A RAND NOTE

Middle-Term Aggregate Model for Projecting Air Force Enlisted Personnel

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The research reported here was sponsored by the United States Air Force under contract F49620-86-C-0008. Further information may be obtained from the Long Range Planning and Doctrine Division, Directorate of Plans, Hq USAF.

Published 1991 by RAND
1700 Main Street, P.O. Box 2138, Santa Monica, CA 90407-2138

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N-3170-AF

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Prepared for the
United States Air Force

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PREFACE

The RAND Corporation is helping to design an Enlisted Force Management System (EFMS) for the Air Force.[1] The EFMS is a decision support system designed to assist managers of the enlisted force in setting and meeting force targets. The system contains computer models that project the force resulting from given management actions, so actions that meet targets can be found. Some of those models analyze separate job specialties (disaggregate models) and others analyze the total enlisted force across all specialties (aggregate models); some models make annual projections (middle-term models) and others make monthly projections.

The Middle-Term Aggregate (MTA) model is the component of the EFMS that projects the aggregate force by year for up to nine fiscal years into the future. The MTA model can be used to analyze the structure and cost of the enlisted force that would result from the following types of management actions: *accessions, reenlistment bonuses, early releases*, and *promotions*. In addition, the force structure and cost projections reflect the effects of user-specified projections of the civilian unemployment rate and the ratio of military wages to civilian wages.

The model contains a user interface of input and output screens that was negotiated with model users before the model was designed. This "top-down" planning ensures that the model provides a well-defined and useful capability. Force programmers will be able to use the MTA model to plan management actions for the next few years by specifying the actions as inputs and observing the implications of those actions as outputs.

The model has five modules:

[1]For an overview of the EFMS see Grace Carter, Jan Chaiken, Michael Murray, and Warren Walker, *Conceptual Design of an Enlisted Force Management System for the Air Force*, The RAND Corporation, N-2005-AF, August 1983.

Module 1: Data Preparation.
Module 2: Annual Projections.
Module 3: Computer-Aided Design of Management Actions.
Module 4: Comparison of Alternative Plans.
Module 5: Monthly Projections.

Module 1 is a "preprocessor." It performs the calculations that need be done only once to set up projections that will be made from a given fiscal year. Module 2 is the main module of the MTA model, projecting annual force structure and annual Military Personnel Account (MPA) costs. Module 3 helps users find accession and promotion plans that will achieve user-specified goals for year-end force strengths by grade. Module 4 can be used to compare the implications of alternative plans. Module 5 spreads the yearly numbers over months for any given fiscal year.

Module 5 will enable force programmers to get a head start on planning monthly management actions for future fiscal years. However, once a fiscal year has started, the programmers will use the EFMS model that was explicitly designed to help fine tune a fiscal-year plan as the fiscal year unfolds. That model, the Short-Term Aggregate Model (SAM), is described in C. Peter Rydell and Kevin Lawson, *Short-Term Aggregate Model for Projecting Air Force Enlisted Personnel (SAM)*, The RAND Corporation, N-3166-AF, July 1990.

This Note is addressed to those in the Air Force who are working on the design and implementation of the EFMS. It should also be of general interest to personnel planners and programmers in all the uniformed services.

This work 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 and Systems Acquisition Program of Project AIR FORCE. The EFMP is part of a larger body of work in that program concerned with the effective utilization of human resources in the Air Force.

SUMMARY

The Middle-Term Aggregate (MTA) model is the component of the Enlisted Force Management System (EFMS)[1] that projects force structure and cost for the aggregate enlisted force (total force across all specialties). The model makes annual projections up to nine fiscal years into the future. The MTA model can be used to examine the force structure and cost implications of the enlisted force that would result from user specified choices of management actions and economic scenario. The force projections carry enough information to describe the enlisted force by category of enlistment, grade, and years of service. At the user's option, the MTA model can provide monthly details within specified fiscal years.

MANAGEMENT ACTIONS AND ECONOMIC INPUTS

The projections depend upon planned management actions and a background economic scenario. The MTA model accepts user choices of the following management actions for each fiscal year of the projection.

- Accessions.
  - -- non-prior service, for a 4-year term of enlistment
  - -- non-prior service, for a 6-year term of enlistment
  - -- prior service
- Percent of force receiving reenlistment bonuses.
  - -- by type of bonus
  - -- by size of bonus
- Early releases.
  - -- to Reserves (the "Palace Chase" program)
  - -- of next fiscal year's losses ("Early Outs")
  - -- of this fiscal year's losses ("Rollups")

[1]For an overview of the EFMS see Grace Carter, Jan Chaiken, Michael Murray, and Warren Walker, *Conceptual Design of An Enlisted Force Management System for the Air Force,* The RAND Corporation, N-2005-AF, August 1983.

- Forced early reenlistments.
  - -- from same fiscal year
  - -- from next fiscal year
- Promotions to the top five grades (E-5 through E-9).

Accessions control gains to the enlisted force. Reenlistment bonuses and early releases control losses from the force. Promotions control the grade distribution of the force.

The MTA model's projections are also conditional upon user specified projections of two economic conditions for each fiscal year.

- Civilian unemployment rate.
- Ratio of military wages to civilian wages.

The higher civilian unemployment and the higher the ratio of military wages to civilian wages the greater the propensity of enlisted personnel to remain in the enlisted force at the end of each term of enlistment.

PROJECTED CONSEQUENCES

The MTA model estimates and reports the following consequences of the management actions and economic conditions by fiscal year:

- Enlisted force inventory.
  - -- by grade
  - -- by category of enlistment
  - -- by grade and years of service
- Average years of service.
  - -- of persons entering each grade
  - -- of persons in each grade
- Annual rates.
  - -- of promotion
  - -- of retention

- Inventory change (by type of change).
  - -- by grade
  - -- by category of enlistment
- Gains (by type of gain).
  - -- by grade
  - -- by category of enlistment
- Losses (by type of loss).
  - -- by grade
  - -- by category of enlistment
- Annual Military Personnel Account cost.
  - -- in nominal dollars
  - -- in constant dollars

STRUCTURE OF THE MTA MODEL

In addition to predicting the consequences of planned management actions, the MTA model can help users design management actions and provides the capability to systematically compare the detailed consequences of alternative plans. These capabilities are embedded in the modular structure of the MTA model.

The MTA model's calculations are done in five modules (see Fig. S.1):

Module 1: Data Preparation.
Module 2: Annual Projections.
Module 3: Computer-Aided Design of Management Actions.
Module 4: Comparison of Alternative Plans.
Module 5: Monthly Projections.

Module 1: Data Preparation

This module is a "preprocessor." It performs calculations that need be done only once to enable the MTA model to make projections for more than one fiscal year and for more than one set of management actions. Specifically, this module obtains the latest available information on inventory levels and flow behavior from the EFMP's

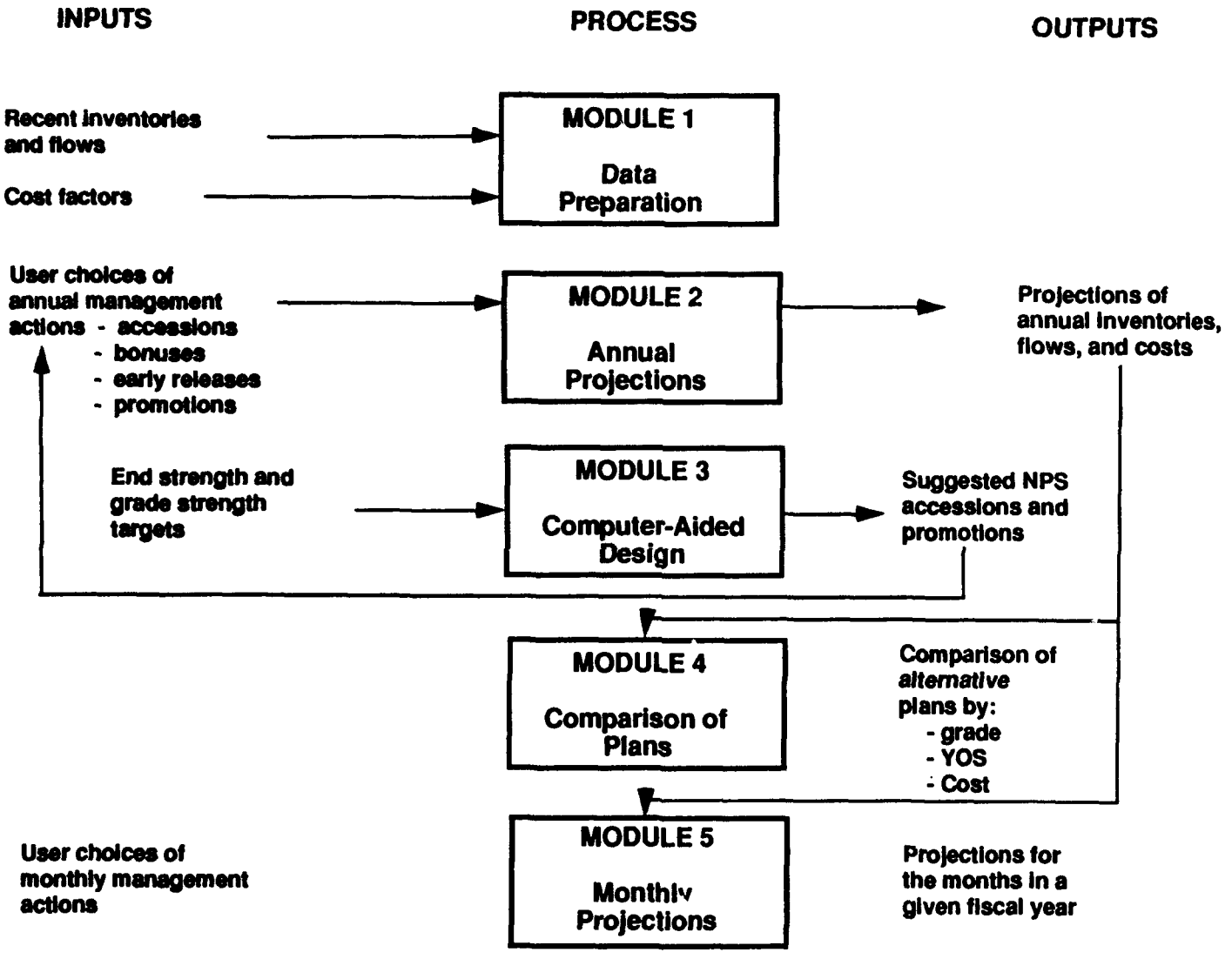

Fig. S.1--Structure of the MTA model

central database, and it blends cohort-year information on loss and reenlistment behavior into fiscal-year information.

Module 2: Annual Projections

This is the main module of the MTA model. It accepts annual management actions and economic conditions as inputs and projects annual inventories, flows, and costs that will result from those actions.

Module 3: Computer-Aided Design of Management Actions

This module computes accession and promotion actions that will enable the inventory to achieve end-strength and grade-strength-ceiling targets for all fiscal years analyzed. Interface menus enable the user to feed the recommended actions into Module 2 to get a complete report on the annual flows and inventories that achieve the targets.

Module 4: Comparison of Alternative Plans

At the user's request, a plan that is sufficiently interesting to be preserved for comparison with other plans can be sent to Module 4. After two or more plans have been constructed, this module can be run to systematically compare the alternative plans.

Module 5: Monthly Projections

At the user's option, annual projections can be spread over the months of any given fiscal year. Doing so requires that the user provide additional inputs that specify the monthly pattern of management actions.

GLOSSARY

BMT	Basic military training
CATENL	Category of enlistment
ETS	Expiration of term of service
EYOS	Years of service that will be completed at the start of the fiscal year in which the expiration of term of service is reached
FY	Fiscal year
Grade	Grade
MOS	Months of service
METS	Months to expiration of term of service
TOE	Term of enlistment
YETS	Years to expiration of term of service
YOS	Years of service

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FIGURES

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I. INTRODUCTION

The EFMS is a computer-based system whose purpose is to improve the decisionmaking and information processing of Air Force Staff members engaged in managing the enlisted force. The objective is to provide a group of airmen best able to support Air Force missions and operational programs within fiscal end-strength constraints. This is an iterative, continuous task, since the Air Force's needs and resources change in response to congressional, presidential, and OSD decisions, decisions by the Air Force, and exogenous labor market forces.

To support the many functions associated with enlisted force management, the EFMS consists of a family of different models.[1] Every model in the EFMS can be simply described by the time horizon of the projections, either monthly or annual; level of aggregation, either occupation-specific or total enlisted force summed across all specialities; and characterization of task, either impact assessment, policy screening, or special purpose.[2]

Figure 1 shows a categorization of the EFMS models. The MTA model is an impact assessment model that makes fiscal year projections of the aggregate enlisted force.

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[1]For a detailed description of the EFMS and its component models, see Walker et al., 1991.

[2]Screening models are generally designed for rapid comparison of many alternative plans or programs using summary or approximate measures of performance. Impact assessment models are used when more detailed or more accurate calculations are required. The impact assessment models form the core of the current implementation of the EFMS.

	Aggregate Force	By Specialty
By Month	Impact Assessment (SAM)	Impact Assessment (DMI)
By Fiscal Year	Impact Assessment (MTA) Policy Screening (ADAM) Special Purpose: • Retirement	Impact Assessment (DMI) Policy Screening (POF) Special Purpose: • BEM • YOSTG • GAM • ALEC

SAM: Short-Term Aggregate Inventory Projection Model
DMI: Middle-Term Disaggregate Inventory Projection Model
MTA: Middle-Term Aggregate Inventory Projection Model
ADAM: Aggregate Dynamic Analysis Model
POF: Part-of-Force Model
BEM: Bonus Effects Model
YOSTG: Year-of-Service Target Generator
GAM: Grade Allocation Model
ALEC: Aggregate Lifecycle Effectiveness and Cost Model

Fig. 1--The EFMS family of models

The MTA model was designed to be used in conjunction with the other aggregate models of the EFMS, SAM[3] and ADAM.[4] Figure 2 shows the information flow and the sequential use of the three aggregate models.

ADAM is a policy screening model and should be used to cycle through a wide variety of management action plans.[5] When the enlisted force manager decides on a small collection of attractive plans, he can then use the MTA to obtain a more detailed and accurate picture. The MTA model will also spread the fiscal year projections to a monthly time horizon, which will give personnel managers a head start on monthly planning for the next fiscal year. Finally, SAM can be used to fine-tune policy during a fiscal year.

PURPOSE OF THE MTA MODEL

The MTA model projects Air Force enlisted personnel by year for up to nine fiscal years into the future. The projections carry enough information to describe the enlisted force by category of enlistment, grade, and years of service. At the user's option, the MTA model can provide monthly details within specified fiscal years.

Force programmers will be able to use the MTA model to plan management actions for the next few years by specifying the actions as inputs and observing the implications of these actions as outputs. They will be able to use the monthly projection capability of the model to plan monthly management actions for a fiscal year before that fiscal year begins. Once a fiscal year is underway, programmers will use the

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[3]Specifications for SAM can be found in Rydell and Lawson (1990).

[4]ADAM is documented in Mickelson and Rydell, 1989a and 1989b.

[5]Adam is similar in many respects to the MTA. In fact, the data for ADAM are taken from the EFMS database for the MTA model. Roughly speaking, the two models are different implementations of the same core specifications. However, ADAM is a screening model designed for rapid comparison of many alternative plans using summary measures of performance. The MTA is an impact assessment model that is slower but more accurate and comprehensive than ADAM, which makes it more appropriate for detailed comparisons of smaller numbers of plans. In contrast to the MTA, ADAM (1) has summary outputs, (2) does not model demotions, (3) does not model Officer's Training School (OTS) or miscellaneous gains and losses, and (4) does not distribute FY inventory flows across months.

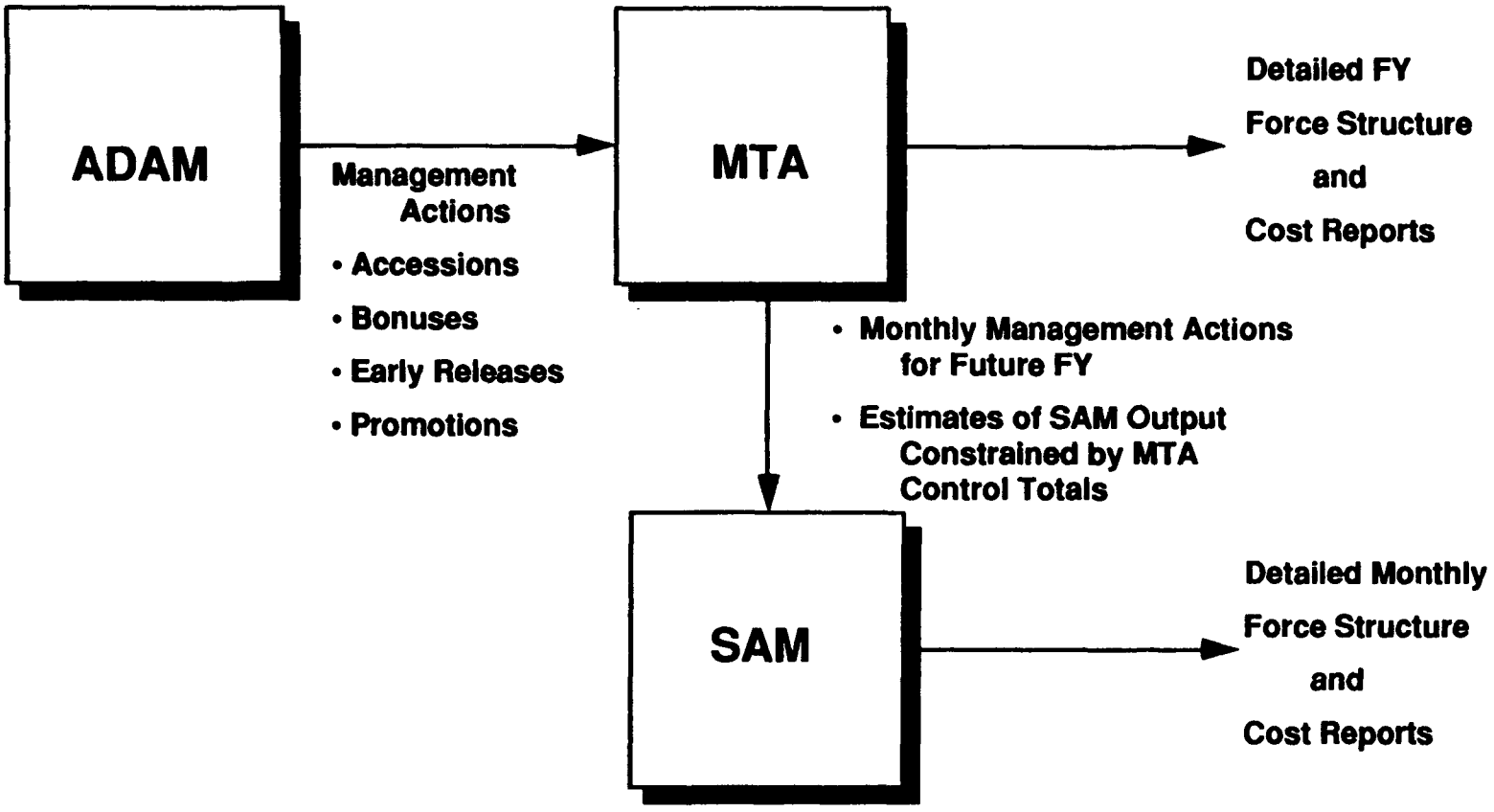

Fig. 2--Relationship among EFMS aggregate models

Short-Term Aggregate Model each month to adjust the plan of monthly actions for the rest of the fiscal year to the latest available information.

When a part of the current fiscal year has passed, force programmers may want to start the MTA model's projections from the projected inventory at the end of the current fiscal year, where that projected inventory is obtained from SAM. The MTA model is flexible enough to provide this capability, if desired. Doing so will require writing a pre-processor to build a starting database using SAM projections. This capability is not explicitly defined in this document. However, nothing in these specifications prevents that capability from being designed and implemented once the MTA model exists.

Management Action Inputs

The MTA model accepts user choices of the following management actions, for each fiscal year of the projection.

- Accessions.
  - -- non-prior service, for a 4-year term of enlistment
  - -- non-prior service, for a 6-year term of enlistment
  - -- prior service
- Percent of force receiving reenlistment bonuses.
  - -- by type of bonus
  - -- by size of bonus
- Early releases.
  - -- to Reserves (the "Palace Chase" program)
  - -- of next fiscal year's losses ("Early Outs")
  - -- of this fiscal year's losses ("Rollups")
- Forced early reenlistments.
  - -- from same fiscal year
  - -- from next fiscal year
- Promotions to the top five grades (E-5 through E-9).

Accessions control gains to the enlisted force. Reenlistment bonuses and early releases control losses from the force. Promotions control the grade distribution of the force.

Economic Condition Inputs

The MTA model's projections are conditional upon user-specified projections of two economic conditions for each fiscal year:

- Civilian unemployment rate.
- Ratio of military wages to civilian wages.

The higher civilian unemployment and the higher the ratio of military wages to civilian wages the greater the propensity of enlisted personnel to remain in the enlisted force at the end of each term of enlistment.

Goal Inputs

Goals for the aggregate enlisted force are customarily summarized by force strength at the end of each fiscal year (called "end strength"), and grade strengths at the end of each fiscal year (called "grade strength ceilings"). A computer-aided-design module of the MTA model accepts user choices of these goals for each fiscal year and then determines the annual accessions and promotions required to achieve these goals.

The model's suggested plan for accessions and promotions is conditional upon the user choices of all other management actions listed above and, of course, upon the user-specified goals. Iterative use of the MTA model's "what-if" and "goal-seeking" modes enables users to construct a plan of management actions that achieves the goals and also satisfies such judgmental criteria as "smooth flow" of accessions and promotions.

Inventory, Inventory Change, and Cost Outputs

To enable users to compare alternative management actions, the MTA model estimates and reports the following consequences of the management actions by fiscal year.

- Enlisted force inventory.
  - -- by grade
  - -- by category of enlistment
  - -- by grade and years of service
- Average years of service.
  - -- of persons entering each grade
  - -- of persons in each grade
- Annual rates.
  - -- of promotion
  - -- of retention
- Inventory change (by type of change).
  - -- by grade
  - -- by category of enlistment
- Gains (by type of gain).
  - -- by grade
  - -- by category of enlistment
- Losses (by type of loss).
  - -- by grade
  - -- by category of enlistment
- Annual Military Personnel Account cost.
  - -- in nominal dollars
  - -- in constant dollars

MODELING PRINCIPLES

Seven principles have been used to design the MTA model so that it does its job well, is easy to implement, and runs efficiently. These principles are:

- Top down design.
- Preprocessing of data.
- Compact accounting system.
- Reference period.
- Iterative annual calculations.
- Computer-aided design of management actions.
- Hierarchy for monthly projections.

Model from the Top Down

Define input/output screens first, then design the model structure to most economically transform the inputs into the desired outputs.

Negotiations between model users and model builders over the content of the input/output screens must, of course, be informed by what available model-building techniques make possible. However, final decisions on model structure should not be made until a complete set of input/output screens exist to define the job to be done.

This approach simplified decisionmaking about what features to include and exclude from the model; if a feature does not affect any of the defined outputs, it can be excluded.

Preprocessing as Much Data as Possible

Design the model to maximize the number of calculations that can be done once up front and need not be redone for subsequent fiscal years or if user choices of management actions change. Put these "once only" calculations in an initial module.

This strategy greatly increases the speed with which the model can project into the future and can evaluate alternative management plans.

Use a Compact Accounting System

Design the accounting systems that carry inventory and flow counts inside of the model so that they are as "compact" as possible. That is, have as few dimensions and as few blank cells as possible.

Like the first strategy, this strategy increases the speed with which the model can project into the future, and the speed with which the model can compare alternative management plans.

Use Recent Behavioral Data in the Reference Case

Use the average annual flow rates (by type of inventory during years immediately before the first projection year or regression equations developed for the Middle-Term Disaggregate Inventory Projection Model (DMI) (see Carter et al., 1987) as the basic predictors of enlisted force behavior. Then modify them as necessary to account for changes in such factors as reenlistment bonus plans between the reference period and a given projection year.

Grounding all behavior rates in the most recently available experience prevents the MTA model from becoming outdated as the Air Force's institutional characteristics and enlisted personnel characteristics change over time. These specifications suggest the three most recent past fiscal years as the basic reference period. Three years is short enough to capture current enlisted force behavior and long enough for extreme behavior in one particular fiscal year to be "averaged out." In the case of expiration of term of service (ETS) losses and reenlistments, the reference rates can also be obtained from the DMI regression equations.

Use a Consistent Level of Detail to Expedite Annual Calculations

Design the model so that it transforms the starting inventory of a fiscal year into an ending inventory that can serve as the starting inventory for the next year's projection. In other words, each year the model projects not only the change in inventory but the inventory itself, in sufficient detail for the annual projection machinery to work for the following year.

Keep Computer-Aided Design of Management Actions Separate from "What-If" Analysis

Keep "what-if" calculations separate from "goal-seeking" calculations, in the interests of making the model understandable and flexible.

Force programmers often choose the level of accessions so that the force size at the end of a fiscal year hits a known target (called "end strength"). Similarly, force programmers often choose the levels of promotion flows during a year so that the force sizes by grade at the end of a fiscal year hit known targets (called "grade strength ceilings").

The calculations necessary to find the actions that achieve those targets can easily be done by the computer, so they are included in the MTA model. However, those goal-seeking calculations are not included in the projection module. Rather they are placed in a special module that does computer-aided design of management actions.

Keeping the two very different jobs separate makes the MTA model easy to understand and implement, and it gives the user the option of overriding the recommendations of the goal-seeking calculations (or not asking for them at all, which speeds the computations).

Subordinate Monthly to Annual Projections

Build the model so that users first choose fiscal year totals for management actions and then choose monthly management actions for a specific fiscal year without changing that year's annual totals.

This strategy allows users to draft a multiyear context for detailed fiscal year planning before doing the detailed planning. It avoids the waste of time that would result if the entire nine-year plan had to be reestimated every time a monthly detail changed in a specific fiscal year's plan.

MODULAR STRUCTURE

The MTA model's calculations are done in five modules (see Fig. 3):

Module 1: Data Preparation.

Module 2: Annual Projections.

Module 3: Computer-Aided Design of Management Actions.

Module 4: Comparison of Alternative Plans.

Module 5: Monthly Projections.

Module 1: Data Preparation

This module is a "preprocessor." It performs calculations that need be done only once to enable the MTA model to make projections for more than one fiscal year and for more than one set of management actions. Specifically, this module obtains the latest available information on inventory levels and flow behavior from the EFMP's central database, and it blends cohort-year information on loss and reenlistment behavior into fiscal-year information.

Module 2: Annual Projections

This is the main module of the MTA model. It accepts annual management actions and economic conditions as inputs and projects the annual inventories, flows, and costs that will result from those actions.

Module 3: Computer-Aided Design of Management Actions

This module computes accession and promotion actions that will enable the inventory to achieve end-strength and grade-strength-ceiling targets for all fiscal years analyzed. Interface menus enable the user to feed the recommended actions into Module 2 to get a complete report on the annual flows and inventories that achieve the targets.

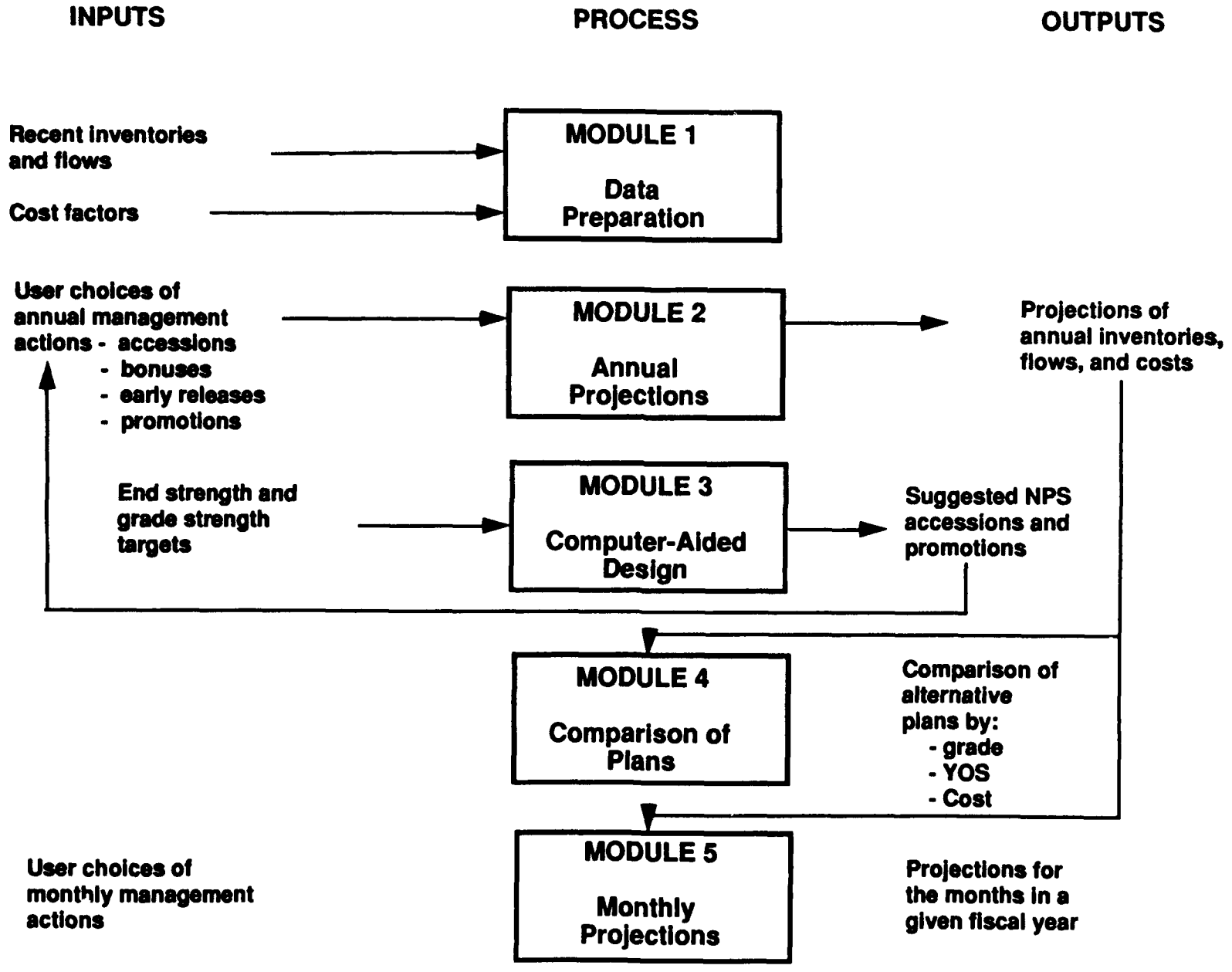

Fig. 3--Structure of the MTA model

Module 4: Comparison of Alternative Plans

At the user's request, a plan that is sufficiently interesting to be preserved for comparison with other plans can be sent to Module 4. After two or more plans have been constructed, this module can be run to systematically compare the alternative plans.

Module 5: Monthly Projections

At the user's option, annual projections can be spread over the months of any given fiscal year. Doing so requires that the user provide additional inputs that specify the monthly pattern of management actions.

OUTLINE

The material in this report can be divided into three distinct topics. Sections I and II introduce the MTA model. Section III outlines the MTA accounting system. Sections IV through VIII provide technical descriptions of each of the modules. Appendixes A, B, and C give detailed specifications on early attrition and promotion calculations, blending loss and reenlistment rates, and predicting terms of enlistment, respectively. Appendixes D through G give detailed action diagrams for each of the modules. The action diagrams are given specifically for the Air Force contingent of the EFMP that is developing the computer code.

II. USER INTERFACE SCREENS

This section presents the input and output screens that users will see when they operate the MTA model. The interface screens for the Annual Projection module accept user-specified inputs of management actions and economic conditions; and they report estimates of inventory, inventory change, and cost. The Computer Aided Design module has input screens for end-strength and grade-strength goals and output screens for the accessions and promotions required to achieve those goals. The Comparison of Plans module has input screens with which to select the plans to be compared and output screens that report the comparisons. The Monthly Projections module has input screens with which to plan monthly details for a given fiscal year and output screens reporting monthly projections.

ANNUAL PROJECTIONS (MODULE 2)

Each input and output screen for the Annual Projections module reports actual events for three past fiscal years, projected events for the current fiscal year, and projected events for up to eight future fiscal years. There will therefore be a possible total of 12 lines of information on each screen in the operational model. These 12 possible lines are indicated by three lines labeled "3 past years," "current year," and "8 future years."

The body of the input and output screens gives the computer names for the variables in the table. The subscript dimensions are explicitly given for the inputs but are left implicit for the outputs.

Input Screens for Module 2

Figure 4 shows the input screens for the Annual Projections module. They include only the inputs that must be provided by the user. Other inputs describing the initial inventory and past enlisted force behavior come from the data preparation module (Module 1, Sec. IV).

The user inputs are of two kinds: assumptions about economic trends (Input Screen 1) and the annual management actions that define the plan to be tested (Input Screens 2-11).

Input Screen 2 obtains NPS accessions by length of term and PS accessions. Users can either enter the total NPS accessions for each fiscal year and the percent 4-year NPS accessions for each year, or they can enter the 4-year and 6-year flows. The MTA model will accept either method of input and will fill out the rest of the NPS accession information automatically.

Input Screens 3 through 5 obtain aggregate summaries of reenlistment bonuses for zones A, B, and C, respectively. These management actions are planned at the disaggregate level (that is, by specific occupations). Aggregations of the disaggregate plans should be used as default values in Input Screens 3 through 5. However, the inputs are explicitly listed on user input screens to provide the opportunity for aggregate planners to explore alternative total bonus levels that can be used as aggregate guidelines for disaggregate planning.

Input Screens 6 and 7 obtain losses caused by early release programs. These programs allow people to leave the enlisted force before the end of their enlistment periods. There are three such early release programs:

- Rollup: early release of personnel in the same fiscal year in which their enlistment period ends, for the purpose of reducing Military Personnel Account costs in the year in which the early release occurs.
- Early Out: early release of personnel in the fiscal year before the fiscal year in which their enlistment period ends, for the purpose of reducing end strength in the year in which the early release occurs.
- Palace Chase: early release of personnel as many as four fiscal years before the fiscal year in which their enlistment period ends, for the purpose of transferring the personnel to the Reserves.

Note that rollups do not affect the end-of-year inventory (because they are early releases during a fiscal year of losses that would have occurred anyway before the end of the fiscal year). However, rollup actions must be specified in annual analyses because they affect the cost of the enlisted force during a fiscal year.

Input Screen 8 allows users to enter the number of forced early reenlistments in each fiscal year. Users enter this number by category of enlistment and by whether the reenlistment would otherwise have occurred in the same or in the next fiscal year. The information on forced early reenlistments from the same fiscal year is carried in the MTA (annual projection) model to make that model's detailed results consistent with annual totals from the SAM (monthly projection) model.

Promotions to grades E-5 through E-9 are explicit management actions entered into the MTA model (Input Screen 9). Promotions to grades E-2 through E-4 will be estimated by historical behavior (by Module 1). Module 3 of the MTA module will compute the promotion flows to grades E-5 through E-9 that are needed to achieve specified grade strength ceilings. This promotion plan can then be entered into Input Screen 7.

The number of demotions that occur each year by grade are user-specified inputs (Input Screen 10) but will usually be filled in by replicating the flows in the historical years. Similarly, the flows involving Officer's Training School and the miscellaneous gains and losses (Input Screen 11) have been made explicit inputs so that users have the option of varying them. But most analyses will probably just replicate the recent history of these flows.

Output Screens for Module 2

The fundamental output needed to evaluate annual plans is the count of the enlisted force by grade and years of service at the end of each fiscal year. However, this output (valuable though it may be for detailed comparison of alternative plans) is too large for an initial evaluation of a plan. So, before reporting the complete grade by years of service matrix, the MTA model offers the user summary screens (see

MTA Annual Input Screen 1

ASSUMPTIONS ABOUT ECONOMIC TRENDS

Fiscal Year	Civilian Unemployment Rate (%)	Ratio of Military to Civilian Pay	Consumer Price Index
3 past years	UNEMPL <FY>		
Current year		MILCIV <FY>	
8 future yrs.			CPI <FY>

MTA Annual Input Screen 2

ACCESSIONS

	NPS Accessions					
		4-Year		6-Year		
Fiscal Year	Total	Percent	Flow	Percent	Flow	PS Accessions Flow
3 past years	TNPS <FY>					PS <FY>
Current year			NPS4 <FY>			
8 future yrs.					NPS6 <FY>	

MTA Annual Input Screen 3

PERCENT OF FORCE RECEIVING ZONE A BONUSES

	Zone A Bonus Multiple						
Fiscal Year	0.5	1.0	2.0	3.0	4.0	5.0	6.0
3 past years	AH <FY>			A3 <FY>			A6 <FY>
Current year		A1 <FY>			A4 <FY>		
8 future yrs.			A2 <FY>			A5 <FY>	

Fig. 4--MTA annual input screens

MTA Annual Input Screen 4

PERCENT OF FORCE RECEIVING ZONE B BONUSES

	Zone B Bonus Multiple						
Fiscal Year	0.5	1.0	2.0	3.0	4.0	5.0	6.0
3 past years	BH <FY>			B3 <FY>			B6 <FY>
Current year		B1 <FY>			B4 <FY>		
8 future yrs.			B2 <FY>			B5 <FY>	

MTA Annual Input Screen 5

PERCENT OF FORCE RECEIVING ZONE C BONUSES

	Zone C Bonus Multiple						
Fiscal Year	0.5	1.0	2.0	3.0	4.0	5.0	6.0
3 past years	CH <FY>			C3 <FY>			C6 <FY>
Current year		C1 <FY>			C4 <FY>		
8 future yrs.			C2 <FY>			C5 <FY>	

MTA Annual Input Screen 6

ROLLUP AND EARLY OUT LOSSES

	Rollups			Early Outs		
Fiscal Year	First Term	Second Term	Career Terms	First Term	Second Term	Career Terms
3 past years	RULOSS <FY, CATENL>					
Current year				EOLOSS <FY, CATENL>		
8 future yrs.						

Fig. 4 (cont'd)

MTA Annual Input Screen 7

PALACE CHASE, OTS, AND MISCELLANEOUS LOSSES

Fiscal Year	Palace Chase Loss	OTS Loss	Miscellaneous Loss
3 past years	PCLOSS <FY>		
Current year		OTSLOSS <FY>	
8 future yrs.			MISCLOSS <FY>

NOTE: Palace Chase losses are early releases to the Reserves, OTS losses are flows from the enlisted force to Officer's Training School, and miscellaneous losses are loss adjustments and other losses.

MTA Annual Input Screen 8

FORCED EARLY REENLISTMENTS

	From Same FY			From Next FY		
Fiscal Year	First Term	Second Term	Career Terms	First Term	Second Term	Career Terms
3 past years						
Current year	FEROUT1POLICY <FY, CATENL>					
8 future yrs.				FEROUT2POLICY <FY, CATENL>		

MTA Annual Input Screen 9

PROMOTIONS INTO GRADES E-5 to E-9

	Grade				
Fiscal Year	E-5	E-6	E-7	E-8	E-9
3 past years Current year 8 future yrs.	PROMIN <FY, Grade>				

Fig. 4 (cont'd)

MTA Annual Input Screen 10

DEMOTION FROM GRADE

Fiscal Year	Grade							
	E-2	E-3	E-4	E-5	E-6	E-7	E-8	E-9
3 past years Current year 8 future yrs.	DEMOOUT <FY, Grade>							

MTA Annual Input Screen 11

OTS AND MISCELLANEOUS GAINS

Fiscal Year	OTS Gain	Miscellaneous Gain
3 past years Current year 8 future yrs.	OTSGAIN <FY>	MISCGAIN <FY>

NOTE: OTS gains are flows into the enlisted force of persons who are scheduled to enter Officer's Training School. Miscellaneous gains include gain adjustments and other gains.

Fig. 4 (cont'd)

Fig. 5) that report the inventory separately by category of enlistment (Output Screen 1), by years of service (Output Screen 2), and by grade (Output Screen 3).

These initial screens offer three high-level summaries of force structure that can be used to quickly evaluate the performance of a plan:

- Percent of the enlisted force in grade E-5 or higher.
- Percent of the enlisted force with four or more years of service.
- Percent of the enlisted force in their second or higher enlistment.

Output Screens 4 and 5 give the average years of service of persons entering each grade and the average years of service of persons in each grade. Output Screens 6 and 7 report promotion rates and retention rates.

A series of output screens analyze inventory changes: by grade (Output Screen 8); by category of enlistment (Output Screen 9); gains by category of enlistment, grade, and reason (Output Screen 10); and losses by category of enlistment, grade, and reason (Output Screens 11). Output Screen 12 shows the relationship between actual ETS losses and policy-free ETS losses (the ETS losses that would occur if no losses had been shifted to the past by early release programs). Output Screen 13 presents total actual reenlistments and shows its decomposition into ETS reenlistments and early reenlistments, while Output Screen 14 shows policy-free reenlistments (the reenlistments that would have occurred in the absence of the forced early reenlistment program) and shows its decomposition into ETS reenlistments and shifts. ("Shifts" are reenlistments that do not happen at a given time because the forced early reenlistment program made them happen at an earlier time).

Output Screens 15a, 15b, and 15c report the predicted force levels by grade and years of service for a single fiscal year. (The matrix for a single year is so large that it occupies three screens.)

Output Screens 16 and 17 give estimates of the annual cost of the enlisted force under the given plan, in nominal dollars, and in constant dollars. The constant dollars will be given in terms of the current year (the first projection year).

When a report is prepared on a given plan, all input screens must be given along with the output screens, because the predictions are conditional upon the assumptions, estimates, and management decisions reflected in the inputs. To check the accuracy of predictions made with the MTA model, the first step is to compare the inputs of economic trends and management actions with actual events.

COMPUTER-AIDED DESIGN OF MANAGEMENT ACTIONS (MODULE 3)

Module 3 has only one input screen, which obtains the user-specified goals for end strengths and for grade strength ceilings for each of the projection years (current year and up to 8 future years) (Fig. 6). The past year information on the input screen is there only for reference purposes.

There are three output screens (Fig. 7). Output Screen 1 compares the goals with the performance of the plan most recently used in Module 2. It reports the additional inventory needed to meet the goals. Output Screen 2 gives the suggested plan of NPS accessions and promotions. To implement this plan, enter the promotion flows on Module 2's Annual Input Screen 10 and the total NPS accessions in the leftmost column of Annual Input Screen 2. Output Screen 3 shows the additional accession and promotion flows needed to meet the goals (the difference between the suggested plan, Screen 2, and the last plan used in Module 2).

COMPARISON OF ALTERNATIVE PLANS (MODULE 4)

The Comparison of Alternative Plans module (Module 4) has only one input screen. It allows the user to specify the names of the two plans to be compared. The first plan should be considered and labeled as a reference plan, and the second should be labeled the test plan.

MTA Annual Output Screen 1

ENLISTED FORCE BY CATEGORY OF ENLISTMENT

End of Fiscal Year	Category of Enlistment: First Term	Second Term	Career Terms	Retirement Eligible Terms	Total	Percent of Force Second Term or Higher
3 past years Current year 8 future yrs.			ENDINV			PERCENT2TERM

MTA Annual Output Screen 2

ENLISTED FORCE BY YEARS OF SERVICE

End of Fiscal Year	Years of Service: 0-3	4-7	8-11	12-15	16-19	20-24	25-29	Total	Percent of Force 4 or more YOS
3 past years Current year 8 future yrs.					ENDINV				PERCENT4YOS

MTA Annual Output Screen 3

ENLISTED FORCE BY GRADE

End of Fiscal Year	Grade: E1-E3	E-4	E-5	E-6	E-7	E-8	E-9	Total	Percent of Force Grade E-5 or Higher
3 past years Current year 8 future yrs.					ENDINV				PERCENT5Grade

Fig. 5--MTA annual output screens

MTA Annual Output Screen 4

AVERAGE YEARS OF SERVICE OF PERSONS ENTERING EACH GRADE

Fiscal Year	Grade E1-E3	E-4	E-5	E-6	E-7	E-8	E-9
3 past years Current year 8 future yrs.	AVGPROMYOS						

MTA Annual Output Screen 5

AVERAGE YEARS OF SERVICE OF PERSONS IN EACH GRADE

End of Fiscal Year	Grade E1-E3	E-4	E-5	E-6	E-7	E-8	E-9
3 past years Current year 8 future yrs.	AVGINVYOS						

MTA Annual Output Screen 6

ANNUAL PROMOTION RATES
(Percent persons in grade X-1 promoted to grade X)

Fiscal Year	Grade E-5	E-6	E-7	E-8	E-9
3 past years Current year 8 future yrs.	PROMOTIONRATE				

Fig. 5 (cont'd)

MTA Annual Output Screen 7

ANNUAL ETS RETENTION RATES
(Reenlistments as percent of policy-free ETS losses plus reenlistments)

Fiscal Year	First Term	Second Term	Career Terms	Average
3 past years Current year 8 future yrs.		RETENTIONRATE		

MTA Annual Output Screen 8

INVENTORY CHANGE BY GRADE: _____

Fiscal Year	Starting Inventory	Gain	Loss	Promotions In	Promotions Out	Demotions In	Demotions Out	Ending Inventory
3 past yrs.	STARTINV			PROMIN		DEMOIN		
Current year		TOTALGAIN			PROMOUT		DEMOOUT	
8 future yrs.			TOTALLOSS					ENDINV

NOTE: Repeated ten times: total, and nine grades.

