

Technical Report 414

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**A DIGITAL SIMULATION MODEL OF MESSAGE  
HANDLING IN THE TACTICAL OPERATIONS  
SYSTEM**

**V. User's Guide to the Integrated  
MANMOD/CASE/SAMTOS  
Computer Simulation**

W. Rick Leahy, Arthur L. Siegel, J. Jay Wolf  
Applied Psychological Services, Inc.

HUMAN FACTORS TECHNICAL AREA

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| 20. ABSTRACT (Continue on reverse side if necessary and identify by block number)<br>This document is a complete guide for the use and interpretation of the computer simulation program--MANMOD. The program is stored in files on the Univac 1108 computer at the Edgewood Arsenal. The MANMOD program calls the Army Research Institute's MANMOD simulation of the Tactical Operations System and provides an interface with the CASE and the SANTOS computer simulation models. → new |  |                                                                                         |  |

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Item 20 (Continued)

The MANMOD program is written in FORTRAN IV. Sufficient information is provided in this manual to allow simulations to be performed by individuals with minimum computer related experience. In addition, detailed flow charts and variable lists are provided for the use of skilled programmers who desire a more technical description of the mechanics of the simulation and to allow program changes to be made more easily.

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W. Rick Leahy, Arthur L. Siegel, J. Jay Wolf  
Applied Psychological Services, Inc.

Submitted by:  
Edgar M. Johnson, Chief  
HUMAN FACTORS TECHNICAL AREA

Approved by:  
Milton S. Katz, Acting Director  
ORGANIZATIONS AND SYSTEMS  
RESEARCH LABORATORY

U.S. ARMY RESEARCH INSTITUTE FOR THE BEHAVIORAL AND SOCIAL SCIENCES  
5001 Eisenhower Avenue, Alexandria, Virginia 22333

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## FOREWORD

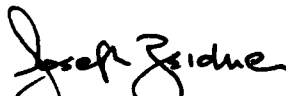
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The Human Factors Technical Area of the Army Research Institute (ARI) is concerned with the human resource demands of increasingly complex battlefield systems designed to acquire, transmit, process, disseminate, and utilize information. Research focuses on human performance problems related to interactions within command-and-control centers as well as issues of system development, performance, effectiveness, and efficiency. It is concerned with such areas as software development, topographic products and procedures, tactical symbology, user-oriented systems, information management, staff operations and procedures, decision support, and sensor systems integration and utilization.

Of special interest are the human factors problems related to the integration of human functions into information-processing systems and to the harmonizing of system components, personnel, and operations in a battlefield environment. To incorporate human functions and performance into simulated system operations, a research program at ARI developed a computer simulation of a generalized human information processing model (MANMOD). MANMOD permits study of system operations and performance under prescribed as well as alternative personnel and equipment configurations.

This user's guide is a companion to ARI Technical Report 413 (Volume IV), which describes the interface of MANMOD with two computer models, CASE and SANTOS, of the Army's tactical operations system (TOS). It documents the MANMOD computer model in sufficient detail to permit on-line simulation by users with minimal computer experience and to facilitate program changes by skilled programmers. This effort supported the Army's cost-effectiveness analysis of TOS (CEATOS) and the investigation of alternative TOS configurations. Earlier reports in the series described sequential versions of MANMOD: batch processing in Volume I (ARI technical report TR-77-A23), on-line processing in Volume II (TR-77-A24), and interactive in Volume III (TR-77-A25). Also, ARI publications TR-77-A22 and Technical Report 407 describe a second-generation model, NETMAN, developed on the basis of MANMOD research.

Research on systems integration and operations is conducted as an in-house effort augmented through contracts with organizations selected for their unique capabilities and facilities for research and development on human performance and computer simulation. This report represents research by personnel from ARI and Applied Psychological Services, Inc., under contract DAHCl9-75-C-0001. The effort is responsive to general requirements of Army Project 2Q762722A765 and to special requirements of the U.S. Army Combined Arms Combat Development Activity. Special requirements are contained in Human Resources Need 76-161, "MAN MODEL interface with other CEATOS support models."

  
JOSEPH ZEIDNER  
Technical Director



# A DIGITAL SIMULATION MODEL OF MESSAGE HANDLING IN THE TACTICAL OPERATIONS SYSTEM: V. User's Guide to the Integrated MANMOD/CASE/SAMTOS Computer Simulation

## BRIEF

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### Requirement:

To develop a user's manual and programmer's guide to the integrated, MANMOD/CASE/SAMTOS simulation of the Army's tactical operations system (TOS). MANMOD simulates activities within a communications station and assesses the effects of operator characteristics on message-handling performance to provide estimates of human performance parameters. CASE simulates the TOS communications network itself and estimates the effects on TOS performance of number of components and network variations. SAMTOS simulates the TOS computer hardware and software.

### Product:

In the integrated simulation, MANMOD accepts network equipment parameter estimates from CASE and generates estimates of human performance parameters for use in the SAMTOS model. This user's guide documents input specifications of simulation parameters, operation and output options, and interpretation of the output data. A program listing and detailed flow charts are provided to facilitate program changes.

### Utilization:

The documentation permits users and programmers to modify the integrated MANMOD/CASE/SAMTOS program to satisfy a larger variety of system simulation requirements. The integration of the three computer simulations provides a useful tool for analyzing and designing alternative system configurations. Within the limits imposed by the lack of appropriate data for validating the model, system effectiveness and other figures of merit can be obtained for alternative system configurations. These alternatives can reflect differences in personnel characteristics, manning levels, message traffic loads, equipment capabilities, performance, or message types. Results can provide insights on equipment design, training and personnel requirements, and the tradeoffs necessary for optimum cost effectiveness.

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## CHAPTER I

### INTRODUCTION

#### Background

Under the sponsorship of the U. S. Army Research Institute for the Behavioral and Social Sciences, in 1971 Applied Psychological Services developed a computer simulation of the U. S. Army's Tactical Operations System (Siegel, Wolf, & Leahy, 1973a). In this model, the psychological factors and the queuing structure of message preparation and transmission at the G3 level are simulated. The MANMOD was set up originally for data card input. Later (Siegel, Wolf, Leahy, & Bearde, 1973b) this capability was extended to allow the model user to change the input data via a terminal and to view summary statistics on the terminal cathode ray tube display. This new capability was considered to increase greatly the flexibility and utility of the MANMOD and thereby allow increased use. A third effort was completed (Leahy, Lautman, Wolf, Bearde, & Siegel, 1974) to allow the real time collection of experimental data (i. e., allowing an online operator to perform part of the message handling task) with subsequent automatic data reduction and incorporation into a fully automatic simulation. The procedure for the completion of performing such subject interactive simulations is reported in A Digital Simulation Model of Message Handling in the Tactical Operations System. III. Further Extensions of the Model for Increased Interaction.

In the current effort, the MANMOD was coupled with the CASE and the SAMTOS models. The advantages of such integration are found in the body of the report titled A Digital Simulation Model of Message Handling in the Tactical Operations System. IV. Model Integration with CASE and SAMTOS to which the present user's manual forms an appendix. In performing the integration, the subject interactive feature was not included because the coupled models are exercised on the U 1108 high speed digital computer system which in the anticipated mode of use will be time shared. Use of a time sharing system prevents a realistic subject/computer interaction.

The "user's manual" presents the information required for employing the integrated model. As such, it also represents a full users manual for MANMOD since MANMOD is the core of the integration.

The manual contains full input data instructions, operating instructions, and out descriptions. A full glossary along with program list and flow charts are included as appendices.

## CHAPTER II

### INPUT DATA

The required input data for specifying the simulation structure for the integrated models are described in this section. Required, optional, and default parameters are delineated, along with a brief rationale concerning the relative impact of parameter changes on the simulation validity and on the computer time usage. Three different systems of input data are used in the model and will be described in this section. There are card input, CRT input, and computer data file input.

#### **Card Input**

Table 2-1 presents the sequence of data cards for entering the MANMOD computer program. There is a total of 29 card types. Six types are control cards which either initiate or bypass the entry of different types of data. These control cards allow default options to be used for simplicity and also allow the capability of making slightly different multiple runs back to back without the need to repeat the input of all of the data. The final data card triggers either a simulation termination or a return to card type 1 and a new simulation. The order of data cards within a run is critical. A single card type out of sequence, an extra card, or a missing card will cause either an aborted run or a meaningless output.

Table 2-2 identifies variable name, variable usage and purpose, card columns, and input format for card types 1 and 2. The variable names are the FORTRAN names used in the computer program. The descriptions are an abstracted version of the text. The card columns identify the computer card columns to be used on the specified card allocated for the variable. For example, in Table 2-2, the variable NSHIFT is shown to occur on card type 2 in card columns 1 to 3. This means the longest value which could be specified is 999. The letter I in the format columns says that the variable is entered in an integer format and no decimal point is required and, in fact, is not allowed. The number entered in these columns is right justified where blanks are read as zeros. That is, a 9 in column one followed by two blanks will be read in as 900. An A under format identifies alphanumeric data where the exact contents of the columns are recorded for later printing. An R under format identifies a real variable. A real number requires a decimal point.

Table 2-1

Input Card Sequence

| <u>Order</u><br>(and Type) | <u>Description of Input Card Contents/Function</u>                     |
|----------------------------|------------------------------------------------------------------------|
| 1                          | Mission title                                                          |
| 2                          | Simulation parameters                                                  |
| 3                          | Option card                                                            |
| 4                          | Names of operators                                                     |
| 5                          | Operation parameters (one card per operator)                           |
| 6                          | Option card                                                            |
| 7                          | Names of message types                                                 |
| 8                          | Hour parameters (one card for each hour)                               |
| 9                          | Option card                                                            |
| 10                         | Error data (one card for each of three error types)                    |
| 11                         | Option card                                                            |
| 12                         | Message length data                                                    |
| 13                         | Message length standard deviation data                                 |
| 14                         | Option card                                                            |
| 15                         | Task analysis data (one card for every task element)                   |
| 16                         | Option card                                                            |
| 17                         | Effectiveness components                                               |
| 18                         | Number of error messages                                               |
| 19                         | Error message VCG data (one card for every error message)              |
| 20                         | Number of information search options                                   |
| 21                         | Information search data (one card for every information search option) |
| 22                         | Option card                                                            |
| 23                         | Correction submission data                                             |
| 24                         | Option card                                                            |
| 25                         | Random walk data                                                       |
| 26                         | Option card                                                            |
| 27                         | Levels of ambiguity data                                               |
| 28                         | Interruption data and message transmission data                        |
| 29                         | Option card                                                            |



Table 2-2

Input--Mission Identification and Simulation Parameters

|                                     |                                                                                                                                                                   | Card<br>Columns | Format |
|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|--------|
| Mission Title (card type 1)         |                                                                                                                                                                   |                 |        |
| IDENT-                              | A run descriptor of up to 72 characters is printed on the top of each page of printout followed by the page number.....                                           | 1-72            | A      |
| Simulation Parameters (card type 2) |                                                                                                                                                                   |                 |        |
| NSHIFT-                             | Number of repetitions or iterations of this mission before summary data are prepared.....                                                                         | 1-3             | I      |
| IHMAX-                              | Number of hours per shift (determines the number of type 6 cards to be read).....                                                                                 | 4-5             | I      |
| MEN(1)-                             | Number of operators of type 1, number of action officers including G-3. The highest numbered AO is the G-3.....                                                   | 6               | I      |
| MEN(2)-                             | Number of operators of type 2, number of input/output device (IOD) operators. The sum of MEN(1) + MEN(2) determines the number of type 5 cards to be read in..... | 7               | I      |
| NERROP-                             | Option to process error messages. If equals 1 error message data will be read in.....                                                                             | 8               | I      |
| INTOP-                              | Option to input interruption and transmission delay data.....                                                                                                     | 9               | I      |
| ORO(1)-                             | Output recording option number 1.....                                                                                                                             | 10              | A      |
|                                     | If equal 1 print input data                                                                                                                                       |                 |        |
| ORO(2)-                             | Output recording option number 2.....                                                                                                                             | 11              | A      |
|                                     | If equal to 1 print hourly message queue                                                                                                                          |                 |        |
| ORO(3)-                             | Not used.....                                                                                                                                                     | 12              | A      |
| ORO(4)-                             | Output recording option 4.....                                                                                                                                    | 13              | A      |
|                                     | If equal to 1 print detail task element processing                                                                                                                |                 |        |
| ORO(5)-                             | Output recording option 5.....                                                                                                                                    | 14              | A      |
|                                     | If equal to 1 print message processing                                                                                                                            |                 |        |
| ORO(6)-                             | Output recording option 6.....                                                                                                                                    | 15              | A      |
|                                     | If equal to 1 print hour and iteration summary                                                                                                                    |                 |        |
| ORO(7)-                             | If equal to 1 allows experimenter change of input data.....                                                                                                       | 16              | A      |
| ORO(8)-                             | If equal to 1 triggers personal interruption data input.....                                                                                                      | 17              | A      |
| ORO(9)-                             | If equal to 1 calls data from CASE.....                                                                                                                           | 18              | A      |
| IDAY-                               | Day of mission simulation.....                                                                                                                                    | 19-20           | I      |
| BKLG-                               | Number of messages in AO/G3 inbox at the beginning of the shift.....                                                                                              | 21-22           | I      |
| PUL-                                | Probability of a non important undetected error in the central computer complex data store.....                                                                   | 25-29           | R      |
| PUS-                                | Probability of a significant error in the central computer complex data store.....                                                                                | 30-34           | R      |
| SRTA-                               | System response time to an inquiry.....                                                                                                                           | 35-39           | R      |
| SRTS-                               | Standard deviation of the system response time to an inquiry.....                                                                                                 | 40-44           | R      |
| IATA(1,1)                           | Task analysis to be used for operator type 1 message type 1....                                                                                                   | 45              | I      |
| IATA(1,2)                           | Same as above but for message type 2.....                                                                                                                         | 46              | I      |
| IATA(1,3)                           | Same as above but for message type 3.....                                                                                                                         | 47              | I      |
| IATA(1,4)                           | Same as above but for message type 4.....                                                                                                                         | 48              | I      |
| IATA(1,5)                           | Same as above but for message type 5.....                                                                                                                         | 49              | I      |
| IATA(1,6)                           | Same as above but for message type 6.....                                                                                                                         | 50              | I      |
| IATA(1,7)                           | Same as above but for message type 7.....                                                                                                                         | 51              | I      |
| IATA(1,8)                           | Same as above but for message type 8.....                                                                                                                         | 52              | I      |
| IATA(2,1)                           | Operator type 2, message type 1.....                                                                                                                              | 53              | I      |
| IATA(2,2)                           | Operator type 2, message type 2.....                                                                                                                              | 54              | I      |
| IATA(2,3)                           | Operator type 2, message type 3.....                                                                                                                              | 55              | I      |
| IATA(2,4)                           | Operator type 2, message type 4.....                                                                                                                              | 56              | I      |
| IATA(2,5)                           | Operator type 2, message type 5.....                                                                                                                              | 57              | I      |
| IATA(2,6)                           | Operator type 2, message type 6.....                                                                                                                              | 58              | I      |
| IATA(2,7)                           | Operator type 2, message type 7.....                                                                                                                              | 59              | I      |
| IATA(2,8)                           | Operator type 2, message type 8.....                                                                                                                              | 60              | I      |
| NTE-                                | Number of task elements overall task analyses to be used (determines the number of type 15 cards to be read in).....                                              | 61-63           | I      |
| Y-                                  | Random number to be used to initialize random number generator (must be odd number greater than 1).....                                                           | 65-71           | R      |
| ICHAIN-                             | Shift number for this run if chaining option is being utilized (ICHAIN= 1 first shift, 0 if no chaining).....                                                     | 76              | I      |
| TZERO-                              | Time at start of shift being simulated.....                                                                                                                       | 77-80           | R      |

### Card Type 1

Card type 1 is the first data card. It must be the first entry in the data file if the cards are read into a file before use in a simulation. The formats for card types 1 and 2 are shown in Table 2-2. Card type 1 provides 72 columns (columns 1 through 72 on a computer card) for a prose description of the mission to be simulated. This prose description is stored in a variable array dimensioned at 12 (6 alphanumeric characters may be stored in each word on the U 1108 computer). The purpose of this title is to allow easy identification of a run. The title is printed at the top of each page of computer printout produced during the simulation.

### Card Type 2

Card type 2 contains the more general simulation parameters to be used to control the simulation. The first variable on this card sets the number of times the entire simulated mission will be repeated (NSHIFT). The results of the simulation will be averaged across all NSHIFT mission repetitions to produce the output data. This repetition is necessary due to the stochastic nature of many simulation aspects. Only after the repetition of the mission across a sufficient number of stochastically generated combinations of events can a more or less stabilized pattern of output be produced. When a totally new mission is under analysis, a comparison of the differences in the results between 10, 20, 50, and 100 iterations is advisable. A difference between the results of only a few per cent is sufficient for selecting the smaller number of iterations for further runs. Naturally, the smallest number of iterations producing a stable output pattern should be selected because the number of iterations is the primary determinant of computer processing time.

The second card type 2 variable is the number of hours to be simulated (IHMAX). Up to 12 hours may be simulated during a shift. The value of this variable will determine the number of type 8 cards read, although the type 6 card will determine if any are read in on a given run. This allows multiple simulations. For example, where 12 hours are simulated in one run, only the first six hours of the 12 might be simulated in a second run. Obviously, more hours may not be simulated on a second run without reading in a new complete set of hour data.

The next variables entered are the number of Action Officers [MEN(1)] and the number of input/output device operators [MEN(2)] to be included in the simulation. At least one of each must be specified. The number of Action Officers includes the G3, who only works on non routine messages. The total number of men [MEN(1) + MEN(2)] may not exceed six.

Variable NERROP of card type 2 determines whether the error message evaluation aspect of the MANMOD will be used in the current run. If the value 1 is entered, then the data cards type 18 to 27 (described later) must be supplied. If any other value is used, error messages occurring in the simulation cause a simple branch in the task analysis and no simulation of the decision process or the information search procedure will occur.

Another option controller is the variable INTOP. If INTOP is set equal to 1, the incoming message interruption and transmission delay features will be used. Exercising this option requires that card type 28 be supplied.

Five output recording options [ORO(1-6)] are available for selection. Samples of each printout option are presented and discussed in Chapter III. These options are triggered by a 1 in the appropriate column. Option 1 provides a printout record of the input data in its entirety. Option 2 provides a printout of the Action Officer message queue which includes the messages already available, as well as the messages which will be arriving during the hour. The IOD queue is also displayed as a result of option 2. Option 3 is not used. Option 4 provides the most detailed record of the simulation including the time and outcome of all tasks performed. This record will produce two pages of printout for each message processed, not counting hour iteration summaries. The program will automatically drop detailed printing after the first iteration. Option 5 produces a printout of message processing information including any errors and the time at which the message completion segments were performed. Option 6 produces hour and iteration summaries. The overall run and shift summaries are automatically called at the appropriate times and thus are not optional.

Options 7, 8, and 9 are not printout options but interaction options. Option 7, when exercised, allows the user to change output via a terminal, as well as to receive summary data on the terminal's cathode ray tube.

Option 8 calls data collected in the subject interactive mode. The subject interactive data collection mode is not currently available on the U 1108 system. However, provision for the use of data collected in this mode has been included if such capability becomes available in the future.

Option 9 allows for entering data provided by the CASE model. This option also enters output data into another file for the later use of the SAMTOS model. These data are described later. The next variable entered is the day of the mission simulated. The day number refers to the number of days which have been worked without a day off up to and including the simulated day. The day number is used as a partial basis for computing operator fatigue level.

The number of messages in the Action Officer's in box (BKLG) at the beginning of the shift is the next variable entered. These represent backlog messages or communications left over from the previous shift. This number is replaced by a simulation generated number for the second shift of a chained run.

The probability of an unimportant undetected error (PUL) is followed by the probability of a significant error (PUS) in the central computer complex. These errors represent noncorrected data which will compose misinformation within the data bank. These probabilities are used in connection with other simulated performance characteristics to predict information loss and other measures of system performance.

The average response time (the time between an inquiry and a response) (SRTA) is entered along with its standard deviation (SRTS). These values may be replaced by CASE generated data if option 9, described above, is exercised.

The IATA (J, IT) array identifies the task analysis or procedure to be used by each operator type (J) in processing each type of message (IT). The exact task analysis data are entered later. The model is presently limited to a maximum of four task analyses. A task analysis may have up to 20 task elements. The total number of task elements (NTE) across all task analyses is entered. This value will determine the number of type 15 cards to be entered later. This value will be overridden by the type 14 and if no cards are to be read in on a particular run.

The random number generator must be initiated by starter value (Y). The starter value will produce a repeatable string of pseudorandom numbers. By using the same initial value of Y, along with an identical set of input data, an exact simulation duplicate can be produced. This capability is useful when a repetition of a specific run is wanted.

A simulation may be run chaining the messages left incomplete on one run to the backlog used on the next run. This chaining option is controlled by the variable ICHAIN. Where no chaining is desired, ICHAIN should be set to zero. When ICHAIN is set to one, the left over messages are recorded onto a data file. When ICHAIN is set to 2, the number of incompleted messages from run 1 are considered as backlog messages and are processed. The time in seconds at the start of the shift being simulated (TZERO) represents the final card type 2 entry.

### Card Types 3, 4, and 5

Table 2-3 presents the operator performance parameters entered on card type 3. Column 1 of card type 3 (ISKIP), if set to 1, will cause the program to skip the section on entering operator parameters. Like the other skip commands in this section, this skip causes a bypassing of the computer program sections which read in the relevant data. That is, if the skip instruction is given but data cards containing operator characteristics are entered, the program will fail.

The first card (card type 4) after the ISKIP card contains the name or other alphanumeric identifiers of each of the operators being simulated. As shown in Table 2-3, the names (NAME) are read from 1 to N, where N is the total number of operators in the system  $[N = \text{MEN}(1) + \text{MEN}(2)]$ . Six card columns are allocated for each name and as many groups of 6 will be read as necessary. These names will be shown on various printouts produced by the simulation and afford interpretive ease.

The operator performance characteristics are entered through card type 5. One card type 5 is employed for each operator. The first column of each card type 5 contains the man number (M). The operator speed entry  $[(F(M))]$  indicates how fast this crewman works in comparison with the average speed specified in the time allocations on the task analysis cards. An average man should be assigned an  $F(M)$  factor of 1.0. As the  $F(M)$  values decrease, the speed of the simulated operator increases. A speed factor of .80 would indicate a rapid worker. Similarly, a speed factor of 1.2 would produce a slower than average worker. Extreme values of less than .5 or more than 1.5 are not recommended as they represent individuals who are grossly atypical. This speed factor is considered independently of the accuracy of work. Operator precision or accuracy is indicated by another factor  $[\text{PREC}(M)]$ . This precision factor is scaled similarly to speed. That is, a highly precise man (i. e., one who makes fewer errors than the average would have a precision factor of less than 1.0). A perfect operator (never any errors or task element failures) would be represented by a value of .8 and a value of 1.2 would result in a grossly incompetent operator.

Stress is produced within the model when nonroutine messages accumulate up in the inbox. Within the model, stress serves to produce faster and more accurate work up to a preset threshold  $[\text{STRM}(M)]$ . This stress threshold is equivalent to the number of priority messages waiting in the inbox which will produce a maximum effort for this man.

The final card type 5 entry represents the man's level of aspiration  $[\text{ASP}(M)]$ . An entry of 1.0 means that this man strives for perfection. Aspiration levels of .90 to .95 have been found to be appropriate in most simulation situations.

Table 2-3  
Input--Operator Parameters

|                                                                                                                                                                                                                                                                                                                                                                                                             | <u>Card<br/>Columns</u> | <u>Format</u> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|---------------|
| Read or skip operator parameters (card type 3)                                                                                                                                                                                                                                                                                                                                                              |                         |               |
| ISKIP- If equal to 1 skip to reading card type 6.<br>If not equal to 1 read card types 4 and 5.....                                                                                                                                                                                                                                                                                                         | 1                       | I             |
| Names of operators (card type 4). Reads in one six<br>character name for each of the men specified in card<br>type 2.                                                                                                                                                                                                                                                                                       |                         |               |
| NAME(1)- Name of operator number 1.....                                                                                                                                                                                                                                                                                                                                                                     | 1-6                     | A             |
| NAME(2)- Name of operator 2.....                                                                                                                                                                                                                                                                                                                                                                            | 7-12                    | A             |
| NAME(M)- Name of operator M                                                                                                                                                                                                                                                                                                                                                                                 |                         |               |
| Operator parameters (card type 5). One card is read in for each<br>man specified in card type 2.                                                                                                                                                                                                                                                                                                            |                         |               |
| M- Man number.....                                                                                                                                                                                                                                                                                                                                                                                          | 1                       | I             |
| F(M)- The speed factor of this man. A faster than average<br>man has an F(M) value less than 1.0. A slower than<br>average man has an F(M) value greater than 1.0.....                                                                                                                                                                                                                                      | 5-9                     | R             |
| PREC(M)- The precision factor of this man. An average man<br>who makes an average number of errors would have<br>a precision factor of 1.0. A highly precise man<br>who makes many fewer than average errors would<br>have a precision factor of 0.9. Perfection is repre-<br>sented by a value of 0.8 and complete failure which<br>would result in unending runs is represented by a<br>value of 1.2..... | 10-14                   | R             |
| STRM(M)- The stress threshold of this man. The number of<br>priority messages in the backlog for this man will<br>produce a maximum effort.....                                                                                                                                                                                                                                                             | 15-19                   | R             |
| ASP(M)- The level of aspiration of this man. An aspiration<br>of 1.0 represents striving for perfection.....                                                                                                                                                                                                                                                                                                | 20-24                   | R             |

### Card Types 6, 7, 8, and 7.5

Table 2-4 presents the hour parameter input information contained on card types 6, 7, 8, and 7.5. Card type 6 allows the option to skip the input of the data called for by card types 7, 8, and 7.5. A 1 in column 1 causes a transfer to reading in the data contained in card type 9. Anything else in this column (as long as it is an integer number) will permit normal input processing.

In card type 7, a six digit alphanumeric identifier is read in for each message type (NMTYP). This identifier will be printed out in the detail record (when this output option is called). It identifies the type of message being processed at any given time.

One type 8 card is involved for each hour specified on the type 2 card, INMAX entry. The first datum on each type 8 card is the hour number (IH). Then, the number of messages which will arrive in the Action Officer's inbox in the final 15 minutes of this hour is indicated [IGP(IH)]. The number of messages arriving in the Action Officer's inbox randomly throughout the hour [IGR(IH)] is the next entry. Messages specified in this category may still, by chance, arrive in the last quarter of the hour. The next value [IUR(IH)] is presently nonfunctional.

Although the number of messages arriving during the hour is fixed [IGP(IH) + IGR(IH)], the priority and the type of each individual message within an iteration is stochastically determined. The probability that any given message type is assigned is specified by the variable FRET(IT, IH). The probabilities are entered cumulatively as IT goes from 1 to 7. For example, if .70, .78, .82, and 1.0 are entered, type 1 has a probability of .70, type 2 has a probability of .08, etc. The final proportion must be equal to 1.0 within an hour. This method allows one random number to be drawn from a uniform distribution (i. e., uniform between 0.0 and 1.0). This one random number is compared with the type probabilities as IT goes from 1 to IT. If the random number .74 was selected, it would be compared with .7 and type 1 would be rejected; then .74 would be compared with type 2, and since its cumulative probability of .78 is greater than .74, message type 2 would be selected.

Message priority is also selected stochastically. The variable FREP(IP, IH) specifies the cumulative probability of each message priority (IP) within each hour (IH). The input form is the same as for FRET, described above.

Table 2-4

## Input--Hour Parameters

|                                                                                                     | Card<br>Columns | Format |
|-----------------------------------------------------------------------------------------------------|-----------------|--------|
| Read or skip hour parameters (card type 6)                                                          |                 |        |
| ISKIP- If equal to 1 skip card type 9<br>If not equal to 1, read card types 7 and 8.....1           | 1               | I      |
| Names of message types (card type 7)                                                                |                 |        |
| NMTYP(1)-Name of message type 1.....1-6                                                             |                 | A      |
| NMTYP(2)-Name of message type 2.....7-12                                                            |                 | A      |
| NMTYP(3)-Name of message type 3.....13-18                                                           |                 | A      |
| NMTYP(4)-Name of message type 4.....19-24                                                           |                 | A      |
| NMTYP(5)-Name of message type 5.....25-30                                                           |                 | A      |
| NMTYP(6)-Name of message type 6.....31-36                                                           |                 | A      |
| NMTYP(7)-Name of message type 7.....37-42                                                           |                 | A      |
| Messages per stimulus data (card type 7.5)                                                          |                 |        |
| RMPS(1)-Number of messages expected per stimulus for message type 1.....1-5                         |                 | R      |
| RMPS(2)-Number of messages expected per stimulus for message type 2.....6-10                        |                 | R      |
| RPMS(3)-Number of messages expected per stimulus for message type 3.....11-15                       |                 | R      |
| RPMS(4)-Number of messages expected per stimulus for message type 4.....16-20                       |                 | R      |
| RPMS(5)-Number of messages expected per stimulus for message type 5.....21-25                       |                 | R      |
| RPMS(6)-Number of messages expected per stimulus for message type 6.....26-30                       |                 | R      |
| RPMS(7)-Number of messages expected per stimulus for message type 7.....31-35                       |                 | R      |
| Hour parameters (card type 8)                                                                       |                 |        |
| One card for each hour specified in card type 2 by IHMAX.                                           |                 |        |
| IH-Hour number.....1-2                                                                              |                 | I      |
| IGP(IH)-Number of messages arriving in AO/G3's inbox in the last 15<br>minutes of this hour.....3-4 |                 | I      |
| IGR(IH)-Number of messages arriving in AO/G3's inbox randomly<br>throughout this hour.....5-6       |                 | I      |
| IUR(IH)-Non functional.....7-8                                                                      |                 | I      |
| FRET(1,IH)-Cumulative proportional occurrence of message type 1 -add.....10-14                      |                 | R      |
| FRET(2,IH)-Type 2-change.....15-19                                                                  |                 | R      |
| FRET(3,IH)-Type 3-delete.....20-24                                                                  |                 | R      |
| FRET(4,IH)-Type 4-query.....25-29                                                                   |                 | R      |
| FRET(5,IH)-Type 5-relay.....30-34                                                                   |                 | R      |
| FRET(6,IH)-Type 6-SPR.....35-39                                                                     |                 | R      |
| FRET(7,IH)-Type 7-SRI.....40-44                                                                     |                 | R      |
| FREP(1,IH)-Cumulative proportion of message occurrence of priority type<br>1 - routine.....45-49    |                 | R      |
| FREP(2,IH)-Priority type 2-priority.....50-54                                                       |                 | R      |
| FREP(3,IH)-Priority type 3-operational immediate.....55-59                                          |                 | R      |
| FREP(4,IH)-Priority type 4-flash.....60-64                                                          |                 | R      |
| FREP(5,IH)-Priority type 5- presidential interrupt.....65-69                                        |                 | R      |
| FRER(IH)-Frequency of routine message arrival per hour.....70-74                                    |                 | I      |
| FREO(IH)-Frequency of arrival of other than routine messages per hour.....75-79                     |                 | I      |



The arrival time of the messages specified in IGR are determined stochastically. However, IGR is controlled by the variables FRER(IH) and FREO(IH). FRER is the frequency of arrival of routine messages per hour, while FREO is the frequency of arrival of other than routine messages (i. e., higher priority).

The columns of card type 7.5 indicate the mean number of messages generated for each stimulus message in the Action Officer's inbox [RMPS(IT)]. A different generation rate may be indicated for each message type. The number of messages generated by IGP and IGR will be compounded by RMPS so that the number of messages available for processing each hour will be a variable with a lower limit of IGP + IGR.

#### **Card Types 9 and 10**

Card type 9 allows the option for skipping the error data of card type 10. Table 2-5 shows the input form for the error data, as indicated by card type 10. The errors produced in the processing of a message are stochastically determined using the input error rates specified for each type of error (IE). Four types of errors are considered: (1) commission--too much information has been supplied, (2) abbreviation, typographic, or spacing, (3) omission--the lack of information where information or an entry should have been made, and (4) other. The type 10 error data card also contains the error rate [ER(IE, IT)] for each type of message (IT). Capacity exists for eight message types, but only seven types are used at present. The error rates indicate the average number of errors per 100 characters printed or typed. Of the errors produced, some will be detected and corrected immediately; some will perturb the simulated computer resulting in an error return, and others will pass through and enter the computer data bank. The Action Officer's errors, which produce computer error returns, are indicated by the variable ERPG, while the percentage of the UIOD's errors which produce error returns is indicated by ERPI. These two variables (ERPG and ERPI) are indicated in the last two columns of the error data card.

#### **Card Types 11, 12, and 13**

Table 2-6 shows the input formats for the message length data. Card type 11 is the bypass option card. Card type 12 contains the mean number of characters [INC(IT)] read in for each message type, and card type 13 contains the standard deviation [INS(IT)] of this mean. Random numbers from a normal distribution are used in conjunction with the mean and standard deviation to determine the exact length of each message of the given type as it is created and added to the message flow.

Table 2-5

Input--Error Data

|                                                                                                            | <u>Card<br/>Columns</u> | <u>Format</u> |
|------------------------------------------------------------------------------------------------------------|-------------------------|---------------|
| Read or skip error data (card type 9)                                                                      |                         |               |
| ISKIP- If equal to 1 skip to card type 11,<br>if not equal to 1, read card type 10.....                    | 1                       | I             |
| Error data (card type 10)                                                                                  |                         |               |
| IE- Type of error, 1= commission, 2= abbreviation,<br>typographical or spacing, 3= omission, 4= other..... | 1                       | I             |
| ER(IE,1)-Error rate per 100 characters of message type 1.....                                              | 2-9                     | R             |
| ER(IE,2)-Message type 2.....                                                                               | 10-17                   | R             |
| ER(IE,3)-Message type 3.....                                                                               | 18-25                   | R             |
| ER(IE,4)-Message type 4.....                                                                               | 26-33                   | R             |
| ER(IE,5)-Message type 5.....                                                                               | 34-41                   | R             |
| ER(IE,6)-Message type 6.....                                                                               | 42-49                   | R             |
| ER(IE,7)-Message type 7.....                                                                               | 50-57                   | R             |
| ER(IE,8)-Non functional.....                                                                               | 58-65                   | R             |
| ERPG- Percentage of G3/A0 errors which produce error returns..                                             | 66-72                   | R             |
| ERPI- Percentage of UIOD errors which produce error returns...                                             | 73-79                   | R             |

Table 2-6

Input--Message Length Data

|                                                                                                                    | <u>Card<br/>Columns</u> | <u>Format</u> |
|--------------------------------------------------------------------------------------------------------------------|-------------------------|---------------|
| Read or skip message length data (card type 11)                                                                    |                         |               |
| ISKIP- If equal to 1, skip to card type 14<br>If not equal to 1, read card types 12 and 13.....                    | 1                       | I             |
| Read message length means (card type 12). Note: The variable INC is<br>explicitly specified as REAL                |                         |               |
| INC(1)- Number of characters in transformed message type 1.....                                                    | 1-9                     | R             |
| INC(2)- Message type 2.....                                                                                        | 10-19                   | R             |
| INC(3)- Message type 3.....                                                                                        | 20-29                   | R             |
| INC(4)- Message type 4.....                                                                                        | 30-39                   | R             |
| INC(5)- Message type 5.....                                                                                        | 40-49                   | R             |
| INC(6)- Message type 6.....                                                                                        | 50-59                   | R             |
| INC(7)- Message type 7.....                                                                                        | 60-69                   | R             |
| INC(8)- Non functional.....                                                                                        | 70-79                   | R             |
| Read message length standard deviations (card type 13). Note: The<br>variable INS is explicitly specified as REAL. |                         |               |
| INS(1)- Standard deviation of characters in transformed message<br>type 1.....                                     | 1-9                     | R             |
| INS(2)- Message type 2.....                                                                                        | 10-19                   | R             |
| INS(3)- Message type 3.....                                                                                        | 20-29                   | R             |
| INS(4)- Message type 4.....                                                                                        | 30-39                   | R             |
| INS(5)- Message type 5.....                                                                                        | 40-49                   | R             |
| INS(6)- Message type 6.....                                                                                        | 50-59                   | R             |
| INS(7)- Message type 7.....                                                                                        | 60-69                   | R             |
| INS(8)- Non functional.....                                                                                        | 70-79                   | R             |

## Card Types 14 and 15

Card type 14 allows a task analysis bypass. The input form for the card type 15 task analytic procedure is shown in Table 2-7. The number of cards expected has been previously indicated by NTE on the type 1 card. Each task analysis card identifies the task analysis number (K), as well as the task element number (I) being described. Five types of tasks [JTYPE(I, K)] may be used. Type 1 identifies a task which allows message rejection at a probability specified by AVPROB(I, K). A rejected message will be held unprocessed in the queue until the next hour, at which time it will be resubmitted for processing. A type 2 element is one whose time refers to a per character processing time. This per character time will be combined with the actual number of characters in a particular message to determine the total processing time. A type 3 element is a decision element. In a decision element, the operator speed factor, precision factor, and stress level do not affect the outcome. This type task is used when a situation independent branching function is incorporated in a task procedure. A similar feature is found in the type 4 element. Type 4 identifies an equipment task whose performance is independent of all operator characteristics. This task is used where the time control aspect of the task is determined by the equipment, e. g., warm up time, computer response time.

Task type 5 is not used at the present.

Task type 6 is a special type of branching task which will receive either an ERR (i. e., simulated error response, the simulated computer will not accept transmission, try again) or a CDR (correct reception). The number of error returns is a function of errors generated by both the Action Officer and the UIOD operator during the preparation and typing of the message. If an error message is received, then human decision time and information search time will be computed and added to the duration of this element. If no error message data were entered for a given simulation, then the element will simply cause the failure of task sequence route to be followed.

The criticality of the task [CRIT(I, K)] is indicated by the entry of a C in column 8 of card type 15. Task criticality is used in the computation of the overall effectiveness measure. Failure of a critical task is recorded and is considered to be detrimental to mission effectiveness.

