TM(L)-1071/000/00

# New and Modified 1604 Computer Programs in Support of Augmentation Milestone 5

6 March 196-

TM-(L)-1071/000/00

# TECHNICAL MEMORANDUM

(TM Series)

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New and Modified

1604 Computer Programs

in Support of Augmentation

Milestone 5

by

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6 March 1963

Approved

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## PREFACE

This document is presented as the first of a series of volumes containing Milestone 5 documentation for the new and modified 1604 Flight Support programs produced in support of Augmentation. The computer programs described in this volume are listed in the table of contents. Future volumes will be issued when warranted and will contain descriptions of the remainder of those programs documented in TM-840/000/01, New and Modified 1604 Computer Programs in Support of Augmentation, Milestone 3.

TABLE OF CONTENTS

IDENTIFICATION

A. Title: Station Position (STPOS), Ident, J28, Mod. AB

B. Programmed: 15 September 1962, R. Siersbeck, TWRUP

C. Modified and Documented: 23 January 1963, G. A. Mahon, System Development Corporation

PURPOSE

To update the RIPOOL in core by correcting existing station coordinates and/or adding new stations.

USAGE

A. One function card can accommodate more than one group of station coordinates, with an option as to format. As many groups of station coordinates as room allows can be put on the same function card.

Format I

*STPOS A B C D.D E F.F G A B C D.D E F.F G . . .

where:

A = station number

B = station name (BCD)

C° = latitude (degrees)

D.D = latitude (minutes)

E = longitude (degrees)

F.F = longitude (minutes)

G = height (feet)

Format II

*STPOS A B C.C D.D E A B C.C D.D E . . .

where:

A = station number

B = station name (BCD)

C.C = latitude (degrees)

D.D = longitude (degrees)

E = height (feet)

B. Input

1. The following cell in the RIPOOL must contain the described information.

| TAG | DESCRIPTION | FORMAT |
|---|---|---|
| NOS | Number of entries in SNO table | Fixed point, integer |

C. Results

1. Upon exit from STPOS the station parameters entered via the function card (or cards) will have been stored in the proper locations in the following RIPOOL tables:

| Table Name | Description | Format |
|---|---|---|
| SNO | Station number | Fixed point, integer |
| SBCD | Station name | BCD |
| SLAT | Station latitude (rads.) | Floating point |
| SLONG | Station longitude(rads.) | Floating point |
| SH | Station height (ft.) | Floating point |

The station name is stored in the SBCD table indexed by station number (see Restrictions) and the station latitude, longitude, and height are stored in SLAT, SLONG and SH, indexed by the relative address of the station number in the SNO table.

2. The following cell in the RIPOOL will be updated.

| TAG | DESCRIPTION | FORMAT |
|---|---|---|
| NOS | Number of entries in SNO table | Fixed point, integer |

D. On-Line Comments

Message No. 1

"NO ROOM AVAILABLE FOR REQUESTED STATION"

STPOS adds a new station by storing its number in the first available cell at the end of the SNO table. If cells reserved for additional stations are filled, the new station is not stored, message No. 1 is initiated on the on-line printer, and the computer

will halt. Control is returned to MTC by activating the start switch.

METHOD

STPOS first determines if the station number from the function card already exists in SNO. If it does and the station number is less than 40, station name is stored in SBCD and the station coordinates are stored in SLAT, SLONG, and SH. If the station number is equal to or greater than 40 only the station coordinates are stored. (See Restrictions.) If the station number does not exist in SNO it is checked to see if it lies within the range 31 to 39 inclusive. If it does it is assumed that the number represents half of a dual station configuration. The station number is decreased by 30, (since this will give the number of the other half which is entered in the table), SNO is again searched, and the station coordinates are stored. Station name however is stored and indexed by the original station number. If the station number does not exist in SNO and does not lie within the range 31-39 (such a number would represent a new station) the station number is stored in the first available cell at the end of the SNO table, (see Restrictions). The station coordinates are stored in SLAT, SLONG, and SH and station name is stored in SBCD if the station number is less than 40.

RESTRICTIONS

1. The station name cannot exceed 8 BCD characters.
2. Format I and II cannot be used on the same function card.
3. The RIPOOL currently contains space for a maximum of 70 stations.
4. The SBCD (station name) table is a 40 entry table indexed by station number, hence STPOS will not store the name of any station with a number equal to or greater than 40.
5. STPOS uses OUTPUT, FLOAT, and one cell of COMMON.
6. STPOS uses the RIPOOL cell listed under Input and sets the RIPOOL cells listed under RESULTS.
7. A reload of the RIPOOL by an auto load or by some other method will

erase from the RIPOOL the coordinates entered by this function.

