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ENLISTED ROTATION MANAGEMENT: USERS GUIDE TO THE COMPUTERIZED EQUILIBRIUM FLOW MODEL

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The planned periodic rotation of enlisted personnel between sea and shore assignments is a firmly established practice in the Navy. Managing rotation in an equitable and effective manner, however, continues to pose serious problems that are extremely difficult to resolve. Previously developed computer programs have successfully demonstrated the feasibility of generating quantitative data useful in rotation-related decisions.

20. ABSTRACT (Continued)

The computer model described in this report provides a highly flexible management tool that can be controlled by the user through selected data on three parameter cards and an input personnel data deck at any desired level of occupational grouping. Basic output consists of equilibrium tours that would support prescribed tours for each of three selected conditions. A secondary output presents summary tables of population aggregate characteristics to aid in broad policy testing and formal action. A variety of other problems may also be dealt with by manipulation of the input parameters.

SUMMARY

Problem

The planned, periodic rotation of enlisted personnel between sea duty and shore duty assignments is a firmly established practice in the Navy. Rotation management objectives, however, are often constrained by conflicting policies that impose severe controls on certain resources. As a consequence, managing the rotation process in an equitable and effective manner continues to pose serious problems that are extremely difficult to isolate and resolve.

Background

For some time, the Navy Personnel Research and Development Center has been developing computer based tools and techniques for application in the Bureau of Naval Personnel (BUPERS) to help improve the management of enlisted rotation. This effort has resulted in a series of computerized models of the rotation process which have been used in BUPERS in various planning or policy testing applications. These models have successfully demonstrated not only the feasibility of computerizing portions of the rotation decision-making process, but also the improvement in management that could result from their use.

Approach

The primary emphasis has been on the development of models which would incorporate the major elements and characteristics of the sea/shore rotation process in such a way that their values and relationships could be measured, manipulated, and if possible, predicted. A previous report* described the conceptual framework of the "Equilibrium Flow Model" encompassing the basic variables and parameters governing the movements of personnel between the broad categories of sea duty and shore duty. This present report provides a detailed guide to the use of the computerized version of the Equilibrium Flow Model as a tool in the management of enlisted personnel.

Findings and Conclusions

Critical to the solution of rotation management problems is the requirement for appropriate quantitative data upon which to base decisions affecting the system. To help meet this need, the computerized model described in this report could be implemented by those managers who wish to emphasize quantitative methods as a basis for decisions and broad policy formulation.

The model is a highly flexible management tool that can be controlled for the most part through selected data on three parameter cards and an input data deck at any selected level of occupational grouping. A sampling of uses would include problems such as (1) determining prospective sea tours for proposed future shore tours; (2) effect upon number of rotation moves if shore tours are extended any specified number of months; (3) changes

*Borgen, N. I., Segal, J. A., and Thorpe, R. P., An Equilibrium Flow Model of the Navy's Enlisted Personnel Rotation Process, San Diego: Naval Personnel and Training Research Laboratory, August 1972 (SRR 73-3).

required to number of shore billets if sea tours are shortened; and (4) the extent of the applicability of selected minimum and maximum sea tour limits across all rates to support broad policy formulation.

A basic output consists of equilibrium tours that would support prescribed tours in the complementary composite for each of three selected conditions: (1) current prescribed tours; (2) estimated actual tours; and (3) future desired prescribed tours.

A secondary output presents in summary tables the aggregate characteristics of the population processed in the basic phase for purposes of viewing the total group as an entity as an aid in broad policy testing and formulation.

Any management model is a tool and successful use presupposes considerable knowledge about the system being managed. The design of the Equilibrium Flow Model is based upon the quantification of rotation variables. The output will be entirely quantitative. The numerous qualitative aspects of rotation management must be introduced by the manager who seeks to influence, or otherwise control, the rotation system towards some identifiable goal.

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INTRODUCTION

Purpose

Among the many important functions of enlisted personnel management are those tasks related to personnel distribution, assignment, and rotation. Under the concept of centralized rating control, a relatively small number of managers in the Bureau of Naval Personnel must deal with an increasing number of details in the routine performance of their job. The magnitude of these tasks is such that increased utilization of automated information decision-making systems is essential if they are to be accomplished efficiently and effectively. To help meet this need in the area of personnel rotation management, a computerized model and its underlying concepts are described in this report with a view towards implementation by those managers who wish to emphasize quantitative methods as a basis for decisions and broad policy formulation. The quantitative nature of this model will readily lend itself to use in testing and evaluating a variety of policies and procedural options related to the management of personnel rotation.

Background

For some time, the Navy Personnel Research and Development Center has been developing computer based tools and techniques for application in the Bureau of Naval Personnel (BUPERS) to help improve the management of enlisted rotation. This effort has resulted in a series of computerized models of the rotation process which have been used in BUPERS in various planning or policy testing applications. These models have successfully demonstrated not only the feasibility of computerizing portions of the rotation decision-making process, but also the improvement in management that could result from their use.

Approach

The primary emphasis has been on the development of models which would incorporate the major elements and characteristics of the sea/shore rotation process in such a way that their values and relationships could be measured, manipulated, and, if possible, predicted. A previous report* described the conceptual framework of the "Equilibrium Flow Model" encompassing the basic variables and parameters governing the movements of personnel between the broad categories of sea duty and shore duty.

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This present report provides a detailed guide to the use of the computerized version of the Equilibrium Flow Model as a tool in the management of enlisted personnel rotation.

ROTATION MANAGEMENT PROBLEMS

The problems associated with rotation management are numerous and complex. While planned periodic reassignment of personnel between sea and shore assignments is a firmly established practice, other pressing requirements often over-ride the rotation plans. Manifestations of rotation problems are typically referred to as: (1) excessive personnel turnover; (2) personnel instability; (3) personnel turbulence; (4) poor skill utilization; (5) skill deterioration; and (6) excessive costs associated with personnel movements, especially those related to permanent change of station (PCS).

One of the most common sources of rotation management problems lies in the area of planned tour completions. The ideal system would have virtually all personnel rotating on their planned rotation dates. One reason that this is not likely to happen is that there are many causes leading to losses of personnel from the population at relatively unpredictable times. The unanticipated loss of an individual typically requires a replacement that frequently must be met by prematurely terminating someone else's tour. This creates an additional vacancy that must be filled in a similar manner, and a chain effect is generated whereby a single loss may trigger dozens of personnel moves. Constant disruptions of this kind tend to generate conditions of personnel instability and morale-inhibiting uncertainty for those adversely affected. Resolution of this problem requires improved procedures for determining tour lengths realistically reflecting conditions that can be expected to exist several years into the future.

One way to approach this problem is to seek quantitative means to divide the population into two aggregates relative to expected length of service. The aggregate with sufficient service expectancy to complete assigned tour cycles would comprise the rotatable population for management purposes, and the remainder would, in general, be excluded from the rotation system. Over time, the size of each group would be optimally determined and the magnitude of the unpredictable moves would approach the finite minimum that managers would always have to deal with.

The Equilibrium Flow Model is built upon this concept.

EQUILIBRIUM FLOW MODEL

Development of the computerized Equilibrium Flow Model has required a comprehensive determination of rotation system concepts and the quantification of many rotation variables. These objective measures will be presented in sections to follow to provide the underlying rationale for the structure of the model. The model will thus permit the manager to objectively quantify some of the conditions that are represented as problem areas and establish, within the limitations and assumptions of the model, the extent to which personnel movement must continue.

Limitations and Assumptions

Personnel rotation is a subset of a more comprehensive assignment process and therefore deals primarily with only a portion of the personnel movements. The model will only generate the number of personnel moves necessary to sustain rotation in accordance with the parameters selected by the user. The actual number of personnel moves, on a month by month basis, may not be subject to precise determination, but in a generalized way, some sort of average number of movements that will reasonably represent the dynamics for longer time spans may be derived through observation of the ongoing system.

Model output may be considered to have limited value in determining absolute values of rotation variables. Its basic function is to support comparative analyses across successive model runs with varied parameters. Proportionate changes will then be of considerable assistance in evaluating the impact of varied parameters. Skill in model use will ultimately move the manager in the direction of a firmer quantitative control.

A number of implicit and explicit assumptions underly any type of model of a system. Among the more prominent underlying this model are:

1. That personnel rotation is a necessary element of career service.

2. That a management objective is related to achieving and maintaining a dynamic equilibrium between the two major duty composites, sea and shore.

3. That a desired equilibrium condition between these two duty composites can be quantitatively specified by the rotation manager.

4. That tour lengths in one duty composite can be specified and substantially adhered to in rotation management.

5. That tour lengths in the complementary duty composite are desired to maintain or move the system towards a specified equilibrium condition.

Structural Elements

A study of the rotation system has provided a structure suitable for modeling by selecting elements that reflect various quantitative dimensions of interest to the rotation manager. Basically, within the rotatable population are two groups of personnel: those assigned to sea duty and those assigned to shore duty. Since direction of rotation is somewhat arbitrary, the groups can be labeled Composites A and B, with initial assignment commencing with A and rotation direction from A to B. Sequential completion of tours in both composites would be referred to as a "rotation cycle" and the process repeated for career personnel with an assignment from B to A.

All assignments within the rotation system have predetermined lengths that are recorded by means of "tour completion dates." In the past, lengths of assignments have been estimated from analysis of historical data with the consequent disadvantage that conditions of the past tended to influence the system long after significant changes had occurred. For example, it was observed that tour lengths in each composite for career personnel were generally in the same ratio as sea to shore billets. This has been appropriate for populations with high continuance rates, but where populations experience considerable losses over time, as with the middle and lower level petty officers, the actual tour ratios would be subject to extensive variation from the billet ratios. Assuming that a dynamic equilibrium reflects the desired condition for personnel manning and rotation, it can only be established and maintained through determination of the real rotation ratio.

The real rotation ratio may be estimated by adjusting the size of the rotatable population either by subtracting out losses or quantitatively defining the continuance for each population subset. The model represented by this description provides measures of personnel continuance by means of specially derived rates referred to as "career factors." These are computed from length-of-service frequency distributions, converted to proportions of the total population, and arranged in a negative-accumulative curve so that at each selected time point the proportion of the population that can be expected to serve beyond those years or months of service is directly determined*.

Another of the basic elements in the structure of the rotation model is a representative tour length for Composite B in the rotation cycle. This is a prerequisite for computing an equilibrium tour for Composite A. The manager may either arbitrarily establish a Composite B tour, or he may accumulate data and estimate an average Composite B tour that reflects that part of the ongoing rotation system. The necessary measures may be accumulated by recording the number of personnel vacating (completing tours in) Composite B each month and the cumulative number of personnel occupying those billets. The cumulative number in billets divided bv the cumulative number vacating gives the tour length index.

Evaluative Criteria

The computerized equilibrium flow model has been programmed to generate appropriate tour length indices for interaction with prescribed tour length indices in each of two broad duty composites. Quantitative data reflecting the structure of the rotation system are employed in computations that simulate the complex interactions of billet ratios and diminishing population sizes over time so that the generated complementary

*A comprehensive description of the theoretical derivation of career factors and the concepts and mathematics of rotation were provided in the previous report of the Equilibrium Flow Model (SRR 73-3).

tour lengths will tend to support a predetermined equilibrium condition of personnel allocation. The model incorporates a requirement for representing future conditions of the system by the introduction of appropriate estimates. While forecasting future conditions has long been recognized as extremely difficult and prone to error, the model has been designed to capitalize on the value of current data as a base for projections. Carefully derived estimates of future conditions are used mainly to indicate the direction in which the manager should seek to influence the system. The degree of confidence the manager has in his projections is used to help determine the magnitude of the influence he should apply.

It is proper then to view the model as a specialized tool that will simulate a rotation system, reflecting the nature of the data employed in it. The degree of correspondence between the model of the system and the real (actual) rotation system ultimately has to be established by the user of the model. Validation of the model requires that this degree of correspondence be determined, and this can only be done through use of the model in real rotation management applications.

For this reason, evaluative criteria should be developed from sources independent of model output. One measure that will help serve this purpose can be obtained by monitoring the tour length assignment system to determine what proportion of rotated personnel actually complete their tours as originally assigned. For example: if 500 personnel were rotated in a specified time period, and it was determined that 300 of those personnel completed tours as originally assigned, the measure of tour assignment effectiveness is 300/500 = 60%. On the other hand, 40% of the personnel would have had their tours modified for some reason related either to the needs of the Navy or a change in individual status.

This is not enough information, however, to determine whether 60% is the highest possible score, or even if it represents a satisfactory state. Repeated measures over time would give some clues as to whether or not this measure could be increased. The manager could assume that improved rotation management could increase this measure, and his management objective initially becomes one of "maximizing" the proportion of assigned tour completions for the rotatable population. Given an understanding of the effects of time in diminishing a population size, it would be logical to conclude that shorter tour lengths would lead to increased tour completions as assigned. For example: in the extreme case, tour lengths of one day would virtually assure that all personnel would complete their assigned tours. However, this solution would generate a high degree of personnel movements with its attendant costs and decreased skill utilization, and counter the desired condition of personnel stability. This adverse effect requires the establishment of arbitrarily determined minimum tour lengths. This means that there will of necessity always be a minimum of specifiable cost and amount of personnel movements associated with personnel rotation. The model will help the manager determine the minimum costs that would be necessary to support the ideal system generated by the rotation model. The difference between the costs and movements associated with the ongoing rotation system, and the ideal system of the model provide the means to estimate the amount of savings and degree of improvement possible through improved rotation management. The model contributes to the resolution of this problem by generating equilibrium tour lengths necessary to support minimum prescribed tour lengths in a complementary composite. The equilibrium tour lengths are computed in accordance with established billet ratios and personnel continuance in the system.

Obviously, the first effects of implementing the decisions resulting from use of the model will not be available until many months have elapsed. Monitoring the tour assignment effectiveness criterion will indicate whether or not the system is moving in the direction of improvement. With the number and complexity of influences that impinge on the rotation system, the implemented tour lengths can only account for part of the change. If the increase in effectiveness is less than expected, but in the right direction, the manager can accelerate the change by increasing his confidence estimate of his forecast. If the assignment effectiveness actually decreases, the manager will have to reexamine his estimate of the future conditions that generated his future equilibrium tour.

The time frame for evaluating the effects of rotation management decisions suggests that many rotation managers will actually be checking tour assignment decisions made by their predecessors, and their own decisions will be checked years later by their successors. The need for uniform management continuity thus becomes apparent and a management model offers a practical means to help achieve this requirement.

The following sections of this report provide a detailed guide to the operation and application of the computerized Equilibrium Flow Model. Program listings and related documentation are included in the appendices.

DESCRIPTION OF THE COMPUTERIZED MODEL

The conceptual structure underlying the model design relates the rotation system elements in such a way that a portion of the system dynamics is simulated. Essentially, these elements are the billet ratios between the two broad duty composites, the dynamic characteristics of the force structure relative to personnel continuance, and a selection of policy prescribed and actual conditions related to tour lengths. Current data for input to the model are readily available to the rotation manager; projections of the appropriate input data for further conditions would have to be worked out prior to model use, however.

Model output consists of two parts*: Part 1 provides details at the rate level pertaining to rate identification, allowances or strengths in each of the two composites for each of two time periods, and obligated service requirements for rotation eligibility. In addition, there are four sets of tour lengths related to policy prescribed sea and shore tours, estimated actual tour lengths, and equilibrium tours for each of the prescribed conditions. This section may run from 15 to 20 pages of output, depending upon the number of rates or level of data aggregation used.

Part 2 presents a comprehensive summary of the cumulative data processed to produce Part 1. Aimed primarily at supporting comparative analysis and broad policy formulation, the data is aggregated so as to quantitatively reflect the rotation dynamics encompassed by Part 1, and thus serve as a measure of the net effect of the total population set processed by the model.

In this section the components of the model are described in detail.

Model Components

The computerized Equilibrium Flow Model is basically a mathematical model that performs all the necessary computations supporting the management applications outlined in this report. The program for the model has been written in FORTRAN IV level G for the IBM 360/65 computer system. Figure 1 illustrates the major segments of the model. Job Control Language (JCL) cards appropriate for the system appear ahead and immediately behind the program deck. An additional card appears at the end of the data to terminate program execution.

The program deck consists of approximately 550 cards, including comment cards. Approximately 30 variables subject to control by the model user are spaced out on three parameter cards. The time-bias design of the model requires two data input cards for each population subset. For example: the 558 enlisted rates would require 1116 data input cards, one half for Time period 1, and the remaining half for Time period 2. The data cards,

*Parts 1 and 2 are shown in Figures 7 and 8 on pages 22 and 27.

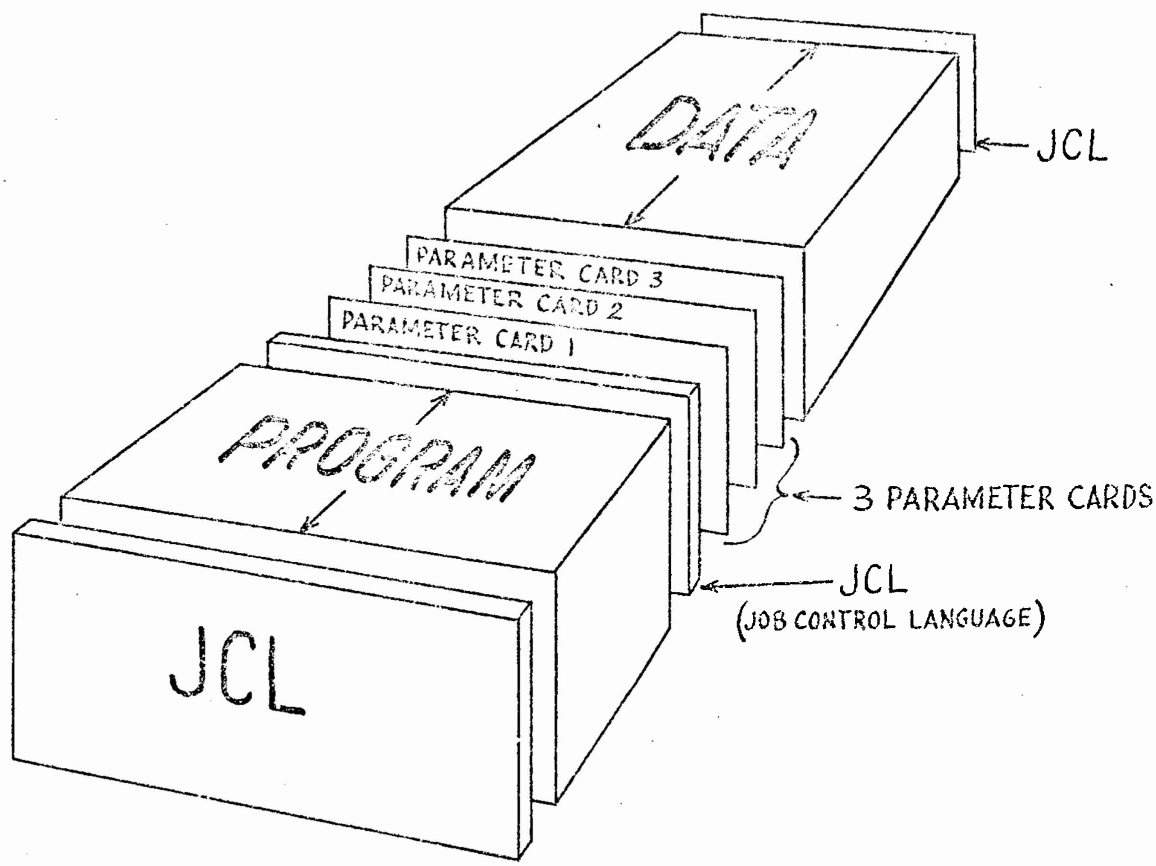


Figure 1. Arrangement of Computer Model Program and Data Deck

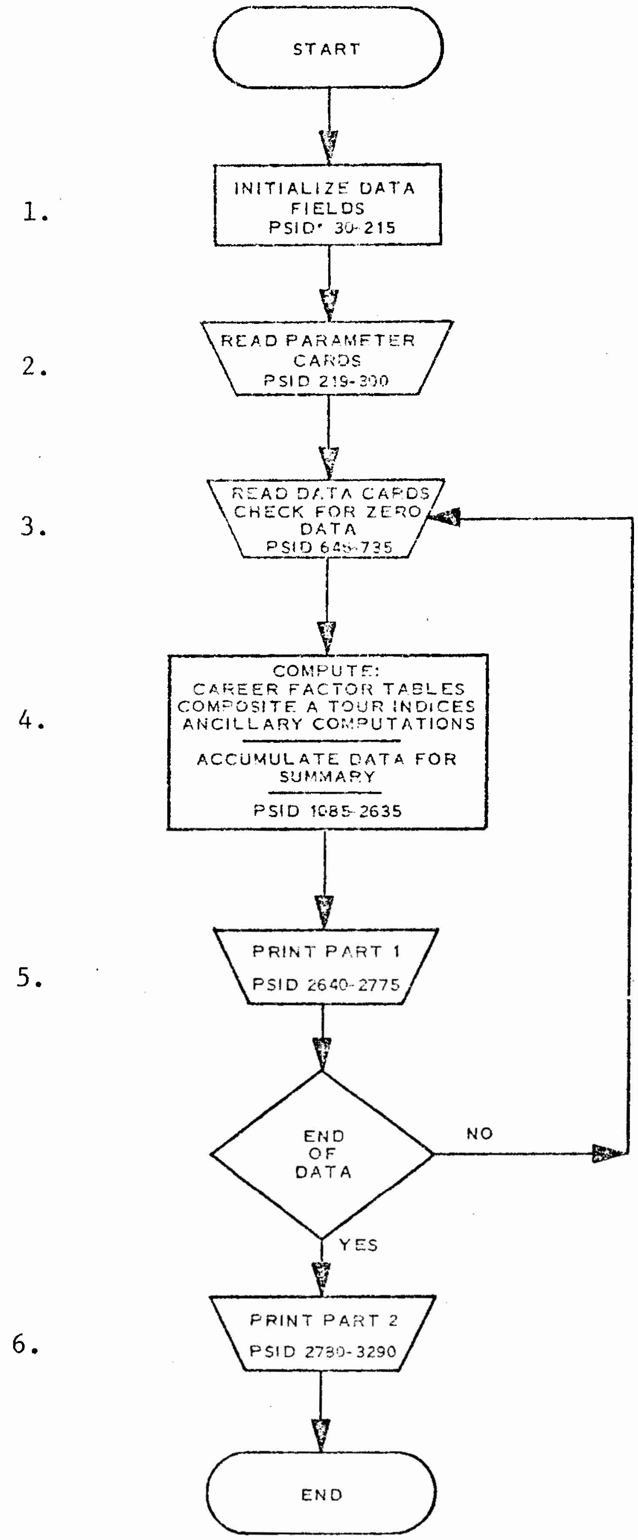
however, appear in pairs; that is, the card for BMCM Time 1 is followed immediately by data card for BMCM Time 2. Separator cards are used to separate groups such as ratings and produces a space between ratings in the Part 1 printout. If the user desires to add NEC (Navy Enlisted Classification) communities, additional data cards must be prepared in appropriate format, and in pairs. Aggregating data such as for rating populations would considerably reduce the size of the data deck, there being approximately 60 ratings requiring two cards for a data deck size of about 120 cards.

