Chapter 14

Tailoring Active Duty Commitments for Reserve Component Service Members

David R. Graham
Colin M. Doyle
Joseph F. Adams
Robert J. Atwell
Ayeh Bandeh-Ahmadi
John R. Brinkerhoff
William R. Burns
H. T. Johnson
Yevgeniy Kirpichevsky
Drew Miller
Timothy Ni
Michael F. Niles
Steven B. Walser

Executive Summary

The role of the Reserve Components (RC) has changed markedly since the attacks of September 11, 2001. Reservists and Guard members have been activated and deployed in large numbers, and have served as key components of the total force fighting the wars in Afghanistan and Iraq. In addition, the rates at which reservists and Guard members have been utilized are very uneven, both within and across the Military Services. The amount of active duty service expected of one reservist or Guard member may be very different from that expected of another one.

In spite of this reality, all reservists and Guard members sign the same contract to perform inactive duty for training (drill) for one weekend per month and two weeks of active duty for training (annual training) per year, and to be subject to an unspecified amount of involuntary mobilization. This contract, a relic of the Cold War, no longer conveys what Guard members and reservists are actually signing up for because the practices of employing members vary greatly between the Services. Certain military skills and certain types of units are much more in demand than others. Experience also suggests that reservists and Guard members vary widely in their willingness to volunteer for deployment.

The views expressed in this paper represent those of the authors and are not necessarily those of the Department of Defense.

The Department of Defense (DOD) is currently weighing future mission assignments for the Reserve Components—to include a variety of strategic reserve, operational, technical, and domestic support missions. It is probable that this future mix of assigned missions will sustain, and perhaps accentuate, the differences in utilization across Services, units, and occupations. Service needs could be most efficiently and effectively addressed if they were able to offer reservists and Guard members tailored commitment contracts that set the expectations for their accession and retention decision making. The ability to tailor commitments also would allow reservists and Guard members to commit upfront to specific amounts of time on active duty and time deployed. Those who are willing to serve more might choose a higher commitment, while others might choose a lower level. Reservists and Guard members could match their level of commitment to those areas in which the needs of the Services accorded with their own preferences.

The possibility of tailoring commitments raises a number of questions regarding personnel and compensation policy. The goal of this study is to examine the recent behavior of RC members to determine: (a) if tailoring commitments is feasible, (b) whether tailoring would be cost effective, (c) whether tailoring would be viewed favorably by RC members, and (d) whether major changes in DOD's compensation system would be required to support tailoring.

The study addresses these matters from two perspectives: First, the study team conducted field research with current reservists and Guard members to learn their perspectives on their deployment experience and their attitudes toward tailored commitments. Second, DOD data on deployment experiences and RC members' decisions to join, stay, or leave the military were assessed using two formal quantitative models: the Reserve Component Simulation Model (R-SIM) and the Dynamic Retention Model (DRM).

Both field research and statistical analyses confirm a wide diversity of preferences among RC members regarding the ideal amount of time spent on active duty during a career. The IDA study team found that prospective and current reservists and Guard members, if offered the choice, would separate into higher and lower levels of commitment, with substantial numbers in each category. The fact-finding conducted for this study, coupled with the findings of a prior IDA study on self-selection for active duty,[1] confirms that de facto commitment choices already happen on an informal basis.

1. David R. Graham, Joseph F. Adams, John R. Brinkerhoff, William R. Burns, Colin M. Doyle, Hansford T. Johnson, Yevgeniy Kirpichevsky, Robert B. Magruder, Steven Mortimer, Saul Pleeter, and Susan L. Rose, *Self-Selection as a Tool for Managing the Demands on Department of Defense (DOD) Personnel*, IDA Paper P-4606 (Alexandria, VA: Institute for Defense Analyses, November 2010).

Research also confirms that when offered a choice of commitments, the split between those choosing the higher and lower commitments can be altered by tying compensation to the commitment choice. The statistical analyses show that the additional compensation required to raise the percentage of personnel choosing a high commitment contract is quite modest in some components. Conversely, they show that sizable numbers of recruits would accept reduced compensation if it were paired with a lower commitment contract.

Overall, the findings suggest that the ability to tailor commitments could provide a valuable tool for managing RC members. The study team concluded that tailoring commitments would be:

1. Feasible. All of IDA's lines of research suggest that recruits and members will be willing to sort themselves into higher and lower levels of commitment. Substantial numbers of members would choose to join units in which a high optempo was necessary.
2. Cost effective for DOD. IDA's results show that many Reserve Component members would choose high commitment contracts even in the absence of additional compensation incentives. Other members would accept reduced compensation if linked to reduced commitments. Offering a choice among commitment contracts increases the total pool of individuals willing to join.
3. Beneficial to RC members. The improved understanding of commitments and the ability to choose commitments allow individuals to make better informed decisions consistent with their preferences. IDA's field research revealed that RC members wish to choose their level of commitment (and to a limited degree can already do so). Thus, individuals are better off than if they were faced with a take-it-or-leave it choice for a commitment contract.
4. Compatible with compensation policies. The study team finds that the inducements (if any) needed to realize an appropriate system of tailored commitments would be moderate, and could be administered through existing programs. It is likely that they could be accommodated through bonuses or other incentives that are compatible with current and proposed compensation policy.

Instituting a system of tailored commitments would require designing new contracts and mapping mission needs to each offer. The recruiting systems for the Guard and Reserve would need to be revamped to take into account the different commitment requirements of each unit and to set the expectations of potential recruits. Finally, a management framework would need to be put in place to design

and implement the system and to adjust compensation to match the demands of the Services with the influx of contracted recruits.

1. Introduction

The role of the Reserve Components (RC) has changed markedly since the attacks of September 11, 2001. Reservists and Guard members have been activated and deployed in large numbers, and have served as key components of the total force fighting the wars in Afghanistan and Iraq. Data will be presented later in this paper to demonstrate these unprecedented demands. The data shall also show that the rates at which reservists and Guard members have been utilized are very uneven, both within and across the Services. The amount of active duty service expected of one reservist or Guard member may be very different from that of another one.

In spite of this reality, all reservists and Guard members sign the same contract to perform inactive duty for training (drill) for one weekend per month and two weeks of active duty for training (annual training) per year, and to be subject to an unspecified amount of involuntary mobilization. In addition to this general commitment, the Secretary of Defense has issued guidance to the Military Services setting the goal that reservists and Guard members should not be required to serve involuntarily for more than one year out of every six on active duty (or the equivalent thereof).

This contract, a relic of the Cold War, no longer conveys what Guard members and reservists are actually signing up for. It has become abundantly clear that certain military skills and certain types of units are much more in demand than others. Reservists and Guard members in these high-demand fields already have very different expectations of service than those in other fields, despite signing the same contract. This study will demonstrate that the practices of employing reservists vary greatly among the Services, both in the overall amount of active duty and deployed time served, and in the frequency and length of the active spells.

It is also reasonable to assume that although all reservists and Guard members currently sign the same contract, their preferences for active duty and deployed time, and their willingness to serve, may vary greatly.

These issues could be addressed by offering tailored commitments to reservists and Guard members. Tailored commitments would allow reservists and Guard members to commit upfront to specific amounts of time on active duty and time deployed. Those who are willing to serve more might choose a higher commitment, while others might choose a lower level. Reservists and Guard members would match themselves to those units or occupations in which the needs of the Services accorded with their own preferences.

The Comprehensive Review of the Roles and Missions of the Reserve Components[2] identified a set of disparate missions for the Reserve Components in the future, each requiring different skills and patterns of usage. Tailored commitments could attract talent into specific areas identified by the Comprehensive Review, to include:

- Ongoing demand skills and units: Reservists and Guard members who can expect to be mobilized and deployed equivalent to one year in every six, in line with the current guidance.
- High demand skills and units: Reservist and Guard members who agree upfront to serve more than the typical time deployed in exchange for some additional compensation. Several types of units and occupation have been in high demand in recent years, such as Civil Affairs.
- Strategic reserve units: Reservists and Guard members who can expect to drill each year and be called up only in a time of "existential" national emergency.
- Support to civil authorities: Reservists and Guard members recruited with the expectation that they will serve short missions within the United States (U.S.) homeland.
- Skilled professionals (for example cyber- and information technology (IT)-related occupations): Reservists and Guard members with civilian skills that are relevant to military work could be offered the option to serve a certain number of weeks or months annually to balance civilian and military commitments.

The focus of this study is to determine how individuals would respond to tailored commitments. It does so by drawing on three complementary sources: First, an examination of trends in activation, deployment, accession and retention over the last decade. Second, IDA's interviews with small groups of Reserve Component service members to determine their attitudes regarding mobilization and compensation. Finally, the two statistical models IDA developed to examine the behavior of RC members over the past decade of high activation rates. These models build on and extend a substantial history of studies examining the willingness of individuals to serve in the all-volunteer force (AVF).

The Reserve Component Simulation Model (R-SIM) was developed by IDA for the Office of the Assistant Secretary of Defense for Reserve Affairs to forecast

2. GEN James E. Cartwright and Secretary Dennis M. McCarthy, *Comprehensive Review of the Future Role of the Reserve Component*, Washington, DC: Office of the Vice Chairman of the Joint Chiefs of Staff and Office of Assistant Secretary of Defense for Reserve Affairs, April 2011.

accessions and continuation rate responses to compensation and activation policies. IDA has extended the R-SIM, which was originally built for the Army Reserve Component, to all components, and expanded it to allow for multiple commitment choices. Next, the study team developed IDA's dynamic retention model (DRM), which relates the joining and staying behavior of reservists to the amount of deployment that they can expect over their careers.

The remainder of the paper is divided as follows: Chapter two examines trends in activation and deployment over the past decade. Chapter three describes the results of the interviews. Chapter four describes the results of the statistical model applications. The concluding chapter summarizes the common themes and variations across the study's lines of analysis. It also explains how the findings of the statistical analysis should be viewed in relation to prior studies.

2. Context: The Reserve Components in the Last Decade

Since September 2001, the Reserve Components have experienced a decade of high operational tempo. Activations and deployments, as well as military compensation, have seen significant changes over the last decade; therefore, it is pertinent to consider how Reserve Component members alter their accession and continuation decisions in light of these changes. Data collected in the decade following September 11, 2001 demonstrate the evolution of the Reserve Components and provide essential context for shaping future policies. Because of the new data collected during this period, it is possible to provide a unique analysis that can help to shape future force management techniques for the Reserve Components.

This chapter examines the trends over the past decade in which activations, deployments, and dwell times have changed significantly. The Global War on Terror (GWOT) caused an increased demand for troops, which resulted in more activations and deployments and decreased dwell times. Defense Manpower Data Center (DMDC) activation and deployment data make it possible to determine precisely the level of activations, deployments, and dwell times, and to relate these experiences to individual choices.

Figure 1 depicts the distribution of all active duty spells served since September 2001. The horizontal axis measures the length of an activation in months; the vertical axis measures the total number of activations of that length that have been served. Table 1 lists the percentage of time that those on active duty have spent deployed to theater. When compared to activations before the, GWOT, when relatively few Reserve Component members were activated, the thousands of members activated since the beginning of the war represent a significant increase in operational tempo.

Many members have been activated multiple times to meet wartime demands resulting in shorter dwell times for members of the Reserve Components.

Another perspective on individuals' activation experience is provided by a recent study for the Office of the Under Secretary of Defense for Personnel and Readiness that evaluates the potential for members of the reserve and active forces to self-select

