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TACTICAL VEHICLE EVALUATION MODEL (TVEM)

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OCTOBER 1980

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U. S. ARMY MATERIEL SYSTEMS ANALYSIS ACTIVITY
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20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

A computer model to compare tactical vehicle fleet mixes in an operational context has been adapted by the US Army Materiel Systems Analysis Activity (AMSAA) from a model developed at the US Army Transportation School. The Simulation, translated into FORTRAN IV, is described herein. Also included are the program listing, program narrative, test case input and output, and other detailed documentation.

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TACTICAL VEHICLE EVALUATION MODEL (TVEM)

1. INTRODUCTION

For several years, personnel in the US Army Materiel Systems Analysis Activity's (AMSAA's) Combat Support Division have recognized the need for a computerized simulation that can evaluate tactical vehicles in an operational sense. AMSAA has models that can perform engineering evaluations, i.e., models that can determine performance factors such as acceleration capability and speed over various road surfaces and terrain types given information about the vehicle's configuration, gear ratios, engine power, etc. However, AMSAA did not have a model that could combine these vehicle performance factors and cargo capacities with scenario-related information such as unit locations, movement schedules, and supply mission tonnages to describe the performance of vehicle fleet mixes. Just such a model was developed by the US Army Transportation School at Fort Eustis, Virginia, in support of the TACV Study.[1] AMSAA personnel obtained, for review, a copy of the model from the Transportation School in order to determine its adequacy for AMSAA's purposes. As a result of this review the model was judged to have some limitations, but, because of its simplicity compared to other transportation models, such as the Tactical Vehicle Fleet Simulation (TVFS) Model, [2] it was felt that the Transportation School Model would serve as an acceptable basic framework for an improved model.

The Transportation School Model was developed by Arthur W. Paarmann while he was employed there as an operations research analyst. Unfortunately, with the exception of Appendix D in the TACV Addendum, [3] little substantive documentation of the model existed and there were no operating instructions to assist potential model users. The model logic was coded in the BASIC language specifically for the Hewlett-Packard Model 9830A mini-computer. In order to fit the model into the memory storage available on that machine, Paarmann was forced to use various memory conserving techniques, among which was the transferal of program segments and large blocks of information back and

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1 Addendum To The Special Analysis Of Standard Tactical Wheeled Vehicle Requirements, (Short Title): TACV Addendum,Volume II: Main Report And Appendixes (sic) A Through J, US Army Training And Doctrine Commmand, August 1979.

2 Hudak, Paul E., Koenig, Lawrence D., and Swanson, George O., Documentation of the Tactical Vehicle Fleet Simulation Model, General Research Corporation, McLean, Virginia, May 1977.

3 Loc. Cit.

forth from central memory to mass storage files established on cassette tapes. Because AMSAA has no HP9830A mini-computers and in order to ensure freedom from restrictions on future expansion, the model was translated into FORTRAN IV for use on large main-frame computers such as the Ballistic Research Laboratories CDC CYBER 76.

The purpose of this report is to provide thorough documentation of the FORTRAN version of the model.

2. DISCUSSION

2.1 Model Description.

The purpose of the Tactical Vehicle Evaluation Model (TVEM) is to compare various fleet mixes in an operational context by providing a meaningful way of combining individual vehicle performance factors with scenario-related information. The vehicle fleet is organized into vehicle pools each of which consists of a specified number of vehicles operating from a given location. The vehicles in a given pool must be identical in terms of essential operating characteristics such as cargo capacity and travel speed. For each pool, a list of supply missions is specified. For each mission, the amount of cargo to be delivered and the time and day that the cargo must be hauled are specified as well as the route (called the link) on which the vehicles must travel in the performance of the mission. If the pool is authorized a higher echelon support pool to undertake the assigned mission in the event that it cannot be performed as scheduled, the number of the pool to which the mission can be transferred must be specified. To allow for the situation in which the pool would have enough vehicles available to haul only part of the cargo in the mission assignment, a parameter must be specified to indicate whether it is permissible to "split" the mission. Each route or link on which a mission is to be performed must specify the vehicle travel times, load and unload times, and various delay times.

The output of the model gives the simulation results by vehicle pool. The results consist of the number of missions completed, the number of assigned vehicles used, the percentage of unused vehicle capacity, and other measures of efficiency. At the user's option the model also produces graphs giving, in terms of percent of total assigned, tons of cargo delivered versus time and cubic feet of cargo delivered versus time. A third graph shows the number of vehicles in use over time.

The TVEM is an event-sequenced, not a time-incremented, simulation. Consequently, it makes little sense, for example, to inquire of the number of days of operations the model can simulate. Instead, the pertinent question is how many operations (missions) the model can process, and this is restricted only by the amount of memory space the model

user can afford to devote to the number of missions per vehicle pool vis-a-vis the number of pools to be simulated. Table 1 gives the current program maxima. These limits can easily be increased by array enlargement whenever necessary. With the current limits, the program requires about 95,000 words of memory space of which approximately 83,000 words are directly addressable, large-core memory resident.

2.2 Model Assumptions.

Assumptions basic to the TVEM are the following.

(1) Each pool consists of a homogeneous set of vehicles. That is, their model-related characteristics such as cargo capacities, travel speeds, and load and unload times are the same.

(2) A mission is characterized by its weight and volume (or vehicle bed space), loading and unloading times, and delay times.

(3) The timing of each mission is specified by the vehicle departure time or the time that the cargo is required to be delivered to the using unit.

(4) Vehicles cannot be swapped between pools. If a pool has missions it cannot accomplish, support is effected by transferring the missions to a supporting pool, not by borrowing vehicles.

2.3 Model Inputs.

The information gathering process for determining the input data values to the TVEM requires that three distinct tasks be undertaken.

(1) Map exercises must be performed to determine the unit location and movements, vehicle resupply routes, and mission schedules.

Such map exercises are frequently an adjunct to a war game.

(2) A vehicle mobility model is used along with the information on the routes generated by the map exercises to determine vehicle speeds and, hence, the travel times on the routes.

(3) The payload tonnage and cubic capacity of the vehicles being evaluated must be determined.

Once the input information gathering tasks are completed, the information must be structured in the following form for each pool.

Table 1

TVEM Program Maxima

Vehicle Pools - Maximum number simulated - 10

Supply Missions - Maximum number per pool - 500(1)

Supply Routes or Links - Maximum number per pool - 100

Vehicle Types - Limited only by the number of pools

Number of Vehicles - Unlimited(2)

---

1 A warning message is printed if the maximum is exceeded because of mission transfers.

2 To find the number of vehicles required to accomplish a given set of missions, one might wish to set the number of vehicles per pool to a very large number.

(1) The characteristics of the pool-

Pool identification number,

Vehicle type identification number,

Vehicle payload in short tons (X10),

Vehicle cubic capacity in cubic feet,

Number of vehicles in the pool.

The data entries for the preceding five items must be punched on one card in 5I5 format.

(2) Schedule of missions. For each mission the following information must be given -

Number of the link on which the mission is to occur,

Day the mission is to occur,

Vehicle departure time, or

Required delivery time,

Mission cargo tonnage in short tons (X10),

Mission cargo volume in cubic feet,

Number of the pool to which the mission can be transferred,

Parameter to indicate whether the mission can be split.

For each mission the preceding eight items must be punched on one card in 8F8.0 format with all decimal points punched. One card must be allotted to each mission and the list of missions must be terminated by a card having a negative number in the first field.

(3) Information on the links. For each link or route on which a mission is to occur, as specified in the schedule of missions, the following information must be supplied -

Link identification number,

Load time,

Travel times,

Unload time,

Mission delay times (times spent in various queues).

The values for each link must be punched on one card in 9F8.0 format with all decimal points punched. One card must be allotted to each link and this series of cards must be terminated by a card having a negative number in the first field.

For an example case to illustrate the structure of the missions and links arrays, refer to Appendix C.

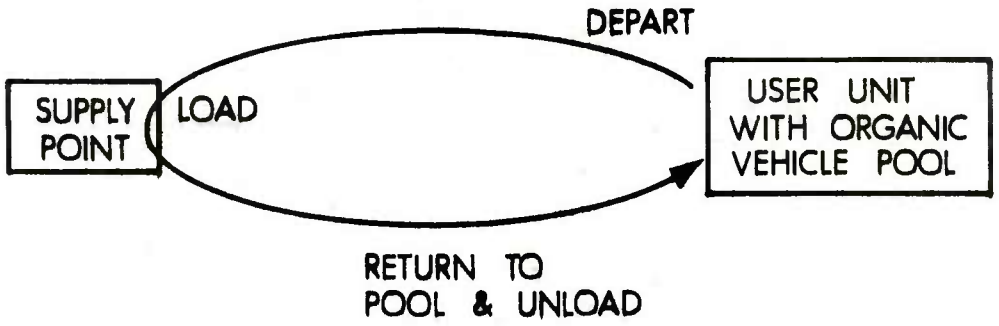
The TVEM can simulate three types of missions: pickup, delivery, and support missions. Diagrams of these mission types are shown in Figures 1, 2, and 3, respectively. The model user represents these three types by various arrangements of the time entries in the links array. In particular, for a pickup mission the entry in field three must be zero, while that in field nine must be greater than zero. To simulate a delivery mission the reverse must be true, i.e., field nine must contain a zero. For a support mission, the values in fields three and nine must both be zero and the times to reload and return to the pool should be combined and entered in field eight. The distinctions between the three types of missions enable the model to properly reflect the fact that delivery of the mission cargo to the consuming unit may be concurrent with the return of the vehicles to the pool (pickup missions) or that the cargo delivery may be completed prior to the return of the vehicles (delivery or support missions). In the second case, although the mission is completed with the cargo delivery, the performing vehicles are not available for another mission until they return to the pool.

2.4 Overview of The Model Logic.

Figure 4 is a flowchart of the main simulation portion of the TVEM. The program subroutines which are concerned with input and output printing, graphing, mission sorting, etc. are not covered by this flowchart.

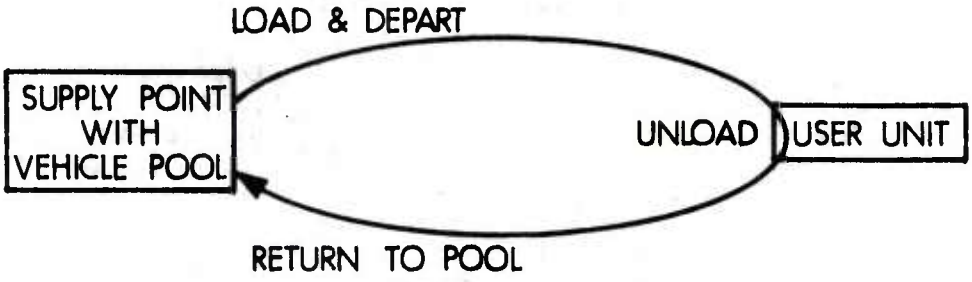
The TVEM processes each pool one-by-one for as many pools as have missions assigned to them. For a given pool, any missions transferred from previously processed pools are first appended to the list of missions originally assigned to it. The model then determines for each mission the time that the vehicles must depart and the time that the vehicles will return to the pool (and thus be available for another mission). These times are put into chronological order with an indication of whether each is a mission departure time or a return time, thus giving a time ordered list of mission events.

Next, the model processes each event in order. If the event is a return from a mission, the number of vehicles returning is added to the number of vehicles available, if any. On the other hand, if the event pertains to a required mission departure, the model calculates the number of vehicles required based on the mission tonnage



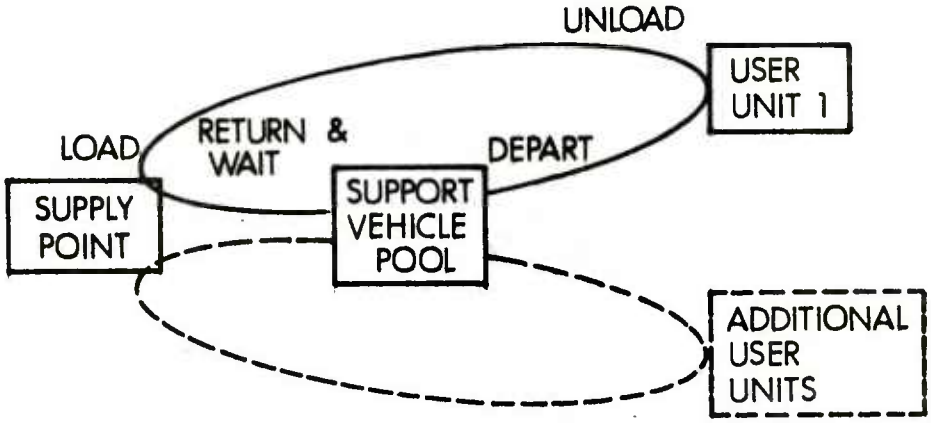
LINK NO.	DELAY	LOAD TIME ON ZERO	TRAVEL TIME	DELAY	UNLOAD OR LOAD TIME	TRAVEL TIME	DELAY	LOAD, UNLOAD, OR ZERO
1	2	3	4	5	6	7	8	9
1.	0.	0.	30.	10.	25.	35.	0.	40.

Figure 1. Illustration of a Pickup Mission with Example Entries in Links Array.



LINK NO.	DELAY	LOAD TIME OR ZERO	TRAVEL TIME	DELAY	UNLOAD OR LOAD TIME	TRAVEL TIME	DELAY	LOAD, UNLOAD, OR ZERO
1	2	3	4	5	6	7	8	9
2.	15.	25.	35.	0.	40.	30.	0.	0.

Figure 2. Illustration of a Delivery Mission with Example Entries in Links Array.



LINK NO. 1	DELAY 2	LOAD TIME OR ZERO 3	TRAVEL TIME 4	DELAY 5	UNLOAD OR LOAD TIME 6	TRAVEL TIME 7	DELAY 8	LOAD, UNLOAD, OR ZERO 9
3.	0.	0.	35.	0.	40.	60.	55.	0.

Figure 3. Illustration of a Support Mission with Example Entries in Links Array.

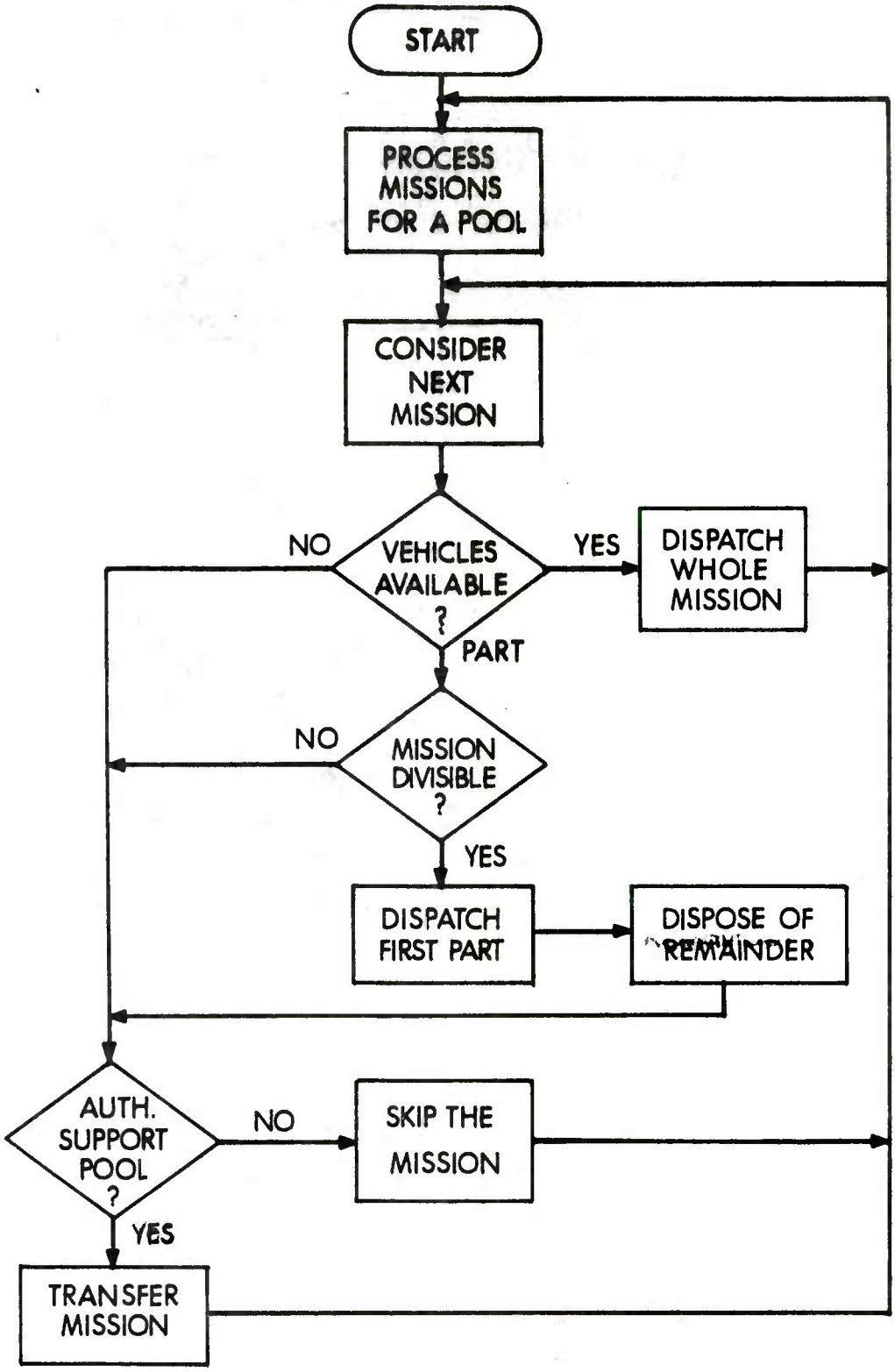


Figure 4. TVEM Flowchart.

and cube. The pool is then checked to see how many vehicles are available relative to the number required. If sufficient vehicles are available, the mission is considered completed and a disposition code for the mission is changed to indicate so. If no vehicles are available, the model checks to see if a support pool is authorized to take the mission. The mission is then either designated for transfer or skipped accordingly. If there are only enough vehicles available to accomplish part of the mission, the model checks to see if the mission can be split. If so, the first part of the mission is considered completed, and the second part is either transferred or skipped as if no vehicles are available. If the mission may not be split, it is handled as if no vehicles are available. During the processing of mission events, the model accumulates various statistics for the vehicles and missions.

For a more detailed discussion of the simulation logic, see Appendix B.

2.5 Model Limitations.

Some inherent limitations of the basic TVEM are the following.

(1) All the vehicles in a given pool must be of the same type in terms of cargo capacity, travel speeds, and load and unload times. It is not clear that the model can be made to simulate a mixed pool consisting of 5-ton and 10-ton trucks, for example, simply through manipulation of input.

> Note. If one wished, however, to simulate a pool consisting of fuel tankers, ammunition trucks, and general cargo trucks, the situation could be handled by setting up three colocated but distinct vehicle pools. A pool consisting of the tankers would be assigned the fuel resupply missions, the ammunition trucks would be assigned the ammunition resupply missions, and the third pool consisting of the general cargo trucks would be assigned the remaining missions.

(2) Mission cargo is characterized to no greater degree than tons and cube in the model.

(3) Scheduled maintenance is not represented in the model, except that one could administer a delay time at the end of each mission to represent the effect on vehicle availability of a per-mission average delay due to scheduled maintenance.

(4) The model does not simulate unscheduled maintenance or the direct effects of enemy combat action on the vehicles.

(5) The information input by means of the links array is in terms of time, not distance. If distances traveled are of interest,

the links array would need to be expanded columnwise to permit the inputting of distances. The logic would then need to be incorporated in the model to tally distances traveled.

(6) The model does not simulate negotiation of mission transfers. Once an additional mission is assigned to a pool as a result of a mission transfer, it cannot be returned to the pool from which it was transferred. Depending upon doctrine, this might not be considered a limitation.

(7) The model is capable of transferring a mission to a second pool if the pool to which it was first transferred cannot complete the mission. However, the model currently has an override mechanism to prevent this (one statement which is easily removable).

(8) The missions assigned to a pool have no associated priorities. Moreover, originally assigned missions have no priority over additionally assigned (transferred) missions or vice-versa.

(9) Missions cannot be deferred in anticipation of slack periods. Indeed the model is very time specific. That is, if an insufficient number of vehicles is available for a mission, it will either be completed in part or transferred or skipped in full with complete disregard of when enough vehicles would be available. Thus, the model would not defer a mission even for one minute.

3. CONCLUSIONS AND RECOMMENDATIONS

While the TVEM can be a useful tool for comparing the performance of various vehicle fleet mixes, its usefulness would be enhanced by several improvements.

(1) The logic should be incorporated in the model to permit deferral of missions.

(2) Travel distances should be incorporated in the information for the routes in addition to the travel times already used. Travel distances are generated during the process of input data development, so a separate exercise would not be necessary. Then the logic should be incorporated in the model to accumulate the distance traveled for each individual vehicle. Once this has been accomplished the model should be expanded to provide an explicit representation of the effects of scheduled and unscheduled maintenance and reliability.

(3) Currently, the model accumulates and outputs statistics by individual pool. The accumulation of fleet-wide statistics would also be quite informative. The fleet-wide report need not be quite as detailed as that given for each pool, rather it would represent a concise summary of fleet performance.

It is envisioned that these model improvements will be undertaken in the near future and that any such modifications will be thoroughly documented.

REFERENCES

1. Addendum To The Special Analysis Of Standard Tactical Wheeled Vehicle Requirements: TACV Addendum, Volume II: Main Report And Appendixes (sic) A Through J, United States Army Training And Doctrine Command, August 1979.

