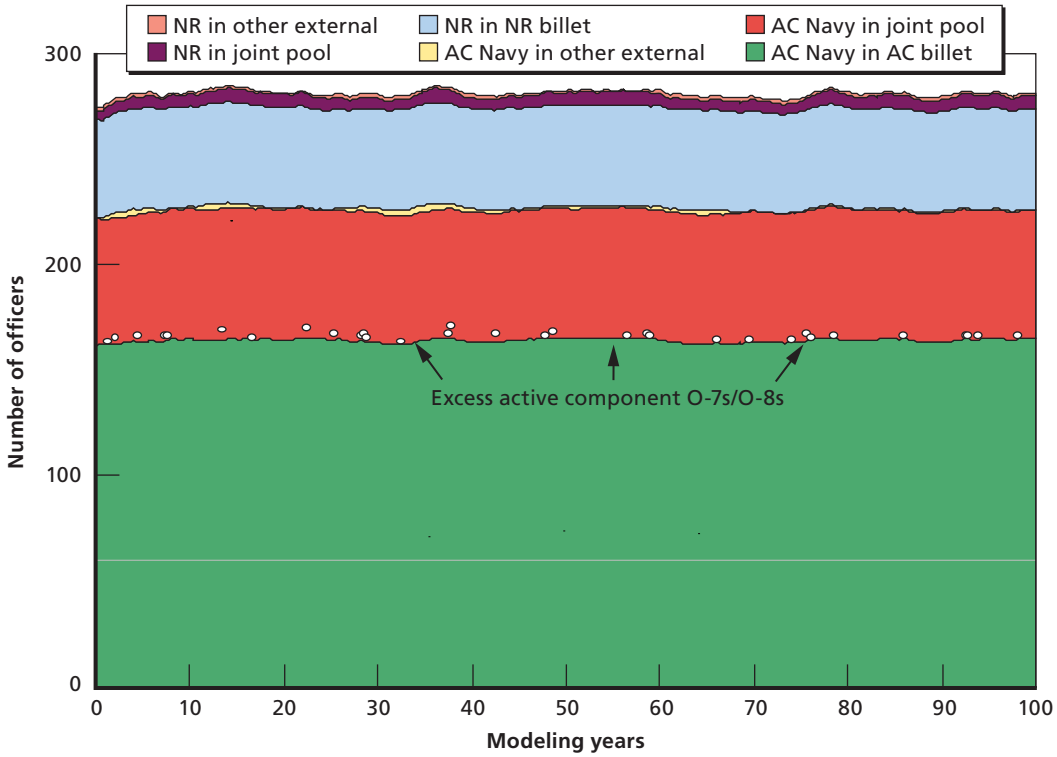
RAND *TR702-A.3*

Figure A.4
Aggregated Air Force Inventory, Scenario 2



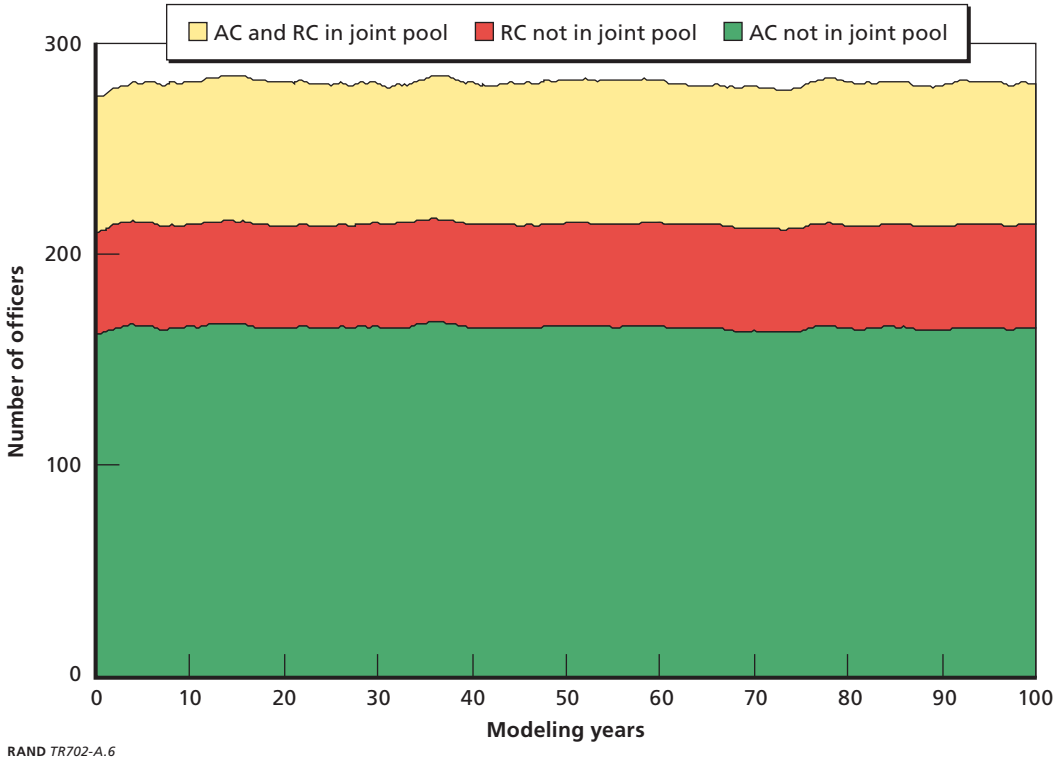
RAND *TR702-A.4*

Figure A.5
Detailed Navy Inventory, Scenario 2