Table 2-7

Input--Task Analytic Data

|                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Card<br>Column          | Format |
|-----------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|--------|
| Read or skip task analysis (card type 14)                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                         |        |
| ISkip-                                                          | If equal to 1, skip to card type 16.....<br>If not equal to 1, read card type 15.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1                       | I      |
| Task analysis (card type 15)                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                         |        |
| One card for each task element specified by NTE in card type 2. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                         |        |
| K-                                                              | Task analysis number.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1-2                     | I      |
| I-                                                              | Task element number within this task analysis.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 3-5                     | I      |
| JTYPE(I,K)-                                                     | Task element type where 1= a task element on which the message may be rejected with a probability specified by AVPROB(I,K), 2= a task element in which the number of characters for this message type will be multiplied times the stochastically determined mean time to produce the time required to transform the message, 3= a decision task element where operator factors such as speed [F(M)], precision [PREC(M)] and stress level [STR(M)] are not allowed to affect the duration or success probability of the task element, 4= an equipment task element where operator factors are considered and the task cannot be failed, 5= not used, 6= a special type of branch task element where either a "COR" or "ERR" response is expected..... | 7                       | I      |
| CRIT(I,K)-                                                      | Criticality of the task element. C= critical, not C is not critical.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 8                       | A      |
| END(I,K)-                                                       | Message processing segment ended by this task element, if any.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 10                      | I      |
| IJF(I,K)-                                                       | The number of the task element which will follow this one if this task element is a failure.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 12-14                   | I      |
| IJS(I,K)-                                                       | The number of the task element which will follow this one if this task element is a success.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 15-17                   | I      |
| AVGTM(I,K)-                                                     | Task element mean performance time.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 20-29                   | R      |
| SIGMA(I,K)-                                                     | Standard deviation of AVGTM(I,K).....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 30-39                   | R      |
| AVPROB(I,K)-                                                    | Task element success probability, the probability that the following task will be IJS(I,K) and not IJF. Also the probability of message rejection when JTYPE(I,K)= 1.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 40-49                   | R      |
| UETYPE(I,K)-                                                    | Undetected error type T= transform, not T= all others.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 50                      | A      |
| UEP(I,K)                                                        | Undetected error probability.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 51-56                   | R      |
| INTS-                                                           | Number of personal interruption types to be considered on this task element. This value determines the number of interruption data cards to be read in. (INTS $\leq$ 4 read 1 additional card; 5 $\leq$ INTS $\leq$ 9 read 2 cards).....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 80                      | I      |
| Interruption data (separate card(s) 4 interruptions/card)       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                         |        |
| ITYP-                                                           | Type of interruption, up to four on a card.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 2,22,42,62              | I      |
| PROB(I,K,ITYP)-                                                 | Probability of this type of interruption.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3-8,23-28,43-48,63-68   | R      |
| ITE(I,K,ITYP)-                                                  | Average duration of interrupt.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 9-14,29-34,49-54,69-74  | R      |
| ADI(I,K,ITYP)-                                                  | Standard deviation of interruption.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 15-20,35-40,55-60,75-80 | R      |

Message processing time within the model is divided into message segments. These segments are based on Baker's (1970) categorization of message handling functions. These time segments are described in the section on model output. The entry in column 10 of each card type 15 indicates the time segment which ends for a given message when the simulation of the performance of the task element being considered by the type 15 card is completed.

The progression of an operator through a task analytic sequence need not be linear. The sequence to be followed may be in any order (with the exception that element 1 must be first) and is determined by whether the current task element is failed or performed successfully. If the current task is failed, the next task to be performed is indicated by IJF(I, K) and if the task is performed successfully, the next task to be performed is indicated by IJS(I, K). Frequently, the current task should be repeated, in case of a failure [IJF(I, K) = I]. Looping back to a previous task (loops should be written very carefully to avoid perpetual loops) or going on to a special task element (i. e., one not performed except in case of failure) are also acceptable alternatives. In the case of an element identified as type 6, the element cannot be failed in the normal sense and the failure sequence will be triggered by an error message logic which does not involve the random walk and the vocalic center group concepts described later.

The sequence number in IJS or IJF (as applicable) will determine the task element to be performed next. A blank or zero entry identifies the completion of the task. A task analysis may have any number of completion points.

The durations for task elements are taken from a normal distribution with an input mean of AVGTM(I, K) and a standard deviation of SIGMA(I, K). These times will be varied stochastically within the model and will tend to be increased by fatigue and decreased by stress. The values used for AVGTM may be obtained through expert judgment, actually timing operations in the field, or some standardized data bank of performance time. The probability that the task element will be performed successfully is indicated by AVPROB(I, K). The probability of failure on that task element is therefore 1 minus AVPROB. In the case of commonly performed elements, success rates in the range .90 to .98 are most frequently used.

Errors are assumed to be either detected or undetected. Detected errors are those which are indicated at some point by operators or by the computer. Undetected errors are those that remain undetected and enter the simulated computer's data bank. The only undetected error type simulated in the MANMOD is the transform type, i. e., where information is transformed from one form to another by the operators. A transform element is indicated by a T in the UETYPE(I, K) column of card type 15.

When a transform element is indicated, the probability that an undetected error will enter the data base [UEP(I, K)] must also be indicated. Unless a type T is indicated in UETYPE, it does not matter what is in UEP (I, K). Undetected errors in the computer data base lower the results of the computations of system effectiveness.

### Card Types 16 and 17

Table 2-8 shows the input format of the effectiveness correlations and weights. The components of these effectiveness measures are described in Siegel, Wolf, and Leahy (1973a).

The final entry on card type 15, INTS, controls the input of personal interruption data. These interruptions include such considerations as personal comfort and interruptions from phone calls. Up to 9 types of interruptions may be considered for any task element. A separate card (cards) is (are) employed to describe this interruption.

Table 2-8

#### Input--Effectiveness Component Data

|                                                      |                                                                                      | Card<br>Columns | Format |
|------------------------------------------------------|--------------------------------------------------------------------------------------|-----------------|--------|
| Read or skip effectiveness components (card type 16) |                                                                                      |                 |        |
| ISKIP-                                               | If equal to 1 skip to read card type 18. If not<br>equal to 1 read card type 17..... | 1               | I      |
| Effectiveness components (card type 17)              |                                                                                      |                 |        |
| CC12-                                                | Correlation between thoroughness and completeness.....                               | 1-4             | R      |
| CC13-                                                | Correlation between thoroughness and responsiveness.....                             | 5-9             | R      |
| CC14-                                                | Correlation between thoroughness and accuracy.....                                   | 10-14           | R      |
| CC23-                                                | Correlation between completeness and responsiveness.....                             | 15-19           | R      |
| CC24-                                                | Correlation between completeness and accuracy.....                                   | 20-24           | R      |
| CC34-                                                | Correlation between responsiveness and accuracy.....                                 | 25-29           | R      |
| W(1)-                                                | Relative weight of thoroughness in computing<br>overall effectiveness.....           | 30-34           | R      |
| W(2)-                                                | Weight of completeness.....                                                          | 35-39           | R      |
| W(3)-                                                | Weight of responsiveness.....                                                        | 40-44           | R      |
| W(4)-                                                | Weight of accuracy.....                                                              | 45-49           | R      |

The weights must sum to 1.0.

Card type 16 is the bypass option and card type 17 contains the effectiveness correlations and weights. These are needed to compute system effectiveness and have been left as a variable because it is believed that these values may change over time. Values currently suggested for entry are:

| <u>Effectiveness Component</u> | <u>Suggested Entry</u> |
|--------------------------------|------------------------|
| CC12                           | .50                    |
| CC13                           | .50                    |
| CC14                           | .50                    |
| CC23                           | .50                    |
| CC24                           | .50                    |
| CC34                           | .50                    |
| W(1)                           | .25                    |
| W(2)                           | .25                    |
| W(3)                           | .25                    |
| W(4)                           | .25                    |

#### Card Types 18 through 27

The entry of error message data is an option which must be specified on the parameter card. Having specified the option, a full set of error message data must be entered. Table 2-9 lists the error message and associated random walk data. The first card (card 18) specifies the number of error messages to be read. This number of error messages must be described in terms of number of vocalic center groups (NVGM) on the following card or cards. The vocalic center group concept is described in the body of the report of which this user's manual forms an appendix. Up to 40 messages may be described on a single computer card. If 41 messages are specified, a second card will be read, but only the first value on that card will be entered.

The number of information search options available to the operator is read in next (card type 19). An information search option is any procedure that a simulated operator might follow in order to determine the error in his message which has produced computer generated error return. It includes such possibilities as consulting reference materials and asking other operators for information. The number of options specified determines the number of option data cards used. The first option datum read in is the option number. Following the option number, the probability that this option would be selected (PROBOP) is entered. This probability must be specified as a cumulative proportion. That is, if options 1, 2, and 3 possess respectively real probabilities of .20, .50, and .30, the entry data would be expressed as .20, .70, and 1.0. The highest option number available must

Table 2-9

Input of Error Message and Random Walk Data

| <u>Card Type</u> | <u>Variable</u> | <u>Description</u>                                                                                                                                                                                                                                  | <u>Format</u> | <u>Card Columns</u> |
|------------------|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------|
| 18               | NE              | Temporary indexer for number of error messages (NERMSG).<br>If equal to zero no type 19 cards will be read in.                                                                                                                                      | I3            | 1                   |
| 19               | NVGM(NE)        | The number of Vocalic Center Groups for each error message will be read in. Up to 99 VCG's may be specified for each. Up to 40 entries are inputted on each card up to a maximum of 100 error message descriptors.                                  | 40I2          | 1-2,<br>3-4, etc.   |
| 20               | NOP             | Temporary indexer for the number of information search options (NOPTIO) for tracing down responses to error messages. If NOP is equal to zero no type 21 cards will be read in. NOP determines the number of type 21 cards read in. (Maximum of 9). | I2            | 1-2                 |
| 21               | I               | The information search option on this card.                                                                                                                                                                                                         | I2            | 1-2                 |
|                  | PROBOP(I)       | The probability (cumulative as I goes from 1 to NOP) that option I will be selected for performance.                                                                                                                                                | F10.3         | 3-12                |
|                  | TIMCOR(I)       | The mean time to perform information search option I.                                                                                                                                                                                               | F10.3         | 13-22               |
|                  | SDCOR(I)        | The standard deviation of TIMCOR(I).                                                                                                                                                                                                                | F10.3         | 23-32               |
|                  | REDAM(I)        | The ambiguity reduction factor produced by this option.                                                                                                                                                                                             | F10.3         | 33-42               |
|                  | DESCOP(I,3)     | A prose description of the option.                                                                                                                                                                                                                  | 3A6           | 43-60               |
| 22               | I               | Indicator for whether correction submission data is to be read in. If equals 1, no type 23 cards will be read in.                                                                                                                                   | I1            | 1                   |
| 23               | PROBCR          | The probability that a change in response to an error message will be correct.                                                                                                                                                                      | F10.3         | 1-10                |
|                  | AVCOR           | The mean time required to input and send a change.                                                                                                                                                                                                  | F10.3         | 11-20               |
|                  | SDACR           | The standard deviation of AVCOR.                                                                                                                                                                                                                    | F10.3         | 21-30               |
| 24               | I               | Option for reading in random walk data (1= yes). If not equal 1, then card type 25 is not expected.                                                                                                                                                 | I1            | 1                   |
| 25               | TSTEP           | The time required to take each step in the random walk, whether left or right or circular.                                                                                                                                                          | F10.3         | 1-10                |
|                  | PRBRT           | The probability of moving right, or toward solution 1 within the one dimensional random walk.                                                                                                                                                       | F10.3         | 11-20               |
|                  | PRBWR           | The probability of moving left, or toward solution 2 within the random walk.                                                                                                                                                                        | F10.3         | 21-30               |
| 26               | I               | Option for reading in cut off points for levels of ambiguity with regard to the number of Vocalic Center Groups. If equal to 1, no card type 27 will be expected.                                                                                   | I1            | 1                   |
| 27               | LEV(IL)         | The cut off points for level of ambiguity where levels 1 and 5 are absorbing states and constitute zero and complete ambiguity respectively.                                                                                                        | 5I5           | 1-5,<br>6-10, etc.  |



have an expressed probability of 1.0. All probabilities higher than 1.0 are treated as if they were 1.0.

The time required to perform each option is stochastically computed from a normal distribution with a mean of TIMCOR and a standard deviation of SDCOR. It is assumed that each information search option has some value in helping the operator determine the solution to the problem posed by the error message. This value is termed the ambiguity reduction factor (REDAM). Ambiguity reduction is expressed as a proportion where a value of 1.0 describes an information source which always provides a solution, i. e., removes all ambiguity. A value of .50 would indicate a source which, on the average, reduces the ambiguity by one-half.

The final information search descriptor is completely optional. A prose description of the search option up to 18 characters in length may be included. This prose description will be displayed to the terminal when experimental control of parameters is desired and will be printed out with the other task information when the detail message processing option is called.

The next category of information to be entered is the correction submission data (card type 22). First, an indicator of whether such data should be read in is required. A 1 in the first column will cause the computer program to bypass the inputting of correction submission data. By bypassing, we mean here (as elsewhere) that the section in the program which reads in such data and stores it in the appropriate place is skipped. The cards themselves are not skipped.

Correction submission data are used when the operator has found a solution to the error message and proceeds to modify the original message. The probability that the solution will correct the message to the satisfaction of the computer is stored in PROBCR. The time to perform such a modification is taken from a normal distribution of mean AVCOR and a standard deviation of SDACR (card type 23).

The simulation of the decision making is performed through the use of a random walk model. The random walk simulation will result in either finding a solution to the problem posed by the error message or will result in a decision of no immediate solution and information search will commence. The input data required are the time required to take each step within the random walk (TSTEP) and the probabilities of moving to a solution (PRBRT) or toward no solution (PRBWR). These are entered on card type 25. These probabilities need not sum to 1.0. The difference between their sum and 1.0 is taken to be the standstill probability, i. e., the probability of moving neither towards or away from a solution. Here, time is spent in the decision making process, but no movement is achieved toward a solution.

The starting point within the random walk has an effect on whether or not and how quickly a solution is reached. There are five possible starting points--locations 1, 2, 3, 4, and 5. Location 1 represents reaching a solution, while location 5 represents deciding that no solution is immediately apparent. The option to read in new cutoff points is triggered by a blank card type 26, while a card type 26 with a 1 in column 1 will bypass this option. The cutoff points (LEV) are in order from 1 to 5 (card type 27), and indicate the highest number of vocalic center groups which an error message may have and still be considered in that category. The smallest number is indicated by the highest number plus 1 of the previous category. For example, if 0, 5, 10, 20, 100 were entered for cutoff points, then no message could have zero vocalic center groups. Therefore, none could start in category 1. A message with six vocalic center groups would be in category 3 since it has more than 5 but less than 10 VCG's. The cutoff points for VCG's should be determined from a study of the distribution of the frequency of occurrence in the error messages under consideration. In the case of an unavailability of such data, the data shown in Table 2-10 may be used. The Table 2-10 data were obtained from an analysis of the vocalic center groups in all current TOS error messages.

Table 2-10

Categorization of Vocalic Center Groups (VCG's) in Current  
TOS Error Messages

---

| <u>Category</u> | <u>Number of VCG's</u> |
|-----------------|------------------------|
| 1               | $\leq 4$               |
| 2               | $> 4 \leq 7$           |
| 3               | $> 7 \leq 10$          |
| 4               | $> 10 \leq 14$         |
| 5               | $> 14$                 |

**Card Types 28 and 29**

In some versions of the TOS, only one tie line is available from the computer. This tie line is used alternately by the CRT terminal and the printer. An incoming message of higher priority than the current message of the UIOD is assumed to have precedence and to cause an interruption and delay in the processing of the current message. (Note: This data is optional and controlled by the value of INTOP on the #2 card.) These incoming messages are generated stochastically with a near frequency of FRHR(IH) per hour (card type 28). Also entered are the mean and standard deviations of the interruption, DURIN(IH) and SDIN(IH).

The computer may be accepting input from a number of terminals at the same time. Transmission delay will result, and this effect is activated by entering the mean and standard deviation of the delays per hour, DEL(IH) and DELSD(IH), as shown in Table 2-11.

Table 2-11

Input of Incoming Message Interruptions and Transmission Delay Data

| <u>Card</u> | <u>Variable</u> | <u>Description</u>                                                    | <u>Card Columns</u> | <u>Format</u> |
|-------------|-----------------|-----------------------------------------------------------------------|---------------------|---------------|
| 28          | IH              | Hour number (one for each hour)                                       | I5                  | 1-5           |
|             | FRHR(IH)        | Frequency of incoming messages of priority greater than 1 for hour IH | F5.0                | 6-10          |
|             | DURIN(IH)       | Mean duration of incoming messages in hour                            | F10.2               | 11-20         |
|             | SDIN(IH)        | Standard deviation of DURIN(IH)                                       | F10.2               | 21-30         |
|             | DEL(IH)         | Mean duration of transmission to computer time                        | F10.2               | 31-40         |
|             | DELSD(IH)       | Standard deviation of DEL(IH)                                         | F10.2               | 41-50         |
| 29          | IREP            | Indicator to read in more normal input data from card file (1= Yes).  | I1                  | 1             |

Card type 29 controls the option to read in part or all of a new simulation scenario. If a 1 is entered, the program will start again and read in a new card type 1.

## Output

The results of the simulation are displayed as printout. The results calculations and the output formats are described in Chapter III of this report. Provision is also made for input display. The various input displays are presented in Figures 2-1 through 2-4. Figure 2-1 generally contains information relative to the scenario simulated including items such as manning factors and message input. Figure 2-2 presents task analytic information input and the input correlations between the components of the effectiveness components and the weights of each component. Figure 2-3 shows the various input records relative to the error message, information search, and random walk input. Figure 2-4 presents similar information relative to interruptions and transmission delays.

# TEST CASE WITH ERROR DATA INCLUDED

|                         |   |                      |           |
|-------------------------|---|----------------------|-----------|
| NO. OF SHIFT ITERATIONS | 2 | NO. OF SIMULATED DAY | 11        |
| NO. OF HOURS PER SHIFT  | 1 | INITIAL PACKLOS '63  | 5         |
| NO. OF ACTION OFFICERS  | 2 | RANDOM NUMBER        | .01111111 |
| ERROR MESSAGES          | 1 |                      |           |
| NO. OF IOO OPERATORS    | 1 |                      |           |

|                                        |                                 |
|----------------------------------------|---------------------------------|
| PROBABILITY OF UNDETECTED ERROR IN CCC | SYSTEM RESPONSE TIME TO INQUIRY |
| LOW IMPORTANCE .000                    | MEAN .000                       |
| SIGNIFICANT .000                       | SD .000                         |

## OPERATOR PARAMETERS

| MAN    | SPEED | PRECISION | STRESS | THRESHOLD | ASPIRATION |
|--------|-------|-----------|--------|-----------|------------|
| OPER 1 | 1.00  | 1.00      | 10.00  |           | .900       |
| OPER 2 | 1.00  | 1.00      | 10.00  |           | .900       |
| OPER 3 | 1.00  | 1.00      | 10.00  |           | .900       |

## MESSAGES PER STIMULUS BY TYPE

|     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|
| 1   | 2   | 3   | 4   | 5   | 6   | 7   |
| .00 | .00 | .00 | .00 | .00 | .00 | .00 |

## HOOR PARAMETERS

| HOOR | 1    | 2   | 3   | 4   | 5   | 6   | 7   | 8   | CUM. MSG FREQ. BY PRIORITY | DELIVERIES PER HOUR | ROUTINE NOT-DOUTING LAST 1/4 HR |
|------|------|-----|-----|-----|-----|-----|-----|-----|----------------------------|---------------------|---------------------------------|
| 1    | 1.00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | 1.00 .00 .00 .00 .00 .00   | .0                  | .0                              |

## ERROR FREQUENCY

| TYPE | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9    | 100  |
|------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| 1    | .08 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .744 | .000 |
| 2    | .02 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .744 | .000 |
| 3    | .15 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .744 | .000 |
| 4    | .05 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .744 | .000 |

## NO. OF CHARACTERS

| IN COMPUTER (M) | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   |
|-----------------|-----|-----|-----|-----|-----|-----|-----|-----|
| 26.00           | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |

Figure 2-1. Printout record of input data.

# TASK ANALYTIC DATA

| TASK | ELEMENT | TYPE | CRITICAL | SEGMENT | NEXT-FAIL | NEXT-SUCC | MEAN-TIME | SIGMA | PROBABILITY | UNDETECTED-ERRROR<br>TYPE |
|------|---------|------|----------|---------|-----------|-----------|-----------|-------|-------------|---------------------------|
| 1    | 1       | 0    | 0        | 1       | 1.000     | 15.00     | 10.0      | 4.00  | .090        | .00                       |
|      | 2       | 0    | 0        | 2       | 2         | 12.00     | 2.50      | 1.5   | .000        | .00                       |
|      | 3       | 0    | 0        | 3       | 4         | 12.00     | 2.50      | .000  | .000        | .00                       |
|      | 4       | 2    | 1        | 1       | .400      | 7.4       | SD=       | .7    |             |                           |
|      | 5       | 0    | 0        | 2       | .700      | 30.0      | SD=       | 3.5   |             |                           |
|      | 6       | 0    | 0        | 5       | 5         | 10.00     | 2.00      | .50   | 1.000       | .00                       |
|      | 7       | 0    | 0        | 6       | 7         | 15.00     | 2.70      | .60   | .000        | .00                       |
|      | 8       | 0    | 0        | 7       | 5.00      | 1.50      | 1.000     | .000  | .000        | .00                       |
|      | 9       | 0    | 0        | 4       | 5         | 7.00      | 1.50      | .090  | .000        | .00                       |
|      | 10      | 0    | 0        | 6       | 2         | 5.00      | 1.00      | .060  | .000        | .00                       |
| 2    | 1       | 6    | 2        | 1       | 4         | 30        | .02       | 1.000 | .000        | .00                       |
|      | 2       | 2    | 0        | 5       | 5         | 2.37      | .47       | 1.000 | .000        | .00                       |
|      | 3       | 0    | 0        | 5       | 5         | 12.00     | 3.00      | .700  | .000        | .00                       |
|      | 4       | 0    | 0        | 7       | 6         | 4.20      | 1.20      | 1.000 | .000        | .00                       |
|      | 5       | 0    | 0        | 5       | 1         | 5         | 1         | 1     | 1           | 1                         |
|      | 6       | 0    | 0        | 2       | 2         | 2         | 2         | 2     | 2           | 2                         |
|      | 7       | 0    | 0        | 2       | 2         | 2         | 2         | 2     | 2           | 2                         |
|      | 8       | 0    | 0        | 2       | 2         | 2         | 2         | 2     | 2           | 2                         |
|      | 9       | 0    | 0        | 2       | 2         | 2         | 2         | 2     | 2           | 2                         |
|      | 10      | 0    | 0        | 2       | 2         | 2         | 2         | 2     | 2           | 2                         |

## TASK ANALYSIS ALLOCATION

| OPERATOR | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|----------|---|---|---|---|---|---|---|---|
| 1        | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 2        | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |

## EFFECTIVENESS COMPONENTS

|       |      |
|-------|------|
| CC12= | .500 |
| CC13= | .500 |
| CC14= | .500 |
| CC23= | .500 |
| CC24= | .500 |
| CC34= | .500 |

## CORRELATIONS BETWEEN COMPONENTS

|       |      |
|-------|------|
| W(1)= | .250 |
| W(2)= | .250 |
| W(3)= | .250 |
| W(4)= | .250 |

Figure 2-2. Task analysis related and effectiveness components input record.

#### ERROR MESSAGE DATA

| ERROR<br>MESSAGE<br>NO | VOCALIC<br>CENTRAL<br>GROUPS |
|------------------------|------------------------------|
| 1                      | 3                            |
| 2                      | 7                            |
| 3                      | 9                            |
| 4                      | 12                           |
| 5                      | 84                           |

#### INFORMATION SEARCH DATA

| OPTION | PROBABILITY | MEAN | SD  | AMBIGUITY<br>REDUCTION | DESCRIPTION |
|--------|-------------|------|-----|------------------------|-------------|
| 1      | .300        | 20.0 | 2.0 | .10                    | AD          |
| 2      | .700        | 40.0 | 4.0 | .20                    | GLOSSARY    |
| 3      | 1.000       | 60.0 | 6.0 | .30                    | NEIGHBOR    |

#### CORRECTION SUBMISSION DATA

PROBABILITY THAT THE CHANGE ENTERED IS CORRECT .700  
 MEAN TIME TO ENTER CHANGE 25.00  
 STANDARD DEVIATION 2.50

#### RANDOM WALK DATA

TIME REQUIRED PER STEP 4.500  
 PROBABILITY OF MOVING RIGHT .600  
 PROBABILITY OF MOVING LEFT .300

#### LEVELS OF AMBIGUITY

| LEVEL | VCGS |
|-------|------|
| 1     | 1    |
| 2     | 5    |
| 3     | 10   |
| 4     | 50   |
| 5     | 0    |

Figure 2-3. Error message and related input record.

INTERRUPTION AND TRANSMISSION DELAY DATA

| HOUR | -----INTERUPTIONS----- |          |     | TRANSMISSION |      |
|------|------------------------|----------|-----|--------------|------|
|      | FREQUENCY              | DURATION | SD  | MEAN         | SD   |
| 1    | 15.0                   | 17.5     | 3.2 | 5.10         | 1.70 |

Figure 2-4. Interruption and transmission delay input record.



### CHAPTER III

#### OPERATIONS AND OUTPUT

In order to call up the full integrated model, some type of terminal is required. The displays and procedures detailed in this section are most appropriate for implementation on the ADS 660 terminal. However, almost any other terminal possessing the appropriate transmission rate may be used.

To implement the integrated model, the first step is to call up the computer and wait until the connect signal (usually a light appears). Next, a computer interface port must be specified such as: #ARI04. A run card must appear next: @RUN run name, charge no, project id, 10, 100. The run name is completely arbitrary and is used only for run identification. The programmer's last name or initials are commonly used. A valid charge number is essential. A project identification of MANMOD is recommended, although not absolutely necessary.

The project identification is followed by an estimated computer running time in minutes (a value preceded by the letter S may be used to specify seconds) and then by the maximum number of pages of computer printout. In order to execute the program, only the statement @ADD TRY·MANMOD is required. Following this instruction, the computer will respond with a series of READY's which refer to the various files being assigned. After all files are ready, the program starts. First, the normal input is read, and then the statement.

APPLIED PSYCHOLOGICAL SERVICES PRESENTS appears on the screen. This statement is followed by basic instructions for use.

After the message is complete, depressing the new line button (if the conversational mode is being used) or the XMIT button if the message mode is used will permit the computer to go on to the next display.

In the next display, the operator is asked to select a data category for change. If no category is selected, normal simulation will commence. If one of the data categories (from 1 to 22) is selected, then the next message will provide an opportunity to change any of the data forms. If the number 99 is selected, an index to the available data categories is presented. If any other number is chosen, the program commits a normal termination. This is the preferred and optimal way to end the program. Other methods may provide problems for data recovery from the normal output file.

## Revised CASE Employment

When data change option 22 is selected, data may be read in from the revised CASE program. The data to be read in consists of the total duration (cumulative) and frequency of interruption at each of the nodes (i. e., intersection or choice points) preselected in the revised CASE model. Of these nodes, only a few are of interest for the MANMOD and these must be identified. After the appropriate nodes (the correct nodes for the test case are 16, 38, and 50) are indicated, the program computes means, and these are displayed on the terminal where changes can be made if the data are unacceptable. These changes are optional and keyed to the hour number. If no hour number is indicated, no change will be made.

In order to execute the revised CASE from the terminal, the instruction

@ADD TRY·RCASE

must be used before the MANMOD implementation described above. When all program files are ready, the CRT will display information concerning the revised CASE model and ask for the project number, title, and the date. After this information is sent, the program will automatically write the interactive information to the correct file. After the CASE program has ended, the MANMOD program should be called to integrate the data.

At the conclusion of the MANMOD simulation, a brief summary display appears. This summary may be followed, at user option, by detailed displays. To accomplish this, the hour number of interest is entered. Entry of a zero hour number returns the program to normal operation and the program may be terminated.

After the program has been terminated, the billing file should be closed by the instruction @FIN. If the port is to be closed (i. e., no other users at current time), then the instruction @@TERM should be entered. The "connect" light should go out at this time and the phone should be hung up.

## Detailed Output

In order to have the detailed simulation results printed, instructions may be entered via CRT or batch terminals.

In the case of the CRT, the following instructions are required:

```
@ RUN...      (if no run is active)
@ ASG,LP      T
@ BRKPT       PRINT$/T
@ DATA, L    PRTFIL
@ END
@ BRKPT       PRINT$
@ FREE        T
@ SYM         T, ARI318
@ FIN
```

The designation ARI318 identifies the remote batch terminal at the Army Research Institute for the Behavioral and Social Sciences.

In order to receive the print from cards directly, the following cards must be punched and submitted:

```
@ RUN...
@ ASG, A      MANMOD*PRTFIL
@ DATA, L    MANMOD*PRTFIL
@ END
@ EOF
```

In the case that a printer is not immediately available, printouts may be directed to the Edgewood Arsenal for mailing to the user. The required instructions in this case are:

```
@ RUN...
@ SUSPEND
@ DATA, L    MANMOD*PRTFIL
@ END
@ RESUME, P
@ FIN
```

The P option following the instruction RESUME will cause an immediate printout (when a printer is available) at the U1108 facility at the Edgewood Arsenal.

## Output Format

The MANMOD provides a variety of output options. The sections which follow describe this output in detail.

### **Detailed Message Output**

A detailed summary can be produced for each simulated message involved in a simulation run. Figure 3-1 shows a sample of this printout and presents the detailed processing data for simulated message number 1, relative to the work of simulated operator number 3. In the Figure 3-1 sample, an ADD type message was processed which was in the first position ("order") in the IOD queue. There was no stress, fatigue, or aspiration influence (1.00 is the steady state or no influence level). Note that aspiration as used here does not refer to the level of aspiration but to the effect of aspiration level on current performance.

A CUM. IDLE of 344.68 means that this crewman has spent this amount of time (in seconds) waiting for a message in this hour. When operator 3 received the message, MESSAGE ARRIVAL 344.7, he began to work on it immediately (MESSAGE START 344.7).

Completion of the first task analytic element took him 7.31 seconds to perform, augmented cumulative elapsed time to 351.99, and the performance was successful (S). The first task element was not a special kind of task or a critical task, and ended time segment 5 (this segment identifies the end of time to select a message from queue). There are sufficient errors already in the current message to produce 5 error returns and no interruptions occurred during this task.

The data starting with TRANSMISSION DELAY refer to task element 3 which is a type 6 task. Type 6 identifies a transmission to the computer. It took 5.3 seconds to transmit the message (due to time sharing delays on the line). An error message level 4 was returned which had an ambiguity level (i. e., number of vocalic central groups) of 12. In the random walk simulation of information processing, only one step was taken which required 4.5 seconds. Absorption was reached at the no solution exit. Since no immediate solution was apparent to the operator, he selected information search option 3, which consists of asking his neighbor (i. e., fellow IOD operator). This took 64.8 seconds and reduced his ambiguity level to 1. He then produced, considered, evaluated (random walk), and reached a solution which took 24 seconds to enter into the computer. The solution was incorrect. Due to the nature of this particular task analytic input, the operator went on to the next task. More often, the task analysis would

# TEST CASE WITH ERROR DATA INCLUDED

|                 |       |               |        |           |    |
|-----------------|-------|---------------|--------|-----------|----|
| MESSAGE NUMBER  | 1     | MAN           | OPER 3 | DAY       | 11 |
| MESSAGE TYPE    | ADD   | STRESS FACTOR | 1.00   | HOUR      | 1  |
| MESSAGE ORDER   | 1     | FATIGUE       | 1.00   | ITERATION | 1  |
|                 |       | ASPIRATION    | 1.00   |           |    |
| MESSAGE ARRIVAL | 344.7 | CUM. IDLF     | 344.68 |           |    |
| MESSAGE START   | 344.7 |               |        |           |    |

| ELEMENT NO.                                                              | EXECUTION TIME | CUMULATIVE TIME | OUTCOME (SEF) | TYPE OF ELEMENT | CRITIC -ALITY | SEGMENT ENDED | ERROR TYPE | ERROR RETURNS | INTRP |
|--------------------------------------------------------------------------|----------------|-----------------|---------------|-----------------|---------------|---------------|------------|---------------|-------|
| 1                                                                        | 7.31           | 351.99          | S             | 0               |               | 5             |            | 5             | .00   |
| 2                                                                        | 4.66           | 356.65          | S             | 0               | C             | 6             |            | 5             | .00   |
| TRANSMISSION DELAY= 5.2657                                               |                |                 |               |                 |               |               |            |               |       |
| ERROR MSG = 4 AMBIGUITY LEVEL = 12                                       |                |                 |               |                 |               |               |            |               |       |
| MSG EVAL RDN 1 STEPS, 4.5 SEC., CONCLUSION = 2 (2 = NO SOLUTION REACHED) |                |                 |               |                 |               |               |            |               |       |
| INFO SEARCH OPTION = 3 ( NEIGHBOR ), TIME= 64.8 SEC., NEW AMBIGUITY = 1  |                |                 |               |                 |               |               |            |               |       |
| MSG EVAL RDN 1 STEPS, 4.5 SEC., CONCLUSION = 1 (2 = NO SOLUTION REACHED) |                |                 |               |                 |               |               |            |               |       |
| TRANSMISSION DELAY FOR CORRECTED MESSAGES = 4.13407                      |                |                 |               |                 |               |               |            |               |       |
| TIME TO ENTER CORRECTION = 24.0 SEC., OUTCOME= 2 (1= CORRECT SOLUTION)   |                |                 |               |                 |               |               |            |               |       |
| 3                                                                        | 5.58           | 459.75          | S             | 6               |               | 0             |            | 4             | .00   |
| 4                                                                        | 129.39         | 588.13          | S             | 2               | C             | 0             |            | 4             | .00   |
| 5                                                                        | 11.24          | 599.37          | S             | 0               |               | 0             |            | 4             | .00   |
| 6                                                                        | 1.45           | 602.82          | S             | 0               | C             | 7             |            | 4             | .00   |

MESSAGE 1  
 COMPLETED BY OPER 3  
 TRANSMISSION ERRORS 0  
 COMMISSION 0  
 ABBREV/TYPO/SPAC 0  
 OMISSION 0  
 OTHER ERRORS 0  
 ---  
 TOT. UNDET. ERRORS 0  
 NO. ERROR RETURNS 5  
 INFORMATION LOSS 0

|             |     |      |       |       |       |       |
|-------------|-----|------|-------|-------|-------|-------|
| MESSAGE NO. | 1   | 3    | 4     | 5     | 6     | 7     |
| 1           | 0.0 | 26.7 | 344.7 | 352.0 | 356.7 | 602.8 |

Figure 3-1. Sample detailed message processing output.

indicate that the operator should repeat task element 3 until the task is completed successfully. The lower portion of the printout indicates that message 1 was completed by operator 3 with no transform errors but with a total of 5 error returns. The message segment end points were 0, .0, 26.7, 349.7, 352.0, 356.7, and 602.8.

### Hourly Summary

Figure 3-2 presents a sample of the hourly summary which can be produced for each simulated hour. In the Figure 3-2 sample, man 1 completed six messages; no messages were rejected or interrupted; the man worked 1658.1 seconds out of the hour and he waited for new messages to come in for 1941.9 seconds. No stress occurred during the hour, and the level of aspiration was .90. This value is in perfect accordance with the level of performance.

Man number 3 completed five messages, and one of these was interrupted. In this case, the interruption caused the processing of the interrupted message to run over the hour summary point. The message will be considered in the next hour summary, although man 3's work time in this hour is considered in the present hourly summary.

The average time to process a message was 1772.7 seconds, and the overall effectiveness in the hour was .58. This overall effectiveness was negatively affected by a very low responsiveness component (.10). Responsiveness is low in this hour because all messages arrived at the beginning of the hour and, accordingly, some were necessarily delayed in a queue before they were processed. The other components of the effectiveness calculation were high. This indicated that once started, the messages were processed quickly with few errors.

All messages in this particular hour were of type 1. The summary in the lower portion of Figure 3-2 shows the average of time spent in each time segment by message type.

### Iteration Summary

A brief summary is printed after every iteration. This summary presents the effectiveness components and overall effectiveness for every hour during the iteration. A sample of the output is shown in Figure 3-3.

END OF HOLD REQUESTS

|           | HOLD DAY | 1 | 11 |
|-----------|----------|---|----|
| ITERATION | 2        |   |    |

OPERATOR PERFORMANCE DATA

| DAY | --MESSAGES-- |          | --TIME--   |        | -----FINAL----- |                           |
|-----|--------------|----------|------------|--------|-----------------|---------------------------|
|     | COMPLETED    | REJECTED | INTERFERED | WORKED | OTHER           | STRESS ASPIRATION PERFORM |
| 1   | 6            | 0        | 0          | 1658.1 | 1041.9          | .00                       |
| 2   | 0            | 0        | 0          | .0     | 3600.0          | .00                       |
| 3   | 5            | 0        | 1          | 2305.6 | 1294.4          | .00                       |

MESSAGE PERFORMANCE DATA

AVERAGE TIME PER MESSAGE 1772.7

MESSAGES IN HOLD QUEUE AT HOLD START 5

TOTAL INFORMATION LOSS 0

EFFECTIVENESS COMPONENTS

|                |      |
|----------------|------|
| THOROUGHNESS   | .02  |
| COMPLETENESS   | .00  |
| RESPONSIVENESS | .10  |
| ACCURACY       | 1.00 |

EFFECTIVENESS .59

# DETAILED MESSAGE TIMING

CUMULATIVE TYPE

MESSAGE

NUMBER

| MESSAGE TYPE | NUMBER | T1     | T2   | T3    | T4     | T5  |
|--------------|--------|--------|------|-------|--------|-----|
| 1            | 1      | .0     | 21.4 | 264.5 | 1116.8 | 3.3 |
| 2            | 1      | 286.3  | 26.8 | 283.0 | 952.0  | 7.1 |
| 3            | 1      | 506.2  | 24.2 | 241.2 | 903.2  | 5.3 |
| 4            | 1      | 961.6  | 31.1 | 211.7 | 879.6  | 6.2 |
| 5            | 1      | 1104.4 | 26.1 | 203.2 | 802.7  | 5.1 |

MESSAGE TYPE

NUMBER

| MESSAGE TYPE | NUMBER | T1    | T2   | T3    | T4    | T5  |
|--------------|--------|-------|------|-------|-------|-----|
| 1            | 5      | 560.7 | 26.0 | 240.7 | 930.0 | 5.4 |
| 2            | 0      | .0    | .0   | .0    | .0    | .0  |
| 3            | 0      | .0    | .0   | .0    | .0    | .0  |
| 4            | 0      | .0    | .0   | .0    | .0    | .0  |
| 5            | 0      | .0    | .0   | .0    | .0    | .0  |
| 6            | 0      | .0    | .0   | .0    | .0    | .0  |
| 7            | 0      | .0    | .0   | .0    | .0    | .0  |

Figure 3-2. Sample hourly summary.