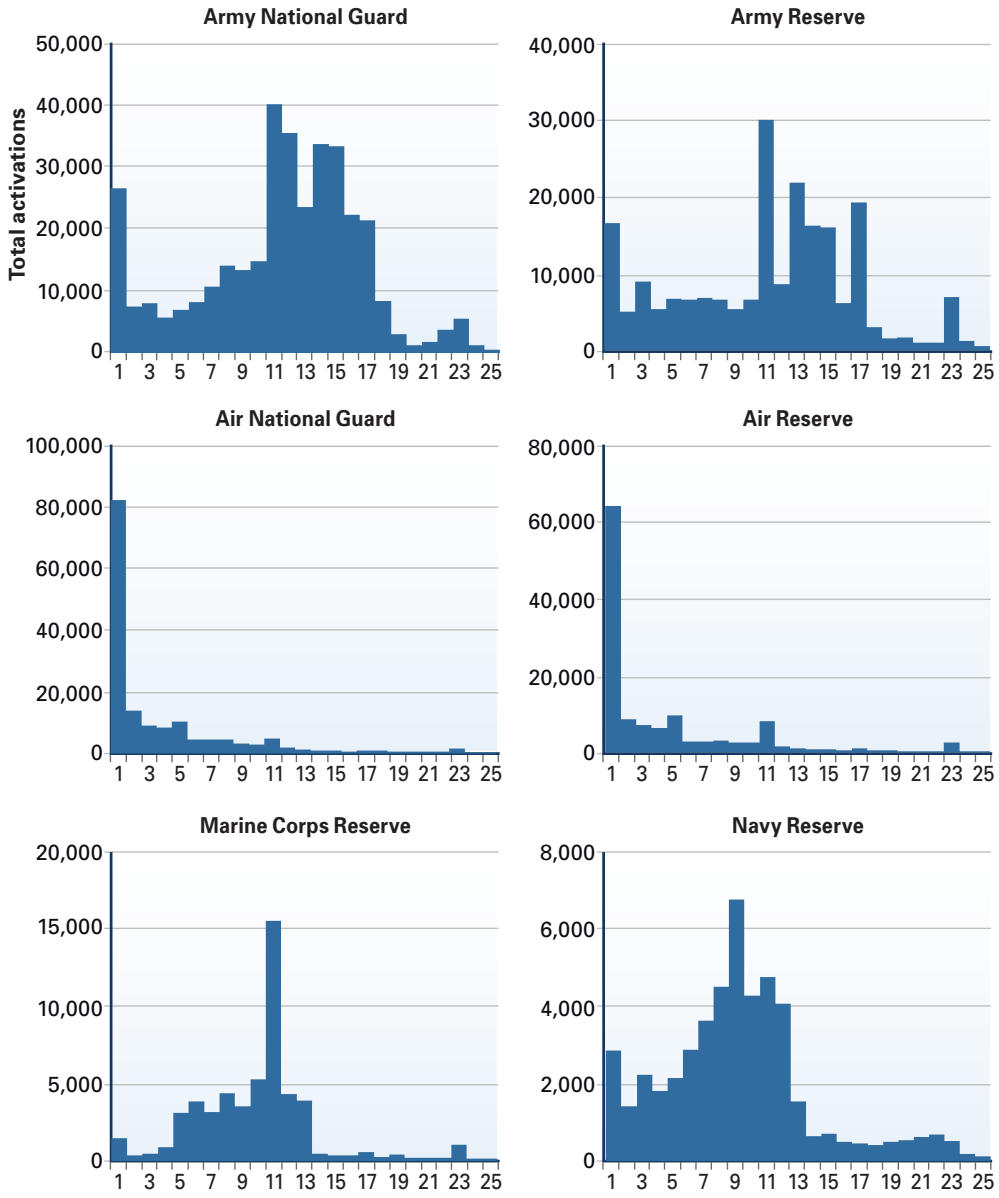


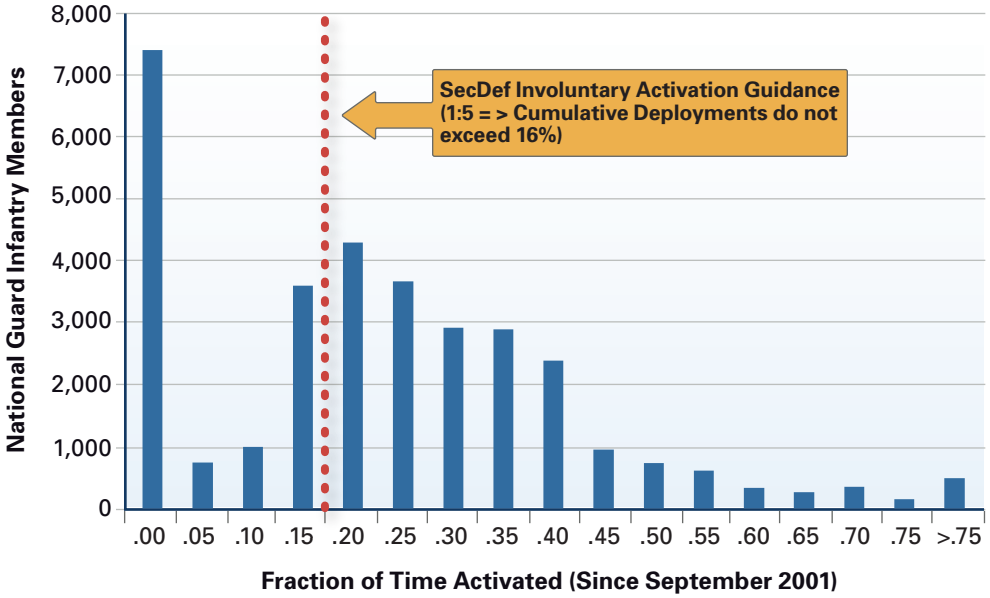
Figure 1. Numbers of Active Duty Spells by Activation Length

for deployments above the goals set by the Secretary. In the study,[3] IDA found tremendous variability in deployment duty time across individuals and that many members of the Guard and reserve are already self-selecting for active duty service beyond their minimum duty requirement.

Table 1. Percentage of Activated Time Spent Deployed

Army National Guard	56.76%
Army Reserve	42.51%
Air National Guard	37.63%
Air Force Reserve	34.36%
Marine Corps Reserve	71.34%
Navy Reserve	45.87%

For the current study, IDA examined data on activations and deployments from the DMDC, matching individual service members with their histories of active duty and deployment. IDA found that the distribution of time served among Guard members and reservists tended to be bi-modal. Figure 2 demonstrates this finding with respect to Army National Guard troops with an infantry occupational specialty. In recent years more than one sixth of this group has been activated at any given time, indicating that the Secretary's guidance that Guard members serve at a 1:5 active duty rotation is not being met in the aggregate. The chart demonstrates that not all members of this occupation have been equally utilized. The horizontal axis



Source: Graham et al., *Self-Selection as a Tool for Managing the Demands on Department of Defense Personnel*, IDA P-4606 (Alexandria, VA: Institute for Defense Analyses, November 2010).

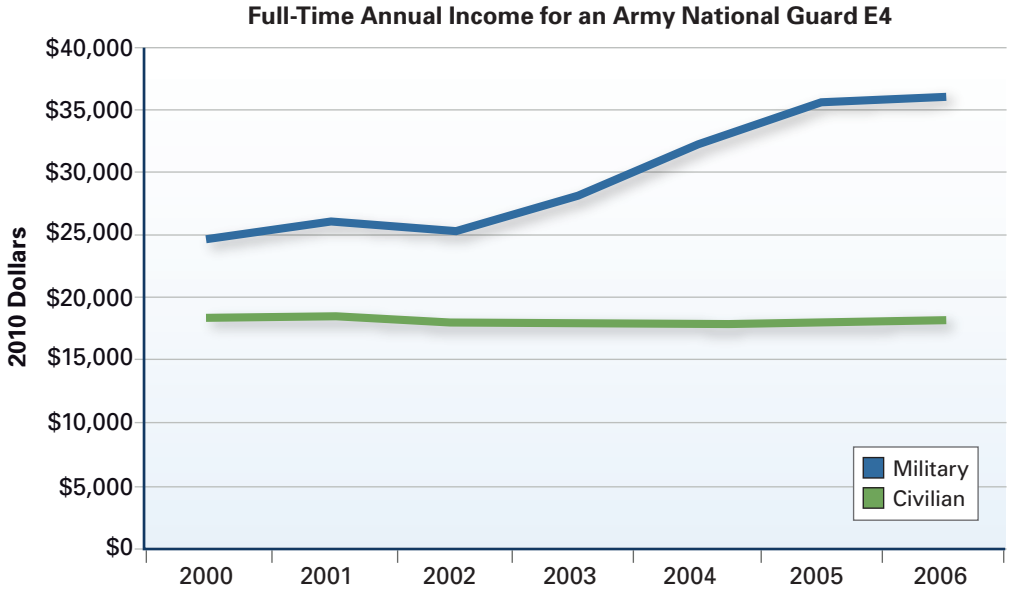
Figure 2. Activation Experience among Individuals in the Army Guard Infantry

3. David R. Graham, Joseph F. Adams, John R. Brinkerhoff, William R. Burns, Colin M. Doyle, Hansford T. Johnson, Yevgeniy Kirpichevsky, Robert B. Magruder, Steven Mortimer, Saul Pleeter, Susan L. Rose, *Self-Selection as a Tool for Managing the Demands on Department of Defense (DOD) Personnel*, IDA Paper P-4606 (Alexandria, VA: Institute for Defense Analyses, November 2010).

plots the fraction of time a member has spent on active duty. The vertical axis plots the number of soldiers (E4 and above) with that history. The red line indicates the fraction appropriate to 1:5 guidance. Many members have never served on active duty, while a substantial number have spent a much greater fraction of their time on active duty than the Secretary's guidance recommends. IDA's research on self-selection finds that at least some of these individuals are choosing to serve additional time on active duty. If offered the choice of tailored commitments, it is likely these Reserve Component members would be willing to select a higher option. Similar patterns are observed in many other occupations and in other Reserve Components.

When making the decision to join the military, individuals must consider their potential civilian and military earnings. It is, therefore, important to consider the relative earnings of military service members compared to civilians with similar qualifications. RAND compiled a data set that calculates civilian earnings and total military compensation of Reserve Component members. These RAND data directly compare the relative difference between military and civilian earnings for individual Reserve Component members; these data indicate what any grade member can expect to earn as a full-time member or as a full-time civilian.

Figure 3 shows an example of full-time military and civilian earnings for enlisted personnel of rank E4. These data show clearly that military earnings are higher than



Source: Figure generated by IDA from data provided by David S. Loughran, RAND Corporation.

Figure 3. Full-Time Annual Income for an Army Guard E4

civilian earnings, and also that military earnings are increasing while civilian earnings are staying relatively flat in real dollars terms. The relative economic value of military service, compared to civilian earnings, has greatly increased since 2000.

This upward trend in military compensation has been accompanied by a weak U.S. economy in recent years. In combination, these factors have substantially increased the financial incentives for RC membership and for active duty time.

The major question over the past decade is how the trends in operational duty time and in financial incentives have interacted to shape individual decisions regarding RC membership and active duty time. These trends are illustrated in the accompanying figures using DMDC Reserve Component Personal data for enlisted, non-prior service members over time. Figure 4 shows accessions by year. Accession

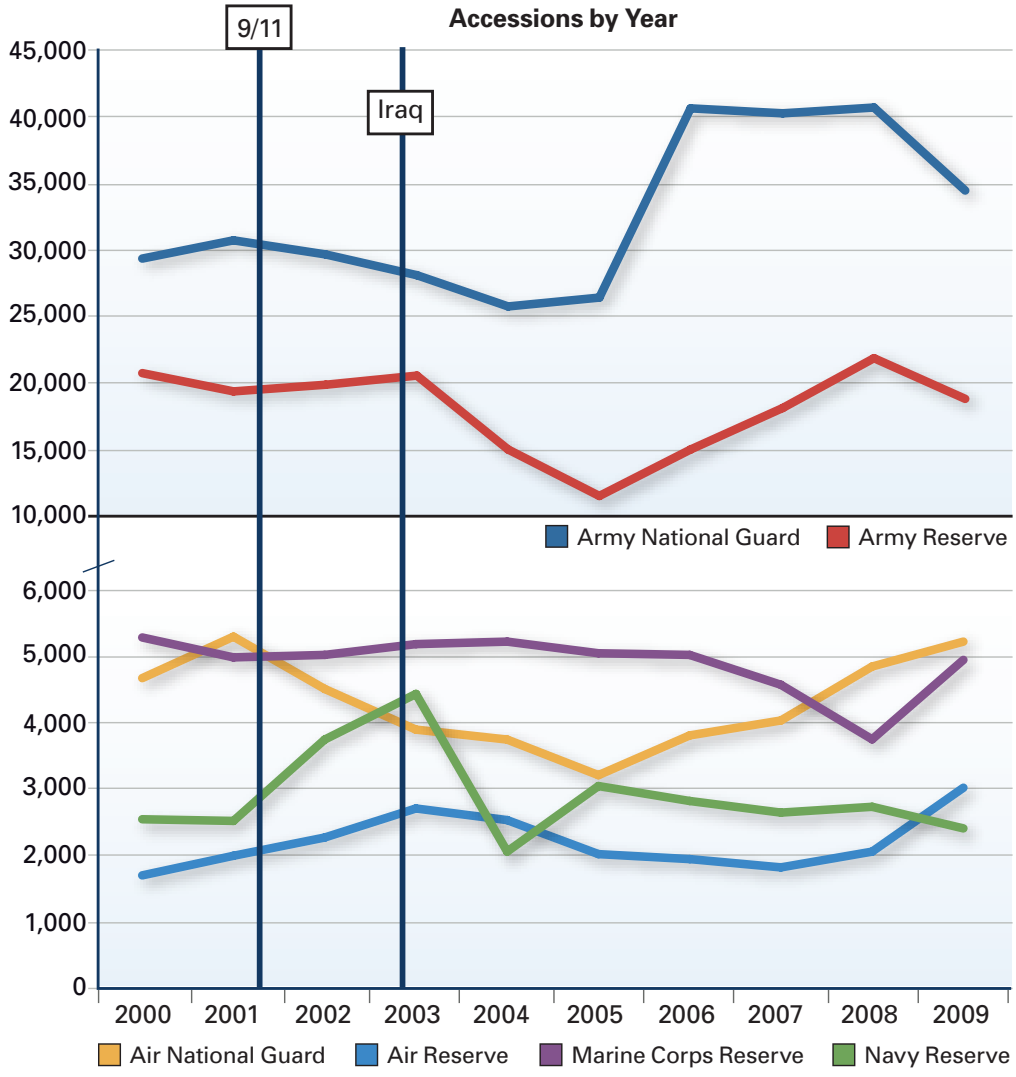


Figure 4. Accessions by Year

numbers are relatively constant through the beginning of Operation Iraqi Freedom. The numbers trended downward during the middle of the decade when fighting became very tough and casualties grew. They recovered by the end of the decade and were equal to or exceeded the levels at the beginning of the decade.

Parallel trend data on RC members' decisions to continue in service are presented in Figure 5. The chart shows the percentage of individuals who continue as RC members six years after joining. (For example, about 50 percent or more of Air National Guard members are still members six years after joining.) It is highly noteworthy from the standpoint of this study that continuation rates rose significantly after the September 2001 terrorist attacks, and that they remained at or above earlier levels throughout the decade.

