NATIONAL BUREAU OF STANDARDS REPORT

10 433

A SEARCH AND RESCUE SIMULATION MODEL FOR THE UNITED STATES COAST GUARD

VOLUME IV

PROGRAMMER LEVEL DOCUMENTATION FOR "OPSIM"

Sponsored by
U. S. Coast Guard

U.S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

NATIONAL BUREAU OF STANDARDS

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[1] Headquarters and Laboratories at Gaithersburg, Maryland, unless otherwise noted; mailing address Washington, D.C. 20234.
[2] Located at Boulder, Colorado 80302.
[3] Located at 5285 Port Royal Road, Springfield, Virginia 22151.

NATIONAL BUREAU OF STANDARDS REPORT

NBS PROJECT
4314561

June 1971

NBS REPORT
10 433

A SEARCH AND RESCUE SIMULATION MODEL FOR THE UNITED STATES COAST GUARD

VOLUME IV

PROGRAMMER LEVEL DOCUMENTATION FOR "OPSIM"

by
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PREFACE

This volume is one of a series which documents a Search and Rescue Simulation Model for the United States Coast Guard. The material reported in this documentation was developed by an interdisciplinary team at the National Bureau of Standards with representation from the U.S. Coast Guard under MIPR Z-70099-0-01935.

The complete documentation is comprised of the following:

Volume I Executive Level Documentation

Volume II Analyst Level Documentation

Volume III Programmer Level Documentation for "PREPROCESSOR"

Volume IV Programmer Level Documentation for "OPSIM"

Volume V Programmer Level Documentation for "POSTPROCESSOR"

Appendix A Flow Charts for Programmer Level Documentation

Appendix B Program Listings for Programmer Level Documentation

The study was initially conducted under the supervision of Martin J. Aronoff; subsequently efforts were supervised by Richard T. Penn, Jr. Technical Project Leadership was supplied throughout the project by Stephen S. Karp. Other participants from the National Bureau of Standards Technical Analysis Division included the following:

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I. Computer Program Listing for OPSIM

Computer listings for OPSIM are found in Appendix B (NBS Report No. 10436).

II. Definition Deck

Every Temporary Entity, Event Notice, Permanent Entity, Attribute, and Set must be described in the Definition Deck. A sample coding form for the Definition Deck is shown in Figure II-1. A listing of the Definition Deck used for OPSIM is included with the program listing For a detailed description of the Definition Deck preparation, the reader is referred to SIMSCRIPT A Simulation Programming Language by Markowitz, Hausner and Karr, Prentice-Hall, Inc., 1963.

Special mention should be made of the manner in which attributes are stored and packed. Packing allows more than one attribute to occupy a single word of computer storage. This is necessary in order to accommodate in core storage the large amount of information utilized by the simulation. Care must be taken, however, that the size of the stored attribute does not exceed the maximum allowable size for the packing code. It should be further noted that time information must be stored as floating point days. For maximum possible accuracy, all attributes which contain specific times (not durations) and other critical values should be stored in full words. The maximum size for several packing codes is shown in Figure II-2 below. This is an amended version of Table 2 found on page 107 of the above references. It should be noted that one-sixth (1/6) packing is also allowed for the UNIVAC 1108 system, but since it is not universally available, it has not been used for OPSIM.

For attributes of Permanent Entities the packing code is in column 44 of the Definition Card. For example the listing of the

PROGRAMMER _____

PROBLEM _____

DATE _____

SIMSCRIPT DEFINITION FORM

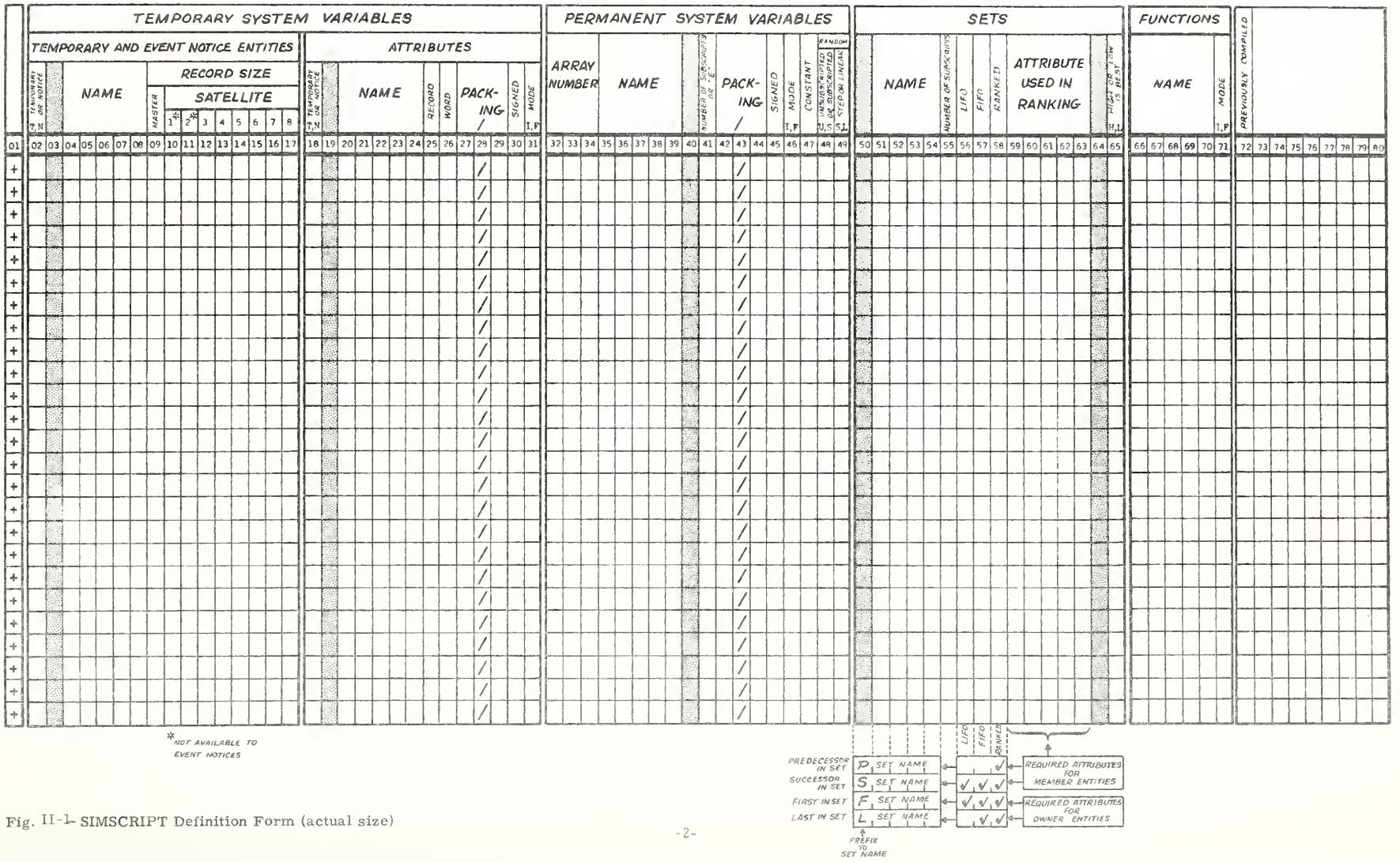

Fig. II-1- SIMSCRIPT Definition Form (actual size)

Maximum Size For Various Packing Codes

Packing Code	Position In Word	Maximum Integer Value Unsigned	Maximum Integer Value Signed	Approximate Maximum Floating Point Value Unsigned	Approximate Maximum Floating Point Value Signed
Blank or 1/1	full word	$2^{35} - 1$	$2^{35} - 1$	2^{-128} to 2^{127}	2^{-128} to 2^{127}
1/2	first half	131,071	131,071	2^{-32} to 2^{31}	2^{-16} to 2^{15}
2/2	second half	131,071	131,071	2^{-32} to 2^{31}	2^{-16} to 2^{15}
1/3	first third	4,095	2,047	Not Permitted	
2/3	second third	4,095	2,047		
3/3	last third	4,095	2,047		
1/4	first quarter	511	255		
2/4	second quarter	511	255		
3/4	third quarter	511	255		
4/4	fourth quarter	511	255		

FIGURE II -2

definition deck in the computer program listings shows the attribute COST being packed two to a word and the attribute STN being packed four to a word.

The attributes of temporary entities are stored in a different manner. Associated with each temporary entity are a "Master Record" and possibly several "Satellite Records". The number of words in the Master Record is found in column 9 and the number of words in each succeeding Sattelite Record follows in columns 10 through 17. There can be at most eight words per record. A particular word of any record may contain more than one different attribute. The storage code appears in columns 25 and 26 with the packing in columns 27-29. For example, the computer listing of the definition deck shows the CASE attribute COUNT with code 123/4 indicating that it is stored in the third quarter of the second word in the first satellite record. A zero or blank in column 25 indicates the master record. Two or more temporary entities and event notices may have attributes of the same name if that attribute occupies the same relative storage position. In this case the attribute name appears in the Definition Deck with only one of the temporary entities or event notices. A pictorial map of the storage layout for CASE, NOTE, NOTIF, and FLT is given below. The other event notices have short records and will not be mapped herein.

It should be noted that storage and retrieval times are somewhat greater for packed attributes than for unpacked ones, and also greater for attributes stored in Satellite Records than those in the Master Record.

A. The Temporary Entity CASE

RECORD	WORD				
0	1	SYTAG	ITOL	Reserved for	
	2	MMM	NNN	linkage to	
	3	XC		Satellite Records	
	4	POB	UTYPE	L	
	5	SIS	S2S	STATN	AIR
	6	OST		RESA	SWELL
	7	NEED	PRI	FLG	SIGNL
	8	PCQUE		SCQUE	
1	1	FPRI	REA	IDLOC	WIND
	2	NOINT	LOC	COUNT	IWAIT
	3	VIS	IS2	TQUE	
	4	NOCAS		OFSHR	
	5	FNSET		LNSET	
	6	FSRHS		LSRHS	
	7	GAMMA		SEXCS	
	8	XCX		YCY	
2	1	NQUE	CNRES	TSVC	
	2	TSM		TQUE1	
	3	COSTC		TWAIT	
	4	STINQ			
	5	TINQ			
	6	VALUE			
	7	OCCUR			
	8	YC		TINT	
3	1	ITOW	BOX	OPFAC	
	2	DMERT			

B. The Event Notice NOTIF

RECORD	WORD
0	1
	2
	3
	4
	5
	6
	7
	8

The first two words are used by Simscript timing routines.			
COMP	NUMBR	DELTA	
CAS		SNSET	
XHAND		YHAND	
OST		RESA	KRES
NEED	PRI	FLG	SIGNL
PCQUE		SCQUE	

C. The Event Notice NOTE

RECORD	WORD
0	1
	2
	3
	4
	5
	6
	7
	8

The first two words are used by Simscript timing routines.			
TS		SSRHS	
SM		ESAC	
SDAY	SFLAG	RSRC	
SLIST		RESA	SASG
blank	PRI	FLG	SIGNL
PCQUE		SCQUE	

D. The Temporary Entity FLT

RECORD	WORD			
0	1	HCREW		linkage to satellite record.
	2	XDEST		YDEST
	3	IDEV		ACASE
	4	TARVL		FITON
	5	XI		YI
	6	DEP		
	7	TFLT		
	8	RLS		
1	1	TOW	MFLG	TOWSP
	2	ROS		

```
C
C                              OPSIM DEFINITIONS
C
C
C ENT--CASE          -  INCOMING CASE TO OPERATIONAL SIMULATOR FROM
C                       EXOGENOUS EVENT TAPE; TEMPORARY ENTITY
C       AIR(CASE)    -  AIR TEMPERATURE AT TIME OF CASE
C       CNRES(CASE)  -  NUMBER OF RESOURCES INVOLVED IN SERVING CASE
C       COSTC(CASE)  -  TOTAL COST FOR CASE
C       COUNT(CASE)  -  NUMBER OF NOTIFS THAT HAVE BEEN COMPLETELY SERVED
C       DMERT(CASE)  -  CASE DEMERIT
C       FLG(CASE)    -  = 1; FLAG TO INDICATE SINGLE RESOURCE CASE IN QUE
C       FNSET(CASE)  -  FIRST NOTIF IN NSET(CASE)
C       FPRI(CASE)   -  INITIAL PRIORITY OF CASE
C       FSRHS(CASE)  -  FIRST NOTE IN SRHS(CASE)
C       GAMMA(CASE)  -  DEGREE OF NON-PARRELLELISM FOR MULTI-RESOURCE CASES
C       IDLOC(CASE)  -  DISTRICT LOCATION OF CASE
C       ISA(CASE)    -  THE ADDITIONAL RESOURCE NEEDED FOR A SHORT SEARCH
C                       (I.E. WHEN S2S(CASE) = 2)
C       ITOL(CASE)   -  = 0 IF CASE WAS NOT SERVED WITHIN TOLERANCE
C                       = 1 IF CASE WAS SERVED WITHIN TOLERANCE
C                       = 2 FIRST ARVSN OR ARSCH HAS NOT YET OCCURRED
C                       = 3 NO CAPABLE RESOURCE TYPES IN SYSTEM
C                       = 4 NO CAPABLE RESOURCE TYPES AT PRIMARY AND
C                           ADJACENT STATIONS
C                       = 5 NO CAPABLE RESOURCE AVAILABLE TO SERVE AIR ESCORT
C                       = 6 IMPOSSIBLE SET OF INPUT PARAMETERS; CASE PLACED
C                           IN EXCS
C                       = 7 FAILSAFE SWITCH IN THE EVENT A CASE TAKES AN
C                           IMPOSSIBLE ROUTE IN PROGRAM
C       ITOW(CASE)   -  IF THE CASE IS A MULTI-RESOURCE CASE WITH A TOW OR
C                       ESCORT NEED, EXOGENOUS EVENT OPSIM STORES THE TYPE OF
C                       TOW OR ESCORT NEED IN ITOW(CASE)
C       IWAIT(CASE)  -  = 0 NO RESOURCE IS RESPONSIBLE FOR COVERING
C                    -  =   NUMBER OF THE RESPONSIBLE RESOURCE COVERING
C       L(CASE)      -  LENGTH OF DISTRESSED UNIT
C       LNSET(CASE)  -  LAST NOTIF IN NSET(CASE)
C       LOC(CASE)    -  = 0 CASE HAS NOT BEEN FOUND
C                    -  = 1 CASE HAS BEEN FOUND
C       LSRHS(CASE)  -  LAST NOTE IN SRHS(CASE)
C       MMM(CASE)    -  NUMBER OF TOWS
C       NEED(CASE)   -  NEED OF SINGLE RESOURCE CASE
C       NNN(CASE)    -  NUMBER OF NEEDS EXCEPT LONG SEARCH AND TOW
C       NOCAS(CASE)  -  HISTORICAL CASE NUMBER
C       NOINT(CASE)  -  CASE INTERRUPT COUNT
C       NQUE(CASE)   -  TOTAL NUMBER OF TIMES THE CASE VISITED A QUEUE
C       NSET(CASE)   -  SET OF EVENT NOTICE ENTITIES CALLED NOTIF WHICH
C                       ARE CREATED FOR EACH NEED OF A MULTI-RESOURCE CASE
C       OCCUR(CASE)  -  TIME THAT CASE OCCURS
C       OFSHR(CASE)  -  DISTANCE OFFSHORE
C       OPFAC(CASE)  -  ORIGINAL STATION NUMBER OF CASE READ FROM INPUT TAPE
C       OST(CASE)    -  ON-SCENE-TIME FOR SINGLE RESOURCE CASE
C       PQUE(CASE)   -  PREDECESSOR IN QUE
C       POB(CASE)    -  NUMBER OF PEOPLE ON BOARD DISTRESSED UNIT
C       PRI(CASE)    -  FINAL PRIORITY OF CASE
C       REA(CASE)    -  FIRST REASON CASE GOES INTO QUEUE
C                       = 0 IF CASE WAS INTERRUPTED
C                       = 1 IF NO AVAILABLE RESOURCES
```

```
C                       = 2 IF CASE NEVER GOES INTO QUEUE
C       RESA(CASE)   -  FIRST RESOURCE SERVING CASE
C       S1S(CASE)    -  NUMBER OF SEARCH RESOURCES OPERATING IN PARALLEL
C       S2S(CASE)    -  = 0  NO SHORT SEARCH
C                       = 1  SHORT SEARCH BY ASSIGNED RESOURCE
C                       = 2  SHORT SEARCH BY ADDITIONAL RESOURCE
C       SCQUE(CASE)  -  SUCCESSOR IN CQUE
C       SEXCS(CASE)  -  SUCCESSOR IN EXCS
C       SIGNL(CASE)  -  INDICATES REASON FOR CASE BEING QUEUED
C                       = 0 QUEUED DUE TO NO AVAILABLE RESOURCES
C                       = 1 QUEUED DUE TO INTERRUPT
C       SRHS(CASE)   -  SET OF EVENT NOTICE ENTITIES CALLED NOTE WHICH ARE
C                       CREATED FOR EACH S1S(CASE) RESOURCES ON A LONG SEARCH
C       STATN(CASE)  -  STATION RECEIVING THE DISTRESS CALL; OPSIM CONVERTED
C                       STATION NUMBER
C       STINQ(CASE)  -  SIMULATED TIME INTERRUPTED NEED ENTERS CQUE
C       SWELL(CASE)  -  SEA SWELL AT TIME OF CASE
C       SYTAG(CASE)  -  = 0 IF THE CASE HAS NEVER CAUSED A STANDBY CREW TO
C                           BE CALLED
C                       = 1 IF THE CASE HAS CAUSED A STANDBY CREW TO BE
C                           CALLED
C       TINQ(CASE)   -  SIMULATED TIME AT WHICH CASE ENTERED CQUE
C       TINT(CASE)   -  TOTAL TIME IN INTERRUPT STATUS IN CQUE
C       TQUE(CASE)   -  TOTAL TIME CASE SPENDS IN CQUE
C       TQUE1(CASE)  -  TIME CASE SPENDS IN QUEUE PRIOR TO FIRST ARVSN OR
C                       ARSCH
C       TSM(CASE)    -  TOTAL SEARCH MILES ON A CASE
C       TSVC(CASE)   -  TOTAL TIME CASE SPENDS IN SYSTEM
C       TWAIT(CASE)  -  ACTUAL TIME FIRST ARSCH OCCURS - OCCUR(CASE) OR
C                       ACTUAL TIME FIRST ARVSN OCCURS - OCCUR(CASE)
C       UTYPE(CASE)  -  TYPE OF DISTRESSED UNIT
C       VALUE(CASE)  -  VALUE OF THE DISTRESSED UNIT
C       VIS(CASE)    -  VISIBILITY AT TIME OF CASE
C       WIND(CASE)   -  WIND AT TIME OF CASE
C       XC(CASE)     -  X COORDINATE -- CASE LOCATION
C       XCX(CASE)    -  X COORDINATE -- ORIGINAL CASE LOCATION
C       YC(CASE)     -  Y COORDINATE -- CASE LOCATION
C       YCY(CASE)    -  Y COORDINATE -- ORIGINAL CASE LOCATION
C
C ENT--NOTIF         -  EVENT NOTICE ENTITY CREATED TO READ IN A NEED OF A
C                       MULTI-RESOURCE CASE; EACH ENTITY--NOTIF--
C                       IS THEN PLACED INTO A FIFO SET--NSET(CASE)
C       CAS(NOTIF)   -  CASE NUMBER OF NOTIF
C       COMP(NOTIF)  -  STATUS OF NOTIF
C                       = 0 IF NOTIF HAS BEEN CAUSED
C                       = 1 IF NOTIF IS IN CQUE
C                       = 2 IF NOTIF IS BEING SERVED
C                       = 3 IF NOTIF IS COMPLETED
C                       = 4 IF NOTIF IS IN A CANCELLED STATE
C                       = 5 IF NOTIF IS CREATED BUT NOT CAUSED FOR THE
C                           SECOND TOW OF A CASE
C       DELTA(NOTIF)-   DELAY OF NEXT RESOURCE RELATIVE TO PREVIOUS RESOURCE
C       FLG(NOTIF)   -  = 2; FLAG TO INDICATE A MULTI-RESOURCE NEED IN CQUE
C       KRES(NOTIF)  -  RESOURCE SERVING NEED
C       NEED(NOTIF)  -  ONE NEED OF A MULTI-RESOURCE CASE
C       NUMBR(NOTIF)-   SEQUENTIAL NUMBER OF TOW
C       OST(NOTIF)   -  ON-SCENE-TIME OF NEED(NOTIF)
C       PCQUE(NOTIF)-   PREDECESSOR IN CQUE
```

```
C       PRI(NOTIF)  -  PRIORITY OF NOTIF
C       RESA(NOTIF) -  FIRST RESOURCE TO SERVE NEED
C       SCQUE(NOTIF)-  SUCCESSOR IN CQUE
C       SIGNL(NOTIF)-  INDICATES REASON FOR NOTIF BEING QUEUED
C                      = 0 QUEUED DUE TO NO AVAILABLE RESOURCES
C                      = 1 QUEUED DUE TO INTERRUPT
C                      = 2 NOTIF IS NOT IN THE QUEUE
C       SNSET(NOTIF)-  SUCCESSOR IN NSET
C       XHAND(NOTIF)-  X COORDINATE OF TOW HAND-OFF
C       YHAND(NOTIF)-  Y COORDINATE OF TOW HAND-OFF
C
C ENT--NOTE         -  EVENT NOTICE ENTITY CREATED FOR EACH OF SIS SEARCH
C                      RESOURCES ON A LONG SEARCH CASE; EACH ENTITY--NOTE--
C                      IS PLACED INTO A FIFO SET--SRHS(CASE)
C       ESAC(NOTE)  -  CASE NUMBER OF NOTE
C       FLG(NOTE)   -  = 3; FLAG TO INDICATE A SEARCH NEED IN CQUE
C       PCQUE(NOTE) -  PREDECESSOR IN CQUE
C       PRI(NOTE)   -  PRIORITY OF NOTE
C       RESA(NOTE)  -  FIRST RESOURCE TO SERVE SEARCH NEED
C       RSRC(NOTE)  -  RESOURCE SERVING SEARCH NEED
C       SASG(NOTE)  -  = 0 IF NO RESOURCE IS ASSIGNED TO THE SEARCH NEED
C                      DURING THE DAY
C                   -  = 1 IF A RESOURCE WAS ASSIGNED TO THE SEARCH NEED
C                      DURING THE DAY
C       SCQUE(NOTE) -  SUCESSOR IN CQUE
C       SDAY(NOTE)  -  DAY OF SEARCH
C       SFLAG(NOTE) -  FLAG TO INDICATE THAT THIS SEARCH NEED WAS SERVICED
C                      BY THE FIRST RESOURCE TO BE ASSIGNED TO THE CASE
C       SIGNL(NOTE) -  INDICATES REASON FOR NOTE BEING QUEUED
C                      = 0 QUEUED DUE TO NO AVAILABLE RESOURCES
C                      = 1 QUEUED DUE TO INTERRUPT
C                      = 2 NOTE IS NOT IN QUEUE
C       SLIST(NOTE) -  SUCCESSOR IN SLIST
C       SM(NOTE)    -  SEARCH MILES A SEARCH RESOURCE ATTEMPTS TO COMPLETE
C       TS(NOTE)    -  TIME SPENT ON SCENE SEARCHING
C
C ENT--FLT          -  TEMPORARY ENTITY CREATED WHEN A RESOURCE WITH
C                      EIAT = 0.0 IS ASSIGNED TO A CASE
C       ACASE(FLT)  -  CASE THAT RESOURCE IS SERVICING
C       DEP(FLT)    -  TIME RESOURCE LEFT LAST POINT TO HEAD IN IT'S
C                      PRESENT DIRECTION
C       FITON(FLT)  -  NOTIF OR NOTE IDENTIFICATION NUMBER
C       HCREW(FLT)  -  SET EQUAL TO 1 WHEN IDLE RES MUST RETURN TO
C                      IT'S HOME STATION DUE TO CREW AVAILABILITY STATUS
C                   -  SET EQUAL TO 2 WHEN AN IDLE RESOURCE MUST RETURN
C                      TO ITS HOME STATION TO REFUEL
C       IDEV(FLT)   -  IDENTIFICATION NUMBER OF UPCOMING ENDOGENOUS EVENT
C                      --ONSCN,ARSCH,ARVSN,COMPL,SSET,FUEL,HOME,HOMEF,
C                      SNDBK
C       MFLG(FLT)   -  FLAG TO INDICATE TYPE OF UPCOMING EVENT
C                      = 1  ARVSN
C                      = 2  ONSCN
C                      = 3  ARSCH
C                      = 4  COMPL
C                      = 5  SSET
C                      = 6  FUEL
C                      = 7  HOME
C                      = 8  HOMEF
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C                    = 9  NOTHING IS SCHEDULED
C                    =10  SNDBK
C                    =11  DELAY
C                    =12  READY
C                    =13  CHEKN
C      RLS(FLT)    -  EXPECTED LEAVE TIME
C      RVS(FLT)    -  ARRIVE ON SCENE TIME
C      TARVL(FLT)  -  TIME RESOURCE ARRIVES AT HOME STATION
C      TFLT(FLT)   -  TIME RESOURCE LEAVES HOME STATION
C      TOW(FLT)    -  TAG TO INDICATE RES IS PRESENTLY TOWING
C      TOWSP(FLT)  -  TOWING SPEED OF RES ON A PARTICULAR CASE
C      XDEST(FLT)  -  X COORDINATE -- DESTINATION OF RES ON ASSIGNMENT
C      YDEST(FLT)  -  Y COORDINATE -- DESTINATION OF RES ON ASSIGNMENT
C      XI(FLT)     -  X COORDINATE -- INTERRUPT LOCATION
C      YI(FLT)     -  Y COORDINATE -- INTERRUPT LOCATION
C
C ENT--RES         -  PERMANENT ENTITY WHERE NRES = NUMBER OF RESOURCES
C      COST(K)     -  COST OF RESOURCE K ON A GIVEN CASE
C      DVEC(K)     -  TIME IT TAKES RESOURCE K TO VECTOR TO THE CASE
C                     LOCATION PLUS THE DELAY TIME IT TAKES TO READY
C                     RESOURCE K
C      EIAT(K)     -  EXPECTED IDLE ALPHA TIME OF RESOURCE K
C      IB(K)       -  =0 IF RESOURCE K IS IDLE
C                  -  =1 IF RESOURCE K IS BUSY
C                  -  =2 IF RESOURCE K IS COVERING
C      IFLT(K)     -  IDENTIFICATION NUMBER OF TEMPORARY ENTITY--FLT--
C                     CREATED WHEN RESOURCE K IS ASSIGNED
C      NCASE(K)    -  TOTAL NUMBER OF CASES SERVED BY RESOURCE K
C      PR(K)       -  PERCENTAGE OF SEARCH MILES COMPLETED BEFORE SUNSET
C                     OR TOLRS BY RESOURCE K
C      PRIOR(K)    -  PRIORITY OF CASE TO WHICH RESOURCE K IS ASSIGNED
C      STN(K)      -  STATION TO WHICH RESOURCE K IS ASSIGNED
C      TUTIL(K)    -  TOTAL TIME RESOURCE K HAS (EIAT)NE(0.0) DURING THE
C                     PRESENT SHIFT
C      TVEC(K)     -  TIME IT TAKES RESOURCE K TO VECTOR TO CASE LOCATION
C      TYPE(K)     -  TYPE OF RESOURCE K
C      UTIL(K)     -  UTILIZATION OF RESOURCE
C      XR(K)       -  X COORDINATE -- LOCATION OF RESOURCE K
C      YR(K)       -  Y COORDINATE -- LOCATION OF RESOURCE K
C
C ENT--RST         -  PERMANENT ENTITY WHERE NRST = NUMBER OF RESOURCE TYPES
C      AUT(I)      -  AVERAGE UTILIZATION OF RESOURCE TYPE I IN DISTRICT
C      COSTD(I)    -  COST/DAY OF OPERATING RESOURCE TYPE I
C      DLAY(I)     -  DELAY TIME NECESSARY TO READY RESOURCE TYPE I AT
C                     IT'S HOME STATION
C      END(I)      -  ENDURANCE IN HOURS FOR RESOURCE TYPE I
C      MR(I)       -  MAINTAINABILITY/RELIABILITY OF RESOURCE TYPE I
C      RCOST(I)    -  RELATIVE COST RANKING OF RESOURCE TYPE I
C      SLIM(I)     -  SWELL LIMIT FOR SOA1(I) OF RESOURCE TYPE I
C      SOA1(I)     -  SPEED OF ADVANCE(WC1) OF RESOURCE TYPE I
C      SOA2(I)     -  SPEED OF ADVANCE(WC2) OF RESOURCE TYPE I
C      SOA3(I)     -  SEARCH SPEED OF ADVANCE OF RESOURCE TYPE I
C      SQTAG(I)    -  TAG TO DISTINGUISH SMALL SURFACE CRAFT, CUTTERS,
C                     C-130'S, AND OTHER AIRCRAFT
C                     = 0  IF TYPE IS A SMALL SURFACE CRAFT
C                     = 1  IF TYPE IS A CUTTER
C                     = 2  IF TYPE IS A C-130
C                     = 3  IF TYPE IS AN AIRCRAFT OTHER THAN A C-130
```

```
C       TF(I)        -  REFUEL TIME FOR RESOURCE TYPE I
C       VOP(I)       -  TAG TO INDICATE IF THE TYPE IS A BOAT OR AIRPLANE
C                       = 0  IF TYPE IS A BOAT
C                       = 1  IF TYPE IS AN AIRPLANE
C
C ENT--STA           -  PERMANENT ENTITY WHERE NSTA = NUMBER OF STATIONS
C                       IN THE DISTRICT
C       ACS(J,I)     -  COVERING AIR STATIONS OF STATION J - RAGGED TABLE
C       ADJS(J,I)    -  ADJACENT STATIONS OF STATION J - RAGGED TABLE
C       AVGTW(J)     -  AVERAGE TWAIT(CASE) OF STATION J
C       BCREW(J)     -  NUMBER OF BUSY CREWS AT STATION J
C       CFTT(J)      -  AVERAGE FAILURE TYPE C (TWAIT-TOL) AT STATION J
C       CUT(J,I)     -  RESPONSIBLE CUTTERS OF STATION J - RAGGED TABLE
C       DMRT(J)      -  NORMALIZED DEMERIT AT STATION J
C       FAIL1(J)     -  NUMBER OF FAILURE TYPE A'S AT STATION J
C       FAIL2(J)     -  NUMBER OF FAILURE TYPE B'S AT STATION J
C       FAIL3(J)     -  NUMBER OF FAILURE TYPE C'S AT STATION J
C       GRP(J)       -  GROUP NUMBER TO WHICH STATION J BELONGS
C       NACS(J)      -  NUMBER OF COVERING AIR STATIONS OF STATION J
C       NADJS(J)     -  NUMBER OF ADJ. STATIONS OF STATION J
C       NCAS(J)      -  NUMBER OF CASES SERVED BY STATION J
C       NCUT(J)      -  NUMBER OF RESPONSIBLE CUTTERS OF STATION J
C       NEEDS(J)     -  NUMBER OF NEEDS SERVED BY STATION J
C       NINTR(J)     -  NUMBER OF INTERRUPTIONS AT STATION J
C       NMBRQ(J)     -  SUM OF ALL NQUE(CASE) WHERE STATN(CASE) = J
C       NSTBY(J)     -  TOTAL NUMBER OF TIMES A STANDBY IS CALLED
C       PSTTN(J)     -  TAG TO INDICATE IF STATION J CAN/CANNOT BE A
C                       PRIMARY STATION OF A CASE
C                       = 0  STATION CANNOT BE A PRIMARY STATION
C                       = 1  STATION CAN BE A PRIMARY STATION
C       REST(J,I)    -  NUMBER OF RESOURCES OF TYPE I AT STATION J
C                       RAGGED TABLE
C       SHIFT(J,I)   -  CREW MANNING LEVEL DURING SHIFT I AT STATION J
C                       RAGGED TABLE
C       TWTOL(J)     -  AVERAGE POSITIVE (TWAIT-TOL) AT STATION J
C       UNPRO(J)     -  TOTAL NUMBER OF TIMES A STANDBY IS CALLED AND NOT
C                       USED (I.E., UNPRODUCTIVE CALL)
C       USE(J)       -  AVERAGE UTILIZATION OF RESOURCES AT STATION J
C       USHF(J,I)    -  UTILIZATION OF RESOURCES DURING SHIFT I AT STATION
C                       J; USHF(J,I) IS AN ATTRIBUTE OF BOTH STA AND WEWDS
C       VCTR(J)      -  AVERAGE TIME-TO-VECTOR AT STATION J
C       XS(J)        -  X COORDINATE -- STATION LOCATION
C       YS(J)        -  Y COORDINATE -- STATION LOCATION
C
C ENT--WEWDS         -  PERMANENT ENTITY WHERE NWEWDS = NUMBER OF WEEKEND
C                       SHIFTS + NUMBER OF WEEKDAY SHIFTS
C       AVUS(I)      -  AVERAGE UTILIZATION OVERALL (IN DISTRICT) DURING
C                       SHIFT I
C       TME(I)       -  TIME THAT SHIFT I ENDS
C       TOTME(I)     -  TOTAL SIMULATED TIME OF SHIFT I
C
C ENT--TOLER         -  PERMANENT ENTITY WHERE NTOLER = NUMBER OF SEVERITY
C                       LEVELS
C       TOL(I)       -  TOLERANCE TIME AT SEVERITY LEVEL I
C       TOLS(I)      -  SEARCH TOLERANCE TIME AT SEVERITY LEVEL I
C
C ENT--CPBL          -  PERMANENT ENTITY WHERE NCPBL = NUMBER OF CAPABILITIES
C       CAP(I)       -  OCTAL NUMBER REPRESENTING ONE ROW OF THE RESOURCE
```

```
C                     CAPABILITY MATRIX
C
C ENT--PRTM         -  PERMANENT ENTITY WHERE NPRTM = MAXIMUM VALUE OF
C                      ANY S1S(CASE)
C      PRTSM(I,J)   -  RAGGED TABLE; FRACTIONAL SPLIT OF TSM(CASE) AS A
C                      FUNCTION OF S1S(CASE)
C
C ENT--PATRL        -  PERMANENT ENTITY WHERE NPATRL = NUMBER OF PATROLLING
C                      CUTTERS
C      IPAT(I)      -  STATION NUMBER OF PATROLLING CUTTER
C
C ENT--SCNVT        -  PERMANENT ENTITY (STATION CONVERSION TABLE)
C      NSN(I)       -  CONVERTED STATION NUMBER FOR STATION I
C
C ENT--GROUP        -  PERMANENT ENTITY WHERE NGROUP = NUMBER OF GROUPS
C      AVDRT(I)     -  NORMALIZED DEMERIT OF GROUP(I)
C      CS(I)        -  NUMBER OF CASES SERVED BY GROUP(I)
C      FL1(I)       -  NUMBER OF FAILURE TYPE A'S IN GROUP(I)
C      FL2(I)       -  NUMBER OF FAILURE TYPE B'S IN GROUP(I)
C      FL3(I)       -  NUMBER OF FAILURE TYPE C'S IN GROUP(I)
C      INTRP(I)     -  NUMBER OF INTERRUPTS IN GROUP(I)
C      NDS(I)       -  NUMBER OF NEEDS SERVED BY GROUP(I)
C      NONPR(I)     -  TOTAL NUMBER OF UNPRODUCTIVE STANDBY CALL-UPS IN GROUP( )
C      NOSB(I)      -  TOTAL NUMBER OF TIMES A STANDBY WAS CALLED IN GROUP(I)
C      TMTAV(I)     -  AVERAGE POSITIVE (TWAIT-TOL) OF GROUP(I)
C      TVAVG(I)     -  AVERAGE TIME-TO-VECTOR OF GROUP(I)
C      TWAVG(I)     -  AVERAGE TWAIT(CASE) OF GROUP(I)
C      USEAV(I)     -  AVERAGE UTILIZATION OF RESOURCES IN GROUP(I)
C
C ENT--DSTRB        -  PERMANENT ENTITY WHERE NDSTRB = NUMBER OF
C                      DISTRIBUTIONS OUTPUT IN REPORT GENERATORS
C      MEEN(DSTRB)  -  MEAN
C      CNTR(DSTRB)  -  COUNTER
C      STDEV(DSTRB)-   STANDARD DEVIATION
C      CATG1(DSTRB)-   FREQUENCY OF EXPRESSION BEING IN A RANGE
C                      > OR = 0.0 AND < OR = 0.5
C      CATG2(DSTRB)-   FREQUENCY OF EXPRESSION BEING IN A RANGE
C                      > 0.5 AND < OR = 1.0
C      CATG3(DSTRB)-   FREQUENCY OF EXPRESSION BEING IN A RANGE
C                      > 1.0 AND < OR = 2.0
C      CATG4(DSTRB)-   FREQUENCY OF EXPRESSION BEING IN A RANGE
C                      > 2.0 AND < OR = 3.0
C      CATG5(DSTRB)-   FREQUENCY OF EXPRESSION BEING IN A RANGE
C                      > 3.0 AND < OR = 4.0
C      CATG6(DSTRB)-   FREQUENCY OF EXPRESSION BEING IN A RANGE
C                      > 4.0 AND < OR = 5.0
C      CATG7(DSTRB)-   FREQUENCY OF EXPRESSION BEING IN A RANGE
C                      > 5.0 AND < OR = 10.0
C      CATG8(DSTRB)-   FREQUENCY OF EXPRESSION BEING IN A RANGE
C                      > 10.0
C
C ENT--HLDY         -  PERMANENT ENTITY WHERE NHLDY = NUMBER OF HOLIDAYS
C      HOLID(I)     -  DAY OF HOLIDAY I
C                      NOTE:  THE OPERATIONAL SIMULATOR CONSIDERS THE FIRST
C                      DAY AS DAY ZERO.  THEREFORE, IF THE MONTH OF JULY WAS
C                      BEING SIMULATED, JULY 4 WOULD BE INPUT AS DAY 3.
C                      IF THE TWO MONTHS OF JUNE AND JULY WERE BEING
C                      SIMULATED, JULY 4 WOULD BE INPUT AS DAY 33.
```

```
C
C ENT--ARSCH        -  EVENT NOTICE ENTITY OCCURRING WHEN A RESOURCE
C                      ARRIVES ON SCENE TO SEARCH
C      LNOTE(ARSCH)-  NOTE IDENTIFICATION NUMBER
C      LRES(ARSCH) -  RES IDENTIFICATION NUMBER
C      LFLG(ARSCH) -  = 1 IF ARSCH WAS CAUSED FOR THE FIRST RESOURCE TO
C                         SEARCH
C                     = 2 IF ARSCH WAS CAUSED FOR ANY RESOURCE EXCEPT
C                         THE FIRST
C
C ENT--ARVSN        -  EVENT NOTICE ENTITY OCCURRING WHEN A RESOURCE
C                      ARRIVES ON SCENE
C      CASNO(ARVSN)-  CASE IDENTIFICATION NUMBER
C      RESNO(ARVSN)-  RESOURCE IDENTIFICATION NUMBER
C
C ENT--CHEKN        -  EVENT NOTICE ENTITY OCCURRING WHEN A 'COVERING'
C                      RESOURCE EXAMINES THE QUEUE; THE RESOURCE WILL EITHER
C                      SERVE A NEED IN THE QUEUE IF CAPABLE OR REMAIN
C                      'COVERING' ON HIS PRESENTLY ASSIGNED CASE
C      CASNO(CHEKN)-  CASE IDENTIFICATION NUMBER
C      RESNO(CHEKN)-  RESOURCE IDENTIFICATION NUMBER
C
C ENT--COMPL        -  EVENT NOTICE ENTITY OCCURRING WHEN A RESOURCE
C                      COMPLETES A SEARCH NEED
C      NCMPL(COMPL)-  NOTE IDENTIFICATION NUMBER
C      RCMPL(COMPL)-  RESOURCE IDENTIFICATION NUMBER
C
C ENT--DELAY        -  EVENT NOTICE ENTITY OCCURRING WHEN A RESOURCE STARTS
C                      TO VECTOR TO THE SCENE OF A CASE (LONG SEARCH NEEDS
C                      EXCLUDED) AFTER HAVING BEEN DELAYED FOR READYING
C      CASNO(DELAY)-  CASE IDENTIFICATION NUMBER
C      RESNO(DELAY)-  RESOURCE IDENTIFICATION NUMBER
C
C ENT--FUEL         -  EVENT NOTICE ENTITY OCCURRING WHEN A RESOURCE
C                      MUST LEAVE CASE TO REFUEL
C      NFUEL(FUEL) -  NOTE IDENTIFICATION NUMBER
C      RFUEL(FUEL) -  RESOURCE IDENTIFICATION NUMBER
C
C ENT--HOME         -  EVENT NOTICE ENTITY OCCURRING WHEN A RESOURCE
C                      ARRIVES AT HIS HOME STATION
C      RESNO(HOME) -  RESOURCE IDENTIFICATION NUMBER
C
C ENT--HOMEF        -  EVENT NOTICE ENTITY OCCURRING WHEN A RESOURCE
C                      ARRIVES AT HIS HOME STATION TO REFUEL
C      NHOM(HOMEF) -  NOTE IDENTIFICATION NUMBER
C      RHOM(HOMEF) -  RESOURCE IDENTIFICATION NUMBER
C
C ENT--NUCRU        -  EVENT NOTICE ENTITY OCCURRING AT THE SHIFT CHANGE
C
C ENT--ONSCN        -  EVENT NOTICE ENTITY OCCURRING AT PRIORITY
C                      REEVALUATION TIME
C      CASNO(ONSCN)-  CASE IDENTIFICATION NUMBER
C      RESNO(ONSCN)-  RESOURCE IDENTIFICATION NUMBER
C
C ENT--READY        -  EVENT NOTICE ENTITY OCCURRING WHEN A RESOURCE STARTS
C                      TO VECTOR TO THE SCENE OF A LONG SEARCH NEED AFTER
C                      HAVING BEEN DELAYED FOR READYING
C      NREAD(READY)-  NOTE IDENTIFICATION NUMBER
```

