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A RAND NOTE

An Enlisted Force Management System Model to
Predict the Effects of Bonus Decisions

Grace M. Carter, Deborah L. Skoller,
Stanley E. Perrin, Clyde S. Sakai

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The RAND Corporation is helping to design
an enlisted Force Management System (EFMS)
for the Air Force. This Note describes the
design, specification, and prototype
implementation of a module in the EFMS that
will help skills managers make bonus
decisions. That module, which is called
the Bonus Effects Model, will enable skills
managers to evaluate the effect of
alternative bonus plans on projected bonus
expenditures and on manpower imbalances in
individual specialties. It provides
estimates by planning year of bonus
expenditures, reenlistments, and inventory
by year of service; and it predicts how
close both reenlistments and inventory will
be to desired targets.

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An Enlisted Force Management System Model to
Predict the Effects of Bonus Decisions

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Prepared for
The United States Air Force

40 Years
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RAND

PREFACE

The RAND Corporation is helping to design an Enlisted Force Management System (EFMS) for the Air Force. The conceptual design of the EFMS is presented in Grace Carter et al., *Conceptual Design of an Enlisted Force Management System for the Air Force,* The RAND Corporation, N-2005-AF, August 1983. This Note provides the design, specifications, and prototype implementation of a module in the EFMS to help skills managers make bonus decisions. The module, called the Bonus Effects Model (BEM), permits skills managers to evaluate the effects of alternative bonus plans on correcting specialty manning imbalances quickly and efficiently. They are then able to estimate bonus effects without paying the computational cost of tracking changes in the entire enlisted force.

The Note should be of interest to those in the Air Force who are working on the design and implementation of the EFMS, to manpower modelers and personnel programmers in all of the uniformed services, and to analysts outside of the military who are involved in manpower and personnel research.

The work described here is part of the Enlisted Force Management Project (EFMP), a joint effort of the Air Force (through the Deputy Chief of Staff for Personnel) and The RAND Corporation. RAND's work falls within the Resource Management Program of Project AIR FORCE. The EFMP is part of a larger body of work in that program that is concerned with the effective utilization of human resources in the Air Force.

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SUMMARY

The Bonus Effects Model (BEM) is an analytical tool to aid managers in making bonus budget decisions. It permits observation of the effects of alterna_ive bonus policy choices on projected inventory and bonus expenditures. Bonus managers can quickly and conveniently obtain information about the effects of various bonus plans on the decisions of individual airmen (reenlistment choice and occupational choice) as well as on the evolution of force structure (projected inventory counts by years of service and occupation, and aggregated over all occupations).

The BEM is an interactive system of programs that interfaces with the user by means of a series of menus. The effects of a bonus plan are displayed for each user-specified specialty in tables that show the reenlistments predicted to occur at each bonus level, the bonus costs that will be incurred each year, a breakdown of inventory by year of service for each planning year, and a comparison of both reenlistments and inventory with targets. These tables permit the user to construct a hypothetical bonus plan and compare that plan with the bonus plan currently in effect. Details of several of these tables follow.

The Bonus Elasticity Table (BET) allows bonus planners to determine the effects of various bonus offers on reenlistments in an Air Force Specialty Code (AFSC). The table displays reenlistment counts, rates, and reenlistment targets. The BET is designed to show the effects of changes in bonus offer on the number of reenlistments in each zone for any given AFSC and the number of cumulative career manyears (based on airmen eligible to reenlist) in each zone and AFSC. This information is obtained by an examination of the extent to which airmen approaching their Expiration of Term of Service (ETS) change their reenlistment decisions.

The BET was constructed from the perspective of fiscal-year cohorts containing the date at which an enlistment contract was scheduled to end. The BET tracks airmen in a given cohort through time to observe the overall reenlistment behavior of that cohort as a consequence of

alternative bonus offers. In this way, it is possible to determine how changes in bonus policies affect the size of a cohort in the long term, as well as the effects of new bonuses on the inventory in the upcoming year.

The Bonus Budget Table displays the amount of money that would be awarded in bonuses to each specialty under any bonus plan. This information is further disaggregated by zone and planning year. The table can be used to compare the budget for any hypothetical bonus plan with the current bonus plan in effect at the time of analysis. In addition, it displays the reenlistment counts that occur when no bonus is offered, under a "base plan" (usually the current plan), and under any hypothetical proposed bonus plan.

The Inventory Status Table shows how the inventory will respond to any given bonus plan. For an individual AFSC, the table compares inventory estimates in each zone among a "no-bonus" plan, the base plan, and the proposed plan. The Inventory Status Table also presents inventory targets for each zone and expresses the predicted inventory counts as a percent of these targets. Further information about the year-of-service (YOS) distribution of the future inventory under any bonus plan can be obtained through more detailed inventory count tables.

Aggregate information on bonus expenditures and outcomes is necessary to prepare a bonus budget. The BEM provides a series of summary tables that allow bonus planners to quickly review the effects of their decisions on overall bonus costs, reenlistments, and inventory. A printout of the bonus budget and obligated bonus cost for every AFSC is provided in the Summary Cost Listing. Presentations of reenlistments and costs by zone and by bonus multiple for each year of the planning horizon can also be obtained. Finally, the number of skills drawing a bonus can be summarized by bonus multiple for any proposed bonus plan.

In preparing a bonus budget, users of the model typically construct an initial bonus plan unconstrained by budget. This plan shows what the cost would be of funding a force that completely meets the targets for retention and inventory. The bonus planner can use this unconstrained plan to build a budget by adjusting the bonus multiples for each AFSC. Using the BEM to build a budget-constrained bonus plan involves making

selections from a series of menus to obtain retention, cost, and inventory information either AFSC by AFSC or in summary.

Much of the data manipulation for the prototype BEM was programmed in SAS, while the interactive capabilities and the final stages of data manipulation were written in EXPRESS. The Air Force will write updated versions of the BEM, and their use of these two programming languages is likely to differ from the way these languages were applied during BEM development. In some sense, there will never be a "final" BEM. All of its component models must be updated regularly to reflect new situations and bonus management needs as they arise. We suggest several ways in which the current version of the model could be improved.

ACKNOWLEDGMENTS

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I. INTRODUCTION

One of the major tasks in managing the Air Force's enlisted force is to meet the personnel targets given by the authorizations, which describe the number of persons that the Air Force wishes to have in each combination of occupation and grade. The Air Force's selective reenlistment bonus (SRB) program provides one lever for meeting authorization targets by providing retention incentives to selected personnel categories.

Selective reenlistment bonuses are offered to members of selected occupations on the condition that they reenlist or extend for at least three years. The amount of the bonus offer can vary by occupation and by year of service (YOS) group. Currently there are three YOS groups that may be offered a bonus: Zone A (3-6 years), Zone B (6-10 years) and Zone C (10-14 years). The amount of an SRB is determined by multiplying an airman's monthly basic pay by the number of years of his additional obligated service, and by a bonus multiple that is specified according to his Air Force Specialty Code (AFSC) and zone. Part of the bonus is paid in an initial lump sum, with the remainder paid annually in equal installments throughout the length of the contract.

The Air Force sets these bonus multiples to help meet its manning requirements and can change them as frequently as every six months. However, excessive instability in the program can lead to morale problems because the changes may be perceived to be arbitrary; Air Force regulations prevent changing any bonus by more than two multiples per year.

There is no permanent legislative authority providing for the payment of SRBs. Instead, Congress extends legislative authority every three to four years. For instance, Congress extended authority for the SRB program on 22 December 1987 with the 1988 Omnibus Budget Reconciliation Law and Continuing Resolution.

Funding for the SRB program is appropriated annually. In fiscal year 1985, the program expended $85.3 million. Some bonus was awarded to 98 specialties during the fiscal year, although there were 240 specialties with personnel in bonus year-groups that could have been awarded a bonus.

This Note describes a prototype model, called the Bonus Effects Model (BEM), to help the Air Force determine its bonus program. The documentation should provide future bonus managers with an understanding of the assumptions and limitations inherent in working with the BEM and its output displays. The Note is also intended as a reference for those in the Air Force who will be responsible for implementing the final model.

PROTOTYPE MODEL OVERVIEW

The BEM is designed to aid bonus managers in making bonus budget decisions. It provides the ability to observe the effects of bonus policy decisions on projected inventory and bonus expenditures. Bonus managers can quickly and conveniently obtain information about the effects of various bonus plans on the decisions of individual airmen (e.g., reenlistment choice and occupational choice) as well as on the evolution of force structure (e.g., projected counts of inventory by year of service).

The model provides diagnostic tables that include inventory summaries across AFSCs, zones, and planning years. It also has displays for each user-specified specialty showing the reenlistments predicted to occur at each bonus level (Bonus Elasticity Table), the bonus costs that will be incurred each year (Bonus Budget Table), and a breakdown of the inventory by year of service for each planning year (Inventory Tables). These displays also compare both reenlistments and inventory with targets. Figure 1 shows an overview of the functional components of the BEM.

Information from many of RAND's modeling efforts that form the basis for the Enlisted Force Management System (EFMS) has been used in building the BEM. The BEM was developed to avoid running the EFMS's
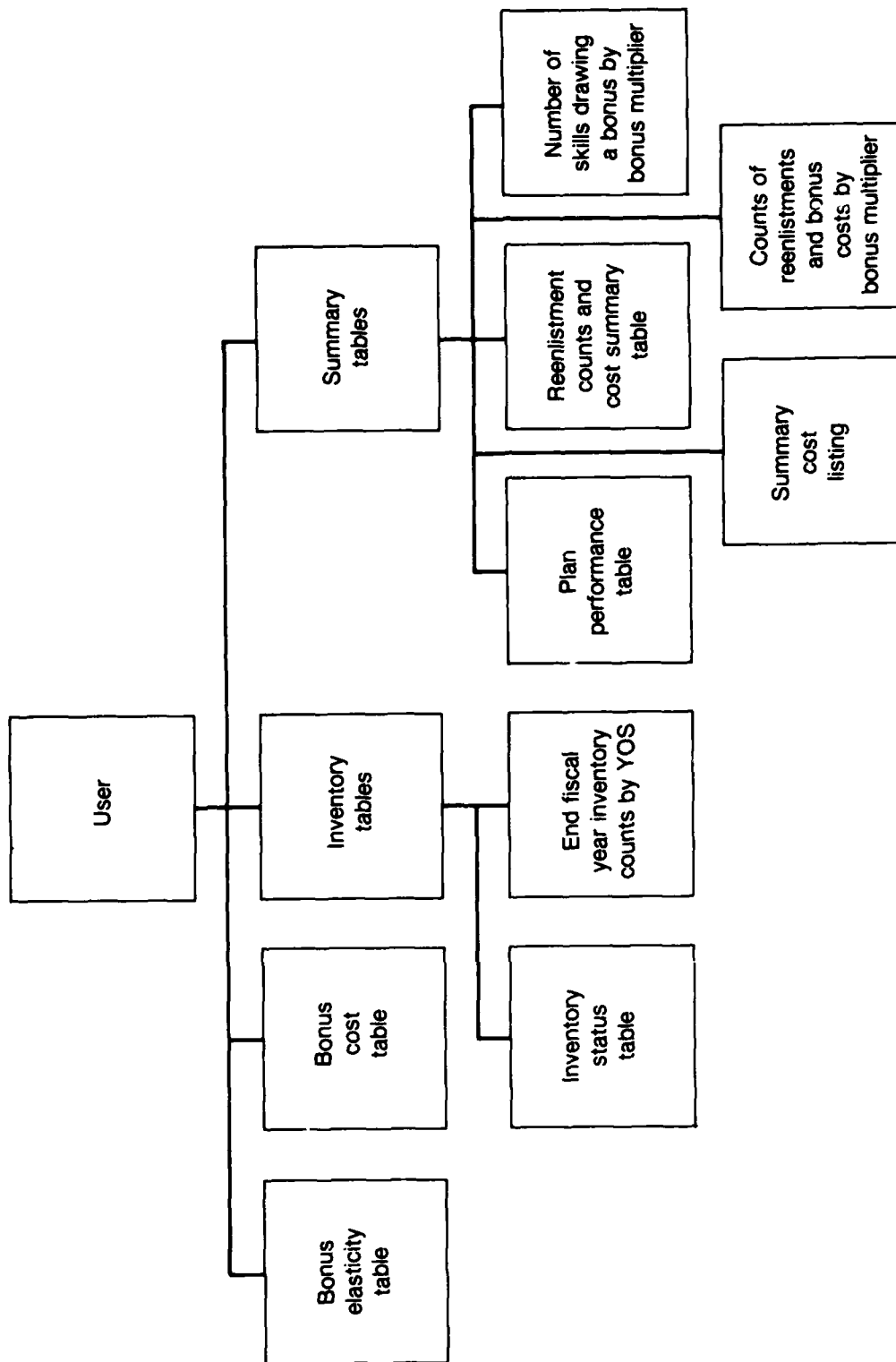
Fig. 1—Functional components of the BEM

large middle-term disaggregate Inventory Projection Model (IPM) whenever a bonus manager needs some information on a bonus plan. The IPM takes an initial inventory of airmen broken down by AFSC and "ages" it to predict what the force will look like in the future. Although it can determine the effects of changes in a bonus plan on force structure, it would not be feasible to run the IPM for every possible bonus plan. Thus, we have developed the BEM as a simplified analytical tool; it retains the IPM model features that strongly affect accuracy of predictions (such as the number of decisionmakers in each specialty and zone during each planning year) but eliminates features that only peripherally affect prediction accuracy (such as how a change in the bonus level in one specialty affects the number of airmen choosing to retrain into *another* specialty through the CAREERS program). The BEM's predictions should facilitate the identification of good bonus plans. These (few) good plans could then be run through the IPM to obtain more accurate and detailed predictions of their performance.

The BEM is an interactive system of programs that interfaces with the user by means of a series of menus. These menus provide options through which the user can display tables, construct a working bonus plan, and compare a hypothetical plan with the current actual bonus plan. Although the tables can be chosen in any sequence desired, the BEM menu screens were designed with an expected order of analysis in mind. This order corresponds to the progression of steps currently used to develop a bonus budget during one of the phases of the planning-programming-budgeting cycle.

SRB BUDGETARY PROCEDURES

Formulating a budget for the SRB program is an iterative process involving a systematic cycle of budget projections and program evaluations requiring the preparation of three SRB budgetary requests for submission to the Office of Secretary of Defense (OSD). The first request is simply a monetary ceiling to be included in the Program Objective Memorandum (POM). This document covers five years in fiscal terms and is reviewed and amended by OSD.[1] The POM is submitted to OSD

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[1]*The Air Force Budget*, AFP 172-4, USAF, 1979.

in the fall of the planning year preceding the fiscal year to be funded. For instance, the POM beginning with FY 88 was submitted to OSD in September 1986. OSD normally produces a final POM within 30 days after it receives the inputs from the services.

The second SRB budgetary request appears in the Budget Estimate Submission (BES), which is the Air Force's statement of the budget required to fund the programs in the first year of the POM. It is prepared in July of the fiscal two years preceding the year to be funded and explains the purpose of the SRB program. The SRB request for the BES is more detailed than that submitted for the POM. For instance, it describes the level of funding in terms of the amount of the initial SRB payments and of installment payments (called obligated payments). Normally, the level of funding requested in the BES does not exceed the level requested in the POM.

During the review of the BES, OSD typically requires some justification of the SRB budget. OSD might ask why the number of new payments is increasing, why the size of the program is increasing, or why the average size of payments is going up. Thus, to justify the budget, the bonus manager must have information on past and projected retention in each particular skill and on the bonus structure required to maintain a mission-capable force.

The third SRB request is the most detailed justification of the level of funding for the Air Force's SRB program. It is submitted to OSD in January of the fiscal year preceding the year to be funded, to be included in the President's Budget for the fiscal year.

CAPABILITIES OF THE BEM

The BEM provides detailed information on the inventory, retention, and costs required for maintaining each particular skill in the Air Force. It also allows comparisons among hypothetical plans for determining which plan provides the best compromise between meeting the target force structure and conforming to budgetary limitations.

Intensive use of the BEM begins during the preparation of a budget request for the BES. The bonus manager uses the model to help him identify the skills and zones within those skills that require an SRB

and determine the magnitude of the SRB that is paid to those skills and zones. The BEM could also be used to estimate the need for bonus money in the POM.

INPUT SOURCES

The EFMS includes an integrated set of models and sub-models that interact with each other as well as with the user. Various models within the EFMS provide necessary information to the BEM. The most important of these is the middle-term disaggregate loss model (Carter et al., 1988). It provides the BEM with information on retention and illustrates how expected reenlistment decisions change as a function of the amount of the bonus offer and economic conditions. 'ine EFMS Blending Program calculates loss and reenlistment rate predictions from these models. A separate model, based on unpublished work of Dean Follman, predicts occupational choices in the CAREERS program and the probability that an airman entering the career force will decide to stay in the same occupational specialty or retrain.

The Year of Service (YOS) Target Generator (Carter et al., 1983) sets YOS targets for each occupational specialty and grade within the specialty. The YOS Target Generator will help SRB managers determine how many persons should reenlist for each specialty and zone. The final model-specified input to the BEM is the number of persons who will reach the end of their contract during each year of the projection period. When the entire EFMS is operational, these decisionmaker counts will come from the middle-term disaggregate IPM. In the prototype version of the BEM, these counts are generated by an IPM based on the YOS Target Generator.

Data sources for the BEM include a data file describing the force as of the beginning of the first model year. These data are called the initial inventory. The BEM also requires as input a recent bonus plan-- that is, the bonus multiples by AFSC and zone during a recent bonus period. A flowchart that identifies the inputs and outputs from the BEM is contained in App. D.

FINAL MODEL IMPLEMENTATION

Much of the data manipulation for the prototype BEM was programmed in SAS, and the interactive capabilities and the final stages of data manipulation were written in EXPRESS.[2] The decision to divide the programming between the two languages in this way was based purely on EFMS staffing availabilities and does not fully exploit the unique capabilities of either language. The final BEM written by the Air Force is likely to be different from the model's current form.

There are also some capabilities missing in this version of the BEM that should be added in future versions. These include cost information (both training costs and lifecycle costs)[3] and an allocation algorithm that would allow planners to allocate a fixed SRB budget among specialties and zones so as to minimize the deviation between the inventory and its target.

In some sense, there will never be a "final" BEM. All the component models of the BEM must be regularly updated to reflect new situations and bonus management needs as they arise.

OUTLINE

This document describes the components and the theory behind the development of the Bonus Effects Model. Sections II, III, and IV each cover one of the BEM's three basic output displays: the Bonus Elasticity Table, the Bonus Budget Table, and the Bonus Inventory Tables. Each section describes the display tables in detail and discusses the assumptions underlying the development of each table. Section V describes the summary tables produced by the BEM. Section VI discusses how information from the BEM can help construct a bonus plan. Operating instructions for the BEM will appear in a separate manual that will be written, maintained, and updated by the Air Force.

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[2] The key features of EXPRESS and an evaluation of its capabilities are presented in Walker et al., December 1986.

[3] Information on lifecycle costs could be added to the BEM using the Aggregate Lifecycle Effectiveness and Cost (ALEC) model (Rydell, 1987).

The appendixes provide technical detail on calculations of various parameters of the BEM. They also document the computer code used in the model.

II. BONUS ELASTICITY TABLE

The Bonus Elasticity Table allows planners to determine the effects of various bonus offers on reenlistments in an AFSC. It displays reenlistment counts, rates, and targets.

Specifically, the BET answers two questions:

- How will the number of persons who reenlist in a zone and in a particular AFSC change if the bonus offer is changed in that AFSC for a particular year?
- How will the number of career manyears contributed by the persons who are eligible to reenlist change if the bonus offer is changed in a particular AFSC for a particular year?