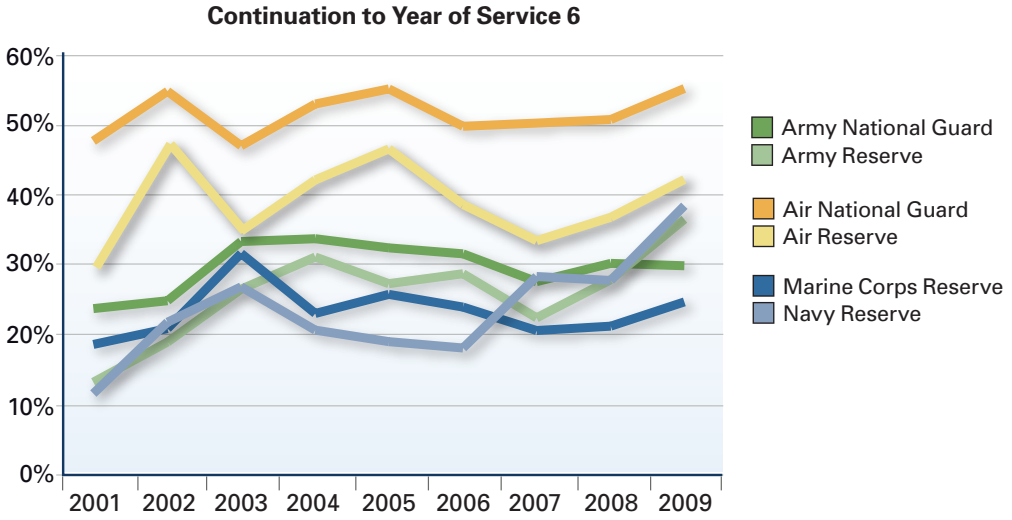


Figure 5. RC Members Continuing to Year of Service (YOS) 6

Consistent with these trends, the field research conducted for this study shows that RC members typically are strongly motivated by their sense of duty and their desire to serve. Indeed, our statistical analysis shows that the willingness to continue RC membership is positively correlated with active duty time: that is, those who are activated are more likely to continue in service.

These data tell the basic story of events and DOD's management of the AVF over the past decade:

- Activation rates are much higher and more persistent than previously reported.
- There has been substantial variability in activation experience across Services and individuals.

- Military pay has risen relative to civilian pay; this trend accelerated after 2005.
- Accessions rates dropped substantially mid-decade (particularly in the Army); they have since recovered to (or risen above) the levels of 2001.
- Continuation rates rose following the September 2001 terrorist attacks, and have remained at or above pre-2001 levels throughout the decade.

Throughout this demanding period, DOD has managed to sustain the AVF and maintain a highly effective, motivated fighting force.

From this data, we can surmise that a new temporary equilibrium has been established: expectations have adjusted; DOD pay has adjusted; the economy has weakened; and individuals have self-selected. Hence, the experience of the last decade provides a natural experiment demonstrating the feasibility of managing the RC with variable activation rates across the force.

3. Findings of the Field Research

The intent of the field research was to complement our formal statistical analysis with a first-hand understanding of individual RC members' attitudes, tastes, and preferences regarding alternative personnel utilization approaches. The primary insights that IDA wanted to determine were:

a. Is there a body of Reserve Component members that would agree to serve in excess of planning objectives (differentiated dwell)?
b. Is there a body of Reserve Component members that would agree to serve in excess of planning objectives if they were provided some additional compensation (differentiated dwell with compensation)?[4]

The results of this work are necessarily impressionistic, and do not carry the same statistical weight as a systematic survey. Nevertheless, the ability to communicate one-on-one with individuals and with small groups provided a depth of understanding regarding their views that could not have been achieved through other means.

Concurrent with this field work, the study team also participated in the DOD-directed 2010–2011 Comprehensive Review of the Roles and Missions of the Reserve Components. This enabled the study team to understand the range of mission assignments that are under consideration within DOD.

4. Definition of dwell: The period of time between the release from involuntary active duty pursuant to section 12302 of Title 10, United States Code and the reporting date for a subsequent tour of active duty pursuant to section 12302 Title 10, United States Code. Such time includes any voluntary active duty performed between two periods of involuntary active duty pursuant to section 12302 of Title 10, United States Code.

A. Approach

The field research conducted for the study benefitted from close collaboration with the Military Departments and their Reserve Components. The IDA study team worked with Pentagon headquarters' organizations to clarify study objectives, the methodology, and to establish a research timeline. Formal questions were posed to the Departments in order to document current and planned utilization philosophies with regard to Reserve Components, methods for organizing and employing Reserve Components, and anticipated demand on Reserve Components.

Working through the Departments, IDA undertook a series of visits to RC units at various locations around the country. These visits provided insights into each unit's experience. These visits permitted the IDA study team to interact with focus groups and to conduct one-on-one interviews with RC members. These visits took place during organizational drill weekends throughout the months of November 2010 to February 2011, based on when identified units and individuals were available. The Military Departments helped coordinate these visits so that members of all of the Reserve Components participated in the field study.[5]

5. **Army Guard:** 1-487 FA, 29th BCT, A Company 29th BSB, A Company 29th BSTB, B Btry 113th FAR, B Company 29th BSB, C Company 29th BSB, C Company 29th BSTB, E Co 113th, G Company 29th BSB, HHB 1-113th FA, HHC 1-293 Inf, HHC 29th BSB, HHC 29th BSTB and HHC 29th IBCT.

Army Reserve: 200th MP Command, 352nd CACOM, 354 CA BDE, 363rd MPCO and 450 CA BN.

Air Guard: 155ARW, 170th, LA ANG, NGB, 153AW and 166NWS.

Air Reserve: 512 AW and 610IOF.

Coast Guard: CF-532, CGLANT-3R5, D8 Western Rivers Division, JFCOM, Joint Staff JS, LANT, NORTHCOM, PSU 305, Sector Boston, Sector Hampton Roads, Sector New York, Sector North Carolina, Station Elizabeth City, Station Emerald Isle, Station Little Creek, USCG HQ and USTRANSCOM.

Marines: 4th CAG, 6th MT BN, HMM-774 and PRP.

Navy: AFRICOM 0166, BUMED Rapid Response, Bravo Surgical Co, CINC HQ, CNO INTEL,

CNO Management Analysis, CNO OPS and PLANS, CNR NDW ROC, DCMA HQ INTL, DIAHQ 0166, DIAHQ 0366, DIAHQ 0466, DLA-HQTR FT BELVOIR, DMA Anacostia, EUCOM J2 0166, FISC Norfolk DET 206, FISC SI-CC B, LSFO DET B, LSO NORTH CENTRAL, MM OP UNIT 206, MSC HQ Det 106, NATO Component CMD 1, NATO DJTF ALPHA, NAVSEA EOD Support, NAVSEA Strike Force Interoperability, Navy Inspector General, NCIS HQ 0166, NGA 0166, NIRR, NIRR-W, NMCB 23, NNWG VTU Washington, NPC Legal, NR Expeditionary Logistics, NR NAVSUP (OPLOG READ), NR NIOC Maryland, NR ONI 0466, NR ONI 0566, NR ONI 0766 , NR ONI 1166, NR ONR/NRL S&T 102, NR PEO (A), NR PEO (T), NR USDELMC, NR USS Emory S. Land (AS-39), NSF NDW, NSF NSWCD Indian Head, NSF NSWCD Dahlgren, OHSU Bethesda HQ, OHSU BETH DET P, OHSU BETH DET Q , OHSU BETH DET S, OHSU BETH DET Y, ONRG S&T 103, OS 6666, OSD Tech Transfer 0166, RLSO NDW, SPAWAR 0366, VR-48, VR-53, VTU 0614.

B. Findings

IDA's field study findings with the Military Departments and individual RC units underscored the phenomenal diversity in mission requirements, demographics and cultures of the Services and their components, and the desires and expectations of reservists in very different life situations. In particular, attitudes about compensation and the willingness to serve are manifested very differently in specific types of units and occupational specialties.

Table 2 highlights the major findings for each of the Military Services. Across the Services, both missions and utilization vary with the RCs providing individuals, teams, detachments, and large brigade sized formations to meet operational demands of differing duration based on Service force generation schemes. For example, many Air Force requirements were satisfied with 90 to 120 day sourcing solutions. Marine Corps Reserve deployments lasted seven months, while Army RC mobilizations of a twelve-month period resulted in actual deployments of eight to nine months. Additionally, the culture of RC utilization varies across Services in terms of their reliance on voluntary and involuntary mobilization. All of the Departments employ mechanisms to permit voluntary, or self-selected, mobilization.

Table 2. Service Approaches for Employing Reserve Components

ARMY ❖ Army Force Generation model requires total Army approach—heavy reliance on National Guard and Reserve ❖ RC contributes at individual, small unit, and brigade level ❖ Federal use of National Guard must account for significant state missions	*MARINE CORPS* ❖ Individual Ready Reserves are used actively to fill unit and individual requirements
NAVY ❖ Employing both Active and Reserve Component individuals while reducing end-strength of both ❖ Strong preference for its current strategic-reserve model	*AIR FORCE* ❖ Employs Reserve Component as an operational reserve ❖ Volunteer deployments are the norm ❖ Maintains parity in readiness across the Active and Reserve Component ❖ Strong preference for the operational reserve model
COAST GUARD ❖ Integrates reserve personnel within active units ❖ Reserve Component available to serve in response to domestic emergencies	

In the course of IDA's field research, the study team met with 1,586 Reserve Component members. Table 3 summarizes the major observations drawn from these interactions.

Table 3. Observations from RC Member Interviews

- Service and component cultures vary greatly, as to management approaches.
- Commitment requirements and operational duty experience vary substantially based upon the Service, mission, and military occupation.
- Both the taste for operational duty, and the practical constraints and availability to serve operational duty vary widely among individuals (and over time for an individual).
- A significant fraction of these individuals would consider committing to more operational duty (see statistics below).

Our interviews included scripted questions to serve as a common baseline of comparison across units and Services. Table 4 summarizes the distribution of responses to questions regarding the willingness to serve. For example, in the Army Reserve, 42 percent of the civil affairs interviewees and 46 percent of the interviewed military police service members indicated that they would be willing to serve in excess of DOD planning objectives of one year mobilized with five years demobilized. These numbers increase to 53 percent and 69 percent, respectively, when the same interviewees are asked whether they would agree to serve in excess of planning objectives if they received additional compensation to ensure their availability for federal mobilization.

Table 4 provides the statistical distribution of the responses to the same questions across all of the RCs.

Table 4. Percent Willing to Commit to Service in Excess of the SecDef Target (1:5)

	Army National Guard	Army Reserve	Navy	Coast Guard	Air National Guard	Air Reserve	Marine Corps Reserve
Without Bonus	61%	44%	46%	61%	54%	47%	69%
With Some Bonus*	72%	60%	55%	69%	68%	62%	81%

* Questions asked:

Would you consider signing a contract or entering into an agreement that would guarantee your availability to be involuntarily mobilized in excess of the current planning objectives? (circle) Yes No If not, why?

Consider that you might be offered a bonus or other compensation to guarantee your availability to serve in excess of current planning objectives. Please rank on a scale from 1 (very undesirable) to 5 (strongly desire), how a bonus or other compensation would affect your willingness to sign a contract.

The percentages include everyone who responded "desire" (4) or "strongly desire" (5) additional compensation.

The field research shows that across the Services, Reserve Component members already experience diverse operational philosophies and commitments. The RC members are also highly diverse in their willingness to serve and their operational duty experience. Given the diversity in the current utilization of RC members, the introduction of tailored commitments can be viewed as an adaptation of policy to reality—rather than a radical departure from current practice. The flexibility offered by a tailored commitment system, in fact, offers both the Services and service members the advantage of being able to create a service agreement that meets the needs of particular missions.

The interview results suggest that RC members would be open to tailoring commitments. Some would opt for current levels of commitment; others might opt for lower commitments if they were available. Up to half would be willing to commit to levels of commitment in excess of current targets. The statistical results reported in the following chapter support these findings.

4. Statistical Models of Reserve Service

The second major line of inquiry was to perform systematic statistical analyses of the behavior of RC members over the past decade.

IDA faced a basic challenge when attempting to predict the responses of reservists and Guard members to tailored commitments: forecasting how people will respond to options that no one has yet faced and that are, for now, purely hypothetical. To accomplish this goal, the IDA study team used data on the choices reservists and Guard members made in the past decade to estimate their "preferences." These data were an indication of the importance of compensation in their decision making and their willingness to serve. We then applied these preferences to predict their responses to hypothetical situations.

The work reported here builds on decades of prior research. Early work on the retention decisions of service members related the retention of active duty members to the expected future monetary benefits of their service. The Annualized Cost of Leaving (ACOL) model developed by John Warner[6] recognized that the decision to continue serving in the military involves more than pecuniary rewards. The retention decision took into account not only expected future monetary benefits, but also the individual's "taste for service." Warner's taste factor was, however, invariant across a member's lifetime. Recognizing that individual circumstances

6. John T. Warner, *Military Compensation and Retention: An Analysis of Alternative Models and a Simulation of a New Retention Model,* CRC 436 (Alexandria, VA: Center for Naval Analysis, 1981).

may change over time, Gotz and McCall[7] developed the Dynamic Retention Model (DRM) that added a transitory component to the taste for service to account for the fact that later retention decisions are affected by factors that were not present during earlier decisions. In response to Gotz and McCall's work, Black, Moffit, and Warner[8] augmented the ACOL formulation with a transitory taste for service in the ACOL-2 model. However, the DRM retains an advantage inasmuch as it accounts for more sophisticated expectations by service members, which include how they value having the option to alter their retention plans in the future in response to altered circumstances.

