

AL-SR-1991-0005



AD-A235 547



ARMSTRONG
LABORATORY

NONLINE OFFICER PROJECTION MODEL

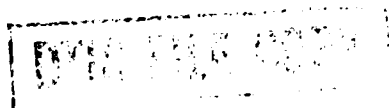
Michael Grant, Capt, USAF

HUMAN RESOURCES DIRECTORATE
MANPOWER AND PERSONNEL DIVISION
Brooks Air Force Base, TX 78235-5000

May 1991

Final Report for Period April 1985 - March 1991

Approved for public release; distribution is unlimited.



DTIC
ELECTE
MAY 16 1991
S B D

91 5 15 037

AIR FORCE SYSTEMS COMMAND
BROOKS AIR FORCE BASE, TEXAS 78235-5000

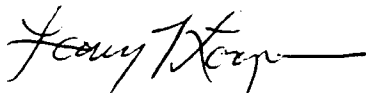
NOTICES

This is a Special Report prepared for the Air Force Directorate of Personnel Plans, Analysis Division (AF/DPXA).

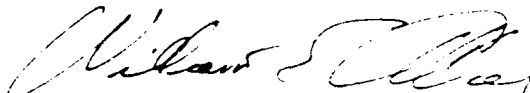
When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely Government-related procurement, the United States Government incurs no responsibility or any obligation whatsoever. The fact that the Government may have formulated or in any way supplied the said drawings, specifications, or other data, is not to be regarded by implication, or otherwise in any manner construed, as licensing the holder, or any other person or corporation; or as conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

The Office of Public Affairs has reviewed this report, and it is releasable to the National Technical Information Service, where it will be available to the general public, including foreign nationals.

This report has been reviewed and is approved for publication.



LARRY T. LOOPER
Chief, Decision Model Function



WILLIAM E. ALLEY, Technical Director
Manpower and Personnel Division



MICHAEL W. BIRDLEBOUGH, Colonel, USAF
Chief, Manpower and Personnel Division

REPORT DOCUMENTATION PAGEForm Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE May 1991	3. REPORT TYPE AND DATES COVERED Final Report - April 1985 - March 1991
4. TITLE AND SUBTITLE Nonline Officer Projection Model		5. FUNDING NUMBERS PE - 62205F PR - 7719 TA - 20 WU - 07	
6. AUTHOR(S) Michael Grant			
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Armstrong Laboratory Human Resources Directorate Manpower and Personnel Division Brooks Air Force Base, TX 78235-5000		8. PERFORMING ORGANIZATION REPORT NUMBER AL-SR-1991-0005	
9. SPONSORING/MONITORING AGENCY NAMES(S) AND ADDRESS(ES)		10. SPONSORING/MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES In support of RPR 85-13, Nonline Officer Projection Model			
12a. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution is unlimited.		12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words) The Nonline Officer Projection Model (NOPM), written in SIMSCRIPT II.5 computer simulation language, produces displays of personnel activities and projects the nonlinear officer force structure for a least 10 years in the future. The model simulates the following personnel activities: promotions, augmentations, accessions, separations, reduction-in-force boards, and selective early retirement boards. The model allows the user to control many options, such as scheduling promotion dates and other personnel activities. The NOPM has been completed and transitioned to AF/DPXA.			
14. SUBJECT TERMS nonline officer force personnel flow model		15. NUMBER OF PAGES 18 16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT UL

TABLE OF CONTENTS

	Page
I. BACKGROUND	1
Model Development	1
II. INPUT FILES	1
Baseline Data File	2
External Events File	2
Officer Inventory	2
III. THE MODEL	3
General Characteristics	3
Personnel Activities Which Affect the Force Structure	5
Promotions	5
Augmentations	6
Accessions	6
Separations	6
Reduction-in-Force (RIF) Boards	6
Selective Early Retirement Boards (SERBs)	6
IV. OUTPUT REPORTS	7
V. CONCLUSION	7

LIST OF FIGURES

	Page
1 Model Flowchart	4
2 Example Event Set	5
3 Reports in Output File	7

Accession For	
NTIS GRA&I	☒
DTIC TAB	☐
Unannounced	☐
Justification	
By _____	
Distribution/ _____	
Availability Codes	
Dist	Avail and/or Special
A-1	

PREFACE

This project was performed in response to Request for Personnel Research (RPR) 85-13 entitled "Nonline Officer Projection Model," submitted by Headquarters Air Force, Directorate of Personnel Plans, Analysis Division (HQ AF/DPXA). It was accomplished as part of Project 7719, Force Acquisition and Distribution Systems, and Task 771920, Manpower and Personnel Models. It is part of the Manpower and Personnel Division's research to assist Air Force personnel planners in making the best use of limited fiscal and personnel resources to accomplish the Air Force mission.

