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NATIONAL BUREAU OF STANDARDS REPORT

10 432

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

VOLUME III

PROGRAMMER LEVEL DOCUMENTATION FOR "PREPROCESSOR"

Sponsored by
U. S. Coast Guard

NBS

U.S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

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

VOLUME III

PROGRAMMER LEVEL DOCUMENTATION FOR "PREPROCESSOR"

by
S. S. Karp, L. K. Cummings, M. D. Maltese, A. L. Weber

Sponsored by
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NATIONAL BUREAU OF STANDARDS

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

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PROGRAMMER LEVEL DOCUMENTATION FOR "PREPROCESSOR"

I. Introduction

The objective of the PreProcessor, PREPRO, is to prepare a set of Search and Rescue cases to be simulated in OPSIM. Figure 1 is a macro level description of PREPRO. Here it is shown that the SAR Assistance Reports go through a series of cleaning routines to produce the OPFAC FILE* which contains a set of cases organized by OPFAC. Multi-unit cases are assembled via a sorting program called MUTAPE to produce a CASE FILE. To include the C-130 interdistrict cases, a program called MUC130 merges the C-130 cases with the CASE FILE to form the PCP CASE FILE. MUTAPE and MUC130 are called the CASE ASSEMBLY PROCESSOR.

Once the PCP CASE FILE is prepared, the remaining major steps of PREPRO can be carried out. The first step calculates the case parameters from the input PCP CASE FILE; the software designed to accomplish this task is designated the Parameter Calculation Program (PCP). The PCP produces the SARSIM CASE FILE for input to the second step, the Demand Generator, DEMGEN, or the HIST program which orders the cases chronologically. DEMGEN or HIST produces a CASE TAPE* the exogeneous event tape input to OPSIM.

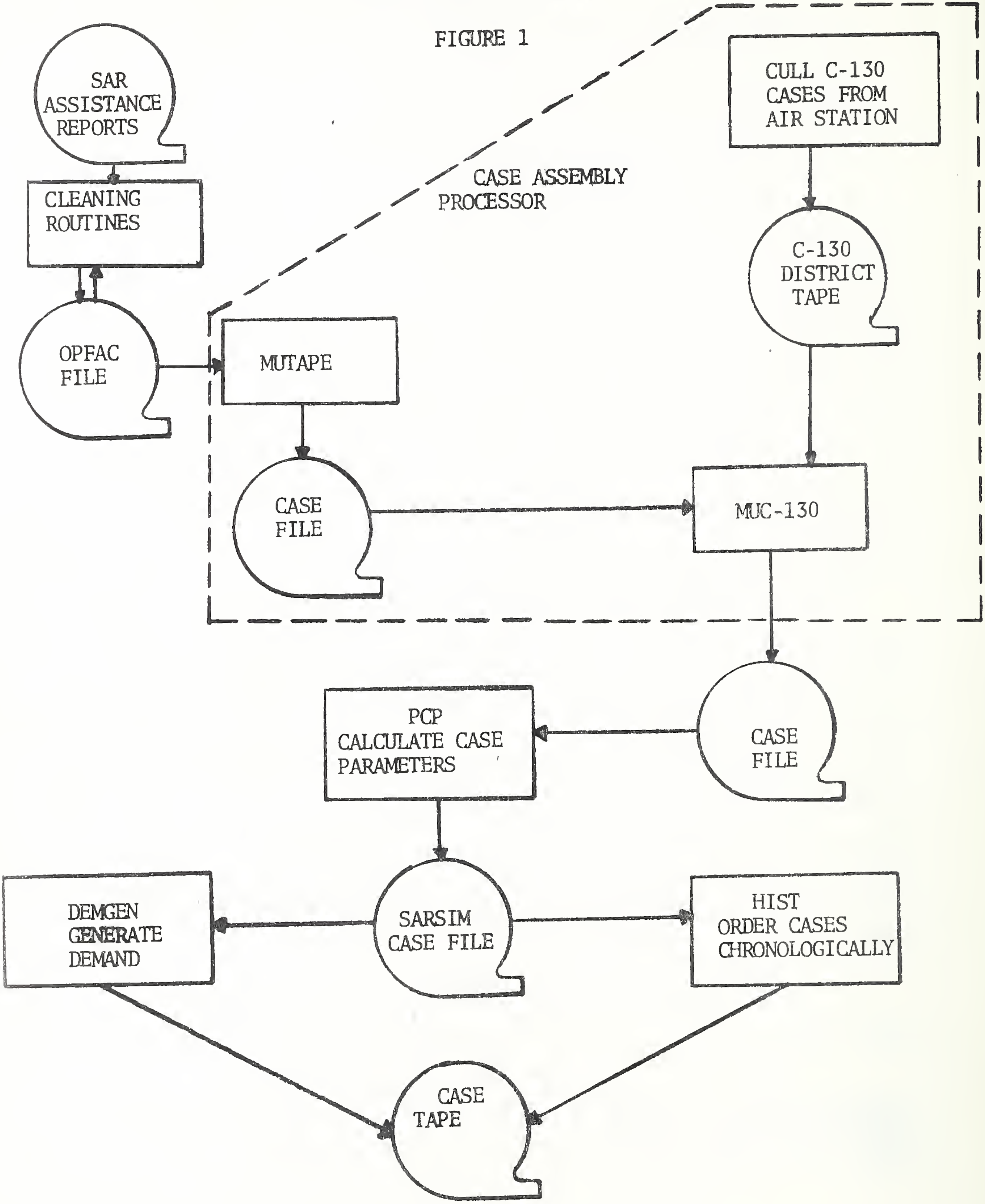
Several options are offered to the user in preparing the final CASE TAPE:

---

*"FILE" refers to a collection of SAR cases not necessarily arragned in chronological order. "TAPE" refers to a FILE in which the cases are arranged chronologically.

MAJOR STEPS IN PREPRO

FIGURE 1



- The user may use the historical dates and times of occurrence of all cases, and the associated case parameters with the HIST option.
- The user may randomly generate the dates and times of occurrence according to hourly exponential distributions, and the full case descriptions relative to the generated time period.
- The user may increase or decrease the case load, and choose to do this relative to the specific case type, the specific station, or across all cases in the entire district.
- The user must specify the scenario limits-that is, the exact time span over which the simulation will be run.
- The user has the option to validate his generated occurrence times against the input values of the arrival rates.

Normally, the mode is to run the CASE ASSEMBLY PROCESSOR, and PCP once, generating the final SARSIM CASE FILE with single unit, multi-unit, and C-130 case descriptions, in that order. Many runs can be made by DEMGEN, depending on the user selected option.

The next sections discuss the CASE ASSEMBLY PROCESSOR; PCP and DEMGEN.

II. Case Assembly Processor

The case Assembly Processor is two FORTRAN V programs which produce the tape that is input to PCP.

MUTAPE assembles the multi-unit cases from the district tape (OPFAC FILE) by gathering together from the participating OPFAC's

for a single case all of the C-cards (SAR Reporting Command data) and associated D-cards (Assisting Resource data). These multi-unit cases are gathered at the end of the single unit cases. The output CASE FILE is a tape with all the single unit cases followed by all of the multi-unit cases.

MUC130 is a cull routine that extracts all of the C-130 cases for either the east or west coast and merges them at the end of the CASE FILE. This new file is called the PCP CASE FILE and contains all of the single-unit cases followed by the multi-unit cases and finally the C-130 cases. Since all of the C-130 cases are in the district 5 or 12 tape, the input to MUC130 is either the district 5 or 12 tape and the CASE FILE from MUTAPE.

A sample of the C-130 cases from the PCP CASE FILE follows:

```
05    15130        ELIZABETH CITY CIS        [illegible]
[illegible]
20520130000300003075000431360800020000200 0000450007 NA05 IA1 16236160005101111111YY 080302000080202 0
8001035504N0761.01000300000000020000810210 6000134060802060810062000000040003010100680009111Y
02[illegible]
[illegible]
10520130000500005070000716120900070012000003500000760K12UK10060363682999063 12Y1 090207700902321 0
90445410N06500W0000500000000900001209031900 600013490902320934456600000001300005801050068773115Y
1052013000009E000507000526626120904000109000100000086822508151613616820541851 5Y1 1209103012091011
209253151N08007.000000000000000000011209500 6000134012091012792500600000200150000801020000003700Y
2052013000024D001907600000000261412001600000001500008271100105111251602090831 4UY 261420302614202 2
6144037160N07541W000000000000001600026160400 600013402614202614400065000000410001201200079003800Y
02[illegible]
[illegible]
20520130002600021070002902393019100008000000030006570250608110234502009133 51Y Y3018357030185403
019403646N07553.00000000000000000000831031500 [illegible]
*****    256 WORDS IN BLOCK    2090 *****


0260000154830192630194000350003002500026010500790037 11Y[illegible]
[illegible]
105201300001000310860000724201093800050000005000008277080410060362511100063 11Y 0109382001095110
110353258N07551.1200120000000000500001140600 600013490109510110359200000000450002702060068777811Y
1052013000035D002808000000014052100000100000000500787004000300312460000913126UU0605302006060110
60650999999999999000000000000000000008092100 60001349060601060650012000200040000401980000000311Y
10520130003600036086000000000715000000000000000000081781202040998986000009837 8UU0715002107152310
715309999999999990000000000000000000008091910 600013480715230715300030000600200000801970000003811Y
105201300038D003208600000000091228000200000000150081730502060212660000803188UY 0912403009124010
91300365N07554W00000000000000000009142800 60001349091240091300003000040010000080101000000911Y
105201300040E0015086000000001021260001000102700000800K1103090613616000551951 5U0102210401022501 1
10015133N07953.000000000000000000013061400 600013401022501100180350005901920000901000000003811Y
105201300045E001806600YVTETF16100000100000004900080860500150605626820091952 5UU1613303016130011
613152750N08420W0300750000000000100016180300 600013401613001613150075000100330001101060068793711Y
105201300046E0019060000389601619140003000000100006878050315060161530330115 85YY 1621003016214510
00000999999999999000000000000000000017210200 60001349162145000000000000000300001401270000003711Y
*****    256 WORDS IN BLOCK    2091 *****


10520130005100051080000947132010000001000000015000840A05 A05060161600S4006511YU 2013137020133210
0000036 8N07838.0500000000000000000020151500 600013492013320000000000000000280001701970000003011Y
10520130052E0025086000000000210000002000000020000          02126600S1013121UU2117371021180112
121504154N05534W00000000000000000000122161100 600013462118 121215000000000901800010102021700003711Y
2052013000550005508600000000260919000300 00007500083810001050112506000251317 1UU2609196026111622
611459999999999990000000000000000000026142900 60001348261116261145008000180055000280197000003811Y
02[illegible]
[illegible]
20520130005900045096000000000107410040000120000000808429100201955250140007294UY0111075101111520
112253210N06850W0700000000000000005003095300 60001347011115011225037500460180000101061779000211Y
02600015490114340115070460000050120000780124177900021 1Y[illegible]
[illegible]
1052013000100010900004Y6055031000000400000050000627705010400414652000007370UU0318007003180810
516239999999999999000000000000000000004201500 600013490318000318230040007013750050197000000201 1Y
40520130000000500090000000001 40 0000000 000000000706822070709989868000098578UU1323403013235180
000009999999999990000000000000000000021071300 [illegible]
*****    256 WORDS IN BLOCK    2092 *****
```

III. PCP - The Program for Calculating Case Parameters

PCP, the computer program developed to calculate the case parameters required by the simulation is comprised of a main program, PCP, which calls subroutines NEEDS, READ, NUCASE and FIELD; all are coded in FORTRAN V. A standard input/output (I/O) routine, NTRAN[1], is also called to allow for a higher degree of parallel processing, not normally permitted by FORTRAN V. By buffering I/O in parallel with computing, more efficient use of the tape (and/or drum) can be gained through the use of NTRAN.

The remaining subroutines and main program descriptions and how to use PCP are discussed in the succeeding sections. Flowcharts and computer listings, will be found in the accompanying NBS Reports 10435 and 10436.

A. The Software

1. The Main Program - PCP

Most of the case parameters are prepared in the main program, PCP. PCP calls subroutine NEEDS to map the assistance rendered to the client, to the need required in OPSIM as coded in the Resource Capability Matrix.

The inputs to PCP include the SAR case descriptions for the district undergoing simulation, i.e. the PCP CASE FILE and the following data set: (a) the district location data; (b) the search speeds for each resource type in the inventory; (c) the needs matrix; (d) the interdistrict (C-130) case location data which includes district centroids and associated accumulative

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[1] UNIVAC 1108 System Manual, section 7, page 9.

probabilities of occurrence (used for cases with unknown locations); and (e) the location of each OPFAC relative to the district origin. A random number seed is also required. The reader is referred to Table 1, page 28, the Input Data to PCP, for a description of each input variable delineated above, the sample input data which follows it, and the illustration for preparing the data set input deck.

Once the data set is read in, PCP processes a case at a time to develop the simulation required case parameters. The reader is referred to Table 3, page 46, Output Data from PCP for a description of each of these parameters as they appear on the case tape. Paper output is also provided and Figure 2, page 48, Example of a Case Description-Output from the PCP, illustrates this form of output.

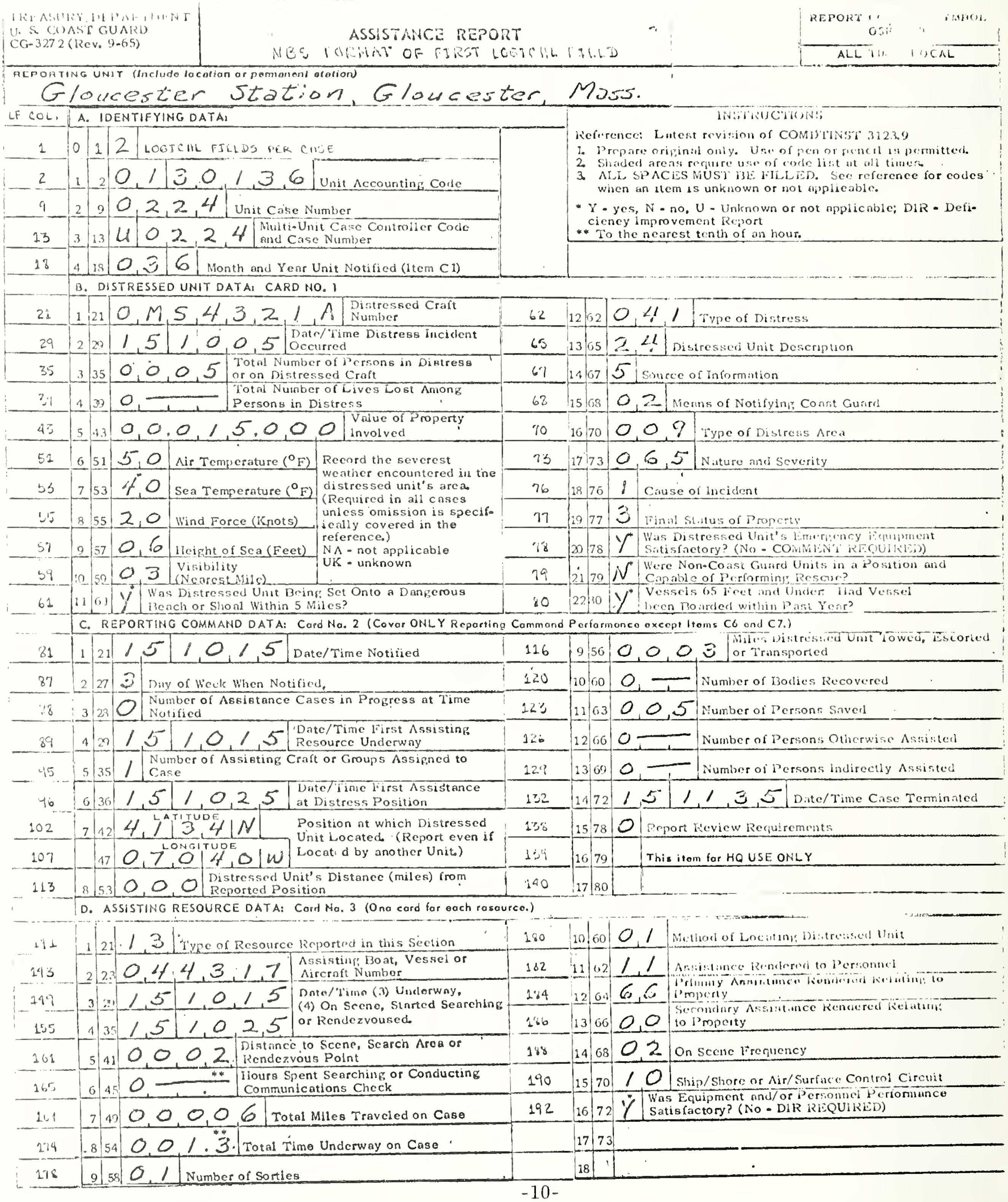
Refer to the Flowcharts of the PCP, Report 10435 during the discussion. A case is read from the PCP case file via subroutine NUCASE. Some of the case data is converted to integer for processing in PCP; other data remains in its alphanumeric form. The reader should refer to the SAR Assistance Report form Figure 3, page 10, during the discussion. NUCASE also determines CMAX, the maximum number of C-cards (Reporting Command Data Cases) and NO(I), the maximum number of D-cards (Assisting-Resource Data) associated with each C-card.