The BET was constructed from the point of view of a cohort defined based on the fiscal year of their scheduled end of contract. That date is called the "original expiration of term of service" or "OETS."[1] The BEM tracks airmen from a given cohort through time to observe the reenlistment behavior of that cohort as a consequence of alternative bonus offers. In this way, it is possible to determine how changing bonus policies affect the size of a cohort in the long term, as well as the effects of new bonuses on the inventory in the upcoming year.

TABLE DESCRIPTION

The BET contains reenlistment probabilities for each combination of AFSC, zone, bonus multiple, and planning year. The model has predictions for the current fiscal year and the following two years. The prototype model contains approximately 400 AFSCs, three zones, 11 bonus multiples, and three plan years.

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[1]An airman may extend his contract, changing his ETS, but not his OETS or his cohort membership.

The table is presented to the user as a series of screens; each one presents data for one AFSC, one zone, and one fiscal year of the planning horizon. The display screen is in tabular form: The rows correspond to the possible bonus offers. There are 11 rows, one for each bonus multiple (from 0 to 5 in steps of 0.5) that could be assigned to an AFSC. Figure 2 presents a sample BET for zone A bonuses in AFSC 491X1 for FY 87.

The rows contain information on the reenlistment behavior of the cohort coming up to their OETS in the specified zone. There are eight variables in each row as follows:

1. the reenlistment rate for the cohort (labeled REENL RATE),
2. the number of airmen that will enter the given AFSC through the CAREERS program if the AFSC has a specified bonus offer and all other AFSCs have the bonus offer given by a specific base case (labeled CAREERS),
3. the number of reenlisting airmen that will remain in the AFSC (labeled STAY SAME),
4. the number of airmen from the cohort that will reenlist given the bonus offer specified (TOTAL REENL),
5. reenlistments as a percent of the reenlistment target (% ADJUSTED TARGET),
6. the percent change in reenlistments from the value under the current bonus plan (% CHG REENL),
7. the number of career manyears the cohort will provide (ACCUM MANYEARS), and
8. the percent change in manning from the amount in the current bonus plan (% CHG ACCUM MANYEARS).

The BET screen also displays information about target reenlistments as a heading above the table itself. The targets are presented as the steady state target and as an adjusted target. The steady state target will be obtained from the YOS Target Generator (Carter et al., 1983) and

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                      BONUS ELASTICITY TABLE

AFSC:  491X1  /  INFORMATION SYS OPR          STEADY STATE TARGET: 772
ZONE:  A                                      ADJUSTED TARGET    : 772
FY.OF.THE.COHORTS:  88                        PLAN:  Saved Work BP
```

| | | | | | % | | | % CHG |
BM	REENL RATE	CAREERS	STAY SAME	TOTAL REENL	ADJUSTED TARGET	% CHG REENL	ACCUM MANYEARS	ACCUM MANYEARS
0.0	50	178	351	529	69	-32	6,247	-35
0.5	54	203	388	591	77	-24	7,364	-24
1.0	57	231	417	648	84	-16	8,074	-16
1.5	60	264	445	709	92	-9	8,834	-9
-> 2.0	63	301	474	775	100	0	9,657	0
2.5	66	344	505	849	110	10	10,579	10
3.0	69	392	536	928	120	20	11,563	20
3.5	72	448	568	1,016	132	31	12,659	31
4.0	75	511	601	1,112	144	43	13,856	43
4.5	77	583	634	1,217	158	57	15,164	57
5.0	80	665	666	1,331	172	72	16,584	72

Fig. 2.1--Sample Bonus Elasticity Table for AFSC 491X1

is the number of reenlistments from airmen reaching original ETS in each zone needed annually to sustain the AFSC in its optimal steady state configuration. The adjusted target, which varies by fiscal year, allows large cohorts to provide reenlistments that cannot be obtained from adjacent small cohorts.

These reenlistment targets can be used to determine whether each AFSC and zone has year group shortages as defined by OSD, and to calculate a bonus plan that would bring the AFSC as close to the steady state target as possible by assigning bonuses within a constrained range but not constrained by total budget.

The remainder of this section concentrates on the calculation of the numbers that appear in the first four columns of the BET. It also includes an explanation of the steady state and adjusted reenlistment targets used in the BET. We begin below with the reenlistment count estimates.

AIR FORCE REENLISTMENT COUNT ESTIMATES

In order to calculate the number of Air Force reenlistments, we begin with the number of persons who will reach their reenlistment decision point (decisionmakers) in a given AFSC, planning year, and zone.[2] These decisionmaker counts will come from the middle-term disaggregate IPM in the operational EFMS. In the prototype version of the BEM, a special IPM is used to produce these counts.

The EFMS loss models (Carter et al., 1987) view the ETS decision as a series of sequential decisions and estimate the following three rates:

1. The probability that an airman will stay in the Air Force beyond his original ETS,

2. The probability that an airman will reenlist on or before his original ETS given that he stays past it, and

3. The probability that an airman will reenlist following an extension.

Separate equations are fitted for each of these three decisions in first-term, second-term, and the career years. The loss models allow loss rates to vary with changes in the unemployment rate and the military to civilian pay ratio. The prototype BEM assumes that economic conditions will remain stable over the planning horizon; the user or system manager must pick an economic forecast that will govern data generation for the model.

Modeling Reenlistment Count Estimates

The middle-term loss models are linear models. The general form of each of the three equations is:

$$P_j = \Sigma_i \alpha_i X_{ij} + \varepsilon \tag{2.1}$$

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[2]The count of decisionmakers includes all persons who are still in the Air Force at OETS plus those who have received an Air Force dispensation for early release from their obligated service.

where P_j is the probability of a specific outcome (either a stay decision or a reenlistment) in the equation for population j (here AFSC and YOS), α_i is the linear coefficient for the ith independent variable, X_{ij} is the mean value of the ith independent variables for population j, and ε is the error term.

This linear specification works well for forecasting purposes because actual changes in the independent variables are quite modest. However, the Bonus Elasticity Table must predict outcomes over large ranges of the bonus variable, and these ranges are outside the competence of a purely linear specification. Consequently, we transform the model into a logit form specified by the equation:

$$\log(P_j/(1 - P_j)) = \Sigma \beta_i X_{ij} + \varepsilon' \qquad (2.2)$$

where β_i is the coefficient of the bonus variable.[3] Table 1 shows the transformation of the linear coefficients obtained from the middle-term loss models to their logit form.[4] The linear coefficients give the derivative of the flow rate with respect to a single bonus multiple.

For each cohort defined by AFSC and YOS at OETS and each bonus multiple, three logit functions are evaluated: (1) the probability that a person in the cohort will stay past his OETS if offered the specified bonus multiple (PR:STAY), (2) the probability that a person in the cohort who will stay past his OETS will do so by reenlisting before OETS if offered the specified bonus multiple (PR:IR), and (3) the probability that a person in the cohort who stayed past his OETS in extension status will end the extension with a reenlistment if he were offered the specified bonus multiple at the time of his OETS (PR:EXT). These probabilities can then be used to determine the probability that a

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[3] A description of the form of the logit equation used in the BEM and the way in which the bonus coefficient is calculated appears in App. A.

[4] The development and specification of the linear models is reported in Carter et al., 1987.

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Table 1

MIDDLE-TERM LOSS MODEL LINEAR COEFFICIENTS
AND LOGIT TRANSFORMATIONS

Middle-Term Loss Model	Linear Coefficient	Logit Coefficient
Loss Before OETS		
First term (YOS ≤ 6)	-0.0343	-0.1486
Second term (YOS > 6 and ≤ 11)	-0.0416	-0.2490
Career		
YOS=12	-0.0088	-0.3300
YOS=13	-0.0053	-0.2000
YOS=14	-0.0032	-0.1200
Extend Given Stayed Past OETS		
First term	-0.0885	-0.3993
Second term	-0.1416	-0.6637
Career	0.0	0.0

person from the cohort will ever reenlist if he is offered the specified
bonus multiple at the time of OETS (PR:ER) as follows:

$$PR{:}ER = (PR{:}STAY)\ (PR{:}IR + (1 - PR{:}IR)\ (PR{:}EXT)) \qquad (2.3)$$

Here, the probability of ever reenlisting is multiplied by the
number of decisionmakers in the AFSC and YOS cohort; these reenlistment
count estimates are summed over YOS to estimate the number of Air Force
reenlistments from the cohorts reaching OETS in each AFSC and zone.[5] For
zones B and C this estimate is simply the number of reenlistments into a
given specialty. For zone A the effects of the CAREERS retraining
program must also be incorporated; the total number of reenlistments in

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[5]This estimate is denoted as the variable AFRENL in the equations
in App. A.

zone A is the sum of those airmen retraining in the CAREERS program and those who have remained in the same skill.

CAREERS FLOW ESTIMATES

To estimate the occupational decisions of airmen, or "CAREERS flows," we developed two models that predict the occupational choices of persons entering the career force; this choice is modeled as a two-stage decision process. The "stay-same" model predicts the number of airmen who remain in their first-term AFSC from the reenlisting sample. The "CAREERS-flows" model determines the numbers of airmen flowing into a particular AFSC given that they cross train.

The "stay-same" model is a linear regression model with no intercept term, in which the independent variables are the bonus multiple and dummy variables for each AFSC. Because there is no intercept term in the model, the coefficients on the AFSC variables give the probability that a person who is in the specified AFSC in the first term and who reenlists will choose to remain in that AFSC for the second term if his first-term AFSC is not offered a bonus. These coefficients and the coefficient on the bonus variable are input into the BEM. The "CAREERS-flows" model is a multivariate logit model that predicts the probability that an airman who has decided to retrain will choose to retrain into each AFSC. This probability is modeled as a function of the bonus multiple offered in each skill, the Career Field Group (CFG) the airman is leaving, and the AFSC into which retraining is to occur. The model assumes that a bonus will result in the same proportional increase in the probability for all AFSCs; thus there is only one bonus coefficient. The other coefficients in the model give the probability that a person who wishes to train out of a specialty in a given CFG will choose to retrain into the specified AFSC. There are five CFGs (Carter et al., 1987); thus, there are five parameters for each AFSC. Only some AFSCs can receive retrainees from the CAREERS retraining program. (Capper AFSCs, for example, which contain only senior non-commissioned officers, do not receive CAREERS retrainees.)

A detailed description of the way in which the stay-same and cross-training predictions are calculated appears in App. A.

Sensitivity Analysis of CAREERS Model

Predictions of the number of persons cross training into a given AFSC through the CAREERS program are based on the bonus offer to all other AFSCs at the time of data generation, rather than the bonus offer being considered by the user for other AFSCs. In this section, we discuss how different the predictions would be if they were updated to reflect the new bonus plan in effect at the end of a model run. The purpose of this analysis is to show the magnitude of the prediction errors introduced by the BEM's assumption that flows into an AFSC do not depend on the bonus offer in other AFSCs.

The bonus offer in other AFSCs affects both the size of the pool of cross trainees and the probability that a person in this pool will choose to cross train into a specified AFSC. To examine this problem, we chose two bonus periods with large differences in zone A bonus plans. Our analysis indicated that the largest annual difference in plans occurred between bonus period 34 (10/01/82 to 3/03/83) and bonus period 37 (10/31/83 to 3/31/84) (see Table 2).

We then ran the BEM separately for each bonus plan to predict the number and specialties of retrainees under each plan. As described in App. A, we construct pools of retrainees, each consisting of those airmen who choose to retrain out of a specialty in one CFG. The differences between these pools are shown in Table 3.

For each AFSC, we calculated the difference in predicted number of retrainees between the bonus periods by subtracting the number of retrainees in bonus plans of period 37 from the number in bonus period 34. We examined these differences in absolute terms, expressed as a percent of the number of retrainees into the specialty, and as a percent of the total number of persons reenlisting into the specialty and zone. This analysis was based on a subset of information from the BEM. We chose one cohort year, 1988, and examined only bonus multiples 0, 1, 2, and 3, because these are the most common bonuses given in zone A.

Table 2

FREQUENCIES OF AFSCS BY BONUS MULTIPLE
FOR TWO BONUS PERIODS

Bonus Multiple	Number of AFSCs		
	Bonus Period		
	34	37	Difference
0.0	37	64	-27
0.5	4	7	-3
1.0	60	45	15
2.0	26	27	-1
3.0	21	6	15
4.0	1	0	1

NOTE: Bonus period 34 covers
10/1/82 to 3/31/83. Bonus period 37
covers 10/31/83 to 3/31/84.

Table 3

EFFECT OF BONUS PLAN ON ESTIMATE OF NUMBER OF PERSONS
RETRAINING IN CAREERS PROGRAM, BY CAREER
FIELD GROUP OF SPECIALTY BEING LEFT

CFG of Losing Specialty	Estimated Number of Retrainees	
	Bonus Period 34	Bonus Period 37
Skilled technicians	1186	1234
Electrical-mechanical	976	1034
Craftsmen	993	996
Facilities & administration	853	874
Other	73	73
Total	4081	4211

NOTE: Bonus period 34 covers 10/1/82 to 3/31/83.
Bonus period 37 covers 10/31/83 to 3/31/84.

As shown in Table 3, the total pool of retrainees does not differ significantly as a result of year-to-year changes among bonus plans. The 3 percent increase in total number of predicted retrainees due to the decrease in bonuses between plans translates into an average difference of 3.08 retrainees per AFSC. The data, however, exhibit variability among AFSCs. To measure the variability, we use the standard deviation across AFSCs of the difference in prediction of retrainees. This number, 4.44, indicates that roughly 75 percent of the AFSCs had predictions under the two plans that differ by less than 7.52 retrainees.

The differences between the predictions increase with the amount of the bonus multiple in the BET table. Table 4 shows the mean error and standard deviation for each of the four bonus multiples selected.

The percentage difference in predictions of retrainees was acceptably small. The average difference across all bonus multiples was -11.5 percent of the number of retrainees with a standard deviation of 1.31 percentage points. This information is similar for each bonus multiple. Retrainees constitute an average of 4.6 percent of total reenlistees with a standard deviation of 3.34 percentage points.

We also examined all cases with large differences between the predictions and found that most of the error in our sample occurs at high bonus multiples. The greatest absolute error (a difference of more than 40 retrainees between the two predictions) occurred for two skills (732X0 and 491X1) when a bonus multiple of 4.0 was offered. These 40 retrainees represent less than 10 percent of retrainees in these specialties. In a subsample of observations conditioned on an absolute difference of more than 20 retrainees between the two predictions, 82 percent of the observations had bonus multiples of 3.0 or greater. Such high bonus multiples are not commonly offered in zone A; thus, this error will probably have little effect on bonus decisions.

Table 4

ANALYSIS OF DIFFERENCES IN
PREDICTED NUMBER OF RETRAINEES
PER AFSC BETWEEN BONUS PLANS
IN PERIODS 34 AND 37

Bonus Multiple	Mean	Standard Deviation
0	-1.71	2.28
1	-2.23	2.97
2	-2.91	3.87
3	-3.79	5.04
4	-4.93	6.56

REENLISTMENT RATE

The Air Force calculates reenlistment rate according to the following formula:

$$\text{Reenlistment Rate} = \frac{\text{Reenlistments}}{\text{Eligible Losses} + \text{Reenlistments}} \qquad (2.4)$$

Air Force enlisted personnel are considered to be eligible to reenlist provided they are within 12 months of their date of separation (DOS), have been given an honorable discharge, and are recommended for reenlistment. Eligible losses are losses of airmen who are eligible to reenlist.[6] Both losses and reenlistments are counted at the time they occur. The reenlistment rate for a given fiscal year is based on

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[6]Certain categories of persons who have decided not to reenlist (e.g., those who have refused overseas assignment) are counted as eligible losses in the reenlistment rate calculation, although they are not formally recommended for reenlistment.

actions of airmen whose term was scheduled to expire in various years. However, if the system is in steady state, the reenlistment rate would also equal the fraction of the eligibles in a fixed year's cohort who reenlist at any time. The calculations used in estimating the reenlistment rate in the BET are presented in App. A.

In estimating what the reenlistment rate will be, the BEM accepts as input an eligibility rate for an OETS cohort and zone. This rate is the fraction of the cohort that will be designated as eligible to reenlist. See App. A for further details.

TARGET REENLISTMENTS

Target reenlistments are used in building a bonus plan that is unconstrained by budget. Based on these targets, the BEM suggests appropriate bonus multiples for each AFSC and zone.

The target reenlistments are input from the steady state YOS Target Generator (Carter et al., 1983, p. 102) and are the number of reenlistments needed annually from those reaching original ETS in each zone to sustain the AFSC in its optimal steady state configuration. The numbers are used as the Bonus Effects Model's reenlistment target with two purposes:

1. To determine whether each AFSC and zone has year group shortages as defined by OSD, and
2. To calculate a bonus plan that would bring the number of reenlistments within an AFSC as close to the steady state target as is possible.

The only constraint on achieving the second objective is the maximum bonus multiple that may be assigned. In particular, the solution is not constrained by total budget and is called the "unconstrained bonus plan."

In building an unconstrained bonus plan, the BEM will calculate an adjusted target when the reenlistment target for at least one year is unattainable and the target for other years is not at the maximum possible value. The Bonus Elasticity Table reports both the input

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reenlistment target and the adjusted target for that AFSC, zone, and fiscal year. It also presents the total reenlistments as a percent of the adjusted reenlistment target.

The unconstrained bonus plan is developed in an iterative stepwise process. The process is not interactive: Once the user has specified the maximum bonus multiple to be considered, the final unconstrained plan is computed automatically. Reenlistment counts are calculated separately for each individual AFSC and zone within AFSC. The bonus multiples range from 0 to a user-specified maximum in steps of 0.5.

In the first step, the adjusted target is defined as the input target. Then, through a series of comparisons, the bonus multiple is selected that produces the closest total reenlistment count to the target reenlistment count. The resulting selection can be either over or under the target.

Once a reenlistment count has been selected, it is determined whether that count was constrained by the user-specified maximum bonus. If the count is not constrained, it is designated adequate. Formally, the requirement for adequacy is that the reenlistment target be closer to the reenlistments estimated at the selected bonus than to the reenlistments estimated at the maximum bonus multiple selected plus one extra multiple step (0.5). This test is done for the reenlistment counts in all three fiscal planning years.

If the plan is adequate for all three years in the model, then the bonus multiples selected are the ones used in the preliminary plan unconstrained by budget. However, if the reenlistment counts turn out to be inadequate for one or more of the planning years, the target in the adequate years will be increased to allow for the reenlistment count shortages and a new bonus multiple selected to meet the increased target. The exact algorithm depends on the number of inadequate years.

If the plan is inadequate in two years, but adequate in one year, then the target in the single adequate year will be adjusted to take the reenlistment count shortage into account. In that case, the target becomes the sum of the input target and the number of reenlistments short in the two inadequate years. Then the bonus multiple is selected for the adequate year that will produce a total reenlistment count as close as possible to the increased target.

If the plan is inadequate in only one year but adequate for the other two years, then the target in each adequate year will be increased by half the number of reenlistments short in the inadequate year. Before selecting a bonus multiple that will meet the requirements of the increased reenlistment target, however, the BEM will determine whether the newly adjusted target can be met in one of the two adequate years with a bonus multiple of zero. If so, the targets in the two years are further readjusted so that the shortage is redistributed among the years, allowing a way to fix as much of the shortage as possible with no bonus.

If the increased target cannot be met in any year with a bonus multiple of zero, then a new bonus multiple must be selected in the adequate years that will produce a total reenlistment count as close as possible to the adjusted target. The shortage is apportioned evenly between the two years. Where this is not feasible because one of the years cannot produce enough people to make up for half of the reenlistment shortage in the inadequate year, then the BEM simply assigns the multiple that will give the highest reenlistment count possible in that year. The remaining year must then be assigned a bonus multiple that will produce enough reenlistments to fill the rest of the shortage.

III. BONUS BUDGET TABLE

The Bonus Budget Table tells the user how many dollars would be awarded in bonuses to each specialty under any specific bonus plan. For each specialty, a bonus plan contains nine numbers giving bonus multiples that might be offered in each of the three years in each of the three zones. After the user inputs a bonus plan (the "proposed plan"), a table is presented that gives estimated reenlistment counts and bonus dollars in each of the three zones in each year of a three-year planning horizon. The table also compares data for the input bonus plan with that for a "base plan," usually the plan in effect at the time of the analysis.

An example screen is shown in Fig. 3. There are three sets of rows corresponding to each of the three zones; within each set there are three rows, each giving data corresponding to one of the three fiscal years of the planning horizon. The first substantive column (labeled NO BONUS REENL COUNTS) in each row gives the estimated number of reenlistments that would occur if the specialty were not offered a bonus during the planning horizon. The next column, labeled BM, gives the amount of the bonus offer under the base bonus plan followed by estimates of the number of reenlistments that would occur that year (REENL COUNTS) and the bonus payment that would be given at reenlistment (BUDGET) if this base plan were used. The next three columns give similar information for another bonus plan that the user has specified called the "proposed plan." The last two columns on the screen merely show how the reenlistment counts and dollars changed in response to going from the base plan to the proposed plan.

ESTIMATING DISTRIBUTION OF REENLISTMENTS ACROSS FISCAL YEARS

The estimated reenlistment counts shown in the Bonus Budget Table are the number of reenlistments expected to occur in each zone during each fiscal year. The calculation of these reenlistment counts begins

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BONUS COST TABLE

AFSC: 491X1   BASE PLAN: Curr BP date
INFORMATION SYS OPR   PROPOSED PLAN: Saved Work BP

		NO BONUS REENL	.....BASE PLAN.....		...PROPOSED PLAN...		.....DELTA.....	
ZONE	FY	COUNTS	BM	REENL COUNTS	COSTS (THOUS)	BM	REENL COUNTS	COSTS (THOUS)	REENL COUNTS	COSTS (THOUS)
A	88	507	0.5	579	386	2.0	728	2,038	149	1,652
A	89	482	0.5	544	363	2.5	773	2,752	229	2,389
A	90	342	0.5	393	262	3.0	696	3,007	303	2,745
B	88	201	0.0	201	0	0.0	201	0	0	0
B	89	230	0.0	230	0	0.0	230	0	0	0
B	90	312	0.0	312	0	0.0	312	0	0	0
C	88	259	0.0	259	0	0.0	259	0	0	0
C	89	276	0.0	276	0	0.0	276	0	0	0
C	90	327	0.0	327	0	0.0	327	0	0	0

Fig. 3--Sample Bonus Budget Table for AFSC 491X1

with the number of reenlistments shown in the Bonus Elasticity Table for
the same specialty, zone, and bonus plan. This value is the number of
persons out of the cohort reaching OETS in that fiscal year that will
ever reenlist; some of these will reenlist in the year preceding OETS
and some will reenlist in the years following OETS. In the Bonus Budget
Table we distribute this number over the fiscal years in which the
predicted reenlistments will actually occur.

In our loss models, a single cohort can reenlist in any of four
fiscal years:

- the fiscal year preceding the year of OETS,
- the fiscal year containing OETS,
- the first fiscal year following OETS,
- the second fiscal year following OETS.

We assume that all reenlistments out of the cohort reaching OETS occur during one of these four years. We also assume that the distribution of reenlistments among these years depends on zone and whether a bonus is offered; but for the same zone and bonus offer the distribution is the same for each future cohort and for each specialty.

Each cohort can reenlist only in exactly four years; it follows that all the persons reenlisting in any fiscal year come from at most four cohorts. In the current fiscal year, reenlistees can come from the cohort that reached OETS two years ago, the one that reached OETS last year, the one that will reach OETS this year, and the one that will reach OETS next year. From the perspective of the model, the bonus offer for the first two cohorts is already history; the number of reenlistments is therefore predetermined. We use historical data to calculate their reenlistments in this fiscal year. The total number who will ever reenlist from the cohort for the current fiscal year is determined from the bonus plan and the BET. Then we estimate the fraction of these who will reenlist in the current fiscal year. In subsequent fiscal years, the number of reenlistees is predicted by the BEM by distributing each cohort's reenlistments across fiscal years. The algorithms used for distributing reenlistments among fiscal years and for subsequently estimating the total number of reenlistments occurring in each fiscal year are presented in App. B.

ESTIMATING THE BONUS BUDGET

Part of the bonus is paid to the airman as a lump sum at the time of reenlistment, and the remainder is paid in installments throughout the term of the contract. During fiscal year 1986, half of the bonus amount was paid as a lump sum. The Bonus Budget Table reports only the lump sum payments, because much of the SRB budget documentation concentrates on these numbers. The installment payments are reported as "obligated costs" in the Plan Performance Table and in various summaries of the budget as discussed further in Sec. V.

There is a "unit bonus cost" for each fiscal year, zone, and possible bonus multiple. This unit bonus cost is an estimate of the average lump sum payment for a single reenlistment with a bonus multiple of one. (This is an estimate because the actual average lump sum payment depends on the YOS and grade distribution of the enlistees.) The costs reported in the bonus budget are merely this unit bonus cost times the estimated number of reenlistees for the AFSC, fiscal year, zone, times the bonus multiple for the appropriate bonus plan (base plan or proposed plan).

The costs that are obligated for future years as a result of the specified plan are also calculated by multiplying the estimated number of reenlistments by input constants that depend only on fiscal year, zone, and bonus multiple.

IV. INVENTORY TABLES

The Inventory Status Table shows how the inventory will respond to
any given bonus plan. The user chooses an AFSC and specifies a bonus
plan that gives the bonus multiple zone and fiscal year of the three-
year planning horizon in the same way as for the bonus budget table
discussed in the last section. The BEM estimates the inventory that
would be present at the end of each of the three planning years given
the bonus offer in that "proposed plan."

In the Inventory Status Table, the BEM presents these inventory
estimates for three YOS groups that correspond to the three bonus zones.
It also presents targets for each of these YOS groups and expresses the
predicted inventory counts as a percent of their targets. To easily
compare the user-proposed plan with alternatives, the Inventory Status
Table also presents estimated counts for the inventory that would result
from a base bonus plan and if no bonus were offered to the specialty.

Fig. 4 is a sample screen of the Inventory Status Table for AFSC
491X1. Each row corresponds to a combination of zone and fiscal year.
The column headings are self-explanatory (BM stands for bonus multiple).

The YOS groups for which inventory and target are presented in the
Inventory Status Table are as follows:

    for zone A: persons with more than 4 and less than 7 YOS
    for zone B: persons with more than 7 and less than 11 YOS
    for zone C: persons with more than 11 and less than 15 YOS.

These groups are those whose end-of-year inventory will be affected by
the bonus offer during the year. For example, responses to a zone A
bonus by 6-year enlistees (persons in the 5-6 YOS group) will increase
the number of persons who stay past OETS and therefore the number of
persons in the 6-7 YOS cell at the end of the year. Very few of those
in the 6-7 YOS cell will have had the opportunity to respond to a zone B
bonus offer.

INVENTORY STATUS TABLE

AFSC: 491X1   BASE PLAN: Curr BP to Date
INFORMATION SYS OPR   PROPOSED PLAN: Saved Work BP

		-----NO BONUS-----			-------BASE PLAN--------				-----PROPOSED PLAN-----		
ZONE	FY	INVEN	TARGET	%	BM	INVEN	TARGET	%	BM	INVEN	TARGET	%
A	88	2,232	2,667	84	0.5	2,301	2,667	86	2.0	2,501	2,667	94
A	89	1,938	2,703	72	0.5	2,050	2,703	76	2.5	2,494	2,703	92
A	90	1,543	2,320	67	0.5	1,686	2,320	73	3.0	2,436	2,320	105
B	88	2,012	2,056	98	0.0	2,012	2,056	98	0.0	2,012	2,056	98
B	89	2,002	1,965	102	0.0	2,002	1,965	102	0.0	2,002	1,965	102
B	90	2,171	2,176	100	0.0	2,171	2,176	100	0.0	2,171	2,176	100
C	88	1,392	1,442	97	0.0	1,392	1,442	97	0.0	1,392	1,442	97
C	89	1,490	1,602	93	0.0	1,490	1,602	93	0.0	1,490	1,602	93
C	90	1,469	1,586	93	0.0	1,469	1,586	93	0.0	1,469	1,586	93

Fig. 4--Sample Inventory Status Table for AFSC 491X1

The user can obtain further information about the YOS distribution of the future inventory by requesting one of the backup inventory count tables. There is one backup table for each AFSC and zone, and an example for zone A is given as Fig. 5. The rows of each of these tables correspond to a single YOS group. For example, the first row of Fig. 5 concerns airmen who have completed three years of service but have not had their fourth anniversary. The table for each zone contains rows for each YOS group covered in the Inventory Status Table and an extra row for the immediately preceding YOS group who will be decisionmakers for the zone, although the number of persons in this year group are not usually affected by the bonus.

The first substantive column of each backup inventory count table describes the inventory at the end of the fiscal year preceding the planning horizon for the model. This is the beginning inventory for the model run. Three other columns (labeled "EOY inven" for end-of-year inventory) give the predicted inventory at the end of each of the three years of the planning horizon under the plan shown in the upper right-hand section of the table.

END FISCAL YEAR INVENTORY COUNTS, BY YOS

AFSC: 491X1 / INFORMATION SYS OPR
ZONE: A   PLAN: Saved work bp

YEAR GROUP	FYR87 EOY INVEN	FYR88 BOY DM	FYR88 EOY INVEN	FYR89 BOY DM	FYR89 EOY INVEN	FYR90 BOY DM	FYR90 EOY INVEN
3-4	1,287	1,157	966	888	993	838	956
4-5	1,024	0	838	0	708	0	795
5-6	692	84	929	137	832	114	709
6-7	596	0	734	0	953	0	931
TOTAL	2,312	1,241	2,501	1,025	2,494	952	2,436
TARGET			2,667		2,703		2,320

Fig. 5--Sample backup inventory table for AFSC 491X1, Zone A

The backup inventory count tables also display the number of persons reaching a decision point during each of the planning years by YOS group. These are found in the columns labeled "BOY DM" for beginning of year decisionmakers, who are classified according to their YOS group at the beginning of the planning year. The table includes only decisionmakers in the zone of the table--thus decisionmakers in the YOS 6-7 cell (if any) will be included in the zone B table. The "TOTAL" row shows the total number of decisionmakers for the zone and inventory over the YOS groups used in the corresponding zone of the Inventory Status Table. The "TARGET" row reproduces the Inventory Status Table's end of fiscal year target information. The inventory targets come from the YOS Target Generator, which will be the subject of another document.

The future inventory is estimated by YOS for each AFSC and bonus offer. The decisionmakers that are affected by the bonus offer during the planning horizon are counted separately from those unaffected. The

inventory unaffected by the bonus offer is derived using an inventory projection model. A detailed presentation of the calculations used in estimating the YOS profile of the future inventory appears in App. C.

V. SUMMARY TABLES

Aggregate information on bonus expenditures and AFSC performance is extremely useful in preparing an SRB budget. The BEM provides a series of summary tables that allow bonus planners to quickly review the effects of their decisions on overall bonus costs, reenlistments, and inventory. This section describes these summaries and briefly discusses the source: of the data presented in the tables.

PLAN PERFORMANCE TABLE

The Plan Performance Table (PPT) summarizes information on inventory, reenlistments, and cost for a proposed working plan (Fig. 6). The PPT presents information by AFSC, zone, and fiscal year. In each category, the table contains the following information:

AFSC: 491X1 / INFORMATION SYS OPR
PLAN: Saved Work BP

ZONE	FY	BONUS MULTIPLE	INVEN	TARGET	% TARGET	REENL RATES	REENL COUNTS	COST OF BUDGET (THOUS)	OBLIG COST (THOUS)
A	88	2.0	2,501	2,667	94	63	728	2,038	2,038
A	89	2.5	2,494	2,703	92	69	773	2,752	2,752
A	90	3.0	2,436	2,320	105	72	696	3,007	3,007
B	88	0.0	2,012	2,056	98	72	201	0	0
B	89	0.0	2,002	1,965	102	74	230	0	0
B	90	0.0	2,171	2,176	100	74	312	0	0
C	88	0.0	1,392	1,442	97	89	259	0	0
C	89	0.0	1,490	1,602	93	90	276	0	0
C	90	0.0	1,469	1,586	93	91	327	0	0

Fig. 6--Sample Plan Performance Table for AFSC 491X1

INVEN -- the estimated inventory that will be present at
the end of the fiscal year

TARGET -- the target inventory for the end of the fiscal year

% TARGET -- estimated inventory as a percent of the target

REENL RATES -- the estimated reenlistment rate (see Eq.(2.4))

REENL COUNTS -- the estimated number of reenlistments during
the fiscal year

BUDGET -- estimated bonus payments during the fiscal year

OBLIG COST -- estimated total budget costs over the term of the
reenlistment contracts

The PPT contains information only for the proposed working plan.
No data on the current plan, previous budgets, or the bonus plan
unconstrained by budget are presented in this table.

The variables in the PPT appear separately in other display tables
previously described. For example, the inventory and target inventory
counts are drawn from the Inventory Status Table (see Sec. IV).
Reenlistment rates are the same as those in the Bonus Elasticity Table
(see Sec. II). Reenlistment counts and the bonus cost variable are
taken from the Bonus Cost Table (see Sec. III).

The obligated cost of the bonus work plan is also displayed in the
PPT. Obligated cost is the amount of money allocated for SRB payments
following the initial bonus payment. The obligated cost variable is
summarized by multiplying the obligated bonus cost by the number of
reenlistments in that AFSC for each zone and fiscal year.

SUMMARY COST LISTING

A printout of the reenlistment counts, bonus budget, and obligated
bonus budget for every AFSC is provided in the Summary Cost Listing
(Fig. 7). The method used to calculate these variables is described in
Sec. III. There is one table for each zone and fiscal year. The bonus
multiples in effect are also displayed for reference.

Unlike the PPT, the Summary Cost Listing juxtaposes reenlistments
and costs of the current plan and the proposed bonus plan. In this way,
bonus managers can compare their proposed bonus plan with the current
plan.

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Report-BEMPSCL      Headquarters United States Air Force  Page            1
AFMPC.DMPDWF                Force Management System        Run Date 02/01/88
1Lt John Doe             Print Summary Cost Listing        Run Time 06:01:41
```