A detailed description of the program deck, parameter cards, and management data cards which comprise the model input appears in the following pages.

1. Program Deck.

Figure 2, provides a macro-level view of the flow through major program components. (1) The accumulation of data for Part 2 requires that many fields be set at zero. (2) Three parameter cards provide the manager with considerable detailed control over many of the quantitative aspects of the program. (3) Allowances, strengths, prescribed tour lengths, minimum and average lengths of service, and sets of career factors are read in from two data cards per population subset (such as rate), one card for each of two selected time periods. (4) Data for each population subset is computed and stored for the aggregate display in Part 2. (5) Data is printed out for each population subset until the last pair of data cards has been processed. (6) Part 2 of the model is then printed out to show the aggregate effects of all the individually computed data sets. This summary is designed to provide the rotation manager with sufficient relative data to enable him to make quantitative comparisons between situations represented by two or more sets of selected parameter values. While the level of generalization portrayed in Part 2 is highly abstract, the means by which it is generated insures that it is a proper representation of the combined effects of parameters as applied to individual populations that make up the entire set.

A complete program listing is provided in Appendix A. The rotation manager, however, need only have a general knowledge of the internal mechanics of the program. The following listing displays the major conceptual elements, and identifies the location of each in the program deck by means of Program Statement Identification (PSID) card numbers appearing at the extreme right.



PROGRAM STATEMENT IDENTIFICATION (PSID) NUMBER APPEARING IN PROGRAM CARD COLUMNS 77-80

Figure 2. Macro-Level Flow Chart of Selected Major Components of the Rotation Management Model

SEGMENT	DESCRIPTION	PSID CARD NUMBERS
1	Initialize data fields	30-215
2	Read parameter cards	219-405
3	Print output titles and column headings	510-550
4	Test for rotation direction (parameter card)	553-555
5	Read data for SHORE to SEA rotation if selected	560-735
6	Print output column headings	740-825
7	Field definitions for data input	827-843
8	Read data for SEA to SHORE rotation if selected	844-905
9	Check for zero data	910-1080
10	Compute and store career factors for 144 months for two time periods	1085-1300
11	Compute manning level percentages	1305-1317
12	Adjust composite tour length when indicated (parameter card 1, fields 5 through 8)	1320-1340
13	Composites A and B tour values are set	1345-1385
14	Select allowance or strength or equitable manning as a basis for tour computations (parameter card 1, field 1)	1390-1547
15	Adjust composite B population to percentage shown (parameter card 1, field 9)	1550-1551
16	Select user determined Composite B tour index if available, otherwise use program algorithm (parameter card 3, ACT SHR TOUR 0 or 1)	1556-1558
17	Algorithm for estimating actual Composite B tour length index	1560-1660

SEGMENT	DESCRIPTION	PSID CARD NUMBERS
18	Compute monthly Composite B vacancy rate for each of three conditions	1665-1680
19	Select months service obligation for rotation eligibility	1685-1725
20	Compute personnel moves, rotatables, and accumulate totals	1730-1935
21	Compute equilibrium Composite A tour for prescribed Composite B tour as shown in Part 1 printout, columns 10 and 11	1980-2110
22	Compute Composite A tours for estimated actual Composite B tours as shown in printout Part 1, columns 12 and 13	2115-2240
23	Compute Composite A tours for desired Composite B tours as shown in printout Part 1, columns 14 and 15	2255-2365
24	Program check on parameter card 3, column selection for Minimum Tour (MINTR)/Maximum Tour (MAXTR). Only Composite A tours for columns 8, 10, 12, or 14 may be used	2370-2455
25	Set A or B flag for tours above or below MINTR or MAXTR (parameter card 1, fields 3 and 4)	2460-2505
26	Accumulate personnel movement data and convert tour lengths to integer format for printing	2515-2635
27	Data fields for Part 1 printout. Print model data for rate (see Figure 7, page 22, for Part 1 display)	2640-2710
28	Print parameter card images	2715-2775
29	Print rotation summary page titles	2780-2850
30	Print rotation summary data Part 2. Personnel movements by pay grade for each condition	2855-2910

SEGMENT	DESCRIPTION	PSID CARD NUMBERS
31	Print summary of rotation dynamics. Number of rates rotatable, above, within and below MINTR and MAXTR	2915-2995
32	Print aggregate summary of totals, non-rotatables, rotatables, number of personnel moves, and tour indices for TOTAL AGGREGATE and for Composites A and B	3000-3210
33	Print final parameter card images. End program.	3212-3290

The Program Statement Identification (PSID) numbers have been utilized in columns 77 through 80 on each program card as a means of facilitating communications about the details of the program. The numbers, running from low to high in sequence, will permit the use of a card sorter to restore the appropriate card order, should the program deck be accidentally shuffled. Intervals between the PSID numbers permit changes and appropriate renumbering within a relatively small span of the established sequence. If program changes are contemplated, the user should refer to the complete program listing in Appendix A. An alphabetical listing of each data field name is provided in Appendix B. Should the user desire to trace through any of the computations, he may substitute data for the field names and perform the same calculation as done by the computer. If program changes are made, all data fields of those names affected must be located and checked to determine whether the desired change will be produced. Appendix C provides a table of data field names and PSID numbers showing where they occur in the program.

2. Parameter Cards.

Use of the computerized Equilibrium Flow Model requires that the rotation manager determine which values and modes are to be used for a specified run. Parameter value selection is partly determined by the reason for applying the model: i.e. to compute tours for implementation; to test the results of newly formulated policy; to ascertain the effects upon the rotation system of altering selected variables; to improve one's understanding of the rotation system; etc.

Prior to use of the model, decisions must therefore be made with regard to the following:

a. Select input data from current or past historical data and projected values to represent future expected conditions. Data from two selected time periods is required.

b. Select: (1) current allowances at some specified manning level; (2) current strengths as allocated; or (3) equitable manning of billets with current strengths.

c. Select direction of the initial rotation: SEA to SHORE or SHORE to SEA.

d. Select population aggregates: Rates, ratings, NEC's, etc. Punch data deck accordingly.

e. Establish method of determining obligated service requirements for rotation eligibility.

f. Establish the minimum and maximum tour lengths for the summary of rotation dynamics by rate.

g. Identify populations to be excluded from rotation: i.e. women, limited duty, special programs, humanitarian shore duty, etc.

Figure 3 illustrates the three parameter cards to be used with the computerized rotation management model. These cards produced the print-outs illustrated in Figures 7 and 8, pages 22 and 27. The parameter card data fields are described on the following pages.

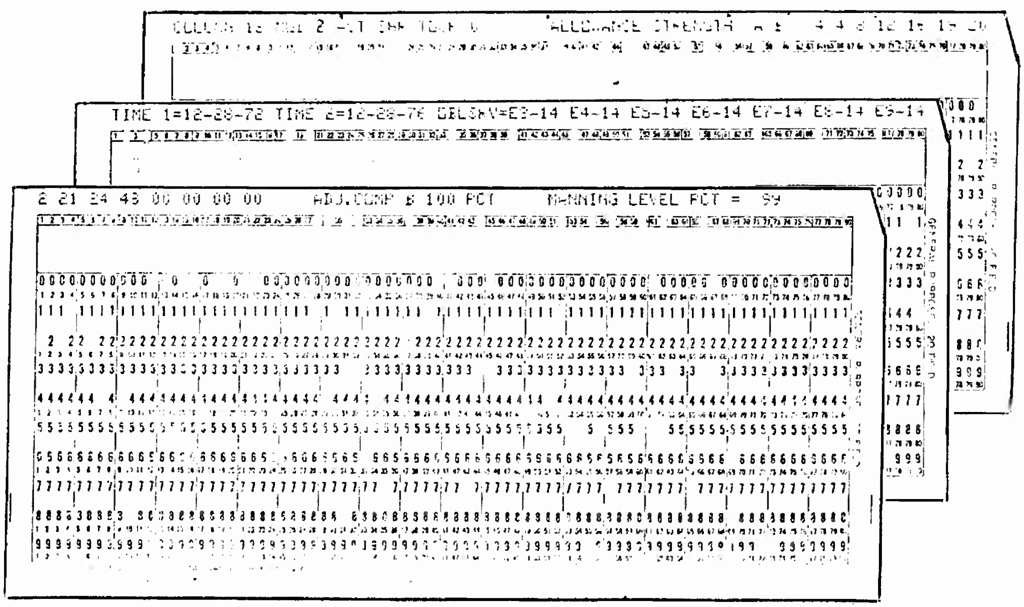


Figure 3. Parameter Cards Used with the Rotation Management Model

CARD 1

Field	Columns	Description
1.	1	Allowance/Strength selector for tour computations 1 = allowance 2 = strength 3 = strength allocated equitably to allowance
2.	3 - 4	Selects direction of rotation: 12 = shore to sea, type duty 1 to 2 21 = sea to shore, type duty 2 to 1
3.	6 - 7	Lower limit for equilibrium tour summary in months (MINTR)
4.	9 - 10	Upper limit for equilibrium tour summary in months (MAXTR)
5.	12 - 13	Sea tour extension in months for Time 1
6.	15 - 16	Sea tour extension in months for Time 2
7.	18 - 19	Shore tour extension in months for Time 1
8.	21 - 22	Shore tour extension in months for Time 2
9.	39 - 41	ADJ COMP B ___ PCT: Provision to adjust Composite B allowance or strength up or down to regulate equilibrium tour in Composite A and number of personnel moves
10.	71 - 73	MANNING LEVEL PCT = ____: Provision to regulate obligated service months relative to manning level percent. Manning levels at or below specified percentage will use obligated service months specified on parameter card 2; manning levels above specified percent will utilize Composite B tour for service obligation for rotation eligibility

CARD 2

Field	Columns	Description
1.	5 - 15	Date of data used for Time 1
2.	24 - 31	Date of data used for Time 2
3. through 9.	43 - 44 49 - 50 55 - 56 61 - 62 67 - 68 73 - 74 79 - 80	Selected obligated service months for rotation eligibility for use with manning levels below that specified on parameter card 1, field 10 for pay grades E-3 through E-9

CARD 3

Field	Columns	Description
1.	8 - 9	Column selector for Part 1 printout for purpose of identifying equilibrium tours above (A), below (B) or within the upper and lower tour limits (MINTR/MAXTR) specified on card 1, fields 3 and 4. Each rate is tallied in the program, flagged in Part 1 where appropriate, and printed out in summary form in Part 2.
2.	15	Mode of printout to be selected by user where: 1 = Part 1 printout only 2 = Parts 1 and 2 will be printed out 3 = Part 2 printout only
3.	30	Actual estimated shore tour (ACT SHR TOUR) selector for utilizing the managers estimate of actual Composite B lengths or the program algorithm described in Appendix C. 0 = Actual estimate of Composite B tour is not available and user desires to utilize program algorithm 1 = Actual estimate of Composite B tour is punched into card number 1 of each pair of data cards in columns 25 and 26. (Figure 6, page 21)
4.	38 - 62	Printout labels to identify user selection of allowance or strength data for computation of tours (parameter card 1, field 1); and additional printout labels for "above", "below" and blank space for equilibrium tours relative to MINTR and MAXTR , fields 3 and 4 of parameter card 1.
5.	63 66 68 70 - 71 73 - 74 76 - 77 79 - 80	Average length-of-service years provided as a basic input to program algorithm described for field 3, column 30 above. These values are used for pay grades E-3 through E-9 respectively.

3. Management Data Input.

Figures 4 and 5 present displays of data basic to rotation management. Two data displays are provided to illustrate actual data used as model input for each of two selected time periods: December 1972 and December 1976. In practice the data may be selected as the latest current data for Time 1 and carefully derived estimates of future data for Time 2.

With reference to Figure 4, page 18, data of interest are displayed under column headings as follows:

Field	Description
1.	Rate abbreviation
2.	Rate code
3.	Sea allowance for selected Time 1 and Time 2
4.	Shore allowance for selected Time 1 and Time 2
5.	Sea strength for selected Time 1 and Time 2
6.	Shore strength for selected Time 1 and Time 2
7.	Allowance for preferred sea duty type 5
8.	Strength for preferred sea duty type 5
9.	Prescribed sea tour length in months
10.	Prescribed shore tour length in months
11.	Average length of service in years
12A.	Minimum length of service years for the pay grade
12B.	Career factor for the year shown in Field 12A.
+1 through +7	Career factors for the year indicated: i.e., minimum length-of-service (LOS) from column 12A. plus the number of years indicated by column heading.

BILLETS AND STRENGTHS BY SEA AND SHORE COMPOSITES

PRESCRIBED TOURS, AVERAGE LENGTH-OF-SERVICE (YRS), MINIMUM LOS-IN-GRADE

AND CUMULATIVE CONTINUATION PROBABILITIES PER YEAR

(BILLET AND STRENGTH DATA AS OF 12-28-72)   DATE = 82   PROGRAM BLTSTR

- R A T E - ABBR (1)	CODE (2)	- ALLOW - SEA (3)	SHORE (4)	STRENGTH SEA (5)	SHORE (6)	PREF.SEA ALW (7)	STR (8)	TOUR MOS. SEA (9)	SHORE (10)	AV.LOS YEARS (11)	MIN LOS (12A)	---CUMULATIVE CONTINUATION PROBABILITIES PER YEAR -- (BASED ON LOS DISTRIBUTION FOR JUNE 30,1972) (12B)	(+1)	(+2)	(+3)	(+4)	(+5)	(+6)	(+7)
BMCM	0100A	120	74	56	80	1	0	48	24	25.6	13	0.9789	0.9789	0.9789	0.9648	0.9648	0.9577	0.9437	0.9085
BMCS	0100J	196	140	155	134	4	8	48	24	23.4	11	0.9939	0.9939	0.9909	0.9756	0.9634	0.9299	0.9116	0.8750
BMC	01001	828	703	805	750	18	22	48	24	17.9	7	0.9937	0.9914	0.9885	0.9811	0.9616	0.9174	0.8589	0.7854
BM1	01002	1265	1091	1450	1042	33	37	66	24	13.1	4	0.9996	0.9961	0.9885	0.9652	0.9272	0.8642	0.7746	0.6602
BM2	01003	1974	982	1585	630	25	17	72	24	7.1	2	0.9973	0.9505	0.6794	0.6085	0.5173	0.4188	0.3768	0.2602
BM3	01004	2633	251	2572	195	9	7	72	24	3.7	1	0.9984	0.9519	0.7562	0.1273	0.0932	0.0714	0.0540	0.0339
BMSN	01005	221	38	100	12	0	1	72	24	4.5	1	1.0000	0.9816	0.8773	0.3190	0.2086	0.1779	0.1288	0.0798
CMCM	0200A	30	33	23	30	3	5	42	24	23.4	13	0.9833	0.9833	0.9833	0.9833	0.9333	0.9000	0.8000	0.7500
CMCS	0200J	33	58	40	85	16	12	42	24	18.8	11	0.9864	0.9660	0.9116	0.8707	0.8231	0.7551	0.6122	0.4762
CMC	02001	437	352	428	310	24	28	66	24	16.0	7	0.9986	0.9959	0.9917	0.9738	0.9255	0.8772	0.7697	0.6924
CM1	02002	498	442	391	263	20	13	72	24	11.5	4	0.9887	0.9761	0.9509	0.8579	0.7925	0.6931	0.5937	0.4951
CM2	02003	742	295	536	83	7	5	72	24	4.8	2	0.9627	0.8368	0.3427	0.2657	0.2191	0.1702	0.1395	0.1119
CM3	02004	1140	61	1076	79	4	6	72	24	2.9	1	0.9645	0.7581	0.4992	0.0468	0.0298	0.0250	0.0194	0.0145
CMSN	02005	230	14	602	45	1	3	72	24	1.6	1	0.7230	0.2664	0.0833	0.0141	0.0082	0.0082	0.0059	0.0047
SMCM	0250A	9	7	9	20	0	3	36	24	22.8	13	1.0000	0.9999	0.9999	0.9688	0.9375	0.9063	0.8125	0.7500
SMCS	0250J	34	32	25	42	4	3	36	24	20.3	11	1.0000	1.0000	0.9765	0.9647	0.9529	0.9176	0.8000	0.6471
SMC	02501	68	149	165	222	3	3	36	24	17.3	7	0.9953	0.9930	0.9906	0.9906	0.9765	0.9648	0.9413	0.8897
SM1	02502	491	295	414	347	2	3	66	24	14.5	4	0.9988	0.9977	0.9954	0.9907	0.9837	0.9628	0.9373	0.8827
SM2	02503	774	226	477	256	0	0	72	24	7.4	2	0.9952	0.9513	0.6413	0.5891	0.5523	0.4727	0.3895	0.3088
SM3	02504	1043	22	909	22	1	1	72	24	3.1	1	0.9923	0.8285	0.5424	0.0645	0.0424	0.0337	0.0279	0.0193
SMSN	02505	492	5	451	4	0	0	72	24	1.7	1	0.7477	0.3135	0.1070	0.0122	0.0046	0.0046	0.0031	0.0031
CSCM	0300A	22	47	22	39	8	4	36	36	19.9	13	1.0000	0.9999	0.9855	0.9855	0.8261	0.5797	0.4783	0.4203
CSCS	0300J	72	77	64	45	8	13	48	36	17.7	11	0.9922	0.9922	0.9688	0.9297	0.8125	0.6797	0.5391	0.3516
CSC	03001	348	320	364	270	31	26	48	36	16.1	7	1.0000	0.9986	0.9972	0.9902	0.9735	0.9317	0.8591	0.7531
CS1	03002	927	667	618	498	18	11	48	36	12.5	4	0.9962	0.9916	0.9740	0.9435	0.8779	0.8008	0.7244	0.6275
CS2	03003	1454	435	1168	157	5	9	42	24	4.6	2	0.9836	0.8345	0.2996	0.2140	0.1724	0.1322	0.0919	0.0717
CS3	03004	1794	112	2103	66	4	3	42	24	2.9	1	0.9960	0.8158	0.4449	0.0392	0.0242	0.0166	0.0139	0.0095
CSSN	03005	1894	71	1281	58	0	0	42	24	1.6	1	0.7932	0.2340	0.0606	0.0057	0.0040	0.0040	0.0028	0.0017
EWCM	0350A	0	10	0	2	0	0	36	24	16.5	13	1.0000	0.9999	0.9999	0.9999	0.0	0.0	0.0	0.0
EWCS	0350J	22	17	8	5	0	1	42	24	16.5	11	1.0000	1.0000	1.0000	0.9000	0.8000	0.6000	0.3000	0.2000
EWC	03501	226	97	84	68	13	6	48	24	13.2	7	1.0000	0.9857	0.9429	0.8786	0.7714	0.6786	0.5429	0.4000
EW1	03502	271	124	144	101	7	11	52	24	9.7	4	1.0000	0.9904	0.9164	0.7942	0.6656	0.4823	0.3923	0.3023
EW2	03503	597	21	79	16	1	0	52	24	5.8	2	1.0000	0.9714	0.7524	0.5524	0.3810	0.2571	0.1429	0.0762
EW3	03504	509	0	182	1	0	0	54	24	2.2	1	0.9156	0.4667	0.2444	0.0311	0.0089	0.0	0.0	0.0
EWSN	03505	95	0	10	0	0	0	54	24	1.1	1	0.5500	0.0667	0.0	0.0	0.0	0.0	0.0	0.0