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C      RREAD(READY)-  RESOURCE IDENTIFICATION NUMBER
C      FREAD(READY)-  = 1  IF READY WAS CAUSED FOR THE FIRST RESOURCE TO
C                          SEARCH
C                     = 2  IF READY WAS CAUSED FOR ANY BUT THE FIRST
C                          RESOURCE TO SEARCH
C
C ENT--SNDBK        -  EVENT NOTICE ENTITY OCCURRING AT END OF REFUELING
C                      TIME OF RESOURCE SERVING A LONG SEARCH NEED; THE
C                      RESOURCE IS VECTORED BACK TO THE SEARCH SCENE
C      NSDBK(SNDBK)-  NOTE IDENTIFICATION NUMBER
C      RSDBK(SNDBK)-  RESOURCE IDENTIFICATION NUMBER
C
C ENT--SRISE        -  EVENT NOTICE ENTITY OCCURRING AT SUNRISE-XXX AT
C                      WHICH TIME THE SUNRISE LIST IS EXAMINED AND
C                      RESOURCES ARE VECTORED TO ARRIVE ON THE SEARCH
C                      SCENE AT SUNRISE OR SOON THEREAFTER
C
C ENT--SSET         -  EVENT NOTICE ENTITY OCCURRING AT SUNSET TO UPDATE
C                      SM(NOTE) OF AN INCOMPLETED SEARCH NEED AND TO FILE
C                      THAT SEARCH NEED IN THE SUNRISE LIST
C      ETON(SSET)  -  NOTE IDENTIFICATION NUMBER
C      SER(SSET)   -  RESOURCE IDENTIFICATION NUMBER
C
C ENT--STNBY        -  EVENT NOTICE ENTITY OCCURRING WHEN A STANDBY CREW
C                      ARRIVES AT ITS' STATION
C      STAT(STNBY) -  IDENTIFICATION NUMBER OF STATION AT WHICH STANDBY
C                      CREW ARRIVES
C
C ENT--XSET         -  EVENT NOTICE ENTITY OCCURRING AT SUNSET EACH DAY;
C                      QUEUED LONG SEARCH CASES ARE REMOVED FROM THE CASE
C                      QUEUE (CQUE) AND PLACED IN THE SUNRISE LIST (LIST)
C
C
C      AIRU         -  AVERAGE UTILIZATION OF AIRCRAFT (EXCLUDING C-130'S)
C      AVUTO        -  AVERAGE UTILIZATION OF RESOURCES OVERALL
C      BUTIL        -  AVERAGE UTILIZATION OF BOATS
C      CL           -  CREW LEVEL AT WHICH STAND-BY CREW IS CALLED
C                      = -1 STANDBY CREWS WILL NEVER BE CALLED
C                      =  0 STANDBY CREW WILL BE CALLED IF SYTAG(CASE)=0
C                           AND THERE IS NO CREW AVAILABLE TO SERVE THE
C                           INCOMING CASE
C                      =  1 STANDBY CREW WILL BE CALLED IF SYTAG(CASE)=0
C                           AND THE LAST AVAILABLE CREW AT THE STATION IS
C                           BEING ASSIGNED TO THE INCOMING CASE; ALSO A
C                           STANDBY CREW WILL BE CALLED IF SYTAG(CASE)=0
C                           AND THERE IS NO CREW AVAILABLE TO SERVE THE
C                           INCOMING CASE
C      CLLCT        -  SYSTEM ATTRIBUTE USED TO COLLECT DAILY UTILIZATIONS
C      COSTO        -  OPTION FOR DETERMINING INCREASING COST
C                      = 0  IF USING RELATIVE COST RANKING
C                      = 1  IF USING COST/DAY * TVEC(RES)
C      CQUE         -  CASE QUEUE RANKED BY PRIORITY AND TIME
C      CSET         -  SET OF RESOURCES RANKED BY COST
C      CUTIL        -  AVERAGE UTILIZATION OF CUTTERS
C      C130U        -  AVERAGE UTILIZATION OF C-130'S
C      DIST         -  DISTRICT BEING EXERCISED
C      EPSLN        -  SMALL TIME INCREMENT
C      EXCS         -  SET OF CASES THAT CANNOT BE SERVED; VALUE OF
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C                    ITOL(CASE) INDICATES WHY CASE CANNOT BE SERVED
C       HO         - USER INPUT; THE DISTANCE OFFSHORE (EXPRESSED IN
C                    NAUTICAL MILES) WHERE THE HAND-OFF FOR A TWO PART
C                    TOW TAKES PLACE
C       IDELT      - INCREMENT TO PRIORITY OF INTERRUPTED CASE
C       IFDAY      - DAY OF THE WEEK ON WHICH SIMULATION BEGINS
C                    (MON.=1, TUES.=2, ETC.)  USER INPUT
C       IMO        - CALCULATED BY THE PROGRAM; USED TO LOCATE MONDAYS
C       ISA        - CALCULATED BY THE PROGRAM; USED TO LOCATE SATURDAYS
C       KKK        - NUMBER OF LOOKS AT PRIORITY REEVALUATION (USER
C                    INPUT-FLOATING POINT)
C       KOUNT      - COUNTER FOR THE NUMBER OF CASES IN THE SYSTEM;
C                    KOUNT IS INCREASED BY 1 WHEN A CASE ENTERS THE
C                    SYSTEM AND DECREASED BY 1 WHEN A CASE IS DESTROYED
C       LIMIT      - UPPER LIMIT FOR NUMBER OF CASES ALLOWED IN SYSTEM
C                    SIMULTANEOUSLY
C       LIST       - A LIST OF HELD-OVER SEARCH CASES WHICH ARE
C                    EXAMINED AT SUNRISE-XRX
C       MCFTT      - AVERAGE FAILURE TYPE C (TWAIT-TOL) IN DISTRICT
C       MEAND      - NORMALIZED DEMERIT IN DISTRICT
C       MEANV      - AVERAGE TIME-TO-VECTOR IN DISTRICT
C       MEANW      - AVERAGE TWAIT(CASE) IN DISTRICT
C       MNTMT      - AVERAGE POSITIVE (TWAIT-TOL) IN DISTRICT
C       NBRCO      - TOTAL NUMBER OF CASES THAT WERE COMPLETED
C       NBRCS      - TOTAL NUMBER OF CASES THAT OCCURRED
C        BRFA      - NUMBER OF FAILURE TYPE A'S IN DISTRICT
C       NBRFB      - NUMBER OF FAILURE TYPE B'S IN DISTRICT
C       NBRFC      - NUMBER OF FAILURE TYPE C'S IN DISTRICT
C       NWD        - NUMBER OF WEEKDAY SHIFTS
C       NWE        - NUMBER OF WEEKEND SHIFTS
C       PDC1       - PERCENTAGE OF SM(I) DESIRABLE TO ACHIEVE, BY EACH
C                    RESOURCE, ON THE FIRST DAY OF THE SEARCH
C       PDC2       - PERCENTAGE OF SM(I) DESIRABLE TO ACHIEVE, BY EACH
C                    RESOURCE, ON ANY BUT THE FIRST DAY OF THE SEARCH
C       PRDN       - PROBABILITY THAT PRIORITY WILL DECREASE WHEN
C                    REEVALUATED
C       PRUP       - PROBABILITY THAT PRIORITY WILL INCREASE WHEN
C                    REEVALUATED
C       PRTOT      - OUTPUT OPTION FOR THE PRINTING OF THE 'CASE CREATED'
C                    AND 'CASE TERMINATED' INFORMATION
C                    = 0  DO NOT PRINT
C                    = 1  PRINT
C       PSET       - SET OF RESOURCES RANKED ON DECREASING PR
C       PSHFT      - NUMBER OF PRESENT SHIFT
C       RAP        - RESOURCE ASSIGNMENT POLICY - USER SELECTED
C                    = 1  -  P,A,PI,AI,Q
C                    = 2  -  P,PI,A,AI,Q
C                    = 3  -  (P+A),(P+A)I,Q
C                    = 4  -  P,PI,Q
C                    = 5  -  P,Q
C                    = 6  -  P,A,Q
C       RISE       - SUNRISE (USER INPUT)
C       RQUE       - SET OF ORDERED RESOURCES
C       SET        - SUNSET (USER INPUT)
C       SNEED      - TOTAL NUMBER OF NEEDS THAT OCCURRED
C       STAPE      - SWITCH FOR TAPE WRITE
C                    = 0; PROGRAM WILL NOT WRITE CASE INFORMATION ON TAPE
C                    =    NUMBER OF THE LOGICAL UNIT ON WHICH CASE
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C                    INFORMATION WILL BE WRITTEN
C       S2PRI      - SEVERITY LEVEL TO WHICH CASE IS RAISED WHILE
C                    A SHORT SEARCH IS BEING SERVED
C       TCHEK      - THE HOURS BETWEEN CHECK-IN TIMES WHEN A 'COVERING'
C                    RESOURCE EXAMINES THE QUEUE; USER INPUT
C       THOOK      - USER INPUT; HOOK-UP TIME ON A TOW CASE
C       TIME       - CURRENT SIMULATED CLOCK TIME
C       TLAST      - TIME AT WHICH THE PRESENT SHIFT BEGAN
C       TOSBY      - TOTAL NUMBER OF TIMES A STANDBY CREW WAS CALLED IN
C                    THE DISTRICT
C       TOTIN      - TOTAL NUMBER OF INTERRUPTED CASES IN DISTRICT
C       TPRI       - MINIMUM PRIORITY AT WHICH A QUEUED NEED OR CASE
C                    IS SERVED BY AN IDLE 'CAPABLE' RESOURCE REGARDLESS
C                    OF THE RESOURCE'S TYPE; USER INPUT
C       TSET       - SET OF RESOURCES RANKED BY TVEC
C       TSP1       - TOW SPEED OF RESOURCES IF L(CASE) IS LESS THAN OR
C                    EQUAL TO 26 FEET
C       TSP2       - TOW SPEED OF RESOURCES IF L(CASE) > 26 FEET
C       TUNPR      - TOTAL NUMBER OF TIMES A STANDBY CREW WAS CALLED
C                    BUT NOT USED IN THE DISTRICT
C       XRX        - THE HOURS BEFORE SUNRISE WHEN HELD OVER SEARCH
C                    CASES ARE EXAMINED FOR RESOURCE ASSIGNMENT (USER
C                    INPUT)
```

III. OPSIM Subroutines and Event Routines

A. Brief description of each routine:

1. Exogenous Event START occurs at TIME = 0.0. The system attribute LIMIT is calculated. The station, resource type, X coordinate and Y coordinate of all resources are set. A Saturday indicator, ISA, and a Monday indicator, IMO are calculated using IFDAY, the first day of the simulation. PSHFT, the present shift, is set after checking IFDAY and the possibility that the first day may be a holiday. The first crew change, the first sunrise and the first sunset are created and caused to occur at the appropriate future times.

2. Endogenous Event NUCRU occurs when there is a change of shift. Utilization data is accumulated for TUTIL, UTIL, USHF and CLLCT. If it is the last shift change of the day, weekend or weekday daily utilization statistics are also collected. PSHFT is updated and an event notice for another NUCRU is caused at the end of the next shift.

The case queue is examined in NUCRU for single resource cases, multi-resource needs and long search needs that can be served by idle resources.

3. Exogenous Event OPSIM creates a temporary entity, CASE, for the incoming case. Attributes of the case are read from the exogenous event tape. The primary station of the case, which is stored in STATN (CASE), is among the input data received from the preprocessor. Note that there is not necessarily a one-to-one correspondence between the preprocessor and operational simulator station numbers; therefore, STATN(CASE) is converted to the correct OPSIM station number. After

this initial conversion, STATN(CASE) may be changed again in an effort to determine the best primary station of the case. If STATN(CASE) was converted to a zero value (meaning that the preprocessor station did not exist as such in the operational simulator), STATN(CASE) is set equal to the nearest OPSIM station in the district that is capable of being a primary station. If STATN (CASE) was converted to an existing operational simulator station that is capable of being a primary, STATN(CASE) is set equal to the nearest station capable of being a primary in a set which includes the primary and all of its adjacents. If STATN(CASE) was converted to an existing operational simulator station that is not capable of being a primary, STATN(CASE) is set equal to the nearest OPSIM station in the district that can be a primary.

Impossible combinations of case attributes are checked for, and if any are found, the case is filed into the exceptional cases set, EXCS. Exogenous Event OPSIM calls Subroutine SRCH for cases with long searches, calls Subroutine SRAS for single resource cases and calls Subroutine MRAS for multi-resource cases.

4. Subroutine SRAS serves as a driver for single resource cases. That is, it calls all necessary subroutines to find an ordered set of resources, to select one of those resources and to serve the case.

5. Subroutine CRES determines all resources capable of serving a single resource case, a multi-resource need or a long search need. To obtain the resource types capable of serving a case, Subroutine CRES first determines six applicable rows of the Resource Capability Matrix from the values SWELL(CASE), WIND(CASE), VIS(CASE), AIR(CASE), OFSHR(CASE), and NEED(CASE). These six rows (The rows of the

Resource Capability Matrix are input as octal numbers in the Initialization Deck. See Section II, Part IV.) are "AND"ed using the FORTRAN AND function to yield a final answer giving all the capable resource types which are stored in IRAY1. Next, Subroutine CRES determines all stations that can serve a case and stores them in IRAY2. All resources that meet the resource type and station requirements are then filed into RQUE. Note that if the number of resource types is ever input greater than twenty, Subroutine CRES must be recompiled and reassembled to increase the dimension of IRAY1. In like manner, if it is ever anticipated that the number of stations capable of serving a case may exceed thirty, the dimension of IRAY2 must be increased.

6. Subroutine VEC calculates TVEC (time-to-vector to the incoming case) for each resource in RQUE. Note that time-to-vector (TVEC) is a function of the location of the resource and speed of the resource's type, which in turn is a function of swell(SWELL).

7. Subroutine OSET orders the capable resources in RQUE. DVEC is set equal to TVEC (time-to-vector) for each capable resource. However, if the resource is idle at it's home station, DVEC is redefined to be TVEC + DLAY (a delay time necessary to ready the resource). Those resources with a DVEC less than or equal to the tolerance of the priority of the case are filed into the set, CSET, which is ranked on the attribute CØST with low value considered best. Before the resource is filed into CSET, the attribute COST is set according to the cost option (COSTO). If the COSTO is equal to zero, COST of the resource is set equal to the relative cost ranking of the type

of the resource. If COSTO is equal to one, COST of the resource is set equal to the cost per day (COSTD) of the type of the resource times the time-to-vector (TVEC). Those resources that cannot vector to the case within tolerance are filed into the set, TSET,which is ranked on the attribute DVEC with low value considered best. The two sets are then merged; all resources in CSET are filed into RQUE and then all resources in TSET are filed into RQUE.

8. Subroutine RESAP searches for a resource in RQUE to serve a single resource case, a multi-resource need or a long search need. It is divided into eight main sections: (1) searching for an idle resource at the primary station, (2) searching for an idle resource in RQUE, (3) searching for an idle resource at an adjacent station, (4) searching for a resource that can be interrupted at the primary station, (5) searching for a resource that can be interrupted at an adjacent station, (6) searching for a resource that can be interrupted in RQUE, (7) setting JRS = 0 to indicate to the calling subroutine that no resource is immediately available, and (8) printing an error message for any impossible route. The sequence for exercising these sections is determined by the user input variable, RAP (Resource Assignment Policy.) As an example, if RAP = 2, sections 1, 4, 3, 5 and 7 are exercised in that order. If at any point a resource is found in sections 1, 4, 3 or 5, Subroutine RESAP returns the number of that resource to the calling subroutine and subsequent sections are not executed. Note that primary station in this explanation of RESAP includes the aircraft covering stations

of the primary and the covering cutters of the primary. Moreover, "adjacent station" includes the aircraft covering stations of the adjacent and the covering cutters of the adjacent.

9. Subroutine ROCA determines both if the resource, selected by Subroutine RESAP, is operational and if there is an available crew. A standby crew may be called if the number of crews at the station of the resource has decreased to the user input value of CL (crew level at which a standby crew is called) and if the case has not previously caused a standby to occur. Note that if CL is equal to -1, standby crews will never be called.

10. Subroutine MRAS is called for every multi-resource case. It establishes timing and causes an Event Notice NOTIF for non-tow needs. If the case requires a tow, Subroutine TOW is called.

11. Endogenous Event NOTIF calls the routines (CRES, VEC, OSET, and RESAP) necessary to locate a resource which can serve a single need of a multi-resource case. If no capable resource exists, Subroutine WRECK is called to destroy the case. If no capable resource is available, the need associated with the NOTIF is filed in the queue CQUE via a call to Subroutine QUEUE. If a capable resource is available, Subroutine SERVE is called.

12. Subroutine TOW creates an Event Notice NOTIF for each tow need of a multi-resource case. It determines the distance and destination of the tow via a call to Subroutine DTD. This information is used to establish hand-off coordinates. If there are no non-tow needs, the first tow NOTIF is caused. (If there are non-tow needs, the first tow NOTIF is caused in Endogenous Event ONSCN.)

13. Subroutine DTD determines the final destination for tow cases. The destination is the primary station of the case unless the primary station is a patrol. In this case the destination is the (first) adjacent station of the primary station. The total distance of the tow is also calculated.)

14. Subroutine SRCH creates an Event Notice NOTE for each long search need. If it is night time (i.e., the present time is greater than or equal to sunset and less than the time at which the sunrise list is examined), Subroutine SRCH attempts to serve the first search need. All remaining search needs are filed into LIST - the sunrise list. If it is daytime, Subroutine SRCH attempts to serve the first search need. All other search needs are caused to occur at TIME + EPSLN, where EPSIN, a user input, is a small time delay usually set to two minutes.

15. Endogenous Event NOTE occurs at TIME + EPSLN for all but the first search need of a long search case that occurs during the daytime. An attempt is made to serve the need. If no resource is available, the search need is filed into CQUE.

16. Subroutine SASS orders the resources in RQUE for search needs only. A call is made to Subroutine CRES to gather all capable resources in the set RQUE. Subroutine VEC is called to calculate TVEC for each resource in RQUE. The local variable TOLRS is set equal to the search tolerance of the priority of the case. If, however, the present time plus the search tolerance of the case priority is greater than the next sunset, TOLRS is redefined to be sunset minus the present time. (Note that this redefinition of TOLRS is used only

in the calculation of PR for airplanes and not in the PR calculation for small boats and cutters.) PR (percentage of search miles that a resource is capable of completing before sunset or within the search tolerance time of the case priority) is then calculated for each resource in RQUE. Those resources that can complete the desired percentage of search miles are filed into CSET. Resources that cannot complete the desired percentage of search miles, but have a PR value greater then 0.0 are filed into PSET which is ranked on the attribute PR with high value considered best. The remaining resources with a PR value of 0.0 are filed into TSET if they meet an endurance check. The three sets are then merged into RQUE.

17. Subroutine SSS is the service routine for long search needs. RES and FLT attributes are updated. Any previously scheduled future event for the resource serving the long search need is cancelled and destroyed. If the resource was idle at its home station when chosen, an Endogenous Event READY is created and caused. If, however, the resource was not at its' home station, an Endogenous Event ARSCH is created and caused for the resource serving the long search need.

18. Endogenous Event READY occurs at the end of the delay time necessary to ready a resource at it's home station before serving a long search need. TVEC (time-to-vector) is calculated, DEP (departure time) is set, XDEST (X coordinate of destination) is set, and YDEST (Y coordinate of destination) is set. An Endogenous Event ARSCH is created and caused to occur at TIME + TVEC.

19. Endogenous Event ARSCH occurs when a resource arrives on scene to serve a long search need. Depending on the endurance of the resource and the present time, one of three possible future events - FUEL, SSET or COMPL - is created and caused to occur.

20. Endogenous Event COMPL occurs when a long search need is completed. A check is made to determine if all long search needs of the case are completed. If this is true, Subroutine SRAS is called for single resource cases, Subroutine MRAS is called for multi-resource cases, and Subroutine TERM is called for cases that have no additional needs.

21. Endogenous Event SSET occurs at sunset when a resource serving a long search need is taken off the case because of darkness. The search need is placed in the sunrise list and a call is made to EXQ for the now idle resource.

22. Endogenous Event FUEL occurs when a resource serving a long search need must return home to refuel. Attributes are updated and Endogenous Event HOMEF is created and caused to occur.

23. Endogenous Event HOMEF occurs when a resource arrives at it's home station to refuel. Attributes are updated and Endogenous Event SNDBK is created and caused to occur.

24. Endogenous Event SNDBK occurs at the completion of refueling of a resource serving a long search need. At this point, the temporary entity FLT is destroyed for the refueled resource, and it is returned to an idle status. A call is made to Subroutine SASS to gather an ordered set of resources capable of serving the remaining portion of the

long search need. The set RQUE is then examined for the best idle resource to serve the need. If the best idle resource is the refueled resource that last served the search need, a new FLT is created, RES, FLT and NOTE attributes are updated, and an arrive-on-scene event (ARSCH) is created and caused to occur at TIME + TVEC. However, if the best idle resource is any other resource, Subroutine SSS is called.

25. Endogenous Event SRISE occurs at RISE-XRX. The sunrise list is examined and resources are vectored to arrive on the search scene at sunrise or soon thereafter. The next SRISE is caused at TIME + 1.0 (day).

26. Endogenous Event XSET occurs at sunset each day. All queued long search needs are removed from CQUE and filed into the sunrise list, LIST. The next XSET is caused at TIME + 1.0 (day).

27. Subroutine SERVE is called every time a resource is assigned to a case for reasons other than a long search. Data is accumulated for several statistics (COSTC, CNRES, NEEDS and NCASE). If the resource is at it's home station, a temporary entity FLT is created to be associated with the resource until it returns home via Endogenous Event HOME. RES and FLT attributes are updated and an Event Notice DELAY is created and caused. If the resource is not at its home station, any event previously scheduled for the resource in connection with some other case is cancelled and destroyed. RES and FLT attributes are updated and an Endogenous Event ARVSN is created and caused.

28. Endogenous Event DELAY occurs at the end of the delay time necessary to ready a resource at it's home station before vectoring to

the scene of any need other than a long search need. XDEST and YDEST (destination coordinates) are set; DEP (departure time) and TFLT (time that resource leaves its home station) are set equal to TIME. An Endogenous Event ARVSN is then created and caused to occur at TIME + ROS.

29. Endogenous Event ARVSN occurs when a resource arrives at the scene of a case for reasons other than a long search. If the resource is the first resource to arrive on scene, data is collected for the statistics RESA, TWAIT, NCAS, AVGTW, TQUE1, and FAIL3. Subroutine STATS is also called to collect other case, station and group statistics. If this is the first resource to arrive on scene there is a check to see if a short search is needed. If so, there is a call to Subroutine SRCHF which establishes the information needed for a short search. The priority of the case is increased to S2PRI until the short search is completed. ARVSN also determines the resource responsible for maintaining coverage. The resource responsible for coverage is chosen from among all resources at the scene of the case as that resource associated with the greatest value of RLS. RLS is equal to the time that the resource arrived on scene plus the on scene time during which the resource will actually serve the particular need. If a covering resource has fulfilled its on scene time, the next resource to arrive on scene will become responsible for coverage and the resource formerly covering will be relieved of duty via a call to Subroutine RETN.

Still another function of ARVSN is to determine the on scene time if the resource will be towing or providing an air escort. For single resource cases there is a call to Subroutine DTD to determine the destination and distance for the tow. (For multi-resource cases this information was previously determined and stored by a call to Subroutine TOW from MRAS.) The length of the case as well as the type of resource serving the tow or air escort determine the speed at which the tow proceeds and thus the on scene time.

30. Subroutine STATS, which can be called from Endogenous Event ARVSN or from Endogenous Event ARSCH, collects station, group and district statistics when the first resource arrives at the scene of a case. It also accumulates case statistics for both weekdays and weekends with holidays being included in the weekend statistics.

31. Subroutine SRCHF is called when the first ARVSN occurs for a case requiring a short search. If an additional resource is needed, Subroutine SASS and RESAP are called. If an additional resource is located, the associated on scene time is calculated. The on scene time of the resource having the first ARVSN is increased so that it remains on scene until the short search is completed. For multi-resources cases an Event Notice NOTIF is created to be associated with the short search. The additional resource is assigned to the case via a call to Subroutine SERVE. If the short search was originally to

be handled by the first arriving resource or if there is no additional resource available, the resource having the first ARVSN will also serve the short search. The on scene time for this resource is increased to include the time spent searching.

32. Endogenous Event ONSCN occurs differently for resources that are towing and resources serving non-tow needs. For non-towing resources there is an ONSCN when the resource first arrives on scene and thereafter at intervals of time equal to the on scene time divided by KKK. On all but the last ONSCN for a particular resource there is a reevaluation of the case priority. At the last ONSCN for the resource serving the last non-tow need of a case there is a check to see if a tow is needed. If so the first tow is initiated. A call to Subroutine CRES determines whether or not the resource serving the last non-tow need can also serve the tow. If so, it is assigned to serve the tow via a call to Subroutine SERVE. If not, an Event Notice NOTIF is caused for the first tow. If a resource is not responsible for coverage at the time of its last ONSCN, it is relieved of duty via a call to Subroutine RETN. For towing resources there is only one occurrence of ONSCN, that being when the tow is completed. There is no reevaluation of the case priority in this situation. If the resource is completing the first of a two part tow, an Event Notice NOTIF is created for the second tow. The attribute COUNT(CASE) keeps track of the number of needs and tows for the case which have been completed. This variable is increased by one whenever a resource has its last ONSCN

for a particular case. There is one exception to the above description which applies to short searches which are served by the first resource to arrive on the scene of the case. The first occurrence of ONSCN for such a resource is after the short search is completed. The priority of the case is immediately restored to the original case priority and the on scene time applicable for this resource is reduced to its origianl value. (Subroutine SRCHF increases on scene time). Thereafter the above description applies depending on whether the resource is towing or not.

33. Subroutine COVER is called when a resource responsible for coverage is interrupted to serve another case. It considers all other resources on the scene of the case being interrupted to determine another resource responsible for coverage. As explained in the description of ARVSN, the attribute RLS is used to establish coverage.

34. Endogenous Event CHEKN occurs every TCHEK hours for a covering resource. Subroutine EXQ is called to determine if the covering resource can serve any case in the queue. If it cannot serve any case in the queue, it remains as the covering resource on it's present case and another CHERN is created and caused to occur at TIME + TCHEK. If it can serve a queued case or need, Subroutine EXQ updates all applicable attributes and calls the proper subroutine to serve the case or need.

35. Subroutine RETN is called when a resource serving other than a long search finishes an assignment. It relieves the resource of its current duty by setting IB = 0 and returns the resource to the system via a call to Subroutine EXQ. If the resource was an additional

resource serving only a short search, the priority of the case is reduced to its original level. If COUNT(CASE) indicates that all needs and tows of the case have been completed, the case is terminated via a call to Subroutine TERM.

36. Subroutine TERM occurs when all the needs and tows of a case have been completed. TSVC (time case spent in system) statistics are accumulated and the value of STAPE is tested. If STAPE is not equal to zero, all pertinent case attributes are output on logical unit STAPE for the post processor. There is no output for the post processor if STAPE is equal to zero. All temporary entities and event notices associated with the case as well as the case itself are destroyed.

37. Endogenous Event HOME occurs when a resource arrives at its home station after finishing an assignment. The temporary entity FLT is destroyed and expected idle alpha time (EIAT) is set to zero. The coordinates of the resource are set to the coordinates of the home station and the number of busy crews is reduced by one. Utilization data is collected in TUTIL.

38. Subroutine SAQ is called from RESAP when a single resource case, a multi-resource need or a long search need is interrupted. If a tow was interrupted, the location of the case and the location of the resource are updated to be the previously calculated interrupt location of the resource. Interrupt statistics (NOINT, TOTIN and NINTR) are accumulated. Subroutine COVER is called if the resource was covering on the interrupted case. If it's determined that the interrupted

resource was covering only, no attempt is made to vector an idle resource to the scene for coverage purposes.

If a single resource case or a search need has been interrupted, Subroutine SAQ attempts to find an idle resource to serve it. The case or need is queued if no capable resource is available. If a multi-resource need has been interrupted, Subroutine QUEUE is called.

39. Subroutine QUEUE is called when a resource is interrupted while serving a multi-resource need or when no capable resource is available to serve a multi-resource need. In the interrupt situation, an attempt is made to locate another resource to serve the need via calls to Subroutines CRES, VEC, OSET, and ROCA. The usual call to RESAP is replaced by a search through the ordered set of resources RQUE. The first non-busy resource with an available crew is assigned to serve the multi-resource need via a call to Subroutine SERVE. RESAP cannot be called since it created the interrupt situation and an infinite logical loop would be generated. If no capable resource is available to serve the need, the NOTIF associated with the need is filed in the queue CQUE. If there are no other NOTIF's of the case already in CQUE or if there are no other NOTIF's of the case in CQUE due to interrupts, and this NOTIF is queued because of an Interrupt, the attributes TINQ and/or STINQ are set to the current value of TIME. If an air escort is to be queued, Subroutine WRECK is called.

40. Subroutine EXQ examines the queue, CQUE, for a single resource case, a multi-resource need or a long search need that can be served by a resource becoming idle. If the resource is not capable of serving any case or need in the queue, an Endogenous Event HOME is created and caused for the recource.

41. Endogenous Event STNBY occurs when a standby crew arrives at it's station. The queue is examined for cases which that station is capable of serving. If the crew cannot be used to serve any CASE or need in the queue, the stand-by crew is not added to the available crews at the station. If the crew can be used, the appropriate subroutine is called to serve the case.

42. Subroutine SVQUE is called when a resource is assigned to serve a NOTIF in the queue CQUE. If there are no other NOTIF's of the case in CQUE, the time in queue TQUE is accumulated. If this NOTIF was queued because of an interrupt and if there are no other NOTIF's of the case in the queue due to interrupts, the attribute TINT is accumulated. The NOTIF is removed from CQUE and Subroutine SERVE is called.

43. Subroutine WRECK is called when a multi-resource case is being terminated for reasons other than completion. It cancels and destroys temporary entities and event notices associated with the case. Any resources serving the case are released via a call to Subroutine EXQ. The case is filed in a set of exceptional cases EXCS to be output at the end of the simulation.

44. Exogenous Event ENDSIM occurs when the simulation is to end. It is triggered by the last entry on the Exogenous Event Tape containing the case input data. Output data are averaged over time and DRIVE is called to control the report output. The statistics and

data of the report output will be described later in part VI of this section. All cases in the set of exceptional cases EXCS are output on logical unit STAPE, if STAPE is unequal to zero.

45. Subroutine DRIVE is called from ENDSIM at the end of the simulation. It serves as a driver to call the several report generators and the output subroutines, EXCASE and JUMPER. It also generates printed output for cases remaining in CQUE and for cases still being served at the end of the simulation.

46. Report SARSIM is the report generator for printing district statistics and station response.

47. Report GRPRES prints group response.

48. Report HEADER is the report generator for printing the heading of the resource utilization section.

49. Report TITLE is the report generator for printing resource utilization for each shift at each station.

50. Report RESULT, a report generator, prints the utilization of each resource.

51. Report HEAD, a report generator, prints the heading of the exceptional cases section.

52. Subroutine EXCASE prints all exceptional cases in the set EXCS.

53. Report DSTRIB prints daily utilization distributions and certain case attribute distributions.

54. Subroutine JUMPER is an output routine printing all changes, additions and deletions to the initialization data base. It is coded in FORTRAN.

B. Note on Flowchart Nomenclature

It should be mentioned that attribute names shown in the flowcharts* are sometimes abbreviated relative to the names in the computer programming code. This abbreviation is due to the lengthiness of the subscripts required to completely identify a particular entity or event notice of which the variable is an attribute. The context removes any possible ambiguity. For example, CUT(ADJS(STAN(CASE), I), J), which is the Jth cutter of the Ith adjacent station of the primary station of CASE, may be abbreviated at CUT(ADJS).

* All flowcharts for OPSIM are found in Appendix A (NBS Report No. 10435).

IV. OPSIM Input Data Deck

A. Composition of the data deck

The data deck is composed of the system specifications card, the initial conditions deck, a blank card, the exogenous events deck and input data for Subroutine JUMPER. The order of these is illustrated in figure IV - 1 below.

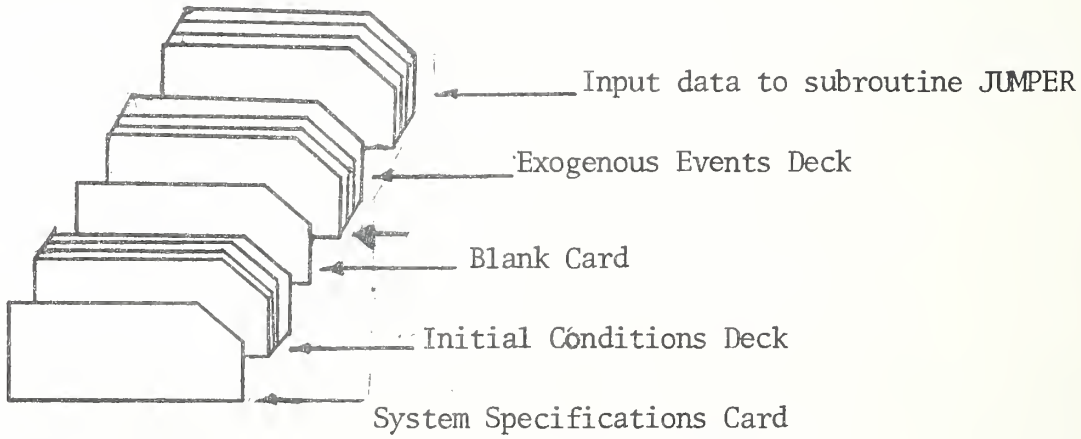

Figure IV - 1

B. System Specifications Card

The contents and format of the system specifications card follow:

Columns	Contents
1	The number one (1).
6	If this Column is non-blank, the initial conditions deck will output to the printer.
7-12	Maximum array number that appears in columns 32 through 34 of the Definition Form (Section II, Part II). This integer is right-justified in the field and presently has the value of 175.

13-18	Right-justified integer number of minutes per hour of simulated time. If left blank, the number of minutes per hour is assumed to be 60. For OPSIM runs, it may be left blank.
19-24	Right-justified integer number of hours per day of simulated time. If left blank, the number of hours per day is assumed to be 24. For OPSIM runs, it may be left blank.
25-30	The initial value of the root to be used in generating random numbers. This is a right-justified integer and must be an odd number. If left blank, it is assumed to be 1. It is suggested that the user fill the field with an odd number.
31-36	Right-justified integer indicating the logical tape unit from which the initial conditions deck is read. If left blank, the initial conditions deck will be read from logical tape unit five - the card reader.
37-42	Right-justified integer indicating the logical tape unit from which the exogenous events deck is read. If left blank, logical tape unit five - the card reader - is assumed.
43-48	Right-justified integer indicating the logical tape unit on which reports are written. If left blank, logical tape unit six - the printer - is assumed.

49-54	Number of lines per page of printed output. This is a right-justified integer, the maximum value of which is 59. The number of lines will be 55 if this field is left blank.

C. Initial Conditions Deck

1. Composition of initial conditions deck

The initial conditions deck consists of initialization cards and data cards keypunched from the form shown in Figure IV-2. Every array number appearing in columns 32-34 of the definition deck must be accounted for in sequential order in the initialization cards. It is suggested that the user read Chapter 14 (Initial Conditions Deck) in SIMSCRIPT, A Simulation Programming Language by Markowitz, Hausner and Karr for farther explanations on procedures for preparing the initial conditions deck.

2. Explanation of format and content of OPSIM's initial conditions deck using the Thirteenth Coast Guard District, July 1968, as an example. Note that all data is right-justified unless otherwise specified.

PROGRAMMER _____

PROBLEM _____

DATE _____

SIMSCRIPT INITIALIZATION FORM

SYSTEM SPECIFICATION CARD

		MAXIMUM ARRAY NUMBER	MINUTES PER HOUR	HOURS PER DAY	RANDOM ROOT	INITIAL CONDITIONS TAPE	EXOGENOUS EVENTS TAPE	REPORT TAPE	LINES PER PAGE	COMMENT	IDENTIFICATION
01 02 03 04 05 06	07 08 09 10 11 12	13 14 15 16 17 18	19 20 21 22 23 24	25 26 27 28 29 30	31 32 33 34 35 36	37 38 39 40 41 42	43 44 45 46 47 48	49 50 51 52 53 54	55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72	73 74 75 76 77 78 79 80
1			6 0	2 4	1	5	5	6	5 5	← These values are automatically inserted if the field is left blank	

INITIALIZATION CARDS

ARRAY NUMBER FROM	ARRAY NUMBER TO	NUMBER OF SUBSCRIPTS	READ-IN VALUES R	SET TO ZERO Z	LIST AND TABLE DIMENSIONS: ROWS — NUMBER OF ROWS	ROWS — ARRAY NUMBER OF ATTRIBUTE EQUAL TO NUMBER OF ROWS	COLUMNS — NUMBER OF COLUMNS	COLUMNS — ARRAY NUMBER OF ATTRIBUTE EQUAL TO NUMBER OF COLUMNS	LIST PACKING /	TABLE READ-IN: ACROSS ROWS R	DOWN COLUMNS C	NEW CARD AT BREAK N	FULL CARD F	PACKING P	RAGGED TABLE R	RANDOM LOOK-UP TABLES: UNSUBSCRIPTED U	SUBSCRIPTED S	STEP FUNCTION S	LINEAR INTERPOLATION L	INDIVIDUAL PROBABILITIES I	CUMULATIVE PROBABILITIES C	INITIAL VALUE OR FORMAT FIELD DESCRIPTION	COMMENT	IDENTIFICATION
01 02 03 04	05 06 07 08	09	10	11 12	13 14	15 16 17 18	19 20 21 22	23 24 25 26 27 28 29 30	31	32 33 34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72	73 74 75 76 77 78 79 80
										/																	

SIMSCRIPT Initialization Form (actual size) Figure IV-2

SAMPLE INITIAL CONDITIONS DECK
DISTRICT 13