## RESULTS OF SHIFT ITERATION 2

| HOUR | THOROUGHNESS | COMPLETENESS | RESPONSIVENESS | ACCURACY | EFFECTIVENESS |
|------|--------------|--------------|----------------|----------|---------------|
| 1    | .92          | .90          | .10            | 1.00     | .58           |

Figure 3-3. Sample iteration summary.

### Run Summary

Six different run summaries are provided. These are:

- manpower utilization
- time segment per message
- effectiveness components
- workload summary
- error summary
- error message processing

Figure 3-4 presents a sample manpower utilization summary. This simulation considered only one hour. Accordingly, the means across hours are the same as the hourly data.

In hour 1, man 1 worked 1831 seconds out of the hour or 51 per cent of the time ( $1831/3600 \times 100$ ). He processed six message units, where message units are the part of the message handling done by any one man. Man 1 used 305 seconds, on the average, to process these message units. He was never under stress and showed a slightly increased level of aspiration (.901 versus .900) over his original aspiration level. Total working times and means across all operators are also provided. All operators worked 43 per cent of the time on the average.

Message segment completion times are shown in Figure 3-5. These times represent:

- T1 - Time spent waiting in Action Officer queue
- T2 - Time to select a format and fill it out
- T3 - Time spent waiting in UIOD queue
- T4 - Time spent entering message
- T5 - Time to send message



| MANPOWER UTILIZATION                |     |      | TIME WORKED | TIME OTHER | MSG UNITS PROCESSED | MEAN TIME PER MESSAGE | FINAL STRESS | FINAL ASPIRATION |
|-------------------------------------|-----|------|-------------|------------|---------------------|-----------------------|--------------|------------------|
| HOUR                                | MAN | PROP |             |            |                     |                       |              |                  |
| 1                                   | 1   | .51  | 1831.       | 1769.      | 6                   | 305.                  | .000         | .901             |
|                                     | 2   | .00  | 0.          | 3600.      | 0                   | 0.                    | .000         | .900             |
|                                     | 3   | .34  | 1241.       | 2359.      | 6                   | 207.                  | .000         | .924             |
| MEANS FOR EACH MAN PER MESSAGE UNIT |     |      |             |            |                     |                       |              |                  |
|                                     | 1   | .51  | 1831.       | 1769.      | 6                   | 305.                  | .000         | .901             |
|                                     | 2   | .00  | 0.          | 3600.      | 0                   | 0.                    | .000         | .900             |
|                                     | 3   | .34  | 1241.       | 2359.      | 6                   | 207.                  | .000         | .924             |
| TOTALS                              |     |      |             | 4128.      | 12                  | 512.                  | .000         | 1.825            |
| GRAND MEANS                         |     |      |             | 1536.      | .43                 | 2064.                 | .000         | .913             |

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| TIME SEGMENTS |  |      |      |      |      |      |      |       |      |      |      |       |          |
|---------------|--|------|------|------|------|------|------|-------|------|------|------|-------|----------|
| HOUR          |  | T1   |      | T2   |      | T3   |      | T4    |      | T5   |      | TOTAL | TOTAL    |
| MSG           |  | TIME | PROP | TIME | PROP | TIME | PROP | TIME  | PROP | TIME | PROP | (SUM) | MESSAGES |
| 1             |  | 47A. | .27  | 26.  | .01  | 256. | .14  | 1025. | .57  | 5.   | .00  | 1790. | A        |
| MEAN          |  | 47A. | .27  | 26.  | .01  | 256. | .14  | 1025. | .57  | 5.   | .00. | 1790. | A        |
|               |  |      |      |      |      |      |      |       |      |      |      |       |          |
| TYPE          |  | T1   |      | T2   |      | T3   |      | T4    |      | T5   |      | TOTAL | N        |
| MSG           |  | TIME | PROP | TIME | PROP | TIME | PROP | TIME  | PROP | TIME | PROP | (SUM) | CPL      |
| 1             |  | 47A. | .27  | 26.  | .01  | 256. | .14  | 1025. | .57  | 5.   | .00  | 1790. | A        |
|               |  |      |      |      |      |      |      |       |      |      |      |       |          |
| PRIOR         |  | T1   |      | T2   |      | T3   |      | T4    |      | T5   |      | TOTAL | N        |
| MSG           |  | TIME | PROP | TIME | PROP | TIME | PROP | TIME  | PROP | TIME | PROP | (SUM) | CPL      |
| 1             |  | 47A. | .27  | 26.  | .01  | 256. | .14  | 1025. | .57  | 5.   | .00  | 1790. | A        |

**Figure 3-5. Sample time segments run summary.**

The mean time across all time and messages to send a message in this run was 1790 seconds. (Note: the different summaries provided do not refer to the same run.) The time and the proportion of the total represented by this time are also shown in the time segment summary. These time segment data are averaged across hour, then averaged across message type (only one shown), and then averaged across message priority (only one shown).

### **Effectiveness Run Summary**

The run summary also summarizes the effectiveness indices (Figure 3-6). These data represent means across iterations by hour and then means across hours for the overall measure.

### **Workload Summary**

Figure 3-7 presents the workload summary format. The left side, backlog and messages delivered represent input values, while the right side shows actual processing rate averages.

### **Error Summary**

Figure 3-8 presents a sample of the error summary. This output summarizes errors by hour and by error type. Also shown are the average number of error returns per message and the average information loss.

### **Error Message Summary**

The error message summary is a new summary, not found in previous versions of the MANMOD. These data represent the mean time per hour per man spent in responding to and processing error messages. In the sample output shown in Figure 3-9, man 3 is the only IOD and hour 1 was the only hour simulated. During this simulation a mean time of 645.2 seconds was spent as a result of error messages.

|      | ----COMPONENTS---- |      |      |      | EFFECT- |
|------|--------------------|------|------|------|---------|
| HOOR | THOR               | COMP | RESP | ACC  | IVENESS |
| 1    | 1.00               | .95  | .92  | 1.00 | .97     |
| MEAN | 1.00               | .95  | .92  | 1.00 | .97     |

Figure 3-6. Sample effectiveness run summary.

| WORKLOAD SUMMARY |       |                    |             |           | -----MESSAGE UNITS----- |     |       |     |       |     |
|------------------|-------|--------------------|-------------|-----------|-------------------------|-----|-------|-----|-------|-----|
| BACKLOG          |       | MESSAGES DELIVERED |             | COMPLETED | REJECTED INTERRUPTED    |     |       |     |       |     |
| HOOR             | AO/G3 | IOD                | LAST 1/4 HR | ANYTIME   | AO/G3                   | IOD | AO/G3 | IOD | AO/G3 | IOD |
| 1                | 5.0   | .0                 | 1           | 0         | 6.0                     | 6.0 | .0    | .0  | .0    | .0  |

Figure 3-7. Sample workload run summary.

| ERROR SUMMARY - BY HOUR |                      |       |       |       |                  |                     |                                |
|-------------------------|----------------------|-------|-------|-------|------------------|---------------------|--------------------------------|
| HOUR                    | -----ERROR TYPE----- |       |       |       | ERROR<br>RETURNS | INFORMATION<br>LOSS | NUMBER OF<br>MESSAGES<br>UNITS |
|                         | 1                    | 2     | 3     | 4     |                  |                     |                                |
| 1                       | .1667                | .0000 | .0000 | .0000 | 5.1667           | .0000               | 12                             |

| ERROR SUMMARY - BY MESSAGE TYPE |                      |       |       |       |                  |                     |                                |
|---------------------------------|----------------------|-------|-------|-------|------------------|---------------------|--------------------------------|
| MESSAGE<br>TYPE                 | -----ERROR TYPE----- |       |       |       | ERROR<br>RETURNS | INFORMATION<br>LOSS | NUMBER OF<br>MESSAGES<br>UNITS |
|                                 | 1                    | 2     | 3     | 4     |                  |                     |                                |
| 1                               | .1667                | .0000 | .0000 | .0000 | 5.1667           | .0000               | 12                             |

Figure 3-8. Sample error run summary.

| TIME SPENT IN RESPONSE TO ERROR MESSAGES |       |    |    |    |    |    |    |    |    |    |    |    |
|------------------------------------------|-------|----|----|----|----|----|----|----|----|----|----|----|
| MAN                                      | HOUR  |    |    |    |    |    |    |    |    |    |    |    |
|                                          | 1     | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 |
| 1                                        | .0    | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 |
| 2                                        | .0    | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 |
| 3                                        | 645.2 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 |

Figure 3-9. Sample error message run summary.

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## Glossary

# GLOSSARY

## -A-

A--Temporary variable used when arithmetic calculations are made with an integer variable.

ACUMTC(IH,M)--Accumulated time spent on error message for run summary.

ADI(I,K,ITYP)--Standard deviation of AITE, the duration of task element interruptions.

AHT--Average handling time for a message. Measured from when a message is selected by an action officer to when the message is sent by the CLOT.

AITE(I,K,ITYP)--Mean duration of task element.

AM--Mean number for poisson distribution.

AO--Action officer (not FORTRAN).

AQT--Average queue time for a message. Measured from when a message arrives in the action officer's inbox to when he selects it for processing.

ASP(M)--The aspiration level for each man. An aspiration of 1.0 represents striving for perfection. An aspiration level of .9 has been found appropriate in many situations.

ASS(M)--Mean final aspiration level.

ATPM--Average time per message processing.

AVAIL(M)--Availability indicator for each crewman, 1= availability.

AVCOR--The average time required to correct a message which produced an error message.

AVGTM(I,K)--Average task element performance time.

AVPROB(I,K)--Task element success probability. That is, the probability that the following task will be IJS and not IJF. Also the probability of a message rejection when JTYPE= 1.

-B-

P--Temporary variable used when calculations must be made using an integer variable.

REL1--Number of messages in AO/G3's inbox of the beginning of the shift.

-C-

CC12--The average correlation between the effectiveness measures thoroughness and completeness.

CC13--The average correlation between the effectiveness measures thoroughness and responsiveness.

CC14--The average correlation between the effectiveness measures thoroughness and accuracy.

CC23--The average correlation between the effectiveness measures completeness and responsiveness.

CC24--The average correlation between the effectiveness measures completeness and accuracy.

CC34--The average correlation between the effectiveness measures responsiveness and accuracy.

CEC(IH,IOP)--Accumulative effectiveness measures for run summary.

CFA(IH,M)--Cumulative final aspiration level for run summary.

CFS(IH,M)--Cumulative final stress level for run summary.

CH(IS)--Cumulative segment completion times.

CHAR(37)--The array in which characters are stored. In the order 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, blank, A, b, c, d, e, f, g, h, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z.

CIDH(IH,M)-- Cumulative time idle for run summary.

CMSG--Cumulative message number. A unique number (within iterations) assigned to each message when it is created. Explicitly specified as REAL.

CMSGNO(MSG,J)--The cumulative message number of each message within the queues.

CMTG(IH,M)--Time spent on message processing per man per hour.

COMMNS(5)--Column means within chained runs.

CP(IP,IS)--Iteration mean performance time per priority per segment.

CRIT(I,K)--Criticality of the task element, C= critical.



CT(IT,IS)--Iteration total time per segment per message type.  
CTSH(IH,IS)--Cumulative segment time by hour.  
CTSP(IP,IS)--Cumulative time segments by message priority data for run summary.  
CTST(IT,IS)--Cumulative time segments by message type data for run summary.  
CTWH(IH,M)--Cumulative time worked for run summary.

-D-

D--Dummy indexer used for glossary reference to matrix.  
DEL(IH)--Mean transmission to computer delay.  
DELSD(IH)--Standard deviation of transmission to computer time.  
DESCOP(NOP,3)--A prose description up to 18 characters in length for each information search option.  
DURIN(IH)--Mean duration of interruption from incoming messages.

-E-

EC(IC)--The value of each effectiveness component.  
EFF--Overall or composite effectiveness.  
END(I,K)--Message processing segment, if any, ended by this task element.  
ENDHR--End of the hour time.  
ER(IE,IT)--Error rate per 100 characters for each type of error -IE- and each type of message, IT.  
ERP(IE)--Percentage of errors which will cause computer error messages.  
ERPG--Percentage of A0/G3 errors which will cause computer error messages.  
ERPI--Percentage of UIOD errors which will cause computer error messages.  
ERSUMT(IT,IOP)--Error sums within chained runs.  
EXASP(M)--Aspiration level per man in run summary.  
EXASPH(IH,M)--Aspiration level, run summary.  
EXTPM(M)--Time per message, run summary.  
EXTPMH(IH,M)--Time per message, run summary.

-F-

F(M)--The speed factor of each man. An average man would be 1.0. A fast man would be .8 and a slow man would be 1.2.

FREQ(IH)--Frequency of arrival of other than routine messages per hour. Not the number of messages but the number of times during the hour at which messages might arrive.

FREP(IP,IH)--The cumulative proportional occurrence of message priority -IP- as IP goes from 1 to 5 during hour IH. The highest used priority within each hour must have a proportion of 1.0.

FREQ(IH)--Frequency of arrival of routine messages per hour. Not the number of messages but the number of times during the hour at which messages might arrive.

FRET(IT,IH)--The cumulative proportional occurrence of message IT as IT goes from 1 to ITMAX during hour IH. For example FRET (1-7, 1) might be .1, .23, .25, .48, .73, .84, 1.00. Used in random calculation of actual message types in any given simulation hour.

FRHR(IH)--Frequency of interruptions from incoming messages per hour.

-G-

GMEANS--Grand means within chained runs.

GTSMNS--Grand total means within chained runs.

-H-

HROVER--Indicator for hour completion.

-I-

I--Task element number. Also temporary index.

IATA(J,IT)--Task analysis to be used for each operator type, J and for each message - IT.

IBLK1--Indicator within chained runs.

ICF--Temporary counter for number of messages.

ICHAIN--Shift number for this run if chaining option is being utilized. Should be set to zero if no chaining is desired.

IDAY--Day of mission simulation. Used in computation of fatigue.

IDENT(18)--A run description or header of 72 characters printed on the top of each page of printout.

IDL(IH,M)--The amount of idle time for each man in each hour.

IE--Error type, 1= commission, 2= typographic (includes abbreviation and spacing), 3= omission, 4= other.

IEND--Option to terminate program (when= 1).

IEK--Time segment indicator point.

IFTE(MSG,J)--Indicator for message interrupted by the end of the hour.

IFTET--Temporary storage for IFTE.

IGP(IH)--Number of messages arriving AO/G3's inbox in the last 15 minutes of hour IH.

IGR(IH)--Number of messages arriving in AO/G3's inbox randomly throughout this hour.

IH--Hour number.

IHH--Index for hour.

IHMAX--Number of hours simulated per iteration.

II--Temporary indexer.

IJP(I,K)--The number of the task element to be performed next if the current task element is failed.

IJS(I,K)--The number of the task element to be performed next if the current task element is performed successfully.

INC(IT)--[REAL] Mean number of characters in the final form of each message type, IT.

INFHR(IH)--Information lost per hour.

INFOLOS(CMSG)--Information loss in current message.  
 INS(IT)--[REAL] Standard deviation of number of characters per message type,  
 INC(IT).  
 INT(M)--Number of error returns remaining in hour interrupted message data.  
 INTOP--Option for card input of interruption and transmission delay.  
 INTS--Total number of interruptions to be run in a task element.  
 INTRPT(M)--Interruption indicator, 1= an incomplete message from previous hour  
 must be completed before either messages are selected.  
 IOP--Option code.  
 IP--Message priority number where, 1= routine, 2= priority, 3= operational  
 immediate, 4= flash, 5= presidential interrupt.  
 IFAGE--Page number of printout.  
 IFD--Random number from a poisson distribution.  
 IPRI(CMSG)--Message priority.  
 IPT1--Pointer for random access file 1.  
 IPT2--Pointer for random access file 2.  
 IPT3--Pointer for random access file 3.  
 IPT4--Pointer for random access file 4.  
 IPT5--Pointer for random access file 5.  
 IPT6--Pointer for random access file 6.  
 IREP--Indicator for sequential runs, 1= real data for new run, blank= terminate  
 program.  
 IRESH(IOP,IH)--Information lost (IOP= 6) number of error returns (IOP= 5) tasks  
 performed per hour (IOP= 7), IOP 1 to 4 accumulate errors per  
 error type.  
 IREST(IOP,IT)--Information lost (IOP= 6), number of error return (IOP= 5), tasks  
 performed (IOP= 7) per message type. IOP 1-4 accumulate number of  
 errors per error type.  
 IS--Time segment for message processing.  
 ISAM--Output file for SAMTOS data.

ISEG--Time segment, 1= time of arrival in AO/G3's queue [TARIV(MSG,1)], 2= time AO/G3 begins message processing, 3= time AO/G3 selects format, 4= time message arrives in UIOD's queue, 5= time UIOD requests format, 6= time UIOD sends message successfully, 7= time UIOD finishes processing message.

ISKIP--Used in data input to skip reading various types of data. Used when making multiple batch runs where only a few variables are changed. The data inputted in previous runs will be used unless new data is read in.

ISTKNT(IP)--The weights per message priority used in computing operator stress.

IT--Message type, 1= add data, 2= change data, 3= delete data, 4= query, 5= relay, 6= special process request, 7= standing request for information.

ITEM--Temporary storage for (MSGNO(I,J)).

ITYMAX--Maximum number of interruption types per task element.

ITYP--Interruption type.

IUR(IH)--Not used.

-J-

J--Operator type, 1= action officer, 2= UIOD.

JE--Index for type of message and other purposes.

JJ--Temporary index for operator type.

JTYPE(I,K)--Task element type for element I of task analysis K. Allowable types are, 1= a task element allows the message to be rejected with a probability of AVPROB(I,K), 2= task element in which the number of characters for this message type will be multiplied times the stochastically determined mean time to produce the time required to transform the messages, 3= a decision task element where operator factors such as speed - F(M), precision-PREC(M), and stress level - STR(M) are not allowed to affect the duration or success probability of the task element, 4= an equipment task element where operator factors are not considered and the task can not be failed, 5= not used, 6= a branch task in which a computer error message causes a branch back to the message correction input task element.

-K-

K--Task analysis number.

KINKS--Number of messages interrupted for hourly processing.

KK--Temporary index for message queue and others.

-L-

LDONE--Counter for crew who have completed the working hour.

LENTH(MSG,J)--Number of characters in message.

LENTHT--Temporary storage for LENTH.

LEV(IL)--Cut off points for levels of ambiguity. Expressing maximum number of vocalic central groups and used for determining starting point within the random walk decision making model.

LINE--Counter for line of print written for chained runs.

LOGBAC(IH,J)--Number of messages carried over from previous hour.

-M-

M--Man number. Each man involved in a simulation is assigned a unique number.

MAN(MSG,J)--Man who is processing message.

MANT--Temporary storage for MAN.

MCL(M)--Messages completed per man for run summary.

MCUM--Cumulative message number of current message.

MEN(D)--Number of men, D= 1 for action officers (including G3), D= 2 for UIOD's, D= 3 for total men in system.

MENS--Total number of men in system.

MESS(LA,J)--Messages for performance this hour, LA= 1 total for hour; LA= 2 messages remaining for hour. This category is decreased as messages are performed.

MGCP(IH,M)--Cumulative messages completed.

MINT--Man interrupted by hour statistics.

MQCPL(IH,M)--Messages completed per hour per man.

MQINT(IH,J)--Number of messages in the queue interrupted each hour.

MQREJ(IH,M)--Messages rejected per hour per man.  
 MSCPL(M)--Messages completed per man.  
 MSEL--Man initials selected to perform next task.  
 MSG--Message position within the queue.  
 MSGER--Error message number.  
 MSGIRP(M)--Message number of interrupted message, if any, for this crewman.  
 MSGNO--Number of messages being processed.  
 MSGS--Message number index.  
 MSGT--Temporary storage for MSGNO.  
 MSREJ(M)--Number of messages rejected per man.  
 MUCOMP(IH,J)--Cumulative messages completed per hour, per queue for run summary.  
 MUINT(IH,J)--Cumulative messages interrupted per hour per queue for run summary.  
 MUREJ(IH,J)--Cumulative messages rejected per hour per queue.

-N-

NAME(M)--The name or title of each man (up to four characters).  
 NCP(IP)- Number of tasks performed of each priority.  
 NCT(IT)--Number of times tasks types are completed in current iterations.  
 NCTSH(IH)--Number of messages performed per hour for run summary.  
 NCTSP(IP)--Number of task performance by priority data for run summary.  
 NCTST(IT)--Number of times task types completed across all iterations.  
 NE--Indexer for number of error messages. Used in input.  
 NER(MSG,J)--Number of error returns.  
 NERROP--Option for card input of error message.  
 NERT--Temporary storage for NER.

NOFAIL(M)--Number of task element failures in an hour.

NOMSG--Cumulative priority weight of messages in queue.

NOMSGS--Number of messages with a priority greater than routine which have arrived.

NOP--Indexer for number of information search options used in input.

NOPTIO--Number of information search options.

NOSUC(M)--Number of task element successes in an hour.

NR--Index for information search options.

NSHF--Current iteration number.

NSHIFT--Total number of iterations to be performed.

NSOL--Outcome from random walk, 1= solution, 2= no solution.

NSTEPS--Number of steps taken within the random work until an absorbing state is reached.

NTE--Number of task elements, total across all task analyses. Used in data input.

NTMT(IT)--Number of tasks performed by type.

NUET--Temporary storage for TNUE.

NVG--Number of vocalic control groups.

NVGM(NE)--Number of vocalic control groups for each error message.

N1--Temporary index.

N2--Temporary index.

N3--Temporary index.

N5--Temporary index.

-O-

ORO(D)--Output recording option. A value of 1 exercises the option, D= 1 for print input data, D= 2 for hourly message queue, D= 3 not used, D= 4 for detail task element processing, D= 5 for message, D= 7 for experimenter change of input data, D= 8 or 9 not used.



OUT(MSG,J)--Outcome for this message, C= completed, I= interrupted, R= rejected,  
blank= ready for processing when time of arrival occurs.

OUTT--Temporary storage for OUT.

-P-

PAFA--Pace adjustment factor for aspiration level.

PAFW--Pace adjustment factor for work fatigue.

PASP(M)--Permanent or initial aspiration level for each crewman. Used for resetting  
the aspiration level at the beginning of each iteration.

PERF(M)--The performance level of M.  $PERF(M) = NOSUP(M) / (NISM(M) + NOFAIL(M))$ .

PRBRT--The probability of moving closer to a solution within the random walk.

PRBWR--The probability of moving closer to a decision of no solution within the  
random walk.

PRIOR(MSG,J)--Message priority.

PRIORT--Temporary storage for message priority.

PROB--Temporary, adjusted, task element success probability.

PROBI(I,K,ITYP)--Probability of occurrence of task element interruption.

PROBOP(NOP)--Probability (cumulative) that each information search option will be  
selected for performance.

PROBCR--The probability that the solution entered to answer the error message will  
be correct.

PROP--Temporary variable used for numerous proportions.

PRP(IS)--Proportion of message handling time spent in each segment.

PUL--Probability of a low importance undetected error getting through to the  
central computer data store.

PUS--Probability of a significant error undetected error getting through to the  
computer data store.

-R-

RD--Pseudo random number from a uniform distribution. Mean and sigma specified by input data.

REDAM(NOP)--The ambiguity reduction factor for each information search option (0-1, 0).

RMPS(IT)--The mean number of messages produced for each A2/13 received item by message type.

RY--Pseudo random number from a uniform distribution between 0 and 1.

-S-

SDACR--The standard deviation of the time required to correct a message.

SDCOR(NOP)--Standard deviation of time required to perform each information search option.

SDIN(I,K)--Standard deviation of each interruption time from incoming message.

SEGS(CMSG,ISEG)--Time at which each message segment is completed.

SF--Stress factor.

SHFTOV--Shift completed indicator.

SIF--Success or fail indicator, S= success, F= fail.

SIGMA(I,K)--Standard deviation of the mean task element performance time - AVTMI(I,K).

SRS(M)--Average final stress per man.

SRTA--System average response time to an inquiry.

SRTS--Standard deviation of the system response time to an inquiry.

ST--Starting time for message processing.

START(M)--Actual starting time for message which was interrupted by hour and processing.

STR(M)--Current crewman stress level.

STRM(M)--The stress threshold for each man. This threshold is expressed as number of messages in the queue allocated to this man. A stress threshold of 10.0 would produce a maximum facilitory stress effect when 10 routine messages were awaiting handling. Higher priority messages are weighted to proportionally more stress producing

-T-

TARIV(MSG,J)--Time of message arrival in queue.

TARIVT--Temporary storage for TARIV.

TCORER--Total time required to respond to error message.

TIE1(MSG,M)--Total number of undetected errors of type 1.

TIE2(MSG,M)--Total number of undetected errors of type 2.

TIE3(MSG,M)--Total number of undetected errors of type 3.

TIE4(MSG,M)--Total number of undetected errors of type 4.

TIMCOR(NOP)--Average time to perform information search options.

TIME--Task element performance time.

TLEN--Intermediate value in the computation of message length.

TMIDL--Average idle time.

TMI(M)--Mean idle time.

TMINCR--Time required to input an answer to error message.

TMCOMP--Total time required within random walk for an absorbing state to be reached.

TMT(IT,IS)--Message segment times by type.

TNUE(MSG,J)--Total number of undetected errors in a message.

TMRSP--Time to perform information search option.

TPM--Time per message.

TPMC(M)--Time per message per man.

TRDEL--Transmission delay time.

TSMNSP--Total sum of means per priority in chained runs.

TSMNST--Total sum of means per message type in chained runs.

TSTEP--The time required to take each step in the random walk.

TW(IH,M)--Amount of time (seconds) worked by each crewman during each hour.

TYPE(MSG,I)--Message type for each message in the current message queue. Separate queues are kept for each type of operation -1.

TYPEET--Temporary storage for type.

TEURO--Time at start of shift being simulated.

T1--Time required for message segment 1.

T2--Time required for message segment 2.

T3--Time required for message segment 3.

T4--Time required for message segment 4.

T5--Time required for message segment 5.

#### -U-

UEE(I,P)--The probability of the occurrence of an undetected error.

UETYPE(I,E)--Undetected error type, T<sub>2</sub> transfer.

UIOD--User of an input/output device (not FORTRAN).

#### -V-

V--Basic execution time function.

VCG--Vocalic central groups (not FORTRAN).

#### -W-

W(IC)--The relative weight of each effectiveness component in computing overall effectiveness.

WOR(M)--Mean time worked.

#### -X-

X--Temporary storage for ICHAIN.

X1--Mean backlog per hour in A0 queue.

X2--Mean backlog for hour in UIOD queue.

X3--Mean messages completed by A0's.

X4--Mean messages completed by AIOD's.

X5--Mean number of messages rejected by AO's.

X6--Mean number of messages rejected by UIOD.

X7--Mean number of messages interrupted by AO's.

X8--Mean number of messages interrupted by UIOD's.

-Y-

Y--Number used to initialize the random number generator. An eight digit positive odd octal number must be used. This number should be changed between runs since the value, if repeated, will produce the same string of pseudo random numbers.

-Z-

Z(M)--Current time (seconds) for each crewman.

ZA--Adjusted task element success probability when stress level exceeds the stress threshold.

ZIF--Stress function for execution time.

ZIH--IH minus 1 in seconds.

ZTEST--test value to determine which man is most available for message processing.

APPENDIX B

Program Listing

```

1*      SUBROUTINE ASPIRF
2*      C      CALCULATES ASPIRATION AND RESULTING PACE ADJUSTMENT
3*      C      FACTOR FOR THIS MAN
4*      INCLUDE COMBLK
5*      PAFA = 1.
6*      PERF(M) = ASP(M)
7*      C      CALCULATE PRESENT PERFORMANCE LEVEL
8*      A = NOSUC(M)
9*      B = NOFAIL(M)
10*     IF(( A + B ) .LE. 0.) GO TO 200
11*     PERF(M) = A/(A+B)
12*     C      NO CHANGE IF PERFORMANCE ROUGHLY EQUALS ASPIRATION LEVEL
13*     IF( ABS(ASP(M) - PERF(M)) .LE. .02) GO TO 200
14*     C      IF PERFORMANCE IS LOW AND STRESS IS LOW
15*     IF ( PERF(M) .GE. ASP(M) .OR. STR(M) .GE. STRM(M)) GO TO 100
16*     PAFA = 1.+.4*(ASP(M)-PERF(M))
17*     GO TO 200
18*     C      IF PERFORMANCE IS HIGH AND STRESS IS LOW
19*     100 IF ( PERF(M) .LT. ASP(M) .OR. STR(M) .GE. STRM(M)) GO TO 110
20*     CALL RANDU(RY,1)
21*     ASP(M) = ASP(M)+ .1*(PERF(M)-ASP(M))*RY
22*     GO TO 200
23*     C      IF PERFORMANCE IS LOW AND STRESS IS HIGH
24*     110 IF ( PERF(M) .GE. ASP(M) .OR. STR(M) .LT. STRM(M)) GO TO 120
25*     PAFA = 1.+.4*(ASP(M)-PERF(M))
26*     ASP(M) = PERF(M)
27*     GO TO 200
28*     C      IF PERFORMANCE IS HIGH AND STRESS IS HIGH
29*     C      IF (STR(M) .LT. STRM(M) .OR. PERF(M) .LE. ASP(M)) GO TO 200
30*     120 STR(M) = .9*STRM(M)
31*     200 CONTINUE
32*     IF( ASP(M) .GT. 1.) ASP(M) = 1.
33*     RETURN
34*     END

```

\*\*\*BAKLOG\*\*\*

\*\*\*PAKLOG\*\*\*

```

1*      SUBROUTINE PAKLOG
2*      C      DETERMINES CHARACTERISTICS OF MESSAGES PRIOR TO SHIFT START
3*      INCLUDE COMBLK
4*      IF (ICHAIN.GE.2) GO TO 300
5*      IF (RKLG .LE. 0 ) GO TO 210
6*      J = 1
7*      MESS(1,J) = RKLG
8*      MESS(2,J) = RKLG
9*      DO 200 MSG = 1, RKLG
10*     C      DETERMINE MESSAGE PRIORITY
11*     CALL RANDU(RY,1)
12*     DO 110 IP = 1,5
13*     IF ( RY .GT. FPREP(IP,1)) GO TO 110
14*     PRIOR(MSG,J) = IP
15*     GO TO 120
16*     110 CONTINUE
17*     120 CONTINUE
18*     C      DETERMINE MESSAGE TYPE
19*     CALL RANDU(RY,1)
20*     DO 130 IT = 1,8
21*     IF ( RY .GT. FPET(IT,1)) GO TO 130
22*     TYPE(MSG,J) = IT
23*     GO TO 140
24*     130 CONTINUE
25*     140 CONTINUE
26*     C      DETERMINE MESSAGE LENGTH
27*     CALL RANDN(RY,RD,0.,1.)
28*     IT = TYPE(MSG,J)
29*     TLEN= INC(IT) + RD * INS(IT) + .400000
30*     IF ( TLEN .LT. (INC(IT)/10.)) TLEN = INC(IT) / 10.
31*     LENTH(MSG,J) = TLEN
32*     C      FILL UP OTHER MESSAGE DESCRIPTOR SLOTS
33*     CMSG = CMSG + 1
34*     ITYC(CMSG) = IT
35*     IPRI(CMSG) = PRIOR(MSG,J)
36*     CMSGNO(MSG,J) = CMSG
37*     C      TARTV(MSG,J) = 0.
38*     TARTV(MSG,J) = TZERO

```



\*\*\*RAKLOG\*\*\*

\*\*\*RAKLOG\*\*\*

```

39*      SEGS(CMSG, 1) = TARIV(MSG,J)
40*      TNUF(MSG,J) = 0.
41*      NER(MSG,J) = 0
42*      MAN(MSG,J) = 0
43*      OUT(MSG,J) = CHAR(11)
44*      IFTE(MSG,J) = 0
45*      200 CONTINUE
46*      IF(ORO(2).NE.CHAR(1)) GO TO 210
47*      210 CONTINUE
48*      DO 215 I=1,200
49*      215 SEGS(I,7)=0.0
50*      RETURN
51*      C GET QUEUE FROM LAST SHIFT
52*      300 CONTINUE
53*      IF(ORO(2).NE.CHAR(1)) GO TO 305
54*      IPAGE=IPAGE+1
55*      WRITE(2,9300) IPAGE
56*      9300 FORMAT(1H1,40X,37HMESSAGE CORRESPONDENCE BETWEEN SHIFTS ,
57*      1 40X,5HPAGE ,I3)
58*      WRITE(2,9305)
59*      9305 FORMAT(/25HOFOR ACTION OFFICER QUEUE )
60*      305 CALL DUMPY2
61*      DO 330 J=1,2
62*      II=MESS(1,J)
63*      MSG=0
64*      DO 315 I=1,IT
65*      IF(OUT(I,J).EQ.CHAR(14)) GO TO 315
66*      MSG=MSG+1
67*      CMSG=CMSG+1
68*      ITEM=CMSGNO(I,J)
69*      CMSGNO(MSG,J)=CMSG
70*      ITYC(CMSG)=TYPE(I,J)
71*      IPRT(CMSG)=PRIOR(I,J)
72*      DO 309 NI=1,4
73*      SEGS(CMSG,NI)=SEGS(ITEM,NI)
74*      309 CONTINUE
75*      TNUF(MSG,J)=TNUF(I,J)
76*      NER(MSG,J)=NER(I,J)
77*      MAN(MSG,J) = 0
78*      OUT(MSG,J)=CHAR(11)
79*      IFTE(MSG,J)=0
80*      IF(MSG.EQ.I) GO TO 310
81*      PRIOR(MSG,J)=PRIOR(I,J)
82*      TYPE(MSG,J)=TYPE(I,J)
83*      LENTH(MSG,J)=LENTH(I,J)
84*      TARIV(MSG,J)=TARIV(I,J)
85*      310 CONTINUE
86*      IF(ORO(2).EQ.CHAR(1)) WRITE(2,9320) I,ITEM,MSG,CMSG
87*      9320 FORMAT(5H MSG.,I3,7H, CMSG.,I4,15H MAPS INTO MSG.,I3,7H, CMSG.,I4)
88*      315 CONTINUE
89*      IF(J.EQ.1 .AND. ORO(2).EQ. CHAR(1)) WRITE(2,9310)
90*      9310 FORMAT(/14HOFOR IOD QUEUE )
91*      MESS(1,J)=MSG
92*      330 MESS(2,J)=MSG
93*      GO TO 210
94*      END

```

```

1*      SUBROUTINE CASEIN
2*      INCLUDE COMBLK
3*      C      CASE MODEL DATA IS INPUTTED FROM DATA FILES HERE
4*      READ(9,1000) FRHR,DURIN,SDIN,DEL,DELSO
5*      1000 FORMAT(60F10.4)
6*      WRITE(2,1005)
7*      1005 FORMAT('1',23X, 'DURATION',14X, 'DELAY' /
8*      1 ' HOUR FREQUENCY MEAN      SD      MEAN      SD ' /)
9*      DO 100 IH = 1,12
10*      WRITE(2,1010) IH,FRHR(IH),DURIN(IH),SDIN(IH),DEL(IH),DELSO(IH)
11*      1010 FORMAT(15,5F10.4)
12*      100 CONTINUE
13*      RETURN
14*      END

```

\*\*\*CHAIN\*\*\*

\*\*\*CHAIN\*\*\*

OMBI K\*\*\* \*\*\*COMBLK\*\*\*

PF.COMBLK,PF.COMBLK  
RLIA70 04/10-12:19:47-(13,0)

```
000 QPDP,ILF *SIPSBAT.COMBLK2,*SIPSBAT.COMBLK2
000 COMBLK PROC
000 INTEGER ORO, CHAR, AVAIL, PRIOR, OUT, UETYPE, END, SIF, CRIT
000 INTEGER SHFTOV, TYPE
000 COMMON IPT1, IPT2, IPT3, IPT4, IPT5, IPT6
000 REAL INC, INS, IDL
000 INTEGER TNUE, BKL6, CMSG, CMSGNO, TIE1, TIE2, TIE3, TIE4
000 COMMON IDENT(12), NSHIFT, IHMAX, MEN(3), ORO(10), NSHF,
000 2 IDAY, BKL6, PUL, PLS, SRTA, SRTS, IATA(2,8), NTF, MPS,
000 3 M, F(6), PREC(6), STRM(6), ASP(6), J, SIF,
000 4 IH, IGP(12), IGR(12), IUR(12), FRFT(7,12),
000 5 FREP(5,12), FRER(12), FRFO(12), 7TH, STR(6), MENS,
000 6 ER(4,7), ERPG(4), EOP(4),
000 7 INC(7), INS(7),
000 8 JTYPE(20,4), CRIT(20,4), END(20,4), IJF(20,4), IJS(20,4),
000 9 AVGTM(20,4), SIGMA(20,4), AVPROB(20,4), UETYPE(20,4), UEP(20,4),
000 1 CC12, CC13, CC14, CC23, CC24, CC34, W(4)
000 COMMON
000 3 MSG, PRIOR(50,2), LENTH(50,2), TYPE(50,2), TARIV(50,2),
000 4 TNUE(50,2), NER(50,2), MAN(50,2), IFTE(50,2), OUT(50,2),
000 6 AVAIL(6), 7(6), MSGS, ST, ENDHR, HROVER, SHFTOV, NOSUC(6),
000 7 NOFAIL(6), LDONE, INTRPT(6), MSGTRP(6),
000 1 TIE1(50,6), TIE2(50,6), TIE3(50,6), TIE4(50,6), PERF(6), TDL(12,6),
000 8 MSCPL(6), MSREJ(6), MQCPL(12,6), MQRFJ(12,6), MQTNT(12,2), TW(12,6)
000 COMMON PAFW, PAFA, IT, K, Y, RY,
000 5 MESS(2,2), CMSG, CMSGNO(50,2), PASP(6)
000 COMMON SEGS(200,7), ITC(200), EC(12,5), ATPM, INFOLS(200),
000 1 TMT(8,5), NTMT(8), INT(6)
000 COMMON CTSH(12,5), NCTSH(12), CTST(8,5),
000 1 NCTST(8), CTSP(5,5), NCTSP(5),
000 2 CTWH(12,6), CIDH(12,6),
000 3 CMTMG(12,6), MGCP(12,6), CEC(12,5),
000 4 CP(5,5), NCP(5), IPRI(200),
000 5 CTH(12,5), NCTH(12), START(6),
000 6 CFS(12,6), CFA(12,6),
000 7 WOR(6), TMI(6), TPMC(6), MCL(6),
000 8 SRS(6), ASS(6), PRP(6), CH(5), IPAGE, NAME(6), NMTP(8)
000 COMMON LOGBAC(12,2), MUCOMP(12,2), MUREJ(12,2), MUINT(12,2)
000 COMMON KINKS, INFLHR(12), IREST(8,7), IRFSH(8,12), CT(8,5), NCT(8)
000 COMMON /DATA/ CHAR(37)
000 COMMON /DATA/ ISTKNT(5), TZERO, TCHAIN, RMPS(7), AGT, AHT
000 COMMON /DATA/ PPORI(10,3,9), AITE(10,3,9), ADI(10,3,9), ITYMAX
000 COMMON /DATA/ LINE(64), GMEANS(7), GTSMNS(12), TSMNST(7,12),
000 1 TSMNSP(5,12), COMMNS(5), ERSUMT(7,7)
000 2, EXTPMH(12,6), EXASPH(12,6), EXTPM(6), EXASP(6), EXPR(2), NCC
000 3, FRHR(12), DURIN(12), SDIN(12), DFL(12), DELSD(12)
000 END
```