The multi-unit case control number, A3, is converted to integer; the case number is retained and therefore only the alphanumeric is changed. This conversion is listed below:

CONVERSION OF A3 TO INTEGER

Old A3	New A3
DXXXX	1XXXX
UXXXX	2XXXX
JXXXX	3XXXX
KXXXX	4XXXX
LXXXX	5XXXX
MXXXX	6XXXX
NXXXX	7XXXX
OXXXX	8XXXX
PXXXX	9XXXX
QXXXX	11XXX
RXXXX	12XXX
SXXXX	13XXX
TXXXX	14XXX
EXXXX	15XXX
WXXXX	16XXX

Unit and C-130 Case Format



TREASURY DEPARTMENT
U. S. COAST GUARD
CG-3272 (Rev. 9-65)

ASSISTANCE REPORT
NBS FORMAT OF FIRST LOGICAL FIELD

REPORT [illegible] SYMBOL
[illegible]
ALL [illegible] LOCAL

REPORTING UNIT *(Include location or permanent station)*
Gloucester Station, Gloucester, Mass.

INSTRUCTIONS

Reference: Latest revision of COMDTINST 3123.9

1. Prepare original only. Use of pen or pencil is permitted.
2. Shaded areas require use of code list at all times.
3. ALL SPACES MUST BE FILLED. See reference for codes when an item is unknown or not applicable.

* Y - yes, N - no, U - Unknown or not applicable; DIR - Deficiency Improvement Report
** To the nearest tenth of an hour.

A. IDENTIFYING DATA:

LF COL.				
1	0	1	2	LOGICAL FIELDS PER CASE
2	1	2	0130136	Unit Accounting Code
9	2	9	0224	Unit Case Number
13	3	13	U0224	Multi-Unit Case Controller Code and Case Number
18	4	18	036	Month and Year Unit Notified (Item C1)

B. DISTRESSED UNIT DATA: CARD NO. 1

21	1	21	0MS4321A	Distressed Craft Number	62	12	62	041	Type of Distress
29	2	29	15 1005	Date/Time Distress Incident Occurred	65	13	65	24	Distressed Unit Description
35	3	35	0005	Total Number of Persons in Distress or on Distressed Craft	67	14	67	5	Source of Information
39	4	39	0 —	Total Number of Lives Lost Among Persons in Distress	68	15	68	02	Means of Notifying Coast Guard
43	5	43	00015000	Value of Property Involved	70	16	70	009	Type of Distress Area
51	6	51	50	Air Temperature (°F)	73	17	73	065	Nature and Severity
53	7	53	40	Sea Temperature (°F)	76	18	76	1	Cause of Incident
55	8	55	20	Wind Force (Knots)	77	19	77	3	Final Status of Property
57	9	57	06	Height of Sea (Feet)	78	20	78	Y	Was Distressed Unit's Emergency Equipment Satisfactory? (No - COMMENT REQUIRED)
59	10	59	03	Visibility (Nearest Mile)	79	21	79	N*	Were Non-Coast Guard Units in a Position and Capable of Performing Rescue?
61	11	61	Y*	Was Distressed Unit Being Set Onto a Dangerous Beach or Shoal Within 5 Miles?	80	22	80	Y*	Vessels 65 Feet and Under: Had Vessel been Boarded within Past Year?

Record the severest weather encountered in the distressed unit's area. (Required in all cases unless omission is specifically covered in the reference.)
NA - not applicable
UK - unknown

C. REPORTING COMMAND DATA: Card No. 2 (Cover ONLY Reporting Command Performance except Items C6 and C7.)

81	1	21	15 1015	Date/Time Notified	116	9	56	0003	Miles Distressed Unit Towed, Escorted or Transported
87	2	27	3	Day of Week When Notified,	120	10	60	0 —	Number of Bodies Recovered
88	3	28	0	Number of Assistance Cases in Progress at Time Notified	123	11	63	005	Number of Persons Saved
89	4	29	15 1015	Date/Time First Assisting Resource Underway	126	12	66	0 —	Number of Persons Otherwise Assisted
95	5	35	1	Number of Assisting Craft or Groups Assigned to Case	129	13	69	0 —	Number of Persons Indirectly Assisted
96	6	36	15 1025	Date/Time First Assistance at Distress Position	132	14	72	15 1135	Date/Time Case Terminated
102	7	42	LATITUDE 4134N	Position at which Distressed Unit Located. (Report even if Located by another Unit.)	138	15	78	0	Report Review Requirements
107		47	LONGITUDE 07040W		139	16	79		This item for HQ USE ONLY
113	8	53	000	Distressed Unit's Distance (miles) from Reported Position	140	17	80		

D. ASSISTING RESOURCE DATA: Card No. 3 (One card for each resource.)

141	1	21	13	Type of Resource Reported in this Section	180	10	60	01	Method of Locating Distressed Unit
143	2	23	044317	Assisting Boat, Vessel or Aircraft Number	182	11	62	11	Assistance Rendered to Personnel
149	3	29	15 1015	Date/Time (3) Underway, (4) On Scene, Started Searching or Rendezvoused.	184	12	64	66	Primary Assistance Rendered Relating to Property
155	4	35	15 1025		186	13	66	00	Secondary Assistance Rendered Relating to Property
161	5	41	0002	Distance to Scene, Search Area or Rendezvous Point	188	14	68	02	On Scene Frequency
165	6	45	0 — **	Hours Spent Searching or Conducting Communications Check	190	15	70	10	Ship/Shore or Air/Surface Control Circuit
169	7	49	00006	Total Miles Traveled on Case	192	16	72	Y*	Was Equipment and/or Personnel Performance Satisfactory? (No - DIR REQUIRED)
174	8	54	001.3 **	Total Time Underway on Case		17	73		
178	9	58	01	Number of Sorties		18			

Figure 3

The location of the cases (x,y) relative to the district origin (LAT, LON) is determined next. If the location data C7A(I) or C7B(I) is a zero or 9999 and no location data is given for the OPFAC A1B(I); i.e., it is undefined in SARSIM, then the case is assigned the following coordinates (XPT, YPT) relative to the district origin (note: these can never be (0,0): The above is true for both single unit and multi-unit cases (in single unit cases, I=1.) If, however, at least one C-card does contain the location data, that location is used relative to the district origin, (LAT, LONG). If the case does not have location data but does have a defined OPFAC A1B(I) with a location, the case then takes on the location (XDELTA, YDELTA), from A1B(I).

If the case does have a valid location (C7A(I), C7B(I)) then (x,y) is calculated using plane geometry.

If the case is an interdistrict (C-130) case, with a valid (C7A(I), C7B(I)) then the distance R to each district centroid, is taken as the minimum R. Once A1A(I) has been determined, (x,y) is calculated. If the case occurred in the district being exercised, DIST, then A1B(I) is set to zero. (A zero code in A1B(I) causes OPSIM to assign the case to the closer station in DIST.)

If an invalid (C7A(I), C7B(I)) is given for interdistrict C-130 cases, then A1A(I) is assigned via the Monte Carlo technique from the accumulative probabilities, PROB(D), where D is the district.

Once (x,y) has been found for all cases in DIST, a check is made to see of (x,y) is in the range (XLOW, XLMT) and (YLOW, YLMT . If not, (x,y) is arbitrarily set to (2,2).

Note, that for multi-unit cases with multiple C-cards the (x,y) is retained in (xx,yy) until all C-cards are reviewed.

MINCI is the date and time of notification for the case and is taken as C1(1), the date and time reporting command was notified, of the first C-card. (The cases are sorted chronologically within each set of SAR assistance forms for each multi-unit case.)

STANO, the sequential number of the primary station, becomes A1B(1) the OPFAC corresponding to C1(1). If A1B(1) is not in the set of current existing OPFAC's, then a new STANO is created, added to the list and STANO becomes the previous STANO number plus one. If no A1B(1) exists, i.e. it is zero, then STANO is zero.

Next TSM, the total number of search miles expended on the case is found as, $TSM = \sum^{\text{D-cards}} (D6(I,J) * SOA3 (D1(I,J)))$ where D6(I,J) is the hours spent searching (by the Ith resource from the Jth Opfac) and SOA3 (D1(I,J)) is the search speed of the assisting resource type D1(I,J).

A simple conversion is made of B16, the code for location of the case in terms of miles off-shore is made. Called MILES, the conversion is given below:

B16 Code	MILES (tenths of nautical miles)
B16A = SXX	0.0
> 1, ≤ 6	3.0
= 7, = 8	30.0

= 9	80.0
= 10, ..., 998	actual number of miles
= 999	9.0

Next, B17B, the coded severity of the case is translated thus, to NSEV:

B17B Code	NSEV
1	1
2	2
3	4
4	3
5	5

If the total search time D6TOT, calculated over all the D-cards on the case exceeds five tenths of an hour, the case is considered a short search case; S1 is set to zero and if the first resource searched (first D6(I,J) is greater than zero) then S2 is set to one. If any other resource other than the first searched, then S2 is set to two.

For each resource, the time the resource arrives on scene and commences serving a need, D4FRST after searching is found: D4FRST(I,J) = D4(I,J) + D6(I,J), where D4(I,J) is the date and time the resource arrived on scene, and D6(I,J) is the time spent searching. Next subroutine NEEDS is called to translate the assistance rendered to the proper NEED(N) code. If the need of a case NEED(N) is any of the following: 10, general escort; 15, tow; 17, air escort; or 19, rescue and tow, then the number of needs other than tow N is decremented, the number of tow resources M is incremented and the need stored in MEED(M). (Any miscellaneous-classed assisting resource data, i.e., any D1(I,J) $\geq$ 70, is not included in the output case description).

The array NEED(N) is a set of requirements for aid other than tow for each case. The array MEED(M) is a temporary array of tow (including escort) needs. If a case has a requirement for tow (M>0), only one such need can exist. Therefore, the MEED(M) array is searched for the need with the highest rank and NEED(NN), NN = N+1, is set to this need. The ranking order from high to low is: 17, 15, 19, 10.

TOS(N), the time spent on scene serving NEED(N) is calculated: TOS(N) = D8(I,J) - D6(I,J) - ENRTE *2*D9(I,J); where ENRTE = D4(I,J) - D3(I,J) and D8(I,J) = Total time underway for this resource.

D6(I,J) = Hours spent searching for this resource.

D9(I,J) = Number of sorties for this resource.

D4(I,J) = Date/Time on scene to start searching for this resource.

D3(I,J) = Date/Time underway for this resource.

Finally, for this assisting resource, the time the resource leaves the scene after performing his need, LVTIME (I,J) is calculated.

The sets D4FRST(I,J) and LVTIME(I,J)are used to find TE, the elapsed time of the case. LAST is the $\underset{I,J}{\text{MAX}}$ {LVTIME (I,J)} and FRST is the $\underset{I,J}{\text{MIN}}$ {D4FRST (I,J)}. The elapsed time, TE, is given by:

$$TE = LAST - FRST$$

TE is used to calculate DELTA(N), for each need of the case.

The MAX {TOS(N)}, MAXTOS, and the $\sum_{N}$ TOS(N), SUMTOS(N) are calculated, NN is set and GAMMA, the degree of non-parallel service on a multi-resource case is calculated, Prior to output of the case, checks are made on the data for such crucial parameters as M, N, and associated NEED(N) and MEED(M). In short, general housekeeping is performed on each case such that no illegal information is left to cause problems when simulating the case in OPSIM.

So far the discussion has stemmed from processing cases with no search or short search involved. For long search cases, (i.e., D6TOT, the total hours in search, greater than or equal to .5) special processing is required to calculate the parameters describing long searches. If the case is a single-resource case, (i.e., CMAX and NO(I) are both one) and D6TOT does not exceed 14 hours, then S1, the number of search resources is set to one. If on the other hand, this is a multi-resource long search, (i.e., either CMAX or NO(I) exceed one), and D6TOT does not exceed 14 hours, NITEHR, the nighthours elapsed during the case, is set to zero and S1 calculated: S1 = D6TOT/(elapsed time - NITEHR). If D6TOT exceeds 14 hours, NITEHR, is calculated and subtracted from elapsed time to determine S1. (A constant 0.99 is added to S1 so that S1 becomes the next integer value after truncation). For all long search cases, a flag S2 is set to 0.

One additional conversion is performed on the parameter B13, the client description, which contains the coded length of the vessel. These conversions are listed below:

Old B13	New B13
50	66
51	101
52	201
60-99	0

The remaining parameters B3, B5, B6, B8, B9, B10, and B12A are ascertained in Subroutine FIELD, and not changed in PCP. See page 24 for an explanation of these parameters.

Once the EOF is reached, the PCP halts.

2) Subroutine NEEDS

Subroutine NEEDS performs a translation of the historical assistance rendered (as reported in the SAR assistance form) to the capabilities delineated in the needs portion of the Resource Capability Matrix. (The reader is referred to the analyst documentation for a review of this matrix.)

Generally, the assistance rendered to personnel, for each resource serving a case is queried before the primary and secondary assistance rendered to property, for the translation. This query, coupled with an investigation of the historical resource rendering aid, forms the core of NEEDS. INEED(N) is the input required by NEEDS. The reader is referred to Table 1 of the Input Data to PCP, the NEEDS matrix, for the correlation of D11 and D12 between the code and the Resource Capability Matrix. Each time a D-card (assisting resource data card) for a case is encountered, in the main program, PCP, subroutine NEEDS is called. Upon entry to NEEDS, the assisting resource code is queried to see if an aircraft rendered assistance. If so, and if the aircraft assisted personnel (i.e., $D11(I,J) > 0$) then a need of the case being processed, NEED(N) becomes INEED(D), where $D = D11(I,J)$. If the aircraft instead rendered primary assistance to property ($D12(I,J) > 0$), then NEED(N) becomes INEED(D), where $D = D12(I,J)$. If the client description, B13, indicates an aircraft and D12(I,J) is coded 68, escort, then the NEED(N) is set to 17, indicating the client requires an escort by an aircraft. See Table 2, page 18. Explanation of NEED(N) for code description. If an aircraft was called to scene, but no assistance rendered, i.e., D11 and D12 are zero, then the NEED is set to 18.

Explanation of NEED(N)

NEED(N)	Description
1	Provide Equipment
2	Deliver Pump/Equipment
3	Made Repairs
4	Fought Fire
5	Vector Other Unit
6	Dewater
7	Refloat
8	Icebreaking
9	Refueled and Supplied
10	Surface Escort
11	Standby
12	Located Property and Owners Advised
13	Freed from Position of Peril
14	General Assistance Rendered Surface
15	Tow; Dewater and Tow; Refloated and To
16	Evacuate (Rescue) People on Board
17	Air Escort
18	General Assistance Rendered
19	Rescue and Towed

Table 2

If the assisting resource was a surface resource, D11 > 0, and either D12 or D13 were one of the following; tow, dewater and tow, refloated and tow, tugbird tow, or recovered property and returned to owner, then NEED(N) is set to 19 implying that assistance was rendered to personnel and property as described above.

If the surface resource assisted property only, and D12 was any one of the following: tow, dewater and tow, refloated and tow, tugbird tow or recovered property and returned to owner, then NEED(N) is set to 15, a requirement for tow. If however D12 was none of these described, then the NEED(N) is extracted from the INEED(D) matrix unless the assistance rendered was escort and the client an aircraft. In the latter case, NEED(N) is set to 17.

If the surface resource is called to scene, and no assistance is rendered to either personnel or property then NEED(N) is set to 14, or general assistance rendered by a surface resource.

Once NEED(N) is set, control is passed back to the calling main program, PCP.