```
0         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
1    1   175     0      0999999     0     7     0     0SYSTEM SPEC.  CARD    INITIALIZATION CARD NO.
   1   0 0 R     0    0    0    0 0 0      0          77                RES          (1)
   2   5 1  Z   77    1    0    0 0 2      0                                       (2)
   6   7 1  Z   77    1    0    0 0 4      0                                       (3)
   8  20 1  Z   77    1    0    0 0 2      0                                       (4)
  21  22 1  Z   77    1    0    0 0 4      0                                       (5)
  23   0 0 R     0    0    0    0 0 0      0          16                RST          (6)
  24   0 1  Z   16   23    0    0 0 2      0                            AUT          (7)
  25   0 1 R    16   23    0    0 0 2      0          12(H4.1)          END          (8)
  30.0  14.0    5.0  16.0  16.0  19.0  14.0 120.0 120.0 120.0 336.0 999.0
  12.0  12.0    4.5   6.5
  26   0 1 R    16   23    0    0 0 2      0          7(U7.2)           COSTD        (9)
    384.00     355.44     288.00     413.28     483.60     355.44     587.28
   7872.00    4104.00    2400.00    5641.44    8514.72   99000.00    5512.80
   3000.00    8889.12
  27   0 1 R    16   23    0    0 0 4      0          16(I4)            RCOST       (10)
   4   2   1   5   6   3   7   8  10   9  13  14  16  12  11  15
  28   0 1 R    16   23    0    0 0 2      0          12(U4.1)          SOA1        (11)
 475.0 384.0 240.0 336.0 264.0 192.0 240.0 475.0 475.0 317.0 475.0 449.0
7656.04092.01800.03036.0
  29   0 1 R    16   23    0    0 0 2      0          12(U4.1)          SOA2        (12)
 317.0 264.0 132.0 211.0 211.0 132.0 158.0 317.0 317.0 211.0 317.0 317.0
7656.04092.01980.03036.0
  30   0 1 R    16   23    0    0 0 2      0          12(U4.1)          SOA3        (13)
 317.0 317.0 211.0 264.0 211.0 158.0 211.0 396.0 396.0 264.0 396.0 396.0
4752.03564.01980.03300.0
  31   0 1 R    16   23    0    0 0 4      0          16(I4)            SLIM        (14)
   5   5   5  10  10  10  10  10  10  10  20  20
  32   0 1 R    16   23    0    0 0 2      0          12(H4.1)          TF          )15)
    .5    .5    .3    .5    .5    .5    .5   1.0   1.0   1.0   8.0   8.0
    .5    .5    .3    .3
  33   0 1 R    16   23    0    0 0 2      0          13(U2.2)          MR          (16)
 0.90 0.90 0.90 0.90 0.90 0.90 0.90 0.50 0.99 0.50 0.50 0.25 0.50
 0.75 0.75 0.75
  34   0 0 R     0    0    0    0 0 0      0          38                STA         (17)
  35   0 2 R    38   34    0    0 0 0     4R          14(I5)            ACS         (18)
   11   29   33                                                              3
   11   29   33                                                              3
   11   12   33                                                              3
   12   33                                                                   2
    0                                                                       1
   11   29   33                                                              3
   11   29   33                                                              3
   11   29   33                                                              3
   11   29   33                                                              3
   11   29   33                                                              3
   29   33                                                                   2
   11   33                                                                   2
   33                                                                        1
   12   33                                                                   2
   33                                                                        1
   11   29   33                                                              3
   11   29   33                                                              3
   11   29   33                                                              3
   12   33                                                                   2
```

33															1
12	33														2
12	33														2
11	29	33													3
12	33														2
33															1
33															1
12	33														2
11	29	33													3
11	33														2
11	29	33													3
12	33														2
33															1
0															1
11	29	33													3
0															1
0															1
0															1
0															1
36	0 2 R		38	34	0	0 0 0		4R		14(I5)			ADJS		(19)
23	30														2
17	28														2
14	31														2
13	15	20													3
0															1
17	28														2
23															1
23															1
28															1
0															1
17	23	28													3
14															1
15	32														2
21	27	31	35												4
13	20														2
18	21														2
18	28														2
16	17														2
24	31	36													3
15	26														2
14	16	27													3
24	26	37													3
30															1
19	22														2
32															1
20	22	38													3
14															1
17															1
17	23	28													3
23															1
14	19	36													3
13	25														2
0															1
0															1
14															1
19	31														2
22															1
26															1