\*\*\*COMPU\*\*\*

\*\*\*COMPU\*\*\*

```

1*      SUBROUTINE ERROR
2*      INCLUDE COMBLK
3*      READ( 7,80) ISKIP
4*      80 FORMAT(I1)
5*      IF( ISKIP .EQ. 1) GO TO 105
6*      DO 100 II = 1,4
7*      READ(7,90) IE, (ER(IF,JE), JE= 1,7), ERPG(IE), FRPI(IE)
8*      90 FORMAT(I1, 7F8.2, 8X, 2F7.2)
9*      100 CONTINUE
10*     105 CONTINUE
11*     IF( ORO(1) .NE. CHAR(1) ) GO TO 135
12*     C      WRITE ERROR RATE DATA
13*     WRITE(2,110)
14*     110 FORMAT( 1H ,/3X, 15HERROR FREQUENCY//
15*     1 23X, 12HMESSAGE TYPE,
16*     2 17X, 15H ERROR RETURNS/
17*     34X,44TYPE,5X,1H1,5X,1H2,5X,1H3,5X,1H4,5X,1H5,5X,1H6,5X,1H7,5X,1H8,
18*     46X, 2HG3, 8X, 3HIOD/)
19*     DO 130 IE = 1,4
20*     WRITE(2,120) IE, (ER(IE,JE),JE=1,7), ERPG(IE), FRPI(IE)
21*     120 FORMAT(1H , 4X, I2, 2X, 7F6.2, 5X,  F8.3, F10.3)
22*     130 CONTINUE
23*     135 CONTINUE
24*     •      READ(7,80) ISKIP
25*     IF( ISKIP .EQ. 1) GO TO 145
26*     C      READ MESSAGE LENGTH DATA
27*     READ(7,140) INC, INS
28*     140 FORMAT( 7F10.2)
29*     145 CONTINUE
30*     IF( ORO(1) .NE. CHAR(1)) GO TO 190
31*     C      WRITE MESSAGE LENGTH DATA
32*     WRITE(2,150) INC, INS
33*     150 FORMAT(1H //3X, 17HNO. OF CHARACTERS,

```

\*FOROR\*\*

\*\*\*ERROR\*\*\*

```

34*      1 23X, 12HMESSAGE TYPE/
35*      2 31X, 1H1, 6X, 1H2, 6X, 1H3, 6X, 1H4, 6X, 1H5, 6X, 1H6, 6X, 1H7, 6X, 1H8/
36*      3 5X, 15HIN COMPUTER (M), 5X, 7F7.2/
37*      4 5X, 16HIN COMPUTER (SD), 4X, 7F7.2//)
38*      READ(7,80) ISKIP
39*      IF( ISKIP .EQ. 1) GO TO 215
40*      WRITE(2,170) IDENT, IPAGE
41*      170 FORMAT(1H1, 15X, 12A6, 13X, 5HPAGE , 14/)
42*      IPAGE = IPAGE + 1
43*      WRITE(2, 180)
44*      180 FORMAT(1H , /9X, 18HTASK ANALYTIC DATA//
45*      1 101X, 16HUNDETECTED-ERROR/
46*      2 2X, 4HTASK, 5X, 7HELEMENT, 4X, 4HTYPE, 3X, 9HCRITICAL ,
47*      3 42H SEGMENT NEXT-FAIL NEXT-SUCC MEAN-TIME , 2X,
48*      4 35HSIGMA PROBABILITY TYPE PROB//)
49*      190 CONTINUE
50*      K = 9999
51*      C      READS IN TASK ANALYTIC DATA
52*      DO 210 N = 1, NTE
53*      READ(7,200) K, I, JTYPE(I,K), CRIT(I,K), END(I,K),
54*      1 IJF(I,K), IJS(I,K), AVGTM(I,K), SIGMA(I,K), AVPROB(I,K),
55*      2 UETYPE(I,K), UEP(I,K), INTS
56*      200 FORMAT(I2, I3, 1X, I1, A1, 1X, I1, 1X, 2I3, 2X, 3F10.3, A1, F6.3, 22X, I2)
57*      IF( INTS .LE. 0) GO TO 197
58*      READ(7,196) ITYP, PROBI(I,K,ITYP), AITE(I,K,ITYP),
59*      1 ADI(I,K,ITYP), LK = 1, INTS)
60*      196 FORMAT(4( I2, F6.3, 2F6.1))
61*      IF( ITYP .GT. ITYMAX) ITYMAX = ITYP
62*      197 CONTINUE
63*      IF( ORO(1) .NE. CHAR(1)) GO TO 210
64*      IF( K .EQ. KP) GO TO 203
65*      KP = K
66*      WRITE(2,202) K
67*      202 FORMAT(1H , 15)
68*      203 CONTINUE
69*      WRITE(2,205) I, JTYPE(I,K), CRIT(I,K), END(I,K),
70*      1 IJF(I,K), IJS(I,K), AVGTM(I,K), SIGMA(I,K), AVPROB(I,K),
71*      2 UETYPE(I,K), UEP(I,K)
72*      205 FORMAT(5X, I10, 9X, I1, 8X, A1, 9X, I1, 2I10, F10.2,
73*      1 F11.2, F9.3, 8X, A1, F11.2)
74*      DO 209 ITYP = 1, ITYMAX
75*      IF( PROBI(I,K,ITYP) .LE. 0.) GO TO 200
76*      WRITE(2,206) ITYP, PROBI(I,K,ITYP), AITE(I,K,ITYP),
77*      1 ADI(I,K,ITYP)
78*      206 FORMAT(15X, 17HINTERUPTION TYPE , 12, 15H PROBABILITY= ,
79*      1 F6.3, 17H MEAN DURATION= , F6.1, 6H SD= , F6.1)
80*      209 CONTINUE
81*      210 CONTINUE
82*      215 CONTINUE
83*      WRITE(2,220) (J, J= 1,8), (LD, ( IATA(LD, JDA),
84*      1 JDA = 1,8), LD= 1,2)
85*      220 FORMAT( 1H , // 25H TASK ANALYSIS ALLOCATION:
86*      1 / 30X, 12HMESSAGE TYPE /
87*      2 10H OPERATOR , 8I10,
88*      3 ( / 15, 5X, 8(9X, I11))
89*      READ(7,80) ISKIP
90*      IF( ISKIP .EQ. 1) GO TO 255

```

```

1*      SUBROUTINE EXPER(IEND)
2*      INCLUDE COMBLK
3*      PRINT 1000
4*      1000 FORMAT( /20X, 'APPLIED PSYCHOLOGICAL SERVICES PRESENTS' , /
5*      1 / 21X, 'AN ON-LINE EXPERIMENTER CONTROL OF THE' /
6*      2 / 20X, '-----MANMOD-----' , /
7*      3 20X, 'A COMPUTER SIMULATION MODEL OF THE ARMY'S' /
8*      5 20X, 'TOS SYSTEM RUN ON THE UNIVAC 1108 COMPUTER' /
9*      6 / 10X, 'IN ORDER FOR THE PROGRAM TO RECEIVE YOUR INSTRUCTIONS',
10*     7 ' IMMEDIATELY' /7X, 'SET THE CRT IN THE MESSAGE MODE' ,
11*     8 ' (I.E. DEPRESS BUTTON MSG.)' /
12*     A / 10X, 'INSTRUCTIONS SHOULD BE INSERTED BETWEEN BRACKETS'
13*     A ' WHERE INDICATED .' /
14*     9 /10X, 'THE XMIT BUTTON SHOULD BE DEPRESSED WHILE THE '
15*     9 ' THE CURSOR IS ON THE' /7X, ' LINE CONTAINING THE INSTRUCTIONS.' /
16*     9 /10X, 'IF NO INSTRUCTIONS ARE NEEDED DEPRESS THE HOME'
17*     9 ' BUTTON FOLLOWED BY THE' /7X, 'XMIT BUTTON.' /
18*     PRINT 1005
19*     1005 FORMAT(
20*     4 10X, ' FAILURE TO POSITION THE CURSOR CORRECTLY' ,
21*     5 ' WILL RESULT IN' /7X, 'WRAP AROUND. THAT IS, THE DISPLAY WILL'
22*     6 ' START IN THE MIDDLE THEN' /

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\*\*\*ERROR\*\*\*

\*\*\*ERROR\*\*\*

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91*      C      READ EFFECTIVENESS COMPONENT CORRELATIONS AND WEIGHTS
92*      READ(7,250) CC12,CC13,CC14,CC23,CC24,CC34,(W(N),N=1,4)
93*      250 FORMAT(.10F5.3)
94*      255 CONTINUE
95*      IF(ORO(1) .NE. CHAR(1)) GO TO 270
96*      WRITE(2,260)CC12,CC13,CC14,CC23,CC24,CC34,(W(N),N=1,4)
97*      260 FORMAT(1H1, 24HEFFECTIVENESS COMPONENTS/
98*      1 / 2X, 31HCORRELATIONS BETWEEN COMPONENTS/
99*      1 3X, 6HCC12= , F5.3/
100*     2 3X, 6HCC13= , F5.3/
101*     3 3X, 6HCC14= , F5.3/
102*     4 3X, 6HCC23= , F5.3/
103*     5 3X, 6HCC24= , F5.3/
104*     6 3X, 6HCC34= , F5.3/
105*     6 / 2X, 25HWEIGHTS OF EACH COMPONENT /
106*     7 3X, 6HW(1)= , F5.3/
107*     8 3X, 6HW(2)= , F5.3/
108*     9 3X, 6HW(3)= , F5.3/
109*     1 3X, 6HW(4)= , F5.3//)
110*     270 CONTINUE
111*     RETURN
112*     END

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\*\*\*EXPER\*\*\*

\*\*\*EXPER\*\*\*

\*FVPER\*\*\*

\*\*\*EXPER\*\*\*

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23*      7 7X, 'CONTINUE ON THE TOP OF THE CRT.' /
24*      8 / 10X, 'WHEN THE INSTRUCTIONS (IF ANY) ARE COMPLETED' ,
25*      8 ' DEPRESS THE XMIT BUTTON.' /
26*      READ 2010,I
27*      2 PRINT 1010
28*      1010 FORMAT(22(1X/), ' [ 1 INDICATE THE NUMBER OF THE DATA CATEGORY',
29*      2 ' TO BE CHANGED.' /
30*      3 ' A RESPONSE GREATER THAN 20 WILL TERMINATE THE PROGRAM.' /
31*      3 ' A BLANK INDICATES NO MORE CHANGES ARE TO BE MADE',
32*      4 ' AND SIMULATION WILL START.' /
33*      5 20X, 'DATA CATEGORIES' /
34*      6 / ' 1 NUMBER OF ITERATIONS',
35*      7 10X, '12 MISSION TITLE' /
36*      9 ' 2 OUTPUT OPTIONS' ,
37*      9 16X, '13 TASK ANALYSIS INDS' /
38*      9 ' 3 OPERATOR TYPE DATA',
39*      912X, '14 OPERATOR SPEED' /
40*      9 ' 4 OPERATOR PRECISION' ,
41*      912X, '15 OPERATOR THRESHOLD' /
42*      9 ' 5 OPERATOR ASPIRATION' /
43*      9 ' 6 MEAN TIME FOR TASKS' ,
44*      911X, '16 SIGMA FOR TASK TIME' / )
45*      PRINT 1014
46*      1014 FORMAT(
47*      9 ' 7 MESSAGE ERROR RATE' ,
48*      912X, '17 PROB-SIGNIFICANT ERROR' /
49*      9 ' 8 PROB-LOW SIGNIF ERROR' ,
50*      99X, '18 MSGS TO AD FOR HOUR' /
51*      9 ' 9 MESSAGES TO AD LAST 15 MIN',
52*      94X, '19 MSG TYPE OCCUR. RATE' /
53*      9 ' 10 MSG PRIOR. OCCUR. RATE',
54*      98X, '20 MEAN CHAR/MSG TYPE' /
55*      9 ' 11 SIGMA FOR CHAR/TYPER' /)
56*      READ 2010,I
57*      2010 FORMAT(2X,I2)
58*      IF( I .LE. 0) GO TO 999
59*      IF( I .LE. 20) GO TO 5
60*      IFND = 1
61*      GO TO 999
62*      5 CONTINUE
63*      GO TO(10,20,30,40,50,60,70,80,90,100,
64*      1 110,120,130,140,150,60,(70,180,190,110),I
65*      10 CONTINUE
66*      PRINT 1020, NSHIFT
67*      1020 FORMAT(22(1X/), ' [1, 13, 'NUMBER OF ITERATIONS' )
68*      READ 2020, NSHIFT
69*      2020 FORMAT(2X, I3)
70*      GO TO 2
71*      C - CHANGE IN OUTPUT RECORDING OPTIONS
72*      20 CONTINUE
73*      PRINT 1030, (J, ORO(J), J = 1,9)
74*      1030 FORMAT(22(1X/),
75*      1 ' [ 1=RECORDING OPTION [ 1=SPECIFICATION' /
76*      2 ' INDICATE ABOVE THE RECORDING OPTION TO BE CHANGED',
77*      3 ' CHANGES WILL BE REFLECTED BELOW' /
78*      4 ' A BLANK INDICATES NO MORE CHANGES ARE TO BE MADE.' /
79*      5 ' A SPECIFICATION OF 1 EXERCISES THE OPTION' //

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\*FVPER\*\*\*

\*\*\*EXPER\*\*\*

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A0*      6 10X, 'OPTION', 10X, 'SPECIFICATION' /
A1*      7 9(10X, I3, 19X, A1 /))
A2*      READ 2030, I, J
A3*      2030 FORMAT(2X, I1, 22X, I1)
A4*      IF( I .LE. 0) GO TO 2
A5*      OR0(I) = J
A6*      GO TO 20
A7*      C      CHANGE IN CREWMAN NAME
A8*      30 CONTINUE
A9*      PRINT 1040, (M, NAME(M), M = 1,6)
A0*      1040 FORMAT( 22(1X/),
A1*      1 ' [ ]=OPERATOR NUMBER [ ]=NEW TYPE OR NAME ' /
A2*      2 ' INDICATE ABOVE THE CHANGES FOR EACH MAN.'
A3*      3 ' CHANGES WILL BE REFLECTED BELOW.' //
A4*      4 ' OPERATOR NUMBER NAME ' /
A5*      5 6(12X, I1, 17X, A6/))
A6*      READ 2040, M, NM
A7*      2040 FORMAT(2X, I1, 21X, A6)
A8*      IF( M .LE. 0) GO TO 2
A9*      NAME(M) = NM
A0*      GO TO 30
A1*      C      CHANGE IN OPERATOR PRECISION
A2*      40 CONTINUE
A3*      PRINT 1050, (M, PREC(M), M = 1,6)
A4*      1050 FORMAT( 22(1X/),
A5*      1 ' [ ]=OPERATOR NUMBER [ ]=PRECISION' /
A6*      2 ' INDICATE CHANGES ABOVE. CHANGES WILL BE REFLECTED BELOW.' /
A7*      4 ' OPERATOR PRECISION ' /
A8*      5 6(4X, I1, 15X, F5.2/))
A9*      READ 2050, M, PR
A0*      2050 FORMAT(2X, I1, 21X, F5.1)
A1*      IF( M .LE. 0) GO TO 2
A2*      PREC(M) = PR
A3*      GO TO 40
A4*      C      CHANGE OPERATOR ASPIRATION LEVEL
A5*      50 CONTINUE
A6*      PRINT 1060, (M, ASP(M), M=1,6)
A7*      1060 FORMAT(22(1X/),
A8*      1 ' [ ]=OPERATOR NUMBER [ ]=ASPIRATION LEVEL' /
A9*      2 ' INDICATE THE CHANGES ABOVE.'
A0*      3 ' CHANGES WILL BE REFLECTED BELOW.' //
A1*      4 ' CREWMAN ASPIRATION' /
A2*      5 6(4X, I1, 15X, F5.2/))
A3*      READ 2060, M, AS
A4*      2060 FORMAT(2X, I1, 21X, F5.2)
A5*      IF( M .LE. 0) GO TO 2
A6*      ASP(M) = AS
A7*      GO TO 50
A8*      C      CHANGE MEAN TIME AND SIGMA FOR TASKS
A9*      60 CONTINUE
A0*      PRINT 1070
A1*      1070 FORMAT(22(1X/), ' [ ]INDICATE THE TASK ANALYSIS TO BE CHANGED')
A2*      READ 2070, K
A3*      2070 FORMAT(2X, I1)
A4*      IF( K .LE. 0) GO TO 2
A5*      64 PRINT 1072, K, (T, AVGTM(I,K), SIGMA(I,K), I=1,20)
A6*      1072 FORMAT(22(1X/),

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\*FvPER\*\*\*

\*\*\*EXPER\*\*\*

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137*      1 ' C J=TASK ELEMENT C J=MEAN C J=SIGMA'//
138*      1 7X, 'TASK ANALYSIS', I3 /
139*      4 3X, 'ELEMENT', 10X, 'MEAN' 8X, 'SIGMA'//
140*      5 20(2X, I4, F18.2, F13.2//)
141*      READ 2072, I, AVG, SIG
142*      2072 FORMAT(2X, I2, 18X, F6.0, 10X, F6.0)
143*      IF( I .LE. 0) GO TO 60
144*      AVGTN(I,K) = AVG
145*      SIGMA(I,K) = SIG
146*      GO TO 64
147*      C CHANGING MESSAGE ERROR RATE
148*      70 CONTINUE
149*      PRINT 1080, (L,L=1,4), (J,(FR (I,J), I = 1,4), J=1,7)
150*      1080 FORMAT( 22(1X//),
151*      1 ' C J=MESSAGE TYPE C J=ERROR TYPE '
152*      3 ' C J=ERROR RATE '//
153*      4 ' INDICATE CHANGES ABOVE. CHANGES WILL BE REFLECTED BELOW'///
154*      5 10X, ' MESSAGE ERROR RATE PER 100 CHARACTERS'//
155*      6 3X, 'MESSAGE', 17X, 'ERROR TYPE',
156*      2/5X, 'TYPE', I9, 3I10 //
157*      7 7(I7, F13.2, 3F10.2, 30X // )
158*      READ 2080, MT, IERT, ERATE
159*      2080 FORMAT(2X, I1, 17X, I1, 16X, F5.0)
160*      IF( MT .LE. 0) GO TO 2
161*      ER(IERT,MT) = ERATE
162*      GO TO 70
163*      C CHANGING THE PROBABILITY OF A LOW SIGNIFICANCE ERROR
164*      80 CONTINUE
165*      PRINT 1090, PUL
166*      1090 FORMAT(22(1X//),
167*      1 ' C F5.2, 'J=PROBABILITY OF A NON IMPORTANT',
168*      2 ' ERROR IN THE COMPUTER DATA STORE' )
169*      READ 2090, PUL
170*      2090 FORMAT(2X, F5.0)
171*      GO TO 2
172*      C CHANGING THE NUMBER OF MESSAGES TO AO IN HE LAST 15 MINUTES'//
173*      90 CONTINUE
174*      PRINT 1100, (IH,IGP(IH),IH=1,12)
175*      1100 FORMAT(22(1X//),
176*      3 ' C J=HOUR C J=NUMBER OF MESSAGES'//
177*      5 ' INDICATE CHANGES ABOVE. CHANGES WILL BE REFLECTED BELOW'//
178*      7 / 6X, 'MESSAGES ARRIVING IN THE LAST 15 MINUTES OF HOUR'//
179*      7 /10X, 'HOUR', 6X, 'NUMBER OF MESSAGES'//
180*      8 12( 1X,I12,I16 //)
181*      READ 2100, IH, NM
182*      2100 FORMAT(2X, I2, 10X, I3)
183*      IF( IH .LE. 0) GO TO 2
184*      IGP(IH) = NM
185*      GO TO 90
186*      C CHANGING MESSAGE PRIORITY OCCURRENCE RATE
187*      100 CONTINUE
188*      PRINT 1110, (I,I=1,5), (IH,(FREP(IP,IH),IP=1,5),IH=1,12)
189*      1110 FORMAT(22(1X//),
190*      1 ' C J=HOUR C J=PRIORITY C J=OCCURRENCE RATE'//
191*      4 ' INDICATE CHANGES ABOVE. CHANGES WILL BE REFLECTED BELOW'//
192*      5 10X, ' MESSAGE PRIORITY OCCURRENCE RATE '
193*      7 / 33X, 'PRIORITY' /

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\*\*\*FVPER\*\*\*

\*\*\*EXPER\*\*\*

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194*      8 5X, 'HOUR', I9, 4I10 //
195*      3 12(1X, I7, F11.2, 4F10.2//)
196*      READ 2110, IH, IP, RATE
197*      2110 FORMAT(2X, I2, 10X, I1, 15X, F5.0)
198*      IF( IH .LE. 0) GO TO 2
199*      FREQ(IP, IH) = RATE
200*      GO TO 100
201*      110 CONTINUE
202*      C      CHANGE MEAN AND SIGMA FOR CHARACTERS PER MESSAGE TYPE
203*      PRINT 1120, (I, INC(I), INS(I), I=1,7)
204*      1120 FORMAT(22(1X//),
205*      4 ' [ ]=MESSAGE TYPE [ ]=MEAN [ ]=SIGMA'//
206*      5 ' INDICATE CHANGES ABOVE. CHANGES WILL BE REFLECTED BELOW.'//
207*      5 10X, 'MESSAGE LENGTH DATA'//
208*      6 4X, 'TYPE OF', 9X, 'NUMBER OF CHARACTERS'//
209*      7 4X, 'MESSAGE', 9X, 'MEAN', 11X, 'SIGMA' //
210*      8 7(1X, I7, 2F16.1//))
211*      READ 2120, MT, AMEAN, SIG
212*      2120 FORMAT(2X, I1, 18X, F6.0, 10X, F6.0)
213*      IF( MT .LE. 0) GO TO 2
214*      IF( AMEAN .GT. 0.) INC(MT) = AMEAN
215*      IF( SIG .GT. 0.) INS(MT) = SIG
216*      GO TO 110
217*      C      CHANGE MISSION TITLE
218*      120 CONTINUE
219*      PRINT 1130, IDENT
220*      1130 FORMAT( 22(1X//),
221*      1 ' [', 12A6, ']'//
222*      2 ' INSERT NEW MISSION TITLE ABOVE')
223*      READ 2130, IDENT
224*      2130 FORMAT(2X, 12A6)
225*      GO TO 2
226*      C      CHANGE TASK ANALYSIS INDICATORS
227*      130 CONTINUE
228*      PRINT 1140, (J, (IATA(I, J), I=1,2), J=1,7)
229*      1140 FORMAT( 22(1X//),
230*      1 ' [ ]=MESSAGE TYPE [ ]=OPERATOR TYPE [ ]
231*      3 ' ]=TASK ANALYSIS' /
232*      5' INDICATE CHANGES ABOVE. CHANGES WILL BE REFLECTED BELOW.'//
233*      6 / 13X, 'TASK ANALYSIS USAGE'//
234*      7 3X, 'MESSAGE', 10X, 'ACTION', 9X, 'UNION'//
235*      8 4X, 'TYPE', 11X, 'OFFICIER', 6X, 'OPERATOR'//
236*      9 21X, '(1)', 11X, '(2)'//
237*      9 7( 1X, I5, I17, I14//))
238*      READ 2140, MT, I, NTA
239*      2140 FORMAT(2X, I1, 17X, I1, 20X, I2)
240*      IF( MT .LE. 0) GO TO 2
241*      IATA(I, MT) = NTA
242*      GO TO 130
243*      C      CHANGE OPERATOR SPEED
244*      140 CONTINUE
245*      PRINT 1150, (J, F(J), J=1,6)
246*      1150 FORMAT(22(1X//),
247*      2 ' [ ]=OPERATOR [ ]=SPEED'//
248*      3 ' INDICATE ANY CHANGES ABOVE.'//
249*      3 'THE CHANGES WILL BE REFLECTED BELOW'
250*      4 // '      OPERATOR      SPEED'//

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\*FVPRF\*\*\*

\*\*\*FXPRF\*\*\*

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251*      5 6(4X, I2, 12X, F5.2//)
252*      READ 2150, J, FJ
253*      2150 FORMAT(2X, I2, 14X, F6.2)
254*      IF( J .LE. 0) GO TO 2
255*      F(J) = FJ
256*      GO TO 140
257*      C      CHANGE OPERATOR STRESS THRESHOLD
258*      150 CONTINUE
259*      PRINT 1160, (J, STRM(J), J=1,6)
260*      1160 FORMAT(22(1X//),
261*      2 ' [ J=OPERATOR [ J=STRESS THRESHOLD'//
262*      3 ' INDICATE ANY CHANGES ABOVE'
263*      4 ' THE CHANGES WILL BE REFLECTED BELOW. ' /
264*      4 / , OPERATOR THRESHOLD' /
265*      5 6(4X, I2, 14X, F6.2 //)
266*      READ 2160, J, ST
267*      2160 FORMAT(2X, I2, 14X, F6.2)
268*      IF( J .LE. 0) GO TO 2
269*      STRM(J) = ST
270*      GO TO 150
271*      C      CHANGE PROBABILITY OF A SIGNIFICANT ERROR
272*      170 CONTINUE
273*      PRINT 1180, PUS
274*      1180 FORMAT( 22(1X//),
275*      1 ' [ PUS, F6.3, ' J=PROBABILITY OF A SIGNIFICANT ERROR IN THE DATA ' )
276*      READ 2180, PUS
277*      2180 FORMAT(2X, F6.3)
278*      GO TO 2
279*      C      CHANGE MESSAGES TO AO RANDOM THROUGH HOUR
280*      180 CONTINUE
281*      PRINT 1190, (IH, IGR(IH), IH=1, 12)
282*      1190 FORMAT(22(1X//),
283*      1 ' [ J=HOUR [ J=MESSAGES'//
284*      2 ' INDICATE CHANGES ABOVE. CHANGES WILL BE REFLECTED BELOW'//
285*      3 ' MESSAGE ARRIVAL RATE'//
286*      4 ' HOUR FREQUENCY'//
287*      5 12(6X, I2, 10X, I3//)
288*      READ 2190, IH, IG
289*      2190 FORMAT(2X, I2, 12X, I3)
290*      IF( IH .LE. 0) GO TO 2
291*      IGR(IH) = IG
292*      GO TO 180
293*      C      CHANGE MESSAGE TYPE OCCURRENCE RATE
294*      190 CONTINUE
295*      PRINT 1200, (IT, IT=1, 7), (IH, (FRET(IT, IH), IT=1, 7), IH=1, 12)
296*      1200 FORMAT(22(1X//),
297*      1 ' [ J=HOUR [ J=TYPE [ J=CUMULATIVE PROPORTION'//
298*      2 ' INDICATE CHANGES ABOVE. CHANGES WILL BE REFLECTED BELOW'//
299*      3 10X, 'FREQUENCY OF MESSAGE TYPES EXPRESSED AS CUMULATIVE PROPORTI
300*      4 0NS'//
301*      5 40X, 'MESSAGE TYPE'//
302*      6 5X, 'HOUR', 10X, 7I7//
303*      7 12(6X, I2, 11X, 7F7.2//)
304*      READ 2200, IH, IT, FPF
305*      2200 FORMAT(2X, I2, 12X, I2, 12X, F5.2)
306*      IF( IH .LE. 0) GO TO 2
307*      FRET(IT, IH) = FPF

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\*FVPER\*\*\*

\*\*\*EXPER\*\*\*

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308*      GO TO 190
309*      999 CONTINUE
310*      RETURN
311*      END
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\*\*\*FATIGU\*\*\*

\*\*\*FATIGU\*\*\*

```
1*      SUBROUTINE FATIGU
2*      C      CALCULATES WORK FATIGUE AS A FUNCTION OF HOUR
3*      INCLUDE COMBLK
4*      DAY = IDAY
5*      PAFW = 1.1147 - .02173 * Z(M) - (DAY - 1.) * .01
6*      PAFW = 1./ PAFW
7*      IF(PAFW .LT. 1.) PAFW = 1.
8*      RETURN
9*      END
```

\*\*\*HOUR\*\*\*

\*\*\*HOUR\*\*\*

```

1*      SUBROUTINE HOUR
2*      C      READS IN MESSAGE BY HOUR VARIABLES
3*      INCLUDE COMBLK
4*      READ(7,40) ISKIP
5*      40 FORMAT(I1)
6*      IF( ISKIP .EQ. 1) GO TO 107
7*      READ(7,50) (NMTYP(IK ),IK=1,9)
8*      50 FORMAT(9A6)
9*      READ(7,60) (RMPS(L),L=1,7)
10*      60 FORMAT(7F5.2)
11*      DO 105 IHE= 1, IHMAX
12*      READ(7,90) IH, IGR(IH), IGR(IH), IUR(IH),
13*      1 (FRET(L,IH),L=1,7), (FREP(K,IH),K= 1,5),
14*      2 FREP(IH), FREP(IH)
15*      90 FORMAT(4I2, 1X, 14F5.0)
16*      DO 100 KY = 1,7
17*      FRET(KY,IH) = FRET(KY,IH)/ 100.
18*      100 CONTINUE
19*      DO 102 KY = 1,5
20*      FREP(KY,IH) = FREP(KY,IH)/ 100.
21*      102 CONTINUE
22*      105 CONTINUE
23*      107 CONTINUE
24*      IF( ORO(1) .NE. CHAR(1)) GO TO 200
25*      WRITE(2,108) (RMPS(L),L=1,7)
26*      108 FORMAT(/32HMESSAGES PER STIMULUS BY TYPE /
27*      1 43H      1      2      3      4      5      6      7 /1X,7F6.2)
28*      WRITE(2,110)
29*      110 FORMAT(1H ,/25H      HOUR PARAMETERS,
30*      1 / 26X, 41H-----INPUT MESSAGES FROM OUTSIDE----- ,
31*      2 // 42H      CUMULATIVE MESSAGE FREQUENCY BY TYPE,
32*      3 33H      CUM. MSG FREQ. BY PRIORITY ,
33*      4 46H      DELIVERIES PER HOUR      NUMBER OF MESSAGES ,
34*      5 / 40H      HOUR      1      2      3      4      5      6      7      8 ,
35*      6 30H      1      2      3      4      5 ,
36*      7 50H      ROUTINE      NOT-ROUTINE      LAST 1/4 HR      ANYTIME /)
37*      DO 130 IHE= 1, IHMAX
38*      WRITE(2,120) IH,

```

\*HOUR\*\*\*

\*\*\*HOUR\*\*\*

```
39*      1 (FRFT(L,IH),L=1,7),(FREP(K,IH),K=1,5),FRER(IH),FREQ(IH),
40*      2 IGP(IH),IGR(IH)
41*      120 FORMAT(1H,1A,1X,7F5.2,9X,5F5.2,F13.1,F11.1,2I11)
42*      130 CONTINUE
43*      200 CONTINUE
44*      IF(OR0(9).NE.CHAR(2)) GO TO 999
45*      DO 900 IHH=1,IHMAX
46*      READ(7,1000) IH,FRHR(IH),DURIN(IH),SDIN(IH),DEL(IH),DELSO(IH)
47*      1000 FORMAT(I2,5F10.4)
48*      IF(IH.GT.0) GO TO 900
49*      WRITE(2,1100)
50*      1100 FORMAT(' ZERO HOUR IN CASE TYPE DATA HAS BOMBED RUN')
51*      900 CONTINUE
52*      WRITE(2,1005)
53*      1005 FORMAT('1',23X,'DURATION',14X,'DELAY' /
54*      1 ' HOUR FREQUENCY MEAN SD MEAN SD'//)
55*      DO 950 IH = 1,IHMAX
56*      WRITE(2,1010) IH,FRHR(IH),DURIN(IH),SDIN(IH),DEL(IH),DELSO(IH)
57*      1010 FORMAT(I5,5E10.4)
58*      950 CONTINUE
59*      999 CONTINUE
60*      RETURN
61*      END
```

\*\*\*ITSUM\*\*\*

\*\*\*ITSUM\*\*\*

```

1*      SUBROUTINE ITSUM
2*      C      PRINTS SHIFT RESULTS
3*      INCLUDE COMPLK
4*      IF( ORO(6) .NE. 1) GO TO 12
5*      WRITE(2,4) IDENT, IPAGE
6*      4 FORMAT(1H1, 15X, 12A6, 13X, 5HPAGE , 14/)
7*      IPAGE = IPAGE + 1
8*      WRITE(2,5) NSHF
9*      5 FORMAT(1H , / 2RH RESULTS OF SHIFT ITERATION, 15/)
10*     WRITE(2,10)(IH,(FC(IH,KL),KL=1,5), 14E 1, IHMAX)
11*     10 FORMAT(1H , //10X, 41HTHOROUGHNESS COMPLETENESS RESPONSIVENESS ,
12*     1 2PHACURACY EFFECTIVENESS/
13*     2 6H HOUR/
14*     3 ( 15, 5F12.2/))
15*     12 CONTINUE
16*     DO 15 IT = 1,7
17*     X = NCT(IT)
18*     IF( X .LE. 0) GO TO 15
19*     NCTST(IT) = NCTST(IT) + NCT(IT)
20*     DO 14 IS = 1,5
21*     C      STORE CUMULATIVE TIME SEGMENTS BY TYPE FOR RUN SUMMARY
22*     CTST(IT,IS) = CTST(IT,IS) + CT(IT,IS)
23*     C      CALCULATE ITERATION MEAN TIME PER SEGMENT PER TYPE
24*     CT(IT,IS) = CT(IT,IS) / X
25*     14 CONTINUE
26*     15 CONTINUE
27*     DO 17 IP = 1,5
28*     X = MCP(IP)
29*     IF( X .LE. 0) GO TO 17
30*     C      ACCUMULATE TIME SEGMENTS BY PRIORITY FOR RUN SUMMARY
31*     NCTSP(IP) = MCP(IP) + NCTSP(IP)
32*     DO 16 IS = 1,5
33*     CTSP(IP,IS) = CTSP(IP,IS) + CP(IP,IS)
34*     CP(IP,IS) = CP(IP,IS) / X
35*     16 CONTINUE
36*     17 CONTINUE
37*     IF( ORO(6) .NE. 1) GO TO 30
38*     WRITE(2,20) (IT, NCT(IT), (CT(IT,IS), IS= 1,5), IT= 1,7)
39*     20 FORMAT(1H , //10X, 80H          NO.          T1          T2

```

```

1*
2*      INCLUDE COMBLK.LIST
2* COMBLK PROC
2*      INTEGER ORO, CHAR, AVAIL, PRIOR, OUT, UETYPE, END, SIF, CRIT
2*      INTEGER SHFTOV, TYPE
2*      COMMON IPT1, IPT2, IPT3, IPT4, IPT5, IPT6
2*      REAL INC, INS, IOL
2*      INTEGER TNUF, BKLG, CMSG, CMSGNO, TIF1, TIF2, TIF3, TIF4
2*      COMMON IDENT(12), NSHIFT, IHMAX, MEN(3), ORO(10), NSHF,
2*      2 IDAY, BKLG, PUL, PHS, SRTA, SRTS, IATA(2,8), NTF, MPS,
2*      3 M, F(6), PREC(6), STRM(6), ASP(6), J, SIF,
2*      4 TH, IGP(12), IGR(12), IUR(12), FRET(7,12),
2*      5 FREP(5,12), FRER(12), FREQ(12), 7TH, STR(6), MENS,
2*      6 ER(4,7), ERPG(4), ERPT(4),
2*      7 INC(7), INS(7),
2*      8 JTYPE(20,4), CRIT(20,4), FND(20,4), TJF(20,4), IJS(20,4),
2*      9 AVGTM(20,4), SIGMA(20,4), AVPROB(20,4), UETYPE(20,4), UEP(20,4),
2*      1 CC12, CC13, CC14, CC23, CC24, CC34, W(4)
2*      COMMON
2*      3 MSG, PRIOR(50,2), LENTH(50,2), TYPE(50,2), TARIV(50,2),
2*      4 TNUF(50,2), NFR(50,2), MAN(50,2), TETF(50,2), OUT(50,2),
2*      6 AVAIL(6), Z(6), MSGS, ST, FNDHR, HROVER, SHFTOV, NOSUC(6),
2*      7 NOFAIL(6), LDONE, INTBPT(6), MSGIRP(6),
2*      1 TIF1(50,6), TIF2(50,6), TIF3(50,6), TIF4(50,6), PREF(6), TDL(12,6),
2*      8 MQCPL(6), MSREFJ(6), MQCPL(12,6), MQREFJ(12,6), MQTINT(12,2), TW(12,6)
2*      COMMON PAEW, PAEA, IT, K, Y, RY,
2*      5 MESS(2,2), CMSG, CMSGNO(50,2), PASP(6)
2*      COMMON SEGS(200,7), ITYC(200), FC(12,5), ATPM, INFOLS(200),

```

\*ITSUM\*\*

\*\*\*ITSUM\*\*\*