2. Hudak, Paul E., Koenig, Lawrence D., and Swanson, George O., Documentation of the Tactical Vehicle Fleet Simulation Model, General Research Corporation, McLean, Virginia, May 1977.

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APPENDIX A

PROGRAM LISTING

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```
      PROGRAM TVEM(INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT,TAPE13)          MAIN      2
      DIMENSION  T(100,9,10), A(500,8,10), E(1000,2,10), P(15,10)         MAIN      3
      DIMENSION  D(500,8), F(500,2,10), O(4,8,10), Q(12,10), G(18,5)      MAIN      4
      INTEGER P                                                           MAIN      5
      LEVEL 2, T,A,F,E,D                                                  MAIN      6
      COMMON / AAA / T,A,F,E,D                                            MAIN      7
      COMMON / GGG / G                                                    MAIN      8
      COMMON / PPP / P                                                    MAIN      9
      COMMON / QQQ / Q                                                    MAIN     10
      COMMON / MCOL/ MCT,MCA,MCG                                          MAIN     11
      COMMON / MAX / MMISS,MLINK                                          MAIN     12
      DATA MAXP/ 10 /                                                     MAIN     13
      DATA MLINK,MCT/ 100, 9 /                                            MAIN     14
      DATA MMISS,MCA/ 500, 8 /                                            MAIN     15
      DATA MRG,MCG/ 18, 5 /                                               MAIN     16
      DATA LIST/ 1 /                                                      MAIN     17
      DATA IPLOT/ 0 /                                                     MAIN     18
      DATA ISP/ 0 /                                                       MAIN     19
   10 FORMAT(16I5)                                                        MAIN     20
   20 FORMAT(10F8.0)                                                      MAIN     21
  100 FORMAT(1H1)                                                         MAIN     22
  110 FORMAT(1H ,125(1HX))                                                MAIN     23
C                                                                         MAIN     24
C                                                                         MAIN     25
C                                                                         MAIN     26
C                                                                         MAIN     27
C-------------------------------------------------------------------      MAIN     28
C               READ IN THE NUMBER OF POOLS TO BE SIMULATED.              MAIN     29
C-------------------------------------------------------------------      MAIN     30
 1000 READ(5,10) NPOOLS                                                   MAIN     31
      IF(NPOOLS.LT.0) STOP                                                MAIN     32
      IF(NPOOLS.GT.0 .OR. NPOOLS.LE. MAXP) GO TO 1005                     MAIN     33
      WRITE(6,160) NPOOLS                                                 MAIN     34
  160 FORMAT(1H ,'WARNING--  NUMBER OF POOLS IS',I5)                      MAIN     35
      STOP                                                                MAIN     36
C-------------------------------------------------------------------      MAIN     37
C               READ THE DATA FOR THE POOLS.                              MAIN     38
C-------------------------------------------------------------------      MAIN     39
 1005 DO 1040 K=1,NPOOLS                                                  MAIN     40
C-------------------------------------------------------------------      MAIN     41
C               READ IN --                                                MAIN     42
C               POOL NUMBER, VEHICLE TYPE NUMBER, PAYLOAD (STX10),        MAIN     43
C               CAPACITY (CUBE), NUMBER OF TRUCKS IN POOL.                MAIN     44
C-------------------------------------------------------------------      MAIN     45
      READ(5,10) (P(J,K),J=1,5)                                           MAIN     46
C-------------------------------------------------------------------      MAIN     47
C               READ IN INFORMATION ON THE LINKS.                         MAIN     48
C-------------------------------------------------------------------      MAIN     49
      K1=0                                                                MAIN     50
      DO 1010 I=1,MLINK                                                   MAIN     51
      READ(5,20) (T(I,J,K),J=1,MCT)                                       MAIN     52
      IF(T(I,1,K).LT.0.) GO TO 1020                                       MAIN     53
      K1=I                                                                MAIN     54
 1010 CONTINUE                                                            MAIN     55
 1020 P(6,K)=K1                                                           MAIN     56
C-------------------------------------------------------------------      MAIN     57
C               READ IN INFORMATION ON THE MISSIONS.                      MAIN     58
```

```
C------------------------------------------------------------------- MAIN       59
      K1=0                                                          MAIN       60
      DO 1030 I=1,MMISS                                             MAIN       61
      READ(5,20) (A(I,J,K),J=1,MCA)                                 MAIN       62
      IF(A(I,1,K).LT.0.) GO TO 1035                                 MAIN       63
      K1=I                                                          MAIN       64
 1030 CONTINUE                                                      MAIN       65
 1035 P(7,K)=K1                                                     MAIN       66
C                                                                   MAIN       67
      IF(LIST.GT.0) CALL OUT1(K)                                    MAIN       68
C                                                                   MAIN       69
 1040 CONTINUE                                                      MAIN       70
C                                                                   MAIN       71
C                                                                   MAIN       72
C                                                                   MAIN       73
C------------------------------------------------------------------- MAIN       74
C               BEGIN SIMULATING THE MISSIONS, PROCESSING ONE POOL AT A MAIN       75
C                    TIME.                                          MAIN       76
C------------------------------------------------------------------- MAIN       77
      DO 7000 K=1,NPOOLS                                            MAIN       78
      WRITE(6,120) P(1,K)                                           MAIN       79
  120 FORMAT(1HO,10X,'SIMULATING POOL NO.',I5)                      MAIN       80
      NM=P(7,K)                                                     MAIN       81
      IF(NM.LE.0) GO TO 7000                                        MAIN       82
      DO 1060 I=1,4                                                 MAIN       83
      DO 1050 J=1,8                                                 MAIN       84
      O(I,J,K)=0.                                                   MAIN       85
 1050 CONTINUE                                                      MAIN       86
 1060 CONTINUE                                                      MAIN       87
      NL=P(6,K)                                                     MAIN       88
C------------------------------------------------------------------- MAIN       89
C               PROCESS THE MISSIONS FOR THIS POOL.                 MAIN       90
C------------------------------------------------------------------- MAIN       91
      DO 2010 I=1,NM                                                MAIN       92
      DO 1065 L=1,NL                                                MAIN       93
      I3=L                                                          MAIN       94
      IF(T(L,1,K).EQ.A(I,1,K)) GO TO 1070                           MAIN       95
 1065 CONTINUE                                                      MAIN       96
      WRITE(6,130) P(1,K),A(I,1,K)                                  MAIN       97
  130 FORMAT(1HO,'WARNING--- FILE',I3,' DOES NOT CONTAIN LINK',F7.0,10X, MAIN      98
     *'SKIPPING TO NEXT POOL')                                      MAIN       99
      GO TO 7000                                                    MAIN      100
 1070 CONTINUE                                                      MAIN      101
C------------------------------------------------------------------- MAIN      102
C               CALCULATE THE TIME REQUIRED TO ACCOMPLISH THE MISSION, MAIN      103
C                    (IF UNDERTAKEN).                               MAIN      104
C------------------------------------------------------------------- MAIN      105
      F(I,1,K)=0.                                                   MAIN      106
      DO 1080 J=2,MCT                                               MAIN      107
      F(I,1,K)=F(I,1,K)+T(I3,J,K)                                   MAIN      108
 1080 CONTINUE                                                      MAIN      109
      IF(A(I,3,K).EQ.0.) GO TO 1090                                 MAIN      110
C------------------------------------------------------------------- MAIN      111
C               CALCULATE DEPARTURE TIME (IN TOTAL MINUTES).        MAIN      112
C------------------------------------------------------------------- MAIN      113
      E(I,1,K)=1440.*A(I,2,K)+A(I,3,K)-40.*AINT(A(I,3,K)/100.)      MAIN      114
      GO TO 2000                                                    MAIN      115
```

```
C------------------------------------------------------------------ MAIN  116
C               CALCULATE THE DEPARTURE TIME (IN TOTAL MINUTES) REQUIRED MAIN  117
C                    TO MEET THE SCHEDULED DELIVERY TIME.           MAIN  118
C------------------------------------------------------------------ MAIN  119
 1990 E(I,1,K)=1440.*A(I,2,K)+A(I,4,K)-40.*AINT(A(I,4,K)/100.)-F(I,1,K) MAIN 120
C------------------------------------------------------------------ MAIN  121
C               IF IT IS A SUPPLY MISSION, DROP THE TIME REQUIRED TO MAIN  122
C                    RETURN TO THE SUPPORT POOL.                    MAIN  123
C------------------------------------------------------------------ MAIN  124
      IF(T(I3,9,K).EQ.0. .OR. A(I,8,K).GT.2.)                       MAIN  125
     *                          E(I,1,K)=E(I,1,K)+T(I3,7,K)+T(I3,8,K) MAIN 126
 2000 CONTINUE                                                      MAIN  127
C------------------------------------------------------------------ MAIN  128
C               CALCULATE THE TIME THE VEHICLES WILL BE AVAILABLE TO MAIN  129
C                    UNDERTAKE THE NEXT MISSION.                    MAIN  130
C------------------------------------------------------------------ MAIN  131
      I7=I+P(7,K)                                                   MAIN  132
      E(I7,1,K)=E(I,1,K)+F(I,1,K)                                   MAIN  133
      E(I,2,K)=FLOAT(I)                                             MAIN  134
      E(I7,2,K)=-E(I,2,K)                                           MAIN  135
C------------------------------------------------------------------ MAIN  136
C               FIND THE PERCENT WT. CAPACITY OF A VEHICLE REQUIRED FOR MAIN 137
C                    THE MISSION.                                   MAIN  138
C------------------------------------------------------------------ MAIN  139
      B5=100.*A(I,5,K)/FLOAT(P(3,K))                                MAIN  140
C------------------------------------------------------------------ MAIN  141
C               FIND THE PERCENT CUBE CAPACITY OF A VEHICLE REQUIRED. MAIN 142
C------------------------------------------------------------------ MAIN  143
      B6=100.*A(I,6,K)/FLOAT(P(4,K))                                MAIN  144
C------------------------------------------------------------------ MAIN  145
C               STORE THE MORE STRINGENT REQUIREMENT.  (THIS IS REALLY MAIN 146
C                    THE NUMBER OF VEHICLES REQUIRED, MULTIPLIED BY 100). MAIN 147
C------------------------------------------------------------------ MAIN  148
      F(I,2,K)=AMAX1(B5,B6)                                         MAIN  149
 2010 CONTINUE                                                      MAIN  150
      F(MMISS,1,K)=1.                                               MAIN  151
C------------------------------------------------------------------ MAIN  152
C               SORT THE MISSION TIMES (INCLUDING AVAILABILITY TIMES) MAIN 153
C                    FROM EARLIEST TO LATEST, GIVING A CHRONOLOGICAL MAIN 154
C                    SEQUENCE OF MISSION EVENTS.                    MAIN  155
C------------------------------------------------------------------ MAIN  156
C                                                                   MAIN  157
      CALL SORT(K)                                                  MAIN  158
C                                                                   MAIN  159
C------------------------------------------------------------------ MAIN  160
C               STORE THE EARLIEST DISPATCH OR DEPARTURE TIME.      MAIN  161
C------------------------------------------------------------------ MAIN  162
      P(9,K)=E(1,1,K)                                               MAIN  163
C------------------------------------------------------------------ MAIN  164
C               STORE LATEST VEHICLE AVAILABILITY TIME.             MAIN  165
C------------------------------------------------------------------ MAIN  166
      I7=2*P(7,K)                                                   MAIN  167
      P(10,K)=E(I7,1,K)                                             MAIN  168
      P(8,K)=0                                                      MAIN  169
      P(11,K)=0                                                     MAIN  170
      NZ3=0                                                         MAIN  171
      NZ7=0                                                         MAIN  172
```

```
      DO 2040 I=1,NM                                                    MAIN      173
      IF(A(I,8,K).GT.2) GO TO 2040                                      MAIN      174
      IF(ISP) 2020,2040,2030                                            MAIN      175
 2020 A(I,8,K)=1.                                                       MAIN      176
      GO TO 2040                                                        MAIN      177
 2030 A(I,8,K)=2.                                                       MAIN      178
 2040 CONTINUE                                                          MAIN      179
C                                                                       MAIN      180
C                                                                       MAIN      181
C                                                                       MAIN      182
C*********************************************************************  MAIN      183
C                                                                       MAIN      184
C               PROCESS EACH EVENT.                                     MAIN      185
C                                                                       MAIN      186
C*********************************************************************  MAIN      187
      NZ=NM                                                             MAIN      188
      DO 5000 I=1,I7                                                    MAIN      189
      NY=INT(ABS(E(I,2,K)))                                             MAIN      190
C-------------------------------------------------------------------    MAIN      191
C               IS IT A MISSION OR A RETURN FROM A MISSION.             MAIN      192
C-------------------------------------------------------------------    MAIN      193
      IF(E(I,2,K).LT.0.) GO TO 2050                                     MAIN      194
C-------------------------------------------------------------------    MAIN      195
C               DETERMINE THE NUMBER OF VEHICLES REQUIRED FOR THE MISSION MAIN      196
C-------------------------------------------------------------------    MAIN      197
      P(8,K)=P(8,K)+INT(F(NY,2,K)/100.)                                 MAIN      198
      IF(AMOD(F(NY,2,K),100.).GT.0.) P(8,K)=P(8,K)+1                    MAIN      199
C-------------------------------------------------------------------    MAIN      200
C               ARE THERE ENOUGH VEHICLES IN THE POOL.                  MAIN      201
C-------------------------------------------------------------------    MAIN      202
      IF(P(8,K).LE.P(5,K)) GO TO 4050                                   MAIN      203
      NZ7=1                                                             MAIN      204
C-------------------------------------------------------------------    MAIN      205
C               DETERMINE THE NUMBER OF VEHICLES RETURNING FROM A MISSION MAIN      206
C                    OR IF THERE ARE NOT ENOUGH VEHICLES IN THE POOL TO MAIN      207
C                    TAKE THE WHOLE MISSION, RESET THE INDICATOR.       MAIN      208
C-------------------------------------------------------------------    MAIN      209
 2050 P(8,K)=P(8,K)-INT(F(NY,2,K)/100.)                                 MAIN      210
      IF(AMOD(F(NY,2,K),100.).GT.0.) P(8,K)=P(8,K)-1                    MAIN      211
      IF(NZ7.EQ.0) GO TO 5000                                           MAIN      212
      NZ7=0                                                             MAIN      213
      I8=INT(A(NY,8,K))                                                 MAIN      214
      IF(I8.GT.8) I8=I8-13                                              MAIN      215
      GO TO (2060,3020,5000,3040,5000,3050,5000,4020), I8               MAIN      216
C                                                                       MAIN      217
C                                                                       MAIN      218
 2060 IF(P(8,K).EQ.P(5,K)) GO TO 3000                                   MAIN      219
      A(NY,8,K)=25.                                                     MAIN      220
      NZ=NZ+1                                                           MAIN      221
      BT=AMAX1(A(NY,5,K)/FLOAT(P(3,K)),A(NY,6,K)/FLOAT(P(4,K)))         MAIN      222
      ZT=FLOAT(P(5,K)-P(8,K))                                           MAIN      223
      Z5=100.*ZT                                                        MAIN      224
      TEMP=ZT/BT                                                        MAIN      225
C-------------------------------------------------------------------    MAIN      226
C               HOW MUCH OF THIS CARGO CAN THE POOL HAUL (IN TONS AND   MAIN      227
C                    CUBE) WITH THE VEHICLES AVAILABLE.                 MAIN      228
C-------------------------------------------------------------------    MAIN      229
```

```
      B5=A(NY,5,K)*TEMP                                                 MAIN      230
      B6=A(NY,6,K)*TEMP                                                 MAIN      231
      F(NY,2,K)=Z5                                                      MAIN      232
C-----------------------------------------------------------------------MAIN      233
C               INCREASE THE INDICATOR TO ACCOUNT FOR THE PARTIAL MISSION MAIN      234
C-----------------------------------------------------------------------MAIN      235
      P(8,K)=P(5,K)                                                     MAIN      236
C-----------------------------------------------------------------------MAIN      237
C               STORE THE INFO ON THE MISSION COMPLETED IN PART.  THE     MAIN      238
C                    REMAINDER OF THE SPLIT MISSION WILL BE SKIPPED OR    MAIN      239
C                    TRANSFERRED (SEE BELOW).                             MAIN      240
C-----------------------------------------------------------------------MAIN      241
      DO 2070 J=1,MCA                                                   MAIN      242
      A(NZ,J,K)=A(NY,J,K)                                               MAIN      243
 2070 CONTINUE                                                          MAIN      244
      A(NZ,5,K)=B5                                                      MAIN      245
      A(NZ,6,K)=B6                                                      MAIN      246
      A(NZ,8,K)=3.                                                      MAIN      247
      F(NZ,1,K)=F(NY,1,K)                                               MAIN      248
      F(NZ,2,K)=Z5                                                      MAIN      249
      NA=2*NZ                                                           MAIN      250
      E(NA,1,K)=E(I,1,K)+F(NY,1,K)                                      MAIN      251
      E(NA,2,K)=-FLOAT(NZ)                                              MAIN      252
      NB=NA-1                                                           MAIN      253
      E(NB,1,K)=E(I,1,K)                                                MAIN      254
      E(NB,2,K)= FLOAT(NZ)                                              MAIN      255
      F(MMISS,1,K)=3.                                                   MAIN      256
C-----------------------------------------------------------------------MAIN      257
C               FIND THE AMOUNT OF CARGO REMAINING FROM THE SPLIT MISSION MAIN      258
C-----------------------------------------------------------------------MAIN      259
      B5=A(NY,5,K)-B5                                                   MAIN      260
      B6=A(NY,6,K)-B6                                                   MAIN      261
C-----------------------------------------------------------------------MAIN      262
C               STORE, FOR REPORTING LATER, THE INFO ON PARTIAL MISSIONS  MAIN      263
C                    SKIPPED OR TRANSFERRED.                              MAIN      264
C                         L1=1 -- ORIGINAL MISSION TRANSFERRED,           MAIN      265
C                         L1=2 -- ORIGINAL MISSION SKIPPED.               MAIN      266
C                    IN EACH CASE THIS IS THE REMAINDER OF A SPLIT        MAIN      267
C                    MISSION.                                             MAIN      268
C-----------------------------------------------------------------------MAIN      269
      L1=1                                                              MAIN      270
      IF(A(NY,7,K).EQ.0.) L1=2                                          MAIN      271
      O(L1,1,K)=O(L1,1,K)+1.                                            MAIN      272
      O(L1,2,K)=O(L1,2,K)+B5                                            MAIN      273
      O(L1,4,K)=O(L1,4,K)+B6                                            MAIN      274
C-----------------------------------------------------------------------MAIN      275
C               CAN THE REMAINDER OF THE MISSION BE TRANSFERRED.          MAIN      276
C-----------------------------------------------------------------------MAIN      277
      IF(A(NY,7,K).EQ.0.) GO TO 4080                                    MAIN      278
C-----------------------------------------------------------------------MAIN      279
C               INCREASE THE COUNTER FOR MISSIONS TRANSFERRED AND STORE   MAIN      280
C                    THE MISSION INFO.                                    MAIN      281
C-----------------------------------------------------------------------MAIN      282
      P(11,K)=P(11,K)+1                                                 MAIN      283
      IP=P(11,K)                                                        MAIN      284
      DO 2080 J=1,MCA                                                   MAIN      285
      O(IP,J)=A(NY,J,K)                                                 MAIN      286
```

```
 2080 CONTINUE                                                          MAIN      287
      D(IP,5)=B5                                                        MAIN      288
      D(IP,6)=B6                                                        MAIN      289
      D(IP,8)=4.                                                        MAIN      290
      GO TO 4080                                                        MAIN      291
C                                                                       MAIN      292
C                                                                       MAIN      293
C-----------------------------------------------------------------------MAIN      294
C               NO VEHICLES AVAILABLE TO HAUL EVEN PART OF THE CARGO.  IF MAIN      295
C                    THE MISSION CAN'T BE TRANSFERRED, IT WILL BE SKIPPED MAIN      296
C-----------------------------------------------------------------------MAIN      297
 3000 F(NY,2,K)=0.                                                      MAIN      298
      A(NY,8,K)=7.                                                      MAIN      299
C-----------------------------------------------------------------------MAIN      300
C               CAN THE MISSION BE TRANSFERRED.                         MAIN      301
C-----------------------------------------------------------------------MAIN      302
      IF(A(NY,7,K).EQ.0.) GO TO 4080                                    MAIN      303
C-----------------------------------------------------------------------MAIN      304
C               STORE THE INFO FOR THE MISSION TO BE TRANSFERRED.       MAIN      305
C-----------------------------------------------------------------------MAIN      306
      A(NY,8,K)=6.                                                      MAIN      307
      P(11,K)=P(11,K)+1                                                 MAIN      308
      IP=P(11,K)                                                        MAIN      309
      DO 3010 J=1,MCA                                                   MAIN      310
      D(IP,J)=A(NY,J,K)                                                 MAIN      311
 3010 CONTINUE                                                          MAIN      312
      GO TO 4080                                                        MAIN      313
C                                                                       MAIN      314
C                                                                       MAIN      315
C-----------------------------------------------------------------------MAIN      316
C               THE MISSION CAN'T BE SPLIT.  IF IT CAN'T BE TRANSFERRED, MAIN      317
C                    IT WILL BE SKIPPED.                                MAIN      318
C-----------------------------------------------------------------------MAIN      319
 3020 F(NY,2,K)=0.                                                      MAIN      320
      A(NY,8,K)=9.                                                      MAIN      321
C-----------------------------------------------------------------------MAIN      322
C               CAN THE MISSION BE TRANSFERRED.                         MAIN      323
C-----------------------------------------------------------------------MAIN      324
      IF(A(NY,7,K).EQ.0.) GO TO 4080                                    MAIN      325
C-----------------------------------------------------------------------MAIN      326
C               STORE THE INFO FOR THE MISSION TO BE TRANSFERRED.       MAIN      327
C-----------------------------------------------------------------------MAIN      328
      A(NY,8,K)=8.                                                      MAIN      329
      P(11,K)=P(11,K)+1                                                 MAIN      330
      IP=P(11,K)                                                        MAIN      331
      DO 3030 J=1,MCA                                                   MAIN      332
      D(IP,J)=A(NY,J,K)                                                 MAIN      333
 3030 CONTINUE                                                          MAIN      334
      GO TO 4080                                                        MAIN      335
C                                                                       MAIN      336
C                                                                       MAIN      337
C-----------------------------------------------------------------------MAIN      338
C               ADDITIONAL MISSION RESULTING FROM TRANSFERRAL OF THE    MAIN      339
C                    REMAINDER OF A SPLIT MISSION.  SINCE THERE ARE NOT MAIN      340
C                    ENOUGH VEHICLES, THE MISSION WILL BE SKIPPED (WILL MAIN      341
C                    NOT BE SPLIT FURTHER).                             MAIN      342
C-----------------------------------------------------------------------MAIN      343
```