Formative work by Asch, Hosek, Mattock, and Panis[9] developed a dynamic retention model to assess RC members' behavior that allowed active duty members to make a three-way retention choice to remain active, join the reserves, or enter civilian life. This model allowed them to forecast the effects of changes to the active and reserve compensation systems together. Their work did not address the implications of activation duty or deployment for the RC members. Dolfini-Reed, Parcell, and Gregory[10] examined the relationship between loss rates in the Selected Reserve and activation and deployment. They did not develop a formal decision model, but they observed that loss rates had fluctuated over time by activation and deployment status and that loss rates were higher for those activated without a deployment than for those activated with a deployment. They concluded that RC members had a preference for shorter active duty tours in places outside the continental United States.

The IDA study team extended this body of work by incorporating RC activation and deployment experience into formal decision models. This allows inferences to be made about the influence of an RC member's duty experience and expectations on his or her accession and continuation decisions. This extension is essential for identifying the distribution of tastes for service among RC members and assessing their willingness to agree to higher or lower duty commitments. In addition, the inclusion of duty experience in explaining service member behavior during the recent decade of high utilization should more accurately identify the effects of compensation and other factors on RC members' decision making.

7. Glenn A. Gotz, and John J. McCall. *A Dynamic Retention Model for Air Force Officers: Theory and Estimate*,. R-3028-AF (Santa Monica, CA: RAND Corporation, 1984).
8. Matthew Black, Robert Moffitt, and John T. Warner. "The Dynamics of Job Separation: The Case of Federal Employee,." *Journal of Applied Econometrics 5* (1990): 245–262.
9. Beth J. Asch, James Hosek, Michael Mattock, and Christina Panis, *Assessing Compensation Reform: Research in Support of the 10th Quadrennial Review of Military Compensation* (Santa Monica, CA: RAND Corporation, 2008).
10. Michelle Dolfini-Reed, Ann Parcell, and Dave Gregory, "Determining Patterns of Reserve Attrition Since September 11, 2001," Annotated Briefing D0010352.A1 (Alexandria, VA: Center for Naval Analysis, 2005).

Two complementary modeling and data approaches were used: an adaptation of the R-SIM and an augmented DRM. As explained subsequently, the R-SIM model builds on earlier modeling of Army RC member behavior, reported in Doyle (2009).[11] The DRM work is a new application and adaptation of the conventional model to examine RC member behavior. Use of the two models offers the advantage of examining a common problem from somewhat different vantage points. In accounting for active duty time, R-SIM offered the advantage that it incorporated activation in the form of cycles of time away and time at home, as it is specified in policy and observed in reality. The DRM, in contrast, measured duty time using overseas deployments, by specifying the probability of a year of service being spent deployed. By utilizing two parallel modeling approaches we can have more certainty that our conclusions are generally applicable and not dependent upon one specific formulation.

Of the two modeling approaches, the DRM allows for more sophisticated expectations on the part of RC members. When choosing between tailored commitments, RC members recognize and anticipate the chance that they may, in the future, decide to leave in any year. In the R-SIM model, RC members are constrained to make a one-time commitment based on the belief that they will serve that commitment out for a full career.

The R-SIM was calibrated using longitudinal data covering the period 2000 to 2006, in which cohorts of service members are observed over time. This period provides a good natural experiment, since it includes the transition from duty demands prior to September 11, 2001 through the major buildup for Operation Iraqi Freedom. The period also saw large changes in compensation. The DRM is calibrated to the year-to-year continuation decisions of a cross-section of service members in September 2008.

The approach and findings for each model are reported in turn. The final chapter compares and contrasts the results.

A. The Reserve Component Simulation Model (R-SIM) of Reserve Service Decisions

1. Model Approach

The R-SIM forecasts accession and continuation rates for a Reserve Component by modeling the behavior over time of those young people who are eligible to join

11. Colin M. Doyle, *The Effect of Activation Policies on Accession and Continuation in the Army Reserve Components: The Annualized Reserve Component Activation Cost of Leaving Model*, IDA Paper P-4270 (Alexandria, VA: Institute for Defense Analyses, August, 2008).

the Reserve Components. Young civilians decide in each year whether to join the Selected Reserve. Reservists and Guard members decide in each year whether to stay or leave the Selected Reserve. They make these decisions by comparing the benefits of leaving in the current year with the benefits of staying. They also consider what their benefits will be in future years as well as in the present.

In the R-SIM three factors affect members' decisions to join, and to stay in, the Reserve Components. First, they value money income. Their benefit from being in the Selected Reserve includes the military income that they earn when not on active duty, and the difference between the military income that they earn on active duty and the civilian income they would otherwise have earned. Second, they care about the amount of time that they spend on active duty, and assign a positive or negative valuation to a day on active duty. Third, random events also affect their decisions; for example, a spousal illness may raise the "cost" of service temporarily. These random shocks are added to income and the valuation of active duty, giving a total measure of "utility"—the reservist's well-being. A reservist decides whether to stay or leave the Reserve Components by comparing the sums of the discounted expected values of present and future utility generated by staying or leaving. IDA also recognizes that members are motivated by a sense of duty; this may be partly captured in the taste for service calculation, but we cannot fully account for this important intangible factor.

The relationship between active duty time and the reservists' utility (their well-being) has two important features. First, the relationship is non-linear: a service member who would prefer six months of active duty to no active duty this year might also prefer no active duty to eighteen months. Second, reservists' past history of time spent on active duty affects the decisions they make today. A reservist's valuation of active duty time for his current utility includes both the number of months on active duty this year *and* the number of months in prior years.

The key feature of the model is that the relationship between active duty and utility can be different for each person. The model assumes that the individuals' attitudes follow a statistical distribution along the axis from active duty being more beneficial to active duty being more costly. Some individuals may prefer no active duty, while others may prefer to have some active duty but not too much time away from home; still others may prefer to be full-time on active duty. Figure 6 presents an illustration of such a distribution. Other parameters estimated in the model capture the importance of compensation, the non-linear effects of active duty time, and the role of the random shocks.

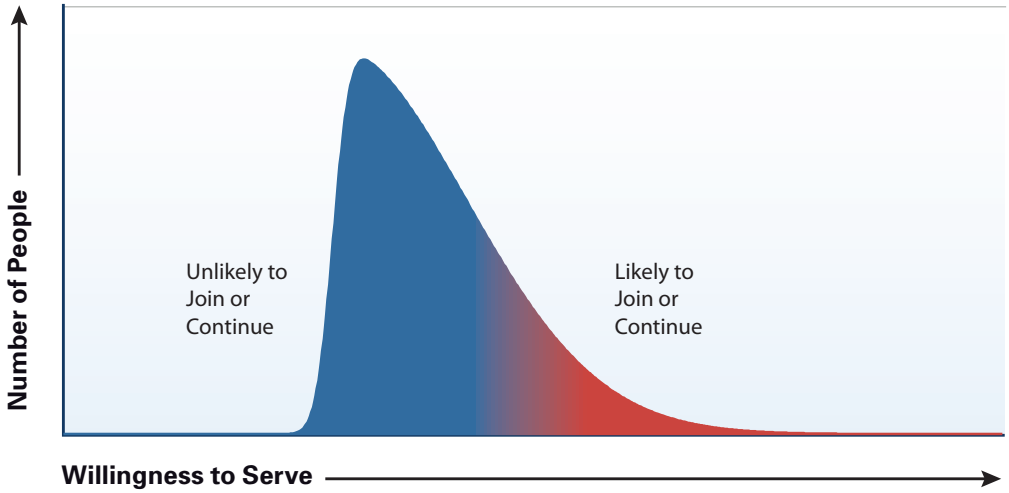


Figure 6. Illustrative Distribution

The R-SIM predicts joining and continuation rates by drawing many thousands of simulated young civilians randomly from the population distribution. Each individual is given a random history of activation based on his or her commitment, and then makes joining and staying decisions based on their parameters and the amount of active duty they receive. Aggregating all of these choices provides the joining and staying rates for the Reserve Component as a whole.

The study team chose the specific parameters of the model used in our predictions by finding the ones that best matched the actual accession and continuation rates of the past decade. We drew a set of random histories of activation for the simulation from the actual patterns of activation that prevailed during that period. We then found the predicted accession and continuations and compared them to actual data. We did this repeatedly for different sets of parameters of the model to generate different predictions. We utilized an algorithm that gradually improved the fit to actual joining and staying at each successive forecast, until we arrived at the best fit. We also accounted for the level of military and civilian earnings in each year, and added parameters for the effects of youth unemployment and war casualties. A full description of IDA's calibration method is presented in Appendix B.[12]

12. We have adopted a calibration approach because the complexity of these behavioral models makes statistical estimation difficult. Calibration is a standard approach in these cases, notably used in the work of Simon, Negrusa, and Warner (2010). We provide measures of the "goodness of fit" of our parameters in the appendices. However, the calibration method does not allow us to provide confidence intervals for the model parameters.

2. Data

The R-SIM model uses several data sources to generate estimates of future accession and continuation rates and predict how reservists will select into contracts with different levels of service. The length in months of activation, deployment and dwell periods; military and civilian compensation levels; and unemployment and casualty data are used as inputs for the model. Personnel data on accession and continuation rates are used to calibrate the model.

Frequency distributions for activation and dwell lengths, and the percentage of activation time that is served in a deployed capacity were derived from Contingency Tracking System data provided by the DMDC. Wartime activation and deployment data were used in the model; observations begin September 2001 and end January 2011. These frequency distributions were used to generate the simulated histories in IDA's calibration by combining alternating periods of active duty and dwell of random lengths.

The model includes a variety of variables that are generally found to be important in explaining accession and joining decisions. Data from a RAND study were used to compute military and civilian compensation levels for military members. The RAND data groups Reserve Component members into cells based on component, rank, and level of activation. Total yearly civilian and military earnings were derived from the Social Security Administration's Master Earnings File.[13] From this data, it is possible to derive and extrapolate expected full-time civilian and military earnings potential for Reserve Component members with differing ranks and total years of service. Youth unemployment rates were taken from the Bureau of Labor Statistics and causality data were taken from the Iraq Coalition Causality Count (http://icasualties.org/).

Accession and continuation numbers were calculated using the DMDC Reserve Component Personnel file. Numbers are based on non-prior service, enlisted members of the Reserve Component. The numbers of non-joiners were inferred from comparing recorded accessions with the size of the relevant civilian population cohort, determined from Census Bureau data. We assumed that the "eligible" population is 25 percent of any given age cohort. To calculate continuation rates, first year service members were tracked over time; if a member left the reserve or switched to another component, he/she was treated as attrition. The table of accession and continuation rates was used in the calibration process to minimize the error between actual and projected rates.

13. This data forms the basis for the paper by David S. Loughran and Jacob Alex Klerman,"The Effect of Activation on the Post-Activation Earnings of Reservists," forthcoming in *Labour Economics*.

3. Results and Findings

The IDA study team utilized the R-SIM to predict non-prior service accessions in each Reserve Component under a series of alternate scenarios. The first column of Table 5 lists the predicted average accessions under the recent rates of utilization. These are the number of civilians joining a component that is predicted by the R-SIM model when the activation rates that have been observed in the past decade are used. These wartime rates are approximately 1:9 in the Air and Navy Reserve Components, 1:4 in the Army Reserve Components and 1:3 in the Marine Corps Reserve. This means that Navy Reservists, for example will serve one month out of every ten on average; or, they will spend a tenth of their time on active duty. The model predicts that 2,931 civilians will join the Navy Reserve when they can expect to serve at a 1:9 rate.

The following two columns predict accessions under alternate demands. The second column predicts accessions when wartime demands are higher than recent history. In this scenario the wartime dwell ratio is 1:3 for the Army Reserve Components, 1:2 for the Marine Corps Reserve, and 1:7 for the Air and Navy Reserve Components. R-SIM forecasts a sizable reduction in accessions across all components. For example, Navy Reservists can now expect to serve one eighth of their time on active duty. The model predicts that 2,648 civilians will join the Navy Reserve if this is the case.

The third column predicts accessions when wartime demands are lower. The wartime dwell ratio is 1:5 for the Army Reserve Components, 1:4 for the Marine Corps Reserve and 1:11 for the Navy and Air Reserve Components. Accessions are notably higher, although the effect is small in some components, notably the Navy Reserve. Navy Reservists can now expect to serve one twelfth of their time on active duty. The model predicts that 3,057 civilians will join the Navy Reserve if this is the case.

Table 5. Annual Non-Prior Service Accessions Under Alternative Demands

	Utilization		
	Baseline	**Higher**	**Lower**
Air National Guard	5541	4569 (-18%)	6639 (+19%)
Air Reserve	2667	2160 (-20%)	2880 (+7%)
Navy Reserve	2931	2648 (-10%)	3057 (+4%)
Army National Guard	28554	25283 (-12%)	30844 (+8%)
Army Reserve	17371	15294 (-12%)	19514 (+12%)
Marine Corps Reserve	4811	3912 (-19%)	5478 (+13%)

Table 6 presents continuation rates for each scenario. These percentages are the fraction of accessions that remain in the Selected Reserve until their sixth year of service. For example, the model predicts that 38 percent of Navy Reservists will remain in the Selected Reserve until their sixth year of service. The continuation rates are better under higher utilization, as the recruits who enter in this scenario are more highly inclined toward active duty. In that case, 47 percent of Navy Reservists will stay for six years. Conversely, continuation is lower in a lower utilization scenario, as those who are less inclined to serve join in greater numbers.