```

40*      1 T3      T4      T5
41*      2 154      TYPE COMPL./
42*      2 ( I7, I15, 5F12.1/))
43*      30 CONTINUE
44*      DO 50 IH = 1, IHMAX
45*      DO 51 L = 1,2
46*      MUINT(IH,L) = MUINT(IH,L) + MQINT(IH,L)
47*      51 CONTINUE
48*      DO 50 M = 1, MENS
49*      J = 1
50*      IF( M .GT. MEN(1)) J = 2
51*      MUCOMP(IH,J) = MUCOMP(IH,J) + MQCPL(IH,M)
52*      MUREJ(IH,J) = MUREJ(IH,J) + MOREJ(IH,M)
53*      50 CONTINUE
54*      IF(ICHAIN.NF.0) CALL DUMPY1
55*      RETURN
56*      END

```

\*\*\*MAIN\*\*\*

\*\*\*MAIN\*\*\*



\*MAIN\*\*\*

\*\*\*MAIN\*\*\*

```

2*          INCLUDE COMBLK
3*          DATA(((AITE(I,J,K),I=1,10),J=1,3),K=1,9)/270*0.0/
4*          DATA(((ADI (I,J,K),I=1,10),J=1,3),K=1,9)/270*0.0/
5*          DATA(((PROBI(I,J,K),I=1,10),J=1,3),K=1,9)/270*0.0/
6*          DATA (CHAR(I),I=1,37) /
7*          1 1H1, 1H2, 1H3, 1H4, 1H5, 1H6, 1H7, 1H8, 1H9, 1H0, 1H ,
8*          2 1HA, 1HB, 1HC, 1HD, 1HE, 1HF, 1HG, 1HH, 1HI, 1HJ, 1HK,
9*          3 1HL, 1HM, 1HN, 1HO, 1HP, 1HQ, 1HR, 1HS, 1HT, 1HU, 1HV, 1HW,
10*         4 1HX, 1HY, 1HZ /
11*         DATA (FRHR(I),I=1,12)/12 * 0.0/
12*         IPAGE = 1
13*         10 CONTINUE
14*         CALL SIMPAM
15*         IF( ICHAIN .EQ. 1) CALL CHAIN
16*         CALL PEOPLE
17*         CALL HOUR
18*         CALL ERROR
19*         IEND = 0
20*         15 CONTINUE
21*         IF( ORO(7) .EQ. CHAR(1)) CALL EXPER(IEND)
22*         IF( IEND .EQ.1) GO TO 999
23*         IF(ORO(9) .EQ. CHAR(1)) CALL CASEIN
24*         IF( ORO(8) .EQ. CHAR(1)) CALL COMPU
25*         DO 140 NSHF = 1,NSHIFT
26*         C      SUBROUTINE RESET PREPARES CONDITIONS FOR START OF
27*         30 CALL RESET
28*         C      NEW SHIFT
29*         40 CALL RAKLOG
30*         60 CALL MESGEN
31*         CALL MANDET
32*         CALL RESHR
33*         IF( SHFIOV .EQ. CHAR(36)) GO TO 130
34*         GO TO 60
35*         C      ALL MESSAGE PROCESSING IS HANDLED TN HERE

```

\*MAIN\*\*\*

\*\*\*MAIN\*\*\*

```
36*      130 CALL ITSUM
37*      C      PRINTS OUT SHIFT RESULTS
38*      140 CONTINUE
39*      C      RUN ANALYSIS
40*      C      PRINTS SHIFT SUMMARY ACROSS ITERATIONS
41*
42*      CALL RUNSUM
43*      READ(7,160) IREP
44*      160 FORMAT( I1)
45*      IF( IREP .EQ. 1 ) GO TO 10
46*      150 CONTINUE
47*      IF( ICHAIN.NF.0) CALL TOTIT
48*      IF( ORO(7) .EQ. CHAR(1)) CALL SUMMER
49*      IF( ORO(7) .EQ. CHAR(1)) GO TO 15
50*      099 CONTINUE
51*      END FILE 2
52*      END
```

\*\*\*MANDET\*\*\*

\*\*\*MANDET\*\*\*

```
1*      SUBROUTINE MANDET
2*      C      SELECTS MAN AND MESSAGE TO PROCESS AS WELL
3*      C      AS DETERMINING WHEN HOUR IS OVER EITHER DUE
4*      C      TO ALL MESSAGES COMPLETED OR ALL MEN FINISHED
5*      INCLUDE COMBLK
6*      10 CONTINUE
7*      C      FORCE COMPLETION OF ALL INTERRUPTED MESSAGES FIRST
8*      IF( KINKS .LE. 0 ) GO TO 19
9*      DO 15 MINT = 1, MENS
10*     IF( INTRPT(MINT) .NE. 1) GO TO 15
11*     KINKS = KINKS - 1
12*     MSEL = MINT
13*     M = MINT
14*     GO TO 80
15*     15 CONTINUE
16*     19 CONTINUE
17*     C      CHECK IF ALL MEN HAVE FINISHED OUT THE HOUR
18*     IF( LDONE .GE. MENS) GO TO 500
19*     20 CONTINUE
20*     C      SELECT THE MAN WITH LOWEST TIME USED WHO IS AVAILABLE
21*     ZTEST=360000.
22*     DO 30 M=1, MENS
23*     IF( 1VAIL(M) .NF. CHAR(1) .OR. 7(M) .GE. ZTEST) GO TO 30
24*     ZTEST = Z(M).
25*     MSEL = M
26*     30 CONTINUE
27*     M = MSEL
28*     IF( INTRPT(M) .EQ. 1 ) GO TO 80
29*     C      IF G3 WAS SELECTED, SEE IF OTHERS ARE WORKING AND
30*     C      MESSAGE PRIORITY IS GREATER THAN 1
31*     35 CONTINUE
32*     IF( MSEL .NF. MEN(1)) GO TO 80
```

\*\*MANDET\*\*\*

\*\*\*MANDET\*\*\*

```

33*      C      SET UP G3 QUEUE FOR REVIEW/
34*      MS = MESS (1,1)
35*      DO 70 MSG = 1,MS
36*      IF (PRIOR(MSG,1) .LT. 2 .OR. OUT(MSG,1) .NE. CHAR(11)) GO TO 70
37*      IF (Z(MSEL) - TARIV(MSG,1)) 40,80,80
38*      40 IDL(IH,MSEL) = IDL(IH,MSEL) - Z(MSEL) + TARIV(MSG,1)
39*      Z(MSEL) = TARIV(MSG,1)
40*      IF (Z(MSEL) .LT. ENDHR) GO TO 20
41*      LDONE = LDONE + 1
42*      AVAIL(MSEL) = CHAR(11)
43*      GO TO 19
44*      70 CONTINUE
45*      C      IF THIS POINT IS REACHED THESE ARE NO MESSAGES WORTHY
46*      C      OF G3S ATTENTION
47*      LDONE = LDONE + 1
48*      AVAIL(MSEL) = CHAR(11)
49*      DIF = 3600. - IDL(IH,MSEL) - TW(IH,MSEL)
50*      IDL(IH,MSEL) = IDL(IH,MSEL) + DIF
51*      Z(MSEL) = ZIH + 3600.
52*      GO TO 10
53*      80 CONTINUE
54*      C      SET J TYPE OF OPERATOR SIMULATED
55*      J = 2
56*      IF (MSEL .LE. MEN(1)) J = 1
57*      IE( INTRPT(M) .EQ. 1 ) GO TO 200
58*      C      ARE THERE ANY MESSAGES LEFT IN THIS QUEUE
59*      IF (MESS(2,J) .GT. 0) GO TO 200
60*      C      IF NOT CLOSE OUT THE HOUR FOR ALL OPERATORS OF THIS TYPE
61*      85 CONTINUE
62*      IF (J .EQ. 2) GO TO 90
63*      IS = 1
64*      IFN = MEN(1)
65*      GO TO 100
66*      90 CONTINUE
67*      C      BEFORE CLOSING OUT 100 FOR HOUR, SEE IF G3-A0 FINISHED
68*      IF (MESS(2,1) .LE. 0) GO TO 95
69*      MC = 0
70*      MS = MEN(1)
71*      DO 92 MA = 1, MS
72*      IF (AVAIL(MA) .NE. CHAR(1)) MC = MC + 1
73*      92 CONTINUE
74*      IF (MS - MC) 95, 95, 93
75*      93 CONTINUE
76*      ZTEST = 360000.
77*      DO 94 MA = 1, MS
78*      IF (AVAIL(MA) .NE. CHAR(1) .OR. Z(M) .GE. ZTEST) GO TO 94
79*      ZTEST = Z(M)
80*      MSEL = MA
81*      M = MSEL
82*      94 CONTINUE
83*      GO TO 15
84*      95 CONTINUE
85*      IS = MEN(1) + 1
86*      IFN = MEN(1) + MEN(2)
87*      100 CONTINUE
88*      DO 110 M = IS, IFN
89*      IDL(IH,M) =      + 3600. - TW(IH,M)

```

\*MANDET\*\*\*

\*\*\*MANDET\*\*\*

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90*      AVAIL(M) = CHAR(11)
91*      IF (Z(M) .LT. ZIH + 3600.) LDONE = LDONE+1
92*      IF( Z(M) .LT. (ZIH + 3600.)) Z(M) = ZIH + 3600.
93*      110 CONTINUE
94*      GO TO 10
95*      C CHECK IF THIS MAN HAS AN INTERRUPTED MESSAGE TO COMPLETE
96*      200 CONTINUE
97*      IF (INTRPT(M) .NE. 1) GO TO 210
98*      MSG = MSGIRP(M)
99*      KM = MESS(1,J)
100*      DO 205 KL = 1, KM
101*      IF( CMSGNO(KL,J) .NE. MSG) GO TO 205
102*      MSG = KL
103*      GO TO 207
104*      205 CONTINUE
105*      WRITE(2,206) MSG,J,M
106*      206 FORMAT(1H1, 19HCUMULATIVE MESSAGEE,110, 17H NOT IN QUEUE N.,
107*      1 I4, 8HFOR MAN , I4)
108*      207 CONTINUE
109*      INTRPT(M) = 0
110*      MSGIRP(M) = 0
111*      GO TO 400
112*      210 CONTINUE
113*      C SELECT NEXT MESSAGE TO PROCESS
114*      MS = MESS (1,J)
115*      MSGTEM = 0
116*      NOMSG = 0
117*      DO 250 ML = 1,MS
118*      IF (OUT(ML,J) .NE. CHAR(11)) GO TO 250
119*      IF (TARIV(ML,J) .GT. Z(M)) GO TO 260
120*      C IF( PRIOR(ML,J) .GT. CHAR(1)) NOMSG = NOMSG + 1
121*      ITEM=PRIOR(ML,J)
122*      NOMSG=NOMSG+ 1STKNT(ITEM)
123*      IF (MSGTEM.LE.0) MSGTEM = ML
124*      IF( PRIOR(ML,J) .LE. PRIOR(MSGTEM,J)) GO TO 250
125*      MSGTEM = ML
126*      250 CONTINUE
127*      IF(MSGTEM.LE. 0 ) GO TO 25
128*      MSG = MSGTEM
129*      GO TO 300
130*      260 CONTINUE
131*      IF(MSGTEM.LE. 0) GO TO 265
132*      MSG = MSGTEM
133*      GO TO 300
134*      265 CONTINUE
135*      C IF NO MESSAGE HAS ARRIVED YET
136*      MSG = ML
137*      GO TO 300
138*      270 CONTINUE
139*      280 CONTINUE
140*      300 CONTINUE
141*      IF( TARIV(MSG,J) .GE. (ZIH + 3600.) ,AND. J .EQ. 2) GO TO 95
142*      IF( TARIV(MSG,J) .GE. ENOHR) GO TO 25
143*      C IS THE SELECTED OPERATOR READY TO PROCESS THE MESSAGE
144*      IF( INTRPT(M) .EQ. 1 ) GO TO 400
145*      IF (Z(M) .GE. TARIV(MSG,J)) GO TO 310
146*      C IF NOT HE IDLES UNTIL MESSAGE ARRIVES

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\*\*\*MANDET\*\*\*

\*\*\*MANDET\*\*\*

```
147*      IDL(IH,M) = IDL(IH,M) + TARIV(MSG,J) - Z(M)
148*      IF( IDL(IH,M) .GT. 3600.) WRITE(2,305) IDL(IH,M), MSG, Z(M), M
149*      305 FORMAT(1H , 29HIN WAIT FOR MESSAGE IDLE IDL=, F10.2,
150*      1 7H MSG= , I5, 8H TIME= , F10.2, 8HFOR MAN , I5)
151*      Z(M) = TARIV(MSG,J)
152*      GO TO 320
153*      310 CONTINUE
154*      320 CONTINUE
155*      340 CONTINUE
156*      350 CONTINUE
157*      C      COMPUTE STRESS LEVEL BASED ON NUMBER OF MESSAGES
158*      C      IN QUEUE, NUMBER OF OPERATORS, AND STRESS THRESHOLD
159*      A = NOMSG
160*      B = MEN(J)
161*      STR(M) = A/B
162*      C      DOES STRESS EXCEED THE THRESHOLD LEVEL
163*      IF(STR(M) .LT. STRM(M)) GO TO 400
164*      IF (PRIOR(MSG,J) .NE. 1 .OR. J .NE. 2) GO TO 400
165*      OUT(MSG,J) = CHAR(29)
166*      400 CONTINUE
167*      CALL ASPIRE
168*      C      CALCULATES ASPIRATION AND RESULTING PACE ADJUSTMENT FACTOR
169*      CALL FATIGU
170*      C      CALCULATES WORK FATIGUE
171*      CALL PROC
172*      GO TO 10
173*      500 CONTINUE
174*      C      HOUR IS COMPLETED
175*      HROVER = CHAR(36)
176*      RETURN
177*      END
```

\*\*\*MESGEN\*\*\*

\*\*\*MESGEN\*\*\*

```

1*      SUBROUTINE MESGEN
2*      C      CREATES MESSAGE QUEUES INCLUDING MERGING BACKLOG
3*      INCLUDE COMRLK
4*      IC = 1
5*      J = 1
6*      LZ = MESS(1,J)
7*      DO 200 MSG = 1, LZ
8*      C      MESSAGES COMPLETED ARE ZEROED OUT
9*      IF( OUT(MSG,J) .EQ. CHAR(14)) GO TO 100
10*     IF( IC .EQ. MSG) GO TO 190
11*     C      MESSAGES INCOMPLETE WILL BE MOVED TO THE BOTTOM OF THE QUEUE IF
12*     C      THEY ARE NOT ALREADY THERE
13*     PRIOR(IC,J) = PRIOR(MSG,J)
14*     LENTH(IC,J) = LENTH(MSG,J)
15*     TYPE(IC,J) = TYPE(MSG,J)
16*     TATIV(IC,J) = TATIV(MSG,J)
17*     TNUF(IC,J) = TNUF(MSG,J)
18*     NER(IC,J) = NER(MSG,J)
19*     MAN(IC,J) = MAN(MSG,J)
20*     IFTE(IC,J) = IFTE(MSG,J)
21*     OUT( IC,J) = OUT(MSG,J)
22*     CMSGNO(IC,J) = CMSGNO(MSG,J)
23*     IF(OUT(IC,J) .EQ. CHAR(29)) OUT(IC,J) = CHAR(11)
24*     IC = IC + 1
25*     100 CONTINUE
26*     PRIOR(MSG,J) = CHAR(11)
27*     LENTH(MSG,J) = 0
28*     C      TATIV(MSG,J) = 0
29*     TATIV(MSG,J) = TZERO
30*     TNUF(MSG,J) = 0

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\*\*\*MSGEN\*\*\*

\*\*\*MSGEN\*\*\*

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31*      NER(MSG,J) = 0
32*      MAN(MSG,J) = CHAR(11)
33*      IFTE(MSG,J) = 0
34*      OUT(MSG,J) = CHAR(11)
35*      GO TO 200
36*      100 CONTINUE
37*      IC = IC + 1
38*      200 CONTINUE
39*      LOGRAC(IH,1) = IC - 1 + LOGRAC(IH,1)
40*      C      IC - 1 IS EQUAL TO THE NUMBER OF MESSAGES IN THE QUEUE
41*      ICF = IC - 1 + IGR(IH) + IGP(IH)
42*      MSG=IC-1
43*      IF(( IGR(IH) + IGP(IH)) .LE. 0) GO TO 310
44*      DO 300 II=IC,ICF
45*      MSG=MSG+1
46*      C      DETERMINE MESSAGE TYPE
47*      CALL RANDU(RY,1)
48*      DO 240 IT= 1,7
49*      IF(RY .GT. FRET(IT,IH)) GO TO 240
50*      TYPE(MSG,J) = IT
51*      GO TO 250
52*      240 CONTINUE
53*      250 CONTINUE
54*      C      DETERMINE NUMBER OF MESSAGES FROM STIMULUS
55*      CALL POIS(RMPS(IT),Y,KK)
56*      IF(KK.LE.0) KK=1
57*      C      DETERMINE MESSAGE TIME OF ARRIVAL
58*      CALL RANDU(PY,1)
59*      IF(MSG .GT. (IC -1 + IGR(IH))) GO TO 260
60*      IF( TYPE(MSG,J) .NE. CHAR(5)) GO TO 255
61*      X=7IH+RY*3600.0
62*      GO TO 270
63*      C      FREQUENCY OF ARRIVAL IS USED HERE TO DETERMINE MESSAGE BUNCH IT
64*      255 CONTINUE
65*      FR = FRER(IH)
66*      IF(IP .GT. 1) FR = FREQ(IH)
67*      CALL RANDU(PY,1)
68*      FT= PY * FR + .49999
69*      IF = FT
70*      FT= IF
71*      X= 7IH +(FT / (FR+1.0) ) * 3600.
72*      GO TO 270
73*      260 X=7IH+ 2700. + PY*900.
74*      270 CONTINUE
75*      C      BUILD MESSAGES
76*      DO 290 JJ=1,KK
77*      IF(JJ.EQ.1) GO TO 230
78*      MSG=MSG+1
79*      C      DETERMINE MESSAGE TYPE
80*      CALL RANDU(RY,1)
81*      DO 1240 IT=1,7
82*      IF(RY.GT.FRET(IT,IH)) GO TO 1240
83*      TYPE(MSG,J) =IT
84*      GO TO 1250
85*      1240 CONTINUE
86*      1250 CONTINUE
87*      230 T=ATIV(MSG,J)=X

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\*MSGFN\*\*

\*\*\*MSGFN\*\*\*

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      88*      C      DETERMINE MESSAGE PRIORITY
      89*      CALL RANDU(PY,1)
      90*      DO 210 IP = 1,5
      91*      IF(RY .GT. FREP(IP,TH)) GO TO 210
      92*      PRIOR(MSG,J) = IP
      93*      GO TO 220
      94*      210 CONTINUE
      95*      220 CONTINUE
      96*      C      DETERMINE MESSAGE LENGTH
      97*      CALL RANDN (RY,RD,0,1)
      98*      IT = TYPE(MSG,J)
      99*      TLEN = INC(IT) + RY * INS(IT) + .4999
     100*      IF( TLEN .LT. (INC(IT)/10.)) TLEN= INC(IT) / 10.
     101*      LENTH(MSG,J) = TLEN
     102*      CMSG = CMSG + 1
     103*      ITYC(CMSG) = TYPE(MSG,J)
     104*      IPRI(CMSG) = PRIOR(MSG,J)
     105*      SEGS(CMSG,1) = TARIV(MSG,J)
     106*      CMSGNO(MSG,J) = CMSG
     107*      TNUF(MSG,J) = 0.
     108*      NER(MSG,J) = 0
     109*      MAN(MSG,J) = CHAR(11)
     110*      IFTF(MSG,J) = 0
     111*      OUT(MSG,J) = CHAR(11)
     112*      IF(MSG.GE.50) GO TO 310
     113*      290 CONTINUE
     114*      300 CONTINUE
     115*      310 ICF=MSG
     116*      MESS(1,1) = ICF
     117*      MESS(2,1) = ICF
     118*      C      SET QUEUE IN ORDER OF MESSAGE ARRIVAL
     119*      DO 400 MSG = 1, ICF
     120*      MC = MSG + 1
     121*      IF( MC .GT. ICF) GO TO 400
     122*      DO 390 MG = MC, ICF
     123*      IF(TARIV(MSG,J) .LT. TARIV(MG,J)) GO TO 390
     124*      IF(TARIV(MSG,J) .EQ. TARIV(MG,J) .AND. PRIOR(MSG,J) .GE.
     125*      1 PRIOR(MG,J)) GO TO 390
     126*      PRIORT = PRIOR(MSG,J)
     127*      LENTHT = LENTH(MSG,J)
     128*      TYPET = TYPE(MSG,J)
     129*      TARTVT = TARIV(MSG,J)
     130*      CMSGT = CMSGNO(MSG,J)
     131*      PRIOR(MSG,J) = PRIOR(MG,J)
     132*      LENTH(MSG,J) = LENTH(MG,J)
     133*      TYPE(MSG,J) = TYPE(MG,J)
     134*      TARIV(MSG,J) = TARIV(MG,J)
     135*      CMSGNO(MSG,J) = CMSGNO(MG,J)
     136*      PRIOR(MG,J) = PRIORT
     137*      LENTH(MG,J) = LENTHT
     138*      TYPE(MG,J) = TYPET
     139*      TARIV(MG,J) = TARTVT
     140*      CMSGNO(MG,J) = CMSGT
     141*      390 CONTINUE
     142*      400 CONTINUE
     143*      IF( PRO(2) .NE. CHAR(1) ) GO TO 435
     144*      C      WRITE OUT AO-G3 HOUR QUEUE

```



FMMSGFN\*\*\*

\*\*\*MESGFN\*\*\*

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145*      WRITE(2, 405) IDENT, IPAGE
146*      405 FORMAT(1H1, 15X, 12A6, 13X, 5HPAGE, 14/)
147*      IPAGE = IPAGE + 1
148*      WRITE(2, 410) IH
149*      410 FORMAT(1H, 9X, 43HMESSAGES GENERATED OR CARRIED OVER FOR HOUR, 15,
150*      1 8H FOR G3//
151*      2 47H ORDER   ARRIVED   PRIORITY   TYPE   LENGTH,
152*      2 62H OUTCOME   TOTAL     ERROR     INTERRUPTED   CUMULATIVE
153*      3/11X, 5H(SEC), 43X, 18HUNDET ERR RETURNS,
154*      4 5X, 25HMAN   ELEMENT   MSG NO//)
155*      DO 430 MSG = 1, ICF
156*      WRITE(2, 420) MSG, TARIV(MSG, J), PRIOR(MSG, J), TYPE(MSG, J),
157*      1LENGTH(MSG, J), OUT(MSG, J), TNUF(MSG, J), NER(MSG, J), MAN(MSG, J),
158*      3 IFTE(MSG, J), CMSGNO(MSG, J)
159*      420 FORMAT(1H, 14, F13.1, 6X, 11, 9X, 11, 112, 7X, A1, 111,
160*      1 19, 9X, 11, 110, 112)
161*      430 CONTINUE
162*      435 CONTINUE
163*      IC = 1
164*      J = 2
165*      IF(MESS(1, J) .EQ. 0) GO TO 500
166*      LZ = MESS(1, J)
167*      DO 500 MSG = 1, LZ
168*      C      MESSAGES COMPLETED ARE ZEROED OUT
169*      IF( OUT(MSG, J) .EQ. CHAR(14)) GO TO 490
170*      C      MESSAGES INCOMPLETE WILL BE MOVED TO THE BOTTOM OF THE QUEUE IF
171*      C      THEY ARE NOT ALREADY THERE
172*      IF( IC .EQ. MSG) GO TO 495
173*      PRIOR(IC, J) = PRIOR(MSG, J)
174*      LENTH(IC, J) = LENTH(MSG, J)
175*      TYPE(IC, J) = TYPE(MSG, J)
176*      TARIV(IC, J) = TARIV(MSG, J)
177*      TNUF(IC, J) = TNUF(MSG, J)
178*      NER(IC, J) = NER(MSG, J)
179*      MAN(IC, J) = MAN(MSG, J)
180*      IFTE(IC, J) = IFTE(MSG, J)
181*      OUT( IC, J) = OUT(MSG, J)
182*      CMSGNO(IC, J) = CMSGNO(MSG, J)
183*      IF(OUT(IC, J) .EQ. CHAR(29)) OUT(IC, J) = CHAR(11)
184*      IC = IC + 1
185*      490 CONTINUE
186*      PRIOR(MSG, J) = 0
187*      LENTH(MSG, J) = 0
188*      TYPE(MSG, J) = 0
189*      C      TARIV(MSG, J) = 0.
190*      TARIV(MSG, J) = TZERO
191*      TNUF(MSG, J) = 0
192*      NER(MSG, J) = 0
193*      MAN(MSG, J) = 0
194*      IFTE(MSG, J) = 0
195*      OUT(MSG, J) = CHAR(11)
196*      GO TO 500
197*      495 IC = IC + 1
198*      500 CONTINUE
199*      IC = IC - 1
200*      LOGRAC(IH, 2) = IC + LOGRAC(IH, 2)
201*      MESS(1, J) = IC

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\*\*\*MSGFN\*\*\*

\*\*\*MESGFN\*\*\*

```
202*      MESS(2,J) = IC
203*      IF( OR0(2) .NE. CHAR(1) ) GO TO 580
204*      IF( IC .LE. 0 ) GO TO 580
205*      WRITE(2, 540 ) IDENT, IPAGE
206*      540 FORMAT(1H1, 15X, 12A6, 13X, 54PAGE , I4/)
207*      IPAGE = IPAGE + 1
208*      WRITE(2,550)
209*      550 FORMAT( 1H , 9X, 23HTOD STARTING HOUR QUEUE//
210*      2 474 ORDER   ARRIVED   PRIORITY   TYPE      LENGTH,
211*      2 624  OUTCOME   TOTAL     ERROR      INTERRUPTED  CUMULATIVE
212*      3/11X, 5H(SEC), 43X, 18HUNDET ERR RETURNS,
213*      4 5X, 25HMAN    FLEWENT   MSG NO//)
214*      DO 570 MSG = 1, IC
215*      WRITE(2,560) MSG, TAPIV(MSG,J), PRIOR(MSG,J), TYPE(MSG,J),
216*      1LENGTH(MSG,J), OUT(MSG,J), TIME(MSG,J), NER(MSG,J), MAN(MSG,J),
217*      3 IFTE(MSG,J), CMSGNO(MSG,J)
218*      560 FORMAT(1H , I4, F13.1, 6X, I1, 9X, I1, I12, 7X, A1, I11,
219*      1 I9, 9X, I1, I10, I12)
220*      570 CONTINUE
221*      580 CONTINUE
222*      RETURN
223*      END
```

\*\*\*PEOPLE\*\*\*

```

1*      SUBROUTINE PEOPLE
2*      C      READS IN PERFORMANCE CAPABILITIES OF JOBS AND ADS
3*      INCLUDE COMPLK
4*      READ(7,50) ISKIP
5*      50  FORMAT(I1)
6*      IF( ISKIP .EQ. 1) GO TO 120
7*      C      READS IN NAMES OF PERSONNEL
8*      READ(7,90) (NAME(M), M = 1,MENS)
9*      90  FORMAT(6A6)
10*     DO 110 MM= 1, MENS
11*     READ(7,100) M, F(M), PREC(M), STRM(M), ASP(M)
12*     100  FORMAT(I1, 3X, 2F5.3, F5.0, F5.3)
13*     PASP(M) = ASP(M)
14*     110  CONTINUE
15*     120  CONTINUE
16*     IF(ORO(1) .NE. CHAR(1)) GO TO 200
17*     WRITE(2,150)
18*     150  FORMAT(1H , 30X, 19HOPERATOR PARAMETERS//
19*     1 12X, 3HMAN, 6X, 5HSPEED, 3X, 9HPRECISTON,
20*     2 8H STRESS , 10HTHRESHOLD , 2X, 10HASPIRATION/)
21*     DO 170 M = 1, MENS
22*     WRITE(2,160) NAME(M), F(M), PREC(M), STRM(M), ASP(M)
23*     160  FORMAT(1H , 11X, A6, 2F10.2, F14.2, F15.3)
24*     170  CONTINUE
25*     200  CONTINUE
26*     RETURN
27*     END

```

\*\*\*POIS\*\*\*

\*\*\*POIS\*\*\*

```

1*      SUBROUTINE POIS(AM,RY,IPD)
2*      C      SUPPLIES RANDOM NUMBERS FROM A POISSON DISTRIBUTION
3*      C      IPD = INTEGER FROM A POISSON DISTRIBUTION
4*      C      AM = A MEAN - ONLY NUMBER REQUIRED
5*      IPD = 0
6*      CALL RANDU(RY,1)
7*      10 CONTINUE
8*      IF( RY .LE. (EXP(-AM)))GO TO 50
9*      R1 = RY
10*     IPD = IPD + 1
11*     CALL RANDU(RY,1)
12*     RY = RY * R1
13*     GO TO 10
14*     50 CONTINUE
15*     RETURN
16*     END

```

\*\*\*PROC\*\*\*

\*\*\*PROC\*\*\*

```

1*      SUBROUTINE PROC
2*      INCLUDE COMBLK
3*      DIMENSION EPP(4)
4*      DIMENSION AVPRB(20,4)
5*      EQUIVALENCE ( AVPRB, AVPRB)
6*      C      CALCULATE STRESS FACTOR FOR MESSAGE
7*      SF = 0.
8*      ZIF = 1.
9*      TMIN = 0.
10*     IF( STR(M) .LE. 1. ) GO TO 3
11*     SF = (STR(M) - 1.)/(STR(M) - 1.)
12*     ZIF = -1.829*SF**3 + 3.472*SF**2 - 2.351 * SF + 1.
13*     IF( SF .GE. 1 ) ZIF = .292
14*     3 CONTINUE
15*     C      DETERMINE APPROPRIATE TASK ANALYSIS FOR THIS MESSAGE TYPE
16*     IT = TYPE(MSG,J)
17*     K = TATA(J,IT)
18*     MCM = CMGNO(MSG,J)
19*     C      SET UP ERROR RATE MATRIX FOR THIS TYPE OPERATOR
20*     IF( J .EQ. 2 ) GO TO 5
21*     DO 4 IE = 1,4

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\*PDOC\*\*\*

\*\*\*PROC\*\*\*

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22*      ERP(IE) = ERPG(IE)
23*      4 CONTINUE
24*      GO TO 7
25*      5 CONTINUE
26*      DO 6 IE = 1,4
27*      ERP(IE) = ERPI(IE)
28*      6 CONTINUE
29*      7 CONTINUE
30*      NERR = 0
31*      TIME = 0.
32*      IF( ORD(4) .NE. CHAR(1)) GO TO 30
33*      C      PRINT OUT START OF MESSAGE PROCESSING PARAMETERS
34*      WRITE(2,8) IDENT, IPAGE
35*      8 FORMAT(1H1, 15X, 12A6, 13X, 5HPAGE, 14/)
36*      IPAGE = IPAGE + 1
37*      WRITE(2,9) MCOM, NAME(M), IDAY, NMTYP(IT), ZIF, IH,
38*      1 MSG, PAFW, NSHF, PAFA, INL(IH,M), TARIV(MSG,J),Z(M)
39*      9 FORMAT(1H, 9X, 14HMESSAGE NUMBER, I6,
40*      2 24H      MAN      , A6, 13H      DAY, I12,
41*      2 /26H      MESSAGE TYPE      , A6, 21H      STRESS FACTOR ,
42*      3 F7.2, 16H      HOUR, I11,
43*      4 /23H      MESSAGE ORDER, I7, 17H      FATIGUE, F13.2,
44*      5 21H      ITERATION, I6,
45*      6 /40X, 10HASPIRATION, F10.2,
46*      7 /40X, 9HCUM, IDLE, F11.2,
47*      8 /25H      MESSAGE ARRIVAL, F10.1,
48*      9 /24H      MESSAGE START ,F11.1 //)
49*      WRITE(2,20)
50*      20 FORMAT(1H, 9X, 31HELEMENT EXECUTION CUMULATIVE ,
51*      1 56HOUTCOME TYPE OF CRITIC SEGMENT ERROR ERROR /
52*      2 11X, 3HNO, 9X, 35HTIME TIME (SFR) ELEMENT,
53*      3 44H -ALITY ENDED TYPE RETURNS INTRP//)
54*      30 CONTINUE
55*      IF(.OUT(MSG,J) .EQ. CHAR(29)) GO TO 512
56*      ST = 7(M)
57*      I = 1
58*      C      SET UP FOR INTERRUPTED MESSAGE IF THERE IS ONE TO BE PROCESSED
59*      IF (IFTE(MSG,J) .LE. 0 ) GO TO 40
60*      ST = START(M)
61*      I = IFTE(MSG,J)
62*      MAN(MSG,J) = 0
63*      OUT(MSG,J) = CHAR(11)
64*      NERR = INT(M)
65*      INT(M) = 0
66*      INTRPT(M) = 0
67*      MSGTRP(M) = 0
68*      IFTE(MSG,J) = 0
69*      START(M) = 0.
70*      GO TO 70
71*      40 CONTINUE
72*      C      DETERMINE IF MESSAGE IS REJECTED BY G-3
73*      IF (J.NE.1.OR.JTYPE(I,K).NE. 1 .OR. PRIOR(MSG,J) .GT. 1)
74*      1 GO TO 65
75*      CALL RANDU(RY,1)
76*      IF (RY .LE. AVPRB(I,K)) GO TO 65
77*      60 OUT(MSG,J) = CHAR(29)
78*      GO TO 512

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\*PROC\*\*\*

\*\*\*PROC\*\*\*

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79*      65 CONTINUE
80*      NERR = NER(MSG,J)
81*      67 CONTINUE
82*      IF( J.EQ. 1 .AND. I.EQ. 1 ) SFGS(MAUM,2) = Z(M)
83*      C      STARTING POINT FOR TASK ELEMENT PROCESSING CYCLE
84*      70 CONTINUE
85*      C      CALCULATION OF INTERRUPT DURATION AND OCCURRENCE
86*      TMIN = 0.
87*      C      THE FOLLOWING BYPASS ASSUMES DIMENSIONS OF 10 TASK ELEMENTS
88*      C      AND 3 TASK ANALYSES
89*      IF( I.GT. 10 .OR. K.GT. 3 ) GO TO 77
90*      DO 76 II = 1,ITYMAX
91*      IF( PROBI(I,K,II) .LE. 0.) GO TO 76
92*      CALL RANDU(RY,1)
93*      IF( RY.GT. PROBI(I,K,II)) GO TO 76
94*      CALL RANDN(RY,RD,0., 1.)
95*      TMIN = RD * ADI(I,K,II) + AITF(I,K,II)
96*      GO TO 77
97*      76 CONTINUE
98*      II = 0
99*      77 CONTINUE
100*     C      DETERMINE IF ACTION UNIT IS A DECISION
101*     IF (JTYPE(I,K).NE. 3 ) GO TO 90
102*     CALL RANDU(RY,1)
103*     IF (RY.GE. AVPRB(I,K)) GO TO 80
104*     SIF = CHAR(30)
105*     GO TO 250
106*     80 CONTINUE
107*     SIF = CHAR(17)
108*     GO TO 250
109*     C      DETERMINE IF AN EQUIPMENT ACTION UNIT IS INVOLVED
110*     90 IF (JTYPE(I,K) .NE. 4 ) GO TO 110
111*     CALL RANDN(RY,RD,0., 1.)
112*     TIME = AVGTM(I,K) + RD*SIGMA(I,K)
113*     IF(TIME .LT. (AVGTM(I,K)/ 3. ))TIME = AVGTM(I,K)/ 3.
114*     CALL RANDU(RY,1)
115*     IF (RY.GE. AVPRB(I,K)) GO TO 100
116*     SIF = CHAR(30)
117*     GO TO 350
118*     100 SIF = CHAR(17)
119*     GO TO 350
120*     110 CONTINUE
121*     C      DETERMINE NUMBER UNNOTED ERRORS THIS TASK ELEMENT
122*     C      FOR TRANSFORM OPERATION
123*     200 CONTINUE
124*     IF (UETYPE(I,K) .NE. CHAR(31)) GO TO 210
125*     AL = LENTH(MSG,J)
126*     IPD = 0
127*     AM = ER(1,IT) * AL/100.
128*     CALL POIS(AM,RY,IPD)
129*     TIE1(MSG,M) = IPD
130*     AM = ER(2,IT) * AL/100.
131*     CALL POIS(AM,RY,IPD)
132*     TIE2(MSG,M) = IPD
133*     AM = ER(3,IT) * AL/100.
134*     CALL POIS(AM,RY,IPD)
135*     TIE3(MSG,M) = IPD