8. Only station coordinates plus the associated numbers and names can be added or changed. Antenna (substation) or pad (other than PAD 0) positions cannot be input.
9. It is necessary to define every function card parameter. A blank field is not legal.

TIMING

1.190m sec. for a sample station using Format I

0.580m sec for a sample station using Format II

STORAGE REQUIREMENTS

A. Space Allocation

| | |
|---|---|
| Program | 44 cells |
| Constants | 2 cells |
| Printout | 5 cells |
| Temporary Storage | 1 cell |
| TOTAL | 52 cells |

plus RIPOOL and 1 cell of COMMON

B. Program Constants

| TAG | CONTENT | FORMAT |
|---|---|---|
| F60 | 60 | Floating Point |
| DEGRAD | 57.2957795131 | Floating Point |

VALIDATION TESTS

STPOS was tested using the deck listed in **Figure 6** . Dumps were taken at the indicated spots and in all cases the RIPOOL was correctly updated. At the start of this test RIPOOL cell NOS equaled 51. The last function card calling STPOS caused the halt and printout indicated under On-Line Comments.

REFERENCES

1. Manual of Operating Instructions for Satellite Control Computer Programs, Volume I - STC, Revision 7
2. TM-714/035/00, Reference and Intercommunication Pool (RIPOOL) - Milestone 11, (in preparation), System Development Corporation.