Accessions are also sensitive to changes in compensation. Table 7 presents total non-prior service accessions under alternative compensation levels. The first column reproduces the predicted accessions under the current policy in Table 5. The second column presents predicted accessions in a scenario in which utilization is unchanged, and total military compensation is reduced by 10 percent. Accessions are lower when compensation is lower, as one would expect. For example, the number joining the Navy falls from 2,931 to 2,742. The magnitude of the effect is highest in the Air Reserve Components, with an 11–15 percent reduction in accessions. The effect is lowest in the Army Reserve Components, where accessions are reduced by only 2–3 percent with a reduction in compensation of 10 percent.

The focus of this study is tailored commitments. Table 8 presents predicted accessions when new recruits are offered a choice between two contracts, defined by the high and low demand cases simulated previously. No additional compensation incentive above the current pay for activation is offered for choosing the higher contract. Nonetheless, the study team found that substantial numbers of the recruits will select the higher commitment. The rate ranges from 33 percent of recruits choosing the higher contract in the Air National Guard to 67 percent opting for higher commitment in the Navy Reserve. Thus, the components can achieve higher accession by allowing recruits to self-select into higher and lower commitments.

Table 6. Continuation to the Sixth Year of Service Under Alternative Demands

	Utilization		
	Baseline	**Higher**	**Lower**
Air National Guard	0.54	0.60	0.50
Air Reserve	0.59	0.64	0.55
Navy Reserve	0.38	0.47	0.34
Army National Guard	0.65	0.68	0.61
Army Reserve	0.59	0.62	0.53
Marine Corps Reserve	0.68	0.65	0.67

Table 7. Annual Non-Prior Service Accessions Under Alternative Compensation Scenarios

		Total Compensation Reduction	
	Baseline	-10%	-15%
Air National Guard	5541	4942 (-11%)	4728 (-15%)
Air Reserve	2667	2267 (-15%)	2119 (-21%)
Navy Reserve	2931	2742 (-7%)	2771 (-6%)
Army National Guard	28554	27860 (-3%)	27919 (-3%)
Army Reserve	17371	17136 (-2%)	16787 (-4%)
Marine Corps Reserve	4811	4573 (-5%)	4575 (-5%)

Table 8. Annual Non-Prior Service Accessions with Commitment Choice

	Commitment		
	Lower	Higher	Total
Air National Guard	4370 (66%)	2218 (33%)	6588
Air Reserve	1696 (58%)	1209 (41%)	2905
Navy Reserve	969 (32%)	2057 (67%)	3026
Army National Guard	13889 (44%)	17251 (55%)	31140
Army Reserve	9561 (49%)	9706 (50%)	19267
Marine Corps Reserve	3128 (57%)	2343 (42%)	5471

Table 9 compares the continuation rates under the current utilization with those under the commitment choice. In most cases the continuation rates are lower, but the effect is small. This result suggests that strength could be maintained when commitment choices are offered.

Table 10 repeats the contract choice simulations when a signing bonus of $5,000 is offered for the higher contract. Large increases in the higher commitment choice are achieved in the Air and Navy Reserve Components and the Army National Guard. For example, the percentage of Navy Reserve recruits choosing the higher contract with the bonus is 10 percentage points higher than the percentage that choose it without a bonus. Table 8 shows that 67 percent of Navy Reservists choose the higher contract with no financial incentive. But with the bonus, 77 percent of Navy Reservists will choose the high contract. The effects are modest for the Army and Marine Corps Reserves, suggesting that greater incentives would be required to increase commitment in those components. This is consistent with our earlier finding that members of the Army Reserve Components are less responsive to changes in compensation. These results demonstrate that sizable increases in the higher commitment choice can be achieved with reasonable and feasible compensation incentives.

Table 9. Annual Non-Prior Service Continuation Under Contract Choice

	Without Choice	With Choice
Air National Guard	0.54	0.52
Air Reserve	0.59	0.55
Navy Reserve	0.38	0.41
Army National Guard	0.65	0.60
Army Reserve	0.59	0.54
Marine Corps Reserve	0.68	0.65

Table 10. Annual Non-Prior Service Accessions with Commitment Choice and $5,000 Bonus for Higher Commitment

	Commitment		
	Lower	Higher	Total
Air National Guard	3583 (-13%)	3014 (+13%)	6597
Air Reserve	1268 (-16%)	1614 (+16%)	2882
Navy Reserve	695 (-10%)	2258 (+10%)	2953
Army National Guard	13189 (-3%)	17737 (+3%)	30926
Army Reserve	9439 (-2%)	9991 (+2%)	19430
Marine Corps Reserve	3080 (-3%)	2471 (+3%)	5551

B. The Dynamic Retention Model (DRM) of Reserve Service Decisions

1. Model Approach

This section models reservists' decisions regarding deployment using a dynamic retention model based on Gotz and McCall (1984) and Simon, Negrusa, and Warner (2010). IDA's DRM characterizes the distribution of taste for deployment across the population of individuals considering military service. This taste distribution then is used to extrapolate preferences for alternative contracts, including expected take up rates and retention under each alternative. Our calibration method is described in Appendix B.

Individuals in IDA's DRM make the decision to enter a particular reserve service or remain in the civilian sector in their first year. Individuals make their annual decisions based on which option offers the highest expected utility. In assessing these expected utilities, they take into account expectations of their own likelihood of staying or leaving in future years. For example, staying in the military one more year entitles a reservist or Guard member to make a decision next year

about whether to continue in military service or leave, an option that is forfeited if the reservist or Guard member leaves for civilian life. Likewise, choosing one military commitment over another closes the door to the other contract. By evaluating the value of each option at each future year in the context of expectations regarding random events and shocks, the reservist takes his/her possible future decisions into account when making today's decision.

2. DRM Results and Findings

IDA evaluated several alternate policies in order to determine their effects on retention. The IDA study team evaluated the effect of a 10 percent reduction in the amount of compensation received by reserve members on accessions and retention. Table 11 shows that accessions in the Navy Reserve, for example, fell by 7 percent from 2,513 to 2,336.

These results can be expressed in terms of elasticities, which are the percentage change in accessions for a 1 percent change in compensation. The results reflect high compensation elasticity in comparison with past studies, as well as with deployment elasticity (in Table 12, below), with the possible exception of the Marine Corps Reserve, where compensation reductions have a significantly lower effect on accessions and retention than in other Services. We capture retention in both tables

Table 11. Decrease Compensation to 90 Percent of Current Military Compensation

Service	Baseline Accessions	Estimated Accessions at 90% compensation	Percent Decrease in Accessions (100% to 90% compensation)	Compensation Elasticity (100% to 90% compensation)	Reduction in Total Man-years Served
Army National Guard	32,797	30,318	8%	0.76%	16%
Army Reserve	19,341	17,551	9%	0.93%	23%
Air National Guard	4,677	4,121	12%	1.19%	38%
Air Reserve	1,910	1,658	13%	1.32%	39%
Marine Corps Reserve	3,745	3,631	3%	0.30%	8%
Navy Reserve	2,513	2,336	7%	0.70%	18%

by computing the total number of man-years of service that the Reserve Component will gain over the course of the career of these members.

The study team also evaluated the effect of an increase of 50 percent in the deployment rate, corresponding to an increase in activation rate from 1:5 to 1:3. As in the case of decreased compensation, Table 12 shows that we found that Marine Corps Reservists are less affected by increases in deployment rates than their counterparts in other Services. The taste distribution of the entering population of reservists varies under different contracts, so it is important to take this into account when estimating effects on retention. Those reservists who choose to enter service under higher deployment rates have higher tastes for service on average and will tend to stay longer as well. The DRM results, shown in Table 12, suggest that at 150 percent of the current deployment rate, total man-years served will fall between 11–39 percent depending on the Service, with the Air Reserve losing the most man-years.

The study team used the DRM to evaluate accessions under a scenario in which two contracts were offered, one at current levels of compensation and one at 150 percent of current deployment rates. We found that sizable numbers of members would choose the higher level of commitment. For example, Table 13 shows that 1,304 members out of a total of 2,924 accessions would choose the higher commitment. That is, 45 percent would choose the high option. The final column of the table

Table 12. Increase Deployment to 1.5 Times the Current Deployment Levels

Service	Baseline Accessions	Estimated Accessions at 150% current deployment rate	Percent Decrease (100% to 150% current rate)	Depl Elasticity (100% to 150% current rate)	Reduction in Total Man-years Served
Army National Guard	32,797	28,615	13%	-0.26%	30%
Army Reserve	19,341	17,000	12%	-0.24%	28%
Air National Guard	4,677	4,192	10%	-0.21%	33%
Air Reserve	1,910	1,656	13%	-0.27%	39%
Marine Corps Reserve	3,745	3,581	4%	-0.09%	11%
Navy Reserve	2,513	2,327	7%	-0.15%	14%

Table 13. Offer Additional Commitment at 1.5 Times the Current Deployment Levels in Addition to Status Quo

Service	Current Single Commitment Total Accessions	Multiple Commitment Accessions			% Increase over single contract
		Current rate deployment	1.5x current deployment	Total	
Army National Guard	32,797	22,384	13,256	35,639	8%
Army Reserve	19,341	13,010	8,726	21,736	11%
Air National Guard	4,677	3,099	2,475	5,574	16%
Air Reserve	1,910	1,303	832	2,135	11%
Marine Corps Reserve	3,745	2,395	2,124	4,519	17%
Navy Reserve	2,513	1,620	1,304	2,924	14%

Table 14. Offer Additional Commitment at 1:9 (0.6 Times Current Deployment Rate) and 15 Percent Reduction in Compensation in Addition to Status Quo

Service	Current Single Commitment Total Accessions	Multiple Commitment Accessions			% Increase over single contract
		Current deployment	0.6x current deployment, 85% current compensation	Total	
Army National Guard	32,797	14,533	23,248	37,780	13%
Army Reserve	19,341	11,148	11,370	22,517	14%
Air National Guard	4,677	3,109	2,202	5,310	12%
Air Reserve	1,910	1,240	918	2,158	11%
Marine Corps Reserve	3,745	2,248	2,355	4,603	19%
Navy Reserve	2,513	1,614	1,335	2,949	15%

indicates that offering two contracts would attract greater total numbers of accessions than under the single contract.[14] In the case of the Navy Reserve, total accessions are 2,924 with choice, and 2,513 without, a difference of 14 percent.

In addition to the previous scenario, the IDA study team evaluated accessions with the DRM under an alternate scenario in which current contracts were offered together with a reduced deployment option at 60 percent of the current deployment rate (analogous to a drop in activation from 1:5 to 1:9) and 85 percent of current pay. Table 14 shows that we found significant increases in accessions of 11–19 percent depending on the Service under the assumption of separate but identical shocks for each contract.

C. Observations

Several broad themes emerged from our statistical work. Across both statistical models, we observed that:

1. Accessions and retention are positively related to compensation.
2. Accessions and retention are sensitive to both activation and deployment.
3. When offered the opportunity to serve for greater levels of active duty, or deployment, many members will select this option even when no additional compensation incentive is offered.
4. The number choosing a high commitment option can be increased with additional compensation.
5. Some members will choose a lower option even if it is paired with significantly lower compensation.

5. Conclusions

This paper uses three lines of research to shed new light on RC member behavior over the last decade. IDA's quantitative work builds on models that have become a standard in the military manpower literature. The study team extended these models to allow RC members to have varying tastes for active duty time and deployment, recognizing that much more than compensation enters the participation decision, and that the willingness to serve in the Reserve Component must be related to the level of active duty time and deployment that a member expects and serves.

Our quantitative findings are novel because there has been little previous work to quantify the ways that RC members vary in their willingness to serve. Although Asch et al. estimate a taste for reserve service, it is unrelated to the levels of active duty

14. Because of the assumptions of the DRM that shocks are completely independent, these increases should be interpreted as upper bounds.

and deployment served. Dolfini-Reed et al. describe average behavior of RC members following deployment but they do not include the varying tastes of RC members. IDA was able to describe the population disposed to join the Reserve Components and to predict their response to alternative utilizations. This is a new innovation.

Several common themes emerged that are relevant for DOD compensation policy:

First, the R-SIM and DRM simulations demonstrate that non-prior service accessions are sensitive to changes in the demands on individuals. R-SIM forecasts find that plausible changes in the rate of activation result in sizable changes in accessions. Likewise, DRM forecasts demonstrate a negative effect on accessions of increases in the amount of deployment.

Second, the R-SIM and DRM simulations demonstrate that accessions are sensitive to changes in compensation. Accessions decline between 2 and 15 percent in response to a 10 percent decline in compensation. Both models predict that the effect of compensation changes is strongest in the Air Reserve Components.

Third, the field research, R-SIM simulations and DRM simulations all confirm that prospective and current reservists and Guard members would separate into higher and lower levels of commitment if offered a choice, with substantial numbers in each commitment category. We found no evidence that all or most members of a Reserve Component would choose the same option. The fact-finding conducted for this study, coupled with the findings of a prior IDA study, confirm that de facto commitment choices already happen on an informal basis.

Fourth, these three lines of research confirm that when a choice of commitments is offered, the split between those choosing the higher and lower commitment can be altered by tying compensation to the commitment choice. The R-SIM forecasts, in particular, suggest that the additional compensation required to raise the choice of the higher commitment significantly is quite modest in some components. The DRM forecasts show that sizable numbers of recruits will select an option with greatly reduced compensation if it is paired with a lower commitment.

The findings the Quadrennial Review of Military Compensation should take away from this study are that tailored commitment contracts are:

1. Feasible. All of IDA's lines of research suggest that recruits and members will be willing to sort themselves into higher and lower levels of commitment. Substantial numbers of members would choose to join units in which a high optempo was necessary.