Figure 4. Data Display Basic to Rotation Management for Time 1

BILLETS AND STRENGTHS BY SEA AND SHORE COMPOSITES

PRESCRIBED TOURS, AVERAGE LENGTH-OF-SERVICE (YRS), MINIMUM LOS-IN-GRADE

AND CUMULATIVE CONTINUATION PROBABILITIES PER YEAR

(BILLET AND STRENGTH DATA AS OF 12-31-76) DATE = 86 PROGRAM BLTSTR

- R A T E - ABBR (1)	CODE (2)	- ALLOW - SEA (3)	SHORE (4)	STRENGTH SEA (5)	SHORE (6)	PREF.SEA ALW (7)	STR (8)	TOUR MOS. SEA (9)	SHORE (10)	AV.LOS YEARS (11)	MIN LOS (12A)	---CUMULATIVE CONTINUATION PROBABILITIES PER YEAR -- (BASED ON LOS DISTRIBUTION FOR JUNE 30,1972) (12B)	(+1)	(+2)	(+3)	(+4)	(+5)	(+6)	(+7)
BMCM	0100A	96	59	45	64	1	0	48	24	26.3	13	0.9789	0.9789	0.9789	0.9789	0.9648	0.9648	0.9577	.9437
BMCS	0100J	157	112	124	107	3	6	48	24	24.2	11	0.9939	0.9939	0.9939	0.9909	0.9756	0.9634	0.9299	0.9116
BMC	01001	662	562	644	600	14	18	48	24	18.4	7	0.9954	0.9937	0.9914	0.9885	0.9811	0.9616	0.9174	0.8589
BM1	01002	1012	873	1160	834	26	30	66	24	13.7	4	1.0000	0.9996	0.9961	0.9885	0.9652	0.9272	0.8642	0.7746
BM2	01003	1579	786	1268	504	20	14	72	24	6.8	2	0.8976	0.8554	0.6115	0.5476	0.4656	0.3765	0.2941	0.2342
BM3	01004	2106	201	2058	156	7	6	72	24	3.3	1	0.8986	0.8567	0.6806	0.1146	0.0839	0.0643	0.0485	0.0305
BMSN	01005	177	30	80	10	0	1	72	24	4.1	1	0.9000	0.8834	0.7896	0.2871	0.1877	0.1601	0.1159	0.0718
GMCM	0200A	24	26	18	24	2	4	42	24	24.1	13	0.9833	0.9833	0.9833	0.9833	0.9833	0.9333	0.9000	0.8000
GMCS	0200J	26	46	32	68	13	10	42	24	19.6	11	0.9932	0.9864	0.9660	0.9116	0.8707	0.8231	0.7551	0.6122
GMC	02001	350	282	342	248	19	22	66	24	16.5	7	1.0000	0.9986	0.9959	0.9917	0.9738	0.9255	0.8772	0.7697
GM1	02002	398	354	313	210	16	10	72	24	12.1	4	0.9962	0.9887	0.9761	0.9509	0.8579	0.7925	0.6931	0.5937
GM2	02003	594	236	429	66	6	4	72	24	4.5	2	0.8664	0.7531	0.3084	0.2391	0.1972	0.1532	0.1259	0.1007
GM3	02004	912	49	861	63	3	5	72	24	2.5	1	0.8680	0.6823	0.4493	0.0421	0.0268	0.0261	0.0175	0.0130
GMSN	02005	184	11	482	36	1	2	72	24	1.2	1	0.6507	0.2398	0.0750	0.0127	0.0074	0.0074	0.0053	0.0042
SMCM	0250A	7		7	16	0	2	36	24	23.5	13	1.0000	1.0000	0.9999	0.9999	0.9688	0.9375	0.9063	0.8125
SMCS	0250J	27	26	20	34	3	2	36	24	21.1	11	1.0000	1.0000	1.0000	0.9765	0.9647	0.9529	0.9176	0.8000
SMC	02501	54	119	132	178	2	2	36	24	17.8	7	0.9953	0.9953	0.9930	0.9906	0.9906	0.9765	0.9648	0.9413
SM1	02502	393	236	331	278	2	2	66	24	15.1	4	1.0000	0.9988	0.9977	0.9954	0.9907	0.9837	0.9628	0.9373
SM2	02503	619	181	382	205	0	0	72	24	7.1	2	0.8957	0.8562	0.5772	0.5302	0.4971	0.4254	0.3505	0.2779
SM3	02504	834	18	727	18	1	1	72	24	2.7	1	0.8931	0.7456	0.4882	0.0580	0.0382	0.0303	0.0251	0.0174
SMSN	02505	394	4	361	3	0	0	72	24	1.3	1	0.6729	0.2821	0.0963	0.0110	0.0041	0.0041	0.0028	0.0028
OSCM	0300A	18	38	18	31	6	3	36	36	20.6	13	1.0000	1.0000	0.9999	0.9855	0.9855	0.8261	0.5797	0.4783
OSCS	0300J	58	62	51	36	6	10	48	36	18.5	11	0.9922	0.9922	0.9922	0.9688	0.9297	0.8125	0.6797	0.5391
OSC	03001	278	256	291	216	25	21	48	36	16.6	7	1.0000	1.0000	0.9986	0.9972	0.9902	0.9735	0.9317	0.8591
OS1	03002	742	534	494	398	14	9	48	36	13.1	4	0.9992	0.9962	0.9916	0.9740	0.9435	0.8779	0.8008	0.7244
OS2	03003	1163	348	934	126	4	7	42	24	4.3	2	0.8852	0.7510	0.2696	0.1926	0.1552	0.1190	0.0827	0.0645
OS3	03004	1435	90	1682	53	3	2	42	24	2.5	1	0.8964	0.7342	0.4004	0.0353	0.0210	0.0167	0.0125	0.0085
OSSN	03005	1515	57	1025	46	0	0	42	24	1.2	1	0.7139	0.2106	0.0545	0.0051	0.0036	0.0036	0.0025	0.0015
EWCM	0350A	0	8	0	2	0	0	36	24	17.2	13	1.0000	1.0000	0.9999	0.9999	0.9999	0.0	0.0	0.0
EWCS	0350J	18	14	6	4	0	1	42	24	17.3	11	1.0000	1.0000	1.0000	1.0000	0.9000	0.8000	0.6000	0.3000
EWC	03501	181	78	67	54	10	5	48	24	13.7	7	1.0000	1.0000	0.9857	0.9429	0.8786	0.7714	0.6786	0.5429
EW1	03502	217	99	115	81	6	9	52	24	10.3	4	1.0000	1.0000	0.9904	0.9164	0.7942	0.6656	0.4823	0.3923
EW2	03503	478	17	63	13	1	0	52	24	5.5	2	0.9000	0.8743	0.6772	0.4972	0.3429	0.2314	0.1286	0.0686
EW3	03504	407	0	146	1	0	0	54	24	1.8	1	0.8240	0.4200	0.2200	0.0280	0.0080	0.0	0.0	0.0
EWSN	03505	76	0	8	0	0	0	54	24	0.7	1	0.4950	0.0600	0.0	0.0	0.0	0.0	0.0	0.0

Figure 5. Data Display Basic to Rotation Management for Time 2

The data displayed in Figures 4 and 5 have been produced from conventional allowance/strength data available to the rotation manager in punched card form and separately produced 30-year career factor data developed by this Center from end fiscal year length-of-service frequency distributions. Duplicate copies of career factors punched cards are available for the years 1966 through 1972.

The program that produces the printout illustrated here simultaneously produces a punched card output for use in the equilibrium flow model. Figure 6 illustrates two sample model input data cards for BMCM, one for each time period dealt with in the model. In order to limit the input data to two cards, the number of career factors has been limited. The model program places the appropriate decimal points after reading the cards.

The data card format is as follows:

FIELD NO.	NO OF COLUMNS	COLUMN NUMBERS	DESCRIPTION
1	4	1-4	Sea Allowance
2	4	5-8	Shore Allowance
3	4	9-12	Sea Strength
4	4	13-16	Shore Strength
5	3	17-19	Allowance: Preferred Sea Duty Type 5
6	3	20-22	Strength: Preferred Sea Duty Type 5
7	2	23-24	Prescribed Sea Tour Months
8	2	25-26	Prescribed or Actual Shore Tour Months
9	3	27-29	Average length-of-service years
10	2	30-31	Minimum years Service for Pay Grade
11	1	32	Date of Data: Month = 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, and A, B, January thru December
	1	33	Date of Data: Year = final digit of year
12-15	20	34-53	Career Factors: minimum service plus 1-3 years
16-19	16	54-69	Career Factors: minimum service plus 4-7 years

FIELD NO.	NO OF COLUMNS	COLUMN NUMBERS	DESCRIPTION
20	1	70	Pay Grade Designator 1-9
21	5	71-75	Rate Code: alpha/numeric
22	5	76-80	Rate Abbreviation
	80		

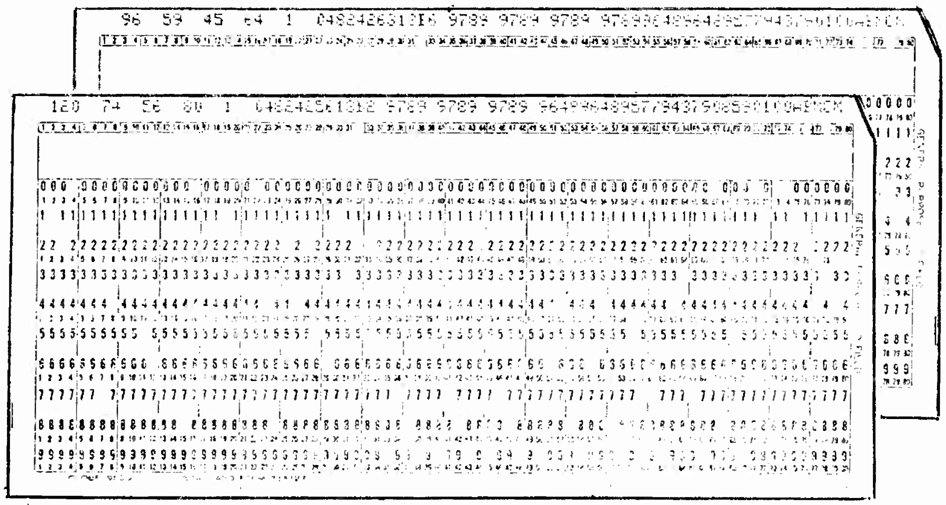


Figure 6. Rotation Management Model Data Input Cards for BMCM Rate

Familiarization with the Model

In order for the model to serve effectively as a management tool, the manager must be thoroughly familiar with its basic structure. The model has been run with partial data as a means to illustrate the narrative description. The dual nature of the model requires two separate output displays: one designed for the "micro-level" of rotation management and the other designed for "macro-level" rotation policy testing and policy formulation.

Part 1, shown as Figure 7, is a multi-page output containing rotation data of primary interest to the rotation manager. The first title line identifies the model and the second line indicates the assumed rotation direction, sea to shore. The third line contains minimum and maximum equilibrium tour length indices for a selected data column as indicated for purposes of a data summary appearing in Part 2. Dates of the data utilized as input and column headings follow immediately below. Selected rotation management data appear in seventeen columns. At the conclusion of the data listing appear three parameter card images that were used to select or generate the data shown. Data rows and parameter cards are numbered to further facilitate description.

PART 1. PAGE 1

PROTO-TYPE EQUILIBRIUM TOUR COMPUTATIONS PROGRAM TF

SEA TO SHORE ROTATION

MINIMUM TOUR OF 24 AND MAXIMUM TOUR OF 48 APPLY TO COLUMN 12

	RATE ABBR	RATE CODE	12-28-72 TIME 1 STRENGTH SEA	SHR	12-28-76 TIME 2 STRENGTH SEA	SHR	MONTHS SRV OBL	----BASIC MODEL---- TIME 1 PR.TOURS SEA	SHR	EQUIL SEA	PR SHR	-------BIASED MODEL------- TIME 1 EQUIL SEA	ACTUAL SHORE	TIME 2 EQUIL SEA	DESIRED SHORE		CYCLE CAR FAC	MAN/LVL PCT
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)		(16)	(17)
1.	BMCM	0100A	56	80	50	72	14	48	24	16	24	22	32	17	24	B	0.9789	70.1
2.	BMCS	0100J	155	134	139	120	14	48	24	28	24	43	38	28	24		0.9664	86.0
3.	BMC	01001	805	750	724	675	24	48	24	25	24	42	40	25	24		0.9395	101.6
4.	BM1	01002	1450	1042	1305	938	24	66	24	32	24	42	33	33	24		0.8957	105.8
5.	BM2	01003	1585	630	1426	567	14	72	24	38	24	28	16	35	24		0.6439	74.9
6.	BM3	01004	2572	195	2315	175	14	72	24	40	24	50	21	51	24	A	0.0859	95.9
7.	BMSN	01005	100	12	90	11	14	72	24	49	24	40	12	47	24		0.2638	43.2
8.	EWCM	0350A	0	2	0	2	ZERO PERSONNEL IN EITHER COMPOSITE PRECLUDES ROTATION											

CARD PARAMETER CARD IMAGE

1. 2 21 24 48 0 0 0 0 ADJ.COMP B 100 PCT MANNING LEVEL PCT = 99

2. TIME 1=12-28-72 TIME 2=12-28-76 OBLSRV=E3-14 E4-14 E5-14 E6-14 E7-14 E8-14 E9-14

3. COLUMN 12 MOD 2 ACT SHR TOUR 0 ALLOWANCE STRENGTH A B 4 4 8 12 16 19 20

Figure 7. Display of Part 1 Rotation Management Model Output

Before using the model, the manager will have to make a number of decisions relative to his interests in rotation data output. He will influence the model through the parameter cards illustrated below the rotation data. For example: he must decide whether he intends to use allowance, strength, or personnel strengths equitably allocated to allowance, and he must also decide which direction rotation is to be simulated. Parameter Card 1 first field shows a "2" which selects "on board strength" as the numbers to use for rotation. A "1" in this field would select ALLOWANCE, and a "3" would select EQUITABLE MANNING by strength. Accordingly, labels STRENGTH or ALLOWANCE will appear above columns 3 through 6 containing that data.

Rotation occurs between broad duty composites SEA (type duty 2) and SHORE (type duty 1). The sequence of these numbers on parameter Card 1 second field directs the selected rotation sequence, in this case: 21 directs SEA to SHORE ROTATION which appears as the second row of the title.

Reference to "tours" in this section imply "tour indices", that is, the tours generated will not be directly implemented but will serve as a base figure to work out a distribution of implementable tour lengths. A later section will provide a methodology for this procedure.

The minimum/maximum tour length specifications are for the purpose of identifying the rates that will have prescribed or equilibrium tours below, within or above the manager-selected limits. The manager must also select the column of interest, which may be column 8, 10, 12, or 14. Tours shown in columns 9, 11, and 15 are specified by the manager and the tour in column 13 is an estimate of the actual tour either generated by an algorithm in the computer program, or provided by the manager as direct input. An alphabetic character will appear in the space between columns 15 and 16 indicating if the tour in the selected column is below (B) the minimum, or above (A) the maximum, tour specified above the column headings. Parameter Cards 1 and 3 contain input for the data described: Card 1 fields 3 and 4 contain the minimum and maximum tour limits; Card 3 contains the selection of column 12 as the column of interest; and a zero (0) indicates that the estimate of actual shore tour length (ACT SHR TOUR 0) was not provided so the program generated the estimated tours appearing in column 13. If the manager provides his own estimate of the actual shore tour, he should punch a "1" in place of the "0" and include the tours as part of the data input.

Each rate processed by the model is numbered in sequence ahead of the rate abbreviation in column 1. The alpha numeric rate code appears in column 2. Columns 3 through 6 display the numbers of personnel for each broad duty composite, sea and shore, for each of two time periods.

The obligated service months for rotation eligibility appears in column 7 and will be equal to the values shown on the right half of parameter Card 2 or the prescribed tour in column 9. Selection of one or the other is governed by the manning level percentage shown in column 17, and control is exercised through parameter Card 1 right hand side where MANNING LEVEL PCT = 99. For the example shown here, all rates with manning levels equal to or above 99% will use prescribed shore tour months for obligated service. To increase use of the 14 month value, the percentage in the parameter Card 1 field should be raised. For example: MANNING LEVEL PCT = 999 will cause every rate to fall below the criterion and select obligated service from parameter Card 2. Conversely, lowering the percentage value will cause more rates to appear above the criterion, and the prescribed tour in column 9 will appear in column 7 as the obligated service required for rotation eligibility. Setting this percentage value to zero, for example, will direct the program to use column 9 prescribed tours for column 7 obligations throughout the run.

Selection of the percentage factor to use will depend upon how the manager views manning-level effect upon rotation availabilities. High manning levels suggest manpower sufficiency and longer service obligations may be both feasible and desirable. Low manning levels suggest manpower shortages, and in order to meet requirements the obligated service factor may have to be modified. The modified factors in parameter Card 2 are specifiable separately for each pay grade. The sample illustrated shows 14 months for each skill level.

A CYCLE CAREER FACTOR for each rate appears in column 16. This value may be used by the rotation manager to estimate the proportion of personnel that can be expected to serve beyond the number of months represented by the sum of the equilibrium tour of interest (columns 10, 12, or 14) and the obligated service required for rotation eligibility (column 7). This proportion is important in the case of many rates with rapid personnel turnover since it provides an indication of which rates may not have sufficient long-term personnel to support rotation. For example: The total BM3 population (columns 5 and 6) of 2315 plus 175 equals 2490 personnel for Time 2. The CYCLE CAREER FACTOR is used as follows: .0859 x 2490 = 214 can be expected to accumulate sufficient time to complete the indicated tour cycle. While this number is sufficient to meet the 175 shore requirements shown, unexpected changes to the personnel or billet structure may create rotation problems. Utilizing data from this column, the manager may remain alerted to potential problem areas of this type.

The remaining elements of Part 1 are the tour months shown under the captions "BASIC MODEL" and "BIASED MODEL".

The Basic Model data relates to the policy prescribed tours for each duty composite (columns 8 and 9) and a revised Composite A equilibrium tour (column 10) that would support the prescribed Composite B tour (column 11). The differences between prescribed sea tours in column 8 and equilibrium tours in column 10 remain to be resolved by rotation managers.

A means to resolve the differences between established policy-prescribed tours and equilibrium tours is provided with the BIASED MODEL. The first step requires the rotation manager to ascertain his real, actual shore tour length for entry in column 13. The model will generate the appropriate equilibrium tour for column 12. This would estimate tours for the ongoing current situation, and provide a base for decisions aimed at influencing the system in a pre-determined direction. The pre-determined direction is provided by specifying future desired Composite B tour indices as data input to column 15. Simultaneously, strength and allowance estimates for some selected future date are also provided for columns 5 and 6, (see figure 7). The model will then generate equilibrium tours for column 14.

Given the validity of the data used to generate the current and future equilibrium tours, the objective is to implement tour lengths that will move the system from its current state to the future desired state. With the inevitable uncertainty that attaches to long range data projections, the manager is not likely to accept the column 14 tour as an absolute value ready for implementation. It is viewed, rather, as an indicator of the direction and the magnitude of a desirable change and a goal to be approached through a series of successive decisions over a considerable period of time. With periodic evaluations based on independent measures of the rotation system, the manager will not implement either tour shown in columns 12 and 14, but will seek a third tour index that will be a more representative estimate of his confidence in the equilibrium tours provided by the model. This is referred to as BIAS. The manager considers all the relevant factors pertaining to the situation, then "biases" the column 12 equilibrium tour in the direction of the column 14 equilibrium tour by an amount that reflects his confidence in his data estimates that were used to generate the tours. For example: BMCM's appear to experience 32 month shore tours. The equilibrium sea tour is 22 months. Column 15 shows the objective is a 24 month actual shore tour which will be supported by a 17 month equilibrium tour (column 14). With an estimated 33% confidence in data projection, the tour to be implemented will be:

$$22 - (22 - 17) \times 1/3 = 22 - 1.7 = 20.3 = 20 \text{ months}$$

Whenever current or projected data change significantly, the model should be run again and the decision process repeated to yield new prescribed tour indices.