3) Subroutine NUCASE

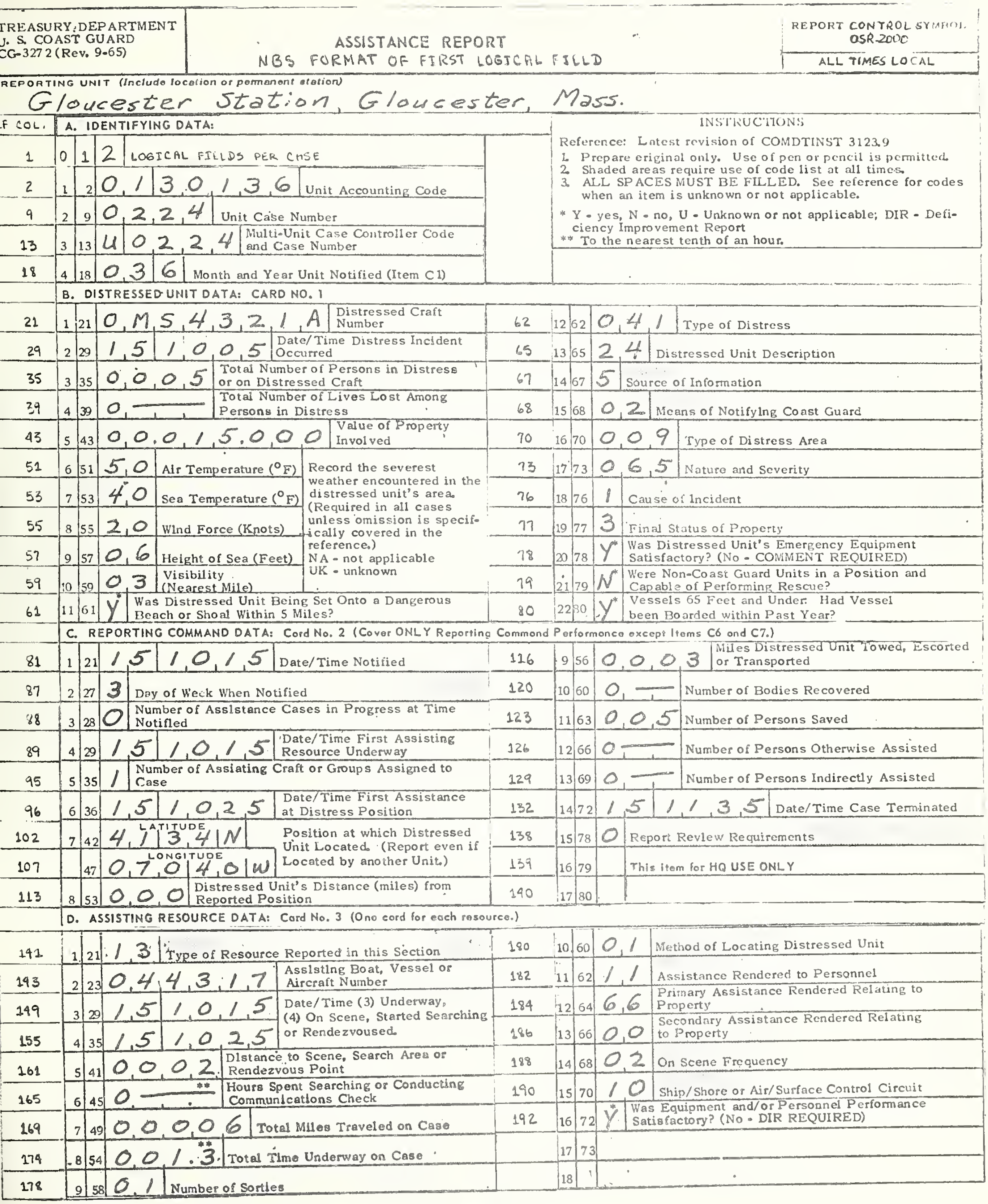
Unit and C130 cases are processed in groups of 32 words (logical fields, LF's). The first logical field is comprised of the number of LF's in the case, the A-card, B-card, C-card, and one D-card. The next logical field contains the number of D-cards and up to 3 D-cards. Each successive LF contains up to 3 additional D-cards. If a case reports no D-cards the number of LF's in the case is set to zero.

Multi-unit (MU) cases have an extra logical field at the beginning of the case which gives the number of LF's in the case, the number of participants (C-cards) and the B-card. The number of LF's for each participant with the corresponding A-card, C-card and D-card data follows, the participants sorted by date and time of notification.

This routine calls READ to get a buffer of data (LOAD) ready for processing. LP is then used as a pointer to indicate the word in LOAD where the case begins (LOAD(LP)). Since a case may exist between buffers, it is transferred to an array called DATA for further processing.

NUCASE then calls FIELD to extract the data to be used by the main program, PCP. The number of C-cards (CMAX) and the number of D-cards for each C-card (NO(I)) is set for each case.

Figure 4 relates the first logical fields and successive fields to the SAR assistance form.



TREASURY DEPARTMENT
U. S. COAST GUARD
CG-3272 (Rev. 9-65)

ASSISTANCE REPORT
NBS FORMAT OF FIRST LOGICAL FIELD

REPORT CONTROL SYMBOL
OSR-2000

ALL TIMES LOCAL

REPORTING UNIT (Include location or permanent station)
Gloucester Station, Gloucester, Mass.

INSTRUCTIONS
Reference: Latest revision of COMDTINST 3123.9
1. Prepare original only. Use of pen or pencil is permitted.
2. Shaded areas require use of code list at all times.
3. ALL SPACES MUST BE FILLED. See reference for codes when an item is unknown or not applicable.

* Y - yes, N - no, U - Unknown or not applicable; DIR - Deficiency Improvement Report
** To the nearest tenth of an hour.

F COL.				A. IDENTIFYING DATA:
1	0	1	2	LOGICAL FIELDS PER CASE
2	1	2	0 1 3 0 1 3 6	Unit Accounting Code
9	2	9	0 2 2 4	Unit Case Number
13	3	13	U 0 2 2 4	Multi-Unit Case Controller Code and Case Number
18	4	18	0 3 6	Month and Year Unit Notified (Item C1)

B. DISTRESSED UNIT DATA: CARD NO. 1

21	1	21	0 M S 4 3 2 1 A	Distressed Craft Number	62	12	62	0 4 1	Type of Distress
29	2	29	1 5 1 0 0 5	Date/Time Distress Incident Occurred	65	13	65	2 4	Distressed Unit Description
35	3	35	0 0 0 5	Total Number of Persons in Distress or on Distressed Craft	67	14	67	5	Source of Information
39	4	39	0 ——	Total Number of Lives Lost Among Persons in Distress	68	15	68	0 2	Means of Notifying Coast Guard
43	5	43	0 0 0 1 5 0 0 0	Value of Property Involved	70	16	70	0 0 9	Type of Distress Area
51	6	51	5 0	Air Temperature (°F)	73	17	73	0 6 5	Nature and Severity
53	7	53	4 0	Sea Temperature (°F)	76	18	76	1	Cause of Incident
55	8	55	2 0	Wind Force (Knots)	77	19	77	3	Final Status of Property
57	9	57	0 6	Height of Sea (Feet)	78	20	78	Y*	Was Distressed Unit's Emergency Equipment Satisfactory? (No - COMMENT REQUIRED)
59	10	59	0 3	Visibility (Nearest Mile)	79	21	79	N*	Were Non-Coast Guard Units in a Position and Capable of Performing Rescue?
61	11	61	Y*	Was Distressed Unit Being Set Onto a Dangerous Beach or Shoal Within 5 Miles?	80	22	80	Y*	Vessels 65 Feet and Under: Had Vessel been Boarded within Past Year?

Record the severest weather encountered in the distressed unit's area. (Required in all cases unless omission is specifically covered in the reference.)
NA - not applicable
UK - unknown

C. REPORTING COMMAND DATA: Card No. 2 (Cover ONLY Reporting Command Performance except Items C6 and C7.)

81	1	21	1 5 1 0 1 5	Date/Time Notified	116	9	56	0 0 0 3	Miles Distressed Unit Towed, Escorted or Transported
87	2	27	3	Day of Week When Notified	120	10	60	0 ——	Number of Bodies Recovered
88	3	28	0	Number of Assistance Cases in Progress at Time Notified	123	11	63	0 0 5	Number of Persons Saved
89	4	29	1 5 1 0 1 5	Date/Time First Assisting Resource Underway	126	12	66	0 ——	Number of Persons Otherwise Assisted
95	5	35	1	Number of Assisting Craft or Groups Assigned to Case	129	13	69	0 ——	Number of Persons Indirectly Assisted
96	6	36	1 5 1 0 2 5	Date/Time First Assistance at Distress Position	132	14	72	1 5 1 1 3 5	Date/Time Case Terminated
102	7	42	LATITUDE 4 1 3 4 N	Position at which Distressed Unit Located. (Report even if Located by another Unit.)	138	15	78	0	Report Review Requirements
107		47	LONGITUDE 0 7 0 4 0 W		139	16	79		This item for HQ USE ONLY
113	8	53	0 0 0	Distressed Unit's Distance (miles) from Reported Position	140	17	80		

D. ASSISTING RESOURCE DATA: Card No. 3 (One card for each resource.)

141	1	21	1 3	Type of Resource Reported in this Section	180	10	60	0 1	Method of Locating Distressed Unit
143	2	23	0 4 4 3 1 7	Assisting Boat, Vessel or Aircraft Number	182	11	62	1 1	Assistance Rendered to Personnel
149	3	29	1 5 1 0 1 5	Date/Time (3) Underway, (4) On Scene, Started Searching or Rendezvoused.	184	12	64	6 6	Primary Assistance Rendered Relating to Property
155	4	35	1 5 1 0 2 5		186	13	66	0 0	Secondary Assistance Rendered Relating to Property
161	5	41	0 0 0 2	Distance to Scene, Search Area or Rendezvous Point	188	14	68	0 2	On Scene Frequency
165	6	45	0 ——**	Hours Spent Searching or Conducting Communications Check	190	15	70	1 0	Ship/Shore or Air/Surface Control Circuit
169	7	49	0 0 0 0 6	Total Miles Traveled on Case	192	16	72	Y*	Was Equipment and/or Personnel Performance Satisfactory? (No - DIR REQUIRED)
174	8	54	0 0 1 . 3**	Total Time Underway on Case		17	73		
178	9	58	0 1	Number of Sorties		18			

FIGURE 4

NBS FORMAT FOR SUCCESSIVE LOGICAL FIELDS

1	0		NUMBER OF D-CARDS PER CASE				
3	1	21	Type of Resource Reported in this Section	42	10	60	Method of Locating Distressed Unit
5	2	23	Assisting Boat, Vessel or Aircraft Number	44	11	62	Assistance Rendered to Personnel
11	3	29	Date/Time (3) Underway, (4) On Scene, Started Searching or Rendezvoused	46	12	64	Primary Assistance Rendered Relating to Property
17	4	35		48	13	66	Secondary Assistance Rendered Relating to Property
23	5	41	Distance to Scene, Search Area or Rendezvous Point	50	14	68	On Scene Frequency
27	6	45	** Hours Spent Searching or Conducting Communications Check	52	15	70	Ship/Shore or Air/Surface Control Circuit
31	7	49	Total Miles Traveled on Case	54	16	72	* Was Equipment and/or Personnel Performance Satisfactory? (No - DIR REQUIRED)
36	8	54	** Total Time Underway on Case	55	17	73	
40	9	58	Number of Sorties	56	18		

D. ASSISTING RESOURCE DATA: Card No. 3 (One card for each resource.)

D. ASSISTING RESOURCE DATA: Card No. 3 (One card for each resource.)

57	1	21	Type of Resource Reported in this Section	96	10	60	Method of Locating Distressed Unit
59	2	23	Assisting Boat, Vessel or Aircraft Number	98	11	62	Assistance Rendered to Personnel
65	3	29	Date/Time (3) Underway, (4) On Scene, Started Searching or Rendezvoused	100	12	64	Primary Assistance Rendered Relating to Property
71	4	35		102	13	66	Secondary Assistance Rendered Relating to Property
77	5	41	Distance to Scene, Search Area or Rendezvous Point	104	14	68	On Scene Frequency
81	6	45	** Hours Spent Searching or Conducting Communications Check	106	15	70	Ship/Shore or Air/Surface Control Circuit
85	7	49	Total Miles Traveled on Case	108	16	72	* Was Equipment and/or Personnel Performance Satisfactory? (No - DIR REQUIRED)
90	8	54	** Total Time Underway on Case	109	17	73	
94	9	58	Number of Sorties	110	18		

D. ASSISTING RESOURCE DATA: Card No. 3 (One card for each resource.)

111	1	21	Type of Resource Reported in this Section	150	10	60	Method of Locating Distressed Unit
113	2	23	Assisting Boat, Vessel or Aircraft Number	152	11	62	Assistance Rendered to Personnel
117	3	29	Date/Time (3) Underway, (4) On Scene, Started Searching or Rendezvoused	154	12	64	Primary Assistance Rendered Relating to Property
125	4	35		156	13	66	Secondary Assistance Rendered Relating to Property
131	5	41	Distance to Scene, Search Area or Rendezvous Point	158	14	68	On Scene Frequency
135	6	45	** Hours Spent Searching or Conducting Communications Check	160	15	70	Ship/Shore or Air/Surface Control Circuit
139	7	49	Total Miles Traveled on Case	162	16	72	* Was Equipment and/or Personnel Performance Satisfactory? (No - DIR REQUIRED)
144	8	54	** Total Time Underway on Case	163	17	73	
148	9	58	Number of Sorties	164	18		

HAVE YOU PREPARED ONE SECTION D FOR EACH CRAFT OR GROUP INDICATED IN ITEM C5?

NAME OF DISTRESSED CRAFT	NAME AND ADDRESS OF OPERATOR	NAME AND ADDRESS OF OWNER IF DIFFERENT
Mary Kay	A. B. See 1020 Main Street Gloucester, Mass.	—

COMMENTS (List names and addresses of persons reported in C10 and C11)

Andrew B. See - Same as above
Joseph C. See - " " "
Andrew B. See, Jr. - " " "
Lee J. See - " " "
John J. Jones - 1022 Main St., Gloucester, Mass.

DATE SUBMITTED	SIGNATURE	REVIEWED AND FORWARDED	DATE	INITIALS
3/16/66	ABE L. SEAMAN		3/16/66	GGC

FIGURE 4 cont.

4. Subroutine READ

Records are read from the input tape, PCP Case File, in NTRAN which allows for buffered I/O in parallel with computation. 256 words are read into one buffer while the other buffer is being processed. Refer to the READ listing in Report 10436.

NPREC indicates the number of records (256 words) that have been read for a particular OPFAC. If it is set to zero in NUCASE the relevant information from from a new OPFAC header (32 words) must be saved, i.e. IPREC set to the number of physical records in that OPFAC. NPREC is incremented every time a new record is read, and when it becomes equal to IPREC the OPFAC is completed and NPREC set backs to zero in NUCASE.

When all the OPFAC data has been read and processed a MU header will be encountered. In addition to setting IPREC, a MU flag is set to let the main program know that MU cases are being processed (MFLAG=1). After MU cases have been completed the C-130 header is encountered and a C-130 flag set (CFLAG=1).

When an EOF is reached, this routine returns to a specified statement number in the main program.

5. Subroutine FIELD

This routine extracts the appropriate bits of the Hollerith words in DATA for each case attribute used by the main program, PCP. It then converts some of these to integer numbers and leaves others in their original alphanumeric form. Below is the list of elements extracted for a case. See Report 10436, for the program listing FIELD.

FORMAT	NAME	DESCRIPTION
A1	A3A	MU controller code
I5	A3	MU case no.
I2	A4A	Month notified
I1	A4B	Year notified
I4	B3	No. of people on board distressed unit (if B3 > 4095, B3 = 4095)
I8	B5	Value of distressed unit (if B5 > 130001, B5 = 130001).
I2	B6	Air temperature (if unknown, B6 = 99)
I2	B8	Wind force (if unknown, B8 = 1)
I2	B9	Sea swell (if unknown, B9 = 1)
I2	B10	Visibility (if unknown, B10 = 99)
I2	B12A	Type of distressed unit
I2	B13	Length of distressed unit
A1	B16A	If B16A = S, case occurred on land
I3	B16	Distance offshore
I1	B17B	Severity
	Entry Point FIELD2 (I=1,...,CMAX)	
I2	A1A(I)	District
I5	A1B(I)	OPFAC
I6	C1(I)	Date/time notified
I4	C1A(I)	Time notified in minutes (tenths)
A1	C5(I)	No. of resources assisting
I2	C7A1(I)	Degrees ladutude
I2	C7A2(I)	Minutes latitude

FORMAT	NAME	DESCRIPTION
I2	C7B1(I)	Degrees longitude
I2	C7Bs(I)	Minutes longitude
I4	C9(I)	Date/time 1st resource underway
I1	LGF	No. of logical fields in case
	Entry Point FIELD3 (I=1,....,CMAX; J=1,...,NO(I))	
I2	D1(I,J)	Assisting resource type
I2	D3A(I,J)	Date resource underway
I2	D3B(I,J)	Hour resource underway
I2	D3C(I,J)	Minutes resource underway
I4	D3(I,J)	Time underway in minutes (tenths)
I2	D4A(I,J)	Date resource on scene
I2	D4B(I,J)	Hour resource on scene
I2	D4C(I,J)	Minute resource on scene
I4	D4(I,J)	Time on scene in minutes (tenths) (if D4(I,J) = 0, D4(I,J) - D3(I,J)).
I4	D6(I,J)	Hours spent searching (tenths)
I4	D8(I,J)	Total time on case (tenths of hours)
I2	D9(I,J)	No. of sorties
I2	D11(I,J)	Assistance to personnel
I2	D12(I,J)	Primary assistance to property
I2	D13(I,J)	Secondary assistance to property

B. User's Guide for PCP

Section A of Table 1 describes in detail the layout of the data deck for PCP. It can be assumed that all data must be punched in the designated card columns, right adjusted.