MTA Annual Output Screen 9

INVENTORY CHANGE BY CATEGORY OF ENLISTMENT: _____

Fiscal Year	Starting Inventory	Gain	Loss	Reenlistments In	Reenlistments Out	Flow to Ret. Elig. In	Flow to Ret. Elig. Out	Ending Inventory
3 past yrs.	STARTINV			REUPIN		RETELIGIN		
Current years		TOTALGAIN			REUPOUT		RETELIGOUT	
8 future yrs.			TOTALLOSS					ENDIV

NOTE: Repeated five times: total and four categories of enlistment.

Fig. 5 (cont'd)

MTA Annual Output Screen 10

GAINS BY CATEGORY OF ENLISTMENT: _____ OR GRADE: _____

Fiscal Year	NPS Accessions 4-Year	6-Year	Total	PS Accession	OTS Gain	Misc. Gain	Total
3 past yrs.	NPS4			PS			TOTALGAIN
Current year		NPS6			OTSGAIN		
8 future yrs.			NPS			MISCGAIN	

NOTE: Repeated 14 times: total, four categories of enlistment, and nine grades.

MTA Annual Output Screen 11

LOSSES BY CATEGORY OF ENLISTMENT: _____ OR GRADE:_____

Fiscal Year	Attrition BMT	STD	ETS Loss	Roll Up	Early Out	Palace Chase	Retire-ment	OTS Loss	Misc. Loss	Total
3 past years	BMTATTLOSS			RULOSS			RETIREMENT			TOTALLOSS
Current year		STDATTLOSS			EOLOSS			OTSLOSS		
8 future yrs.			ETSLOSS			PCLOSS			MISCLOSS	

NOTE: Repeated 14 times: total, four categories of enlistment, and nine grades.

Fig. 5 (cont'd)

MTA Annual Output Screen 12

POLICY-FREE ETS LOSSES BY CATEGORY OF ENLISTMENT: _____ OR GRADE: _____

Fiscal Year	ETS Loss	Roll Up Shift	Early Out Shift	Palace Chase Shift	Policy-Free ETS Loss
3 past yrs.	ETSLOSS			PCSHIFT	
Current year		RUSHIFT			PFETSLOSS
8 future yrs.			EOSHIFT		

NOTE: Repeated 14 times: total, four categories of enlistment, and nine grades.

MTA Annual Output Screen 13

ACTUAL REENLISTMENTS OUT BY CATEGORY OF ENLISTMENT OR GRADE

Fiscal Year	ETS Reenlistments	Early Reenlistments From: Same FY	Early Reenlistments From: Next FY	Total actual Reenlistments
3 past yrs.	ETSREUPOUT			REUPOUT
Current year		FEROUT1		
8 future yrs.			FEROUT2	

NOTE: Repeated 14 times: total, four categories of enlistment, and nine grades.

Fig. 5 (cont'd)

MTA Annual Output Screen 14

POLICY-FREE REENLISTMENTS OUT BY CATEGORY OF ENLISTMENT OR GRADE

Fiscal Year	ETS Reenlistments	Early Reenlistments Shifted to: Same FY	Early Reenlistments Shifted to: Past FY	Policy-free Reenlistments
3 past yrs.	ETSREUPOUT			PFREUPOUT
Current year		FEROUT1SHIFT		
8 future yrs.			FEROUT2SHIFT	

NOTE: Repeated 14 times: total, four categories of enlistment, and nine grades.

MTA Annual Output Screen 15a

ENLISTED FORCE BY GRADE AND YEARS OF SERVICE: END OF FY _____

Years of Service	Grade: E-1	E-2	E-3	E-4	E-5	E-6	E-7	E-8	E-9	Total
0										
1										
2										
3										
4					ENDINV					
5										
6										
7										
8										
9										

NOTE: Repeated up to 12 times: three past fiscal years, current fiscal year, and up to eight future fiscal years.

Fig. 5 (cont'd)

MTA Annual Output Screens 15b

ENLISTED FORCE BY GRADE AND YEARS OF SERVICE: END OF FY ____

Years of Service	Grade E-1	E-2	E-3	E-4	E-5	E-6	E-7	E-8	E-9	Total
10										
11										
12										
13										
14						ENDINV				
15										
16										
17										
18										
19										

NOTE: Repeated up to 12 times: three past fiscal years, current fiscal year, and up to eight future fiscal years.

MTA Annual Output Screens 15c

ENLISTED FORCE BY GRADE AND YEARS OF SERVICE: END OF FY ____

Years of Service	Grade E-1	E-2	E-3	E-4	E-5	E-6	E-7	E-8	E-9	Total
20										
21										
22										
23										
24						ENDINV				
25										
26										
27										
28										
29										
Total										
% 4+ YOS										

NOTE: Repeated up to 12 times: three past fiscal years, current fiscal year, and up to eight future fiscal years.

Fig. 5 (cont'd)

MTA Annual Output Screen 16

ANNUAL MILITARY PERSONNEL ACCOUNT COSTS
(Nominal dollars)

Fiscal Year	Basic Pay	Retired Pay Accrual	BAQ and VHA	Incentive and Special Pay	Misc. Pay	PCS Cost	Total
3 past yrs.	NBASICPAY			NINCENTPAY			NTOTALCOST
Current year		NRETIREPAY			NMISCPAY		
8 future yrs.			NBAQVHA			NPCSCOST	

MTA Annual Output Screen 17

ANNUAL MILITARY PERSONNEL ACCOUNT COSTS
(Constant dollars)

Fiscal Year	Basic Pay	Retired Pay Accrual	BAQ and VHA	Incentive and Special Pay	Misc. Pay	PCS	Total
3 past yrs.	CBASICPAY			CINCENTPAY			CTOTALCOST
Current year		CRETIREPAY			CMISCPAY		
8 future yrs.			CBAQVHA			CPCSCOST	

Fig. 5 (cont'd)

MTA Design Input Screen

GOALS FOR FORCE SIZE AT THE END OF EACH FISCAL YEAR
FOR THE TOP FIVE GRADES AND FOR THE TOTAL INVENTORY

Fiscal Year	Grade Strength					End Strength
	E-5	E-6	E-7	E-8	E-9	
3 past years Current year 8 future yrs.	GradeCEILING <FY, Grade>					ENDSTRENGTH <FY>

Fig. 6--MTA design input screen

MTA Design Output Screen 1

**DIFFERENCE BETWEEN GOALS AND PERFORMANCE OF PLAN
CURRENTLY BEING TESTED BY MODULE 2**

Fiscal Year	**Grade Strength**					**End Strength**
	E-5	**E-6**	**E-7**	**E-8**	**E-9**	
Current year 8 future yrs.	**G <FY, Grade>**					**E <FY>**

Fig. 7--MTA design output screens

MTA Design Output Screen 2

TOTAL PROMOTIONS AND NPS ACCESSION
REQUIRED TO ACHIEVE GOALS

Fiscal Year	Promotions into Grade					NPS Accessions
	E-5	E-6	E-7	E-8	E-9	
Current year 8 future yrs.		NEWPROMIN <FY, Grade>				NEWNPS <FY>

MTA Design Output Screen 3

ADDITIONAL PROMOTIONS AND NPS ACCESSIONS
REQUIRED TO ACHIEVE GOALS

Fiscal Year	Promotions into Grade					NPS Accessions
	E-5	E-6	E-7	E-8	E-9	
Current year 8 future yrs.		ADDPROM <FY, Grade>				ADDNPS <FY>

Fig. 7 (cont'd)

There are 15 output screens from Module 4. They display various Force Structure and Cost Comparisons for the two plans based on the outputs from Module 2. Summary comparative information is presented for the test plan, the reference plan, and their difference (test plan - reference plan). The 15 output screens are listed below, followed by Output Screen 1 (Fig. 8), which shows comparative information on the total force ending inventory. The remaining output screens (not shown here) enable the user to examine other Module 2 output variables. Obtaining the information for these screens is simply a database management problem that requires keeping track of all Module 2 outputs for each plan and doing the subtractions that produce the differences.

Summary Plan Comparison

1. Total force ending inventory
2. Grade E1-E3 ending inventory
3. Grade E-4 ending inventory
4. Grade E-5 ending inventory
5. Grade E-6 ending inventory
6. Grade E-7 ending inventory
7. Grade E-8 ending inventory
8. Grade E-9 ending inventory
9. Years of service range 0-4 ending inventory
10. Years of service range 5-7 ending inventory
11. Years of service range 8-11 ending inventory
12. Years of service range 12-15 ending inventory
13. Years of service range 16+ ending inventory
14. Cost in Nominal Dollars
15. Cost in Constant Dollars

MTA Output Comparison Screen

SUMMARY PLAN COMPARISON: TOTAL FORCE

FY	Plan 1	Plan 2	Difference (Plan 1 - Plan 2)
3 past years Current year 8 future yrs.			

Fig. 8--MTA output comparison screen

MONTHLY PROJECTIONS (MODULE 5)

The user interface for the Monthly Projections module must first obtain three numbers from the user:

- FY corresponding to the "current year" of the plan being used.
- Number of plan among all alternative plans starting from that FY.
- FY for which monthly details are to be provided.

The remainder of the user interface for Module 5 is identical to that of Module 2 of SAM. See Rydell and Lawson, 1990, for documentation of the SAM model.

The input screens for the Monthly Projections module are the same as the Module 2 input screens for SAM. However, users will not be able to change the totals of monthly inputs on these screens. Rather, those annual totals will be obtained from the MTA's Annual Projections module (Module 2). To change the annual totals, users will have to go back to Module 2. This approach facilitates top down planning of management actions: Annual actions for a given fiscal year are planned in the context of results for many years, then monthly actions are planned in the context of a single year.

III. THEORY OF ANNUAL PROJECTIONS

This section describes the accounting systems used by the MTA model to count the inventory at the start of fiscal years and to count flows during fiscal years. The description of the accounting systems includes discussions of the accounting identities (relationships that are true by definition) that link various flows with each other and link inventory change with flows.

INVENTORY ACCOUNTING

Explicit Dimensions

The MTA model describes the inventory of enlisted personnel using three dimensions: Grade, Years of Service (YOS), and Track. "Grade" is pay grade and ranges from E-1 through E-9. "YOS" is the number of years that an enlisted person has been in the Air Force, counted at the beginning of a fiscal year and truncated to the nearest integer. For example, YOS = 0 at the end of the fiscal year in which a person joined the Air Force, and YOS = 1 at the end of the next fiscal year. "Track" is a number from 1 to 11 that characterizes the relationship between term of enlistment and YOS.

First-term inventory is divided into two Tracks. Track 1 contains personnel who enlist for a first term of four years, and Track 2 contains personnel who enlist for a first term of six years. Each Track can be defined by the years of service that will be completed when the ETS is reached, denoted by EYOS, for "End Years of Service." For Track 1, EYOS = 3; for Track 2, EYOS = 5.

To describe the second-term inventory in an analogous way requires eight Tracks (numbered from 3 to 10). Each has a different EYOS, ranging from 6 to 13. Table 1 makes the pattern of the Tracks clear.

The MTA model does not do time-in-term accounting for categories of enlistment three and higher.[1] All these terms are lumped together in Track 11 (see Table 1).

[1]Career term and Retirement-eligible term.

Table 1

DEFINITION OF INVENTORY TRACKS

	Track										
YOS	1	2	3	4	5	6	7	8	9	10	11
0	x	x									
1	x	x									
2	x	x									
3	E	x	x		x						
4	x	x	x	x	x	x					
5	x	E	x	x	x	x	x				
6		x	E	x	x	x	x	x			x
7		x	x	E	x	x	x	x	x		x
8	First		x	x	E	x	x	x	x	x	x
9	Term			x	x	E	x	x	x	x	x
10					x	x	E	x	x	x	x
11						x	x	E	x	x	x
12							x	x	E	x	x
13								x	x	E	x
14									x	x	x
15										x	x
16			Second Term								x
17											x
18											x
19											x
20											x
21											x
22											x
23								Retirement-			x
24								Eligible			x
25								Term			x
26											x
27											x
28											x
29											x

NOTE: x = inventory at start of fiscal year, E = inventory at start of fiscal year in which persons reach their original ETS. Inventory after the ETS year in Tracks 1 through 10 are on extensions of their original term of service.

An accounting strategy similar to the MTA model's use of Tracks was originally proposed for the DMI model under the name of "term types." However, the designers of that model required that complete time-in-term accounting be done for career terms as well as for the first and second terms, and the term type accounting became so cumbersome that the strategy was abandoned. In other words, not doing time-in-term accounting after the second term is the price that must be paid to make the term-type strategy advantageous. That price is not large, because there are few ETS losses during the career terms, so estimating them less precisely does not significantly decrease the overall accuracy of loss estimates.

Implicit Dimensions

The Tracks provide complete time-in-term accounting for the first two categories of enlistment. The number of years to ETS, denoted by "YETS" in the first and second terms, can be computed using the formula:

$$YETS = EYOS - YOS + 1,$$

where EYOS are the years of service that will be completed at the start of the fiscal year in which ETS occurs in a given Track (see the locations of the letter "E" in Table 1).

Although MTA accounting explicitly contains only Grade, YOS, and Track, it implicitly contains YETS and Category of Enlistment (CATENL). Unfortunately, the EFMP has evolved two definitions of CATENL, which differ in their interpretations of "retirement eligible." The short-term aggregate IPM and this middle-term aggregate IPM define "retirement eligible" as inventory at the start of a fiscal year that is actually eligible for retirement at that time (YOS $\geq$ 20). The middle-term disaggregate IPM (DMI) defines "retirement eligible" as inventory at the start of the fiscal year that either is currently eligible for retirement or will become eligible for retirement during the fiscal year (YOS $\geq$ 19).[2] Fortunately, the accounting system for the MTA model can

[2]In its original specification, the middle-term disaggregate model defined retirement eligible as YOS $\geq$ 20; however, during its development it was thought useful to make all retirements during a year come from one category of enlistment at the start of the year, so the definition

support either definition. Users of EFMP models must be careful to check which definition of CATENL is being used in any given model or data base.

Details of Inventory Accounting

Table 2 pulls together the above discussion and explicitly shows how the grade dimension interacts with YOS and Track. It also shows the values of the implicit dimensions CATENL and YETS.

FLOW ACCOUNTING

Start-of-Year vs. End-of-Year Accounting

Flows in the MTA model occur during a fiscal year. For fiscal year projections, one does not need to specify when the flow occurs. However, one does need to decide whether to account for those flows by inventory characteristics as of the start or the end of the fiscal year.

Losses are modeled by start-of-year inventory times a loss rate, so it is convenient to do loss accounting by start-of-year YOS. Accessions are recognized only in constructing the end-of-year inventory, so it is convenient to do accession accounting by end-of-year YOS.

Reenlistments-out are like losses, so they are done by start-of-year YOS (and Track), and reenlistments-in are like gains, so they are done by end-of-year YOS (and Track). Finally, promotion/demotion calculations are best done by end-of-year accounting, after the force has been "aged."

"Continuation" flows connect start-of-year and end-of-year accounting. Continuations are flows within a Track from one YOS cell to the next higher YOS cell. Continuation outflows are done by start-of-year accounting, and continuation inflows are done by end-of-year accounting.

---

was changed to YOS ≥ 19. The price of this simplicity in the inner workings of the DMI model is that its output is inconsistent with the output of the short- and middle-term aggregate IPMs.

Table 2

INVENTORY ACCOUNTING STRUCTURE

CATENL	YETS	YOS	E-1	E-2	E-3	E-4	E-5	E-6
		Track 1: first term, EYOS = 3						
1	4	0						
1	3	1						
1	2	2			[36 cells]			
1	1	3						
1	0	4						
1	-1	5						
		Track 2: first term, EYOS = 5						
1	6	0						
1	5	1						
1	4	2						
1	3	3			[48 cells]			
1	2	4						
1	1	5						
1	0	6						
1	-1	7						
			E-4	E-5	E-6	E-7		
		Track 3: second term, EYOS = 6						
2	4	3						
2	3	4						
2	2	5		[24 cells]				
2	1	6						
2	0	7						
2	-1	8						
		Track 4: second term, EYOS = 7						
2	4	4						
2	3	5						
2	2	6		[24 cells]				
2	1	7						
2	0	8						
2	-1	9						

Table 2 (cont'd)

CATENL	YETS	YOS	E-4	E-5	E-6	E-7
		Track 5: second term, EYOS = 8				
2	6	3				
2	5	4				
2	4	5				
2	3	6		[32 cells]		
2	2	7				
2	1	8				
2	0	9				
2	-1	10				
		Track 6: second term, EYOS = 9				
2	6	4				
2	5	5				
2	4	6				
2	3	7		[32 cells]		
2	2	8				
2	1	9				
2	0	10				
2	-1	11				
		Track 7: second term, EYOS = 10				
2	6	5				
2	5	6				
2	4	7				
2	3	8		[32 cells]		
2	2	9				
2	1	10				
2	0	11				
2	-1	12				

Table 2 (cont'd)

CATENL	YETS	YOS	E-4	E-5	E-6	E-7	E-8	E-9
		Track 8: second term, EYOS = 11						
2	6	6						
2	5	7						
2	4	8						
2	3	9		[32 cells]				
2	2	10						
2	1	11						
2	0	12						
2	-1	13						
		Track 9: second term, EYOS = 12						
2	6	7						
2	5	8						
2	4	9						
2	3	10		[32 cells]				
2	2	11						
2	1	12						
2	0	13						
2	-1	14						
			E-4	E-5	E-6	E-7	E-8	E-9
		Track 10: second term, EYOS = 13						
2	6	8					NA	NA
2	5	9					NA	NA
2	4	10					NA	NA
2	3	11		[32 cells]			NA	NA
2	2	12					NA	NA
2	1	13					NA	NA
2	0	14					NA	NA
2	-1	15					NA	NA

Table 2 (cont'd)

CATENL	YOS	E-4	E-5	E-6	E-7	E-8	E-9
	Track 11: career terms						
3	6						
3	7						
3	8						
3	9						
3	10						
3	11						
3	12			[84 cells]			
3	13						
3	14						
3	15						
3	16						
3	17						
3	18						
3	19						
4	20						
4	21						
4	22						
4	23						
4	24			[60 cells]			
4	25						
4	26						
4	27						
4	28						
4	29						

NOTES: CATENL = category of enlistment (first, second, career, and retirement-eligible); YETS = years to expiration of term of service ETS); YOS = years of service; EYOS = years of service in the ETS year. NA indicates inventory is not defined for that cell.

To summarize the above discussion:

Start-of-Fiscal-Year Accounting

- Losses from starting inventory.
- Reenlistments out of a cell.
- Flow out to retirement eligibility.
- Continuation outflow.

End-of-Fiscal-Year Accounting

- Continuation inflow.
- Accessions.
- Losses from accessions.
- Reenlistments in.
- Flow into retirement eligibility.
- Promotions and demotions.

POLICY-FREE ETS LOSSES AND REENLISTMENTS

Generally, the MTA model estimates flows during a year by multiplying the inventory at the start of a year by flow rates. The major deviation from this simple Markovian scheme is the estimation of ETS losses and reenlistments. These flows are estimated by multiplying a "policy-free inventory" by "policy-free flow rates" and then adjusting the "policy-free flow" to the actual flow. "Policy-free" means free of the effects of early release programs (e.g., Palace Chase, Early Out, Rollup) and the forced early reenlistment program. In the case of reenlistments, the inventory is further adjusted to take out losses during a fiscal year, so the reenlistment rates are calculated from the inventory of survivors. The purpose of doing the inventory adjustments is to obtain flow rates that are strictly behavioral (more stable over time), hence can be more accurately estimated.

These adjustments have often caused confusion during discussions of loss and reenlistment estimation. Most of the confusion has resulted from not understanding that the early release and forced early

reenlistment programs cause two kinds of flows. The most obvious flow is the extra losses or reenlistments that occur in a fiscal year. For example, if 100 persons are given Early Outs during FY88, there are 100 additional losses during that year that would not have occurred if the program had not been invoked. The second flow, which tends to be overlooked, is the losses and reenlistments that no longer occur because of these programs. For example, in the case of the 100 Early Outs during FY88, there will be 100 fewer losses during FY89 than there would have been if those Early Outs had not occurred.

To make sure that the estimation equations properly identify the losses and reenlistments that do not occur because of the early release and reenlistment programs, the MTA model gives those losses and reenlistments the name "shifts," indicating a loss or reenlistment that does not occur when expected because it has been shifted to an earlier time.

An example of a shift is EOSHIFT, which stands for "Early Out Shift." In the above example of the 100 Early Outs during FY88, EOSHIFT = 100 in FY89. A positive number indicates the losses that do not occur.

A second source of confusion is failure to distinguish between counts of early release shifts and the inventory reductions caused by those shifts. By "inventory reductions" we mean the inventory at the start of a fiscal year that no longer exists because some losses have been shifted from after to before the inventory date. The Rollup program does not generate any inventory reductions because the shifts and losses occur in the same fiscal year. The Early Out program generates inventory reductions at the start of a fiscal year that equal the shifts during the fiscal year (which are the same as the losses in the previous fiscal year). The case of the Palace Chase program is more complicated, however. Only Palace Chase shifts that occur after the inventory date and are linked to losses before the inventory date get counted as inventory reductions.

The forced early reenlistment program is of particular interest because it causes both reductions and increases. For every reenlistment-out that is shifted to an earlier fiscal year (causing an inventory reduction), there is a reenlistment-in that is also shifted to the earlier fiscal year (causing an inventory increase). The inventory increases are treated as negative inventory reductions internal to the model. Forced early reenlistments that shift reenlistments within a fiscal year do not cause inventory changes at the end or start of fiscal years.

For example, assume that without a forced early reenlistment program there would be 1000 reenlistments in FY89 and 1100 reenlistments in FY90; and assume that a forced early reenlistment program causes 400 reenlistments to occur in FY89 that would otherwise have occurred in FY90, and 100 reenlistments to occur earlier in FY89 than would have otherwise happened. Then we have:

Item	FY89	FY90
Policy-free reenlistments (PFREUPOUT)	1000	1100
Shifts to previous fiscal year (FEROUT2SHIFT)	0	400
Shifts within same fiscal year (FEROUT1SHIFT)	100	0
ETS reenlistments (ETSREUP)	900	700
Early reenlistments from next year (FEROUT2)	400	0
Early reenlistments from same year (FEROUT1)	100	0
Total actual reenlistments (REUPOUT)	1400	700

ETS reenlistments are the accounting vehicle that creates the connection between policy-free reenlistments and actual reenlistments. They are the reenlistments that would have occurred in the absence of the forced early reenlistment program less the reenlistments shifted to a earlier time.

ETS Losses

By definition, "Policy-Free ETS losses" in a given fiscal year are the nonattrition, nonretirement losses that would occur in that fiscal year if the Palace Chase, Early Out, and Rollup programs had never existed in the past and will not exist in the present and future.

Actual ETS losses are the Policy-Free ETS losses minus those that have been shifted by the Palace Chase, Early Out, and Rollup programs.

ETSLOSS = PFETSLOSS - PCSHIFT - EOSHIFT - RUSHIFT

where ETSLOSS = Actual ETS losses that occur during a fiscal year.
PFETSLOSS = "Policy-Free" ETS losses (the ETS losses that would have occurred in the fiscal year if there never had been and never will be any early release programs).
PCSHIFT = ETS losses that would have occurred during this fiscal year if they had not been shifted to earlier fiscal years by the Palace Chase program.
EOSHIFT = ETS losses that would have occurred during this fiscal year if they had not been shifted to the previous fiscal year by the Early Out program.
RUSHIFT = ETS losses during this fiscal year that have been shifted to an earlier month in the fiscal year by the Rollup program.

The MTA model uses the above equation to estimate ETS losses from Policy-Free ETS losses. The model estimates Policy-Free ETS losses by first adjusting the inventory to what it would have been if there were no early release or forced early reenlistment programs, and then multiplying that inventory by the loss rate that would exist if there were no early release programs.

PFETSLOSS = PFETSLOSSRATE * (STARTINV + PCINVRED + EOINVRED + FERINVRED)

where PFETSLOSS = Policy-Free ETS losses (the ETS losses that would have occurred in the fiscal year if there never had been and never will be any early release programs).
PFETSLOSSRATE = Policy-Free ETS loss rate (the ETS loss rate that would have occurred in the fiscal year if there never had

been and never will be any early release programs).

STARTINV = Actual start-of-fiscal-year inventory.

PCINVRED = Inventory that does not exist at the start of the fiscal year because of previous fiscal years' Palace Chase programs. This is equal to the sum of all losses shifted from this and future fiscal years to previous fiscal years by previous years' Palace Chase programs. (Note that the summation must be done carefully to classify the shifted inventory by the YOS as of the start of the current fiscal year.)

EOINVRED = Inventory that does not exist at the start of the fiscal year because of previous fiscal year's Early Out programs. This is equal to the sum of all losses shifted from this fiscal year to the previous fiscal year by the previous year's Early Out program.

FERINVRED = Inventory "reductions" at the start of the fiscal year because of the forced early reenlistment program (can be positive, as when a first term reenlistment-out occurred early, or negative as when a second term reenlistment-in occurred early).

Reenlistments

By definition, the "policy-free reenlistments" in a given fiscal year are the reenlistments that would occur if the forced early reenlistment program did not exist. Actual reenlistments equal the policy-free reenlistments plus this year's forced reenlistments from the next year less last year's forced reenlistments from this year.

$$REUPOUT = PFREUPOUT + FEROUT2 - FEROUT2SHIFT$$

where REUPOUT = Actual reenlistments-out during a fiscal year.

PFREUPOUT = "Policy-free" reenlistments-out (the reenlistments

that would have occurred in the fiscal year if there were no forced early reenlistment program).

FEROUT2 = Forced early reenlistments in the fiscal year coming from reenlistments that otherwise would have occurred in the next fiscal year.

FEROUT2SHIFT = Reenlistments-out that would have occurred in this fiscal year if they had not been shifted to the previous fiscal year by the forced early reenlistment program.

The model estimates policy-free reenlistments by first adjusting the inventory to what it would have been if there were no early release or reenlistment programs, then adjusting the inventory to reflect only survivors, and finally multiplying that inventory by the reenlistment rate that would exist if there were no early release programs.

$$PFREUPOUT = PFREUPRATE * (STARTINV + PCINVRED + EOINVRED + FERINVRED - ATTINV - PFETSLOSS)$$

where PFREUPOUT = Reenlistments out during a fiscal year.

PFREUPRATE = Policy-Free reenlistment rate (the ratio of reenlistments to inventory that has been adjusted to remove the effects of early release programs and policy-free losses).

ATTINV = Attrition from starting inventory.

PFETSLOSS = Policy-Free ETS losses (the ETS losses that would have occurred in the fiscal year if there never had been and never will be any early release programs).

FERINVRED = Inventory "reductions" at the start of the fiscal year due to the forced early reenlistment program (can be positive, as when a first term reenlistment-out occurred early, or negative, as when a second term reenlistment-in occurred early).

LOSS AND REENLISTMENT MODELS

The MTA model predicts losses and reenlistments by multiplying inventories by loss rates for each cell in the inventory accounting structure. The EFMP has found that loss and reenlistment rates vary considerably by those inventory characteristics. For example, loss and reenlistment rates are highest for inventory cells in which enlisted persons reach the end of their obligated term of service.[3] In other words, a major strength of the MTA model's method of predicting losses and reenlistments is that it uses inventory groups that have fairly homogeneous behavior.

In addition to controlling for inventory group, the MTA model also adjusts loss and reenlistment rates for changes in management policy and economic conditions. These adjustments are the same as those made in the DMI. Both the MTA and DMI separation rate models are based on the EFMP's basic research on separation rates, which found that ETS loss rates and reenlistment rates vary with the following econometric factors (Carter et al., 1987, p. 26):

- Reenlistment bonuses.
- Civilian unemployment rate.
- Ratio of military wages to civilian wages.
- Proportion high school graduates.
- Proportion AFQT Group III or lower.
- Proportion male.
- Proportion married.
- Proportion black.

The formula that implements those findings can be written as follows, where the summation is across all the econometric variables, indexed by "k."

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[3]The expiration-of-term-of-service cells in the MTA model's accounting structure are the ones with YETS = 1. The YETS dimension is implied by the Track and YOS dimensions for the first and second categories of enlistment (see Table 2).

$$R = H + \text{Sum } [C_k * V_k]$$

where R = separation rate (loss rate or reenlistment rate).
H = constant term.
C_k = coefficient of econometric variable k.
V_k = value of econometric variable k.

This formula can be rewritten to express the predictions as deviations from the prediction in a reference situation. To do this, first write the formula for the reference separation rate as a function of the reference values of the econometric variables:

$$R(ref) = H + \text{Sum } [C_k * V_k(ref)]$$

where $R(ref)$ = separation rate in reference situation.
$V_k(ref)$ = value of econometric variable k in reference situation.

Then, subtract this equation from the earlier one to get:

$$R - R(ref) = \text{Sum } \{C_k * [V_k - V_k(ref)]\}$$

and rewrite the result as:

$$R = R(ref) + \text{Sum } \{C_k * [V_k - V_k(ref)]\}$$

This final form of the prediction equation shows that only econometric variables that are expected to deviate from the reference situation need be explicitly carried in the MTA model. Variables that do not change during the projection years have $[V_k - V_k(ref)] = 0$, so they drop out of the prediction equation. For example, it is not necessary to carry the proportion of high school graduates in the prediction equations.

The list of econometric variables that are expected to change substantially over the MTA model's projection years are reenlistment bonuses, unemployment rate, and ratio of military wages to civilian wages. Consequently, only these econometric variables are on the MTA

model's input screens and only these variables are carried inside the MTA model. The EFMP has found (Carter et al., 1987) that when any of those factors increases, loss rates decrease and reenlistment rates increase.

The DMI model has implemented this same choice of econometric variables to carry in separation rate forecasting equations. The econometric variables that are not used explicitly to forecast separation rates in these models are used implicitly since they are used in the econometric estimation of the coefficients, C_k, to control for all relevant factors. These controls insure that the estimates of the coefficients are unbiased.

Adjusting Separation Rates for Projection Years

The adjustment formulas in the MTA model use the following transformation of the forecasting equation.

$$R = R(ref) * \{1 + Sum\ [D_k * [V_k - V_k(ref)]\}$$

where $D_k = C_k/R(ref)$

As an example of how this forecasting equation works, assume there are 1000 people in an accounting cell's inventory at the start of the projection year, the reference year loss rate is 0.50, the econometric variable is the natural logarithm of the percent unemployment, and the adjustment parameter, D, is 0.65. Then, if the unemployment rate is five percent in the reference situation and six percent in the projection year, there are 559 projected losses from the cell during the projection year:

$$\begin{aligned} F &= [1000]\ [0.50]\ [\ 1 + [0.65]\ [\log(6) - \log(5)]\ ] \\ &= [500]\ [\ 1 + [0.65]\ [\ 1.792 - 1.609\ ]\ ] \\ &= [500]\ [\ 1 + [0.65]\ [\ 0.183\ ]\ ] \\ &= [500]\ [\ 1.119\ ] \\ &= 559 \end{aligned}$$

Appendix B presents the details of the above adjustment formula. The appendix gives the exact form of all the econometric variables, such as the logarithmic transformation of unemployment rates. The appendix also shows how the fiscal-year adjustment parameters, D(k), are estimated from the cohort-year parameters produced by the EFMP econometric analyses. The conversion of cohort-year parameters to fiscal-year parameters is called "blending," because it involves blending the behavior of all the cohorts that intersect a given fiscal year into that fiscal year's behavior.

Solving the blending problem requires implementing the mapping defined in Table 3. Except for the first cohort year, behavior during a cohort-year influences behavior during two fiscal years. For example, the cohort year loss rate for one year before expiration of term of service (YETS = 1) influences both the fiscal year loss rate for inventory that will reach ETS in the current fiscal year (YETS = 1) and the loss rate for inventory that will reach ETS in the next fiscal year (YETS = 2).

Another way to understand the mapping in Table 3 is to consider all the cohort years that influence a given fiscal year. Consider an inventory counted at the start of a fiscal year that will reach ETS during the fiscal year. For part of the fiscal year members of this inventory will be in the final cohort year before ETS, and for the rest

Table 3

MAPPING OF COHORT YEARS INTO FISCAL YEARS

Cohort Years to ETS	Fiscal Years to ETS					
	4	3	2	1	0	-1
4	x					
3	x	x				
2		x	x			
1			x	x		
0				x	x	
-1					x	x

of the fiscal year members of this inventory will be in the first cohort year after ETS. That is why fiscal year YETS = 1 is influenced by cohort year YETS = 1 and YETS = 0.

The idea behind this method can best be illustrated by an example. Suppose that the losses during a fiscal year from the fiscal year YETS = 1 have historically been 4/5 from cohort year YETS = 1 and 1/5 from cohort year YETS = 0. Suppose further that a reenlistment bonus offer decreases the cohort year YETS = 1 loss rate by 7 percentage points and the cohort year YETS = 0 loss rate by 3 percentage points. Then we conclude that the reenlistment bonus offer will decrease the fiscal year YETS = 1 loss rate by (4/5)(7) + (1/5)(3) = 6.2 percentage points.

COST ESTIMATION

The MTA model projects the annual Military Personnel Account (MPA) budget that will be required to pay for the projected enlisted force. That budget includes the following personnel costs:

- Basic pay.
- Retired pay accrual.
- Basic Allowance for Quarters (BAQ) and Variable Housing Allowance (VHA).
- Incentive and special pay.
- Miscellaneous pay.
- Permanent Change of Station (PCS) cost.

The projection is done by multiplying numbers of full-time equivalent persons (person-years) by cost factors that are average costs per person-year during the reference period, adjusted for changes in military wages over time. The wage adjustment is done with two user-specified inputs: the ratio of military to civilian wages, and the Consumer Price Index (see Fig. 4, Annual Input Screen 1).

The adjustment formula is

$$A(y) = [W(y) * C(y)]/[W(r) * C(r)]$$

where A(y) = adjustment factor (ratio of cost in projection year to cost in reference period).

W(r) = military/civilian wage ratio in the reference period.

W(y) = military/civilian wage ratio in the projection year.

C(r) = Consumer Price Index in the reference period.

C(y) = Consumer Price Index in the projection year.

The assumptions used by this formula are that civilian wages increase in proportion to the Consumer Price Index, and all types of MPA costs increase in proportion to the military wage index used in constructing the military/civilian wage ratio. These assumptions are acceptable because the MTA model does not attempt an exact estimate of the required MTA budget, it produces an estimate that is good enough to guide enlisted force planning. The cost estimation method adopted has the virtue that it makes consistent estimates of the size and cost of the enlisted force. When the user-specified ratio of military to civilian wages increases, the size of the force increases because reenlistments increase, and the cost of the force increases because the additional reenlistments increase the average pay bracket as well as because the pay in any given bracket increases.

IV. DATA PREPARATION (MODULE 1)

OVERVIEW

This first module of the MTA model assembles three kinds of data:

- Information on the three most recent fiscal years for the MTA model's input and output screens (see Sec. II).
- Inputs for Module 2's annual projections:
  - Loss rates (by type)
  - Reenlistment rates
  - Promotion rate patterns
  - Recent history of early releases
  - Recent history of forced early reenlistments
  - Recent history of reenlistment bonuses
  - Recent history of economic conditions
  - Parts of year worked by gains and losses (for costing)
- Inputs for Module 5's monthly projections:
  - Monthly distribution of annual losses (by type)
  - Monthly distribution of annual reenlistments

In all cases, the work of Module 1 need be done only once a year. In other words, Module 1 has been designed to include only one-time calculations that are not affected by user inputs of assumptions or management plans. Appendix D presents the action diagram that describes the inputs, calculations, and outputs of this module. There are two alternative ways that the loss and enlistment rates can be calculated. Appendix D shows one way; the second is described at the end of this section.

As soon as the data on the last month of the previous fiscal year become available, Module 1 should be run and the MTA model should be made ready to run from the start of the new fiscal year. Once this has been done, projections for up to nine years can be run. Alternative projections can be made for different assumptions about future economic conditions and different plans for management actions. All these alternative projections use the same Module 1 results.

FLOW RATES AND DISTRIBUTIONS DURING THE REFERENCE PERIOD

The data required for Module 2 (annual projections) consist of flows, flow rates, and flow distributions during a reference situation. All the flows, flow rates, and distributions can be determined from recent historical data (App. D shows how these can be calculated from the last three years of data). The loss and enlistment rates can also be estimated using the regression equations developed for the DMI. Using the regression equations would maintain consistency between the MTA rates and rates used in the DMI models.

Tests and evaluations of the DMI confirm that the regression based loss rates yield very good forecasts at the AFSC (occupation) level of detail. The next subsection describes how the regression equations can be used to calculate aggregate loss and reenlistment rates. Those calculations are slightly more cumbersome than calculations used to determine the loss and reenlistment rates from recent historical data.

The data required for Module 5 (monthly projections) largely consist of distributions of annual flows across the 12 months of a fiscal year. These distributions are used in Module 5 to allocate annual totals (produced by Module 2) to monthly details.

In most cases, the MTA model uses the recent past as its reference situation. For concreteness, these specifications assume that the most recent three fiscal years are the reference period. However, any number of years can be used. Note that, independent of the length of the reference period, three years of recent events are required by the input and output screens to show recent trends to model users. During the test and evaluation of the MTA model, an analysis can be performed to see if different lengths of the reference period influence prediction accuracy.

The reference period flow rates and distributions are ratios of information from the entire reference period. For example, if loss rates are calculated from recent historical data instead of from the DMI's regression equations, a loss rate is calculated as the ratio of the losses during the years in the reference period to the inventories at the start of those years in the reference period.

$$\text{Loss rate} = (L1 + L2 + \ldots + Ln)/(I1 + I2 + \ldots + In)$$

where

n = Number of years in the reference period.
Ly = Loss in the yth year of the reference period.
Iy = Inventory at the start of the yth year of the reference period.

ESTIMATING LOSS AND REENLISTMENT RATES FROM REGRESSION EQUATIONS

Regression equations developed for the DMI can also be used to provide reference loss and reenlistment rates for the MTA. The regression equations were originally estimated from data for the period June 1973 through June 1983 (see Carter et al., 1987) but are updated annually in the EFMS.

These regression models use demographic characteristics of the enlisted force in addition to economic conditions and management policies to predict flow rates. Demographic information from the recent past is used when the models are implemented.

Estimating loss and reenlistment rates from the regression equations involves three steps:

Step 1: Estimate cohort loss and reenlistment rates.

(a) For any given year, start with an airman inventory file [e.g., the Uniform Airman Records file or the Year-At-Risk file (see Murray et al., 1989)].

(b) Obtain mean values (during a recent historical period) for each explanatory variable in the middle-term loss and reenlistment regression equations by modifying the programs used to prepare the inputs for the DMI.

(c) Define a reference situation that has zero reenlistment bonuses.

(d) Evaluate the loss and reenlistment models at those mean values of the explanatory variables.

Step 2: Convert cohort rates into fiscal year rates.

Run the current DMI data preparation program called the Blending Program (documented in unpublished RAND research by Rydell et al.),

which converts cohort rates into fiscal-year rates, assuming that all the enlisted force is in a single specialty. This conversion is called "blending" because many cohort rates are needed to estimate one fiscal year's rate.

Step 3: Separate attrition from nonattrition loss rates.

Separate the loss rates estimated in Steps 1 and 2 into attrition loss rates and nonattrition loss rates. Specifically, separate losses during the last years of service in a term of enlistment into attrition losses and ETS losses, and separate losses during the retirement eligible terms into attrition losses and retirements by using rates estimated from recent historical behavior as the attrition rate estimates, and then subtracting these estimates from the total loss rates (obtained in Steps 1 and 2) to get the nonattrition loss rates.

The resulting loss and reenlistment rates correspond to the variables PFETSLOSSRATE and PFREUPRATE defined in App. D.

V. ANNUAL PROJECTIONS (MODULE 2)

OVERVIEW

The Annual Projections module of the MTA model (MTA2) is the machinery that projects Air Force enlisted personnel year by year for up to nine fiscal years into the future. Module 2 responds to user-chosen management actions by calculating personnel flows and the end-of-fiscal-year inventory by category of enlistment, grade, and years of service. Appendix D details the Module 2 inventory projection calculations.

Module 2 is Markovian and uses the principle of generating a full accounting structure (Track by YOS by Grade) for each type of personnel flow. Calculations are performed iteratively, one fiscal year at a time. At the conclusion of a fiscal year's calculations, the inventory and flows are aggregated and entered in the output screens for the appropriate fiscal year. Thus, only one complete accounting structure for the inventory and each type of personnel flow is required.

Module 2 performs three distinct functions iteratively for up to nine fiscal years. The functions are:

- Aging the force.
- Promoting the force.
- Generating output screens.

Figure 9 represents an overview of Module 2. Aging the force consists of determining the number of airmen who, starting at the beginning of a fiscal year, survive into the next fiscal year, and the corresponding YOS distribution. During this process losses, retirements, reenlistments, and continuation flows are determined; the inventory is adjusted for these flows; and the YOS of the survivors is incremented. Promoting the force determines the final Grade distribution. The output screen generator simply aggregates inventory, gains, and losses to the appropriate level of detail for each of the

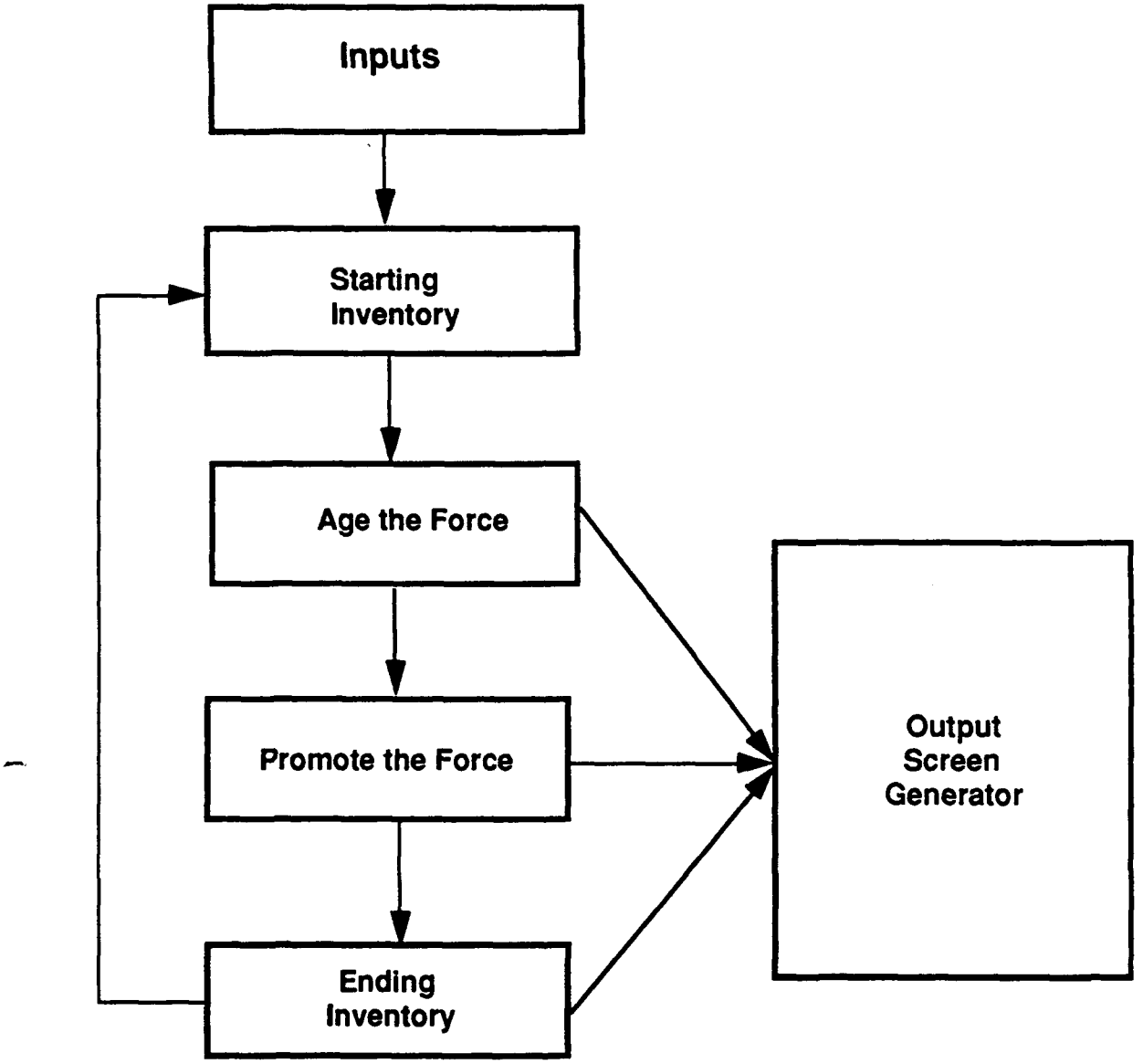

Fig. 9--Overview of MTA2

Module 2 output screens. The module is Markovian, so a fiscal year's ending inventory is mapped into the next year's starting inventory and the calculations repeat.