With final reference to Figure 7, the entire Boatswains Mate (BM) rating has been processed in lines 1 through 7. Line 8 illustrates a "non-rotatable" rate diagnostic which will appear whenever any one of the four duty composites in columns 3 through 6 have zero data. Reassignment of these personnel must be done outside the rotation system.

After completion of processing the input data, parameter card images are displayed as a means of identifying the output. A detailed description of the structure of the parameter cards appears separately under a description of the computer model program deck.

At this point the aggregation of data has also been completed and the program will print the single page Part 2 summary data described in the next section.

Figure 8 illustrates model output Part 2. There are four separate tabulations of aggregate data reflecting the net effects of the rate by rate data processing. The fifth section is a duplicate copy of the parameter Card images that may be used to match Parts 1 and 2 should they become separated.

Table 1 illustrates Section 1, the aggregate monthly personnel rotation movement summary.

TABLE 1. Display of Section 1 Part 2 Showing Details of Aggregated Monthly Personnel Moves for Various Situations

PART 2.

SECTION 1. MONTHLY PERSONNEL ROTATION MOVEMENT SUMMARY BASED ON STRENGTH

COMPOSITE A TO B ROTATION

ROW	E-3	E-4	E-5	E-6	E-7	E-8	E-9	TOTAL	
1 COLUMN ----------(8)	0.2	1.8	6.9	15.8	15.4	3.1	1.1	44.3	TIME 1= 12-28-72
2 COLUMN ----------(9)	0.5	8.1	26.2	43.4	31.2	5.6	3.3	118.5	TIME 1= 12-28-72
3 COLS. (8) AND (9)	0.7	9.9	33.2	59.2	46.6	8.7	4.5	162.7	TIME 1= 12-28-72
4 COLS. (10) AND (11)	1.0	16.2	52.5	86.8	62.5	11.2	6.7	236.9	TIME 1= 12-28-72
5 COLS. (12) AND (13)	2.1	18.3	78.9	63.6	37.2	7.0	5.0	212.2	TIME 1= 12-28-72
6 COLS. (14) AND (15)	0.9	14.6	47.2	78.2	56.2	10.0	6.0	213.3	TIME 2= 12-28-76

The accumulated rotation moves for each paygrade appear in columns under paygrade designations. The rows are identified relative to tour indices in Part 1 for both the basic and the biased model. Row sums of moves appear under the total column heading, and the appropriate time period and date of data follow to the right.

PART 2.

SECTION 1. MONTHLY PERSONNEL ROTATION MOVEMENT SUMMARY BASED ON STRENGTH

COMPOSITE A TO B ROTATION

ROW		E-3	E-4	E-5	E-6	E-7	E-8	E-9	TOTAL	
1	COLUMN ---------(8)	0.2	1.8	6.9	15.8	15.4	3.1	1.1	44.3	TIME 1= 12-28-72
2	COLUMN ---------(9)	0.5	8.1	26.2	43.4	31.2	5.6	3.3	118.5	TIME 1= 12-28-72
3	COLS. (8) AND (9)	0.7	9.9	33.2	59.2	46.6	8.7	4.5	162.7	TIME 1= 12-28-72
4	COLS. (10) AND (11)	1.0	16.2	52.5	86.8	62.5	11.2	6.7	236.9	TIME 1= 12-28-72
5	COLS. (12) AND (13)	2.1	18.3	78.9	63.6	37.2	7.0	5.0	212.2	TIME 1= 12-28-72
6	COLS. (14) AND (15)	0.9	14.6	47.2	78.2	56.2	10.0	6.0	213.3	TIME 2= 12-28-76

ROW SECTION 2. SUMMARY OF ROTATION DYNAMICS BY RATE

1 NUMBER OF ROTATABLE RATES = 7 OUT OF 8 RATES WITH 5 RATES AT OR BELOW 99 PERCENT MANNING LEVEL

2 FOR TOUR LENGTHS IN COLUMN 12, 1 RATES WILL HAVE EQUIL TOURS SHORTER THAN 24 MONTHS

3 - - - - - - - - - - - - - - - - - - 1 RATES WILL HAVE EQUIL TOURS LONGER THAN 48 MONTHS

4 - - - - - - - - - - - - - - - - - - 5 RATES FALL WITHIN PRESCRIBED LIMITS

SECTION 3. STRENGTH SUMMARY — SECTION 4. STRENGTH SUMMARY

		+--TOTAL AGGREGATE--+							+----COMPOSITE A-----+					+--COMPOSITE B--+		
ROW	COLUMNS	TOTAL (1)	TYPE FIVE (2)	NON-ROT (3)	ROTA-TABLE (4)	MOVES/ MONTH (5)	TOUR INDEX (6)	ROW	TOTAL (7)	NON-ROT (8)	ROTA-TABLE (9)	MOVES/ MONTH (10)	TOUR INDEX (11)	TOTAL (12)	MOVES/ MONTH (13)	TOUR INDEX (14)
1	(8)&(9)	9658.	92	4099.	5467.	162.7	33.6	1	6723	4099.	2624.	44.3	59.2	2843	118.5	24.0
2	(10)&(11)	- - -	- -	2987.	6579.	236.9	27.8	2	- -	2987.	3736.	118.5	31.5	- -	118.5	24.0
3	(12)&(13)	9658.	92	2781.	6785.	212.2	32.0	3	6723	2781.	3942.	106.1	37.2	2843	106.1	26.8
4	(14)&(15)	8688.	81	2635.	5972.	213.3	28.0	4	6049	2635.	3414.	106.6	32.0	2558	106.6	24.0

CARD SECTION 5. PARAMETER CARD IMAGE

1. 2 21 24 48 0 0 0 0 ADJ.COMP B 100 PCT MANNING LEVEL PCT = 99

2. TIME 1=12-28-72 TIME 2=12-28-76 OBLSRV=E3-14 E4-14 E5-14 E6-14 E7-14 E8-14 E9-14

3. COLUMN 12 MOD 2 ACT SHR TOUR 0 ALLOWANCE STRENGTH A B 4 4 8 12 16 19 20

Figure 8. Display of Part 2 Rotation Management Model Output

Data for rows 1 and 2 are separated because they represent the moves that would occur for prescribed sea and shore tours. An imbalance will typically be evident here where the tours are not representative of the real rotation ratio. These moves are combined in row 3 for direct comparability with data in the remaining rows that deal with three pairs of equilibrium-prescribed tour indices.

Since the model has been designed to assist the manager in improving rotation, the conditions represented by the data in rows 1 through 4 are mainly of analytical interest relative to current and past practice in rotation management. Data in rows 5 and 6 are designed to assist the manager in quantifying the current on-going actions and a projected desired state towards which he desires to move the system. The management objective is to stabilize actual tours for personnel in the direction of more uniformly prescribed tours that may be promulgated as rotation policy directives.

The movement matrix may also serve to estimate costs associated with rotation by multiplying the data cells of interest by the average cost of rotation moves. For example: Row 5 shows an estimated actual rotation movement rate of 212 per month. If the average rotation move costs $2000, the total monthly cost is 212 x 2000 = $414,000 for the BM rating. When all the rotatable rates are run in the model, total rotation movement cost estimates can be readily determined.

Section 2 illustrated in Table 2 displays a summary of rotation dynamics by rate. The data source is Part 1 illustrated in Figure 7. Row 1 indicates that 7 out of 8 rates processed are "rotatable" in the sense that personnel are assigned to both composites. Zero data in either sea or shore composite is used to direct management attention to cases needing special attention, such as the EWCM illustrated with its diagnostic message.

TABLE 2. Display of Section 2, Part 2 Model Printout

```
ROW                      SECTICN 2. SUMMARY OF ROTATION CYNAMICS BY RATE
 1 NUMBER OF ROTATABLE RATES =      7 CUT CF     8 RATES WITH     5 RATES AT CR BELCW  S9 PERCENT MANNING LEVEL
 2 FOR TCUR LENGTHS IN COLUMN 12,   1 RATES WILL HAVE EQUIL TOURS SHCRTER THAN 24 MCNTHS
 3 - - - - - - - - - - - - - - -    1 RATES WILL HAVE EQUIL TOURS LCNGER THAN  48 MCNTHS
 4 - - - - - - - - - - - - - - -    5 RATES FALL WITHIN PRESCRIBEC LIMITS
```

Low manning levels are also a concern in rotation management so the number of rotatable rates with manning levels below that specified on parameter Card 1 will be indicated in row 1.

Having selected the Part 1 column of interest, the remaining rows will show the number of rates relative to the tour limits specified in fields 3 and 4 of parameter Card 1.

Data in row 2 may be used by the manager to determine the number of rates to be considered for exclusion from rotation due to insufficient personnel available to complete minimum tour cycles. The specific rates may be identified by examining the Part 1 output where these data rows are flagged by the letter "B" between columns 15 and 16.

Data in row 3 indicate the number of rates with tour lengths in excess of a desired maximum as specified on parameter Card 1. These rates are identified in Part 1, by the letter "A" appearing in the row between columns 15 and 16, and may call for special attention in connection with efforts to improve rotation for the so-called "deprived" rates.

Row 4 provides the number of rates for which the tour limits are appropriate and provide a comparative measure with the numbers in rows 3 and 4 to ascertain the extent of applicability of these tour limits. If in the total aggregate of all rotatable rates there is a disproportionate share of rates outside the limits, some sort of management action is indicated. For example: deleting those rates with tours below the minimum will remove them from rotation to the "wet-dry" concept of assignment to a given composite for the duration of obligated service. Those rates with tours greater than the maximum will require some adjustment to billet ratios to bring the tour lengths within the desired limits. Even without specific management action, Section 2 will provide a concise summary of aggregate policy testing relative to prescribed tour lengths for one of the duty composites. If a significant majority of the rates fall within the specified limits, the policy tours may be considered feasible.

Sections 3 and 4 are strength/allowance summaries at two levels of aggregation. Section 3 illustrated by Table 3 provides a macro-level picture of combined duty composites for all rotatable rates by showing the total numbers of personnel for each of four conditions. Rows 1 through 3 contain data for time period 1 and row 4 contains data for the projected time period 2.

Table 3. Display of Section 3, Part 2 Model Printout

SECTION 3. STRENGTH SUMMARY

		+--TOTAL	AGGREGATE			--+
ROW / COLUMNS	TOTAL (1)	TYPE FIVE (2)	NON-ROT (3)	ROTA-TABLE (4)	MOVES/ MONTH (5)	TOUR INDEX (6)
1 (8)&(9)	9658.	92	4099.	5467.	162.7	33.6
2 (10)&(11)	- - -	- -	2987.	6579.	236.9	27.8
3 (12)&(13)	9658.	92	2781.	6785.	212.2	32.0
4 (14)&(15)	8688.	81	2635.	5972.	213.3	28.0

Column 1 shows the total number of personnel comprising the rotatable rates processed by the model. Column 2 contains the number of non-rotatable personnel in preferred sea duty type 5. Column 3 quantifies the number of personnel that will not accumulate sufficient time in service to rotate in accordance with prescribed tour lengths. Column 4 shows the number that will exceed the prescribed tour lengths, and consequently, rotate. Column 5 moves per month are taken directly from Section 1 and divided into the rotatables in column 4 to generate the tour index months shown in column 6.

Monitoring this tour index will provide the manager with a gross measure of rotation movement trends.

Section 4 is illustrated by Table 4 where the totals for each duty composite are separated for a macro-level view of rotation dynamics.

Table 4. Display of Section 4, Part 2 Model Printout.

SECTION 4. STRENGTH SUMMARY

	+----COMPOSITE	A	----+			+--COMPOSITE	B--+	
ROW	TOTAL (7)	NON-ROT (8)	ROTA-TABLE (9)	MOVES/ MONTH (10)	TOUR INDEX (11)	TOTAL (12)	MOVES/ MONTH (13)	TOUR INDEX (14)
1	6723	4099.	2624.	44.3	59.2	2843	118.5	24.0
2	- -	2987.	3736.	118.5	31.5	- -	118.5	24.0
3	6723	2781.	3942.	106.1	37.2	2843	106.1	26.8
4	6049	2635.	3414.	106.6	32.0	2558	106.6	24.0

Composite B data comprise the total shown in column 12, and rotation moves from this composite are one half the total moves appearing in column 5, Section 3. The tour index (column 14) expresses the ratio of column 12 data divided by column 13 data.

Composite A data is more complex in that the total number in column 7 are separated into non-rotatables (column 8) and rotatables (column 9). Under equilibrium conditions the moves per month (column 10) match the Composite B moves (column 13). The tour index (column 11) is the ratio of rotatables (column 9) divided by moves per month (column 10). By specific management design the non-rotatables are all in Composite A and do not figure in the monthly rotation moves. This group, however, does participate in a variety of moves connected with training, operational requirements and separations.

Comparison of A and B tour indices provides quantitative estimates of rotation dynamics and facilitates detection of directional trends in the system over lengthy time periods.

The parameter card image in section 5 is identical to that described in Part 1 and is duplicated in Part 2 as a means to match parts should they become separated.

Peripheral Tasks Related to Model Use

The Equilibrium Flow Model that has been the subject of extensive description throughout preceding pages of this report has been pictured as a relatively generalized model with primary value in the area of comparative analyses. Among its limitations it was mentioned that it may be considered to have limited value in determining absolute values of rotation variables. The gap between the generalized nature of the model-generated tour indices and the specific nature of implemented assigned tour lengths to personnel may be readily bridged by some relatively simple desk calculation procedures.

One of the first tasks to be accomplished is the establishment of representative average tour lengths for each rate assigned to duty in Composite B for that part of the model that simulates the ongoing rotation system. The average tour length that evolves may also be viewed as a tour index in that it represents a synthesis of many individuals completing tours of varying length.

The necessary measures may be accumulated by recording the number of personnel vacating (completing tours in) Composite B each month. The cumulative number in billets divided by the cumulative number vacating gives the tour length index. Table 5 illustrates a procedure for deriving such data. The procedure can be carried on indefinitely, generating a moving average type of tour index.

Table 5. Derivation of a Moving Average Tour Index for Rotation Management

	M	O	N	T	H	S
	1	2	3	4	5	6...
Cumulative Number In Billets	300	650	945	1270	1630	2000
Cumulative Number Vacating	12	26	35	47	63	83
Tour Length Index*	25.0	25.0	27.0	27.0	25.8	24.1

*Tour Length Index = Cumulative number in billets divided by the Cumulative number vacating

A suitable generalization from the above table would be that the average monthly flow rate out of Composite B due to tour completions was 83/6 = 13.8 moves per month for an average 2000/6 = 333 personnel yielding an average tour length of 24.1 months. This value should replace the algorithm generated tour in the model as soon as it is available.

1. Structuring the Decision Bias

The computerized equilibrium flow model has been programmed to generate appropriate equilibrium tour length indices for interaction with prescribed tour length indices in each of two broad duty composites. The model incorporates a requirement for representing future conditions of the system by the introduction of appropriate estimates. While forecasting future conditions has long been recognized as extremely difficult and prone to error, the model has been designed to capitalize on the value of current data as a base for projections. Carefully derived estimates of future conditions are used mainly to indicate the direction in which the manager should seek to influence the system. The degree of confidence the manager has in his projections is used to help determine the magnitude of the influence he should apply. A hypothetical example will be formulated to illustrate how the manager may use the model to implement a decision bias that will tend to influence the rotation system in a desired direction to a desired degree.

Assume the model has been run, and the manager has obtained the following equilibrium tour length indices. His task is to modify one of them so as to generate a tour index that will tend to drive the system towards the projected state represented by the future tour index.

Time 1 (current) equilibrium tour = 38 months

Time 2 (future) equilibrium tour = 47 months

With an estimated 33% confidence in data projections the tour index to be implemented will be:

$$.33\ (47 - 38) + 38 = 41 \text{ months} \quad \text{(Composite A)}$$

The manager will assign tours that average 41 months for his population subset. This does not mean he will actually assign 41 months as tour lengths for all personnel, but the aggregates of assignments should generate a personnel flow rate equal to that for 41 month tours.

2. Converting a Tour Index to a Tour Distribution

Developing a practical distribution of feasible tour lengths equal to a policy tour index is a relatively simple procedure on a desk calculator. To illustrate this procedure, a 41 month policy tour index will be used to illustrate how a manager can fit it to actual conditions.

Assume that the manager must observe a 48 month prescribed tour for Composite A of 1640 personnel. The policy prescribed equilibrium tour indicates a 41 month tour index which reflects a monthly flow rate of 40.0 personnel. The manager's task is one of rotating as many of the 1640 personnel as possible at the 48 month tour. He will rotate the remainder at an arbitrarily selected minimum 24 month tour. Table 6 illustrates how to arrange the data in preparation for the necessary computation.

Table 6. Computing the Maximum Number of Personnel That May Be Assigned a 48 Month Prescribed Tour With the Remainder Allocated to 24 Month Tours thus conforming to the Equilibrium Tour Index

No. of Personnel		Tour Index or Tour Length	Monthly Flow Rate
Given	1640	41	40.0
Compute	1640 - x	48	$\frac{1640 - x}{48}$
Compute	x	24	$\frac{x}{24}$

To complete the table it is necessary to solve for x in terms of monthly flow rate:

$$\frac{1640 - x}{48} + \frac{x}{24} = 40.0$$

$$\frac{48(1640 - x)}{48} + \frac{48x}{24} = 40.0 \times 48$$

$$1640 - x + 2x = 1920$$
$$x = 1920 - 1640$$
$$x = 280$$

$$1640 - x = 1360$$

Substituting the values into Table 6 format:

No. of Personnel		Tour Index or Tour Length	Monthly Flow Rate
Given	1640	41	40.0
Computed	1360	48	28.3
Computed	280	24	11.7
Check	1640	41	40.0

Two general rules are applicable to this problem: (1) the arbitrarily selected minimum tour must be in the opposite direction from the tour index as the prescribed tour; and (2) the greater the difference between the prescribed tour and the arbitrarily selected minimum tour, the larger the number of personnel that can be rotated at the prescribed tour. For example: if the minimum tour could be 12 months, 1547 personnel would rotate at 48 months and 93 personnel would rotate at 12 months for the 41 month equilibrium tour index.

An additional consideration must be made in assigning tour lengths to personnel going to type duty 3 or 4. Unaccompanied personnel receive shorter tour lengths than those accompanied by their dependents. Many billets have DOD prescribed tours that differ from Navy prescribed tours. The manager thus has to deal with a distribution of tour lengths rather than a single prescribed tour. The overall rotation still must meet equilibrium conditions represented by the tour index. The fewer different tour lengths applicable, the easier the rotation managers task, but it is a relatively simple theoretical task to accomodate any number of different tour lengths. A tabular method for accomodating three different prescribed tours for a composite will be presented.

For example: Assume that portions of personnel in this population are assigned to duty that requires 24, 36, and 48 month tour lengths. The aggregate consists of 1640/41 = 40 personnel moves per month. Table 7 illustrates how to arrange the distribution given the number of 24, 36, and 48 month billets that must be filled so as to facilitate the necessary computation to follow.

Table 7. Equating a Tour Length Index with a Distribution of Tours of Varying Lengths

No. of Personnel	Tour Length	*Monthly Flow Rate
200	24	8.33
100	36	2.78
1,000	48	20.80
x	z	y
1,640	41	40.0

*Monthly Flow Rate = number of personnel divided by tour length

To complete the table, it is necessary to compute how many personnel (x), at what tour length (z), will yield the monthly personnel flow rate (y). Use of simple arithmetic will yield the values of x, y, and z as follows:

(1) $x = 1640 - 200 - 100 - 1000 = 340$

(2) $y = 40.00 - 8.33 - 2.78 - 20.80 = 8.09$

(3) $z = 340 / 8.09 = 42.0$ months tour length

This tells the manager that for this aggregate he can assign the numbers of personnel shown for each of the predetermined prescribed tours, but to have the entire group rotating in accordance with the policy prescribed equilibrium tour he will have to tour 340 personnel at 42 months each.

These tour length assignments will become increasingly valid as the system moves towards equilibrium. However, nothing prevents the manager from modifying tour lengths to meet specific contingencies. If the system simulation improves, the number of tour modifications should decrease as the system approaches equilibrium. However, due to the inherent time lag and difficulties in forecasting future conditions, rotation equilibrium may never be actually established, or if established, can not be expected to remain for long. For this reason rotation management is viewed as an implemented decision process aimed at influencing or "driving" the rotation system in the direction of equilibrium.