FLOW DIAGRAMS

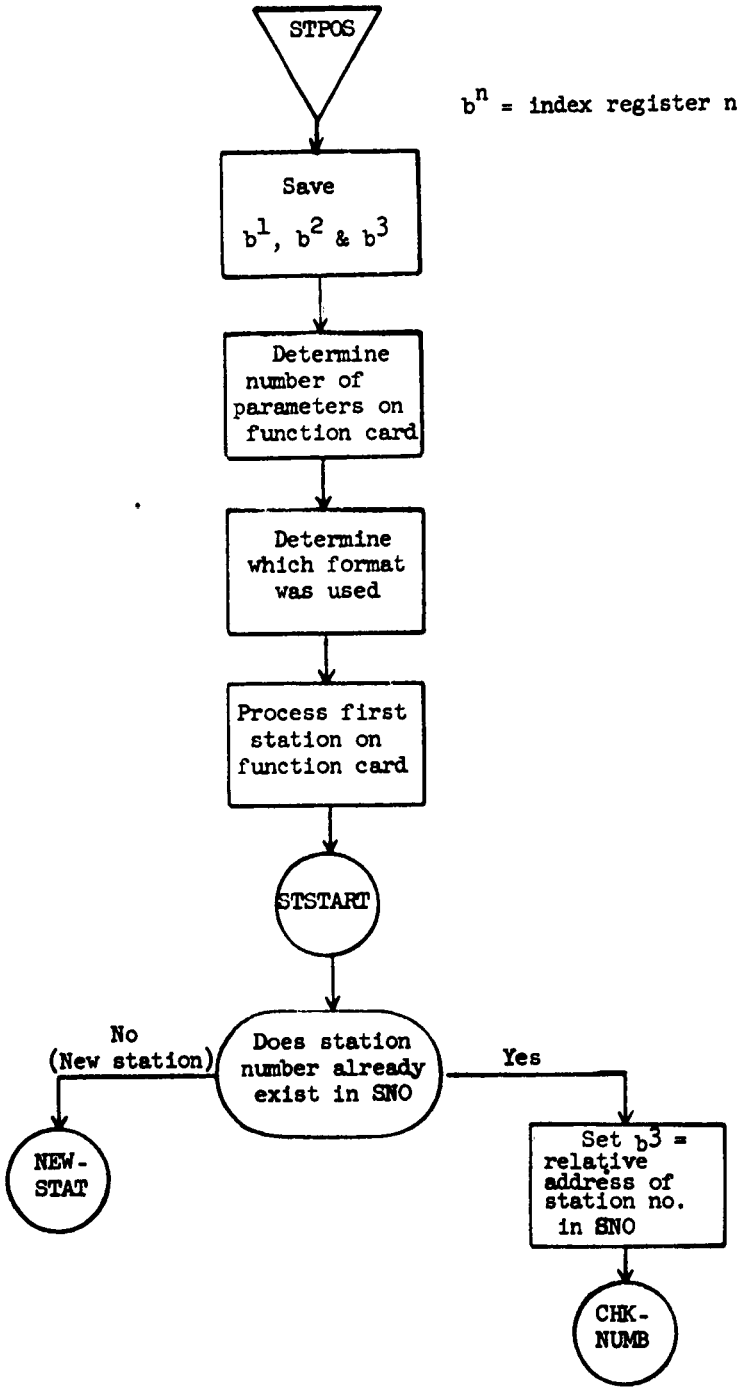



Figure 1.