Appreciation is expressed to Capt Bobby R. Treat for his original design work with the FORTRAN version and Mr Larry T. Looper and Capt Sheree Engquist for their assistance and knowledge of modeling personnel flows. Finally, the author wishes to thank Mrs Kathy Suggs for her effort in putting this document in its final form.

SUMMARY

Analyzing the effects of compensation, promotion, and policy alternatives on Air Force officers is of key concern to effective personnel management. The officer inventory will fluctuate with respect to these changes; so, the Air Force needs to be able to predict the impact that might occur. Officer strength projection models are used for decision making and force planning to explore the projected impact of proposed changes to the way the officer force is managed. Initially, such projection models were developed for the large force of line officers and then used by the decision-makers for the smaller nonlinear officer force. However, the many differences between the two forces call for separate projection models. To meet this need, the Air Force Directorate of Personnel Plans, Analysis Division (AF/DPXA) requested a model that would

1. dynamically simulate personnel activity for each competitive nonlinear category, and
2. provide detailed displays that would portray the personnel activity during the model simulation.

The Nonlinear Officer Projection Model (NOPM), written in the SIMSCRIPT II.5 simulation language, simulates many real-world personnel activities (i.e. promotions, augmentations, and separations), using current nonlinear officer data to make projections. The model produces several displays of the personnel activities and also projects the nonlinear officer force structure for at least 10 years in the future. It also allows the user to control several options, to change constraints such as the dates of promotion boards, and to evaluate the results of such a policy decision. The model was transitioned to AF/DPXA upon completion.

NONLINE OFFICER PROJECTION MODEL

I. BACKGROUND

In order to make effective use of limited personnel and fiscal resources, the Air Force uses force projection and management models to analyze the effects of compensation, promotion, and policy alternatives on officer personnel. Proper use of such models provides more effective force planning and greater insight into the impacts of proposed changes to the officer force structure. Unfortunately, current force projection models do not distinguish between the various nonlinear categories and the line force. The nonlinear promotion-competitive categories consist of the Judge Advocate General (JAG) Corps, Chaplain Corps, Medical Corps, Dental Corps, Medical Service Corps, and Biomedical Service Corps officers.

This special report presents an improved method to separately manage the nonlinear force. The Nonlinear Officer Projection Model (NOPM) was developed in response to Request for Personnel Research (RPR) 85-13 from the Air Force Directorate of Personnel Plans, Analysis Division (DPXA). This report describes the model and illustrates how the model is run. Section II explains the model's input files. User-selected input variables from those files significantly impact the model's personnel activities and the resulting output. Section III describes the NOPM itself and the simulated personnel activities. Section IV explains the output reports that summarize the nonlinear officer force's personnel activities and inventory levels. Section V provides a conclusion.

As requested in the RPR, this model (a) dynamically simulates personnel activity for each competitive nonlinear officer category, and (b) provides detailed displays of the personnel activity during model simulation.

Model Development

In 1985, the Air Force Human Resources Laboratory (AFHRL)¹ began working on the NOPM and initially used the FORTRAN computer language. However, it soon became apparent that a simulation language such as SIMSCRIPT II.5 was more appropriate for the development of a promotion flow model. By November 1986, a SIMSCRIPT II.5 version of the model was completed, demonstrated, and accepted by the users, AF/DPXA and the Policy Division (AF/DPXO). The model's transition to Air Staff began in January 1987 and was completed in December 1987.

The NOPM consists of three main parts: the input files (Section II), the model (Section III), and the output reports (Section IV) used for decision making.

II. INPUT FILES

The model input is contained in three separate files:

1. Baseline data file - This file includes the simulation start and stop dates, number of iterations, separation rates, etc.

¹AFHRL has been redesignated Human Resources Directorate, Armstrong Laboratory.

2. External events file - This file includes the personnel activities and information about policy decision changes which occur at a specified time in the simulation.