Obviously, the first effects of implementing the decisions shown here would not be available until at least 24 months have elapsed, and the final effects not felt until 48 months have elapsed. Monitoring the tour assignment effectiveness criteria will indicate whether or not the system is moving in the direction of improvement.

The time frame for evaluating the effects of rotation management decisions relative to tour lengths suggests that many rotation managers will actually be checking tour assignment decisions made by their predecessors, and their own decisions will be checked years later by their successors. The need for uniform procedures and management continuity thus becomes apparent and a management model offers a practical means to help achieve this requirement.

Application of the Model

The computerized equilibrium flow model has a potential for a variety of uses at many rotation management levels where quantitative support is desired for administrative decisions and broad policy formulation.

Part 1 of the model has been designed to provide rating managers with equilibrium tour indices applicable to rates, ratings and NEC communities. Converting tour indices to implementable tour lengths has been covered in the section of this report titled "Peripheral Tasks Related to Model Use".

Part 2 of the model is intended for those managers who deal with rotation at a higher level of personnel aggregation such as ratings, rating groups, DOD occupation groups, or the entire sea and shore composites. The summary data can be particularly useful in evaluating the effects of varied parameters such as tour extensions on total number of rotation moves and equilibrium tour length indices for any selected population aggregate. Comparative analyses of data from a series of model runs can be of considerable assistance in determining rotation policies applicable to a specified proportion of the total population.

Either or both parts of the model may be used by any rotation manager who wishes to improve his understanding of rotation dynamics. The extent to which model output may be implemented through administrative decision procedures is entirely left to the manager.

Data input is arranged on punched cards which are easy for the manager to change, duplicate, arrange in desired order and grouping, or delete data not wanted.

Model application more specific in nature can be determined by reviewing the data fields of the three parameter cards. (see also pages 15-16).

Card 1.

The model will utilize allowance, strength, or strength at equitable manning as indicated in field 1.

Direction of rotation may be either sea to shore or shore to sea.

The user must specify minimum and maximum tour constraints for the purpose of differentiating those rates below, within or above the tour lengths of immediate interest. This section can be an aid in ascertaining to what extent policy prescribed tour lengths may be applicable.

If it is desired to learn the effects of changing prescribed sea or shore tours, the number of months changed can be specified for each time period for each composite. Entering the number of months desired extension on the parameter card will have them added to the prescribed tours. Preceding the number with a minus sign will shorten the tours by that amount. The equilibrium tours and number of monthly personnel moves will reflect the net effect of the tour length change.

Many rates have shore personnel occupying billets, but the personnel may not be rotatable, i.e., women in uniform and perhaps some proposed civilian substitutions. Once the manager has determined the proportion of non-rotatables to his total shore aggregate, he can specify the complementary percentage (100% minus non-rotatable percent) to be included in rotation. Should he desire to test the effects of increased shore billets to reduce sea tours, he can multiply his shore aggregate by a selected number greater than 100%. A specified percentage change will alter the rotation moves by the same amount so the manager can test the effects of increasing or decreasing personnel moves by any selected percentage.

The user of the model also has some flexibility in selecting the obligated service requirements for rotation eligibility. The normal service obligation can be considered equal to the prescribed tour length the individual is rotating into. This is linked in the model to manning levels above that specified on the parameter card. Where the manning level is below that specified, the service obligation will be taken from the second parameter card. It is up to the manager to determine what this alternative value should be. Initially this value has been set at a minimum of 14 months. One or the other of these obligations will be used throughout the model run. A program change would be necessary to tailor obligated service months to specific rates, and some corresponding value would then have to be added to one of the data input cards for each rate.

The prescribed shore tour plus its preceding equilibrium sea tour constitutes a rotation cycle for the rate. In practice, an obligated service requirement for rotation eligibility may replace the prescribed shore tour so that the rotation cycle months may approximate the sea tour plus the service obligation. In either case, it is of interest in rotation management to know what proportion of personnel commencing a rotation cycle can be expected to complete it. The career factor for the cycle is printed in column 16 of Part 1 in the form of a four place decimal. For example, in Figure 7, line 5, BM2, column 16 shows 64% (.6439) can be expected to complete a rotation cycle in Time 2 of 28 months (column 12) plus obligated service of 14 months (column 7) for a total rotation cycle of 40 months. Where the career factor approaches zero it is an indication that the rate might frequently have insufficient personnel to sustain rotation under time and might better be handled under the "wet/dry" concept of assigning personnel proportionately to sea or shore without opportunity for rotation. If this solution is not feasible, then a shorter rotation cycle may be prescribed by reducing the shore tour whereby a larger proportion of personnel can be expected to serve throughout the cycle.

Card 2.

Card 2 provides means to specify the date of the input data for printing out in Parts 1 and 2. Alternate obligated service months for each pay grade appear across columns 43 through 80 for use when manning levels are below a specified level.

Card 3.

Part 1 displays equilibrium sea tours and prescribed shore tours for various situations of possible interest. The three columns that contain the equilibrium tours are 10, 12, and 14. Equilibrium tours above or below the minimum and maximum tours specified on Card 1 are identified by a letter A or B as appropriate. In the aggregate, these are summarized in a brief table in Part 2. The manager must indicate here the data column of interest. This part of the model will show which rates will fall within the selected limits for policy considerations, and also show those rates above and below the limits that will be policy exceptions. The summary table (Section 2) can provide totals that can be converted to proportions to assess the extent to which the specified parameter will generate rotation tours suitable for policy generalizations.

Rate managers will primarily be interested in Part 1 output, but the Summary Tables in Part 2 can also be useful for comparative analyses.

Part 2 has been designed primarily for managers who are looking at the broad rotation picture with a view to formulating useful generalizations about rotation dynamics. However, they must be interested in knowing which rates distort the rotation picture and thus will want Part 1 for detailed reference.

As an economical option, the user can direct the model to print out either Part 1 or Part 2, or if he desires the complete output, he can so specify. It is difficult to establish that point where data quantity transits from insufficient to excessive, and is here left for the manager to determine. If he is dealing with rotation at the rate level, Part 1 is probably adequate since the total effect represented by the aggregate contributes nothing directly applicable. If, however, the manager is monitoring the broad aspects of rotation over several years, seeking repetitive cycles or distinct trends, only Part 2 is likely to be of value and the excess pages of Part 1, will merely occupy shelf space.

This decision must be made by the user of the model. The options have been designed-in for use when desired and are described on page 16 under parameter field 2, mode of printout desired.

In conclusion, it can only be emphasized that any management model is a tool and successful use presupposes considerable knowledge about the system being managed. The design has basically been that of quantifying rotation variables. The output will be entirely quantitative. The numerous qualitative aspects of rotation management must be introduced by the manager who seeks to influence or otherwise control the rotation system toward some identifiable goal.