Note that the location data for the current district and the OPFAC location data must be changed for each district in order to exercise that district.

Section B of Table 1 gives the exact input layout for the first district. Note that the card columns 1-80 are indicated in the table.

Figure 5, the deck setup for a PCP run is presented as a guide for the NBS system UNIVAC 1108.

Section A: Table 1

Input Data to PCP (Cards)

Location data for current district being exercised:

CC	FORMAT	NAME	Description
1- 6	I6	DIST	current district being exercised
7-12	I6	LAT	latitude and longitude of district origin (minutes)
13-18	I6	LONG	
19-25	F7.3	ZBETA	longitude correction factor
26-31	I6	XPT	X,Y distance from origin for cases at OPFAC with no location data
32-37	I6	YPT	
38-43	I6	XLMT	Upper limit of X,Y for current district
44-49	I6	YLMT	
50-55	I6	XLOW	Lower limit of X,Y for current district
56-61	I6	YLOW	
62-67	I6	XDELTA	X,Y distance from OPFAC for cases with no location data, but a given OPFAC.
68-73	I6	YDELTA	

(All distances in nautical miles.)

Table 1

TABLE 1 Continued

Search speeds

CC	FORMAT	NAME	DESCRIPTION
1-80	20I4	SOA3(I) I=1,...,70	Speeds of advance for each type of resource (D1) (knots)

Needs Matrix

CC	FORMAT	NAME	DESCRIPTION
1-80	20I4	INEED(I) I=1,...,100	Explicit need for each type of assistance rendered (D11, D12, & D13)

District centroids and probabilities (followed by EOF)

CC	FORMAT	NAME	DESCRIPTION
1-2	I2	I	District
9-10	I2	DLAT(I)	Degrees & minutes latitude of district centroid
11-12	I2	MLAT(I)	
18-20	I3	DLON(I)	Degrees & minutes longitude of district centroid
21-22	I2	MLON(I)	
29-33	F5.3	PROB(I)	Probability of a C130 case occurring in district I, accumulative.

Opfac location data (followed by EOF)

CC	FORMAT	NAME	DESCRIPTION
7-11	I5	LIST(NS)	OPFAC
16-21	I6	XSTA(NS)	X,Y location of OPFAC from the district origin
22-27	I6	YSTA(NS)	
		NS=1,..., no. of OPFACs with location data	

Random number seed

CC	FORMAT	NAME	DESCRIPTION
1-12	012	B(1)	Octal seed used as input to random no. generator.
14-25	012	B(2)	

```
                    ***INPUT DATA TO PCP***

     (CARD COLUMNS ARE INDICATED BEFORE EACH SET OF DATA)


C130 OPFAC

         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

20130



LOCATION DATA FOR CURRENT DISTRICT

         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

    01  255C  4200 44.385     1     1   354   150  -177  -150     4    -4



SEARCH SPEEDS

         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

  12  12  12  12   8   8   8   8   8  12   6  12  10   8   8   0   0   0   0   0
   0   0   0   0   0   0   0   0   0  10  10  15  15   0   0   0   0   0   0  10
  15  15  15  15  15  15  15   0   0  15  15  15  15  15  15  15   0   0   0 160
 130 110  85 130 130 130   0   0   0   0



NEEDS MATRIX

         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

   0   0   0   0   0   0   0   0   0  16  16  16  16  16   1  16   5  16   0   0
   0   0   0   0   0   0   0   0   0  16  16  16  16   5  18  18   0   0   0  18
   1   5  18  18   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0  14
   4   6  15   7  15  15   9  10  15   2   2   8  13   3  12  15  18  14  11   0
   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0  16   0  18   0



DISTRICT CENTROIDS AND PROBABILITIES

         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

 1      4145      6710      0.081
 3      3830      7130      0.221
```

TABLE I Continued

```
 5       3505       7310       0.780
 7       2855       7640       1.000
 EOF



OPFAC LOCATION DATA

          1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

            11101       -46    -9
            11103       -46    -9
            11204       -46    -9
            11205       -11    70
            11207       -11    70
            11212       -11    70
            11218       -42   -52
            11303       -42   -52
            11401       -46    -9
            11404       -46    -9
            11405       -46    -9
            12103       -42   -52
            12104       -32    34
            12609       -29     6
            13107       -41   -52
            13121       -32    34
            13122       -30   -59
            13247        -5   -73
            13255       106   122
            13265       -61   -62
            17115        38    96
            17203        38    96
            17205       -62   -59
            17207        74   108
            17209       -11    70
            20110       -63   -54
            20130      -290  -374
            30103       -80   -70
            30105       -46    -9
            30109        -5   -73
            30115       -23   -44
            30121       -61   -62
            30124         3   -47
            30130       -16    59
            30133       -37   -69
            30136       -29     6
            30139       -34    27
            30141       106   122
            30142        10    75
            30145       -36    18
            30154       -41   -12
            30157       -67   -67
            30160       -32    34
            30163       134   138
            30166       -11   -26
            30169       -33   -20
            30606        16    80
            30612        38    96
            31310       -11    70
```

TABLE I Continued

```
      31320          -30    -59
      31420           74    108
' EOF



RANDOM NUMBER SEED

         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

15444773060'.255751305264.
```

PCP Sample Deck

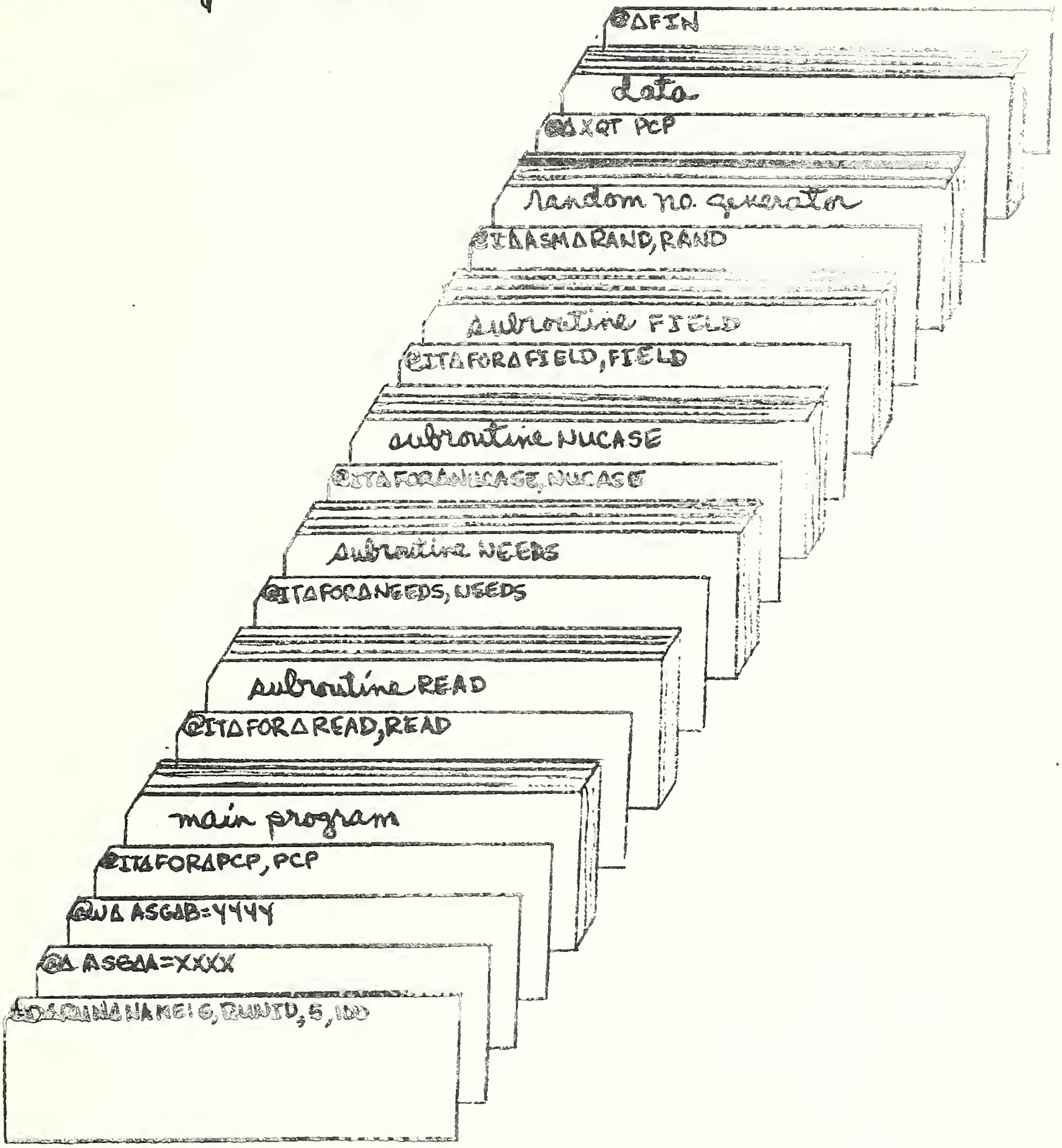


Figure 5

C. Example PCP Output and Interpretation of Output

Table 2, Output Data from PCP, describes each parameter, its format and PCP name, as it appears on the SARSIM CASE FILE

Figure 2 page 48 is an Example of a Case Description as processed in PCP, with the same format, sequence and description as appears in Table 2.

Table 2

Output Data From PCP (Tape)

WORD	FORMAT	NAME	DESCRIPTION
1	I2	A1A(1)	District
2	I3	STANO	Station number
3	I5	A3	Case Number
4	I3	A4	Month/Year Notified
5	I6	MINC1	Date/time notified (minimum C1 for MU case)
6	I4	B3	No. of people on board distressed unit
7	I8	B5	Value of distressed unit
8	I2	B6	Air temperature
9	I2	B8	Wind force
10	I2	B9	Sea swell
11	I2	B10	Visibility
12	I2	B12A	Type of distressed unit
13	I2	B13	Length of distressed unit
14	I1	NSEV	Severity
15	I2	NN	No. of explicit needs (NN=N if M=0; NN=N+1 if M>0)
16	I1	N	No. of needs except search and tow
17	I1	M	No. of resources that towed or escorted
18	I2	GAMMA	Degree of non-parallelism for multi-resource case

TABLE II Continued

19	I4	TE	Time on scene (tenths of hours)
20	I1	S1	No. of parallel long search. res.
21	I2	S2	Type of short search (code)
22	I4	TSM	Total search miles (whole time)
23	I5	MILES	Distance offshore (tenths of mi.)
24	I5	X	Location of case from
25	I5	Y	district origin
26, 29,....	I2	NEED(I)	Explicit need (I=1..NN)
27, 30,....	I4	TOS(I)	Time on scene (I=1..NN)
28, 31,....	I2	DELTA(I)	Delay of next resourse relative to previous resource (I=1..NN)

Note: The above data describes one case. Each case is written on the output tape in an unformatted binary write. This may take one or two write statements in PCP depending on the size of the case. The 1st write dumps 28 words on tape; the 2nd write dumps the remaining words needed to describe the case.

EXAMPLE OF A CASE DESCRIPTION AS PROCESSED IN PCP

```
 1     5 20003   127 52330    32        130001    63     36     10      8     12    201  1
 1     1     0     0   423     0     0       0     9      2      2
 3   423     0

 1     5 20001    78162325     0             0    72      4      3     12     70      0  4
 1     1     0     0     0     0     0       0     9      2      2
18     0     0

 1     6 20001   116250148     1             0    63     18      5      3     70      0  4
 1     1     0     0   810     0     0       0     9      2      2
16   810     0

 1     6 20002   116261955     1             0    51     15      4      0     70      0  4
 1     1     0     0   484     0     0       0     9      2      2
16   484     0

 1     6 20003    27210554     1         30000    33     37      7     10     60      0  5
 1     0     1     0     0     1     0       9     9      2      2
17     0     0

 1     6 20001    97290840     0             0    51     20      6     10     70      0  4
 1     1     0     0     0     0     0       0     9     -7     66
18     0     0

 1     6 20002   127281658     0             0    66      1      0     10     70      0  5
 1     1     0     0     0     0     0       0     9      2      2
18     0     0

 1     6 20003    18 51100     0             0    69     20      5     10     70      0  5
 1     1     0     0   524     0     0       0     9      2      2
16   524     0

 1     6 20001   108130830     0             0    49     10      8     10     70      0  5
 1     1     0     0    28     0     0       0     9      2      2
18    28     0

 1     7 20001    86231600     1             0    57     18      3     10     70      0  5
 1     1     0     0     0     0     0       0     9      2      2
18     0     0

 1     7 20002    17 91212    85        130001    99     25      1     99     11    201  5
 1     1     0     0    65     1     0      69     9      2      2
14    65     0

 1     7 20003    37191601     1         75000    27     16      4     15     11      0  4
 1     1     0     0    26     0     0       0  3590      2      2
11    26     0

 1     7 20005    47132115     0             0    99      1      1     99     70      0  4
 1     1     0     0     0     0     0       0     9      2      2
18     0     0

 1     7 20001    87101210     0             0    52     20      5     99     70      0  4
 1     1     0     0   102     0     0       0     9      2      2
18   102     0

 1     7 20003    18151135     0             0    65     12      7     10     70      0  1
 1     1     0     0    20     0     0       0    80      2      2
```

FIGURE 2

IV. DEMGEN and HIST

A. Introduction and Description of the Programs

The final step of the preprocessing is the ordering of the case histories for input to the operational simulator OPSIM. There are two alternative programs to do this, DEMGEN and HIST. HIST creates a chronological file of cases, and DEMGEN orders the cases randomly according to the user's direction. These final programs take a Coast Guard historical case load tape containing the original assistance reports and converts it to an exogenous event tape, the CASE TAPE, suitable to be used as input to OPSIM.

The tape input to DEMGEN contains the SARSIM CASE FILE, single unit case histories arranged chronologically by OPFAC. The OPFACs are ordered numerically by their identification numbers. Multi-unit cases next appear on the tape chronologically arranged. C-130 cases appear last on the tape, also arranged chronologically.

Each case regardless of type contains a fixed length record of 28 FORTRAN words. This record may be followed by a variable length record containing 3(N-1) FORTRAN words, where N, number of needs, is defined by the 15th word of the first block. In sum, all cases contain at minimum, a fixed length record, which may or may not be followed by a variable length record.

1. Program DEMGEN. Program DEMGEN can generate the CASE TAPE in a number of ways, depending upong the specific arrangement of the options available to the user.

In general, DEMGEN reads a case from the SARSIM CASE FILE and determines from the cases' historical occurrence time,into which one of 8 possible "boxes", located on drum, the case is to be inserted. ("Boxes" are explained further on in this section). The one exception to this process occurs when one wishes to generate a CASE TAPE according to more specific and selective criteria than a mere random duplication or increase of the SARSIM CASE TAPE. In this event cases taken from the PCP are put into "auxiliary bins" before being inserted into one of the 8 possible boxes. When all the cases appearing on the SARSIM Case File have been thus inserted into boxes, DEMGEN takes the given (input) starting time (day, hour and minute) and selects the box corresponding to that time. It then randomly selects a case from the box and assigns the given starting time to the case, as the case occurrence time.

DEMGEN rearranges the order of the words describing the case, does some minor calculations, and writes the case onto the CASE TAPE. The arrival time of the next case is then calculated, the appropriate box is chosen and another case is randomly picked. (The occurrence time of this case is taken to be the arrival time mentioned above.) The same word order rearrangements and minor calculations are made and this case is then written onto the output CASE TAPE. This process is repeated until either a given elapsed time period has been exceeded by the last calculated arrival time, or a given number of cases have been written onto the tape.

The input card deck consists of the following cards.

(a) An option card which governs program flow

(b) Optionally, the following cards:

(1) PERCENT card which is the percentage by which the historical case load is changed.

(2) MAX CASE card which tells the program how may cases to generate onto the output tape.

(3) A NODRUM card if it is desired to increase the historical

caseload selectively; e.g., the number of severe cases by x percent and the number of cases involving fires by y percent.

(c) The CALENDAR cards which define the time interval over which the historical cases occurred. The calendar is used, in part, for the calculation of the historical hourly arrival rates for each of the eight boxes. Once a given input tape has been used and the historical arrival rates calculated, all subsequent runs using the same input tape can read the arrival rates into core.