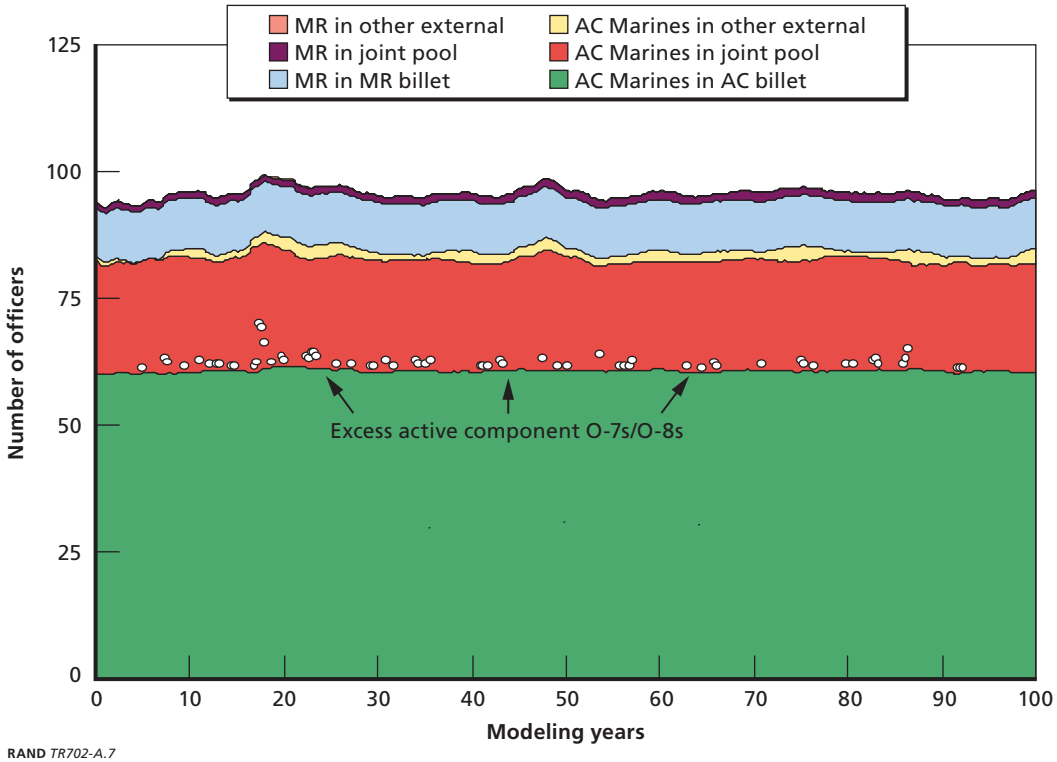
RAND *TR702-A.5*

Figure A.6
Aggregated Navy Inventory, Scenario 2



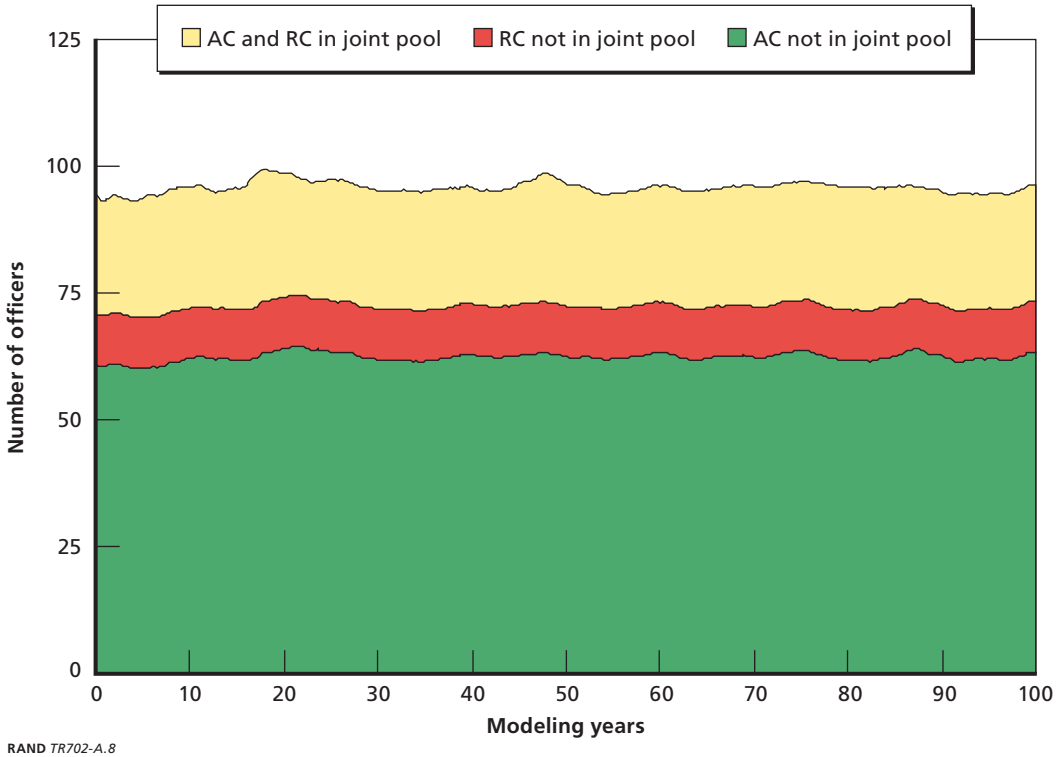
RAND *TR702-A.6*

Figure A.7
Detailed Marine Corps Inventory, Scenario 2