APPENDIX A

PROGRAM LISTING

APPENDIX A

PROGRAM LISTING

```
FORTRAN IV G LEVEL  21                     MAIN                  DATE = 73197          14/51/45
                                                                                                   PSID
                   C PROGRAM TRPOL4/TOUR EQUIL MODEL WITH SUMMARY OF MOVEMENT DYNAMICS              30
 0001                    REAL*8 RCODE,RATE,PERS1,PERS3,TITL1,TITL2, RABBR                           35
 0002                    DIMENSION CF(12),FC(12),KTOUR(12),FACMAT(146), FCMT(146)                   40
 0003                    DIMENSION  PMV1(9),PMV2(9),PMV3(9),PMV4(9), SEAMV(9),SHORV(9)              45
 0004                    DIMENSION NT1(4), NT2(4), ROTSB(4)   ,TROT(4),TNROT(4),SVCB(9)             50
 0005                    DIMENSION AVSRV(9), KSRV(9),KVOB(9) , LVOB(9)                              55
 0006                    CALL ERRSET (209,256, -1, 1 )                                              60
 0007                    KREV = 0                                                                   65
 0008                    KTR  = 0                                                                   70
 0009                    LONG = 0                                                                   75
 0010                    NMBR = 0                                                                   80
 0011                    NEGML  = 0                                                                 82
 0012                    L= 1                                                                       85
 0013                    NRATE  = 0                                                                 90
 0014                    TOTS   = 0.0                                                               95
 0015                    TOTSH  = 0.0                                                              100
 0016                    TOT1   = 0.0                                                              105
 0017                    TOT2   = 0.0                                                              110
 0018                    TOT3   = 0.0                                                              115
 0019                    TOT4   = 0.0                                                              120
 0020                    TROT1  = 0.0                                                              125
 0021                    TROT2  = 0.0                                                              130
 0022                    TROT3  = 0.0                                                              135
 0023                    TROT4  = 0.0                                                              140
 0024                    DO   5 N = 1,4                                                            145
 0025                    NT1(N)  = 0                                                               150
 0026                    NT2(N)  = 0                                                               155
 0027                    ROTSB(N)  = 0.0                                                           160
 0028                     TROT(N)  = 0.0                                                           165
 0029                    TNROT(N)  = 0.0                                                           170
 0030                  5 CONTINUE                                                                  175
 0031                    DO  10 N = 1,9                                                            180
 0032                    SEAMV(N)  = 0.0                                                           185
 0033                    SHORV(N)  = 0.0                                                           190
 0034                    PMV1(N)  = 0.0                                                            195
 0035                    PMV2(N)  = 0.0                                                            200
 0036                    PMV3(N)  = 0.0                                                            205
 0037                    PMV4(N)  = 0.0                                                            210
 0038                 10 CONTINUE                                                                  215
                   C
                   C     READ PARAMETER CARD 1                                                     219
                   C
                   C     KBORS = BILLET OR STRENGTH   1= ALLOW   2=STRENGTH   3= EQUIT. MANNING    220
                   C     KROT = ROTATION DIRECTION   21 = SEA TO SHORE   12 = SHORE TO SEA         221
                   C     MINTR = MINIMUM TOUR FOR SUMMARY OF EQUILIBRIUM TOURS                     223
                   C     MAXTR = MAXIMUM TOUR FOR SUMMARY OF EQUILIBRIUM TOURS                     224
                   C     SEA-   = NUMBER OF MONTHS TO EXTEND PRESCR. SEA TOUR FOR TIMES 1 AND 2    225
                   C     SHR- = NUMBER OF MONTHS TO EXTEND PRESCR. SHORE TOUR FOR TIMES 1 AND 2    226
                   C     ADJ   = PERCENTAGE ADJUST TO COMP.B TO CHANGE NUMBER OF ROTATABLES        227
                   C     PRCT   = MANNING LEVEL PERCENT FOR SELECTING OBLIGATED SERVICE MONTHS     228
                   C
 0039                    READ   12,KBORS,KROT,MINTR,MAXTR,SEA1,SEA2,SHR1,SHR2,    ADJ,PRCT         229
                   C
 0040                 12 FORMAT( I1,1X,I2, 2I3,4F3.0,16X,F3.0,29X,F3.0, 7X    )                    230
 0041                    KADJ = ADJ                                                                231
 0042                    ADJ = ADJ * .01                                                           232
                   C
                   C     READ PARAMETER CARD 2                                                     235
```

```
              C
              C      READ DATES OF DATA FOR PRINTOUT TITLE- TIME PERIODS 1 AND 2
              C      SVOB()= READ SERVICE OBLIGATION MONTHS FOR ROTATION ELIGIBILITY
              C
 0043                READ   20,DATE1,DATE2,DATE3,DATE4,DATE5,DATE6,DATE7,DATE8,
                    1  (SVOB(N),N= 3,9 )
              C
 0044             20 FORMAT( A4,A3,2A4, 1X,A4,A3,2A4, 7X, 7(4X,F2.0)    )
              C
              C      READ PARAMETER CARD 3
              C
              C      KOL   = SELECT COLUMN PART 1 PRINTOUT FOR MINTR/MAXTR SUMMARY
              C      MOD   = SELECT PRINTOUTS DESIRED 1=PART1 2=PARTS 1+2 3=PART 2 ONLY
              C      JACT  = ESTIMATE OF ACTUAL COMPOSITE TOUR MONTHS PROVIDED AS INPUT
              C      PERS- = PRINTOUT LABELS FOR ALLOWANCE OR STRENGTHS
              C      ABOVE = FLAG FOR RATES EXCEEDING MAXTR IN SELECTED COLUMN (KOL)
              C      BELOW=  FLAG FOR RATES LESS THAN MINTR IN SELECTED COLUMN (KOL)
              C      EVEN  = BLANK FOR RATES WITHIN SELECTED MINTR/MAXTR RANGE
              C      KSRV()= SELECTED AVERAGE LOS YEARS FOR ACTUAL TOUR EST. ALGORITHM
              C
 0045                READ   23,KOL,MOD,JACT,PERS1,PERS2,PERS3,PERS4,ABOVE,BELOW,EVEN,
                    1 (KSRV(N), N = 3,5 ) , (KSRV(N),N= 6,9)
              C
 0046             23 FORMAT( 7X,I2,4X,I2,14X,I1,7X,   A5,A4,1X,A5,A4,1X,A1,1X,A1,1X,A1,
                    1 3I2, 4I3   )
 0047                IF (MOD .GT. 3) GO TO 999
              C
 0048                JKOL = KOL
 0049                DIFF = EVEN
 0050                KPCT = PRCT
 0051                PRCT = PRCT * .01
 0052                MSEA1 = SEA1
 0053                MSEA2 = SEA2
 0054                MSHR1 = SHR1
 0055                MSHR2 = SHR2
 0056                DO 25 N = 3,9
 0057                AVSRV(N) = KSRV(N)
 0058                KVOB(N) = SVOB(N)
 0059                LVOB(N) = SVOB(N)
 0060             25 CONTINUE
 0061                IF (KBORS .GE. 2) GO TO 30
 0062                TITL1 = PERS1
 0063                TITL2 = PERS2
 0064                GO TO 35
 0065             30 TITL1 = PERS3
 0066                TITL2 = PERS4
 0067             35 CONTINUE
 0068                GO TO 43
 0069             36 KREV = KREV + 1
 0070                PRINT 37
              C
              C      PRINT PARAMETER CARD IMAGE JUST BEFORE CHANGING ROTATION DIRECTION
              C
 0071             37 FORMAT(//1X,4HCARD,        25X,     20HPARAMETER CARD IMAGE      /  )
 0072                PRINT  38,KBORS,KROT,MINTR,MAXTR,MSEA1,MSEA2,MSHR1,MSHR2,
                    1 KADJ, KPCT
 0073             38 FORMAT(2X,3H1. ,I1,1X,I2,2I3,4I3,5X,12H ADJ.COMP 8 ,I3, 5H PCT ,
                    1 4X,20HMANNING LEVEL PCT = , I3   /)
```

```
0074          PRINT 39, DATE1,DATE2,DATE3,DATE4,DATE5,DATE6,DATE7,DATE8,
             1 (LVCB(N), N = 3,9)
0075       39 FORMAT( 2X,3H2. ,      A4,A3,2A4, 1X, A4, A3, 2A4, 1X,
             1           1CHOBLSRV=E3- , I2, 4H E4-, I2, 4H E5-, I2,4H E6-,
             2  I2, 4H E7-, I2, 4H E8-, I2, 4H E9-, I2  /     )
0076          PRINT  40,KOL,MOD,JACT,PERS1,PERS2,PERS3,PERS4,ABOVE,BELOW,EVEN,
             1 (KSRV(N), N = 3,5 ) , (KSRV(N),N= 6,9)
0077       40 FORMAT(2X,3H3. ,7HCOLUMN ,I2,4H MOD,I2,14H ACT SHR TOUR ,I1,6X,
             1 A5, A4, 1X, A5, A4,1X, A1,1X,A1,1X,A1, 3I2, 4I3  /)
      C
0078          IF (KROT .NE. 21) GO TO 42
0079          KROT = 12
0080          GO TO 43
0081       42 KROT = 21
0082       43 K = 0
0083          M = 0
0084       45 PRINT 50, L
      C
      C       PRINT TITLES FOR PART 1 PRINTOUT
      C
0085       50 FORMAT(1H1,/1X,8HPART 1. , 2X,5HPAGE , I2,  /42X,
             1  40HPROTO-TYPE EQUILIBRIUM TOUR COMPUTATIONS,
             2     25X, 14HPROGRAM TRPOL4       )
0086          IF(KBCRS .NE. 3) GO TO 60
0087          PRINT 55
0088       55 FORMAT( /46X,31HAND EQUITABLE SEA/SHORE MANNING  /)
      C
      C       TEST FOR ROTATION DIRECTION PROCEED TO APPROPRIATE CARD READ FORMAT
      C
0089       60 IF ( KROT .EQ. 21) GO TO 115
0090          PRINT 65
0091       65 FORMAT( /51X,21HSHORE TO SEA ROTATION/)
0092          PRINT 70, MINTR,MAXTR,KOL
0093       70 FORMAT ( 30X,16HMINIMUM TOUR OF ,I3,1X, 20HAND MAXIMUM TOUR OF ,
             1 I3, 1X, 16HAPPLY TO COLUMN  , I2  /)
0094          PRINT 75,DATE3,DATE4,DATE7,DATE8, TITL1, TITL2, TITL1,TITL2
0095       75 FORMAT( 21X,      2A4,     3X,     2A4,    7X19H----BASIC MODEL----,11X
             A 27H-------BIASED MODEL------- ,/
             1 8X30HRATE     RATE    TIME 1    TIME 2 ,3X6HMONTHS,
             2 6X10HT I M E   1 , 17X,8HTIME   1 ,7X8HTIME   2 ,/
             38X 11HABBR    CODE,2XA5,A4,1XA5,A4,2X,25HSRV    PR.TOURS  EQUIL  PR
             4        9X,  27HEQUIL  ACTUAL EQUIL DESIRED,4X,14HCYCLE  MAN/LVL  /
             521X46HSHR   SEA   SHR   SEA    OBL   SHR   SEA    SHR    SEA   ,
             6  9X, 26H SEA    SHORE    SEA    SHORE ,4X, 13HCAR FAC    PCT      /
             7 8X,59H(1)      (2)     (3)  (4)   (5)  (6)   (7)    (8)  (9)    (10) (11)
             8 ,   9X,     25H(12)    (13)    (14)    (15)   ,7X,11H(16)    (17)     / )
0096          L = L + 1
0097          IF ( L .GT. 30) GO TO 999
      C
      C    READ ALLOWANCE - STRENGTH DATA CARDS FOR TIME PERIOD 1
      C
0098       80 READ(5,85,END=999)SHAL1,SALW1,SHST1,SSTR1,PFAL1,PFST1,PSHR1,PSEA1,
             1EXPSV1,MSRV1, (CF(J),J=2, 9),JPGRD,RCODE,GRD,RATE
0099       85 FORMAT( 4F4.0,2F3.0,2F2.0,F3.0,F2.0,2X,4F5.0,4F4.0,
             1  I1, A4, A1, A5    )
0100          IF (JPGRD - 1 ) 87, 36, 90
      C  SPACE BETWEEN RATINGS
0101       87 K = 1
```

```
            C      NEW PAGE CONTROL
 0102              IF (MOD .EQ. 3) GO TO 80
 0103              M = M + 1
 0104              IF(M .GT. 4) GO TO 43
 0105              GO TO 80
            C
            C    READ ALLOWANCE - STRENGTH DATA CARDS FOR TIME PERIOD 2
            C
 0106           90 READ 95,SHAL2,SALW2,SHST2,SSTR2,PFAL2,PFST2,PSHR2,PSEA2,
                  1        MSRV2, (FC(J), J=2, 9 ), RABBR
 0107           95 FORMAT( 4F4.0,2F3.0,2F2.0, 3X, F2.0,2X,4F5.0,4F4.0, 6X, A5 )
 0108              NRATE = NRATE + 1
 0109              NMBR = NMBR + 1
 0110              GO TO 160
 0111          115 PRINT 120
            C
 0112          120 FORMAT( /51X,21HSEA TO SHORE ROTATION/)
            C
 0113              PRINT 122,MINTR,MAXTR,KOL
 0114          122 FORMAT ( 30X,16HMINIMUM TOUR OF ,I3,1X, 20HAND MAXIMUM TOUR OF ,
                  1 I3, 1X, 16HAPPLY TO COLUMN  , I2  /)
 0115              PRINT 125,DATE3,DATE4,DATE7,DATE8, TITL1, TITL2, TITL1,TITL2
 0116          125 FORMAT( 21X,     2A4,    3X,    2A4,   7X19H----BASIC MODEL----,11X
                  A 27H-------BIASED MODEL-------  ,/
                  1 8X30HRATE    RATE    TIME 1     TIME 2 ,3X6HMONTHS,
                  2 6X10HT I M E  1 , 17X,8HTIME  1 ,7X6HTIME  2 ,/
                  38X 11HABBR   CODE,2XA5,A4,1XA5,A4,2X,25HSRV    PR.TOURS  EQUIL  PR
                  4      9X,  27HEQUIL  ACTUAL EQUIL DESIRED,4X,14HCYCLE   MAN/LVL  /
                  521X46HSEA  SHR  SEA  SHR   CBL  SEA  SHR   SEA   SHR  ,
                  6  9X, 26H SEA   SHORE   SEA   SHORE ,4X, 13HCAR FAC    PCT      /
                  7 8X,59H(1)     (2)    (3)  (4)  (5)  (6)  (7)    (8)  (9)   (10) (11)
                  8 ,   9X,     25H(12)    (13)    (14)    (15) , 7X,11H(16)    (17)     / )
 0117              L = L + 1
 0118              IF ( L .GT. 30) GO TO 999
            C
            C      READ DATA FROM CARD INPUT- TWO CARDS PER RATE OR AGGREGATE
            C      SALW- = READ NUMBERS FOR SEA  ALLOWANCE FOR TIME PERIOD
            C      SHAL- = READ NUMBERS FOR SHORE ALLOWANCE FOR TIME PERIOD
            C      SSTR- = READ NUMBERS FOR SEA STRENGTH FOR APPROPRIATE TIME PERIOD
            C      SHST- = READ NUMBERS FOR SHORE STRENGTH FOR APPROPRIATE TIME PERIOD
            C      PRFS  = READ NUMBERS FOR PREFERRED ALLOWANCE TYPE DUTY 5
            C      PFSH  = READ NUMBERS FOR PREFERRED STRENGTH  TYPE DUTY 5
            C      PSEA-  = READ PRESCRIBED SEA TOUR MONTHS
            C      PSHR-  = READ PRESCRIBED SHORE TOUR MONTHS
            C      EXPSV-= AVERAGE LENGTH OF SERVICE YEARS (EXPECTANCY OF SERVICE)
            C      MSRV- = MINIMUM LENGTH OF SERVICE YEARS FOR PAYGRADE
            C      CF()  = CAREER FACTORS FOR TIME 1
            C      FC()  = CAREER FACTORS FOR TIME 2
            C      JPGRD = PAYGRADE  LEVEL  E-1 THROUGH E-9
            C      RCODE = RATE CODE (FIRST 4 DIGITS )
            C      GRD    = RATE CODE ( FIFTH DIGIT OR ALPHA CHARACTER)
            C      RATE   = RATE ABBREVIATION
            C
            C    READ ALLOWANCE - STRENGTH DATA CARDS FOR TIME PERIOD 1
            C
 0119          130 READ(5,135,END=999)SALW1,SHAL1,SSTR1,SHST1,PFAL1,PFST1,PSEA1,
                  1 PSHR1,EXPSV1,MSRV1, (CF(J),J=2, 9),JPGRD,RCODE,GRD,RATE
 0120          135 FORMAT( 4F4.0,2F3.0,2F2.0,F3.0,F2.0,2X,4F5.0,4F4.0,
```

```
                     1  I1, A4, A1, A5    )                                              849
0121                   IF (JPGRD - 1 )137, 36,15C                                        852
0122                137 K = 1                                                            853
0123                   IF (MOD .EQ. 3) GC TO 13C                                         855
             C
             C    PAGE CONTROL BASED ON ZERO IN BLUE SEPARATOR CARDS                     857
             C
0124                   M = M + 1                                                         860
             C
             C        INSERT ALTERNATE OPERATING STATEMENT FOR SPACING OF RATINGS IN PART 1
             C
             C      IF ( M .GE.   ) GC TO 43   INSERT NUMBER OF GRCUPS DESIREC PER PAGE IN PART 1
0125                   IF(M .GE. 5) GO TC 43                                             865
0126                   GO TC 130                                                         870
             C
             C    READ ALLOWANCE - STRENGTH DATA CARDS FOR TIME PERICD 2                 875
             C
0127                150 READ 155,SALW2,SHAL2,SSTR2,SHST2,PFAL2,PFST2,PSEA2,PSHR2,        880
                     1        MSRV2, (FC(J), J=2, 9 ), RABBR                             885
0128                155 FORMAT( 4F4.C,2F3.C,2F2.C, 3X, F2.0,2X,4F5.0,4F4.0, 6X, A5 )     890
             C
             C      INSERT OPERATING STATEMNT TO DELETE LOWER PAYGRADES IF DESIREC
             C
             C     IF (JPGRD .LT.    ) GO TO 13C INSERT CESIREC PAYGRADE IN SEPARATE STATEMENT
             C                                     OMITTING 'C' IN COLUMN 1
             C
0129                   NRATE = NRATE + 1                                                 895
0130                   NMBR = NMBR + 1                                                   9C0
0131                160 CONTINUE                                                         9C5
             C
             C  CHECK ALLOWANCE ANC/OR STRENGTH FOR ZERO CATA                            910
             C
0132                   IF(KBCRS .NE. 1) GO TC 170                                        915
0133                    CHECK = SALW1 * SHAL1 * SALW2 * SHAL2                            920
0134                   ICHECK = CHECK                                                    925
0135                   IF ( ICHECK .NE. 0) GO TC 205                                     930
0136                   NRATE = NRATE - 1                                                 935
0137                   LSEAN = SALW1                                                     940
0138                   LSHRN = SHAL1                                                     945
0139                   LSEAT = SALW2                                                     950
0140                   LSHRT = SHAL2                                                     955
0141                   GO TC 178                                                         960
0142                170 CHK = SSTR1 * SHST1 * SSTR2 * SHST2                              965
0143                   ICHK = CHK                                                        970
0144                   IF (ICHK .NE. 0) GO TO 2C5                                        975
0145                   NRATE = NRATE - 1                                                 980
0146                   LSEAN = SSTR1                                                     985
0147                   LSHRN = SHST1                                                     990
0148                   LSEAT= SSTR2                                                      995
0149                   LSHRT = SHST2                                                     1CCC
0150                178 CONTINUE                                                         1CC5
0151                   IF(MOD .EQ. 3) GO TO 203                                          1010
0152                   IF ( K .EQ. 1) GO TO 190                                          1015
             C
             C      PRINT MESSAGE IF RATE IS EXCLUDED FROM ROTATICN                      1C17
             C
0153                   PRINT 180,NMBR,RATE,RCODE,GRC,LSEAN,LSHRN, LSEAT,LSHRT            1C20
0154                180 FORMAT(1XI4,2H. ,A5,2X,A4,A1,4I5,2X,54HZERC PERSCNNEL IN EITHER CO    1025
```

```
                 IMPOSITE PRECLUDES ROTATION     )
0155                GO TO 200
0156            190 PRINT 195,NMBR,RATE,RCODE,GRD,LSEAN,LSHRN, LSEAT,LSHRT
0157            195 FORMAT(/1XI4,2H. ,A5,2XA4,A1,4I5,2X,54HZERO PERSONNEL IN EITHER CO
                 IMPOSITE PRECLUDES ROTATION     )
0158                K = 0
0159            200 CONTINUE
0160                IF(M .GT. 4) GO TO 43
0161            203 CONTINUE
0162                IF( KRCT .EQ. 21) GO TO 130
0163                GO TO 80
0164            205 CONTINUE
0165                EXPSRV = EXPSV1 * .1
0166                DO 210 J = 2, 9
0167                CF(J) = CF(J) * .CC01
0168                FC(J) = FC(J) * .CC01
0169            210 CONTINUE
          C
          C         COMPUTE CAREER FACTOR TABLE FOR 144 MONTHS
          C
0170                CF(1) = 1.000
0171                FC(1) = 1.000
0172                ITOT = 1
0173                KOUNT = 1
0174                DO 320 LOOP = 1,8
0175                CFAC1 = CF(KOUNT)
0176                CFAC5 = FC(KOUNT)
0177                CFAC2 = CF(KOUNT + 1)
0178                CFAC6 = FC(KOUNT + 1)
0179                FACINT =(CFAC1 - CFAC2) / 12
0180                FRCT1 = FACINT
0181                ENTFAC =(CFAC5 - CFAC6) / 12
0182                FRCT5 = ENTFAC
0183                FACMAT(ITOT) = CFAC1
0184                  FCMT(ITOT) = CFAC5
0185                DO 310 ITEM = 1, 11
0186                ITOT = ITOT + 1
0187                FACMAT(ITOT)= CFAC1 - (FACINT * ITEM)
0188                  FCMT(ITOT)= CFAC5 - (ENTFAC * ITEM)
0189            310 CONTINUE
0190                ITOT = ITOT + 1
0191                KOUNT = KOUNT + 1
0192            320 CONTINUE
0193                FACMAT(ITOT) = CFAC2
0194                  FCMT(ITOT) = CFAC6
0195                ITOT = ITOT + 1
0196                DO 325 LOOP = 1, 48
0197                CFAC2 = CFAC2 - FRCT1
0198                CFAC6 = CFAC6 - FRCT5
0199                FACMAT(ITOT) = CFAC2
0200                FCMT(ITOT) = CFAC6
0201                ITOT = ITOT + 1
0202            325 CONTINUE
          C
          C         STORE CAREER FACTORS IN PROPER MONTH CELL OF TABLE
          C
0203                DO 330 ITOT = 1,144
0204                  FCMT(ITOT) =    FCMT(ITOT + 1)
```

```
0205         330 FACMAT(ITCT) = FACMAT(ITCT + 1)                                  1300
           C                 COMPUTE PERCENT MANNING LEVEL                        1305
0206             PCT1 = (SSTR1 + SHST1) / (SALW1 + SHAL1)                         1310
0207             PCT2 = (SSTR2 + SHST2) / (SALW2 + SHAL2)                         1315
0208             PCNT1 = PCT1 * 100                                               1316
0209             PCNT2 = PCT2 * 100                                               1317
           C
           C       MAKE ADJUSTMENTS TO TOUR LENGTHS WHEN SPECIFIED ON PARAMETER CARD 1   1320
           C
0210         340 PSEA1 = PSEA1 + SEA1                                             1325
0211             PSEA2 = PSEA2 + SEA2                                             1330
0212             PSHR1 = PSHR1 + SHR1                                             1335
0213             PSHR2 = PSHR2 + SHR2                                             1340
0214         350 PSEA  = PSEA2                                                    1345
0215             MSEA = PSEA2                                                     1350
0216             PSHR = PSHR2                                                     1355
0217             MSHR = PSHR2                                                     1360
0218             SEAP = PSEA2                                                     1365
0219             LSEA = PSEA2                                                     1370
0220             SHRP = PSHR2                                                     1375
0221             LSHR = PSHR2                                                     1380
0222         355 CONTINUE                                                         1385
           C
           C     COMPUTE COMP A TOUR BASED ON EITHER ALLOW OR STRGTH (PARAM CARD 1)   1390
           C
           C                          STRENGTHS                                   1405
0223             IF (KBCRS - 2 ) 460,420,440                                      1410
0224         420 CONTINUE                                                         1411
0225             SSTR2 = SSTR2 * 1.125 }  Adjustment to time 2 strength data     {T1412
0226             SHST2 = SHST2 * 1.125 }  Remove these cards if adjustment       {T1412
0227             PFST2 = PFST2 * 1.125 }  is not desired.                        {T1412
0228             LSEAN = SSTR1                                                    1415
0229             LSHRN = SHST1                                                    1420
0230             LSEAT  = SSTR2                                                   1425
0231             LSHRT  = SHST2                                                   1430
0232             SEAN = SSTR1                                                     1435
0233             SHRN = SHST1                                                     1440
0234             SEAT  = SSTR2                                                    1445
0235             SHRT  = SHST2                                                    1450
0236             LPFD1 = PFST1                                                    1455
0237             LPFD2 = PFST2                                                    1460
0238             GO TO 470                                                        1465
0239         440 CONTINUE                                                         1470
           C
           C               COMPUTE EQUITABLE MANNING                              1475
           C
0240             SALW1 = SALW1 * PCT1 + 0.5                                       1480
0241             SALW2 = SALW2 * PCT2 + 0.5                                       1485
0242             SHAL1 = SHAL1 * PCT1 + 0.5                                       1490
0243             SHAL2 = SHAL2 * PCT2 + 0.5                                       1495
           C
           C                          ALLOWANCES                                  1500
0244         460 LSEAN = SALW1                                                    1505
0245             LSHRN = SHAL1                                                    1510
0246             LSEAT = SALW2                                                    1515
0247             LSHRT = SHAL2                                                    1520
0248             SEAN = SALW1                                                     1525
0249             SHRN = SHAL1                                                     1530
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```
0250              SEAT   = SALW2                                                   1535
0251              SHRT   = SFAL2                                                   1540
0252              LPFC1  = PFAL1                                                   1545
0253              LPFC2  = PFAL2                                                   1546
0254          470 CONTINUE                                                         1547
0255              N = JPGRD                                                        1548
            C
            C    TALLY RATES BELOW MANNING LEVEL PERCENT ON PARAMETER CARD 1
0256              IF( PCT1 .GT. PRCT ) GO TO 475                                   1549
            C     SET ROT SERV OBLIG = 0 IF MAN/LEVEL EXCEEDS PARAMETER CARD 1 VALUE
            C
0257              NEGML = NEGML + 1                                                1550
0258              GO TO 478                                                        1551
0259          475 CONTINUE                                                         1552
0260               KVOB(N) = 0                                                     1553
0261          478 CONTINUE                                                         1554
            C    ADJUST COMPOSITE B TO PERCENTAGE ON PARAMETER CARD 1
            C
0262              SHRN = SHRN * ADJ                                                1555
0263              SHRT = SHRT * ADJ                                                1556
            C
            C     BYPASS THE FOLLOWING ALGORITHM IF ACTUAL COMP B TOUR INDEX IS USED   1557
            C  IF PARAMETER CARD 3  ACT SHR TOUR = 1  BYPASS PROGRAM ALGORITHM     1558
            C
0264              IF ( JACT .NE. 0) GO TO 492                                      1559
            C
            C  ALGORITHM FOR ESTIMATING MOVEMENT TURBULENCE FOR ACTUAL CONDITIONS  1560
            C BY INTEGRATING MANNING LEVEL AND  RELATIVE AVERAGE LOS FOR THE RATE   1565
            C
0265              IF( JPGRD - 6) 481,482,483                                       1575
0266          481 AJSHR = SHRP                                                     1580
0267              GO TO 484                                                        1585
0268          482 AJSHR = SHRP  *1.25                                              1590
0269              GO TO 484                                                        1595
0270          483 AJSHR = SHRP  *1.50                                              1600
0271          484 CONTINUE                                                         1605
0272              SRVEXP = EXPSRV                                                  1610
0273              IF( PCT1 .GT. .999 ) GO TO 490                                   1615
            C
            C
            C   MANNING LEVEL PERCENT FOR COMPUTING ESTIMATED ACTUAL MOVES          1620
            C
0274              SRVEXP = EXPSRV * PCT1                                           1624
0275          490 CONTINUE                                                         1645
0276              PSHR3 = SRVEXP /AVSRV(N) * AJSHR                                 1650
0277              KSHR = PSHR3 + .5                                                1655
0278              GO TO 494                                                        1656
0279          492 PSHR3 = PSHR1                                                    1657
0280              KSHR = PSHR3                                                     1658
            C
            C            COMPUTE MONTHLY SHORE VACANCY RATE                        1662
            C
0281          494 SHV1 = SHRN / PSHR                                               1665
0282              SHV2 = SHRN / PSHR3                                              1670
0283              SHV3 = SHRT / SHRP                                               1680
            C
            C   SELECT SERVICE OBLIGATION FOR DESIRED ROTATION ELIGIBILITY         1685
            C
```

```
0284              IF(KVCB(N) .NE. C)   GO TO 495                                            1690
            C    SET RCTATICN SERVICE CBLICATICN = COMPCSITE B TOUR IF CBLIGATICN KVCB = 0
0285              SOBL  = SHRP                                                              1695
0286              KOBL  = SCBL                                                              1700
0287              GO TC 498                                                                 1705
0288          495 SCBL  = SVOB(N)                                                           1710
0289              KOBL  = SCBL                                                              1715
0290          498 CONTINUE                                                                  1720
0291              KVOB(N) = SVOB(N)                                                         1725
            C
            C        COMPUTE PERSONNEL ROTATICN MOVES                                       1730
            C
0292              KF  = PSEA1 + SCBL                                                        1745
0293              HMVS1 = SEAN / PSEA                                                       1750
0294              HMVS1 = HMVS1 * FACMAT(KF)                                                1755
            C
            C       COMPUTE ROTATABLES FOR PRESCRIBED SEA AND SHORE TOURS                   1760
            C       AS SHOWN IN PRINTOUT PART 1 COLUMNS 8 AND 9                             1762
            C
0295              ROTSB(1) = SEAN * FACMAT(KF)                                              1765
0296              TROT(1) = TROT(1) + ROTSB(1)                                              1770
0297              SEA = HMVS1                                                               1775
0298              HMVS2 = HMVS1 + SHV1                                                      1780
0299              SHV5 = SHV1 * 2                                                           1785
0300              SHV6 = SHV2 * 2                                                           1790
0301              SHV7 = SHV3 * 2                                                           1795
0302              SEAMV(N) = SEAMV(N) + SEA                                                 1800
0303              SHORV(N) = SHORV(N) + SHV1                                                1805
0304              PMV1(N) = PMV1(N) + HMVS2                                                 1810
0305              PMV2(N) = PMV2(N) + SHV5                                                  1815
0306              PMV3(N) = PMV3(N) + SHV6                                                  1820
0307              PMV4(N) = PMV4(N) + SHV7                                                  1825
0308              TOTS = TOTS + SEA                                                         1830
0309              TOTSH = TOTSH + SHV1                                                      1835
0310              TOT1 = TOT1 + HMVS2                                                       1840
0311              TOT2 = TOT2 + SHV5                                                        1845
0312              TOT3 = TOT3 + SHV6                                                        1850
0313              TOT4 = TOT4 + SHV7                                                        1855
            C
            C         ACCUMULATE ALLOWANCE OR STRENGTH NUMBERS                              1865
            C
0314              NT1(1) = NT1(1) + LSEAN                                                   1875
0315              NT2(1) = NT2(1) + LSEAT                                                   1880
0316              NT1(2) = NT1(2) + LSHRN                                                   1885
0317              NT2(2) = NT2(2) + LSHRT                                                   1890
0318              NT1(3) = NT1(1) + NT1(2)                                                  1895
0319              NT2(3) = NT2(1) + NT2(2)                                                  1900
0320              NT1(4) = NT1(4) + LPFC1                                                   1905
0321              NT2(4) = NT2(4) + LPFC2                                                   1910
0322              TOT21 = TCT2 / 2                                                          1915
0323              TOT31 = TCT3 / 2                                                          1920
0324              TOT42 = TOT4 / 2                                                          1925
0325              FNT12 = NT1(2)                                                            1930
0326              FNT22 = NT2(2)                                                            1935
            C
            C    COMPUTE EQUILIBRIUM COMP A TOUR FOR PRESCRIBED CCMP B TOUR TIME 1          1940
            C      AS SHOWN IN PRINTOUT PART 1 COLUMNS 10 AND 11                            1945
            C
```

```
      TRYRS = 9.0
      DO 505 J = 1,8
      TRYRS = TRYRS - 1.0
      TMOS = TRYRS * 12.0
      SEACF = FACMAT(TMOS)
      RSEAB = SEACF * SEAN
      CMPSTR = RSEAB / SHV1
      AAA = CMPSTR + SOBL
      BBB = TMOS + 6.0
      IF( AAA - BBB) 505,510,510
  505 CONTINUE
  510 TRYRS = TRYRS + 1.0
      TMOS = TRYRS * 12.0
      DO 520 LOOP = 1,23
      TMOS  =  TMOS - 1.0
      SEACF = FACMAT(TMOS)
      RSEAB = SEACF * SEAN
      CMPSTR = RSEAB / SHV1
      AAA = CMPSTR + SOBL
      BBB = TMOS + 6.0
      IF( AAA - BBB) 520,530,530
  520 CONTINUE
  530 JSEA = CMPSTR + .5
      ROTSB(2) = RSEAB
      TROT(2) = TROT(2) + ROTSB(2)
C
C     COMPUTE EQUILIBRIUM COMP A TOUR FOR EST ACTUAL COMP B TOUR TIME 1
C       AS SHOWN IN PRINTOUT PART 1 COLUMNS 12 AND 13
C
      TRYRS = 9.0
      DO 552 J = 1,8
      TRYRS = TRYRS - 1.0
      TMOS = TRYRS * 12.0
      PRJCF = FACMAT(TMOS)
      PRJSB = PRJCF * SEAN
      STRCMP = PRJSB / SHV2
      AAA = STRCMP + SOBL
      BBB = TMOS + 6.0
      IF( AAA - BBB) 552,554,554
  552 CONTINUE
  554 TRYRS = TRYRS + 1.0
      TMOS = TRYRS * 12.0
      DO 556 LOOP = 1,23
      TMOS  =  TMOS - 1.0
      PRJCF = FACMAT(TMOS)
      PRJSB = PRJCF * SEAN
      STRCMP = PRJSB / SHV2
      AAA = STRCMP + SOBL
      BBB = TMOS + 6.0
      IF( AAA - BBB) 556,560,560
  556 CONTINUE
  560 KSEA = STRCMP + .5
      ROTSB(3) = PRJSB
      TROT(3) = TROT(3) + ROTSB(3)
C
C     COMPUTE EQUILIBRIUM COMP A TOUR FOR DESIRED COMP B TOUR FOR TIME 2
C       AS SHOWN IN PRINTOUT PART 1 COLUMNS 14 AND 15
C
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```
                TRYRS = 9.0
                DO 562 J = 1,8
                TRYRS = TRYRS - 1.0
                TMOS = TRYRS * 12.0
                PRJCF = FCMT(TMOS)
                PSEAB = PRJCF * SEAT
                STRCMP = PSEAB / SHV3
                AAA = STRCMP + SOBL
                BBB = TMOS + 6.0
                IF( AAA - BBB) 562,564,564
            562 CONTINUE
            564 TRYRS = TRYRS + 1.0
                TMOS = TRYRS * 12.0
                DO 566 LOOP = 1,23
                TMOS  =  TMOS - 1.0
                PRJCF = FCMT(TMOS)
                PSEAB = PRJCF * SEAT
                STRCMP = PSEAB / SHV3
                AAA = STRCMP + SOBL
                BBB = TMOS + 6.0
                IF( AAA - BBB) 566,568,568
            566 CONTINUE
            568 NSEA = STRCMP + .5
                IF(KOL .NE. 14) GO TO 575
                KOLM = NSEA
                KCYC = NSEA + KOBL
                PROP = FCMT(KCYC)
                GO TO 598
            575 IF(KOL .NE. 12) GO TO 580
                KOLM = KSEA
                KCYC = KSEA + KOBL
                PROP = FACMAT(KCYC)
                GO TO 598
            580 IF(KOL .NE. 10) GO TO 585
                KOLM = JSEA
                KCYC = JSEA + KOBL
                PROP = FACMAT(KCYC)
                GO TO 598
            585 IF(KOL .NE.  8) GO TO 590
                KOLM = MSEA
                KCYC = MSEA + KOBL
                PROP = FACMAT(KCYC)
                GO TO 598
      C
      C     PRINT DEFAULT MESSAGE IF WRONG COLUMN SELECTED ON PARAMETER CARD 3
      C
            590 PRINT 595
      C
            595 FORMAT(/2X,68HPROGRAM DEFAULTS TO COL.14 IF SELECTION IS OTHER THA
               1N 8,10,12 OR 14  /)
      C
                KOL = 14
                KOLM = NSEA
            598 CONTINUE
                IF( KOLM .GE. MINTR) GO TO 567
                KTR = KTR + 1
                DIFF = BELOW
                GO TO 565
```