FISCAL YEAR: 88   BASE PLAN: Curr BP to Date
ZONE: A   PROPOSED PLAN: Saved Work BP

| | | ....BASE PLAN............ | | | ....PROPOSED PLAN.......... | | |
AFSC	BM	REENL COUNTS	COST ($ 000)	OBLIG COST ($ 000)	BM	REENL COUNTS	COST ($ 000)	OBLIG COST ($ 000)
100X0	0.0	0	0	0	0.0	0	0	0
111X0	1.0	42	66	65	0.0	36	0	0
112X0	0.0	62	0	0	0.5	71	47	47
113X0B	0.5	24	16	16	0.0	21	0	0
113X0C	0.5	187	125	125	0.0	174	0	0
114X0	0.0	93	0	0	0.0	93	0	0
115X0	0.0	25	0	0	0.0	25	0	0
116X0	0.5	31	21	21	0.0	25	0	0
117X0	1.0	14	22	22	3.0	18	78	78

Fig. 7--Sample Summary Cost Listing

Reenlistment Counts and Cost Summary Table

A more aggregate presentation of reenlistments and budget figures is provided in the Reenlistment Counts and Cost Summary Table (Fig. 8). This table presents program totals of reenlistment counts, lump sum bonus payments, and future bonus payments obligated with these lump sum payments. The numbers are based on the proposed SRB work plan, and totals are given for each zone and fiscal year. The information is summed across AFSCs allowing a review of the overall pattern of reenlistment counts and bonus dollars as a function of zone and fiscal year.

The Reenlistment Counts and Cost Summary Table displays information for a single plan at a time. It is possible to obtain summaries for any plan (proposed, current, bonus unconstrained by budget, etc.) by specifying the desired plan when selecting the summary table from the menu.

REENLISTMENT COUNTS AND COST SUMMARY TABLE

PLAN: Saved Work BP

| FY | | ....ZONE........... | | | |
		A	B	C	TOTAL
88	REENLISTMENT COUNTS	21,461	9,026	7,669	38,156
	COST ($ 000)	36,868	10,873	4,147	51,889
	OBLIGATION COST ($ 000)	36,868	10,873	4,147	51,889
89	REENLISTMENT COUNTS	23,733	11,909	10,054	45,696
	COST ($ 000)	42,286	9,588	3,001	54,875
	OBLIGATION COST ($ 000)	42,286	9,588	3,001	54,875
90	REENLISTMENT COUNTS	18,900	16,156	11,729	46,785
	COST ($ 000)	39,711	9,161	5,674	54,546
	OBLIGATION COST ($ 000)	39,711	9,161	5,674	54,546

Fig. 8--Sample Reenlistment Counts and Cost Summary Table

Counts of Reenlistments and Bonus Costs by Bonus Multiple

The BEM provides two summaries that aggregate data according to bonus multiple. These are the Counts of Reenlistments and Bonus Costs by Bonus Multiple (described here), and the Number of Skills Drawing a Bonus by Bonus Multiple (described in the next subsection).

The table of Counts of Reenlistments and Bonus Costs displays the distribution of reenlistments and lump sum bonus payments across all bonus multiples (Fig. 9). It is additionally disaggregated by fiscal year and zone. The bonus planner can use this summary to quickly determine the number of reenlistments occurring at each bonus level, and the overall cost for each bonus multiple in a given zone.

```
-------------------------------------------------------------------------
                    SUMMARY MULTIPLE TABLE - PART 1
                  COUNTS OF REENLISTMENTS AND BONUS COSTS
FY: 88
PLAN:  Saved Work BP
```

	......ZONE A......		......ZONE B......		......ZONE C......	
BM	REENL COUNTS	COST ($ 000)	REENL COUNTS	COST ($ 000)	REENL COUNTS	COST ($ 000)
0.0	10,696	0	5,366	0	6,279	0
0.5	1,523	1,016	343	276	111	76
1.0	339	534	322	514	35	39
1.5	571	1,250	296	728	13	21
2.0	868	2,430	994	3,304	230	497
2.5	798	2,841	628	2,174	195	567
3.0	6,666	28,797	1,077	3,877	806	2,946
3.5	0	0	0	0	0	0
4.0	0	0	0	0	0	0
4.5	0	0	0	0	0	0
5.0	0	0	0	0	0	0
TOTAL:	21,461	36,868	9,026	10,873	7,669	4,147

Fig. 9--Sample Counts of Reenlistments and Bonus Costs Table

This table comprises three screens; each screen displays information for one fiscal year.

As in the Reenlistment Counts and Cost Summary Table, information is displayed only for a single plan. The user can obtain the same information for another plan by initially specifying the desired plan.