```
 37   0 2 R     38   34    0    0 0 0      4R          14(I5)                CUT          (20)
   2                                                                                  1
   1                                                                                  1
   2    4                                                                             2
   3                                                                                  1
   0                                                                                  1
   9                                                                                  1
   9   10                                                                             2
   0                                                                                  1
   7   10                                                                             2
   7    9    34                                                                       3
   2    6                                                                            2
   3                                                                                  1
   4                                                                                  1
   3                                                                                  1
   4                                                                                  1
   0                                                                                  1
   0                                                                                  1
   0                                                                                  1
   0                                                                                  1
   4                                                                                  1
   3                                                                                  1
   4                                                                                  1
   0                                                                                  1
   0                                                                                  1
   4                                                                                  1
   4                                                                                  1
   0                                                                                  1
   6                                                                                  1
   2    6                                                                             2
   0                                                                                  1
   0                                                                                  1
   4                                                                                  1
   0                                                                                  1
  10                                                                                  1
   0                                                                                  1
   0                                                                                  1
   0                                                                                  1
   0                                                                                  1
 38   0 1 R     38   34    0    0 0 2      0           12(D4.1)              XS           (21)
156.  106.   90.   76.    0.  106.  160.  145.  134.  139.  106.   90.
 69.   83.   77.   81.   55.   55.   87.   78.   85.   84.  150.   84.
 76.   82.   90.  106.  106.  156.   88.   68.  163.  145.   81.0  85.0
 81.0  77.0
 39   0 1 R     38   34    0    0 0 2      0           12(D4.1)              YS           (22)
 94.  127.   11. -158.    0.  127.  121.   76.  128.  151.  127.   11.
-174.   19. -157.   53.  142.  115.  -27. -138.   43.  -82.   94.  -59.
-236. -122.   11.  127.  127.   94.  -17. -216. -500.  164.   14.0 -23.0
 -82.0-120.0
 40   0 1  Z    38   34    0    0 0 2      0                                AVGTW        (23)
 41   0 1  Z    38   34    0    0 0 4      0                                BCREW        (24)
 42   0 1  Z    38   34    0    0 0 4      0                                FAIL1        (25)
 43   0 1  Z    38   34    0    0 0 4      0                                FAIL2        (26)
 44   0 1  Z    38   34    0    0 0 2      0                                FAIL3        (27)
 45   0 1  Z    38   34    0    0 0 4      0                                NCAS         (28)
 46   0 1  Z    38   34    0    0 0 2      0                                NEEDS        (29)
 47   0 1  Z    38   34    0    0 0 4      0                                NINTR        (30)
 48   0 1  Z    38   34    0    0 0 4      0                                NSTRY        (31)
```

```
49   0 2 R     38  34    0    0 0 0      4R          16(I4)                REST          (32)
                                                                 2                      16
                                                                 1                      16
                                                           1                            16
                                                           1                            16
                                                                                        16
                                                 1                                      16
                                                 1                                      16
                                                 1                                      16
                                                 1                                      16
                                                 1                                      16
                                                                       3                16
                                                                           2            16
                    1         1                                                        16
 2                  3               1                                                  16
 1                       1          1                                                  16
 2                  1    1          1                                                  16
 1                  1               1                                                  16
                    1               1                                                  16
                    1               1                                                  16
                    1               1                                                  16
      1             1               1                                                  16
 1                  1               1    1                                             16
 4                                                                                      16
                    1               1    1                                             16
                    1               1                                                  16
                    1               1                                                  16
 1                                                                                      16
 1                                                                                      16
                                                                           3            16
 1             1                                                                      16
                                    1    1                                             16
                                    1    1                                             16
                                                      2                               16
                                                 1                                      16
                         1                                                              16
                    1                                                                   16
                         1                                                              16
                    1                                                                   16
50   0 2 R     38  34    0    0 0 0      4R          8(I4)                 SHIFT         (33)
 1   1   1     1   1     1    1   1                                                      8
 1   1   1     1   1     1    1   1                                                      8
 1   1   1     1   1     1    1   1                                                      8
 1   1   1     1   1     1    1   1                                                      8
 1   1   1     1   1     1    1   1                                                      8
 1   1   1     1   1     1    1   1                                                      8
 1   1   1     1   1     1    1   1                                                      8
 1   1   1     1   1     1    1   1                                                      8
 1   1   1     1   1     1    1   1                                                      8
 1   1   1     1   1     1    1   1                                                      8
 1   1   1     1   1     1    1   1                                                      8
 1   1   1     1   1     1    1   1                                                      8
 2   2   2     2   2     2    2   2                                                      8
 7   6   7     7   7     6    7   7                                                      8
 3   3   3     3   3     3    3   3                                                      8
 5   5   5     5   5     5    5   5                                                      8
 3   3   3     3   3     3    3   3                                                      8
 2   2   2     2   2     2    2   2                                                      8
```

```
  2   2   2   2   2   2   2   2                                                 8
  3   3   3   3   3   3   3   3                                                 8
  3   3   3   3   3   3   3   3                                                 8
  5   4   5   5   5   4   5   5                                                 8
  2   2   2   2   2   2   2   2                                                 8
  3   3   3   3   3   3   3   3                                                 8
  2   2   2   2   2   2   2   2                                                 8
  2   2   2   2   2   2   2   2                                                 8
  1   1   1   1   1   1   1   1                                                 8
  1   1   1   1   1   1   1   1                                                 8
  1   1   1   1   1   1   1   1                                                 8
  1   2   2   1   1   2   2   1                                                 8
  2   2   2   2   2   2   2   2                                                 8
  2   2   2   2   2   2   2   2                                                 8
  1   1   1   1   1   1   1   1                                                 8
  0   1   1   0   0   1   1   0                                                 8
  0   1   0   0   0   1   0   0                                                 8
  0   1   0   0   0   1   0   0                                                 8
  0   1   0   0   0   1   0   0                                                 8
  0   1   0   0   0   1   0   0                                                 8
 51   0 1  Z   38  34   0   0 0 4     0                        UNPRO     (34)
 52   0 1  Z   38  34   0   0 0 2     0                        USE       (35)
 53   0 0 R     0   0   0   0 0 0     0          8             WEWDS     (36)
 54   0 2  Z   38  34   8  53 0 2     2                        USHF      (37)
 55   0 1  Z    8  53   0   0 0 2     0                        AVUS      (38)
 56   0 1 R     8  53   0   0 0 2     0          8(H2.2)       TME       (39)
8.0016.0020.0024.00 8.0016.0020.0024.00
 57   0 1  Z    8  53   0   0 0 2     0                        TOTME     (40)
 58   0 0 R     0   0   0   0 0 0     0          5             TOLER     (41)
 59   0 1 R     5  58   0   0 0 2     0          5(H2.2)       TOL       (42)
4.00 3.00 2.00 1.00  .50
 60   0 1 R     5  58   0   0 0 2     0          5(H2.2)       TOLS      (43)
14.00 6.00 4.00 2.00 1.00
 61   0 0 R     0   0   0   0 0 0     0          43            CPBL      (44)
 62   0 1 R    43  61   0   0 0 0     0          6(012)        CAP       (45)
      177777      177777      177760      177760      177777      177760
      177760      014760      177760      177760      177777      177777
      177760      177760      177760      177763      000017      177777
      177760      157760      114760      114760      000160      157761
      157760      016760      000760      177777      116677      016677
      000077      177777      177775      114777      177777      014777
      177777      177617      177777      157777      116777      016777
      000777
 63   0 0 R     0   0   0   0 0 0     0          16            MSK       (46)
 64   0 1 R    16  63   0   0 0 0     0          6(012)        MASK      (47)
      100000      040000      020000      010000      004000      002000
      001000      000400      000200      000100      000040      000020
      000010      000004      000002      000001
 65   0 0 R     0   0   0   0 0 0     0          10            PRTM      (48)
 66   0 2 R    10  65   0   0 0 0     2R         10(U1.3)      PRTSM     (49)
1.000                                                                     1
 .700 .300                                                                2
 .500 .300 .200                                                           3
 .450 .250 .250 .050                                                      4
 .350 .200 .200 .200 .050                                                 5
 .270 .170 .170 .170 .170 .050                                            6
 .250 .140 .140 .140 .140 .140 .050                                       7
 .200 .125 .125 .125 .125 .125 .125 .050                                  8
```

```
.180 .110 .110 .110 .110 .110 .110 .110 .050                                  9
.150 .100 .100 .100 .100 .100 .100 .100 .100 .050                            10
 67   0 0  Z    0   0   0   0 0 0     0                                      LLIST      (50)
 68   0 0 R     0   0   0   0 0 0     0          4                           PATRL      (51)
 69   0 1 R     4  68   0   0 0 4     0          18(I4)                      IPAT       (52)
 35  36  37  38
 70   0 0  Z    0   0   0   0 0 0     0                                      AVUTO      (53)
 71   0 0 R     0   0   0   0 0 0     0          0                           CL         (54)
 72   0 0 R     0   0   0   0 0 0     0          1                           COSTO      (55)
 73   0 0 R     0   0   0   0 0 0     0          13                          DIST       (56)
 74   0 0 R     0   0   0   0 0 0     0          .0014                       EPSLN      (57)
 75  80 0  Z    0   0   0   0 0 0     0                                      ---        (58)
 81   0 0 R     0   0   0   0 0 0     0          4.0                         HO         (59)
 82   0 0 R     0   0   0   0 0 0     0          1                           IDELT      (60)
 83   0 0 R     0   0   0   0 0 0     0          1                           IFDAY      (61)
 84  85 0  Z    0   0   0   0 0 0     0                                      IMOISA     (62)
 86   0 0 R     0   0   0   0 0 0     0          2.0                         KKK        (63)
 87  98 0  Z    0   0   0   0 0 0     0                                      ---        (64)
 99   0 0 R     0   0   0   0 0 0     0          4                           NWD        (65)
100   0 0 R     0   0   0   0 0 0     0          4                           NWE        (66)
101   0 0 R     0   0   0   0 0 0     0          .50                         PDC1       (67)
102   0 0 R     0   0   0   0 0 0     0          .50                         PDC2       (68)
103   0 0 R     0   0   0   0 0 0     0          .65                         PRDN       (69)
104   0 0 R     0   0   0   0 0 0     0          .10                         PRUP       (70)
105   0 0  Z    0   0   0   0 0 0     0                                      PSHFT      (71)
106   0 0 R     0   0   0   0 0 0     0          2                           RAP        (72)
107   0 0 R     0   0   0   0 0 0     0          .25                         RISE       (73)
108   0 0 R     0   0   0   0 0 0     0          .8333333                    SET        (74)
109   0 0  Z    0   0   0   0 0 0     0                                      SNEED      (75)
110   0 0 R     0   0   0   0 0 0     0          5                           S2PRI      (76)
111   0 0 R     0   0   0   0 0 0     0          .007                        THOOK      (77)
112 114 0  Z    0   0   0   0 0 0     0                                      ---        (78)
115   0 0 R     0   0   0   0 0 0     0          240.0                       TSP1       (79)
116   0 0 R     0   0   0   0 0 0     0          288.0                       TSP2       (80)
117   0 0  Z    0   0   0   0 0 0     0                                      TUNPR      (81)
118   0 0 R     0   0   0   0 0 0     0          .16666                      XRX        (82)
119   0 0  Z    0   0   0   0 0 0     0                                      FLIST      (83)
120   0 1 R    16  23   0   0 0 4     0          16(I4)                      VOP        (84)
  0   0   0   0   0   0   0   0   0   0   0   0   0   1   1   1   1
121   0 0  Z    0   0   0   0 0 0     0                                      LIMIT      (85)
122   0 0  Z    0   0   0   0 0 0     0                                      KOUNT      (86)
123   0 0 R     0   0   0   0 0 0     0          62                          SCNVT      (87)
124   0 1 R    62 123   0   0 0 4     0          18(I4)                      NSN        (88)
  1   1   2   3   4   5   6   7   8   9  10   0   0   0   0   0   0   0
  0   0  34  11  12  13  14  15  16  17   0  18  19  20  21  22  23  24
 25  26  35   0  30  27   0   0   0   0   0   0   0   0   0   0   0   0
  0   0   0   0   0   0  33   0
125   0 0 R     0   0   0   0 0 0     0          0                           STAPE      (89)
126   0 0 R     0   0   0   0 0 0     0          4                           TPRI       (90)
127   0 1  Z   77   1   0   0 0 2     0                                      DVEC       (91)
128   0 1 R    16  23   0   0 0 4     0          16(I4)                      SQTAG      (92)
  0   0   0   0   0   0   0   1   1   1   1   1   2   3   3   3
129   0 1 R    16  23   0   0 0 2     0          7(H3.6)                     DLAY       (93)
  .166666   .166666   .083333   .166666   .166666   .166666   .166666
  .25       .083333   .333333  1.5       1.5       .25       .25
  .083333   .083333
130   0 0 R     0   0   0   0 0 0     0          .083333                     TCHEK      (94)
131   0 1  Z   38  34   0   0 0 2     0                                      DMRT       (95)
```