RAND *TR702-A.7*

Figure A.8
Aggregated Marine Corps Inventory, Scenario 2



RAND *TR702-A.8*

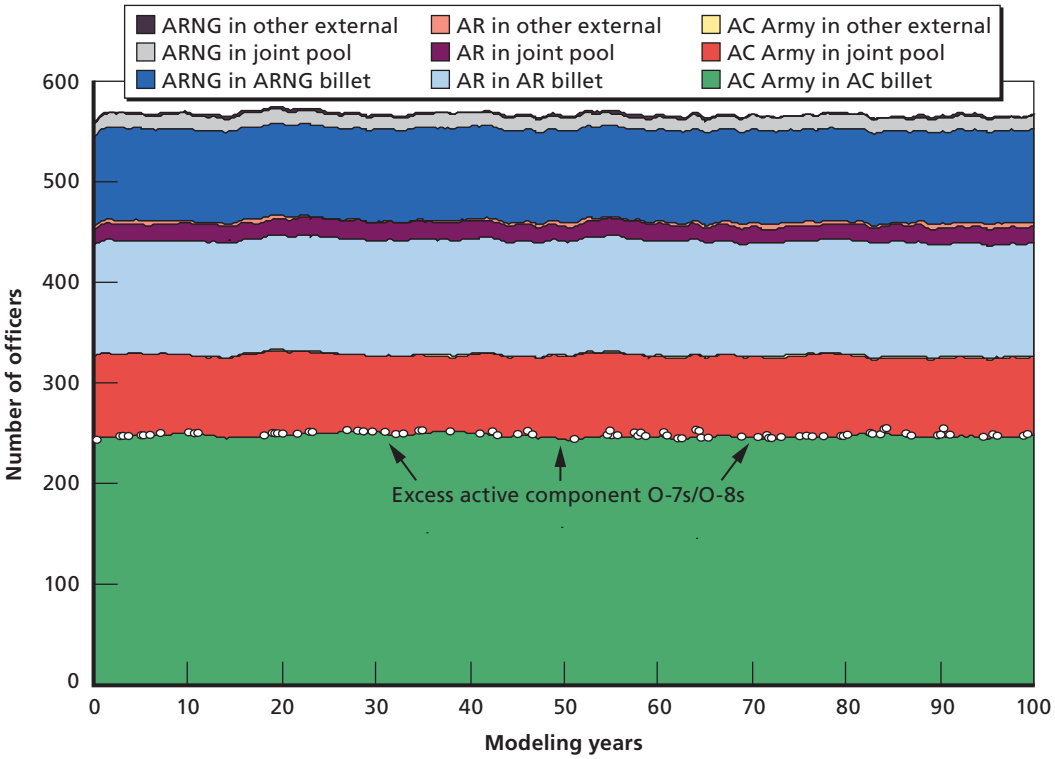
Table A.3
Active Component End-Strength Analysis for Scenario 3