NUMBER OF SKILLS DRAWING A BONUS BY BONUS MULTIPLE

Like the "Counts of Reenlistments and Bonus Costs by Bonus Multiple" summary, the Number of Skills Drawing a Bonus table disaggregates information by fiscal year and zone at the level of the bonus multiple (Fig. 10). The table displays the total number of AFSCs drawing a bonus in each fiscal year, zone, and bonus multiple. It also provides a program summary of the number of skills receiving a bonus.

```
                    SUMMARY MULTIPLE TABLE - PART 2
                    NUMBER OF SKILLS DRAWING A BONUS: 169

FY: 88
PLAN:  Saved Work BP


            BM      ZONE A    ZONE B    ZONE C


           0.5        9        11         7
           1.0        6        14         4
           1.5       10         8         1
           2.0        6        19         8
           2.5       10        25         7
           3.0       63        28        11
           3.5        0         0         0
           4.0        0         0         0
           4.5        0         0         0
           5.0        0         0         0

         TOTAL:     104       105        38
```

Fig. 10--Sample summary display showing
Number of Skills Drawing a Bonus

The table layout is similar to that of the previous summary table. There are three screens, one for each fiscal year. The three zones head the columns of the table. Any bonus plan can be summarized in this way so it is possible to compare the number of skills receiving a bonus in the proposed plan, for instance, with the number in the current plan, or in the plan unconstrained by budget.

VI. CONSTRUCTING A BONUS PLAN WITH THE BONUS EFFECTS MODEL

The BEM is designed to be a flexible tool that will show the effects of any bonus plan on reenlistments, bonus costs, and inventory. The original design for the EFMS called for information displayed in the BEM, plus a "bonus optimization model" that would allocate a fixed budget so as to minimize the weighted sum over AFSCs of a measure of the difference between the inventory and its target. Although it would be fairly simple to build such an optimizing model from the data in the BEM tables, a shortage of resources has postponed this procedure indefinitely. In the absence of an optimization model, the user must rely on his own ingenuity and the rules of thumb that bonus managers have used for years to develop an optimal, or near optimal, bonus plan.

In this section, we discuss one way to develop a very good bonus plan. It begins with the bonus plan unconstrained by budget that would get us as close as possible to the target. Then bonuses are reduced from this plan using various criteria. The first criterion to be applied is mission criticality--bonuses will not be paid to skills that are not essential for the defense mission. Then the bonuses that add least (per dollar) to retention, those that go to skills with the smallest shortages, and those that go to skills that are less critical than the most critical skills are identified, permitting reduction of bonuses for those skills. The tradeoffs implied among these criteria are up to the bonus manager and his superiors, and the model does not even require that the criteria be made explicit.

ESTABLISHING INITIAL BONUS PLANS

The first step in preparing a budget is to construct a bonus plan unconstrained by budget. This plan shows what the cost would be of funding a force that completely meets the targets for retention and inventory. It is used as a starting point from which to adjust bonuses for a budget. Part of the bonus is paid to the airman as a lump sum at

the time of reenlistment, and the remainder is paid in installments throughout the term of the contract. During fiscal year 1986, half of the bonus amount was paid as a lump sum. The BEM provides separate information about lump sum and installment payment. This is useful because much of the SRB budget documentation examines lump sum payments.

The bonus manager must first identify the skills that are defense-essential. Some skills are not considered to be defense-essential and would never receive a bonus regardless of the level of manning. The bonus manager must initially assign a bonus of zero to these skills.

The bonus manager must also determine the highest bonus multiple he would consider paying. Budget constraints and retention trends normally drive this decision process (good retention trends might lead to a multiple being capped at a three, but poor retention trends may necessitate raising this cap).

The computer constructs the unconstrained plan given the maximum bonus multiple. The model suggests bonus multiples for each AFSC, zone, and year using the Bonus Elasticity Table. The user reviews each of these suggestions and makes modifications as needed. In particular, the user will set the bonus for the mission nonessential AFSCs to zero.

CONSTRUCTING AN SRB PROGRAM BUDGET

The bonus planner can use the unconstrained plan to build a budget by adjusting the bonus multiples for each AFSC. Using the BEM model to build a budget-constrained bonus plan involves choosing a starting bonus plan and then making selections from a series of menus to obtain retention, cost, and inventory information either AFSC by AFSC or in summary.

When the user is exploring alternative plans, they are saved as "work plans." The computer will initialize a new work plan by reading an input file. In most cases this predesigned plan is the one the user had when he finished his last session. But the initialization file may also come from either the "current plan" or the plan unconstrained by budget as chosen by the user. Creating hypothetical working plans involves making changes to the predesigned plan, one AFSC at a time.

The next step is to select the AFSCs that are candidates for a
change in their SRB. Identifying them requires analysis of the effects
of various bonus multiples on the reenlistment, inventory, and budget
for each AFSC. The BEM prompts the user for the AFSC he wishes to
examine. For each AFSC selected, the model displays the working plan
that lists the bonus multiples for zones A, B, and C and by allowing the
user to change any of these multiples. The user then compares the
effect of alternatives with the effects of the current bonus offer
labeled "current plan" in displays. When a mission-essential AFSC
appears to be falling critically short of its target for reenlistments
and inventory, particularly in zone A, it becomes a candidate for an SRB
or an increased SRB. Because 70 percent of the money in the SRB program
has been spent on zone A bonuses in the past, the bonus planner
concentrates on identifying critical manning shortages for zone A,
particularly in the upcoming fiscal year. He also should examine all
SRB skills to see if some are projected to remain overmanned and
consequently could have their SRBs reduced.

The BEM provides several tables to aid the bonus planner in his
analysis. The first two tables to be used are most likely the Plan
Performance Table and the Bonus Elasticity Table. Both present
information for each AFSC by fiscal year and zone. As discussed
earlier, the Plan Performance Table summarizes all the outcomes of the
current plan so the user can quickly determine if it is generally
satisfactory. The Bonus Elasticity Table shows how each year's number
of reenlistments would respond to any change in the bonus amount so the
user can estimate what would be required to fix the AFSC.

Exploring the Effects of Bonus Changes on Inventory

The size of the SRB assigned to an AFSC depends on several factors,
including the extent of the manning shortage in one zone and the manning
level of the other zones. For instance, if the inventory in zone A for
a particular AFSC were only 82 percent of the target with a bonus
multiple of one, it might appear necessary to raise the multiple.
However, if the inventory for zone B were 128 percent of the target,

then it might be desirable to account for the overages in zone B by maintaining the slight shortage in zone A.

Trends in the level of manning are also important in determining the size of an SRB to be paid. For instance, if the PPT shows that in FY 87 the inventory for zone B is 128 percent of the target, but in FY 88 the inventory declines to only 92 percent of the target, the bonus planner might choose not to reduce the bonus multiple during FY 87 in order to avoid compounding shortages predicted for FY 88.

Information on the inventory effects of alternative bonus plans is usually obtained from the Inventory Status Table (Fig. 4). The backup inventory tables help the user understand how the year group shortages or overages are caused by year groups of different sizes marching through the force. The information on the number of decisionmakers in each year group and year show which fraction of the shortage can be remedied by changing the SRB.

Exploring the Effects of Bonus Changes on the Bonus Budget

In addition to examining the effects of bonuses on inventory and reenlistments, the bonus planner must consider the effect of SRB changes on both the budget associated with each candidate AFSC and the budget for the program itself.[1] Information about bonus payments at the time of reenlistment can be obtained from the Bonus Budget Table.

The Bonus Budget Table compares the costs of providing the bonus multiples listed in the current plan with the costs for the bonus multiples in the working plan. These costs and the differences between them are displayed for each AFSC by zone and fiscal year.

Changing an SRB

Using the BEM, the bonus planner can modify the working plan by making decisions about individual AFSCs, changing the bonus multiples one skill at a time. When the bonus manager is satisfied with the plan for a particular AFSC, he can choose a new AFSC to analyze, examine the summary tables, or save his work plan and end the session.

---

[1]Information on lifecycle costs for the AFSC will eventually be added to the BEM using the ALEC model (Rydell, 1987).

SAVING THE BONUS PLANS

The model contains an option for maintaining historical bonus plans, the bonus plan that is currently in effect, and other hypothetical work plans. The user can save up to nine bonus plans in addition to the plan "unconstrained by budget." One of these plans is eventually chosen as the next current plan. At this point, the user must move the "old" current plan to history with the chosen plan established as the "new" current plan. After this is done, all other working plans are removed from the on-line data base.

Maintaining historical bonus plans can assist the bonus manager in various ways. For instance, when working with direct AFSC conversions the user can start with the bonus plan currently in effect and examine reenlistments, inventory, and cost for just the new AFSCs.[2] There are two AFSC conversions a year, October 31 and April 30. At these times, the bonus planner need only examine the AFSCs undergoing conversion. The number of AFSCs converted is normally fairly small--approximately ten to fifteen. Most of these conversions are direct. No SRB changes are necessary for direct conversions.

The bonus planner can also use the stored bonus plans to make changes to the bonuses assigned after the SRB program has been funded. He may decide to reallocate money by adding AFSCs to the program, by removing some, or by decreasing the bonus multiples for certain AFSCs and increasing the multiples for others. The user can also examine the money-constrained plan that he constructed for the President's Budget and modify that plan based on current information.

---

[2]Indirect AFSC conversions may require additional analyses based on the mission-critical character of the skill and the manning levels of each of the old AFSCs contributing to the new skill. If one of the old AFSCs received an SRB, the new skill often will receive one as well.

Appendix A

CALCULATIONS OF REENLISTMENT ESTIMATES IN THE BONUS ELASTICITY TABLE

REENLISTMENT COUNT EQUATIONS

The logit form of the equation to estimate reenlistment counts is:

$$\log[P_j/(1 - P_j)] = \Sigma \beta_i X_{ij} + \epsilon' \tag{A.1}$$

Since, for our BEM, we are interested in changes in P_j only as a function of the bonus amount, we can lump all the other independent variables into the constant term, so the equation we use is:

$$\log[P_j/(1 - P_j)] = C_j + \beta_i X_{ij} + \epsilon' \tag{A.2}$$

where C_j is a constant and β_i is the coefficient of the bonus variable in Eq. (A.1). According to Haggstrom (1983), β_i can be estimated using the following formula:

$$\beta_i = (n/SS_E)\alpha_i \tag{A.3}$$

where SS_E is the sum of the squared errors of the linear regression equation presented in Sec. III (Eq.(2.1)), n is the sample size, and α_i is the bonus coefficient in Eq. (2.1). The value C_j is calculated so that the P_j calculated from Eq. (A.2) is exactly the same number as the P_j calculated from Eq. (2.1) in Sec. II with a bonus offer of 0.

CAREERS FLOW ESTIMATES

Stay-same Prediction

A linear regression model is used to calculate the fraction of airmen out of those reenlisting who will remain in the same AFSC rather than participating in CAREERS retraining. The prediction is conditioned on the first-term AFSC and the bonus offer specified. It is calculated for zone A only. For AFSC j, let:

D_j = number of persons reaching OETS in zone A in a
particular year,

$AFRENL_j$ = number of persons out of D_j estimated to
reenlist.

The number of reenlistees that will stay in the same AFSC if the bonus
offer is B_j is estimated by:

$$STAYSAME_j(B_j) = AFRENL_j * MIN(1,C1 + C2 * B_j) \qquad (A.4)$$

This is the variable appearing on the BET screen as the number of
reenlisting airmen that will remain in the given AFSC. The remaining
persons, $AFRENL_j$ - $STAYSAME_j$, will train out of the AFSC through the
CAREERS program.

Cross-Training Predictions

The model of the flow into AFSCs through the CAREERS program used
by the BEM is a simplification of the flow model used in the EFMS's
middle-term disaggregate IPM. For the reader to understand the
rationale for the model used by the BEM, we first present the full IPM
CAREERS flow model below. Then we discuss the simplification used by
the BEM.

Both the IPM and the BEM CAREERS flow models use the same parameter
set, which was discussed in Sec. II. They are used to calculate the
probability that an airman who wishes to move out of a specialty in a
given CFG will choose to train into a specified AFSC, j, given a
particular bonus offer. In the IPM, the equation for this probability
is as follows:

$$PC_j(CFG,B) = exp(c_j + d * B_j)/\Sigma \, exp(c_i + d * B_i) \qquad (A.5)$$

where c_i is the coefficient for the probability that a person who wishes
to train out of a specialty in this CFG will choose to train into AFSC

i; d is an empirically defined coefficient on the bonus; B_i is the bonus offer in AFSC i; and B denotes the vector of bonus offers to all specialties.

The number of persons from the CFG who participate in the CAREERS program is found by summing:

$$POOL(CFG,B) = \sum_{i \varepsilon CFG} AFRENL_i(B_i) - STAYSAME_i(B_i) \qquad (A.6)$$

Then, the number of persons who will enter AFSC j through the CAREERS program is given by:

$$CAREERS_j(B) = \sum_{CFG} PC_j(CFG,B) * POOL(CFG,B) \qquad (A.7)$$

Thus, the flow into AFSC j depends on the bonus opportunities in *all* other AFSCs. This dependence, which reflects reality, was deemed too computation-intensive for use in a model that was designed for quick evaluation of all alternative possibilities in each AFSC. Consequently, the prediction of the number of persons who will enter AFSC j through the CAREERS program is calculated only once for each bonus offer in AFSC j. During that calculation, the bonus offer in all other AFSCs is fixed at a "typical" level, which in all recent runs has been the bonus plan in effect at the time of data generation.

Finally, we calculate the total number of reenlistments into specialty j, $TOTALR_j$:

$$TOTALR_j = STAYSAME_j + CAREERS_j, \text{ for zone A}$$

$$\text{and } TOTALR_j = A_j, \text{ for zones B and C.}$$

Reenlistment Rate Estimates

In the equations that calculate estimated reenlistment rate, the eligibility rate for an OETS cohort and zone is E, the fraction of the cohort that will be designated as eligible to reenlist. The model assumes that this rate does not vary by AFSC, zone, or bonus offer. For any given time period and zone, the eligibility rate can be calculated as:

$$E = \frac{\text{Eligible losses + Reenlistments}}{\text{Total ETS losses + Reenlistments}} \tag{A.8}$$

where ETS losses are any losses that occur after 12 months before OETS. In deciding whether an ETS loss is an eligible loss, one should use the rules for calculating eligibility for the reenlistment rate rather than the rules for determining subsequent eligibility to reenlist. Then we estimate the reenlistment rate for AFSC j and for zones B and C as:

$$\text{Reenlistment Rate} = \frac{\text{TOTALR}_j}{E{*}D_j} \tag{A.9}$$

and for zone A:

$$\text{Reenlistment Rate} = \frac{\text{TOTALR}_j}{E{*}D_j - (\text{AFRENL}_j - \text{STAYSAME}_j) + \text{CAREERS}_j} \tag{A.10}$$

When predictions of number of reenlistments exceed the predicted number of eligibles, the predicted reenlistment count is set to the number of eligibles.[1]

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[1]The decreased reenlistments are divided proportionately between cross trainees and others in zone A.

Appendix B

CALCULATIONS OF REENLISTMENT ESTIMATES
IN THE BONUS BUDGET TABLE

ESTIMATING FISCAL YEAR DISTRIBUTION OF REENLISTMENTS

It may help the reader understand our algorithm to first consider the difference between cohort loss rates and fiscal year loss rates. Cohort loss rates give loss rates in every 12-month period ending on the anniversary of the OETS of the group of persons in the cohort. The fiscal year loss rates give loss rates during a particular fiscal year. The Blending Program of the EFMS translates the cohort loss rates from the middle-term loss model into fiscal year loss rates for each IPM cell. Similarly, cohort extension rates are translated into fiscal year extension rates. The fiscal year extension rates give the probability that a person who stays through the end of the fiscal year will be in extension status at the end of the year.

Our cohort loss model demonstrates a substantial effect of the bonus on losses and reenlistments before OETS. For a particular cohort, let us define:

$y = 2$ is the fiscal year preceding OETS,

$y = 1$ is the fiscal year containing OETS,

$y = 0$ is the fiscal year following OETS,

$y = -1$ is the second fiscal year following OETS.

Then, the losses affected by bonus occur almost exclusively in year $y = 1$, but reenlistments occur in years $y = 2$ and $y = 1$.[1] To adequately capture these effects, we first use the Blending Program to calculate fiscal year loss rates assuming there is no program of early releases

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[1]The Air Force may operate an "early release" program that moves losses from $y = 1$ to $y = 2$, but the BEM does not simulate such programs. Persons who have actually left the Air Force prior to the beginning of the planning horizon through an early release program are counted as if they were still in the Air Force.

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and that reenlistments before OETS occur at OETS. We then calculate the total reenlistments occurring at OETS for each bonus level and finally spread this total amount of reenlistments between the years y = 2 and y = 1.

The cohort loss analysis found at most a small effect of bonuses on losses from extension.[2] We can adequately capture this effect by assuming that the effect of bonuses on loss and reenlistment rates in the extension years is the same for the fiscal year loss rate as for the cohort loss rate. This would be true if all extension losses and reenlistments occur at the end of the cohort year. This assumption will not introduce any serious distortion into our predictions given the small bonus effects under consideration.

For our application, the Blending Program calculates continuation rates and reenlistment rates for each IPM cell, assuming no bonuses are offered to any AFSC and that there is no program of early releases or of reenlistments before OETS.[3] The BEM modifies these rates to reflect the predictions consistent with an input bonus plan. (This is the same plan used to determine the size of the flows in the CAREERS program as described in Sec. II.) This modification increases the fiscal year rates by the same amount as the model predicts that cohort rates would increase because of the bonus plan.

The continuation rates and reenlistment rates are given for each IPM cell. In the YOS ranges with which we are concerned, an IPM cell is defined for each combination of category of enlistment, AFSC, grade, YOS, and years-to-ETS (YETS). In the BEM, we assemble the rates for each cohort that will reach OETS at a particular YOS in a particular AFSC, grade, and category of enlistment, and obtain five rates:

c(YETS) = continuation rate for persons in the IPM cell with
YETS = 1, 0, -1, and

---

[2]In the current specification, bonuses do not affect the outcome of extensions at all.
[3]This is the same Blending run needed by the YOS Target Generator.

r(YETS) = reenlist given stay rate for persons in the IPM cell with YETS = 1, 0.

Note that, by assumption, $r(-1) = 1.0$.

We then estimate the number of persons in the inventory at the start of the fiscal year[4] who will reenlist in each of the next three years. Let d = the number of decisionmakers and $n(y)$ = the number of persons reenlisting in the yth fiscal year relative to OETS; then

$$n(1) = d * c(1) * r(1) \tag{B.1}$$

$$n(0) = d * c(1) * [1 - r(1)] * c(0) * r(0) \tag{B.2}$$

$$n(-1) = d * c(1) * [1 - r(1)] * c(0) * [1 - r(0)] * c(-1). \tag{B.3}$$

The distribution of reenlistments among the four years in which the cohort may reenlist is defined as:

$F(y,b)$ = Fraction of reenlistments of the cohort that will occur during y if the bonus offer is b (b takes on only two values; $b = 0$ for AFSCs not offered a bonus, and $b = 1$ for bonus AFSCs).

For each zone we want the two distributions, $F(y,b)$, corresponding to $b = 0$ for AFSCs not offered a bonus and $b = 1$ for bonus AFSCs. Consequently, we sum the values of n given in Eqs. (B.1) and (B.3) over all cohorts reaching OETS in the zone and over all AFSCs with that value of b in the input bonus plan. Let $N(t,b)$ be the summed value of $n(t)$ over the AFSCs with bonus value b. Then

$$F(1,b) + F(2,b) = N(1,b)/[N(1,b) + N(0,b) + N(-1,b)], \tag{B.4}$$

$$F(0,b) = N(0,b)/[N(1,b) + N(0,b) + N(-1,b)], \tag{B.5}$$

$$F(-1,b) = N(-1,b)/[N(1,b) + N(0,b) + N(-1,b)]. \tag{B.6}$$

---

[4]The inventory counts are first adjusted to what they would be if there were no early release program and no early reenlistments.