```
132   0 1 R    38  34   0   0 0 4      0          18(I4)          GRP      (96)
  7   7   7   7   6   6   6   6   6   6   8   8   1   2   1   2   3   3
  2   1   2   1   4   1   1   1   2   3   8   4   2   1   5   9   2   2
  1   1
133   0 1  Z   38  34   0   0 0 2      0                          VCTR     (97)
134   0 1  Z   38  34   0   0 0 2      0                          TWTOL    (98)
135   0 0  Z    0   0   0   0 0 0      0                          MEAND    (99)
136   0 0  Z    0   0   0   0 0 0      0                          MEANV    (100)
137   0 0  Z    0   0   0   0 0 0      0                          MNTMT    (101)
138   0 0 R     0   0   0   0 0 0      0          9               GROUP    (102)
139 151 1  Z    9 138   0   0 0 2      0                                   (103)
152 155 0  Z    0   0   0   0 0 0      0                                   (104)
156   0 0 R     0   0   0   0 0 0      0          12              DSTRB    (105)
157 167 1  Z   12 156   0   0 0 2      0                                   (106)
168   0 0  Z    0   0   0   0 0 0      0                          CLLCT    (107)
169   0 0 R     0   0   0   0 0 0      0          1               HLDY     (108)
170   0 1 R     1 169   0   0 0 4      0          18(I4)          HOLID    (109)
  3                                                                       (110)
171   0 1 R    38  34   0   0 0 4      0          18(I4)          PSTTN
  0   0   0   0   0   0   1   1   1   1   0   0   1   1   1   1   1   1
  1   1   1   1   1   1   1   1   0   0   0   0   1   1   1   1   1   1
  1   1
172   0 1  Z   38  34   0   0 0 4      0                          NMBRQ    (111)
173   0 0 R     0   0   0   0 0 0      0          0               PRTOT    (112)
174   0 1  Z   38  34   0   0 0 2      0                          CFTT     (113)
175   0 0  Z    0   0   0   0 0 0      0                          MCFTT    (114)
```

EXPLANATION OF INITIAL CONDITIONS INPUT

INITIALIZATION CARD	COLUMNS	CONTENT
1	1-4	The number "1".
	12	The letter "R".
	50-66	Left-justified integer giving the total number of resources in a run.
	67-80	Field for comment.
2	1-4	The number "2".
	5-8	The number "5".
	10	The number "1".
	13	The letter "Z".
	15-18	Integer giving the total number of resources.
	19-22	The number "1".
	34	The number "2".
	67-80	Field for comment.
3	1-4	The number "6".
	5-8	The number "7".
	10	The number "1".
	13	The letter "Z".
	15-18	Integer giving the total number of resources.
	19-22	The number "1".
	34	The number "4".
	67-80	Field for comment.
4	1-4	The number "8".
	5-8	The number "20".
	10	The number "1".
	13	The letter "Z".
	15-18	Integer giving the total number of resources.
	19-22	The number "1".
	34	The number "2".
	67-80	Field for comment.
5	1-4	The number "21".
	5-8	The number "22".

INITIALIZATION CARD	COLUMNS	CONTENT
	10	The number "1".
	13	The letter "Z".
	15-18	Integer giving the total number of resources.
	19-22	The number "1".
	34	The number "4".
	67-80	Field for comment.
6	1-4	The number "23".
	12	The letter "R".
	50-66	Left-justified integer giving the number of resource types.
	67-80	Field for comment.
7	1-4	The number "24"
	10	The number "1".
	13	The letter "Z".
	15-18	Integer giving the number of resource types.
	19-22	The number "23".
	34	The number "2".
	67-80	Field for comment.
8	1-4	The number "25".
	10	The number "1".
	12	The letter "R".
	15-18	Integer giving the number of resource types.
	19-22	The number "23".
	34	The number "2".
	50-66	Left-justified format - 12(H4.1)
	67-80	Field for comment

Data cards must follow initialization card number 8 to read in endurance times for each resource type. The format for these data cards is given in columns 50-66 of the initialization card. In this case, the format is 12(H4.1). The "12" gives the number of fields per card. The letter "H" indicates that the endurance times are to be read in decimal hours. The "4.1" indicates there will be four places to the left of the decimal point, the decimal point and one place after the decimal point making each field occupy six columns.

INITIALIZATION CARD	COLUMNS	CONTENT
9	1-4	The number "26".
	10	The number "1".
	12	The letter "R".
	15-18	Integer giving the number of resource types.
	19-22	The number "23".
	34	The number "2".
	50-66	Left-justified format - 7(U7.2)
	67-80	Field for comment.

Data cards are required after initialization card 9 to read in the cost per day of each resource type. The format 7(U7.2), indicates seven floating point numbers per card each with seven places before the decimal point, the decimal point and two places after the decimal point. The "U" means that "unsigned" floating point numbers are being read in.

10	1-4	The number "27".
	10	The number "1".
	12	The letter "R".
	15-18	Integer giving the number of resource types.
	19-22	The number "23".
	34	The number "4".
	50-66	Left-justified format - 16(I4)
	67-80	Comment field.

Data cards to read the relative cost ranking of each resource type should follow initialization card 10. The format 16(I4) implies sixteen integers per card with four columns per field.

11	1-4	The number "28".
	10	The number "1".
	12	The letter "R".
	15-18	Integer giving the number of resource types.
	19-22	The number "23".
	34	The number "2".

INITIALIZATION CARD	COLUMNS	CONTENT
	50-66	Left-justified format - 12(U4.1).
	67-80	Comment field.

Data cards to read speed-of-advance I for each resource type follow card 11. These are read in miles per day under the format 12(U4.1).

12	1-4	The number "29".
	10	The number "1".
	12	The letter "R".
	15-18	Integer giving the number of resource types.
	19-22	The number "23".
	34	The number "2".
	50-66	Left-justified format - 12(U4.1).
	67-80	Comment field.

Following initialization card 12 are the data cards to read speed-of-advance II for each resource type. These are read in miles per day under the format 12(U4.1).

13	1-4	The number "30".
	10	The number "1".
	12	The letter "R".
	15-18	Integer giving the number of resource types.
	19-22	The number "23".
	34	The number "2".
	50-66	Left-justified format - 12(U4.1).
	67-80	Comment field.

Data cards to read the search speed-of-advance for each resource type follow card 13. These are also input in miles per day under the format 12(U4.1).

14	1-4	The number "31".
	10	The number "1".
	12	The letter "R".
	15-18	Integer giving the number of resource types.

INITIALIZATION CARD	COLUMNS	CONTENT
	19-22	The number "23".
	34	The number "4".
	50-66	Left-justified format - 16(I4).
	67-80	Comment field

Data cards follow to read in the swell limit on speed-of-advance I for each resource type. The swell limit is expressed in feet under the format 16(I4). Note that there is no swell limit for an aircraft resource type.

15	1-4	The number "32".
	10	The number "1".
	12	The letter "R".
	15-18	Integer giving the number of resource types.
	19-22	The number "23".
	34	The number "2".
	50-66	Left-justified format - 12(H4.1).
	67-80	Comment field.

Data cards follow to read the time-to-refuel for each resource type. The format is 12(H4.1).

16	1-4	The number "33".
	10	The number "1".
	12	The letter "R".
	15-18	Integer giving the number of resource types.
	19-22	The number "23".
	34	The number "2".
	50-66	Left-justified format - 13(U2.2).
	67-80	Comment field.

Data cards follow to input operational probabilities for each resource type under the format 13(U2.2).

17	1-4	The number "34".
	12	The letter "R".
	50-66	Left-justified integer giving the number of stations.
	67-80	Comment field
18	1-4	The number "35".
	10	The number "2".

INITIALIZATION CARD	COLUMNS	CONTENT
	12	The letter "R".
	15 - 18	Integer giving the number of stations.
	19 - 22	The number "34".
	40	The number "4".
	41	The letter "R".
	50 - 66	Left-justified format - 14(I5).
	67 - 80	Comment field

Following initialization card 18 is the ragged table (refer to Mar Markowitz for an explanation of ragged tables) to input the covering aircraft stations of each station. There is usually one input card per station in this set of data cards. Each card contains the aircraft covering stations of one station under the format 14(I5) and an integer right-justified in columns 71 and 72 giving the number of fields to be read from the card. If a station has more than 14 aircraft covering stations, the first card would contain the first 14 and the letter "C" heypunched in column 72. The next card would contain the remaining aircraft covering stations with the numbers of fields to be read keypunched in columns 71 and 72. Note that if a station has no aircraft covering station, a "0" should be keypunched in column 4 and a "1" should be keypunched in column 72 on the card for that station.

19	1-4	The number "36".
	10	The number "2".
	12	The letter "R".
	15-18	Integer giving the number of stations.
	19-22	The number "34".
	40	The number "4".
	41	The letter "R".
	50-66	Left-justified format - 14(I5).
	67-80	Comment field

Following initialization card 19 is the ragged table to input the adjacent stations of each station. The above discussion on the ragged table input of aircraft covering stations applies here also.

20	1-4	The number "37".
	10	The number "2".
	12	The letter "R".
	15-18	Integer giving the number of stations.
	19-22	The number "34".
	40	The number "4".
	41	The letter "R".

INITIALIZATION CARD	COLUMNS	CONTENT
	50-66	Left-justified format - 14(I5).
	67-80	Comment field.

Following card 20 is the ragged table to input the covering cutters of each station. The discussion of ragged table input above applies.

21	1-4	The number "38".
	10	The number "1".
	12	The letter "R".
	15-18	Integer giving the number of stations.
	19-22	The number "34".
	34	The number "2".
	50-66	Left-justified format - 12(D4.1).
	67-80	Comment field.

Data cards to input the X coordinate of each station follow initialization card 21. The format 12(D4.1) calls for "12" fields per card. The "D4.1" means that signed floating point numbers with four places before the decimal point, the decimal point and one place after the decimal point are to be read.

22	1-4	The number "39".
	10	The number "1".
	12	The letter "R".
	15-18	Integer giving the number of stations.
	19-22	The number "34".
	34	The number "2".
	50-66	Left-justified format - 12(D4.1).
	67-80	Comment field.

Data cards to input the Y coordinate of each station follow initialization card 22. The format, 12(D4.1), is explained above under initialization card 21.

23	1-4	The number "40".
	10	The number "1".
	13	The letter "Z".
	15-18	Integer giving the number of stations.

INITIALIZATION CARD	COLUMNS	CONTENT
	19-22	The number "34".
	34	The number "2".
	67-80	Comment field
24	1-4	The number "41".
	10	The number "1".
	13	The letter "Z".
	15-18	Integer giving the number of stations.
	19-22	The number "34".
	34	The number "4".
	67-80	Comment field.
25	1-4	The number "42".
	10	The number "1".
	13	The letter "Z".
	15-18	Integer giving the number of stations.
	19-22	The number "34".
	34	The number "4".
	67-80	Comment field.
26	1-4	The number "43".
	10	The number "1".
	13	The letter "Z".
	15-18	Integer giving the number of stations.
	19-22	The number "34".
	34	The number "4".
	67-80	Comment field.
27	1-4	The number "44".
	10	The number "1".
	13	The letter "Z".
	15-18	Integer giving the number of stations.
	19-22	The number "34".
	34	The number "2".
	67-80	Comment field.
28	1-4	The number "45".
	10	The number "1".

INITIALIZATION CARD	COLUMNS	CONTENT
	13	The letter "Z".
	15-18	Integer giving the number of stations.
	19-22	The number "34".
	34	The number "4".
	67-80	Comment field.
29	1-4	The number "46".
	10	The number "1".
	13	The letter "Z".
	15-18	Integer giving the number of stations.
	19-22	The number "34".
	34	The number "2".
	67-80	Comment field.
30	1-4	The number "47".
	10	The number "1".
	13	The letter "Z".
	15-18	Integer giving the number of stations.
	19-22	The number "34".
	34	The number "4".
	67-80	Comment field.
31	1-4	The number "48".
	10	The number "1".
	13	The letter "Z".
	15-18	Integer giving the number of stations.
	19-22	The number "34".
	34	The number "4".
	67-80	Comment field.
32	1-4	The number "49".
	10	The number "2".
	12	The letter "R".
	15-18	Integer giving the number of stations.
	19-22	The number "34".
	40	The number "4".

INITIALIZATION CARD	COLUMNS	CONTENT
	41	The letter "R".
	50-66	Left-justified format - 16(I4).
	67-80	Comment field.

The table to input the number of resources of each resource type at each station follows initialization card 32. There is usually one input card per station in this data set. Each card contains the number of resources of each resource type at a station read in under the format 16(I4) and an integer right-justified in columns 71 and 72 giving the number of resource If there are more than 16 resource types, the first card for a station would contain the number of resources of the first 16 types and a C keypunched in column 72. The next card would contain the number of resources of the remaining types and the number of fields to be read keypunched in column 71 and 72.

33	1-4	The number "50".
	10	The number "2".
	12	The letter "R".
	15-18	Integer giving the number of stations.
	19-22	The number "34".
	40	The number "4".
	41	The letter "R".
	50-66	Left-justified format - 8(I4).
	67-80	Comment field.

The table to input the number of crews during each shift at each station follows initialization card 33. There is one input card per station in this data set. Each card contains the number of crews during each shift for a station under the format 8(I4) and an integer right-justified in columns 71 and 72 giving the number of shifts. The number of shifts cannot be greater than 8.

34	1-4	The number "51".
	10	The number "1".
	13	The letter "Z".
	15-18	Integer giving the number of stations.

INITIALIZATION CARD	COLUMNS	CONTENT
	19-22	The number "34".
	34	The number "4".
	67-80	Comment field.
35	1-4	The number "52".
	10	The number "1".
	13	The letter "Z".
	15-18	Integer giving the number of stations.
	19-22	The number "34".
	34	The number "2".
	67-80	Comment field.
36	1-4	The number "53".
	12	The letter "R".
	50-66	Left-justified integer giving the total number of weekend shifts and weekday shifts.
	67-80	Comment field.
37	1-4	The number "54".
	10	The number "2".
	13	The letter "Z".
	15-18	Integer giving the number of stations.
	19-22	The number "34".
	23-26	Integer giving the total number of shifts.
	27-30	The number "53".
	40	The number "2".
	67-80	Comment field.
38	1-4	The number "55".
	10	The number "1".
	13	The letter "Z".
	15-18	Integer giving the number of shifts.
	19-22	The number "53".
	34	The number "2".
	67-80	Comment field.

INITIALIZATION CARD	COLUMNS	CONTENT
39	1-4	The number "56".
	10	The number "1".
	12	The letter "R".
	15-18	Integer giving the number of shifts.
	19-22	The number "53".
	34	The number "2".
	50-66	Left-justified format - 8(H2.2).
	67-80	Comment field.

One data card follows initialization card 39 to input the times that the shifts end. Times that weekday shifts end are keypunched forst with the times that weekend shifts end keypunched last. The format, 8(H2.2) indicates a maximum of eight fields on the card with the times given in decimal hours.

40	1-4	The number "57".
	10	The number "1".
	13	The letter "Z".
	15-18	Integer giving the number of shifts.
	19-22	The number "53".
	34	The number "2".
	67-80	Comment field.
41	1-4	The number "58".
	12	The letter "R".
	50-66	The number "5", left-justified.
	67-80	Comment field.
42	1-4	The number "59".
	10	The number "1".
	12	The letter "R".
	15-18	The number "5".
	19-22	The number "58".
	34	The number "2".
	50-66	Left-justified format - 5(H2.2).
	67-80	Comment field.

INITIALIZATION CARD	COLUMNS	CONTENT

One data card follows initialization card 42 to input tolerance times in decimal hours. Note that there are always 5 tolerance times. The first tolerance time will have the greatest value since severity level 1 is the lowest priority.

43	1-4	The number "60".
	10	The number "1".
	12	The letter "R".
	15-18	The number "5".
	19-22	The number "58".
	34	The number "2".
	50-66	Left-justified format - 5(H2.2).
	67-80	Comment field.

One data card follows to input search tolerance times in decimal hours. Again there are always 5 search tolerance times and the first will have the greatest value since severity level 1 is the lowest priority.

44	1-4	The number "61".
	12	The letter "R".
	50-66	Left-justified integer giving the number of rows in the Resource Capability Matrix (Figure IV-3).
	67-80	Comment field.
45	1-4	The number "62".
	10	The number "1".
	12	The letter "R".
	15-18	Integer giving the number of rows in the Resource Capability Matrix
	19-22	The number "61".
	50-66	Left-justified format - 6(012).
	67-80	Comment field.

Data cards to input the Resource Capability Matrix follow initialization card 45. The format, 6(012) indicates 6 fields per card with 12 columns per field. Each row of the Resource Capability Matrix is represented by one octal number. (See Figure IV-3). The Resource Capability Matrix must be changed

1 - indicates capability
0 - indicates non-capability

FIGURE IV-3

SAMPLE RESOURCE CAPABILITY MATRIX

Row Number	For Attribute	RESOURCE TYPE																Right-justified Octal Number Representing Row
		40's	30's	17's	44's	52's	36's	MRB/MSB	82/95	82/95-P	WYTM/L	MEC	HEC	C-130	HU 16	H H 52	HH-3	
1	NEED: Provide Equipment	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	177777
2	NEED: Deliver Pump/ Equipment	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	177777
3	NEED: Made repairs	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	177760
4	NEED: Fought fires	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	177760
5	NEED: Vector other unit	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	177777
6	NEED: Dewatered	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	177760
7	NEED: Refloated	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	177760
8	NEED: Icebreaking	0	0	0	1	1	0	0	1	1	1	1	1	0	0	0	0	014760
9	NEED: Refueled and re-supplied	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	177760
10	NEED: Surface Escort	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	177760
11	NEED: Stoodby	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	177777
12	NEED: Located property and owner advised	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	177777
13	NEED: Freed from position of peril	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	177760
14	NEED: General assistance rendered - Surface	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	177760
15	NEED: Towed - 0 < L(CASE) < 30'	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	177760
16	NEED: Evacuate POB's - 0 < POB(CASE) < 5	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	177763
17	NEED: Air Escort	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	000017
18	NEED: General Assistance Rendered	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	177777
19	NEED: Rescue and Tow	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	177760

(continued)

FIGURE IV-3

SAMPLE RESOURCE CAPABILITY MATRIX

1 - indicates capability
0 - indicates non-capability

Row Number	For Attribute	RESOURCE TYPE																Right-justified Octal Number Representing Row
		40's	30's	17's	44's	52's	36's	MRB/MSB	82/95	82/95-P	WYTM/L	MEC	HEC	C-130	HU 16	H H 52	HH-3	
20	NEED: Towed - 30 ≤ L(CASE) < 65'	1	1	0	1	1	1	1	1	1	1	1	1	0	0	0	0	157760
21	NEED: Towed - 65' ≤ L(CASE) < 100'	1	0	0	1	1	0	0	1	1	1	1	1	0	0	0	0	114760
22	NEED: Towed - 100' ≤ L(CASE) < 200'	1	0	0	1	1	0	0	1	1	1	1	1	0	0	0	0	114760
23	NEED: Towed - L(CASE) ≥ 200'	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	000160
24	NEED: Evacuate POB's 5 ≤ POB(CASE) < 10	1	1	0	1	1	1	1	1	1	1	1	1	0	0	0	1	157761
25	NEED: Evacuate POB's 10 ≤ POB(CASE)< 18	1	1	0	1	1	1	1	1	1	1	1	1	0	0	0	0	157760
26	NEED: Evacuate POB's 18 ≤ POB(CASE)< 25	0	0	0	1	1	1	0	1	1	1	1	1	0	0	0	0	016760
27	NEED: Evacuate POB's POB(CASE) ≥ 25	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	000760
28	0' ≤ SWELL(CASE) < 5'	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	177777
29	5' ≤ SWELL(CASE) < 10'	1	0	0	1	1	1	0	1	1	0	1	1	1	1	1	1	116677
30	10 ≤ SWELL(CASE) < 20'	0	0	0	1	1	1	0	1	1	0	1	1	1	1	1	1	016677
31	SWELL(CASE) ≥ 20'	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	000077
32	WIND(CASE) < 60	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	177777
33	WIND(CASE) ≥ 60	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	177775
34	VIS(CASE) = 0	1	0	0	1	1	0	0	1	1	1	1	1	1	1	1	1	114777
35	VIS(CASE) > 0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	177777
36	AIR(CASE) < 20°	0	0	0	1	1	0	0	1	1	1	1	1	1	1	1	1	014777
37	AIR(CASE) ≥ 20°	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	177777
38	0 ≤ OFSHR(CASE) < 1/2	1	1	1	1	1	1	1	0	0	0	0	0	1	1	1	1	177017

(continued)

1 - indicates capability
0 - indicates non-capability

FIGURE IV-3

SAMPLE RESOURCE CAPABILITY MATRIX

Row Number	For Attribute	RESOURCE TYPE																Right-justified Octal Number Representing Row
		40's	30's	17's	44's	52's	36's	MRB/MSB	82/95	82/95-P	WYTM/L	MEC	HEC	C-130	HU 16	H H 52	HH-3	
39	1/2 ≤ OFSHR(CASE) < 5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	177777
40	5 ≤ OFSHR(CASE) < 10	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	157777
41	10 ≤ OFSHR(CASE) < 20	1	0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	116777
42	20 ≤ OFSHR(CASE) < 50	0	0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	016777
43	OFSHR(CASE) ≥ 50	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	000777

INITIALIZATION CARD	COLUMNS	CONTENT

if there is a change in the number of resource types and if there is a change in the capable/non-capable status of any matrix element. Of course, it would also need to be changed if more rows were added, but this would also require a change in the computer programming code in Subroutine CRES.

46	1-4	The number "63".
	12	The letter "R".
	50-66	Left-justified integer giving the number of resource types.
	67-80	Comment field.
47	1-4	The number "64".
	10	The number "1".
	12	The letter "R".
	15-18	Integer giving the number of resource types.
	19-22	The number "63".
	50-66	Left-justified format - 6(012).
	67-80	Comment field.

Data cards follow initialization card 47 to input the permanent attribute, "MASK". MASK(I), where I is the ordinal designation of a particular resource type, is used in Subroutine CRES in determining what resource types can serve a case. After "ANDing" the appropriate rows of the Resource Capability Matrix (see Subroutine CRES in Section II, Part III), each MASK(I) is "ANDed" with that product to determine if the Ith resource type can serve the case. From the above explanation of the function of "MASK", the input of "MASK" can be understood. (See Figure IV-4). For example, MASK(1) should have all bits of the 36-bit UNIVAC 1108 word zeroed out except the one representing the first resource type - thus the right justified octal number, 100000. If the number of resource types was increased to 17, MASK(1) would be input as 200000, MASK(2) would be input as 100000, etc.

48	1-4	The number "65".
	12	The letter "R".
	50-66	Left-justified integer giving to maximum number of S1S(CASE), number of resources operating in parallel on a long search case; the maximum number is presently 10.

FIGURE IV-4

SAMPLE "MASK" INPUT FOR SIXTEEN RESOURCE TYPES

"MASK" Input For Resource Type No.	Binary Representation of "MASK" Octal Number	Right-justified Octal Number ("MASK" Input)
1 - (40's)	←Zero fill for first 20 bits of word→ 1 000 000 000 000 000	100000
2 - (30's)	←Zero fill→ 0 100 000 000 000 000	040000
3 - (17's)	←Zero fill→ 0 010 000 000 000 000	020000
4 - (44's)	←Zero fill→ 0 001 000 000 000 000	010000
5 - (52's)	←Zero fill→ 0 000 100 000 000 000	004000
6 - (36's)	←Zero fill→ 0 000 010 000 000 000	002000
7 - (MRB/MSB)	←Zero fill→ 0 000 001 000 000 000	001000
8 - (82/95)	←Zero fill→ 0 000 000 100 000 000	000400
9 - (82/95-P)	←Zero fill→ 0 000 000 010 000 000	000200
10 - (WYTM/L)	←Zero fill→ 0 000 000 001 000 000	000100
11 - (MEC)	←Zero fill→ 0 000 000 000 100 000	000040
12 - (HEC)	←Zero fill→ 0 000 000 000 010 000	000020
13 - (C-130)	←Zero fill→ 0 000 000 000 001 000	000010
14 - (HU-16)	←Zero fill→ 0 000 000 000 000 100	000004
15 - (HH-52)	←Zero fill→ 0 000 000 000 000 010	000002
16 - (HH-3)	←Zero fill→ 0 000 000 000 000 001	000001

INITIALIZATION CARD	COLUMNS	CONTENT
	67-80	Comment field.
49	1-4	The number "66".
	10	The number "2".
	12	The letter "R".
	15-18	Integer giving the maximum SIS(CASE).
	19-22	The number "65".
	40	The number "2".
	41	The letter "R".
	50-66	Left-justified format - 10(U1.3).
	67-80	Comment field.

The ragged table to input the fractional split of the total search miles on a case as a function of S1S(CASE) follows initialization card 49. The format 10(U1.3) indicates 10 fields per card with 5 columns in each field. The U means unsigned numbers must be input. The first data card inputs the percentage of search miles assigned to the resource when S1S(CASE) = 1, the second data card inputs the fractional split of the total search miles when S1S(CASE) = 2, the third data card inputs the fractional split when S1S(CASE) = 3, etc. Each of the data cards must have an integer right-justified in columns 71 and 72 to indicate how many fields will be read from the card.

50	1-4	The number "67".
	13	The letter "Z"
	67-80	Comment field.
51	1-4	The number "68".
	12	The letter "R".
	50-66	Left-justified integer giving the number of patrolling cutters.
	67-80	Comment field.
52	1-4	The number "69".
	10	The number "1".
	12	The letter "R".
	15-18	Integer giving the number of patrolling cutters.
	19-22	The number "68".

INITIALIZATION CARD	COLUMNS	CONTENT
	34	The number "4".
	50-66	Left-justified format - 18(I4).
	67-80	Comment field.

Data cards follow to input the ordinal designations of the patrolling cutters under the format 18(I4).

53	1-4	The number "70".
	13	The letter "Z".
	67-80	Comment field.
54	1-4	The number "71".
	12	The letter "R".
	50-66	Left-justified integer giving the option for CL (See OPSIM Definitions, Section II, Part II).
	67-80	Comment field.
55	1-4	The number "72".
	12	The letter "R".
	50-66	Left-justified integer giving the option of COSTO (See OPSIM Definitions, Section II, Part II).
	67-80	Comment field.
56	1-4	The number "73".
	12	The letter "R".
	50-66	Left-justified integer giving the district.
	67-80	Comment field.
57	1-4	The number "74".
	12	The letter "R".
	50-66	Left-justified floating point number expressed in decimal days giving EPSLN, a small time delay for causing the Endogeneous Event NOTE for all but the first long search resource.
	67-80	Comment field.
58	1-4	The number "75".
	5-8	The number "80".

INITIALIZATION CARD	COLUMN	CONTENT
	13	The letter "Z".
	67-80	Comment field.
59	1-4	The number "81".
	12	The letter "R".
	50-66	Left-justified floating point number expressed in nautical miles giving the distance offshore where the hand-off for a two-part tow takes place.
	67-80	Comment field.
60	1-4	The number "82".
	12	The letter "R".
	50-66	Left-justified integer giving the increment to the priority of an interrupted case.
	67-80	Comment field.
61	1-4	The number "83".
	12	The letter "R".
	50-66	Left-justified integer giving the day of the week on which the simulation begins (Monday = 1, Tuesday = 2, etc.)
	67-80	Comment field.
62	1-4	The number "84".
	5-8	The number "85".
	13	The letter "Z".
	67-80	Comment field.
63	1-4	The number "86".
	12	The letter "R".
	50-66	Left-justified floating point number giving the number of looks at priority reevaluation.
	67-80	Comment field.
64	1-4	The number "87".
	5-8	The number "98".

INITIALIZATION CARD	COLUMNS	CONTENT
	13	The letter "Z".
	67-80	Comment field.
65	1-4	The number "99".
	12	The letter "R".
	50-66	Left-justified integer giving the number of weekday shifts.
	67-80	Comment field.
66	1-4	The number "100".
	12	The letter "R".
	50-66	Left-justified integer giving the number of weekend shifts.
	67-80	Comment field.
67	1-4	The number "101".
	12	The letter "R".
	50-66	Left-justified floating point number giving the percentage of search miles desirable to achieve by each resource on the first day of a long search.
	67-80	Comment field.
68	1-4	The number "102".
	12	The letter "R".
	50-66	Left-justified floating point number giving the percentage of search miles desirable to achieve by each resource on any but the first day of a long search.
	67-80	Comment field.
69	1-4	The number "103".
	12	The letter "R".
	50-66	Left-justified floating point number giving the probability that the priority will decrease when reevaluated.
	67-80	Comment field.
70	1-4	The number "104".
	12	The letter "R".

INITIALIZATION CARD	COLUMNS	CONTENT
	50-66	Left-justified floating point number giving the probability that the priority will increase when reevaluated.
	67-80	Comment field.
71	1-4	The number "105".
	13	The letter "Z".
	67-80	Comment field.
72	1-4	The number "106".
	12	The letter "R".
	50-66	Left-justified integer giving the option for the resource assignment policy (See OPSIM Definitions, Section II, Part II).
	67-80	Comment field.
73	1-4	The number "107"
	12	The letter"R".
	50-66	Left-justified floating point number expressed in decimal days giving the time for sunrise.
	67-80	Comment field.
74	1-4	The number "108".
	12	The letter "R".
	50-66	Left-justified floating point number expressed in decimal days giving the time for sunset.
	67-80	Comment field.
75	1-4	The number "109".
	13	The letter "Z".
	67-80	Comment field.
76	1-4	The number "110".
	12	The letter "R".
	50-66	Left-justified integer giving the priority level to which a CASE is raised while a short search is being served.

INITIALIZATION CARD	COLUMNS	CONTENT
	67-80	Comment field.
77	1-4	The number "111".
	12	The letter "R".
	50-66	Left-justified floating point number expressed in decimal days giving the hook-up time on a tow case.
	67-80	Comment field.
78	1-4	The number "112".
	5-8	The number "114".
	13	The letter "Z".
	67-80	Comment field.
79	1-4	The number "115".
	12	The letter "R".
	50-66	Left-justified floating point number expressed in nautical miles per day giving the tow speed of resources if L(CASE) $\leq$ 26 feet.
	67-80	Comment field.
80	1-4	The number "116".
	12	The letter "R".
	50-66	Left-justified floating point number expressed in nautical miles per day giving the tow speed of resources if L(CASE) > 26 feet.
	67-80	Comment field.
81	1-4	The number "117".
	13	The letter "Z".
	67-80	Comment field.
82	1-4	The number "118".
	12	The letter "R".
	50-66	Left-justified floating point number expressed in decimal days giving the hours before sunrise when held over long search cases are examined for resource assignment.

INITIALIZATION CARD	COLUMNS	CONTENT
	67-80	Comment field.
83	1-4	The number "119".
	13	The letter "Z".
	67-80	Comment field.
84	1-4	The number "120".
	10	The number "1".
	12	The letter "R".
	15-18	Integer giving the number of resource types.
	19-22	The number "23".
	34	The number "4".
	50-66	Left-justified format - 16(I4).
	67-80	Comment field.

Data cards follow initialization card 84 to input indicators (0 if resource type is a boat; 1 if resource type is an airplane) for each resource type under the format 16(I4).

85	1-4	The number "121".
	13	The letter "Z".
	67-80	Comment field.
86	1-4	The number "122".
	13	The letter "Z".
	67-80	Comment field.
87	1-4	The number "123".
	12	The letter "R".
	50-66	Left-justified integer giving the maximum number of OPFAC(CASE), the station of the case input from the Exogenous Event Tape.
	67-80	Comment field.
88	1-4	The number "124".
	10	The number "1".
	12	The letter "R".

INITIALIZATION CARD	COLUMNS	CONTENT
	15-18	Integer giving the maximum number of OPFAC(CASE).
	19-22	The number "123".
	34	The number "4".
	50-66	Left-justified format - 18(I4).
	67-80	Comment field.
Data cards follow to input the station conversion table under the format 18(I4).		
89	1-4	The number "125".
	12	The letter "R".
	50-66	Left-justified integer giving the logical unit number on which the case attributes will be written for Quick Query.
	67-80	Comment field.
90	1-4	The number "126".
	12	The letter "R".
	50-66	Left-justified integer giving the minimum priority at which a queued need or case is served by an idle capable resource regardless of the resource's type.
	67-80	Comment field.
91	1-4	The number "127".
	10	The number "1".
	13	The letter "Z".
	15-18	Integer giving the number of resources.
	19-22	The number "1".
	34	The number "2".
	67-80	Comment field.
92	1-4	The number "128".
	10	The number "1"
	12	The letter "R".
	15-18	Integer giving the number of resource types.

INITIALIZATION CARD	COLUMNS	CONTENT
	19-22	The number "23".
	34	The number "4".
	50-66	Left-justified format, 16(I4).
	67-80	Comment field.

Data cards follow to input indicators for each resource type under the format 16(I4). (0 for small vessels, 1 for cutters, 2 for C-130's and 3 for aircraft).

93	1-4	The number "129".
	10	The number "1".
	12	The letter "R".
	15-18	Integer giving the number of resource types.
	19-22	The number "23".
	34	The number "2".
	50-66	Left-justified format, 7(H3.6).
	67-80	Comment field.

Following initialization card 93 are the data cards to input a delay time for each resource type under the format, 7(H3.6).'

94	1-4	The number "130".
	12	The letter "R".
	50-66	Left-justified floating point number giving the amount of time in decimal days between check-in times when a 'covering' resource examines the queue.
	67-80	Comment field.
95	1-4	The number "131".
	10	The number "1".
	13	The letter "Z".
	15-18	Integer giving the number of stations.
	19-22	The number "34".
	34	The number "2".
	67-80	Comment field.
96	1-4	The number "132".

INITIALIZATION CARD	COLUMNS	CONTENT
	10	The number "1".
	12	The letter "R".
	15-18	Integer giving the number of stations.
	19-22	The number "34".
	34	The number "4".
	50-66	Left-justified format, 18(I4).
	67-80	Comment field.

Data cards follow initialization card 96 to input the group number of each station under the format, 18(I4).

97	1-4	The number "133".
	10	The number "1".
	13	The letter "Z".
	15-18	Integer giving the number of stations.
	19-22	The number "34".
	34	The number "2".
	67-80	Comment field.
98	1-4	The number "134".
	10	The number "1".
	13	The letter "Z".
	15-18	Integer giving the number of stations.
	19-22	The number "34".
	34	The number "2".
	67-80	Comment field.
99	1-4	The number "135".
	13	The letter "Z".
	67-80	Comment field.
100	1-4	The number "136".
	13	The letter "Z".
	67-80	Comment field.
101	1-4	The number "137".
	13	The letter "Z".

INITIALIZATION CARD	COLUMNS	CONTENT
	67-80	Comment field.
102	1-4	The number "138".
	12	The letter "R".
	50-66	Left-justified integer giving the number of groups.
	67-80	Comment field.
103	1-4	The number "139".
	5-8	The number "151".
	10	The number "1".
	13	The letter "Z".
	15-18	Integer giving the number of groups.
	19-22	The number "138".
	34	The number "2".
	67-80	Comment field.
104	1-4	The number "152".
	5-8	The number "155".
	13	The letter "Z".
	67-80	Comment field.
105	1-4	The number "156".
	12	The letter "R".
	50-66	Left-justified integer giving the number of distributions output in REPORT DSTRIB.
	67-80	Comment field.
106	1-4	The number "157".
	5-8	The number "167".
	10	The number "1".
	13	The letter "Z".
	15-18	Integer giving the number of distributions output in REPORT DSTRIB.
	19-22	The number "156".
	34	The number "2".
	67-80	Comment field.

INITIALIZATION CARD	COLUMNS	CONTENT
107	1-4	The number "168".
	13	The letter "Z".
	67-80	Comment field.
108	1-4	The number "169".
	12	The letter "R".
	50-66	Left-justified integer giving the number of holidays to be read in. If there are no holidays, input the number "1" in this field.
	67-80	Comment field.
109	1-4	The number "170".
	10	The number "1".
	12	The letter "R".
	15-18	Integer giving the number of holidays. If there are not holidays, read in the number "1" here.
	19-22	The number "169".
	34	The number "4".
	50-66	Left-justified format, 18(I4).
	67-80	Comment field.

Data cards follow initialization card 109 to read in holidays. A value of -1 should be read in here if there are no holidays.

110	1-4	The number "171".
	10	The number "1".
	12	The letter "R".
	15-18	Integer giving the number of stations.
	19-22	The number "34".
	34	The number "4".
	50-66	Left-justified format, 18(I4).

Following initialization card 110 are the data cards to input PSTTN for each station under the format 18(I4). PSTTN is a tag to indicate if the station can or cannot be a primary station.

INITIALIZATION CARD	COLUMNS	CONTENT
111	1-4	The number "172".
	10	The number "1".
	13	The letter "Z".
	15-18	Integer giving the number of stations.
	19-22	The number "34".
	34	The number "4".
	67-80	Comment field.
112	1-4	The number "173".
	12	The letter "R".
	50-66	Left-justified integer giving the output option for printing/not printing the 'case created' and 'case terminated' information.
	67-80	Comment field.
113	1-4	The number "174".
	10	The number "1".
	13	The letter "Z".
	15-18	Integer giving the number of stations.
	19-22	The number "34".
	34	The number "2".
	67-80	Comment field.
114	1-4	The number "175".
	13	The letter "Z".
	67-80	Comment field.

D. Blank Card

A blank card must follow the initial conditions deck.

E. Exogenous Event Deck

The exogenous events may be read from cards or from magnetic tape. For efficiency, OPSIM is reading exogenous events from magnetic tape.

There are three types of exogenous events in the operational simulator: (1) Exogenous Event START, (2) Exogenous Event OPSIM, and (3) Exogenous Event ENDSIM. START occurs only once and must be the first event to occur at TIME = 0.0. OPSIM occurs every time a case comes into the system. ENDSIM, an event to end the simulation, occurs only once and must be the last event on the tape. The contents and format of the exogenous tape event tape follow.

TYPE OF EVENT	CARD	COLUMNS	CONTENT
START	1	3	The number "3" to indicate Exogenous Event START.
(3)		7	A zero, "0", to give the day the event occurred.
		10	A zero, "0", to give the hour the event occurred.
		12	A zero, "0", to give the minute the event occurred.
OPSIM	1	3	The number "1" to indicate Exogenous Event OPSIM.
(1)		4-7	Right-justified integer giving the day the event occurred.
		8-10	Right-justified integer giving the hour the event occurred.
		11-12	Right-justified integer giving the minute the event occurred.
		13-15	IDLOC(CASE), right-justified integer.
		16-20	OPFAC(CASE), right-justified integer.
		21-25	NOCAS(CASE), right-justified integer.
		26-30	POB(CASE), right-justified integer.
		31-35	AIR(CASE), right-justified integer.
		36-40	WIND(CASE), right-justified integer.
		41-45	SWELL(CASE), right-justified integer.
		46-50	VIS(CASE), right-justified integer.
		51-55	UTYPE(CASE), right-justified integer.
		56-60	L(CASE), right-justified integer.
		61-65	FPRJ(CASE), right-justified integer.
		66-70	N, right-justified integer. N = NNN(CASE) if MMM(CASE) = 0, N = NNN(CASE) + 1 if MMM(CASE) > 0
	2	1-5	NNN(CASE), right-justified integer.
		6-10	MMM(CASE) right-justified integer.
		11-15	GAMMA(CASE), right-justified integer.
		16-20	S1S(CASE), right-justified integer.

TYPE OF EVENT	CARD	COLUMNS	CONTENT
		21-25	S2S(CASE), right-justified integer.
		26-30	TSM(CASE), right-justified integer.
		31-35	OFSHR(CASE), right-justified integer given in tenths of miles.
		36-40	XC(CASE), right-justified integer.
		41-45	YC(CASE), right-justified integer.
		46-50	BOX(CASE), right-justified integer.
		51-60	VALUE(CASE) right-justified integer.

If a single resource case is being input, card 3 is read under the format (I2, D1.4).

	3	1-2	NEED(CASE), right-justified integer.
		3-8	OST(CASE), a floating point number expressed in decimal days input under the format D1.4.

If a multi-resource case is being input, card 3 is read under the format 6(I2, D1.4, D1.2).

	3	1-2	NEED(NOTIF), right-justified integer.
		3-8	OST(NOTIF), a floating point number expressed in decimal days.
		9-12	DELTA(NOTIF), a floating point number.

Note that there are six sets of the above three fields on one input card. There is one set per need of a multi-resource case so that NEED (NOTIF), OST(NOTIF), and DELTA(NOTIF) are read repeatedly across the card for all NNN(CASE) needs. More than one card may be required to read in all needs.

	4	I2	ITOW(CASE), right-justified integer read in only for multi-resource cases with a tow or escort need.
ENDSIM	1	3	The number "2" to indicate Exogenous Event ENDSIM.
(2)		4-7	Right-justified integer giving the last day of the simulation.
		8-10	Right-justified integer giving the last hour of the simulation.
		11-12	Right-justified integer giving the last minute of the simulation.

F. Data to Subroutine JUMPER

The input data to Subroutine JUMPER immediately follows the Exogenous Event Deck. If the Exogenous Event Deck is read from magnetic tape, the data will follow the blank card.

Following is a description of the format and content of the JUMPER data set:

FORTRAN REPORT GENERATOR - INPUT DECK ORDER AND CARD FORMAT

CARD NUMBER	COLUMN NUMBERS	LINE REF. ON REPORT OUTPUT	VALUE IN SAMPLE RUN. (IF CARD TYPE IS MULTIPLY USED, ONLY VALUES FROM FIRST CARD SHOWN)	VARIABLE TYPE	DESCRIPTION OF VARIABLE
1	1&2		2	I2	District Number
	3-14		Aug. 12, 1970	2A6	Run Data
2	1-10		Non-Peak	2A5	Peak or Now Peak Season
	11&12		69	I2	Year
3	1&2		68	I2	Year from
	3&4		69	I2	Year to
4	1&2		3	I2	Number of "Pct Change For"'s to be entered
5	1-5		2.4	F5.1	Percent Age Change
	6-17		OPFAC 56	3A6	Attribute of Run That is Being Changed
6	1&2	A1	1	I2	Number of Added Stations
7	1-3	A1	122	I3	Station Number
	4-8		6138	F8.1	X Coordinate
	9-13		765432.1	F8.1	Y Coordinate
	14-16		1	I3	Covering Air Station
	17-19		2	I3	Covering Air Station
	20-22		3	I3	Covering Air Station
	23-25		4	I3	Covering Air Station
	26-28		523	I3	Covering Adjacent Station
	29-31		524	I3	Covering Adjacent Station
	32-34		525	I3	Covering Adjacent Station
	35-37		526	I3	Covering Adjacent Station
	38-40		636	I3	Responsible Cutter
	41-43		637	I3	Responsible Cutter
	44-46		638	I3	Responsible Cutter
	47-49		639	I3	Responsible Cutter
	50-52		640	I3	Responsible Cutter
8	1&2	A2	3	I2	Number of Deleted OPFACs
9	1-3	A2	121	I3	Numbers of the deleted OPFACs
10	1&2	A3	2	I2	Number of OPFACs with Attribute Changes
11	1-3	A3	67	I3	OPFAC Number
	4-75		CHANGE ABC TO XXX, DEF TO YYY, CHI TO ZZZ	12A6	Changes in Attributes
12	1&2	B1	1	I2	Number of New Resource Types
13	1&2	B1	5	I2	Resource Type
	3-9		9999.9	F7.1	COSTD
	10-16		6375.2	F7.1	END
	17-211		63.75	F5.2	MR
	22-25		71.1	F4.1	SLim
	26-30		22.2	F5.1	SØA1
	31-35		33.3	F5.1	SØA2
	36-40		44.4	F5.1	SØA3
	41-46		555.5	F6.1	If
14	1&2	B2	1	I2	Number of Attribute Changes
15	1&2	B2	8	I2	Number of Resource Type
	1-3	B2	CHANGE COST D TO 367.5, SLIM TO 2.3 AND IF TO 5555.5	12A6	Changes in Attributes
16	1&2		0	I2	Number of Resource Types with Capability Changes
17	1-72	B3	N.A. SINCE NO TYPES HAVE CHANGED	I3	Type Number with Capability Changes
18	1&2	B3	3	I2	Number of New OPFACs
19	1-72	C1	OPFAC RST 1-2 RST 9-5	12A6	OPFAC Number and Changes
20	1&2	C1	0	02	Number of Existing OPFACs with Inventory Changes
21	1-72	C2	N.A.	12A6	OPFAC number and Changes
22	1&2	C2	3	I2	Number of New OPFACs
23	1-3	D1	122		OPFAC Number

	4-6	3	3	I3	Number of Crews in Shift 1
	7-9	3	3	I3	Number of Crews in Shift 2
23	10-12	D1	3	I3	Number of Crews in Shift 3
	13-15		4	I3	Number of Crews in Shift 4
	16-18		4	I3	Number of Crews in Shift 5
	19-21		3	I3	Number of Crews in Shift 6
	22-24		3	I3	Number of Crews in Shift 7
	25-27		3	I3	Number of Crews in Shift 8
24	1&2	D2	2	I2	Number of Existing OPFACs with Crew Changes
25	1-72	D2	OPFAC 79: CHANGE SHFT 1 TO 500, SHFT 8 TO 5	12A6	OPFAC Number and Crew Level Changes
26	1-5	E1	22	I2	Number of Demgen Tape
27	1-12	E1	NA	2A6	Scenario Tape Input (N.A. or Number)
28	1-12	E1	1963-1970	2A6	Dates for Data Base
29	1-12	E1	PEAK	2A6	Season (Peak or Now Peak)
30	1-5	E1	98400	I5	Number of Cases
31	1-30	E1	FROM 12107160 TO 12106167	5A6	Number of Days or Inclusive Dates
32	1-3	E2	005	I3	Number of Special Reports
33	1-3	E2	023	I3	Number of Each Special Report

FIGURE IV-5
Samples Output from Subroutine JUMPER