```
 3040 F(NY,2,K)=0.                                                      MAIN      344
      A(NY,8,K)=11.                                                     MAIN      345
      GO TO 4080                                                        MAIN      346
C                                                                       MAIN      347
C                                                                       MAIN      348
C-----------------------------------------------------------------------MAIN      349
C               ADDITIONAL MISSION RESULTING FROM TRANSFERRAL OF AN     MAIN      350
C                    ENTIRE MISSION.                                    MAIN      351
C-----------------------------------------------------------------------MAIN      352
 3050 IF(P(8,K).EQ.P(5,K)) GO TO 4000                                   MAIN      353
      A(NY,8,K)=24.                                                     MAIN      354
      NZ=NZ+1                                                           MAIN      355
      BT=AMAX1(A(NY,5,K)/FLOAT(P(3,K)),A(NY,6,K)/FLOAT(P(4,K)))         MAIN      356
      ZT=FLOAT(P(5,K)-P(8,K))                                           MAIN      357
      Z5=100.*ZT                                                        MAIN      358
      TEMP=ZT/BT                                                        MAIN      359
C-----------------------------------------------------------------------MAIN      360
C               HOW MUCH OF THIS CARGO CAN THE POOL HAUL (IN TONS AND   MAIN      361
C                    CUBE) WITH THE VEHICLES AVAILABLE.                 MAIN      362
C-----------------------------------------------------------------------MAIN      363
      B5=A(NY,5,K)*TEMP                                                 MAIN      364
      B6=A(NY,6,K)*TEMP                                                 MAIN      365
      F(NY,2,K)=Z5                                                      MAIN      366
C-----------------------------------------------------------------------MAIN      367
C               INCREASE THE INDICATOR TO ACCOUNT FOR THE PARTIAL MISSION MAIN      368
C-----------------------------------------------------------------------MAIN      369
      P(8,K)=P(5,K)                                                     MAIN      370
C-----------------------------------------------------------------------MAIN      371
C               STORE THE INFO ON THE MISSION COMPLETED IN PART.  THE   MAIN      372
C                    REMAINDER OF THE SPLIT MISSION WILL BE SKIPPED     MAIN      373
C                    BECAUSE, AS THE MODEL NOW STANDS, IT WILL NOT BE   MAIN      374
C                    TRANSFERRED TO YET ANOTHER POOL.                   MAIN      375
C-----------------------------------------------------------------------MAIN      376
      DO 3060 J=1,MCA                                                   MAIN      377
      A(NZ,J,K)=A(NY,J,K)                                               MAIN      378
 3060 CONTINUE                                                          MAIN      379
      A(NZ,5,K)=B5                                                      MAIN      380
      A(NZ,6,K)=B6                                                      MAIN      381
      A(NZ,8,K)=16.                                                     MAIN      382
      F(NZ,1,K)=F(NY,1,K)                                               MAIN      383
      F(NZ,2,K)=Z5                                                      MAIN      384
      NA=2*NZ                                                           MAIN      385
      E(NA,1,K)=E(I,1,K)+F(NY,1,K)                                      MAIN      386
      E(NA,2,K)=-FLOAT(NZ)                                              MAIN      387
      NB=NA-1                                                           MAIN      388
      E(NB,1,K)=E(I,1,K)                                                MAIN      389
      E(NB,2,K)= FLOAT(NZ)                                              MAIN      390
      F(MMISS,1,K)=3.                                                   MAIN      391
C-----------------------------------------------------------------------MAIN      392
C               FIND THE AMOUNT OF CARGO REMAINING FROM A SPLIT MISSION. MAIN      393
C-----------------------------------------------------------------------MAIN      394
      B5=A(NY,5,K)-B5                                                   MAIN      395
      B6=A(NY,6,K)-B6                                                   MAIN      396
C-----------------------------------------------------------------------MAIN      397
C               STORE, FOR REPORTING LATER, THE INFO ON PARTIAL MISSIONS MAIN      398
C                    SKIPPED OR TRANSFERRED.                            MAIN      399
C                         L1=3 -- ADDITIONAL MISSION TRANSFERRED,       MAIN      400
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C                       L1=4 -- ADDITIONAL MISSION SKIPPED.                MAIN      401
C-------------------------------------------------------------------------- MAIN      402
      L1=3                                                                 MAIN      403
      IF(A(NY,7,K).EQ.0.) L1=4                                             MAIN      404
      D(L1,1,K)=D(L1,1,K)+1.                                               MAIN      405
      D(L1,2,K)=D(L1,2,K)+B5                                               MAIN      406
      D(L1,4,K)=D(L1,4,K)+B6                                               MAIN      407
C-------------------------------------------------------------------------- MAIN      408
C               CAN THE MISSION BE TRANSFERRED.                            MAIN      409
C-------------------------------------------------------------------------- MAIN      410
      IF(A(NY,7,K).EQ.0.) GO TO 4080                                       MAIN      411
C-------------------------------------------------------------------------- MAIN      412
C               STORE THE INFO FOR THE MISSION TO BE TRANSFERRED.          MAIN      413
C-------------------------------------------------------------------------- MAIN      414
      P(11,K)=P(11,K)+1                                                    MAIN      415
      IP=P(11,K)                                                           MAIN      416
      DO 3070 J=1,MCA                                                      MAIN      417
      D(IP,J)=A(NY,J,K)                                                    MAIN      418
 3070 CONTINUE                                                             MAIN      419
      D(IP,5)=B5                                                           MAIN      420
      D(IP,6)=B6                                                           MAIN      421
      D(IP,8)=17.                                                          MAIN      422
      GO TO 4080                                                           MAIN      423
C                                                                          MAIN      424
C                                                                          MAIN      425
C-------------------------------------------------------------------------- MAIN      426
C               NO VEHICLES AVAILABLE TO HAUL EVEN PART OF THE CARGO.  IF  MAIN      427
C                    THE MISSION CAN'T BE TRANSFERRED, IT WILL BE SKIPPED  MAIN      428
C-------------------------------------------------------------------------- MAIN      429
 4000 F(NY,2,K)=0.                                                         MAIN      430
      A(NY,8,K)=13.                                                        MAIN      431
C-------------------------------------------------------------------------- MAIN      432
C               CAN THE MISSION BE TRANSFERRED.                            MAIN      433
C-------------------------------------------------------------------------- MAIN      434
      IF(A(NY,7,K).EQ.0.) GO TO 4080                                       MAIN      435
C-------------------------------------------------------------------------- MAIN      436
C               STORE THE INFO FOR THE MISSION TO BE TRANSFERRED.          MAIN      437
C-------------------------------------------------------------------------- MAIN      438
      A(NY,8,K)=19.                                                        MAIN      439
      P(11,K)=P(11,K)+1                                                    MAIN      440
      IP=P(11,K)                                                           MAIN      441
      DO 4010 J=1,MCA                                                      MAIN      442
      D(IP,J)=A(NY,J,K)                                                    MAIN      443
 4010 CONTINUE                                                             MAIN      444
      GO TO 4080                                                           MAIN      445
C                                                                          MAIN      446
C                                                                          MAIN      447
C-------------------------------------------------------------------------- MAIN      448
C               THE MISSION CAN'T BE SPLIT.  IF IT CAN'T BE TRANSFERRED,   MAIN      449
C                    IT WILL BE SKIPPED.                                   MAIN      450
C-------------------------------------------------------------------------- MAIN      451
 4020 F(NY,2,K)=0.                                                         MAIN      452
      A(NY,8,K)=15.                                                        MAIN      453
C-------------------------------------------------------------------------- MAIN      454
C               CAN THE MISSION BE TRANSFERRED.                            MAIN      455
C-------------------------------------------------------------------------- MAIN      456
      IF(A(NY,7,K).EQ.0.) GO TO 4080                                       MAIN      457
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C------------------------------------------------------------------ MAIN      458
C               STORE THE INFO FOR THE MISSION TO BE TRANSFERRED.   MAIN      459
C------------------------------------------------------------------ MAIN      460
      A(NY,8,K)=21.                                                 MAIN      461
      P(11,K)=P(11,K)+1                                             MAIN      462
      IP=P(11,K)                                                    MAIN      463
      DO 4030 J=1,MCA                                               MAIN      464
      D(IP,J)=A(NY,J,K)                                             MAIN      465
 4030 CONTINUE                                                      MAIN      466
      GO TO 4080                                                    MAIN      467
C                                                                   MAIN      468
C                                                                   MAIN      469
C------------------------------------------------------------------ MAIN      470
C               SET THE MISSION DISPOSITION INDICATOR FOR MISSIONS THAT MAIN  471
C                    WERE COMPLETED.                                MAIN      472
C------------------------------------------------------------------ MAIN      473
 4050 I8=INT(A(NY,8,K))                                             MAIN      474
      A(NY,8,K)=10.                                                 MAIN      475
      IF(I8.EQ.4 .OR. I8.EQ.17) GO TO 4080                          MAIN      476
      A(NY,8,K)=12.                                                 MAIN      477
      IF(I8.EQ.6 .OR. I8.EQ.19) GO TO 4080                          MAIN      478
      A(NY,8,K)=14.                                                 MAIN      479
      IF(I8.EQ.8 .OR. I8.EQ.21) GO TO 4080                          MAIN      480
      A(NY,8,K)=FLOAT(I8)                                           MAIN      481
C------------------------------------------------------------------ MAIN      482
C               SET THE INDICATOR FOR MAXIMUM VEHICLE USEAGE IN THE POOL. MAIN 483
C------------------------------------------------------------------ MAIN      484
 4080 IF(P(8,K).LE.NZ3) GO TO 5000                                  MAIN      485
      NZ3=P(8,K)                                                    MAIN      486
 5000 CONTINUE                                                      MAIN      487
C                                                                   MAIN      488
C                                                                   MAIN      489
C                                                                   MAIN      490
      P(7,K)=NZ                                                     MAIN      491
      P(8,K)=NZ3                                                    MAIN      492
      DO 5010 I=1,NZ                                                MAIN      493
      IF(A(I,8,K).LT.24.) GO TO 5010                                MAIN      494
      F(I,2,K)=0.                                                   MAIN      495
 5010 CONTINUE                                                      MAIN      496
C                                                                   MAIN      497
      CALL SORT(K)                                                  MAIN      498
C                                                                   MAIN      499
C------------------------------------------------------------------ MAIN      500
C               MOVE THE INFORMATION ON MISSIONS TO BE TRANSFERRED TO THE MAIN 501
C                    PROPER POOLS.                                  MAIN      502
C------------------------------------------------------------------ MAIN      503
      IF(P(11,K).EQ.0) GO TO 6000                                   MAIN      504
      NTRANS=P(11,K)                                                MAIN      505
      DO 5050 KK=1,NPOOLS                                           MAIN      506
      IF(KK.EQ.K) GO TO 5050                                        MAIN      507
      FK=FLOAT(KK)                                                  MAIN      508
      DO 5040 NN=1,NTRANS                                           MAIN      509
      T7=D(NN,7)-100.*FLOAT(INT(D(NN,7)/100.))                      MAIN      510
      IF(T7.NE.FK) GO TO 5040                                       MAIN      511
      IF(P(7,KK).LT.MMISS) GO TO 5020                               MAIN      512
      WRITE(6,100)                                                  MAIN      513
      WRITE(6,110)                                                  MAIN      514
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      WRITE(6,140) KK,P(7,KK)                                                  MAIN      515
  140 FORMAT(1H ,'WARNING--- MISSION OVERFLOW IN POOL',I3,10X,'TRUNCATED       MAIN      516
     * AT ',I4,' MISSIONS')                                                    MAIN      517
      WRITE(6,110)                                                            MAIN      518
      GO TO 5050                                                              MAIN      519
 5020 P(7,KK)=P(7,KK)+1                                                       MAIN      520
      I7=P(7,KK)                                                              MAIN      521
      DO 5030 J=1,MCA                                                         MAIN      522
      A(I7,J,KK)=D(NN,J)                                                      MAIN      523
 5030 CONTINUE                                                                MAIN      524
      A(I7,7,KK)=FLOAT(INT(D(NN,7)/100.))                                     MAIN      525
C-------------------------------------------------------------------------   MAIN      526
C               MISSION WILL NOT BE TRANSFERRED TO YET ANOTHER POOL.         MAIN      527
C                    (THIS OVERRIDES THE PREVIOUS STATEMENT).                MAIN      528
C-------------------------------------------------------------------------   MAIN      529
      A(I7,7,KK)=0.                                                           MAIN      530
 5040 CONTINUE                                                                MAIN      531
 5050 CONTINUE                                                                MAIN      532
 6000 CONTINUE                                                                MAIN      533
C                                                                             MAIN      534
C                                                                             MAIN      535
C-------------------------------------------------------------------------   MAIN      536
C               CALCULATE VEHICLE STATISTICS.                                MAIN      537
C-------------------------------------------------------------------------   MAIN      538
      F1=0.                                                                   MAIN      539
      F2=0.                                                                   MAIN      540
      F3=0.                                                                   MAIN      541
      F4=0.                                                                   MAIN      542
      DO 6005 I=1,12                                                          MAIN      543
      Q(I,K)=0.                                                               MAIN      544
 6005 CONTINUE                                                                MAIN      545
      I7=P(7,K)                                                               MAIN      546
      DO 6040 I=1,I7                                                          MAIN      547
      IF(F(I,2,K).EQ.0.) GO TO 6040                                           MAIN      548
      DO 6010 L=1,NL                                                          MAIN      549
      NY=L                                                                    MAIN      550
      IF(T(L,1,K).EQ.A(I,1,K)) GO TO 6015                                     MAIN      551
 6010 CONTINUE                                                                MAIN      552
 6015 CONTINUE                                                                MAIN      553
      F5=F(I,2,K)/100.                                                        MAIN      554
      F1=F1+F5                                                                MAIN      555
      F2=F2+AINT(F5)                                                          MAIN      556
      F3=F3+A(I,6,K)                                                          MAIN      557
      F4=F4+A(I,5,K)                                                          MAIN      558
      IF(AMOD(F(I,2,K),100.).EQ.0.) GO TO 6020                                MAIN      559
      F2=F2+1.                                                                MAIN      560
      F(I,2,K)=100.*AINT(F5)+100.                                             MAIN      561
      F5=F(I,2,K)/100.                                                        MAIN      562
 6020 Q(1,K)=Q(1,K)+F5*(T(NY,4,K)+T(NY,7,K))                                  MAIN      563
      Q(2,K)=Q(2,K)+F5*T(NY,2,K)                                              MAIN      564
      Q(3,K)=Q(3,K)+F5*T(NY,5,K)                                              MAIN      565
      Q(4,K)=Q(4,K)+F5*T(NY,8,K)                                              MAIN      566
      IF(T(NY,9,K).EQ.0.) GO TO 6030                                          MAIN      567
C-------------------------------------------------------------------------   MAIN      568
C               FOR PICK-UP MISSIONS.                                        MAIN      569
C-------------------------------------------------------------------------   MAIN      570
      Q(5,K)=Q(5,K)+F5*T(NY,6,K)                                              MAIN      571
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      Q(6,K)=Q(6,K)+F5*T(NY,9,K)                                        MAIN      572
      GO TO 6040                                                        MAIN      573
C-----------------------------------------------------------------------MAIN      574
C               FOR DELIVERY OR SUPPORT MISSIONS.                       MAIN      575
C-----------------------------------------------------------------------MAIN      576
 6030 Q(5,K)=Q(5,K)+F5*T(NY,3,K)                                        MAIN      577
      Q(6,K)=Q(6,K)+F5*T(NY,6,K)                                        MAIN      578
 6040 CONTINUE                                                          MAIN      579
      IF(P(5,K).EQ.0) GO TO 6050                                        MAIN      580
C-----------------------------------------------------------------------MAIN      581
C               UNUSED CAPACITY-                                        MAIN      582
C-----------------------------------------------------------------------MAIN      583
      Q(7,K)=100.*(F2-F1)/F2                                            MAIN      584
C-----------------------------------------------------------------------MAIN      585
C               CUBIC EFFICIENCY-                                       MAIN      586
C-----------------------------------------------------------------------MAIN      587
      Q(8,K)=100.*F3/(F1*FLOAT(P(4,K)))                                 MAIN      588
C-----------------------------------------------------------------------MAIN      589
C               WEIGHT EFFICIENCY-                                      MAIN      590
C-----------------------------------------------------------------------MAIN      591
      Q(9,K)=100.*F4/(F1*FLOAT(P(3,K)))                                 MAIN      592
 6050 CONTINUE                                                          MAIN      593
 7000 CONTINUE                                                          MAIN      594
C                                                                       MAIN      595
C                                                                       MAIN      596
C                                                                       MAIN      597
C                                                                       MAIN      598
C***********************************************************************MAIN      599
C                                                                       MAIN      600
C          POST-PROCESSOR SECTION                                       MAIN      601
C                                                                       MAIN      602
C***********************************************************************MAIN      603
      DO 10000 K=1,NPOOLS                                               MAIN      604
      WRITE(6,100)                                                      MAIN      605
      WRITE(6,110)                                                      MAIN      606
C                                                                       MAIN      607
      CALL OUT2(K)                                                      MAIN      608
C                                                                       MAIN      609
      DO 7060 I=1,MRG                                                   MAIN      610
      DO 7050 J=1,MCG                                                   MAIN      611
      G(I,J)=0.                                                         MAIN      612
 7050 CONTINUE                                                          MAIN      613
 7060 CONTINUE                                                          MAIN      614
      NM=P(7,K)                                                         MAIN      615
      IF(NM.LE.0) GO TO 9050                                            MAIN      616
      DO 9010 I=1,NM                                                    MAIN      617
      L=INT(A(I,8,K))                                                   MAIN      618
      IF(L.GE.1 .AND. L.LE.25) GO TO (7070,7070,8000,9010,9010,7080,7090 MAIN      619
     A ,7080,7090,8010,8020,8030,8040,8030,8040,8060,8050,9010,8035,9010 MAIN      620
     B ,8035,9010,9010,8050,8070), L                                    MAIN      621
      WRITE(6,150) L                                                    MAIN      622
  150 FORMAT(1H ,'WARNING-- IMPROPER MISSION DISPOSITION CODE=',I5)      MAIN      623
      GO TO 9010                                                        MAIN      624
C-----------------------------------------------------------------------MAIN      625
C               MISSION COMPLETED IN FULL.  A8 CODE WAS 1 OR 2.         MAIN      626
C-----------------------------------------------------------------------MAIN      627
 7070 I1=2                                                              MAIN      628
```

```
      I2=1                                                              MAIN      629
      GO TO 8090                                                        MAIN      630
C-----------------------------------------------------------------------MAIN      631
C               MISSION TRANSFERRED IN FULL.  A8 CODE WAS 6 OR 8.       MAIN      632
C-----------------------------------------------------------------------MAIN      633
 7080 I1=3                                                              MAIN      634
      I2=1                                                              MAIN      635
      GO TO 8090                                                        MAIN      636
C-----------------------------------------------------------------------MAIN      637
C               MISSION SKIPPED IN FULL.  A8 CODE WAS 7 OR 9.           MAIN      638
C-----------------------------------------------------------------------MAIN      639
 7090 I1=4                                                              MAIN      640
      I2=1                                                              MAIN      641
      GO TO 8090                                                        MAIN      642
C-----------------------------------------------------------------------MAIN      643
C               MISSION COMPLETED IN PART.  A8 CODE WAS 3.              MAIN      644
C-----------------------------------------------------------------------MAIN      645
 8000 I1=5                                                              MAIN      646
      GO TO 9000                                                        MAIN      647
C-----------------------------------------------------------------------MAIN      648
C               ADDITIONAL FRACTIONAL MISSION COMPLETED.  A8 CODE WAS 10.MAIN      649
C-----------------------------------------------------------------------MAIN      650
 8010 I1=10                                                             MAIN      651
      I2=9                                                              MAIN      652
      I3=8                                                              MAIN      653
      GO TO 8080                                                        MAIN      654
C-----------------------------------------------------------------------MAIN      655
C               ADDITIONAL FRACTIONAL MISSION SKIPPED.  A8 CODE WAS 11. MAIN      656
C-----------------------------------------------------------------------MAIN      657
 8020 I1=11                                                             MAIN      658
      I2=9                                                              MAIN      659
      I3=8                                                              MAIN      660
      GO TO 8080                                                        MAIN      661
C-----------------------------------------------------------------------MAIN      662
C               ADDITIONAL MISSION COMPLETED IN FULL.  A8 CODE- 12 OR 14.MAIN      663
C-----------------------------------------------------------------------MAIN      664
 8030 I1=13                                                             MAIN      665
      I2=12                                                             MAIN      666
      I3=8                                                              MAIN      667
      GO TO 8080                                                        MAIN      668
C-----------------------------------------------------------------------MAIN      669
C               ADDITIONAL MISSION TRANSFERRED IN FULL. A8 CODE-19 OR 21 MAIN      670
C-----------------------------------------------------------------------MAIN      671
 8035 I1=14                                                             MAIN      672
      I2=12                                                             MAIN      673
      I3=8                                                              MAIN      674
      GO TO 8080                                                        MAIN      675
C-----------------------------------------------------------------------MAIN      676
C               ADDITIONAL MISSION SKIPPED IN FULL.  A8 CODE WAS 13 OR 15 MAIN     677
C-----------------------------------------------------------------------MAIN      678
 8040 I1=15                                                             MAIN      679
      I2=12                                                             MAIN      680
      I3=8                                                              MAIN      681
      GO TO 8080                                                        MAIN      682
C-----------------------------------------------------------------------MAIN      683
C               ADDITIONAL MISSION TRANSFERRED OR SKIPPED IN PART.      MAIN      684
C                    A8 CODE WAS 17 OR 24.                              MAIN      685
```