It remains to divide Eq. (B.4) into the two components of the distribution [F(1,b) and F(2,b)]. We treat the fraction of the decisionmaking cohort who reenlist in the year preceding the year of their OETS as a constant that does not depend on the bonus offer at OETS, because it makes no sense to have persons responding to policies that they are unaware of at the time of their decision.[5] Let ER be the number of persons in a given zone who had their OETS in the current fiscal year, but who reenlisted before the current fiscal year. This number is known at the time of the model run. Let DM = the total number of decisionmakers for that zone and fiscal year.[6] Then we estimate that ER/DM of the decisionmakers in each AFSC will reenlist early each year. Under this assumption:

$$F(2,b) = (ER/DM) * (D_j/TOTALR_j) \tag{B.7}$$

for both values of b. Finally, we obtain F(1,b) by subtraction of Eq. (B.7) from Eq. (B.4).

ESTIMATING NUMBER OF REENLISTMENTS DURING EACH FISCAL YEAR

Let us number the fiscal years of the planning horizon, starting with the current fiscal year as 1. By definition, the number of persons reenlisting into AFSC j from the cohort reaching OETS in fiscal year c who reenlist in fiscal year t if the bonus offer for AFSC j in fiscal year c is B_{jc} is given by:

$$F(c - t + 1,(B_{jc}) * TOTALR_j(B_{jc}),$$

where F(y,b) is defined as 0 for y > 2 and y < -1.

---

[5] It may be possible to improve on this estimate by modeling the reenlistments in response to a *change* in the bonus rather than in response to the *level* of the bonus offer as our models do now.

[6] DM is the sum of D_j over all AFSCs j.

Persons reenlisting in any fiscal year come from at most four cohort years. In the current fiscal year, reenlistees come from the cohorts with c = -1, 0, 1, 2. For the first of these two cohorts, the bonus offer is history. Thus, from the point of view of the model, the number of reenlistments is predetermined. We call this number $RU_j(t)$, the reenlistments unaffected by the bonus that will occur in year t into AFSC j. In the operational EFMS it will be calculated in the middle-term disaggregate IPM (as the count of reenlistments in the current fiscal year for AFSC j out of the cells with YETS = 0, and YETS = -1). In the prototype BEM, it is calculated from a special IPM derived from the YOS Target Generator.

In fiscal year 2, the reenlistees come from cohorts c = 0, 1, 2, and 3. The reenlistees from cohort c = 0 are also unaffected by the bonus plan and are calculated from the IPM as the number of reenlistments in year 2 from YETS = -1. In fiscal year 3, the reenlistees come from cohorts 1, 2, 3, and 4. In this case the reenlistments unaffected by the bonus plan being considered now are from cohort 4. In the operational EFMS, this too can come from a run of the IPM with the current plan, because the number of persons who reenlist in the year before their OETS is assumed not to vary with the bonus offer at OETS.

Finally, the total number of persons reenlisting in year t in AFSC j if the bonus offer in each year c of the planning horizon is B_{jc} is given by:

$$R_j(B_{j1}, B_{j2}, B_{j3}) = RU_j(t) + \sum_c F(c - t + 1, b(B_{jc})) * TOTALR_{jc}(B_{jc}).$$

Appendix C

CALCULATING THE FUTURE INVENTORY PROFILE
IN THE INVENTORY TABLES

STRUCTURE OF INVENTORY ESTIMATES

To estimate the YOS profile of the future inventory, we first
isolate the cohorts that will be affected by the bonus offered during
the planning horizon. These are the decisionmakers that were discussed
in Sec. II. But now we need additional subscripts. Let

$D(j,c,k)$ = the number of decisionmakers in the cohort reaching OETS
in AFSC j during year c with YOS k at the beginning of c;

$TIMINV(j,c,k,t,B_{jc})$ = the number of decisionmakers in the cohort
reaching OETS in AFSC j during year c who will be present
and in YOS k at the end of year t if the cohort is offered
the bonus multiple B_{jc}, for $t \geq c$.[1]

By definition, all the inventory who are not counted in TIMINV are
unaffected by the bonus plan and will be counted in:

$IU(j,k,t)$ = count of the inventory in AFSC j unaffected by the
bonus offered during the planning horizon who are
in YOS k at the end of year t.

Then the total inventory for AFSC j, YOS k, and year t, $INV(j,k,t)$, is

$$INV(j,k,t) = IU(j,k,t) + \sum_{c=1}^{t} TIMINV(j,c,k,t) \qquad (C.1)$$

---

[1]This is the TIMED.INVENTORY variable in the EXPRESS program.

ESTIMATING NUMBER OF DECISIONMAKERS
REMAINING IN THE INVENTORY

To estimate the number of decisionmakers remaining in the inventory in each future year as a function of the bonus offer, we use a simple inventory projection model. As in the case of the calculations of the timing of reenlistments (Sec. II), we simplify the model by concentrating on cohort loss rates. We also omit modeling decisionmakers' AFSC changes that occur after reenlistment but before the end of the planning horizon. (These changes should be rare in any event and are forbidden for bonus recipients by regulation.) Finally, in the current implementation, a single attrition rate is used for losses after reenlistment for all AFSCs and year groups.

From the calculations in Sec. II we have·

$PR:STAY(j,c,k,B_{jc})$ = the estimated fraction of decisionmakers who will stay past their OETS from the cohort *reaching OETS in AFSC j during year c with YOS k* at the beginning of year c if the cohort is offered the bonus multiple B_{jc},

$PR:IR(j,c,k,B_{jc})$ = the estimated fraction of those staying past OETS who will reenlist before OETS, from the cohort reaching OETS in AFSC j during year c with YOS k at the beginning of year c if the cohort is offered the bonus multiple B_{jc}, and

$AFRENL(j,c,k,B_{jc})$ = the estimated number of persons who will reenlist out of the cohort reaching OETS in AFSC j during year c with YOS k at the beginning of year c if the cohort is offered bonus multiple B_{jc}.

Also define:

> a = average continuation rate in first years after reenlistment
>   in bonus year groups[2]

> $c0(j,k)$ = fraction of those who stay past their OETS in
>   extended status who will still be in the Air Force
>   a year after OETS.

> $r0(j,k)$ = fraction of those who reenlist during their first
>   extension year out of those who stay past their OETS
>   in extended status and are still in the Air Force a
>   year after OETS.

Then, for zones B, and C we use the following estimating equations:

$$TIMINV(j,c,k + 1,c,B_{jc}) = D(j,c,k) * PR{:}STAY(j,c,k,B_{jc}) \qquad (C.2)$$

$$TIMINV(j,c,k + 2,\overset{\bullet}{c} + 1,B_{jc}) = D(j,c,k) * PR{:}STAY(j,c,k,B_{jc}) *$$

$$(PR{:}IR(j,c,k,B_{jc}) * a + (1 - PR{:}IR(j,c,k,B_{jc})) * c0(j,k). \qquad (C.3)$$

$$TIMINV(j,c,k + 3,c + 2,B_{jc}) = AFRENL(j,c,k,B_{jc})$$

$$- D(j,c,k) * PR{:}STAY(j,c,k,B_{jc}) * PR{:}IR(j,c,k,B_{jc}) * (1 - a**2)$$

$$- D(j,c,k) * PR{:}STAY(j,c,k,B_{jc}) * (1 - PR{:}IR(j,c,k,B_{jc}))$$

$$* c0(j,k) * r0(j,k) * (1 - a). \qquad (C.4)$$

Equations (C.2) and (C.3) directly calculate those decisionmakers remaining in the Air Force. Equation (C.4) takes those who eventually reenlist and subtracts attrition losses for those reenlisting at or before OETS and for those reenlisting during the first extension year.

---

[2]a is approximately 0.98.

For zone A we multiply each of these three equations by the ratio of the total reenlistees into the specialty ("stay same" and retrained) to the reenlistees from the specialty (stay same). (In our notation this ratio is TOTALR/AFRENL.)[3] This is equivalent to assuming that CAREERS retrainees are assigned to their new AFSC at OETS. The inventory is not decremented for CAREERS trainees who are in technical training.

ESTIMATING THE INVENTORY UNAFFECTED BY THE BONUS

The inventory unaffected by the bonus offer during the planning horizon, $IU(j,k,t)$, is calculated from the middle-term disaggregate IPM (or from the IPM associated with the YOS Target Generator) as follows. Let

$INV(j,k,t,y)$ = the projected inventory for end of year t for AFSC j, YOS k, and YETS y, and

$RENLIN(j,k,c,t,e)$ = the estimated number of reenlistments during year t into AFSC j with YOS k at the end of the year, and term of enlistment e from the cohort reaching OETS in year c.

RENLIN is positive only for cohorts reaching OETS in a bonus zone.

The cohort from which the reenlistees come is determined from the YETS value of the cell from which the reenlistments come. For YETS = 2 or 1, the reenlistments are from cohort c = t; For YETS = 0, the reenlistments are from cohort c = t - 1; and for YETS = -1, the reenlistments are from the cohort c = t - 2.

---

[3]The multiplication by TOTALR/AFRENL is actually done for all zones in the program (step 6 in App. E) but the multiplier is 1 for zones B and C.

For t = the first year of the planning horizon, IU(j,k,t) is easily calculated as:

$$IU(j,k,1) = \sum_{y=-1,1}^{6} INV(j,k,1,y) - \sum_{e=4,6} RENLIN(j,k,1,1,e). \quad (C.5)$$

This equation should be obvious, because there is only one cohort to exclude from IU and it can appear in the inventory only as either first year extendees (y = 0, excluded from the first summation) or as reenlistees. Equation (C.5) applies only to k ≤ 15; for other k, IU is found by summing INV over all values of y.

For the other two years of the planning horizon, the situation is a little more complicated because we must exclude reenlistees retained from earlier decisionmaking cohorts as well as those from the current cohort. Also, the IPM does not maintain a memory of the cell from which the reenlistee came. In the calculations, we assume that losses and occupational flows occur to the model decisionmakers at the same rate as for others in the same AFSC, YOS, and YETS group. So, for the second year of the planning horizon, we have:

$$IU(j,k,2) = \sum_{y=1}^{6} INV(j,k,2,y) - \sum_{c=1}^{2} \sum_{e=4,6} RENLIN(j,k,c,2,e)$$

$$-INV(j,k,2,3) * RENLIN(j,k,1,1,4)/INV(j,k,1,4)$$

$$-INV(j,k,2,5) * RENLIN(j,k,1,1,6)/INV(j,k,1,6). \quad (C.6)$$

The last two subtrahends are the portions of the YETS 3 and 5 cells that come from model decisionmakers who reenlisted by the end of the first planning year. Equation (C.6) applies for k ≤ 15. For k = 16, calculate Eq. (C.6) and add INV(j,h,2,0). For other k, IU is found by summing inventory over all values of y.

For the third planning year we have:

$$IU(j,k,3) = \sum_{y=1}^{6} INV(j,k,3,y) - \sum_{c=1}^{3} \sum_{e=4,6} RENLIN(j,k,c,3,e)$$

-INV(j,k,3,2) * (RENLIN(j,k,1,1,4)/INV(j,k,1,4))

-INV(j,k,3,4)a * (RENLIN(j,k,1,1,6)/INV(j,k,1,6))

-INV(j,k,3,3) * (RENLIN(j,k,1,2,4) + RENLIN(j,k,2,2,4)/INV(j,k,2,4))

-INV(j,k,3,5) * (RENLIN(j,k,1,2,6) + RENLIN(j,k,2,2,6)/INV(j,k,2,6)). (C.7)

Equation (C.7) applies for $k \leq 15$. For $k = 16$, add INV(j,k,3,0). For $k = 17$, add INV(j,k,3,0) + INV(j,k,-1). For other k, IU is found by summing the inventory over all values of y.

Appendix D

OVERVIEW FLOW CHART OF THE BEM

Key A = AFSC
B = Bonus
Z = Zone
Y = YOS
T = Cohort
P = Plan year
◯ ▢ = Input file
▢ = Output file
* = Sent to Air Force
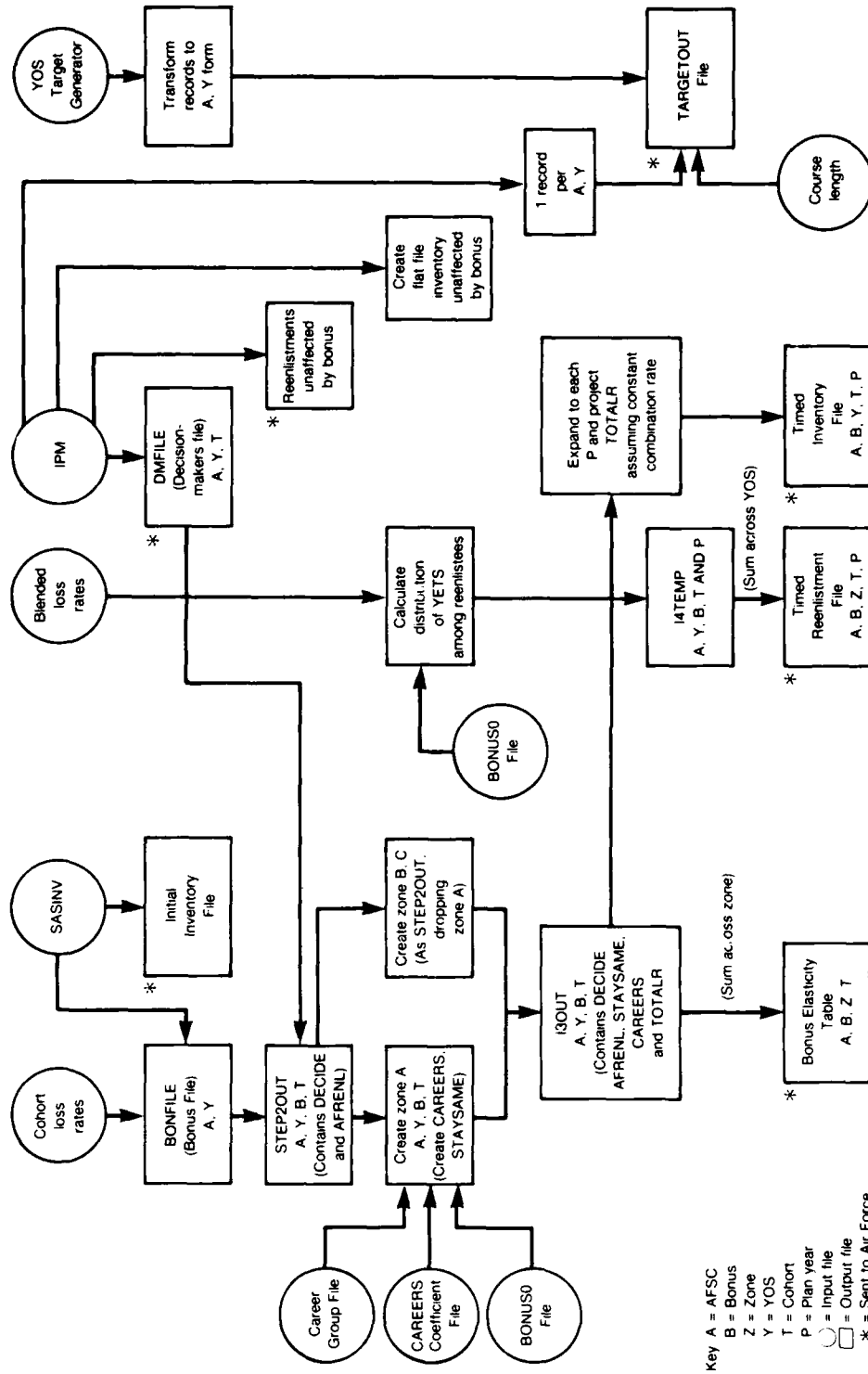
Appendix E

DOCUMENTATION OF THE SAS PROGRAMS FOR THE BEM

DESCRIPTION OF PROGRAMS

This section documents the SAS computer programs that build the data base for the BEM EXPRESS program. Because the code is long and complex, we divided it into functional parts, which we call "steps." There are seven steps; the output of each step is either an intermediate table or one of the final tables used in the BEM. There are seven SAS programs, each corresponding to one of the steps.

The documentation of the SAS programs is organized according to these steps. The documentation includes discussions of the intent of the algorithm and descriptions of the variables. An annotated computer specification of the algorithm is also provided at the end of the appendix. To describe the equations in the programs, we have broken down the documentation into "substeps"--Step 1a, 1b, 2a, etc. The substeps also appear in the SAS programs for reference purposes.

STEP 1

The output of this step is an intermediate file with one record for each AFSC and YOSETS (YOS at ETS), giving the logit parameters for the expected outcomes of the term if the bonus offer at ETS is 0. The term outcomes that are calculated are:

1. leaving the Air Force before ETS,
2. being in extended status at ETS given that one has stayed past ETS in an extension,
3. leaving the Air Force after having stayed past ETS in an extension.

There are two inputs for Step 1. The first is four files containing airman inventory. Each file corresponds to a category of enlistment (CATENL) and contains one record per IPM cell.

The second input is the data for cohort loss rates. This data set also contains one record per IPM cell.

Step 1a

The four input inventory files are assembled into a single file, selecting only records with CATENL $\leq$ 3 and YOS $\leq$ 13 and YETS $\leq$ 1.

Step 1b

Next the cohort loss rates are input and, as in Step 1a, only records with CATENL $\leq$ 3 and YOS $\leq$ 13 and YETS $\leq$ 1 are selected. At this point, loss rates and reenlistment rates are adjusted to reflect assumptions about unemployment and military pay if they are different from those in the input file. Loss rates and reenlistment rates are also adjusted to a no-bonus level if necessary. The variable YOSETS is calculated. It gives the YOS that the inventory in the cell will have (or had) at OETS.

Step 1c

The two files are sorted by AFSC, YOS, YETS, GRADE, and CATENL and merged. (If a cell in the cohort loss rate file is not present in the inventory file, then the variable FORCE giving the inventory is set close to zero.)

To check on the consistency of the coding of IPM cells in the inventory and loss model file, a separate data set (CHKDAT) is created containing records for inventory cells without loss rates. This file should be empty (or at least nearly so). Another data set, CHK2, is created containing records with out-of-range values for continuation rates or reenlist given stay rates.

The average loss rate (expressed as a continuation rate, XCONT) and reenlistment rate (XRENL) are calculated for each AFSC, YOS, and YETS. The averages are across grades (GRADE) and CATENL and are weighted by the inventory count.

Step 1d

The file is sorted by AFSC and YOSETS to create a record giving the continuation rates and the reenlistment rates at YETS = 1, 0, and -1 for the cohort that reaches OETS with a YOS given by YOSETS. These rates are trimmed to be within 0.0001 and 0.9999.

Step 1e

The logit parameter corresponding to the following rates are calculated:

1. leaving the Air Force before ETS (ALPHA),
2. being in extended status at ETS given that one has stayed in the Air Force past ETS (ALPHAR1),
3. leaving the Air Force as the outcome of an extension (ALPHAR2).

STEP 2

This step adds a bonus dimension and cohort dimension to the file produced in Step 1. To do this, the Step 1 file is expanded to one record per AFSC, YOSETS, bonus level, and plan year. Additional variables are also calculated here: the probability that a person reaching OETS will ever reenlist given a specific bonus level, and the number of persons from the cohort who would ever reenlist at that bonus level.

The inputs for Step 2 are the intermediate output file created in Step 1 and the Decision-Maker File (DMFILE). The DMFILE contains one record for each AFSC, YOSETS, and cohort year (COHYEAR). Each record contains one variable--DECIDE--that is the number of airmen in the cohort who are scheduled to reach OETS during that plan year for each AFSC and YOSETS.

Another set of inputs for Step 2 are the bonus coefficients from the middle-term disaggregate loss model. These coefficients are written into the code.

Step 2a

This step produces one record for each AFSC and YOSETS that contains three variables (NX87, NX88, and NX89), each giving the number of decisionmakers in one of the plan years.

Step 2b

The file created in Step 2a is merged with the output from Step 1. For each record on the Step 1 file, three records are created, one for each cohort year.