	Army	Air Force	Navy	Marine Corps
AC O-7s				
Average size of end-strength violation	2.92	2.44	1.83	1.53
Largest end-strength violation	7	7	4	3
Number of quarters with end-strength violations (out of 400 modeling quarters)	24	18	12	57
Number of times end-strength violations occurred in consecutive quarters	4	3	2	12
Number of times end-strength violations lasted 4 quarters or more (i.e., 1 year or more)	0	0	0	1
Most consecutive quarters with end-strength violations	3	2	2	4
Estimated rate of end-strength violations	1 every 5.7 quarters	1 every 9.1 quarters	1 every 18.2 quarters	1 every 4.6 quarters
AC O-8s				
Average size of end-strength violation	1.25	1.16	1.30	1.07
Largest end-strength violation	4	5	3	2
Number of quarters with end-strength violations (out of 400 modeling quarters)	61	38	10	14
Number of times end-strength violations occurred in consecutive quarters	8	5	1	1
Number of times end-strength violations lasted 4 quarters or more (i.e., 1 year or more)	0	0	0	0
Most consecutive quarters with end-strength violations	3	2	2	3
Estimated rate of end-strength violations	1 every 5.3 quarters	1 every 9.1 quarters	1 every 30.8 quarters	1 every 26.7 quarters

Table A.4
Reserve Component End-Strength Analysis and Officers in External Positions for Scenario 3

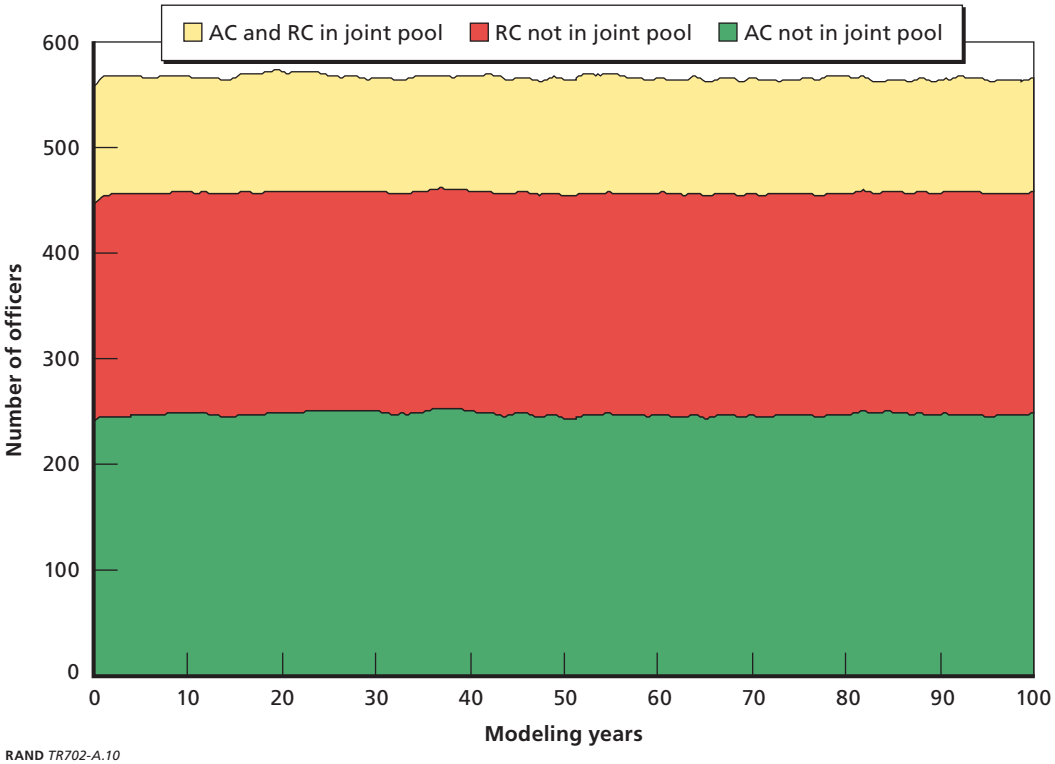
	Army Reserve	Army National Guard	Air Force Reserve	Air National Guard	Navy Reserve	Marine Reserve
Average number of O-7s and O-8s above statutory limits	0.0	0.0	0.0	0.0	0.0	0.0
Average number of officers in joint pool	16.3	13.4	10.9	10.7	7.0	1.5
Average number of officers in other external positions	3.0	1.8	1.1	1.8	0.2	0.0
Average number of officers in all external positions	19.3	15.2	12.0	12.5	7.2	1.6
Maximum allowed number of officers in all external positions	23	18	15	16	9	2