AGING THE FORCE

"Aging" the force means to take inventory counts by YOS and Track at the start of the fiscal year and transform them into inventory counts by YOS and Track at the end of the fiscal year. During this transformation grade is held constant.

Two fundamental identities define the aging process. The first accounting identity splits the starting inventory apart and estimates the part of the inventory that neither leaves nor reenlists (called continuation outflow) as a residual. The inventory and flows in this first identity are classified by the Track, YOS, and Grade that exist at the start of the fiscal year.

(1) Starting Inventory = Losses from starting inventory
+ Reenlistments out
+ Flow out to retirement eligibility
+ Continuation outflow

The second accounting identity puts the inventory back together again. The inventory and flows in this second identity are classified by the Track, YOS, and Grade that exist at the end of the fiscal year.

(2) Ending Inventory = Continuation inflow
+ Gains
- Losses from gains
+ Reenlistments in
+ Flow into retirement eligibility

Figure 10 presents the details required to age the force (e.g. transform a fiscal year's starting inventory into an end-of-fiscal-year inventory). The management actions interact with the enlisted inventory

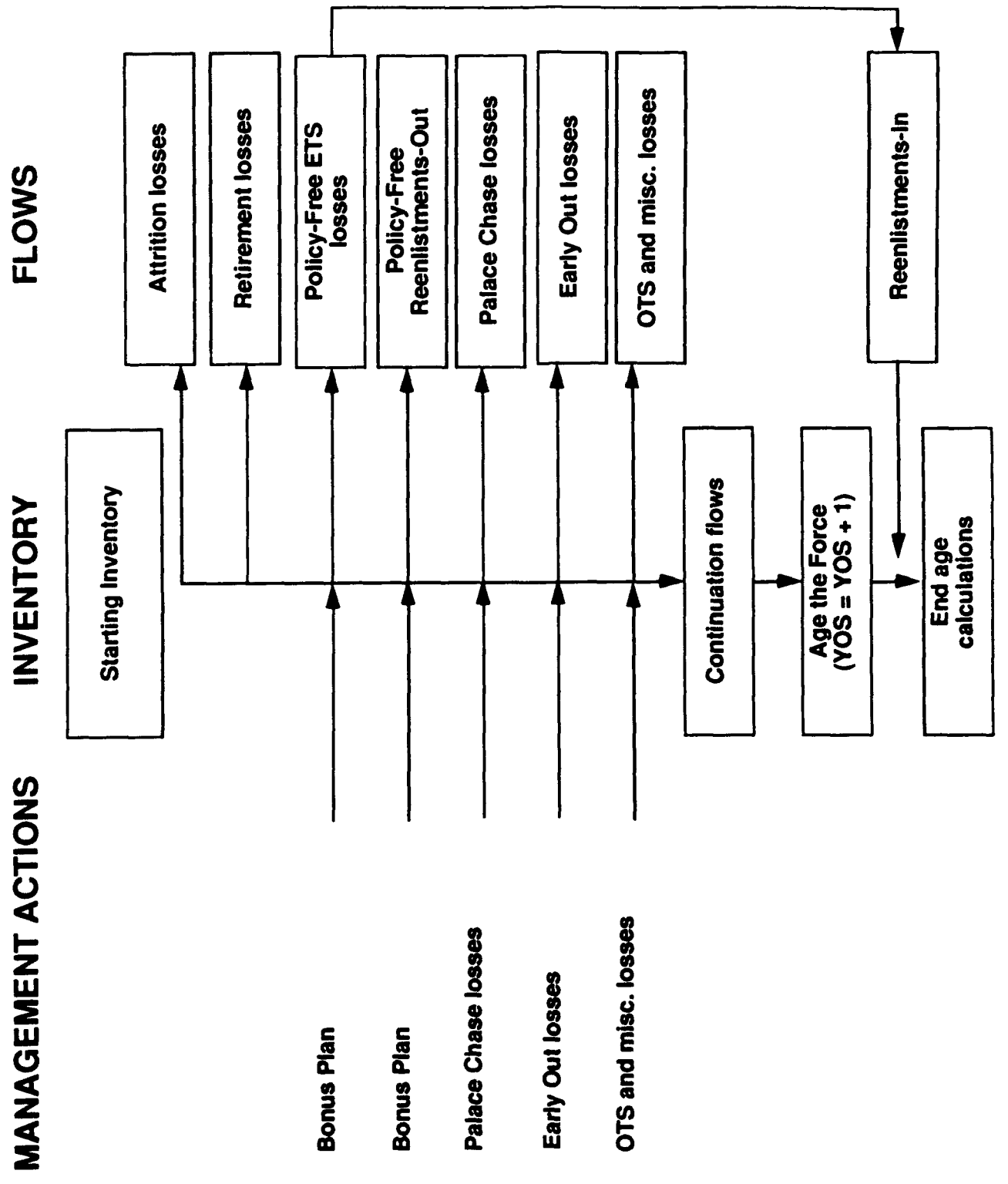

Fig. 10--Detailed calculations required to age the force

and ultimately affect flows. The inventory evolves over time as losses and reenlistments out are removed from the inventory. The result of removing all of the losses and reenlistments from the inventory is the continuation flows. The YOS variable is incremented by one, holding grade constant, and reenlistments are added back in with the YOS variable incremented by one and Track appropriately changed. Finally, gains (NPS and PS accessions) enter the force.

Losses

The MTA model distinguishes among eight types of losses from the enlisted force.

- Attrition.
- Palace Chase losses.
- Early Out losses.
- Rollup losses.
- ETS losses.
- Retirement losses.
- OTS losses.
- Miscellaneous losses.

Attrition losses are involuntary losses (e.g., death).

Palace Chase losses are early releases of personnel (as many as four fiscal years before the fiscal year in which their enlistment period ends) for the purpose of transferring to the Reserves.

Early Out losses are early releases of personnel in the fiscal year before the fiscal year in which their enlistment period ends, for the purpose of reducing end strength in the year in which the early release occurs.

Rollup losses are early releases of personnel in the same fiscal year in which their enlistment period ends, for the purpose of reducing Military Personnel Account costs in that fiscal year.

Retirement losses are voluntary losses of personnel who have been in the enlisted force for at least 20 years and who are therefore eligible for retirement. Personnel who have YOS = 19 at the start of the fiscal year (meaning that they have then been in the enlisted force for more than 19 years and less than 20 years) become eligible for retirement during that fiscal year. This means that some retirement losses come from the career term category of enlistment. (In particular, almost all of the losses from the YOS = 19 cell of Track 11 are retirements.)

ETS losses are voluntary, nonretirement losses at the end of a term of enlistment, including such losses that occur after one or more extensions. ETS losses do not include the involuntary losses due to attrition or losses due to management action in the Palace Chase, Early Out, or Rollup programs, nor do they include OTS or miscellaneous losses.

The MTA model's ETS losses are different from the DMI model's losses during the ETS year. Users of these models must be careful not to get confused by the difference. The DMI model distinguishes between losses during the ETS year, which is the cohort-year leading up to and including the date on which an enlisted person reaches the expiration of their term of service (OETS), and losses during extension years, which are the years after OETS. Moreover, the DMI model's losses during the ETS year include both attrition and nonattrition losses that occur during that cohort year. In contrast, the MTA model's ETS losses include losses from the ETS year and the extension years but exclude attrition losses.

OTS losses are flows from the enlisted force to Officer's Training School. These losses are personnel who came into the enlisted force as OTS gains and were scheduled all along to leave the enlisted force in this manner. However, the OTS losses in any given fiscal year do not necessarily equal OTS gains, so these flows must be in the MTA model for it to correctly estimate force strengths at the end of each fiscal year. Miscellaneous losses include "other losses" and "gain adjustments."

Gains

The MTA model distinguishes among five types of gains to the enlisted force.

- Non-prior service (NPS) accessions for a 4-year term of enlistment.
- Non-prior service (NPS) accessions for a 6-year term of enlistment.
- Prior service (PS) accessions.
- OTS gains.
- Miscellaneous gains.

NPS accessions enter the force in YOS = 0 cells in either Track 1 or Track 2, depending upon the initial term of enlistment. Accessions come into the enlisted force sometime during the fiscal year. At the end of a fiscal year they have been in the enlisted force for less than one year. Consequently they have YOS = 0 in the end-of-year inventory.

PS accessions enter the enlisted force primarily at the start of the second term. OTS gains are flows into the enlisted force of personnel who are scheduled to go to Officer's Training School. Miscellaneous gains include: recalls from the Reserves, returned dropped from rolls, delayed reenlistments, other gains, and gain adjustment.

Reenlistments

Reenlistments-out occur only in cells with YETS = 2, 1, 0, and -1 in Tracks 1 through 10, and in cells with YOS 8 or higher in Track 11. Inventory with YETS = 2 at the start of a fiscal year will reach the start of their ETS year in cohort time (and therefore be at risk of a reenlistment) somewhere during the fiscal year.

The early reenlistment program forces airmen to separate from the Air Force or reenlistment before their contracted ETS. The purpose of this program is to force a larger number of early losses than could be obtained by making early losses voluntary.

Reenlistments-in equal reenlistments-out with YOS increased by 1 and the Track changed appropriately. Changing from first-term Tracks to second-term Tracks and second-term Tracks to career-term Tracks will be explicitly programmed in the MTA model. However, such programming will not be difficult.

For first-term airmen (Tracks 1 and 2) reenlisting into a second-term Track (Track 3 through 10) the following formula can be used to determine the appropriate second-term Track for the reenlistment inflow.

$$\text{New Track} = \text{YOS at time of reenlistment} + \text{second-term term of enlistment} - 3$$

This equation is easily derived given the following:

$$\text{For the second term:} \quad EYOS = YETS + YOS - 1$$
$$\text{For the second term:} \quad \text{Track}[i] = EYOS - 3, \quad i = 3 \text{ to } 10$$

Substituting appropriately we find for the second term:

$$\text{Track}[i] = YETS + YOS - 1 - 3$$

When an airman enters the second term, YETS = second-term TOE, and second-term YOS - 1 = first-term YOS. Appropriate substitution gives the first of the above equations.

Tables 4 and 5 give the mappings from first-term Tracks into second-term Tracks at the corresponding second-term YOS level.

For second-term airmen reenlisting into the career term, reenlistments must be summed by YOS and Grade over all corresponding Tracks (3 to 10). These reenlistments flow into Track 11 at the same Grade with YOS incremented by one.

For career-term airmen reenlisting into the retirement-eligible career term, the reenlistment flow is essentially a continuation flow.

Table 4

REENLISTMENT FLOWS FROM FIRST-TERM TRACK 1 INTO SECOND-TERM TRACKS

YOS at Time of Reenlistment	Second Term			
	with TOE = 4		with TOE = 6	
	Track	YOS	Track	YOS
2	3	3	5	3
3	4	4	6	4
4	5	5	7	5
5	6	6	8	6

Table 5

REENLISTMENT FLOWS FROM FIRST-TERM TRACK 2 INTO SECOND-TERM TRACKS

YOS at Time of Reenlistment	Second Term			
	with TOE = 4		with TOE = 6	
	Track	YOS	Track	YOS
4	5	5	7	5
5	6	6	8	6
6	7	7	9	7
7	8	8	10	8

Flows to Retirement Eligibility

To do net change accounting for the career and retirement-eligible categories of enlistment we need to explicitly recognize the flow from YOS = 19 to YOS = 20 in Track 11. This flow would not be necessary if the output screens combined categories of enlistment 3 and 4 into a single category.

Continuations

Continuations are an accounting construct that makes flow accounting complete. They are inventory within a Track that do nothing except "age" during the fiscal year--neither leave the enlisted force nor change category of enlistment. Continuation inflows equal continuation outflows with YOS increased by 1.

PROMOTING THE FORCE

The inventory is promoted after the inventory has been aged. Promotion means to take inventory counts by Grade and Track after the aging calculations and transform them into inventory counts by Grade and Track at the end of the fiscal year. During this transformation YOS is held constant. Promoting the force moves the inventory counts one column to the right in inventory accounting structure.

The fundamental identity is:

Ending Inventory = Starting Inventory
- Promotions out
- Demotions out
+ Promotions in
+ Demotions in

Figure 11 presents the details required to promote the force (transform the aged inventory into an end-of-fiscal-year inventory). The management actions interact with the enlisted inventory to affect the flow, grade distribution, and ending inventory.

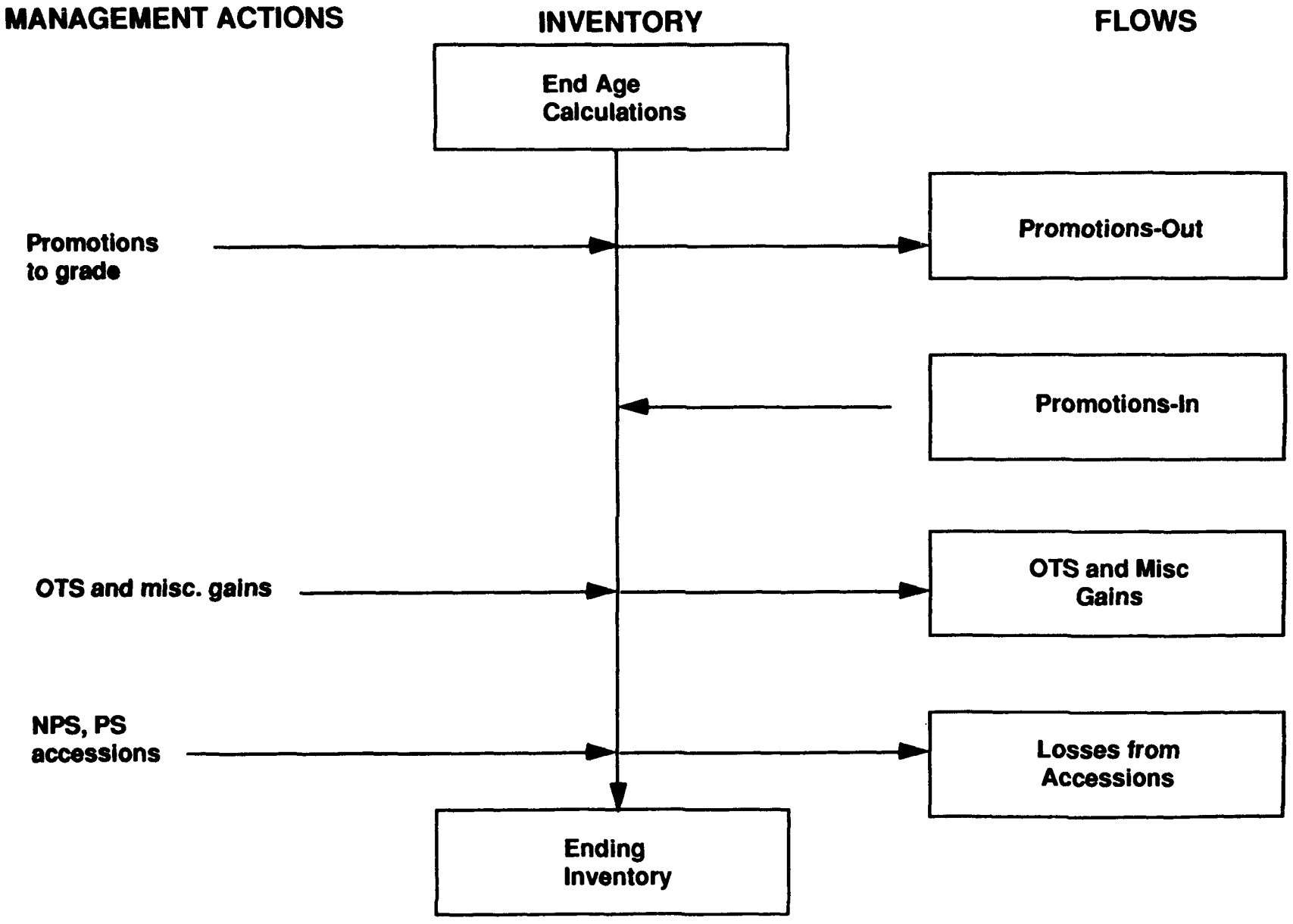

Fig. 11--Detailed calculations required to promote the force

Promotions to the top five grades are user-specified values. Historical trial promotion rates are used to spread promotions to the inventory accounting structure level. Promotions-out are equal to promotions-in at the next higher grade.

EARLY ATTRITION AND PROMOTIONS

Although the MTA model is essentially a Markovian model, one aspect is inherently non-Markovian, that of determining the early attrition and promotion of non-prior service accessions and airmen in their first year of service. By definition, "early attritions" and "early promotions" are attritions and promotions during a fiscal year of persons who are either accessions during that fiscal year or who are in the inventory at the start of the fiscal year with either YOS = 0 or YOS = 1. These flows require special consideration because of rapid automatic promotion through the first three grades. For example, an airmen entering the enlisted force at pay grade E-1 with a six-year term of enlistment will be promoted to pay grade E-3 within six months. Appendix A discusses early attritions and promotions theory, notation, and calculations.

VI. COMPUTER-AIDED DESIGN OF MANAGEMENT ACTIONS (MODULE 3)

OVERVIEW

The goals of enlisted force planning are customarily summarized by total inventories at the end of each fiscal year, called end strengths, and by inventories in each of the top five grades at the end of each fiscal year, called grade strength ceilings. The Computer-Aided Design of Management Actions module (Module 3), or goal seeking module, determines management actions (NPS accession and promotions flows) that will achieve user-specified end strength and grade strength goals.

The goal seeking module is designed to be used in conjunction with the Annual Inventory Projection module (Sec. V) as follows (see Fig. 3):

- *Step A*: Run Annual Inventory Projection module with a trial plan for NPS accessions and promotions (and all the other management actions).
- *Step B*: Run the goal seeking module to obtain revised NPS accessions and promotions that will achieve user-specified end strength and grade strength goals.[1]
- *Step C*: Rerun Annual Inventory Projection module with the new NPS accession and promotion actions to get details on the performance of the revised plan of management actions.

Step B can be run more than once before Step C if users want to explore tradeoffs among goals for different years. For example, if a sudden decrease in end strength causes an extreme dip in annual accessions, users might want to spread the decrease over two or more years to smooth annual accessions.

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[1]The results of the goal seeking module can be automatically supplied to the management action space of the Annual Inventory Projection module.

Also, the entire three-step procedure can be iterated if users find the implications of the suggested management actions to be unacceptable. For example, if the promotion flows required to achieve grade strength ceilings imply promotion rates that vary too much from year to year, users might want to adjust inventory levels by revising reenlistment bonus policy (in Step A) so that the suggested promotions (from Step B) lead to promotion rates (in Step C) that are more stable over time.

The point is that, just as the name "computer-aided design" implies, this module assists in designing policy, it does not determine policy. The Annual Inventory Projection module and the Computer-Aided Design of Management Actions module together make testing alterrative strategies straightforward and easy. However, users of the MTA model must create the strategies to be tested.

Approximations are used in the implementation of the goal seeking calculations. Users will find that when a plan suggested by the goal seeking module is implemented in the Annual Inventory Projection module the resulting performance does not exactly match the specified goals. If the degree of mismatch is unacceptably large, particularly in the later projection years, then a repeat of steps B and C will be needed to fine tune the plan. Appendix F describes the inputs, calculations, and outputs associated with Module 3.

In practice, iteration of the three steps will be needed anyway for another reason. Users, presumably, will want to revise the accessions and promotions suggested by the goal seeking module to make them satisfy judgmental criteria such as "smoothness." Also, users will change other management actions in the Annual Inventory Projection module, such as prior service accessions and Early Outs, to compensate for the revisions. The revised plan will rarely achieve the goals exactly on the first iteration.

DETERMINING ACCESSIONS TO ACHIEVE END STRENGTH GOALS

Determining the number of NPS accessions to achieve end strength goals is a fairly straightforward process. This process takes the results of the most previous run of the Annual Inventory Projection module (which includes a promotion and accession plan) and proceeds through the following five steps:

Step 1. Determine difference between end strength goal and projected inventory for each year.
Step 2. Estimate survival rates of NPS accessions.
Step 3. Calculate number of additional accessions required to survive to the end of each projection year.
Step 4. Determine actual additional NPS accessions required at the beginning of each projection year.
Step 5. Find total number of NPS Accessions needed in each projection year to achieve end strength goals.

It might seem that the additional NPS accessions required to achieve the end strength goals for each projection year can be easily determined by subtracting the total ending inventory from the end strength goal for each projection year. Unfortunately, this is not true. A considerable number of NPS accessions are lost from attrition shortly after entering the force, which obviously affects the required number of accessions in that year and all subsequent years. Thus, the problem is to estimate the number of NPS accessions that must survive in each of the projection years and then adjust actual NPS accessions accordingly.

Step 1 estimates accessions that would be needed if there were no attrition of these accessions. To adjust for attrition requires the estimation of two types of survival rates (Step 2). The first survival rate is the proportion of NPS accessions during a fiscal year that are still in the enlisted force at the end of that fiscal year. The second is the proportion of NPS accessions that enter the enlisted force during

FY = a (where a ranges over all projection years) who are still in the enlisted force at the start of FY = b and survive to the end of FY = b, for $b \geq a$.

The third step is to calculate the additional accessions that must survive to the end of the each fiscal year. For the first projection year, the required additional *survived accessions* equal the difference between the end strength goal and the projected inventory. For the subsequent projection years, the required additional survived accessions equal this difference minus survivors from all earlier year's additional accessions. The second survival rate described above is used in this calculation.

The fourth step is to determine the additional actual NPS accessions required during each projection year. The additional actual NPS accessions equal the required survived accessions at the end of the projection year divided by the proportion of accessions during the projection year that survive to the end of that year.

The last step is to calculate the total NPS accessions required to achieve the end strength goals. This is done by adding the additional actual NPS accessions to the trial plan's NPS accessions for each projection year.

DETERMINING PROMOTIONS TO ACHIEVE GRADE STRENGTH GOALS

Determining the number of promotions into the top five grades to achieve grade strength goals is quite easy provided one does Grade E-9 for all projection years first, then Grade E-8 for all projection years, and so on. As in determining NPS accessions to achieve end strength goals, the algorithm to determine promotions to achieve grade strength goals uses the results of the most previous run of the Annual Inventory Projection module.

The first step is to calculate the additional grade strength required to achieve the goals. This is easily done by subtracting the total ending inventory by grade from the grade strength ceilings for each projection year.

The additional promotions necessary to achieve required additions to grade strength equal the required additions to grade strength minus survivors of additions to grade strength made in the previous projection year plus additional promotions to the next higher grade in the current projection year. These calculations are done starting with Grade E-9 for projection years 1 through 12. The calculations then are done for Grade E-8 for projection years 1 through 12, and continue downward through Grade E-5.

Finally, the total number of promotions to the top five grades in each projection year is calculated by adding the additional promotions by grade to the trial plan's promotions for each projection year.

VII. COMPARISON OF ALTERNATIVE PLANS (MODULE 4)

Module 4 of the Middle-term Aggregate Inventory Projection Model (MTA4) systematically compares alternative named plans for the current fiscal year and up to eight future fiscal years. The purpose of the plan comparison is to view the personnel implications, over time, of alternative management actions, to assess the tradeoffs associated with these plans, and to obtain as much information as possible about why plans have to be revised to make better plans in future years.

Plans of interest are named and saved for comparison during runs of Module 2. Sending a plan made by MTA2 to MTA4 not only enables comparison of plans, but also archives the plan for future reference and analysis. At a minimum, any plan that is used in formal planning exercises should be retained. It will also be useful to retain alternative plans that were considered but not adopted. In a future year a currently rejected plan may become more attractive.

An unambiguous, consistent, and easy to use system for naming alternative plans is the key to making MTA4 work (along with database management procedures). The suggested naming system is to label a plan with:

XXXXXXXX-FF

where XXXXXXXX = number or eight-character name of plan
FF = fiscal year (last two digits)

INPUTS FROM MODULE 2

The inputs from MTA2 to MTA4 are identical to the outputs from MTA2 to its output interface screens. This information must be available for each of the two named plans compared by MTA4. The names of the plans are supplied through the input screen for MTA4.

Name of Plan 1

XXXXXXXX	Name or number of reference plan (eight characters)
FF	Fiscal year (last two characters)

Name of Plan 2

XXXXXXXX	Name or number of test plan (eight characters)
FF	Fiscal year (last two characters)

CALCULATIONS

The program for MTA4 must accomplish the following three tasks:

- Access and retain the inputs defining the two plans being compared.
- Fill out the initial MTA4 output screens.
- Give the user access to any of the MTA2 output screens for either plan, and to the screen-by-screen difference between the two plans.

The first task does not require special calculations.

The second task does require summing over dimensions of the basic accounting structure and finding differences between the two plans. These calculations are fairly simple and are presented on the MTA4 output screens.

The third task is extremely simple to define. Thus, neither the screens nor the calculations are given. Giving the user access to the MTA2 output screens is a database management problem that does not involve calculations. The only calculation required is the difference between the two plans.

VIII. MONTHLY PROJECTIONS (MODULE 5)

PURPOSE

The monthly projection module of the MTA model (MTA5) gives month by month detail on inventories and flows during a user-specified projection year. This capability will be useful to force programmers in getting a head start on monthly planning for the next full fiscal year while still only part way through the current fiscal year. Once the next fiscal year is under way, the programmers will use the SAM to fine tune the monthly plan for the rest of the fiscal year as each month's actual events become known.

In fact, not only will SAM hand off monthly projections to the MTA model once the fiscal year has started, but the MTA model's monthly projection module is built using the SAM model. This means that the input and output screens that the user sees when using the MTA model for monthly projections are identical to the screens that the user sees when using SAM.

DESIGN STRATEGY

The strategy for building Module 5 of the MTA model is to use as much as possible from the already constructed SAM model. This strategy offers two advantages: First, the "look and feel" of MTA5 will be similar to that of SAM, so MTA5 will be easy to use; and second, MTA5 will be easy to construct and maintain.

Conceptually, building MTA5 requires only three steps:

- Take the version of SAM2 that runs from the start of the current fiscal year.
- Preserve all of its inputs that do not change with fiscal year.
- Use annual control totals from MTA2 to adjust those inputs that do change with fiscal year.

In practice, as usual, there are numerous details to attend to, but the general idea remains simple.

Appendix A

EARLY ATTRITION AND PROMOTION

By definition, "early attritions" and "early promotions" are attritions and promotions during a fiscal year of persons who are either accessions during that fiscal year or who are in the inventory at the start of the fiscal year with either YOS = 0 or YOS = 1. These flows require special analysis because of rapid, automatic promotion through the first three grades. This appendix provides a complete analysis of these flows. Modules 1 and 2 of the MTA model draw on the material in this appendix as needed to specify data preparation (Module 1) and annual projection (Module 2).

PROMOTION PHASE POINTS TO GRADES E-2 THROUGH E-4

For grades E-1 through E-4, promotion is based on fixed phase points. The entry grade for four-year enlistees is E-1. The entry grade for six-year enlistees is E-1 during basic military training. They then become E-3.

For four-year enlistees, the E-2 phase point is six months, the E-3 phase point is 16 months, and the E-4 phase point is 30 months "below the zone" and 36 months normally.

For six-year enlistees, the E-4 phase point is 24 months "below the zone" and 30 months normally.

At the end of the first (partial) calendar month in service, enlisted personnel are "0 months in service" (MOS = 0). At the end of the second calendar month in service enlisted personnel are "1 month in service" (MOS = 1). At the end of the 13th calendar month in service enlisted personnel are "12 months in service" (MOS = 12) and "1 year in service" (YOS = 1).

Table A.1 shows how the fixed phase points for promotion to grades E-2 through E-4 line up on the MOS/YOS method of counting time in service.

Table A.1

GRADE E-1 THROUGH E-4 BY MONTHS IN SERVICE

	4-Year Enlistee				6-Year Enlistee			
MOS	E-1	E-2	E-3	E-4	E-1	E-2	E-3	E-4
				YOS = 0				
0	x				x			
1	x						x	
2	x						x	
3	x						x	
4	x						x	
5	x						x	
6		x					x	
7		x					x	
8		x					x	
9		x					x	
10		x					x	
11		x					x	
				YOS = 1				
12		x					x	
13		x					x	
14		x					x	
15		x					x	
16			x				x	
17			x				x	
18			x				x	
19			x				x	
20			x				x	
21			x				x	
22			x				x	
23			x				x	

Table A.1 (cont'd)

GRADE E-1 THROUGH E-4 BY MONTHS IN SERVICE

	4-Year Enlistee				6-Year Enlistee			
MOS	E-1	E-2	E-3	E-4	E-1	E-2	E-3	E-4
				YOS = 2				
24			x				x	b
25			x				x	b
26			x				x	b
27			x				x	b
28			x				x	b
29			x				x	b
30			x	b				x
31			x	b				x
32			x	b				x
33			x	b				x
34			x	b				x
35			x	b				x
				YOS = 3				
36				x				x
37				x				x
38				x				x
etc.				x				x

NOTE: x = normal grade; b = grade resulting from a below-the-zone (BTZ) promotion to grade E-4.

EARLY ATTRITIONS AND PROMOTIONS

Attritions and promotions from accessions during a fiscal year, and from a starting inventory that has YOS = 0 or YOS = 1, are complex enough to require special analysis. Tables A.2 and A.3 show the possible fates of accessions and starting inventories in terms of the grade of those who leave during the fiscal year and the grade of those who stay at the end of the fiscal year. Those possible fates are a consequence of the automatic promotion rules in Table A.1.

Tables A.4 and A.5 report rough estimates of the distribution across all possible fates. The estimates were made using summary loss rates from the SAM and ALEC models together with the automatic promotion phase points in Table A.1. The estimation was done with eyeball numerical integration and is not intended to be exact. For the MTA model, these proportions will be estimated by tabulating data from the three fiscal years before the start of the projections.

Tables A.6 and A.7 apply the estimated distributions to accession and inventory counts for FY87 to get estimates of early attrition losses during FY87. Again, these estimates are provided merely to illustrate the theory. The MTA model will estimate these flows for each projection year based upon that year's starting inventory and accession plan.

MODELING EARLY ATTRITION AND PROMOTION

Notation

The first step in modeling early attrition and promotion flows is to define notation for the distribution of each of the sources of those flows. Tables A.8 and A.9 define the required notation. The general form of the variable names is SxDy, where S stands for "source," x is the number of the source in order of appearance in these tables, D stands for "distribution coefficient," and y is the number that identifies the fate for a given source, counting from left to right in the tables. In each case, the interpretation of SxDy is the proportion of source x that has fate y during the fiscal year.

Tables A.4 and A.5 provide an indication of the values of these distribution coefficients. Module 1 of the MTA model estimates these coefficients from the behavior of the enlisted force in the three fiscal years before the start of the projections. The estimation involves counting the size of each source in each of the three fiscal years, counting the size of each fate for each source in each of the three fiscal years, and then taking the ratios of the sum of the three fate counts to the sum of the three source counts for each SxDy coefficient.

Table A.2

INCIDENCE OF LOSSES AND SURVIVORS FROM ACCESSIONS AND EARLY INVENTORY: 4-YEAR TOE

	Losses During FY by Status at Time of Loss									
	E-1					End of FY Inventory				
Source	BMT	STD	E-2	E-3	E-4	E-1	E-2	E-3	E-4	Total
Accessions During Fiscal Year										
Accessions	x	x	x			x	x			
Inventory at Start of Fiscal Year										
YOS=0, E-1	x	x	x				x	x		
YOS=0, E-2			x	x				x		
YOS=1, E-2			x	x				x		
YOS=1, E-3				x	x			x	x	

NOTE: STD refers to standard attrition loss of airmen in grade E-1 who have completed BMT.

Table A.3

INCIDENCE OF LOSSES AND SURVIVORS FROM ACCESSIONS AND EARLY INVENTORY: 6-YEAR TOE

	Losses During FY by Status at Time of Loss									
	E-1					End of FY Inventory				
Source	BMT	STD	E-2	E-3	E-4	E-1	E-2	E-3	E-4	Total
Accessions During Fiscal Year										
Accessions	x			x		x		x		
Inventory at Start of Fiscal Year										
YOS=0, E-1	x			x				x		
YOS=0, E-3				x				x		
YOS=1, E-3				x	x			x	x	

Table A.4

DISTRIBUTION OF LOSSES AND SURVIVORS FROM ACCESSIONS AND EARLY INVENTORY: 4-YEAR TOE

	Losses During FY by Status at Time of Loss									
	E-1					End of FY Inventory				
Source	BMT	STD	E-2	E-3	E-4	E-1	E-2	E-3	E-4	Total
Accessions During Fiscal Year										
Accessions	.080	.040	.020			.450	.410			1.000
Inventory at Start of Fiscal Year										
YOS=0, E-1	.007	.015	.055				.612	.311		1.000
YOS=0, E-2			.040	.030				.930		1.000
YOS=1, E-2			.006	.080				.914		1.000
YOS=1, E-3				.070	.004			.858	.068	1.000

NOTE: Entries are illustrative estimates chosen to be consistent with promotion policies and annual loss rates.

Table A.5

DISTRIBUTION OF LOSSES AND SURVIVORS FROM ACCESSIONS AND EARLY INVENTORY: 6-YEAR TOE

	Losses During FY by Status at Time of Loss									
	E-1					End of FY Inventory				
Source	BMT	STD	E-2	E-3	E-4	E-1	E-2	E-3	E-4	Total
Accessions During Fiscal Year										
Accessions	080			.060		.110		.750		1.000
Inventory at Start of Fiscal Year										
YOS=0, E-1	.007			.120				.873		1.000
YOS=0, E-3				.120				.880		1.000
YOS=1, E-3				.045	.055			.190	.710	1.000

NOTE: Entries are illustrative estimates chosen to be consistent with promotion policies and annual loss rates.

Table A.6

FY87 COUNTS OF LOSSES AND SURVIVORS FROM ACCESSIONS AND EARLY INVENTORY: 4-YEAR TOE

	Losses During FY by Status at Time of Loss									
	E-1					End of FY Inventory				
Source	BMT	STD	E-2	E-3	E-4	E-1	E-2	E-3	E-4	Total
Accessions During Fiscal Year										
Accessions	3743	1872	935			21055	19184			46791
Inventory at Start of Fiscal Year										
YOS=0, E-1	154	329	1207				13430	6825		21945
YOS=0, E-2			957	717				22240		23915
YOS=1, E-2			86	1148				13116		14350
YOS=1, E-3				2175	124			26657	2113	31069

NOTE: Entries are illustrative estimates chosen to be consistent with promotion policies and annual loss rates.

Table A.7

FY87 COUNTS OF LOSSES AND SURVIVORS FROM ACCESSIONS AND EARLY INVENTORY: 6-YEAR TOE

	Losses During FY by Status at Time of Loss									
	E-1					End of FY Inventory				
Source	BMT	STD	E-2	E-3	E-4	E-1	E-2	E-3	E-4	Total
Accessions During Fiscal Year										
Accessions	671			503		923		6292		8390
Inventory at Start of Fiscal Year										
YOS=0, E-1	5			77				563		645
YOS=0, E-3				1005				7372		8377
YOS=1, E-3				370	452			1563	5839	8224

NOTE: Entries are illustrative estimates chosen to be consistent with promotion policies and annual loss rates.

Table A.8

NOTATION FOR DISTRIBUTION OF LOSSES AND SURVIVORS FROM ACCESSIONS AND EARLY INVENTORY: 4-YEAR TOE

	Losses During FY by Status at Time of Loss									
	E-1					End of FY Inventory				
Source	BMT	STD	E-2	E-3	E-4	E-1	E-2	E-3	E-4	Total
Accessions During Fiscal Year										
Accessions	S1D1	S1D2	S1D3			S1D4	S1D5			1.000
Inventory at Start of Fiscal Year										
YOS=0, E-1	S2D1	S2D2	S2D3				S2D4	S2D5		1.000
YOS=0, E-2			S3D1	S3D2				S3D3		1.000
YOS=1, E-2			S4D1	S4D2				S4D3		1.000
YOS=1, E-3				S5D1	S5D2			S5D3	S5D4	1.000

Table A.9

NOTATION FOR DISTRIBUTION OF LOSSES AND SURVIVORS FROM ACCESSIONS AND EARLY INVENTORY: 6-YEAR TOE

	Losses During FY by Status at Time of Loss									
	E-1					End of FY Inventory				
Source	BMT	STD	E-2	E-3	E-4	E-1	E-2	E-3	E-4	Total
Accessions During Fiscal Year										
Accessions	S6D1			S6D2		S6D3		S6D4		1.000
Inventory at Start of Fiscal Year										
YOS=0, E-1	S7D1			S7D2				S7D3		1.000
YOS=0, E-3				S8D1				S8D2		1.000
YOS=1, E-3				S9D1	S9D2			S9D3	S9D4	1.000

Required Results

1. Estimate the following variables for Tracks 1 and 2, YOS 0 and 1, Grades E-1 through E-6. Note that in keeping with the conventions established in Sec. III, attrition losses from accessions are counted by end-of-year YOS, and attrition losses from inventory are counted by start-of-year YOS. These conventions mean that the attrition counts for YOS = 0 include both losses from accessions during the year and losses from inventory that has YOS = 0 at the start of the year.

BMTATTLOSS [Track] <YOS, Grade> = Attrition during fiscal year while the enlisted person is in basic military training.

STDATTLOSS [Track] <YOS, Grade> = Attrition during fiscal year after the enlisted person has completed basic military training.

2. Estimate the following variables for Tracks 1 and 2, YOS 0, 1, and 2, Grades E-1 through E-6. Note that in keeping with the conventions established in Sec. III, promotions (both out and in) are counted by end-of-year YOS. These conventions mean that promotions flows of accessions are counted as YOS = 0 flows and that promotions flows of starting inventory are counted as YOS ≥1 flows. Of course, ending inventory is counted by end-of-year YOS.

PROMOUT [Track] <YOS, Grade> = Promotion out of grade during fiscal year.

PROMIN [Track] <YOS, Grade> = Promotion into grade during fiscal year.

ENDINV [Track] <YOS, Grade> = Inventory at end of fiscal year.

Calculations

Preset all output variables (all variables on the left side of the following equations) to zero. Then construct the following nonzero entries.

Attrition: TOE = 4

```
BMTATTLOSS [Track = 1] <YOS = 0, Grade = 1> =
           S1D1 * NPS4
         + S2D1 * STARTINV [Track = 1] <YOS = 0, Grade = 1>
STDATTLOSS [Track = 1] <YOS = 0, Grade = 1> =
           S1D2 * NPS4
         + S2D2 * STARTINV [Track = 1] <YOS = 0, Grade = 1>
STDATTLOSS [Track = 1] <YOS = 0, Grade = 2> =
           S1D3 * NPS4
         + S2D3 * STARTINV [Track = 1] <YOS = 0, Grade = 1>
         + S3D1 * STARTINV [Track = 1] <YOS = 0, Grade = 2>
STDATTLOSS [Track = 1] <YOS = 0, Grade = 3> =
           S3D2 * STARTINV [Track = 1] <YOS = 0, Grade = 2>
STDATTLOSS [Track = 1] <YOS = 1, Grade = 2> =
           S4D1 * STARTINV [Track = 1] <YOS = 1, Grade = 2>
STDATTLOSS [Track = 1] <YOS = 1, Grade = 3> =
           S4D2 * STARTINV [Track = 1] <YOS = 1, Grade = 2>
         + S5D1 * STARTINV [Track = 1] <YOS = 1, Grade = 3>
STDATTLOSS [Track = 1] <YOS = 1, Grade = 4> =
           S5D2 * STARTINV [Track = 1] <YOS = 1, Grade = 3>
```

Attrition: TOE = 6

```
BMTATTLOSS [Track = 2] <YOS = 0, Grade = 1> =
           S6D1 * NPS6
         + S7D1 * STARTINV [Track = 2] <YOS = 0, Grade = 1>
STDATTLOSS [Track = 2] <YOS = 0, Grade = 3> =
           S6D2 * NPS6
           S7D2 * STARTINV [Track = 2] <YOS = 0, Grade = 1>
         + S8D1 * STARTINV [Track = 2] <YOS = 0, Grade = 3>
STDATTLOSS [Track = 2] <YOS = 1, Grade = 3> =
           S9D1 * STARTINV [Track = 2] <YOS = 1, Grade = 3>
STDATTLOSS [Track = 2] <YOS = 1, Grade = 4> =
           S9D2 * STARTINV [Track = 2] <YOS = 1, Grade = 3>
```

Promotions out: TOE = 4

PROMOUT [Track = 1] <YOS = 0, Grade = 1> =
S1D5 * NPS4

PROMOUT [Track = 1] <YOS = 1, Grade = 1> =
+ [S2D4 + S2D5] * STARTINV [Track = 1] <YOS = 0, Grade = 1>

PROMOUT [Track = 1] <YOS = 1, Grade = 2> =
+ [S2D5] * STARTINV [Track = 1] <YOS = 0, Grade = 1>
+ [S3D3] * STARTINV [Track = 1] <YOS = 0, Grade = 2>

PROMOUT [Track = 1] <YOS = 2, Grade = 2> =
+ [S4D3] * STARTINV [Track = 1] <YOS = 1, Grade = 2>

PROMOUT [Track = 1] <YOS = 2, Grade = 3> =
+ [S5D4] * STARTINV [Track = 1] <YOS = 1, Grade = 2>

Promotions in: TOE = 4

PROMIN [Track = 1] <YOS = 0, Grade = 2> =
S1D5 * NPS4

PROMIN [Track = 1] <YOS = 1, Grade = 2> =
S2D4 * STARTINV [Track = 1] <YOS = 0, Grade = 1>

PROMIN [Track = 1] <YOS = 1, Grade = 3> =
S2D5 * STARTINV [Track = 1] <YOS = 0, Grade = 1>
+ S3D3 * STARTINV [Track = 1] <YOS = 0, Grade = 2>

PROMIN [Track = 1] <YOS = 2, Grade = 3> =
S4D3 * STARTINV [Track = 1] <YOS = 1, Grade = 2>

PROMIN [Track = 1] <YOS = 2, Grade = 4> =
S5D4 * STARTINV [Track = 1] <YOS = 1, Grade = 3>

Promotions out: TOE = 6

PROMOUT [Track = 2] <YOS = 0, Grade = 1> =
S6D4 * NPS6

PROMOUT [Track = 2] <YOS = 1, Grade = 1> =
S7D3 * STARTINV [Track = 2] <YOS = 0, Grade = 1>

PROMOUT [Track = 2] <YOS = 2, Grade = 3> =
S9D4 * STARTINV [Track = 2] <YOS = 1, Grade = 3>

Promotions in: TOE = 6

PROMIN [Track = 2] <YOS = 0, Grade = 3> =
S6D4 * NPS6

PROMIN [Track = 2] <YOS = 1, Grade = 3> =
S7D3 * STARTINV [Track = 2] <YOS = 0, Grade = 1>

PROMIN [Track = 2] <YOS = 2, Grade = 4> =
S9D4 * STARTINV [Track = 2] <YOS = 1, Grade = 3>

Ending Inventory: TOE = 4

ENDINV [Track = 1] <YOS = 0, Grade = 1> =
S1D4 * NPS4

ENDINV [Track = 1] <YOS = 0, Grade = 2> =
S1D5 * NPS4

ENDINV [Track =1] <YOS = 1, Grade = 2> =
S2D4 * STARTINV [Track = 1] <YOS = C, Grade = 1>

ENDINV [Track = 1] <YOS = 1, Grade = 3> =
S2D5 * STARTINV [Track = 1] <YOS = 0, Grade = 1>
+ S3D3 * STARTINV [Track = 1] <YOS = 0, Grade = 2>

ENDINV [Track = 1] <YOS = 2, Grade = 3> =
S4D3 * STARTINV [Track = 1] <YOS = 1, Grade = 2>
+ S5D3 * STARTINV [Track = 1] <YOS = 1, Grade = 3>

ENDINV [Track = 1] <YOS = 2, Grade = 4> =
S5D4 * STARTINV [Track = 1] <YOS = 1, Grade = 3>

Ending Inventory: TOE = 6

ENDINV [Track = 2] <YOS = 0, Grade = 1> =
S6D3 * NPS6

ENDINV [Track = 2] <YOS = 0, Grade = 3> =
S6D4 * NPS6

ENDINV [Track = 2] <YOS = 1, Grade = 3> =
S7D3 * STARTINV [Track = 2] <YOS = 0, Grade = 1>
+ S8D2 * STARTINV [Track = 2] <YOS = 0, Grade = 3>

ENDINV [Track = 2] <YOS = 2, Grade = 3> =
+ S9D3 * STARTINV [Track = 2] <YOS = 1, Grade = 3>

ENDINV [Track = 2] <YOS = 2, Grade = 4> =
+ S9D4 * STARTINV [Track = 2] <YOS = 1, Grade = 3>

Appendix B

BLENDING COHORT-YEAR BEHAVIOR INTO FISCAL-YEAR BEHAVIOR

Econometric analyses by the EFMP have shown that the following variables affect losses and reenlistments of the enlisted force and might be expected to change significantly over the MTA model's projection years. (see Carter et al., 1987):

- Civilian unemployment rate (percent).
- Military/civilian wage ratio.
- Zone A reenlistment bonus multiple.
- Zone B reenlistment bonus multiple.
- Zone C reenlistment bonus multiple.