```
                    SARSIM - DISTRICT 2                                                    DATE AUG12,1970

                      NON - PEAK   1969

                    FORECAST FROM 1968  TO  69
                          WITH
                      2.4 PCT CHANGE FOR OPFAC 56
                    -17.3 PCT CHANGE FOR CLIENTEL 31
                      6.8 PCT CHANGE FOR TIME PERIOD 6

                          I.  INPUT CONDITIONS

A. STATION CHANGES
   1. ADD
      OPFAC 122  XS =     631.8YS = 765432.1 ACS =   1,  2,  3,  4  ADJS = 523,524,525,526  CUT = 636,637,638,639,640
      OPFAC 123  XS =     531.7YS = 123456.7 ACS = 122,121,124, 25  ADJS =   2,  3,  4,  5  CUT = 909, 98,907,906,905
      OPFAC 124  XS =    1000.0YS = 666666.6 ACS = 444,333,222,111  ADJS = 555,666,777,888  CUT = 353,354,355,356,357
   2. DELETE
      OPFAC 121
      OPFAC 133
      OPFAC 145
   3. ATTRIBUTE CHANGE
      OPFAC  67   CHANGE ABC TO XXX, DEP TO YYY,CHI TO ZZZ
      OPFAC  21   CHANGE JKL TO PPP, MNO TO SSS, FGH TO HQX
B.  RESOURCE TYPE CHANGES
   1. NEW  (SEE INITIALIZATION DATA FOR CHANGES TO CAPABILITY MATRIX(CPBL))
      RST= 5      COSTD= 9999.9   ENO= 6375.2  MR=63.57  SLIM=71.1  SOA1= 22.2  SOA2= 33.3  SOA3= 44.4  TF= 555.5
   2. ATTRIBUTE CHANGE
      RST 8       CHANGE COSTD TO 357.5, SLIM TO 24.3 AND TF TO 5555.5
   3. CAPABILITY CHANGE
      NO CAPABILITY CHANGES
C.  RESOURCE INVENTORY CHANGES
   1. NEW OPFACS
      OPFAC 122  RST 1 = 2  RST 9 = 5
      OPFAC 123   RST  3 = 4  RST 17 = 2  RST 13 = 6
      OPFAC 124  RST 2 = 3
   2. EXISTING OPFACS
      NO RESOURCE CHANGES TO  EXISTING OPFACS
D.  CREW MANNING LEVEL CHANGES
   1. NEW OPFACS
      OPFAC 122  SHFT1=  3  SHFT2=  3  SHFT3=  3  SHFT4=  4  SHFT5=  4  SHFT6=  3  SHFT7=  3  SHFT8=  3
      OPFAC 123  SHFT1=  2  SHFT2=  2  SHFT3=  2  SHFT4=  2  SHFT5=  3  SHFT6=  3  SHFT7=  1  SHFT8=  1
      OPFAC 124  SHFT1=  5  SHFT2=  5  SHFT3=  5  SHFT4=  5  SHFT5=  5  SHFT6=  5  SHFT7=  2  SHFT8=  2
   2. EXISTING OPFACS
      OPFAC 79, CHANGE SHFT1 TO 003  SHFT8 TO 5
      OPFAC 30, CHANGE SHFT5 TO   2, SHFT9 TO 6
E. USER INPUT OPTIONS
   1. PREPROCESSOR
      DEMGEN TAPE    22
      SCENERIO INPUT NA
      DATA BASE   1963-1970
      SEASON PEAK
      NUMBER OF CASES  98400
      NUMBER OF DAYS   FROM 12/07/66 TO 12/06/67
   2. POSTPROCESSOR
      SPECIAL OUTPUT VIA QUICK QUERY
      REPORT  23
      REPORT  31
      REPORT  65
```

V. User's Guide

The computer code consisting of the Definition Deck, Events List, Exogenous Events, Endogenous Events, and subroutines is stored on the FASTRAND drum for the UNIVAC 1108 at NBS under the file name CGSIM. It is assumed that the case input or demand data is stored on magnetic tape. (The large number of cases for most runs makes the use of keypunched cards impractical.) The unit or input device on which the tape is to be mounted is specified by letter on an ASG (assign) control card and by number in column 42 of the first card of the Initialization Deck referred to as the System Specifications Card. The letter and number must be in agreement, with A corresponding to 7, B to 8, etc. If it is desired to output attributes of the individual cases, the system variable STAPE must be set equal to the number of the output device. If this number corresponds to a tape drive, there must be an ASG control card assigning the appropriate tape.

A sample run deck will now be described. The reader is referred to Figure V-1. The following symbols will be used:

@ = keypunch both a seven and an eight in column one

Δ = blank

A complete description of the individual cards follows:

Card 1:

D is the priority of the run. The number of tapes, execution time, and the number of output pages determine the priority of a run.

RUN is simply the indication of a RUN card.

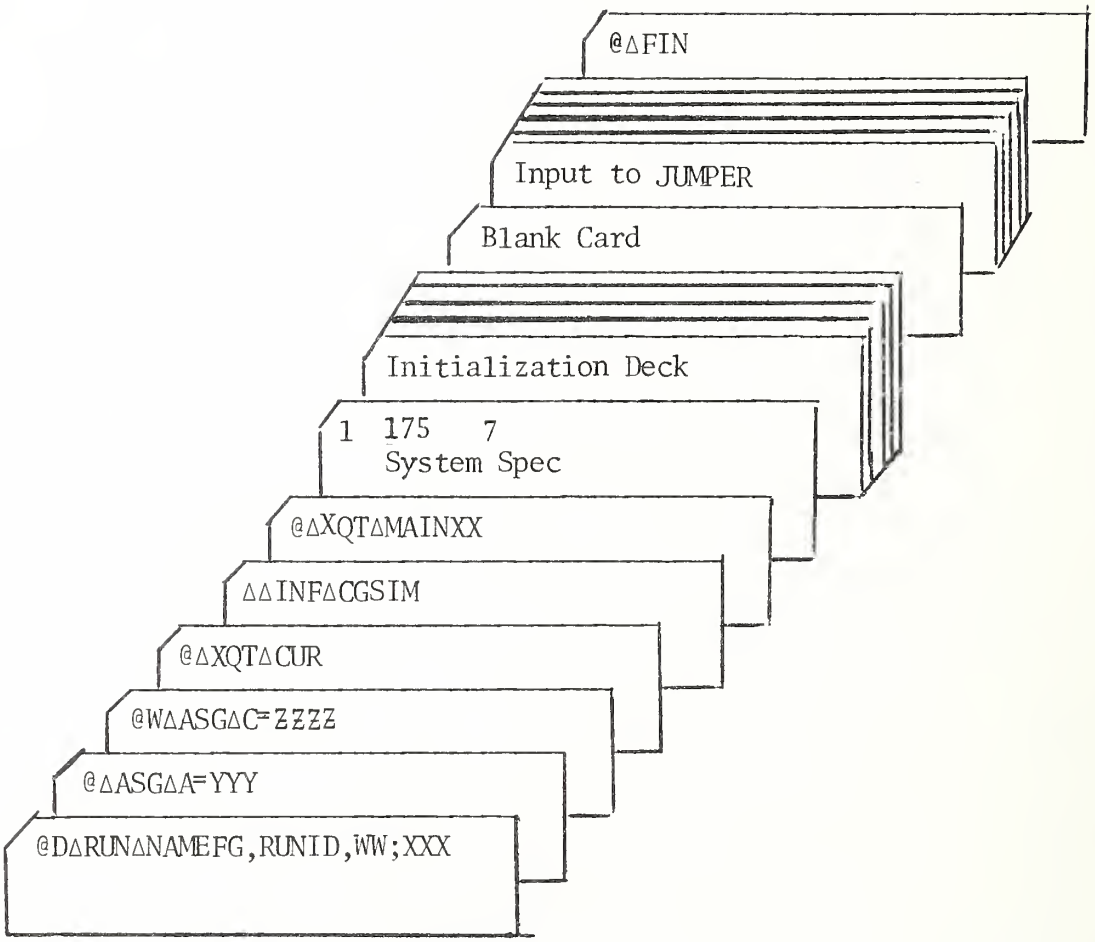

FIGURE V-1

A Sample Run Deck

NAMEFG is the six character user name.

RUNID is a five digit charge number.

WW is the maximum time in minutes. Execution terminates abruptly if WW is exceeded.

XXX is the maximum number of pages to be output. Execution terminates if XXX is exceeded.

Card 2:

ASG designates a tape assignment.

A specifies the letter of the tape drive.

YYYY is the reel number of the tape to be mounted. For Figure V-1 this corresponds to the case input data since the number 7 appears in column 42 of the System Specifications Card.

Card 3:

W indicates the tape will be written on.

C is the letter of the tape drive. The variable STAPE should be set to 9 so that case output will be written on this tape.

ZZZZ is the reel number of the tape to be mounted. If it is desired to obtain a new tape for this prupose, an S is placed next to the W (on either side) and nothing is keypunched on the card after the letter C.

Card 4:

Keypunched exactly as shown. This calls in the Complex Utility Routines.

Card 5:

Keypunched exactly as shown. This brings the program file CGSIM into the user storage.

Card 6:

Keypunch exactly as shown. This begins execution of the program.

Card 7:

This is the System Specifications Card described in part IV of the Operational Simulator documentation. It receives individual attention here only to show the correspondence between the 7 in column 42 and the assignment of tape A on Card 2.

Initialization, Blank Card, and JUMPER Input: These were described in part IV.

Last Card

Keypunch exactly as shown. This indicates that the run is finished.

It may at some time be desirable to change some portion of the computer code. A complete detailed description of all the control cards needed to accomplish such a change is quite lengthy and involves detailed explanation of UNIVAC 1108 control cards and SIMSCRIPT techniques. Instead, Figure V-2 will list the formatted cards required to change both Subroutine SERVE and Endogenous Event ARVSN as an example. The new version of the program will exist in the second file of the tape reel YYYY mounted here on unit B.

Major points to note in Figure V-2 are as follows:

1. There is no choice regarding the tape unit used by SIMSCRIPT to output the compiled version of the program, it must be unit B.
2. The Definition Deck must preceed the routines being recompiled.
3. A card with "$" in column 1 must follow the last routine being recompiled.

Figure V-2

Run Deck to Revise SERVE and ARVSN

Card Column

Number 1

```
@DΔRUNΔNAMEFG,RUNID,WW,XXX
@WΔASGΔB=YYYY
@ΔXQTΔCUR
ΔΔINFΔSIMSC6
@NΔXQTΔSIM
      Place the Definition Deck here.
      Place the New Version of Subroutine SERVE here.
      Place the New Version of Endogenous Event ARVSN here.
$
@ΔXQTΔCUR
ΔΔERS
ΔΔINFΔCGSIM
ΔΔDELΔSERVE/CODE
ΔΔDELΔXARVSN/CODE
ΔΔINΔB
@NΔASM,*ΔSERVE,SERVE
@NΔASM,*ΔXARVSN,XARVSN
@ΔXQTΔCUR
ΔΔDELΔSERVE
ΔΔDELΔXARVSN
ΔΔDELΔDEFSXX
ΔΔPAC
ΔΔOUTΔB
ΔΔTEFΔB
ΔΔTRIΔB
@ΔFIN
```

Figure V-3

Execution of the Revised Program

Card Column
Number 1

```
@DΔRUNΔNAMEFG,RUNID,WW,XXX
@ΔASGΔA=XXXX
@ΔASGΔB=YYYY
@ΔXQTΔCUR
ΔΔPEFΔB
ΔΔINΔB
@ΔXQTΔMAINXX
      Initialization Deck
      Blank Card
      Input to JUMPR
@ΔFIN
```

4. Endogenous Events are referred to on DEL (delete) Cards and ASM (assemble) cards with an "X" preceeding the name.

5. There are other ways by which to accomplish the change shown in Figure V-2. This is a reasonable way, however, which should serve the purpose for users who wish to avoid detailed involvement with SIMSCRIPT and/or the UNIVAC 1108.

Having revised the code, it is then desired to execute the new version of the program. Assuming the case input tape to be found on tape reel XXXX and that STAPE = 0 so that no case output is desired, Figure V-3 shows a typical follow-up run to the run shown in Figure V-2.

The process of adding or deleting entries in the Definition Deck is somewhat complicated. SIMSCRIPT compiles a translator provided subroutine package for every definition on every card of the Definition Deck. Because of the large number of definitions required by OPSIM, the standard compilation and assembly procedures set up an overflow condition on the UNIVAC 1108. The suggested "fix" for this overflow breaks the assembled version into two parts which are now arbitrarily named A and B. Thus, one run is required to compile, assemble, the list the assembled code in order to see how to split the code, and a second run actually accomplishes the split via two more assemblies. An example of the first run is shown in Figure V-4.

The user must next examine the output from this first run. A computer reproduction of a sample Definition Deck is shown in Figure V-5. The assembly listing corresponding to this Definition Deck

FIGURE V-4

Run to Compile and List Assembly of Definition Deck

```
@DΔRUNΔNAMEFG,RUNID,WW,XXX
@WΔASGΔB=YYYY
@ΔXQTΔCUR
ΔΔINFΔSIMSC6
@NΔXQTΔSIM
        Place the revised Definition Deck here.
$
@ΔXQTΔCUR
ΔΔERS
ΔΔINFΔSIMLIB
ΔΔINΔB
@IΔASM,*ΔDEFSXX,DEFSXX
@ΔFIN
```

```
COMPILED BY UNIVAC 1107/1108 SIMSCRIPT 1.5  DATED - MAR.  6, 1969  VERSION 2.11

234567890123456789012345678901234567890123456789012345678901234567890123456789012
T CASE 2          T AIR   011/4 1   1RES    E
                  T XC    02    *F  2COST   1   2 F
```

FIGURE V-5

Computer Output Version of Sample Definition Deck

is shown in Figure V-6. The six-digit numbers at the left of the listing are line numbers. The entities and attributes appear in the listing with a single letter prefix. The line on which an entity or attribute name appears and all lines up to the next entity or attribute constitute a package which must not be split. The first four lines and the last line (line 52) must appear in both sections A and B. A "good" place to split this assembly is after line 27. Figure V-7 shows the run which will result in A containing lines 1 - 27 and 52 B containing lines 1 - 4 and 28 - 52. The new version of OPSIM is then output in the second file of reel number YYYY.

Before concluding this part, some mention should be made of computer running time. Generally it takes approximately three to five minutes to compile all of the OPSIM routines. The assembly process requires approximately 10 minutes. To compile and assemble one or two routines in a single computer run can take as long as two to three minutes. As far as execution times are concerned, a set of about 900 real cases occurring during the month of July 1968 in District 1 was simulated in approximately 5 minutes when operating with 109 resources. When the number of resources was reduced to 34, execution time decreased to 2 1/2 minutes. When the number of resources was increased to 218, execution time increased to approximately 7 1/2 minutes.

FIGURE V-6

Sample Assembly Listing

```
@1 ASM,* OEFSXX,OEFSXX
ASSEMBLED BY UNIVAC 1108 EXEC 11 ASSEMBLER   2404 0008A

000001                                                          SIMREG
000002                    000000000016          M              EQU     14
000003                                          $(2)           LIT .
000004                                          $(1) .
000005       01   000000  27 16 14 00 0 000003  CCASE*  L,M     A0,LCASE .
000006 U          000001  72 01 00 00 0 000000          SLJ     CRXXE .
000007            000002  74 04 00 13 0 000000          J       0,B11 .
000008            000003  000000000000          LCASE   +0 .
000009            000004  000000000002                  +2 .
000010            000005  27 16 14 00 0 000003  OCASE*  L,M     A0,LCASE .
000011 U          000006  72 01 00 00 0 000000          SLJ     OEXXS .
000012            000007  74 04 00 13 0 000000          J       0,B11 .
000013            000010  27 00 14 13 1 000000  GAIR*   L       A0,*0,B11 .
000014            000011  24 16 14 00 0 000001          A,M     A0,1 .
000015            000012  27 16 17 00 0 000006          L,M     A3, 6 .
000016 U          000013  72 01 00 00 0 000000          SLJ     GETUXX .
000017            000014  74 04 00 13 0 000001          J       1,B11 .
000018            000015  27 00 14 13 1 000000  PAIR*   L       A0,*0,B11 .
000019            000016  24 16 14 00 0 000001          A,M     A0,1 .
000020            000017  27 16 17 00 0 000006          L,M     A3, 6 .
000021 U          000020  72 01 00 00 0 000000          SLJ     PUTUXX .
000022            000021  74 04 00 13 0 000001          J       1,B11 .
000023 U          000022  74 13 14 00 0 000000          LMJ     B12,ERRXX .
000024            000023  061627050505                  'AIR  ' .
000025            000024  27 16 14 00 0 000001  NRES*   L,M     A0,  1 .
000026 U          000025  27 00 15 00 1 000000          L       A1,*XXL1 .
000027            000026  74 04 00 13 0 000000          J       0,B11 .
000028            000027  27 00 14 13 1 000000  GXC*    L       A0,*0,B11 .
000029            000030  27 00 15 14 0 000002          L       A1,2,A0 .
000030            000031  74 04 00 13 0 000001          J       1,B11 .
000031            000032  27 00 14 13 1 000000  PXC*    L       A0,*0,B11 .
000032            000033  06 00 15 14 0 000002          S       A1,2,A0 .
000033            000034  74 04 00 13 0 000001          J       1,B11 .
000034            000035  27 16 14 00 0 000002  GCOST*  L,M     A0,  2 .
000035 U          000036  27 01 16 00 1 000000          L,H2    A2,*XXL1 .
000036            000037  27 16 17 00 0 000002          L,M     A3, 2 .
000037            000040  10 00 04 13 1 000000          L       A4,*0,B11 .
000038 U          000041  72 01 00 00 0 000000          SLJ     XXOS .
000039 U          000042  72 01 00 00 0 000000          SLJ     GETUXX .
000040 U          000043  72 01 00 00 0 000000          SLJ     UUXX   .
000041            000044  74 04 00 13 0 000001          J       1,B11 .
000042            000045  27 16 14 00 0 000002  PCOST*  L,M     A0,  2 .
000043 U          000046  27 01 16 00 1 000000          L,H2    A2,*XXL1 .
000044            000047  27 16 17 00 0 000002          L,M     A3, 2 .
000045            000050  10 00 04 13 1 000000          L       A4,*0,B11 .
000046 U          000051  72 01 00 00 0 000000          SLJ     PUXX   .
000047 U          000052  72 01 00 00 0 000000          SLJ     XXOS .
000048 U          000053  72 01 00 00 0 000000          SLJ     PUTUXX .
000049            000054  74 04 00 13 0 000001          J       1,B11 .
000050 U          000055  74 13 14 00 0 000000          LMJ     A0,ERRXX .
000051            000056  102430310505                  'COST ' .
000052                                                  END .
```

FIGURE V-7

Splitting the Assembly of the Definition Deck