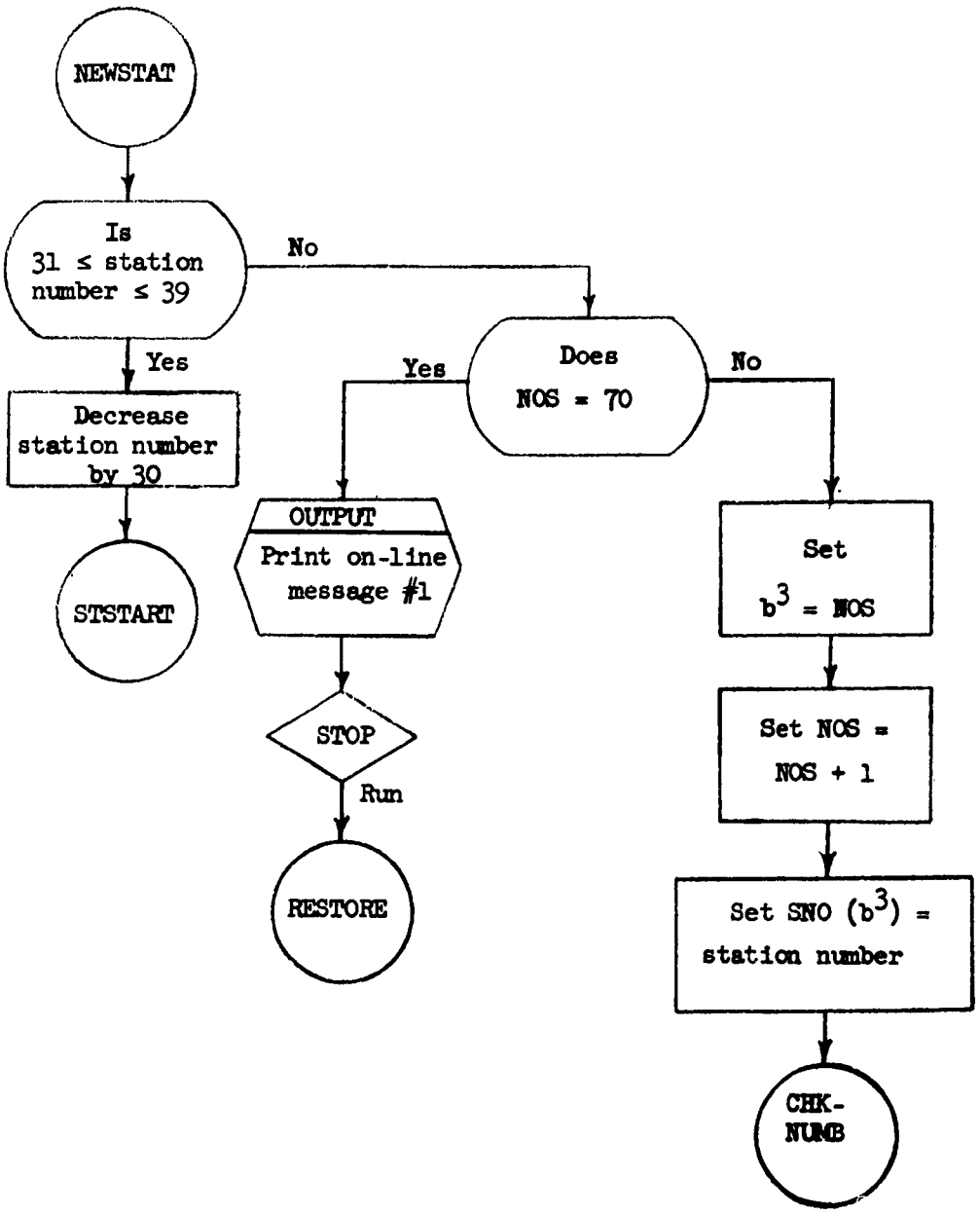

NEWSTAT
Is
31 ≤ station
number ≤ 39
No
Yes
Decrease
station number
by 30
STSTART
Yes
Does
NOS = 70
No
OUTPUT
Print on-line
message #1
STOP
Run
RESTORE
Set
$b^3$ = NOS
Set NOS =
NOS + 1
Set SNO ($b^3$) =
station number
CHK-
NUMB

Figure 2.

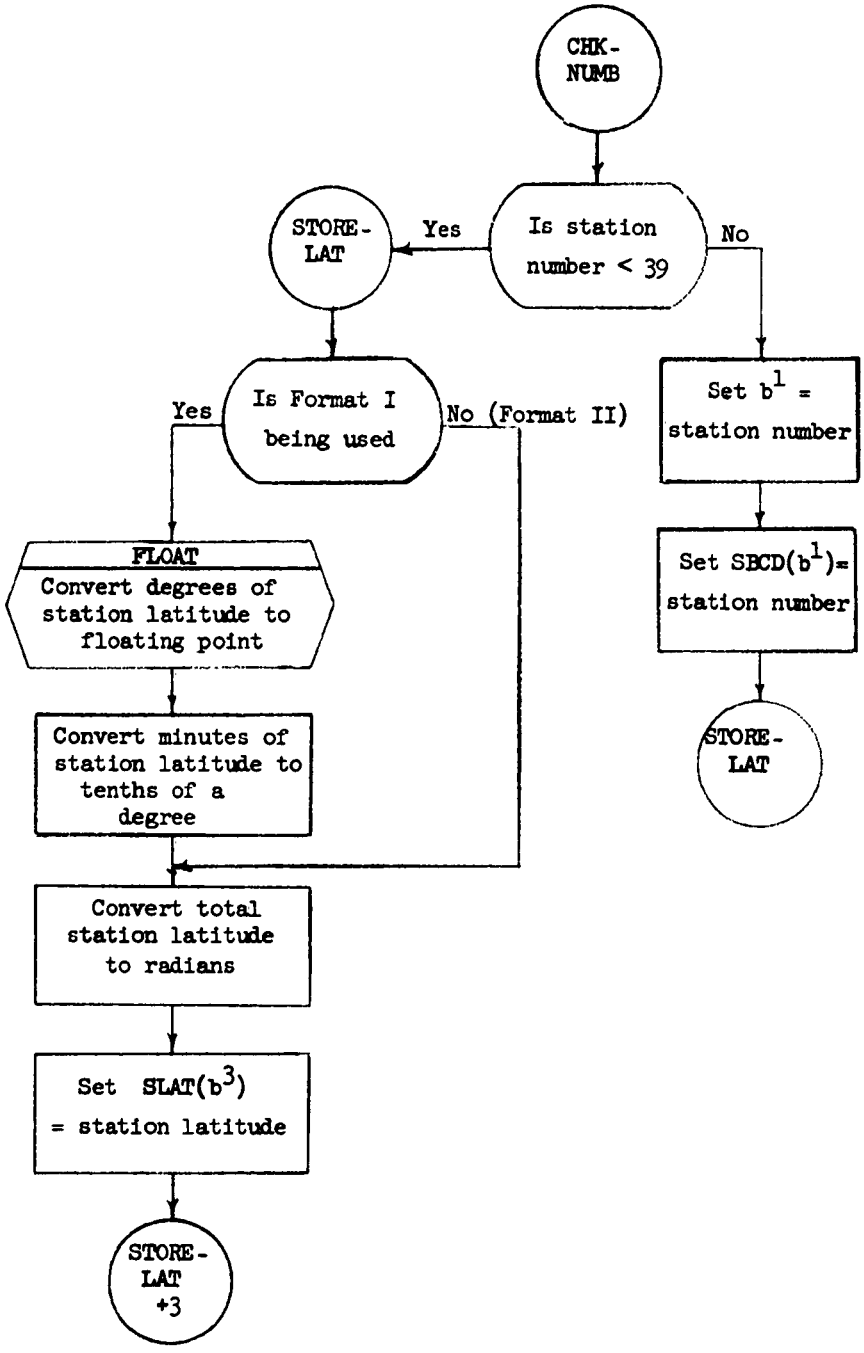

CHK-NUMB
Is station number < 39
Yes
No
STORE-LAT
Is Format I being used
Yes
No (Format II)
Set $b^1$ = station number
FLOAT
Convert degrees of station latitude to floating point
Set SBCD($b^1$)= station number
Convert minutes of station latitude to tenths of a degree
STORE-LAT
Convert total station latitude to radians
Set SLAT($b^3$) = station latitude
STORE-LAT +3

Figure 3.