Step 2c

For each record in the file created in Step 2b, 11 records are written, one for each value of bonus from 0 to 5.0 in increments of 0.5. Each record gives the probability that a person reaching OETS will ever reenlist given that value of the bonus.

The probabilities of each of the three term outcomes described in Sec. III above are calculated at the specified bonus offer. These are based on input logit parameters from Step 1 and the logit coefficients on the bonus derived from the middle-term loss models. These coefficients are specified in the program for ranges of YOSETS.

Using the probabilities of the three-term outcomes calculated in the previous step, the probability of ever reenlisting (YER) is calculated from Eq. (2.3). In addition, the number of persons from the cohort who would reenlist at that bonus value (AFRENL) is also calculated (AFRENL = DECIDE * YER).

Step 2d

The data set is sorted according to AFSC, YOSETS, BONUS, and COHYEAR.

STEP 3

The major purpose of this step is to calculate the occupational decisions of airmen (careers flows). The output of this step is an intermediate file of the same format as the Step 2 output, but additionally containing (1) STAYSAME = the number of persons who choose to remain in a particular AFSC, (2) CAREERS = the number of persons flowing into a particular AFSC throughout cross-training, and (3) TOTALR = the total number of persons reenlisting into a particular AFSC. These variables are also conditioned on bonus offer, cohort year, and YOSETS, as are the variables in Step 2.

There are four inputs to Step 3: (1) the file created in Step 2, (2) the parameters of the careers program, (3) the CFG for each AFSC, and (4) the bonus file giving the bonus multiples for each AFSC by zone and bonus period. The second file contains seven parameters for each AFSC. These are:

  (1) STAYSC(AFSC), a constant term for the regression of the probability that a person who is in an AFSC in the first term and who reenlists will choose to remain in that AFSC for the second term,

  (2-6)CARCON(CFG,AFSC), the coefficient for the probability that a person who wishes to train out of a specialty in the CFG will choose to train into the particular AFSC. There are five parameters for the five values of CFG,

  (7) CARFLOW(AFSC), a dummy variable taking on the value of 1 if an AFSC can receive retrainees in the CAREERS program, 0 otherwise.

Step 3a

The input file giving the CAREERS parameters is merged with the file giving the CFG for an AFSC, in order to append the CFG and the seven parameters of the CAREERS program to that AFSC. If the AFSC does not appear in the parameter file, then we treat it as a capper and assume that no one transfers into it through the CAREERS program. Thus, STAYSC is set to 1.0 and CARFLOW is set to 0.0.

Step 3b

The file from Step 3a is merged with the intermediate file created in Step 2 by AFSC. Only records for which we have Step 2 data are kept. This file is divided into two files according to zone. Records with YOSETS = 3-5 go into file TZONEA, while other records go into TZONEBC.

Step 3c

The number of reenlistees who will remain in the AFSC (rather than participating in CAREERS retraining) is calculated (STAYSAME) for the bonus offer given by BONUS:

$$STAYSAME = MIN(1, STAYSC + 0.0622 * BONUS) * AFRENL$$

We also calculate the number of persons who leave the AFSC for another through the CAREERS program (CAROUT):

$$CAROUT = AFRENL - STAYSAME$$

For each of the five CFGs we calculate variables (PRSK, PREM, PRCR, PRFS, PROT) giving the numerators of Eq. (A.5). This is the first step in calculating the probabilities that a person who wishes to train out of a specialty in each CFG will choose to train into each AFSC bonus offer.

Step 3d

At this point the zone A bonus multiples for each AFSC are input for a previous bonus plan (bonus period). This bonus data are merged with the data set from Step 3c to select the particular records from the Step 3c file that have the bonus value corresponding to the input bonus plan.

Step 3e

The number of persons from each CFG who participate in the CAREERS program is found by summing CAROUT over the AFSCs in the CFG. These values are saved as CAROUT in data set POOL3.

The denominators for Eq. (A.5), the probability that a person who wishes to train out of a speciality in each CFG will choose to train into a particular AFSC is found by summing the numerators of Eq. (A.5) over *all* AFSCs. This is data set POOL2.

Step 3f

These "pools" are merged by year (COHYEAR) into a SAS data set (POOLTMP) with one record for each year and CFG. Each record contains all five values of the denominator of Eq. (A.5) (one for each CFG), but only the CAREERS outflow for the CFG. In data set POOL the records are combined to one record per year with five additional variables giving the value of CAROUT corresponding to each CFG.

Step 3g

The data sets POOL and ZONEA (containing the values for STAYSAME and the numerator for the individual CFG probabilities) are merged by year.

The probability that a person who wishes to train out of a specialty in his CFG will choose to train into the particular AFSC of the record if the bonus offer is given by the bonus variable on the record is calculated and stored in array PROB(CFG).

The variable CAREERS is calculated, which is the number of persons who would enter the AFSC through the CAREERS program if this AFSC had a bonus offer of BONUS and all other AFSCs had the bonus offer given in the selected bonus plan:

$$CAREERS = \Sigma POOL(CFG) * PROB(CFG).$$

The output of this step is data ZONEA2.

Step 3h

The intermediate data set I3OUT is created by appending the data sets ZONEA2 with ZONEBC. The merged data set is organized by AFSC, COHYEAR, BONUS, and YOSETS.

The total reenlistments that will flow into the particular AFSC (TOTALR) is computed:

1. If Zone is A then TOTALR = CAREERS + STAYSAME (taking into account CAREERS program).
2. Otherwise, for Zones B and C, TOTALR = AFRENL.

Step 3i

The variable SOMEBON (specifies whether a bonus was received) is created for later use in Step 5.

STEP 4

This step creates the Bonus Elasticity Table from the output of Step 3. The intermediate file I3OUT is input and the file is summed across YOSETS giving one record for each AFSC, zone, cohort year, and bonus multiple.

On the record defined by each combination of AFSC, zone, cohort year, and bonus multiple, the variables included are (1) the number of decisionmakers (DECIDE), (2) the number of persons from a cohort that would ever reenlist (AFRENL), (3) the number of reenlistees who will remain in the AFSC (rather than participating in CAREERS retraining) (STAYSAME), (4) the number of persons who would enter the AFSC through the CAREERS program (CAREERS), and (5) the total reenlistments that will flow into the particular AFSC (TOTALR).

STEP 5

The aim of this step is to calculate the data array "TIMERENL," which provides the number of reenlistments in a plan year for a particular AFSC, zone, cohort, and bonus offer. This data set contains one record for each AFSC, zone, bonus multiple, plan year, and cohort. In addition to the subscripts, each record contains only one variable, TIMERENL--the number of reenlistments.

There are six inputs for this step. They are (1) the inventory files described in Step 1, (2) the number of early reenlistments for each IPM cell, (3) the blended loss rates, (4) the decisionmaker file described in Step 2, (5) the bonus file containing bonus multiples by AFSC described in Step 3, and (6) the intermediate output file created in Step 3.

Step 5a

The inventory files are input in this step and combined with the number of early reenlistments for each category of enlistment. The three resulting merged files for each category of enlistment are assembled into one file. These inventory files are input in order to weight the observations giving the timing of reenlistments.

Step 5b

The blended loss rates are input and assembled into one record per AFSC, YOSETS, GRADE, and YETS. A value of CATENL is selected for each YOSETS and other records are deleted. At this point, the continuation rate (CONTRT1, CONTRT0, CONTM1) and the reenlistment rate (reenlist given stay) (REEN1, REEN0, REENM1) obtained from the blended loss rates are created for YETS = 1, 0, and -1, respectively. These rates are trimmed to be within but not equal to 0 and 1.

Step 5c

The data set from Step 5b is merged with the inventory counts from Step 5a by AFSC, YOSETS, and GRADE. Records are included only if the data are present in both data sets.

Step 5d

The bonus file described in Step 3 is input and a given bonus plan (same one as in Step 3) is selected. This data set is sorted by AFSC and zone.

Step 5e

The bonus file from Step 5d is input and merged with the file from Step 5c giving reenlistment and inventory information by AFSC and zone. A variable is created documenting whether a bonus has been received for that AFSC during the selected bonus period (SOMEBON = 1 if the bonus was > 0). The blended loss rates are adjusted to reflect rates at the bonus amount on the file using the linear coefficients from the middle-term loss models.

The fraction of persons who will reenlist is estimated for the following time periods:

1. in the fiscal year containing OETS (NREEN1),
2. in the first fiscal year following the fiscal year containing OETS (NREENO),
3. in the second fiscal year following the fiscal year containing OETS (NREENM1).

Each rate is weighted by the number of people reaching ETS in the first plan year in that AFSC and YOSETS.

Step 5f

We calculate the sum of the reenlistments in each of the three YETS over two groups of AFSCs, those with a bonus and those without a bonus.

Step 5g

In this step, the inventory file is merged with the bonus file for later use calculating the fraction of early reenlistments (from cells with YETS = 2) to the six average reenlistment rate values.

The fraction of early reenlistments is calculated for six categories: two fractions for each zone--one for AFSCs with a bonus and one for AFSCs without. The fraction (FREARLY) is the number of early reenlistments divided by the sum of the inventory and the number of early reenlistments.

Step 5h

Data from Steps 5f and 5g are combined to estimate the distribution of reenlistments over the years to ETS (Eqs. (4.4) through (4.7)).

The distributions of average reenlistment rates are used to distribute the total reenlistment count flowing into a particular AFSC (TOTALR) across calendar time. We assume that the number of persons who reenlist early (with YETS = 2) is unaffected by the bonus amount.

To do this, we merge the data set with the distributions of the reenlistment rate that incorporate the fraction of early reenlistments (DISTR) with the intermediate data set from Step 3 (I3OUT). This data set (ADDDISTR) is disaggregated to one record per AFSC, YOSETS, BONUS, and COHYEAR.

For the cohort of the first planning year, the number of early reenlistments (ERENL) must be subtracted from TOTALR. We obtain ERENL from the inventory file. Thus, this file is aggregated by AFSC and YOSETS and merged with ADDDISTR.

Step 5i

The resulting data set from Step 5h has the necessary information
to calculate the timed reenlistments (TIMRENL) for each plan year. This
is done for each plan year relative to the cohort year.

In general, TIMRENL is the product of TOTALR and the distribution
of reenlistments at each YETS. However, if the plan year is the same as
the cohort year and the plan year ha, pens to be the first plan year in
the BEM, then we subtract the observed early reenlistments from the
total predicted for YETS = 2 and YETS = 1:

$$TIMRENL = MAX(0,(RREEN2 + RREEN1) * TOTALR-ERENL)$$

This data file is summed across YOSETS within the zone, yielding
the final output data set (TIMERENL).

STEP 6

This step creates the timed inventory file (TIMEINV), containing
one record per AFSC, YOS, cohort (COHYEAR), fiscal year of the planning
horizon (FYINV), and bonus level. Each record contains only one
variable, TIMEINV, which is the number of people from that year's cohort
who will be in the inventory in that planning year with the specified
YOS and AFSC. There is only one input for this step, the intermediate
output file from Step 3.

For each cohort of the *current* planning year, there are three
records in the output file (when current year is 1987, then a record for
1987, 1988, and 1989 are output). Likewise, for each cohort of the next
planning year, only two records are output (1988 and 1989). The
variable indexing the planning years to be output is FYINV.

For each record, the size of the cohort that would be present is
calculated. Attrition rates in the first year or two after reenlistment
are estimated using a single constant (currently 0.02) for all AFSCs and
YOS. This constant is stored in the variable CATTR as the percentage
remaining after attrition in any year following reenlistment.

The equations in the program are 5.1, 5.2, and 5.3   In the program variable names they are as follows:

TIMINV(1) = (TOTALR/AFRENL) * DECIDE * YSTAY

TIMINV(0) = (TOTALR/AFRENL) * DECIDE * YSTAY * (YIR * CATTR + (1 - YIR) * CONTRTO)

TIMINV(-1) = (TOTALR/AFRENL) * (AFRENL - DECIDE * YSTAY * ((1 - CATTR) * (1 + CATTR)) - DECIDE * YSTAY * (1 - YIR) * CONTRTO * REENO * (1 - CATTR))

STEP 7

This step creates the file TARGET, which contains information on the inventory targets. The input is a SAS file containing the target inventory for each year of the planning horizon as it is output from the YOS Target Generator. In the prototype, there is one record for each AFSC, grade, termtype,[1] and fiscal year. Each record contains the target inventory for each of the eight YETS cells in a termtype. When the YOS Target Generator is converted to an operational program, the input data will contain the inventory for each cell in that version of the generator.

The second input file gives the inventory unaffected by the bonus. This is array IU described in Sec. V, as produced by the IPM associated with the YOS Target Generator. These IPM counts include persons in training. A file containing the fraction of the first year spent in training for each AFSC is used to remove those in training.

Step 7a

A table is set up that gives the YOSETS for each termtype. It is used to assign YOS to each of the eight inventory counts on the input file. This step should be unnecessary after the YOS Target Generator has been converted to its planned form.

---

[1] A termtype is a collection of IPM cells.

Step 7b

The target inventory counts are summed to produce a single count
for each combination of YOS, AFSC, and fiscal year.

Step 7c

The inventory unaffected by the bonus is input and a record for
each AFSC, YOS, and plan year (FYINV) is created.

Step 7d

The file STUDNTFR gives the fraction of the first year inventory
that is in training. These data are merged with the file from Step 7c
and students removed from the inventory counts.

Step 7e

The files from Step 7b and 7d are merged to produce the output
file, containing one record per AFSC, plan year, and YOS. In addition
to the subscript, it contains only the inventory and target variables.

LISTING OF SAS PROGRAMS FOR THE BONUS ELASTICITY MODEL

Provided below are the actual SAS programs that are used in
creating the BEM. The step numbers refer to the discussion above, which
comments on these programs.

STEP 1

```
//S0139BM1 JOB (1807,300,6,8),'BAM(STEP1)',CLASS=N
//S1 EXEC SAS
//*
//*  STEP1: INPUT DATA FILES
//*
//INFILE1 DD DSN=B.B6005.A1807.INV.CAT1,DISP=SHR
//INFILE2 DD DSN=B.B6005.A1807.INV.CAT2,DISP=SHR
//INFILE3 DD DSN=B.B6005.A1807.INV.CAT3,DISP=SHR
//INPDG DD DSN=B.B6005.A1807.LOSSES.IPM1ETS,DISP=SHR
//       DD DSN=C.C2292.A1807.LOSSES.IPM1EXT,DISP=SHR
//       DD DSN=A.A0353.A1807.LOSSES.IPM2ETS,DISP=SHR
//       DD DSN=A.A0353.A1807.LOSSES.IPM2EXT,DISP=SHR
//       DD DSN=A.A0353.A1807.LOSSES.IPMCETS,DISP=SHR
//       DD DSN=A.A0353.A1807.LOSSES.IPMCEXT,DISP=SHR
//       DD DSN=C.C2292.A1807.LOSSEXTR,DISP=SHR
```

```
//OUT DD DSN=S.S0139.A1807.FY86IPM.BONFILE,VOL=SER=USER36,
//      UNIT=USER,DISP=(NEW,CATLG),SPACE=(TRK,(30,10),RLSE)
//SYSIN DD *


    OPTIONS NOCENTER;

****   STEP 1A:   ****;

    DATA CELL1;
      SET INFILE1.INVCAT1;

        LENGTH YETS 4;

          YETS=TOE-YOS;

          IF (YETS=-1 OR YETS=0 OR YETS=1) AND YOS <= 13;
          CATENL=1;
          DROP TOE;

    DATA CELL2;
      SET INFILE2.INVCAT2;

          CATENL=2;

          IF (YETS=-1 OR YETS=0 OR YETS=1) AND YOS <= 13;

    DATA CELL3;
      SET INFILE3.INVCAT3;

          CATENL=3;
          IF (YETS=-1 OR YETS=0 OR YETS=1) AND YOS <= 13;

    PROC APPEND BASE=CELL1
              DATA=CELL2;

    PROC APPEND BASE=CELL1
              DATA=CELL3;

  PROC SORT DATA=CELL1;
    BY AFSC YOS YETS GRADE CATENL;

   ****   STEP 1B:   ****;

    DATA INPLR;
        LENGTH DEFAULT=4;
          INFILE INPDG;

          INPUT  @ 1 CATENL    1.
                 @ 2 AFSC      $CHAR6.
                 @ 8 GRADE     2.
```

```
                    @10  YOS      2.
                    @12  TOE      2.
                    @14  YETS     2.
                    @16  ESLOSS   9.6
                    @25  ES_EXT   9.6;
        IF AFSC='871X0' THEN AFSC='871X0A';
        IF YETS=-1 THEN ES_EXT=0;

        IF (YETS=-1 OR YETS=0 OR YETS=1) AND YOS <= 13;

        CONTRT=1-ESLOSS;
        RENLGS=1-ES_EXT;

        YOSETS=YOS + YETS - 1;
```

```
*******************************************************************
*IF UNEMPLOYMENT RATE OR MIL/CIV PAY RATIO ARE PREDICTED TO DIFFER **
*FROM THAT USED IN THE INPUT FILE, ADJUST LOSS RATES HERE          **
*******************************************************************;


****  STEP 1C:  ****;

  PROC SORT DATA=INPLR;
      BY AFSC YOS YETS GRADE CATENL;

  DATA INVDATA CHKDAT;

  MERGE INPLR (IN=HAVLR) CELL1 (IN=HAVINV);
      BY AFSC YOS YETS GRADE CATENL;

      IF HAVINV=0 THEN FORCE=0.00001;
      XCONT=FORCE*CONTRT;
      XRENL=FORCE*RENLGS;


        IF HAVLR=1 THEN OUTPUT INVDATA;
            ELSE OUTPUT CHKDAT;



  PROC FREQ DATA=CHKDAT;
     TABLES CATENL*YOS*YETS
            CATENL*AFSC/LIST;
     WEIGHT FORCE;

   DATA CHK2;
   SET INPLR;
   IF CONTRT < 0 OR CONTRT > 1 OR RENLGS < 0 OR RENLGS > 1;

  PROC PRINT DATA=CHK2(OBS=1000);
```

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```
    TITLE PRINTOUT OF DATASET CHK2 CHECKS RANGES;

  PROC SUMMARY NWAY DATA=INVDATA;
      CLASS AFSC YOSETS YETS;
         VAR FORCE XCONT XRENL;

        OUTPUT OUT=SUMFILE SUM=;

  PROC PRINT DATA=SUMFILE(OBS=500);
  TITLE PRINTOUT OF DATASET SUMFILE (SUMMARY OF INVENTORY DATA);

     DATA AVGFILE;
       SET SUMFILE;
       CONTRT=XCONT/FORCE;
       RENLGS=XRENL/FORCE;

     DROP XCONT XRENL;

**** STEP 1D:   ****;


  PROC SORT DATA=AVGFILE;
     BY AFSC YOSETS YETS;

  DATA OUT.BONFILE;
     SET AVGFILE;

        BY AFSC YOSETS YETS;

     RETAIN CONTM1 CONTRT0 CONTRT1
            REENM1 REEN0 REEN1 NYETS1;

  ARRAY CRATE(I) CONTM1 CONTRT0 CONTRT1;
  ARRAY REENL(I) REENM1 REEN0   REEN1;



     I=YETS+2;
     CRATE=CONTRT;
     REENL=RENLGS;

    IF FIRST.AFSC OR FIRST.YOSETS THEN NYETS1=0;
    IF YETS=1 THEN NYETS1=FORCE;


IF LAST.AFSC OR LAST.YOSETS THEN DO;

       DO OVER CRATE;

          IF CRATE <= 0 THEN CRATE=0.00001;
```

```
        IF CRATE >= 1 THEN CRATE=0.99999;

        IF REENL <= 0 THEN REENL=0.00001;

        IF REENL >= 1 THEN REENL=0.99999;
     END;