```
@DΔRUNΔNAMEFG, RUNID,WW,XXX
@WΔASGΔB=YYYY
@ΔXQTΔCUR
ΔΔINFΔCGSIM
ΔΔDELΔA/CODE
ΔΔDELΔB/CODE
ΔΔINΔB
@IΔASM,*ΔDEFSXX,A
-28,51
@IΔASM,*ΔDEFSXX,B
-5,27
@ΔXQTΔCUR
ΔΔDELΔDEFSXX
ΔΔPAC
ΔΔOUTΔB
ΔΔTEFΔB
ΔΔTRIΔB
@ΔFIN
```

VI. Interpretation of Output

In order to interpret properly the output produced by OPSIM, it is necessary to understand the calculations of the various statistics. A complete list of all statistical attributes discussed herein is given in Figure VI-1. The explanation of the collection of these statistics will be presented in like order; however, some preliminary definitions are required first.

TIME: In the context to follow, this will refer to the total time simulated for a given run.

NRES: The total number of resources in the district being simulated.

NSTA: The total number of stations in the district being simulated.

NWEWDS: The total number of weekend and weekday shifts.

NRST: The total number of resource types.

REST(I,J): The total number of resources of type J at station I.

TOTME(K): The total simulated time occurring during shift K. This attribute of WEWDS is accumulated in Endogenous Event NUCRU and Exogenous Event ENDSIM.

TUTIL(L): The total time during a particular shift for which EIAT(L) $\neq$ 0. This attribute of RES is set to zero at the start of every new shift. At the end of a shift its value is accumulated into UTIL(L) and USHF(I,K) for the appropriate values of I and K.

FIGURE VI-1

COLLECTION OF STATISTICS IN OPSIM

ENTITY	STATISTIC	ROUTINES WHERE STATISTICS ARE COLLECTED
CASE:	CNRES	SERVE,SSS,EXQ,STNBY
	COSTC	SERVE,SSS,EXQ,STNBY
	DMERT	STATS
	NDINT	SAQ
	NQUE	SRAS,SRCH,NOTE,SRISE,SAQ,QUEUE
	REA	SRAS,SRCH,NOTE,SRISE,SAQ,QUEUE
	RESA	ARVSN,ARSCH
	TINT	NUCRU,XSET,EXQ,STNBY,SVQUE
	TQUE	NUCRU,XSET,EXQ,STNBY,SVQUE
	TQUE1	ARVSN,ARSCH
	TSVC	TERM
	TWAIT	ARVSN,ARSCH
NOTIF:	RESA	ARVSN
NOTE:	RESA	ARSCH
RES:	NCASE	SERVE,SSS,EXQ,STNBY
	UTIL	NUCRU,ENDSIM
RST:	AUT	ENDSIM
STA:	AVGTM	ARVSN,ARSCH,ENDSIM
	CFTT	ENDSIM
	DMRT	STATS,ENDSIM
	FAIL1	SRAS,NOTIF,SRCH
	FAIL2	SRAS,NOTIF,SRCH
	FAIL3	ARVSN,ARSCH
	NCAS	ARVSN,ARSCH
	NEEDS	SERVE,SSS,EXQ,STNBY
	NINTR	SAQ
	NMBRQ	TERM
	NSTBY	ROCA
	TWTOL	STATS,ENDSIM
	UNPRO	STNBY
	USE	ENDSIM
	USHF	NUCRU,ENDSIM
	VCTR	STATS,ENDSIM
WEADS:	AVUS	ENDSIM
	USHF	NUCRU,ENDSIM
GROUP:	AVDRT	STATS,ENDSIM
	CS	ENDSIM
	FL1	ENDSIM
	FL2	ENDSIM
	FL3	ENDSIM
	INTRP	ENDSIM
	NDS	ENDSIM
	NONPR	ENDSIM
	NOSR	ENDSIM
	TMTAV	STATS,ENDSIM
	TVAVG	STATS,ENDSIM
	TWAVG	STATS,ENDSIM
	USEAV	ENDSIM
USTRA:	MEEM	NUCRU,STATS,TERM,ENDSIM
	CNTR	NUCRU,STATS,TERM

	STDEV	NUCRU,STATS,TERM,ENDSIM
	CATG1-CATG8	NUCRU,STATS,TERM
SYSTEM VAR:	AIRU	ENDSIM
	AVUTO	ENDSIM
	BUTIL	ENDSIM
	CUTIL	ENDSIM
	C130U	ENDSIM
	KOUNT	DPSIM,TERM,ENDSIM
	LIMIT	START,ENDSIM
	MCFTT	ENDSIM
	MEAND	STATS,ENDSIM
	MEANV	STATS,ENDSIM
	MEANW	ENDSIM
	MNTMT	STATS,ENDSIM
	NBRCD	TERM
	NBRCS	DPSIM
	NBRFA	ENDSIM
	NBRFB	ENDSIM
	NBRFC	ENDSIM
	SNEED	ENDSIM
	TDSBY	ROCA
	TDTIN	SAQ
	TUNPR	STNBY

Following is an explanation of the statistics collected in OPSIM:

CNRES(CASE): The total number of resources assigned to serve a case.

COSTC(CASE): This is the total cost of the case. It is equal to the sum of COST(IRS) for every resource IRS assigned to serve the case.

DMERT(CASE): This is the case demerit calculated in Subroutine STATS. If (TWAIT-TOL) $\leq$ 0, then DMERT = 0.0. If (TWAIT-TOL) > 0, then DMERT is calculated as follows. If OFSHR > 20 and PRI $\leq$ 2 or if OFSHR > 20 and PRI > 2, then DMERT = 2.0 * (TWAIT - TOL). If OFSHR $\leq$ 20 and PRI > 2, then DMERT = 3.0 * (TWAIT - TOL). If OFSHR > 20 and PRI $\leq$ 2, then DMERT = TWAIT - TOL.

NOINT(CASE): The total number of times that the resource(s) serving a case are interrupted.

NQUE(CASE): The total number of times that the case enters a queue. This value is increased by one every time that a need, tow, or search is filed in the queue.

REA(CASE): The reason the case first enters a queue. The meanings of the various values this can assume are given in part II.

RESA(CASE): This is the first resource to arrive on the scene of the case.

TINT(CASE): The total time that some need, tow, or search of the case is in the queue because of an interrupt. Time starts to accumulate in this attribute as soon as the first need, tow, or search of the case is in interrupt status in CQUE. It ceases to accumulate when the last need, tow, or search in the queue because of an interrupt is served.

TQUE(CASE): Total time during which at least one need, tow, or search of the case is in the queue.

TQUE1(CASE): Total time before the first resource arrives on the scene of the case for which at least one need, tow or search of the case is in the queue.

TSVC(CASE): Total time the case is in the system. A case is considered "in the system" from the time it occurs until the time at which the resource serving the last need, tow, or search leaves the scene of the case having completed its duty.

TWAIT(CASE): Total time between the occurrence of the case and the time that the first resource arrives on scene.

RESA(NOTIF): The first resource to arrive on the scene of the case for the purpose of serving a particular need or tow NOTIF.

RESA(NOTE): The first resource to arrive on the scene of the case for the purpose of serving a long search NOTE.

NCASE(RES): The total number of times a resource is assigned to service. It is increased every time a resource is assigned to a need, even if it serves more than one need of the same case.

UTIL(L): This attribute assumes two roles in the simulation. While the simulation is in progress it contains the total time for which EIAT(L) $\neq$ 0. At the end of the simulation in ENDSIM the value UTIL(L) is divided by TIME. It then represents average utilization for resource L. Let UTIL(L)1 denote the value before the division occurs.

AUT(J): This is the average utilization of resource type J. It is calculated in ENDSIM as follows:

$$AUT(J) = \left[\sum_{L\varepsilon J} UTIL(L)^{1}\right]/\left[TIME*\sum_{I=1}^{NSTA} REST(I,J)\right].$$

AVGTW(STA): The average time in hours that cases have to wait. The waiting time is attributed to the station of the first resource to arrive on the scene of the case.

CFTT(STA): The average Failure type C(TWAIT-TOL) at a station expressed in decimal hours. This is calculated in Subroutine ENDSIM.

CFTT(STA) = TWTOL(STA)1 *24.0)/FAIL3(STA).

DMRT(STA): During the simulation, DMRT(STA) is an accumulation of the case demerits, DMERT(CASE), and is accounted to the station of the first resource to arrive on the scene of the case. In ENDSIM, to obtain the normalized demerit at the station in decimal hours, DMRT(STA) is replaced by (DMRT(STA) *24.0*R)/NCAS(STA) where R

is the sum of all positive (TWAIT-TOL) in the district divided by the sum of all case demerits in the district.

FAIL1(STA),
FAIL2(STA),
FAIL3(STA): The total number of Failure type A, type B, and type C respectively at a given station. FAIL1 and FAIL2 are attributed to the primary station of the case. FAIL3 is accounted to the station of the first resource to arrive on the scene of the case.

NCAS(STA): The number of cases for which a resource from this station was the first resource to arrive on the scene of the case.

NEEDS(STA): The number of times resources from this station were assigned to service.

NINTR(STA): The number of times resources from this station were interrupted while serving one case to serve another case.

NMBRQ(STA): The number of times a case, multi-resource need or long search need was queued at this station. The queue is attributed to the primary station of the case.

NSTBY(STA): The number of times that a standby was called at the station.

TWTOL(STA): During the simulation, TWTOL(STA) is an accumulation of all positive (TWAIT-TOL) and is accounted to

the station of the first resource to arrive on the scene of the case. In ENDSIM, to obtain the average positive (TWAIT-TOL) at the station in decimal hours, TWTOL(STA) is replaced by TWTOL(STA)1* 24.0)/NCAS(STA). Let TWTOL(STA)1 denote the value before the division occurs.

UNPRO(STA): The number of times that a standby was called at the station but not used.

USE(I): This is the average utilization at station I. It is calculated in ENDSIM as follows:

$$USE(I) = [\sum_{K=1}^{NWWDS} USHF(I,K)^1]/[TIME^* \sum_{J=1}^{NRST} REST(I,J)].$$

USHFI,K): This attribute assumes two roles in the simulation. During the simulation it is an accumulation of TUTIL(L) for "appropriate" values of L. That is, at the end of every shift K, the value of TUTIL(L) is accumulated into USHF(I,K) if resource L has STN(L) = I. At the end of the simulation in ENDSIM, USHF (I,K) is replaced by the following quotient:

$$USHF(I,K)/[TOTME(K)^*\sum_{J=1}^{NRST} REST(I,J)].$$

Thus USHF(I,K) becomes average utilization during shift K at station I. Let $USHF(I,K)^1$ refer to the value of USHF(I,K) described above immediately before the division is executed.

VCTR(STA): VCTR(STA) is an accumulation of the time-to-vector (TVEC) of the first resource to arrive on the scene of the case and is accounted to the station of that resource. At the end of the simulation in ENDSIM, VCTR(STA) is replaced by VCTR(STA) *24.0/NCAS(STA) for the average TVEC in decimal hours.

AVUS(K): This is the average utilization during shift K. It is calculated in ENDSIM as follows:

$$AVUS(K) := \left[\sum_{I=1}^{NSTA} USHF(I,K)^{1}\right]/[TOTME\ (K)*NRES].$$

AVDRT(GROUP): AVDRT(GROUP) is an accumulation of case demerits, DMERT(CASE), and is accounted to the group of the station of the first resource to arrive on the scene of the case. To obtain the normalized demerit of the group in decimal hours, AVDRT(GROUP) is replaced by (AVDRT(GROUP)*24.0*R)/CS(GROUP) in ENDSIM. R is the sum of all positive (TWAIT-TOL) in the district divided by the sum of all case demerits in the district.

CS(GROUP) The number of cases for which a resource from this group was the first resource to arrive on the scene of the case.

FL1(GROUP), FL2(GROUP), FL3(GROUP): The total number of failure type A, type B and type C respectively in a given group. FL1 and FL2

are attributed to the group of the primary station of a case. FL3 is attributed to the group of the station of the first resource to arrive on the scene of a case.

INTRP(GROUP): The number of times resources from this group were interrupted.

NDS(GROUP): The number of times resources from this group were assigned to service.

NONPR(GROUP): The number of times that a standby was called at the stations belonging to the group but not used.

NOSB (GROUP): The number of times that a standby was called at the stations belonging to the group.

TMTAV(GROUP): During the simulation, TMTAV(GROUP) is an accumulation of all positive (TWAIT-TOL) and is accounted to the group of the station of the first resource to arrive on the scene of the case. To obtain, the average positive (TWAIT-TOL) of the group in decimal hours, TMTAV(GROUP) is replaced by TMTAV(GROUP)*24.0/CS (GROUP) in ENDSIM.

TVAVG (GROUP): During the simulation, TVAVG(GROUP) is an accumulation of TVEC of the first resource to arrive on the scene of a case and is accounted to the group of the station of that resource. In ENDSIM, to obtain the average

TVEC of the group in decimal hours, TVAVG(GROUP) is replaced by TVAVG(GROUP) *24.0/CS(GROUP).

TWAVG(GROUP): TWAVG(GROUP) is an accumulation of TWAIT(CASE) and is attributed to the group of the station of the first resource to arrive on the scene of the case. To obtain the average TWAIT of the group in decimal hours, TWAVG(GROUP) is replaced by TWAVG(GROUP) *24.0/ CS(GROUP) in ENDSIM.

USEAV(GROUP): This is the average utilization of the group. It is calculated in ENDSIM as follows:

$$USEAV(GROUP) = \left[\sum_{K=1}^{NWEWDS} \sum_{I \in GROUP} USHF(I,K)^{1}\right] / \left[TIME^{*} \sum_{J=1}^{NRST} \sum_{I \in GROUP} REST(I,J)\right]$$

MEEN(I): The arithmetic mean of certain attributes output in REPORT DSTRIB. During the simulation, MEEN(I) contains the sum of the values of the observations. In ENDSIM, this sum is divided by the number of observations to obtain the mean.

CNTR(I): The number of observations made.

STDEV(I): The standard deviation of certain attributes output in REPORT DSTRIB. During the simulation, STDEV(I) contains the sum of the squares of the observation values. In ENDSIM, STDEV(I) is replaced by:

$$[STDEV(I)/CNTR(I)] - [MEEN(I)]^{2}$$

MEEN(I) is the arithmetic mean as explained after the division in ENDSIM.

CAT1(I)-CATG8(I): Eight separate categories in which to store the distribution of observations for output in REPORT DSTRIB.

AIRU: The average utilization of aircraft excluding C-130's. This is calculated in ENDSIM as follows:

$$AIRU = \left[\sum_{I \in L} UTIL(I)^1\right] / \left[TIME * \sum_{J=1}^{NSTA} \sum_{K \in M} REST(J,K)\right]$$

where L is the set of resources having SQTAG(TYPE(I)) =3 and M is the set of resource types having SQTAG(K) =3.

AVUTØ: This is average overall utilization. It is calculated in ENDSIM as follows:

$$AVUTO = \left[\sum_{K=1}^{NWWDS} \sum_{I=1}^{NSTA} USHF(I,K)^1\right] / [TIME*NRES].$$

BUTIL: The average utilization of small vessels. This is calculated in ENDSIM as follows:

$$BUTIL = \left[\sum_{I \in L} UTIL(I)^1\right] / \left[TIME * \sum_{J=1}^{NSTA} \sum_{K \in M} REST(J,K)\right]$$

where L is the set of resources having SQTAG(TYPE(I))=0 and M is the set of resource types having SQTAG(K) = 0.

CUTIL: The average utilization of cutters. In ENDSIM, this is calculated as follows:

$$CUTIL = \left[\sum_{I \in L} UTIL(I)^1\right] / \left[TIME * \sum_{J=1}^{NSTA} \sum_{K \in M} REST(J,K)\right]$$

where L is the set of resources having SQTAG(TYPE (I)) = 1 and M is the set of resource types having SQTAG(K) = 11

C130U: The average utilization of C-130's.

KOUNT: During the simulation KOUNT is the number of cases currently residing in core storage. At the end of the simulation KOUNT is set equal to the sum of the values NCAS for all stations.

LIMIT: During the simulation, LIMIT is an estimate of the maximum number of cases which can reside in core storage simultaneously. In ENDSIM, LIMIT is set equal to the sum of the values NMBRQ for all stations.

MCFTT: The average Failure type C in the district expressed in decimal hours. This is calculated in Subroutine ENDSIM; it is the sum of all the positive values of (TWAIT-TOL) in the district multiplied by 24 and divided by NBRFC.

MEAND: The normalized demerit in the district. It is an accumulation of all the case demerits during the simulation. In ENDSIM, its is replaced with (MEAND*24.0*R)/ $\sum_{I=1}^{NSTA}$ NCAS(I) where R is the sum of all positive (TWAIT-TOL) in the district divided by the sum of all case demerits in the district.

MEANV: The average TVEC in the district of the first resource to arrive on the scene of a case. It is an accumulation of these times-to-vector during the simulation. In ENDSIM, it is replaced by MEANV *24.0/ $\sum_{I=1}^{NSTA}$ NCAS(I).

MEANW: The average time that a case must wait prior to the arrival of the first resource. This is the sum of the values of TWAIT for all cases multiplied by 24 and divided by the sum of the values NCAS for all stations.

MNTMT: The average positive (TWAIT-TOL) in the district. This is the sum of all the positive values of (TWAIT-TOL) multiplied by 24 and divided by the sum of the values NCAS for all stations.

NBRCO: The number of cases that were actually completed.

NBRCS: The total number of cases that occurred.

NBRFA,
NBRFB,
NBRFC: Total number of Failures of type A, B, and C, respectively in the district. These are the sums of FAIL1(STA), FAIL2(STA) and FAIL3(STA) respectively taken over all stations.

SNEED: The total number of needs. This is the sum of NEEDS(STA) over all stations. This may not equal the actual number of needs that occurred since any need served by more than one resource (as would be the case, for example, if an interrupt occurs) is counted more than once.

TOSBY: The total number of times a standby is called. This is the sum of NSTBY(STA) over all stations.

TOTIN: The total number of interrupts. This is the sum of NINTR(STA) over all stations.

TUNPR: The total number of standbys called and not used. This is the sum of UNPRO(STA) over all stations.

The output produced by OPSIM is of two basic types, the "Report Output" and the "Tape Output" containing the attributes of the individual cases. The two types will be discussed separately below.

The Report Output consists of eight different divisions. A sample of the Report Output received when OPSIM is run with PRTOT = 0 is given in Figure VI-2. The first division is labeled "Input Conditions". This is the output produced by the FORTRAN Subroutine JUMPER described in part IV. It indicates cahnges from a base condition in the Initialization Deck which were made for the current run.

The second division is labeled "District Statistics". The following entities and attributes are output in this division: NBRCS, NBRCO, NBRFA, NBRFB, NBRFC, TIME, AVUTO, AVUS for all shifts, AUT for all resource types, BUTIL, CUTIL, C130U, AIRU, TOSBY, and TUNPR. All these statistics are labeled by the output with a brief but reasonable definition.

The third division is labeled "Station Response". There is a row of print for every station in the district being simulated. The following list will indicate the correspondence between column labels and attribute names.

FIGURE VI-2 (Sample Report Output)

```
 SARSIM - DISTRICT13                                        DATE MAY 21, 1971

   PEAK          1968

 FORECAST FROM 1968  TO  68

 I.  INPUT CONDITIONS

A. STATION CHANGES
   1. ADD
      NO ADDITIONS
   2. DELETE
      NO DELETIONS
   3. ATTRIBUTE CHANGE
      NO ATTRIBUTE CHANGES
B.  RESOURCE TYPE CHANGES
   1. NEW  (SEE INITIALIZATION DATA FOR CHANGES TO CAPABILITY MATRIX(CPBL))
      NO NEW ADDITIONS
   2. ATTRIBUTE CHANGE
      NO ATTRIBUTE CHANGES
   3. CAPABILITY CHANGE
      NO CAPABILITY CHANGES
C.  RESOURCE INVENTORY CHANGES
   1. NEW OPFACS
      NO NEW OPFACS
   2. EXISTING OPFACS
      NO RESOURCE CHANGES TO  EXISTING OPFACS
D.  CREW MANNING LEVEL CHANGES
   1. NEW OPFACS
      NO CHANGES
   2. EXISTING OPFACS
      NO CHANGES IN EXISTING MANNING LEVELS
E. USER INPUT OPTIONS
   1. PREPROCESSOR
      DEMGEN TAPE     0
      SCENERIO INPUT NA
      DATA BASE   JULY 68 HIST
      SEASON PEAK
      NUMBER OF CASES    865
      NUMBER OF DAYS   FROM JULY 1 THROUGH JULY 31
   2. POSTPROCESSOR
      SPECIAL OUTPUT VIA QUICK QUERY
      NO SPECIAL REPORTS
   3. OPSIM
      RAP    =  2
      TOL(1) =  0.17 DAYS      TOLS(1) =  0.58 DAYS
      TOL(2) =  0.12 DAYS      TOLS(2) =  0.25 DAYS
      TOL(3) =  0.08 DAYS      TOLS(3) =  0.17 DAYS
      TOL(4) =  0.04 DAYS      TOLS(4) =  0.08 DAYS
      TOL(5) =  0.02 DAYS      TOLS(5) =  0.04 DAYS
      IDELT  =  1
      KKK    =  2.
      PRON   =  0.65
      PROP   =  0.10
      HO     =  4.   NAUTICAL MILES
```

II. DISTRICT STATISTICS

A. CASE SUMMARY

```
TOTAL NUMBER OF CASES THAT OCCURRED =              865
TOTAL NUMBER OF CASES THAT WERE COMPLETED =        860
TOTAL NUMBER OF CASES WITH FAILURE A =               0
TOTAL NUMBER OF CASES WITH FAILURE B =               0
TOTAL NUMBER OF CASES WITH FAILURE C =             118
TOTAL SIMULATED TIME (DAYS) =                      31.
```

B. RESOURCE SUMMARY

```
AVERAGE UTILIZATION OVERALL = 4.73%
AVERAGE UTILIZATION BY SHIFTS:
                        SHIFT 1  -   2.55%
                        SHIFT 2  -   4.47%
                        SHIFT 3  -   5.07%
                        SHIFT 4  -   4.04%
                        SHIFT 5  -   4.47%
                        SHIFT 6  -   9.26%
                        SHIFT 7  -   7.71%
                        SHIFT 8  -   5.99%
AVERAGE UTILIZATION BY RESOURCE TYPES:
                        RESOURCE TYPE 1  -   8.91%
                        RESOURCE TYPE 2  -   1.99%
                        RESOURCE TYPE 3  -   0.27%
                        RESOURCE TYPE 4  -   5.13%
                        RESOURCE TYPE 5  -   9.48%
                        RESOURCE TYPE 6  -   1.99%
                        RESOURCE TYPE 7  -   0.37%
                        RESOURCE TYPE 8  -   6.86%
                        RESOURCE TYPE 9  -   0.  %
                        RESOURCE TYPE10  -   0.47%
                        RESOURCE TYPE11  -  11.60%
                        RESOURCE TYPE12  -   0.  %
                        RESOURCE TYPE13  -   5.13%
                        RESOURCE TYPE14  -   2.74%
                        RESOURCE TYPE15  -   2.62%
                        RESOURCE TYPE16  -   0.  %
COMBINED UTILIZATION OF BOATS              -    4.90%
COMBINED UTILIZATION OF CUTTERS            -    5.27%
COMBINED UTILIZATION OF C130               -    5.13%
COMBINED UTILIZATION OF OTHER AIRCRAFT     -    2.67%
```

C. STATION SUMMARY