Figure A.9
Detailed Army Inventory, Scenario 3



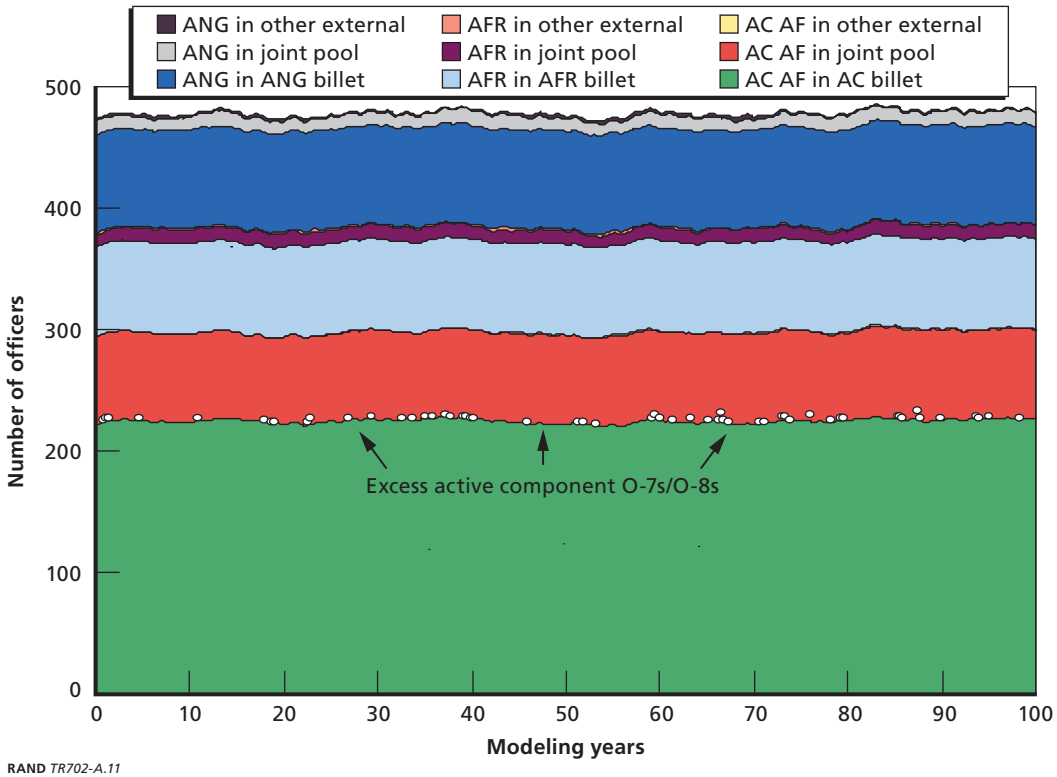
RAND *TR702-A.9*

Figure A.10
Aggregated Army Inventory, Scenario 3



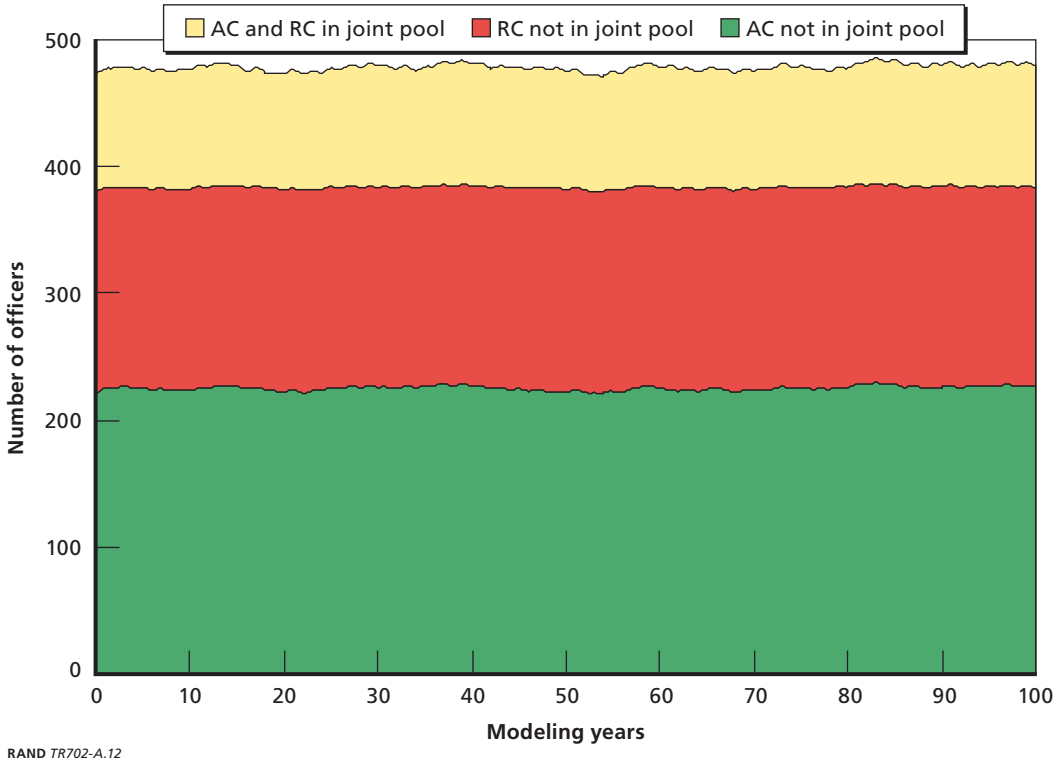