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POC\*\*\*

\*\*\*PROC\*\*\*

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136*      AM = ER(4,IT) * AL/100.
137*      CALL POIS(AM,RY,IPD)
138*      TIE4(MSG,M) = IPD
139*      TNUE(MSG,J)=(TIE1(MSG,M)+TIE2(MSG,M)
140*      1+TIE3(MSG,M) + TIE4(MSG,J))*PREC(M) + TNUE(MSG,J)
141*      IRESH(1,IH) = IRESH(1,IH) + TIE1(MSG,M)
142*      IRESH(2,IH) = IRESH(2,IH) + TIE2(MSG,M)
143*      IRESH(3,IH) = IRESH(3,IH) + TIE3(MSG,M)
144*      IRESH(4,IH) = IRESH(4,IH) + TIE4(MSG,M)
145*      IREST(1,IT) = IREST(1,IT) + TIE1(MSG,M)
146*      IREST(2,IT) = IREST(2,IT) + TIE2(MSG,M)
147*      IREST(3,IT) = IREST(3,IT) + TIE3(MSG,M)
148*      IREST(4,IT) = IREST(4,IT) + TIE4(MSG,M)
149*      IRESH(7,IH) = IRESH(7,IH) + 1
150*      IREST(7,IT) = IREST(7,IT) + 1
151*      GO TO 212
152*      210 CONTINUE
153*      C      FOR OTHER THAN TRANSFORM OPEATIONS
154*      CALL RANDU(RY,1)
155*      IF (RY .GE. UEP(I,K)*PREC(M))GO TO 212
156*      TNUE(MSG,J) = 1 + TNUE(MSG,J)
157*      212 CONTINUE
158*      C      DETERMINE CUMULATIVE NO. UNNOTED ERRORS TO GENERATE ERR RESPONSES
159*      IF( IETYPE(I,K) .NE. CHAR(31)) GO TO 215
160*      C      FOR TRANSFORM ERRORS
161*      AM = TIE1(MSG,M) * ERP(1)
162*      CALL POIS(AM,RY,IPD)
163*      NER(MSG,J) = NER(MSG,J) + IPD
164*      AM = TIE2(MSG,M) * ERP(2)
165*      CALL POIS(AM,RY,IPD)
166*      NER(MSG,J) = NER(MSG,J) + IPD
167*      AM = TIE3(MSG,M) * ERP(3)
168*      CALL POIS(AM,RY,IPD)
169*      NER(MSG,J) = NER(MSG,J) + IPD
170*      AM = TIE4(MSG,M) * ERP(4)
171*      CALL POIS(AM,RY,IPD)
172*      NER(MSG,J) = NER(MSG,J) + IPD
173*      IF( NER(MSG,J) .GT. 20) NER(MSG,J) = 20
174*      NERR = NER(MSG,J)
175*      GO TO 220
176*      215 CONTINUE
177*      CALL RANDU(RY,1)
178*      IF( RY .GE. ERP( 1)) GO TO 250
179*      IF( NER(MSG,J) .GT. 20) GO TO 250
180*      NER(MSG,J) = NER(MSG,J) + 1
181*      NERR = NERR + 1
182*      220 CONTINUE
183*      C      CALCULATES TASK ELEMENT EXECUTION TIME
184*      250 CONTINUE
185*      CALL RANDN(RY,RD,0., 1.)
186*      V = AVGTM(I,K) + RD*(SIGMA(I,K))
187*      TIME = F(M) *V*7IF*PAFA*PAFW
188*      IF(TIME .LT. (AVGTM(I,K)/ 3.)) TIME = AVGTM(I,K)/3.
189*      C      CHECK IF TIME IS A FUNCTION OF MESSAGE LENGTH
190*      IF (JTYPE(I,K) .EQ. 2 ) TIME = TIME* LENTH(MSG,J)
191*      C      DETERMINES IF INTERRUPTION DUE TO INCOMING MESSAGE HAS OCCURRED
192*      IF(J .NE. 2 .OR. FRHR(IH) .LE. 0.0) GO TO 259

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\*P=OC\*\*\*

\*\*\*PROC\*\*\*

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193*      CALL RANDU(RY,1)
194*      IF(RY .GT. (FRHR(IH)/3600.) * TIME) GO TO 259
195*      CALL RANDU(RY,1)
196*      TIME = RY * TIME
197*      CALL RANDM(RY,RO,0.,1.)
198*      TMIN=RD*SDIN(IH) * DURIN(IH)
199*      II=10
200*      SIF= CHAR(20)
201*      C      SETTING I TO 1 ASSUMES TASK ELEMENT 2 SHOULD BE EXECUTED NEXT
202*      I = 1
203*      GO TO 350
204*      259  CONTINUE
205*      C      MODIFY ORIGINAL SUCCESS PROBABILITY AS FUNCTION OF PRECISION
206*      IF (PREC(M)-1.) 260,270,280
207*      260  PROR =(1. - AVPRB(I,K))* (1. - PREC(M))* 5.  + AVPRB(I,K)
208*      GO TO 290
209*      270  PROR = AVPRB(I,K)
210*      GO TO 290
211*      280  PROB = AVPRB(I,K) * (5. * (1. - PREC(M)) + 1. )
212*      C      DETERMINES IF TASK ELEMENT IS A SUCCESS OR NOTED FAILURE
213*      290  CALL RANDU(RY,1)
214*      IF( STR(M) .LE. (STRM(M)/ 4.)) GO TO 294
215*      IF( ASP(M) + 1. .LT. PROB) GO TO 294
216*      IF( STR(M) .LE. STRM(M)) GO TO 292
217*      IF( RY .LT. ASP(M)) GO TO 300
218*      GO TO 295
219*      292  CONTINUE
220*      ZA = PROB + (ASP(M)/3.)*(((4. * STR(M))/STRM(M)) - 1.)
221*      IF( RY .LT. ZA) GO TO 300
222*      GO TO 295
223*      294  IF (RY .LE. PROB) GO TO 300
224*      295  SIF = CHAR(17)
225*      GO TO 350
226*      300  SIF = CHAR(30)
227*      C      ADJUST TIME OF CURRENT WORK AND TOTAL WORK
228*      350  Z(M) = Z(M)+ TIME  + TMIN
229*      TW(IH,M) = TW(IH,M) + TIME + TMIN
230*      C      LAST TASK ELEMENT OF A TIME SEGMENT
231*      IF (END(I,K) .EQ. CHAR(11)) GO TO 400
232*      IEK = END(I,K)
233*      SEG5(MCUM,IEK) = Z(M)
234*      C      IS THIS A TYPE 6 TASK ELEMENT
235*      400  CONTINUE
236*      L = I
237*      IF (JTYPE(I,K) .NE. 6 ) GO TO 450
238*      C      PERFORM ERROR RETURN IF INDICATED
239*      IF ( NERR ) 410,410,420
240*      410  I=IJS(I,K)
241*      GO TO 500
242*      420  I = IJF(I,K)
243*      NOFAIL(M)=NOFAIL(M)+3
244*      NERR = NERR + 1
245*      GO TO 500
246*      C      SET UP NEXT TASK ELEMENT
247*      450  IF(SIF .EQ. CHAR(17)) GO TO 460
248*      I = IJS(I,K)
249*      GO TO 470

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\*POC\*\*\* \*\*\*PROC\*\*\*

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250*      460 I = IJF(I,K)
251*      C      COUNT FAILURE / SUCCESS FOR CRITICAL TASK ELEMENTS
252*      470 IF (CRIT(L,K) .NE. CHAR(14)) GO TO 500
253*      IF(SIF .EQ. CHAR(17)) GO TO 480
254*      NOSUC(M)=NOSUC(M)+1
255*      GO TO 500
256*      480 CONTINUE
257*      NOFAIL(M)=NOFAIL(M)+1
258*      C      DOES THIS TASK ELEMENT RUN OVER THE HOUR
259*      500 CONTINUE
260*      IF (Z(M) .LT. ENDDR) GO TO 505
261*      C      RETAIN CURRENT TASK ELEMENT DATA FOR NEXT HOUR MESSAGE
262*      C      ALLOCATE TIME USED IN THIS HOUR AND IN NEXT HOUR
263*      DIF = TW(IH,M) + IDL(IH,M) - 3600.
264*      IF( DIF .GE. 0) GO TO 501
265*      IDL(IH,M) = IDL(IH,M) - DIF
266*      GO TO 503
267*      501 CONTINUE
268*      TW(IH + 1, M) = DIF
269*      TW(IH,M) = TW(IH,M) - DIF
270*      503 CONTINUE
271*      LDONE = LDONE + 1
272*      AVAIL(M) = 0
273*      IF( I .LE. 0 ) GO TO 505
274*      IETE(MSG,J) = I
275*      MAN(MSG,J) = M
276*      OUT(MSG,J) = CHAR(20)
277*      START(M) = ST
278*      505 CONTINUE
279*      C      PRINT OPTION 4 - RECORD TASK ELEMENT RESULTS
280*      IF( ORO(4) .NE. CHAR(11)) GO TO 507
281*      WRITE(2 ,506)L,TIME,Z(M), SIF,JTYPE(L,K), CRIT(L,K), FND(L,K),
282*      1 UETYPE(L,K), NERR,TMIN,II
283*      506 FORMAT(1H ,I13,F14.2,F11.2,5X,A1,9X,I1,7X,A1,7X,I1,9X,
284*      1 A1, I12,F6.2, 15)
285*      507 CONTINUE
286*      TMIN = 0
287*      C      IF MESSAGE INCOMPLETE OR REJECTED
288*      IF( OUT(MSG,J) .EQ. CHAR(29))GO TO 512
289*      IF( OUT(MSG,J) .EQ. CHAR(20)) GO TO 515
290*      C      LAST TASK ELEMENT
291*      IF( I .GT. 0) GO TO 70
292*      IF( J .EQ. 1) GO TO 508
293*      C      CALCULATE INFORMATION LOSS
294*      T = TNUC(MSG,J)
295*      C      B = INC(IT)
296*      C      INFOLS(MCUM) = ((PUL + 10. * PUS) * T) / R + .4999
297*      INFOLS(MCUM) = ((PUL + 10. * PUS) * T) + .4999
298*      INELHR(IH) = INELHR(IH) + INFOLS(MCUM)
299*      IRESH(6,IH) = IRESH(6,IH) + INFOLS(MCUM)
300*      IREST(6,IT) = IREST(6,IT) + INFOLS(MCUM)
301*      IRESH(5,IH) = IRESH(5,IH) + NFR(MSG,J)
302*      IREST(5,IT) = IREST(5,IT) + NFR(MSG,J)
303*      IRESH(7,IH) = IRESH(7,IH) + 1
304*      IREST(7,IT) = IREST(7,IT) + 1
305*      508 CONTINUE
306*      C      SET TASK ELEMENT IF COMPLETED

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\*PDOC\*\*\*

\*\*\*PRNC\*\*\*

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307*      IF (OUT(MSG,J).EQ.CHAR(11)) OUT(MSG,J) = CHAR(14)
308*      MSCPL(M) = MSCPL(M) + 1
309*      MQCPL(IH,M) = MQCPL(IH,M) + 1
310*      C      ACCUMULATE MEAN TIME PER MESSAGE FOR RUN SUMMARY
311*      CMTMG(IH,M) = CMTMG(IH,M) + 7(M) - ST
312*      C      PRINT OPTION 5-RECORD RESULTS OF MESSAGE SEGMENT
313*      IF( ORO(5) .NE. CHAR(1) ) GO TO 520
314*      IF(OUT(MSG,J) .NE. CHAR(14)) GO TO 600
315*      IF( M .GT. MEN(1)) GO TO 510
316*      WRITE(2,509) MCUM, NAME(M), TIE1(MSG,M),
317*      1 TIE2(MSG,M), TIE3(MSG,M), TIF4(MSG,M),TNUE(MSG,J),
318*      2 NER(MSG,J), INFOLS(MCUM)
319*      509 FORMAT(1H ,/16H      MESSAGE, I4,
320*      1 / 23H      PROCESSED BY , A6,
321*      2 /26H      TRANSFORM ERRORS,
322*      3 / 21H      COMMISSION, I12,
323*      4 / 26H      ABBREV/TYPO/SPAC, I7,
324*      4 / 19H      OMISSION , I14,
325*      5 / 22H      OTHER ERRORS, I11, /30X, 4H----,
326*      6 / 29H      TOT. UNDET. ERRORS, I4,
327*      7 // 27H      NO. ERROR RETURNS, I6,
328*      8 / 26H      INFORMATION LOSS , I7/)
329*      GO TO 520
330*      510 CONTINUE
331*      WRITE(2,511) MCUM, NAME(M), TIE1(MSG,M),
332*      1 TIE2(MSG,M), TIE3(MSG,M), TIF4(MSG,M),TNUE(MSG,J),
333*      2 NER(MSG,J), INFOLS(MCUM)
334*      511 FORMAT( 1H ,/16H      MESSAGE, I4,
335*      1 / 23H      COMPLETED BY , A6,
336*      2 /26H      TRANSFORM ERRORS,
337*      3 / 21H      COMMISSION, I12,
338*      4 / 26H      ABBREV/TYPO/SPAC, I7,
339*      4 / 19H      OMISSION , I14,
340*      5 / 22H      OTHER ERRORS, I11, /30X, 4H----,
341*      6 / 29H      TOT. UNDET. ERRORS, I4,
342*      7 // 27H      NO. ERROR RETURNS, I6,
343*      8 / 26H      INFORMATION LOSS , I7/)
344*      GO TO 520
345*      512 CONTINUE
346*      IF( ORO(4) .NE. CHAR(1) ) GO TO 514
347*      WRITE(2,513) MSGNO(MSG,J), NAME(M)
348*      513 FORMAT(1H , 7HMESSAGE, I5,2X, 13H REJECTED BY , A6)
349*      514 CONTINUE
350*      MQREJ(IH,M) = MQREJ(IH,M) + 1
351*      MSREJ(M) = MSREJ(M) + 1
352*      MESS(2,J) = MESS(2,J) - 1
353*      GO TO 600
354*      515 CONTINUE
355*      IF( ORO(4) .NE. CHAR(1)) GO TO 517
356*      WRITE(2,516) MSGNO(MSG,J), M
357*      516 FORMAT(1H , 7HMESSAGE, I5,2X, 19HINTERRUPTED WITH MAN, I3)
358*      517 CONTINUE
359*      INTRPT(M) = 1
360*      MSGIRP(M) = MCUM
361*      INT(M) = NERR
362*      MQINT(IH,J) = MQINT(IH,J) + 1
363*      MESS(2,J) = MESS(2,J) - 1

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POOC\*\*\*

\*\*\*PROC\*\*\*

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364*      GO TO 600
365*      520 CONTINUE
366*      IF( J .EQ. 1) GO TO 530
367*      MESS(2,2) = MESS(2,2) - 1
368*      SEGS(MCUM,7) = Z(M)
369*      ATPM = ATPM + SEGS(MCUM,6) - SEGS(MCUM,1)
370*      AQT=AQT+SEGS(MCUM,2)-SEGS(MCUM,1)
371*      AHT=AHT+SEGS(MCUM,6)-SEGS(MCUM,2)
372*      GO TO 600
373*      530 CONTINUE
374*      MESS(2,1) = MESS(2,1) - 1
375*      MT = MESS(1,2) + 1
376*      C      COMPLETED MESSAGES FROM AQ-63 GO INTO IOQ QUEUE
377*      TARIV(MT,2) = Z(M)
378*      CMSGNO(MT,2) = CMSGNO(MSG,1)
379*      PRIOR(MT,2) = PRIOR(MSG,1)
380*      LENTH(MT,2) = LENTH(MSG,1)
381*      TYPE(MT,2) = TYPE(MSG,1)
382*      TTRUE(MT,2) = TTRUE(MSG,1)
383*      NER(MT,2) = NER(MSG,1)
384*      MAN(MT,2) = 0
385*      IFTE(MT,2) = 0
386*      OUT(MT,2) = CHA2(11)
387*      MESS(2,2) = MESS(2,2) + 1
388*      MESS(1,2) = MT
389*      C      SORT TO PUT MESSAGES IN ORDER OF ARRIVAL TIME
390*      DO 550 MGS = 1, MT
391*      MGS1 = MGS + 1
392*      IF( MGS1 .GT. MT) GO TO 550
393*      DO 540 MG = MGS1, MT
394*      IF( TARIV(MGS,2) .LE. TARIV(MG,2)) GO TO 540
395*      PRIORT = PRIOR(MGS,2)
396*      LENTHT = LENTH(MGS,2)
397*      TYPET = TYPE(MGS,2)
398*      TARIVT = TARIV(MGS,2)
399*      MSGT = CMSGNO(MGS,2)
400*      NUET = TTRUE(MGS,2)
401*      NERT = NER(MGS,2)
402*      OUTT = OUT(MGS,2)
403*      IFLET = IFTE(MGS,2)
404*      MANT = MAN(MGS,2)
405*      PRIOR(MGS,2) = PRIOR(MG,2)
406*      LENTH(MGS,2) = LENTH(MG,2)
407*      TYPE(MGS,2) = TYPE(MG,2)
408*      TARIV(MGS,2) = TARIV(MG,2)
409*      CMSGNO(MGS,2) = CMSGNO(MG,2)
410*      TTRUE(MGS,2) = TTRUE(MG,2)
411*      NER(MGS,2) = NER(MG,2)
412*      OUT(MGS,2) = OUT(MG,2)
413*      IFTE(MGS,2) = IFTE(MG,2)
414*      MAN(MGS,2) = MAN(MG,2)
415*      PRIOR(MG,2) = PRIORT
416*      LENTH(MG,2) = LENTHT
417*      TYPE(MG,2) = TYPET
418*      TARIV(MG,2) = TARIVT
419*      CMSGNO(MG,2) = MSGT
420*      TTRUE(MG,2) = NUET

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\*PROC\*\*\* - \*\*\*PROC\*\*\*

```

421*      NER(MG,2) = NERT
422*      OUT(MG,2) = OUTT
423*      IFTE(MG,2) = IFTET
424*      MAN(MG,2) = MANT
425*      540 CONTINUE
426*      550 CONTINUE
427*      600 CONTINUE
428*      IF( ORO(5) .NE. CHAR(1)) GO TO 700
429*      IF(J.EQ.2 .AND. OUT(MSG,J).EQ.CHAR(14)) WRITE(2,650)MCUM,
430*      1(SEGS(MCUM,IS), IS = 1,7)
431*      650 FORMAT(1H , 22H      MESSAGE NO., I5/ 2X,
432*      1 7HSEGMENT, 2X, 1H1, 9X, 1H2, 9X, 1H3, 9X, 1H4, 9X, 1H5, 9X, 1H6,
433*      2 9X, 1H7, //4X, 7F10.1)
434*      700 CONTINUE
435*      RETURN
436*      END

```

\*\*\*RANDN\*\*\* - \*\*\*RANDN\*\*\*

```

1*      SUBROUTINE RANDN(RY,RO,AM,S)
2*      A = 0.0
3*      DO 10 I= 1,12
4*      CALL RANDU(RY,1)
5*      10 A= A + RY
6*      RO=(A-6.0) * S + AM
7*      RETURN
8*      END

```

\*\*\*RANDU\*\*\* - \*\*\*RANDU\*\*\*

```

1*      SUBROUTINE RANDU(RY,N)
2*      IRY = IFIX( RY / .74505806E-08)
3*      IRY = AND(IRY * 65539, 134217727)
4*      RY = FLOAT(IRY * .74505806E-08)
5*      RETURN
6*      END

```

\*\*\*RESET\*\*\* - \*\*\*RESET\*\*\*

```

1*      SUBROUTINE RESET
2*      C      RESETS CONDITIONS REQUIRED TO START A NEW SHIFT
3*      C      I.E. A NEW SIMULATION ITERATION OR RUN
4*      INCLUDE COMPLY
5*      SHFTOV = CHAR(11)
6*      MESS(1,1) = 0
7*      MESS(1,2) = 0
8*      MESS(2,1) = 0
9*      MESS(2,2) = 0
10*     PAFA = 1.
11*     PAFW = 1.
12*     AQT=0.0
13*     AHT=0.0
14*     ATPM = 0.
15*     KINKS = 0
16*     DO 20 IH = 1, IHMAX
17*     INFLH2(IH) = 0
18*     DO 10 IC = 1,5
19*     EC(IH,IC) = 0.
20*     10 CONTINUE
21*     DO 15 KQ = 1,MENS
22*     MREFJ(IH,KQ) = 0
23*     MQCPL(IH,KQ) = 0
24*     TW(IH,KQ) = 0.
25*     IDL(IH,KQ) = 0.
26*     15 CONTINUE
27*     DO 17 J = 1,2
28*     MQINT(IH,J) = 0
29*     17 CONTINUE
30*     20 CONTINUE
31*     IH = 1
32*     C      ZIH = 0.
33*     ZIH=IZERO
34*     ENDR = ZIH + 3600.
35*     SHFTOV = CHAR(11)
36*     DO 50 CMSG= 1,200
37*     ITYC(CMSG) = 0
38*     INFOLS(CMSG) = 0
39*     DO 40 ITT = 1,7
40*     C      SEGS(CMSG,ITT) = 0.
41*     SEGS(CMSG,ITT) = ZIH
42*     40 CONTINUE
43*     50 CONTINUE
44*     DO 100 M = 1,MENS

```

\*RSET\*\*\*

\*\*\*RSET\*\*\*

```
45*      ASP(M) = PASP(M)
46*      AVAIL(M) = CHAR(1)
47*      C      Z(M) = 0.
48*      Z(M) = ZIH
49*      PERF(M) = ASP(M)
50*      NOSUC(M) = 0
51*      NOFATL(M) = 0
52*      INTRPT(M) = 0
53*      MSGIRP(M) = 0
54*      MSCPL(M) = 0
55*      MSREFJ(M) = 0
56*      INT(M) = 0
57*      DO 90 MGG = 1, 50
58*      TIE1(MGG,M) = 0.
59*      TIE2(MGG,M) = 0.
60*      TIE3(MGG,M) = 0.
61*      TIE4(MGG,M) = 0.
62*      90 CONTINUE
63*      100 CONTINUE
64*      CMSG = 0
65*      DO 300 J = 1, 2
66*      DO 200 I = 1, 50
67*      CMSGNO(I,J) = 0
68*      PRIOR(I,J) = 0
69*      LENTH(I,J) = 0
70*      TYPE(I,J) = 0
71*      C      TARTV(I,J) = 0.
72*      TARTV(I,J) = ZIH
73*      TNUF(I,J) = 0
74*      NER(I,J) = 0
75*      MAN(I,J) = 0
76*      IFTE(I,J) = 0
77*      OUT(I,J) = CHAR(11)
78*      200 CONTINUE
79*      300 CONTINUE
80*      DO 400 IT = 1, 8
81*      NIMT(IT) = 0
82*      NCT(IT) = 0
83*      DO 350 KP = 1, 5
84*      TMT(IT,KP) = 0.
85*      CT(IT,KP) = 0.
86*      350 CONTINUE
87*      400 CONTINUE
88*      DO 450 IP = 1, 5
89*      NCP(IP) = 0
90*      DO 450 KP = 1, 5
91*      CP(IP,KP) = 0.
92*      450 CONTINUE
93*      RETURN
94*      END
```

\*\*\*RESHR\*\*\*

\*\*\*RESHR\*\*\*

```

1*      SUBROUTINE RESHR
2*      C      RESETS CONDITIONS FOR START OF SIMULATION OF NEXT HOUR
3*      C      ALSO COMPUTES HOUR SUMMARY
4*      INCLUDE COMBLK
5*      INFOLC = INFLHR(IH)
6*      C      CALCULATE THOROUGHNESS-EC(1)- FOR THIS HOUR
7*      A = 0
8*      DO 5 M = 1, MENS
9*      A = A + MQCPL(IH,M)
10*     5 CONTINUE
11*     B = MESS(1,2)
12*     C = MESS(1,1)
13*     IF(( B + C ) .GT. 0.) GO TO 8
14*     DO 6 I = 1,5
15*     EC(IH,I) = 1.
16*     6 CONTINUE
17*     EFF = 1.
18*     GO TO 45
19*     8 CONTINUE
20*     EC(IH,1) = A/(B+C)
21*     IF( EC(IH,1) .LT. 0.) EC(IH,1) = 0.
22*     C      CALCULATE COMPLETENESS -EC(2)- FOR THIS HOUR
23*     DO 10 M = 1,MENS
24*     EC(IH,2) = EC(IH,2) + PERF(M)
25*     10 CONTINUE
26*     EC(IH,2) = EC(IH,2) / MENS
27*     IF( EC(IH,2) .LT. 0.) EC(IH,2) = 0.
28*     C      CALCULATE RESPONSIVENESS-EC(3)- FOR THIS HOUR
29*     A = 0
30*     MS = MEN(1) + 1
31*     DO 30 M = MS, MENS
32*     A = A + MQCPL(IH,M)
33*     30 CONTINUE
34*     ATPM = ATPM/A

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\*RFSHR\*\*\*

\*\*\*RESHR\*\*\*

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35*      C      EC(IH,3) = 1. - ATPM/ 700.
36*      C      IF( EC(IH,3) .LT. 0.) EC(IH,3) = 0.
37*      C      NEW RESPONSIVENESS 04/28/73
38*      AQT=AQT/A
39*      AHT=AHT/A
40*      X=1.0
41*      IF(AHT.GT.300.) X=1.3-.001*AHT
42*      IF(X.GT.1.0) X=1.0
43*      IF(X.LT.0.0) X=0.0
44*      EC(IH,3)=X
45*      X=1.0
46*      IF(AQT.GT.300.) X=(96.-0.02*AQT)/90.
47*      IF(X.GT.1.0) X=1.0
48*      IF(X.LT.0.0) X=0.0
49*      EC(IH,3)=EC(IH,3)*X
50*      C      CALCULATE ACCURACY -EC(4)- FOR THIS HOUR
51*      X = FLOAT(INFOLC) / 10.
52*      EC(IH,4) = 1. - X/A
53*      IF( EC(IH,4) .LT. 0.) EC(IH,4) = 0.
54*      C      CALCULATE EFFECTIVENESS
55*      TEM=CC12**2 + CC13**2 + CC14**2 + CC23**2 + CC24**2 + CC34**2
56*      EFF=TEM/6.0
57*      EFF = EFF * ( W(1) * EC(IH,1) + W(2)*EC(IH,2) + W(3)*EC(IH,3)
58*      1 + W(4) * EC(IH,4))
59*      EFF=EFF + ((6.0-TEM)/6.0) * ( EC(IH,1)**W(1) * EC(IH,2)**W(2) *
60*      1 EC(IH,3)**W(3) * EC(IH,4)**W(4))
61*      EC(IH,5) = EFF
62*      IF( EC(IH,5) .LT. 0.) EC(IH,5) = 0.
63*      C      ACCUMULATE RUN EFFECTIVENESS DATA
64*      45 CONTINUE
65*      DO 50 I = 1,5
66*      CEC(IH,I) = CEC(IH,I) + EC(IH,I)
67*      50 CONTINUE
68*      C      ACCUMULATE MANPOWER UTILIZATION RUN DATA
69*      DO 60 M = 1,MENS
70*      CTWH(IH,M) = CTWH(IH,M) + TW(IH,M)
71*      CIDH(IH,M) = CIDH(IH,M) + IDL(IH,M)
72*      MGCP(IH,M) = MGCP(IH,M) + MSCPL(M)
73*      IF( STR(M) .LT. 0.) STR(M) = 0.
74*      CFS(IH,M) = CFS(IH,M) + STR(M)
75*      CFA(IH,M) = CFA(IH,M) + ASP(M)
76*      60 CONTINUE
77*      IF( ORO(6) .NE. CHAR(1) ) GO TO 530
78*      WRITE(2,490) IDENT, IPAGE
79*      490 FORMAT(1H1, 15X, 12A6, 13X, 5HPAGE , 14/)
80*      IPAGE = IPAGE + 1
81*      WRITE(2,512) IH, IDAY, NSHF
82*      512 FORMAT(1H , 19HEND OF HOUR RESULTS, 11X, 4HHOUR, 110/
83*      1 31X, 3HDAY, 111/
84*      2 31X, 9HITERATION, 15//)
85*      WRITE(2,513)(( M, MSCPL(M), MSREJ(M), INTRPT(M), TW(IH,M),
86*      1 IDL(IH,M), STR(M), ASP(M), PERE(M) ), M=1, MENS )
87*      513 FORMAT(1H , 25HOPERATOR PERFORMANCE DATA/
88*      1 28X, 12H--MESSAGES--, 14X, AH--TIME--, 12X,
89*      2 17H-----FINAL-----/
90*      3 13X, 38HMAN COMPLETED REJECTED INTERRUPTED,
91*      4 48H WORKED OTHER STRESS ASPIRATION PERFORM/

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\*RcSHR\*\*

\*\*\*RFSHR\*\*\*

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92*      5(14X, I2, I11, I10, I10, F12.1, F10.1, F9.2, F9.2, F10.2/ )
93*      WRITE(2, 514)ATPM,MESS(1,1), INFOLC, (EC(IH,IV),IV=1,4), EFF
94*      514 FORMAT(1H, 19X, 24HMESSAGE PERFORMANCE DATA/
95*      1 23X, 24HAVERAGE TIME PER MESSAGE, F25.1/
96*      2 23X, 37HMESSAGES IN AO-G3 QUEUE AT HOUR START, I10/
97*      3 23X, 22HTOTAL INFORMATION LOSS, I25/
98*      4 23X, 24HEFFECTIVENESS COMPONENTS/
99*      5 26X, 12HTHOROUGHNESS, F14.2/
100*     5 26X, 12HCOMPLETENESS, F14.2/
101*     6 26X, 14HRESPONSIVENESS, F12.2/
102*     7 26X, 8HACCURACY, F18.2/
103*     A 47X, 6H-----, /25X, 14HEFFECTIVENESS=F13.2/)
104*     WRITE(2,520)
105*     520 FORMAT(1H, 1AX, 23HDETAILED MESSAGE TIMING/
106*     1 20X, 17HCUMULATIVE TYPE/22X, 7HMESSAGE/
107*     2 22X, 6HNUMBER, 16X,
108*     3 42HT1      T2      T3      T4      T5)
109*     530 CONTINUE
110*     DO 550 MSG = 1, CMSG
111*     IF(SEGS(MSG,7) .LE. 0) GO TO 550
112*     IT = ITCY(MSG)
113*     T1 = SEGS(MSG,2) - SEGS(MSG,1)
114*     T2 = SEGS(MSG,3) - SEGS(MSG,2)
115*     T3 = SEGS(MSG,4) - SEGS(MSG,3)
116*     T4 = SEGS(MSG,5) - SEGS(MSG,4)
117*     T5 = SEGS(MSG,6) - SEGS(MSG,5)
118*     IF( ORO(6) .NE. CHAR(1)) GO TO 541
119*     WRITE(2,540) MSG,IT,T1,T2,T3, T4, T5
120*     540 FORMAT(1H, 21X, I3, I11, 5F10.1)
121*     541 CONTINUE
122*     C      ACCUMULATE TIME SEGMENT TIMES BY TYPE
123*     TMT(IT,1) = TMT(IT,1) + T1
124*     TMT(IT,2) = TMT(IT,2) + T2
125*     TMT(IT,3) = TMT(IT,3) + T3
126*     TMT(IT,4) = TMT(IT,4) + T4
127*     TMT(IT,5) = TMT(IT,5) + T5
128*     NTMT(IT) = NTMT(IT) + 1
129*     CT(IT,1) = CT(IT,1) + T1
130*     CT(IT,2) = CT(IT,2) + T2
131*     CT(IT,3) = CT(IT,3) + T3
132*     CT(IT,4) = CT(IT,4) + T4
133*     CT(IT,5) = CT(IT,5) + T5
134*     NCT(IT) = NCT(IT) + 1
135*     C      ACCUMULATE TIME SEGMENT TIMES BY HOUR
136*     CTSH(IH,1) = CTSH(IH,1) + T1
137*     CTSH(IH,2) = CTSH(IH,2) + T2
138*     CTSH(IH,3) = CTSH(IH,3) + T3
139*     CTSH(IH,4) = CTSH(IH,4) + T4
140*     CTSH(IH,5) = CTSH(IH,5) + T5
141*     NCTSH(IH) = NCTSH(IH) + 1
142*     C      ACCUMULATE TIME SEGMENT TIMES BY PRIORITY
143*     IP = IPRI(MSG)
144*     CP(IP,1) = CP(IP,1) + T1
145*     CP(IP,2) = CP(IP,2) + T2
146*     CP(IP,3) = CP(IP,3) + T3
147*     CP(IP,4) = CP(IP,4) + T4
148*     CP(IP,5) = CP(IP,5) + T5

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\*ReSHR\*\*\*

\*\*\*RFSHR\*\*\*

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149*      NCP(IP) = NCP(IP) + 1
150*      SEGS(MSG,7) = 0.
151*      550 CONTINUE
152*      DO 570 IT = 1,7
153*          X = NTMT(IT)
154*          DO 560 L = 1,5
155*              IF( NTMT(IT) .EQ. 0 ) GO TO 560
156*              TMT(IT,L) = TMT(IT,L) / X
157*          560 CONTINUE
158*      570 CONTINUE
159*          IF( ORO(6) .NE. CHAR(1) ) GO TO 600
160*          WRITE(2,580)(( IT, NTMT(IT), (TMT(IT,L), L= 1,5), IT= 1,7)
161*      580 FORMAT(1H, /20X,17HMESSAGE      NUMBER/
162*          1 23X, 17HTYPE      COMPLETED,
163*          2 46X  T1          T2          T3          T4          T5/
164*          3(24X, I1, I11,      5F10.1))
165*      590 CONTINUE
166*      600 CONTINUE
167*      C      GET READY FOR NEXT HOUR
168*          HROVER = CHAR(11)
169*          DO 700 M = 1,MENS
170*              AVAIL(M) = CHAR(1)
171*              MSCPL(M) = 0
172*              MSRFJ(M) = 0
173*              DO 650 MGG = 1,50
174*                  TIE1(MGG,M) = 0.
175*                  TIE2(MGG,M) = 0.
176*                  TIE3(MGG,M) = 0.
177*                  TIE4(MGG,M) = 0.
178*          650 CONTINUE
179*      700 CONTINUE
180*          KINKS = MQINT(IH,1) + MQINT(IH,2)
181*          IH = IH + 1
182*          IF(IH .GE. (IHMAX + 1 )) SHFTOV = CHAR(36)
183*          ZIH = ZIH + 3600.
184*          END4R = ZIH + 3600.
185*      800 CONTINUE
186*          LDONE = 0
187*          ATPM = 0
188*          AQT=0.0
189*          AHT=0.0
190*          DO 850 IT = 1,8
191*              NTMT(IT) = 0
192*          DO 840 L = 1,5
193*              TMT(IT,L) = 0.
194*      840 CONTINUE
195*      850 CONTINUE
196*          RETURN
197*          END