```
C-------------------------------------------------------------------- MAIN  686
 8050 I1=12                                                          MAIN  687
      I2=8                                                           MAIN  688
      GO TO 8090                                                     MAIN  689
C-------------------------------------------------------------------- MAIN  690
C               ADDITIONAL MISSION COMPLETED IN PART.  A8 CODE WAS 16. MAIN  691
C-------------------------------------------------------------------- MAIN  692
 8060 I1=16                                                          MAIN  693
      GO TO 9000                                                     MAIN  694
C-------------------------------------------------------------------- MAIN  695
C               MISSION SKIPPED IN PART.  A8 CODE WAS 25.           MAIN  696
C-------------------------------------------------------------------- MAIN  697
 8070 I1=1                                                           MAIN  698
      GO TO 9000                                                     MAIN  699
 8080 G(I3,1)=G(I3,1)+1.                                             MAIN  700
      G(I3,2)=G(I3,2)+A(I,5,K)                                       MAIN  701
      G(I3,4)=G(I3,4)+A(I,6,K)                                       MAIN  702
 8090 G(I2,1)=G(I2,1)+1.                                             MAIN  703
      G(I2,2)=G(I2,2)+A(I,5,K)                                       MAIN  704
      G(I2,4)=G(I2,4)+A(I,6,K)                                       MAIN  705
 9000 G(I1,1)=G(I1,1)+1.                                             MAIN  706
      G(I1,2)=G(I1,2)+A(I,5,K)                                       MAIN  707
      G(I1,4)=G(I1,4)+A(I,6,K)                                       MAIN  708
 9010 CONTINUE                                                       MAIN  709
C-------------------------------------------------------------------- MAIN  710
C               ORIGINAL MISSIONS EITHER TRANSFERRED IN PART OR SKIPPED MAIN  711
C                    IN PART.                                       MAIN  712
C               ADDITIONAL WHOLE MISSIONS EITHER TRANSFERRED OR SKIPPED MAIN  713
C                    IN PART.                                       MAIN  714
C-------------------------------------------------------------------- MAIN  715
      DO 9020 J=1,MCG                                                MAIN  716
      G(6,J)=O(1,J,K)                                                MAIN  717
      G(7,J)=O(2,J,K)                                                MAIN  718
      G(17,J)=O(3,J,K)                                               MAIN  719
      G(MRG,J)=O(4,J,K)                                              MAIN  720
 9020 CONTINUE                                                       MAIN  721
      DO 9030 I=1,MRG                                                MAIN  722
      G(I,3)=100.*G(I,2)/(G(1,2)+G(8,2))                             MAIN  723
      G(I,5)=100.*G(I,4)/(G(1,4)+G(8,4))                             MAIN  724
 9030 CONTINUE                                                       MAIN  725
      DO 9040 I=1,MRG                                                MAIN  726
      G(I,2)=G(I,2)/10.                                              MAIN  727
      G(I,4)=G(I,4)/100.                                             MAIN  728
 9040 CONTINUE                                                       MAIN  729
C                                                                    MAIN  730
      CALL OUT3                                                      MAIN  731
      CALL OUT4(K)                                                   MAIN  732
C                                                                    MAIN  733
      IF(IPLOT.EQ.0) GO TO 9050                                      MAIN  734
C                                                                    MAIN  735
      CALL PLOT(K)                                                   MAIN  736
C                                                                    MAIN  737
 9050 WRITE(6,110)                                                   MAIN  738
10000 CONTINUE                                                       MAIN  739
      GO TO 1000                                                     MAIN  740
      END                                                            MAIN  741
```

```
: SORT       76/76   OPT=1 ROUND=+-*/              FTN 4.8+508        06/09/80  11.24.

C*********************************************************************** SORT        2
C                                                                       SORT        3
C**** SUBROUTINE SORT                                                   SORT        4
C        SORT TIMES FOR THE POOL.                                       SORT        5
C                                                                       SORT        6
C*********************************************************************** SORT        7
      SUBROUTINE SORT(K)                                                SORT        8
      DIMENSION  T(100,9,10), A(500,8,10), E(1000,2,10), P(15,10)       SORT        9
      DIMENSION  D(500,8), F(500,2,10)                                  SORT       10
      INTEGER P                                                         SORT       11
      LEVEL 2, T,A,F,E,D                                                SORT       12
      COMMON / AAA / T,A,F,E,D                                          SORT       13
      COMMON / MAX / MMISS,MLINK                                        SORT       14
      COMMON / PPP / P                                                  SORT       15
C                                                                       SORT       16
C                                                                       SORT       17
      KS=INT(F(MMISS,1,K))                                              SORT       18
      IF(KS.EQ.2) GO TO 500                                             SORT       19
      IF(KS.GE.3) GO TO 200                                             SORT       20
      F(MMISS,1,K)=2.                                                   SORT       21
  200 JM=2*P(7,K)                                                       SORT       22
      IM=JM-1                                                           SORT       23
      DO 400 I=1,IM                                                     SORT       24
      I1=I+1                                                            SORT       25
      DO 300 J=I1,JM                                                    SORT       26
      IF(E(I,1,K).LT.E(J,1,K)) GO TO 300                                SORT       27
      IF(E(I,1,K).GT.E(J,1,K)) GO TO 210                                SORT       28
      IF(E(I,2,K).LE.E(J,2,K)) GO TO 300                                SORT       29
      GO TO 250                                                         SORT       30
  210 TEMP=E(I,1,K)                                                     SORT       31
      E(I,1,K)=E(J,1,K)                                                 SORT       32
      E(J,1,K)=TEMP                                                     SORT       33
  250 TEMP=E(I,2,K)                                                     SORT       34
      E(I,2,K)=E(J,2,K)                                                 SORT       35
      E(J,2,K)=TEMP                                                     SORT       36
  300 CONTINUE                                                          SORT       37
  400 CONTINUE                                                          SORT       38
  500 RETURN                                                            SORT       39
      END                                                               SORT       40
```

```
C*********************************************************************** OUT1    2
C                                                                       OUT1    3
C**** SUBROUTINE OUT1                                                   OUT1    4
C        PRINT OUT INPUT DATA FOR THE POOL.                             OUT1    5
C                                                                       OUT1    6
C*********************************************************************** OUT1    7
      SUBROUTINE OUT1(K)                                                OUT1    8
      DIMENSION  T(100,9,10), A(500,8,10), E(1000,2,10), P(15,10)       OUT1    9
      DIMENSION  D(500,8), F(500,2,10)                                  OUT1   10
      INTEGER P                                                         OUT1   11
      LEVEL 2, T,A,F,E,D                                                OUT1   12
      COMMON / AAA / T,A,F,E,D                                          OUT1   13
      COMMON / MCOL/ MCT,MCA,MCG                                        OUT1   14
      COMMON / PPP / P                                                  OUT1   15
    5 FORMAT(1H )                                                       OUT1   16
   10 FORMAT(1H1)                                                       OUT1   17
   20 FORMAT(1H ,125(1HX))                                              OUT1   18
  100 FORMAT(1H ,125(1H-))                                              OUT1   19
  110 FORMAT(1H0)                                                       OUT1   20
C                                                                       OUT1   21
C                                                                       OUT1   22
      WRITE(6,10)                                                       OUT1   23
      WRITE(6,20)                                                       OUT1   24
      WRITE(6,30) P(1,K)                                                OUT1   25
   30 FORMAT(1H0,10X,'POOL NUMBER      ',I5)                            OUT1   26
      WRITE(6,40) P(2,K)                                                OUT1   27
   40 FORMAT(1H ,10X,'VEHICLE NUMBER.  ',I5)                            OUT1   28
      WRITE(6,50) P(3,K)                                                OUT1   29
   50 FORMAT(1H ,10X,'VEH. PAY.(STX10)',I5)                             OUT1   30
      WRITE(6,60) P(4,K)                                                OUT1   31
   60 FORMAT(1H ,10X,'VEH. CUBIC CAP. ',I5)                             OUT1   32
      WRITE(6,70) P(5,K)                                                OUT1   33
   70 FORMAT(1H ,10X,'NO. OF VEHICLES ',I5)                             OUT1   34
      WRITE(6,80) P(6,K)                                                OUT1   35
   80 FORMAT(1H ,10X,'NUMBER OF LINKS ',I5)                             OUT1   36
      WRITE(6,90) P(7,K)                                                OUT1   37
   90 FORMAT(1H ,10X,'NO. OF MISSIONS ',I5)                             OUT1   38
      WRITE(6,100)                                                      OUT1   39
      WRITE(6,110)                                                      OUT1   40
      WRITE(6,115)                                                      OUT1   41
  115 FORMAT(1H0,59X,'LINKS')                                           OUT1   42
      WRITE(6,116)                                                      OUT1   43
  116 FORMAT(1H ,59X,'-----')                                           OUT1   44
      WRITE(6,5)                                                        OUT1   45
      WRITE(6,120)                                                      OUT1   46
  120 FORMAT(1H ,20X,'C1        C2        C3        C4        C5        OUT1   47
     *C6        C7        C8        C9')                               OUT1   48
      WRITE(6,130)                                                      OUT1   49
  130 FORMAT(1H ,'T(R,C)',7X,'/','---------------------------------------- OUT1   50
     *----------------------------------------------------')            OUT1   51
      N=P(6,K)                                                          OUT1   52
      IF(N.GT.0) GO TO 135                                              OUT1   53
      WRITE(6,133)                                                      OUT1   54
  133 FORMAT(1H0,51X,'NO LINKS ASSIGNED')                               OUT1   55
      GO TO 153                                                         OUT1   56
  135 DO 150 I=1,N                                                      OUT1   57
      WRITE(6,140) I,(T(I,J,K),J=1,MCT)                                 OUT1   58
```

```
E OUT1       76/76   OPT=1 ROUND=+-*/                FTN 4.8+508        06/09/80  11.24.

  140 FORMAT(1H ,6X,'R',I3,3X,'/',9F10.1)                                  OUT1      59
  150 CONTINUE                                                             OUT1      60
  153 WRITE(6,110)                                                         OUT1      61
      WRITE(6,110)                                                         OUT1      62
      WRITE(6,155)                                                         OUT1      63
  155 FORMAT(1HO,52X,'MISSIONS')                                           OUT1      64
      WRITE(6,156)                                                         OUT1      65
  156 FORMAT(1H ,52X,'--------')                                           OUT1      66
      WRITE(6,5)                                                           OUT1      67
      WRITE(6,157)                                                         OUT1      68
  157 FORMAT(1H ,20X,'C1        C2        C3        C4        C5           OUT1      69
     *C6        C7        C8')                                            OUT1      70
      WRITE(6,160)                                                         OUT1      71
  160 FORMAT(1H ,'A(R,C)',7X,'/','-------------------------------------    OUT1      72
     *-----------------------------------------')                         OUT1      73
      N=P(7,K)                                                             OUT1      74
      IF(N.GT.0) GO TO 164                                                 OUT1      75
      WRITE(6,163)                                                         OUT1      76
  163 FORMAT(1HO,47X,'NO MISSIONS ASSIGNED')                               OUT1      77
      GO TO 175                                                            OUT1      78
  164 DO 170 I=1,N                                                         OUT1      79
      WRITE(6,165) I,(A(I,J,K),J=1,MCA)                                    OUT1      80
  165 FORMAT(1H ,6X,'R',I3,3X,'/',8F10.1)                                  OUT1      81
  170 CONTINUE                                                             OUT1      82
  175 WRITE(6,110)                                                         OUT1      83
      WRITE(6,110)                                                         OUT1      84
      WRITE(6,20)                                                          OUT1      85
      RETURN                                                               OUT1      86
      END                                                                  OUT1      87
```

```
E OUT2        76/76    OPT=1 ROUND=+-*/                FTN 4.8+508          06/09/80  11.24.

C*****************************************************************************  OUT2        2
C                                                                               OUT2        3
C****  SUBROUTINE OUT2                                                          OUT2        4
C         PRINT HEADING FOR OUTPUT FROM SIMULATION.                             OUT2        5
C                                                                               OUT2        6
C*****************************************************************************  OUT2        7
                                                                                OUT2        8
      SUBROUTINE OUT2(K)                                                        OUT2        9
      DIMENSION  P(15,10)                                                       OUT2       10
      INTEGER P                                                                 OUT2       11
      COMMON / PPP / P                                                          OUT2       12
    5 FORMAT(1H )                                                               OUT2       13
C                                                                               OUT2       14
C                                                                               OUT2       15
      WRITE(6,10) P(1,K)                                                        OUT2       16
   10 FORMAT(1HO,10X,'OUTPUT FOR POOL NO.     ',I5)                           OUT2       17
      WRITE(6,20) P(2,K)                                                        OUT2       18
   20 FORMAT(1H ,10X,'VEHICLE NUMBER          ',I5)                           OUT2       19
      WRITE(6,30) P(3,K)                                                        OUT2       20
   30 FORMAT(1H ,10X,'VEHICLE PAYLOAD (STX10)',I5)                            OUT2       21
      WRITE(6,40) P(4,K)                                                        OUT2       22
   40 FORMAT(1H ,10X,'VEHICLE CUBIC CAPACITY ',I5)                            OUT2       23
      WRITE(6,50) P(5,K)                                                        OUT2       24
   50 FORMAT(1H ,10X,'NO. OF VEHICLES IN POOL',I5)                            OUT2       25
      IF(P(7,K).GT.0) GO TO 100                                                 OUT2       26
      WRITE(6,60)                                                               OUT2       27
   60 FORMAT(1HO,20X,'NO MISSIONS ASSIGNED')                                    OUT2       28
  100 WRITE(6,5)                                                                OUT2       29
      RETURN                                                                    OUT2       30
      END
```

```
C*********************************************************************** OUT3      2
C                                                                       OUT3      3
C**** SUBROUTINE OUT3                                                   OUT3      4
C       PRINT MISSION STATUS REPORT.                                    OUT3      5
C                                                                       OUT3      6
C*********************************************************************** OUT3      7
      SUBROUTINE OUT3                                                   OUT3      8
      DIMENSION G(18,5)                                                 OUT3      9
      COMMON / GGG / G                                                  OUT3     10
      COMMON / MCOL/ MCT,MCA,MCG                                        OUT3     11
   10 FORMAT(1HO)                                                       OUT3     12
 1000 FORMAT(1H+,31X,F4.0,F10.1,1X,F8.1,F9.1,1X,F8.1)                   OUT3     13
C                                                                       OUT3     14
C                                                                       OUT3     15
      WRITE(6,10)                                                       OUT3     16
      WRITE(6,10)                                                       OUT3     17
      WRITE(6,20)                                                       OUT3     18
   20 FORMAT(1H ,'M I S S I O N  S T A T U S  R E P O R T')              OUT3     19
      WRITE(6,30)                                                       OUT3     20
   30 FORMAT(1H ,'----------------------------------------')            OUT3     21
      WRITE(6,40)                                                       OUT3     22
   40 FORMAT(1HO,31X,' NO.     S.T.    % ST    100 CF    % CF')        OUT3     23
      WRITE(6,50)                                                       OUT3     24
   50 FORMAT(1H ,31X,'-----  --------  ------  --------  ------')       OUT3     25
      WRITE(6,60)                                                       OUT3     26
      WRITE(6,1000) (G(1,J),J=1,MCG)                                    OUT3     27
   60 FORMAT(1H ,'1) ORIGINAL MISSIONS ASSIGNED  ')                     OUT3     28
      WRITE(6,70)                                                       OUT3     29
      WRITE(6,1000) (G(2,J),J=1,MCG)                                    OUT3     30
   70 FORMAT(1H ,9X,'COMPLETED IN FULL      ')                         OUT3     31
      WRITE(6,80)                                                       OUT3     32
      WRITE(6,1000) (G(3,J),J=1,MCG)                                    OUT3     33
   80 FORMAT(1H ,9X,'CONTRACTED IN FULL     ')                         OUT3     34
      WRITE(6,90)                                                       OUT3     35
      WRITE(6,1000) (G(4,J),J=1,MCG)                                    OUT3     36
   90 FORMAT(1H ,9X,'SKIPPED IN FULL        ')                         OUT3     37
      WRITE(6,100)                                                      OUT3     38
      WRITE(6,1000) (G(5,J),J=1,MCG)                                    OUT3     39
  100 FORMAT(1H ,9X,'   COMPLETED IN PART  ')                          OUT3     40
      WRITE(6,110)                                                      OUT3     41
      WRITE(6,1000) (G(6,J),J=1,MCG)                                    OUT3     42
  110 FORMAT(1H ,9X,'   CONTRACTED IN PART ')                          OUT3     43
      WRITE(6,120)                                                      OUT3     44
      WRITE(6,1000) (G(7,J),J=1,MCG)                                    OUT3     45
  120 FORMAT(1H ,9X,'   SKIPPED IN PART    ')                         OUT3     46
      WRITE(6,130)                                                      OUT3     47
      WRITE(6,1000) (G(8,J),J=1,MCG)                                    OUT3     48
  130 FORMAT(1HO,'2) ADDITIONAL MISSIONS ASSIGNED')                     OUT3     49
      WRITE(6,140)                                                      OUT3     50
      WRITE(6,1000) (G(9,J),J=1,MCG)                                    OUT3     51
  140 FORMAT(1H ,9X,'FRACTIONAL MISSIONS   ')                           OUT3     52
      WRITE(6,150)                                                      OUT3     53
      WRITE(6,1000)(G(10,J),J=1,MCG)                                    OUT3     54
  150 FORMAT(1H ,9X,'  COMPLETED           ')                         OUT3     55
      WRITE(6,160)                                                      OUT3     56
      WRITE(6,1000)(G(11,J),J=1,MCG)                                    OUT3     57
  160 FORMAT(1H ,9X,'  SKIPPED             ')                         OUT3     58
```

```
1 OUT3       76/76   OPT=1 ROUND=+-*/                FTN 4.8+508        06/09/80  12.24.

      WRITE(6,170)                                                      OUT3       59
      WRITE(6,1000)(G(12,J),J=1,MCG)                                    OUT3       60
  170 FORMAT(1H ,9X,'WHOLE MISSIONS          ')                         OUT3       61
      WRITE(6,180)                                                      OUT3       62
      WRITE(6,1000)(G(13,J),J=1,MCG)                                    OUT3       63
  180 FORMAT(1H ,9X,'  COMPLETED IN FULL     ')                        OUT3       64
      WRITE(6,185)                                                      OUT3       65
      WRITE(6,1000)(G(14,J),J=1,MCG)                                    OUT3       66
  185 FORMAT(1H ,9X,'  CONTRACTED IN FULL    ')                        OUT3       67
      WRITE(6,190)                                                      OUT3       68
      WRITE(6,1000)(G(15,J),J=1,MCG)                                    OUT3       69
  190 FORMAT(1H ,9X,'  SKIPPED IN FULL       ')                        OUT3       70
      WRITE(6,200)                                                      OUT3       71
      WRITE(6,1000)(G(16,J),J=1,MCG)                                    OUT3       72
  200 FORMAT(1H ,9X,'  COMPLETED IN PART     ')                        OUT3       73
      WRITE(6,210)                                                      OUT3       74
      WRITE(6,1000)(G(17,J),J=1,MCG)                                    OUT3       75
  210 FORMAT(1H ,9X,'  CONTRACTED IN PART    ')                        OUT3       76
      WRITE(6,220)                                                      OUT3       77
      WRITE(6,1000)(G(18,J),J=1,MCG)                                    OUT3       78
  220 FORMAT(1H ,9X,'  SKIPPED IN PART       ')                        OUT3       79
      RETURN                                                            OUT3       80
      END                                                               OUT3       81
```

```
E OUT4       76/76  OPT=1 ROUND=+-*/                FTN 4.8+508        06/09/80  11.24.