RAND *TR702-A.10*

Figure A.11
Detailed Air Force Inventory, Scenario 3



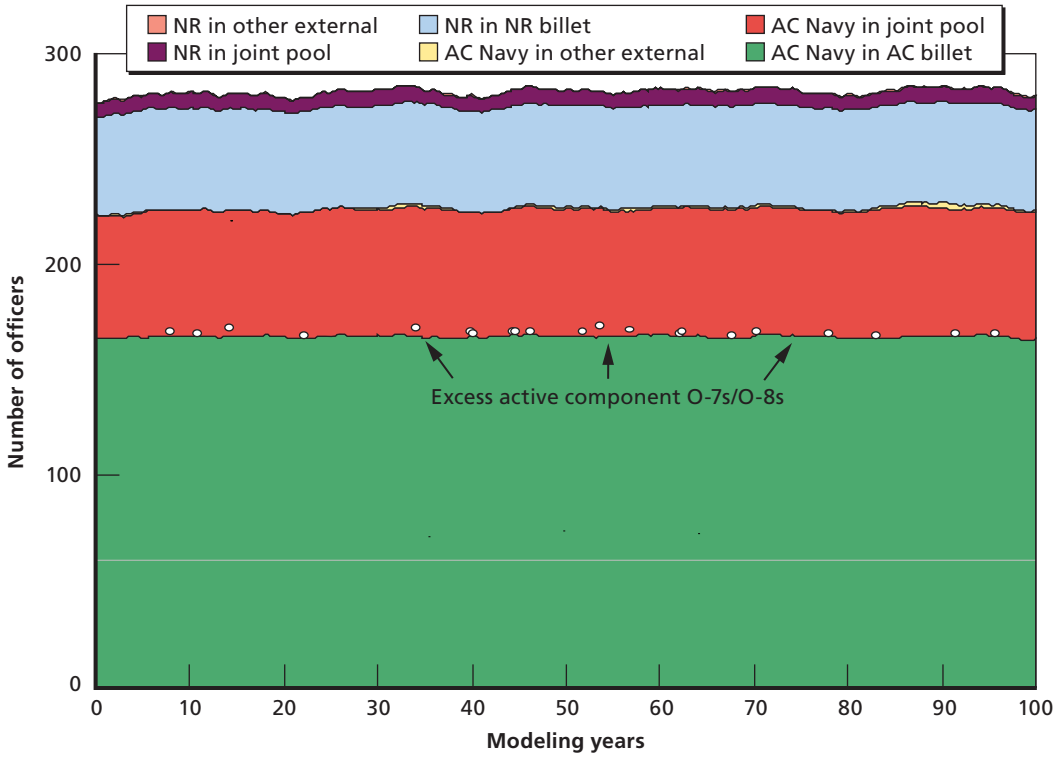
RAND *TR702-A.11*

Figure A.12
Aggregated Air Force Inventory, Scenario 3



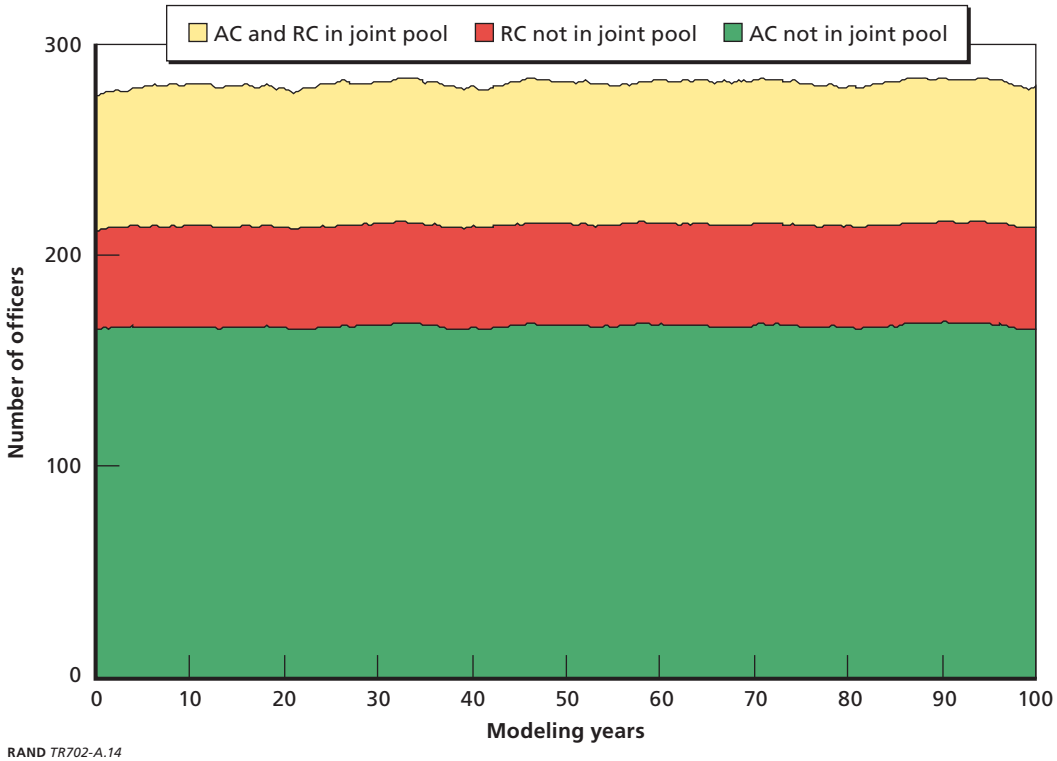