3. Officer inventory file - This file includes actual attributes of the current inventory of nonlinear officers.

Baseline Data File

The baseline data file contains the basic information needed to control the model. For example, the dates to begin and end the model simulation are stated in this file. Additionally, separation rates determined from past officer separation data are included. These rates establish the probability of separation for a nonlinear officer in each specific competitive category, defined by time-in-grade and time-in-service. A list of the grade structure for each competitive category is also included. Specific grades are unattainable with certain amounts of time-in-service. For example, a JAG officer with over 30 years of service could not be a captain. The list sets the limits for promotions within each competitive category. Information on accessions, such as distribution of the accession pool, is also included in the baseline data file.

Other information included in the baseline data file to control the model are option indicators set by the user, report flags (which select the output reports to print), the number of iterations to run the model, the competitive category indicator, the number of officers in the inventory, and the number of officers allowed in the inventory.

External Events File

The second input file is the external events file. This file includes the personnel activities and information about policy changes that occur at a specified time in the simulation. In this file, the user sets the date and time for the external events to occur and the event's characteristic information. For example, the user may specify a majors' promotion board on February 15, 1990. The model will schedule the board at the appropriate time during the simulation run.

The following boards are scheduled in the external events file: promotion boards, Regular commission appointment boards, reduction-in-force (RIF) boards, and selective early retirement boards. Additionally, the external events file contains routines that allow the user to change accession information, separation rates, and other miscellaneous parameters throughout the simulation.

Officer Inventory

The third input file, the officer inventory file, contains the actual officer attributes of the current inventory. This file is created from the Air Force Military Personnel Center's officer personnel record files, which are updated quarterly. At the time of the run initialization, the model creates from the officer inventory file an officer with the following attributes: grade, nonselection counter, component (Regular/Reserve), date of rank, active duty service commitment date, date of separation, date of commissioning, date of entry to active duty, promotion date, quality index, and selective early retirement board (SERB) index.

III. THE MODEL

General Characteristics

The NOPM is written in a computer simulation language called SIMSCRIPT II.5. This simulation language has a time-scale, called the "event set," which efficiently models events over time. Editing, adding, and deleting data are accomplished with a user-friendly routine.

Because SIMSCRIPT II.5 is an entity-based language (simulates with individual records) and allows discrete event simulation, the NOPM is an entity-based discrete event simulation model. An example of an entity in this case is each officer, and an event may be a promotion board or any of the other personnel activities modeled by the NOPM. During the run, the individual entities (each officer) proceed through the simulated events at discrete points in time. Meanwhile, each officer's attributes are changed based on the events corresponding to policy decisions.

When the user starts the model (see Figure 1), he/she is prompted to select several options which control the baseline data file and the external events file. One of the controlled options is promotion board dates.

The NOPM will schedule the events on an event set or time-line (see Figure 2). After all events are scheduled, the model reads the officer data in the current officer inventory input file. After all three input files are read, the model begins simulating the events on the event set (see Figure 2). The model will proceed through the event set until it encounters an event. It will then leave the event set routine and perform the scheduled event's routine. When the event is completed, the model returns to the event set to obtain the next scheduled event. The model will perform the event and return once again to the event set.

As illustrated in the general flowchart (Figure 1), the simulation continues through the event set until all scheduled events are simulated. The model will start at the beginning and run another iteration through the same steps until it completes the number of iterations chosen by the user. Each iteration is a statistical sample and averaged to obtain the final numbers in the output reports. When all the iterations are completed, the model will print the user-selected reports; then the operation is finished.

The model can project the nonlinear officer force structure for at least 10 years in the future. This aspect of the model is very useful in that Air Staff can use the model's projections to determine the best time to schedule a promotion board. Different board dates can be selected, variations in the force structure 10 years from the present date can be run with the NOPM, and the results can be studied to aid in decision making. The NOPM displays the simulated personnel activities in simple, readable output reports.

Because nonlinear officer promotion selections occur within a single competitive category independently of the other categories, the model is run for only one competitive category at a time. Therefore, to run the model the user must initially specify the nonlinear competitive category.