Increases in civilian unemployment, increases in military wages relative to civilian wages, and increases in reenlistment bonuses all make the Air Force more attractive than civilian alternatives, so loss rates fall and reenlistment rates rise.

Users of the MTA model enter data on the above list of variables on their input screens (the aggregate bonus policy is entered by the distributions across bonus multiples). However, the inside of the model uses the following transformations of the variables (where "Log" stands for the natural logarithm):

- Log (civilian unemployment rate).
- Log (military/civilian wage ratio).
- A1 = zone A bonus multiple if multiple $\leq$ 1 = 1 if multiple > 1.
- A2 = 0 if zone A bonus multiple $\leq$1 = multiple - 1 if multiple > 1.
- Ap = 1 if zone A bonus received in past.
- Zone B bonus multiple.
- Zone C bonus multiple.

To incorporate the effects of these variables in the MTA model's projections, the ETS loss rates, retirement rates, and reenlistment rates in the MTA model are estimated with the following equation. An inventory, I, is multiplied by a reference rate, R, which in turn is multiplied by a factor that adjusts the rate for the effects of various econometric variables (see Eq. (B.1)).

Note that the only elements of Eq. (B.1) that change with the projection year, or with the management policy being evaluated, are the variables V(i), and the inventory, I. The reference rate, R, and the reference values of the variables, X(i), are reestimated only when the first projection year changes; and the coefficients, D(i), are reestimated only when the econometric analyses are updated.

$$F(i,y) = I(i,y)R(t,y)\{1 + \text{Sum}[D(i,y,k)\{V(k) - X(k)\}]\} \quad (B.1)$$

where
- i = track in which cell is located
- y = YOS of cell
- F = flow out of cell during fiscal year
- I = cell inventory at start of fiscal year
- R = flow rate during reference period (the three fiscal years before the start of the projections)
- D(i,y,k) = proportion increase in flow rate per unit change in econometric variable k in cell with Track i and YOS y
- V(k) = value of econometric variable k during fiscal year
- X(k) = value of econometric variable k during reference period

In the case of ETS losses, the inventory is a policy-free inventory, and in the case of reenlistments, the inventory is the policy-free inventory that survives to the end of the fiscal year (see Sec. II). But we are not focusing on those inventory adjustments here. Rather, this appendix examines the coefficients, D, that adjust the reference flow rate in response to changes in the econometric variables. In particular, this appendix shows how the fiscal-year coefficient, D, can be obtained from cohort-year coefficients C(a) and C(b), by the following equation:

$$D(i,y,k) = W(i,y,a)C(i,y,k,a)/R(i,y,a) + W(i,y,b)C(i,y,k,b)/R(i,y,b) \quad (B.2)$$

where $W(i,y,a)$ = Proportion of flow during fiscal year in a cell with YOS = y that comes from the cohort-year flow with YOS = y

$W(i,y,b)$ = Proportion of flow during fiscal year in a cell with YOS = y that comes from the cohort-year with YOS = y + 1

$C(i,y,k,a)$ = absolute increase in the flow rate during the cohort-year with YOS = y per unit increase in econometric variable k

$C(i,y,k,b)$ = absolute increase in the flow rate during the cohort-year with YOS = y + 1 per unit increase in econometric variable k

$R(i,y,a)$ = flow rate during the cohort year with YOS = y

$R(i,y,b)$ = flow rate during the cohort year with YOS = y + 1

The need for Eq. (B.2) arises because of a disconnect between the way the econometric analyses were done and the way they must be used in the MTA model. The econometric analyses estimated the effect of the above variables on cohort-year behavior of the enlisted force, but the MTA model requires estimates of the fiscal-year behavior. The so-called "blending problem" faced in building the MTA model is how to blend the behavior of all the cohorts that participate in a given fiscal year. Equation (B.2) presents the solution to that problem. This appendix first derives that equation, and then presents a Symphony spreadsheet program that implements it.

The econometric analyses are documented in Carter et al. (1987). A summary description of the results is given in Sec. IV of Rydell (1987).

Tables B.21 and B.22 give the estimates of the D coefficients needed to implement Eq. (B.1) that are implied by these econometric analyses. The D coefficients in these two output tables can be used in the MTA model until the econometric analyses are updated. When the econometric analyses are redone, their results must be entered into the spreadsheet program and updated D coefficients obtained.

THEORY OF BLENDING

The following discussion considers the effect of a single variable (for example, a reenlistment bonus multiple) on a particular flow (for example, ETS loss) from a specific cell (defined by Track and YOS) in the MTA model. The discussion derives Eqs. (B.1) and (B.2) for that particular instance. The generalization to all cells and all econometric variables is straightforward.

The behavior of the enlisted force that has YOS = y at the start of a fiscal year is a mixture of its behavior in the cohort years YOS = y and YOS = y + 1. At the start of the fiscal year, inventory with fiscal-year YOS = y has cohort-year YOS = y behavior, but by the end of the fiscal year that inventory has cohort-year YOS = y + 1 behavior. For example, a person with 30 months of service at the start of a fiscal year has fiscal year YOS = 2 and cohort year YOS = 2 for the first half of the fiscal year but fiscal years YOS = 2 and cohort year YOS = 3 for the second half of the fiscal year.

The econometric analyses of cohort behavior provide the constant term, R, and the slope coefficient, C, for each cohort year.

$$L_j = P_j[R_j + C_j * V] \qquad \text{(B.3)}$$

or, equivalently

$$L_j = P_j R_j[1 + (C_j/R_j) * V] \qquad \text{(B.4)}$$

where j = cohort year

L_j = loss from cohort year j

P_j = inventory of enlisted personnel at the start of cohort year j

R_j = loss rate constant term

C_j = coefficient

V = variable that affects losses

$V(ref)$ = variable in reference situation

The total loss during a fiscal year is a mixture of the behavior of two cohort years a and b:

$$L = L_a + L_b \tag{B.5}$$

where L = loss during fiscal year
L_a = loss from cohort year a
L_b = loss from cohort year b

Applying Eq.(B.4) to each part of the fiscal year loss yields:

$$L_a = L_a(ref)[1 + (C_a/R_a)\{V - V(ref)\}] \tag{B.6}$$
$$L_b = L_b(ref)[1 + (C_b/R_b)\{V - V(ref)\}] \tag{B.7}$$

where $L_a(ref)$ = loss in fiscal year from cohort year a, under reference conditions--i.e., when $V = V(ref)$
$L_b(ref)$ = loss in fiscal year from cohort year b, under reference conditions--i.e., when $V = V(ref)$

These equations can be rewritten in terms of the fiscal-year loss rate and the participation of each cohort-year in that fiscal-year loss rate:

$$L_a = L(ref)W_a[1 + (C_a/R_a)\{V - V(ref)\}] \tag{B.8}$$
$$L_b = L(ref)W_b[1 + (C_b/R_b)\{V - V(ref)\}] \tag{B.9}$$

where $L(ref)$ = loss during fiscal year if variables have reference values
$W_a = L_a(ref)/L(ref)$
$W_b = L_b(ref)/L(ref)$

Then, recognizing that $W_a + W_b = 1$, we can sum Eqs. (B.8) and (B.9) to obtain:

$$L = L(ref)[1 + (W_a * C_a/R_a) + (W_b * C_b/R_b)\{V - V(ref)\}] \tag{B.10}$$

This equation is the answer to the blending problem in the MTA model. One simply uses the weights, W_a and W_b, to weight the cohort coefficients of (V - V(ref)), C_a/R_a and C_b/R_b, into a weighted average coefficient that works for fiscal-year loss rates.

Transforming Eq.(B.10) into a form where Eq.(B.1) and Eq.(B.2) are easier to see yields:

$$L = L(ref)[1 + D\{V - V(ref)\}] \quad (B.11)$$

$$D = (W_a C_a/R_a) + (W_b C_b/R_b) \quad (B.12)$$

Participation of Cohort-Years in a Fiscal Year

To estimate the weights, W_a and W_b, we first recall their definition:

$$W_a = L_a(ref)/L(ref)$$
$$W_b = L_b(ref)/L(ref)$$

We need to know what proportion of the loss during a given fiscal year comes from each of the two cohort-years that exist in that fiscal year. To get the answer we turn to the Month-at-Risk (MAR) database developed by the EFMP for analyses of short-run enlisted force behavior.[1] That file gives monthly information, but this theoretical discussion just uses quarters of the year. (The implementation of these ideas below will use the monthly detail.)

The MAR database shows that during any specified period of time (which we take to be our reference case) losses during cohort-year a are:

A_1 = loss during the first quarter of cohort-year a
A_2 = loss during the second quarter of cohort-year a
A_3 = loss during the third quarter of cohort-year a
A_4 = loss during the fourth quarter of cohort-year a

[1]Unpublished RAND research by Kip Fisher and William Mickelson.

and that losses during cohort-year b are:

B_1 = loss during the first quarter of cohort-year b
B_2 = loss during the second quarter of cohort-year b
B_3 = loss during the third quarter of cohort-year b
B_4 = loss during the fourth quarter of cohort-year b

During the fiscal year there are four possible alignments of quarterly cohorts:

Alignment 1:	A_1	A_2	A_3	A_4
Alignment 2:	A_2	A_3	A_4	B_1
Alignment 3:	A_3	A_4	B_1	B_2
Alignment 4:	A_4	B_1	B_2	B_3

The sums of participation by each cohort year are particularly easy to formulate:

$$\text{Sum of } A_i = 4 * A_4 + 3 * A_3 + 2 * A_2 + A_1$$
$$\text{Sum of } B_i = 3 * B_1 + 2 * B_2 + 1 * B_3$$

Note also, that those sums immediately give us the weights we need to finish solving the MTA model's blending problem:

$$W_a = (\text{Sum of } A_i)/(\text{Sum of } A_i \text{ and } B_i)$$
$$W_b = (\text{Sum of } B_i)/(\text{Sum of } A_i \text{ and } B_i)$$

IMPLEMENTATION OF BLENDING

To implement the above solution to the blending problem, a Symphony spreadsheet program has been constructed to convert inputs of cohort coefficients, C, and rates, R, into the fiscal year coefficients, D. It needs to be rerun every time the econometric analyses are redone. However, in years when the results of previous econometric analyses are being used, the output of this program can be simply fed unchanged into

Module 2 of the MTA model. The rest of this appendix documents the spreadsheet program.

All the displays in the Symphony program are listed together at the end of this appendix for ease of reference.

- Tables B.1 through B.7 accept inputs.
- Tables B.8 through B.20 report calculations.
- Tables B.21 and B.22 give the outputs.

Inputs to Blending

The inputs required by the blending program are the slope coefficients, C, in the cohort-year behavioral equations (Tables B.1 through B.4), and the intercepts, R, in the cohort-year behavioral equations. The inputs in Tables B.5 and B.6 are used to calculate the intercepts for the first and second terms (the results of the calculation are reported in Table B.8). The intercepts for the career and retirement-eligible terms are entered in Table B.7.

Blending Calculations

As just mentioned, Table B.8 calculates the cohort-year separation rates in the first and second terms.

Tables B.9 through B.16 calculate the proportions, W_a and W_b, with which each cohort-year participates in a given fiscal year. These calculations are done separately for losses and for reenlistments, for YETS = 1 and YETS = 0, and for the first term and the second term. Each of these tables multiplies the monthly flow in a monthly cohort by the number of times that that monthly flow occurs in the fiscal year. The logic is the same as the quarterly analysis of W_a and W_b given above, only now the analysis is by month. The proportions are given in the last line of each table, W_a first, and W_b second.

Tables B.17 through B.20 calculate the C/R ratios for each cohort year and use the proportions W_a and W_b to weight them together to obtain the fiscal year coefficients, D, reported in the right-hand column of each table.

Finally, Tables B.21 and B.22 report the fiscal-year coefficients, D, for each cell in the MTA inventory account. The construction of these tables draws on the coefficients in Tables B.17 and B.20 for the first and second terms, applying the bonus coefficients only in YOS ranges where each bonus is offered. For the career and retirement-eligible terms, the D coefficients are estimated by the C/R ratios for the ETS year (because the MTA model does not do time-in-term accounting in these categories of enlistment). Those C/R ratios are calculated directly from the inputs in Tables B.3, B.4, and B.7.

Table B.1

COEFFICIENTS IN THE LINEAR EQUATIONS FOR LOSS AND EXTENSION RATES: FIRST TERM

	Cohort Year YETS		
Econometric Variable	1	0	-1
Loss Rate (probability of leaving)			
Log % civilian unemployment	-0.361	-0.200	-0.404
Log military/civilian wage ratio	-0.437	0.062	0.125
First bonus multiple	-0.034	0.000	0.000
Higher bonus multiples	-0.013	0.000	0.000
Extension Rate (probability of extending, given stay)			
Log % civilian unemployment	0.000	0.000	0.000
Log military/civilian wage ratio	0.000	0.000	0.000
First bonus multiple	-0.038	0.000	0.000
Higher bonus multiples	-0.038	0.000	0.000

SOURCE: Rydell, 1987, p. 24.

NOTE: Probability of one year extension, given extension, is 0.494.

Table B.2

COEFFICIENTS IN THE LINEAR EQUATIONS FOR LOSS AND EXTENSION RATES: SECOND TERM

	Cohort Year YETS		
Econometric Variable	1	0	-1
Loss Rate (probability of leaving)			
Log % civilian unemployment	-0.234	-0.144	-0.349
Log military/civilian wage ratio	-0.128	-0.395	-0.957
Bonus multiple	-0.042	0.000	0.000
Past zone A bonus dummy variable	0.037	0.000	0.000
Extension Rate (probability of extending, given stay)			
Log % civilian unemployment	-0.376	0.000	0.000
Log military/civilian wage ratio	-0.633	0.000	0.000
Bonus multiple	-0.142	0.000	0.000
Past zone A bonus dummy variable	0.000	0.000	0.000

SOURCE: Rydell, 1987, p. 25.

NOTE: Probability of one year extension, given extension, is 0.413.

Table B.3

COEFFICIENTS IN THE LINEAR EQUATIONS FOR LOSS AND EXTENSION RATES: CAREER TERMS

Econometric Variable	Numeric Factor	Formula Factor
Loss Rate (probability of leaving)		
Log % civilian unemployment	-12.518	exp(-(YOS/2)-exp(-10)
Log military/civilian wage ratio	-40.088	exp(-(YOS/2)-exp(-10)
Bonus multiple	-2.167	exp(-(YOS/2)-exp(-10)
Extension Rate (probability of extending, given stay)		
Log % civilian unemployment	0.000	
Log military/civilian wage ratio	0.000	
Bonus multiple	0.000	

SOURCE: Rydell, 1987, p.26.

Table B.4

COEFFICIENTS IN THE LINEAR EQUATIONS FOR LOSS AND EXTENSION RATES: RETIREMENT-ELIGIBLE TERMS

Econometric Variable	Coefficient
Loss Rate (probability of leaving)	
Log % civilian unemployment	-0.135
Log military/civilian wage ratio	0.000
Extension Rate (probability of extending, given stay)	
Log % civilian unemployment	0.000
Log military/civilian wage ratio	0.000

SOURCE: Rydell, 1987, footnote, p. 23.

Table B.5

MONTHLY FLOWS FROM A MONTHLY COHORT:
FIRST TERM

METS at Start of Month	Flow During Month			Inventory at Start of Month
	ATTR	ETS	REEN	
12	50	3	128	4310
11	26	5	81	4129
10	25	7	66	4018
9	20	4	62	3920
8	21	5	61	3834
7	20	9	61	3746
6	21	15	63	3656
5	22	16	63	3557
4	21	32	101	3456
3	23	35	96	3302
2	16	87	110	3148
1	11	1435	226	2935
0	6	42	32	1263
-1	5	40	41	1183
-2	5	58	42	1096
-3	5	30	34	991
-4	5	28	33	922
-5	4	43	34	857
-6	3	24	30	776
-7	3	20	32	719
-8	3	23	32	665
-9	4	18	30	607
-10	3	17	31	555
-11	2	54	37	505
-12	2	13	23	411
-13	2	12	22	374
-14	1	13	20	338
-15	1	10	18	304
-16	2	10	17	275
-17	1	11	17	246
-18	1	8	17	216
-19	1	7	17	191
-20	1	8	18	166
-21	1	10	18	139
-22	0	10	18	110
-23	0	57	25	82
Total	338	2215	1756	

Table B.6

MONTHLY FLOWS FROM A MONTHLY COHORT:
SECOND TERM

METS at Start of Month	Flow During Month			Inventory at Start of Month
	ATTR	ETS	REEN	
12	6	1	48	1265
11	3	0	20	1211
10	3	0	18	1187
9	2	1	17	1166
8	3	1	15	1146
7	3	1	15	1127
6	3	3	18	1109
5	3	3	21	1085
4	4	5	72	1058
3	3	5	60	977
2	2	7	57	909
1	2	187	224	844
0	2	14	19	431
-1	1	6	18	396
-2	1	8	18	371
-3	1	7	15	343
-4	1	5	13	321
-5	1	6	13	301
-6	0	4	13	282
-7	1	5	12	264
-8	0	4	11	246
-9	0	4	12	230
-10	1	3	11	213
-11	1	4	14	199
-12	0	4	9	179
-13	1	3	8	166
-14	0	2	9	154
-15	0	2	6	143
-16	0	3	6	134
-17	0	2	7	125
-18	0	1	6	115
-19	0	2	5	108
-20	0	1	6	100
-21	0	1	6	93
-22	0	2	7	86
-23	2	12	62	77
Total	51	320	894	

Table B.7

ANNUAL ETS LOSSES OR RETIREMENTS AS PROPORTION OF STARTING INVENTORY AND REENLISTMENTS AS PROPORTION OF SURVIVORS: CAREER TERMS AND RETIREMENT-ELIGIBLE TERMS

YOS	Nonattrition Loss Rate	Reenlistment Rate
6	0.0159	0.0000
7	0.0110	0.0000
8	0.0144	0.0129
9	0.0278	0.0571
10	0.0314	0.1226
11	0.0328	0.1866
12	0.0209	0.1565
13	0.0148	0.1563
14	0.0119	0.2085
15	0.0082	0.3453
16	0.0049	0.1878
17	0.0032	0.1049
18	0.0022	0.0814
19	0.3315	0.2342
20	0.2618	0.2397
21	0.2303	0.2410
22	0.2376	0.2410
23	0.1682	0.2412
24	0.1389	0.2412
25	0.3652	0.2412
26	0.2619	0.2412
27	0.3510	0.2412
28	0.2680	0.2412
29	1.0000	0.2412

Table B.8

ETS LOSS RATES AND REENLISTMENT RATES BY COHORT YETS

Cohort YETS	Inv. at Start of Cohort Yr	Attr During CY	ETS During CY	Reen. During CY	ETS Rate	Cond'l Reen. Rate
First Term						
1	4310	277	1652	1118	0.383	0.469
0	1263	49	396	407	0.313	0.498
-1	411	13	167	231	0.407	1.000
Second Term						
1	1265	37	214	583	0.169	0.575
0	431	10	71	171	0.165	0.488
-1	179	5	35	139	0.197	1.000

Table B.9

PARTICIPATION OF COHORT YEARS IN FISCAL YEARS:
FIRST TERM, ETS LOSS, FY YETS = 1

		First Cohort Year		Second Cohort Year	
METS	Monthly Flow	Times in FY	Annual Flow	Times in FY	Annual Flow
12	3	1	3		
11	5	2	10		
10	7	3	20		
9	4	4	18		
8	5	5	26		
7	9	6	52		
6	15	7	102		
5	16	8	125		
4	32	9	290		
3	35	10	349		
2	87	11	961		
1	1435	12	17215		
0	42			11	463
-1	40			10	398
-2	58			9	521
-3	30			8	238
-4	28			7	194
-5	43			6	256
-6	24			5	120
-7	20			4	80
-8	23			3	69
-9	18			2	36
-10	17			1	17
-11	54			0	0
Total			19171		2392
Distribution			0.889		0.111

Table B.10

PARTICIPATION OF COHORT YEARS IN FISCAL YEARS:
FIRST TERM, ETS LOSS, FY YETS = 0

		First Cohort Year		Second Cohort Year	
METS	Monthly Flow	Times in FY	Annual Flow	Times in FY	Annual Flow
0	42	1	42		
-1	40	2	80		
-2	58	3	174		
-3	30	4	119		
-4	28	5	138		
-5	43	6	256		
-6	24	7	168		
-7	20	8	159		
-8	23	9	208		
-9	18	10	178		
-10	17	11	192		
-11	54	12	645		
-12	13			11	138
-13	12			10	119
-14	13			9	113
-15	10			8	81
-16	10			7	70
-17	11			6	64
-18	8			5	40
-19	7			4	27
-20	8			3	24
-21	10			2	20
-22	10			1	10
-23	57			0	0
Total		2359			706
Distribution		0.770			0.230

Table B.11

PARTICIPATION OF COHORT YEARS IN FISCAL YEARS:
FIRST TERM, REENLISTMENT, FY YETS = 1

		First Cohort Year		Second Cohort Year	
METS	Monthly Flow	Times in FY	Annual Flow	Times in FY	Annual Flow
12	128	1	128		
11	81	2	161		
10	66	3	199		
9	62	4	247		
8	61	5	307		
7	61	6	367		
6	63	7	442		
5	63	8	507		
4	101	9	909		
3	96	10	960		
2	110	11	1207		
1	226	12	2707		
0	32			11	355
-1	41			10	414
-2	42			9	380
-3	34			8	269
-4	33			7	231
-5	34			6	202
-6	30			5	152
-7	32			4	126
-8	32			3	95
-9	30			2	60
-10	31			1	31
-11	37			0	0
Total		8140		2314	
Distribution		0.779		0.221	

Table B.12

PARTICIPATION OF COHORT YEARS IN FISCAL YEARS:
FIRST TERM, REENLISTMENT, FY YETS = 0

		First Cohort Year		Second Cohort Year	
METS	Monthly Flow	Times in FY	Annual Flow	Times in FY	Annual Flow
0	32	1	32		
-1	41	2	83		
-2	42	3	127		
-3	34	4	135		
-4	33	5	165		
-5	34	6	202		
-6	30	7	213		
-7	32	8	252		
-8	32	9	285		
-9	30	10	298		
-10	31	11	338		
-11	37	12	446		
-12	23			11	252
-13	22			10	220
-14	20			9	182
-15	18			8	144
-16	17			7	118
-17	17			6	105
-18	17			5	84
-19	17			4	69
-20	18			3	55
-21	18			2	36
-22	18			1	18
-23	25			0	0
Total			2575		1283
Distribution			0.667		0.333

Table B.13

PARTICIPATION OF COHORT YEARS IN FISCAL YEARS:
SECOND TERM, ETS LOSS, FY YETS = 1

		First Cohort Year		Second Cohort Year	
METS	Monthly Flow	Times in FY	Annual Flow	Times in FY	Annual Flow
12	1	1	1		
11	0	2	1		
10	0	3	1		
9	1	4	3		
8	1	5	4		
7	1	6	5		
6	3	7	20		
5	3	8	23		
4	5	9	49		
3	5	10	50		
2	7	11	73		
1	187	12	2242		
0	14			11	154
-1	6			10	61
-2	8			9	76
-3	7			8	53
-4	5			7	37
-5	6			6	34
-6	4			5	22
-7	5			4	18
-8	4			3	13
-9	4			2	8
-10	3			1	3
-11	4			0	0
Total			2472		481
Distribution			0.837		0.163

Table B.14

PARTICIPATION OF COHORT YEARS IN FISCAL YEARS:
SECOND TERM, ETS LOSS, FY YETS = 0

		First Cohort Year		Second Cohort Year	
METS	Monthly Flow	Times in FY	Annual Flow	Times in FY	Annual Flow
0	14	1	14		
-1	6	2	12		
-2	8	3	25		
-3	7	4	27		
-4	5	5	26		
-5	6	6	34		
-6	4	7	31		
-7	5	8	37		
-8	4	9	40		
-9	4	10	40		
-10	3	11	35		
-11	4	12	54		
-12	4			11	40
-13	3			10	33
-14	2			9	22
-15	2			8	18
-16	3			7	20
-17	2			6	11
-18	1			5	5
-19	2			4	7
-20	1			3	4
-21	1			2	2
-22	2			1	2
-23	12			0	0
Total			374		163
Distribution			0.697		0.303

Table B.15

PARTICIPATION OF COHORT YEARS IN FISCAL YEARS:
SECOND TERM, REENLISTMENT, FY YETS = 1

		First Cohort Year		Second Cohort Year	
METS	Monthly Flow	Times in FY	Annual Flow	Times in FY	Annual Flow
12	48	1	48		
11	20	2	39		
10	18	3	54		
9	17	4	67		
8	15	5	77		
7	15	6	90		
6	18	7	123		
5	21	8	169		
4	72	9	645		
3	60	10	596		
2	57	11	627		
1	224	12	2687		
0	19			11	211
-1	18			10	185
-2	18			9	160
-3	15			8	118
-4	13			7	94
-5	13			6	79
-6	13			5	66
-7	12			4	49
-8	11			3	34
-9	12			2	24
-10	11			1	11
-11	14			0	0
Total			5221		1033
Distribution			0.835		0.165

Table B.16

PARTICIPATION OF COHORT YEARS IN FISCAL YEARS:
SECOND TERM, REENLISTMENT, FY YETS = 0

		First Cohort Year		Second Cohort Year	
METS	Monthly Flow	Times in FY	Annual Flow	Times in FY	Annual Flow
0	19	1	19		
-1	18	2	37		
-2	18	3	53		
-3	15	4	59		
-4	13	5	67		
-5	13	6	79		
-6	13	7	93		
-7	12	8	98		
-8	11	9	103		
-9	12	10	121		
-10	11	11	120		
-11	14	12	170		
-12	9			11	99
-13	8			10	83
-14	9			9	77
-15	6			8	50
-16	6			7	45
-17	7			6	44
-18	6			5	32
-19	5			4	22
-20	6			3	18
-21	6			2	12
-22	7			1	7
-23	62			0	0
Total			1020		489
Distribution			0.676		0.324

Table B.17

FISCAL YEAR COEFFICIENTS BY CATEGORY OF ENLISTMENT:
FIRST TERM, ETS LOSS

Item	Cohort Year YETS 1	0	-1	Average Ratio (Coef/Rate)
Log % civilian unemployment				
Coef. of Variable	-0.361	-0.200	-0.404	
Separation Rate	0.383	0.313	0.407	
Ratio (Coef/Rate)	-0.942	-0.637	-0.992	
FY YETS = 2	1.000			-0.942
FY YETS = 1	0.889	0.111		-0.908
FY YETS = 0		0.770	0.230	-0.719
FY YETS = -1			1.000	-0.992
Log military/civilian wage ratio				
Coef. of Variable	-0.437	0.062	0.125	
Separation Rate	0.383	0.313	0.407	
Ratio (Coef/Rate)	-1.140	0.197	0.307	
FY YETS = 2	1.000			-1.140
FY YETS = 1	0.889	0.111		-0.992
FY YETS = 0		0.770	0.230	0.222
FY YETS = -1			1.000	0.307
First bonus multiple				
Coef. of Variable	-0.034	0.000	0.000	
Separation Rate	0.383	0.313	0.407	
Ratio (Coef/Rate)	-0.089	0.000	0.000	
FY YETS = 2	1.000			-0.089
FY YETS = 1	0.889	0.111		-0.079
FY YETS = 0		0.770	0.230	0.000
FY YETS = -1			1.000	0.000
Higher bonus multiples				
Coef. of Variable	-0.013	0.000	0.000	
Separation Rate	0.383	0.313	0.407	
Ratio (Coef/Rate)	-0.034	0.000	0.000	
FY YETS = 2	1.000			-0.034
FY YETS = 1	0.889	0.111		-0.030
FY YETS = 0		0.770	0.230	0.000
FY YETS = -1			1.000	0.000

Table B.18

FISCAL YEAR COEFFICIENTS BY CATEGORY OF ENLISTMENT:
FIRST TERM, REENLISTMENT

Item	Cohort Year YETS 1	0	-1	Average Ratio (Coef/Rate)
Log % civilian unemployment				
Coef. of Variable	0.000	0.000	0.000	
Separation Rate	0.469	0.498	1.000	
Ratio (Coef/Rate)	0.000	0.000	0.000	
FY YETS = 2	1.000			0.000
FY YETS = 1	0.889	0.111		0.000
FY YETS = 0		0.770	0.230	0.000
FY YETS = -1			1.000	0.000
Log military/civilian wage ratio				
Coef. of Variable	0.000	0.000	0.000	
Separation Rate	0.469	0.498	1.000	
Ratio (Coef/Rate)	0.000	0.000	0.000	
FY YETS = 2	1.000			0.000
FY YETS = 1	0.889	0.111		0.000
FY YETS = 0		0.770	0.230	0.000
FY YETS = -1			1.000	0.000
First bonus multiple				
Coef. of Variable	0.038	0.000	0.000	
Separation Rate	0.469	0.498	1.000	
Ratio (Coef/Rate)	0.081	0.000	0.000	
FY YETS = 2	1.000			0.081
FY YETS = 1	0.889	0.111		0.072
FY YETS = 0		0.770	0.230	0.000
FY YETS = -1			1.000	0.000
Higher bonus multiples				
Coef. of Variable	0.038	0.000	0.000	
Separation Rate	0.469	0.498	1.000	
Ratio (Coef/Rate)	0.081	0.000	0.000	
FY YETS = 2	1.000			0.081
FY YETS = 1	0.889	0.111		0.072
FY YETS = 0		0.770	0.230	0.000
FY YETS = -1			1.000	0.000

Table B.19

FISCAL YEAR COEFFICIENTS BY CATEGORY OF ENLISTMENT: SECOND TERM, ETS LOSS

Item	Cohort Year YETS 1	0	-1	Average Ratio (Coef/Rate)
Log % civilian unemployment				
Coef. of Variable	-0.234	-0.144	-0.349	
Separation Rate	0.169	0.165	0.197	
Ratio (Coef/Rate)	-1.386	-0.873	-1.772	
FY YETS = 2	1.000			-1.386
FY YETS = 1	0.889	0.111		-1.329
FY YETS = 0		0.770	0.230	-1.080
FY YETS = -1			1.000	-1.772
Log military/civilian wage ratio				
Coef. of Variable	-0.128	-0.395	-0.957	
Separation Rate	0.383	0.313	0.407	
Ratio (Coef/Rate)	-0.334	-1.261	-2.350	
FY YETS = 2	1.000			-0.334
FY YETS = 1	0.889	0.111		-0.437
FY YETS = 0		0.770	0.230	-1.512
FY YETS = -1			1.000	-2.350
Bonus multiple				
Coef. of Variable	-0.042	0.000	0.000	
Separation Rate	0.383	0.313	0.407	
Ratio (Coef/Rate)	-0.110	0.000	0.000	
FY YETS = 2	1.000			-0.110
FY YETS = 1	0.889	0.111		-0.097
FY YETS = 0		0.770	0.230	0.000
FY YETS = -1			1.000	0.000
Past zone A bonus				
Coef. of Variable	0.037	0.000	0.000	
Separation Rate	0.383	0.313	0.407	
Ratio (Coef/Rate)	0.097	0.000	0.000	
FY YETS = 2	1.000			0.097
FY YETS = 1	0.889	0.111		0 086
FY YETS = 0		0.770	0.230	0.000
FY YETS = -1			1.000	0.000

Table B.20

FISCAL YEAR COEFFICIENTS BY CATEGORY OF ENLISTMENT: SECOND TERM, REENLISTMENT

Item	Cohort Year YETS 1	0	-1	Average Ratio (Coef/Rate)
Log % civilian unemployment				
Coef. of Variable	0.376	0.000	0.000	
Separation Rate	0.575	0.488	1.000	
Ratio (Coef/Rate)	0.654	0.000	0.000	
FY YETS = 2	1.000			0.654
FY YETS = 1	0.889	0.111		0.581
FY YETS = 0		0.770	0.230	0.000
FY YETS = -1			1.000	0.000
Log military/civilian wage ratio				
Coef. of Variable	0.633	0.000	0.000	
Separation Rate	0.469	0.498	1.000	
Ratio (Coef/Rate)	1.348	0.000	0.000	
FY YETS = 2	1.000			1.348
FY YETS = 1	0.889	0.111		1.199
FY YETS = 0		0.770	0.230	0.000
FY YETS = -1			1.000	0.000
Bonus multiple				
Coef. of Variable	0.142	0.000	0.000	
Separation Rate	0.469	0.498	1.000	
Ratio (Coef/Rate)	0.302	0.000	0.000	
FY YETS = 2	1.000			0.302
FY YETS = 1	0.889	0.111		0.269
FY YETS = 0		0.770	0.230	0.000
FY YETS = -1			1.000	0.000
Past zone A bonus				
Coef. of Variable	0.000	0.000	0.000	
Separation Rate	0.469	0.498	1.000	
Ratio (Coef/Rate)	0.000	0.000	0.000	
FY YETS = 2	1.000			0.000
FY YETS = 1	0.889	0.111		0.000
FY YETS = 0		0.770	0.230	0.000
FY YETS = -1			1.000	0.000

Table B.21

EFFECT OF VARIABLES ON FISCAL-YEAR ETS LOSS RATES

		Proportion Change per Unit Change in Variable						
Track	YOS	Log Unempl	Log Wage Ratio	Average First Zone A Bonus Multiple	Average Higher Zone A Bonus Multiple	Percent of 2nd Termer Receiving Bonus	Average Zone B Bonus Multiple	Average Zone C Bonus Multiple
1	0	0	0	0	0	0	0	0
1	1	0	0	0	0	0	0	0
1	2	-0.942	-1.140	-0.089	-0.034	0	0	0
1	3	-0.908	-0.992	-0.079	-0.030	0	0	0
1	4	-0.719	0.222	0	0	0	0	0
1	5	-0.992	0.307	0	0	0	0	0
2	0	0	0	0	0	0	0	0
2	1	0	0	0	0	0	0	0
2	2	0	0	0	0	0	0	0
2	3	0	0	0	0	0	0	0
2	4	0	-1.140	-0.089	-0.034	0	0	0
2	5	0	-0.992	-0.079	-0.030	0	0	0
2	6	0	0.222	0	0	0	0	0
2	7	0	0.307	0	0	0	0	0

Table B.21 (cont'd)

		Proportion Change per Unit Change in Variable						
Track	YOS	Log Unempl	Log Wage Ratio	Average First Zone A Bonus Multiple	Average Higher Zone A Bonus Multiple	Percent of 2nd Termer Receiving Bonus	Average Zone B Bonus Multiple	Average Zone C Bonus Multiple
3	3	0	0	0	0	0	0	0
3	4	0	0	0	0	0	0	0
3	5	-1.386	-0.334	-0.110	-0.110	0.097	0	0
3	6	-1.329	-0.437	0	0	0.086	-0.097	0
3	7	-1.080	-1.512	0	0	0	0	0
3	8	-1.772	-2.350	0	0	0	0	0
4	4	0	0	0	0	0	0	0
4	5	0	0	0	0	0	0	0
4	6	-1.386	-0.334	0	0	0.097	-0.110	0
4	7	-1.329	-0.437	0	0	0.086	-0.097	0
4	8	-1.080	-1.512	0	0	0	0	0
4	9	-1.772	-2.350	0	0	0	0	0
5	3	0	0	0	0	0	0	0
5	4	0	0	0	0	0	0	0
5	5	0	0	0	0	0	0	0
5	6	0	0	0	0	0	0	0
5	7	-1.386	-0.334	0	0	0.097	-0.110	0
5	8	-1.329	-0.437	0	0	0.086	-0.097	0
5	9	-1.080	-1.512	0	0	0	0	0
5	10	-1.772	-2.350	0	0	0	0	0
6	4	0	0	0	0	0	0	0
6	5	0	0	0	0	0	0	0
6	6	0	0	0	0	0	0	0
6	7	0	0	0	0	0	0	0
6	8	-1.386	-0.334	0	0	0.097	-0.110	0
6	9	-1.329	-0.437	0	0	0.086	-0.097	0
6	10	-1.080	-1.512	0	0	0	0	0
6	11	-1.772	-2.350	0	0	0	0	0

Table B.21 (cont'd)

Track	YOS	Proportion Change per Unit Change in Variable: Log Unempl	Log Wage Ratio	Average First Zone A Bonus Multiple	Average Higher Zone A Bonus Multiple	Percent of 2nd Termer Receiving Bonus	Average Zone B Bonus Multiple	Average Zone C Bonus Multiple
7	5	0	0	0	0	0	0	0
7	6	0	0	0	0	0	0	0
7	7	0	0	0	0	0	0	0
7	8	0	0	0	0	0	0	0
7	9	-1.386	-0.334	0	0	0.097	-0.110	0
7	10	-1.329	-0.437	0	0	0.086	0	-0.097
7	11	-1.080	-1.512	0	0	0	0	0
7	12	-1.772	-2.350	0	0	0	0	0
8	6	0	0	0	0	0	0	0
8	7	0	0	0	0	0	0	0
8	8	0	0	0	0	0	0	0
8	9	0	0	0	0	0	0	0
8	10	-1.386	-0.334	0	0	0.097	0	-0.110
8	11	-1.329	-0.437	0	0	0.086	0	-0.097
8	12	-1.080	-1.512	0	0	0	0	0
8	13	-1.772	-2.350	0	0	0	0	0
9	7	0	0	0	0	0	0	0
9	8	0	0	0	0	0	0	0
9	9	0	0	0	0	0	0	0
9	10	0	0	0	0	0	0	0
9	11	-1.386	-0.334	0	0	0.097	0	-0.110
9	12	-1.329	-0.437	0	0	0.086	0	-0.097
9	13	-1.080	-1.512	0	0	0	0	0
9	14	-1.772	-2.350	0	0	0	0	0
10	8	0	0	0	0	0	0	0
10	9	0	0	0	0	0	0	0
10	10	0	0	0	0	0	0	0
10	11	0	0	0	0	0	0	0
10	12	-1.386	-0.334	0	0	0.097	0	-0.110
10	13	-1.329	-0.437	0	0	0.086	0	-0.097
10	14	-1.080	-1.512	0	0	0	0	0
10	15	-1.772	-2.350	0	0	0	0	0

Table B.21 (cont'd)

		Proportion Change per Unit Change in Variable						
Track	YOS	Log Unempl	Log Wage Ratio	Average First Zone A Bonus Multiple	Average Higher Zone A Bonus Multiple	Percent of 2nd Termer Receiving Bonus	Average Zone B Bonus Multiple	Average Zone C Bonus Multiple
11	6	0	0	0	0	0	0	0
11	7	0	0	0	0	0	0	0
11	8	-15.882	-50.862	0	0	0	-2.749	0
11	9	-4.982	-15.954	0	0	0	-0.862	0
11	10	-2.668	-8.544	0	0	0	0	-0.462
11	11	-1.542	-4.939	0	0	0	0	-0.267
11	12	-1.457	-4.667	0	0	0	0	-0.252
11	13	-1.233	-3.949	0	0	0	0	-0.213
11	14	-0.911	-2.919	0	0	0	0	0
11	15	-0.775	-2.482	0	0	0	0	0
11	16	-0.741	-2.373	0	0	0	0	0
11	17	-0.618	-1.980	0	0	0	0	0
11	18	-0.444	-1.421	0	0	0	0	0
11	19	-0.408	0	0	0	0	0	0
11	20	-0.516	0	0	0	0	0	0
11	21	-0.587	0	0	0	0	0	0
11	22	-0.569	0	0	0	0	0	0
11	23	-0.804	0	0	0	0	0	0
11	24	-0.973	0	0	0	0	0	0
11	25	-0.370	0	0	0	0	0	0
11	26	-0.516	0	0	0	0	0	0
11	27	-0.385	0	0	0	0	0	0
11	28	-0.504	0	0	0	0	0	0
11	29	-0.135	0	0	0	0	0	0

Table B.22

EFFECT OF VARIABLES ON FISCAL-YEAR REENLISTMENT RATES

		Proportion Change per Unit Change in Variable						
Track	YOS	Log Unempl	Log Wage Ratio	Average First Zone A Bonus Multiple	Average Higher Zone A Bonus Multiple	Percent of 2nd Termer Receiving Bonus	Average Zone B Bonus Multiple	Average Zone C Bonus Multiple
1	0	0	0	0	0	0	0	0
1	1	0	0	0	0	0	0	0
1	2	0	0	0.081	0.081	0	0	0
1	3	0	0	0.072	0.072	0	0	0
1	4	0	0	0	0	0	0	0
1	5	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
2	1	0	0	0	0	0	0	0
2	2	0	0	0	0	0	0	0
2	3	0	0	0	0	0	0	0
2	4	0	0	0.081	0.081	0	0	0
2	5	0	0	0.072	0.072	0	0	0
2	6	0	0	0	0	0	0	0
2	7	0	0	0	0	0	0	0

Table B.22 (cont'd)

		Proportion Change per Unit Change in Variable						
Track	YOS	Log Unempl	Log Wage Ratio	Average First Zone A Bonus Multiple	Average Higher Zone A Bonus Multiple	Percent of 2nd Termer Receiving Bonus	Average Zone B Bonus Multiple	Average Zone C Bonus Multiple
3	3	0	0	0	0	0	0	0
3	4	0	0	0	0	0	0	0
3	5	0.654	1.348	0.302	0.302	0	0	0
3	6	0.581	1.199	0	0	0	0.269	0
3	7	0	0	0	0	0	0	0
3	8	0	0	0	0	0	0	0
4	4	0	0	0	0	0	0	0
4	5	0	0	0	0	0	0	0
4	6	0.654	1.348	0	0	0	0.302	0
4	7	0.581	1.199	0	0	0	0.269	0
4	8	0	0	0	0	0	0	0
4	9	0	0	0	0	0	0	0
5	3	0	0	0	0	0	0	0
5	4	0	0	0	0	0	0	0
5	5	0	0	0	0	0	0	0
5	6	0	0	0	0	0	0	0
5	7	0.654	1.348	0	0	0	0.302	0
5	8	0.581	1.199	0	0	0	0.269	0
5	9	0	0	0	0	0	0	0
5	10	0	0	0	0	0	0	0
6	4	0	0	0	0	0	0	0
6	5	0	0	0	0	0	0	0
6	6	0	0	0	0	0	0	0
6	7	0	0	0	0	0	0	0
6	8	0.654	1.348	0	0	0	0.302	0
6	9	0.581	1.199	0	0	0	0.269	0
6	10	0	0	0	0	0	0	0
6	11	0	0	0	0	0	0	0

Table B.22 (cont'd)

		Proportion Change per Unit Change in Variable						
Track	YOS	Log Unempl	Log Wage Ratio	Average First Zone A Bonus Multiple	Average Higher Zone A Bonus Multiple	Percent of 2nd Termer Receiving Bonus	Average Zone B Bonus Multiple	Average Zone C Bonus Multiple
7	5	0	0	0	0	0	0	0
7	6	0	0	0	0	0	0	0
7	7	0	0	0	0	0	0	0
7	8	0	0	0	0	0	0	0
7	9	0.654	1.348	0	0	0	0.302	0
7	10	0.581	1.199	0	0	0	0	0.269
7	11	0	0	0	0	0	0	0
7	12	0	0	0	0	0	0	0
8	6	0	0	0	0	0	0	0
8	7	0	0	0	0	0	0	0
8	8	0	0	0	0	0	0	0
8	9	0	0	0	0	0	0	0
8	10	0.654	1.348	0	0	0	0	0.302
8	11	0.581	1.199	0	0	0	0	0.269
8	12	0	0	0	0	0	0	0
8	13	0	0	0	0	0	0	0
9	7	0	0	0	0	0	0	0
9	8	0	0	0	0	0	0	0
9	9	0	0	0	0	0	0	0
9	10	0	0	0	0	0	0	0
9	11	0.654	1.348	0	0	0	0	0.302
9	12	0.581	1.199	0	0	0	0	0.269
9	13	0	0	0	0	0	0	0
9	14	0	0	0	0	0	0	0
10	8	0	0	0	0	0	0	0
10	9	0	0	0	0	0	0	0
10	10	0	0	0	0	0	0	0
10	11	0	0	0	0	0	0	0
10	12	0.654	1.348	0	0	0	0	0.302
10	13	0.581	1.199	0	0	0	0	0.269
10	14	0	0	0	0	0	0	0
10	15	0	0	0	0	0	0	0

Table B.22 (cont'd)

		Proportion Change per Unit Change in Variable						
Track	YOS	Log Unempl	Log Wage Ratio	Average First Zone A Bonus Multiple	Average Higher Zone A Bonus Multiple	Percent of 2nd Termer Receiving Bonus	Average Zone B Bonus Multiple	Average Zone C Bonus Multiple
11	6	0	0	0	0	0	0	0
11	7	0	0	0	0	0	0	0
11	8	0	0	0	0	0	0	0
11	9	0	0	0	0	0	0	0
11	10	0	0	0	0	0	0	0
11	11	0	0	0	0	0	0	0
11	12	0	0	0	0	0	0	0
11	13	0	0	0	0	0	0	0
11	14	0	0	0	0	0	0	0
11	15	0	0	0	0	0	0	0
11	16	0	0	0	0	0	0	0
11	17	0	0	0	0	0	0	0
11	18	0	0	0	0	0	0	0
11	19	0	0	0	0	0	0	0
11	20	0	0	0	0	0	0	0
11	21	0	0	0	0	0	0	0
11	22	0	0	0	0	0	0	0
11	23	0	0	0	0	0	0	0
11	24	0	0	0	0	0	0	0
11	25	0	0	0	0	0	0	0
11	26	0	0	0	0	0	0	0
11	27	0	0	0	0	0	0	0
11	29	0	0	0	0	0	0	0

Appendix C

PREDICTING TERMS OF ENLISTMENT

The MTA model requires the probability that a reenlistment out of the first term will be for a new term of four years (rather than a six-year term). This probability is specified in the model as being different for Tracks 1 and 2, and different by bonus multiple.