RAND *TR702-A.12*

Figure A.13
Detailed Navy Inventory, Scenario 3



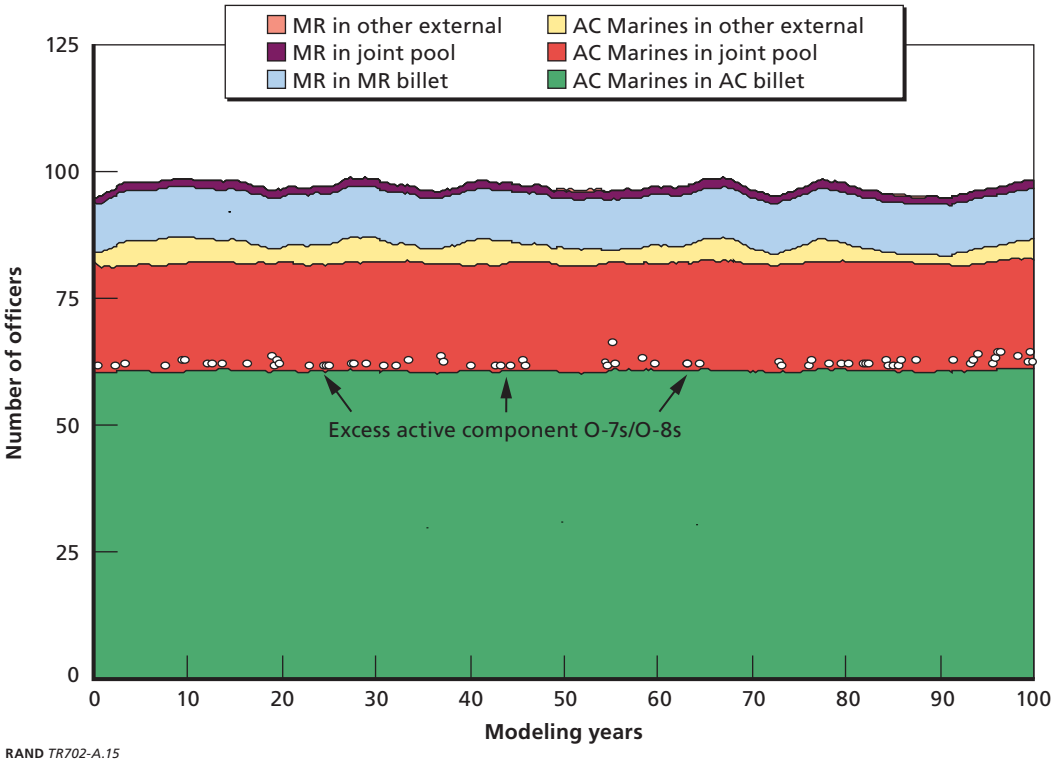
RAND *TR702-A.13*

Figure A.14
Aggregated Navy Inventory, Scenario 3