2. Cost effective. IDA demonstrated that many members would choose high commitments even in the absence of compensation incentives. We further observed that the incentives required to entice more members into high demand units would not be unfeasibly expensive.
3. Welfare-promoting. In IDA's models, RC members are automatically selecting the level of service that best matches their preferences. They are thus better off than if they were faced with one commitment. They also benefit from the increased certainty of demand that tailored commitments offer. IDA's interviews revealed that RC members already wish to choose their level of commitment.
4. Compatible with policy. IDA found that the inducements (if any) needed to realize an appropriate system of tailored commitments are not enormous. They could likely be accommodated through bonuses or other incentives that are compatible with current and proposed compensation policy.

Instituting a system of tailored commitments would require designing new contracts and mapping mission needs to each offer. The recruiting systems for the Guard and Reserve would need to be revamped to take into account the different commitment requirements of each unit and to set the expectations on the part of potential recruits. Finally, a management framework would need to be put in place to design and implement the system, and to match the demands of the Services with the influx of contracted recruits.

Appendix A. The R-SIM Model

A. The Determinants of Active Duty Time

The national security environment can be either "wartime" or "peacetime," and it changes from year to year. The transitions between these states follow a known Markov process,[15] with a transition matrix *W*. For example, if we, the IDA study team, estimate a Markov model on the years since the American Revolution,[16] the transition matrix would be

$$W = \begin{pmatrix} p(peace|peace) & p(war|peace) \\ p(peace|war) & p(war|war) \end{pmatrix} = \begin{pmatrix} .9321 & .0679 \\ .2185 & .7815 \end{pmatrix}.$$

15. For more on the Markov process, see Ronald A. Howard, *Dynamic Probabilistic Systems* (New York: Wiley, 1971).
16. IDA designates the years of the War of 1812, the Civil War, the Spanish American War, World War I, World War II, the Korean Conflict, the Vietnam War, the Gulf War, and the current GWOT era (2002-2007) as wartime.

The elements of the matrix are the probabilities of peace (or war) occurring next year given a state of peace (or war) this year. The matrix gives a probability of 93.21 percent for the transition from peace to peace, 6.79 percent for the transition from peace to war, 21.85 percent for the transition from war to peace, and 78.15 percent for the transition from war to war. If this Markov process is applied to a long series of years, the result is a "steady state" in which 24 percent of history is spent in a state of wartime and 76 percent of years are characterized as peacetime.

In R-SIM, each year can be characterized as "limited wartime," "heavily engaged wartime," or "peacetime." In a limited wartime year, the reservist faces some probability of involuntary mobilization. In a time of heavily engaged war, the reservist faces a higher probability of involuntary mobilization. In a peacetime year, the reservist faces no chance of involuntary active duty. IDA assumes that reservists expect heavily engaged wartime mobilization rates will be similar to those of the current Global War on Terror (GWOT) era (post-9/11/2001). This includes the wars in Iraq and Afghanistan. In a period of lower-intensity wartime, the reservist will expect to be called up an average of once in six years, without knowledge of the timing of these activations.

The IDA study team has estimated this three-state Markov process on the years of the all-volunteer force (1973 to 2007). The Gulf War and the post-9/11 years are considered "heavily engaged wartime" and the years of the interventions in Grenada, Panama, Bosnia, and Kosovo "limited wartime." The resulting transitions are

$$W = \begin{pmatrix} p(peace|peace) & p(heavy|peace) & p(ltd|peace) \\ p(peace|heavy) & p(heavy|heavy) & p(ltd|heavy) \\ p(peace|ltd) & p(heavy|ltd) & p(ltd|ltd) \end{pmatrix} = \begin{pmatrix} .6876 & .0992 & .2132 \\ .1058 & .7041 & .1902 \\ .2649 & .1201 & .6150 \end{pmatrix}$$

The steady state years are 38.5 percent peace, 34.6 percent limited war, and 27 percent heavily engaged war. In order to compare this steady state with the one generated from the long historical series, we liken major wars to the historic wartime state and consider minor wars to fall under the historic peacetime state. We implicitly treat minor wars as peace years in our long historic series. The resulting steady state is close to the one generated from the long series.

During the wartime states, the lengths of a soldier's activations follow a known probability distribution. His dwell times between activations will be determined by another distribution. In R-SIM forecasts, these distributions are determined by the appropriate tailored commitment.

When calibrating the model to recent history, it is assumed that in the event of either heavily engaged or limited wartime, activation lengths will be distributed as they have been during the years 2002–2009. In heavily engaged wartime, the dwell times will also follow recent history. We account for the high number of Guard members and reservists who have never been activated by including an equivalent number of ten-year dwells to the distribution.

B. The Decision Process

Reservists' utility is determined by three factors: income, the money-equivalent utility of time spent on active duty, and random disturbances. Past active duty time matters in today's utility. The active duty time is given by

$$A_t\left(H^i\right) = \sum_{s=0}^{t} a_{t-s}^i$$

where a_t^i is 1 if individual i with a particular history of active duty (denoted H^i) serves on active duty in month t.

For notational simplicity, we denote

$$A_t^i \equiv A_t\left(H_t^i\right).$$

The one-period utility function measures an individual's well-being in the current month. It is given by

$$u(t,i) = m_t + \alpha_1 A_t^i + \alpha_2 \left(A_t^i\right)^2$$

where m_t is money income, which includes both military and civilian income. Civilian income is not earned during active duty. The utility function is linear in money income, which ensures that people are risk-neutral in money. The parameters α_1 and α_2 describe an individual's unique utility function. The utility function is quadratic in accumulated active duty time. This formulation allows active duty time to have declining marginal utility. If this is the case, any gain in utility from a second month on active duty will be less than the gain from the first month; alternatively, any loss in utility from a month on active duty will be greater than the loss from the prior month. If the marginal utility of active duty is declining, individuals will be risk-averse in active duty time.

Individuals care about their well-being in future years. They measure lifetime utility as the discounted present values of each future month's one-period utility. For an individual at the present time *t*, the expected return to staying until a future time *T* is given by

$$U_T(t,i) = E_t\left(\sum_{\tau=t}^{T}\beta^{\tau-t}u(\tau)\middle|i\right) = E_t\left(\sum_{\tau=t}^{T}\left(\beta^{\tau-t}m_t + \beta^{\tau-t}\alpha_1 A_t + \beta^{\tau-t}\alpha_2\left(A_t^2\right)\right)\middle|i\right)$$

where β is the discount factor for the present value calculation. $E_t(\ )$ is the expectations operator, capturing the individual's forecast of the future at present time *t*. It follows that:

$$U_T(t,i) = \sum_{\tau=t}^{T}\left(\beta^{\tau-t}E_t\left(m_\tau|i\right)\right) + \alpha_1\sum_{\tau=t}^{T}\left(\beta^{\tau-t}E_t\left(A_\tau|i\right)\right) + \alpha_2\sum_{\tau=t}^{T}\left(\beta^{\tau-t}E_t\left(A_\tau^2|i\right)\right)$$

The values of $E_t\left(m_\tau|i\right)$, $E_t\left(A_\tau|i\right)$ and $E_t\left(A_\tau^2|i\right)$, are determined by the activation rule. $E_t\left(m_\tau|i\right)$ is the expectation at present time *t* of money income at future time τ.

We now define

$$U_T^2(t,i) = \frac{U_T(t,i)}{\sum_{\tau=t}^{T}\left(\beta^{\tau-t}\right)} = ACOL_T + \alpha_1 S_{T1} + \alpha_2 S_{T2}$$

where

$$ACOL_T = \frac{\sum_{\tau=t}^{T}\left(\beta^{\tau-t}E_t\left(m_\tau|i\right)\right)}{\sum_{\tau=t}^{T}\left(\beta^{\tau-t}\right)}$$

$$S_{T1} = \frac{\sum_{\tau=t}^{T}\left(\beta^{\tau-t}E_t\left(A_\tau|i\right)\right)}{\sum_{\tau=t}^{T}\left(\beta^{\tau-t}\right)}$$

$$S_{T2} = \frac{\sum_{\tau=t}^{T}\left(\beta^{\tau-t}E_t\left(A_\tau^2|i\right)\right)}{\sum_{\tau=t}^{T}\left(\beta^{\tau-t}\right)}.$$

The variable $ACOL_T$ is the money cost of leaving the service, expressed as an average annual amount. The variable S_{T1} is a measure of the number of depreciated months of active duty that the individual can expect to enter into an average month's utility during his career. S_{T1} is a discounted measure of the total time that the reservist expects to spend on active duty during his career. The variable S_{T2} measures the square of the active duty months entering an average month's utility.

IDA assumes that the parameter α_1 varies across 18-year-old males in the national population according to a skew-normal distribution. We designate the location, scale and shape parameters of this distribution as ξ, ω and γ.

An individual chooses whether to join a given Reserve Component or remain a civilian. We do not model the process of choosing between Reserve Components or between the Reserve and Active Components. The individual will join if the expected lifetime utility from doing so is greater than zero,

$$JoinUtility = ACOL_T + \alpha_1 S_{T1} + \alpha_2 S_{T2} + \varphi_j > 0.$$

The individual will stay if the expected lifetime utility from doing so is greater than zero,

$$StayUtility = ACOL_T + \alpha_1 S_{T1} + \alpha_2 S_{T2} + \varphi_s > 0.$$

The variable φ is a mean-zero normally distributed random error with standard deviation σ_φ.

We calibrate the parameters α_2, σ_φ, ξ, ω and γ.

C. Calibrating the Model

IDA uses the Nelder-Mead polytope optimization method[17] to estimate values for each parameter which minimizes the squared percentage difference between predicted and actual accession/continuation data. Since the compensation data is limited to fiscal years 2000 to 2006, accessions are calibrated to those seven years. Continuation rates up to six years of service are simulated for those reservists who joined from 2000 to 2006. We calibrate continuation data up to six years of service; subsequent continuation rates are not included so that the release from contracts does not influence the model. Predicted observations are weighed in the objective function so that accessions and continuation have an equal overall effect. Table A-1 demonstrates the minimized objectives for the case of the Army National Guard. The

17. For more on the Nelder-Mead polytope optimization method, see Kenneth L. Judd, *Numerical Methods in Economics* (Cambridge, MA: MIT Press, 1998).

value of the minimized objective function is 0.031. The fits for the other components are similar in magnitude.

$$\text{Objective Function : Squared error} = \frac{20}{7}\sum_{t=2000}^{2006}\left(\frac{actual\_join_t - predicted\_join_t}{actual\_join_t}\right)^2 +$$

$$\sum_{t=2001}^{2006}\left(\frac{actual\_contin_{1,t} - predicted\_contin_{1,t}}{actual\_contin_{1,t}}\right)^2 + \ldots + \sum_{t=2005}^{2006}\left(\frac{actual\_contin_{5,t} - predicted\_contin_{5,t}}{actual\_contin_{5,t}}\right)^2$$

Table A-1. Model Fit for the Army National Guard

Data Observations						
FY	**Accessions**	**YOS1**	**YOS2**	**YOS3**	**YOS4**	**YOS5**
2000	29,118					
2001	30,520	82.9%				
2002	29,465	81.6%	81.0%			
2003	27,833	83.7%	85.0%	87.2%		
2004	25,405	81.4%	83.1%	88.2%	89.6%	
2005	26,105	80.8%	80.8%	87.1%	89.4%	90.0%
2006	40,772	84.8%	80.0%	85.6%	90.3%	91.8%
Predictions						
2000	25,483					
2001	26,084	79.5%				
2002	20,318	79.8%	84.3%			
2003	21,558	89.4%	85.3%	90.1%		
2004	22,179	88.1%	91.6%	91.8%	94.3%	
2005	22,967	87.4%	91.0%	93.8%	94.7%	95.9%
2006	23,185	86.1%	90.4%	93.4%	94.8%	95.9%
Squared Percentage Errors						
2000	0.01558					
2001	0.02113	0.00175				
2002	0.09637	0.00049	0.00168			
2003	0.05083	0.00457	0.00001	0.00115		
2004	0.01612	0.00669	0.01045	0.00162	0.00277	
2005	0.01445	0.00674	0.01614	0.00595	0.00346	0.00430
2006	0.18606	0.00021	0.01692	0.00822	0.00247	0.00195

Minimizing the objective function is equivalent to maximizing a measure of fit defined as one minus the weighted sum of the squared percentage errors. That statistic will take on a value of one when the model perfectly fits the data. Since it is not bound by zero, it can take on negative values if the fit is sufficiently poor. For the Army National Guard the value of this goodness-of-fit statistic is 0.75. The fits for the other components are similar.

To account for economic conditions, which may influence an individual to join the reserves, a parameter for youth unemployment, α_U, is included in the join utility function. Therefore a parameter, α_C, for casualties is included in the join utility function of the Army National Guard, Army Reserve, and Marine Corps Reserve. We find that not only are casualties heavily concentrated in the land components, they are not correlated with accessions in the Navy Reserve or Air components. We recognize that in some years, especially in times of high unemployment and/or peacetime, accessions may be demand limited, and that many models use the official enlistment goals released by the Services themselves to constrain the number of simulated accessions. These goals are not included in R-SIM, however, because by many accounts they are set with the labor supply in mind, and thus may be endogenous to our estimation. Therefore we calibrate the parameters $\alpha_2, \sigma_{\varphi_J}, \sigma_{\varphi_S}, \xi, \omega, \gamma, \alpha_U$, and α_C.