This appendix draws on unpublished EFMP econometric analyses by Carter and Hackett. The inputs to the MTA model are given below in Table C.8.

Tables C.1 and C.2 give the conclusions of the econometric analysis. Note that the YOS coefficients have been rescaled to make the YOS effect zero for low YOS. Tables C.3 and C.4 use these results to construct the independent effects of bonuses and years of service. Then Table C.5 adds these two effects to get the combined effect. Table C.6 recognizes the frequency of reenlistments by Track and YOS. Table C.7 uses those frequencies to construct a weighted average of the probability of a 4-year TOE by bonus multiple. Finally, Table C.8 reports the results in a condensed format and shows the notation for the results used in the MTA2 module.

All the tables in this appendix were generated by a Symphony spreadsheet program. That program can be used to calculate new parameters for the MTA2 model any time that the econometric analysis is updated.

Table C.1

COEFFICIENTS OF VARIABLES IN EQUATION FOR PROBABILITY OF 4-YEAR TERM OF ENLISTMENT

Variable	Value of Coefficient
Constant term	0.8868
Some bonus	-0.4453
Bonus incentive	-0.0490
Extended	0.1812
YOS<5	0.0000
YOS=5	-0.1350
YOS=6	-0.0975
YOS>6	-0.2437

NOTE: Constant term chosen to make predicted probability of 4-year TOE, under no bonus, equal to the actual probability.

Table C.2

BONUS INCENTIVE TO REENLIST FOR SIX YEARS

	Bonus Multiple							
	0	0.5	1	2	3	4	5	6
Incentive ($000)	0.000	0.840	1.604	3.157	4.692	4.614	4.614	4.614

Table C.3

EFFECT OF REENLISTMENT BONUS ON PROBABILITY
OF A 4-YEAR TERM OF ENLISTMENT

	Bonus Multiple							
	0	0.5	1	2	3	4	5	6
Bonus Effect	0.8868	0.4003	0.3629	0.2868	0.2116	0.2154	0.2154	0.2154

Table C.4

EFFECT OF YEARS OF SERVICE AND TRACK
ON PROBABILITY OF 4-YEAR TERM OF ENLISTMENT

	Initial TOE	
YOS	4-year	6-year
0	0.000	0.000
1	0.000	0.000
2	0.000	0.000
3	0.000	0.000
4	0.181	0.000
5	0.046	-0.135
6	na	0.084
7	na	-0.063

Table C.5

EFFECT OF TRACK, YOS, AND BONUS
ON PROBABILITY OF 4-YEAR TERM OF ENLISTMENT

	Bonus Multiple							
YOS	0	0.5	1	2	3	4	5	6
				4-year initial TOE				
0	0.887	0.400	0.363	0.287	0.212	0.215	0.215	0.215
1	0.887	0.400	0.363	0.287	0.212	0.215	0.215	0.215
2	0.887	0.400	0.363	0.287	0.212	0.215	0.215	0.215
3	0.887	0.400	0.363	0.287	0.212	0.215	0.215	0.215
4	1.000	0.582	0.544	0.468	0.393	0.397	0.397	0.397
5	0.933	0.447	0.409	0.333	0.258	0.262	0.262	0.262
				6-year initial TOE				
0	0.887	0.400	0.363	0.287	0.212	0.215	0.215	0.215
1	0.887	0.400	0.363	0.287	0.212	0.215	0.215	0.215
2	0.887	0.400	0.363	0.287	0.212	0.215	0.215	0.215
3	0.887	0.400	0.363	0.287	0.212	0.215	0.215	0.215
4	0.887	0.400	0.363	0.287	0.212	0.215	0.215	0.215
5	0.752	0.265	0.228	0.152	0.077	0.080	0.080	0.080
6	0.971	0.484	0.447	0.371	0.295	0.299	0.299	0.299
7	0.824	0.338	0.300	0.224	0.149	0.153	0.153	0.153

Table C.6

REENLISTMENTS OUT OF TRACKS 1 AND 2 DURING FY87

YOS	Reen FY87	Percent Dist.
	4-year initial TOE	
0	0	0.000
1	0	0.000
2	6003	0.260
3	12643	0.548
4	3193	0.138
5	1234	0.053
Total	23077	1.000
	6-year initial TOE	
0	0	0.000
1	0	0.000
2	0	0.000
3	0	0.000
4	999	0.359
5	1525	0.548
6	220	0.079
7	40	0.014
Total	2784	1.000

Table C.7

PROBABILITY OF 4-YEAR TERM OF REENLISTMENT
BY BONUS MULTIPLE

	Bonus Multiple							
YOS	0	0.5	1	2	3	4	5	6
				4-year initial TOE				
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	0.231	0.104	0.094	0.075	0.055	0.056	0.056	0.056
3	0.486	0.219	0.199	0.157	0.116	0.118	0.118	0.118
4	0.138	0.080	0.075	0.065	0.054	0.055	0.055	0.055
5	0.050	0.024	0.022	0.018	0.014	0.014	0.014	0.014
Sum	0.905	0.428	0.390	0.314	0.239	0.243	0.243	0.243
				6-year initial TOE				
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4	0.318	0.144	0.130	0.103	0.076	0.077	0.077	0.077
5	0.412	0.145	0.125	0.083	0.042	0.044	0.044	0.044
6	0.077	0.038	0.035	0.029	0.023	0.024	0.024	0.024
7	0.012	0.005	0.004	0.003	0.002	0.002	0.002	0.002
Sum	0.819	0.332	0.295	0.219	0.143	0.147	0.147	0.147

Table C.8

PROBABILITY OF 4-YEAR TERM OF REENLISTMENT
BY TRACK AND BONUS MULTIPLE

Initial TOE	Bonus Multiple 0	0.5	1	2	3	4	5	6
	Probability of 4-Year TOE							
4-year	0.905	0.428	0.390	0.314	0.239	0.243	0.243	0.243
6-year	0.819	0.332	0.295	0.219	0.143	0.147	0.147	0.147
	Notation Used in MTA2							
4-year	TOE1Z	TOE1AH	TOE1A1	TOE1A2	TOE1A3	TOE1A4	TOE1A5	TOE1A6
6-year	TOE2Z	TOE2AH	TOE2A1	TOE2A2	TOE2A3	TOE2A4	TOE2A5	TOE2A6

Appendix D

MODULE 1 ACTION DIAGRAM (DATA PREPARATION)

This appendix documents the inputs, calculations, and outputs of Module 1. It assumes that all flows, flow rates, and distributions are to be determined using the past three years as the reference situation. If the regression equations (Carter et al., 1987) are to be used for predicting loss and reenlistment rates, see Sec. IV for the implementation algorithm.

NOTATION FOR DIMENSIONS OF VARIABLES

The major dimensions of the data inputs are Track, fiscal year, year of service, and grade. Of course, all the dimensions are not required by every datum. Zone A bonus multiples, for example, vary only by fiscal year. Most variables, however, are like starting inventory, which does require all the dimensions:

STARTINV [i] <FY, YOS, Grade>

STARTINV = Enlisted force inventory at the start of the fiscal year

i = Track number, 1 through 11 (see Table 2).
Note that the Track number is part of the variable name, as in STARTINV1, STARTINV2, etc., rather than being a subscript.

FY = Fiscal year, three past years and up to nine projection years.

YOS = Years of service, number of entire years completed as of the start or end of a fiscal year (see Sec. III for a discussion of which variables use start-of-year accounting and which variables use end-of-year accounting).

Grade = E-1 through E-9.

INPUTS

The bulk of the inputs to Module 1 must be obtained for each of the three fiscal years before the first projection year. The three years of data are needed to fill in the three past-year lines on the input and output screens of Module 2, and to estimate reference-period rates and distributions. However, some variables must be collected for longer time periods. Since the difficulty (and sometimes the method) of assembling inputs varies with the number of years for which they must be obtained, the inputs are grouped by time period in the following discussion.

Eight Years of Data by Fiscal Year

The following data must be assembled for eight years before the first projection year. Only the past three years of zone A bonuses are needed for the input screens, but the past eight years are needed to construct the "past zone A bonus" variable used by Module 2 to estimate loss rates.

AH <FY> = Percent of force receiving zone A bonus with multiple = 0.5.

Aj <FY> = Percent of force receiving zone A bonus with multiple = j, where j = 1 through 6.

Six Years of Data by Fiscal Year

Palace Chase losses are needed for the past six years, because Palace Chase shifts are estimated from three previous years of Palace Chase losses.

PCLOSS [i] <FY, YOS, Grade> = Palace Chase losses.

Four Years of Data by Fiscal Year

The following data must be assembled for four years before the first projection year. The previous year's Early Out loss is needed to estimate a given year's Early Out shift.

EOLOSS [i] <FY, YOS, Grade> = Early Out losses.

Three Years of Data by Fiscal Year

The following data must be assembled for three years years before the first projection year. For these variables, the only subscript necessary is FY.

Economic Conditions and Zone B and C Reenlistment Bonuses.

UNEMPL <FY> = Civilian unemployment rate (percent).

MILCIV <FY> = Ratio of military wages to civilian wages.

CPI <FY> = Consumer Price Index in the middle of the FY.

BH <FY> = Percent of force receiving zone B bonus with multiple <FY> = 0.5.

Bj <FY> = Percent of force receiving zone B bonus with multiple <FY> = j, where j <FY> = 1 through 6.

CH <FY> = Percent of force receiving zone C bonus with multiple = 0.5.

Cj <FY> = Percent of force receiving zone C bonus with multiple <FY> = j, where j = 1 through 6.

Early Attrition and Promotion. The estimation of attrition losses and promotions during the early years of an enlisted person's Air Force career requires special analysis. The relationship between inventories and flows is fairly complex. Appendix A provides a complete discussion of the problem. The following flows are needed to model these early attritions and promotions. The notation "NUMSxDy" indicates the numerator of the SxDy ratio, where that ratio is the proportion of source "x" that is distributed to destination "y" each fiscal year.

NUMS1D1 <FY> = NPS4 accessions during a fiscal year that are lost during that fiscal year while still in basic military training.

NUMS1D2 <FY> = NPS4 accessions during a fiscal year that are lost during that fiscal year after completing basic military training but while still in grade E-1.

NUMS1D3 <FY> = NPS4 accessions during a fiscal year that are lost during that fiscal year after completing basic military training and that are in grade E-2 at the time of leaving.

NUMS1D4 <FY> = NPS4 accessions during a fiscal year that survive to the

end of the fiscal year and are in grade E-1 at the end of the fiscal year.

NUMS1D5 <FY> = NPS4 accessions during a fiscal year that survive to the end of the fiscal year and are in grade E-2 at the end of the fiscal year.

NUMS2D1 <FY> = STARTINV [1] <FY, YOS = 0, Grade = 1> that are lost during the fiscal year while still in basic military training.

NUMS2D2 <FY> = STARTINV [1] <FY, YOS = 0, Grade = 1> that are lost during the fiscal year after completing basic military training but while still in grade E-1.

NUMS2D3 <FY> = STARTINV [1] <FY, YOS = 0, Grade = 1> that are lost during the fiscal year and that are in grade E-2 at the time of the loss.

NUMS2D4 <FY> = STARTINV [1] <FY, YOS = 0, Grade = 1> that survive to the end of the fiscal year and are in grade E-2 at the end of the fiscal year.

NUMS2D5 <FY> = STARTINV [1] <FY, YOS = 0, Grade = 1> that survive to the end of the fiscal year and are in grade E-3 at the end of the fiscal year.

NUMS3D1 <FY> = STARTINV [1] <FY, YOS = 0, Grade = 2> that are lost during the fiscal year while in grade E-2.

NUMS3D2 <FY> = STARTINV [1] <FY, YOS = 0, Grade = 2> that are lost during the fiscal year while in grade E-3.

NUMS3D3 <FY> = STARTINV [1] <FY, YOS = 0, Grade = 2> that survive to the end of the fiscal year and are in grade E-3 at the end of the fiscal year.

NUMS4D1 <FY> = STARTINV [1] <FY, YOS = 1, Grade = 2> that are lost during the fiscal year while in grade E-2.

NUMS4D2 <FY> = STARTINV [1] <FY, YOS = 1, Grade = 2> that are lost during the fiscal year while in grade E-3.

NUMS4D3 <FY> = STARTINV [1] <FY, YOS = 1, Grade = 2> that survive to the end of the fiscal year and are in grade E-3 at the end of the fiscal year.

NUMS5D1 <FY> = STARTINV [1] <FY, YOS = 1, Grade = 3> that are lost during the fiscal year while in grade E-3.

NUMS5D2 <FY> = STARTINV [1] <FY, YOS = 1, Grade = 3> that are lost during the fiscal year while in grade E-4.

NUMS5D3 <FY> = STARTINV [1] <FY, YOS = 1, Grade = 3> that survive to the end of the fiscal year and are in grade E-3 at the end of the fiscal year.

NUMS5D4 <FY> = STARTINV [1] <FY, YOS = 1, Grade = 3> that survive to the end of the fiscal year and are in grade E-4 at the end of the fiscal year.

NUMS6D1 <FY> = NPS6 accessions during a fiscal year that are lost during the fiscal year while still in basic military training.

NUMS6D2 <FY> = NPS6 accessions during a fiscal year that are lost during the fiscal year while in grade E-3.

NUMS6D3 <FY> = NPS6 accessions during a fiscal year that survive to the end of the fiscal year and are in grade E-1 at the end of the fiscal year.

NUMS6D4 <FY> = NPS6 accessions during a fiscal year that survive to the end of the fiscal year and are in grade E-3 at the end of the fiscal year.

NUMS7D1 <FY> = STARTINV [2] <FY, YOS = 0, Grade = 1> that are lost during the fiscal year while still in basic military training.

NUMS7D2 <FY> = STARTINV [2] <FY, YOS = 0, Grade = 1> that are lost during the fiscal year while in grade E-3.

NUMS7D3 <FY> = STARTINV [2] <FY, YOS = 0, Grade = 1> that survive to the end of the fiscal year and are in grade E-3 at the end of the fiscal year.

NUMS8D1 <FY> = STARTINV [2] <FY, YOS = 0, Grade = 3> that are lost during the fiscal year while in grade E-3.

NUMS8D2 <FY> = STARTINV [2] <FY, YOS = 0, Grade = 3> that survive to the end of the fiscal year and are in grade E-3 at the end of the fiscal year.

NUMS9D1 <FY> = STARTINV [2] <FY, YOS = 1, Grade = 3> that are lost during the fiscal year while in grade E-3.

NUMS9D2 <FY> = STARTINV [2] <FY, YOS = 1, Grade = 3> that are lost during the fiscal year while in grade E-4.

NUMS9D3 <FY> = STARTINV [2] <FY, YOS = 1, Grade = 3> that survive to the end of the fiscal year and are in grade E-3 at the end of the fiscal year.

NUMS9D4 <FY> = STARTINV [2] <FY, YOS = 1, Grade = 3> that survive to the end of the fiscal year and are in grade E-4 at the end of the fiscal year.

Three Years of Data, by Fiscal Year, YOS, and Grade

Gain and Loss Weights. "Gain weights" and the "loss weights" are needed during cost estimation because gains come into the force part way through the year, and losses leave the force part way through the year. In each case the weight indicates the proportion of the fiscal year that the average person who is a gain or loss is in the force (on the payroll). For example, if gains occur at a constant rate during the year, then the gain weight is 0.5. The loss weights need to be done by type of loss for the cost estimates to be sensitive to changes in management actions. For example, the MTA model will recognize the cost savings achieved by rollups only if rollups have their own loss weight.

GAINWEIGHT <FY, YOS, Grade> = Fraction of a year that average gain is in the force.

BMTATTLOSSWEIGHT <FY, YOS, Grade> = Fraction of a year that a BMTATTLOSS is in the force.

STDATTLOSSWEIGHT <FY, YOS, Grade> = Fraction of a year that a STDATTLOSS is in the force.

ETSLOSSWEIGHT <FY, YOS, Grade> = Fraction of a year tha a ETSLOSS is in the force.

RULOSSWEIGHT <FY, YOS, Grade> = Fraction of a year that a RULOSS is in the force.

EOLOSSWEIGHT <FY, YOS, Grade> = Fraction of a year that a EOLOSS is in the force.

PCLOSSWEIGHT <FY, YOS, Grade> = Fraction of a year that a PCLOSS is in the force.

RETIREMENTWEIGHT <FY, YOS, Grade> = Fraction of a year that a RETIREMENT is in the force.

OTSLOSSWEIGHT <FY, YOS, Grade> = Fraction of a year that a OTSLOSS is in the force.

MISCLOSSWEIGHT <FY, YOS, Grade> = Fraction of a year that a MISCLOSS is in the force.

Cost Factors. Military Personnel Account cost factors are needed for the three past years. These cost factors should be in nominal dollars; they should reflect all changes in compensation, including changes due to price inflation. The cost factors should be prepared by YOS and Grade, because these are the major dimensions that influence personnel costs.

Annual Output Screen 16 will report the nominal costs estimated using these factors. Then Annual Output Screen 17 will report the constant dollar costs implied by the nominal costs, where the adjustment to constant dollars will be done using the Consumer Price Index (CPI).

BASICPAYFACTOR <FY, YOS, Grade> = Basic pay per person-year.

RETIREPAYFACTOR <FY, YOS, Grade> = Retired pay accrual per person-year.

BAQVHAFACTOR <FY, YOS, Grade> = Basic Allowance for Quarters and Variable Housing Allowance per person-year.

INCENTPAYFACTOR <FY, YOS, Grade> = Incentive and Special Pay per person-year.

MISCPAYFACTOR <FY, YOS, Grade> = Miscellaneous Pay per person-year.

PCSCOSTFACTOR <FY, YOS, Grade> = Permanent Change of Station Cost per person-year.

Three Years of Data by Track, FY, YOS, and Grade

The following data must be assembled for three years before the first projection year. For these variables, in addition to the fiscal year subscript, each variable must be constructed for each Track, and within each Track should have the appropriate YOS and Grade subscript ranges (see Table 1).

STARTINV [i] <FY, YOS, Grade> = Inventory at the start of the fiscal year.

ENDINV [i] <FY, YOS, Grade> = Inventory at the end of the fiscal year.

PROMIN[i] <FY, YOS, Grade> = Promotions into grade during fiscal year, by end of year YOS.

PROMOUT[i] <FY, YOS, Grade> = Promotions out of grade during fiscal year, by end of year YOS.

DEMOIN [i] <FY, YOS, Grade> = Demotions into grade, by end of year YOS.

DEMOOUT [i] <FY, YOS, Grade> = Demotions out of grade, by end of year YOS.

REUPIN [i] <FY, YOS, Grade> = Reenlistments into inventory cell, by end of year YOS.

REUPOUT [i] <FY, YOS, Grade> = Reenlistments out of inventory cell, by start of year YOS.

RETELIGIN [i] <FY, YOS, Grade> = Continuation flows into YOS = 20 inventory cells during the fiscal year.

RETELIGOUT [i] <FY, YOS, Grade> = Continuation flows out of YOS = 19 cells during the fiscal year.

NPS4 [i] <FY, YOS, Grade> = NPS accessions with 4-year TOE.

NPS6 [i] <FY, YOS, Grade> = NPS accessions with 6-year TOE.

PS [i] <FY, YOS, Grade> = Prior service accessions.

OTSGAIN [i] <FY, YOS, Grade> = Gains to enlisted force of persons scheduled to go to Officer's Training School.

MISCGAIN [i] <FY, YOS, Grade> = Miscellaneous gain.

BMTATTLOSS [i] <FY, YOS, Grade> = Attrition losses of persons who are still in basic military training.

STDATTLOSS [i] <FY, YOS, Grade> = Attrition losses of persons who have completed basic military training.

ETSLOSS [i] <FY, YOS, Grade> = Expiration of term of service loss.

RULOSS [i] <FY, YOS, Grade> = Losses before expiration of term of service (but in the same fiscal year as their ETS) due to Rollup program.

RETIREMENT [i] <FY, YOS, Grade> = Retirement losses (does not include attritions).

OTSLOSS [i] <FY, YOS, Grade> = Losses to the enlisted force of persons going to Officer's Training School.

MISCLOSS [i] <FY, YOS, Grade> = Miscellaneous losses.

One Year of Data by 12 Months

The actual values of the outputs generated by the Module 1 of SAM need to be obtained for the fiscal year just before the first projection year. These variables give behavioral flows by month during the past fiscal year. They will be used as default values to produce distributions across the 12 months; those in turn will be used to convert MTA2 annual projections into monthly projections for MTA5.

INVATT <CATENL, Grade, Month> = Attrition from start of year inventory.

PFETSLOSS <CATENL, Grade, Month> = Policy free ETS loss.

REENLISTOUT <CATENL, Grade, Month> = Reenlistment-out.

RETELIGOUT <CATENL, Grade, Month> = Flow to retirement eligibility.

CALCULATIONS

Estimated Flows

Some flows during past fiscal years are estimated from other flows that are directly observed. A trivial example is that the total loss for the entire force is estimated from more detailed losses. A nontrivial example is Palace Chase shifts, which are estimated from Palace Chase losses.

Total Gains and Losses. The following summations should be done preserving Track, YOS, and Grade detail.

TOTALGAIN =

NPS4
+ NPS6
+ PS
+ OTSGAIN
+ MISCGAIN

```
TOTALLOSS =
          BMTLOSS
        + STDLOSS
        + ETSLOSS
        + RULOSS
        + EOLOSS
        + PCLOSS
        + RETIREMENT
        + OTSLOSS
        + MISCLOSS
```

Military Personnel Account Costs. In the workyear calculations, data on inventories and flows should be summed across all Tracks (i = 1 through 11) to get the indicated variables with FY, YOS, and Grade dimensions.

```
WORKYEARS <FY, YOS, Grade> =
      STARTINV <FY, YOS, Grade>
    + GAINWEIGHT <FY, YOS, Grade> * TOTALGAIN <FY, YOS, Grade>
    - BMTATTLOSSWEIGHT <FY, YOS, Grade> * BMTATTLOSS <FY, YOS, Grade>
    - STDATTLOSSWEIGHT <FY, YOS, Grade> * STDATTLOSS <FY, YOS, Grade>
    - ETSLOSSWEIGHT <FY, YOS, Grade> * ETSLOSS <FY, YOS, Grade>
    - RULOSSWEIGHT <FY, YOS, Grade> * RULOSS <FY, YOS, Grade>
    - EOLOSSWEIGHT <FY, YOS, Grade> * EOLOSS <FY, YOS, Grade>
    - PCLOSSWEIGHT <FY, YOS, Grade> * PCLOSS <FY, YOS, Grade>
    - RETIREMENTWEIGHT <FY, YOS, Grade> * RETIREMENT <FY, YOS, Grade>
    - OTSLOSSWEIGHT <FY, YOS, Grade> * OTSLOSS <FY, YOS, Grade>
    - MISCLOSSWEIGHT <FY, YOS, Grade> * MISCLOSS <FY, YOS, Grade>

NBASICPAY <FY, YOS, Grade> =
      WORKYEARS <FY, YOS, Grade> * BASICPAYFACTOR <FY, YOS, Grade>
NRETIREPAY <FY, YOS, Grade> =
      WORKYEARS <FY, YOS, Grade> * RETIREPAYFACTOR <FY, YOS, Grade>
NBAQVHA <FY, YOS, Grade> =
      WORKYEARS <FY, YOS, Grade> * BAQVHAFACTOR <FY, YOS, Grade>
```

NINCENTPAY <FY, YOS, Grade> =

WORKYEARS <FY, YOS, Grade> * INCENTPAYFACTOR <FY, YOS, Grade>

NMISCPAY <FY, YOS, Grade> =

WORKYEARS <FY, YOS, Grade> * MISCPAYFACTOR <FY, YOS, Grade>

NPCSCOST <FY, YOS, Grade> =

WORKYEARS <FY, YOS, Grade> * PCSCOSTFACTOR <FY, YOS, Grade>

NTOTALCOST =

NBASICPAY
+ NRETIREPAY
+ NBAQVHA
+ NINCENTPAY
+ NMISCPAY
+ NPCSCOST

To fill in Annual Output Screen 16 (see Sec. II), simply sum the above variables over all YOS and Grade. To fill in Annual Output Screen 17, which gives MPA account costs in constant dollars, adjust the Screen 16 results using the CPI information placed in Input Screen 1. The constant dollars are in terms of price levels during the most recent past fiscal year, so the nominal costs (Screen 14) should be multiplied by the ratio of the CPI in the given fiscal year to the CPI in the most recent past projection year.

Early Release Shifts and Inventory Reductions. Early release "shifts" are losses that no longer occur at a given time because they have been shifted to an earlier time by an early release program. Early release "inventory reductions" are start-of-year inventories that no longer exist because early release programs have shifted losses from after to before that inventory date.

The shifts and inventory reductions for all three early release programs can be calculated from information on early release losses. Table D.1 shows the relationships between early release losses and the associated shifts.

The table is constructed in terms of years to expiration of term of service. If a person joins the enlisted force for a 4-year term of enlistment, then YETS = 4 during their first full fiscal year in the service, YETS = 3 during their second full fiscal year in the service, YETS = 2 during their third full year in the service, and YETS = 1 during the fiscal year in which they will leave the service unless they extend or reenlist. If they reenlist, a new YETS count starts in their new enlistment category. If they extend, YETS becomes 0 during their first full fiscal year in extension status, and YETS = -1 during their second full fiscal year in extension status.

For the extension years (YETS = 0 and -1) and for Track 11, Table D.1 assumes that shifts occur in the same fiscal year as the loss, for all three types of early release. This assumption is true enough and the early release losses in those cases are small enough for this assumption to be acceptable. For the nonextension years (YETS > 0) in Tracks 1 through 10, Table D.1 exactly implements the rule used in all EFMP models, that early release losses are presumed to be taken from losses that otherwise would have occurred at the original end of term of service.

Drawing upon the relationships in Table D.1, we can write equations for the early release shifts and inventory reductions in Tracks 1 through 10. Note that the shifts are needed to fill in the output screens for past fiscal years, but the inventory reductions are needed only for calculating inputs to Module 2.

The following equations assume that Track and Grade do not change as a loss is shifted from one point to another. YETS does change, of course, increasing by one year for every year that a loss is shifted one year earlier. These variables should be calculated with complete Track, YOS, and Grade detail. To convert YETS into YOS for a given Track (in Tracks 1 through 10) consult Table 2.

Palace Chase:

PCSHIFT <FY, YETS = -1> = PCLOSS <FY, YETS = -1>

PCSHIFT <FY, YETS = 0> = PCLOSS <FY, YETS = 0>

Table D.1

TIMING OF EARLY RELEASE SHIFTS RELATIVE TO LOSSES

YETS in FY of Loss	Number of FY to Shift			
	0	1	2	3
Palace Chase				
4				x
3			x	
2		x		
1	x			
0	x			
-1	x			
Early Out				
2		x		
1		x		
0		x		
-1		x		
Rollup				
2	x			
1	x			
0	x			
-1	x			

```
PCSHIFT <FY, YETS = 1>      =   PCLOSS <FY, YETS = 1>
                              + PCLOSS <FY-1, YETS = 2>
                              + PCLOSS <FY-2, YETS = 3>
                              + PCLOSS <FY-3, YETS = 4>
PCINVRED <FY, YETS = 1>     =   PCLOSS <FY-1, YETS = 2>
                              + PCLOSS <FY-2, YETS = 3>
                              + PCLOSS <FY-3, YETS = 4>
PCINVRED <FY, YETS = 2>     =   PCLOSS <FY-1, YETS = 3>
                              + PCLOSS <FY-2, YETS = 4>
PCINVRED <FY, YETS = 3>     =   PCLOSS <FY-1, YETS = 4>
PCSHIFT <FY, YETS = -1>     =   PCLOSS <FY, YETS = -1>
```

Early Out:

```
EOSHIFT <FY, YETS = -1>     =   EOLOSS <FY-1, YETS = 0>
EOSHIFT <FY, YETS = 0>      =   EOLOSS <FY-1, YETS = 1>
EOSHIFT <FY, YETS = 1>      =   EOLOSS <FY-1, YETS = 2>
EOINVRED <FY, YETS = -1>    =   EOLOSS <FY-1, YETS = 0>
EOINVRED <FY, YETS = 0>     =   EOLOSS <FY-1, YETS = 1>
EOINVRED <FY, YETS = 1>     =   EOLOSS <FY-1, YETS = 2>
```

Rollup:

```
RUSHIFT <FY, YETS = -1>     =   RULOSS <FY-1, YETS = -1>
RUSHIFT <FY, YETS = 0>      =   RULOSS <FY-1, YETS = 0>
RUSHIFT <FY, YETS = 1>      =   RULOSS <FY-1, YETS = 1>
RUINVRED <FY, YETS = -1>    =   0
RUINVRED <FY, YETS = 0>     =   0
RUINVRED <FY, YETS = 1>     =   0
```

The equations for early release shifts and inventory reductions for Track 11 are especially simple because the MTA model does not do time in term accounting there. The necessary approximations are acceptable because there are very few early releases after the second term. The same equations are used for all grades.

```
PCSHIFT [Track = 11] <FY, YOS>  = PCLOSS [Track = 11] <FY-1, YOS-1>
```

```
EOSHIFT [Track = 11] <FY, YOS>  = EOLOSS [Track = 11] <FY-1, YOS-1>
RUSHIFT [Track = 11] <FY, YOS>  = RULOSS [Track = 11] <FY, YOS>
PCINVRED [Track = 11] <FY, YOS> = PCLOSS [Track = 11] <FY-1, YOS-1>
EOINVRED [Track = 11] <FY, YOS> = EOLOSS [Track = 11] <FY-1, YOS-1>
RUINVRED [Track = 11] <FY, YOS> = 0
```

Policy Free ETS Losses. Now that early release shifts have been calculated, we can fill in the final items in the MTA model's output screens for past fiscal years. The missing item is policy free losses, which by definition are those losses that would have occurred if no early release shifts existed.

```
PFETSLOSS = ETSLOSS
          + RUSHIFT
          + EOSHIFT
          + PCSHIFT
```

Cost Factors for Annual Projections. The averages of the cost factors during the three years in the reference period are inputs to Module 2 that enable projections of the MTA budget.

```
BASICPAYFACTOR <YOS, Grade>  = BASICPAYFACTOR <REF, YOS, Grade>
RETIREPAYFACTOR <YOS, Grade> = RETIREPAYFACTOR <REF, YOS, Grade>
BAQVHAFACTOR <YOS, Grade>    = BAQVHAFACTOR <REF, YOS, Grade>
INCENTPAYFACTOR <YOS, Grade> = INCENTPAYFACTOR <REF, YOS, Grade>
MISCPAYFACTOR <YOS, Grade>   = MISCPAYFACTOR <REF, YOS, Grade>
PCSCOSTFACTOR <YOS, Grade>   = PCSCOSTFACTOR <REF, YOS, Grade>
```

The average gain and loss weights during the reference period should be calculated by making ratios of the following sums over the three fiscal years in the reference period. This calculation is done cell by cell.

```
GAINWEIGHT <YOS, Grade> =
    Sum [ GAINWEIGHT <FY, YOS, Grade> * TOTALGAIN <FY, YOS, Grade> ]
```

```
  / Sum [ TOTALGAIN <FY, YOS, Grade ]

BMTATTLOSSWEIGHT <YOS, Grade> =
    Sum [ BMTATTLOSSWEIGHT <YOS, Grade> * BMTATTLOSS <FY, YOS, Grade> ]
  / Sum [ BMTATTLOSS <FY, YOS, Grade> ]

STDATTLOSSWEIGHT <YOS, Grade> =
    Sum [ STDATTLOSSWEIGHT <YOS, Grade> * STDATTLOSS <FY, YOS, Grade> ]
  / Sum [ STDATTLOSS <FY, YOS, Grade> ]

ETSLOSSWEIGHT <YOS, Grade> =
    Sum [ ETSLOSSWEIGHT <YOS, Grade> * ETSLOSS <FY, YOS, Grade> ]
  / Sum [ ETSLOSS <FY, YOS, Grade> ]

RULOSSWEIGHT <YOS, Grade> =
    Sum [ RULOSSWEIGHT <YOS, Grade> * RULOSS <FY, YOS, Grade> ]
  / Sum [ RULOSS <FY, YOS, Grade> ]

EOLOSSWEIGHT <YOS, Grade> =
    Sum [ EOLOSSWEIGHT <YOS, Grade> * EOLOSS <FY, YOS, Grade> ]
  / Sum [ EOLOSS <FY, YOS, Grade> ]

PCLOSSWEIGHT <YOS, Grade> =
    Sum [ PCLOSSWEIGHT <YOS, Grade> * PCLOSS <FY, YOS, Grade> ]
  / Sum [ PCLOSS <FY, YOS, Grade> ]

RETIREMENTWEIGHT <YOS, Grade> =
    Sum [ RETIREMENTWEIGHT <YOS, Grade> * RETIREMENT <FY, YOS, Grade> ]
  / Sum [ RETIREMENT <FY, YOS, Grade> ]

OTSLOSSWEIGHT <YOS, Grade> =
    Sum [ OTSLOSSWEIGHT <YOS, Grade> * OTSLOSS <FY, YOS, Grade> ]
  / Sum [ OTSLOSS <FY, YOS, Grade> ]
```

```
MISCLOSSWEIGHT <YOS, Grade> =
    Sum [ MISCLOSSWEIGHT <YOS, Grade> * MISCLOSS <FY, YOS, Grade> ]
  / Sum [ MISCLOSS <FY, YOS, Grade> ]
```

Early Attrition and Promotion

"Early attritions" and "early promotions" are attritions and promotions during a fiscal year of persons who are either accessions during that fiscal year or who are in the inventory at the start of the fiscal year with either YOS = 0 or YOS = 1. These flows require special analysis because of rapid automatic promotion through the first three grades. Appendix A provides a complete analysis of these flows. This subsection draws on the part of that analysis showing what data Module 1 must prepare for Module 2 (see Tables A.8 and A.9).

The notation for these data items is SxDy, where "S" is source, "x" is the number of the source in order of appearance in Tables A.8 and A.9, "D" is destination, and y is the number of the destination for a given source from left to right in the tables. In each case, interpretation of SxDy is the proportion of source x that has fate y during the fiscal year. Note that the sum of SxDy across all possible destinations, y, of a given source must equal 1.0. This identity should be used as a check of data validity during data preparation.

```
S1D1 = NUMS1D1 <REF> / NPS4 <REF>
S1S2 = NUMS1D2 <REF> / NPS4 <REF>
S1S3 = NUMS1D3 <REF> / NPS4 <REF>
S1D4 = NUMS1D4 <REF> / NPS4 <REF>
S1D5 = NUMS1D5 <REF> / NPS4 <REF>
S2D1 = NUMS2D1 <REF> / STARTINV [1]  <REF, YOS = 0, Grade = 1>
S2D2 = NUMS2D2 <REF> / STARTINV [1]  <REF, YOS = 0, Grade = 1>
S2D3 = NUMS2D3 <REF> / STARTINV [1]  <REF, YOS = 0, Grade = 1>
S2D4 = NUMS2D4 <REF> / STARTINV [1]  <REF, YOS = 0, Grade = 1>
S2D5 = NUMS2D5 <REF> / STARTINV [1]  <REF, YOS = 0, Grade = 1>
S3D1 = NUMS3D1 <REF> / STARTINV [1]  <REF, YOS = 0, Grade = 2>
S3D2 = NUMS3D2 <REF> / STARTINV [1]  <REF, YOS = 0, Grade = 2>
```

```
S3D4 = NUMS3D3 <REF> / STARTINV [1]  <REF, YOS = 0, Grade = 2>
S4D5 = NUMS4D1 <REF> / STARTINV [1]  <REF, YOS = 1, Grade = 2>
S4D2 = NUMS4D2 <REF> / STARTINV [1]  <REF, YOS = 1, Grade = 2>
S4D3 = NUMS4D3 <REF> / STARTINV [1]  <REF, YOS = 1, Grade = 2>
S5D1 = NUMS5D1 <REF> / STARTINV [1]  <REF, YOS = 1, Grade = 3>
S5D2 = NUMS5D2 <REF> / STARTINV [1]  <REF, YOS = 1, Grade = 3>
S5D3 = NUMS5D3 <REF> / STARTINV [1]  <REF, YOS = 1, Grade = 3>
S5D4 = NUMS5D4 <REF> / STARTINV [1]  <REF, YOS = 1, Grade = 3>
S6D1 = NUMS6D1 <REF> / NPS6 <REF>
S6D2 = NUMS6D2 <REF> / NPS6 <REF>
S6D3 = NUMS6D3 <REF> / NPS6 <REF>
S6D4 = NUMS6D4 <REF> / NPS6 <REF>
S7D1 = NUMS7D1 <REF> / STARTINV [2] <REF, YOS = 0, Grade = 1>
S7D2 = NUMS7D2 <REF> / STARTINV [2] <REF, YOS = 0, Grade = 1>
S7D3 = NUMS7D3 <REF> / STARTINV [2] <REF, YOS = 0, Grade = 1>
S8D1 = NUMS8D1 <REF> / STARTINV [2] <REF, YOS = 0, Grade = 3>
S8D2 = NUMS8D2 <REF> / STARTINV [2] <REF, YOS = 0, Grade = 3>
S9D1 = NUMS9D1 <REF> / STARTINV [2] <REF, YOS = 1, Grade = 3>
S9D2 = NUMS9D2 <REF> / STARTINV [2] <REF, YOS = 1, Grade = 3>
S9D3 = NUMS9D3 <REF> / STARTINV [2] <REF, YOS = 1, Grade = 3>
S9D4 = NUMS9D4 <REF> / STARTINV [2] <REF, YOS = 1, Grade = 3>
```

Late Attrition

Module 2 estimates late attrition (attrition from inventory with YOS > 2 at the start of the fiscal year) by multiplying each fiscal year's starting inventory by the attrition rate that occurred during the reference period. That reference attrition rate is calculated as follows:

For YOS > 2, all Tracks, all grades:

```
STDATTRATE [i] < YOS, Grade> =
        STDATTLOSS [i] <REF, YOS, Grade>
    /   STARTINV [i] <REF, YOS, Grade>
```

Nonattrition Losses

The following loss rates are used in Module 2 to either estimate losses or spread user-specified total losses of a given type. In the case of PFETSLOSSRATE, the rate may be replaced by the result of regression equations, as described in Sec. IV.

```
PFETSLOSSRATE [i] <YOS, Grade> =
     [ PFETSLOSS [i] <REF, YOS, Grade> ]
   / [ STARTINV [i] <REF, YOS, Grade>
       + PCINVRED [i] <REF, YOS, Grade>
       + EOINVRED [i] <REF, YOS, Grade> ]

PCLOSSRATE [i] <YOS, Grade> =
     [ PCLOSS [i] <REF, YOS, Grade>
   / [ STARTINV [i] <REF, YOS, Grade>

EOLOSSRATE [i] <YOS, Grade> =
     [ EOLOSS [i] <REF, YOS, Grade>
   / [ STARTINV [i] <REF, YOS, Grade>

RULOSSRATE [i] <YOS, Grade> =
     [ RULOSS [i] <REF, YOS, Grade>
   / [ STARTINV [i] <REF, YOS, Grade>

OTSLOSSRATE [i] <YOS, Grade> =
     [ OTSLOSS [i] <REF, YOS, Grade>
   / [ STARTINV [i] <REF, YOS, Grade>

MISCLOSSRATE [i] <YOS, Grade> =
     [ MISCLOSS [i] <REF, YOS, Grade>
   / [ STARTINV [i] <REF, YOS, Grade>
```

Retirements

Retirements occur only in Track 11. For this reason, the retirement variable has no track suffix.

```
RETIRERATE <YOS, Grade> = [ RETIREMENT <REF, YOS, Grade> ]
                        / [ STARTINV <REF, YOS, Grade> ]
```

Reenlistments

The following reenlistment rate is used to estimate policy free reenlistments. A rate obtained from the DMI regression equations may alternatively be used, as described in Sec. IV.

```
PFREUPRATE [i] <YOS, Grade> =
     [ REUPOUT [i] <REF, YOS, Grade> ]
   / [ STARTINV [i] <REF, YOS, Grade>
       + PCINVRED [i] <REF, YOS, Grade>
       + EOINVRED [i] <REF, YOS, Grade>
       - BMTATTLOSS [i] <REF, YOS, Grade>
       - STDATTLOSS [i] <REF, YOS, Grade>
       - PFETSLOSS [i] <REF, YOS, Grade> ]
```

Gains

In Module 2, the user-specified inputs of gains must be spread by distributions to the Track, Grade, and YOS dimensions. The numerator of these distribution variables is the average flow by cell during the reference period. The denominator of these distribution variables is the average total flow across all accounting cells in the reference period.

```
PSDIST [i] <YOS, Grade>
      =   PS [i] <REF, YOS, Grade> / PS <REF>

OTSGAINDIST [i] <YOS, Grade>
      =   OTSGAIN [i] <REF, YOS, Grade> / OTSGAIN <REF>
```

MISCGINDIST [i] <YOS, Grade>

= MISCGAIN [i] <REF, YOS, Grade> / MISCGAIN <REF>

Demotions and Promotions

To spread user-specified inputs for demotions and promotions, Module 2 needs trial demotion and promotion rates.

TRIALDEMORATE [i] <YOS, Grade> =

DEMOOUT [i] <REF, YOS, Grade>

/ STARTINV [i] <REF, YOS, Grade>

TRIALPROMRATE [i] <YOS, Grade> =

PROMOUT [i] <REF, YOS, Grade>

/ STARTINV [i] <REF, YOS, Grade>

Reference Case Values of Econometric Variables

UNEMPL <FY> = Civilian unemployment rate (percent).

MILCIV <FY> = Ratio of military wages to civilian wages.

AH <FY> = Percent of force receiving zone A bonus with multiple = 0.5.

Aj <FY> = Percent of force receiving zone A bonus with multiple = j, where j = 1 through 6.