(d) The SCENARIO card which is based upon the Fiscal Year 1969 (day 1 is considered to be July 1, 1968 and subsequent dates are assigned a day number relative to day 1) and which gives the start and end, day, hour and minute of the first, and last case respectively, that will be put onto the CASE TAPE.

(e) The PEAK PERIOD SCENARIO card which defines the number of peak periods and the start and end day of each peak period with respect to July 1, 1968.

(f) The HOLIDAY SCENARIO card: which contains the number of holidays in the scenario and the day number (with respect to July 1, 1968) of each holiday.

(g) The Box I.D. card which gives the box number (1-8) for any combination of peak or non-peak period, weekday or weekend, day or night, the box number identified with that combination.

(h) SEED card containing the double precision random number "seed".

(i) NSCEN card which specifies the number of versions to be generated.

A more detailed description of these cards is given in Part C. of this section, "User's Guide for DEMGEN". Before going into a more detailed discussion of the program logic, a description should be made of the arrangement of the 8 "boxes" on drum. When a case is read from the input tape into core, the occurrence time of that case is used to determine into which one of the eight boxes the case should be inserted. The box numbers are given below:

Box 1 =	Peak Period	Weekdays	Days
Box 2 =	Peak Period	Weekdays	Nights
Box 3 =	Peak Period	Weekends	Days
Box 4 =	Peak Period	Weekends	Nights
Box 5 =	Non-Peak	Weekdays	Days
Box 6 =	Non-Peak	Weekdays	Nights
Box 7 =	Non-Peak	Weekends	Days
Box 8 =	Non-Peak	Weekends	Nights

Here weekends are taken to mean both weekends and holidays. Days are defined to be the hours 0800-2000 inclusive. The boxes are nothing more than locations on the drum. Each box is a drum unit with a starting address defined by a user written I/O table. For the 3 year District 1 historical tape containing about 12,000 cases the following table shows the number of FORTRAN words allocated to each box, and the number of cases that actually were put into each box in a specific run.

Box No.	Logical Unit No.	Capacity in Words Defined by I/O Table	#Cases
1	10	100,000	2060
2	11	40,000	744
3	12	70,000	2037

4	13	30,000	504
5	14	140,000	3231
6	15	40,000	969
7	16	50,000	1431
8	17	30,000	399

For runs using historical caseloads from other districts, or where the caseload becomes greater than 12,000 the user should be aware of the possibility that the boxes, as defined presently, may have to be redefined so that each box is large enough to hold all the cases assigned to it. The current drum allocation (8 boxes and 4 auxiliary boxes) reserves 580,000 of the 688,127 storage locations available to the user.

The numbered paragraphs below are a more detailed description of the computer logic. The reader should consult the DEMGEN flowcharts to better comprehend the following steps.

(1) The input deck is read into core storage

(2) Optionally, the number of days in each box is calculated (ISWIT (3) $\neq$ 1) or, the historical rates of occurrence (λ) are read into core, (ISWIT (3) = 1).

(3) Counters are initialized. The logical drum units (the boxes) are set to their origin and the address pointer (IADR (I,J) contains the address of the J^{th} case in the I^{th} box) of the first case in every box is set to 1.

(4) The first 28 words of a case are read into core from the input tape. If the value of the 15th word is 0 or 1 then the case has been completely described. If the value of the 15th word is n, n > 1, then a block of (n-1) *3 additional words is read into

core. If it is desired to create an output tape which has the same case distribution as the input tape, (ISWIT(1)=1), subroutine BOX is called immediately. However, if one desires to create a case tape according to more selective criteria (ISWIT (1) = 3) a call is made to the user modified subroutine SELECT, before subroutine BOX is called.

(5) Subroutine BOX determines from the historical occurrence time of the case, the box number of the box into which the case is to be inserted plus the hour of the day the case occurred. The arrays:

(a) NC(I,J) = Number of cases in Box I, occurrence hour J,

(b) CBOX(I) = Number of cases in Box I, and

(c) IADR(I,K) = starting address of the Kth case in the Ith box

are then updated.

(6) The case is then written onto the logical drum unit corresponding to the box determined in (5), in a single block, whose length is the total number of words used to describe the case [28 + (n-1) *3, n > 0]. The next case on the input tape is accessed and steps (4)-(6) are re-executed until a 99 is encountered in the first word of a 28 word record.

(7) At this point every case on the input tape has been processed and the 8 boxes filled. The exception to this occurs when one is to increase the historical case load by selective criteria (ISWIT(1) = 3). When this occurs, cases meeting the selective criteria have been stored in auxiliary bins and they must be randomly selected from these bins and inserted into the boxes, before the boxes can be considered full. Subroutine ADD performs this function.

(8) The historical mean hourly arrival rate is calculated for each of the 8 boxes according to:

$\lambda_{ij} = NC_{ij}/DAYS_i$ where NC_{ij} is the number of cases in the Ith box, Jth hour,

$DAYS_i$ is the number of days occurring in the time period represented by the Ith box over the time period covered by the input tape. Note that the λ_{ij}'s can optionally be read into core, in which case this calculation is by-passed.

(9) If the input caseload is to be changed by x percent then the λ_{ij}'s are multiplied by the factor (1 + x/100).

(10) At this point DEMGEN is ready to select cases from boxes, give them new occurrence times, and write them onto the output tape. First, a 4 word code record is written on the output tape. The first case written will have an occurrence time equal to the scenario start day and hour which are input data, chosen with respect to the Fiscal 1969 calendar.

(11) Using the Fiscal 69 calendar and the case occurrence time, (day and hour) the box number of the case is determined.

(12) The box number and case occurrence hour determine λ_{ij}.

(13) The INUMth case in the box is selected to be written onto the output tape according to:

INUM = CBOX (IBOX) *RN + 1

where IBOX = box number

RN = a random number ($0 < RN \leq 1$), and

CBOX (IBOX) = number of cases in box IBOX.

(14) The address of the first word of the INUMth case in box, IBOX is known, as is the address of the INUM + 1st case. Subtracting the smaller address from the larger will give the number of words used to describe the INUMth case. The drum is spaced forward to the INUMth case and it is read into core. The ordering of the words is changed to conform to the output tape format and the case is written onto the output tape, with a minimum of 2 card images used to describe the case.

(15) At this point the occurrence time of the next case is calculated. The procedure is based on the assumption that case interarrival times are exponentially distributed over periods of time less than one hour. A well known procedure [1] is then used to calculate DELTA, the interarrival time.

Using the cumulative exponential distribution,

$$\text{Prob}\ \{\text{DELTA} \leq t\} = 1 - \exp[-\lambda_{ij} t],$$

a sample can be found by setting

$$\text{DELTA} = -\text{Ln}\ [\text{RN}]/\lambda_{ij}, \text{ where}$$

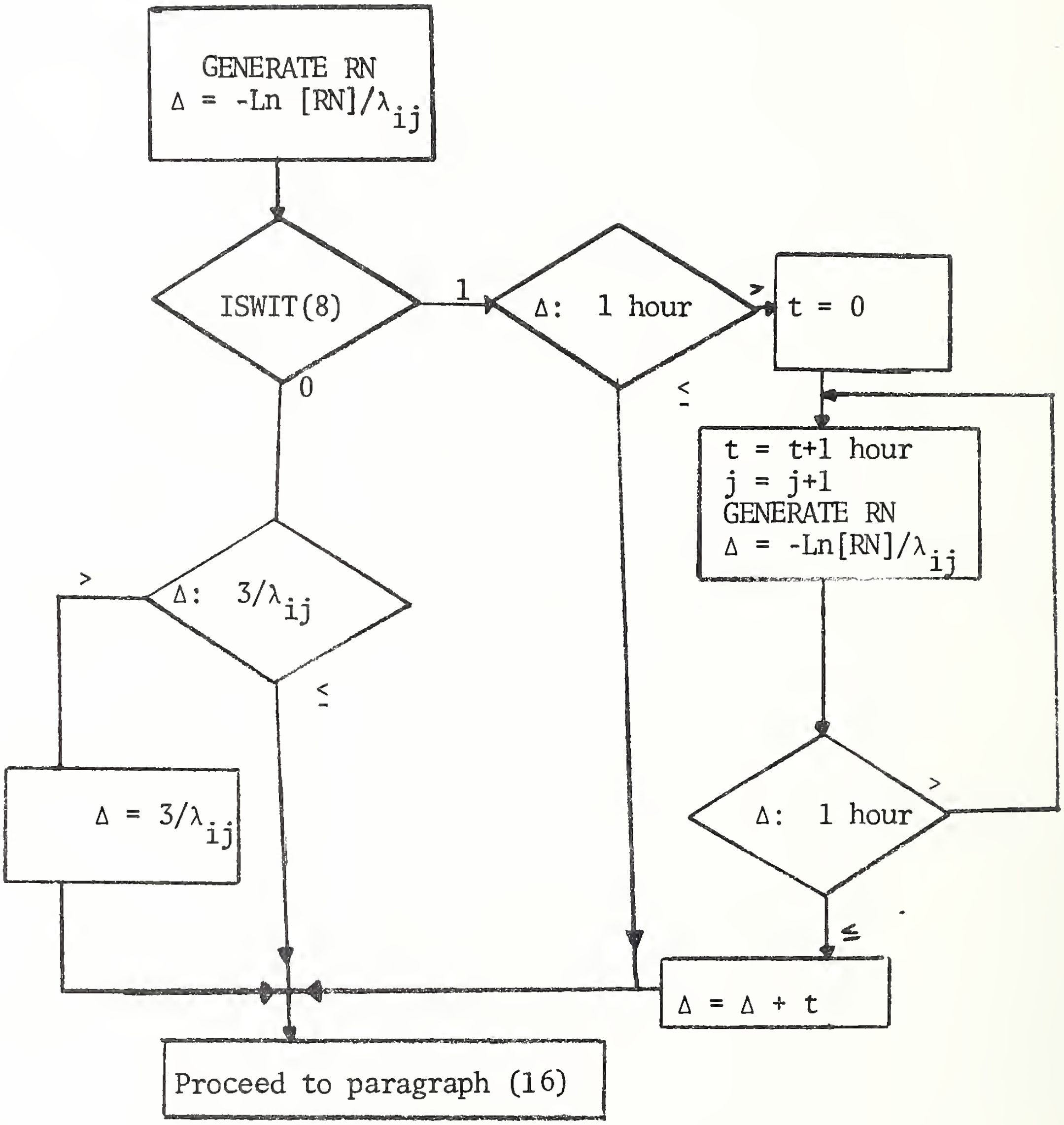
RN = a uniformly distributed random number on (0,1]

If the DELTA generated in this manner is not larger than one hour, one proceeds to paragraph (16).

However, if DELTA is larger than certain values it is modified by one of two procedures designed to eliminate excessively large interarrival values. The technique used is an option of the user (specified by ISWIT(8)); both are outlined in the following chart.

---

[1] For example, F. Hillier and G. Lieberman, Introduction to Operations Research, Holden-Day, Inc., 1967. See p. 447.


GENERATE RN
$\Delta = -\text{Ln}\ [RN]/\lambda_{ij}$
ISWIT(8)
1
0
Δ: 1 hour
>
≤
t = 0
t = t+1 hour
j = j+1
GENERATE RN
$\Delta = -\text{Ln}[RN]/\lambda_{ij}$
>
Δ: $3/\lambda_{ij}$
≤
$\Delta = 3/\lambda_{ij}$
>
Δ: 1 hour
≤
$\Delta = \Delta + t$
Proceed to paragraph (16)

(16) DELTA is then added to the current time (in minutes) which is then converted to the proper format (0000-2400).

(17) If the time exceeds 2400 hours the day is updated. The new day and time is checked against the scenario end day and hour. Generation of cases ceases either when :

(a) scenario end time is exceeded (ISWIT(10) = 0) or

(b) the number of cases on the CASE TAPE exceeds an input variable MAXCA (ISWIT(10) = 1).

Otherwise the steps described in paragraphs (11) - (16) are repeated.

(18) After the last case has been written onto the CASE TAPE DEMGEN is finished. All that remains is to print out composite statistics describing the scenario generated. The output is presented first using Coast Guard station numbers as headings and then repeated using OPSIM station numbers. Then, if ISWIT(9) = 1, the output tape is rewound and the first 50 cases which were generated are printed out.

If the user desires to generate more than one version of this scenario, the program returns to paragraph (7) of this report and repeats the process until NSCEN versions have been written onto the output tape, with each version separated by an end of file mark.

2. Program HIST

The computer program HIST is a UNIVAC FORTRAN V program which creates a historical demand tape* to be used as input to OPSIM. This demand tape contains a subset of the cases existing on the PCP output tape, the SARSIM CASE FILE, chronologically ordered by their historical arrival times. The description of HIST given below is divided into 3 sections, input, the program, and output.

A. Input

The only input to HIST is the output tape of PCP (i.e., SARSIM CASE FILE). This tape contains in order, single unit, multi-unit, and C-130 cases. Single unit cases are ordered by OPFAC identification number, and within each OPFAC by historical date and time of arrival. Multi-Unit and C-130 cases are ordered by the historical arrival time.

B. The Program

The purpose of HIST is to produce a demand tape containing the above cases, or a subset of them, in chronological order. This is done in the following steps. The reader is directed to the flowcharts of HIST, Report 10435.

(1) The first single unit case belonging to the first OPFAC on the SARSIM CASE FILE is read into core. The case is then checked against any scenario limits. Instead of creating a CASE TAPE containing all the cases from the SARSIM File ordered chronologically, it may be desirable to order a specific subset of the SARSIM caseload;

e.g., only those cases occurring during the first three months of 1969, or only those cases occurring during the summer of 1968. In this case a culling routine (usually consisting of a few lines of FORTRAN code) can be inserted in the program immediately after the case is read from the PCP tape. If the case falls within these limits, it is accepted and is output onto drum and the starting address of the case is noted. This starting address will become the pointer giving the address of the first case in the bin, into which all single unit acceptable cases belonging to the first OPFAC are inserted. An auxiliary pointer is also initialized at this time.

(2) As succeeding cases belonging to this OPFAC are accepted, they are written sequentially onto drum and the auxiliary pointer is incremented.

(3) As soon as an acceptable case is encountered bearing a new OPFAC I.D. code a new bin is created which has a starting address equal to the current value of the auxiliary pointer.

(4) Succeeding acceptable cases belonging to the new OPFAC are then written onto drum sequentially behind the first case, the auxiliary pointer being updated each time a case is inserted into the bin.

(5) This process continues until all single unit cases have been read from the SARSIM CASE FILE,culled, and inserted into their proper OPFAC bins.

(6) The next type of case, the multi-unit case is read from the SARSIM CASE FILE, and is inserted, after culling, into the multi-unit bin; the current value of the auxiliary pointer at the time the first acceptable multi-unit case is encountered becomes the starting address pointer of the multi-unit bin.

(7) The procedure in paragraph (6) is repeated for the last type of case on the SARSIM CASE FILE, the C-130 case.

(8) When the process outlined in paragraphs (1) - (7) has been completed, n + 2 bins will have been created, where n is the number of different OPFAC's encountered in inserting the single unit cases into bins. The starting address of the first case in each bin the cases will be ordered chronologically.

(9) The first case in each of the n+2 bins is then examined, the case with the earliest arrival time is chosen, and,after modification of the case descriptors, is written onto the output Case Tape. The address pointer of the bin from which the case has been picked, is incremented and now points to the first word of the next case in that bin.

(10) The process described in (9) is repeated for the new set of n+2 cases, each occupying the top position in its bin. If at any time during this process a bin becomes empty, a bin switch is set to eliminate the empty bin from consideration.

(11) The program stops when all bins are empty.

C. Output

The output of HIST is the historical demand tape, the CASE TAPE, a Fortran formatted tape, containing variable length records. The first record is a 4 word initializing record required by OPSIM, containing a 3 in the first word and zeros in the remaining three. The last record on the demand tape also has 4 words, containing a 2 in the first word, the day number plus 2 in the second word, where day number is the day number (relative to the day number of the first case) of the last case on the demand tape. The third and 4th words are zero.

The format of the variable length record describing each case is shown in Table 4.

Table 3

DEMGEN and HIST Output Format of a Variable Length Record Describing a Case

The record is composed of a variable number of card images, a minimum of two card images is needed to characterize a case.