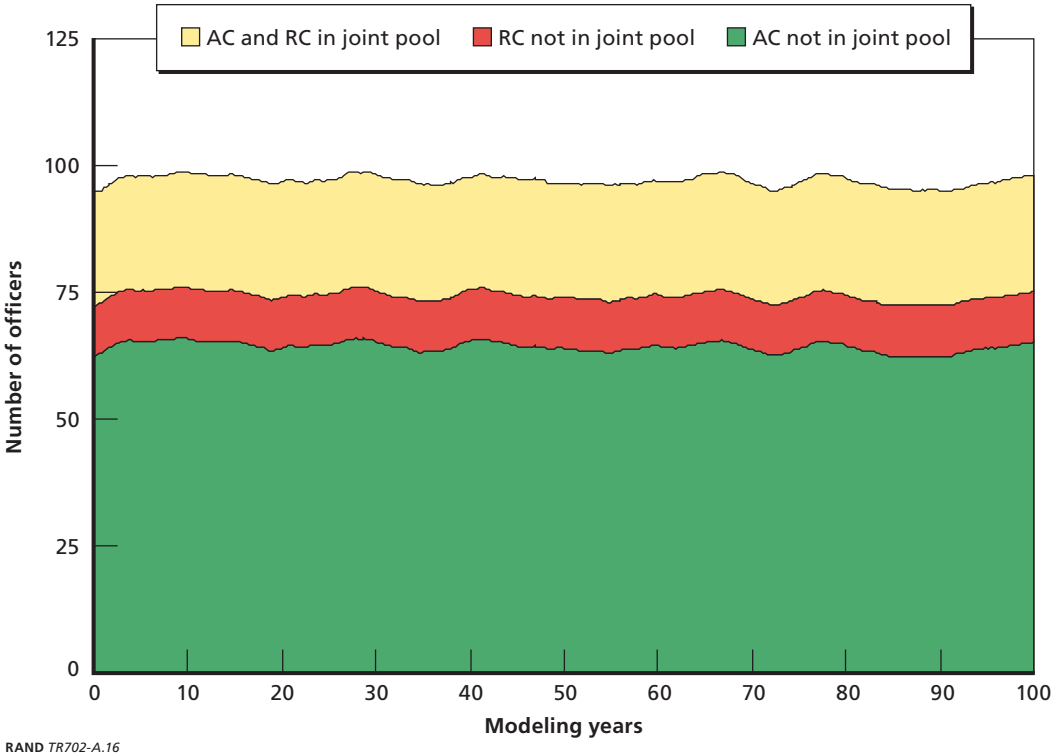
RAND *TR702-A.14*

Figure A.15
Detailed Marine Corps Inventory, Scenario 3



RAND *TR702-A.15*

Figure A.16
Aggregated Marine Corps Inventory, Scenario 3



RAND *TR702-A.16*