C*********************************************************************** OUT4        2
C                                                                         OUT4        3
C**** SUBROUTINE OUT4                                                     OUT4        4
C        PRINT VEHICLE STATUS REPORT.                                     OUT4        5
C                                                                         OUT4        6
C*********************************************************************** OUT4        7
      SUBROUTINE OUT4(K)                                                  OUT4        8
      DIMENSION  T(100,9,10), A(500,8,10), E(1000,2,10), P(15,10)         OUT4        9
      DIMENSION  D(500,8), F(500,2,10), Q(12,10)                          OUT4       10
      INTEGER P                                                           OUT4       11
      LEVEL 2, T,A,F,E,D                                                  OUT4       12
      COMMON / AAA / T,A,F,E,D                                            OUT4       13
      COMMON / PPP / P                                                    OUT4       14
      COMMON / QQQ / Q                                                    OUT4       15
    5 FORMAT(1H )                                                         OUT4       16
   10 FORMAT(1HO)                                                         OUT4       17
 1000 FORMAT(1H+,23X,F10.1,8X,F6.1,7X,F8.2)                               OUT4       18
C                                                                         OUT4       19
C                                                                         OUT4       20
      WRITE(6,10)                                                         OUT4       21
      WRITE(6,10)                                                         OUT4       22
      WRITE(6,20)                                                         OUT4       23
   20 FORMAT(1H ,'V E H I C L E   S T A T U S   R E P O R T')             OUT4       24
      WRITE(6,30)                                                         OUT4       25
   30 FORMAT(1H ,'----------------------------------------')              OUT4       26
      WRITE(6,40) P(8,K)                                                  OUT4       27
   40 FORMAT(1H ,'NO. OF VEHICLES USED          ',I3)                     OUT4       28
      IF(P(8,K).GT.0) GO TO  60                                           OUT4       29
      WRITE(6,5)                                                          OUT4       30
      WRITE(6,50)                                                         OUT4       31
   50 FORMAT(1H ,'NO MISSIONS PERFORMED')                                 OUT4       32
      WRITE(6,5)                                                          OUT4       33
      GO TO 215                                                           OUT4       34
   60 WRITE(6,70) Q(7,K)                                                  OUT4       35
   70 FORMAT(1H ,'UNUSED CAPACITY (%)           ',F4.0)                   OUT4       36
      WRITE(6,80) Q(8,K)                                                  OUT4       37
   80 FORMAT(1H ,'VEHICLE CUBIC EFFICIENCY (%) ',F4.0)                    OUT4       38
      WRITE(6,90) Q(9,K)                                                  OUT4       39
   90 FORMAT(1H ,'VEHICLE PAYLOAD EFF. (%)      ',F4.0)                   OUT4       40
      WRITE(6,5)                                                          OUT4       41
      WRITE(6,100)                                                        OUT4       42
  100 FORMAT(1H ,'CONSIDERING ONLY THE VEHICLES USED AND MISSIONS PERFOR   OUT4       43
     *MED-')                                                              OUT4       44
      WRITE(6,5)                                                          OUT4       45
      WRITE(6,110)                                                        OUT4       46
  110 FORMAT(1H ,25X,'TOT. VEH-HRS      PERCENT      AVER/MISSION')       OUT4       47
      WRITE(6,120)                                                        OUT4       48
  120 FORMAT(1H ,25X,'------------      -------      ------------')       OUT4       49
      S=FLOAT(P(8,K)*(P(10,K)-P(9,K)))                                    OUT4       50
      U=0.                                                                OUT4       51
      N7=P(7,K)                                                           OUT4       52
      DO 130 I=1,N7                                                       OUT4       53
      IF(F(I,2,K).EQ.0.) GO TO 130                                        OUT4       54
      U=U+1.                                                              OUT4       55
  130 CONTINUE                                                            OUT4       56
      U=60.*U                                                             OUT4       57
      V=0.                                                                OUT4       58
```

```
E OUT4       76/76   OPT=1 ROUND=+-*/                FTN 4.8+508        06/09/80  11.24.

      DO 140 I=1,6                                                        OUT4       59
      V=V+Q(I,K)                                                          OUT4       60
  140 CONTINUE                                                            OUT4       61
      T1=Q(1,K)/60.                                                       OUT4       62
      T2=100.*Q(1,K)/S                                                    OUT4       63
      T3=Q(1,K)/U                                                         OUT4       64
      WRITE(6,150)                                                        OUT4       65
      WRITE(6,1000) T1,T2,T3                                              OUT4       66
  150 FORMAT(1H ,'TRAVEL                ')                              OUT4       67
      T1=Q(2,K)/60.                                                       OUT4       68
      T2=100.*Q(2,K)/S                                                    OUT4       69
      T3=Q(2,K)/U                                                         OUT4       70
      WRITE(6,160)                                                        OUT4       71
      WRITE(6,1000) T1,T2,T3                                              OUT4       72
  160 FORMAT(1H ,'DELAY (DEPT. POINT)   ')                              OUT4       73
      T1=Q(3,K)/60.                                                       OUT4       74
      T2=100.*Q(3,K)/S                                                    OUT4       75
      T3=Q(3,K)/U                                                         OUT4       76
      WRITE(6,170)                                                        OUT4       77
      WRITE(6,1000) T1,T2,T3                                              OUT4       78
  170 FORMAT(1H ,'DELAY (INTERM. POINT)')                               OUT4       79
      T1=Q(4,K)/60.                                                       OUT4       80
      T2=100.*Q(4,K)/S                                                    OUT4       81
      T3=Q(4,K)/U                                                         OUT4       82
      WRITE(6,180)                                                        OUT4       83
      WRITE(6,1000) T1,T2,T3                                              OUT4       84
  180 FORMAT(1H ,'DELAY (RTN POINT)     ')                              OUT4       85
      T1=Q(5,K)/60.                                                       OUT4       86
      T2=100.*Q(5,K)/S                                                    OUT4       87
      T3=Q(5,K)/U                                                         OUT4       88
      WRITE(6,190)                                                        OUT4       89
      WRITE(6,1000) T1,T2,T3                                              OUT4       90
  190 FORMAT(1H ,'LOADING               ')                              OUT4       91
      T1=Q(6,K)/60.                                                       OUT4       92
      T2=100.*Q(6,K)/S                                                    OUT4       93
      T3=Q(6,K)/U                                                         OUT4       94
      WRITE(6,200)                                                        OUT4       95
      WRITE(6,1000) T1,T2,T3                                              OUT4       96
  200 FORMAT(1H ,'UNLOADING             ')                              OUT4       97
      T1=(S-V)/60.                                                        OUT4       98
      T2=100.*(S-V)/S                                                     OUT4       99
      T3=(S-V)/U                                                          OUT4      100
      WRITE(6,210)                                                        OUT4      101
      WRITE(6,1000) T1,T2,T3                                              OUT4      102
  210 FORMAT(1H ,'IDLE                  ')                              OUT4      103
  215 WRITE(6,5)                                                          OUT4      104
      T1=FLOAT(P(10,K)-P(9,K))/60.                                        OUT4      105
      WRITE(6,220) T1                                                     OUT4      106
  220 FORMAT(1H ,'HRS FROM FIRST DEPARTURE AND LAST DESIRED ARRIVAL= ',   OUT4      107
     * F8.2)                                                             OUT4      108
      RETURN                                                              OUT4      109
      END                                                                 OUT4      110
```

```
C*********************************************************************** PLOT      2
C                                                                       PLOT      3
C**** SUBROUTINE PLOT                                                   PLOT      4
C        PLOT OUTPUT FOR THE POOL.                                      PLOT      5
C                                                                       PLOT      6
C*********************************************************************** PLOT      7
      SUBROUTINE PLOT(K)                                                PLOT      8
C                                                                       PLOT      9
C                                                                       PLOT     10
      DIMENSION  T(100,9,10), A(500,8,10), E(1000,2,10), P(15,10)       PLOT     11
      DIMENSION  D(500,8), F(500,2,10), G(18,5)                         PLOT     12
      DIMENSION  HR(2000), VEH(2000), TON(2000), CUBE(2000), TM(2000)   PLOT     13
      DIMENSION  LABEL(4), SS(10), SR(10), RS(10), PP(10)               PLOT     14
      DIMENSION  RRR(10), RSS(10), RSR(10), SRS(10)                     PLOT     15
      INTEGER P                                                         PLOT     16
      LEVEL 2, T,A,F,E,D                                                PLOT     17
      COMMON / AAA / T,A,F,E,D                                          PLOT     18
      COMMON / GGG / G                                                  PLOT     19
      COMMON / PPP / P                                                  PLOT     20
      DATA LABEL/'BUTLER','BLDG 367','X3452','CSD-SMB'/                 PLOT     21
      NM=P(7,K)                                                         PLOT     22
      IF(NM.EQ.0) RETURN                                                PLOT     23
      N2=2*NM                                                           PLOT     24
      START=FLOAT(P(9,K))                                               PLOT     25
      FINIS=FLOAT(P(10,K))                                              PLOT     26
      NL=P(6,K)                                                         PLOT     27
      T1=0.                                                             PLOT     28
      T2=0.                                                             PLOT     29
      TV=0.                                                             PLOT     30
      TT=0.                                                             PLOT     31
      TC=0.                                                             PLOT     32
      DO 1100 I=1,N2                                                    PLOT     33
      J1=2*I-1                                                          PLOT     34
      VEH(J1)=TV                                                        PLOT     35
      TON(J1)=TT                                                        PLOT     36
      CUBE(J1)=TC                                                       PLOT     37
      J2=2*I                                                            PLOT     38
      NY=INT(ABS(E(I,2,K)))                                             PLOT     39
      HR(J2)=(E(I,1,K)-START)/60.                                       PLOT     40
      VEH(J2)=TV+SIGN(F(NY,2,K),E(I,2,K))/100.                          PLOT     41
      TM(J2)=HR(J2)                                                     PLOT     42
      IF(E(I,2,K).GT.0.) GO TO 1050                                     PLOT     43
      DO 1025 L=1,NL                                                    PLOT     44
      I3=L                                                              PLOT     45
      IF(T(L,1,K).EQ.A(NY,1,K)) GO TO 1035                              PLOT     46
 1025 CONTINUE                                                          PLOT     47
 1035 IF(T(I3,9,K).GT.0.) GO TO 1045                                    PLOT     48
      TM(J2)=(E(I,1,K)-(T(I3,7,K)+T(I3,8,K))-START)/60.                 PLOT     49
 1045 IF(F(NY,2,K).EQ.0.) GO TO 1050                                    PLOT     50
      T1=T1+A(NY,5,K)                                                   PLOT     51
      T2=T2+A(NY,6,K)                                                   PLOT     52
 1050 TON(J2)=10.*T1/(G(1,2)+G(8,2))                                    PLOT     53
      CUBE(J2)=T2/(G(1,4)+G(8,4))                                       PLOT     54
      HR(J1)=HR(J2)                                                     PLOT     55
      TM(J1)=TM(J2)                                                     PLOT     56
      TV=VEH(J2)                                                        PLOT     57
      TT=TON(J2)                                                        PLOT     58
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      TC=CUBE(J2)                                                          PLOT       59
 1100 CONTINUE                                                             PLOT       60
      N3=2*N2-1                                                            PLOT       61
      ENCODE( 50, 1200, SS )                                               PLOT       62
 1200 FORMAT( ' NUMBER OF VEHICLES IN USE VS. TIME>')                      PLOT       63
      ENCODE( 30, 1300, SR )                                               PLOT       64
 1300 FORMAT( ' NUMBER OF VEHICLES>')                                      PLOT       65
      ENCODE( 30, 1400, RS )                                               PLOT       66
 1400 FORMAT( ' TIME, IN HOURS>')                                          PLOT       67
      ENCODE( 100, 1500, RRR )                                             PLOT       68
 1500 FORMAT( ' SHORT TONS DELIVERED (% OF TOTAL ASSIGNED) VS. TIME>')     PLOT       69
      ENCODE( 70, 1600, RSS )                                              PLOT       70
 1600 FORMAT( ' % OF TOTAL SHORT TONS ASSIGNED>')                          PLOT       71
      ENCODE( 100, 1700, RSR )                                             PLOT       72
 1700 FORMAT( ' CUBIC FEET DELIVERED (% OF TOTAL ASSIGNED) VS. TIME>')     PLOT       73
      ENCODE( 50, 1800, SRS )                                              PLOT       74
 1800 FORMAT( ' % OF TOTAL CUBIC FEET ASSIGNED >')                         PLOT       75
      ENCODE( 40, 1900, PP ) K                                             PLOT       76
 1900 FORMAT( ' POOL NUMBER',I3,'>')                                       PLOT       77
      CALL PLTBEG( 13. , 29. , 1.0 , 13 , LABEL )                          PLOT       78
      CALL FIXSCA( HR , N3+1 , 8. , XS , XMIN , XMAX , DX )                PLOT       79
      CALL FIXSCA( VEH , N3+1 , 6. , YS , YMIN , YMAX , DY )               PLOT       80
      CALL PLTSCA( 2. , 2. , XMIN , YMIN , XS , YS )                       PLOT       81
      CALL PLTDTS( 1 , 0 , HR , VEH , N3+1 , 0 )                           PLOT       82
      CALL PLTAXS( DX , DY , XMIN , XMAX , YMIN , YMAX , 4 )               PLOT       83
      CALL LABELA( DX , DY , XMIN , XMAX , YMIN , YMAX , 1.0 , 1.0 )       PLOT       84
      CALL PLTSYM( 0.10 , SS , 0. , XMIN+(XS*2) , YMAX+(YS*0.25) )         PLOT       85
      CALL PLTSYM( 0.08 , SR , 90., XMIN-(XS*0.75) , YMIN+(YS*2) )         PLOT       86
      CALL PLTSYM( 0.08 , RS , 0. , XMIN+(XS*3) , YMIN-(YS*0.5) )          PLOT       87
      CALL PLTSYM( 0.15 , PP , 0. , XMIN+(XS*3.25), YMAX+(YS*0.75) )       PLOT       88
C BEGIN PLOT OF SHORT TONS DELIVERED                                       PLOT       89
      CALL FIXSCA( TM , N3+1 , 8. , XS , XMIN , XMAX , DX )                PLOT       90
      CALL PLTSCA( 2. , 11. , TM , 0 , XS , 16.66 )                        PLOT       91
      CALL PLTDTS( 1 , 0 , TM , TON , N3+1 , 0 )                           PLOT       92
      CALL PLTAXS( DX , 10. , XMIN , XMAX , 0. , 100. , 4 )                PLOT       93
      CALL LABELA( DX , 10. , XMIN , XMAX , 0. , 100. , 1.0 , 1.0 )        PLOT       94
      CALL PLTSYM( 0.10 , RRR , 0 , XMIN+(XS*1) , 102. )                   PLOT       95
      CALL PLTSYM( 0.08 , RSS , 90. , XMIN-(XS*0.5) , 20. )                PLOT       96
      CALL PLTSYM( 0.08 , RS , 0. , XMIN+(XS*3) , -9. )                    PLOT       97
      CALL PLTSYM( 0.15 , PP , 0. , XMIN+(XS*3.25) , 108. )                PLOT       98
C BEGIN PLOT OF CUBIC FEET DELIV.                                          PLOT       99
      CALL FIXSCA( TM , N3+1 , 8. , XS , XMIN , XMAX , DX )                PLOT      100
      CALL PLTSCA( 2. , 20. , TM , 0 , XS , 16.66 )                        PLOT      101
      CALL PLTDTS( 1 , 0 , TM , CUBE , N3+1 , 0 )                          PLOT      102
      CALL PLTAXS( DX , 10. , XMIN , XMAX , 0. , 100. , 4)                PLOT      103
      CALL LABELA( DX , 10. , XMIN , XMAX , 0. , 100. , 1.0 , 1.0 )        PLOT      104
      CALL PLTSYM( 0.10 , RSR , 0. , XMIN+(XS*1) , 102. )                  PLOT      105
      CALL PLTSYM( 0.08 , SRS , 90. , XMIN-(XS*0.5) , 20. )                PLOT      106
      CALL PLTSYM( 0.08 , RS , 0. , XMIN+(XS*3) , -9. )                    PLOT      107
      CALL PLTSYM( 0.15 , PP , 0. , XMIN+(XS*3.25) , 108. )                PLOT      108
      CALL PLTPGE                                                          PLOT      109
      RETURN                                                               PLOT      110
      END                                                                  PLOT      111
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APPENDIX B

PROGRAM NARRATIVE

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APPENDIX B

PROGRAM NARRATIVE

This appendix consists of a detailed documentation of the TVEM model logic in the form of a nearly line-by-line explanation of the FORTRAN coding. However, portions of the main program that are concerned only with the calculation of statistics and auxiliary subroutines are not documented. Included at various points in the program narrative are line numbers which refer to the program lines of coding as shown at the right hand side of each page in Appendix A.

TVEM PROGRAM NARRATIVE

The program first reads the number of vehicle pools that are to be simulated. If the value is negative, execution ceases. Otherwise, the program checks to ensure that the number of pools is positive and less than or equal to the maximum number of pools permitted. If the constraint is violated, a warning is printed and execution ceases.

If the constraint on the number of pools is satisfied, the program next reads the input data for each pool (loop 40-70).* First, the pool number, vehicle type identification number, the payload for the vehicle in short tons (x10), the cubic capacity, and the number of vehicles assigned to the pool are read. Next, the information on the links for the pool is read (loop 51-55). When a negative number is encountered in the first field of an input card, program control jumps out of the loop and the number of links for the pool is stored. Next, the data on the missions assigned to the pool are read (loop 61-65). When a negative entry is encountered in the first field of an input card, program control jumps out of this loop and the number of missions assigned to the pool is stored. Finally, a parameter called "LIST" is checked and the input information for the pool is printed if and only if the value assigned to the parameter is positive.

After the input information is read for all of the pools, the model begins simulating the missions by processing one pool at a time and in the order of the pools as read in (loop 78-594).

In the first part of the simulation loop (lines 78-179), various data are calculated on the missions to include times of departure and times of return from missions. First, the number of the pool is retrieved and a message is printed. The number of missions assigned to the pool is retrieved. If the number of missions is not positive, the model skips the pool and considers the next one. An auxiliary array for storage of information on the disposition of the remainder of split missions is cleared (loops 83-87), and the number of links for this pool is retrieved.

The model considers each of the missions assigned to the pool (loop 92-150). First, a search is made for the link on which the mission is to occur. If the proper link is not found, a warning is printed and the model skips to consider the next pool. Next, the number of minutes that would be required to accomplish the mission is determined (loop 107-109). Then either the dispatch time or the departure time for the mission is determined. If it is a delivery mission,

*Refers to the line number as shown on the right hand side of the program listing in Appendix A.

the number of minutes required for the vehicles to return to the supply point after having delivered the cargo is dropped from the delivery time. On the other hand, if it is a pickup mission, the time for departure is determined. Next, regardless whether it is a pickup mission or a delivery mission, the time that the vehicles will be available to undertake another mission is determined and stored. The model then calculates the percent capacity of a single vehicle, in terms of cube as well as weight, that is required for the mission cargo, and the more stringent requirement is stored. Finally, after this information for all the missions has been determined, an auxiliary parameter for the sorting routine is set to one.

The event times (departures, deliveries, and returns) are then sorted according to chronological order. If two event times are the same and one is an availability time, the availability event is ranked before the departure or delivery event. After the events are sorted, the earliest delivery or departure time and the latest vehicle availability time are stored.

Before processing each of the events, some auxiliary parameters are initialized. In particular, the program initializes to zero counters for: the number of vehicles occupied performing missions, the number of missions transferred, and the maximum number of vehicles in the pool occupied performing missions throughout the simulation. In addition, an auxiliary parameter used in the event processing is initialized to zero. Next, the parameter for each mission that controls permission to split the mission is examined (loop 173-179). If the control integer "ISP" has been set to zero, all permission parameters are left to remain as read in. If the control integer is -1, permission is given so that any mission can be split when necessary. If, on the other hand, the control integer is +1, no mission will be allowed to be split. Finally, the counter for the total number of missions for the pool is initialized to the number of missions assigned.

Each event is now processed in chronological order (loop 189-487). The index for the event is retrieved and examined to determine whether the event is a mission or a return from a mission. If it is a return, the number of vehicles occupied is lessened by the number of vehicles returning and the model then considers the next event (lines 210-212). On the other hand, if it is a mission, the number of vehicles occupied is increased by the number of vehicles required to undertake the mission. If there are enough vehicles available, the mission is considered completed and the mission disposition code is set to one of several values indicating such. The counter for maximum vehicle utilization is then examined and is set to the larger of its current value or the number of vehicles occupied. The model then considers the next event.

If, however, the pool does not have enough vehicles to accomplish the entire mission, the counter indicating the number of vehicles occupied is reset to its former value and the current mission disposition code is retrieved. Program control then passes to one of five locations depending on the value of the current mission disposition code.

Suppose the mission is an originally assigned mission that may be split. If there are no vehicles at all available to undertake even part of the mission and the mission cannot be transferred, the array element indicating the percent of one vehicle required for the mission (which is really the number of vehicles required multiplied by 100) is reset to zero. The mission disposition code is set to a value indicating a mission skipped in full. After examining the maximum vehicle usage parameter, the next event is considered. If the mission can be transferred to another pool, the mission disposition code is set to a value indicating a mission transferred in full, the counter for the number of missions transferred out of the pool is increased by one, and the mission information is temporarily stored pending later execution of the mission transfer. After examining the maximum vehicle usage parameter, the next event is considered.

On the other hand, if there are some vehicles available to haul part of the mission, processing proceeds as follows. A mission disposition code is set to a value indicating a mission skipped in part, but this could be reset later if the remainder of the mission can be transferred. The counter for the number of missions is incremented by one to reflect the mission being split. The model calculates the amount of the cargo (in tons and cube) that the pool can haul with the vehicles available and stores the number of vehicles that will participate on the split mission (multiplied by 100). The indicator for the number of vehicles occupied is increased by the number of vehicles hauling the cargo for the split mission. Next, the information is stored for the split mission. In particular, the amount of tons and cube that will be delivered is stored and the mission disposition code for this new mission is set to a value indicating a mission completed in part.