**** STEP 1E:   *****;


 ALPHA=LOG((1-CONTRT1)/CONTRT1);

 ALPHAR1=LOG((1-REEN1)/REEN1);

   EVERR=CONTRT0*(REEN0 + (1-REEN0)*CONTM1);

   IF EVERR > 0 AND EVERR < 1 THEN
        ALPHAR2=LOG((1-EVERR)/EVERR);

   OUTPUT;
END;

PROC CONTENTS DATA=OUT._ALL_;

//
```

STEP 2

```
//S0139BM2 JOB (1807,200,6,8),'BAM(STEP2)',CLASS=N
//S1 EXEC SAS
//*
//*  STEP 2:   INPUT DATA FILES
//*
//INFIL1 DD DSN=S.S0139.A1807.FY86IPM.BONFILE,DISP=SHR
//INFIL2 DD DSN=C.C2292.A1807.DMFILED,DISP=SHR
//OUT DD DSN=S.S0139.A1807.FY86STP2.OUT,VOL=SER=USER41,
//     UNIT=USER,DISP=(NEW,CATLG),SPACE=(TRK,(500,300),RLSE)
//SYSIN DD *


****************************************************************
*   STEP 2:   CREATE BONUS ELASTICITY TABLE:   *
*   READ IN FILE CREATED IN STEP 1 (SEE        *
*   PROGRAM CALLED BAM(STEP1)  AND EXPAND       *
*   TO ONE RECORD PER AFSC, YOSETS, AND         *
*   BONUS LEVEL.                                *
**************************************************************** ;


OPTIONS NOCENTER;

     PROC PRINT DATA=INFIL1.BONFILE(OBS=100);
     ITLE PRINTOUT OF INPUT FILE CREATED IN STEP 1;


     PROC PRINT DATA=INFIL2.DMFILED(OBS=100);
     TITLE PRINTOUT OF DMFILED (FIRST 100 OBS);

****  STEP 2A:  ****;

 DATA DM;
 LENGTH DEFAULT=4;

 RETAIN NX87 NX88 NX89;

    SET INFIL2.DMFILED;
    BY AFSC YOSETS COHYEAR;

       IF FIRST.YOSETS THEN DO;

          NX87=0;
          NX38=0;
          NX89=0;

       END;

       IF COHYEAR=87 THEN NX87=DECIDE;
```

```
         IF COHYEAR=88 THEN NX88=DECIDE;
         IF COHYEAR=89 THEN NX89=DECIDE;

         IF LAST.YOSETS THEN OUTPUT;

****  STEP 2B  ****;

     DATA BONFIL2;
       MERGE INFIL1.BONFILE(IN=HAVBON) DM(IN=HAVDM);
       BY AFSC YOSETS;

     IF HAVBON;

     IF HAVDM=0 THEN DO;
       DECIDE=0;
       COHYEAR=87;
       OUTPUT;

       COHYEAR=88;
       OUTPUT;

       COHYEAR=89;
       OUTPUT;

     END;

     ELSE DO;
         DECIDE=NX87;
         COHYEAR=87;
         OUTPUT;

         DECIDE=NX88;
         COHYEAR=88;
         OUTPUT;

         DECIDE=NX89;
         COHYEAR=89;
         OUTPUT;

     END;

****  STEP 2C:  ****;

     DATA OUT.STEP2;
         SET BONFIL2;

     ARRAY BONARRAY(I) BON1-BON11;

     DROP BON1-BON11;

     RETAIN BON1 0.0BON2 0.5 BON3 1.0 BON4 1.5 BON5 2.0
```

```
             BON6 2.5 BON7 3.0 BON8 3.5 BON9 4.0 BON10 4.5
             BON11 5.0;


****************************************************************************
** INCORPORATING THE LOGIT COEFFICIENTS FROM THE MID-TERM LOSS MODELS   **
****************************************************************************;


     BONO=0.0;

     IF YOSETS <= 5 THEN DO;
        BONE=-0.3993;
     END;


     IF YOSETS > 5 AND YOSETS <= 10 THEN DO;
        BONL=-0.2490;
        BONE=-0.6637;
     END;

     IF YOSETS = 11 THEN DO;
        BONL=-0.33;
        BONE=-0.0;
     END;

     IF YOSETS = 12 THEN DO;
        BONL=-0.20;
        BONE=-0.0;
     END;

     IF YOSETS = 13 THEN DO;
        BONL=-0.12;
        BONE=-0.0;
     END;


   DO I=1 TO 11;
     BONUS=BONARRAY;

   IF YOSETS <= 5 THEN DO;
               IF BONUS =  ).0 THEN X= 0.0;
           ELSE IF BONUS =  0.5 THEN X=-0.0743;
           ELSE IF BONUS >= 1.0 THEN X=-0.1486 + (BONUS-1) * (-0.0576);
           YSTAY = 1/(1 + EXP(ALPHA + X));
   END;

   ELSE   YSTAY  = 1/(1+EXP(ALPHA+BONL*BONUS));
          YIR    = 1/(1+EXP(ALPHAR1+BONE*BONUS));
          YEREXT = 1/(1+EXP(ALPHAR2+BONO*BONUS));
          YER    = YSTAY*(YIR+(1-YIR)*YEREXT);
          AFRENL=DECIDE*YER;
```

```
      OUTPUT;
  END;

      KEEP AFSC YOSETS YETS BONUS COHYEAR DECIDE AFRENL
          YSTAY YIR YER CONTM1 CONTRTO CONTRT1
          REENM1 REENO REEN1;

***** STEP 2G:  *****;

    PROC SORT DATA=OUT.STEP2;
      BY AFSC YOSETS BONUS COHYEAR;

    PROC PRINT DATA=OUT.STEP2(OBS=100);
    TITLE DATASET OUT.STP2--AFSC AND BONUS;

//
```

STEP 3

```
//S0139BM3 JOB (1807,400,6,8),'BAM(STEP3)',CLASS=S
//S1 EXEC SAS,REGION=2000K
//WORK DD UNIT=USER,VOL=SER=TEMP11,SPACE=(6160,(1000,400),,,ROUND)
//*
//*  STEP 3:  INPUT DATA FILES
//*
//INP1 DD DSN=S.S0139.A1807.FY86STP2.OUT,DISP=OLD
//INP2 DD DSN=S.S0139.A1807.FY86.COEFFOUT,DISP=OLD
//INP3 DD DSN=B.B6005.A1807.EDITED.CEMPG86.DAT,DISP=SHR
//INP4 DD DSN=B.B6005.A1807.EDITED.BO.FY86,DISP=SHR
//I3OUT DD DSN=FY86.STEP3OUT,DISP=NEW,VOL=SER=006149,
//      UNIT=HIGH9,DCB=DEN=4,LABEL=2
//SYSIN DD *


OPTIONS NOCENTER;

     PROC PRINT DATA=INP1.STEP2(OBS=100);
     TITLE PRINTOUT OF INPUT FILE CREATED IN STEP 2;
     PROC CONTENTS DATA=INP1._ALL_;

****  STEP 3A:  ****;

DATA CAREERS;
     INFILE INP2;

     INPUT AFSC $ 1-6 (STAYSC CCONSK CCONEM CCONCR CCONFS
           CCONOT) (8.4) CARFLOW 2.;

     PROC PRINT DATA=CAREERS(OBS=100);
     TITLE PRINTOUT OF INPUT CAREER COEFFICIENT FILE;


   DATA CFGPFILE;
      LENGTH DEFAULT=4;
      INFILE INP3;
      INPUT   ATTLE      $    1 - 25
              AFSC       $   29 - 34
              CFGP       $   41 - 46
              TIER       $   50 - 53
              PCFGP      $   55 - 61   ;
      KEEP AFSC CFGP;

     IF CFGP='SKETCH' THEN CFGP='SKTECH';

   PROC SORT DATA=CFGPFILE;      BY AFSC;
   PROC SORT DATA=CAREERS ;      BY AFSC;

     PROC PRINT DATA=CFGPFILE(OBS=100);
```

```
     TITLE PRINTOUT OF SCFILES (AFSC AND CFGP);

 DATA CFFILE;

    MERGE CAREERS(IN=HAVCAR) CFGPFILE;
      BY AFSC;
         IF HAVCAR=0 THEN DO;
             STAYSC=1.0;
             CARFLOW=0;
         END;

 PROC PRINT DATA=CFFILE(OBS=50);
 TITLE PRINTOUT OF CFFILE;

****  STEP 3B:  ****;

  DATA TZONEA ZONEBC;

    MERGE CFFILE INP1.STEP2(IN=HAVDAT);
      BY AFSC;

    IF HAVDAT;

   STAYSAME=.;
   CAREERS=.;

   IF AFSC='293X3' THEN DELETE;


   IF YOSETS=3 OR YOSETS=4 OR YOSETS=5 THEN OUTPUT TZONEA;
   ELSE OUTPUT ZONEBC;

****  STEP 3C:  ****;

  DATA ZONEA;
    SET TZONEA;

      STAYSAME=MIN(1,STAYSC+0.0622*BONUS)*AFRENL;
      CAROUT=AFRENL-STAYSAME;

    IF CARFLOW=1 THEN DO;
      PRSK=EXP(CCONSK+0.264*BONUS);
      PREM=EXP(CCONEM+0.264*BONUS);
      PRCR=EXP(CCONCR+0.264*BONUS);
      PRFS=EXP(CCONFS+0.264*BONUS);
      PROT=EXP(CCONOT+0.264*BONUS);
    END;


      PROC PRINT DATA=ZONEA(OBS=100);
      TITLE PRINTOUT OF ZONEA;
```

```
**** STEP 3D:  ****;

   DATA BONA;

     INFILE INP4;

     INPUT @ 1  AFSC     $CHAR6.
           @ 8  PERIOD   $CHAR2.
           @ 11 ZONE     $CHAR1.
           @ 30 BONUS    4.1 ;

     IF PERIOD='44' AND ZONE='A';
** PERIOD 44 GOES FROM 10/31/85 TO PRESENT **;


     ACTBON=BONUS;
     DROP BONUS;


        DATA CAROUTFL;
        MERGE ZONEA(IN=HAVCNT) BONA(IN=HAVBON);
        BY AFSC;
        IF (HAVBON=1 AND BONUS=ACTBON) OR (BONUS=0 AND HAVBON=0);
        ACTBON=BONUS;
        DROP BONUS;

        PROC PRINT DATA=CAROUTFL(OBS=500);

**** STEP 3E:  ****;

        PROC SUMMARY DATA=CAROUTFL;
        CLASS COHYEAR CFGP;
        VARIABLE CAROUT PRSK PREM PRCR PRFS PROT;
        OUTPUT OUT=POOL1 SUM = CAROUT SUMSK SUMEM SUMCR SUMFS SUMOT;
        PROC PRINT DATA=POOL1;
        TITLE PRINTOUT OF SUMMARY OF CAROUTFL, SUMS;

        DATA POOL2;
           SET POOL1;

           IF _TYPE_=2;

           KEEP COHYEAR SUMSK SUMEM SUMCR SUMFS SUMOT;

        PROC PRINT DATA=POOL2(OBS=100);
        TITLE PRINTOUT OF POOL2;

        DATA POOL3;
           SET POOL1;

           IF _TYPE_ = 3;
```

```
        KEEP COHYEAR CFGP CAROUT;

    PROC PRINT DATA=POOL3(OBS=100);
    TITLE PRINTOUT OF POOL3;

**** STEP 3F:  ****;

    DATA POOLTMP;
        MERGE POOL2 POOL3;
            BY COHYEAR;

    PROC PRINT DATA=POOLTMP(OBS=50);
    TITLE PRINTOUT OF POOLTMP;


    DATA POOL;
    RETAIN POOLSK POOLEM POOLCR POOLFS POOLOT;
    SET POOLTMP;
    BY COHYEAR;
    IF CFGP = 'SKTECH' THEN POOLSK=CAROUT;
    IF CFGP = 'EMREP ' THEN POOLEM=CAROUT;
    IF CFGP = 'CRSRSP' THEN POOLCR=CAROUT;
    IF CFGP = 'FSADM ' THEN POOLFS=CAROUT;
    IF CFGP = 'OTHER ' THEN POOLOT=CAROUT;
    DROP CAROUT;
    IF LAST.COHYEAR THEN OUTPUT;
    PROC PRINT DATA=POOL(OBS=100);
    TITLE PRINTOUT OF POOL;

    PROC SORT DATA=ZONEA; BY COHYEAR AFSC BONUS;

**** STEP 3G:  ****;

    DATA ZONEA2;
    MERGE ZONEA POOL;
    BY COHYEAR;
    ARRAY PROB(I) PRSK PREM PRCR PRFS PROT;
    ARRAY SUM (I) SUMSK SUMEM SUMCR SUMFS SUMOT;
    ARRAY POOL(I) POOLSK POOLEM POOLCR POOLFS POOLOT;
    CAREERS=0;
     IF CARFLOW=1 THEN DO OVER PROB;
    PROB=PROB/SUM;
    CAREERS=CAREERS+POOL*PROB;
    END;

 KEEP AFSC BONUS COHYEAR CAREERS STAYSAME YOSETS YETS AFRENL DECIDE
        YSTAY YIR YER CONTM1 CONTRTO CONTRT1
        REENM1 REENO REEN1;

****  STEP 3H:  ****;
```

```
        PROC APPEND BASE=ZONEA2
                  DATA=ZONEBC(DROP=STAYSC CCONSK CCONEM CCONCR
                       CCONFS CCONOT CARFLOW CFGP);

        PROC SORT DATA=ZONEA2;
          BY AFSC COHYEAR BONUS YOSETS;


        DATA I30UT.STEP3;
          SET ZONEA2;


              IF YOSETS <= 5 THEN ZONE='A';
         ELSE IF YOSETS <= 9 THEN ZONE='B';
         ELSE                      ZONE='C';

             IF ZONE='A' THEN TOTALR=CAREERS+STAYSAME;
                         ELSE TOTALR=AFRENL;

**** STEP 3I:  ****;

         IF BONUS > 0 THEN SOMEBON=1;
                   ELSE SOMEBON=0;

         PROC PRINT DATA=I30UT.STEP3(OBS=100);
         TITLE PRINTOUT OF I30UT;


//
```

STEP 4

```
//S0139BM4 JOB (1807,400,6,8),'BAM(STEP4)',CLASS=S
//S1 EXEC SAS,REGION=2000K,SORT=10
//WORK DD UNIT=USER,VOL=SER=TEMP11,SPACE=(6160,(1000,400),,,ROUND)
//INP DD DSN=FY86.STEP3OUT,DISP=OLD,VOL=SER=006149,
//     UNIT=HIGH9,DCB=DEN=4,LABEL=2
//OUT DD DSN=S.S0139.A1807.FY86BET,DISP=(NEW,CATLG),VOL=SER=USER36,
//     UNIT=USER,SPACE=(TRK,(700,500),RLSE)
//SYSIN DD *

OPTIONS NOCENTER;


   PROC SORT DATA=INP.STEP3 OUT=AFSCSORT; BY AFSC;


   PROC SUMMARY NWAY DATA=AFSCSORT;
           BY AFSC;
   CLASS ZONE COHYEAR BONUS;
   VAR DECIDE AFRENL STAYSAME CAREERS TOTALR;

   OUTPUT OUT=OUTSUM SUM=;

   PROC PRINT DATA=OUTSUM(OBS=500);
   TITLE OUTSUM;


   DATA OUT.BET;
     SET OUTSUM;

   DROP _TYPE_ _FREQ_;
   PROC PRINT DATA=OUT.BET(OBS=1000);
   TITLE PRINTOUT OF ELASTIC TABLE;

//
```

STEP 5

```
//S0139BM5 JOB (1807,790,6,8),'BAM(STEP5)',CLASS=S
//S1 EXEC SAS,SORT=10
//WORK DD UNIT=USER,VOL=SER=TEMP10,SPACE=(6160,(2000,800),,,ROUND)
//*
//*  STEP 5:   INPUT DATA FILES
//*
//INP1 DD DSN=B.B6005.A1807.INV.CAT1,DISP=SHR
//INP2 DD DSN=B.B6005.A1807.INV.CAT2,DISP=SHR
//INP3 DD DSN=B.B6005.A1807.INV.CAT3,DISP=SHR
//INEAR1 DD DSN=B.B6005.A1807.EARLYREE.CAT1,DISP=SHR
//INEAR2 DD DSN=B.B6005.A1807.EARLYREE.CAT2,DISP=SHR
//INEAR3 DD DSN=B.B6005.A1807.EARLYREE.CAT3,DISP=SHR
//INP4 DD DSN=B.B6005.A1807.OUTPUTG.ALLMAFSC,DISP=SHR
//INP5 DD DSN=C.C2292.A1807.DMFILED,DISP=SHR
//INP6 DD DSN=B.B6005.A1807.EDITED.B0.FY86,DISP=SHR
//INP7 DD DSN=FY86.STEP3OUT,DISP=OLD,VOL=SER=0C6149,
//      UNIT=HIGH9,DCB=DEN=4,LABEL=2
//* OUT DD DSN=S.S0139.A1807.TIMERENL,DISP=NEW,UNIT=USER,
//*       VOL=SER=USER33,SPACE=(TRK,(40,20),RLSE)
//OUT DD DSN=TIMERENL.NEWFIX,DISP=NEW,UNIT=HIGH9,
//      DCB=DEN=4,VOL=SER=001601,LABEL=5
//SYSIN DD *

**** STEP 5A:   ****;

OPTIONS NOCENTER;

    DATA CELL1;
      SET INP1.INVCAT1;

      LENGTH YETS 4;

       YETS=TOE-YOS;

       IF YETS=1 AND YOS <= 13;
       CATENL=1;
       DROP TOE;

       YOSETS=YOS+YETS-1;

    DATA ERENL1;
       LENGTH DEFAULT=4;
       SET INEAR1.EARLREE1;
       IF (YOS = 3 AND TOE = 4) OR (YOS=5 AND TOE=6);
       ERENL = FORCE;
       IF YOS < 0 THEN DELETE;
       YETS=TOE-YOS;
       IF YETS < -1 THEN DELETE;
```

```
      DROP TOE FORCE;

PROC SORT DATA=CELL1; BY AFSC YOS GRADE YETS;
PROC SORT DATA=ERENL1; BY AFSC YOS GRADE YETS;

DATA TOTCAT1;
  MERGE CELL1 ERENL1;
    BY AFSC YOS GRADE YETS;

  IF ERENL=. THEN ERENL=0;

     IF FORCE=. THEN FORCE=0;

          IF YOSETS < = 5 THEN ZONE='A';
     ELSE IF YOSETS <= 9 THEN ZONE = 'B';
     ELSE                    ZONE = 'C';


;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;; ;

   DATA CELL2;
     SET INP2.INVCAT2;

       CATENL=2;

       IF YETS=1 AND YOS <= 13;

       YOSETS=YOS+YETS-1;


     DATA ERENL2;
        LENGTH DEFAULT=4;
        SET INEAR2.EARLREE2;
        IF YETS = 2 AND (YOS >= 7 AND YOS <= 12);
        ERENL = FORCE;
        YETS=1;

        DROP FORCE;

PROC SORT DATA=CELL2; BY AFSC YOS GRADE YETS;
PROC SORT DATA=ERENL2; BY AFSC YOS GRADE YETS;

DATA TOTCAT2;
  MERGE CELL2 ERENL2;
    BY AFSC YOS GRADE YETS;

  IF ERENL=. THEN ERENL=0;

    IF FORCE= . THEN FORCE=0;

          IF YOSETS < = 5 THEN ZONE='A';
```

```
           ELSE IF YOSETS <= 9 THEN ZONE = 'B';
           ELSE                       ZONE = 'C';


********************************************************************************;

    DATA CELL3;
      SET INP3.INVCAT3;