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0429          567 CONTINUE                                                          2480
            C
            C       TEST FCR MAXIMUM / MINIMUM TOURS AS INDICATED CN PARAM CARD 1    2485
            C
0430              IF( KOLM .LE. MAXTR) GC TC 565                                    2490
0431              LONG = LCNG + 1                                                   2495
0432              DIFF = ABCVE                                                      2500
0433          565 CONTINUE                                                          2505
            C
            C     ACCUMULATE ROTATABLES FOR COMPUTED EQUILIBRIUM TCURS              2507
            C
0434              ROTSB(4) = PSEAB                                                  2515
0435              TROT(4) = TRCT(4) + RCTSB(4)                                      2520
0436              SUM1 = TRCT(1) + NT1(2)                                           2525
0437              SUM2 = TRCT(2) + NT1(2)                                           2530
0438              SUM3 = TRCT(3) + NT1(2)                                           2535
0439              SUM4 = TRCT(4) + NT2(2)                                           2540
            C
            C     STORE EQUIL TCUR CCMP A AND COMP B TCURS                          2569
            C
0440          570 KTCUR(1) = LSEA                                                   2570
0441              KTOUR(2) = LSHR                                                   2575
0442              KTOUR(3) = JSEA                                                   2580
0443              KTOUR(4) = MSHR                                                   2585
0444              KTCUR(5) = KSEA                                                   2590
0445              KTCUR(6) = KSHR                                                   2595
0446              KTOUR(7) = NSEA                                                   2600
0447              KTOUR( 8) = LSHR                                                  2605
            C
            C     ACCUMULATE TOTAL NCN-ROTATABLES                                   2609
            C
0448              TNROT(1) =NT1(1)- TRCT(1)                                         2610
0449              TNROT(2) =NT1(1)- TROT(2)                                         2615
0450              TNROT(3) =NT1(1)- TROT(3)                                         2620
0451              TNROT(4) =NT2(1)- TROT(4)                                         2625
0452              IF(MCD - 2) 660,660,678                                           2630
0453          660 CONTINUE                                                          2635
0454              IF(K .EQ. 1) GO TC 672                                            2640
            C
            C     PRINT CUTPUT FCR PART 1                                           2642
            C
            C
            C     DATA FCR THE FCLLCWING FIELDS APPEAR CN PRINTCUT BELCW NUMBERS AS SHCWN
            C
            C            ---(1)---- ---(2)---  (3)   (4)   (5)   (6)   (7)
            C
0455              PRINT 670,NMBR,RABBR,RCCDE,GRD,LSEAN,LSHRN,LSEAT,LSHRT,KCBL,       2645
            C         (8) THRU (15)                    BLANK (16)  (17)
                 1(KTCUR(J),J=1,8),                    DIFF, PRCP,PCNT1             2650
0456          670 FORMAT( 1X,I4,2H. ,  A5,2X,A4,A1,4I5,I5,1X,2(2I5,1X), 5X,4I7,2X,   2655
                 1  A1, 2X, F7.4, F7.1    )                                         2656
0457              CIFF = EVEN                                                       2660
0458              GO TC 678                                                         2665
            C
            C     SPACE BETWEEN RATINGS CN PRINT OUT                                2669
            C
0459          672 PRINT 674,NMBR,RABBR,RCCDE,GRD,LSEAN,LSHRN,LSEAT,LSHRT,KCBL,       2670
                 1(KTOUR(J),J=1,8),                    DIFF, PRCP,PCNT1             2675
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0460          674 FORMAT(/1X,I4,2H. ,   A5,2X,A4,A1,4I5,I5,1X,2(2I5,1X), 5X,4I7,2X,        2680
                 1  A1, 2X, F7.4, F7.1   )                                                   2681
0461              DIFF = EVEN                                                                2685
0462              K = C                                                                      2690
0463          678 CONTINUE                                                                   2695
0464              IF (KRCT .EQ. 21) GO TO 130                                                2700
0465              GO TO 80                                                                   2705
0466          999 CONTINUE                                                                   2710
0467              IF( MCD -2) 49CC,685,9CO                                                   2715
0468          685 PRINT 690                                                                  2720
            C
            C     PRINT PARAMETER CARD IMAGE AT END OF PART 1 PRINTOUT                      2722
            C
0469          690 FORMAT(//1X,4HCARD,   25X,        20HPARAMETER CARD IMAGE       /  )       2725
            C
0470              PRINT 695,KBCRS,KRCT,MINTR,MAXTR,MSEA1,MSEA2,MSHR1,MSHR2,                  2726
                 1 KADJ, KPCT                                                                2728
0471          695 FORMAT(2X,3H1. ,I1,1X,I2,2I3,4I3,5X,12H ADJ.COMP B ,I3, 5H PCT ,           2730
                 1 4X,20HMANNING LEVEL PCT = , I3    /)                                      2735
0472              PRINT 700,DATE1,DATE2,DATE3,DATE4,DATE5,DATE6,DATE7,DATE8,                 2740
                 1 (LVCB(N), N = 3,9)                                                        2745
0473          700 FORMAT( 2X,3H2. ,      A4,A3,2A4, 1X, A4, A3, 2A4, 1X,                     2749
                 1              1CHOBLSRV=E3- , I2, 4H E4-, I2, 4H E5-, I2,4H E6-,           2750
                 2  I2, 4H E7-, I2, 4H E8-, I2, 4H E9-, I2   /      )                        2755
0474              PRINT 720,KOL,MOD,JACT,PERS1,PERS2,PERS3,PERS4,ABOVE,BELOW,EVEN,           2760
                 1 (KSRV(N), N = 3,5 ) , (KSRV(N),N= 6,9)                                    2765
0475          720 FORMAT(2X,3H3. ,7HCOLUMN ,I2,4H MOD,I2,14H ACT SHR TOUR ,I1,6X,            2770
                 1 A5, A4, 1X, A5, A4,1X, A1,1X,A1,1X,A1, 3I2, 4I3  /)                       2775
            C
            C     PRINT TITLE FOR SUMMARY PAGE PART 2                                        2777
            C
0476          900 PRINT 1000, TITL1, TITL2                                                   2780
0477         1000 FORMAT(1H1, / 1X,8HPART 2.  /17X,54HSECTION 1. MONTHLY PERSONNEL R         2786
                 1OTATION MOVEMENT SUMMARY , 1X, 9HBASED ON , A5, A4    )                    2787
0478              IF(KBCRS .NE. 3) GO TO 1006                                                2795
0479              PRINT 1004                                                                 2800
0480         1004 FORMAT( /38X,31HAND EQUITABLE SEA/SHORE MANNING  /)                        2805
0481         1006 CONTINUE                                                                   2806
0482              IF (KREV .LT. 1) GO TO 1008                                                2810
0483              PRINT 1007                                                                 2815
0484         1007 FORMAT(/39X,36HCOMPOSITE A TO B AND B TO A ROTATION   /)                   2820
0485              GO TO 1017                                                                 2825
            C
            C     PRINT PERSONNEL MOVEMENT SUMMARY TABLE FOR EACH OF FOUR CONDITIONS         2827
            C
0486         1008 PRINT 1010                                                                 2830
0487         1010 FORMAT ( /40X,25HCOMPOSITE A TO B ROTATION    /)                           2835
0488         1017 PRINT 1018                                                                 2840
0489         1018 FORMAT(1X,3HROW,24X,51HE-3      E-4      E-5      E-6      E-7      E-8    2845
                 1      E-9   ,3X, 5HTOTAL      /)                                           2850
0490              PRINT 1020, (SEAMV(N), N= 3,9), TOTS, DATE1,DATE2,DATE3,DATE4              2855
0491         1020 FORMAT(2X, 21H1 COLUMN ---------(8) , 7F8.1, F8.1,2X, 4A4  )               2860
0492              PRINT 1024,(SHORV(N), N = 3,9), TOTSH , DATE1,DATE2,DATE3,DATE4            2865
0493         1024 FORMAT( /2X,21H2 COLUMN ---------(9), 7F8.1, F8.1,2X, 4A4  )               2870
0494              PRINT 1028, (PMV1(N), N = 3,9), TOT1,   DATE1,DATE2,DATE3,DATE4            2875
0495         1028 FORMAT( /2X,21H3 COLS.  (8) AND  (9), 7F8.1, F8.1,2X, 4A4  )               2880
0496              PRINT 1030, (PMV2(N), N = 3,9), TOT2,   DATE1,DATE2,DATE3,DATE4            2885
0497         1030 FORMAT( /2X,21H4 COLS. (10) AND (11), 7F8.1, F8.1,2X,4A4   )               2890
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0498            PRINT 1034, (PMV3(N), N = 3,9), TOT3,   DATE1,DATE2,DATE3,DATE4
0499       1034 FORMAT( /2X,21H5 COLS. (12) AND (13), 7F8.1, F8.1,2X, 4A4  )
0500            PRINT 1036, (PMV4(N), N = 3,9), TOT4,   DATE5,DATE6,DATE7,DATE8
0501       1036 FORMAT( /2X,21H6 COLS. (14) AND (15), 7F8.1, F8.1,2X, 4A4  )
          C
          COMPUTE NUMBER OF RATES ROTATABLE,ABOVE,WITHIN AND BELOW TOUR LIMITS
          C
0502            NREM = NRATE - KTR - LONG
          C
0503            PRINT 2060
0504       2060 FORMAT(///1X,3HROW,18X,47HSECTION 2. SUMMARY OF ROTATION DYNAMICS
               1BY RATE      )
          C
0505            PRINT 2080, NRATE, NMBR, NEGML, KPCT
0506       2080 FORMAT( /2X,     30H1 NUMBER OF ROTATABLE RATES = ,2X,I4,
               1 8H CUT OF , I4, 6H RATES ,
               2 1X, 5HWITH , I4, 1X, 17HRATES AT OR BELOW , I4,
               3 1X, 21HPERCENT MANNING LEVEL     )
0507            PRINT 2090, KOL, KTR, MINTR
0508       2090 FORMAT(/2X,29H2 FOR TOUR LENGTHS IN COLUMN ,I2,1H, , 1X, I3,
               1 41H RATES WILL HAVE EQUIL TOURS SHORTER THAN , I3, 7H MONTHS    )
0509            PRINT 2094,LONG, MAXTR
0510       2094 FORMAT( /2X,32H3 - - - - - - - - - - - - - - - ,
               1  I4, 41H RATES WILL HAVE EQUIL TOURS LONGER THAN , I3,
               1 7H MONTHS     )
0511            PRINT 2096, NREM
0512       2096 FORMAT( /2X,32H4 - - - - - - - - - - - - - - - ,
               1               I4,36H RATES FALL WITHIN PRESCRIBED LIMITS     )
0513            TOT5 = NT1(3) + NT1(4)
0514            TOT6 = NT2(3) + NT2(4)
          C
          C     COMPUTE AVERAGE TOUR LENGTH INDICES
          C
0515            AVTR1  = SUM1    / TOT1
0516            AVTR2  = SUM2    / TOT2
0517            AVTR3  = SUM3    / TOT3
0518            AVTR4  = SUM4    / TOT4
0519            AVTR5  = TROT(1) / TOT5
0520            AVTR6  = TROT(2) / TOT21
0521            AVTR7  = TROT(3) / TOT31
0522            AVTR8  = TROT(4) / TOT42
0523            AVTR9  = FNT12 / TOTSH
0524            AVTR10 = FNT12 / TOT21
0525            AVTR11 = FNT12 / TOT31
0526            AVTR12 = FNT22 / TOT42
          C
          C     PRINT AGGREGATE TOTALS AND AGGREGATES FOR COMPOSITES A AND B
          C
0527            PRINT 3000, TITL1, TITL2,TITL1, TITL2
0528       3000 FORMAT(///17X,11HSECTION 3. ,A5,A4, 8HSUMMARY , 24X, 11HSECTION 4.
               1 ,A5, A4, 8HSUMMARY  / )
0529            PRINT 3010
0530       3010 FORMAT( 15X,42H+ - - T O T A L   A G G R E G A T E - - + ,
               1 2X, 39H+- - - - C O M P O S I T E   A - - - -+  ,
               2 4X, 18H+--COMPOSITE  B--+    )
0531            PRINT 3020
0532       3020 FORMAT(/23X,33HTYPE  NON-   ROTA-   MOVES/  TOUR  ,
               3 16X,5CHNON-     ROTA-   MOVES/ TOUR          MOVES/ TOUR  /
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                4  6X, 8HCOLUMNS ,2X, 41HTOTAL  FIVE  ROT    TABLE   MONTH  INDEX ,      3115
                5 7X, 57HTOTAL    ROT     TABLE    MONTH  INDEX  TOTAL  MONTH  INDEX,    3120
                8/1X,3HROW, 13X,40H(1)    (2)     (3)      (4)      (5)     (6) ,4H ROW,  3125
                9  4X,56H(7)     (8)      (9)      (10)    (11)    (12)     (13)  (14) /) 3130
          C                   (1)     (2)      (3)      (4)   (5)  (6)     (7)     (8)    3131
0533             PRINT 3050,TOT5,NT1(4),TNROT(1),SUM1,TOT1,AVTR1,NT1(1),TNROT(1),         3135
          C           (9)     (10)     (11)   (12)      (13) (14)
                1 TROT(1), TOTS , AVTR5,NT1(2),TOTSH,AVTR9                               3140
0534      3050 FORMAT( /1X,3H 1 , 9H (8)& (9),            F8.0,I5,2F8.0,F8.1,F6.1,        3145
                1 4H   1, I8, 2F8.0, F8.1, F7.1, I7, F8.1, F6.1     )                    3150
          C                   (1)     (2)      (3)      (4)   (5)  (6)     (7)     (8)
0535             PRINT 3060,              TNROT(2),SUM2,TOT2,AVTR2,          TNROT(2),    3155
          C           (9)     (10)     (11)   (12)      (13) (14)
                1 TROT(2), TOT21, AVTR6,          TOT21,AVTR10                           3160
0536      3060 FORMAT( /1X,3H 2 , 22H(10)&(11)     - - -   - -,    2F8.0,F8.1,F6.1,       3165
                1 4H   2,4X,4H - -,2F8.0, F8.1, F7.1,3X4H - -,F8.1, F6.1     )           3170
          C                   (1)     (2)      (3)      (4)   (5)  (6)     (7)     (8)
0537             PRINT 3070,TOT5,NT1(4),TNROT(3),SUM3,TOT3,AVTR3,NT1(1),TNROT(3),         3175
          C           (9)     (10)     (11)   (12)      (13) (14)
                1 TROT(3), TOT31, AVTR7,NT1(2),TOT31,AVTR11                              3180
0538      3070 FORMAT( /1X,3H 3 , 9H(12)&(13),             F8.0,I5,2F8.0,F8.1,F6.1,       3185
                1 4H   3, I8, 2F8.0, F8.1, F7.1, I7, F8.1, F6.1     )                    3190
          C                   (1)     (2)      (3)      (4)   (5)  (6)     (7)     (8)
0539             PRINT 3080,TOT6,NT2(4),TNROT(4),SUM4,TOT4,AVTR4,NT2(1),TNROT(4),         3195
          C           (9)     (10)     (11)   (12)      (13) (14)
                1 TROT(4), TOT42, AVTR8,NT2(2),TOT42,AVTR12                              3200
0540      3080 FORMAT( /1X,3H 4 ,9H(14)&(15) ,             F8.0,I5,2F8.0,F8.1,F6.1,       3205
                1 4H   4, I8, 2F8.0, F8.1, F7.1, I7, F8.1, F6.1     )                    3210
          C
          C      PRINT FINAL PARAMETER CARD IMAGE                                         3212
          C
0541      4900 PRINT 5000                                                                 3215
0542      5000 FORMAT(//1X,4HCARD,14X,31HSECTION 5. PARAMETER CARD IMAGE        /  )     3220
          C
0543             PRINT 5005,KBORS,KROT,MINTR,MAXTR,MSEA1,MSEA2,MSHR1,MSHR2,               3225
                1 KADJ, KPCT                                                             3230
0544      5005 FORMAT(2X,3H1. ,I1,1X,I2,2I3,4I3,5X,12H ADJ.COMP B ,I3, 5H PCT ,           3235
                14X, 20HMANNING LEVEL PCT = , I3    /)                                   3240
0545             PRINT 5010,DATE1,DATE2,DATE3,DATE4,DATE5,DATE6,DATE7,DATE8,              3245
                1 (LVCB(N), N = 3,9)                                                     3250
0546      5010 FORMAT( 2X,3H2. ,     A4,A3,2A4, 1X, A4, A3, 2A4, 1X,                      3254
                1                1CHOBLSRV=E3- , I2, 4H E4-, I2, 4H E5-, I2,4H E6-,      3255
                2  I2, 4H E7-, I2, 4H E8-, I2, 4H E9-, I2  /      )                      3260
0547             PRINT 5020,KCL,MOD,JACT,PERS1,PERS2,PERS3,PERS4,ABOVE,BELOW,EVEN,        3265
                1 (KSRV(N), N = 3,5 ) , (KSRV(N),N= 6,9)                                 3270
0548      5020 FORMAT(2X,3H3. ,7HCOLUMN ,I2,4H MOD,I2,14H ACT SHR TOUR ,I1,6X,            3275
                1 A5, A4, 1X, A5, A4,1X, A1,1X,A1,1X,A1, 3I2, 4I3  /)                    3280
0549             STOP                                                                     3285
0550             END                                                                      3290
```

APPENDIX B

GLOSSARY OF PROGRAM DATA FIELD NAMES

GLOSSARY OF APPENDIX B PROGRAM DATA FIELD NAMES* FOR THE

COMPUTERIZED EQUILIBRIUM FLOW MODEL

AAA - Computed sea tour plus length-of-service obligation for rotation eligibility.

ABOVE - Selects "flag" A from parameter card for equilibrium tours above specified MAXTR.

ADJ - Percentage adjustment to composite B numbers where 100% results in no change, lower percentage figure reduces composite B numbers and higher percentage figure increases composite B numbers.

AJSHR - Amount to adjust shore tour for program algorithm that computes estimate of actual shore tour lengths.

AVTRx - Denotes average tour lengths where position "x" contains a numerical identifier differentiating tour lengths contained within the program for printing summary tables in Part 2, Section 3.