CARD 1 FORMAT (I3, I4, I3, I2, I3, 11I5)

Column No.	Case Descriptor
1-3	IDNO=1 (the same for every case on the tape)
4-7	Occurrence day of case
8-10	Occurrence hour of case
11-12	Occurrence minute of case
13-15	District No.
16-20	Station No.
21-25	Case No.
26-30	Number of People on Board
31-35	Air temperature
36-40	Wind
41-45	Sea Height
46-50	Visibility
51-55	Type of Vessel
56-60	Length
61-65	Severity of case
66-70	N (Number of explicit needs)

CARD 2 FORMAT (10I5, I10)

Column No.	Case Descriptor
1-5	NNN (Number of Needs other than search or tow)
6-10	MMM (Number of resources that towed or escorted)
11-15	GAMMA
16-20	S1S
21-25	S2S
26-30	TSM (Total Search Miles)

31-35	Miles (Distance offshore)
36-40	X
41-45	Y
46-50	Box No. (Box from which case was selected.)
51-60	Value of Vessel

CARD 3 and Succeeding Cards

If N (the number of explicit needs) is greater than zero and MMM = 0 then N values of the group

NEED(I) = the I.D. number of the Ith need

TOS(I) = Time on scene for the Ith need

DELTA(I) = Delay of Ith need

are calculated. These are written onto the Output Tape in card image format, 6 groups to a card with FORMAT (6 (I2, F6.4, F4.2))

Card 3 NEED(1), TOS(1), DELTA(1),......, NEED(6), TOS(6), DELTA(6)

Card 4 NEED(7),TOS(7), DELTA(7),......., NEED(12), TOS(12), DELTA(12)

Card 5

⋮

However, if N > 1 and MMM (the Number of resources that towed or searched) > 0, then the last group (NEED(N), TOS(N), DELTA(N)) must be written on tape as a separate card image with FORMAT (I2, F6.4, F4.2).

B. Subroutines Within DEMGEN

DEMGEN uses four FORTRAN subroutines, an assembly language random number generator and a user supplied I/O table which defines the drum units and capacities of the 8 "boxes" plus auxiliary units corresponding to auxiliary bins if needed. Descriptions of each of these routines are found in the following paragraphs.

1. FORTRAN Subroutines

(a) Subroutine BOX

Subroutine BOX is called when a case is accessed from the input tape. Given the historical occurrence time of the case, BOX will determine the number of the box into which the case is to be inserted along with the hourly interval (1-24) that the case occurred.

(b) Subroutine SELECT

SELECT is called whenever ISWIT(1) = 3. It must reflect the specific criteria by which a case is selected and put into an auxiliary bin. Since the selective criteria may change from run to run, the user must supply the 1 or 2 lines of FORTRAN code which does the culling. Two examples of this are given below, and in Figure 5.

Example A is an example of the coding of SELECT for a computer run approximating the SARSIM caseload, but increasing the cases where the number of people on board are greater than 3, by 50%. A single auxiliary bin is defined by the I/O table.

Example B is an example of the coding of SELECT for a computer run where the number of cases whose severity is greater than 4 is to be increased by 40%, and the number of tow cases increased by 70%, otherwise approximating the SARSIM case load. Two auxiliary bins are defined by the I/O table.

```
      SUBROUTINE SELECT
      COMMON/SEAL/ NUPPER
      DIMENSION IADR(8,4500),NADR(4,1000),CPER(24),CBOX(8),NCASES(24)
     1,ICASE(100)
      COMMON NODRUM,IADR,NADR,NCASES,CPER,CBOX,ICASE
C
C  THESE ARE USER FURNISHED STATEMENTS
C
      IAUNIT=18
      IF(ICASE(6).LT.4) GO TO 1
      J=1
      NCASES(J)=NCASES(J)+1
      K=NCASES(J)+1
      NADR(J,K)=NADR(J,K-1)+NUPPER
      CALL NTRAN(18,1,NUPPER,ICASE(1),L)
   20 IF(L+1) 25,20
    1 RETURN
   25 WRITE(6,507)
  507 FORMAT (2X,'ERROR IN NTRAN TRANSMISSION IN SELECT')
      STOP
      END
```

```
      SUBROUTINE SELECT
      COMMON/SEAL/ NUPPER
      DIMENSION IADR(8,4500),NADR(4,1000),CPER(24),CBOX(8),NCASES(24)
     1,ICASE(100)
      COMMON NODRUM,IADR,NADR,NCASES,CPER,CBOX,ICASE
C
C  THESE ARE USER FURNISHED STATEMENTS
C
      IDRUM=0
      IF(ICASE(14).GT.3)  IDRUM=1
      IF(ICASE(17).GT.0)  IDRUM=2
      IF(IDRUM.EQ.0) GO TO 1
      IAUNIT=17+IDRUM
      NCASES(IDRUM)=NCASES(IDRUM)+1
      K=NCASES(IDRUM)+1
      NADR(IDRUM,K)=NADR(IDRUM,K-1)+NUPPER
      CALL NTRAN(IAUNIT,1,NUPPER,ICASE(1),L)
   20 IF(L+1) 25,20
    1 RETURN
   25 WRITE(6,507)
  507 FORMAT (2X,'ERROR IN NTRAN TRANSMISSION IN SELECT')
      STOP
```

FIGURE 6

(c) Subroutine ADD

ADD is called whenever ISWIT(1) = 3. When the input tape containing the historical tape has been read, non-culled cases are located in the 8 bins. The culled cases are located in the auxiliary bins, all cases of a specific type, in the same bin. Subroutine ADD takes the cases out of the bins in a random fashion and inserts them into their proper box, until the desired percentage increase for that type of case has been reached.

(d) Subroutine ADTIME

ADTIME is called whenever ISWIT(8) = 1, and whenever the interarrival time of the next case exceeds 60 minutes. It calculates the interarrival time, DELTA, according to the formulae given in Section IV.A.1.

2. The I/O Subroutine.

Below is a listing of the current I/O user supplied subroutine which defines the sizes of the 8 boxes plus four auxiliary bins. The auxiliary bins have a capacity of 25,000 FORTRAN words each. If more auxiliary bins are to be used, the I/O table must be modified in accordance with the instructions in Table 5.

3. The Random Number Generator

This subroutine is an assembly language routine written by the Computer Services Division at N.B.S. The user must supply the seed. Any odd octal number can be used. The standard seed is the number described in Section IV.C, User's Guide for DEMGEN.

HOW TO ASSEMBLE YOUR OWN FORTRAN I/O TABLE(1)

FORTRAN users may assemble their own I/O Table replacing the standard on the EXEC-II system. The I/O Table correlates logical read and write units referenced in a FORTRAN I/O statement (such as "READ INPUT TAPE 10, ARRAY") with particular hardware devices in the computer room (card reader, magnetic tape uniservos, etc.).

Example I/O Table

```
7
8I         ASM    IO, IO

           +3      .  STANDARD PUNCH

           +2      .  STANDARD PRINT

           +1      .  STANDARD CARD READER

NTAB$*     -4      .  UNIT 0 = CARD REREAD UNIT

           +2      .  UNIT 1 = PRINTER

           +1      .  UNIT 2 = CARD READER

           +0      .  UNIT 3 (NOT USED)

          +'A'     .  UNIT 4 = TAPE A

          END
```

(Words after a period are treated as comments and are ignored by the Assembler.)

The signed values in this Table each stand for a particular hardware device; the lines in this Table each relate to a logical unit number or a standard unit. Therefore, a value entered on a particular line connects a hardware device to a unit number.

In the more detailed explanation that follows, refer to the example above.

---

(1) This section is reproduced from the NBS Computer Services Division, Systems Notice #2, February 26, 1968.

Explanation

1) The values in this table each stand for a particular hardware device; i.e.,

+1 always points to the card reader.

+2 always points to the printer.

+3 always points to the card punch.

-4 always points to the card reread unit (FORTRAN V).

+'A' always points to tape A.

A complete table of these values is given later in this section.

2) The programmer who made this I/O Table used logical units 0, 1, 2, and 4 in his program; i.e., he wrote I/O statements such as the one below which references unit 2:

```
        READ (2,99)  (KARD(I), I = 1,14)
     99 FORMAT (13A6,A2)
```

In the I/O Table, he must make entries as follows:

On line NTAB$ enter the hardware device value for unit 0.

On the line NTAB$ +1 (i.e. one line after NTAB$) enter the hardware device value for unit 1.

On line NTAB$ +2 (i.e. two lines after NTAB$) enter the hardware device value for unit 2.

etc.

In the READ statement shown above, the programmer intended that unit 2 refer to the card reader. Therefore on line NTAB$ +2, he entered the value +1, which points to the card reader (as explained in paragraph 1). The other values were entered similarly: Note that since unit 3 was never referenced in the program, he entered +0 on line NTAB$ +3. Any value might have been used here.

3) This programmer also referenced the standard PUNCH, PRINT, and READ units; i.e. he wrote I/O statements such as the one below which references the standard card punch:

```
          PUNCH 10,ALPHA,BETA,GAMMA

       10 FORMAT (3F10.5)
```

For the standard units, he must make entries in the lines preceding NTAB$. The values entered on these lines are fixed as follows:

The line NTAB$ -3 is reserved for the standard punch unit; therefore enter the value +3 on this line.
The line NTAB$ -2 is reserved for the standard print unit; therefore enter the value +2 on this line.
The line NTAB$ -1 is reserved for the standard card reader; therefore enter the value +1 on this line.

Format of the I/O Table

As stated before, the I/O Table is in 1108 Assembler format. Rather than define this format, it is simpler to give a few rules relating to the I/O Table.

1) NTAB$* must start in column 1.

2) The asterisk (*) following NTAB$ is required; it makes this label accessible to EXEC-II.

3) Values may start in or beyond column 2.

4) At least one space must separate the label NTAB$* from the value following it.

5) A period starts the comments field; at least one space must precede the period.

6) The last line must contain the word END starting in or beyond column 2.

Hardware device values

The values which point to particular hardware devices are given below.

+1	always points to the	card reader
+2	"	printer
+3	"	card punch
+4	"	console typewriter
-4	"	card re-read unit (FORTRAN V)
-0	"	card re-read unit (FORTRAN IV)
+'A'	"	logical tape unit A
+'B'	"	logical tape unit B
.		.
.		.
.		.
+'Z'	"	logical tape unit Z
+'-'	"	logical tape unit -
+'('	"	logical tape unit (
+DRUM1	points to a drum area called DRUM1. Drum areas require additional entries in the I/O Table. See the explanation under <u>Drum assignments</u>.	

Tape and drum assignments require some further explanation. See the following page.

Tape assignment

The following explains how the I/O Table connects the unit number in a FORTRAN I/O statement to the final tape assignment made by the operator at the console.

The example I/O Table on page VIII-1 shows that the programmer wishes unit 4 to reference a tape drive. He picks logical label 'A' and enters it in the I/O Table on line NTAB$ + 4. He also punches an ASG control card for his job deck, containing logical label 'A' and the tape reel number, such as:

```
7   ASG    A = 1103
8
```

When his job deck is read in, the ASG control card causes the console typeout:

```
MOUNT 1103
```

and the operator mounts tape reel 1103 on an empty tape drive. When the job comes up for execution, the operator types in the physical number of the tape drive. If it is tape drive 3, he types in:

```
/3  1103
```

and program execution continues.

Drum assignment

The FH432 drums have approximately 646,000 cells available to the user for scratch area during execution of his program. Address bounds of the scratch area are from:

1300000 to 3777777 octal
360448 to 1048575 decimal

The user may treat this area just as he would treat scratch tapes.

The I/O Table may be constructed to take advantage of drum scratch area. Use the entries +DRUM1 +DRUM2 etc., in the I/O Table to point to different drum areas. For each DRUM entry, a set of seven locations must be set aside in the NTAB$ table. The general form of this is

```
DRUM  (starting address)
      (ending address)
      (starting address)
            +0
            +0
            +0
            +0
```

See example on the following page.

Example

Construct an input/output table which

(a) assigns 0 as the card re-read unit
(b) units 1, 2, 3 and 5 as card reader
(c) unit 4 as card punch
(d) unit 6 as printer
(e) 7 and 8 as two different drum scratch areas - each 300000 cells
(f) unit 9 as tape A and unit 10 as tape B.

```
7
8I     ASM       IO, IO
                 +3
                 +2
                 +1
NTAB$*           -4
                 +1
                 +1
                 +1
                 +3
                 +1
                 +2
                 +DRUM1
                 +DRUM2
                 +'A'
                 +'B'
DRUM1            +400001
                 +700000
                 +400001
       DO         4    ,    +0       (Generates 4 lines of zeroes)
DRUM2            +700001
                 +1000000
                 +700001
       DO         4    ,    +0       (Generates 4 lines of zeroes)
       END
```

(See note on next page.)

<u>Note</u>: The DO directive used above generates identical lines of coding. Its format is:

```
DO   count   ,   line of coding
```

represents a blank space.

'DO' appears in the entry field. One or more spaces follow.

'count' is the number of times to repeat the line of coding.

'count' is followed by <u>one</u> space and a comma.

The next character after the comma corresponds to column 1 of the line of coding desired.

Thus, DO   4   ,   + 0 is equivalent to

```
+ 0
+ 0
+ 0
+ 0
```

STANDARD INPUT/OUTPUT TABLE

Logical Unit	Assignment
0	Reread
1	Card Reader
2	Printer
3	Card Punch
4	Console
5	Card Reader
6	Printer
7 through 32	Tapes A through Z
33	Tape (
34	Tape -
35 and 36	Entire Drum 1300000 to 3777777 (octal)
37 and 38	Lower Half 1300000 to 2537777
39 and 40	Upper Half 2540000 to 3777777
41 and 42	Lower Third 1300000 to 2177777
43 and 44	Middle Third 2200000 to 3077777
45 and 46	Upper Third 3100000 to 3777777

C. User's Guide for DEMGEN

This section discusses the program options available to the user, the setting up of the input deck the format of the output tape and some examples of typical runs showing the arrangement of the input deck for each run.

1. Options Available to the User

The values of the array ISWIT(I), which are punched on the OPTION CARD and read into memory, govern the logic in a given run of the program. These are:

WORD	Switch Setting	OPTION
ISWIT(1)	1	This run will create an output case load similar in characteristics to the input caseload.
ISWIT(1)	3	This run will create cases similar to the input tape with x types of cases increased by CPER(I) percent (I=1,x)
ISWIT(2)	0	The caseload of the scenario produced is equal to that of the input tape.
ISWIT(2)	1	The caseload is increased by PER percent.
ISWIT(3)	1	Special validation option: historical Lambdas are read into core. An output tape will not be created. The Lambdas of the generated

WORD	Switch Setting	OPTION
		cases will be printed out along with the historical Lambdas.
ISWIT(3)	0	Normal operation of Program. Cases are generated using historical Lambdas and an output tape is created.
ISWIT(8)	0	The interarrival time of the next case is taken to be $\leq 3/\lambda_{ij}$ (60).
ISWIT(8)	1	The interarrival time is calculated according to the formulae in Section IV. A.1.
ISWIT(9)	0	The cases on the Output Tape will not be printed.
ISWIT(9)	1	The first 50 cases of the Output Tape will be printed.
ISWIT(10)	0	Cases will cease being generated when the scenario end day and hour are exceeded.
ISWIT(10)	1	Cases will cease being generated when a given number of cases, MAXCA, has been exceeded.

Note that these switch settings are mutually independent and no conflict in settings can exist.

2. The Input Deck

The cards making up the input deck are described below. They are arranged in the order listed.

CARD A

OPTION CARD

Column	Variable Name	Format	Value
1	ISWIT(1)	I1	1 or 3
2	ISWIT(2)	I1	1 or 0
3	ISWIT(3)	I1	1 or 0
4	ISWIT(4)	I1	Not Used (Blank)
5	ISWIT(5)	I1	Not Used (Blank)
6	ISWIT(6)	I1	Not Used (Blank)
7	ISWIT(7)	I1	Not Used (Blank)
8	ISWIT(8)	I1	0 or 1
9	ISWIT(9)	I1	0 or 1
10	ISWIT(10)	I1	0 or 1

CARD B

PERCENTAGE INCREASE CARD (OPTIONAL)

This card is used if ISWIT(2) = 1. Otherwise it is omitted.

Column	Variable Name	Format	Value
1-5	PER	F5.0	The value of the percent increase of the input caseload desired.

CARD C

MAX CASES CARD (OPTIONAL)

This card is used if ISWIT(10) = 1 and is otherwise omitted.

Column	Variable Name	Format	Value
1-5	MAXCA	I5	The number of cases desired on the output tape.

CARD D

AUXILIARY BIN CARD(S) (OPTIONAL)

This card is used if ISWIT(1) = 3 and otherwise omitted. If used, the run will create cases according to a more selective and specific criteria than merely increasing the input caseload by PER percent[1/]

[1/] In this case, subroutine SELECT is used and must be changed to reflect the specific selective criteria by which the user desires to accept a case and put it in an auxiliary bin. Note that the auxiliary bins are drum logical units defined in the I/O Table and their limits must be large enough to hold all the cases assigned to them.