For the remainder of the split mission, the amounts of undelivered tons and cube of the cargo are determined and this information is stored in an auxiliary array for later reporting. If the remainder of the mission can be transferred, the information is stored in row one of the array. If it cannot be transferred and thus must be skipped, the information is stored in row two. If the remainder of the mission cannot be transferred, the model simply examines the maximum vehicle usage parameter and proceeds to consider the next event. If the mission can be transferred, the counter for the number of missions transferred out of the pool is increased by one, the mission information (including the remaining tons and cube) is temporarily stored for later execution of the mission transfer, and the mission disposition code is

changed to indicate a mission transferred in part. Finally, after examining the maximum vehicle usage parameter, the next event is considered.

Suppose the mission is an originally assigned mission that may not be split. Since the model earlier determined that not enough vehicles are available to undertake the entire mission, only two possible outcomes remain: if the mission cannot be transferred, it will be skipped. To execute this, the model first resets to zero the indicator for the percent capacity of one vehicle in the original pool required for the mission. The mission disposition code is first set to a value indicating a mission skipped in full. If the mission cannot be transferred, the parameter tracking maximum vehicle usage is examined after which the next event is considered. However, if the mission can be transferred, the mission disposition code is changed to a value indicating a mission transferred in full. Then the indicator for the number of missions transferred out of the pool is incremented by one and the mission information is temporarily stored for later execution of transfer. Finally, after examining the maximum vehicle usage parameter, the next event is considered.

Suppose the mission is an additional mission assigned because of a mission transferred in part from another pool. Since the model earlier determined that not enough vehicles are available to undertake the mission, the mission will be skipped. That is, since the mission was transferred in from another pool and represents the remainder of a split mission, it will not be split further. So the transferred remainder must either be completed in full or be skipped in full. Accordingly, the model resets to zero the indicator for how much of the capacity of one vehicle is required for the mission (the number of vehicles required multiplied by 100) and sets the mission disposition code to a value indicating an additionally assigned (as opposed to an originally assigned mission) fractional mission that was skipped. After examining the maximum vehicle usage parameter, the next event is considered.

Suppose the mission is an additional mission assigned because of the transferal of an entire mission from another pool and that splitting is permissible. The model earlier determined that not enough vehicles are available to undertake the whole mission. If there are no vehicles at all available to undertake even part of the mission, the value indicating the percent of the capacity of one vehicle required for the mission is reset to zero. If the mission cannot be transferred to yet another pool, the mission disposition code is set to a value indicating an additionally assigned entire mission that was skipped in full. After examining the parameter indicating maximum vehicle usage, the model considers the next event. On the other hand, if the mission can be transferred, the mission disposition code is set to a value indicating a mission further transferred in full. After incrementing by one the counter for missions transferred out, the mission information is temporarily

stored pending later execution of transfer. Finally, after examining the indicator for maximum vehicle usage, the model considers the next event.

If there are some vehicles available to haul part of the mission cargo, processing proceeds as follows. A mission disposition code is set to a value indicating that an additionally assigned entire mission was skipped in part. This may be reset later if the remainder of the split mission can be transferred. The counter for the number of missions is incremented by one to reflect that the mission is being split. The model next determines how much of the cargo (in tons and cube) the pool can haul with the vehicles available and stores the number of vehicles that will participate on the split mission (multiplied by 100). The indicator for the number of vehicles occupied is increased by the number of vehicles hauling the cargo for the split mission. Since all the remaining available vehicles in the pool will be used for the split mission, this means that the indicator will be set to the total number of vehicles in the pool. Next, the information for the split mission is stored including the tons and cube of the cargo that will be delivered. The mission disposition code for this part of the split mission is set to a value indicating an additionally assigned mission completed in part.

For the remainder of the split mission, the undelivered tons and cube of the cargo are determined and stored in an auxiliary array for later reporting. If the remainder of the mission can be transferred to yet another pool, the information is stored in row three of the array. If it cannot be transferred and thus must be skipped, the information is stored in row four. If the remainder of the mission cannot be transferred, the model simply examines the indicator for maximum vehicle usage and proceeds to consider the next event. If the remainder of the mission can be transferred, the counter for the number of missions transferred out of the pool is increased by one, the mission information (including the remaining tons and cube) is temporarily stored pending later execution of transfer, and the mission disposition code is set to a value indicating an additionally assigned mission transferred in part. Finally, after examining the indicator for maximum vehicle usage, the next event is considered.

Suppose the mission is an additional mission assigned because of the transferal of an entire mission from another pool and that splitting is not permissible. The model determined earlier that not enough vehicles are available to undertake the whole mission. Consequently, only two possible mission outcomes remain: if the mission cannot be transferred, it will be skipped. The model first resets to zero the indicator for the percent capacity of a single vehicle required for the mission. Then the mission disposition code is first set to a value indicating an additionally assigned mission skipped in full. If the mission cannot be transferred to yet another pool,

the parameter indicating maximum vehicle usage is examined after which the next event is considered. However, if the mission can be transferred, the mission disposition code is set to a value indicating an additionally assigned mission transferred in full. Then the indicator for the number of missions transferred out of the pool is incremented by one and the mission information is temporarily stored pending later execution of mission transfers. Finally, after examining the parameter for maximum vehicle usage, the next event is considered. This exhausts the examination of all possible types of missions and their possible outcomes.

After processing all the events for the pool, the total number of missions assigned to the pool and the maximum number of vehicles in the pool that were occupied at any one time are stored. The model sets to zero the indicator for the percentage capacity of one vehicle required for the mission for all missions that were skipped in part (loop 493-496). The mission events are then resorted to bring into chronological order those additional missions formed because of missions that were split.

In the next program segment (lines 504-533), missions are transferred to other pools. If the pool currently being considered has no missions to be transferred out, this section is skipped. On the other hand, if the pool does have some missions to be transferred, the transfers are executed in the following way. Each of the pools, other than that for which missions are being transferred out, are examined in turn (loop 506-532). For each potential recipient, all of the missions to be transferred are examined (loop 509-531) for those which are be to assigned to the receiving pool. For each such mission, the counter for the number of missions assigned to the receiving pool is incremented by one and the mission information is transferred to the array containing information on missions assigned to the receiving pool (522-524). Before considering the next mission to be transferred to the receiving pool, the mission array element containing the number of the pool to which the mission can be transferred is set to zero (line 530).

The next program segment calculates the vehicle statistics for the pool whose missions have just been processed. Four auxiliary accumulating parameters are set to zero and the array to store the statistics is cleared (loop 543-545). Each of the missions assigned to the pool is considered (loop 547-579). If the mission was skipped or transferred, the next mission is considered. If the mission was undertaken by the pool, the link on which the mission took place is located (loop 549-552). Next, the fraction of the capacity of one vehicle required to haul the mission cargo is determined. (This could be a non-integral value such as 1.75.) This value is accumulated, as is the integral part of the value. The tons and cube of mission cargo are also accumulated. If the fraction of the capacity of one vehicle required for the mission cargo is non-integral, its value is

increased to the next higher integral value so that the actual number of vehicles sent on the mission can be determined.

> Example. Suppose the pool has two trucks of 10 tons capacity each and suppose a mission requires delivery of 17.5 tons of cargo. Then 1.75 of the capacity of one truck or 1.75 trucks are required for the mission. Since one cannot send out 3/4 of a truck, two trucks will be sent on the mission. In addition, we see that 2.5 tons of hauling capacity or 12.5 percent of the 20 tons total is unused. (For simplicity I have assumed that the cargo is such that the vehicles "weigh out" before they would "cube out" in the example.)

Next the following values are accumulated:

(a) vehicle-minutes travel time,

(b) vehicle-minutes delay time (departure point),

(c) vehicle-minutes delay time (intermediate point),

(d) vehicle-minutes delay time (return point).

And finally, the vehicle-minutes of load time and the vehicle-minutes of unload time are accumulated. Once the statistics have been totalled for all the missions undertaken by the pool, the following three values are calculated for the pool:

(a) total unused capacity in percent,

(b) cubic efficiency in percent,

(c) weight efficiency in percent.

At this point in the program (line 594), processing of the missions for the pool under current consideration is finished (end of loop 78-594) and program control returns to consider the next pool.

APPENDIX C

EXAMPLE CASE AND INPUT STRUCTURE

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APPENDIX C

EXAMPLE CASE AND INPUT STRUCTURE

In this appendix, a simple example case is developed and the corresponding entries for the links and missions arrays are shown. The appendix also includes a tabulation of the input cards for the case and an illustration of the stacking structure for input to the TVEM. Finally, some notes on the missions arrays are included.

Suppose that it is required to simulate approximately two days of operations of a vehicle fleet consisting of three pools. The first pool, identified as Pool Number 1, is organic to a 155mm howitzer battery. The second, Pool Number 5, is organic to a mechanized infantry battalion. The third pool, Pool Number 2, belongs to a 155mm artillery battalion headquarters and service battery and takes all missions that Pool Number 1 cannot complete.

Pool Number 1 consists of six 5-ton trucks, identified as Type 7, each of which has a cubic capacity of 100 cubic feet. The vehicles are co-located with the firing battery and supply the gun crews by traveling to an ammunition transfer point (ATP), loading, and traveling back to the battery where the ammunition is unloaded. The average speed of the vehicles is 20 kilometers per hour empty and 18 kilometers per hour when carrying a load. The one-way distance from the battery to the ATP is only 20 kilometers, but it increases to 30 kilometers at 0800 hours on the second day when the battery is ordered to a new firing position that is ten kilometers forward. The pool is required to support the relocation of the battery by towing the howitzers and hauling the basic load of ammunition for each howitzer which is five tons and occupies 75 cubic feet. There are six howitzers in a 155mm battery. The pool is also required to deliver 15 tons of ammunition to the battery at 0600 and at 1430 hours on each of the two days. The packaged volume of 155mm ammunition is 15 cubic feet per ton. Automatic loading equipment at the ATP can load the trucks in 20 minutes, but loading or unloading by the truck crews at the firing position invariably requires 30 minutes. Except for the mission to support the battery relocation, all of the missions can be split or transferred to the service battery pool whenever necessary. Missions that can be split are denoted by an entry of 1 in field eight of the missions array. If a mission cannot be split, a 2 should be placed in field eight.

The pool characteristics which are to be punched in 5I5 format on the first input card for this pool are:

pool number - 1,

vehicle type - 7,

payload (short tons x 10) - 50,

capacity (cube) - 100,

number of vehicles - 6.

The entries for the links and missions array for Pool Number 1 are shown in Figure C-1.

Pool Number 5, which supports the mechanized infantry battalion, operates out of the battalion field trains area. The vehicles wait, fully loaded, at the pool for resupply requests from the maneuver battalion. Upon receiving a request, the trucks travel to the battalion, unload, travel back to a supply point to reload, and return to the pool. The distance from the field trains area to the maneuver battalion is five kilometers, but the return portion of the link involves a 15 kilometer trip to the supply point followed by an additional ten kilometer trip to the pool. The pool consists of eight 2 1/2 ton trucks of type 10, each of which has a cubic capacity of 75 cubic feet. The average speed of the trucks is 50 kilometers per hour unloaded and 30 kilometers per hour loaded. Loading or unloading requires 15 minutes. Requests from the maneuver battalion require that 15 tons (450 cubic feet) of supplies be dispatched at 0930 hours on the first day and at 0830 on the second day. It is also necessary to dispatch a mission to haul five tons (300 cubic feet) on each of the two days at 1200 hours. After a slack period, the pool must dispatch a mission to deliver ten tons (450 cubic feet) each evening at 2045 hours to the maneuver battalion. The pool has no higher echelon pool to which missions can be transferred, but the missions can be split with the exception of the daily noontime mission.

The first input card for this pool gives the pool characteristics punched in 5I5 format. The characteristics are:

pool number - 5,

vehicle type - 10,

payload (short tons x 10) - 25,

capacity (cube) - 75,

number of vehicles - 8.

The entries for the links and missions arrays for Pool Number 5 are shown in Figure C-2.

The third pool, Pool Number 2, consists of six trucks of the same type as are in Pool Number 1. Its primary mission is to support the pool that is organic to the 155mm howitzer battery by taking all missions that the firing battery pool cannot accomplish. Its secondary mission is to procure all classes of supplies and deliver them to the firing battery. Accordingly, the pool has only two assigned missions per day. The first is

LINKS ARRAY

LINK NO.	DELAY TIME	LOAD TIME OR ZERO	TRAVEL TIME	DELAY TIME	UNLOAD OR LOAD TIME	TRAVEL TIME	DELAY TIME	LOAD, UNLOAD OR ZERO
1.	0.	0.	60.	0.	20.	67.	0.	30.
2.	0.	30.	33.	0.	30.	0.	0.	0.
3.	0.	0.	90.	0.	20.	100.	0.	30.
-11.								

MISSIONS ARRAY

LINK NO.	DAY	DEPARTURE TIME	DELIVERY TIME	SHORT TONS × 10	CUBIC FEET	TRANSFER POOL NO.	SPLITTING PARAMETER
1.	1.	0.	600.	150.	225.	2.	1.
1.	1.	0.	1430.	150.	225.	2.	1.
1.	2.	0.	600.	150.	225.	2.	1.
2.	2.	800.	0.	300.	450.	0.	2.
3.	2.	0.	1430.	150.	225.	2.	1.
-12.							

Figure C-1. Links and Missions Arrays for Pool Number 1.

LINKS ARRAY

LINK NO.	DELAY TIME	LOAD TIME OR ZERO	TRAVEL TIME	DELAY TIME	UNLOAD LOAD OR TIME	TRAVEL TIME	DELAY TIME	LOAD, UNLOAD OR ZERO
4.	0.	0.	10.	0.	15.	18.	35.	0.
-21.								

MISSIONS ARRAY

LINK NO.	DAY	DEPARTURE TIME	DELIVERY TIME	SHORT TONS × 10	CUBIC FEET	TRANSFER POOL NO.	SPLITTING PARAMETER
4.	1.	930.	0.	150.	450.	0.	1.
4.	1.	1200.	0.	50.	300.	0.	2.
4.	1.	0.	2045.	100.	450.	0.	1.
4.	2.	830.	0.	150.	450.	0.	1.
4.	2.	1200.	0.	50.	300.	0.	2.
4.	2.	0.	2045.	100.	450.	0.	1.
-22.							

Figure C-2. Links and Missions Arrays for Pool Number 5.

a mail delivery to the firing battery which departs at 0900 hours each day. The second mission is to draw Class VI rations and deliver them to the firing battery. In order to ensure the high morale of the firing crews and the personnel in the fire direction center, these rations must arrive at the battery position no later than 1730 hours each day. The cargo for both of these daily missions is negligible in terms of tonnage and cube, and only five minutes is required to load and unload the cargo. The one-way distance from the service battery to the firing battery is only five kilometers until 0800 hours on the second day when the distance increases to 12 kilometers because of the movement of the firing battery. The average speed of the vehicles is 20 kilometers per hour for the two assigned missions. These missions can neither be transferred to another pool nor can they be split. The service battery pool is located adjacent to an ATP. If a mission is transferred from Pool Number 1, the vehicles will load, travel to the firing battery, unload, and return to the service battery pool.

The first input card for this pool consists of the pool characteristics which are the same as those for Pool Number 1. However, the first value on the card, which is the pool identification number, is 2. The entries for the links and missions arrays for Pool Number 2 are given in Figure C-3.

Because this pool can receive missions transferred from Pool Number 1, its input data must not be placed before that of Pool Number 1. Accordingly, the data for Pool Number 2 can be placed in second or third position.

The first input card for the entire input deck must give the number of pools to be simulated which is three for this example. The value should be punched in I5 format in the first field. The last card of the input deck should contain a negative integer punched in the first five columns. All entries in the links and missions arrays must be punched in F8.0 format with all decimal points punched. Figure C-4 shows the general structure of input for the TVEM. The tabulation of the input cards for the example case is given below.

LINKS ARRAY

LINK NO.	DELAY TIME	LOAD TIME OR ZERO	TRAVEL TIME	DELAY TIME	UNLOAD OR LOAD TIME	TRAVEL TIME	DELAY TIME	LOAD, UNLOAD OR ZERO
1.	0.	20.	17.	0.	30.	15.	0.	0.
3.	0.	20.	40.	0.	30.	36.	0.	0.
5.	0.	5.	15.	0.	5.	15.	0.	0.
6.	0.	5.	36.	0.	5.	36.	0.	0.
-31.								

MISSIONS ARRAY

LINK NO.	DAY	DEPARTURE TIME	DELIVERY TIME	SHORT TONS x 10	CUBIC FEET	TRANSFER POOL NO.	SPLITTING PARAMETER
5.	1.	900.	0	1.	1.	0.	2.
5.	1.	0.	1730.	1.	1.	0.	2.
6.	2.	900.	0	1.	1.	0.	2.
6.	2.	0.	1730.	1.	1.	0.	2.
-32.							

Figure C-3 Links and Missions Arrays for Pool Number 2.

********** INPUT LISTING FOR EXAMPLE CASE **********

```
    3
    1     7    50   100      6
 1.       0.        0.       60.      0.       20.      67.      0.       30.
 2.       0.       30.       33.      0.       30.       0.      0.        0.
 3.       0.        0.       90.      0.       20.     100.      0.       30.
-11.
 1.       1.        0.      600.    150.      225.       2.      1.
 1.       1.        0.     1430.    150.      225.       2.      1.
 1.       2.        0.      600.    150.      225.       2.      1.
 2.       2.      800.        0.    300.      450.       0.      2.
 3.       2.        0.     1430.    150.      225.       2.      1.
-12.
    5    10.   25.   75.     8
 4.       0.        0.       10.      0.       15.      18.     35.       0.
-21.
 4.       1.      930.        0.    150.      450.       0.      1.
 4.       1.     1200.        0.     50.      300.       0.      2.
 4.       1.        0.     2045.    100.      450.       0.      1.
 4.       2.      830.        0.    150.      450.       0.      1.
 4.       2.     1200.        0.     50.      300.       0.      2.
 4.       2.        0.     2045.    100.      450.       0.      1.
-22.
    2     7    50   100      6
 1.       0.       20.       17.      0.       30.      15.      0.       0.
 3.       0.       20.       40.      0.       30.      36.      0.       0.
 5.       0.        5.       15.      0.        5.      15.      0.       0.
 6.       0.        5.       36.      0.        5.      36.      0.       0.
-31.
 5.       1.      900.        0.      1.        1.       0.      2.
 5.       1.        0.     1730.      1.        1.       0.      2.
 6.       2.      900.        0.      1.        1.       0.      2.
 6.       2.        0.     1730.      1.        1.       0.      2.
-32.
-9999
```

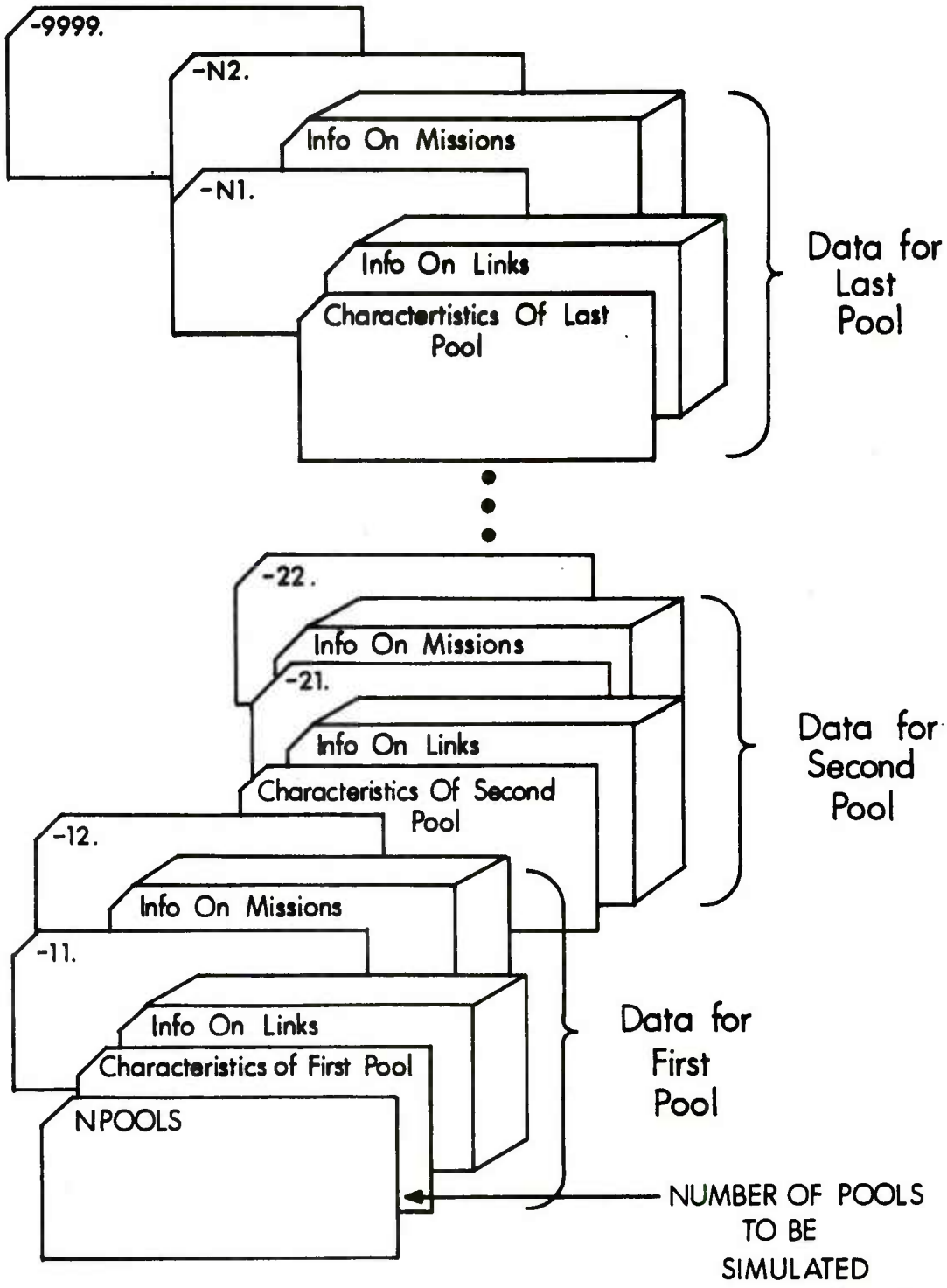

Figure C-4. Input Deck Structure.