```

\*\*\*RUNSUM\*\*\*

\*\*\*RUNSUM\*\*\*

```

1*      SUBROUTINE RUNSUM
2*      C      PRINTS RUN SUMMERY AVERAGES ACCROSS ITERATIONS
3*      INCLUDE COMPLK
4*      WRITE(2,5) IDENT, IPAGE
5*      5 FORMAT(1H1, 15X, 12A6, 13X, 5HPAGE , 14/)
6*      IPAGE = IPAGE + 1
7*      M=ICHAIN
8*      IF(M.LE.0) M=1
9*      WRITE(2,10) M
10*     10 FORMAT(1H /10X, 5HSHIFT,12, 9H SUMMARY//)
11*     C      PRINT OUT MANPOWER UTILIZATION DATA
12*     WRITE(2,20)
13*     20 FORVAT(1H , //9X, 20HMANPOWER UTILIZATION,
14*     1 // 15X, 31HTIME WORKED ... TIME OTHER ,
15*     2 21HMSG UNITS MEAN TIME,
16*     3 20H FINAL FINAL,
17*     5 /46X, 23HPROCESSED PER MESSAGE,
18*     6 21H STRESS ASPIRATION ,
19*     7 /4X, 27H HOUR MAN PROD )

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\*RINSIJM\*\*\*

\*\*\*RUNSIJM\*\*\*

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20*      X = NSHIFT
21*      DO 25 M = 1, MENS
22*      TPMC(M) = 0.
23*      MCL(M) = 0
24*      SRS(M) = 0.
25*      ASS(M) = 0.
26*      WOR(M) = 0.
27*      TMI(M) = 0.
28*      25 CONTINUE
29*      DO 50 IH = 1, IHMAX
30*      WRITE(2,26) IH
31*      26 FORMAT(1H, I5)
32*      DO 40 M = 1, MENS
33*      WORK = CTWH(IH,M)/X
34*      WOR(M) = WOR(M) + WORK
35*      TMIDL = CIDH(IH,M)/X
36*      TMI(M) = TMI(M) + TMIDL
37*      PROP = WORK/ 3600.
38*      YY= MGCP(IH,M)
39*      TPM = CMTMG(IH,M)/YY
40*      IF( YY .LE. 0 ) TPM = 0.
41*      TPMC(M) = TPMC(M) + CMTMG(IH,M)
42*      MCL(M) = MCL(M) + MGCP(IH,M)
43*      SR = CFS(IH,M)/X
44*      SRS(M) = SRS(M) + SR
45*      AS = CFA(IH,M) / X
46*      ASS(M) = ASS(M) + AS
47*      EXIPMH(IH,M) = TPM
48*      EXASPH(IH,M) = AS
49*      MGC = FLOAT( MGCP(IH,M)) / X
50*      WRITE(2,30) M,WORK,PROP,TMIDL,MGC,
51*      1 TPM, SR, AS
52*      30 FORMAT(1H, 5X,      I10, F8.0, F7.2, F10.0, I12, F14.0,F12.3,
53*      1 F9.3)
54*      40 CONTINUE
55*      50 CONTINUE
56*      WRITE(2,70)
57*      70 FORMAT(1H, /36H MEANS FOR EACH MAN PER MESSAGE UNIT )
58*      Q = IHMAX
59*      A = 00
60*      B = 0
61*      C = 0
62*      D = 0
63*      E = 0.
64*      H = 0
65*      G = MENS
66*      DO 100 M = 1, MENS
67*      WORK = WOR(M) / Q
68*      TMIDL = TMI(M) / Q
69*      PROP = WORK/ 3600.
70*      YY= MCL(M)
71*      TPM = 0
72*      IF( MCL(M) .LE. 0 ) GO TO 75
73*      TPM = TPMC(M) / YY
74*      75 CONTINUE
75*      SR = SRS(M) / Q
76*      AS = ASS(M) / Q

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FR, NSIM\*\*\*

\*\*\*RUNSIM\*\*\*

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77*      IF(WORK.EQ.0.0) GO TO 78
78*      A = A + WORK
79*      B = B + TMIDL
80*      C = C + YY
81*      D = D + TPM
82*      E = E + SR
83*      H = H + AS
84*      GO TO 79
85*      78 G=G-1
86*      79 CONTINUE
87*      EXTDM(M) = TPM
88*      EXASP(M) = AS
89*      WRITE(2, 80) M, WORK, PROP, TMIDL, MCL(M), TPM, SR, AS
90*      80 FORMAT(1H, I15, F8.0, F7.2, F10.0, I12, F14.0, F12.3, F9.3)
91*      100 CONTINUE
92*      WRITE(2, 120)
93*      120 FORMAT( 1H, / 7H TOTALS)
94*      KC = C
95*      PROP = WORK / ( MENS * 3600.)
96*      WRITE(2,140) A, PROP, B, KC, D, E, H
97*      WRITE(2,130)
98*      130 FORMAT(1H, // 12H GRAND MEANS/)
99*      WORK = A / G
100*      TMIDL = B / G
101*      MSG = C / G
102*      TPM = D / G
103*      SR = E / G
104*      AS = H / G
105*      PROP = WORK / 3600.
106*      WRITE(2,140) WORK, PROP, TMIDL, MSG, TPM, SR, AS
107*      140 FORMAT(1H, F23.0, F7.2, F10.0, I12, F14.0, F12.3, F9.3)
108*      C PRINT OUT TIME SEGMENT DATA BY HOUR
109*      WRITE(2,5) IDENT, IPAGE
110*      IF(ICHAIN.EQ.0) GO TO 145
111*      GMEANS(1)=GMEANS(1)+WORK
112*      GMEANS(2)=GMEANS(2)+PROP
113*      GMEANS(3)=GMEANS(3)+TMIDL
114*      GMEANS(4)=GMEANS(4)+MSG
115*      GMEANS(5)=GMEANS(5)+TPM
116*      GMEANS(6)=GMEANS(6)+SR
117*      GMEANS(7)=GMEANS(7)+AS
118*      IBLK1=IBLK1+1
119*      ENCODE(48,9145,LINE) ICHAIN,WORK,PROP,TMIDL,MSG,TPM,SR,AS
120*      9145 FORMAT(I7,F16.0,F7.2,F10.0,I12,F14.0,F12.3,F9.3)
121*      C WRITE(3,IBLK1) LINE
122*      145 CONTINUE
123*      IPAGE = IPAGE + 1
124*      NCC = 0
125*      WRITE(2,200)
126*      200 FORMAT(1H, 24X, 13H TIME SEGMENTS,
127*      1 /7X, 34H----T1---- ----T2---- ----T3----,
128*      2 41H ----T4---- ----T5---- TOTAL TOTAL,
129*      3 /41H HOUR TIME PROP TIME PROP TIME PROP,
130*      4 43H TIME PROP TIME PROP (SIM) MESSAGES )
131*      DO 250 IH = 1, IHMAX
132*      IF( NCTSH(IH) .LE. 0) GO TO 250
133*      SUM = 0.

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\*R,NSIJM\*\*\*

\*\*\*RUNSIJM\*\*\*

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134*      X = NCTSH(IH)
135*      NCC = NCC + NCTSH(IH)
136*      DO 210 IS = 1,5
137*      CH(IS) = CH(IS) + CTSH(IH,IS)
138*      CTSH(IH,IS) = CTSH(IH,IS) / X
139*      SUM = SUM + CTSH(IH,IS)
140*      210 CONTINUE
141*      DO 220 IS = 1,5
142*      PRP(IS) = CTSH(IH,IS) / SUM
143*      220 CONTINUE
144*      WRITE(2,230) IH, (CTSH(IH,IS), PRP(IS), IS=1,5), SUM, NCTSH(IH)
145*      230 FORMAT(1H, I4, 5(F6.0, F6.2), F10.0, I6)
146*      250 CONTINUE
147*      SUM = 0.
148*      DO 260 IS = 1,5
149*      CH(IS) = CH(IS) / NCC
150*      SUM = SUM + CH(IS)
151*      260 CONTINUE
152*      DO 270 IS = 1,5
153*      PRP(IS) = CH(IS) / SUM
154*      270 CONTINUE
155*      EXPR(1) = SUM
156*      WRITE(2,280) (CH(IS), PRP(IS), IS = 1,5), SUM, NCC
157*      280 FORMAT(1H, /5H MEAN, 5(F6.0, F6.2), F10.0, I6)
158*      IF(ICHAIN.EQ.0) GO TO 285
159*      K=-1
160*      DO 282 I=1,5
161*      K=K+2
162*      GTSMNS(K)=GTSMNS(K)+CH(I)
163*      282 GTSMNS(K+1)=GTSMNS(K+1)+PRP(I)
164*      GTSMNS(11)=GTSMNS(11)+SUM
165*      GTSMNS(12)=GTSMNS(12)+NCC
166*      ENCODE(48,9282,LINE) ICHAIN, (CH(IS), PRP(IS), IS=1,5), SUM, NCC
167*      9282 FORMAT(I4, IX, 5(F6.0, F6.2), F10.0, I6)
168*      IBLK1=IBLK1+1
169*      C WRITE(3,IBLK1) LINE
170*      285 CONTINUE
171*      C PRINT OUT TIME SEGMENT DATA BY MESSAGE TYPE
172*      WRITE(2,290) (IS, IS=1,5)
173*      290 FORMAT(1H // 6H TYPE ,
174*      1 5(6H ----T, I1, 5H---- ),
175*      2 14H TOTAL N,
176*      3 /54 MSG, 5(12H TIME PROP),
177*      4 16H (SUM) CPL)
178*      C DO 370 IT = 1,8
179*      DO 378 IT=1,7
180*      IF(NCTST(IT).LE. 0) GO TO 370
181*      X = NCTST(IT)
182*      SUM = 0.
183*      DO 340 IS = 1,5
184*      CTST(IT,IS) = CTST(IT,IS) / X
185*      SUM = SUM + CTST(IT,IS)
186*      340 CONTINUE
187*      DO 350 IS = 1,5
188*      PRP(IS) = CTST(IT,IS) / SUM
189*      350 CONTINUE
190*      WRITE(2, 360) IT, (CTST(IT,IS), PRP(IS), IS=1,5),

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NR, NSUM\*\*\*

\*\*\*PUNSUM\*\*\*

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191*      1 SUM, NCTST(IT)
192*      360 FORMAT(1H, I3, 1X, 5(F6.0,F6.2), F10.0, I6)
193*      C 370 CONTINUE
194*      370 IF(ICHAIN.EQ.0) GO TO 378
195*      K=-1
196*      DO 372 I=1,5
197*      K=K+2
198*      TSMNST(IT,K)=TSMNST(IT,K)+CTST(IT,I)
199*      372 TSMNST(IT,K+1)=TSMNST(IT,K+1)+PRP(I)
200*      TSMNST(IT,11)=TSMNST(IT,11)+SUM
201*      TSMNST(IT,12)=TSMNST(IT,12)+NCTST(IT)
202*      ENCODE(84,9378,LINE) ICHAIN,IT,(CTST(IT,IS),PRP(IS),IS=1,5),SUM,
203*      1 NCTST(IT)
204*      9378 FORMAT(I6,I4,1X,5(F6.0,F6.2),F10.0,I6)
205*      IBLK1=IBLK1+1
206*      C WRITE(3,IBLK1) LINE
207*      378 CONTINUE
208*      C PRINT OUT TIME SEGMENT DATA BY MESSAGE PRIORITY
209*      WRITE(2,380) (IS, IS = 1,5)
210*      380 FORMAT(1H, // 6H PRIOR,
211*      1 5(6H ----T,I1, 5H---- ),
212*      2 14H TOTAL N,
213*      3 /5H MSG, 5(12H TIME PROP),
214*      4 16H (SUM) CPL)
215*      DO 455 IP=1,5
216*      C DO 450 IP = 1,5
217*      IF( NCTSP(IP) .LE. 0) GO TO 450
218*      X = NCTSP(IP)
219*      SUM = 0.
220*      DO 400 IS = 1,5
221*      CTSP(IP,IS) = CTSP(IP,IS) / X
222*      SUM = SUM + CTSP(IP,IS)
223*      400 CONTINUE
224*      DO 410 IS = 1,5
225*      PRP(IS) = CTSP(IP,IS) / SUM
226*      410 CONTINUE
227*      WRITE(2,420) IP, (CTSP(IP,IS),PRP(IS),IS=1,5),SUM,NCTSP(IP)
228*      420 FORMAT(1H, I3, 1X, 5(F6.0,F6.2), F10.0, I6)
229*      C 450 CONTINUE
230*      450 IF(ICHAIN.EQ.0) GO TO 455
231*      K=-1
232*      DO 452 I=1,5
233*      K=K+2
234*      TSMNSP(IP,K)=TSMNSP(IP,K)+CTSP(IP,I)
235*      452 TSMNSP(IP,K+1)=TSMNSP(IP,K+1)+PRP(I)
236*      TSMNSP(IP,11)=TSMNSP(IP,11)+SUM
237*      TSMNSP(IP,12)=TSMNSP(IP,12)+NCTSP(IP)
238*      ENCODE(84,9378,LINE) ICHAIN,IP,(CTSP(IP,IS),PRP(IS),IS=1,5),SUM,
239*      1NCTSP(IP)
240*      IBLK1=IBLK1+1
241*      C WRITE(3,IBLK1) LINE
242*      455 CONTINUE
243*      C PRINT OUT EFFECTIVENESS BY HOUR DATA
244*      WRITE(2,5) IDENT, IPAGE
245*      IPAGE = IPAGE + 1
246*      WRITE(2,460)
247*      460 FORMAT(1H, //19X,29H----COMPONENTS---- EFFECT-, /10X,

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\*RINSIJM\*\*\*

\*\*\*RINSIJM\*\*\*

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248*      1 3AHHOUR      THOR COMP RESP ACC      IVENFSS)
249*      X = NSHIFT
250*      DO 470 IC = 1,5
251*      CH(IC) = 0.
252*      470 CONTINUE
253*      DO 500 IH = 1,IHMAX
254*      DO 480 IC = 1,5
255*      CEC(IH,IC) = CEC(IH,IC) / X
256*      CH(IC) = CH(IC) + CEC(IH,IC)
257*      480 CONTINUE
258*      WRITE(2,490) IH, (CEC(IH,IC), IC = 1,5)
259*      490 FORMAT(1H, I13, 4X, 4F5.2, F8.2)
260*      500 CONTINUE
261*      DO 510 IC = 1,5
262*      CH(IC) = CH(IC) / 0
263*      510 CONTINUE
264*      EXPR(2) = CH(5)
265*      WRITE(2,520) (CH(IC), IC = 1,5)
266*      520 FORMAT(1H, /10X, 4HMEAN, 4X, 4F5.2, F8.2)
267*      IF(ICHAIN.EQ.0) GO TO 530
268*      DO 525 I=1,5
269*      525 COMMNS(I)=COMMNS(I)+CH(I)
270*      ENCODE(42,9525,LINE) ICHAIN,(CH(I),I=1,5)
271*      9525 FORMAT(10X,I4,4X,4F5.2,F8.2)
272*      IBLK1=IBLK1+1
273*      C WRITE(3,IBLK1) LINE
274*      530 CONTINUE
275*      C PRINT OUT WORKLOAD SUMMARY
276*      WRITE(2,5) IDENT, IPAGE
277*      IPAGE = IPAGE + 1
278*      WRITE(2,540)
279*      540 FORMAT(1H, 20X, 16HWORKLOAD SUMMARY ,
280*      1 / 47X, 28H-----MESSAGE UNITS----- ,
281*      2 / 11X, 31HBACKLOG      MESSAGES DELIVERED ,
282*      3 38H      COMPLETED      REJECTED INTERRUPTED ,
283*      4 /43H      HOUR AO/G3      IOD LAST 1/4 HR      ANYTIME ,
284*      5 36H      AO/G3      IOD AO/G3      IOD AO/G3 IOD      )
285*      DO 600 IH = 1, IHMAX
286*      WRITE(2, 560) IH
287*      560 FORMAT(1H, I5)
288*      X1 = LOGBAC(IH,1) / X
289*      X2 = LOGBAC(IH, 2) / X
290*      X3 = MUCOMP(IH,1) / X
291*      X4 = MUCOMP(IH,2) / X
292*      X5 = MUREJ(IH,1) / X
293*      X6 = MUREJ(IH,2) / X
294*      X7 = MUINT(IH,1) / X
295*      X8 = MUINT(IH,2) / X
296*      WRITE(2,590) X1,X2,IGP(IH),IGR(IH), X3,X4,X5,X6,X7,X8
297*      590 FORMAT(1H, F13.1, F6.1, I8,I11,F10.1,F7.1,F5.1,F7.1,F6.1,F5.1)
298*      600 CONTINUE
299*      C PRINT ERROR SUMMARY
300*      WRITE(2,5) IDENT, IPAGE
301*      IPAGE = IPAGE + 1
302*      WRITE(2,620)
303*      620 FORMAT(1H, 20X, 23HERROR SUMMARY - BY HOUR//)
304*      WRITE(2,630)

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\*R,NSIJM\*\*\*

\*\*\*RUNSIJM\*\*\*

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305*      630 FORMAT(1H , 16X, 29H-----ERROR TYPE----- , 6X,
306*      1 30HERROR INFORMATION NUMBER OF ,
307*      2 / 14X, 27H1 2 3 ,10H 4 ,
308*      3 30HRETURNS LOSS MESSAGES , /74X, 5HUNITS )
309*      WRITE(2,640)
310*      640 FORMAT(1H , 9H HOUR )
311*      DO 700 IH = 1, IHMAX
312*      IF( IRESH(7, IH) .LE. 0 ) GO TO 700
313*      X = IRESH(7, IH)
314*      DO 650 IET = 1, 6
315*      PRP(IET) = IRESH(IET, IH)
316*      PRP(IET) = PRP(IET) / (X / 2.)
317*      650 CONTINUE
318*      WRITE(2,660) IH, (PRP(IET), IET= 1,6), IRESH(7, IH)
319*      660 FORMAT(1H , 1A, F8.4, 5F10.4, 111)
320*      700 CONTINUE
321*      WRITE(2,710)
322*      710 FORMAT(1H , ///20X, 31HERROR SUMMARY - BY MESSAGE TYPE )
323*      WRITE(2,630)
324*      WRITE(2,720)
325*      720 FORMAT(1H , 9H MESSAGE, / 9H TYPE )
326*      C DO 800 IT = 1, 7
327*      DO 810 IT=1, 7
328*      IF( IREST(7, IT) .LE. 0) GO TO 800
329*      X = IREST(7, IT)
330*      DO 730 IET = 1, 6
331*      PRP(IET) = IREST(IET, IT)
332*      PRP(IET) = PRP(IET) / (X / 2.)
333*      730 CONTINUE
334*      WRITE(2, 660) IT, (PRP(IET), IET= 1,6), IREST(7, IT)
335*      C 800 CONTINUE
336*      800 IF( ICHAIN.EQ.0) GO TO 810
337*      DO 805 I=1, 6
338*      805 ERSUMT(IT, I)=ERSUMT(IT, I)+PRP(I)
339*      ERSUMT(IT, 7)=IREST(7, IT)+ERSUMT(IT, 7)
340*      ENCODE(54, 9805, LINE) ICHAIN, IT, (PRP(I), I=1, 6), IREST(7, IT)
341*      9805 FORMAT(I3, I5, F8.4, 5F10.4, 111)
342*      IBLK1=IBLK1+1
343*      C WRITE(3, IBLK1) LINE
344*      810 CONTINUE
345*      825 RETURN
346*      END

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\*\*\*SIMPAM\*\*\*

\*\*\*SIMPAM\*\*\*

```

1*      SUBROUTINE SIMPAM
2*      C      SIMULATIONS PARAMETERS ARE READ IN
3*      INCLUDE COMPLK
4*      READ(7,100) IDENT
5*      100 FORMAT(12A6)
6*      READ(7,200) NSHIFT, IHMAX, MEN(1), MEN(2), NERROP, (ORO(L), L=1,9),
7*      2      IDAY, RKLK, PUL, PUS, SRTA, SRTS,
8*      C      3 ((IATA(J,N), N= 1,8), J= 1,2), NTE, Y
9*      3 ((IATA(J,N), N= 1,8), J= 1,2), NTE, Y, ICHAIN, TZERO
10*      200 FORMAT(I3, I2, 2I1, I1, 1X, 9A1, 2I2, 2X, 4F5.3, 16I1, I3, F8.8, 4X, I1, F4.0)
11*      C 200 FORMAT(I3, I2, 2I1, 2X, 6I1, 3X, 2I2, 2X, 4F5.3, 16I1, I3, A8)
12*      TZERO=TZERO*3600.
13*      PUL = PUL / 100.
14*      PUS = PUS / 100.
15*      MEN(3)= MEN(1) + MEN(2)
16*      MENS = MEN(3)
17*      C      ZERO RUN SUMMARY COUNTERS
18*      DO 220 IH = 1, IHMAX
19*      NCTSH(IH) = 0
20*      FRHR(IH) = 0.
21*      DURIN(IH) = 0.
22*      SGIN(IH) = 0.
23*      DEL(IH) = 0.
24*      DELSD(IH) = 0.
25*      DO 205 IES = 1,8
26*      IRESH(IES, IH) = 0
27*      205 CONTINUE
28*      DO 210 J = 1,2
29*      LOGRAC(IH,J) = 0
30*      MUCOMP(IH,J) = 0
31*      MUREJ(IH,J) = 0
32*      MUINT(IH,J) = 0
33*      210 CONTINUE
34*      DO 215 IC = 1,5
35*      CEC(IH,IC) = 0.
36*      215 CONTINUE
37*      DO 220 M = 1, MENS
38*      MGCP(IH,M) = 0