        CATENL=3;
        IF YETS=1 AND YOS <= 13;

      YOSETS=YOS+YETS-1;


     DATA ERENL3;
        LENGTH DEFAULT=4;
        SET INEAR3.EARLREE3;
        IF YETS = 2 AND (YOS >= 9 AND YOS <= 13);
        ERENL = FORCE;
        YETS=1;

        DROP FORCE;

   PROC SORT DATA=CELL3; BY AFSC YOS GRADE YETS;
   PROC SORT DATA=ERENL3; BY AFSC YOS GRADE YETS;

   DATA TOTCAT3;
     MERGE CELL3 ERENL3;
       BY AFSC YOS GRADE YETS;

    IF ERENL=. THEN ERENL=0;

    IF FORCE=. THEN FORCE=0;


            IF YOSETS < = 5 THEN ZONE='A';
       ELSE IF YOSETS <= 9 THEN ZONE = 'B';
       ELSE                       ZONE = 'C';


********************************************************************************;

    PROC APPEND BASE=TOTCAT1
                DATA=TOTCAT2;

    PROC APPEND BASE=TOTCAT1
                DATA=TOTCAT3;


   PRO  SORT DATA=TOTCAT1;
```

```
         BY AFSC YOSETS GRADE YETS;

**** STEP 5B:  ****;

     DATA BLINPLR;
        LENGTH DEFAULT=4;
        INFILE INP4;
  INPUT   @1 CATENL      1.
          @ 4 AFSC       $CHAR6.
          @10 GRADE      2.
          @12 YOS        2.
          @14 TOE        2.
          @16 YETS       2.
          @18 ESLOSS     9.6
          @27 ES_EXT     9.6;
       CONTRT=1-ESLOSS;
       RENLGS=1-ES_EXT;
       YOSETS=YOS+YETS-1;
        IF (YETS=-1 OR YETS=0 OR YETS=1) AND YOS <= 13;
       IF YETS LT -1 THEN DELETE;
       IF CATENL = 2 AND YOSETS LT 6 THEN DELETE;
       IF CATENL = 2 AND YOSETS GT 10 THEN DELETE;
       IF CATENL = 3 AND (YOSETS LT 11 OR YOSETS GT 13) THEN DELETE;

     PROC SORT DATA=BLINPLR; BY AFSC YOSETS GRADE YETS;

     DATA OUTSET;
       LENGTH DEFAULT=4;
       SET BLINPLR;
       /*** AGGREGATE TO ONE RECORD PER AFSC, GRADE, AND TERMTYPE.
              *****/
       BY AFSC YOSETS GRADE YETS;

       RETAIN  CONTM1 CONTRT0 CONTRT1
               REENM1 REEN0 REEN1 ;
       ARRAY CRATE(I) CONTM1 CONTRT0-CONTRT1;
       ARRAY REENL(I) REENM1 REEN0 REEN1;


       I=YETS+2;
       CRATE=CONTRT;
       REENL=RENLGS;


       IF LAST.GRADE THEN DO;
               DO OVER CRATE;
               IF CRATE <= 0 THEN CRATE = 0.00001;
               IF REENL <= 0 THEN REENL = 0.00001;
               IF CRATE >= 1 THEN CRATE = 0.99999;
               IF REENL >= 1 THEN REENL = 0.99999;
               END;
```

```
            OUTPUT;
            END;

****  STEP 5C:  ****;

      /* merge this data set with the INVENTORY*/

   PROC PRINT DATA=OUTSET(OBS=100);
   TITLE PRINTOUT OF DATA OUTSET;

      DATA BLENDCNT;
            MERGE OUTSET(IN=HAVOUT) TOTCAT1(IN=HAVINV);
            BY AFSC YOSETS GRADE;

               IF HAVOUT AND HAVINV;;

   PROC PRINT DATA=BLENDCNT(OBS=500);
   TITLE DATASET BLENDCNT;

****  STEP 5D:  ****;

   DATA BONFILE;

     INFILE INP6;

     INPUT @ 1  AFSC      $CHAR6.
           @ 8  PERIOD    $CHAR2.
           @ 11 ZONE      $CHAR1.
           @ 30 BONUS     4.1 ;

    IF PERIOD='44'; ** PERIOD 44 GOES FROM 10/31/85 TO PRESENT **;


     ACTBON=BONUS;
     DROP BONUS;

      PROC SORT DATA=BONFILE;
         BY AFSC ZONE;

      PROC SORT DATA=TOTCAT1;
         BY AFSC ZONE;

****  STEP 5E:  ****;

   /* merge blendcnt with the file giving bonus at the end of the fiscal
year, and create a variable SOMEBON = 1 if current bonus > 0. */

      DATA BLNDCNT2;
        MERGE BLENDCNT(IN=HAVCNT) BONFILE(IN=HAVBON);
        BY AFSC ZONE;
```

```
      IF HAVCNT;

            IF HAVBON = 0 THEN ACTBON=0;
            IF ACTBON > 0 THEN SOMEBON=1;
                        ELSE SOMEBON=0;

**  ADJUSTING THE BLENDED LOSS RATES TO REFLECT BONUS EFFECTS **;

            IF YOSETS <= 5 THEN DO;
                    IF ACTBON=0.0 THEN X=0.0;
                ELSE IF ACTBON=0.5 THEN X=-0.017;
                ELSE IF ACTBON >= 1.0 THEN X=-0.034-0.013*(ACTBON-1);
                CONTRT1=CONTRT1-X;
                REEN1 = REEN1 + 0.089*ACTBON;
            END;

            IF YOSETS > 5 AND YOSETS <= 10 THEN DO;
                CONTRT1=CONTRT1+0.042*ACTBON;
                REEN1=   REEN1+0.142*ACTBON;
            END;

            IF YOSETS = 11 THEN
                CONTRT1=CONTRT1+0.0088*ACTBON;

            IF YOSETS = 12 THEN
                CONTRT1=CONTRT1+0.0053*ACTBON;

            IF YOSETS = 13 THEN
                CONTRT1=CONTRT1+0.0032*ACTBON;

                NRCH= 1.0;
                NREEN1=NRCH*CONTRT1*REEN1;
                NRCH= NRCH*CONTRT1-NREEN1;
                NREEN0=NRCH*CONTRT0*REEN0;
                NRCH= NRCH*CONTRT0-NREEN0;
                NREENM1=NRCH*CONTM1;

                WNREEN1=(FORCE+ERENL)*NREEN1;
                WNREEN0=(FORCE+ERENL)*NREEN0;
                WNREENM1=(FORCE+ERENL)*NREENM1;

                /*** WE SHALL ASSUME THAT PEOPLE DON'T DELAY THEIR REENL
                        AND LOSE THEIR BONUS. ****/
      IF (YOSETS = 5 OR YOSETS=9 OR YOSETS=13) AND SOMEBON=1 THEN DO;
                    WNREEN1=WNREEN1+WNREEN0+WNREENM1;
                    WNREEN0=0;
                    WNREENM1=0;
                     END;

      IF (YOSETS = 8 OR YOSETS = 12) AND SOMEBON=1 THEN DO;
```

```
                        WNREEN0=WNREEN0+WNREENM1;
                        WNREENM1=0;

                        END;

**** STEP 5F:  ****;

        PROC SUMMARY DATA=BLNDCNT2 NWAY;
                CLASS ZONE SOMEBON;
                VARIABLES WNREEN1 WNREEN0 WNREENM1;
                OUTPUT OUT=OUTSUM SUM=;

**** STEP 3G:  ****;

            DATA BONINV;
                MERGE TOTCAT1(IN=HAVCNT) JONFILE(IN=HAVBON);
                BY AFSC ZONE;

                IF HAVCNT;

                IF HAVBON = 0 THEN ACTBON=0;
                IF ACTBON > 0 THEN SOMEBON=1;
                             ELSE SOMEBON=0;


        PROC SUMMARY DATA=BONINV;
                CLASS ZONE SOMEBON;
                VARIABLES FORCE ERENL;

        OUTPUT OUT=OUTSUM2 SUM=;

PROC PRINT DATA=OUTSUM2(OBS=100);

        DATA EARLY;
        SET OUTSUM2;

        IF _TYPE_ = 3 AND SOMEBON = 0;
        FREARLY = ERENL/(FORCE+ERENL);


        PROC SORT DATA=OUTSUM;
             BY ZONE SOMEBON;

        PROC PRINT DATA=OUTSUM(OBS=800);
        TITLE PRINTOUT OF SUMMARY DATA=OUTSUM SUMS FOR BLNDCNT2;

          PROC SORT DATA=OUTSUM2;
                BY ZONE SOMEBON;

**** STEP 5H:  ****;
```

```
    DATA DISTR;
            MERGE OUTSUM EARLY; BY _TYPE_ ZONE;

/* Changing the bonus can't affect the early reenlistments.
            We will take the fraction of early reenlistments from the
            zero bonus case and calculate only the distribution among
            the three years YETS = 1,0,-1 for the bonus cases */


            ARRAY WREEN WNREEN1 WNREENO WNREENM1;
            ARRAY RENDIST RREEN1 RREENO RREENM1;

            RTEMP=WNREEN1+WNREENO+WNREENM1;
            DO OVER RENDIST;
            RENDIST=WREEN/RTEMP;
            END;
            DROP RTEMP WNREEN1 WNREENO WNREENM1   ;


    PROC PRINT DATA=DISTR(OBS=200);
    TITLE DATASET DISTR;


    PROC SORT DATA=INP7.STEP3 OUT=I3OUT; BY ZONE SOMEBON;

    DATA ADDDISTR;
            MERGE I3OUT DISTR(IN=HAVDIST);
            BY ZONE SOMEBON;

            DROP _TYPE_ _FREQ_ FORCE ERENL;



    PROC SORT DATA=ADDDISTR; BY AFSC YOSETS BONUS COHYEAR;

    PROC PRINT DATA=ADDDISTR(OBS=200);
    TITLE DATASET ADDDISTR;

     PROC SUMMARY NWAY DATA=TOTCAT1;
     CLASS AFSC YOSETS;
     VARIABLE ERENL;

     OUTPUT OUT=SUMN SUM=;

**** STEP 5I:  ****;

    DATA DONE;
            MERGE ADDDISTR(IN=HAVDISTR) SUMN(IN=HAVINV);
            BY AFSC YOSETS;

            LENGTH DEFAULT=4;
```

```
            IF HAVINV=0 THEN ERENL=0;
            IF HAVDISTR;


            PLANYR=COHYEAR-1;
            TIMRENL=FREARLY*DECIDE;
            IF PLANYR >= 87 THEN OUTPUT;

            PLANYR=COHYEAR;
            IF PLANYR NE 87 THEN
            TIMRENL=MAX(0,RREEN1*TOTALR-FREARLY*DECIDE);

            ELSE TIMRENL=MAX(0, RREEN1* TOTALR-ERENL);

            OUTPUT;

            PLANYR=COHYEAR+1;
            TIMRENL=RREEN0*TOTALR;
            IF PLANYR <= 89 THEN OUTPUT;

            PLANYR=COHYEAR+2;
            TIMRENL=RREENM1*TOTALR;
            IF PLANYR <= 89 THEN OUTPUT;


  PROC PRINT DATA=DONE(OBS=500);
   TITLE PRINTOUT OF DATA=DONE;

PROC SUMMARY NWAY DATA=DONE;
    BY AFSC;
    CLASS ZONE COHYEAR PLANYR BONUS;
      VAR TIMRENL;

   OUTPUT OUT=OUT.TIMERENL(DROP= _TYPE_ _FREQ_) SUM=;

PROC PRINT DATA=OUT.TIMERENL(OBS=1000);
TITLE DATASET OUT.TIMERENL;

    //
```

STEP 6

```
//S0139BM6 JOB (1807,700,6,8),'BAM(STEP6)',CLASS=S
//S1 EXEC SAS,SORT=10
//WORK DD UNIT=USER,VOL=SER=TEMP10,SPACE=(6160,(2000,800),,,ROUND)
//I3INP DD DSN=FY86.STEP3OUT,DISP=OLD,VOL=SER=006149,
//      UNIT=HIGH9,DCB=DEN=4,LABEL=2
//OUT DD DSN=TIMEINV,DISP=NEW,UNIT=HIGH9,DCB=DEN=4,
//    VOL=SER=001601,LABEL=(2)
//SYSIN DD *


OPTIONS NOCENTER;


    DATA PLANYEAR;
      LENGTH DEFAULT = 4;
        SET I3INP.STEP3;

    CATTR=0.98;

    FYINV=COHYEAR;
    YOS=YOSETS+1;
    IF DECIDE > 0 THEN
    TIMINV=(TOTALR/AFRENL) * DECIDE * YSTAY;
    ELSE TIMINV=0;
    OUTPUT;

    FYINV=COHYEAR+1;
    YOS=YOSETS+2;
    IF DECIDE > 0 THEN
    TIMINV=(TOTALR/AFRENL)*DECIDE*YSTAY*(YIR*CATTR+(1-YIR)*CONTRTO);
    ELSE TIMINV=0;
    IF FYINV <= 89 THEN OUTPUT;

    FYINV=COHYEAR+2;
    YOS=YOSETS+3;
    IF DECIDE > 0 THEN
  TIMINV=(TOTALR/AFRENL)*(AFRENL-DECIDE*YSTAY*((1-CATTR)*(1+CATTR))
              -DECIDE*YSTAY*(1-YIR)*CONTRTO*REENO*(1-CATTR));
    ELSE TIMINV=0;
    IF FYINV <= 89 THEN OUTPUT;

   KEEP AFSC YOS COHYEAR FYINV BONUS TIMINV;


    PROC SORT DATA=PLANYEAR OUT=OUT.TIMEINV;
      BY AFSC YOS COHYEAR FYINV BONUS;

   PROC PRINT DATA=OUT.TIMEINV(OBS=1500);
```

```
    TITLE DATASET OUT.TIMEINV;

//
STEP 7

//S0139DEB JOB (1807,300,6,8),'STEP7',CLASS=S
//* TIPS ALL BEMTARG USER33 SPACE=35,10 SASLIB
//S1 EXEC SAS
//* INTARG DD DSN=S.S0139.A1807.TARGET,DISP=SHR
//INTARG DD DSN=TARGET,DISP=SHR,UNIT=HIGH9,
//    VOL=SER=006235,LABEL=(2)
//INYOS DD DSN=C.C2292.A1807.EXTRDATF,DISP=SHR
//STUFILE DD DSN=C.C2292.A1807.STUFIL86,DISP=SHR
//OUT DD DSN=FY86.TARGFILE,DISP=NEW,UNIT=HIGH9,DCB=DEN=4,
//      VOL=SER=001601,LABEL=(3)
//SYSIN DD *

    OPTIONS NOCENTER;

**** STEP 7A:  ****;

    DATA TARGFILE;
     LENGTH DEFAULT=4;
        SET INTARG.TARGET;


***********************************************
** SETTING UP THE TABLE TO CALCULATE    **
** YOSETS BASED ON YEAR AND CATENL      **
***********************************************;


    ARRAY TTARR () TT1-TT23;
    ARRAY YOSARR (K) YOETS1-YOETS23;
    ARRAY CATARR (K) CAT1-CAT23;

    RETAIN CAT1-CAT2 1 CAT3-CAT12 2 CAT13-CAT22 3 CAT23 4
        TT1-TT23 YOETS1-YOETS23;

    IF _N_=1 THEN DO;

        DO K=1 TO 23;

            IF K=1 THEN YOSARR=3;
      ELSE IF K=2 THEN YOSARR=5;
      ELSE IF K > 2 AND K <= 7 THEN YOSARR= K+4;
      ELSE IF K > 7 AND K <= 12 THEN YOSARR= K+1;
      ELSE IF K > 12 AND K <= 22 THEN YOSARR= K-2;
      ELSE IF K=23 THEN YOSARR=28;

        END;
    END;
```

```
        IF TT = . OR YEAR = . THEN DELETE;
          K=TT;
       IF K >= 1 AND K <= 23 THEN DO;
          YOSETS=YOSARR;
          CATENL=CATARR;
       END;


*************************************************
** GETTING THE TARGET                        **
*************************************************;

 KEEP AFSC YOS FYINV TCOUNT;
 ARRAY INV(I) INVM1 INV0-INV6;

    FYINV=YEAR;
    DO I=1 TO 8;
    YOS=YOSETS-(I-3);
    TCOUNT=INV;
    IF YOS >0 THEN OUTPUT;
    END;

**** STEP 7B:  ****;

PROC SORT DATA=TARGFILE; BY AFSC FYINV YOS;
 PROC PRINT DATA=TARGFILE(OBS=500);
 TITLE PRINTOUT OF TARGFILE;


      DATA TARGFIL2;
      LENGTH DEFAULT=4;
      SET TARGFILE;
      BY AFSC FYINV YOS;
      RETAIN TARGET;
      IF FIRST.YOS THEN TARGET = 0;
      IF TCOUNT > 0 THEN TARGET=TCOUNT+TARGET;
      IF LAST.YOS THEN OUTPUT;
      DROP TCOUNT;
    PROC PRINT DATA=TARGFIL2(OBS=200);
    TITLE DATA SET TARGFIL2 (SUMMARY);

**** STEP 7C:  ****;

*************************************************
**  GETTING THE INVENTORY NOT SUBJECT *
**  TO BONUS EFFECTS                      *
*************************************************;


      DATA OTHINV2;
      LENGTH DEFAULT=4;
        INFILE INYOS;
```

```
            INPU

                @    1 AFSC          $CHAR6.
                @    7 FYINV          2.
                @    9 (YINV0-YINV29) (RB4.);


        KEEP AFSC YOS FYINV EXINVT;
        ARRAY TEMPINV (J) YINV0-YINV29;


********************************************
**  USING THE IPM INSIDE THE     **
**  YOS TARGET GENERATOR INTO     **
**  A FILE WITH ONE RECORD PER   **
**  AFSC, YOS AND FYINV WITH      **
**  EXINVT--THE INVENTORY COUNT**
**  ASSOCIATED WITH THE YOS       **
********************************************;


        IF FYINV = . THEN DELETE;
        DO J=1 TO 30;
         YOS=J-1;
          EXINVT=TEMPINV;
          OUTPUT;
        END;

    PROC PRINT DATA=OTHINV2(OBS=200);
    TITLE OTHINV2;


       PROC SORT DATA=OTHINV2;
          BY AFSC FYINV YOS;

**** STEP 7D:  ****;

    DATA STUFILE;
       INFILE STUFILE;
       INPUT AFSC $ 1-6
                  @ 9 STUDNTFR  7.4;
    PROC SORT DATA=STUFILE; BY AFSC;
    PROC PRINT DATA=STUFILE(OBS=500);
    TITLE STUFILE;


    DATA OTHDONE;
       MERGE OTHINV2(IN=HAVINV) STUFILE(IN=HAVSTU);
          BY AFSC;

            IF HAVINV;

          IF EXINVT < 0 THEN EXINVT=0;
```

```
        IF HAVSTU AND YOS EQ 0 THEN EXINVT = EXINVT * (1-STUDNTFR);


    PROC PRINT DATA=OTHDONE(OBS=500);
    TITLE DATASET OTHDONE;

**** STEP 7E:  ****;

    PROC SORT DATA=TARGFIL2;
      BY AFSC FYINV YOS;

  DATA OUT.TARGET;

    MERGE OTHDONE(IN=HAVEXTRA) TARGFIL2(IN=HAVTARG);
      BY AFSC FYINV YOS;
     IF HAVEXTRA = 0 THEN EXINVT = 0;
     IF HAVTARG  = 0 THEN TARGET = 0;
     KEEP AFSC FYINV YOS EXINVT TARGET;


    PROC PRINT DATA=OUT.TARGET(OBS=500);
    TITLE FINAL DATASET PARTB;

//
```

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