Column	Variable Name	Format	Value
1-2	NODRUM	I2	The number of auxiliary bins into which the cases meeting the selective criteria are to be inserted.
3-7	CPER(1)	F5.2	CPER(I) is the percent
8-12	CPER(2)	F5.2	Increase desired for all
13-14	CPER(3)	F5.2	Those cases in the Ith
....	....	"	auxiliary bin.

Up to twelve bin percentages are defined on the first card. If additional bins are used, the 13th bin percentage starts in column 1 of the 2nd card.

CARD E

PEAK PERIOD CARD(S)

This card contains the number of peak periods in the time interval covered by the SARSIM CASE FILE (input tape) and the start and end week in reference to the input calendar. (card F)

Column	Variable Name	Format	Value
1-2	NPP	I2	Number of peak periods in the time interval covered by the input tape.
3-4	IYEARS	I2	The number of years covered by the SARSIM CASE FILE relative to 1966; 1966 is assigned the value 1.

Column	Variable Name	Format	Value
5-7	ISWPP(1)	I3	ISWPP(I) is the start
8-10	IEWPP(1)	I3	week of the Ith peak
11-13	ISWPP(2)	I3	period and IEWPP(I) is the
14-16	IEWPP(2)	I3	end week of the Ith peak
.....	....		period.
.....	....		

The first card contains up to 10 pairs of start and end peak periods. If additional peak periods are to be defined a second card is used containing 10 peak periods; the 1~~3~~th peak period start week beginning in column 1.

CARD F

HISTORICAL CALENDAR CARDS

These cards contain the array CAL(I,J,K) which for a given month I, day J and year K, will equal the week number. For example, CAL (7,1,1) = 1. (July 1st 1966 is the start week). For I a weekday CAL(I,J,K) is even. For I a weekend or holiday CAL(I,J,K) is odd.

Column	Variable Name	Format	Value
1-6	CAL(1,1,1)	I6	There are 12 entries per
7-12	CAL(2,1,1)	I6	card. The first card contains
13-18	CAL(3,1,1)	I6	the values of CAL(I,J,K) for
19-24	CAL(4,1,1)	I6	day 1, year 1, and all months.
.....	....		The 2nd card is for day 2 and
.....	....		year 1. The 31st card for

67-72	CAL(12,1,1)	I6	day 31 year 1. A calendar for a 3 year historical input tape will contain 93 cards.

CARD G

SCENARIO LIMITS CARD

This card contains the start hour and day, end hour and day of the scenario. (relative to July 1, = day 1) If a specific number of cases are to be generated (ISWIT(10) = 1), the end day and hour of the scenario cannot be determined in advance and are left blank.

Column	Variable Name	Format	Value
1-4	ISCSH	I4	start hour of the scenario
5-8	ISCSD	I4	start day (relative to July 1)of the scenario
9-12	ISCEH	I4	End hour of scenario
13-1	ISCED	I4	End day (relative to July 1 of the scenario

CARD H

SCENARIO PEAK PERIOD CARD

This card contains the number of peak periods and the start and end day of each peak period of the scenario. The start and end days of the peak periods are calculated relative to July 1.

Column No.	Variable Name	Format	Value
1-2	NSPP	I2	Number of scenario peak periods
3-5	NSPPS(1)	I3	NSPPS(I) is the start

Column	Variable Name	Format	Value
6-8	NSPPE(1)	I3	day of the Ith peak period,
.....	.....		NSPPE(I) is the end day of
27-29	NSPPS(10)	I3	the Ith peak period, all
30-32	NSPPE(10)	I3	taken relative to July 1.

CARD I

HOLIDAY CARD

This card contains the number of holidays in the time interval covered by the scenario, or if the scenario end hour and day are not known, the number of holidays in any time interval large enough to contain the occurrence hour and day of the last case written onto the Output Tape. It also contains the day number, relative to July 1 of each of the holidays.

Column	Variable Name	Format	Value
1-2	NOHOLS	I2	Number of holidays in scenario.
3-5	IHOL(1)	I3	IHOL(I) is the
6-8	IHOL(2)	I3	day number of the
9-11	IHOL(3)	I3	Ith holiday
.....			relative to July 1 .
.....			
.....			
60-62	IHOL(20)	I3	

The day numbers of 20 holidays can be put onto the first card.

Succeeding cards if needed contain 20 holidays per card each beginning in column 1 and taking 3 columns with an I3 format.

CARD J

BOX I.D. TABLE CARD

This card remains the same for every run. It contains the values of the array, ILIST(I,J,K);

I = 1, 2; J = 1, 2; K = 1, 2; where:

I = 1 Peak Period

I = 2 Non-Peak

J = 1 Weekday

J = 2 Weekend or Holiday

K = 1 Day

K = 2 Night

ILIST(I,J,K) for a particular configuration of I, J, K gives the box number as follows:

Column	Variable Name	Format	Value Box No.
1	ILIST(1,1,1)	I1	1
2	ILIST(2,1,1)	I1	5
3	ILIST(1,2,1)	I1	3
4	ILIST(2,2,1)	I1	7
5	ILIST(1,1,2)	I1	2
6	ILIST(2,1,2)	I1	6
7	ILIST(1,2,2)	I1	4
8	ILIST(2,2,2)	I1	8

CARD K

RANDOM NUMBER SEED

A double precision random number seed is read into the array B(1), B(2). The seed is read according to an octal format.

Column	Variable Name	Format	Value
1-12	B(1)	012	154447730601
14-25	B(2)	012	255751305264

CARD L

LAMBDA CARDS (OPTIONAL)

If ISWIT(3) = 1 the historical λ_{ij}'s are not calculated, but read into core via these cards. The array LAMBDA (I,J) contains the value of λ_{ij} for box number I (I=1,8) and hour J (J=1,24)

Column	Variable Name	Format
1-5	LAMBDA(1,1)	F5.3
6-10	LAMBDA(2,1)	F5.3
11-15	LAMBDA(3,1)	F5.3
16-20	LAMBDA(4,1)	F5.3
21-25	LAMBDA(5,1)	F5.3
.....	....	....
.....	....	....
56-60	LAMBDA(12,1)	F5.3

reverse order

There are twelve Lambdas to a card. Two cards for each box, giving a total of 16 cards.

3. Output Description

(a) Output of the program is in two forms:

The printed output displays

1. the historical lambdas;

2. the number of observations (days) in each of the 8 boxes over the time period covered by the scenario; or if ISWIT(10) = 1, the time period ending with the occurrence time of the last generated case.

3. the λ_{ij}'s of the generated cases.

(b) The Output Tape which contains the generated cases. This tape is a formatted tape containing variable length records. It starts and ends with a 4 word record. The format and contents of the record describing the case is shown in Table 4.

4. EXAMPLES

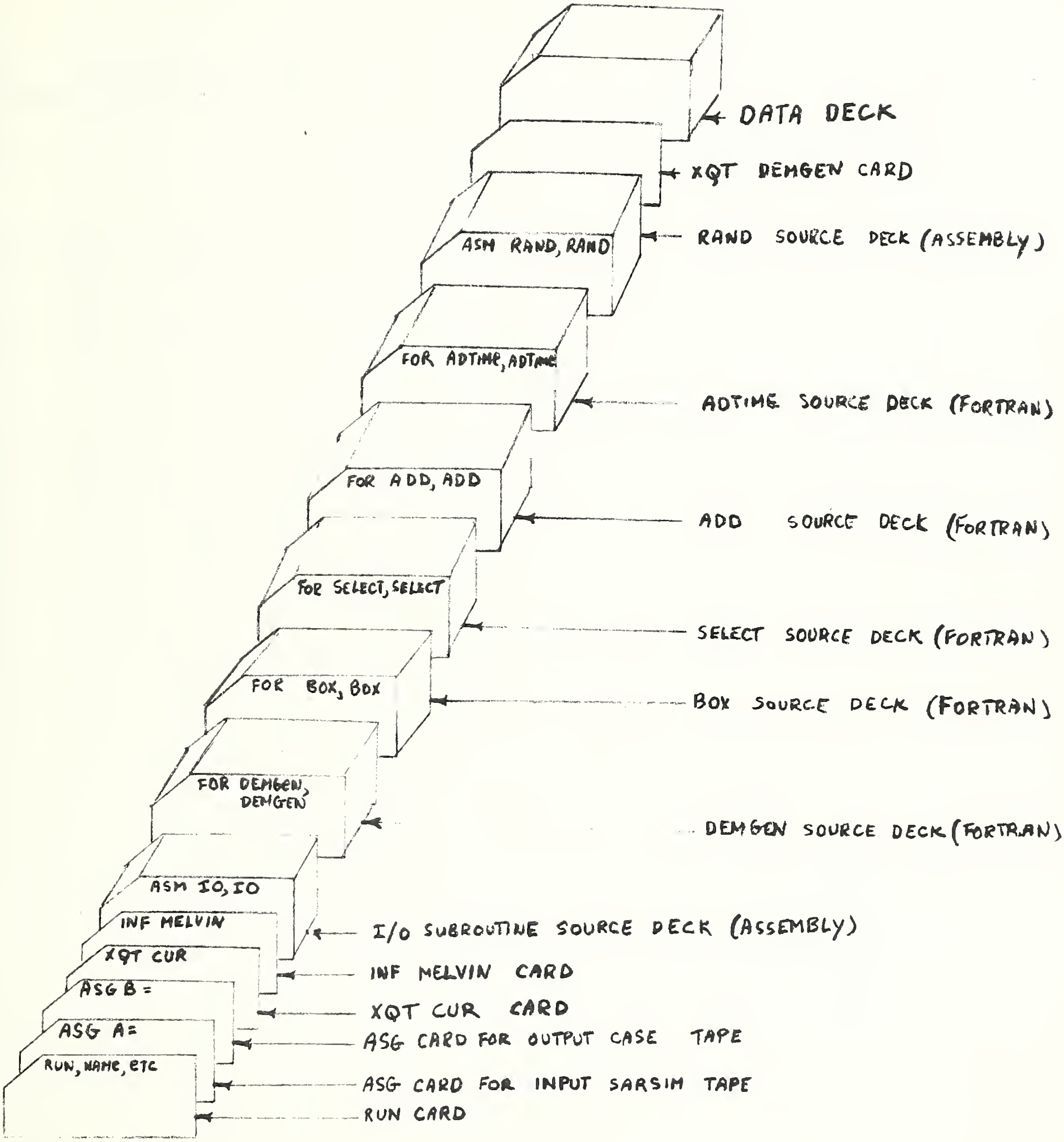
Below are two examples of possible runs. A printout of the input card deck for each of the examples follows.

(a) A run is desired where the historical lambdas are to be read from data cards, an output tape is not to be created, scenario start time and day are July 1, 1968, hour 1 and cases are to be generated for 135 days ending at 2400 hours of the 135th day.

The purpose of this run is to compare the historical against the generated lambdas.

(b) An output tape is to be generated which will contain 2500 cases, starting date August 10, 1968, hour 1. The input caseload tape is to be increased by 20%.

FIGURE 7



DECK SET UP OF DEMGEN FOR RUN AT N.B.S. ON UNIVAC 1108

EXAMPLE A

```
1 1        11
   0.
0303 14 28105129210250
      53      62      70      79      88      96              10      18      27      36      44
      54      62      70      79      88      96       1      10      18      27      36      44
      54      62      70      80      88      97       1      10      19      28      36      45
      54      63      71      80      88      97       1      10      19      28      36      45
      54      63      71      80      88      98       2      10      19      28      37      46
      54      64      72      80      89      98       2      11      20      28      37      46
      55      64      72      80      89      98       2      11      20      28      38      46
      55      64      72      81      90      98       2      12      20      29      38      46
      56      64      72      81      90      98       3      12      20      29      38      46
      56      64      72      82      90      99       3      12      21      30      38      47
      56      65      73      82      90      99       4      12      21      30      39      47
      56      65      73      82      90     100       4      12      22      30      39      48
      56      66      74      82      91     100       4      13      22      30      39      48
      57      66      74      82      91     100       4      13      22      30      40      48
      57      66      74      83      92     100       4      14      22      31      40      48
      58      66      74      83      92     100       5      14      22      31      40      48
      58      66      74      84      92     101       5      14      23      32      40      49
      58      67      75      84      92     101       6      14      23      32      40      49
      58      67      75      84      92     102       6      14      24      32      41      50
      58      68      76      84      93     102       6      15      24      32      41      50
      59      68      76      84      93     102       6      15      24      32      42      50
      59      69      76      85      94     102       6      16      24      33      42      50
      60      68      76      85      94     102       7      16      24      33      42      50
      60      68      76      86      94     103       7      16      25      34      42      51
      60      69      77      86      94     103       8      16      25      34      42      51
      60      69      77      86      94     104       8      16      26      34      43      52
      60      70      78      86      95     104       8      17      26      34      43      52
      61      70      78      86      95     104       8      17      26      34      44      52
      61              78      87      96     104       8      18      26      35      44      52
      62              78      87      97     104       9      18      26      35      44      52
      62              78              96               9      18              36              53
     159     166     174     184     192     201     105     114     122     131     140     148
     158     166     175     184     192     201     105     114     123     132     140     149
     158     167     175     184     192     202     106     114     123     132     140     149
     158     167     176     184     193     202     105     114     123     132     141     150
     158     168     176     184     193     202     106     115     124     132     141     150
     159     168     176     185     194     202     106     115     124     132     142     150
     159     168     176     185     194     202     106     116     124     133     142     150
     160     168     176     186     194     203     107     116     124     133     142     150
     160     168     177     186     194     203     107     116     125     134     142     151
     160     169     177     186     194     204     108     116     125     134     142     151
     160     169     178     186     195     204     108     116     126     134     143     152
     160     170     178     186     195     204     108     117     126     134     143     152
     161     170     178     187     196     204     108     117     126     134     144     152
     161     170     178     187     196     204     108     118     126     135     144     152
     162     170     178     188     196     205     109     118     126     135     144     152
     162     170     179     188     196     205     109     118     127     136     144     153
     162     171     179     188     196     206     110     118     127     136     144     153
     162     171     180     188     197     206     110     118     128     136     145     154
     162     172     180     188     197     206     110     119     128     136     145     154
     163     172     180     189     198     206     110     119     128     136     146     154
     163     172     180     189     198     206     110     120     128     137     146     154
```

ExAMPLE A (cont.)

```
   164   173   180   190   198   207   111   120   128   137   146   154
   164   172   181   190   198   207   111   120   129   138   146   155
   164   173   181   190   198   208   112   120   129   138   146   155
   164   173   182   190   199   208   112   120   130   138   147   157
   164   174   182   190   199   208   112   121   130   138   147   156
   165   174   182   191   200   208   112   121   130   138   148   156
   165   174   182   191   200   208   112   122   130   139   148   156
   166   174   182   192   200   209   113   122   130   139   148   156
   166         183   192   201   209   113   122   131   140   148   157
   166         183         200         114   122         140         157
   263   271   279   288   296   305   210   218   227   236   244   253
   262   271   279   288   296   306   210   218   228   236   245   254
   262   272   280   288   297   306   210   219   229   236   245   254
   263   272   280   288   297   306   211   219   228   236   246   254
   263   272   280   289   298   306   210   220   228   237   246   254
   264   272   280   289   298   306   211   220   228   237   246   254
   264   272   280   290   298   307   211   220   229   238   246   255
   264   273   281   290   298   307   212   220   229   238   246   255
   264   273   281   290   298   308   212   220   230   238   247   256
   264   274   282   290   299   308   212   221   230   238   247   256
   265   274   282   290   299   308   212   221   230   238   249   256
   265   274   282   291   300   308   212   222   230   239   248   256
   266   274   282   291   300   308   213   222   230   239   248   256
   266   274   282   292   300   309   213   222   231   240   248   257
   266   275   283   292   300   309   214   222   231   240   248   257
   266   275   283   292   300   310   214   222   232   240   249   258
   266   276   284   292   301   310   214   223   232   240   249   258
   267   276   284   292   301   310   214   223   232   240   250   258
   267   276   284   293   302   310   214   224   238   241   250   258
   268   276   284   293   302   310   215   224   232   241   250   259
   268   276   284   294   302   311   215   224   233   242   250   259
   268   277   285   294   302   311   216   224   233   242   250   259
   268   277   285   294   302   312   216   224   234   242   251   260
   268   278   286   294   303   312   216   225   234   242   251   260
   269   278   286   294   303   312   216   225   234   242   252   260
   269   278   286   295   304   312   216   226   234   243   253   260
   270   278   286   295   304   312   217   226   234   243   252   260
   270   278   286   296   304   313   217   226   235   244   252   261
   270         287   296   304   313   218   226   235   244   252   261
   270         287   296   305   314   218   226   236   244   253   262
   270         288         305         218   227         244         262
   0    12400 135
 2  1 77319365
 8  4 65134149178185237334
15372648
154447730601 255751305264
                                          .503 .643 .678 .834
 .950 .9501.0501.1861.010 .995 .789 .764
 .216 .191 .161 .075 .095 .141 .286 .352
                                          .789 .648 .402 .382
                                          .6981.0471.3261.163
2.1862.7332.7673.1862.9422.2671.7791.593
 .302 .337 .256 .186 .128 .198 .407 .581
                                         1.1981.081 .640 .500
                                          .393 .349 .388 .464
```