BBB - Career factor selected from appropriate table offset the specified six months to adjust mid-year data to end-of-year data.

BELOW - Selects "flag" B from parameter card for equilibrium tours below specified MINTR.

CFn - Career Factors for TIME 1.

CFACx - Adjacent career factors selected from table for interpolating month values between yearly factors. Numerical identifiers in position x differentiate the selected factors.

CHECK - Zero data check for allowance or strength, TIME 1.

CHK - Zero data check for allowance or strength, TIME 2.

CMPSTR - Computed equilibrium sea tour for TIME 1.

DATEx - Stored labels for print-out showing dates of input data; "x" values run from 1 through 8.

*Subscript "n" indicates a dimensioned array. Subscript "x" indicates a numerical identifier to differentiate otherwise identical alpha-field names.

DIFF - Field identifier for direction of tour length difference between computed equilibrium tour and either MAXTR or MINTR; selects word ABOVE, EVEN or BELOW for later selection of A, B or (blank) to appear between columns 15 and 16 in Part 1 Printout.

ENTFAC - Interpolated career factor for TIME 2.

EVEN - Selects a blank space from parameter card for identifying equilibrium tours that fall within the specified MINTR and MAXTR.

EXPSRV - Average length of service years expressed to one decimal place. (Derived from EXPSV1 X 0.1)

EXPSV1 - Average length of service years multiplied by ten to eliminate decimal point for space conservation on data card.

FACINT - Career factor interpolated for each month from annual factors.

FACMATn - Career factor used in computing interpolated values for TIME 1.

FCn - Career factors for TIME 2.

FCMTn - Career factor used in computing interpolated values for TIME 2.

FNT12 - Total number of personnel at TIME 1

FNT22 - Total number of personnel at TIME 2.

FRCT1 - Interpolated career factor derived from FACINT.

FRCT5 - Interpolated career factor derived from ENTFAC.

GRD - Enlisted grade (paygrade level).

HMVS1 - Personnel moves resulting from a prescribed sea tour and adjusted by the appropriate career factor.

HMVS2 - Personnel moves resulting from combined sea moves (HMVS1) and moves resulting from prescribed shore tour (SHV1).

ITEM - Program "Do Loop" counter.

ITOT - Career factor matrix cell location used in dimensioned array.

J - Program "Do Loop" counter.

JACT - Field name for value punched in parameter card 3, column 30 to indicate whether or not estimate of actual shore tour length is provided as input data.

JPGRD - Enlisted grade (paygrade level) integer format.

JSEA - Equilibrium sea tour for policy prescribed shore tour.

K - Operation counter controlling space between ratings on printout.

KBORS - Field name for value punched in parameter card 1, column 1 for directing program to use allowance, strength or equitable manning for rotation computations.

KCYC - Length of career rotation cycle in months.

KF - Career factor selector for rotation career cycle.

KOL - Data column selector for identifying equilibrium tours relative to the specified MINTR and MAXTR on parameter card 1.

KOLM - Field set equal to various equilibrium tours for integer format and logical branching tests within the program.

KOUNT - Career factor cell matrix location used in computing interpolated career factor values.

KPCT - Specified manning level percent located on parameter card 1, columns 71-73.

KREV - Data field used to reverse rotation direction of model when a "1" appears in column 70 of the card used to separate rating groups in data input deck.

KROT - Navy duty type identifiers in columns 3 and 4 of parameter card 1 indicating direction of rotation by their arranged sequence. 21 = type duty 2 to type duty 1 for sea to shore rotation. Reversed rotation of shore to sea will be obtained by a "12".

KSEA - Equilibrium tour that will support the estimated actual prescribed tour in the complementary composite.

KSRVn - Average length-of-service years against which to compare individual rate lengths-of-service for computation of estimated actual personnel movement rates in program algorithm. Values for each paygrade appear in columns 63-80 on parameter card 3.

KTOURn - A dimensioned array for accumulation of computed equilibrium tours and prescribed complementary tours.

KTR - Counter for the number of equilibrium tours shorter than the specified MINTR on parameter card 1. Total appears in Part 2, Section 2, Row 2.

L - Page counter for Part 1 printout.

LONG - Counter for the number of equilibrium tours longer than the specified MAXTR on parameter card 1. Total appears in Part 2, Section 2, Row 3.

LOOP - Program "Do loop" counter for computing career factor matrix.

M - Space between ratings counter for Part 1 printout

MAXTR - Specified maximum equilibrium tour appearing on parameter card 1, columns 9 and 10.

MINTR - Specified minimum equilibrium tour appearing on parameter card 1, columns 6 and 7.

MOD - Field on parameter card 3 column 15 for indicating mode of printout; Parts 1 or 2 or 1 and 2.

MSRV1 - Minimum length-of-service years for pay grade level for TIME 1.

MSRV2 - Minimum length-of-service years for pay grade level for TIME 2.

NEGML - Counter for number of rates below manning level specified on parameter card 1 columns 71-73.

NMBR - Counter for the number of rates processed by the model and each number is printed immediately ahead of each rate abbreviation in Part 1 printout. Total appears in Part 2, Section 2, Row 1.

NRATE - Counter for the number of rotatable rates processed by the model. Total appears in Part 2 summary under Section 2 Row 1.

NREM - Counter for the number of rates falling within MINTR and MAXTR. Total appears in Part 2, Section 2, Row 4.

NSEA - Equilibrium tour for future desired prescribed tour.

NT1n - Data field for accumulating total numbers of strength or allowance for TIME 1. Comprises a data array.

NT2n - Data field for accumulating total numbers of strength or allowance for TIME 2. Comprises a data array.

PCNT1 - Percent manning level at TIME 1. (PCT1 X 100)

PCNT2 - Percent manning level at TIME 2. (PCT2 X 100)

PCT1 - Ratio of strength to allowance at TIME 1.

PCT2 - Ratio of strength to allowance at TIME 2.

PERSx - Data names for printout labels: ALLOWANCE and STRENGTH. Numerical identifiers in position "x" differentiate four PERSx names.

PFAL1 - Preferred type duty 5 allowance for TIME 1.

PFAL2 - Preferred type duty 5 allowance for TIME 2.

PFST1 - Preferred type duty 5 strength for TIME 1.

PFST2 - Preferred type duty 5 strength for TIME 2.

PMVxn - Accumulation of monthly personnel moves in a data array for each of four conditions differentiated by numbers in position "x".

PRCT - Specified manning level percent appearing on parameter card 1 in columns 71-73.

PRJCF - Career factor selected from matrix for computing equilibrium sea tour.

PRJSB - Estimated number of sea billets or strength computed with career factor.

PROP - Proportion of personnel that can be expected to complete a rotation cycle.

PSEAB - Number of rotatable sea billets or strength as computed.

PSEA1 - Prescribed sea tours for TIME 1.

PSEA2 - Prescribed sea tours for TIME 2.

PSHR1 - Prescribed shore tours for TIME 1.

PSHR2 - Prescribed shore tours for TIME 2.

PSHR3 - Estimated actual shore tour for TIME 1

RABBR - Rate abbreviation.

RATE - Rate abbreviation.

RCODE - Rate code.

ROTSBn - Number of rotatable sea billets or strengths accumulated in array for aggregate summary Part 2.

RSEAB - Number of rotatable sea billets or strengths.

SALW1 - Sea allowance TIME 1.

SALW2 - Sea allowance TIME 2.

SEA - Number of monthly moves resulting from prescribed sea tours.

SEACF - Career factor selected from appropriate cell matrix for use in computing rotatables.

SEAMVn - Number of monthly moves related to prescribed sea tours. Used to accumulate total moves in a dimensioned array.

SEA1 - Number of months to add or subtract to sea tour length as indicated on parameter card 1, columns 12-13 for TIME 1.

SEA2 - Number of months to add or subtract to sea tour length as indicated on parameter card 1, columns 15-16 for TIME 2.

SHAL1 - Shore allowance for TIME 1.

SHAL2 - Shore allowance for TIME 2.

SHORVn - Dimensioned array for accumulating number of shore vacancies due to tour completions.

SHR1 - Number of months to add or subtract from shore tour length on parameter card 1, columns 18-19 for TIME 1.

SHR2 - Number of months to add or subtract from shore tour length on parameter card 1, columns 21-22 for TIME 2.

SHST1 - Shore strength for TIME 1.

SHST2 - Shore strength for TIME 2.

SHVx - Accumulated shore vacancies due to tour completions for a variety of situations differentiated by index numbers in "x" position.

SOBL - Length of service obligation months for rotation eligibility.

SRVEXP - Service expectancy or average length of service for each rate.

SSTR1 - Sea strength for TIME 1.

SSTR2 - Sea strength for TIME 2.

STRCMP - Computed equilibrium sea tour length in months.

SUMx - Accumulation of numbers of rotatables for each of four conditions differentiated by numbers in "x" position.

SVOBn - Manager specified service obligation months for rotation eligibility appearing on parameter card 2, coulmns 43-80 for each of pay grades 3 through 9.

TITLx - Selects labels ALLOWANCE or STRENGTH in accordance with parameter indicator on card 1, column 1. TITL1 and TITL2 are required to print complete label.

TMOS - Selects career factor for number of months for program "do loops".

TNROTn - Total number of non-rotatables for aggregate summary, used in a dimensioned array for each of four situations.

TOTS - Accumulates total number at sea for aggregate summary in Part 2.

TOTSH - Accumulates total number ashore for aggregate summary in Part 2.

TOTx - Accumulates total number of personnel moves due to tour completions for aggregate summary in Part 2, for each of six situations.

TOTxx - Accumulates total number of personnel moves due to tour completions for separate duty composites for aggregate summary in Part 2, for each of three situations.

TROTn - Accumulates total number of rotatables in dimensioned array for each of four situations for aggregate summary in Part 2.

TRYRS - Sets initial number of tour years to begin iteration process for computing equilibrium tour months.

DATA FIELD SUBSTITUTIONS AND DUPLICATIONS

AVSRVn = KSRVn

ICHECK = CHECK

ICHK = CHK

JKOL = KOL

KADJ = ADJ

KOBL = SOBL

KSHR = PSHR3

KVOBn = SVOBn

LPFD1 = PFAL1 = PFST1

LPFD2 = PFAL2 = PFST2

LSEA = PSEA2

LSEAN = SALW1 = SSTR1

LSEAT = SALW2 = SSTR2

LSHR = PSHR2

LSHRN = SHAL1 = SHST1

LSHRT = SHAL2 = SHST2

LVOBn = SVOBn

MSEA = PSEA2

MSEA1 = SEA1

MSEA2 = SEA2

MSHR = PSHR2

MSHR1 = SHR2

MSHR2 = SHR2

N = JPGRD

PSEA = PSEA2

PSHR = PSHR2

SEAN = SALW1 = SSTR1

SEAP = SPEA2

SEAT = SALW2 = SSTR2

SHRN = SHAL1 = SHST1

SHRP = PSEA2

SHRT = SHAL2 = SHST2

TITLx = PERSx

APPENDIX C

DATA FIELD LOCATIONS IN PROGRAM

FIELD NAME	LOCATION BY PSID NUMBERS
AAA	2020,2030,2075,2085,2150,2160,2205,2215,2290,2300,2345,2355
ABOVE	230, 470,2500,2760,3265
ADJ	229, 231, 232,1552,1553
AJSHR	1580,1590,1600,1650
AVSRV	55, 350,1650
AVTR1	3010,3035
AVTR2	3015,3155
AVTR3	3020,3175
AVTR4	3025,3195
AVTR5	3030,3140
AVTR6	3035,3160
AVTR7	3040,3180
AVTR8	3045,3200
AVTR9	3050,3140
AVTR10	3055,3160
AVTR11	3060,3180
AVTR12	3065,3200
BBB	2025,2030,2080,2085,2155,2160,2210,2215,2295,2300,2350,2355
BELOW	2308 470,2760,3265
CF	40, 655, 847,1100,1120,1145,1155
CFAC1	1145,1165,1185,1205
CFAC2	1155,1165,1235,1255,1265,
CFAC5	1150,1175,1190,1210,
CFAC6	1160,1175,1240,1260,1270
CHECK	920, 925,
CHK	965, 970,
CMPSTR	2015,2020,2070,2075,2100
DATE1	239, 450,2740,2855,2865,2875,2885,2895,3245
DATE2	239, 450,2740,2855,2865,2875,2885,2895,3245
DATE3	239, 450, 585, 765,2740,2855,2865,2875,2885,2895,3245
DATE4	239, 450, 585, 76582740,2855,2865,2875,2885,2895,3245
DATE5	239, 450,2740,2905,3245
DATE6	239, 450,2740,2905,3245
DATE7	239, 450, 585, 765,2740,2905,3245
DATE8	239, 450, 585, 765,2740,2905,3245
DIFF	310,2470,2500,2650,2675,2660,2685
ENTFAC	1175,1180,1210,
EVEN	230, 310, 470,2660,2685,2760,3265
EXPSRV	1090,1610,1624
EXPSV1	655, 847,1090
FACINT	1165,1170,1205
FACMAT	40,1185,1205,1235,1265,1300,1755,1765,2005,2060,2135,2190,2392
FACMAT	2407,2422
FC	40, 715, 880,1130,1125,1150,1160
FCMT	40,1190,1210,1240,1270,1295,2275,2330,2377
FNT12	1930,3050,3055,3060
FNT22	1935,3065
FRCT1	1170,1255
FRCT5	1180,1260
GRD	655, 847,1020,1040,2645,2670
HMVS1	1750,1755,1775,1780
HMVS2	1780,1810,1840
ICHECK	925, 930
ICHK	970, 975
ITEM	1195,1205,1210
ITOT	1130,1185,1190,1200,1205,1210,1220,1235,1240,1245,1265,1270,12758
ITOT	1290,1295,1300
J	1095,1990,2120,2650,2675
JACT	280, 470,1559,2760
JKOL	305
JPGRD	6558 665, 847, 852,1548,1575

FIELD NAME	LOCATION BY PSID NUMBERS
JSEA	2100,2405,2406,2580
K	510, 675, 853,1015,1055,2640,2690
KADJ	231, 430,2726,3230
KBORS	229, 370, 430, 540, 915,1410,2726,2795,3225
KCYC	2375,2377,2391,2392,2406,2407,2421,2422
KF	1745,1755,1765
KOBL	1700,1715,2376,2391,2406,2421,2645,2670
KOL	280, 305, 470, 570, 750,2370,2385,2400,2415,2445,2760,2960,3265
KCLM	2375,2390,2405,2420,2450,2460,2490
KOUNT	1135,1145,1150,1155,1160,1225
KPCT	315, 430,2726,2945,3230
KREV	65, 410,2810
KROT	229, 430, 490, 495, 505, 555,1075,2700,2726,3225
KSEA	2225,2390,2391,2590
KSHR	1655,1658,2595
KSRV	55, 285, 350, 475,2765,3270
KTOUR	40,2570,2575,2580,2585,2590,2595,2600,2605,2650,2675
KTR	70,2465,2925,2960
KVOB	55, 355,1551,1690,1725
L	85, 525, 640, 645, 820, 825
LONG	75,2495,2925,2975
LOOP	1140,1250,2050,2180,2320
LPFD1	1455,1545,1905
LPFD2	1460,1546,1910
LSEA	1370,2570
LSEAN	940, 985,1020,1040,1415,1505,1875,2345,2670,
LSEAT	950, 995,1020,1040,1425,1515,1880,2645,2670
LSHR	1380,2575,2605
LSHRN	945, 990,1020,1040,1420,1510,1885,2645,2670
LSHRT	955,1000,1020,1040,1430,1520,1890,2645,2670
LVOB	55, 360, 455,2745,3250
M	520, 690, 695, 860, 865,1065
MAXTR	229, 430, 570, 750,2490,2726,2975,3225
MINTR	229, 430, 570, 750,2726,2960,3225
MOD	280, 296, 470, 685, 855,1010,2630,2715,2760,3265
MSEA	1350,2421
MSEA1	325, 430,2726,3225
MSEA2	330, 430,2726,3225
MSHR	1360,2585
MSHR1	335, 430,2726,3225
MSHR2	340, 430, 880,2726,3225
MSRV1	655, 847
MSRV2	715
N	145, 180, 345,1548,2745,2765,2855,2865,2875,2885,2895,2905,3250
N	3270
NEGML	82,1550,2945
NMBR	80, 730, 900,1020,1040,2645,2670,2645
NRATE	90, 725, 895, 935, 980,2925,2945
NREM	2925,2990
NSEA	2365,2375,2376,2600
NT1	50, 150,1875,1885,1895,1905,1930,2525,2530,2535,2610,2615,2620
NT1	3000,3135,3135,3140,3175,3175,3180
NT2	50, 155,1880,1890,1900,1910,1935,2540,2625,3005,3195,3195,3200
PCNT1	1316,2650,2675
PCNT2	1317,
PCT1	1310,1316,1480,1490,1549,1615,1624
PCT2	1315,1317,1485,1495
PERS1	35, 280, 375, 470,2760,3265
PERS2	280, 380, 470,2760,3265
PERS3	35, 280, 390, 470,2760,3265
PERS4	280, 395, 470,2760,3265

FIELD NAME	LOCATION BY PSID NUMBERS
PFAL1	650, 846,1545
PFAL2	710, 880,1546
PFST1	650, 846,1455
PFST2	710, 880,1460
PMV1	45, 195,1810,2875
PMV2	45, 200,1815,2885
PMV3	45, 205,1820,2895
PMV4	45, 210,1825,2905
PRCT	229, 315, 320,1549
PRJCF	2135,2140,2190,2195,2275,2280,2330,2335
PRJSB	2140,2145,2195,2200,2235
PROP	2377,2392,2407,2422,2650,2675
PSEA	1345,1750
PSEAB	2280,2285,2335,2340,2515
PSEA1	650, 846,1325,1745
PSEA2	710, 880,1330,1345,1350,1365,1370
PSHR	1355,1665
PSHR1	650, 847,1335,1657
PSHR2	710, 880,1340,1355,1360,1375,1380
PSHR3	1650,1655,1657,1658,1670
RABBR	358 715, 880,2645,2670
RATE	358 655, 847,1020,1040
RCODE	358 655, 847,1020,1040,2645,2670
ROTSB	50, 160,1765,1770,2105,2110,2235,2240,2515,2520
RSEAB	2010,2015,2065,2070,2105
SALW1	650, 846, 920, 940,1300,1480,1505,1525
SALW2	710, 880, 920, 950,1315,1485,1515,1535
SEA	1775,1800,1830
SEACF	2005,2010,2060,2065
SEAMV	45, 85,1800,2855
SEAN	1435,1525,1750,1765,2010,2065,2140,2195
SEAP	1365
SEAT	1445,1535,2280,2335
SEA1	229, 325,1325
SEA2	229, 330,1330
SHAL1	650, 846, 920, 940,1300,1490,1510,1530
SHAL2	710, 880, 920, 955,1315,1520,1540
SHRN	1440,1530,1552,1665,1670
SHRP	1375,1580,1590,1600,1680,1695
SHRT	1450,1540,1553,1680
SHORV	45, 190,1805,2865
SHR1	229, 335,1335
SHR2	229, 340,1340
SHST1	650, 846, 965, 990,1300,1420,1440
SHST2	710, 880, 965,1000,1315,1430,1450,1495
SHV1	1665,1780,1785,1805,1835,2015,2070
SHV2	1670,1790,2145,2200
SHV3	1680,1795,2285,2340
SHV5	1785,1815,1845
SHV6	1790,1820,1850
SHV7	1795,182581855
SOBL	1695,1700,1710,1715,1745,2020,2075,2150,2205,2290,2345
SRVEXP	1610,1624,1650
SSTR1	650, 846, 965, 985,1310,1415,1435
SSTR2	710, 880, 9658 995,1315,1425,1445
STRCMP	2145,2150,2200,2205,2225,2285,2290,2340,2345,2365
SUM1	2525,3010,3135
SUM2	2530,3015,3155
SUM3	2535,3020,3175
SUM4	2540,3025,3195
SVOB	50, 240, 355, 360,1710,1725

FIELD NAME	LOCATION BY PSID NUMBERS
TITL1	35, 375, 390, 585, 765,2780,3070
TITL2	35, 380, 395, 585, 765,2780,3070
TMOS	2000,2005,2025,2045,2055,2060,2080,2130,2135,2155,2175,2185,2190
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TROT	50, 165,1770,2110,2240,2520,2525,2530,2535,2540,2610,2615,2620
TROT	2625,3030,3035,3040,3045,3140,3160,3180,3200
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