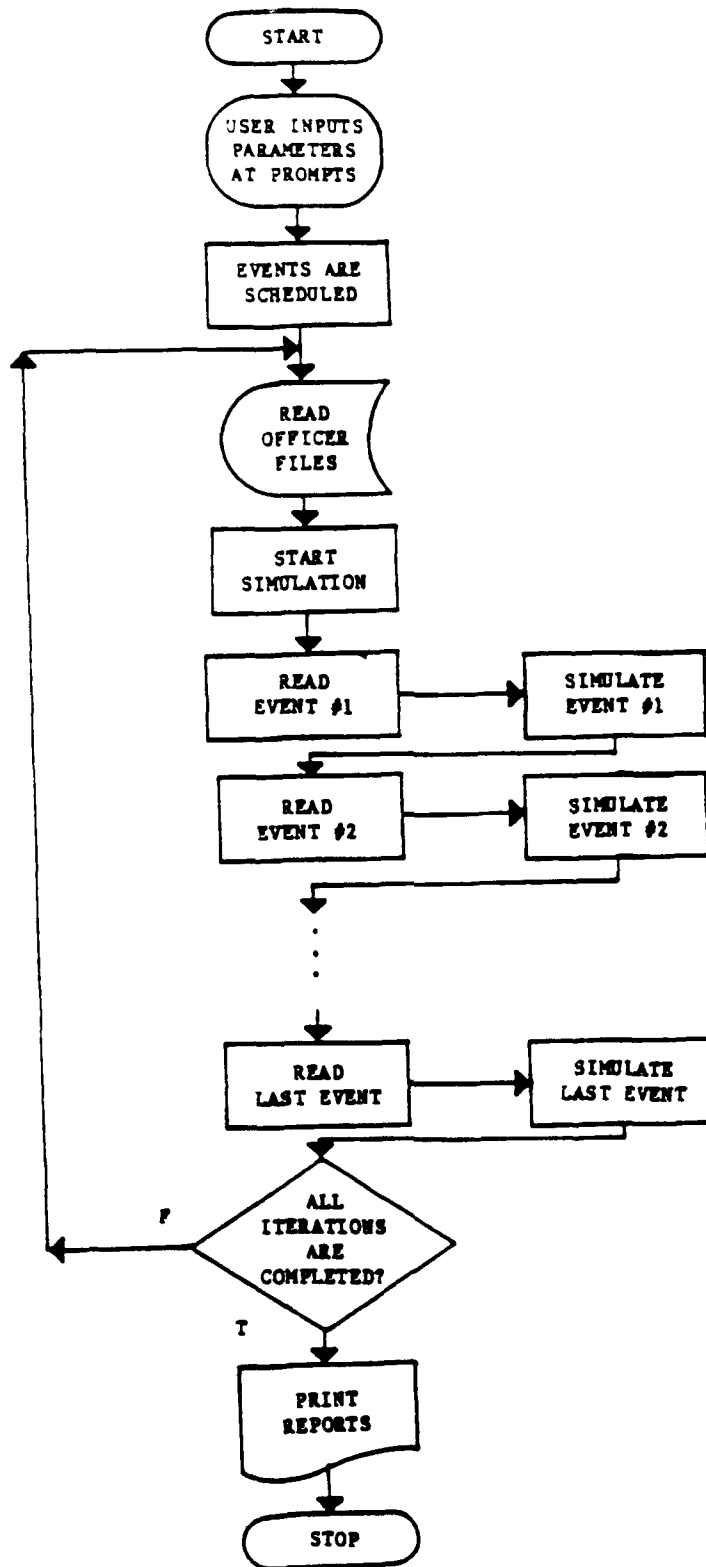


Figure 1. Model Flowchart.

SCHEDULE	EVENT
1 Jan 89	Simulation Start Date
5 Jan 89	Officers' Accession
12 Jun 89	Augmentation Board
24 May 89	Promotion Board
30 Jun 89	RIF Board
10 May 89	Promotion Board
13 May 89	Officers' Accession
*	*
*	*
*	*
*	*
1 Jan 93	End Simulation

Figure 2. Example Event Set.

Personnel Activities Which Affect the Force Structure

There are six personnel activities modeled in the NOPM which affect the force structure of the nonlinear competitive category being modeled: promotions, augmentations (Regular commissioned officer inventory increases), accessions (new officers added to the total nonlinear category inventory), separations, reduction-in-force boards, and selective early retirement boards.

Promotions

Officers are promoted in either of two ways: (a) through a selection board, or (b) by becoming fully qualified. In the model, the selection boards are scheduled in the external events input file. The model first determines the list of eligible officers in each promotion zone. Then, the model makes the promotion selections based on either the promotion opportunity or historical promotion rates.

The number of officers promoted with the promotion opportunity option is determined by the number of grade vacancies due to separations/retirements or promotions. For example, if a JAG major separates or is promoted to lieutenant colonel, an eligible JAG captain is promoted to major to fill the vacancy. On the other hand, the number of officers promoted with the historical promotion rate option is determined by the numbers selected in past promotion boards. Therefore, the same number of officers promoted in the past in that nonlinear category will be promoted in the model's promotion boards. The user selects the option for promotion board selections. The list of officers eligible for promotion is exhausted each month.