BH <FY> = Percent of force receiving zone B bonus with multiple <FY> = 0.5.

Bj <FY> = Percent of force receiving zone B bonus with multiple <FY> = j, where j <FY> = 1 through 6.

CH <FY> = Percent of force receiving zone C bonus with multiple = 0.5.

Cj <FY> = Percent of force receiving zone C bonus with multiple <FY> = j, where j = 1 through 6.

Civilian unemployment, the military/civilian wage ratio, and reenlistment bonuses affect loss and reenlistment rates in the MTA model. Appendix B gives the exact definitions of the econometric variables used to capture these effects. Module 2 of the MTA model requires average values of the econometric variables during the reference period in order to calculate the changes in these variables

from the reference period to a given projection year. The following formulas calculate these average values.

Unemployment rates and military/civilian wage ratios are transformed by taking the natural logarithm to build the econometric variables. The average during the reference period is the sum of these transformed variables divided by three.

```
REFLOGUNEMPL =
    [  log ( UNEMPL <FY=1> )
     + log ( UNEMPL <FY=2> )
     + log ( UNEMPL <FY=3> ) ] / 3

REFLOGMILCIV =
    [  log ( MILCIV <FY=1> )
     + log ( MILCIV <FY=2> )
     + log ( MILCIV <FY=3> ) ] / 3
```

Zone A bonuses are split into two variables in the econometric analysis. The first variable captures bonuses up to and including multiple 1, the second variable captures additional bonuses beyond multiple 1. The averages of these two variables during the reference period can be constructed by appropriately weighting the average percent receiving each specific zone A bonus multiple during the reference period. Recall that the notation Aj <REF> means the average of the percent receiving zone A bonus multiple "j" over the three past fiscal years in the reference period.

```
REFA1AVG =
      [ 0.5 * AH <REF> + A1 <REF> + A2 <REF>
        + A3 <REF> + A4 <REF> + A5 <REF> + A6 <REF> ] / 100

REFA2AVG =
      [1 * A2 <REF> + 2 * A3 <REF> + 3 * A4 <REF>
       + 4 * A5 <REF> + 5 * A6 <REF> ] / 100
```

The zone B and zone C bonus variables are simply the average bonus multiple received during the reference period.

```
REFBAVG =
      [ 0.5 * BH <REF> + 1 * B1 <REF> + 2 * B2 <REF>
        + 3 * B3 <REF> + 4 * B4 <REF> + 5 * B5 <REF>
        + 6 * B6 <REF> ] / 100

REFCAVG =
      [ 0.5 * CH <REF> + 1 * C1 <REF> + 2 * C2 <REF>
        + 3 * C3 <REF> + 4 * C4 <REF> + 5 * C5 <REF>
        + 6 * C6 <REF> ] / 100
```

The average proportion of enlisted persons in the second term who were receiving a Zone A bonus during the reference period (because one was offered in the past at the time they reenlisted) is the most complex of the econometric variables. This variable is needed only for the second term. It varies by Track and YOS within each Track, because the number of years since the reenlistment point where a zone A bonus might have been received varies by Track and YOS.

To construct this variable one must carefully distinguish between the percent of reenlistments that receive a zone A bonus in a given fiscal year and the percent of inventory that is receiving a bonus in a given fiscal year. Persons who are receiving a bonus in a given fiscal year must have reenlisted in a past year when reenlistment bonuses were offered. Consequently, to construct the APASTAVG variable for the reference period requires knowing how many years ago the persons in a given inventory cell reenlisted and the proportion of reenlistments in that past year that received a bonus. Moreover, the information on time to past reenlistment and the past bonuses must be sent to Module 2, so the APASTAVG variable can be constructed in the projection years.

For any given YOS in a given Track, the formula for the proportion of inventory that is receiving a zone A bonus is:

APASTAVG [i] <FY, YOS> =

W4 [i] * DUMMYA <FY + YETS - 5>

+ W6 [i] * DUMMYA <FY + YETS - 7>

where

APASTAVG [i] <FY, YOS> = proportion of inventory in a cell that is receiving a zone A bonus

DUMMYA <FY> = proportion of reenlistments receiving a zone A bonus during FY

= [AH <FY> + A1 <FY> + A2 <FY> + A3 <FY>

+ A4 <FY> + A5 <FY> + A6 <FY>] / 100

W4 [i] = proportion of inventory in Track i that has a 4-year term of reenlistment

W6 [i] = proportion of inventory in Track i that has a 6-year term of reenlistment

To implement the above calculations we require estimates of the weights W4 and W6, which indicate the fractions of inventory in a cell that have 4-year and 6-year terms of enlistments. Actually, we only need to estimate one of those variables because they must, by definition, sum to 1.0.

W6 [i] = 1.0 - W4 [i]

All persons in Tracks 3 and 4 have a 4-year term of enlistment, by definition of those Tracks. So the weight W4 is always equal to 1.0 there.

W4 [i] = 1.0 if i = 3 or 4

The other Tracks in the second term contain a mixture of four-year and six-year enlistments. An approximate measure of the proportion of each term length is the ratio of inventory at YETS = 4 to the sum of inventories at YETS = 4 and YETS = 6. This method of measuring the W4 weight is accurate enough for MTA model purposes.

W4 [i] = STARTINV [i] <REF, YETS = 4>
/ [STARTINV [i] <REF, YETS = 4>
+ STARTINV [i] <REF, YETS = 6>] if i = 5 through 10

Then, averaging over all three reference years provides the required average of the APASTAVG variable during the reference period.

REFAPASTAVG [i] <YOS> = APASTAVG [i] <REF, YOS>

This variable is an input to Module 2. The average proportion of reenlistments receiving zone A bonuses for the eight years before the first projection year must also be sent to Module 2, because the APASTAVG variable must be calculated for the projection years.

Sx = proportion of inventory receiving zone A bonuses x years ago.

In the following formulas, FPY = first projection year. In other words, if the MTA model is being made ready in October 1988, then S1 = DUMMYA <1987>, S2 = DUMMYA <1986>, and so on. Module 2 needs these Sx variables to calculate APASTAVG for each projection year.

S8 = DUMMYA <FPY-8>
S7 = DUMMYA <FPY-7>
S6 = DUMMYA <FPY-6>
S5 = DUMMYA <FPY-5>
S4 = DUMMYA <FPY-4>
S3 = DUMMYA <FPY-3>
S2 = DUMMYA <FPY-2>
S1 = DUMMYA <FPY-1>

Monthly Distributions

The MTA5 module requires distributions of the SAM1 outputs by month during a fiscal year. These distributions should be constructed from actual values of the SAM1 output variables for the past fiscal year. The prefix "d" on a variable name indicates a distribution variable, and the prefix "d" on a subscript indicates the dimension over which the distribution has been constructed (the sum of the "d" variable over the "d" subscripts equals 1.0). Analogously, the "t" prefix indicates totals across the indicated subscripts.

```
dINVATT <CATENL, Grade, dMonth> =
      INVATT <CATENL, Grade, dMonth>
    / tINVATT <CATENL, Grade, tMonth>
dPFETSLOSS <CATENL, Grade, dMonth> =
      PFETSLOSS <CATENL, Grade, Month>
    / tPFETSLOSS <CATENL, Grade, tMonth>
dREENLISTOUT <CATENL, Grade, dMonth> =
      REENLISTOUT <CATENL, Grade, Month>
    / tREENLISTOUT <CATENL, Grade, tMonth>
dRETELIGOUT <CATENL, Grade, dMonth> =
      RETELIGOUT <CATENL, Grade, Month>
    / tRETELIGOUT <CATENL, Grade, tMonth>
```

OUTPUTS

Outputs to Module 2 (Annual Projections)

Inventory and Flow Rates.

```
INV [i] <YOS Grade>              = Inventory in Track i, i = 1 through 11.
STDATTRRATE [i] <YOS Grade>      = Attrition rate in Track i, i = 1 through 11.
RETIRERATE <YOS Grade>           = Retirement rate in Track 11.
PFETSLOSSRATE [i] <YOS Grade> = Policy free fiscal year ETS loss rate in
                                  reference case for Track i, i = 1 through 11
                                  calculated from either recent historical data
                                  or from regression models (see Sec. IV).
```

PFREUPRATE [i] <YOS Grade> = Policy free fiscal year reenlistment rate in reference case for Track i, i = 1 through 11. calculated from either recent historical data or from regression models (see Sec. IV).

TRIALPROMRATE [i] <YOS Grade> = Trial promotions out of Grade for Track i, i = 1 to 11.

PCLOSSRATE [i] <YOS Grade> = Trial Palace Chase loss rate for Track i, i = 1 through 11.

EOLOSSRATE [i] <YOS Grade> = Trial Early Out loss rate for Track i, i = 1 through 11.

RULOSSRATE [i] <YOS Grade> = Trial Rollup loss rate for Track i, i = 1 through 11.

TRIALDEMORATE [i] <YOS Grade> = Trial demotion rate.

OTSLOSSRATE [i] <YOS Grade> = Trial OTS loss rate.

MISCLOSSRATE [i] <YOS Grade> = Trial MISC loss rate.

OTSGAINDIST [i] <YOS Grade> = OTS gain distribution.

MISCGAINDIST [i] <YOS Grade> = MISC gain distribution.

PSDIST [i] <YOS Grade> = Prior service gain distribution.

Average Values of Econometric Variables in Reference Period.

REFLOGUNEMPL = Average log of percent civilian unemployment during the reference period.

REFLOGMILCIV = Average log of the ratio of military to civilian wages during the reference period.

REFA1AVG = Average of A1 variable during reference period.

REFA2AVG = Average of A2 variable during reference period.

REFAPASTAVGAVG [i] <YOS> = Average percent of enlisted persons in the second term who were receiving a Zone A bonus during the reference period (because one was offered in the past at the time they reenlisted, needed for i = 3 through 10).

REFBAVG = Average zone B bonus multiple during the reference period.

REFCAVG = Average zone C bonus multiple during the reference period.

Information Needed to Calculate APASTAVG During the Projection Years.

W4 [i] = Proportion of inventory in given cell that has a 4-year term of enlistment.

S8 = Proportion of inventory receiving zone A bonuses 8 years ago.

S7 = Proportion of inventory receiving zone A bonuses 7 years ago.

S6 = Proportion of inventory receiving zone A bonuses 6 years ago.

S5 = Proportion of inventory receiving zone A bonuses 5 years ago.

S4 = Proportion of inventory receiving zone A bonuses 4 years ago.

S3 = Proportion of inventory receiving zone A bonuses 3 years ago.

S2 = Proportion of inventory receiving zone A bonuses 2 years ago.

S1 = Proportion of inventory receiving zone A bonuses 1 year ago.

Distribution Proportions for Early Attrition and Promotion.

S1D1 <FY> = Proportion of NPS4 accessions during a fiscal year that are lost during that fiscal year while still in basic military training.

S1D2 <FY> = Proportion of NPS4 accessions during a fiscal year that are lost during that fiscal year after completing basic military training but while still in grade E-1.

S1D3 <FY> = Proportion of NPS4 accessions during a fiscal year that are lost during that fiscal year after completing basic military training and that are in grade E-2 at the time of leaving.

S1D4 <FY> = Proportion of NPS4 accessions during a fiscal year that survive to the end of the fiscal year and are in grade E-1 at the end of the fiscal year.

S1D5 <FY> = Proportion of NPS4 accessions during a fiscal year that survive to the end of the fiscal year and are in grade E-2 at the end of the fiscal year.

S2D1 <FY> = Proportion of STARTINV [1] <FY, YOS = 0, Grade = 1> that are lost during the fiscal year while still in basic military training.

S2D2 <FY> = Proportion of STARTINV [1] <FY, YOS = 0, Grade = 1> that are lost during the fiscal year after completing basic military training but while still in grade E-1.

S2D3 <FY> = Proportion of STARTINV [1] <FY, YOS = 0, Grade = 1> that are lost during the fiscal year and that are in grade E-2 at the time of the loss.

S2D4 <FY> = Proportion of STARTINV [1] <FY, YOS = 0, Grade = 1> that survive to the end of the fiscal year and are in grade E-2 at the end of the fiscal year.

S2D5 <FY> = Proportion of STARTINV [1] <FY, YOS = 0, Grade = 1> that survive to the end of the fiscal year and are in grade E-3 at the end of the fiscal year.

S3D1 <FY> = Proportion of STARTINV [1] <FY, YOS = 0, Grade = 2> that are lost during the fiscal year while in grade E-2.

S3D2 <FY> = Proportion of STARTINV [1] <FY, YOS = 0, Grade = 2> that are lost during the fiscal year while in grade E-3.

S3D3 <FY> = Proportion of STARTINV [1] <FY, YOS = 0, Grade = 2> that survive to the end of the fiscal year and are in grade E-3 at the end of the fiscal year.

S4D1 <FY> = Proportion of STARTINV [1] <FY, YOS = 1, Grade = 2> that are lost during the fiscal year while in grade E-2.

S4D2 <FY> = Proportion of STARTINV [1] <FY, YOS = 1, Grade = 2> that are lost during the fiscal year while in grade E-3.

S4D3 <FY> = Proportion of STARTINV [1] <FY, YOS = 1, Grade = 2> that survive to the end of the fiscal year and are in grade E-3 at the end of the fiscal year.

S5D1 <FY> = Proportion of STARTINV [1] <FY, YOS = 1, Grade = 3> that are lost during the fiscal year while in grade E-3.

S5D2 <FY> = Proportion of STARTINV [1] <FY, YOS = 1, Grade = 3> that are lost during the fiscal year while in grade E-4.

S5D3 <FY> = Proportion of STARTINV [1] <FY, YOS = 1, Grade = 3> that survive to the end of the fiscal year and are in grade E-3 at the end of the fiscal year.

S5D4 <FY> = Proportion of STARTINV [1] <FY, YOS = 1, Grade = 3> that

survive to the end of the fiscal year and are in grade E-4 at the end of the fiscal year.

S6D1 <FY> = Proportion of NPS6 accessions during a fiscal year that are lost during the fiscal year while still in basic military training.

S6D2 <FY> = Proportion of NPS6 accessions during a fiscal year that are lost during the fiscal year while in grade E-3.

S6D3 <FY> = Proportion of NPS6 accessions during a fiscal year that survive to the end of the fiscal year and are in grade E-1 at the end of the fiscal year.

S6D4 <FY> = Proportion of NPS6 accessions during a fiscal year that survive to the end of the fiscal year and are in grade E-3 at the end of the fiscal year.

S7D1 <FY> = Proportion of STARTINV [2] <FY, YOS = 0, Grade = 1> that are lost during the fiscal year while still in basic military training.

S7D2 <FY> = Proportion of STARTINV [2] <FY, YOS = 0, Grade = 1> that are lost during the fiscal year while in grade E-3.

S7D3 <FY> = Proportion of STARTINV [2] <FY, YOS = 0, Grade = 1> that survive to the end of the fiscal year and are in grade E-3 at the end of the fiscal year.

S8D1 <FY> = Proportion of STARTINV [2] <FY, YOS = 0, Grade = 3> that are lost during the fiscal year while in grade E-3.

S8D2 <FY> = Proportion of STARTINV [2] <FY, YOS = 0, Grade = 3> that survive to the end of the fiscal year and are in grade E-3 at the end of the fiscal year.

S9D1 <FY> = Proportion of STARTINV [2] <FY, YOS = 1, Grade = 3> that are lost during the fiscal year while in grade E-3.

S9D2 <FY> = Proportion of STARTINV [2] <FY, YOS = 1, Grade = 3> that are lost during the fiscal year while in grade E-4.

S9D3 <FY> = Proportion of STARTINV [2] <FY, YOS = 1, Grade = 3> that survive to the end of the fiscal year and are in grade E-3 at the end of the fiscal year.

S9D4 <FY> = Proportion of STARTINV [2] <FY, YOS = 1, Grade = 3> that

survive to the end of the fiscal year and are in grade E-4 at the end of the fiscal year.

Losses due to Early Release Programs.

PCLOSS [i] <FY, YOS, Grade> = Three past years of ETS losses that would have occurred during this fiscal year if they had not been shifted to earlier fiscal years by the Palace Chase program, needed for FY = FPY-1, FPY-2, AND FPY-3, where FPY is "first projection year."

EOLOSS [i] <FY, YOS, Grade> = Previous fiscal year's ETS losses that would have occurred during this fiscal year if they had not been shifted to the previous fiscal year by the Early Out program (needed for FY = FPY-1).

Cost Factors for Annual Projections.

BASICPAYFACTOR <YOS, Grade> = Basic pay per person-year.

RETIREPAYFACTOR <YOS, Grade> = Retired pay accrual per person-year.

BAQVHAFACTOR <YOS, Grade> = Basic Allowance for Quarters and Variable Housing Allowance per person-year.

INCENTPAYFACTOR <YOS, Grade> = Incentive and Special Pay per person-year.

MISCPAYFACTOR <YOS, Grade> = Miscellaneous Pay per person-year.

PCSCOSTFACTOR <YOS, Grade> = Permanent Change of Station cost per person-year.

Weights for Estimating Workyears for Costing.

GAINWEIGHT <YOS, Grade> = Fraction of a year that a gain works.

BMTATTLOSSWEIGHT <YOS, Grade> = Fraction of a year that a BMTATTLOSS works.

STDATTLOSSWEIGHT <YOS, Grade> = Fraction of a year that a STDATTLOSS works.

ETSLOSSWEIGHT <YOS, Grade> = Fraction of a year that a ETSLOSS works.

RULOSSWEIGHT <YOS, Grade> = Fraction of a year that a RULOSS works.

EOLOSSWEIGHT <YOS, Grade> = Fraction of a year that a EOLOSS works.

PCLOSSWEIGHT <YOS, Grade> = Fraction of a year that a PCLOSS works.

RETIREMENTWEIGHT <YOS, Grade> = Fraction of a year that a RETIREMENT works.

OTSLOSSWEIGHT <YOS, Grade> = Fraction of a year that a OTSLOSS works.

MISCLOSSWEIGHT <YOS, Grade> = Fraction of a year that a MISCLOSS works.

Outputs to Module 5 (Monthly Projections)

dINVATT <CATENL, Grade, dMonth>

dPFETSLOSS <CATENL, Grade, dMonth>

dREENLISTOUT <CATENL, Grade, dMonth>

dRETELIGOUT <CATENL, Grade, dMonth>

S1D1

S1D2

S6D2

S1D3

S6D2

Appendix E

MODULE 2 ACTION DIAGRAM (ANNUAL PROJECTIONS)

This appendix documents the inputs, calculations, and outputs of Module 2.

INPUTS

The inputs to Module 2 of the MTA model are of two types. The first is input generated by Module 1 (Data Preparation). The second is user-specified inputs. The variables associated with the user-specified inputs and the variable definitions are listed below, as are the internal variables created by the module.

Module 1 Inputs

The following Module 1 inputs are required to initialize and run Module 2. The variable names with short descriptions are given.

Inventory and Flow Rates.

INV [i] <YOS Grade>	Inventory in Track i, i = 1 through 11.
STDATTRRATE [i] <YOS Grade>	Attrition Rate in Track i, i = 1 through 11.
RETIRERATE <YOS Grade>	Retirement Rate in Track 11.
PFETSLOSSRATE [i] <YOS Grade>	Policy free fiscal year ETS loss rate in reference case for Track i, i = 1 through 11.
PFREUPRATE [i] <YOS Grade>	Policy free fiscal year reenlistment rate in reference case for Track i, i = 1 through 11.
FEROUT2 [i] <FY=0 YOS Grade>	Forced early reenlistments in year before the first projection year that came from the first projection year (NOTE: The FY variable should be initialized to 0 or one less than the first projection year).
FEROUT1TRIALRATE[i]<YOS Grade>	Trial forced early reenlistment rates

	from same fiscal year.
FEROUT2TRIALRATE[i]<YOS Grade>	Trial forced early reenlistment rates from next fiscal year.
TRIALPROMRATE [i] <YOS Grade>	Trial promotions out of Grade for Track i, i = 1 to 11.
PCLOSSRATE [i] <YOS Grade>	Trial Palace Chase loss rate for Track i, i = 1 through 11.
EOLOSSRATE [i] <YOS Grade>	Trial Early Out loss rate for Track i, i = 1 through 11.
RULOSSRATE [i] <YOS Grade>	Trial Rollup loss rate for Track i, i = 1 through 11.
TRIALDEMORATE [i] <YOS Grade>	Trial demotion rate.
OTSLOSSRATE [i] <YOS Grade>	Trial OTS loss rate.
MISCLOSSRATE [i] <YOS Grade>	Trial MISC loss rate.
OTSGAINDIST [i] <YOS Grade>	OTS gain distribution.
MISCGAINDIST [i] <YOS Grade>	MISC gain distribution.
PSDIST [i] <YOS Grade>	Prior service gain distribution.

Average Values of Econometric Variables in Reference Period.

REFLOGUNEMPL	Average log of percent civilian unemployment during the reference period.
REFLOGMILCIV	Average log of the ratio of military to civilian wages during the reference period.
REFA1AVG	Average bonus multiple for Zone A bonuses between multiples 0 and 1 during reference period.
REFA2AVG	Average bonus multiple for Zone A bonuses greater than multiple 1 during reference period.
REFAPASTAVG [i] <YOS>	Average percent of enlisted persons in second term who were receiving a Zone A bonus during the reference period for Track i, i = 3 to 10.

REFBAVG	Average zone B bonus multiple during the reference period.
REFCAVG	Average zone C bonus multiple during the reference period.

Information Needed to Calculate APASTAVG During the Projection Years.

W4 [i]	Proportion of inventory in given cell that has a 4-year term of enlistment.
S8	Proportion of inventory receiving zone A bonus 8 years ago.
S7	Proportion of inventory receiving zone A bonus 7 years ago.
S6	Proportion of inventory receiving zone A bonus 6 years ago.
S5	Proportion of inventory receiving zone A bonus 5 years ago.
S4	Proportion of inventory receiving zone A bonus 4 years ago.
S3	Proportion of inventory receiving zone A bonus 3 years ago.
S2	Proportion of inventory receiving zone A bonus 2 years ago.
S1	Proportion of inventory receiving zone A bonus 1 year ago.

Distribution Proportions for Early Attrition and Promotion.

SxDy	The proportion of Source x that is distributed to Destination y during a fiscal year (see App. A).

Losses due to Early Release Programs.

PCLOSS [i] <PASTFY YOS Grade>	Three past years of ETS losses that would have occurred during this fiscal year if they had not been shifted to earlier fiscal years by the Palace Chase program.
EOLOSS [i] <PASTFY YOS Grade>	Previous fiscal year's ETS losses that would have occurred during this fiscal year if they had not been shifted to the previous fiscal year by the Early Out program.

Cost Factors for Annual Projections.

BASICPAYFACTOR <Grade, YOS>	Basic pay per person-year.
RETIREPAYFACTOR <Grade, YOS>	Retired pay accrual per person-year.
BAQVHAFACTOR <Grade, YOS>	Basic Allowance for Quarters and Variable Housing Allowance per person-year.
INCENTPAYFACTOR <Grade, YOS>	Incentive and special pay per person-year
MISCPAYFACTOR <Grade, YOS>	Miscellaneous pay per person-year.
PCSCOSTFACTOR <Grade, YOS>	Permanent Change of Station cost per person-year.

Weights for Estimating Workyears for Costing.

GAINWEIGHT <YOS Grade>	Fraction of a year that a gain works.
BMTATTLOSSWEIGHT <YOS Grade>	Fraction of a year that a BMTATTLOSS works.
STDATTLOSSWEIGHT <YOS Grade>	Fraction of a year that a STDATTLOSS works.
ETSLOSSWEIGHT <YOS Grade>	Fraction of a year that a ETSLOSS works.
RULOSSWEIGHT <YOS Grade>	Fraction of a year that a RULOSS works.
EOLOSSWEIGHT <YOS Grade>	Fraction of a year that a EOLOSS works.
PCLOSSWEIGHT <YOS Grade>	Fraction of a year that a PCLOSS works.

RETIREMENTWEIGHT <YOS Grade>	Fraction of a year that a RETIREMENT works.
OTSLOSSWEIGHT <YOS Grade>	Fraction of a year that a OTSLOSS works.
MISCLOSSWEIGHT <YOS Grade>	Fraction of a year that a MISCLOSS works.

Inputs from Appendix B

The following variables are the econometric variables from blending.

LCOEFLOGUNEMPL [i] <YOS>	Econometric coefficients for log unemployment rate for fiscal year loss equations.
LCOEFLOGMILCIV [i] <YOS>	Econometric coefficients for log military civilian wage ratio for fiscal year loss equations.
LCOEFA1AVG [i] <YOS>	Econometric coefficients for average bonus multiple for Zone A bonuses between multiples 0 and 1 for fiscal year loss equations.
LCOEFA2AVG [i] <YOS>	Econometric coefficients for average bonus multiple for Zone A bonus greater than multiple 1 for fiscal year loss equations.
LCOEFAPASTAVG [i] <YOS>	Econometric coefficients for past zone A bonus multiple for fiscal year loss equations.
LCOEFBAVG [i] <YOS>	Econometric coefficients for average zone B bonus multiple for fiscal year loss equations.
LCOEFCAVG [i] <YOS>	Econometric coefficients for average zone C bonus multiple for fiscal year loss equations.
RCOEFLOGUNEMPL [i] <YOS>	Econometric coefficients for log unemployment rate for fiscal year reenlistment equations.

RCOEFLOGMILCIV [i] <YOS>	Econometric coefficients for log military civilian wage ratio for fiscal year reenlistment equations.
RCOEFA1AVG [i] <YOS>	Econometric coefficients for average bonus multiple for Zone A bonuses between multiples 0 and 1 for fiscal year reenlistment equations.
RCOEFA2AVG [i] <YOS>	Econometric coefficients for average bonus multiple for Zone A bonus greater than multiple 1 for fiscal year reenlistment equations.
RCOEFAPASTAVG [i] <YOS>	Econometric coefficients for past zone A bonus multiple for fiscal year reenlistment equations.
RCOEFBAVG [i] <YOS>	Econometric coefficients for average zone B bonus multiple for fiscal year reenlistment equations.
RCOEFCAVG [i] <YOS>	Econometric coefficients for average zone C bonus multiple for fiscal year reenlistment equations.

Inputs from Appendix C

TOEiZ	=	Probability of 4-year TOE, Track i, no bonus.
TOEiAH	=	Probability of a 4-year TOE, Track i, zone A bonus multiple = 0.5.
TOEiAm	=	Probability of a 4-year TOE, Track i, zone A bonus multiple m = 1 to 6.

User-Specified Inputs

The following are user-specified inputs to Module 2. These inputs are obtained from the user input screens described in Sec. II. The variable names with short descriptions are given.

UNEMPL <FY>	Civilian unemployment rate (%).
MILCIV <FY>	Ratio of military wages to civilian wages.

CPI <FY>	Annual change in Consumer Price Index (%).
NPS4 <FY>	Non-prior service accessions with 4 year TOE.
NPS6 <FY>	Non-prior service accessions with 6 year TOE.
PS <FY>	Prior Service accessions.
AH <FY>	Percent force receiving zone A bonus multiple 0.5.
A1 <FY>	Percent force receiving zone A bonus multiple 1.0.
A2 <FY>	Percent force receiving zone A bonus multiple 2.0.
A3 <FY>	Percent force receiving zone A bonus multiple 3.0.
A4 <FY>	Percent force receiving zone A bonus multiple 4.0.
A5 <FY>	Percent force receiving zone A bonus multiple 5.0.
A6 <FY>	Percent force receiving zone A bonus multiple 6.0.
BH <FY>	Percent force receiving zone B bonus multiple 0.5.
B1 <FY>	Percent force receiving zone B bonus multiple 1.0.
B2 <FY>	Percent force receiving zone B bonus multiple 2.0.
B3 <FY>	Percent force receiving zone B bonus multiple 3.0.
B4 <FY>	Percent force receiving zone B bonus multiple 4.0.
B5 <FY>	Percent force receiving zone B bonus multiple 5.0.
B6 <FY>	Percent force receiving zone B bonus multiple 6.0.
CH <FY>	Percent force receiving zone C bonus multiple 0.5.
C1 <FY>	Percent force receiving zone C bonus multiple 1.0.
C2 <FY>	Percent force receiving zone C bonus multiple 2.0.
C3 <FY>	Percent force receiving zone C bonus multiple 3.0.
C4 <FY>	Percent force receiving zone C bonus multiple 4.0.
C5 <FY>	Percent force receiving zone C bonus multiple 5.0.
C6 <FY>	Percent force receiving zone C bonus multiple 6.0.
RULOSS <FY CATENL>	Rollup losses by category of enlistment.
EOLOSS <FY CATENL>	Early Out losses by category of enlistment.
PCLOSS <FY>	Total Palace Chase losses.
PROMIN <FY Grade>	Promotions into Grade ($5 \leq$ Grade ≤ 9).
DEMOOUT <FY Grade>	Demotions out of Grade.
OTSGAIN <FY>	Officer Training School gains.
OTSLOSS <FY>	Officer Training School losses.
MISCGAIN <FY>	Miscellaneous gains.
MISCLOSS <FY>	Miscellaneous losses.

FEROUT1POLICY <FY catenl>	Forced early reenlistments from same fiscal year.
FEROUT2POLICY <FY catenl>	Forced early reenistments from next fiscal year.

Internal Variables Created

The following variables are created by Module 2. Variables without specified dimensions are defined to be scalars. The variable names with short descriptions are given.

Inventory and Personnel Flows.

STARTINV [i] <YOS Grade>	Start of fiscal year inventory.
ENDINV [i] <YOS Grade>	End of fiscal year inventory.
BMTATTLOSS [i] <YOS Grade>	Attrition during fiscal year while the enlisted person is in basic military training for Track i, i = 1 and 2.
STDATTLOSS [i] <YOS Grade>	Attrition during fiscal year after the enlisted person has completed basic military training for Track i, i = 1 to 11.
RETIRELOSS <YOS Grade>	Retirement flow out of Track 11.
ETSLOSS [i] <YOS Grade>	End of Term of Service losses out of Track i, i = 1 to 11.
REUPFLOW [i] <YOS Grade>	Reenlistment flow out of Track i, i = 1 to 11.
PCLOSS [i] <YOS Grade>	Palace Chase losses in this fiscal year from Track i, i = 1 to 11.
EOLOSS [i] <YOS Grade>	Early Out losses in this fiscal year from Track i, i = 1 to 11.
RULOSS [i] <YOS Grade>	Rollup out losses in this fiscal year from Track i, i = 1 to 11.
CONTINFLOW [i] <YOS Grade>	Continuation flows in this fiscal year in Track i,i = 1 to 11.
PROMOUT [i] <YOS Grade>	Promotion flows out of Grade from

	Track i, i = 1 to 11.
PROMIN [i] <YOS Grade>	Promotion flows into Grade from Track i, i = 1 to 11.
DEMOFLOW [i] <YOS Grade>	Demotion flows out of Grade from Track i, i = 1 to 11.
DEMOIN [i] <YOS Grade>	Demotion flows into Grade from Track i, i = 1 to 11.
OTSGAIN [i] <YOS Grade>	OTS gains by Track.
OTSLOSS [i] <YOS Grade>	OTS losses.
MISCGAIN [i] <YOS Grade>	MISC gains.
MISCLOSS [i] <YOS Grade>	MISC losses.
PS [i] <YOS Grade>	Prior service accessions.
FEROUT1 [i] <YOS Grade>	Forced early reenlistment flows out from same fiscal year.
FERIN1 [i] <YOS Grade>	Forced early reenlistments flows in from same fiscal year.
FERIN2 [i] <YOS Grade>	Forced early reenlistments flows in from next fiscal year.
ETSREUPOUT [i] <YOS Grade>	ETS reenlistments out.

Econometric Variables for Current Fiscal Year.

LOGUNEMPL	Log unemployment rate.
LOGMILCIV	Log ratio military wages to civilian wages.
A1AVG	Average bonus multiple for zone A bonuses. between multiples 0 and 1.
A2AVG	Average bonus multiple for zone A bonuses greater than multiple 1.
APASTAVG [i] <YOS>	Average past zone A bonus multiple.
BAVG	Zone B average bonus multiple.
CAVG	Zone C average bonus multiple.

Term of Enlistment Probability.

TOE4RATE [i]	4-year TOE rate for first term reenlistments from Track i, i = 1 to 2.

Scalars for Totaling Trial Personnel Flows.

TPC	Total trial Palace Chase losses.
TEO1	Total trial first term Early Out losses.
TEO2	Total trial second term Early Out losses.
TEOC	Total trial career term Early Out losses.
TRU1	Total trial first term Rollup losses.
TRU2	Total trial second term Rollup losses.
TRUC	Total trial career term Rollup losses.
T1FER1	Total forced early reenlistment flows. from same fiscal year in CATENL = 1.
T2FER1	Total forced early reenlistment flows from same fiscal year in CATENL = 2.
TCFER1	Total forced early reenlistment flows from same fiscal year in career term.
T1FER2	Total forced early reenlistment flows from next fiscal year in CATENL = 1.
T2FER2	Total forced early reenlistment flows from next fiscal year in CATENL = 2.
TCFER2	Total forced early reenlistment flows from next fiscal year in career term.
TOT1REUPOUT	Total first term policy free reenlistments out.
TOT2REUPOUT	Total second term policy free reenlistments out.
TOTCREUPOUT	Total career term policy free reenlistments out.

TOTDEMOOUT <Grade>	Total trial demotions out of Grade.

Shifts and Inventory Reductions.

PCINVRED [i] <YOS Grade>	Palace Chase inventory reductions in Track i, i = 1 through 11.
EOINVRED [i] <YOS Grade>	Early Out inventory reductions in Track i, i = 1 through 11.
PCSHIFT [i] <YOS Grade>	ETS losses that would have occurred during this fiscal year if they had not been shifted to earlier fiscal years by the Palace Chase program.
EOSHIFT [i] <YOS Grade>	ETS losses that would have occurred during this fiscal year if they had not been shifted to the previous fiscal year by the Early Out program.
RUSHIFT [i] <YOS Grade>	ETS losses during this fiscal year that have been shifted to an earlier month in the fiscal year by the Rollup program.
FEROUT1SHIFT [i] <YOS Grade>	ETS reenlistments out that would have occurred had they not been shifted to an earlier time in the same fiscal year.
FEROUT2SHIFT [i] <YOS Grade>	ETS reenlistments out that would have occurred had they not been shifted to an earlier fiscal year.
FERIN1SHIFT [i] <YOS Grade>	Forced early reenlistments-in shifted to an early time in the same fiscal year.
FERIN2SHIFT [i] <YOS Grade>	Forced early reenlistments-in shifted to previous fiscal year.
FERINVRED [i] <YOS Grade>	Inventory reduction resulting from force early reenlistment program.

INVENTORY AND PERSONNEL FLOW PROJECTION

This subsection contains specifications to project enlisted force personnel for up to nine years into the future.

As described above, the model retains one complete accounting structure (Track by YOS by Grade) for the inventory and each type of personnel flow in memory. The output screen generator processes the inventory and personnel flow information after each fiscal year's calculations are completed and sends the aggregate output to the proper the output screen.

Notation

The notational conventions that have been used to simplify the presentation of the calculations are:

- [i] indicates Track. If [i] is used without the YOS and Grade dimensions explicitly given it is assumed calculations are performed over the appropriate ranges of these dimensions.
- <dimension> is used as an explicit indicator of the dimension(s) on a variable.
- Lower case t in front of a dimension (e.g. tYOS) means to *sum* over the relevant range of that variable.
- Semicolon indicates the end of an expression.
- User-specified inputs (e.g. OTSGAINS, PS) that are spread to complete accounting structure detail retain the same name.

Calculations

The following calculations are performed sequentially for up to nine fiscal years. A fiscal year indicator will be required. This dimension is explicitly indicated only where necessary.

1. Reset loss flow variables to zero and start of fiscal year inventory to previous year's ending inventory.

+- DO for Track i = 1 ;

```
|     STARTINV [i] = INV [i] ;
|     STDATTLOSS [i] = 0 ;
|     BMTATTLOSS [i] = 0 ;
|     RETIRELOSS [i] = 0 ;
|     ETSLOSS [i] = 0 ;
|     REUPFLOW [i] = 0 ;
|     PCLOSS [i] = 0 ;
|     EOLOSS [i] = 0 ;
|     RULOSS [i] = 0 ;
|     PROMIN [i] = 0 ;
|     PROMOUT [i] = 0 ;
|     OTSLOSS [i] = 0 ;
|     MISCLOSS [i] = 0 ;
|     PS [i] = 0 ;
|     OTSGAIN [i] = 0 ;
|     MISCGAIN [i] = 0 ;
|     APASTAVG [i] = 0 ;
|     FERIN1 [i] = 0 ;
|     FERIN2 [i] = 0 ;
+-- END ;
```

2. Adjust econometric variables for current scenario.

```
/*  For the current fiscal year  */

LOGUNEMPL = LOG (UNEMPL <FY>) ;
LOGMILCIV = LOG (MILCIV <FY>) ;
A1AVG = [0.5 * AH <FY> + A1 <FY> + A2 <FY> + A3 <FY> + A4 <FY>
                    + A5 <FY> + A6 <FY>] / 100 ;
A2AVG = [1 * A2 <FY> + 2 * A3 <FY> + 3 * A4 <FY> + 4 * A5 <FY>
                  + 5 * A6 <FY>] / 100 ;

IF (3 ≤ i ≤ 10) THEN
```

```
   APASTAVG [i] <YOS> = W4 [i] * S [FY + YETS-5]
                      + (1 - W4 [i]) * S [FY + YETS-7] ;
/*  NOTE:  S [x] = Sx for x = 1 to 6 (in other words a particular past
        zone A bonus from the stack)  */

BAVG = [0.5 * BH <FY> + B1 <FY> + 2 * B2 <FY> + 3 * B3 <FY> + 4 * B4 <FY>
                    + 5 * B5 <FY> + 6 * B6 <FY>] / 100 ;
CAVG = [0.5 * CH <FY> + C1 <FY> + 2 * C2 <FY> + 3 * C3 <FY> + 4 * C4 <FY>
                    + 5 * C5 <FY> + 6 * C6 <FY>] / 100 ;

/*  Update stack of past zone A bonuses, retain these variables for
    the next projection year.  */

S8 = S7 ;
S7 = S6 ;
S6 = S5 ;
S5 = S4 ;
S4 = S3 ;
S3 = S2 ;
S2 = S1 ;
S1 = AH + A1 + A2 + A3 + A4 + A5 + A6 ;
```

3. Spread this fiscal year's Palace Chase, Early Out, Rollup, OTS, and MISC losses to cell accounting structure.

```
   /*  Trial losses by cell accounting structure  */
+- DO FOR Track i, i = 1 to 11 ;
|     PCLOSS [i] = INV [i] * TRIALPCRATE [i] ;
|     EOLOSS [i] = INV [i] * TRIALEORATE [i] ;
|     RULOSS [i] = INV [i] * TRIALRURATE [i] ;
|     OTSLOSS [i] = INV [i] * OTSLOSSRATE [i] ;
|     MISCLOSS [i] = INV [i] * MISCLOSSRATE [i] ;
+- END ;
```

```
/*  Total over CATENL, all terms in Palace Chase case  */

          i = 11
TPC =  SUM (PCLOSS [i] <tYOS tGrade>)
          i = 1

TEO1 = EOLOSS [i = 1] <tYOS tGrade> + EOLOSS [i = 2] <tYOS tGrade> ;

          i = 10
TEO2 = SUM (EOLOSS [i] <tYOS tGrade>) ;
          i = 3

TEOC = EOLOSS [i = 11] <tYOS tGrade> ;

TRU1 = RULOSS [i = 1] <tYOS tGrade> + RULOSS [i = 2] <tYOS tGrade> ;

          i = 10
TRU2 = SUM (RULOSS [i] <tYOS tGrade>) ;
          i = 3

TRUC = RULOSS [i = 11] <tYOS tGrade> ;

      i = 11
OTS = SUM (OTSLOSS [i] <tYOS tGrade>) ;
      i = 1

       i = 11
MISC = SUM (MISCLOSS [i] <tYOS tGrade>) ;
       i = 1

  /*  spread actual early release losses to cells  */
+- DO FOR Track i, i = 1 to 11 ;
|        PCLOSS [i] = (PCLOSS <FY> / TPC) * PCLOSS [i] ;
|
```

```
|     IF (CATENL = 1) THEN   /*  NOTE: this is Tracks 1 and 2  */
|        EOLOSS [i] = (EOLOSS <FY CATENL> / TEO1) * EOLOSS [i] ;
|
|     IF (CATENL = 2) THEN   /*  NOTE:  this is Tracks 3 through 10 */
|        EOLOSS [i] = (EOLOSS <FY CATENL> / TEO2) * EOLOSS [i] ;
|
|     IF (CATENL = 3) THEN   /*  NOTE:  this is Track 11  */
|        EOLOSS [i] = (EOLOSS <FY CATENL> / TEOC) * EOLOSS [i] ;
|
|
|     IF (CATENL = 1) THEN   /*  NOTE: this is Tracks 1 and 2  */
|        RULOSS [i] = (RULOSS <FY CATENL> / TRU1) * RULOSS [i] ;
|
|     IF (CATENL = 2) THEN   /*  NOTE:  this is Tracks 3 through 10 */
|        RULOSS [i] = (RULOSS <FY CATENL> / TRU2) * RULOSS [i] ;
|
|     IF (CATENL = 3) THEN   /*  NOTE:  this is Track 11  */
|        RULOSS [i] = (RULOSS <FY CATENL> / TRUC) * RULOSS [i] ;
|
|      OTSLOSS [i] = (OTSLOSS <FY> / OTS) * OTSLOSS [i] ;
|
|      MISCLOSS [i] = (MISCLOSS <FY> / MISC) * MISCLOSS [i] ;
|
+- END ;
```