Appendix B. DRM Model of Reserve Service Decisions

The Institute for Defense Analyses models reservists' decisions regarding deployment using a dynamic retention model (DRM) based on Gotz and McCall[18] and Simon, Negrusa, and Warner.[19] The DRM characterizes the distribution of taste for deployment across the population of individuals considering military service. Then we use this taste distribution to extrapolate preferences for alternative contracts, including expected take up rates and retention under each alternative. It is important to consider expectations about both take up rates and retention together because these allow policymakers to evaluate how total service can be expected to vary under alternative contracts, and, likewise, how much extra payments are made to individuals who otherwise would have stayed under less expensive policies in order to incentivize more reservists to join and/or stay longer in the reserves.

IDA's treatment extends past work by putting forward a framework to consider multiple alternative contracts as well as multiple states of military service (deployed and non-deployed).

18. Glenn A. Gotz, and John J. McCall, *A Dynamic Retention Model for Air Force Officers: Theory and Estimates*, R-3028-AF. (Santa Monica, CA: RAND Corporation, 1984).

19. C. J. Simon, S. Negrusa, and J. T. Warner, "Educational Benefits and Military Service: An Analysis of Enlistment, Reenlistment, and Veterans' Benefit Usage 1991–2005," *Economic Inquiry* 48 (2010): 1008–1031.

A. Specification

Individuals in IDA's DRM make a decision of whether to enter a particular reserve service or remain in the civilian sector in their first year. We evaluate these decisions for individuals considering entering at age 18 with no prior service. Past work characterizes the significantly higher stay rates for those with past prior service due to higher tastes for service and the additional pull of retirement that generally applies to this population.

As with IDA's Reserve Component Simulation Model (R-SIM), the study team models the decision to join each service separately; in other words, individuals in IDA's model do not compare different reserve Services and active duty options when choosing which to join, rather they evaluate whether they prefer a particular reserve service, say the Army National Guard, to remaining a civilian. If an alternative commitment is offered at entry, then an individual considering joining compares both contracts as well as the civilian option. Having joined a reserve service, individuals face annual decisions to stay, leave, or take an alternative reserve commitment if it is offered.

For the sake of simplicity, the IDA study team evaluated scenarios in which a take-it-or-leave-it alternative reserve commitment is offered only once, either at the time of joining or in a subsequent year. Because we are not modeling changes to promotion policies, the study team also assumes that all individuals face fixed expectations regarding their promotion path (See Table B-1) and corresponding annual compensation increases in the military sector as well as in the civilian sector. This money income is composed of military pay, reserve retirement pay, and average civilian earnings.

Since IDA is estimating individuals' propensities for making commitments—commitments to enter military service, to accepting varied deployment rates, to leaving for the civilian sector forever—it is important to consider the effect of uncertainties in the form of random events that each person faces. For example, a spouse's illness may raise the "cost" of service temporarily. A basic assumption of retention modeling is that individuals take expectations about the size of these shocks into account as they plan for contingencies. These random shocks are also expressed in dollar terms; they are added to income and the valuation of reserve deployment time, giving a total measure of the value of military service to the reservist.

Individuals make their annual decisions based on which option offers the highest expected value payoff. In accessing these expected payoffs, they take into account expectations of their own likelihood of staying or leaving in future years. For example, staying in the military one more year entitles a service member to make a

decision next year about whether to continue in military service or leave, an option that is forfeited if the service member leaves for civilian service. Likewise, choosing one military commitment over another closes the door to the other contract. By evaluating the value of each option at each future year in the context of expectations regarding random events and shocks, the DRM takes into account the option values of contracts with different levels of commitment, whereas the R-SIM does not.

For a reserve service member with deployment utility function *U(d)* and expected probability L of leaving after this year, expected payoffs from each military (m) and civilian (c) option at year y are calculated as follows:

$$EV_m(y) = U(d)(1-p_d) + U(d+1)p_d + MilPay(y) + CivPay(y) + [EV_m(y+1) + EV_r(y+1)](1-L) + EV_c(y+1)L + \varepsilon_m$$

$$EV_c(y) = CivPay(y) + EV_c(y+1) + \varepsilon_c.$$

Each option has a different uncertainty (ε_m or ε_c) associated with it, which are assumed to be identical and independently distributed following an extreme value distribution with mean zero and dispersion parameter b.

Different military contracts are differentiated by different levels of $MilPay(y)$ and probabilities of deployment, p_d. IDA assumes that any alternative military commitment offered is subject to its own shock, ε_α, which can be either the same for all military contracts ($\varepsilon_\alpha = \varepsilon_m$; comparable to R-SIM) or completely independent. The likely reality is that the uncertainty from an alternate military contract probably lies somewhere between these two extremes because the uncertainty a military commitment subjects one to is partly specific to the military experience in general and partly contract-specific. As a result, IDA is able to employ both of these shock scenarios as boundaries to its range of expectations for take up and continuation rates under alternate policies.

B. Utility specification

Individuals' different tastes for deployment are reflected in different utility functions, *U(d)*, which may take on positive and/or negative values. To characterize this variation in tastes for deployment across the population, the IDA study team made the following assumptions on these utility functions:

(1) *U(d)* is a function of cumulative deployment, *d*. In other words, an individual in the reserves gets a utility from his total number of past years in deployment.

(2) *U(0)* = 0: Individuals with no past deployment get no utility (positive or negative) from deployment.

(3) Each individual has a characteristic level of cumulative deployment, d^*, at which he or she gets his or her maximum utility. For any other level of cumulative deployment d, $U(d) < U(d^*)$.

(4) for $U_{dH}(d) > U_{dL}(d)$ for $dH > dL$: Individuals with higher peak deployment levels, d^*, have higher utilities for any positive level of deployment. This assumption yields nested utility curves that do not intersect each other, as seen in the figure below.

(5) $U(d)$ is symmetric in d and continuous, for the sake of retaining the simplicity of the model.

Together, these assumptions yield characteristic utility curves $U_{d^*}(d)$ for each individual, given his or her peak deployment level d^*, that look like those in Figure B-1.

These utility curves are characterized by parabolas given by the equation below. Here, k is a positive multiplier that produces utilities in dollars. It is an exogenously set model parameter that can be varied to yield different stay/leave retention profiles.

$$U_{d^*}(d) = kd(2d^* - d)$$

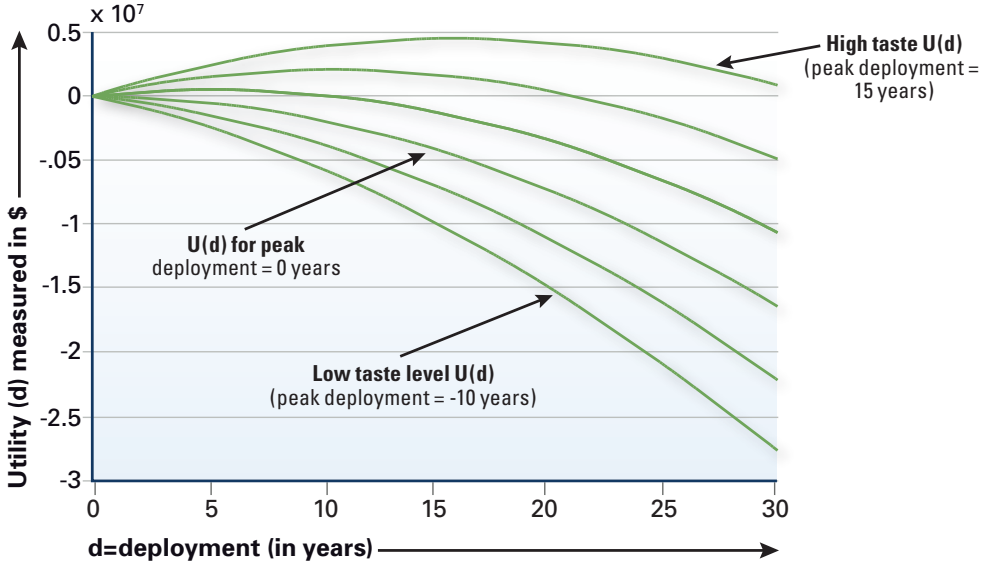


Figure B-1. Utility (d) for Different Taste Levels

Under these assumptions, an individual's peak deployment level, d^*, is enough to specify his or her utility function $U_{d^*}(d)$ for any level of deployment. It should be noted that both positive and negative d^* are allowed. Although it is impossible to be deployed a negative number of years, a negative d^* simply means that $U(d) < 0$ for all positive levels of deployment. A more negative d^* means even more negative utilities from positive levels of deployment.

IDA assumes that the population considering each military reserve service has a distribution of peak tastes for deployment, some negative and others positive. The study team estimates this d^* distribution for each reserve service, assuming it follows an extreme value distribution, calculating the stay and leave rates at each year of service and comparing these to actual retention profiles for each reserve service.

C. Calibration

Assuming existing values for civilian and military pays as well as retirement compensation policies and deployment rates, IDA calculated expected values for each option (EV_m, EV_a, and EV_c) as well as leave rates starting with year 30 and iterating to year 0 at which time the join decision is made. Based on the cumulative stay rates output by the model, the study team calibrates the mean and variance (μ_ε and σ_ε) of the extreme value distribution of ε_m and the mean and variance for the normal distribution of peak taste levels, d*, for each service, to most closely match actual retention profiles. In addition, we also calibrated the money value of utility, which is the multiplier k in the equation for $U_{d^*}(d)$ in the previous section.

IDA's approach for this calibration is simply to hand-select values for μ_ε, σ_ε, μ_d, σ_d, and k that output a stay profile for years of service, 1 through 30, that best matches actual stay rates for each service during this period. We perform these calibrations by hand. For an example, see Figure B-2 which shows the actual cumulative stay rates for the Army Guard in red and the estimated cumulative stay rates for the calibrated parameters in blue. It should be noted that the actual values reflect a sharper drop in retention around year 5; this is a common feature of actual retention profiles across the reserve Services. It seems to be indicative of selectively enforced minimum service requirements during the first five years of service. Because service members in the DRM can freely choose to leave or stay in each year, this feature is not observed in the model results.

Since there are five variables to calibrate and thus equally many degrees of freedom, there is generally more than one set of values that would generate a close fit to the actual retention profile for each Service. Accordingly, when estimating entry and retention under alternate policy scenarios, the IDA study team also checks to make

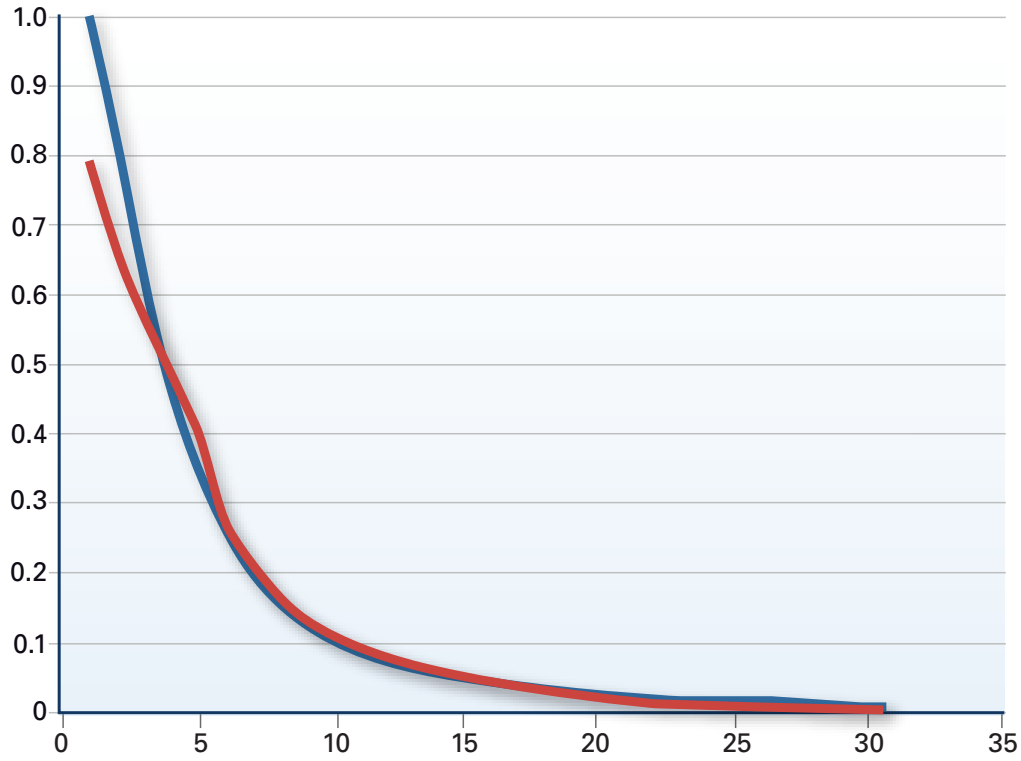


Figure B-2. Cumulative Stay Rates in Army Guard, by Year of Service (1 through 30)

sure the results are robust to variations in values for calibrated variables that yield similar retention profiles under the baseline scenario.