```
TOTAL NUMBER OF TIMES A STANDBY WAS CALLED (ALL STATIONS) =    95
TOTAL NUMBER OF TIMES A STANDBY WAS CALLED BUT NOT USED (ALL STATIONS) =    93
```

III. STATION RESPONSE

	NUMBER OF CASES	NUMBER OF NEEDS	FAILURE TYPE A	FAILURE TYPE B	FAILURE TYPE C	NO. OF Q	TOTAL INTERRUPTED NEEDS	AVERAGE TVEC (HOURS)	AVERAGE TWAIT (HOURS)	AVG. CFAIL TWAIT-TOL (HOURS)	AV. POS. TWAIT-TOL (HOURS)	NORMLZD DEMERIT (HOURS)	STANDBYS CALLS/UNPRO.	AVERAGE UTILIZATION
STA 1	0	0	0	0	0	0	0	0.	0.	0.	0.	0.	0/ 0	0. %
STA 2	0	0	0	0	0	0	0	0.	0.	0.	0.	0.	0/ 0	0. %
STA 3	1	2	0	0	0	0	0	0.67	2.17	0.	0.	0.	0/ 0	0.47%
STA 4	14	20	0	0	13	0	0	3.27	6.11	4.02	3.73	2.77	0/ 0	22.79%
STA 5	0	0	0	0	0	0	0	0.	0.	0.	0.	0.	0/ 0	0. %
STA 6	0	0	0	0	0	0	0	0.	0.	0.	0.	0.	0/ 0	0. %
STA 7	18	26	0	0	0	0	3	1.03	1.24	0.	0.	0.	0/ 0	9.57%
STA 8	3	3	0	0	1	2	0	2.86	3.11	4.38	1.46	1.27	0/ 0	3.23%
STA 9	22	25	0	0	3	1	2	1.03	1.24	0.46	0.06	0.08	0/ 0	9.73%
STA 10	11	28	0	0	3	5	2	0.96	1.16	0.51	0.14	0.18	0/ 0	11.86%
STA 11	30	41	0	0	5	0	1	0.26	0.52	0.23	0.04	0.05	13/12	2.74%
STA 12	18	25	0	0	8	0	0	0.65	0.77	0.48	0.21	0.28	2/ 2	4.67%
STA 13	4	9	0	0	0	0	0	0.53	0.69	0.	0.	0.	0/ 0	1.14%
STA 14	121	171	0	0	11	0	0	0.90	1.06	1.97	0.18	0.19	0/ 0	10.68%
STA 15	34	48	0	0	6	1	0	0.63	0.79	0.29	0.05	0.07	0/ 0	3.79%
STA 16	123	146	0	0	3	0	0	0.44	0.60	0.70	0.02	0.02	0/ 0	5.91%
STA 17	27	47	0	0	0	0	0	0.42	0.59	0.	0.	0.	0/ 0	2.84%
STA 18	25	42	0	0	4	0	0	0.95	1.11	1.06	0.17	0.22	0/ 0	7.07%
STA 19	15	30	0	0	1	0	1	0.28	0.45	0.08	0.01	0.01	0/ 0	2.02%
STA 20	67	77	0	0	15	1	0	0.47	0.64	0.18	0.04	0.04	0/ 0	4.57%
STA 21	26	32	0	0	1	0	0	0.43	0.60	0.17	0.01	0.01	0/ 0	1.79%
STA 22	55	74	0	0	12	0	0	0.50	0.68	0.28	0.06	0.08	0/ 0	6.01%
STA 23	56	73	0	0	6	0	2	0.96	1.18	2.72	0.29	0.27	5/ 4	5.40%
STA 24	10	16	0	0	5	1	0	3.47	3.59	4.98	2.44	2.89	0/ 0	5.41%

	NUMBER OF CASES	NUMBER OF NEEDS	FAILURE TYPE A	FAILURE TYPE B	FAILURE TYPE C	NO. OF Q	TOTAL INTERRUPTED NEEDS	AVERAGE TVEC (HOURS)	AVERAGE TWAIT (HOURS)	AVG. CFAIL TWAIT-TOL (HOURS)	AVG. POS. TWAIT-TOL (HOURS)	NORMLZD DEMERIT (HOURS)	STANDBYS CALLS/UNPRO.	AVERAGE UTILIZATION
STA 25	20	27	0	0	1	0	0	0.52	0.68	0.47	0.02	0.03	0/ 0	3.11%
STA 26	11	15	0	0	1	0	0	0.61	0.78	0.36	0.03	0.04	0/ 0	1.48%
STA 27	0	0	0	0	0	0	0	0.	0.	0.	0.	0.	0/ 0	0. %
STA 28	4	5	0	0	1	0	0	1.02	3.07	4.33	1.08	0.94	0/ 0	2.48%
STA 29	11	15	0	0	1	0	1	0.54	0.60	0.02	0.00	0.00	0/ 0	1.26%
STA 30	0	2	0	0	0	0	0	0.	0.	0.	0.	0.	0/ 0	0.22%
STA 31	7	8	0	0	2	0	0	2.42	2.58	4.46	1.27	1.42	0/ 0	2.32%
STA 32	21	23	0	0	1	0	0	0.70	0.92	2.02	0.10	0.12	0/ 0	2.82%
STA 33	11	22	0	0	8	2	1	0.84	1.69	1.31	0.95	1.16	2/ 2	5.13%
STA 34	2	2	0	0	1	5	0	0.53	0.86	0.44	0.22	0.29	2/ 2	0.47%
STA 35	45	63	0	0	4	1	8	0.87	1.00	1.80	0.16	0.14	42/42	25.63%
STA 36	6	8	0	0	0	3	0	0.09	0.26	0.	0.	0.	4/ 4	1.92%
STA 37	39	42	0	0	1	1	3	0.33	0.47	0.60	0.02	0.01	21/21	8.85%
STA 38	7	7	0	0	0	1	0	0.08	0.25	0.	0.	0.	4/ 4	1.02%
TOTAL/AVG	864	1174	0	0	118	24	24	0.74	0.97	1.49	0.20	0.20	95/ 93	4.73%

NOTE: 1. SCALING FACTOR FOR NORMLZD DEMERIT (12TH COLUMN ABOVE) = 0.433
2. COEFFICIENTS USED IN THE CALCULATION OF CASE DEMERIT: 1,2,3

IV . RESOURCE UTILIZATION (PERCENT)

	SHIFT1	SHIFT2	SHIFT3	SHIFT4	SHIFT5	SHIFT6	SHIFT7	SHIFT8
STATN 1	0. %	0. %	0. %	0. %	0. %	0. %	0. %	0. %
RST 12								
RES 1 (ASSIGNED TO 0 NEEDS) = 0. %								
RES 2 (ASSIGNED TO 0 NEEDS) = 0. %								
	SHIFT1	SHIFT2	SHIFT3	SHIFT4	SHIFT5	SHIFT6	SHIFT7	SHIFT8
STATN 2	0. %	0. %	0. %	0. %	0. %	0. %	0. %	0. %
RST 12								
RES 3 (ASSIGNED TO 0 NEEDS) = 0. %								
	SHIFT1	SHIFT2	SHIFT3	SHIFT4	SHIFT5	SHIFT6	SHIFT7	SHIFT8
STATN 3	0. %	2.00%	0. %	0. %	0. %	0. %	0. %	0. %
RST 11								
RES 4 (ASSIGNED TO 2 NEEDS) = 0.47%								
	SHIFT1	SHIFT2	SHIFT3	SHIFT4	SHIFT5	SHIFT6	SHIFT7	SHIFT8
STATN 4	8.97%	20.62%	25. %	16.70%	31.16%	36.58%	50.12%	39.59%
RST 11								
RES 5 (ASSIGNED TO 20 NEEDS) = 22.73%								
	SHIFT1	SHIFT2	SHIFT3	SHIFT4	SHIFT5	SHIFT6	SHIFT7	SHIFT8
STATN 6	0. %	0. %	0. %	0. %	0. %	0. %	0. %	0. %
RST 8								
RES 6 (ASSIGNED TO 0 NEEDS) = 0. %								
	SHIFT1	SHIFT2	SHIFT3	SHIFT4	SHIFT5	SHIFT6	SHIFT7	SHIFT8
STATN 7	2.91%	9.86%	13.13%	12.20%	1.83%	17.99%	18.28%	15.95%
RST 8								
RES 7 (ASSIGNED TO 26 NEEDS) = 9.56%								
	SHIFT1	SHIFT2	SHIFT3	SHIFT4	SHIFT5	SHIFT6	SHIFT7	SHIFT8
STATN 8	2.13%	4.55%	5.47%	6.19%	2.89%	0. %	0. %	0. %
RST 8								
RES 8 (ASSIGNED TO 3 NEEDS) = 3.23%								
	SHIFT1	SHIFT2	SHIFT3	SHIFT4	SHIFT5	SHIFT6	SHIFT7	SHIFT8
STATN 9	7.10%	7.94%	9.28%	10.80%	2.54%	20.52%	20.86%	11.87%
RST 8								
RES 9 (ASSIGNED TO 25 NEEDS) = 9.71%								
	SHIFT1	SHIFT2	SHIFT3	SHIFT4	SHIFT5	SHIFT6	SHIFT7	SHIFT8
STATN 10	1.76%	10.35%	20.73%	10.11%	10.44%	16.46%	30.09%	19.01%
RST 8								
RES 10 (ASSIGNED TO 28 NEEDS) = 11.83%								
	SHIFT1	SHIFT2	SHIFT3	SHIFT4	SHIFT5	SHIFT6	SHIFT7	SHIFT8
STATN 11	1.39%	3.06%	1.56%	1.15%	3.50%	5.11%	6.29%	4.84%
RST 14								
RES 11 (ASSIGNED TO 1 NEEDS) = 0.08%								
RES 12 (ASSIGNED TO 3 NEEDS) = 0.23%								
RES 13 (ASSIGNED TO 37 NEEDS) = 7.91%								
	SHIFT1	SHIFT2	SHIFT3	SHIFT4	SHIFT5	SHIFT6	SHIFT7	SHIFT8
STATN 12	0.29%	3.38%	3.57%	4.00%	0.28%	14.16%	8.13%	7.23%
RST 15								
RES 14 (ASSIGNED TO 9 NEEDS) = 4.39%								
RES 15 (ASSIGNED TO 16 NEEDS) = 4.94%								
	SHIFT1	SHIFT2	SHIFT3	SHIFT4	SHIFT5	SHIFT6	SHIFT7	SHIFT8
STATN 13	2.76%	0. %	0.57%	0.79%	3.23%	1.22%	0. %	0. %
RST 4								
RES 16 (ASSIGNED TO 8 NEEDS) = 1.08%								

```
  RST   6
    RES  17 (ASSIGNED TO    1 NEEDS) =  0.31%
                      SHIFT1       SHIFT2       SHIFT3       SHIFT4       SHIFT5       SHIFT6       SHIFT7       SHIFT8
STATN  14              8.05%        7.89%       12.36%       10.74%        9.69%       18.06%       16.90%       14.37%
  RST   1
    RES  18 (ASSIGNED TO   50 NEEDS) = 14.29%
    RES  19 (ASSIGNED TO   75 NEEDS) = 29.27%
  RST   4
    RES  20 (ASSIGNED TO    6 NEEDS) =  2.14%
    RES  21 (ASSIGNED TO   15 NEEDS) =  5.01%
    RES  22 (ASSIGNED TO   23 NEEDS) = 12.91%
  RST   7
    RES  23 (ASSIGNED TO    2 NEEDS) =  0.36%
                      SHIFT1       SHIFT2       SHIFT3       SHIFT4       SHIFT5       SHIFT6       SHIFT7       SHIFT8
STATN  15              1.58%        4.56%        0.98%        3.39%        2.41%        8.13%        8.04%        8.75%
  RST   1
    RES  24 (ASSIGNED TO   39 NEEDS) =  9.06%
  RST   5
    RES  25 (ASSIGNED TO    8 NEEDS) =  2.05%
  RST   7
    RES  26 (ASSIGNED TO    1 NEEDS) =  0.26%
                      SHIFT1       SHIFT2       SHIFT3       SHIFT4       SHIFT5       SHIFT6       SHIFT7       SHIFT8
STATN  16              1.01%        6.08%        8.92%        3.78%        6.47%       14.66%       12.25%        2.22%
  RST   1
    RES  27 (ASSIGNED TO   31 NEEDS) =  5.49%
    RES  28 (ASSIGNED TO   90 NEEDS) = 17.45%
  RST   4
    RES  29 (ASSIGNED TO   19 NEEDS) =  5.07%
  RST   5
    RES  30 (ASSIGNED TO    6 NEEDS) =  1.47%
  RST   7
    RES  31 (ASSIGNED TO    0 NEEDS) =  0.  %
                      SHIFT1       SHIFT2       SHIFT3       SHIFT4       SHIFT5       SHIFT6       SHIFT7       SHIFT8
STATN  17              1.92%        3.64%        5.62%        4.07%        1.37%        0.80%        2.99%        0.61%
  RST   1
    RES  32 (ASSIGNED TO   34 NEEDS) =  6.23%
  RST   4
    RES  33 (ASSIGNED TO   12 NEEDS) =  2.14%
  RST   6
    RES  34 (ASSIGNED TO    1 NEEDS) =  0.13%
                      SHIFT1       SHIFT2       SHIFT3       SHIFT4       SHIFT5       SHIFT6       SHIFT7       SHIFT8
STATN  18              5.09%        7.64%        6.87%        9.22%        9.28%        9.53%        4.00%        3.25%
  RST   4
    RES  35 (ASSIGNED TO   34 NEEDS) = 11.32%
  RST   6
    RES  36 (ASSIGNED TO    8 NEEDS) =  2.81%
                      SHIFT1       SHIFT2       SHIFT3       SHIFT4       SHIFT5       SHIFT6       SHIFT7       SHIFT8
STATN  19              0.09%        3.51%        3.60%        2.45%        0.21%        3.58%        1.78%        0.  %
  RST   4
    RES  37 (ASSIGNED TO   27 NEEDS) =  3.62%
  RST   6
    RES  38 (ASSIGNED TO    3 NEEDS) =  0.41%
                      SHIFT1       SHIFT2       SHIFT3       SHIFT4       SHIFT5       SHIFT6       SHIFT7       SHIFT8
STATN  20              2.23%        3.46%        1.05%        4.05%        5.32%       14.91%        8.67%        5.30%
  RST   4
```

```
    RES  39 (ASSIGNED TO   57 NEEDS) = 10.58%
  RST   6
    RES  40 (ASSIGNED TO   17 NEEDS) =  2.62%
  RST   7
    RES  41 (ASSIGNED TO    3 NEEDS) =  0.49%
                      SHIFT1      SHIFT2      SHIFT3      SHIFT4      SHIFT5      SHIFT6      SHIFT7      SHIFT8
STATN  21              0.  %       1.17%       3.55%       0.30%       2.07%       5.43%       5.14%       1.86%
  RST   2
    RES  42 (ASSIGNED TO   16 NEEDS) =  1.99%
  RST   4
    RES  43 (ASSIGNED TO   15 NEEDS) =  3.25%
  RST   6
    RES  44 (ASSIGNED TO    1 NEEDS) =  0.14%
                      SHIFT1      SHIFT2      SHIFT3      SHIFT4      SHIFT5      SHIFT6      SHIFT7      SHIFT8
STATN  22              4.46%       7.67%       7.31%       4.08%       1.84%      10.33%       6.90%       6.20%
  RST   1
    RES  45 (ASSIGNED TO   51 NEEDS) = 19.  %
  RST   4
    RES  46 (ASSIGNED TO   21 NEEDS) =  4.66%
  RST   6
    RES  47 (ASSIGNED TO    2 NEEDS) =  0.34%
  RST   7
    RES  48 (ASSIGNED TO    0 NEEDS) =  0.  %
                      SHIFT1      SHIFT2      SHIFT3      SHIFT4      SHIFT5      SHIFT6      SHIFT7      SHIFT8
STATN  23              3.42%       4.68%       7.15%       5.81%       6.14%       5.22%       5.20%      12.71%
  RST   1
    RES  49 (ASSIGNED TO    1 NEEDS) =  1.15%
    RES  50 (ASSIGNED TO    4 NEEDS) =  0.46%
    RES  51 (ASSIGNED TO   13 NEEDS) =  2.37%
    RES  52 (ASSIGNED TO   55 NEEDS) = 17.56%
                      SHIFT1      SHIFT2      SHIFT3      SHIFT4      SHIFT5      SHIFT6      SHIFT7      SHIFT8
STATN  24              2.12%       0.83%       1.39%       0.76%      15.42%      15.63%      16.66%      13.51%
  RST   4
    RES  53 (ASSIGNED TO   12 NEEDS) =  8.78%
  RST   6
    RES  54 (ASSIGNED TO    3 NEEDS) =  7.24%
  RST   7
    RES  55 (ASSIGNED TO    1 NEEDS) =  0.19%
                      SHIFT1      SHIFT2      SHIFT3      SHIFT4      SHIFT5      SHIFT6      SHIFT7      SHIFT8
STATN  25              2.39%       6.99%       0.  %       0.  %       1.04%       6.40%       3.64%       0.  %
  RST   4
    RES  56 (ASSIGNED TO   23 NEEDS) =  5.27%
  RST   6
    RES  57 (ASSIGNED TO    4 NEEDS) =  0.94%
                      SHIFT1      SHIFT2      SHIFT3      SHIFT4      SHIFT5      SHIFT6      SHIFT7      SHIFT8
STATN  26              0.69%       2.22%       1.98%       1.87%       0.11%       2.51%       1.15%       0.53%
  RST   4
    RES  58 (ASSIGNED TO   12 NEEDS) =  2.58%
  RST   6
    RES  59 (ASSIGNED TO    3 NEEDS) =  0.37%
                      SHIFT1      SHIFT2      SHIFT3      SHIFT4      SHIFT5      SHIFT6      SHIFT7      SHIFT8
STATN  27              0.  %       0.  %       0.  %       0.  %       0.  %       0.  %       0.  %       0.  %
  RST   1
    RES  60 (ASSIGNED TO    0 NEEDS) =  0.  %
                      SHIFT1      SHIFT2      SHIFT3      SHIFT4      SHIFT5      SHIFT6      SHIFT7      SHIFT8
```

```
STATN  28                1.25%       0.03%       0.39%       0.  %       1.68%       14.54%       0.  %       11.57%
  RST   1
    RES  61 (ASSIGNED TO    5 NEEDS) =  2.47%
                       SHIFT1      SHIFT2      SHIFT3      SHIFT4      SHIFT5      SHIFT6      SHIFT7      SHIFT8
STATN  29                0.15%       0.38%       0.  %       0.66%       2.31%       3.95%       4.81%       4.50%
  RST  15
    RES  62 (ASSIGNED TO    3 NEEDS) =  0.15%
    RES  63 (ASSIGNED TO    2 NEEDS) =  0.68%
    RES  64 (ASSIGNED TO   10 NEEDS) =  2.94%
                       SHIFT1      SHIFT2      SHIFT3      SHIFT4      SHIFT5      SHIFT6      SHIFT7      SHIFT8
STATN  30                0.  %       0.92%       0.  %       0.  %       0.  %       0.  %       0.  %       0.  %
  RST   1
    RES  65 (ASSIGNED TO    1 NEEDS) =  0.16%
  RST   3
    RES  66 (ASSIGNED TO    1 NEEDS) =  0.27%
                       SHIFT1      SHIFT2      SHIFT3      SHIFT4      SHIFT5      SHIFT6      SHIFT7      SHIFT8
STATN  31                4.33%       0.44%       3.40%       6.24%       0.  %       0.  %       0.  %       1.19%
  RST   6
    RES  67 (ASSIGNED TO    7 NEEDS) =  3.16%
  RST   7
    RES  68 (ASSIGNED TO    1 NEEDS) =  1.49%
                       SHIFT1      SHIFT2      SHIFT3      SHIFT4      SHIFT5      SHIFT6      SHIFT7      SHIFT8
STATN  32                3.15%       3.47%       1.07%       2.76%       0.  %       3.18%       6.29%       4.05%
  RST   6
    RES  69 (ASSIGNED TO   21 NEEDS) =  5.45%
  RST   7
    RES  70 (ASSIGNED TO    2 NEEDS) =  0.19%
                       SHIFT1      SHIFT2      SHIFT3      SHIFT4      SHIFT5      SHIFT6      SHIFT7      SHIFT8
STATN  33                4.82%       2.97%       3.83%       4.16%       6.08%       4.23%       13.10%      14.87%
  RST  13
    RES  71 (ASSIGNED TO    7 NEEDS) =  2.43%
    RES  72 (ASSIGNED TO   15 NEEDS) =  7.83%
                       SHIFT1      SHIFT2      SHIFT3      SHIFT4      SHIFT5      SHIFT6      SHIFT7      SHIFT8
STATN  34                0.  %       0.  %       0.  %       0.  %       0.  %       4.23%       1.27%       0.  %
  RST  10
    RES  73 (ASSIGNED TO    2 NEEDS) =  0.47%
                       SHIFT1      SHIFT2      SHIFT3      SHIFT4      SHIFT5      SHIFT6      SHIFT7      SHIFT8
STATN  35               12.29%      30.35%      32.86%      22.45%      14.46%      62.02%      23.02%      11.11%
  RST   5
    RES  74 (ASSIGNED TO   63 NEEDS) = 25.56%
                       SHIFT1      SHIFT2      SHIFT3      SHIFT4      SHIFT5      SHIFT6      SHIFT7      SHIFT8
STATN  36                0.  %       3.77%       3.24%       0.  %       0.  %       6.69%       0.  %       0.  %
  RST   4
    RES  75 (ASSIGNED TO    8 NEEDS) =  1.92%
                       SHIFT1      SHIFT2      SHIFT3      SHIFT4      SHIFT5      SHIFT6      SHIFT7      SHIFT8
STATN  37                0.07%      12.11%      12.57%       4.55%       0.  %      37.44%       6.97%       0.  %
  RST   5
    RES  76 (ASSIGNED TO   42 NEEDS) =  8.83%
                       SHIFT1      SHIFT2      SHIFT3      SHIFT4      SHIFT5      SHIFT6      SHIFT7      SHIFT8
STATN  38                0.  %       2.08%       0.  %       0.  %       0.  %       5.46%       0.  %       0.  %
  RST   4
    RES  77 (ASSIGNED TO    7 NEEDS) =  1.02%
```

V. EXCEPTIONAL CASES

VI. DISTRIBUTIONS

A. SYSTEM

		PERCENT								
	MEAN	STD. DEV.	0-0.5	0.5-1.0	1.0-2.0	2.0-3.0	3.0-4.0	4.0-5.0	5.0-10.0	>10
DAILY UTILIZATION OVERALL (WEEKDAYS) -	3.86	1.25	0	0	1	5	7	5	4	0
DAILY UTILIZATION OVERALL (WEEKENDS) -	6.88	1.30	0	0	0	0	0	0	9	0

B. CASES

			HOURS								
			MEAN	STD. DEV.	0-0.5	0.5-1.0	1.0-2.0	2.0-3.0	3.0-4.0	4.0-5.0	5.0-10.0	>10
TWAIT	(ALL CASES)	WEEKDAYS -	1.00	1.42	161	183	73	16	4	5	14	2
TWAIT	(ALL CASES)	WEEKENDS -	0.86	1.32	165	173	45	6	3	5	7	2
TVEC	(ALL CASES)	WEEKDAYS -	0.77	1.26	268	106	54	8	5	6	10	1
TVEC	(ALL CASES)	WEEKENDS -	0.63	0.89	243	107	35	8	2	7	4	0
TWAIT-TOL	(ALL CASES)	WEEKDAYS -	-1.81	2.07	30	10	8	3	5	3	7	0
TWAIT-TOL	(ALL CASES)	WEEKENDS -	-2.03	1.98	30	10	3	1	2	2	3	1
DEMERIT	(ALL CASES)	WEEKDAYS -	0.24	1.04	30	10	8	3	5	3	7	0
DEMERIT	(ALL CASES)	WEEKENDS -	0.16	0.93	30	10	3	1	2	2	3	1
TSVC	(ALL CASES)	WEEKDAYS -	2.66	3.65	7	69	204	78	31	15	31	19
TSVC	(ALL CASES)	WEEKENDS -	2.32	3.30	3	84	192	59	22	11	21	14

THERE WERE NO CASES IN THE QUEUE WHEN THE SIMULATION ENDED AT 31.00.04

THE FOLLOWING RESOURCES WERE BUSY WHEN THE SIMULATION ENDED AT 31.00.04

RESOURCE	RESOURCE STATION	XR	YR	IB	CASE	OCCUR	CASE STATION	NNN	MMM	S1S	S2S	XC	YC	TWAIT
9	9	111.	129.	2	2220039	30.21.34	9	0	1	0	0	111.	129.	0.01.24
10	10	-11.	96.	2	2110037	30.04.57	34	1	2	0	0	-11.	96.	0.00.57
45	22	72.	-99.	1	3610036	27.14.34	22	9	0	1	0	72.	-99.	0.01.13
53	24	84.	-59.	1	3120031	30.21.49	19	1	0	0	0	86.	-26.	0.00.00

LABEL	ATTRIBUTE
Number of Cases	NCAS(STA)
Number of Needs	NEEDS(STA)
Failure Type A	FAIL1(STA)
Failure Type B	FAIL2(STA)
Failure Type C	FAIL3(STA)
Number of Q's	NMBRQ(STA)
Total Interrupted Needs	NINTR(STA)
Average TVEC (Hours)	VCTR(STA)
Average TWAIT (Hours)	AVGTW(STA)
Average CFAIL (TWAIT-TOL)(Hours)	CFTT(STA)
Average Pos. TWAIT-TOL (Hours)	TWTOL(STA)
Normalized Demerit (Hours)	DMRT(STA)
Standbys Calls/Unpro.	NSTBY(STA), UNPRO(STA)
Average Utilization	USE(STA)

The last row printed in this division is labeled "TOTAL/AVG". Reading from left to right the entries in this row are KOUNT, SNEED, NBRFA, NBRFB, NBRFC, LIMIT, TOTIN, MEANV, MEANW, MCFTT, MNTMT, MEAND , TOSBY, TUNPR, and AVUTO.

"Group Response" labels the fourth division. The correspondence between column labels and attribute names follows.

LABEL	ATTRIBUTE
Number of cases	CS(GROUP)
Number of needs	NDS(GROUP)

Failure Type A	FL1(GROUP)
Failure Type B	FL2(GROUP)
Failure Type C	FL3(GROUP)
Total Interrupted Needs	INTRP(GROUP)
Average TVEC (Hours)	TVAVG(GROUP)
Average TWAIT (Hours)	TWAVG(GROUP)
Average Pos. TWAIT-TOL (Hours)	TMTAV(GROUP)
Normalized Demerit	AVDRT(GROUP)
Times Standby Called	NOSB(GROUP)
Unporductive Standby Calls	NONPR(GROUP)
Average Utilization	USEAV(GROUP)

The fifth division is labeled "Resource Utilization (Percent)". Here again the output is grouped by station. The columns labeled "SHIFT1", "SHIFT2", etc. contain the attribute USHF(I,J) for the station I and shift J. Every resource assigned to the station is listed in a group according to resource type; the average utilization UTIL and the number of needs served by the resource NCASE are printed.

The sixth division is labeled "Exceptional Cases". It prints the major attributes of all cases which were not completely processed because of some unusual circumstances. The value of ITOL(CASE) which is among the attributes printed gives some indication of the reason that the case was termed "exceptional" and was filed in the set EXCS.

The seventh division is broken into two sections. The mean, standard deviation and distribution of both weekday and weekend utilization are

output in the first section. In the second section, the mean, standard deviation and distribution of certain critical attributes are printed.

The eighth and final division prints the status of cases which are in the queue and are not completed and resources which are still busy when the simulation ends. The following attributes are labeled and printed for cases remaining in the queue: NOCAS, OCCUR, STATN, NNN, MMM, S1S, S2S, XC, YC, TINQ, SIGNL and FLG. If there are no remaining cases in the queue, a message only is printed. For the cases being served when the simulation ends the following attributes are labeled and printed: NOCAS, OCCUR, STATN, NNN, MMM, S1S, S2S, XC, YC, and TWAIT. The case attributes here refer to the case stored in ACASE (IFLT(IRS)), that is the case to which the resource is assigned. It should be noted here that TWAIT is zero until the first resource arrives on the scene of the case. If no resources are busy at the end of the simulation a message to this effect is printed.

The second basic type of output has been referred to as the "Tape Output". This output is produced only if the value of STAPE is non-zero. If the value of STAPE corresponds to a tape unit, a tape must be requested by the appropriate letter on an ASG control card as described in part V, User's Guide. Every time that a case terminates via completion and STAPE $\neq 0$, Subroutine TERM outputs the major attributes of the case. Four records are written for each case. The contents of each record will be given, followed by the SIMSCRIPT format as well as a FORTRAN format for reading the records.

Record 1: NBRCO, OPFAC, NOCAS, IDLOC, OCCUR, BOX, FPRI, MMM, NNN, GAMMA, NEED, AIR, OFSHR, VIS, WIND, SWELL, L, POB, S1S, S2S, TSM, OST, DMERT.

SIMSCRIPT Format: (3I5, I3, D3.4, I5,I1, 2I2, D3.2, I2, I5, D4.2, 6I5, I2, D5.0, 2D1.4).

FORTRAN Format: (3I5, I3, F8.4, I5, I1, 2I2, F6.2, I2, I5, F7.2, 6I5, I2, F6.0, 2F6.4).

Record 2: UTYPE, VALUE, XCX, YCY, XC, YC, STATN, CNRES, RESA, PRI, REA, COSTC, ITOL, NOINT, NQUE, TINT, TQUE, TQUE1, TSVC, TWAIT.

SIMSCRIPT Format: (I5, I10, 4D5.2, I5, I2, I3, 2I1, D7.2, I1, 2I2, 5D3.4).

FORTRAN Format: (I5, I10, 4F8.2, I5, I2, I3, 2I1, F10.2, I1, 2I2, 5F8.4).

Records 3 and 4 apply to NOTIF's and NOTE's respectively. Four attributes of NOTIF and one attribute of NOTE are always output for five NOTIF's and five NOTE's, regardless of the actaul number of NOTIF's and NOTE's associated with the case. If there are less than five of either, the meaningless portion of the record will contain zero's. If there are more than five of either, only the "first" five will be output. "First" refers to the order in which they were filed in their respective sets NSET and SRHS. The actaul variables are first stored in a buffer and then output.

Record 3: NEED, OST, DELTA, RESA, NEED, OST, DELTA, RESA, etc.

SIMSCRIPT Format: (5(I2, D1.4, D1.2, I3)).

FORTRAN Format: (5(I2, F6.4, F4.2 I3)).

Record 4: RESA, RESA, RESA, RESA, RESA.

SIMSCRIPT Format: (5I3).

FORTRAN Format: (5I3).

It should be noted that the variable NBRCO output in record 1 simply provides a sequence number for the cases being printed.

At the end of the simulation, if STAPE ≠ 0, the four records described above are output for all cases filed in EXCS. They are printed in the order in which they were filed in EXCS. It should be noted that all information for NOTE or NOTIF was destroyed when the case was filed in EXCS. Thus the third and fourth records for these cases will always be zero filled. The sequence numbers for these cases begins with the value NBRCO + 1, where NBRCO is the number of cases completed at the end of the simulation.

There is one significant warning message which could occur during the execution of a simulation. It is printed in Exogenous Event OPSIM, as an attempted "Failsafe" device to prevent too many cases from entering the simulation system at one time, thereby exceeding core storage and destroying all data of the run because of an abnormal abort. The variable KOUNT is increased by one every time a case is created and decreased by one when a case is destroyed. Thus KOUNT is (during the simulation) the number of cases currently being processed in the system. A variable LIMIT is calculated in Exogenous Event START. It is an estimate of the maximum number of Cases which can reside in core storage at one time. It is an empirical

relation based on the number of resources NRES, the number of stations NSTA, the number of resource types NRST, the number of groups NGROUP and the number of distributions, NDSTRB; it is given by:

(10500. - 10. * NRES - 19. *NSTA - 6.* NRST - 6.* NGROUP - 5. *NDSTRB)/50.

For example, with 109 resources, 47 stations, 16 resource types, 8 groups and 12 distributions, there can be approximately 165 cases in the system at one time. It should be emphasized that this is only an estimate which could be revised at any time.

If at any time the value of KOUNT exceeds the value of LIMIT, the warning is printed. From then on, cases will be destroyed as soon as they occur. Those cases already in the system at the time the message is written will be processed until completion.


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