As occurs in the real world, the model also promotes officers when they become fully qualified. Being fully qualified literally means one is automatically scheduled for promotion after a specified time interval and no selection board is necessary to obtain the promotion. The basis for being fully qualified is date of rank and time-in-grade. For example, a JAG officer enters the force as a first lieutenant, and after 6 months of active duty is fully qualified for promotion to captain. Therefore, during a JAG simulation, some JAG officers will be promoted by boards whereas others will automatically earn promotion after their first 6 months of active duty by becoming fully qualified.

Augmentations

The model schedules regular commission augmentations in the external events file. The regular appointment boards determine which officers are eligible for regular commission and then selects the appropriate number of Reserve officers to receive the Regular commission.

The number of Reserve officers is not handled directly in the model. However, the model separation rates force a greater number of Reserve officers out of the nonline inventory. This modeling technique supports the policy of not offering indefinite Reserve status to every Reserve officer.

Accessions

In the model, new officers are created and added to the force under one of the following user-specified options: (a) Officers are accessed (added) to meet a maximum strength requirement, or (b) officers are accessed to meet a desired manning level. In addition, accessions can be modeled by changing the desired manning levels and accession rates in the external events file.

Separations

Officer separations are based on either grade and time-in-grade or grade and time-in-service. Here, again, the user selects the option for determining separations. Each separation option, grade and either time-in-grade or time-in-service, has a different set of separation rates which are in the baseline data file. This process of aging the force and separations occurs monthly. During each month, the force is decreased according to the separation probabilities corresponding to the separation option chosen by the user. The monthly aging for the competitive category separates the number of officers who probabilistically "decide" to separate.

Reduction-in-Force (RIF) Boards

When there is a need to reduce the officer inventory, RIF boards allow the Air Force to control the officer inventory. The nonline model simulates RIF boards, which are scheduled in the external events file. An example of an officer vulnerable to the RIF board is a captain who has not been appointed to a Regular commission and has completed 3 to 11 years of service.

Officers selected to leave the service by the RIF board are separated before the first day of the seventh month following the board. Here, again, the user is in control: The use of a RIF board and the selection criteria and rates are options controlled by the user in the external events input file.

Selective Early Retirement Boards (SERBs)

SERBs are similar to RIF boards in that both reduce the officer inventory to control manning levels. SERBs are also scheduled in the external events input file. Officers meeting one of the following criteria are vulnerable for mandatory retirement:

1. Any officer eligible for retirement (over 20 years of service).
2. A lieutenant colonel with two nonselections to colonel.
3. A colonel with 4 or more years time-in-grade.

Those officers selected for mandatory retirement are retired before the first day of the seventh month following the SERB. Those officers *not* selected for mandatory retirement are not subjected to another SERB for at least 5 years.

IV. OUTPUT REPORTS

Reports displaying the personnel activities (separations, promotions, etc.) and the force distribution comprise the model's output (see Figure 3). The user controls through the input file which reports are to be printed. The model generates two types of reports: interim reports and final reports.

Reports in Output File

Interim Reports

- At each occurrence
 - Promotion boards
 - Regular appointment boards
 - RIF boards
 - SERBs
- Monthly and yearly
 - Force distribution
 - Personnel activity summaries

Final Report

Figure 3. Reports in Output File.

Interim reports display the information for each individual run. These interim reports are scheduled monthly, yearly, and/or at a specified time (at each occurrence). The monthly and yearly reports include the force distribution and summary of personnel activity for the nonlinear category simulation. The board summaries display the probabilities of being selected, the number eligible for selection, and the number of officers selected. Final reports contain the information from all the runs, including averages and ranges of category strengths.

V. CONCLUSION

Development of a model to simulate nonlinear officer projections was completed successfully. Because of the event set feature, the SIMSCRIPT language allows force activity to be modeled, producing projections of the strength for the nonlinear category modeled.

The completed model met both requirements set by the Air Force Directorate for Personnel Plans, Analysis Division (AF/DPXA) in the RPR. The RPR requested a model that would (a) dynamically simulate personnel activity for each competitive nonlinear category, and (b) provide detailed displays which would portray the personnel activity during the model simulation. The NCPM was transitioned from AFHRL to AF/DPXA, which is using it to project future nonlinear officer levels. These projections are used to make top-level decisions about manning levels, to set promotion board rates, and to get an overall look at the future of the nonlinear competitive categories. AF/DPXA is currently exploring the possibility of using the model for the line officer force.