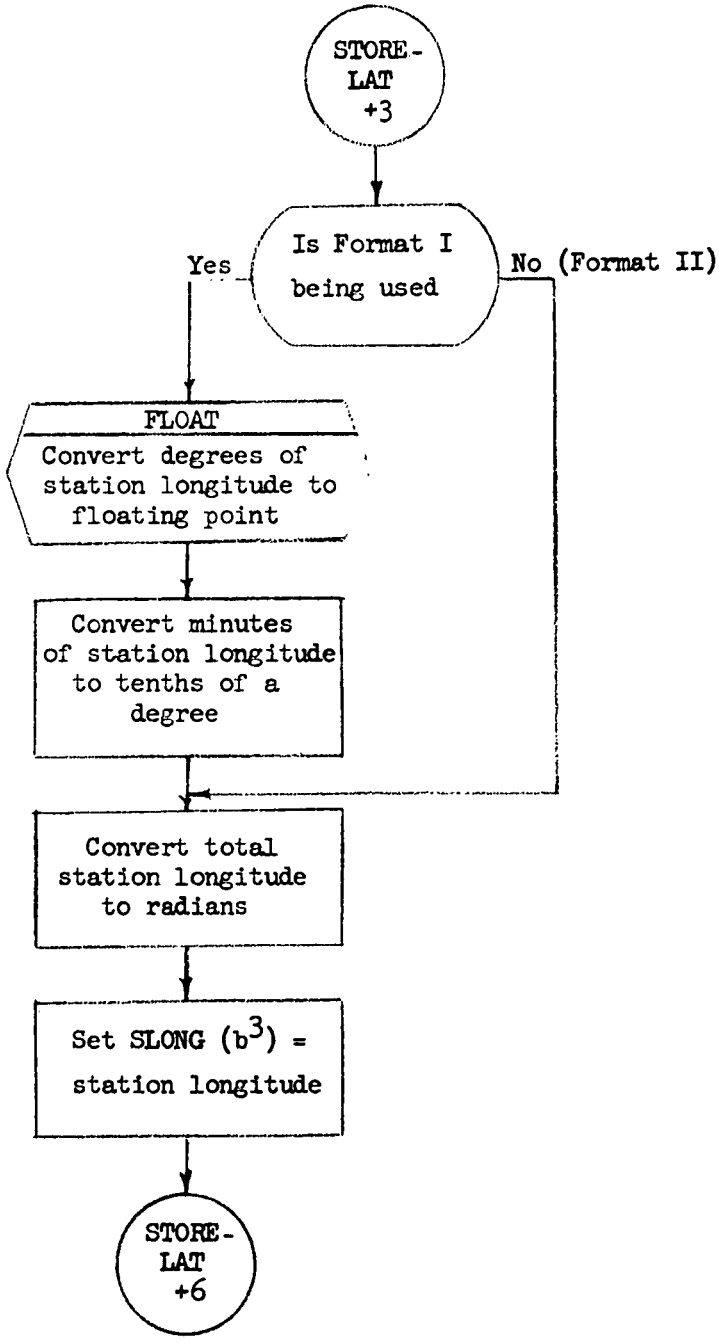

STORE-
LAT
+3
Is Format I
being used
Yes
No (Format II)
FLOAT
Convert degrees of
station longitude to
floating point
Convert minutes
of station longitude
to tenths of a
degree
Convert total
station longitude
to radians
Set SLONG (b3) =
station longitude
STORE-
LAT
+6

Figure 4.