Civilian and military pays are estimated using data from the Social Security Administration which tracks actual civilian and military compensation for each individual. IDA received an aggregate version of this data from RAND. The average total civilian compensation received by service members with less than a month of active duty time is calculated for each reserve and paygrade. Assuming that service members follow a fixed promotion path (Table B-1, estimated compensation for each YOS is calculated by assigning each year to a particular paygrade, with 3 percent increases assumed in years without a formal promotion. Likewise, the average military compensation

Table B-1. Promotion Path Assumed for All Services

YOS	Pay Grade
1	E01
1	E02
2	E03
3	E04
4,5,6,7	E05
8,9,10,11	E06
12,13,14,15	E07
16,17,18	E08
19+	E09

Table B-2. Annual Civilian Compensation in Dollars

YOS	Army National Guard	Army Reserve	Air National Guard	Air Reserve	Marine Corps Reserve	Navy Reserve
1	14,491	16,550	12,050	15,812	18,752	14,272
2	15,634	16,603	20,561	19,377	20,155	24,293
3	20,310	19,912	25,326	25,547	24,959	29,044
4	27,868	26,082	37,157	36,830	31,833	37,551
5	28,704	26,864	38,272	37,935	32,788	38,677
6	29,565	27,670	39,420	39,073	33,772	39,837
7	30,452	28,500	40,602	40,245	34,785	41,032
8	35,352	35,020	45,640	44,744	43,842	44,182
9	36,412	36,071	47,009	46,087	45,158	45,508
10	37,505	37,153	48,420	47,469	46,512	46,873
11	38,630	38,268	49,872	48,893	47,908	48,279
12	40,581	41,256	48,446	49,771	53,422	50,758
13	41,799	42,493	49,900	51,264	55,025	52,281
14	43,053	43,768	51,397	52,802	56,675	53,849
15	44,344	45,081	52,939	54,386	58,376	55,464
16	43,413	47,443	52,218	54,970	56,009	55,414
17	44,715	48,866	53,785	56,619	57,689	57,076
18	46,056	50,332	55,398	58,317	59,420	58,789
19	48,508	53,124	53,039	56,048	59,280	59,345
20	49,963	54,718	54,631	57,729	61,059	61,125
21	51,462	56,359	56,270	59,461	62,891	62,959
22	53,006	58,050	57,958	61,245	64,777	64,848
23	54,596	59,791	59,696	63,082	66,721	66,793
24	56,234	61,585	61,487	64,975	68,722	68,797
25	57,921	63,433	63,332	66,924	70,784	70,861
26	59,659	65,336	65,232	68,932	72,907	72,987
27	61,449	67,296	67,189	71,000	75,095	75,176
28	63,292	69,315	69,204	73,130	77,348	77,431
29	65,191	71,394	71,281	75,324	79,668	79,754
30	67,147	73,536	73,419	77,583	82,058	82,147

Derived from 2007 Social Security Admin Data by Paygrade, Assuming Promotion Path in Table B-1 and 3 percent Annual Increase in Compensation in Years with No Promotion

Table B-3. Annual Military Compensation in Dollars

YOS	Army National Guard	Army Reserve	Air National Guard	Air Reserve	Marine Corps Reserve	Navy Reserve
1	22,901	19,490	23,516	18,413	18,483	14,115
2	37,483	28,281	30,357	22,302	31,708	24,117
3	54,845	42,455	46,080	43,069	35,911	38,344
4	66,130	59,810	60,865	54,062	38,508	52,108
5	68,114	61,605	62,691	55,684	39,663	53,671
6	70,158	63,453	64,572	57,354	40,853	55,281
7	72,262	65,357	66,509	59,075	42,079	56,940
8	73,928	71,299	72,135	68,803	57,629	66,109
9	76,146	73,437	74,299	70,868	59,358	68,092
10	78,431	75,641	76,528	72,994	61,139	70,135
11	80,783	77,910	78,824	75,183	62,973	72,239
12	90,214	83,317	89,184	88,926	72,549	68,756
13	92,920	85,817	91,860	91,594	74,726	70,818
14	95,708	88,391	94,615	94,342	76,968	72,943
15	98,579	91,043	97,454	97,172	79,277	75,131
16	107,817	94,779	107,455	107,153	86,199	74,592
17	111,052	97,622	110,678	110,367	88,785	76,830
18	114,383	100,551	113,999	113,678	91,449	79,135
19	133,247	115,197	126,175	123,278	104,043	80,444
20	137,245	118,653	129,960	126,976	107,165	82,857
21	141,362	122,212	133,859	130,785	110,380	85,343
22	145,603	125,879	137,875	134,709	113,691	87,903
23	149,971	129,655	142,011	138,750	117,102	90,541
24	154,470	133,545	146,271	142,913	120,615	93,257
25	159,104	137,551	150,659	147,200	124,233	96,054
26	163,877	141,677	155,179	151,616	127,960	98,936
27	168,794	145,928	159,835	156,165	131,799	101,904
28	173,858	150,306	164,630	160,850	135,753	104,961
29	179,073	154,815	169,569	165,675	139,826	108,110
30	184,446	159,459	174,656	170,645	144,020	111,353

Derived from 2007 Social Security Admin Data by Paygrade Assuming Promotion Path in Table B-1 and a 3 percent Annual Increase in Compensation in Years with No Promotion

Table B-4. Deployment Rates by Service and YOS

YOS	Army National Guard	Army Reserve	Air National Guard	Air Reserve	Marine Corps Reserve	Navy Reserve
1	1.7%	1.3%	0.1%	0.4%	1.0%	1.7%
2	11.9%	10.3%	2.7%	3.7%	9.7%	9.0%
3	16.7%	13.8%	4.9%	6.0%	14.2%	10.0%
4	15.6%	11.3%	5.8%	4.8%	15.2%	10.5%
5	13.8%	8.1%	5.0%	4.6%	13.5%	8.3%
6	17.2%	9.2%	4.9%	5.6%	11.4%	7.3%
7	15.1%	8.0%	4.6%	4.8%	11.3%	6.8%
8	14.9%	8.7%	4.7%	5.2%	15.9%	6.8%
9	14.5%	9.6%	4.5%	4.1%	17.8%	5.6%
10	15.3%	10.3%	4.9%	5.7%	19.9%	8.2%
11	14.8%	9.9%	4.5%	5.6%	18.1%	6.7%
12	13.9%	9.3%	4.4%	5.9%	21.0%	6.2%
13	13.6%	8.8%	4.1%	4.9%	18.6%	7.4%
14	13.5%	9.7%	3.8%	6.3%	19.5%	7.6%
15	14.6%	8.3%	4.5%	4.8%	17.7%	7.4%
16	14.2%	8.6%	4.0%	5.5%	13.4%	7.1%
17	13.8%	7.8%	4.5%	4.5%	15.5%	6.5%
18	13.3%	9.0%	4.5%	5.3%	16.8%	5.6%
19	13.0%	9.3%	4.1%	5.0%	11.2%	5.6%
20	13.0%	7.4%	3.6%	5.2%	12.4%	6.9%
21	13.4%	8.0%	4.8%	6.7%	12.0%	5.2%
22	13.3%	8.1%	4.0%	4.3%	13.0%	8.3%
23	12.5%	7.2%	5.1%	5.0%	14.3%	5.8%
24	12.6%	8.9%	5.0%	4.4%	8.7%	6.6%
25	15.1%	8.9%	4.9%	3.7%	9.8%	8.0%
26	13.2%	7.8%	5.0%	6.1%	18.7%	7.6%
27	13.5%	8.8%	3.7%	5.1%	13.2%	7.1%
28	13.5%	9.2%	4.8%	6.5%	13.5%	8.9%
29	12.6%	8.1%	5.5%	6.8%	19.0%	7.5%
30	11.5%	7.6%	4.3%	4.4%	16.1%	6.6%

Reflecting Average Deployment Rates from September 30, 2008 to September 30, 2009

received for service members with less than a month of service is calculated and multiplied by a factor of twelve to arrive at annual pays.

Reserve retirement compensation is estimated according to current policies as outlined by Williams.[20] The IDA study team calculated retirement compensation using the following equation, assuming that reservists earn 78 retirement points per non-deployed year and 360 points per deployed year. We substitute 96 percent of Final Military Compensation for High-Three Basic Compensation since IDA's model does not track the latter explicitly:

$$\text{Retirement Compensation} = \frac{\text{points}}{360} \times 0.025 \times .096 \times \text{Final Military Pay}$$

Expectations regarding existing deployment rates are calculated for each service for each YOS level based on the average of the population deployed at each YOS between September 30, 2008 and September 30, 2009. (See Table B-4)

D. Discussion of Model Assumptions

Following Simon, Negrusa, and Warner, the probability that an individual will select a given option x = {m, a, or c} from amongst the choices *m* (baseline military contract), a (alternative military contract) and *c* (civilian sector) is as follows, where *b* is the variance (technically, the dispersion parameter) for the shock to each contract, ε_m, ε_a, and ε_c:

$$P_x(y) = \frac{e^{EV_x(y)/b}}{e^{EV_m(y)/b} + e^{EV_a(y)/b} + e^{EV_c(y)/b}}$$

As stated, this model specification relies on a shock to each option. Here, it is assumed that the dispersion for ε_m and ε_c are the same and that any alternative commitment offered has its own uncertainty, ε_a, which follows the same distribution. If two contracts are quite different, then the assumption that they have separate draws of the shock is sensible, but if they are quite similar then one could argue they should be subject to the same shock. Since these shocks are identical and independently distributed this means we can only evaluate contracts that are sufficiently different from existing alternatives to be subject to such a sizeable relative shock. Since in actuality, there is likely to be some component of ε_a and ε_m in common with the military experience in general, we may be overestimating the shock ε_a relative to ε_m and thus the estimates of take up rates under scenarios where alternate contracts are offered are likely to be overestimates.

20. Cindy Williams, ed., *Filling the Ranks: Transforming the U. S. Military Personnel System* (Cambridge, MA: The MIT Press, 2004).

References

Asch, Beth J., James Hosek, Michael Mattock, and Christina Panis. *Assessing Compensation Reform: Research in Support of the 10th Quadrennial Review of Military Compensation*. Santa Monica, CA: RAND Corporation, 2008.

Black, Matthew, Robert Moffitt, and John T. Warner. "The Dynamics of Job Separation: The Case of Federal Employ*ees.*" *Journal of Applied Econometrics* 5 (1990): 245–262.

Brinkerhoff, John R., John C. Tilson, Fred Breaux, and Stanley A. Horowitz. *Reserve Volunteerism*. IDA Paper P-3153. Alexandria, VA: Institute for Defense Analyses, April 1996.

Cartwright, GEN James E. and Secretary Dennis M. McCarthy. *Comprehensive Review of the Future Role of the Reserve Component.* Washington, DC: Office of the Vice Chairman of the Joint Chiefs of Staff and Office of Assistant Secretary of Defense for Reserve Affairs, April 2011.

Dale, Charles. *The Determinants of Attrition From the Army Selected Reserves.* Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences, 1989.

Dolfini-Reed, Michelle, Ann Parcell, and Dave Gregory. "Determining Patterns of Reserve Attrition Since September 11, 2001." Annotated Briefing D0010352. A1. Alexandria, VA: Center for Naval Analysis, 2005.

Doyle, Colin M. *The Effect of Activation Policies on Accession and Continuation in the Army Reserve Components: The Annualized Reserve Component Activation Cost of Leaving Model*. IDA Paper P-4270. Alexandria, VA: Institute for Defense Analyses, August, 2008.

Fugita, Stephen S. and Hyder A. Lakhani. *The Economic and Noneconomic Determinants of Retention in the Reserve/Guard Units*. Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences, 1991.

Gotz, Glenn A. and John J. McCall. *A Dynamic Retention Model for Air Force Officers: Theory and Estimates.* R-3028-AF. Santa Monica, CA: RAND Corporation, 1984.

Graham, David R., Joseph F. Adams, John R. Brinkerhoff, William R. Burns, Colin M. Doyle, Hansford T. Johnson, Yevgeniy Kirpichevsky, Robert B. Magruder, Steven Mortimer, Saul Pleeter, Susan L. Rose. *Self-Selection as a Tool for Managing the Demands on Department of Defense (DOD) Personnel.* IDA Paper P-4606. Alexandria, VA: Institute for Defense Analyses, November 2010.

Grissmer, David W., Sheila Nataraj Kirby, and Priscilla M. Schlegel. *Changing Patterns of Nonprior Service Attrition in the Army National Guard and Army Reserve.* Santa Monica, CA: RAND Corporation, 1988.

Kirby, Sheila Nataraj and David W. Grissmer. *Reassessing Enlisted Reserve Attrition: A Total Force Perspective*. Santa Monica, CA: RAND Corporation, 1993.

Kirby, Sheila Nataraj and Scott Naftel. "The Impact of Deployment on the Retention of Military Reservists." *Armed Forces & Society* 26 (2000): 259–84.

Marquis, M. Susan and Sheila Nataraj Kirby. *Economic Factors in Reserve Attrition: Prior Service Individuals in the Army National Guard and Army Reserve*. Santa Monica, CA: RAND Corporation, 1989.

O'Donohue, Daniel J. "First-term Retention of Enlisted Selected Marine Corps (SMCR) Reservists." MS diss., Naval Postgraduate School, 1988.

Price, Jonathan D. "Effects of Activation on Selected Marine Corps Reserve Prior Service Enlisted Continuation Rates in the Post-9/11 Era." MS diss., Naval Postgraduate School, 2010.

Simon, C. J., S. Negrusa, and J. T. Warner. Educational Benefits and Military Service: An Analysis of Enlistment, Reenlistment, and Veterans' Benefit Usage 1991–2005. *Economic Inquiry* 48 (2010): 1008–1031.

Tan, Hong W. *Non-Prior Service Reserve Enlistments.* Santa Monica, CA: RAND Corporation, 1991.

Waite, Joseph P. "Affiliation of Naval Veterans with the Selected Reserve in the 21st Century." MBA diss., Naval Postgraduate School, 2005.

Warner, John T. *Military Compensation and Retention: An Analysis of Alternative Models and a Simulation of a New Retention Model*. CRC 436. Alexandria, VA: Center for Naval Analysis, 1981.

Williams, Cindy, ed. *Filling the Ranks: Transforming the U. S. Military Personnel System*. Cambridge, MA: MIT Press, 2004.