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\*STMPAM\*\*\*

\*\*\*SIMPAM\*\*\*

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39*      CMTMG(IH,M) = 0.
40*      CTWH(IH,M) = 0.
41*      CIDH(IH,M) = 0.
42*      CFS(IH,M) = 0.
43*      CFA(IH,M) = 0.
44*      220 CONTINUE
45*      DO 230 IP = 1,5
46*      NCTSP(IP) = 0
47*      DO 229 IS = 1,5
48*      CTSP(IP,IS) = 0.
49*      229 CONTINUE
50*      230 CONTINUE
51*      DO 240 IT = 1,8
52*      NCTST(IT) = 0
53*      DO 239 IP = 1,5
54*      CTST(IT,IP) = 0.
55*      239 CONTINUE
56*      240 CONTINUE
57*      DO 245 IES = 1,8
58*      DO 245 IT = 1,7
59*      IREST(IES, IT) = 0
60*      245 CONTINUE
61*      C      PRINT SIMULATION PARAMETER INPUTS IF CALLED FOR
62*      IF(OR0(1) .NE. CHAR(1)) GO TO 500
63*      WRITE(2,250) IDENT, IPAGE
64*      250 FORMAT(1H1, 15X, 12A6, 13X, 5HPAGE , I4/)
65*      IPAGE = IPAGE + 1
66*      WRITE(2,300)      NSHIFT, IDAY, IHMAX, BKLG, MEN(1), Y, MEN(2),
67*      2 NERROP, PUL, SRTA, PUS , SRTS
68*      300 FORMAT(1H ,
69*      1 2X, 23HNO. OF SHIFT ITERATIONS, I13, 10X,
70*      2 20HNO. OF SIMULATED DAY, I13/
71*      3 3X, 22HNO. OF HOURS PER SHIFT, I14, 10X,
72*      4 19HINITIAL BACKLOG 'G3, I14/
73*      5 3X, 23HNO. OF ACTION OFFICIERS, 12Y, I1,
74*      5 10Y, 13HRANDOM NUMBER, 12X, F10.8/
75*      6 3X, 'ERROR MESSAGES', 18X, I1/
76*      6 3X, 20HNO. OF IND OPERATORS, 15X, I1//
77*      7 3X, 38HPROBABILITY OF UNDETECTED ERROR IN CCC, 8X,
78*      8 31HSYSTEM RESPONSE TIME TO INQUIRY/
79*      9 10X, 14HLOW IMPORTANCE, F6.3,
80*      A 26X, 4HMEAN, F7.3/
81*      1 10X, 11HSIGNIFICANT, F9.3,
82*      2 26X, 2HSD, F9.3//)
83*      500 CONTINUE
84*      RETURN
85*      END

```

\*\*\*SUMMER\*\*\*

\*\*\*SUMMER\*\*\*

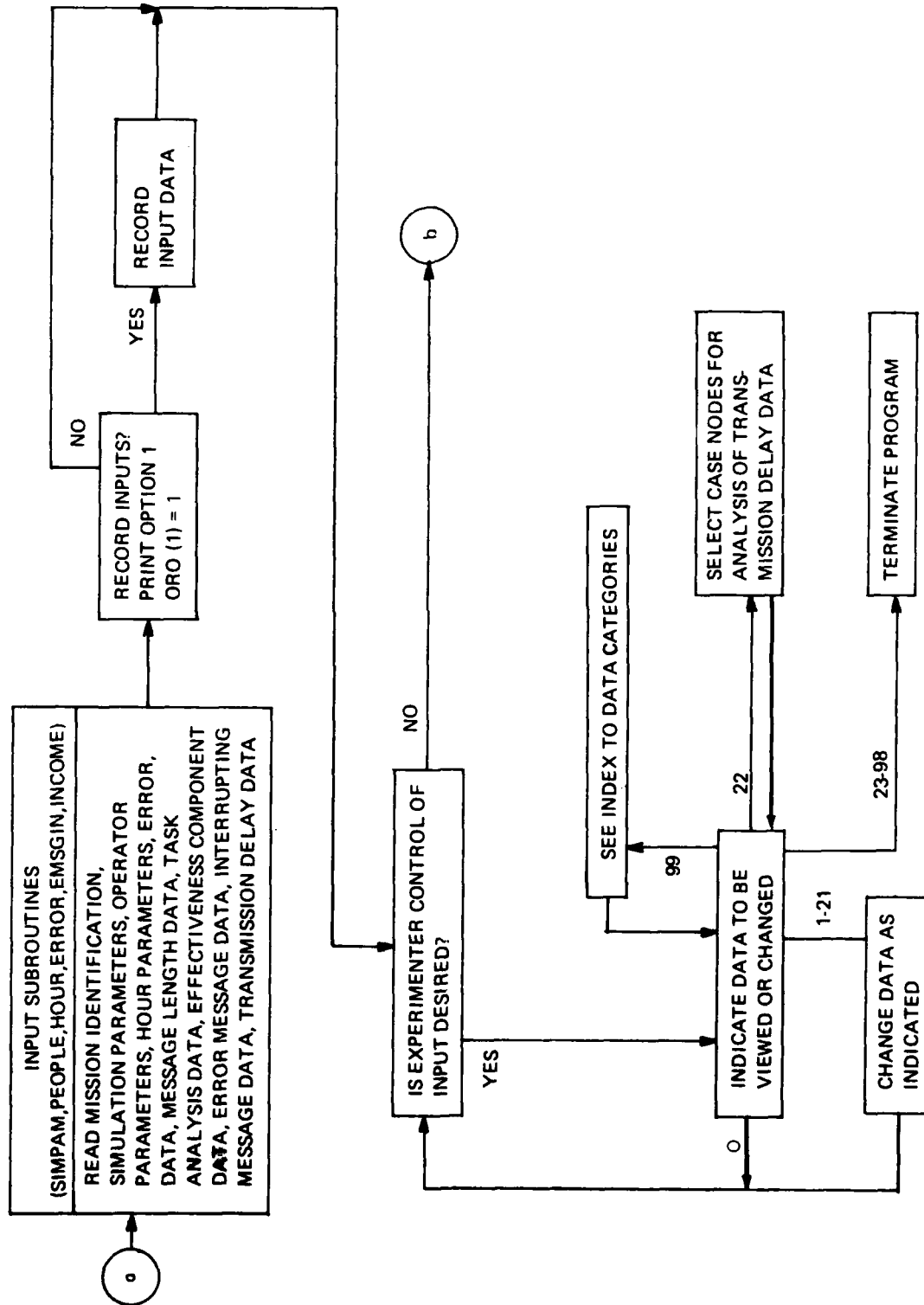
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1*      SUBROUTINE SUMMER
2*      INCLUDE COMPLK
3*      PRINT 1000
4*      1000 FORMAT(22(1X/),
5*      1 ' [ ] DO YOU WANT A SIMULATION SUMMARY?')
6*      READ 2000, ANSW
7*      2000 FORMAT(2X,A3)
8*      IF( ANSW .EQ. ' NO' .OR. ANSW .EQ. 'NO ') GO TO 999
9*      PRINT 1010, NSHIFT, NCC, EXPR(1), EXPR(2), (M, MCL(M),
10*      1 EXTPM(M), EXASP(M), M=1, MENS)
11*      1010 FORMAT(22(1X/),
12*      1 /8X, 'AFTER', I4, ' ITERATTONS' //
13*      2 ' MESSAGES PROCESSED =', I8/
14*      3 ' AVG TIME PER MESSAGE= ', F8.1/
15*      4 ' EFFECTIVENESS      =', F8.3/
16*      5 ' MAN MSGS AVG TIME/MSG   ASP' /
17*      6 6(I3, I6, F14.1, F7.3/))
18*      READ 2000, ANSW
19*      50  CONTINUE
20*      PRINT 1020
21*      1020 FORMAT(22(1X/),
22*      1 ' [ ] WHICH HOUR SUMMARY DO YOU WANT?')
23*      READ 2010, L
24*      2010 FORMAT(2X, I2)
25*      IF( L .LE. 0) GO TO 999
26*      PRINT 1030, L, NSHIFT, MUCOMP(L,2), (M, MGCP(L,M),
27*      1 EXTPMH(L,M), EXASPH(L,M), M=1, MFNS)
28*      1030 FORMAT(22(1X/),
29*      1 /5X, 'HOUR', I3, ' AFTER', I4, ' ITERATTONS.' //
30*      2 ' MESSAGES PROCESSED =', I8, ///
31*      3 ' MAN MSGS AVG TIME/MSG   ASP' /
32*      4 6(I3, I6, F14.1, F7.3/))
33*      READ 2000, ANSW
34*      GO TO 50
35*      999 CONTINUE
36*      RETURN
37*      END

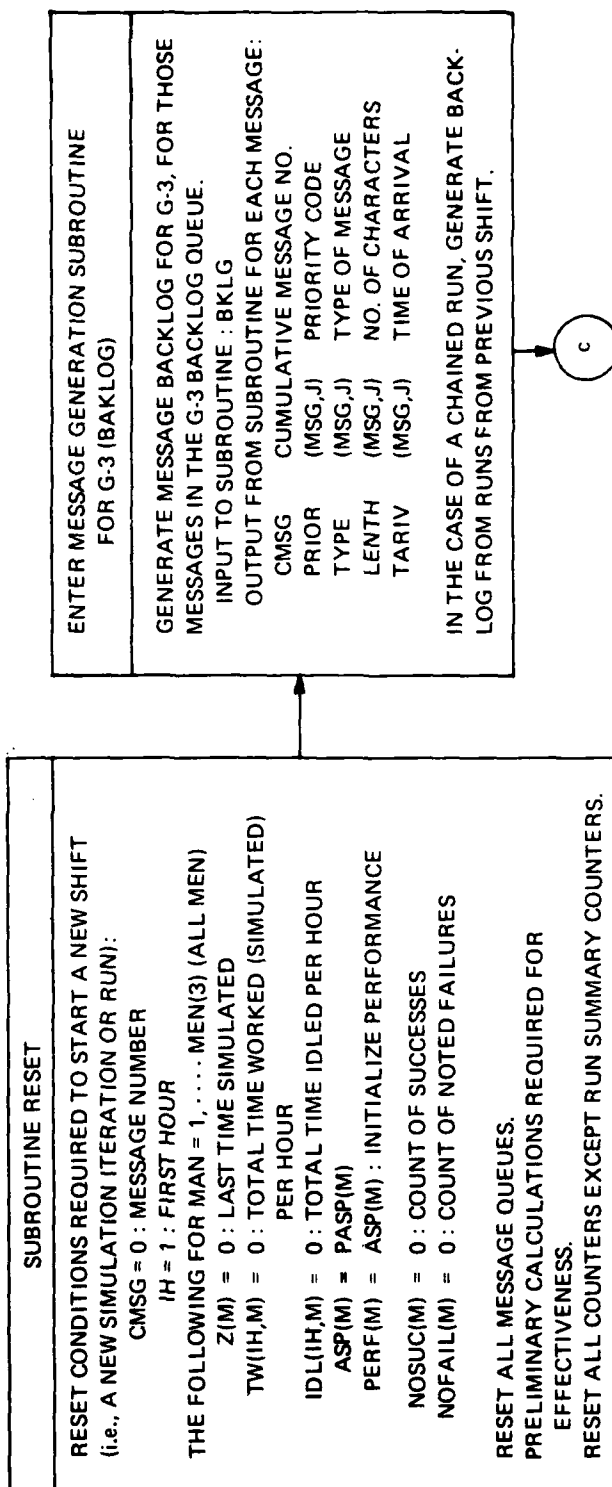
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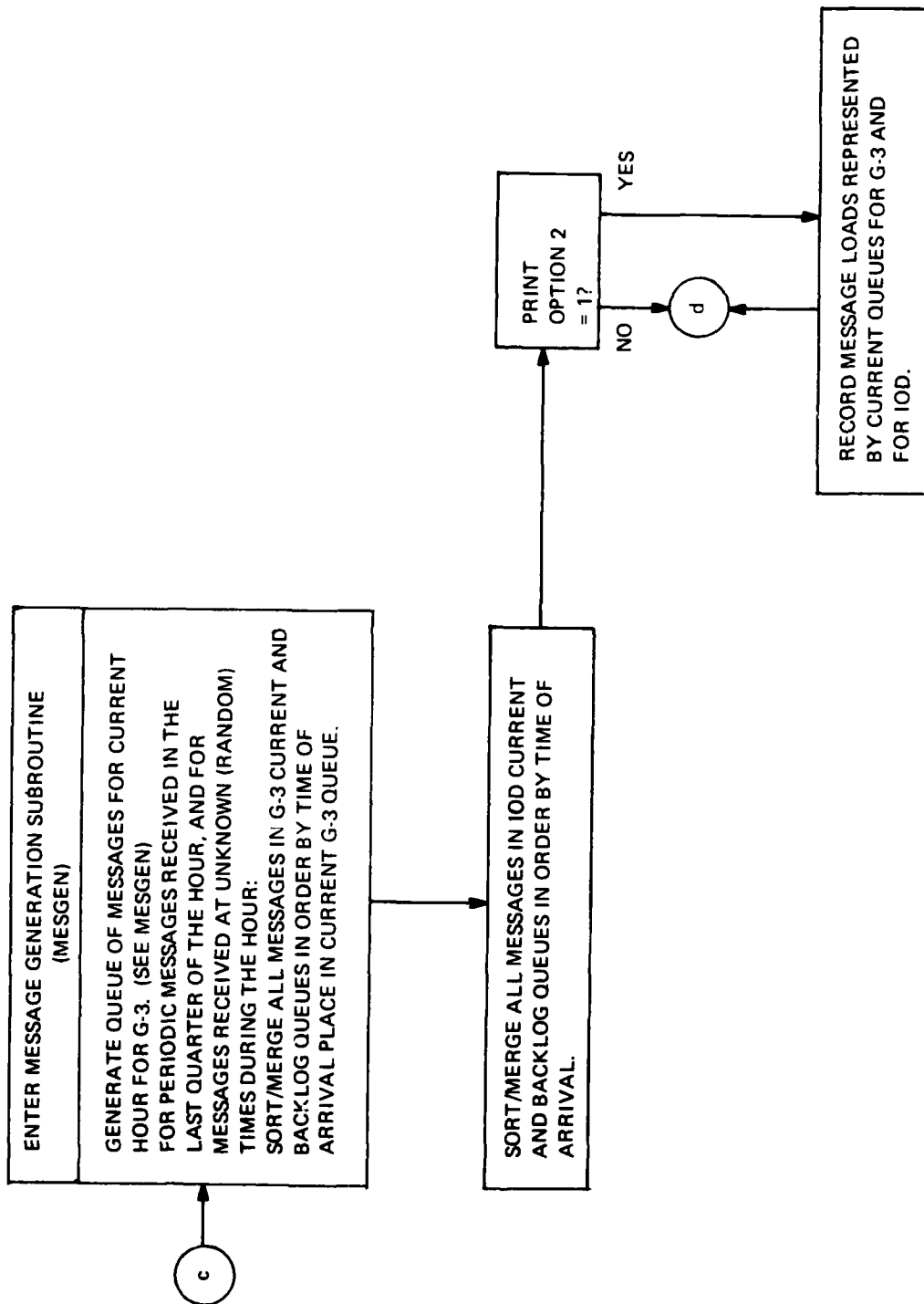
APPENDIX C

Flow Charts

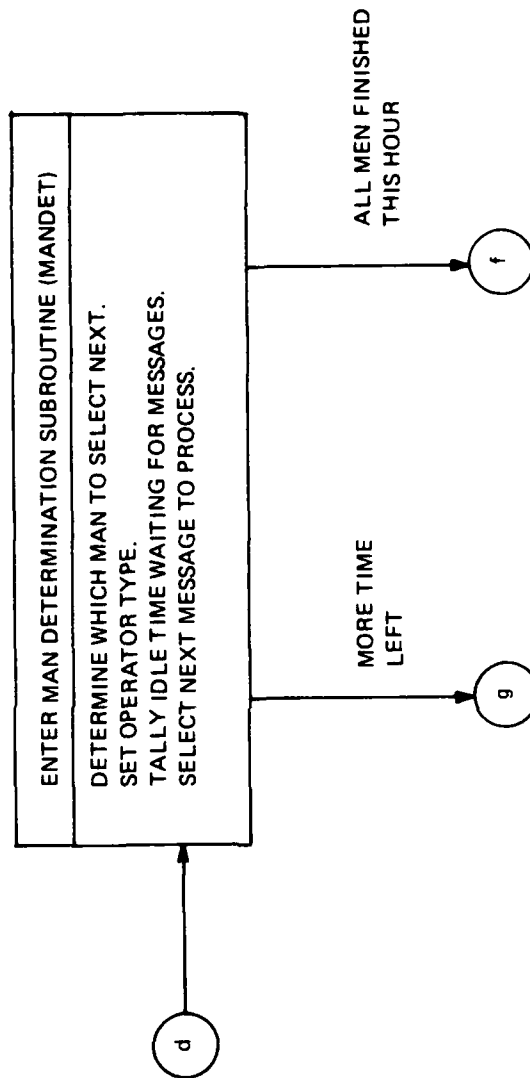


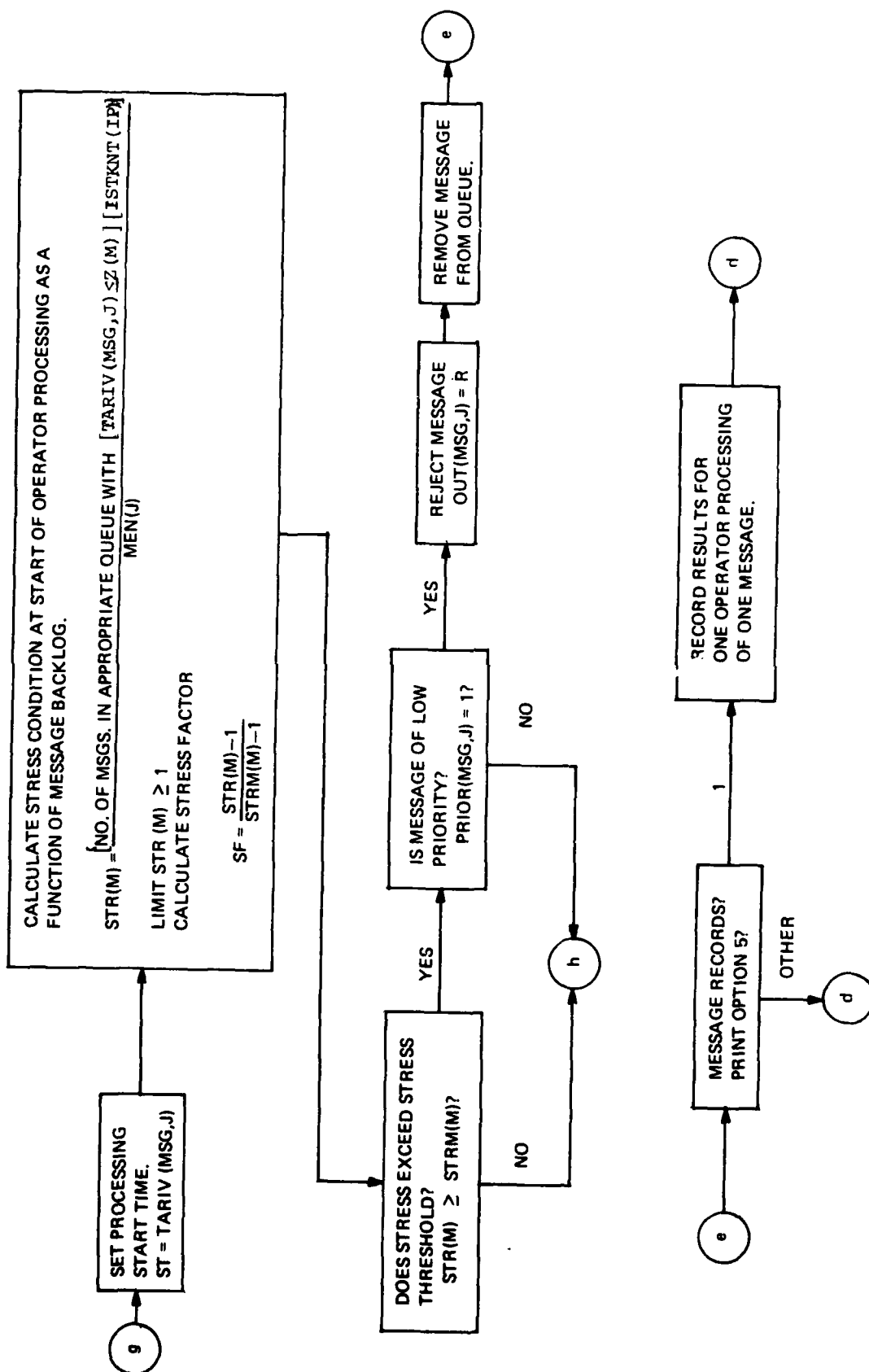
MAIN SEQUENCE LOGIC FLOW FOR MANMOD  
(ROUTINE SIPS)

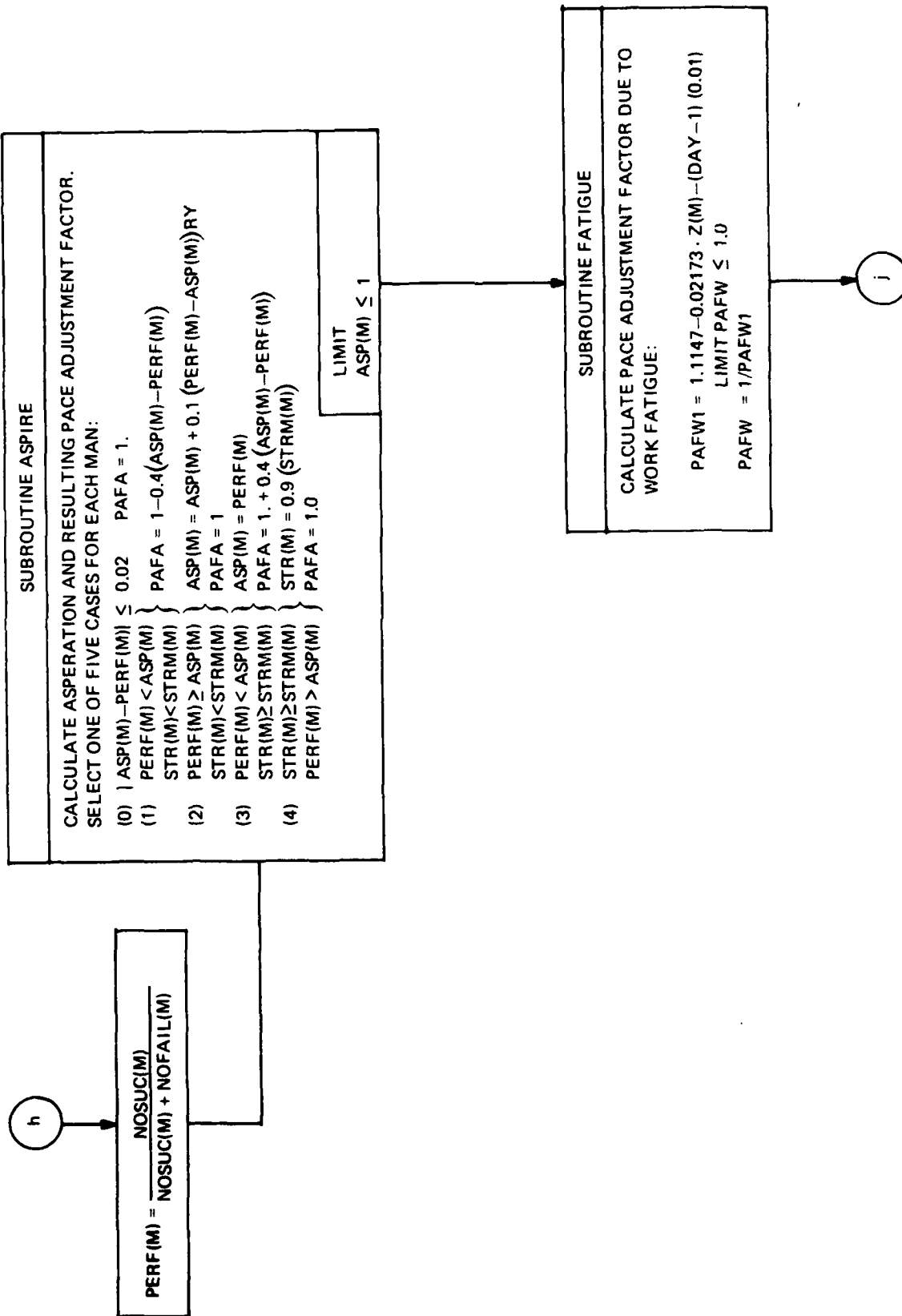


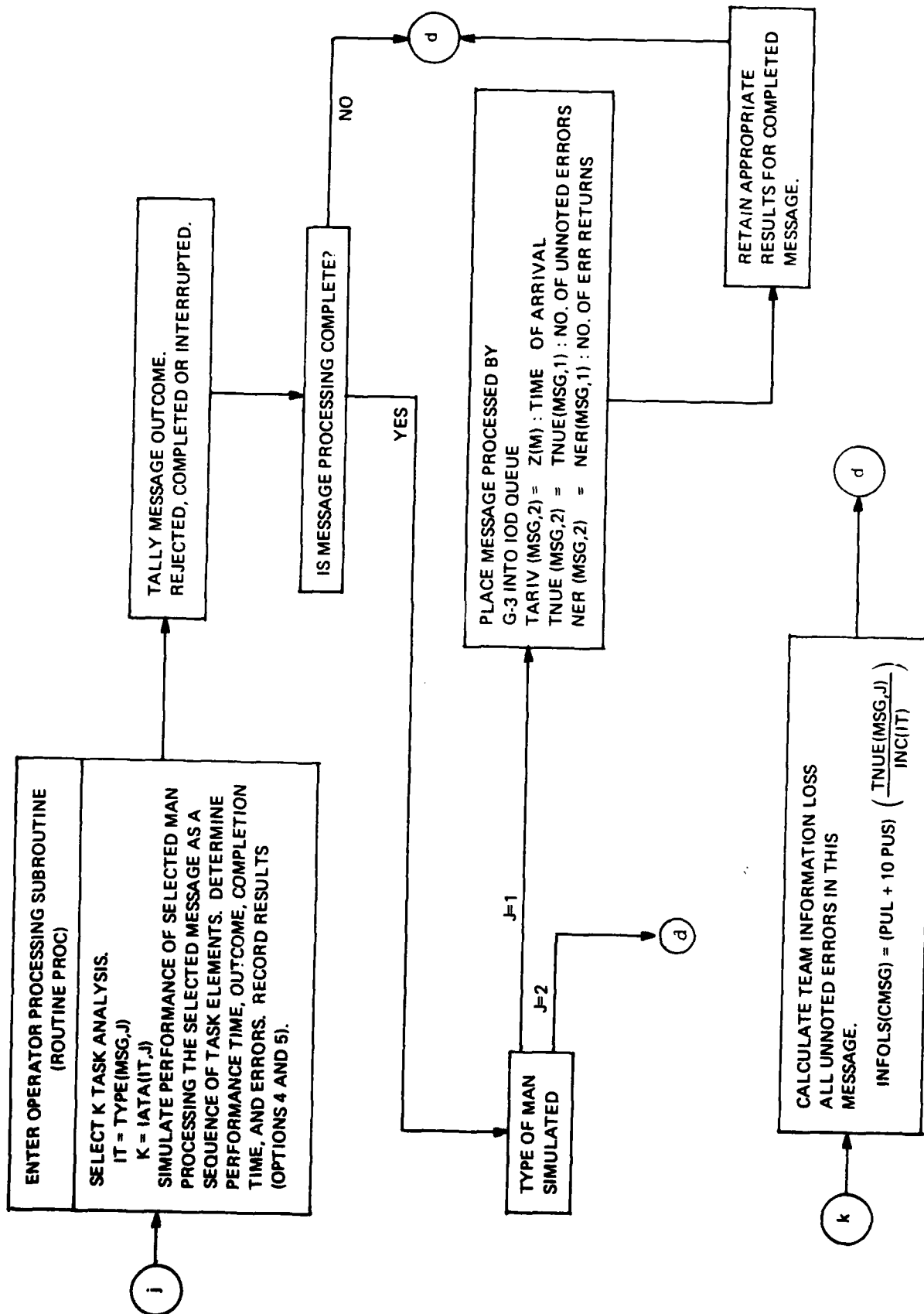


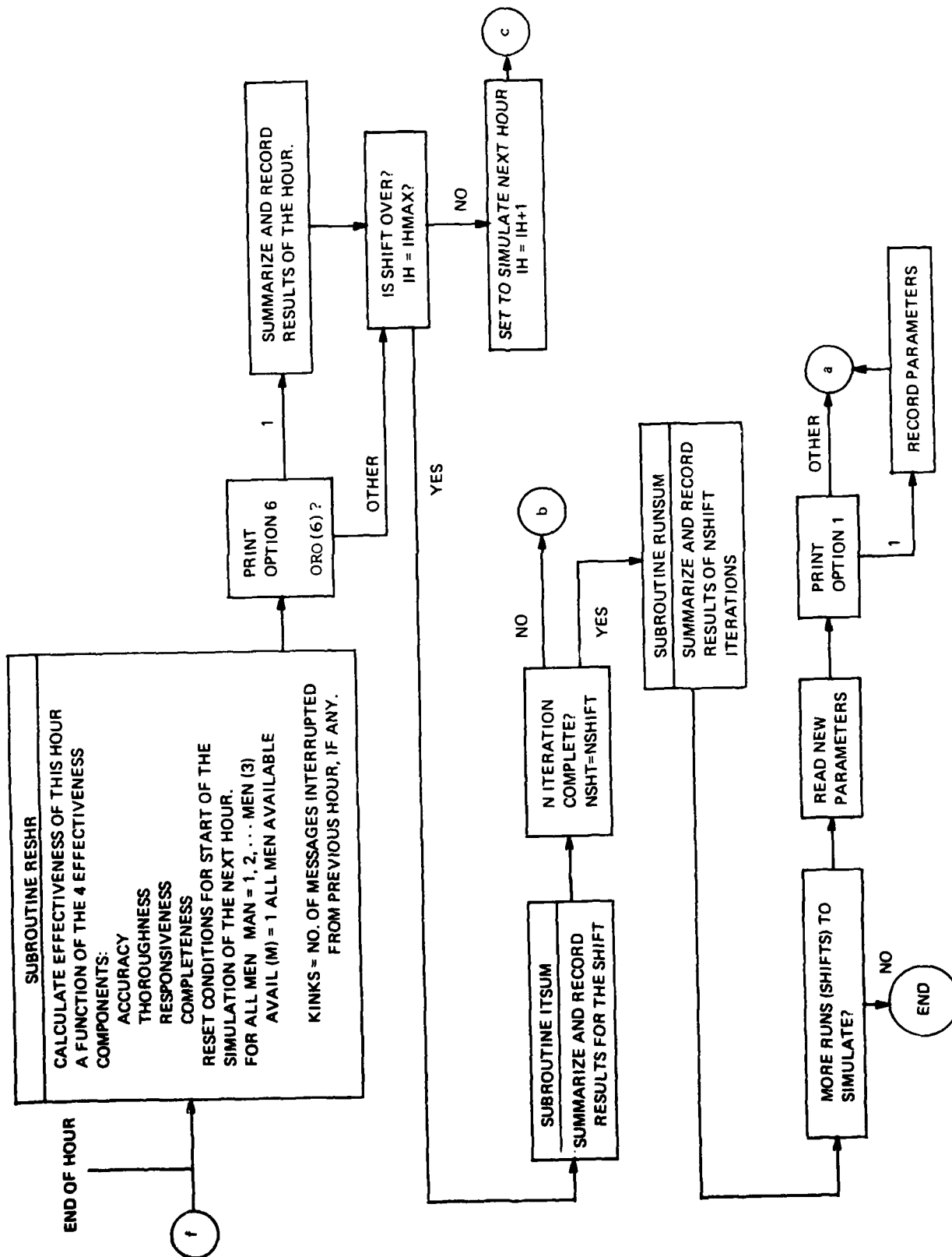




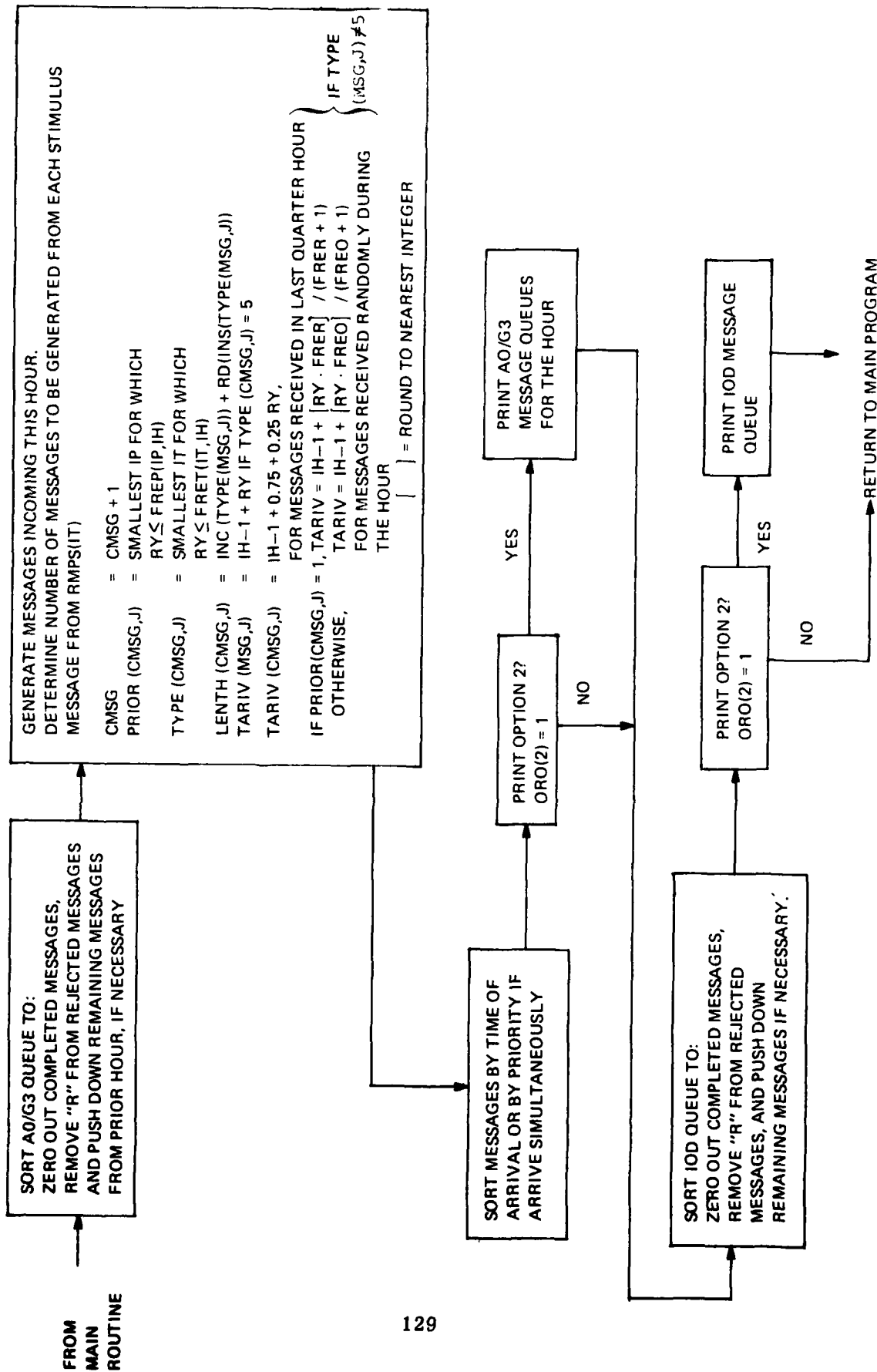








Message Generation Subroutine

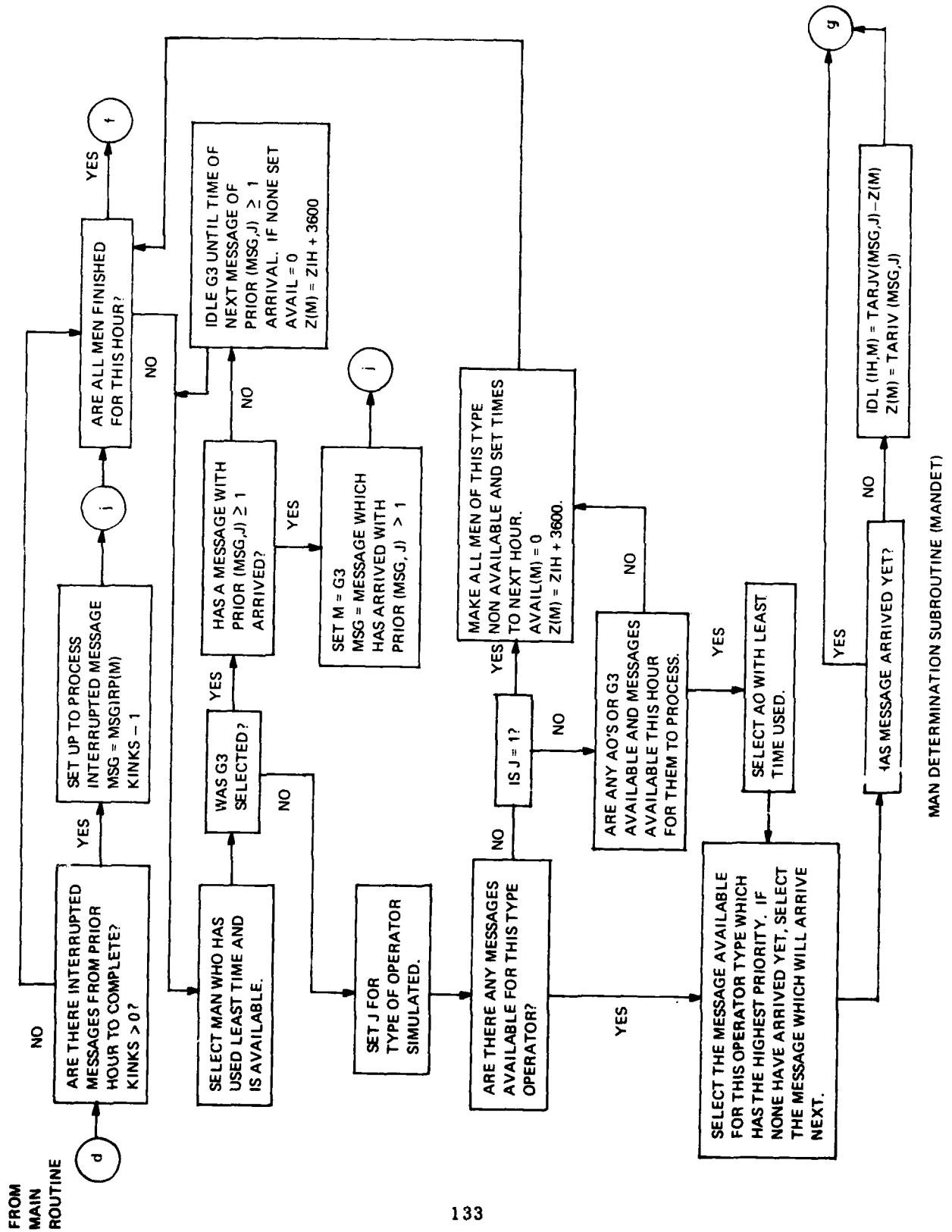


MESSAGE GENERATION SUBROUTINE (MESGEN)

Man Determination Subroutine

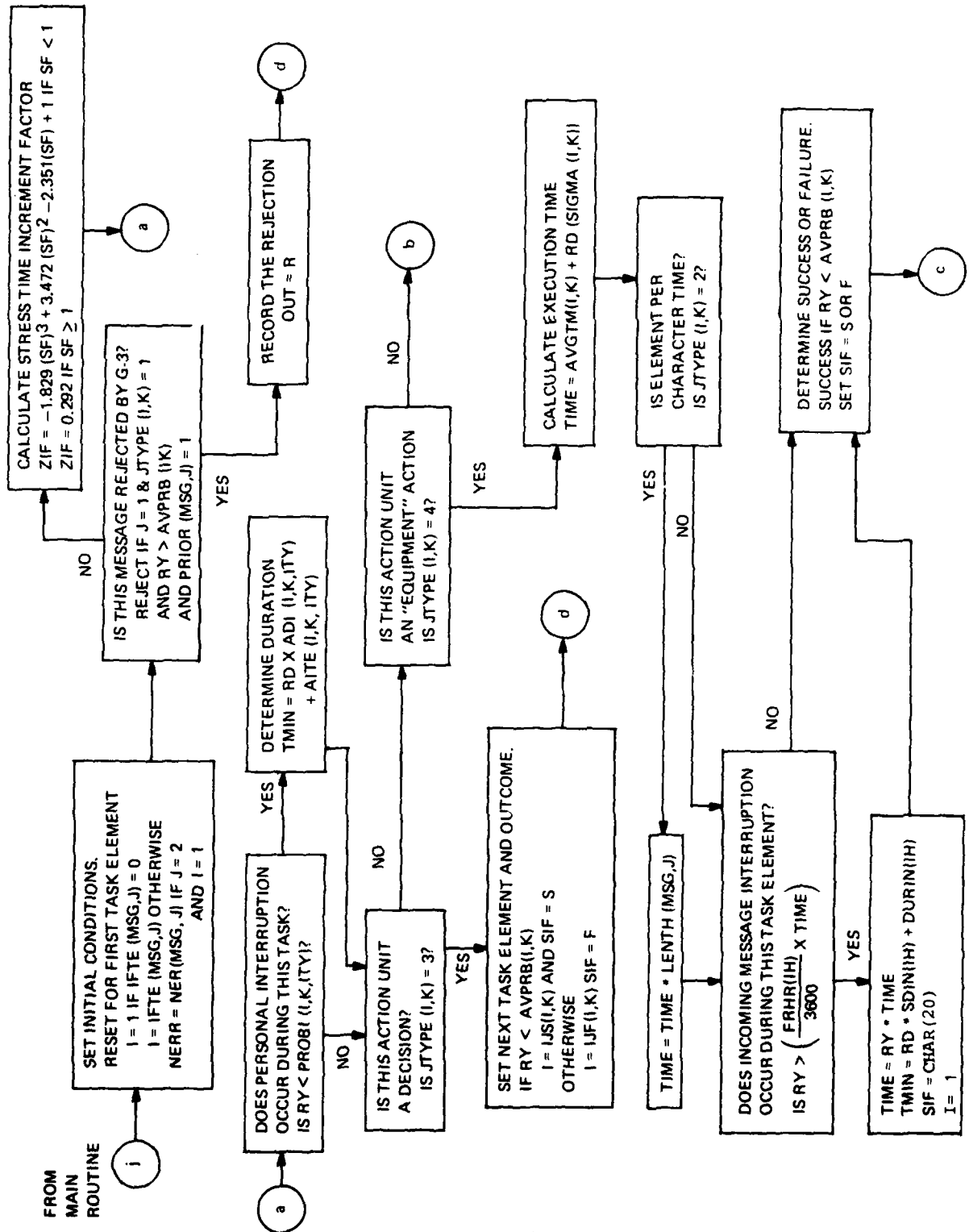
Note: All circled letters refer to main logic flow.



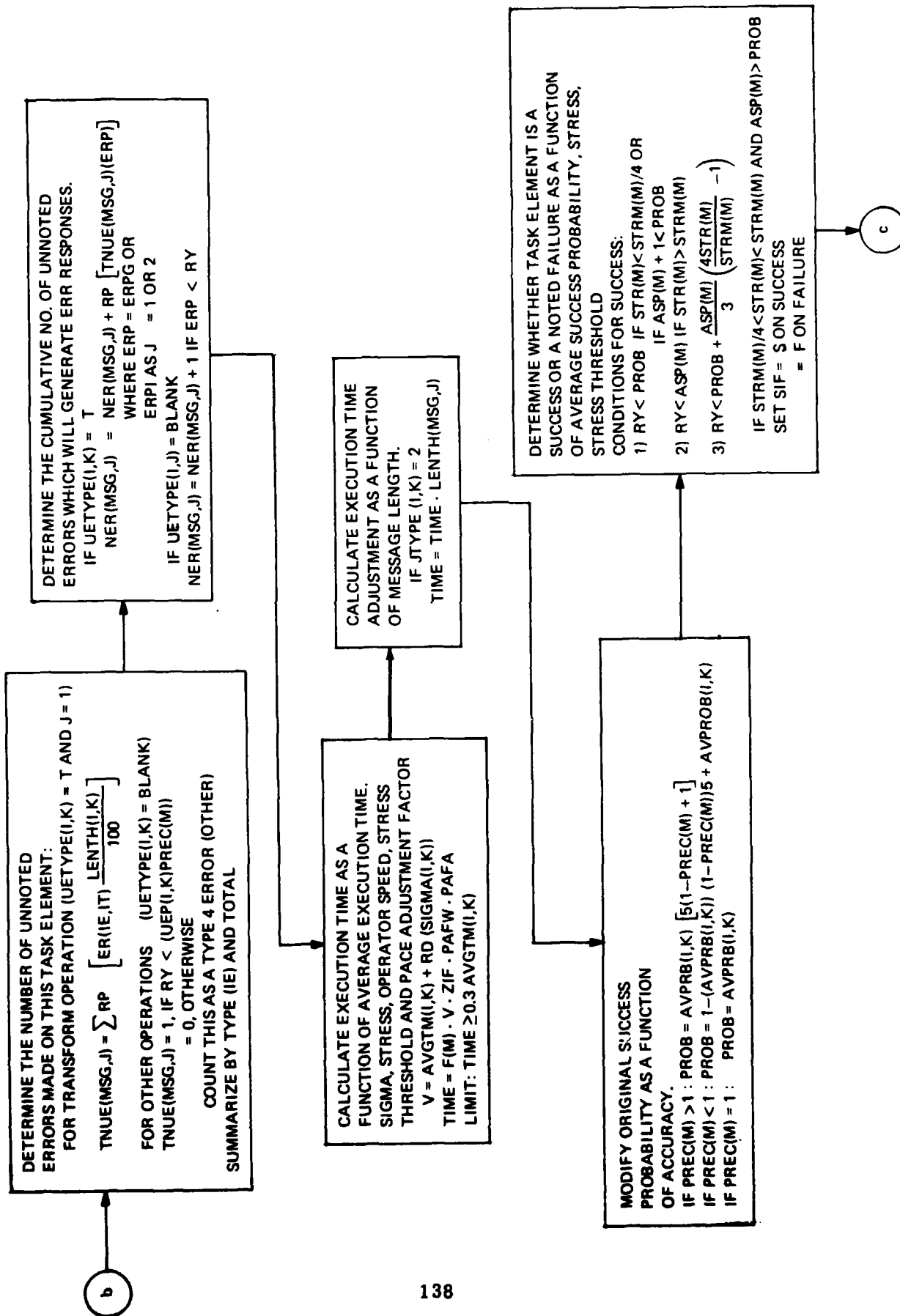


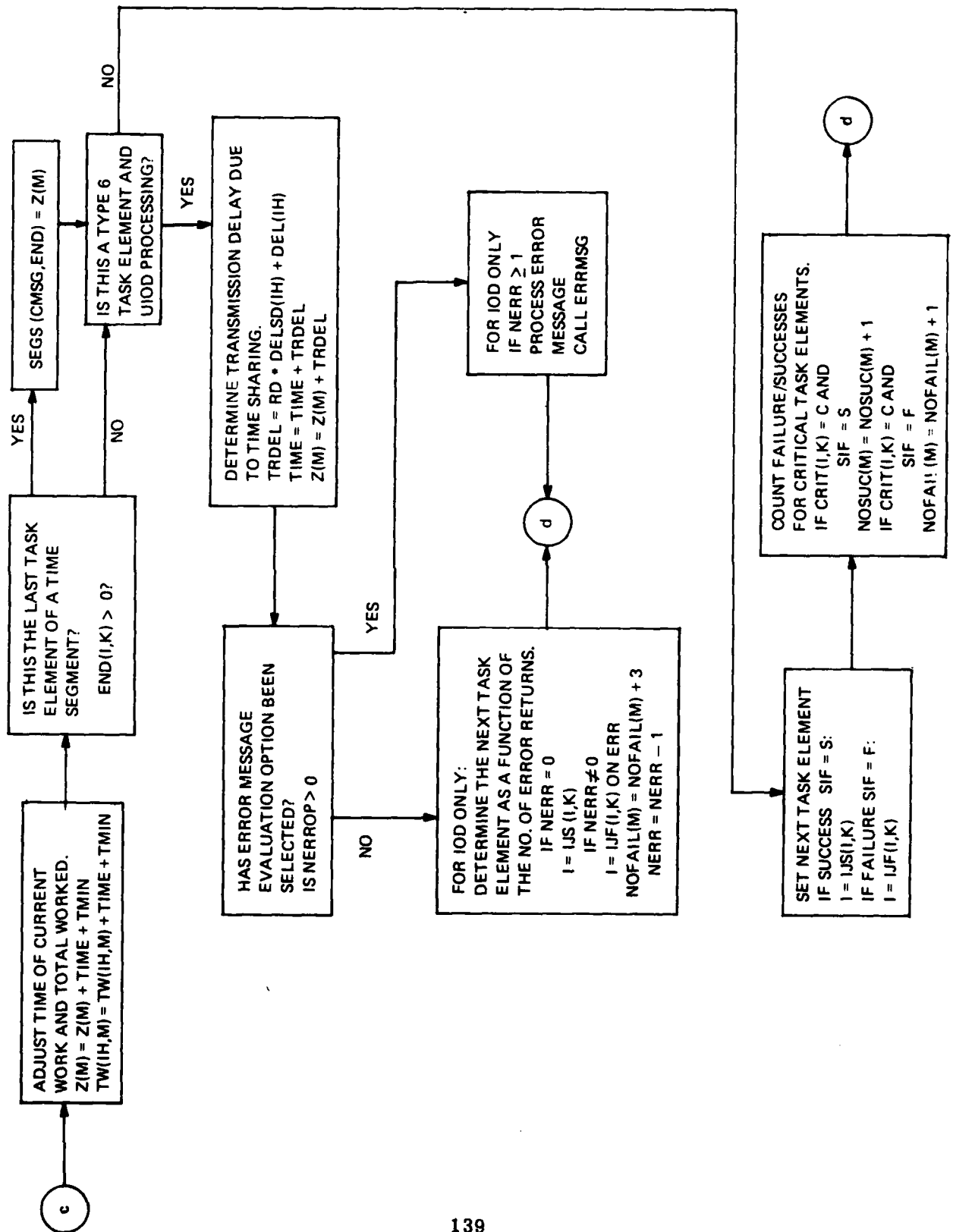
Operator Processing Subroutine

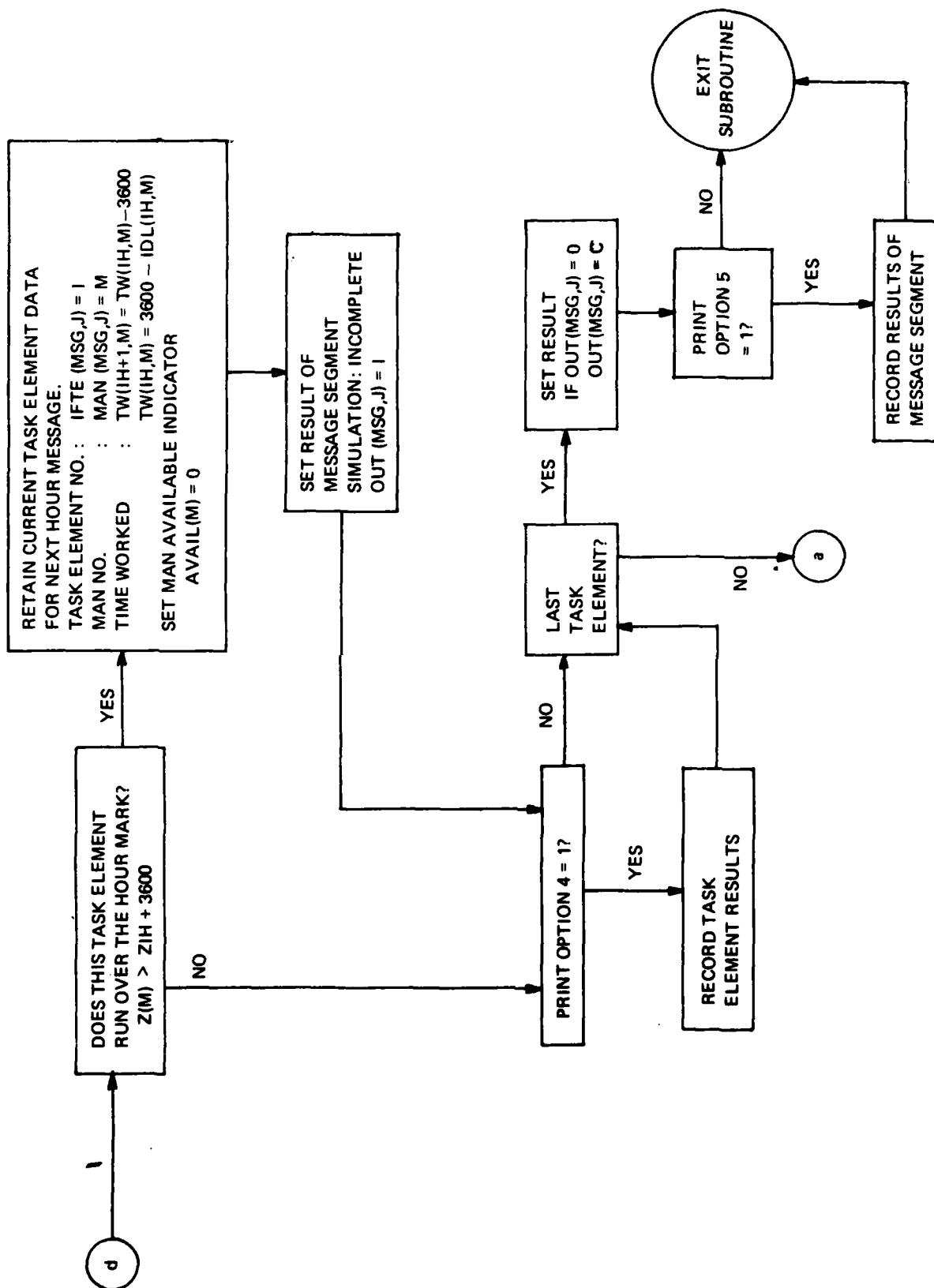
Note: All circled letters (except j) refer to logic points internal to this subroutine.



OPERATOR PROCESSING SUBROUTINE







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 1 Intelligence Material Dev Ofc, EWL, Ft Holabird  
 1 USA SE Signal Sch, Ft Gordon, ATTN: ATSO-EA  
 1 USA Chaplain Ctr & Sch, Ft Hamilton, ATTN: ATSC-TE-RD  
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 1 USA Armor Sch, Ft Knox, ATTN: ATSB-DI-E  
 1 USA Armor Sch, Ft Knox, ATTN: ATSB-DT-TP  
 1 USA Armor Sch, Ft Knox, ATTN: ATSB-CD-AD  
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 1 HQUSACDEC, Ft Ord, ATTN: ATEC-EX-E-Hum Factors  
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 1 USAEC, Ft Monmouth, ATTN: AMSEL-CT-HDP  
 1 USAEC, Ft Monmouth, ATTN: AMSEL-PA-P  
 1 USAEC, Ft Monmouth, ATTN: AMSEL-SI-CB  
 1 USAEC, Ft Monmouth, ATTN: C, Fac Dev Br  
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 1 USA Infantry Bd, Ft Benning, ATTN: STEBC-TE-T  
 1 USASMA, Ft Bliss, ATTN: ATSS-LRC  
 1 USA Air Def Sch, Ft Bliss, ATTN: ATSA-CTD-ME  
 1 USA Air Def Sch, Ft Bliss, ATTN: Tech Lib  
 1 USA Air Def Bd, Ft Bliss, ATTN: FILES  
 1 USA Air Def Bd, Ft Bliss, ATTN: STEBD-PO  
 1 USA Cmd & General Stf College, Ft Leavenworth, ATTN: Lib  
 1 USA Cmd & General Stf College, Ft Leavenworth, ATTN: ATSW-SE-L  
 1 USA Cmd & General Stf College, Ft Leavenworth, ATTN: Ed Advisor  
 1 USA Combined Arms Cmbt Dev Act, Ft Leavenworth, ATTN: DepCdr  
 1 USA Combined Arms Cmbt Dev Act, Ft Leavenworth, ATTN: CCS  
 1 USA Combined Arms Cmbt Dev Act, Ft Leavenworth, ATTN: ATCASA  
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 1 USAECOM, Night Vision Lab, Ft Belvoir, ATTN: AMSEL-NV-SD  
 3 USA Computer Sys Cnd, Ft Belvoir, ATTN: Tech Library  
 1 USAMERDC, Ft Belvoir, ATTN: STSFB-DQ  
 1 USA Eng Sch, Ft Belvoir, ATTN: Library  
 1 USA Topographic Lab, Ft Belvoir, ATTN: ETL-TD-S  
 1 USA Topographic Lab, Ft Belvoir, ATTN: STINFO Center  
 1 USA Topographic Lab, Ft Belvoir, ATTN: ETL-GSL  
 1 USA Intelligence Ctr & Sch, Ft Huachuca, ATTN: CTD-MS  
 1 USA Intelligence Ctr & Sch, Ft Huachuca, ATTN: ATS-CTD-MS  
 1 USA Intelligence Ctr & Sch, Ft Huachuca, ATTN: ATSI-TE  
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 1 CDR, HQ Ft Huachuca, ATTN: Tech Ref Div  
 2 CDR, USA Electronic Prog Grd, ATTN: STEEP-MT-S  
 1 HQ, TCATA, ATTN: Tech Library  
 1 HQ, TCATA, ATTN: AT CAT-OP-Q, Ft Hood  
 1 USA Recruiting Cnd, Ft Sheridan, ATTN: USARCPM-P  
 1 Senior Army Adv., USAFAGOD/TAC, Elgin AF Aux Fld No. 9  
 1 HQ, USARPAC, DCSPER, APO SF 96568, ATTN: GPPE-SE  
 1 Scimmon Lib, Academy of Health Sciences, Ft Sam Houston  
 1 Marine Corps Inst., ATTN: Dean-MCI  
 1 HQ, USMC, Commandant, ATTN: Code MTMT  
 1 HQ, USMC, Commandant, ATTN: Code MPI-20-28  
 2 USCG Academy, New London, ATTN: Admission  
 2 USCG Academy, New London, ATTN: Library  
 1 USCG Training Ctr, NY, ATTN: CO  
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 1 USCG, Psychol Res Br, DC, ATTN: GP 1/62  
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1 US Marine Corps Liaison Ofc, AMC, Alexandria, ATTN: AMCGS-F  
 1 USATRADOC, Ft Monroe, ATTN: ATRO-ED  
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 1 USATRADOC, Ft Monroe, ATTN: ATTS-EA  
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 1 HQUSA Aviation Sys Cmd, St Louis, ATTN: AMSAV-ZDR  
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 1 USA Air Def Sch, Ft Bliss, ATTN: ATSA TEM  
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 1 NAVAIRSTA, Norfolk, ATTN: Safety Ctr  
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 1 AFHRL (TT) Lowry AFB  
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 2 AFHRL (DOJZ) Brooks AFB  
 1 AFHRL (DOJN) Lackland AFB  
 1 HOUAF (IINYSO)  
 1 HOUAF (DPXXA)  
 1 AFVTG (RD) Randolph AFB  
 3 AMRL (HE) WPAFB, OH  
 2 AF Inst of Tech, WPAFB, OH, ATTN: ENE/SL  
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 1 AFOSR (NL), Arlington  
 1 AF Log Cmd, McClellan AFB, ATTN: ALC/DPCRB  
 1 Air Force Academy, CO, ATTN: Dept of Bel Scn  
 5 NavPers & Dev Ctr, San Diego  
 2 Navy Med Neuropsychiatric Rsch Unit, San Diego  
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