Notes On Missions Array

(1) Mission times. The times should be given in 24-hour clock time.

(2) Mission days. Do not input the first day of simulation as day zero. Instead, start with day one.

(3) Mission transfer code. Field seven gives the pool to which the mission can be transferred. Pool identification numbers should be one or two digit, positive numbers. A zero indicates that the mission will not be transferred. An entry of the form "402" signifies that the mission could first be transferred to pool number 2. If pool number 2 cannot complete the mission, it will then be transferred to pool number 4.

(4) Mission transfer. On input for a pool, mission transfers must be coded so as to transfer the missions to pools that will be simulated later in the sequence of pool processing. For example, suppose there are three pools for which the data are input in the order: Pool 1, Pool 2, Pool 3. Missions in Pool 1 could be transferred to either Pool 2 or Pool 3, or both. On the other hand, missions assigned to Pool 2 can be transferred only to Pool 3, not to Pool 1. Moreover, missions assigned to Pool 3 cannot be transferred anywhere.

(5) Mission transfer. If a mission is input for a pool in such a way that it could be transferred to another pool, provision for the link on which the mission is to occur must be made in the receiving pool. Of course, it is to be expected that the travel times, delay times, etc., could be quite different from those in the link input for the first pool.

(6) Mission splitting parameter. The parameter for splitting missions is given in field eight of the missions array. An entry of "1" allows the mission to be split if the pool cannot complete the mission. An entry of "2" denies permission to split the mission.

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APPENDIX D

TEST CASE INPUT AND OUTPUT

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APPENDIX D

TEST CASE INPUT AND OUTPUT

Because the example case given in Appendix C is rather simple in terms of the output that would be generated by the TVEM, it was decided to report on a more complicated test case in this Appendix. The test case whose input and output are described herein was that which was used to test the translated version of the model. It was designed so as to exercise the model quite fully and, hence, yields output that is much more interesting than that which would result from the simulation of the example case in Appendix C.

Test Case Input

According to the first input card, the data for this test case consist of information on five vehicle pools. The important points regarding the input data for each of the vehicle pools are given in the following paragraphs.

The second input card identifies the first pool as Pool Number 1. This pool consists of two trucks of Type Number 7 each of which can haul 1/2 ton or 100 cubic feet of cargo. The next six cards give the information on the links on which any missions assigned to this pool are to occur. For the first three links we see that the zeros in field nine denote that missions on these links will be delivery missions. On the other hand, the zeros in field three for the last three links denote that missions on these links will be pickup missions. Finally, the data for the links are terminated by a negative number in the first field of the ninth card.

The next nine cards comprise the schedule of missions assigned to the pool. The missions are scheduled to occur at various times over a two day period. Notice that if the departure time is specified for a mission, the value in the field for the delivery time is zero, and vice-versa. All of the missions except the third, eighth, and ninth can be split if necessary. With the exception of the first, fourth, and seventh missions, all can be transferred to another pool if necessary. In that event the missions will be transferred to a pool identified as Pool Number 4. If Pool Number 4 cannot complete these missions, they will be transferred to Pool Number 5. However, with the override in effect to prevent this, any such missions will be skipped by Pool Number 4. The amounts of tonnage and volume of the cargo for each mission are given in fields five and six, respectively. For example, for the first listed mission, one-tenth ton of cargo occupying ten cubic feet must be delivered on the first day at 1:27 A.M. The mission cannot be transferred, but may be split. (Because of the capacity of the two trucks assigned to this pool compared to the small amount of cargo for this mission, it will not be split, however.) Finally, the mission is to be hauled on Link Number 1. According to the second listed mission, one short ton of cargo occupying 70 cubic feet is to be delivered on Link Number 2. The vehicles are to depart from the pool at 8:30 A.M. on the first day. The mission can be split if only one of the two vehicles is available at the scheduled time and the remaining half-ton of mission cargo would be transferred to Pool Number 4. Or, if neither of the vehicles is available, the entire mission will be transferred to Pool Number 4. The remaining seven missions are similar. The mission schedule is terminated by the negative number in the first field of the nineteenth card. This concludes the input data for the first pool.

The data for the second and third pools follow those for the first pool and are of a similar nature. The data for Pool Number 4, however, are somewhat different. Only three missions are assigned to this pool, all of which are to occur on Link Number 16. However, the list of links contains data for sixteen links. This reflects the fact that the pool might be

assigned additional missions in support of the first three vehicle pools. Because any mission transferred to Pool Number 4 could be designated to occur on any one of the other fifteen links, provision for this situation must be made by including data for them in the list of links.

Pool Number 5, with five trucks of two tons and 500 cubic feet capacity each, has no assigned missions. However, without the override that prevents secondary transfer of missions, additional missions could be assigned to this pool resulting from transferral of some of the missions that were first transferred to Pool Number 4 from those that were originally assigned to the first three pools. Therefore, data are provided for sixteen links although it was not necessary to do so. With no missions originally assigned and no possibility of additional mission assignments, our test case results for Pool Number 5 should show that no missions were undertaken.

The input data for the test case simulation of five pools is terminated by a card with a negative integer in the first five columns. Without the terminator card it would be possible to input data for a second case to be run as a separate simulation in the same run stream.

```
    5
    1     7     5   100     2
 1.       1.          1.       1.       6.       6.       1.       6.       0.
 2.       2.          2.       2.       5.       5.       2.       5.       0.
 3.       3.          3.       3.       4.       4.       3.       4.       0.
 4.       4.          0.       4.       3.       3.       4.       3.       3.
 5.       5.          0.       5.       2.       2.       5.       2.       2.
 6.       6.          0.       6.       1.       1.       6.       1.       1.
-100001.
  1.      1.          0.     127.       1.      10.       0.       1.
  2.      1.        830.       0.      10.      70.     504.       1.
  4.      1.          0.     200.       1.     300.     504.       2.
  5.      1.          0.     115.       3.      30.       0.       1.
  6.      1.        115.       0.      30.     150.     504.       1.
  1.      2.        815.       0.      20.     100.     504.       1.
  3.      2.          0.     115.       2.      20.       0.       1.
  4.      2.        330.       0.      15.      50.     504.       2.
  4.      2.          0.     135.       5.     100.     504.       2.
-100002.
    2     8    10   200     5
 7.      11.         11.      10.       7.      20.      10.       5.       0.
 8.      10.         10.      15.       8.      15.      15.       5.       0.
 9.       9.          9.      10.       9.      15.      10.       5.       0.
10.       8.          0.      15.      10.      20.      15.       5.       8.
11.       7.          0.      10.      11.      20.      10.       5.       7.
-200001.
 7.       1.         30.       0.       5.     100.       0.       2.
11.       1.          0.     200.      20.     450.     504.       1.
 8.       1.        530.       0.      50.     800.     504.       1.
10.       1.          0.    1000.     100.    1000.     504.       2.
 9.       1.       1400.       0.      50.    1100.     504.       2.
 7.       2.        500.       0.     150.    1000.     504.       1.
11.       2.          0.    1100.      15.     400.     504.       1.
 8.       2.       1230.       0.      25.     400.     504.       1.
10.       2.          0.    1615.      40.     850.     504.       1.
 9.       2.       2000.       0.      30.     500.       0.       2.
 7.       3.          0.     900.      80.    1500.     504.       1.
-200002.
    3     9    10   200     5
12.      15.         15.      10.      12.       5.      10.       5.       0.
13.      14.         14.      15.      13.       7.      15.       5.       0.
14.      13.          0.      10.      14.       5.      10.       5.      13.
15.      12.          0.      15.      15.       7.      15.       5.      12.
-300001.
12.       0.          0.    1700.       5.      50.     504.       2.
13.       0.          0.    2000.      40.     100.     504.       2.
14.       0.        830.       0.      50.      50.     504.       1.
15.       0.       1400.       0.     100.     100.     504.       1.
12.       0.          0.    2400.      20.      50.     504.       1.
13.       1.          0.     100.      80.     100.     504.       1.
14.       1.       1000.       0.      30.      50.     504.       1.
15.       1.       1300.       0.      10.     100.     504.       1.
12.       2.          0.     500.     100.      50.     504.       1.
13.       2.          0.     600.      20.     200.     504.       1.
14.       2.          0.     900.      40.     100.     504.       1.
```

```
 15.      2.       1400.    0.       50.      200.     504.     1.
 12.      3.       30.      0.       30.      100.     504.     1.
 12.      3.       100.     0.       150.     1000.    504.     1.
 12.      3.       115.     0.       150.     1000.    504.     1.
 12.      3.       130.     0.       200.     1200.    504.     2.
 12.      3.       230.     0.       200.     1200.    504.     2.
 12.      3.       300.     0.       150.     1000.    504.     1.
-300002.
     4    10    20   500     6
 1.       0.       0.       5.       0.       7.       5.       15.      0.
 2.       0.       0.       16.      0.       8.       6.       8.       0.
 3.       0.       0.       7.       0.       9.       7.       15.      0.
 4.       0.       0.       18.      0.       9.       8.       9.       0.
 5.       0.       0.       9.       0.       8.       9.       15.      0.
 6.       0.       0.       20.      0.       7.       10.      7.       0.
 7.       0.       0.       10.      0.       6.       10.      15.      0.
 8.       0.       0.       19.      0.       6.       9.       6.       0.
 9.       0.       0.       8.       0.       7.       8.       15.      0.
 10.      0.       0.       17.      0.       8.       7.       8.       0.
 11.      0.       0.       6.       0.       9.       6.       15.      0.
 12.      0.       0.       15.      0.       10.      5.       10.      0.
 13.      0.       0.       5.       0.       5.       5.       15.      0.
 14.      0.       0.       20.      0.       5.       10.      5.       0.
 15.      0.       0.       15.      0.       5.       10.      15.      0.
 16.      0.       0.       10.      0.       5.       10.      0.       5.
-400001.
 16.      0.       800.     0.       5.       100.     0.       2.
 16.      1.       800.     0.       5.       100.     0.       2.
 16.      2.       800.     0.       5.       100.     0.       2.
-400002.
     5    10    20   500     5
 1.       0.       0.       5.       0.       7.       5.       15.      0.
 2.       0.       0.       16.      0.       8.       6.       8.       0.
 3.       0.       0.       7.       0.       9.       7.       15.      0.
 4.       0.       0.       18.      0.       9.       8.       9.       0.
 5.       0.       0.       9.       0.       8.       9.       15.      0.
 6.       0.       0.       20.      0.       7.       10.      7.       0.
 7.       0.       0.       10.      0.       6.       10.      15.      0.
 8.       0.       0.       19.      0.       6.       9.       6.       0.
 9.       0.       0.       8.       0.       7.       8.       15.      0.
 10.      0.       0.       17.      0.       8.       7.       8.       0.
 11.      0.       0.       6.       0.       9.       6.       15.      0.
 12.      0.       0.       15.      0.       10.      5.       10.      0.
 13.      0.       0.       5.       0.       5.       5.       15.      0.
 14.      0.       0.       20.      0.       5.       10.      5.       0.
 15.      0.       0.       15.      0.       5.       10.      15.      0.
 16.      0.       0.       10.      0.       5.       10.      5.       0.
-500001.
-500002.
-9999
```

Test Case Output

The first five pages of output from the test case simulation are listings of the input data for each of the five pools, to include the pool characteristics and the links and missions arrays for each.

The next five pages of output give the simulation results by pool. Because Pool Number 4 is, perhaps, the most interesting, its output will be discussed in detail. In addition to a short listing of the characteristics of the pool, the output for each pool consists of a Mission Status Report and a Vehicle Status Report.

In the Mission Status Report, the information concerning the disposition of missions is divided into two mission categories: original missions assigned and additional missions assigned. For this pool three missions were originally assigned and seventeen were additionally assigned. The three original missions required a total of 1.5 short tons to be hauled and the cargo occupied 300 cubic feet total volume. The 1.5 short tons represents 1.2 percent of the total mission tonnage assigned in both categories and the 300 cubic feet represents 3.2 percent of the total cargo volume. All three original missions were completed in full.

The additional missions are subdivided into two categories: fractional missions and whole missions. The fractional missions result from the transferal from the first three pools of the remainders of split missions. Of the seventeen additional missions, nine were fractional missions and the remaining eight were whole missions. Of the nine fractional missions, seven were completed and two were not. Because fractional missions can neither be split further nor transferred to another pool, it was necessary to skip these two missions. Of the eight whole missions, five were completed in full and two were skipped in full. The remaining mission was completed in part and the remainder of this split mission was skipped. Because of the override preventing transferal of additionally assigned missions to another pool, the whole missions that could not be completed were skipped as was the remainder of the split mission.

As in the case of original missions assigned, information is printed for each of the disposition categories under the additional missions assigned. This consists of the number of short tons and volume of cargo as well as the percentages of the totals that each represents.

Under the Vehicle Status Report the first item of information reported is the number of vehicles used. Here we see that during at least some portion of the simulation of Pool Number 4, all six trucks were occupied performing missions. The percent unused capacity, which is seventeen percent for this pool, is the per-mission average percent of underutilization of the hauling capacity of the trucks. A truck is underutilized whenever the amount of cargo specified by a mission request requires the dispatching of an additional truck, even though only a fraction of its capacity is required to complete the mission. The percent cubic efficiency and percent

vehicle payload efficiency represent the per-mission average degree of mismatch between the configuration of the truck in terms of its weight versus volume capacity and the weight versus volume of the cargo to be hauled.

The last table in the Vehicle Status Report gives the total number of vehicle-hours that the trucks spent in each of the activity categories shown. Notice that many of the six vehicles in this pool spent a large amount of time idle. Because the number of hours from first departure to last desired arrival was 73.42, the total number of vehicle-hours amounts to 440.42. Therefore, the 415.4 vehicle-hours in the idle category represents 94.3 percent of the total. Recalling from the Mission Status Report that sixteen missions were completed, we see that the 415.4 vehicle-hours in the idle category represent an average of 25.96 vehicle-hours per mission. The percentages and per-mission averages for the other six activity categories are determined similarly.

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POOL NUMBER	1
VEHICLE NUMBER	7
VEH. PAY.(STX10)	5
VEH. CUBIC CAP.	100
NO. OF VEHICLES	2
NUMBER OF LINKS	6
NO. OF MISSIONS	9

LINKS

T(R,C)	C1	C2	C3	C4	C5	C6	C7	C8	C9
R 1 /	1.0	1.0	1.0	1.0	6.0	6.0	1.0	6.0	0.0
R 2 /	2.0	2.0	2.0	2.0	5.0	5.0	2.0	5.0	0.0
R 3 /	3.0	3.0	3.0	3.0	4.0	4.0	3.0	4.0	0.0
R 4 /	4.0	4.0	0.0	4.0	3.0	3.0	4.0	3.0	3.0
R 5 /	5.0	5.0	0.0	5.0	2.0	2.0	5.0	2.0	2.0
R 6 /	6.0	6.0	0.0	6.0	1.0	1.0	6.0	1.0	1.0

MISSIONS

A(R,C)	C1	C2	C3	C4	C5	C6	C7	C8
R 1 /	1.0	1.0	0.0	127.0	1.0	10.0	0.0	1.0
R 2 /	2.0	1.0	830.0	0.0	10.0	70.0	504.0	1.0
R 3 /	4.0	1.0	0.0	200.0	1.0	300.0	504.0	2.0
R 4 /	5.0	1.0	0.0	115.0	3.0	30.0	0.0	1.0
R 5 /	6.0	1.0	115.0	0.0	30.0	150.0	504.0	1.0
R 6 /	1.0	2.0	815.0	0.0	20.0	100.0	504.0	1.0
R 7 /	3.0	2.0	0.0	115.0	2.0	20.0	0.0	1.0
R 8 /	4.0	2.0	330.0	0.0	15.0	50.0	504.0	2.0
R 9 /	4.0	2.0	0.0	135.0	5.0	100.0	504.0	2.0

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POOL NUMBER	2
VEHICLE NUMBER	8
VEH. PAY.(STX10)	10
VEH. CUBIC CAP.	200
NO. OF VEHICLES	5
NUMBER OF LINKS	5
NO. OF MISSIONS	11

LINKS

T(R,C)	C1	C2	C3	C4	C5	C6	C7	C8	C9
R 1 /	7.0	11.0	11.0	10.0	7.0	20.0	10.0	5.0	0.0
R 2 /	8.0	10.0	10.0	15.0	8.0	15.0	15.0	5.0	0.0
R 3 /	9.0	9.0	9.0	10.0	9.0	15.0	10.0	5.0	0.0
R 4 /	10.0	8.0	0.0	15.0	10.0	20.0	15.0	5.0	8.0
R 5 /	11.0	7.0	0.0	10.0	11.0	20.0	10.0	5.0	7.0

MISSIONS

A(R,C)	C1	C2	C3	C4	C5	C6	C7	C8
R 1 /	7.0	1.0	30.0	0.0	5.0	100.0	0.0	2.0
R 2 /	11.0	1.0	0.0	200.0	20.0	450.0	504.0	1.0
R 3 /	8.0	1.0	530.0	0.0	50.0	800.0	504.0	1.0
R 4 /	10.0	1.0	0.0	1000.0	100.0	1000.0	504.0	2.0
R 5 /	9.0	1.0	1400.0	0.0	50.0	1100.0	504.0	2.0
R 6 /	7.0	2.0	500.0	0.0	150.0	1000.0	504.0	1.0
R 7 /	11.0	2.0	0.0	1100.0	15.0	400.0	504.0	1.0
R 8 /	8.0	2.0	1230.0	0.0	25.0	400.0	504.0	1.0
R 9 /	10.0	2.0	0.0	1615.0	40.0	850.0	504.0	1.0
R 10 /	9.0	2.0	2000.0	0.0	30.0	500.0	0.0	2.0
R 11 /	7.0	3.0	0.0	900.0	80.0	1500.0	504.0	1.0

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POOL NUMBER	3
VEHICLE NUMBER	9
VEH. PAY.(STX10)	10
VEH. CUBIC CAP.	200
NO. OF VEHICLES	5
NUMBER OF LINKS	4
NO. OF MISSIONS	18

LINKS

T(R,C)	C1	C2	C3	C4	C5	C6	C7	C8	C9
R 1 /	12.0	15.0	15.0	10.0	12.0	5.0	10.0	5.0	0.0
R 2 /	13.0	14.0	14.0	15.0	13.0	7.0	15.0	5.0	0.0
R 3 /	14.0	13.0	0.0	10.0	14.0	5.0	10.0	5.0	13.0
R 4 /	15.0	12.0	0.0	15.0	15.0	7.0	15.0	5.0	12.0

MISSIONS

A(R,C)	C1	C2	C3	C4	C5	C6	C7	C8
R 1 /	12.0	0.0	0.0	1700.0	5.0	50.0	504.0	2.0
R 2 /	13.0	0.0	0.0	2000.0	40.0	100.0	504.0	2.0
R 3 /	14.0	0.0	830.0	0.0	50.0	50.0	504.0	1.0
R 4 /	15.0	0.0	1400.0	0.0	100.0	100.0	504.0	1.0
R 5 /	12.0	0.0	0.0	2400.0	20.0	50.0	504.0	1.0
R 6 /	13.0	1.0	0.0	100.0	80.0	100.0	504.0	1.0
R 7 /	14.0	1.0	1000.0	0.0	30.0	50.0	504.0	1.0
R 8 /	15.0	1.0	1300.0	0.0	10.0	100.0	504.0	1.0
R 9 /	12.0	2.0	0.0	500.0	100.0	50.0	504.0	1.0
R 10 /	13.0	2.0	0.0	600.0	20.0	200.0	504.0	1.0
R 11 /	14.0	2.0	0.0	900.0	40.0	100.0	504.0	1.0
R 12 /	15.0	2.0	1400.0	0.0	50.0	200.0	504.0	1.0
R 13 /	12.0	3.0	30.0	0.0	30.0	100.0	504.0	1.0
R 14 /	12.0	3.0	100.0	0.0	150.0	1000.0	504.0	1.0
R 15 /	12.0	3.0	115.0	0.0	150.0	1000.0	504.0	1.0
R 16 /	12.0	3.0	130.0	0.0	200.0	1200.0	504.0	2.0
R 17 /	12.0	3.0	230.0	0.0	200.0	1200.0	504.0	2.0
R 18 /	12.0	3.0	300.0	0.0	150.0	1000.0	504.0	1.0

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POOL NUMBER	4
VEHICLE NUMBER	10
VEH. PAY.(STX10)	20
VEH. CUBIC CAP.	500
NO. OF VEHICLES	6
NUMBER OF LINKS	16
NO. OF MISSIONS	3