4. Spread the FY's forced early reenlistments to detailed accounting cells, estimating both forced reenlistments-out and forced reenlistments-in.

```
+- DO FOR Track i, i = 1 to 11 ;
|     FEROUT2 [i] <FY> = INV [i] * FEROUT2TRIALRATE [i] ;
|     FEROUT1 [i] <FY> = INV [i] * FEROUT1TRIALRATE [i] ;
+- END ;
```

```
/* Forced Reenlistment out from next fiscal year */

   T1FER2 = FEROUT2 [i = 1] <FY tYOS tGrade>
              + FEROUT2 [i = 2] <FY tYOS tGrade> ;

              i = 10
   T2FER2 = SUM (FEROUT2 [i] <FY tYOS tGrade>) ;
              i = 3

   TCFER2 = FEROUT2 [i = 11] <FY tYOS tGrade> ;

+- DO FOR Track i, i = 1 to 11 ;
|
|     IF (CATENL = 1) THEN   /*  NOTE: this is Tracks 1 and 2  */
|        FEROUT2 [i] <FY> = (FEROUT2POLICY <Catenl = 1> / T1FER2)
|                            * FEROUT2 [i] <FY> ;
|
|     IF (CATENL = 2) THEN   /*  NOTE:  this is Tracks 3 through 10 */
|        FEROUT2 [i] <FY> = (FEROUT2POLICY <Catenl = 2> / T2FER2)
|                            * FEROUT2 [i] <FY> ;
|
|     IF (CATENL = 3) THEN   /*  NOTE:  this is Track 11  */
|        FEROUT2 [i] <FY> = (FEROUT2POLICY <Catenl = 3> / TCFER2)
|                            * FEROUT2 [i] <FY> ;
+- END ;

 /* Forced reenlistment out from same fiscal year */

   T1FER1 = FEROUT1 [i = 1] <FY tYOS tGrade>
              + FEROUT1 [i = 2] <FY tYOS tGrade> ;

              i = 10
   T2FER1 = SUM (FEROUT1 [i] <FY tYOS tGrade>) ;
              i = 3
```

```
   TCFER1 = FEROUT1 [i = 11] <FY tYOS tGrade> ;

  +- DO FOR Track i, i = 1 to 11 ;
  |
  |     IF (CATENL = 1) THEN   /*  NOTE: this is Tracks 1 and 2  */
  |        FEROUT1 [i] <FY> = (FEROUT1POLICY <Catenl = 1> / T1FER1)
  |                           * FEROUT1 [i] <FY> ;
  |
  |     IF (CATENL = 2) THEN   /*  NOTE:  this is Tracks 3 through 10 */
  |        FEROUT1 [i] <FY> = (FEROUT1POLICY <Catenl = 2> / T2FER1)
  |                           * FEROUT1 [i] <FY> ;
  |
  |     IF (CATENL = 3) THEN   /*  NOTE:  this is Track 11  */
  |        FEROUT1 [i] <FY> = (FEROUT1POLICY <Catenl = 3> / TCFER1)
  |                           * FEROUT1 [i] <FY> ;
  +- END ;

          /* TOE4RATE calculations */

TOE4RATE1 =
    TOE1Z * (100 - AH - A1 - A2 - A3 - A4 - A5 - A6) / 100
  + TOE1AH * (AH / 100)
  + TOE1A1 * (A1 / 100)
  + TOE1A2 * (A2 / 100)
  + TOE1A3 * (A3 / 100)
  + TOE1A4 * (A4 / 100)
  + TOE1A5 * (A5 / 100)
  + TOE1A6 * (A6 / 100) ;


TOE4RATE2 =
    TOE2Z * (100 - AH - A1 - A2 - A3 - A4 - A5 - A6) / 100
  + TOE2AH * (AH / 100)
```

```
 + TOE2A1 * (A1 / 100)
 + TOE2A2 * (A2 / 100)
 + TOE2A3 * (A3 / 100)
 + TOE2A4 * (A4 / 100)
 + TOE2A5 * (A5 / 100)
 + TOE2A6 * (A6 / 100) ;

    /* Forced early reenlistments in from next fiscal year */

+- DO FOR YOS = 2 TO 5 ;        /*  Track 1  */
|      FERIN2 [YOS + 1] <YOS + 1 Grade> = FERIN2 [YOS + 1] <YOS + 1 Grade>
|              + TOE4RATE1 * FEROUT2 [i = 1] <YOS Grade> ;
|      FERIN2 [YOS + 3] <YOS + 1 Grade> = FERIN2 [YOS + 3] <YOS + 1 Grade>
|              + (1 - TOE4RATE1) * FEROUT2 [i = 1] <YOS Grade> ;
+- END ;

+- DO FOR YOS = 4 TO 7 ;        /*  Track 2  */
|      FERIN2 [YOS + 1] <YOS  + 1 Grade> = FERIN2 [YOS + 1] <YOS + 1 Grade>
|              + TOE4RATE2 * FEROUT2 [i = 2] <YOS Grade> ;
|      FERIN2 [YOS + 3] <YOS + 1 Grade> = FERIN2 [YOS + 3] <YOS + 1 Grade>
|              + (1 - TOE4RATE2) * FEROUT2 [i = 2] <YOS Grade> ;
+- END ;

   FERIN2 [11] <YOS = 6 Grade> = FERIN2 [11] <YOS = 6 Grade>
           + FEROUT2 [3] <YOS = 5 Grade> ;

   FERIN2 [11] <YOS = 7 Grade> = FERIN2 [11] <YOS = 7 Grade>
           + FEROUT2 [3] <YOS = 6 Grade>
           + FEROUT2 [4] <YOS = 6 Grade> ;

   FERIN2 [11] <YOS = 8 Grade> = FERIN2 [11] <YOS = 8 Grade>
           + FEROUT2 [3] <YOS = 7 Grade>
           + FEROUT2 [4] <YOS = 7 Grade>
           + FEROUT2 [5] <YOS = 7 Grade> ;
```

```
+- DO FOR j = 3 TO 6 ;
|  +- DO FOR YOS = 8 TO 12 ;
|  |     FERIN2 [11] <YOS + 1 Grade> = FERIN2 [11] <YOS + 1 Grade>
|  |        + FEROUT2 [j] <YOS>
|  |        + FEROUT2 [j + 1] <YOS>
|  |        + FEROUT2 [j + 2] <YOS>
|  |        + FEROUT2 [j + 3] <YOS> ;
|  +- END ;
+- END ;

   FERIN2 [11] <YOS = 14 Grade> = FERIN2 [11] <YOS = 14 Grade>
           + FEROUT2 [8] <YOS = 13 Grade>
           + FEROUT2 [9] <YOS = 13 Grade>
           + FEROUT2 [10] <YOS = 13 Grade> ;

   FERIN2 [11] <YOS = 15 Grade> = FERIN2 [11] <YOS = 15 Grade>
           + FEROUT2 [9] <YOS = 14 Grade>
           + FEROUT2 [10] <YOS = 14 Grade> ;

   FERIN2 [11] <YOS = 16 Grade> = FERIN2 [11] <YOS = 16 Grade>
           + FEROUT2 [10] <YOS = 15 Grade> ;

    /* Forced early reenlistments in from same fiscal year /*

+- DO FOR YOS = 2 TO 5 ;        /*  Track 1  */
|     FERIN1 [YOS + 1] <YOS + 1 Grade> = FERIN1 [YOS + 1] <YOS + 1 Grade>
|             + TOE4RATE1 * FEROUT1 [i = 1] <YOS Grade> ;
|     FERIN1 [YOS + 3] <YOS + 1 Grade> = FERIN1 [YOS + 3] <YOS + 1 Grade>
|             + (1 - TOE4RATE1) * FEROUT1 [i = 1] <YOS Grade> ;
+- END ;

+- DO FOR YOS = 4 TO 7 ;        /*  Track 2  */
|     FERIN1 [YOS + 1] <YOS + 1 Grade> = FERIN1 [YOS + 1] <YOS + 1 Grade>
|             + TOE4RATE1 * FEROUT1 [i = 2] <YOS Grade> ;
```

```
|      FERIN1 [YOS + 3] <YOS + 1 Grade> = FERIN1 [YOS + 3] <YOS + 1 Grade>
|              + (1 - TOE4RATE2) * FEROUT1 [i = 2] <YOS Grade> ;
+- END ;

   FERIN1 [11] <YOS = 6 Grade> = FERIN1 [11] <YOS = 6 Grade>
           + FEROUT1 [3] <YOS = 5 Grade> ;

   FERIN1 [11] <YOS = 7 Grade> = FERIN1 [11] <YOS = 7 Grade>
           + FEROUT1 [3] <YOS = 6 Grade>
           + FEROUT1 [4] <YOS = 6 Grade> ;

   FERIN1 [11] <YOS = 8 Grade> = FERIN1 [11] <YOS = 8 Grade>
           + FEROUT1 [3] <YOS = 7 Grade>
           + FEROUT1 [4] <YOS = 7 Grade>
           + FEROUT1 [5] <YOS = 7 Grade> ;

+- DO FOR j = 3 TO 6 ;
|  +- DO FOR YOS = 8 TO 12 ;
|  |     FERIN1 [11] <YOS + 1 Grade> = FERIN1 [11] <YOS + 1 Grade>
|  |        + FEROUT1 [j] <YOS>
|  |        + FEROUT1 [j + 1] <YOS>
|  |        + FEROUT1 [j + 2] <YOS>
|  |        + FEROUT1 [j + 3] <YOS> ;
|  +- END ;
+- END ;

   FERIN1 [11] <YOS = 14 Grade> = FERIN1 [11] <YOS = 14 Grade>
           + FEROUT1 [8] <YOS = 13 Grade>
           + FEROUT1 [9] <YOS = 13 Grade>
           + FEROUT1 [10] <YOS = 13 Grade> ;

   FERIN1 [11] <YOS = 15 Grade> = FERIN1 [11] <YOS = 15 Grade>
           + FEROUT1 [9] <YOS = 14 Grade>
           + FEROUT1 [10] <YOS = 14 Grade> ;
```

```
FERIN1 [11] <YOS = 16 Grade> = FERIN1 [11] <YOS = 16 Grade>
        + FEROUT1 [10] <YOS = 15 Grade> ;
```

5. Calculate shifts and inventory reductions for policy free calculations.

```
+- DO FOR Track i, i = 1 to 10 ;
|
|  PCSHIFT [i] <FY YETS=-1> = PCLOSS [i] <FY YETS = -1> ;
|  PCSHIFT [i] <FY YETS = 0>  = PCLOSS [i] <FY YETS = 0>  ;
|  PCSHIFT [i] <FY YETS = 1>  = PCLOSS [i] <FY YETS = 1>
|                           + PCLOSS [i] <FY-1 YETS = 2>
|                           + PCLOSS [i] <FY-2 YETS = 3>
|                           + PCLOSS [i] <FY-3 YETS = 4>;
|
|  PCINVRED [i] <FY YETS = 1> = PCLOSS <FY-1 YETS = 2>
|                           + PCLOSS <FY-2 YETS = 3>
|                           + PCLOSS <FY-3 YETS = 4>    ;
|
|  PCINVRED [i] <FY YETS = 2> = PCLOSS <FY-1 YETS = 3>
|                           + PCLOSS <FY-2 YETS = 4>    ;
|
|  PCINVRED [i] <FY YETS = 3> = PCLOSS <FY-1 YETS = 4>    ;
|
|
|  EOSHIFT [i] <FY YETS = -1> = EOLOSS [i] <FY-1 YETS = 0>;
|  EOSHIFT [i] <FY YETS = 0>  = EOLOSS [i] <FY-1 YETS = 1>;
|  EOSHIFT [i] <FY YETS = 1>  = EOLOSS [i] <FY-1 YETS = 2>;
|
|  EOINVRED [i] <FY YETS = -1> = EOLOSS [i] <FY-1 YETS = 0>;
|  EOINVRED [i] <FY YETS = 0> = EOLOSS [i] <FY-1 YETS = 1>;
|  EOINVRED [i] <FY YETS = 1> = EOLOSS [i] <FY-1 YETS = 2>;
|
```

```
|  RUSHIFT [i] <FY YETS = -1> = RULOSS [i] <FY YETS = -1>;
|  RUSHIFT [i] <FY YETS = 0>  = RULOSS [i] <FY YETS = 0> ;
|  RUSHIFT [i] <FY YETS = 1>  = RULOSS [i] <FY YETS = 1> ;
|
+- END ;

   PCSHIFT [i = 11] <FY YOS> = PCLOSS [i = 11] <FY-1 YOS-1>;
   EOSHIFT [i = 11] <FY YOS> = EOLOSS [i = 11] <FY-1 YOS-1>;
   RUSHIFT [i = 11] <FY YOS> = RULOSS [i = 11] <FY YOS>    ;

   PCINVRED [i = 11] <FY YOS> = PCLOSS [i = 11] <FY-1 YOS-1>;
   EOINVRED [i = 11] <FY YOS> = EOLOSS [i = 11] <FY-1 YOS-1>;
```

6. Calculate shifts and inventory reductions caused by forced early reenlistments.

```
+- DO FOR Track i, i = 1 to 11 ;
|     FEROUT2SHIFT [i] <FY YOS Grade> = FEROUT2 [i] <FY-1 YOS-1 Grade> ;
|     FERIN2SHIFT [i] <FY YOS Grade> = FERIN2 [i] <FY-1 YOS Grade> ;
|     FEROUT1SHIFT [i] <YOS Grade> = FEROUT1 [i] <YOS Grade> ;
|     FERIN1SHIFT [i] <YOS Grade> = FERIN1 [i] <YOS Grade> ;
+- END ;

   FERINVRED [i] <YOS Grade> = FEROUT2SHIFT [i] <YOS Grade> -
                               FERIN2SHIFT [i] <YOS Grade> ;
```

7. Calculate Attrition Losses.

```
   /*  EARLY ATTRITIONS  */
+- DO for Track i = 1 ;
|     BMTATTLOSS [i] <YOS = 0 Grade = 1> =   S1D1 * NPS4
|                                          + S2D1 * INV [i] <YOS = 0 Grade = 1> ;
|
```

```
|     STDATTLOSS [i] <YOS = 0 Grade = 1> =   S1D2 * NPS4
|                                          + S2D2 * INV [i] <YOS = 0 Grade = 1> ;
|
|     STDATTLOSS [i] <YOS = 0 Grade = 2> =   S1D3 * NPS4
|                                          + S2D3 * INV [i] <YOS = 0 Grade = 1>
|                                          + S3D1 * INV [i] <YOS = 0 Grade = 2> ;
|
|     STDATTLOSS [i] <YOS = 0 Grade = 3> = S3D2 * INV [i] <YOS = 0 Grade = 2> ;
|
|     STDATTLOSS [i] <YOS = 1 Grade = 2> = S4D1 * INV [i] <YOS = 1 Grade = 2> ;
|
|     STDATTLOSS [i] <YOS = 1 Grade = 3> =   S4D2 * INV [i] <YOS = 1 Grade = 2>
|                                          + S5D1 * INV [i] <YOS = 1 Grade = 3> ;
|
|     STDATTLOSS [i] <YOS = 1 Grade = 4> = S5D2 * INV [i] <YOS = 1 Grade = 3> ;
|
+- END ;

+- DO for Track i = 2 ;
|     BMTATTLOSS [i] <YOS = 0 Grade = 1> =   S6D1 * NPS6
|                                          + S7D1 * INV [i] <YOS = 0 Grade = 1> ;
|
|     STDATTLOSS [i] <YOS = 0 Grade = 3> =   S6D2 * NPS6
|                                          + S7D2 * INV [i] <YOS = 0 Grade = 1>
|                                          + S8D1 * INV [i] <YOS = 0 Grade = 3> ;
|
|     STDATTLOSS [i] <YOS = 1 Grade = 3> = S9D1 * INV [i] <YOS = 1 Grade = 3> ;
|
|     STDATTLOSS [i] <YOS = 1 Grade = 4> = S9D2 * INV [i] <YOS = 1 Grade = 3> ;
|
+- END ;

   /*  LATE ATTRITIONS  */
```

```
+- DO for Track i, i = 1 to 2   ;
|     IF (YOS ≥ 2) THEN
|        STDATTRLOSS [i] <YOS Grade> = STDATTRRATE [i] <YOS Grade>
|                                      * INV [i] <YOS Grade> ;
+- END  ;

+- DO for Track i, i = 3 to 11   ;
|     STDATTRLOSS [i] <YOS Grade> = STDATTRRATE [i] <YOS Grade>
|                                   * INV [i] <YOS Grade>  ;
+- END  ;
```

8. Calculate Retirement Losses.

```
/*  Check for High Year of Tenure.  */

+- DO for Track i, i = 11 ;
|    IF Grade = 5 AND YOS ≥ 19 OR
|       Grade = 6 AND YOS ≥ 22 OR
|       Grade = 7 AND YOS ≥ 25 OR
|       Grade = 8 AND YOS ≥ 27 OR
|       Grade = 9 AND YOS ≥ 29
|           THEN RETIRELOSS <YOS Grade> = INV [i] <YOS Grade> ;
|
|    ELSE
|      RETIRELOSS <YOS Grade> = RETIRERATE <YOS Grade>
|                                   * INV [i] <YOS Grade>  ;
|
+- END ;
```

9. Calculate Policy free ETS Losses for each Track

```
+- DO FOR Track i, i = 1 to 11 over all YOS and Grade values ;
|
|      /* Calculate Policy free ETS loss flow  */
|
|     ETSLOSS [i] = ((INV [i] + PCINVRED [i]
|                             + EOINVRED [i] + FERINVRED [i])
|        * (PFETSLOSSRATE [i])
|        * (1 + LCOEFLOGUNEMPL [i] <YOS> * {LOGUNEMPL <FY>-REFLOGUNEMPL}
|             + LCOEFLOGMILCIV [i] <YOS> * {LOGMILCIV <FY>-REFLOGMILCIV}
|             + LCOEFA1AVG [i] <YOS> * {A1AVG <FY> - REFA1AVG}
|             + LCOEFA2AVG [i] <YOS> * {A2AVG <FY> - REFA2AVG}
|             + LCOEFAPASTAVG [i] <YOS> * {APASTAVG <FY> - REFAPASTAVG}
|             + LCOEFBAVG [i] <YOS> * {BAVG <FY> - REFBAVG}
|             + LCOEFCAVG [i] <YOS> * {CAVG <FY> - REFCAVG} ) ) ;
|
|     /*  account for possible negative ETS loss flow  */
|
|     ETSLOSS [i] = max (ETSLOSS [i], 0)
|
|     /* account for possible ETSLOSSes larger than the inventory  */
|
|     ETSLOSS [i] = min (ETSLOSS [i], INV [i]) ;
|
+- END ;
```

10. Update inventory for attrition losses, retirements, and policy free ETS losses.

```
+- DO FOR Track i, i = 1 to 10 ;
|
|       /*  Attrition losses  */
|     IF (1 ≤ i ≤ 2) and (YOS ≥ 2) THEN
|       INV [i] = max (INV [i] - STDATTRLOSS [i], 0) ;
|
|       /*  NOTE:  Early attrition losses from Tracks 1 and 2 at  */
|       /*  YOS < 2  do not affect reenlistments.                  */
|
|     IF (i ≥ 3) THEN
|       INV [i] = max (INV [i] - STDATTRLOSS [i], 0) ;
|
|       /*  Retirement Losses  */
|     IF (i = 11) THEN
|       INV [i] = max (INV [i] - RETIRELOSS [i], 0) ;
|
|       /*  policy free ETS losses  */
|  +- IF (1 ≤ i ≤ 2) AND (YOS ≥ 2) THEN DO ;
|  |     IF (ETSLOSS [i] > INV [i]) THEN
|  |         ETSLOSS [i] = INV [i] ;
|  |
|  |     INV [i] = INV [I] - ETSLOSS [i] ;
|  +- END ;
|
|  +- IF (i ≥ 3) THEN DO ;
|  |     IF (ETSLOSS [i] > INV [i]) THEN
|  |       ETSLOSS [i] = INV [i] ;
|  |
|  |     INV [i] = INV [I] - ETSLOSS [i] ;
|  +- END ;
|
+- END ;
```

11. Calculate Policy free Reenlistments out of each Track.

```
+- DO FOR Track i, i = 1 to 11 ;
|
|     REUPFLOW [i] = ((INV [i] + PCINVRED [i]
|                              + EOINVRED [i] + FERINVRED [i])
|        * (PFREUPRATE [i])
|        * (1 + RCOEFLOGUNEMPL [i] <YOS> * {LOGUNEMPL <FY> - REFLOGUNEMPL}
|             + RCOEFLOGMILCIV [i] <YOS> * {LOGMILCIV <FY> - REFLOGMILCIV}
|             + RCOEFA1AVG [i] <YOS> * {A1AVG <FY> - REFA1AVG}
|             + RCOEFA2AVG [i] <YOS> * {A2AVG <FY> - REFA2AVG}
|             + RCOEFAPASTAVG [i] <YOS> * {APASTAVG <FY> - REFAPASTAVG}
|             + RCOEFBAVG [i] <YOS> * {BAVG <FY> - REFBAVG}
|             + RCOEFCAVG [i] <YOS> * {CAVG <FY> - REFCAVG} ) ) ;
|
|     /*  Those first term airmen who are extension that are not lost
|         are assumed to reenlist.  */
|
|  +- IF (i = 1 AND YOS = 5) OR (i = 2 AND YOS = 7)) THEN DO ;
|  |     REUPFLOW [i] <YOS> = INV [i] <YOS>
|  +- END ;
|
|     /*  Those second term airmen who are extension that are not lost
|         are assumed to reenlist.  */
|  +- IF ((3 ≤ i ≤ 10) AND (YETS = -1) THEN DO ;
|  |     REUPFLOW [i] <YETS> = INV [i] <YETS>
|  +- END ;
|
|     /*  account for possible negative REUP flow */
|     REUPFLOW [i] = max (REUPFLOW [i], 0)
|
|     /* account for possible REUPFLOWS larger than the inventory  */
|     REUPFLOW [i] = min (REUPFLOW [i], INV [i]) ;
+- END ;
```

12. Calculate ETS Reenlistments and actual reenlistments.

```
+- DO FOR Track i, i = 1 to 11 ;
|     ETSREUPOUT [i] = REUPFLOW [i] - FEROUTSHIFT1 [i]
|                                   - FEROUTSHIFT1 [i] ;
|     REUPFLOW [i] = ETSREUPOUT [i] + FEROUT1 [i] + FEROUT2 [i] ;
+- END ;
```

13. Adjust policy free ETS losses to actual ETS losses by subtracting Palace Chase, Early Out, and Rollup shifts.

```
+- DO FOR Track i, i = 1 to 11 ;
|     ETSLOSS [i] = max (ETSLOSS [i] - PCSHIFT [i], 0) ;
|     ETSLOSS [i] = max (ETSLOSS [i] - EOSHIFT [i], 0) ;
|     ETSLOSS [i] = max (ETSLOSS [i] - RUSHIFT [i], 0) ;
+- END ;
```

14. Update inventory for early release losses, OTS losses, and MISC losses.

```
+- DO FOR Track i, i = 1 to 11 ;
|
|  INV [i] = max (INV [i] - PCLOSS [i], 0) ;
|  INV [i] = max (INV [i] - EOLOSS [i], 0) ;
|  INV [i] = max (INV [i] - OTSLOSS [i], 0) ;
|  INV [i] = max (INV [i] - MISCLOSS [i], 0) ;
|  INV [i] = INV [i] + EOSHIFT [i] + PCSHIFT [i];
|
+- END ;
```

15. Calculate Continuation Flows.

```
+- DO FOR Track i, i = 1 TO 11 ;
|     INV [i] = max (INV [i] - REUPFLOW [i], 0) ;
|
|     CONTINFLOW [i] = INV [i] ;
+- END ;
```

16. Age the force.

```
/*  Age force by adding 1 to YOS variable, changing Tracks where
    necessary. */

/* NOTE: incrementing YETS is the same as decrementing YOS  */

+- DO FOR Track i = 1 ;
|  +- DO FOR YOS = 4 TO 2 ;
|  |     INV [i] <YOS + 1> = INV [i] <YOS>  ;
|  +- END ;
|       INV [i] <YOS = 2> = 0 ;
+- END ;

+- DO FOR Track i = 2 ;
|  +- DO FOR YOS = 6 TO 2 ;
|  |     INV [i] <YOS + 1> = INV [i] <YOS>  ;
|  +- END ;
|       INV [i] <YOS = 2> = 0 ;
+- END ;

+- DO FOR Track i, i = 3 TO 4 ;
|    +- IF YETS ≥ 0 THEN DO ;
|    |     INV [i] <YOS + 1> = INV [i] <YOS>  ;
|    +- END ;
|       INV [i] <YETS = 4> = 0 ;
```

```
  +- END ;

  +- DO FOR Track i, i = 5 TO 10 ;
  |    +- IF YETS ≥ 0 THEN DO ;
  |    |     INV [i] <YOS + 1> = INV [i] <YOS>  ;
  |    +- END ;
  |       INV [i] <YETS = 6> = 0 ;
  +- END ;

  +- DO FOR Track i = 11  ;
  |  +- DO FOR YOS = 28 TO 6 ; /* decrementing YOS  */
  |  |     INV [i] <YOS + 1> = INV [i] <YOS>  ;
  |  +- END ;
  |     INV [i] <YOS = 6> = 0 ;
  +- END ;
```

17. Add reenlistments in.

```
/*  Reenlistments from first term into the second term  */

/*  Track 1  */

/*  NOTE:  YOS is used as an indicator of both YOS and Track  */
  +- DO FOR YOS = 2 TO 5 ;
  |     INV [YOS + 1] <YOS + 1> = INV [YOS + 1] <YOS + 1>
  |                     + (TOE4RATE 1 * REUPFLOW [1] <YOS>)  ;
  |     INV [YOS + 3] <YOS + 1> = INV [YOS + 1] <YOS + 1>
  |                     + ((1 - TOE4RATE 1) * REUPFLOW [1] <YOS>) ;
  +- END;

/*  Track 2  */

  +- DO FOR YOS = 4 TO 7 ;
  |     INV [YOS + 1] <YOS + 1> = INV [YOS + 1] <YOS + 1>
```

```
  |                     + (TOE4RATE 2 * REUPFLOW [2] <YOS>) ;
  |     INV [YOS + 3] <YOS + 1> = INV [YOS + 3] <YOS + 1>
  |                     + ((1 - TOE4RATE 2) * REUPFLOW [2] <YOS>) ;
  +- END;

/*  Calculate reenlistments from second term into the career term (NRE)  */

     INV [11] <YOS = 6> =   INV [11] <YOS = 6> + REUPFLOW [3] <YOS = 5>  ;
     INV [11] <YOS = 7> =   INV [11] <YOS = 7> + REUPFLOW [3] <YOS = 6>
                          + REUPFLOW [4] <YOS = 6>  ;
     INV [11] <YOS = 8> =   INV [11] <YOS = 8> + REUPFLOW [3] <YOS = 7>
                          + REUPFLOW [4] <YOS = 7> + REUPFLOW [5] <YOS = 7>  ;

+- DO FOR j = 3 TO 6 ;              /*  Set counter  */
|  +- DO FOR YOS = 8 TO 12 ;
|  |     INV [11] <YOS + 1> =  INV [11] <YOS + 1> + REUPFLOW [j] <YOS>
|  |                         + REUPFLOW [j + 1] <YOS> + REUPFLOW [j + 2] <YOS>
|  |                         + REUPFLOW [j + 3] <YOS> ;
|  +- END ;
+- END ;

    INV [11] <YOS = 14> = INV [11] <YOS = 14> + REUPFLOW [8] <YOS = 13>
                        + REUPFLOW [9] <YOS = 13> + REUPFLOW [10] <YOS = 13> ;
    INV [11] <YOS = 15> = INV [11] <YOS = 15> + REUPFLOW [9] <YOS = 14>
                        + REUPFLOW [10] <YOS = 14>  ;
    INV [11] <YOS = 16> = INV [11] <YOS = 16> + REUPFLOW [10] <YOS =  15>  ;
```

18. Determine promotions out of each Track.

```
/*  Calculate trial promotions out of each grade for each Track.  */
  +- DO FOR Track i = 1 TO 11 ;
  |
  |     PROMOUT [i] = INV [i] * TRIALPROMRATE [i] ;
  |
```

```
|  +- IF (1 ≤ i ≤ 2) THEN DO ;
|  |     PROMOUT [i = i] <YOS = 0 Grade = 1> = S1D5 * NPS4 <FY> ;
|  |     PROMOUT [i = 1] <YOS = 1 Grade = 1> = (S2D4 + S2D5) *
|  |                                           INV [i = 1] <YOS = 0 Grade = 1> ;
|  |     PROMOUT [i = 1] <YOS = 1 Grade = 2> =
|  |                       (S2D5) * INV [i = 1] <YOS = 0 Grade = 1>
|  |                     + (S3D3) * INV [i = 1] <YOS = 0 Grade = 2> ;
|  |     PROMOUT [i = 1] <YOS = 2 Grade = 2> =
|  |                       (S4D3) * INV [i = 1] <YOS = 1 Grade = 2> ;
|  |     PROMOUT [i = 1] <YOS = 2 Grade = 3> =
|  |                       (S5D4) * INV [i = 1] <YOS = 1 Grade = 2> ;
|  |
|  |     PROMOUT [i = 2] <YOS = 0 Grade = 1> = (S6D4) * NPS6 <FY> ;
|  |     PROMOUT [i = 2] <YOS = 1 Grade = 1> =
|  |                       (S7D3) * INV [i = 2] <YOS = 0 Grade = 1> ;
|  |     PROMOUT [i = 2] <YOS = 2 Grade = 3> =
|  |                       (S9D4) * INV [i = 2] <YOS = 1 Grade = 3> ;
|  |
|  +- END ;
|
+- END ;

/*  Calculate the total number of trial promotions out of each grade.  */

      IF (YOS ≥ 2) THEN
          TOTPROMOUT <Grade> = PROMOUT [1] <tYOS Grade>
                             + PROMOUT [2] <tYOS Grade> ;

      TOTPROMOUT <Grade> = TOTPROMOUT <Grade>
                           i = 11
                         + SUM (PROMOUT [i] <tYOS Grade>  ;
                           i = 3

/*  Calculate actual promotion outflows by adjusting the detailed trial
```

```
    promotions out to reflect promotion policy.  */

+- DO FOR Track i = 1 TO 11 ;
|    IF ((1 ≤ i ≤ 2) AND (YOS ≥ 2)) OR (i ≥ 3) THEN
|    +- DO FOR Grade = 4 TO 9 ;
|    |   PROMOUT [i] <Grade - 1> = (PROMIN <FY Grade>/TOTPROMOUT <Grade - 1>)
|    |                              * PROMOUT [i] <Grade - 1> ;
|    +- END ;
+- END ;
```

19. Calculate promotion inflows and adjust inventory.

```
+- DO FOR Track i = 1 TO 11 ;
|    IF (Grade > 1) THEN
|      PROMIN [i] <YOS Grade> = PROMOUT [i] <YOS Grade-1> ;
+- END ;

/*  Subtract promotion outflows and add promotion inflows.  */

 +D DO FOR Track i = 1 TO 2 ;
 |    IF (Grade = 3) AND (YOS ≥ 3) THEN
 |      INV [i] <YOS Grade> = INV [i] <YOS Grade>
 |                           - PROMOUT [i] <YOS Grade> ;
 |    IF (YOS ≥ 3) AND (4 ≤ Grade ≤ 6) THEN
 |      INV [i] <YOS Grade> = INV [i] <YOS Grade>
 |                           - PROMOUT [i] <YOS Grade>
 |                           + PROMIN [i] <YOS Grade>  ;
 +- END ;

 +- DO FOR Track i = 3 TO 10 ;
 |    IF Grade = 4 THEN
 |      INV [i] <Grade = 4> = INV [i] <Grade = 4> - PROMOUT [i] <Grade = 4> ;
 |  +- DO FOR Grade 5 TO 7 ;
 |  |    INV [i] <Grade> = INV [i] <Grade> - PROMOUT [i] <Grade>
```

```
|  |                        + PROMIN [i] <Grade>   ;
|  +- END ;
+- END ;

+- DO FOR Track i = 11 ;
|    IF Grade = 4 THEN
|       INV [i] <Grade = 4> = INV [i] <Grade = 4> - PROMOUT [i] <Grade = 4> ;
|  +- DO FOR Grade 5 TO 9 ;
|  |    INV [i] <Grade> = INV [i] <Grade> - PROMOUT [i] <Grade>
|  |                        + PROMIN [i] <Grade-1>   ;
|  +- END ;
+- END ;
```

20. Determine Demotions out of each Track and adjust inventory.

```
/*  Calculate trial Demotions out of each grade for each Track.  */

  +- DO FOR Track i = 1 TO 11 ;
  |
  |     DEMOFLOW [i] = INV [i] * TRIALDEMORATE [i] ;
  |
  +- END ;

/*  Calculate the total number of trial demotions out of each grade.  */

                              i = 11
       TOTDEMOOUT <Grade> =   SUM (DEMOFLOW [i] <tYOS Grade>   ;
                              i = 3

/*  Calculate actual demotion outflows by adjusting the detailed trial
    demotions out to reflect demotion policy.  */

+- DO FOR Track i = 1 TO 11 ;
|
```

```
|   +- DO FOR Grade = 2 TO 9 ;
|   |   DEMOFLOW [i] <YOS Grade> = (DEMOOUT <FY Grade> / TOTDEMOOUT <Grade>)
|   |                              * DEMOFLOW [i] <YOS Grade> ;
|   |
|   |   DEMOIN [i] <YOS Grade - 1> = DEMOFLOW [i] <YOS Grade> ;
|   |
|   +- END ;
+- END ;

/* Update inventory to adjust for demotion outflows and inflows. */
/*  Subtract demotion outflows and add demotion inflows.  */

 +- DO FOR Track i = 1 TO 11 ;
 |    IF (Grade = 9) THEN
 |      INV [i = 11] <YOS Grade> = INV [i = 11] <YOS Grade>
 |                          - DEMOFLOW [i = 11] <YOS Grade> ;
 |
 |    ELSE IF (2 ≤ Grade ≤ 8)
 |      INV [i] <YOS Grade> = INV [i] <YOS Grade>
 |                          - DEMOFLOW [i] <YOS Grade>
 |                       + DEMOIN [i] <YOS Grade>  ;
 |
 |    ELSE IF (Grade = 1)
 |      INV [i] = INV [i] <YOS Grade> + DEMOIN [i] <YOS Grade> ;
 |
 +- END ;
```

21. Adjust inventory FOR OTS and MISC gains, and Prior Service accessions.

```
 +- DO FOR Track i = 11 ;
 |
 |    PS [i] <YOS Grade> = PSDIST [i] <YOS Grade> * PS <FY> ;
 |
```

```
|    OTSGAIN [i] <YOS Grade> = OTSGAINDIST [i] <YOS Grade>
|                            * OTSGAIN <FY> ;
|    MISCGAIN [i] <YOS Grade> = MISGAINDIST [i] <YOS Grade>
|                            * MISCGAIN <FY> ;
|
|    INV [i] = INV [i] + OTSGAIN [i] + MISCGAIN [i] + PS [i] ;
|
+- END ;
```

22. Determine ending inventory for Tracks 1 and 2 with YOS ≤ 1.

```
INV [i = 1] <YOS = 0 Grade = 1> = S1D4 * NPS4 ;
INV [i = 1] <YOS = 0 Grade = 2> = S1D5 * NPS4 ;
INV [i = 1] <YOS = 1 Grade = 2> = S2D4 * INV [i = 1] <YOS = 0 Grade = 1> ;
INV [i = 1] <YOS = 1 Grade = 3> = S2D5 * INV [i = 1] <YOS = 0 Grade = 1>
                                + S3D3 * INV [i = 1] <YOS = 0 Grade = 2> ;
INV [i = 1] <YOS = 2 Grade = 3> = S4D3 * INV [i = 1] <YOS = 1 Grade = 2>
                                + S5D3 * INV [i = 1] <YOS = 1 Grade = 3> ;
INV [i = 1] <YOS = 2 Grade = 4> = S5D4 * INV [i = 1] <YOS = 1 Grade = 3> ;


INV [i = 2] <YOS = 0 Grade = 1> = S6D3 * NPS6 ;
INV [i = 2] <YOS = 0 Grade = 3> = S6D4 * NPS6 ;
INV [i = 2] <YOS = 1 Grade = 3> = S7D3 * INV [i = 2] <YOS = 0 Grade = 1>
                                + S8D2 * INV [i = 2] <YOS = 0 Grade = 3> ;
INV [i = 2] <YOS = 2 Grade = 3> = S9D3 * INV [i = 2] <YOS = 1 Grade = 3> ;
INV [i = 2] <YOS = 2 Grade = 4> = S9D4 * INV [i = 2] <YOS = 1 Grade = 3> ;
```

23. Calculate the number of workyears in the fiscal year and the nominal cost by detailed accounting structure.

$$\text{STARTINV}\langle \text{YOS Grade} \rangle = \sum_{i=1}^{i=11} \text{STARTINV}[i]\langle \text{YOS Grade} \rangle ;$$

```
                          i = 11
TOTALGAIN <YOS Grade> = SUM (PS [i] <YOS Grade> + OTSGAIN [i] <YOS Grade>
                          i = 1  + MISCGAIN [i] <YOS Grade>
                           + NPS4 <YOS = 0 Grade = 1> + NPS6 <YOS = 0 Grade = 1>)
;

BMTATTLOSS <YOS Grade> = BMTATTLOSS [i = 1] <YOS = 0 Grade = 1>
                        + BMTATTLOSS [i = 2] <YOS = 0 Grade = 1> ;

                           i = 11
ETSLOSS [i] <YOS Grade> = SUM (ETSLOSS [i] <YOS Grade>) ;
                           i = 1

                          i = 11
RULOSS [i] <YOS Grade> = SUM (RULOSS [i] <YOS Grade>) ;
                          i = 1

                          i = 11
EOLOSS [i] <YOS Grade> = SUM (EOLOSS [i] <YOS Grade>) ;
                          i = 1

                          i = 11
PCLOSS [i] <YOS Grade> = SUM (PCLOSS [i] <YOS Grade>) ;
                          i = 1

                             i = 11
RETIREMENT [i] <YOS Grade> = SUM (RETIRELOSS [i] <YOS Grade>) ;
                             i = 1

                           i = 11
OTSLOSS [i] <YOS Grade> = SUM (OTSLOSS [i] <YOS Grade>) ;
                           i = 1

                            i = 11
MISCLOSS [i] <YOS Grade> = SUM (MISCLOSS [i] <YOS Grade>) ;
```

i = 1

```
WORKYEARS <YOS, Grade> =
      STARTINV <YOS, Grade>
    + GAINWEIGHT <YOS, Grade> * TOTALGAIN <YOS, Grade>
    - BMTATTLOSSWEIGHT <YOS, Grade> * BMTATTLOSS <YOS, Grade>
    - STDATTLOSSWEIGHT <YOS, Grade> * STDATTLOSS <YOS, Grade>
    - ETSLOSSWEIGHT <YOS, Grade> * ETSLOSS <YOS, Grade>
    - RULOSSWEIGHT <YOS, Grade> * RULOSS <YOS, Grade>
    - EOLOSSWEIGHT <YOS, Grade> * EOLOSS <YOS, Grade>
    - PCLOSSWEIGHT <YOS, Grade> * PCLOSS <YOS, Grade>
    - RETIREMENTWEIGHT <YOS, Grade> * RETIREMENT <YOS, Grade>
    - OTSLOSSWEIGHT <YOS, Grade> * OTSLOSS <YOS, Grade>
    - MISCLOSSWEIGHT <YOS, Grade> * MISCLOSS <YOS, Grade>   ;

/* Using the estimates of workyears by YOS and Grade, multiplying by the
cost factor, and adjusting for changes in military wages gives the
nominal costs.  */

NBASICPAY <YOS Grade> =
      WORKYEARS <YOS Grade>
    * BASICPAYFACTOR <YOS Grade>
    * [ MILCIV <FY> * CPI <FY> ]
    / [ MILCIV <REF> * CPI <REF> ]

NRETIREPAY <YOS, Grade> =
      WORKYEARS <YOS, Grade>
    * RETIREPAYFACTOR <YOS, Grade>
    * [ MILCIV <FY> * CPI <FY> ]
    / [ MILCIV <REF> * CPI <REF> ]

NBAQVHA <YOS, Grade> =
      WORKYEARS <YOS, Grade>
    * BAQVHAFACTOR <YOS, Grade>
```

```
    * [ MILCIV <FY> * CPI <FY> ]
    / [ MILCIV <REF> * CPI <REF> ]

NINCENTPAY <YOS, Grade> =
      WORKYEARS <YOS, Grade>
    * INCENTPAYFACTOR <YOS, Grade>
    * [ MILCIV <FY> * CPI <FY> ]
    / [ MILCIV <REF> * CPI <REF> ]

NMISCPAY <YOS, Grade> =
      WORKYEARS <YOS, Grade>
    * MISCPAYFACTOR <YOS, Grade>
    * [ MILCIV <FY> * CPI <FY> ]
    / [ MILCIV <REF> * CPI <REF> ]

NPCSCOST <YOS, Grade> =
      WORKYEARS <YOS, Grade>
    * PCSCOSTFACTOR <YOS, Grade>
    * [ MILCIV <FY> * CPI <FY> ]
    / [ MILCIV <REF> * CPI <REF> ]
```

24. Set ending inventory variable.

```
+- DO FOR Track i = 11 ;
|
|  ENDINV [i] <YOS Grade> = INV [i] <YOS Grade> ;
|
+- END ;
```

25. Output Screen Generator.

The internal variables created are passed to the output screen generator. The output screen generator processes the force and personnel flow information after each fiscal year's calculations are completed. The

model retains one fiscal year's force and flow information in memory at a time, processes this information, and sends it to the proper location on the output screen. The output variables are listed below.