EXAMPLE A (cont.)

```
.556  .579  .625  .604  .558  .430  .388  .388
.104  .085  .080  .044  .050  .094  .136  .225
                                                .329  .248  .200  .110
                                                .286  .384  .396  .416
.506  .645  .588  .698  .645  .482  .465  .331
.098  .065  .041  .061  .053  .098  .122  .216
                                                .347  .176  .196  .155
```

EXAMPLE B

```
     111
 20.
2500
303 14 28105129210250
   53     62     70     79     88     96            10     18     27     36     44
   54     62     70     79     88     96      1     10     18     27     36     44
   54     62     70     80     88     97      1     10     19     28     36     45
   54     63     71     80     88     97      1     10     19     28     36     45
   54     63     71     80     88     98      2     10     19     28     37     46
   54     64     72     80     89     98      2     11     20     28     37     46
   55     64     72     80     89     98      2     11     20     28     38     46
   55     64     72     81     90     98      2     12     20     29     38     46
   56     64     72     81     90     98      3     12     20     29     38     46
   56     64     72     82     90     99      3     12     21     30     38     47
   56     65     73     82     90     99      4     12     21     30     39     47
   56     65     73     82     90    100      4     12     22     30     39     48
   56     66     74     82     91    100      4     13     22     30     39     48
   57     66     74     82     91    100      4     13     22     30     40     48
   57     66     74     83     92    100      4     14     22     31     40     48
   58     66     74     83     92    100      5     14     22     31     40     48
   58     66     74     84     92    101      5     14     23     32     40     49
   58     67     75     84     92    101      6     14     23     32     40     49
   58     67     75     84     92    102      6     14     24     32     41     50
   58     68     76     84     93    102      6     15     24     32     41     50
   59     68     76     84     93    102      6     15     24     32     42     50
   59     69     76     85     94    102      6     16     24     33     42     50
   60     68     76     85     94    102      7     16     24     33     42     50
   60     68     76     86     94    103      7     16     25     34     42     51
   60     69     77     86     94    103      8     16     25     34     42     51
   60     69     77     86     94    104      8     16     26     34     43     52
   60     70     78     86     95    104      8     17     26     34     43     52
   61     70     78     86     95    104      8     17     26     34     44     52
   61            78     87     96    104      8     18     26     35     44     52
   62            78     87     97    104      9     18     26     35     44     52
   62            78            96            9     18            36            53
  159    166    174    184    192    201    105    114    122    131    140    149
  158    166    175    184    192    201    105    114    123    132    140    149
  158    167    175    184    192    202    106    114    123    132    140    149
  158    167    176    184    193    202    105    114    123    132    141    150
  158    168    176    184    193    202    106    115    124    132    141    150
  159    168    176    185    194    202    106    115    124    132    142    150
  159    168    176    185    194    202    106    116    124    133    142    150
  160    168    176    186    194    203    107    116    124    133    142    150
  160    168    177    186    194    203    107    116    125    134    142    151
  160    169    177    186    194    204    108    116    125    134    142    151
  160    169    178    186    195    204    108    116    126    134    143    152
  160    170    178    186    195    204    108    117    126    134    143    152
  161    170    178    187    196    204    108    117    126    134    144    152
  161    170    178    187    196    204    108    118    126    135    144    152
  162    170    178    188    196    205    109    118    126    135    144    152
  162    170    179    188    196    205    109    118    127    136    144    153
  162    171    179    188    196    206    110    118    127    136    144    153
  162    171    180    188    197    206    110    118    128    136    145    154
  162    172    180    188    197    206    110    119    128    136    145    154
  163    172    180    189    198    206    110    119    128    136    146    154
```

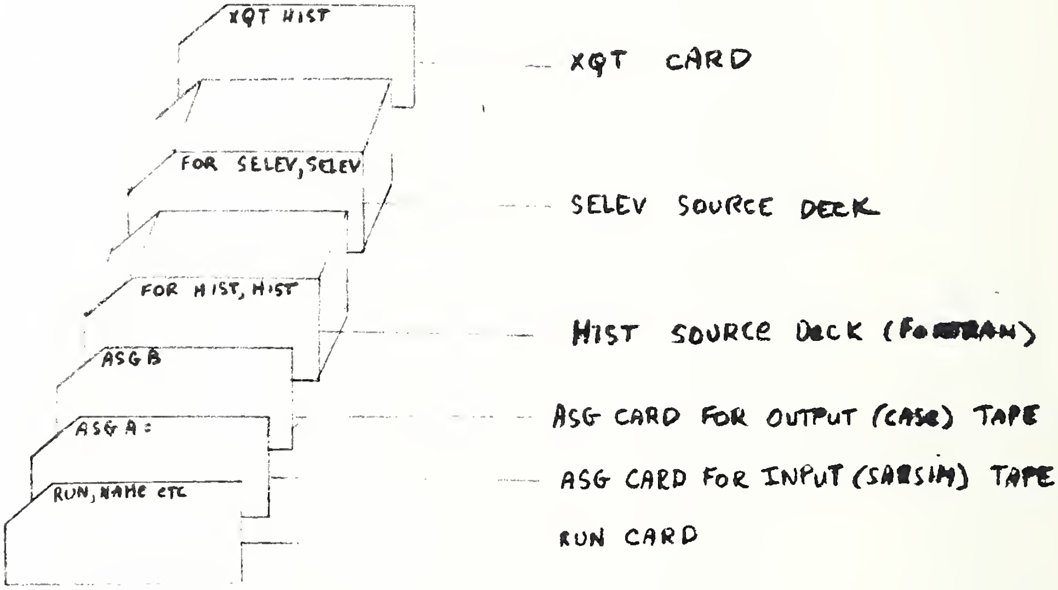
EXAMPLE B (CONT.)

```
 163    172    180    189    198    206    110    120    128    137    146    154
 164    173    180    190    198    207    111    120    128    137    146    154
 164    172    181    190    198    207    111    120    129    138    146    155
 164    173    181    190    198    208    112    120    129    138    146    155
 164    173    182    190    199    208    112    120    130    138    147    157
 164    174    182    190    199    208    112    121    130    138    147    156
 165    174    182    191    200    208    112    121    130    138    148    156
 165    174    182    191    200    208    112    122    130    139    148    156
 166    174    182    192    200    209    113    122    130    139    148    156
 166           183    192    201    209    113    122    131    140    148    157
 166           183           200           114    122           140           157
 263    271    279    288    296    305    210    218    227    236    244    253
 262    271    279    288    296    306    210    218    228    236    245    254
 262    272    280    288    297    306    210    219    229    236    245    254
 263    272    280    288    297    306    211    219    228    236    246    254
 263    272    280    289    298    306    210    220    228    237    245    254
 264    272    280    289    298    306    211    220    228    237    246    254
 264    272    280    290    298    307    211    220    229    238    246    255
 264    273    281    290    298    307    212    220    229    238    246    255
 264    273    281    290    298    308    212    220    230    238    247    256
 264    274    282    290    299    308    212    221    230    238    247    256
 265    274    282    290    299    308    212    221    230    238    249    256
 265    274    282    291    300    308    212    222    230    239    248    256
 266    274    282    291    300    308    213    222    230    239    248    256
 266    274    282    292    300    309    213    222    231    240    248    257
 266    275    283    292    300    309    214    222    231    240    248    257
 266    275    283    292    300    310    214    222    232    240    249    258
 266    276    284    292    301    310    214    223    232    240    249    258
 267    276    284    292    301    310    214    223    232    240    250    258
 267    276    284    293    302    310    214    224    238    241    250    258
 268    276    284    293    302    310    215    224    232    241    250    258
 268    276    284    294    302    311    215    224    233    242    250    259
 268    277    285    294    302    311    216    224    233    242    250    259
 268    277    285    294    302    312    216    224    234    242    251    260
 268    278    286    294    303    312    216    225    234    242    251    260
 269    278    286    294    303    312    216    225    234    242    252    260
 269    278    286    295    304    312    216    226    234    243    253    260
 270    278    286    295    304    312    217    226    234    243    252    260
 270    278    286    296    304    313    217    226    235    244    252    261
 270           287    296    304    313    218    226    235    244    252    261
 270           287    296    305    314    218    226    236    244    253    262
 270           288           305           218    227           244           262
  0   41
2   1  77319365
8   4  65134149178185237334
15372648
154447730601  255751305264
```

D. Users Guide for HIST

There is no input data deck, the only input to HIST is the SARSIM CASE FILE. The only output of HIST is the historical demand tape, the CASE TAPE.

FIGURE NO. 8



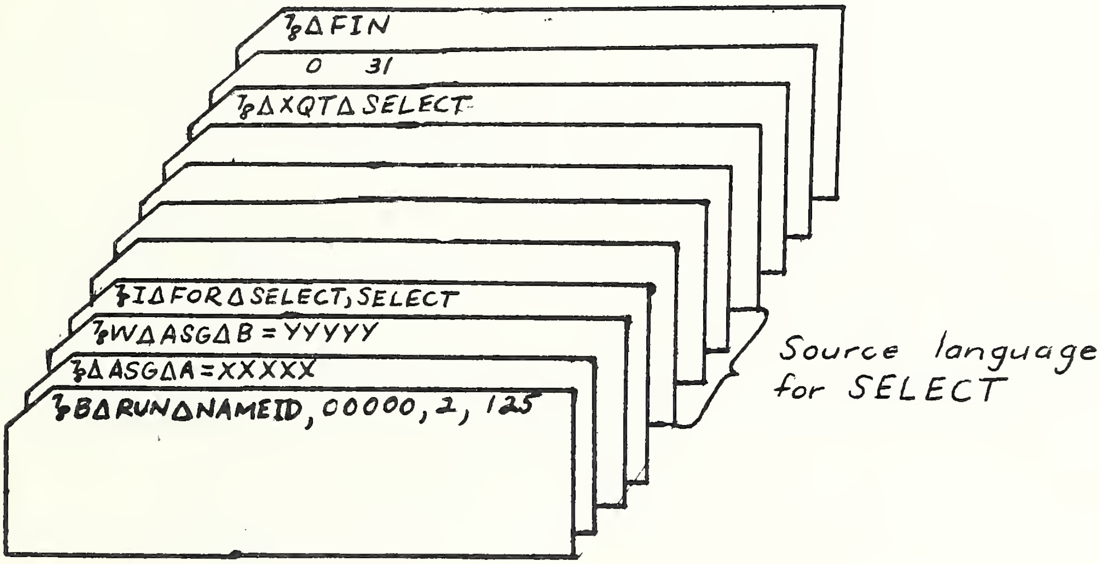
DECK SET UP OF HIST FOR

RUN AT N.B.S. UNIVAC 1108

V. SELECT

SELECT, a FORTRAN program, was introduced as an intermediate step between the PreProcessor and the Operational Simulator to alter the occurrence times of the events on the exogenous event tape. Before describing the possible uses of SELECT, an explanation of the run deck will be given.

The composition of the run deck follows:



The first card is the UNIVAC 1108 run control card. The next two cards are assign control cards. The exogenous event tape created by DEMGEN or HIST should be mounted on logical unit A. The new exogeneous event tape to be created by SELECT should be mounted on logical unit B with a write ring in. Following the fourth card, which is a control card to call the FORTRAN compiler, is the source language for Program SELECT. This source language is listed on the following pages. Next is the execute control card succeeded by the one required data card to input IFIRST, the first day, and ILAST, the last day, under the format (2I5). The FIN control card indicates the end of the run stream.

As mentioned above, SELECT is an intermediate step to alter occurrence times on the exogenous event tape; however, it may or may not be necessary to run SELECT before running OPSIM. The data for each event on the exogenous event tape contains three numbers (the day, hour, and minute) representing the time at which the event occurs. Program OPSIM considers the first day to be day zero; if the exogenous event tape has been created such that the first day is day zero, SELECT may not have to be executed. If the tape was created such that the first day is day one, SELECT should be executed to change the times. For example, suppose that an exogenous event tape has been generated for the month of July, and it considered the first day as day one. Program SELECT should be run with IFIRST = 1 and ILAST = 32. A new exogenous event tape, beginning at time zero and continuing to midnight of July 31, would be generated. Note that both DEMGEN and HIST now consider the first day to be day zero.

Another possible use of Select is to change the time at which Exogenous Event ENDSIM occurs. If the exogenous event tape was created such that the simulation ends at some arbitrary future time greater than the occurrence time of the last case, SELECT should be executed to set it equal to midnight of the last day of the time duration being simulated. For example, suppose that an exogenous event tape has been generated for the month of July, and it considered the first day as day zero but arbitrarily set the time for the end of the simulation to be three days past the occurrence time of the last case. SELECT should be executed with IFIRST = 0 and ILAST = 31. Again, both DEMGEN and HIST now correctly set the occurrence time of Exogenous Event ENDSIM to be midnight of the last day of the time duration being simulated.

Lastly, Program SELECT can be used to select a portion of an exogenous event tape for simulation. For example, suppose an exogenous event tape has been created for the months of January, February and March of 1969. The user, however, wants to simulate February only. SELECT should then be executed with IFIRST = 31 and ILAST = 59; a new exogenous event tape, beginning at time zero and continuing to midnight of February 28, would be created.

Program SELECT Source Language

```
      DIMENSION IN(500),A(50),B(50)
   10 READ (5,800,END=1000) IFIRST,ILAST
      WRITE (6,800) IFIRST,ILAST
  800 FORMAT (2I5)
      WRITE (8,802)
  802 FORMAT ('   3    0   0 0')
      WRITE (6,902)
  902 FORMAT ('    3    0   0 0')
  100 IKEEP = 0
      READ (7,805) (IN(I),I=1,16)
  805 FORMAT (I3,I4,I3,I2,I3,11I5)
      IDAY = IN(2)
      IF (IN(1) .EQ. 3) GO TO 100
      IF (IN(1) .EQ. 2) GO TO 200
      IF (IN(2) .LT. IFIRST .OR. IN(2) .GE. ILAST) GO TO 110
      IN(2) = IN(2)-IFIRST
      IEND = IN(2)
      IKEEP = 1
      WRITE (8,805) (IN(I),I=1,16)
      WRITE (6,905) (IN(I),I=1,16)
  905 FORMAT (1H ,I3,I4,I3,I2,I3,11I5)
  110 N=IN(16)
      READ (7,810) (IN(I),I=1,11)
  810 FORMAT (10I5,I10)
      NNN = IN(1)
      MMM = IN(2)
      IF (IKEEP .EQ. 0) GO TO 130
      WRITE (8,810) (IN(I),I=1,11)
      WRITE (6,910) (IN(I),I=1,11)
  910 FORMAT (1H ,10I5,I10)
  130 IF (N .LE. 0) GO TO 500
      IF (N .GT. 1) GO TO 150
      IF (MMM .GT. 1) GO TO 150
      READ (7,815) IN(1),A(1)
  815 FORMAT (I2,F6.4)
      IF (IKEEP .EQ. 0) GO TO 500
      WRITE (8,815) IN(1),A(1)
      WRITE (6,915) IN(1),A(1)
  915 FORMAT (1H ,I2,F6.4)
      GO TO 500
  150 IF (NNN .EQ. 0) GO TO 180
      INI = N
      IF (MMM .GT. 0) INI = N-1
      READ (7,820) (IN(I),A(I),B(I),I=1,INI)
  820 FORMAT (6(I2,F6.4,F4.2))
      IF (IKEEP .EQ. 0) GO TO 170
      WRITE (8,820) (IN(I),A(I),B(I),I=1,INI)
      WRITE (6,920) (IN(I),A(I),B(I),I=1,INI)
  920 FORMAT (1H ,6(I2,F6.4,F4.2))
  170 IF (MMM .EQ. 0) GO TO 500
  180 READ (7,825) IN(1)
  825 FORMAT (I2)
      IF (IKEEP .EQ. 0) GO TO 500
      WRITE (8,825) IN(1)
      WRITE (6,925) IN(1)
  925 FORMAT (1H ,I2)
  500 IF (IDAY .LE. ILAST) GO TO 100
  200 ILAST = ILAST - IFIRST
```

```
      WRITE (8,830) ILAST
  830 FORMAT ('  2',I4,'  005')
      WRITE (6,930) ILAST
  930 FORMAT ('   2',I4,'  005')
      ENDFILE 8
      WRITE (6,935)
  935 FORMAT (1H0)
      GO TO 10
 1000 STOP
      END
```

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