LINKS

T(R,C)	C1	C2	C3	C4	C5	C6	C7	C8	C9
R 1	1.0	0.0	0.0	5.0	0.0	7.0	5.0	15.0	0.0
R 2	2.0	0.0	0.0	16.0	0.0	8.0	6.0	8.0	0.0
R 3	3.0	0.0	0.0	7.0	0.0	9.0	7.0	15.0	0.0
R 4	4.0	0.0	0.0	18.0	0.0	9.0	8.0	9.0	0.0
R 5	5.0	0.0	0.0	9.0	0.0	8.0	9.0	15.0	0.0
R 6	6.0	0.0	0.0	20.0	0.0	7.0	10.0	7.0	0.0
R 7	7.0	0.0	0.0	10.0	0.0	6.0	10.0	15.0	0.0
R 8	8.0	0.0	0.0	19.0	0.0	6.0	9.0	6.0	0.0
R 9	9.0	0.0	0.0	8.0	0.0	7.0	8.0	15.0	0.0
R 10	10.0	0.0	0.0	17.0	0.0	8.0	7.0	8.0	0.0
R 11	11.0	0.0	0.0	6.0	0.0	9.0	6.0	15.0	0.0
R 12	12.0	0.0	0.0	15.0	0.0	10.0	5.0	10.0	0.0
R 13	13.0	0.0	0.0	5.0	0.0	5.0	5.0	15.0	0.0
R 14	14.0	0.0	0.0	20.0	0.0	5.0	10.0	5.0	0.0
R 15	15.0	0.0	0.0	15.0	0.0	5.0	10.0	15.0	0.0
R 16	16.0	0.0	0.0	10.0	0.0	5.0	10.0	0.0	5.0

MISSIONS

A(R,C)	C1	C2	C3	C4	C5	C6	C7	C8
R 1	16.0	0.0	800.0	0.0	5.0	100.0	0.0	2.0
R 2	16.0	1.0	800.0	0.0	5.0	100.0	0.0	2.0
R 3	16.0	2.0	800.0	0.0	5.0	100.0	0.0	2.0

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POOL NUMBER	5
VEHICLE NUMBER	10
VEH. PAY.(STX10)	20
VEH. CUBIC CAP.	500
NO. OF VEHICLES	5
NUMBER OF LINKS	16
NO. OF MISSIONS	0

LINKS

T(R,C)	C1	C2	C3	C4	C5	C6	C7	C8	C9
R 1 /	1.0	0.0	0.0	5.0	0.0	7.0	5.0	15.0	0.0
R 2 /	2.0	0.0	0.0	16.0	0.0	8.0	6.0	8.0	0.0
R 3 /	3.0	0.0	0.0	7.0	0.0	9.0	7.0	15.0	0.0
R 4 /	4.0	0.0	0.0	18.0	0.0	9.0	8.0	9.0	0.0
R 5 /	5.0	0.0	0.0	9.0	0.0	8.0	9.0	15.0	0.0
R 6 /	6.0	0.0	0.0	20.0	0.0	7.0	10.0	7.0	0.0
R 7 /	7.0	0.0	0.0	10.0	0.0	6.0	10.0	15.0	0.0
R 8 /	8.0	0.0	0.0	19.0	0.0	6.0	9.0	6.0	0.0
R 9 /	9.0	0.0	0.0	8.0	0.0	7.0	8.0	15.0	0.0
R 10 /	10.0	0.0	0.0	17.0	0.0	8.0	7.0	8.0	0.0
R 11 /	11.0	0.0	0.0	6.0	0.0	9.0	6.0	15.0	0.0
R 12 /	12.0	0.0	0.0	15.0	0.0	10.0	5.0	10.0	0.0
R 13 /	13.0	0.0	0.0	5.0	0.0	5.0	5.0	15.0	0.0
R 14 /	14.0	0.0	0.0	20.0	0.0	5.0	10.0	5.0	0.0
R 15 /	15.0	0.0	0.0	15.0	0.0	5.0	10.0	15.0	0.0
R 16 /	16.0	0.0	0.0	10.0	0.0	5.0	10.0	5.0	0.0

MISSIONS

A(R,C)	C1	C2	C3	C4	C5	C6	C7	C8

NO MISSIONS ASSIGNED

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OUTPUT FOR POOL NO.	1
VEHICLE NUMBER	7
VEHICLE PAYLOAD (STX10)	5
VEHICLE CUBIC CAPACITY	100
NO. OF VEHICLES IN POOL	2

M I S S I O N   S T A T U S   R E P O R T

	NO.	S.T.	% ST	100 CF	% CF
1) ORIGINAL MISSIONS ASSIGNED	9.	8.7	100.0	8.3	100.0
COMPLETED IN FULL	5.	2.1	24.1	2.3	27.7
CONTRACTED IN FULL	2.	1.6	18.4	3.5	42.2
SKIPPED IN FULL	0.	0.0	0.0	0.0	0.0
COMPLETED IN PART	2.	1.5	17.2	.8	9.0
CONTRACTED IN PART	2.	3.5	40.2	1.8	21.1
SKIPPED IN PART	0.	0.0	0.0	0.0	0.0
2) ADDITIONAL MISSIONS ASSIGNED	0.	0.0	0.0	0.0	0.0
FRACTIONAL MISSIONS	0.	0.0	0.0	0.0	0.0
COMPLETED	0.	0.0	0.0	0.0	0.0
SKIPPED	0.	0.0	0.0	0.0	0.0
WHOLE MISSIONS	0.	0.0	0.0	0.0	0.0
COMPLETED IN FULL	0.	0.0	0.0	0.0	0.0
CONTRACTED IN FULL	0.	0.0	0.0	0.0	0.0
SKIPPED IN FULL	0.	0.0	0.0	0.0	0.0
COMPLETED IN PART	0.	0.0	0.0	0.0	0.0
CONTRACTED IN PART	0.	0.0	0.0	0.0	0.0
SKIPPED IN PART	0.	0.0	0.0	0.0	0.0

V E H I C L E   S T A T U S   R E P O R T

NO. OF VEHICLES USED	2
UNUSED CAPACITY (%)	2D.
VEHICLE CUBIC EFFICIENCY (%)	42.
VEHICLE PAYLOAD EFF. (%)	100.

CONSIDERING ONLY THE VEHICLES USED AND MISSIONS PERFORMED-

	TOT. VEH-HRS	PERCENT	AVER/MISSION
TRAVEL	.8	1.3	.12
DELAY (DEPT. POINT)	.4	.7	.06
DELAY (INTERM. POINT)	.6	1.0	.09
DELAY (RTN POINT)	.6	1.0	.09
LOADING	.3	.4	.04
UNLOADING	.6	1.0	.09
IDLE	60.1	94.6	8.58

HRS FROM FIRST DEPARTURE AND LAST DESIRED ARRIVAL= 31.75

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OUTPUT FOR POOL NO.	2
VEHICLE NUMBER	8
VEHICLE PAYLOAD (STX10)	10
VEHICLE CUBIC CAPACITY	200
NO. OF VEHICLES IN POOL	5

M I S S I O N   S T A T U S   R E P O R T

	NO.	S.T.	% ST	100 CF	% CF
1) ORIGINAL MISSIONS ASSIGNED	11.	56.5	100.0	81.0	100.0
COMPLETED IN FULL	7.	18.5	32.7	35.0	43.2
CONTRACTED IN FULL	2.	15.0	26.5	21.0	25.9
SKIPPED IN FULL	0.	0.0	0.0	0.0	0.0
COMPLETED IN PART	2.	10.0	17.7	12.7	15.7
CONTRACTED IN PART	2.	13.0	23.0	12.3	15.2
SKIPPED IN PART	0.	0.0	0.0	0.0	0.0
2) ADDITIONAL MISSIONS ASSIGNED	0.	0.0	0.0	0.0	0.0
FRACTIONAL MISSIONS	0.	0.0	0.0	0.0	0.0
COMPLETED	0.	0.0	0.0	0.0	0.0
SKIPPED	0.	0.0	0.0	0.0	0.0
WHOLE MISSIONS	0.	0.0	0.0	0.0	0.0
COMPLETED IN FULL	0.	0.0	0.0	0.0	0.0
CONTRACTED IN FULL	0.	0.0	0.0	0.0	0.0
SKIPPED IN FULL	0.	0.0	0.0	0.0	0.0
COMPLETED IN PART	0.	0.0	0.0	0.0	0.0
CONTRACTED IN PART	0.	0.0	0.0	0.0	0.0
SKIPPED IN PART	0.	0.0	0.0	0.0	0.0

V E H I C L E   S T A T U S   R E P O R T

NO. OF VEHICLES USED	5
UNUSED CAPACITY (%)	8.
VEHICLE CUBIC EFFICIENCY (%)	81.
VEHICLE PAYLOAD EFF. (%)	97.

CONSIDERING ONLY THE VEHICLES USED AND MISSIONS PERFORMED-

	TOT. VEH-HRS	PERCENT	AVER/MISSION
TRAVEL	12.8	4.5	1.43
DELAY (DEPT. POINT)	5.1	1.8	.56
DELAY (INTERM. POINT)	4.6	1.6	.51
DELAY (RTN POINT)	2.7	.9	.30
LOADING	7.1	2.5	.79
UNLOADING	7.7	2.7	.85
IDLE	243.9	85.9	27.09

HRS FROM FIRST DEPARTURE AND LAST DESIRED ARRIVAL= 56.75

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OUTPUT FOR POOL NO.	3
VEHICLE NUMBER	9
VEHICLE PAYLOAD (STX10)	10
VEHICLE CUBIC CAPACITY	200
NO. OF VEHICLES IN POOL	5

M I S S I O N   S T A T U S   R E P O R T

	NO.	S.T.	% ST	100 CF	% CF
1) ORIGINAL MISSIONS ASSIGNED	18.	142.5	100.0	66.5	100.0
COMPLETED IN FULL	9.	27.5	19.3	8.0	12.0
CONTRACTED IN FULL	4.	57.0	40.0	36.0	54.1
SKIPPED IN FULL	0.	0.0	0.0	0.0	0.0
COMPLETED IN PART	5.	20.0	14.0	5.8	8.7
CONTRACTED IN PART	5.	38.0	26.7	16.7	25.1
SKIPPED IN PART	0.	0.0	0.0	0.0	0.0
2) ADDITIONAL MISSIONS ASSIGNED	0.	0.0	0.0	0.0	0.0
FRACTIONAL MISSIONS	0.	0.0	0.0	0.0	0.0
COMPLETED	0.	0.0	0.0	0.0	0.0
SKIPPED	0.	0.0	0.0	0.0	0.0
WHOLE MISSIONS	0.	0.0	0.0	0.0	0.0
COMPLETED IN FULL	0.	0.0	0.0	0.0	0.0
CONTRACTED IN FULL	0.	0.0	0.0	0.0	0.0
SKIPPED IN FULL	0.	0.0	0.0	0.0	0.0
COMPLETED IN PART	0.	0.0	0.0	0.0	0.0
CONTRACTED IN PART	0.	0.0	0.0	0.0	0.0
SKIPPED IN PART	0.	0.0	0.0	0.0	0.0

V E H I C L E   S T A T U S   R E P O R T

NO. OF VEHICLES USED	5
UNUSED CAPACITY (%)	1.
VEHICLE CUBIC EFFICIENCY (%)	15.
VEHICLE PAYLOAD EFF. (%)	100.

CONSIDERING ONLY THE VEHICLES USED AND MISSIONS PERFORMED-

	TOT. VEH-HRS	PERCENT	AVER/MISSION
TRAVEL	19.0	5.6	1.36
DELAY (DEPT. POINT)	10.9	3.2	.78
DELAY (INTERM. POINT)	10.7	3.2	.76
DELAY (RTN POINT)	4.0	1.2	.29
LOADING	8.4	2.5	.60
UNLOADING	7.1	2.1	.51
IDLE	278.4	82.2	19.88

HRS FROM FIRST DEPARTURE AND LAST DESIRED ARRIVAL= 67.70

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OUTPUT FOR POOL NO.	4
VEHICLE NUMBER	10
VEHICLE PAYLOAD (STX10)	20
VEHICLE CUBIC CAPACITY	500
NO. OF VEHICLES IN POOL	6

M I S S I O N   S T A T U S   R E P O R T

	NO.	S.T.	% ST	100 CF	% CF
1) ORIGINAL MISSIONS ASSIGNED	3.	1.5	1.2	3.0	3.2
COMPLETED IN FULL	3.	1.5	1.2	3.0	3.2
CONTRACTED IN FULL	0.	0.0	0.0	0.0	0.0
SKIPPED IN FULL	0.	0.0	0.0	0.0	0.0
COMPLETED IN PART	0.	0.0	0.0	0.0	0.0
CONTRACTED IN PART	0.	0.0	0.0	0.0	0.0
SKIPPED IN PART	0.	0.0	0.0	0.0	0.0
2) ADDITIONAL MISSIONS ASSIGNED	17.	128.1	98.8	91.3	96.8
FRACTIONAL MISSIONS	9.	54.5	42.1	30.8	32.6
COMPLETED	7.	31.5	24.3	15.4	16.4
SKIPPED	2.	23.0	17.7	15.3	16.3
WHOLE MISSIONS	8.	73.6	56.8	60.5	64.2
COMPLETED IN FULL	5.	18.6	14.4	26.5	28.1
CONTRACTED IN FULL	0.	0.0	0.0	0.0	0.0
SKIPPED IN FULL	2.	40.0	30.9	24.0	25.5
COMPLETED IN PART	1.	12.0	9.3	8.0	8.5
CONTRACTED IN PART	0.	0.0	0.0	0.0	0.0
SKIPPED IN PART	1.	3.0	2.3	2.0	2.1

V E H I C L E   S T A T U S   R E P O R T

NO. OF VEHICLES USED	6
UNUSED CAPACITY (%)	17.
VEHICLE CUBIC EFFICIENCY (%)	33.
VEHICLE PAYLOAD EFF. (%)	98.

CONSIDERING ONLY THE VEHICLES USED AND MISSIONS PERFORMED-

	TOT. VEH-HRS	PERCENT	AVER/MISSION
TRAVEL	13.1	3.0	.82
DELAY (DEPT. POINT)	0.0	0.0	0.00
DELAY (INTERM. POINT)	0.0	0.0	0.00
DELAY (RTN POINT)	6.8	1.5	.42
LOADING	.3	.1	.02
UNLOADING	5.0	1.1	.31
IDLE	415.4	94.3	25.96

HRS FROM FIRST DEPARTURE AND LAST DESIRED ARRIVAL= 73.42

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

```
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

        OUTPUT FOR POOL NO.         5
        VEHICLE NUMBER            10
        VEHICLE PAYLOAD (STX10)   20
        VEHICLE CUBIC CAPACITY   500
        NO. OF VEHICLES IN POOL    5

                 NO MISSIONS ASSIGNED

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX


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APPENDIX E

GLOSSARY OF VARIABLES IN MAIN PROGRAM

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Glossary Of Variables In Main Program

A	Array for missions information.
BT	Amount of the capacity of a vehicle required to haul the cargo for a given mission.
B5	Number of tons of the mission cargo that the pool can haul with the vehicles available.
B6	Number of cubic feet of the mission cargo that the pool can haul with the vehicles available.
D	Array for temporary storage of information on missions that are to be transferred.
E	Array containing event times relative to the missions. Contains mission dispatch time and the time vehicles will be available for subsequent missions.
F	Auxiliary array containing the number of minutes required to accomplish each mission and the number of vehicles required to haul the mission cargo (multiplied by 100).
FK	An auxiliary parameter that stores the value of the index KK in floating point form.
F1, F2, F3, F4, F5	Auxiliary parameters used for storage and accumulation of certain mission statistics.
G	Array used to store mission statistics for reporting according to the proper mission disposition.
I	Loop index.
IP	Index used in the storage of information on missions that are to be transferred.
IPLOT	Control integer for plotting of simulation results.
ISP	Control integer for modifying, en masse, mission splitting parameters.
I1, I2, I3	Indices used in storage of mission statistics in G array.

I7	Index used in storage of vehicle availability information in E array and storage of information on transferred missions in A array.
I8	Integer form of mission disposition code.
J	Auxiliary index used to reference information in various arrays.
K	Index for referencing information in various arrays with respect to pool number.
KK	Index used in referencing pools for the transferal of missions.
K1	Auxiliary index used to determine the number of originally assigned missions and the number of links input for each pool.
L	Index used to reference information in various arrays with respect to links.
LIST	Control parameter for printing input information for each pool.
L1	Auxiliary index that is used in storing information on the remainder of split missions.
MAXP	Control parameter for the maximum number of pools that can be simulated.
MCA	Control parameter indicating the number of columns in the A array.
MCG	Control parameter indicating the number of columns in the G array.
MCT	Control parameter indicating the number of columns in the T array.
MLINK	Control parameter for the maximum number of links for each pool.
MMISS	Control parameter for the maximum number of missions for each pool.
MRG	Control parameter for the number of rows in the G array.
NA	Auxiliary index for referencing the proper row in the E array.

NB	Auxiliary index for referencing the proper row in the E array.
NL	The number of links for a pool.
NM	The number of missions assigned to a pool.
NN	Control index for the number of missions to be transferred out of a pool.
NPOOLS	The number of pools being simulated.
NTRANS	The total number of missions to be transferred out of a pool.
NY	Auxiliary index used to reference the proper rows of various arrays.
NZ	Auxiliary index which indicates the total number of missions that are assigned to a pool. It is incremented by one each time a mission is split.
NZ3	Auxiliary index that is used to keep track of the maximum number of vehicles used in a pool.
NZ7	Auxiliary parameter that is used to control program flow.
O	Array that is used to store information on the remainders of split missions.
P	Array that is used to store the characteristics of each pool and other bits of information pertaining to each pool.
Q	Array that is used to store the information on vehicle status for the pools.
T	Array that is used to store the information on the links for the pools.
TEMP	Auxiliary variable that is used for temporary storage.
T7	Auxiliary variable that is used to indicate the pool to which missions are to be transferred.
ZT	The number of vehicles on-hand in a pool.
Z5	The number of vehicles occupied on a mission multiplied by 100.

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APPENDIX F

IDENTIFICATION OF ENTRIES IN VARIOUS ARRAYS

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Variables In Array P(15,10)

P(1,K) - Pool identification number of the K-th pool.

P(2,K) - Vehicle type identification number.

P(3,K) - Vehicle payload, in short tons X 10.

P(4,K) - Vehicle capacity, in cubic feet.

P(5,K) - Number of vehicles assigned to the pool.

P(6,K) - Number of links or routes for the pool.

P(7,K) - Number of missions assigned to the pool.

P(8,K) - Number of vehicles occupied performing missions.

P(9,K) - Earliest vehicle dispatch time.

P(10,K) - Latest desired vehicle availability time.

P(11,K) - Number of missions to be transferred out of the pool.

P(12,K) - Unused

P(13,K) - Unused

P(14,K) - Unused

P(15,K) - Unused

Variable ISP

Controls the splitting parameter for all missions.

ISP = - 1 All missions will be permitted to be split when necessary.

ISP = 0 Missions retain their assigned values of the splitting parameter.

ISP = 1 Missions will not be permitted to be split.

Mission Disposition Code

The TVEM controls the accumulation and reporting of mission statistics by disposition category in the Mission Status Report through the assignment of a code value to each mission during the simulation of a vehicle pool. The assignment of the code also facilitates the proper handling of missions that have been transferred. At the initial assignment of missions, the model uses the splitting parameter as the code. If the mission is not completed in full, the code value is changed to indicate its disposition, i.e., split, transferred, etc.

The array element A(I,8,K) contains the code value for the I-th mission assigned to the K-th pool. The list of code values and their associated meanings follows:

List of Mission Disposition Codes

Original Missions:

1 - Mission completed in full. Splitting was permissible.

2 - Mission completed in full. Splitting was not permissible.

3 - Mission completed in part.

4 - Mission transferred in part. Remainder of a mission completed in part (Code 3).

6 - Mission transferred in full. Even though splitting was permissible, no vehicles were available.

7 - Mission skipped in full. Transfer was not permissible and, even though splitting was permissible, no vehicles were available.

8 - Mission transferred in full. Splitting was not permissible.

9 - Mission skipped in full. Neither splitting nor transfer was permissible.

25 - Mission skipped in part. Remainder of a mission completed in part (Code 3) that could not be transferred (as in Code 4).

Additional Missions:

10 - Fractional mission completed (from Code 4).

11 - Fractional mission skipped (from Code 4). Not enough vehicles were available and the mission will not be further split (in the current version of the model.)

12 - Mission completed in full (from Code 6).

13 - Mission skipped in full (from Code 6). Even though splitting was permissible, no vehicles were available and further transfer was not permissible.

14 - Mission completed in full (from Code 8).

15 - Mission skipped in full (from Code 8). Neither splitting nor further transfer was permissible.

16 - Mission completed in part (from Code 6).

*17 - Mission further transferred in part (from Code 6). Remainder of a mission completed in part (Code 16).

*19 - Mission further transferred in full (from Code 6). Even though splitting was permissible, no vehicles were available.

*21 - Mission further transferred in full (from Code 8).

24 - Mission skipped in part (from Code 6). Remainder of a mission completed in part (Code 16) that could not be transferred in part (as in Code 17).

* Codes 17, 19, and 21 are not in use. In the current version of the model, additional missions are prevented from transferal to yet another pool by line 530 (A(I7, 7, KK) = Ø). Instead, such missions will be skipped, as in Codes 24, 13, and 15 respectively.

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