Output Screen 1: Enlisted Force by CATENL

```
ENDINV <FY CATENL = 1>  = INV [i = 1] <tYOS tGrade CATENL = 1>
                        + INV [i = 2] <tYOS tGrade CATENL = 1> ;

                          i = 10
ENDINV <FY CATENL = 2> = SUM (INV [i] <tYOS tGrade CATENL = 2>)
                          i = 3

/*  NOTE:  total over YOS is restricted to the given ranges  */

IF (6 ≤ YOS ≤ 19) THEN
      ENDINV <FY CATENL = 3> = INV [i = 11] <tYOS tGrade CATENL = 3> ;

IF (20 ≤ YOS ≤ 29) THEN
      ENDINV <FY CATENL = 4> = INV [i = 11] <tYOS tGrade CATENL = 4> ;

TOTAL <FY> = ENDINV <FY tCATENL> ;

                       j = 4
PERCENT2TERM <FY> = (SUM (ENDINV <FY CATENL = j>) / TOTAL1 <FY>) * 100 ;
                       j = 2
```

Output Screen 2: Enlisted Force by YOS

```
IF (0 ≤ YOS ≤ 3) THEN
                              i = 3
          YOS0_3INV <FY> = SUM (INV [i] <tYOS tGrade>) ;
                              i = 1
```

```
IF (4 ≤ YOS ≤ 7) THEN
                                i = 11
          YOS4_7INV <FY> =  SUM (INV [i] <tYOS tGrade>) ;
                                i = 1

IF (8 ≤ YOS ≤ 11) THEN
                                 i = 11
          YOS8_11INV <FY> =  SUM (INV [i] <tYOS tGrade>) ;
                                 i = 3

IF (12 ≤ YOS ≤ 15) THEN
                                  i = 11
          YOS12_15INV <FY> =  SUM (INV [i] <tYOS tGrade>) ;
                                  i = 7
IF (16 ≤ YOS ≤ 19) THEN
          YOS16_19INV <FY> =  INV [i = 11] <tYOS tGrade>) ;

IF (20 ≤ YOS ≤ 24) THEN
          YOS20_24INV <FY> =  INV [i = 11] <tYOS tGrade>) ;

IF (25 ≤ YOS ≤ 29) THEN
          YOS25_29INV <FY> =  INV [i = 11] <tYOS tGrade>) ;

TOTAL2 <FY> = YOS0_3INV <FY> + YOS4_7INV <FY> + YOS8_11INV <FY>
            + YOS12_15INV <FY> + YOS16_19INV <FY> + YOS20_24INV <FY>
            + YOS25_29INV <FY> ;

PERCENT4YOS = ((YOS4_7INV <FY> + YOS8_11INV <FY> + YOS12_15INV <FY>
             + YOS16_19INV <FY> + YOS20_24INV <FY> + YOS25_29INV <FY>)
               / TOTAL2 <FY>) * 100 ;
```

Output Screen 3: Enlisted Force by Grade

```
IF (Grade ≤ 3) THEN
```

```
ENDINV <FY Grade> = INV [i = 1] <tYOS Grade> + INV [i = 2] <tYOS Grade> ;

                    i = 11
ENDINV <FY Grade> = SUM (INV [i] <tYOS Grade> ;
                    i = 1

TOTAL <FY> = ENDINV <FY tGrade> ;

PERCENT5Grade <FY> = ((ENDINV <FY t(5 ≤ Grade ≤ 9)>) / TOTAL <FY>) * 100 ;
```

Output Screen 4: Average YOS entering each Grade.

```
                          i = 11   YOS = 29
                          SUM (  SUM (YOS * PROMOUT [i] <YOS Grade>) )
AVGPROMYOS <FY Grade> =   i = 1    YOS = 0
                          ──────────────────────────────────────────

                          i = 11
                          SUM  (PROMOUT [i] <tYOS Grade = 4>)
                          i = 1
```

Output Screen 5: Average YOS in each Grade.

```
                          i = 11   YOS = 29
                          SUM (  SUM (YOS * INV [i] <YOS Grade>) )
AVGINVYOS <FY Grade> =    i = 1    YOS = 0
                          ──────────────────────────────────────────

                          i = 11
                          SUM  (INV [i] <tYOS Grade>)
                          i = 1
```

Output Screen 6: Annual Promotion Rates.

```
/*  The prepromotion inventory can be found by:                    */
/*   PREPROMINV = ENDINV + PROMOTIONS OUT - PROMOTIONS IN          */

                                  i = 11
PROMOTIONRATE <FY Grade = 5> = (SUM (PROMOUT [i] <tYOS Grade = 4>)
                                  i = 1
                       i = 11
                    / ( (SUM (INV [i] <tYOS Grade = 4>)
                         i = 1
                       i = 11

                    + SUM (PROMOUT [i] <tYOS Grade = 4>)
                      i = 1
                      i = 2
                    - SUM (PROMIN [i] <tYOS Grade = 3>) ) * 100 ;
                      i = 1

                                  i = 11
PROMOTIONRATE <FY Grade = 6> = (SUM (PROMOUT [i] <tYOS Grade = 5>)
                                  i = 1
                       i = 11
                    / ( (SUM (INV [i] <tYOS Grade = 5>)
                         i = 1
                       i = 11
                    + SUM (PROMOUT [i] <tYOS Grade = 5>)
                      i = 1
                      i = 11
                    - SUM (PROMIN [i] <tYOS Grade = 4>) ) * 100 ;
                      i = 1

                                  i = 11
PROMOTIONRATE <FY Grade = 7> = (SUM (PROMOUT [i] <tYOS Grade = 6>)
                                  i = 1
                       i = 11
```

```
                / ( (SUM (INV [i] <tYOS Grade = 6>)
                      i = 1
                  i = 11
                + SUM (PROMOUT [i] <tYOS Grade = 6>)
                  i = 1
                  i = 11
                - SUM (PROMIN [i] <tYOS Grade = 5>) ) * 100 ;
                  i = 1


                                  i = 11
PROMOTIONRATE <FY Grade = 8> = (SUM (PROMOUT [i] <tYOS Grade = 7>)
                                  i = 3
                      i = 11
                / ( (SUM (INV [i] <tYOS Grade = 7>)
                      i = 3
                  i = 11
                + SUM (PROMOUT [i] <tYOS Grade = 7>)
                  i = 3
                  i = 11
                - SUM (PROMIN [i] <tYOS Grade = 6>) ) * 100 ;
                  i = 1


PROMOTIONRATE <FY Grade = 9> = (PROMOUT [i = 11] <tYOS Grade = 8>)
                             / (INV [i = 11] <tYOS Grade = 8>
                             + PROMOUT [i = 11] <tYOS Grade = 8>
                            i = 11
                          - SUM (PROMIN [i] <tYOS Grade = 7>) * 100 ;
                            i = 3
```

Output Screen 7: Annual ETS Retention Rates.

```
/*  Reenlistments as percent of policy-free ETS losses plus
    reenlistments.  */
```

```
RETENTIONRATE <FY CATENL = 1> = ((REUPFLOW [i = 1] <tYOS tGrade>
                                + REUPFLOW [i = 2] <tYOS tGrade>)
                               / (REUPFLOW [i = 1] <tYOS tGrade>
                                  + REUPFLOW [i = 2] <tYOS tGrade>
                                  + ETSLOSS [i = 1] <tYOS tGrade>
                                  + ETSLOSS [i = 2] <tYOS tGrade>
                                  + PCSHIFT [i = 1] <tYOS tGrade>
                                  + PCSHIFT [i = 2] <tYOS tGrade>
                                  + EOSHIFT [i = 1] <tYOS tGrade>
                                  + EOSHIFT [i = 2] <tYOS tGrade>
                                  + RUSHIFT [i = 1] <tYOS tGrade>
                                  + RUSHIFT [i = 2] <tYOS tGrade> )) * 100 ;

                                   i = 10
RETENTIONRATE <FY CATENL = 2> = ((SUM (REUPFLOW [i] <tYOS tGrade>))
                                   i = 3
                                   i = 10
                               / ( SUM (REUPFLOW [i] <tYOS tGrade>)
                                   i = 3
                                   i = 10
                                 + SUM (ETSLOSS [i] <tYOS tGrade>)
                                   i = 3
                                   i = 10
                                 + SUM (PCSHIFT [i] <tYOS tGrade>)
                                   i = 3
                                   i = 10
                                 + SUM (EOSHIFT [i] <tYOS tGrade>)
                                   i = 3
                                   i = 10
                                 + SUM (RUSHIFT [i] <tYOS tGrade>) ) * 100 ;
                                   i = 3

RETENTIONRATE <FY CATENL = 3> = ((REUPFLOW [i = 11] <tYOS tGrade>)
                               / (REUPFLOW [i = 11] <tYOS tGrade>
```

```
                                + ETSLOSS [i = 11] <tYOS tGrade>
                                + PCSHIFT [i = 11] <tYOS tGrade>
                                + EOSHIFT [i = 11] <tYOS tGrade>
                                + RUSHIFT [i = 11] <tYOS tGrade> )) * 100 ;

                    i = 11
AVERAGE <FY> = ( SUM (REUPFLOW [i] <tYOS tGrade>) )
                    i = 1
                   i = 11
              / ( SUM (REUPFLOW [i] <tYOS tGrade>)
                   i = 1
                   i = 11
                   SUM (ETSLOSS [i] <tYOS tGrade>)
                   i = 1
                   i = 11
                   SUM (PCSHIFT [i] <tYOS tGrade>)
                   i = 1
                   i = 11
                   SUM (EOSHIFT [i] <tYOS tGrade>)
                   i = 1
                   i = 11
                   SUM (RUSHIFT [i] <tYOS tGrade>) ) * 100 ;
                   i = 1
```

Output Screen 8: Inventory Change by Grade.

```
+- DO FOR (1 ≤ Grade ≤ 9) ;
|                              i = 11
|      STARTINV <FY Grade> = SUM (STARTINV [i] <tYOS Grade>
|                              i = 1
|
|
|      TOTALGAIN <FY Grade = 1> = MISCGAIN [i = 1] <tYOS Grade = 1>
|                               + MISCGAIN [i = 2] <tYOS Grade = 1>
```

```
|                              + OTSGAIN [i = 1] <tYOS Grade = 1>
|                              + OTSGAIN [i = 2] <tYOS Grade = 1>
|                              + NPS4 <FY> + NPS6 <FY> ;
|
|      IF (Grade ≥ 2) THEN
|                                    i = 11
|          TOTALGAIN <FY Grade> =  SUM (MISGAIN [i] <tYOS Grade>
|                                    i = 1  + OTSGAIN [i] <tYOS Grade>
|                                         + PS [i] <tYOS Grade> ) ;
|
|
|      TOTALLOSS <FY Grade = 1> =  BMTATTLOSS [i = 1] <YOS = 0 Grade = 1>
|                               + BMTATTLOSS [i = 2] <YOS = 0 Grade = 1>
|                               + STDATTLOSS [i = 1] <tYOS Grade = 1>
|                               + STDATTLOSS [i = 2] <tYOS Grade = 1>  ;
|
|      IF (Grade ≥ 2) THEN
|                                   i = 11
|          TOTALLOSS <FY Grade> = SUM (STDATTLOSS [i] <tYOS Grade>
|                                   i = 1  + EOLOSS [i] <tYOS Grade>
|                                        + PCLOSS [i] <tYOS Grade>
|                                        + RULOSS [i] <tYOS Grade>
|                                        + ETSLOSS [i] <tYOS Grade>
|                                        + RETIRELOSS [i] <tYOS Grade>
|                                        + OTSLOSS [i] <tYOS Grade>
|                                        + MISCLOSS [i] <tYOS Grade> ) ;
|
|    +- DO FOR Grade = 2 TO 9 ;
|    |                                 i = 11
|    |     TOTALPROMIN <FY Grade> = SUM (PROMIN [i] <tYOS Grade> ) ;
|    |                                 i = 1
|    |
|    |                                    i = 11
|    |     TOTALPROMOUT <FY Grade - 1> = SUM (PROMOUT [i] <tYOS Grade - 1>) ;
```

```
|    |                                    i = 1
|    |
|    +- END ;
|
|    +- DO FOR Grade = 2 TO 9 ;
|    |                                  i = 11
|    |     TOTALDEMOIN <FY Grade - 1> = SUM (DEMOIN [i] <tYOS Grade - 1> ) ;
|    |                                  i = 1
|    |
|    |                                 i = 11
|    |     TOTALDEMOOUT <FY Grade> = SUM (DEMOOUT [i] <tYOS Grade>) ;
|    |                                 i = 1
|    |
|    +- END ;
|                             i = 11
|        ENDINV <FY Grade> = SUM (INV [i] <tYOS Grade>) ;
|                             i = 1
+- END ;
```

Output Screen 9: Inventory Change by CATENL.

```
+- DO FOR (1 ≤ CATENL ≤ 4) ;
|                              i = 11
|      STARTINV <FY CATENL> = SUM (STARTINV [i] <tYOS tGrade CATENL>
|                              i = 1
|
|
|      TOTALGAIN <FY CATENL = 1> = MISCGAIN [i] <tYOS tGrade CATENL = 1>
|                              + OTSGAIN [i] <tYOS tGrade CATENL = 1>
|                              + NPS4 <FY>
|                              + NPS6 <FY> ;
|
|      IF (CATENL ≥ 2) THEN
|         TOTALGAIN <FY CATENL> = MISCGAIN [i] <tYOS tGrade CATENL>
```

```
|                                + OTSGAIN [i] <tYOS tGrade CATENL>
|                                + PS [i]
|
|                                    i = 11
|          TOTALLOSS <FY CATENL> = SUM (BMTATTLOSS [i] <tYOS tGrade CATENL>
|                                    i = 1  + STDATTLOSS [i] <tYOS tGrade CATENL>
|                                         + EOLOSS [i] <tYOS Grade CATENL>
|                                         + PCLOSS [i] <tYOS Grade CATENL>
|                                         + RULOSS [i] <tYOS Grade CATENL>
|                                         + ETSLOSS [i] <tYOS Grade CATENL>
|                                         + RETIRELOSS [i] <tYOS Grade CATENL>
|                                         + OTSLOSS [i] <tYOS Grade CATENL>
|                                         + MISCLOSS [i] <tYOS Grade CATENL> ) ;

|     +- DO FOR CATENL = 1 TO 3 ;
|     |                                  i = 11
|     |      REUPIN <FY CATENL + 1> = SUM (REUPIN [i] <tYOS tGrade CATENL> ) ;
|     |                                  i = 1
|     |
|     |                                     i = 11
|     |      REUPOUT <FY CATENL> = SUM (REUPOUT [i] <tYOS tGrade CATENL>) ;
|     |                                     i = 1
|     |
|     +- END ;
|                                i = 11
|         ENDINV <FY CATENL> = SUM (INV [i] <tYOS tGrade CATENL>) ;
|                                i = 1
+- END ;
```

Output Screen 10: Gains by CATENL or Grade.

```
/*  BY CATENL  */

NPS4 <FY CATENL> = NPS6 <FY CATENL> = NPS <FY CATENL> = 0 ;
```

```
NPS4 <FY CATENL = 1> = NPS4 <FY> ;
NPS6 <FY CATENL = 1> = NPS6 <FY> ;
NPS <FY CATENL = 1> = NPS4 <FY> + NPS6 <FY> ;

                  i = 11
PS <FY CAT. NL> = SUM (PS [i] <tYOS tGrade CATENL>) ;
                  i = 1
                       i = 11
OTSGAIN <FY CATENL> = SUM (OTSGAIN [i] <tYOS tGrade CATENL>) ;
                       i = 1
                        i = 11
MISCGAIN <FY CATENL> = SUM (MISCGAIN [i] <tYOS tGrade CATENL>) ;
                        i = 1

TOTALGAIN <FY CATENL> = NPS <FY CATENL + PS <FY CATENL>
                      + OTSGAIN <FY CATENL> + MISCGAIN <FY CATENL> ;

/*  BY Grade  */

NPS4 <FY Grade> = NPS6 <FY Grade> = NPS <FY Grade> = 0 ;
NPS4 <FY Grade = 1> = NPS4 <FY> ;
NPS6 <FY Grade = 1> = NPS6 <FY> ;
NPS <FY Grade = 1> = NPS4 <FY> + NPS6 <FY> ;

                  i = 11
PS <FY Grade> = SUM (PS [i] <tYOS Grade>) ;
                  i = 1

                       i = 11
OTSGAIN <FY Grade> = SUM (OTSGAIN [i] <tYOS Grade>) ;
                       i = 1
                        i = 11
MISCGAIN <FY Grade> = SUM (MISCGAIN [i] <tYOS Grade>) ;
                        i = 1
```

```
TOTALGAIN <FY Grade> = NPS <FY Grade> + PS <FY Grade>
                     + OTSGAIN <FY Grade> + MISCGAIN <FY Grade> ;
```

Output Screen 11: Losses by CATENL OR Grade.

```
/*  by  Category of enlistment  */

BMTATTLOSS <FY CATENL = 1> = BMTATTLOSS [i = 1] <tYOS tGrade>
                           + BMTATTLOSS [i = 2] <tYOS tGrade> ;

                             i = 11
STDATTLOSS <FY CATENL> = SUM (STDATTLOSS [i] <tYOS tGrade CATENL>) ;
                             i = 1

                            i = 11
ETSLOSS <FY CATENL> = SUM (ETSLOSS [i] <tYOS tGrade CATENL>) ;
                            i = 1

                           i = 11
RULOSS <FY CATENL> = SUM (RULOSS [i] <tYOS tGrade CATENL>) ;
                           i = 1

                           i = 11
EOLOSS <FY CATENL> = SUM (EOLOSS [i] <tYOS tGrade CATENL>) ;
                           i = 1

                           i = 11
PCLOSS <FY CATENL> = SUM (PCLOSS [i] <tYOS tGrade CATENL>) ;
                           i = 1

RETIREMENT <FY CATENL> = RETIRELOSS [i = 11] <tYOS tGrade> ;

                            i = 11
OTSLOSS <FY CATENL> = SUM (OTSLOSS [i] <tYOS tGrade CATENL>) ;
```

```
                        i = 1

                         i = 11
MISCLOSS <FY CATENL> = SUM (MISCLOSS [i] <tYOS tGrade CATENL>) ;
                         i = 1

TOTALLOSS <FY CATENL> =  BMTATTLOSS <FY CATENL>
                        + STDATTLOSS <FY CATENL>
                        + ETSLOSS <FY CATENL>
                        + RULOSS <FY CATENL>
                        + EOLOSS <FY CATENL>
                        + PCLOSS <FY CATENL>
                        + RETIREMENT <FY CATENL>
                        + OTSLOSS <FY CATENL>
                        + MISCLOSS <FY CATENL>  ;

/*  by  Grade  */

BMTATTLOSS <FY Grade> = BMTATTLOSS [i = 1] <tYOS Grade>
                         + BMTATTLOSS [i = 2] <tYOS Grade> ;

                         i = 11
STDATTLOSS <FY Grade> = SUM (STDATTLOSS [i] <tYOS Grade>) ;
                         i = 1

                       i = 11
ETSLOSS <FY Grade> = SUM (ETSLOSS [i] <tYOS Grade>) ;
                       i = 1

                      i = 11
RULOSS <FY Grade> = SUM (RULOSS [i] <tYOS Grade>) ;
                      i = 1

                      i = 11
```

```
EOLOSS <FY Grade> = SUM (EOLOSS [i] <tYOS Grade>) ;
                    i = 1

                    i = 11
PCLOSS <FY Grade> = SUM (PCLOSS [i] <tYOS Grade>) ;
                    i = 1

RETIREMENT <FY Grade> = RETIRELOSS [i = 11] <tYOS Grade> ;

                     i = 11
OTSLOSS <FY Grade> = SUM (OTSLOSS [i] <tYOS Grade>) ;
                     i = 1

                      i = 11
MISCLOSS <FY Grade> = SUM (MISCLOSS [i] <tYOS Grade> ) ;
                      i = 1

TOTALLOSS <FY Grade> =  BMTATTLOSS <FY Grade>
                       + STDATTLOSS <FY Grade>
                       + ETSLOSS <FY Grade>
                       + RULOSS <FY Grade>
                       + EOLOSS <FY Grade>
                       + PCLOSS <FY Grade>
                       + RETIREMENT <FY Grade>
                       + OTSLOSS <FY Grade>
                       + MISCLOSS <FY Grade>  ;
```

Output Screen 12: Policy Free ETS Losses by CATENL or Grade.

```
/*  By category of enlistment  */

                      i = 11
ETSLOSS <FY CATENL> = SUM (ETSLOSS [i] <tYOS tGrade CATENL>) ;
                      i = 1
```

```
                        i = 11
RUSHIFT <FY CATENL> = SUM (RUSHIFT [i] <tYOS tGrade CATENL>) ;
                        i = 1

                        i = 11
EOSHIFT <FY CATENL> = SUM (EOSHIFT [i] <tYOS tGrade CATENL>) ;
                        i = 1

                        i = 11
PCSHIFT <FY CATENL> = SUM (PCSHIFT [i] <tYOS tGrade CATENL>) ;
                        i = 1

PFETSLOSS <FY CATENL> =  ETSLOSS <FY CATENL>
                         + RUSHIFT <FY CATENL>
                         + EOSHIFT <FY CATENL>
                         + PCSHIFT <FY CATENL>  ;

/*  By Grade  */

                       i = 11
ETSLOSS <FY Grade> = SUM (ETSLOSS [i] <tYOS Grade>) ;
                       i = 1

                       i = 11
RUSHIFT <FY Grade> = SUM (RUSHIFT [i] <tYOS Grade>) ;
                       i = 1

                       i = 11
EOSHIFT <FY Grade> = SUM (EOSHIFT [i] <tYOS Grade>) ;
                       i = 1

                       i = 11
PCSHIFT <FY Grade> = SUM (PCSHIFT [i] <tYOS Grade>) ;
                       i = 1
```

```
PFETSLOSS <FY Grade> =  ETSLOSS <FY Grade>
                      + RUSHIFT <FY Grade>
                      + EOSHIFT <FY Grade>
                      + PCSHIFT <FY Grade>  ;
```

Output Screen 13: Actual Reenlistments Out by Category of Enlistment or Grade.

```
/*  By category of enlistment  */

                        i = 11
ETSREUPOUT <FY CATENL> = SUM (ETSREUPOUT [i] <tYOS tGrade CATENL> ;
                        i = 1

                       i = 11
FEROUT1 <FY CATENL> = SUM (FEROUT2 [i] <tYOS tGrade CATENL> ;
                       i = 1

                       i = 11
FEROUT2 <FY CATENL> = SUM (FEROUT2 [i] <tYOS tGrade CATENL> ;
                       i = 1

REUPOUT <FY CATENL> = ETSREUPOUT <FY CATENL> + FEROUT1 <FY CATENL>
                                             + FEROUT2 <FY CATENL> ;


/*  By grade  */

                        i = 11
ETSREUPOUT <FY Grade> = SUM (ETSREUPOUT [i] <tYOS Grade> ;
                        i = 1
```

```
                    i = 11
FEROUT1 <FY Grade> = SUM (FEROUT2 [i] <tYOS Grade> ;
                    i = 1

                    i = 11
FEROUT2 <FY Grade> = SUM (FEROUT2 [i] <tYOS Grade> ;
                    i = 1

REUPOUT <FY Grade> = ETSREUPOUT <FY Grade> + FEROUT1 <FY Grade>
                                           + FEROUT2 <FY Grade> ;
```

Output Screen 14: Policy-Free Reenlistments Out by Category of Enlistment or Grade

```
/*  By category of enlistment  */

                      i = 11
ETSREUPOUT <FY CATENL> = SUM (ETSREUPOUT [i] <tYOS tGrade CATENL> ;
                      i = 1

                        i = 11
FEROUT1SHIFT <FY CATENL> = SUM (FEROUT1SHIFT [i] <tYOS tGrade CATENL> ;
                        i = 1

                        i = 11
FEROUT2SHIFT <FY CATENL> = SUM (FEROUT2SHIFT [i] <tYOS tGrade CATENL> ;
                        i = 1

PFREUPOUT <FY CATENL> = ETSREUPOUT <FY CATENL> + FEROUT1SHIFT <FY CATENL>
                                               + FEROUT2SHIFT <FY CATENL> ;
```

```
/*  By grade  */


                          i = 11
ETSREUPOUT <FY Grade> = SUM (ETSREUPOUT [i] <tYOS Grade> ;
                          i = 1


                            i = 11
FEROUT1SHIFT <FY Grade> = SUM (FEROUT1SHIFT [i] <tYOS Grade> ;
                            i = 1


                            i = 11
FEROUT2SHIFT <FY Grade> = SUM (FEROUT2SHIFT [i] <tYOS Grade> ;
                            i = 1

REUPOUT <FY Grade> = ETSREUPOUT <FY Grade> + FEROUT1SHIFT <FY Grade>
                                           + FEROUT2SHIFT <FY Grade> ;
```

Output Screen 15: Force by Grade and YOS.

```
                            i = 11
   ENDINV <FY YOS Grade> = SUM (INV [i] <YOS Grade>) ;
                            i = 1

   TOTYOS <FY YOS> = ENDINV <FY YOS tGrade> ;

   TOTGrade <FY Grade> = ENDINV <FY tYOS Grade> ;

   IF (YOS ≥ 4) THEN
      PERCENT4PLUS <FY Grade> = ((ENDINV <FY tYOS Grade>)
                                 / TOTGrade <FY Grade>) * 100 ;
```

Output Screen 16: Annual Military Personnel Account Costs (Nominal).

```
NBASICPAY <FY> = NBASICPAY <tYOS tGrade> ;
NRETIREPAY <FY> = NRETIREPAY <tYOS tGrade> ;
NBAQVHA <FY> = NBAQVHA <tYOS tGrade> ;
NINCENTPAY <FY> = NINCENTPAY <tYOS tGrade> ;
NMISCPAY <FY> = NMISCPAY <tYOS tGrade> ;
NPCSCOST <FY> = NPCSCOST <tYOS tGrade> ;
NTOTALCOST <FY> = NTOTALCOST <tYOS tGrade> ;
```

Output Screen 17: Annual Military Personnel Account Costs (Constant).

Once the nominal MPA budget has been completed, the estimation of the constant dollar MPA budget is a simple transformation using the Consumer Price Index.

```
CBASICPAY <FY> =
      NBASICPAY <FY>
    * CPI <most recent past fiscal year)
    / CPI <FY>



CRETIREPAY <FY> =
      NRETIREPAY <FY>
    * CPI <most recent past fiscal year)
    / CPI <FY>

CBAQVHA <FY> =
      NBAQVHA <FY>
    * CPI <most recent past fiscal year)
    / CPI <FY>

CINCENTPAY <FY> =
      NINCENTPAY <FY>
    * CPI <most recent past fiscal year)
```

```
    / CPI <FY>

CMISCPAY <FY> =
      NMISCPAY <FY>
    * CPI <most recent past fiscal year)
    / CPI <FY>

CPCSCOST <FY> =
      NPCSCOST <FY>
    * CPI <most recent past fiscal year)
    / CPI <FY>

/*  END OF FISCAL YEAR LOOP:  RETURN TO STEP 1  */
```

OUTPUTS

The output generator of Module 2 aggregates inventory and personnel flows at desirable levels of detail and sends them directly to the Module 2 output screens. These outputs are not explicitly listed here.

Some output from Module 2 is required by Modules 3, 4, and 5. These outputs are listed below.

Outputs to Module 3

Module 3 requires the following outputs in order to perform its calculations. These outputs are conditional on an explicit management action plan and choice of economic climate.

STARTINV <FY YOS> = Starting inventory for each projected fiscal year by YOS.

STARTINV <FY Grade> = Starting inventory for each projected fiscal year by Grade.

TOTALLOSS <FY YOS> = Total loss during fiscal year from inventory with given YOS at the start of each projected fiscal year.

TOTALLOSS <FY Grade>= Total loss during fiscal year from inventory with given Grade at the start of each projected fiscal year.

PROMIN <FY Grade> = Promotions into top five grades.

NPS <FY> = Total non-prior service accessions.

PS <FY> = Total prior service accessions.

ENDINV <FY> = Inventory at end of fiscal year.

ENDINV <FY Grade> = Inventory at end of fiscal year by Grade.

Outputs to Module 4

All input and output screens of Module 2 get sent to Module 4.

Outputs to Module 5

NPS4

NPS6

PS

RULOSS

EOLOSS <CATENL>

PROMOUT <Grade>

DEMOOUT <Grade>

OTSGAIN

MISCGAIN

PCLOSS

OTSLOSS

MISCLOSS

BMTATTLOSS <CATENL, Grade>

STDATTLOSS <CATENL, Grade>

PFETSLOSS <CATENL, Grade>

RETIREMENT <CATENL, Grade>

REENLISTOUT <CATENL, Grade>

RETELIGOUT <CATENL, Grade>

MILCIV <FY> = Military/civilian wage ratio for FY analyzed by MTA5.

CPI <FY> = Consumer Price Index for FY analyzed by MTA5.

MILCIV <FPY> = Military/civilian wage ratio for current FY--i.e., the "first projection year" in the MTA model.

CPI <FPY> = Consumer Price Index for current FY--i.e., the "first projection year" in the MTA model.

STARTINV <CATENL, Grade>

EOSHIFT <FY, Grade, CATENL>

PCSHIFT <FY, Grade, CATENL>

PCLOSS <FY, Grade, CATENL, YETS = 1>

PCLOSS <FY, Grade, CATENL, YETS = 0>

PCLOSS <FY, Grade, CATENL, YETS = -1>

PCLOSS <FY, Grade, CATENL, Track = 11>

Appendix F

MODULE 3 ACTION DIAGRAM (COMPUTER-AIDED DESIGN OF MANAGEMENT ACTIONS)

This appendix documents the inputs, calculations, and outputs of Module 3.

INPUTS

Inputs from Module 1

The proportions of accessions that survive to the end of the fiscal year, and the proportions of inventory that have YOS = 0 at the start of the year that survive to the end of the year, are estimated in Module 1 from experience during the three years before the first projection year.

S1D4 = Proportion of NPS4 accessions during a fiscal year that survive to the end of the fiscal year and are in grade E-1 at the end of the fiscal year.

S1D5 = Proportion of NPS4 accessions during a fiscal year that survive to the end of the fiscal year and are in grade E-2 at the end of the fiscal year.

S2D4 = Proportion of STARTINV [1] <Grade = 1, YOS = 0> that survive to the end of the fiscal year and are in grade E-2 at the end of the fiscal year.

S2D5 = Proportion of STARTINV [1] <Grade = 1, YOS = 0> that survive to the end of the fiscal year and are in grade E-3 at the end of the fiscal year.

S3D3 = Proportion of STARTINV [1] <Grade = 2, YOS = 0> that survive to the end of the fiscal year and are in grade E-3 at the end of the fiscal year.

S6D3 = Proportion of NPS6 accessions during a fiscal year that survive to the end of the fiscal year and are in grade E-1 at the end of the fiscal year.

S6D4 = Proportion of NPS6 accessions during a fiscal year that survive to the end of the fiscal year and are in grade E-3 at the end of the fiscal year.

S7D3 = Proportion of STARTINV [2] <Grade = 1, YOS = 0> that survive to the end of the fiscal year and are in grade E-3 at the end of the fiscal year.

S8D2 = Proportion of STARTINV [2] <Grade = 3, YOS = 0> that survive to the end of the fiscal year and are in grade E-3 at the end of the fiscal year.

Inputs from Module 2

The inputs from Module 2 must be for an explicit plan of management actions and economic conditions. Only a few variables from Module 2's output are needed in Module 3's calculations. However, the conclusions from Module 3 are conditional upon the entire Module 2 analysis.

For all projection years, for all YOS

TOTALLOSS <FY, YOS> = Total loss during fiscal year from inventory with given YOS at the start of the fiscal year, resulting from plan currently being tested by Module 2.

STARTINV <FY, YOS> = Starting inventory for fiscal year with given YOS at the start of the fiscal year, resulting from plan currently being tested by Module 2.

NPS <FY> = Total NPS accessions in plan currently being tested by

Module 2.

ENDINV <FY> = Inventory at end of fiscal year, resulting from plan currently being tested by Module 2.

For all projection years, for Grade = 5 through 9:

TOTALLOSS <FY, Grade> = Total loss during fiscal year from inventory with given grade at the start of the fiscal year, resulting from plan currently being tested by Module 2.

STARTINV <FY, Grade> = Starting inventory for fiscal year with given grade at the start of the fiscal year, resulting from plan currently being tested by Module 2.

PROMIN <FY, Grade> = Promotions into top five grades in plan currently being tested by Module 2.

ENDINV <FY, Grade> = Inventory at end of fiscal year by grade, for grades 5 through 9, resulting from plan currently being tested by Module 2.

From Module 3 Input Screen

The goals that Module 3 designs management actions to achieve are from the input screen to the module.

GradeCEILING <FY, Grade> = Grade strength goal.

ENDSTRENGTH <FY> = End strength goal.

CALCULATIONS

Choosing Accessions to Achieve End Strength Goals

Additional End Strength Required to Achieve Goal.

E <FY> = ENDSTRENGTH <FY> - ENDINV <FY>

Definition of Survival Rates.

SURVIVENEWNPS <FY> = Proportion of NPS accessions during a fiscal year that are still in the enlisted force at the end of that fiscal year.

Sab = Proportion of NPS accessions that enter the enlisted force during FY = a and are still in the enlisted force at the start of FY = b that survive to the end of FY = b.

```
+- Do for all projection years, FY = 1 through 9:
|
|  SURVIVENEWNPS <FY> =
|      [ NPS4 <FY> * (S1D4 + S1D5) + NPS6 <FY> * (S6D3 + S6D4) ]
|      / [ NPS4 <FY> + NPS6 <FY> ]
|
+- End

+- Do for a = 1 through 8
|
|  +- Do for  b = a + 1 through 9
|  |
|  | If b = a + 1 then
|  |
|  | Sab =
|  |     [ NPS4 <a> * ((S1D4) * (S2D4 + S2D5) + (S1D5) * (S3D3))
|  |       + NPS6 <a> * ((S6D3) * (S7D3) + (S6D4) * (S8D2)) ]
|  |     / [ NPS4 <a> * (S1D4 + S1D5) + NPS6 <a> * (S6D3 + S6D4) ]
|  |
```

```
|  | Else if b > a+1
|  |
|  | Sab =  1 - TOTALLOSS <FY = b, YOS = b - a - 1> / STARTINV <FY = b, YOS =
b - a - 1>
|  |
|- +End
+- End
```

To understand the above formula for Sab in terms of the YOS-specific loss rate, think of accessions that enter the force in FY = a. At the end of FY = a those accessions have YOS = 0, at the end of FY = a + 1 those accessions have YOS = 1, and at the end of FY = a + (b - a) those accessions have YOS = (b - a). Consequently, at the *beginning* of FY = a + (b - a) = b those accessions have YOS = (b - a - 1).

Additional NPS Accessions that Survive to End of Fiscal Year. It turns out to be easier to first calculate the additional accessions that must survive to the end of the fiscal year. These survived accessions are then inflated by dividing by the partial year survival rate, SURVIVENEWNPS, to obtain the the additional accessions during the fiscal year.

Let Ab = additional accessions during FY = b that survive to the end of that fiscal year. For the first projection year, the additional survived accessions equal the additional end strength. For the subsequent projection years, the additional survived accessions equal the additional end strength minus survivors from earlier year's additional accessions.

```
A1 =   E <FY = 1>

A2 =   E <FY = 2>
     - (A1) * (S12)

A3 =   E <FY = 3>
     - (A2) * (S23)
     - (A1) * (S12) * (S13)
```

A4 = E <FY = 4>
- (A3) * (S34)
- (A2) * (S23) * (S24)
- (A1) * (S12) * (S13) * (S14)

A5 = E <FY = 5>
- (A4) * (S45)
- (A3) * (S34) * (S35)
- (A2) * (S23) * (S24) * (S25)
- (A1) * (S12) * (S13) * (S14) * (S15)

A6 = E <FY = 6>
- (A5) * (S56)
- (A4) * (S45) * (S46)
- (A3) * (S34) * (S35) * (S36)
- (A2) * (S23) * (S24) * (S25) * (S26)
- (A1) * (S12) * (S13) * (S14) * (S15) * (S16)

A7 = E <FY = 7>
- (A6) * (S67)
- (A5) * (S56) * (S57)
- (A4) * (S45) * (S46) * (S47)
- (A3) * (S34) * (S35) * (S36) * (S37)
- (A2) * (S23) * (S24) * (S25) * (S26) * S(27)
- (A1) * (S12) * (S13) * (S14) * (S15) * (S16) * (S17)

A8 = E <FY = 8>
- (A7) * (S78)
- (A6) * (S67) * (S68)
- (A5) * (S56) * (S57) * (S58)
- (A4) * (S45) * (S46) * (S47) * (S48)
- (A3) * (S34) * (S35) * (S36) * (S37) * (S38)
- (A2) * (S23) * (S24) * (S25) * (S26) * S(27) * (S28)
- (A1) * (S12) * (S13) * (S14) * (S15) * (S16) * (S17) * (S18)

A9 = E <FY = 9>
- (A8) * (S89)
- (A7) * (S78) * (S79)
- (A6) * (S67) * (S68) * (S69)
- (A5) * (S56) * (S57) * (S58) * (S59)
- (A4) * (S45) * (S46) * (S47) * (S48) * S(49)
- (A3) * (S34) * (S35) * (S36) * (S37) * (S38) * (S39)
- (A2) * (S23) * (S24) * (S25) * (S26) * S(27) * (S28) * (S29)
- (A1) * (S12) * (S13) * (S14) * (S15) * (S16) * (S17) * (S18) * (S19)

Additional NPS Accessions During Fiscal Year. The additional NPS accessions required during each fiscal year equal the survived accessions required at the end of the fiscal year divided by the rate at which accessions during the fiscal year survive to the end of the fiscal year.

Do for b = 1 through 9:

ADDNPS <b> = Ab / SURVIVENEWNPS <b>

New Total NPS Accessions. The new plan's total NPS accessions equal the old plan's accessions plus the additional accessions.

Do for FY = 1 through 9:

NEWNPS <FY> = NPS <FY> + ADDNPS <FY>

Choosing Promotions to Achieve Grade Strength Goals

The additional promotions necessary to achieve required additions to grade strengths equal the required additions to grade strengths minus survivors of additions to grade strength made in the previous fiscal year plus additional promotions to the next higher grade in the given fiscal year. The calculations are straightforward provided one does

Grade 9 for fiscal years 1 through 9 first, then Grade 8 for fiscal years 1 through 9, and so on.

Additional Grade Strength Required to Achieve Goal.

```
Do for Grade = 5 though 9:

G <FY, Grade> = GradeCEILING <FY, Grade> - ENDINV <FY, Grade>
```

Grade 9 Additional Promotions.

```
Do for FY = 1:

ADDPROM<1,9> = G<1,9>

Do for FY = 2 through 9:

ADDPROM<FY,9> =   G<FY,9>
          - G<FY-1,9> * [1 - TOTALLOSS<FY,9> / STARTINV<FY,9>]
```

Grade 8 Additional Promotions.

```
Do for FY = 1:

ADDPROM<1,8> =   G<1,8>
         + ADDPROM<1,9>

Do for FY = 2 through 9:

ADDPROM<FY,8> =   G<FY,8>
          - G<FY - 1,8> * [1 - TOTALLOSS<FY,8> / STARTINV<FY,8>]
          + ADDPROM<FY,9>
```

Grade 7 Additional Promotions.

```
Do for FY = 1:

ADDPROM<1,7> =   G<1,7>
         + ADDPROM<1,8>

Do for FY = 2 through 9:

ADDPROM<FY,7> =   G<FY,7>
          - G<FY - 1,7> * [1 - TOTALLOSS<FY,7> / STARTINV<FY,7>]
          + ADDPROM<FY,8>
```

Grade 6 Additional Promotions.

```
Do for FY = 1:

ADDPROM<1,6> =   G<1,6>
         + ADDPROM<1,7>

Do for FY = 2 through 9:

ADDPROM<FY,6> =   G<FY,6>
          - G<FY - 1,6> * [1 - TOTALLOSS<FY,6> / STARTINV<FY,6>]
          + ADDPROM<FY,7>
```

Grade 5 Additional Promotions.

```
Do for FY = 1:

ADDPROM<1,5> =   G<1,5>
         + ADDPROM<1,6>

Do for FY = 2 through 9:
```

ADDPROM<FY,5> = G<FY,5>
- G<FY - 1,5> * [1 - TOTALLOSS<FY,5> / STARTINV<FY,5>]
+ ADDPROM<FY,6>

New Promotions to Top Five Grades.

Do for all projection years and GradeS 5 through 9:

NEWPROMIN <FY, Grade> = PROMIN <FY, Grade> + ADDPROM <FY, Grade>

OUTPUTS

The following outputs get placed on Output Screens 1 through 3:

G <FY, Grade> = Additional inventory in given grade required to meet grade strength goal.

ADDPROM <FY, Grade> = Additional promotions into given grade required to achieve grade strength goal.

NEWPROMIN <FY, Grade> = Promotions into top five grades required to achieve grade strength goals.

E <FY> = Additional total inventory required to meet end strength goal.

ADDNPS <FY> = Additional NPS accessions required to achieve end strength goal.

NEWNPS <FY> = Total NPS accessions required to achieve end strength goals.

Appendix G

MODULE 5 ACTION DIAGRAM (MONTHLY PROJECTIONS)

This appendix documents the inputs, calculations, and outputs of Module 5.

INPUTS

Most of the inputs needed by MTA5 are inputs that have already been provided to SAM2 for the current fiscal year. These inputs are assumed to be available to MTA5 without being explicitly mentioned. The inputs discussed below are those needed to revise or replace those SAM2 inputs that vary by fiscal year.

Inputs from MTA2 for MTA5 Input Screens

The input screens for the MTA5 module are the same as the SAM2 input screens. However, users will not be able to change the annual totals of monthly inputs on these screens. Rather, those annual totals will be obtained from MTA2. To change the annual totals users will have to go back to MTA2. This model design facilitates top down planning of management actions: Annual actions for a given fiscal year are planned in the context of results for many years, then monthly actions are planned in the context of a single year.

For all the input screens listed below, (1) obtain the annual totals of the indicated variables from MTA2 for the specific fiscal year of interest, (2) place these totals at the bottom of the input screen, and (3) revise the SAM2 code so that the last month in the fiscal year (September) will be calculated as a residual from the yearly total. Users will be able to change the numbers for the first 11 months in the fiscal year. Note that users will have to be careful not to let the input for the 12th month become negative.

For MTA5 Input Screen 2.

NPS4

NPS6

PS

For MTA5 Input Screen 3.

RULOSS

This screen is the exception to the general pattern of placing the control totals at the bottom of the screen. Here the control total is across all entries in the table. Make the lower right corner cell in the table be the one that is calculated as a residual.

For MTA5 Input Screen 4.

EOLOSS <CATENL>

For MTA5 Input Screen 5.

PROMOUT <Grade>

For MTA5 Input Screen 6.

DEMOOUT <Grade>

For MTA5 Input Screen 7.

OTSGAIN

MISCGAIN

For MTA5 Input Screen 8.

PCLOSS

OTSLOSS

MISCLOSS

Other Inputs from MTA2

Needed to Generate SAM1 output.

NPS4

NPS6

BMTATTLOSS <CATENL, Grade>

STDATTLOSS <CATENL, Grade>

PFETSLOSS <CATENL, Grade>

RETIREMENT <CATENL, Grade>

REENLISTOUT <CATENL, Grade>

RETELIGOUT <CATENL, Grade>

Needed to Update Cost Factors.

MILCIV <FY> = Military/civilian wage ratio for FY analyzed by MTA5.

CPI <FY> = Consumer Price Index for FY analyzed by MTA5.

MILCIV <FPY>= Military/civilian wage ratio for current FY--i.e., the "first projection year" in the MTA model.

CPI <FPY> = Consumer Price Index for current FY--i.e., the "first projection year" in the MTA model.

Other Inputs.

STARTINV <CATENL, Grade>

EOSHIFT <FY, Grade, CATENL>

PCSHIFT <FY, Grade, CATENL>

PCLOSS <FY, Grade, CATENL, YETS = 1>

PCLOSS <FY, Grade, CATENL, YETS = 0>

PCLOSS <FY, Grade, CATENL, YETS = -1>

PCLOSS <FY, Grade, CATENL, Track = 11>

Inputs from MTA1

These inputs to MTA5 are needed generate the equivalent of SAM1 output.

dINVATT <CATENL, Grade, dMonth>

dPFETSLOSS <CATENL, Grade, dMonth>

dRETIREMENT <CATENL, Grade, dMonth>

dREENLISTOUT <CATENL, Grade, dMonth>

dRETELIGOUT <CATENL, Grade, dMonth>

S1D1

S1D2

S6D1

S1D3

S6D2

CALCULATIONS

Starting Inventory

The MTA5 module will start its monthly projections from the inventory that exists at the start of the fiscal year being analyzed.

STARTINV <CATENL, Grade>

Estimation of Attrition from Starting Inventory

```
NPSATTLOSS <CATENL = 1, Grade = 1> =
        NPS4 * (S1D1 + S1D2)
      + NPS6 * S6D1
NPSATTLOSS <CATENL = 1, Grade = 2> =
        NPS4 * S1D3
NPSATTLOSS <CATENL = 1, Grade = 3> =
        NPS6 * S6D2
INVATT <CATENL, Grade> =
           BMTATTLOSS <CATENL, Grade>
         + STDATTLOSS <CATENL, Grade>
         - NPSATTLOSS <CATENL, Grade>
```

Estimation of SAM1 Outputs

To see where these inputs enter the SAM2 module, and hence must enter the MTA5 module, see Rydell and Lawson (1990).

```
INVATT <CATENL, Grade, Month> =
        INVATT <CATENL, Grade>
      * dINVATT <CATENL, Grade, dMonth>
```

```
PFETSLOSS <CATENL, Grade, Month> =
        PFETSLOSS <CATENL, Grade>
      * dPFETSLOSS <CATENL, Grade, dMonth>
RETIREMENT <CATENL, Grade, Month> =
        RETIREMENT <CATENL, Grade>
      * dRETIREMENT <CATENL, Grade, dMonth>
REENLISTOUT <CATENL, Grade, Month> =
        REENLISTOUT <CATENL, Grade>
      * dREENLISTOUT <CATENL, Grade, dMonth>
RETELIGOUT <CATENL, Grade, Month> =
        RETELIGOUT <CATENL, Grade>
      * dRETELIGOUT <CATENL, Grade, dMonth>
```

Updating of Cost Factors

The inputs to the SAM2 module for the current fiscal year include cost factors such as BASICPAYFACTOR <Grade>. These must be updated to the fiscal year being analyzed using the ratio of military to civilian wages, MILCIV <FY>, and the Consumer Price Index, CPI <FY>, for the fiscal year being analyzed. These indexes must be normalized by their value during the first projection year, FPY. The indexes for both the fiscal year being analyzed and the current projection year are obtained from MTA2 (Input Screen 1).

```
BASICPAYFACTOR <FY, Grade> =
     BASICPAYFACTOR < Grade>
   * [ MILCIV <FY> * CPI <FY> ]
   / [ MILCIV <FPY> * CPI <FPY> ]

RETIREPAY <FY, Grade> =
     RETIREPAY < Grade>
   * [ MILCIV <FY> * CPI <FY> ]
   / [ MILCIV <FPY> * CPI <FPY> ]
BAQVHA <FY, Grade> =
     BAQVHA < Grade>
```

```
   * [ MILCIV <FY> * CPI <FY> ]
   / [ MILCIV <FPY> * CPI <FPY> ]
INCENTPAY <FY, Grade> =
     INCENTPAY < Grade>
   * [ MILCIV <FY> * CPI <FY> ]
   / [ MILCIV <FPY> * CPI <FPY> ]
MISCPAY <FY, Grade> =
     MISCPAY < Grade>
   * [ MILCIV <FY> * CPI <FY> ]
   / [ MILCIV <FPY> * CPI <FPY> ]
PCSCOST <FY, Grade> =
     PCSCOST < Grade>
   * [ MILCIV <FY> * CPI <FY> ]
   / [ MILCIV <FPY> * CPI <FPY> ]
```

Early Release Shifts

The early release shifts in the fiscal year being analyzed that come from early release losses that occurred before the start of the fiscal year must be constructed by taking the estimated shifts for the current fiscal year (that come with SAM2) and adjusting them with total annual shifts from the MTA2 module.

```
EOSHIFTHIST <FY, Grade, CATENL, Month> =
    EOSHIFTHIST <Grade, CATENL, Month>
  * EOSHIFT <FY, Grade, CATENL>
  / tEOSHIFTHIST <Grade, CATENL, tMonth>
PCSHIFTHIST <FY, Grade, CATENL, Month> =
    PCSHIFTHIST <Grade, CATENL, Month>
  * [ PCSHIFT <FY, Grade, CATENL>
      - PCLOSS <FY, Grade, CATENL, YETS = 1>
      - PCLOSS <FY, Grade, CATENL, YETS = 0>
      - PCLOSS <FY, Grade, CATENL, YETS = -1> ]
      - PCLOSS <FY, Grade, CATENL, Track = 11 ]
  / tPCSHIFTHIST <Grade, CATENL, tMonth>
```

Note that PCSHIFT from the MTA2 module is too large a control total because it contains shifts caused by PC losses in the fiscal year being analyzed as well as from earlier fiscal years. Subtracting off the extra shifts in PCSHIFT gives the control total needed to adjust the PCSHIFTHIST variable. The condition YETS = i means to subtract this variable only for middle term accounting cells where YETS = i, and the condition Track = 11 means to subtract this variable only for middle term accounting cells in Track 11.

OUTPUTS

The MTA5 module will produce exactly the same output screens as the SAM2 module. Those screens are:

Summary Output Screen 1: Summary of Plan Performance
Summary Output Screen 2: Summary of Short-Term Management Actions

Detailed Output Screen 1: Inventory Change by Grade
Detailed Output Screen 2: Inventory Change by Category of Enlistment
Detailed Output Screen 3: Gains by CATENL and Grade
Detailed Output Screen 4: Losses by CATENL and Grade
Detailed Output Screen 5: Attrition Losses
Detailed Output Screen 6: Policy Free ETS Losses by CATENL and Grade
Detailed Output Screen 7: Inventory at End of Month by CATENL
Detailed Output Screen 8: MPA Cost for Fiscal Year

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