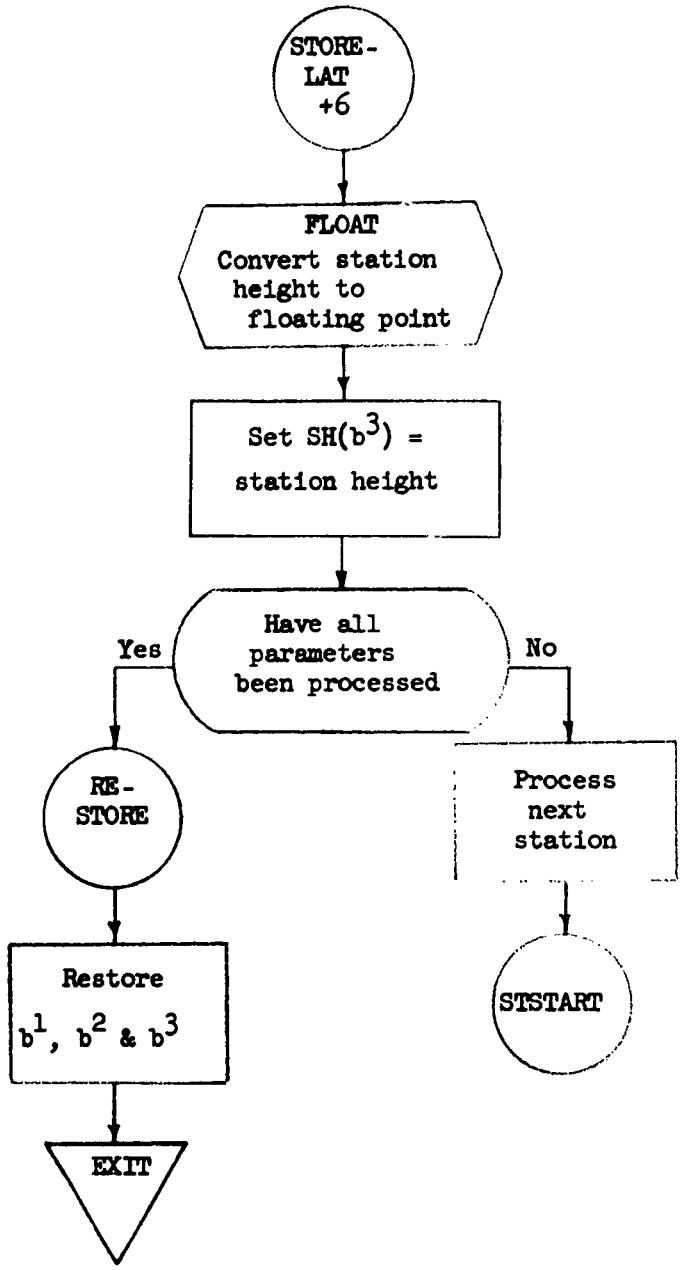

STORE-
LAT
+6
FLOAT
Convert station
height to
floating point
Set SH(b3) =
station height
Have all
parameters
been processed
Yes
No
RE-
STORE
Process
next
station
Restore
b1, b2 & b3
STSTART
EXIT

Figure 5.

```
* 3 STPOS 1 COOK 0. 0. 0
* DUMP 3 4700B 7000B
*STPOS 3 ANNE 95 30.5 60 45. 100 38 IOS-A 57 12. 104 20. 30
*STPOS 30 GEO 80 15. 130 30. 50 40 NOBCD 70 30. 70 30. 10
*STPOS 1 COOK 80.5 80.5 10 39 THUL-A 90.5 90.5 20 14 GEO1 66. 66. 90
*STPOS 15 GEO2 1. 1. 1 16 GEO3 10. 10. 2 17 GEO4 12. 12. 12 18 GEO5 15. 15. 15
*STPOS 19 GEO6 20. 20. 20 41 GEO7 25. 25. 25 42 GEO8 10. 10. 10
*STPOS 43 GE9 9. 9. 9 44 GE10 8. 8. 8 45 G11 7. 7. 7 46 G12 6. 6. 6
*STPOS 47 G13 5. 5. 5 48 G14 4. 4. 4 49 G15 3. 3. 3 50 G16 2. 2. 2
*STPOS 51 G17 25. 25. 25
* DUMP 3 4700B 7000B
*STPOS 14 GEO1 33. 33. 33
* DUMP 3 4700B 7000B
*STPOS 60 TOOMANY 20. 20. 20 61 TOOMANY 20. 23. 25
* DUMP 3 4700B 7000B
* EOT 3
```

**Figure 6.**

IDENTIFICATION

A. Title: Telemetry Mode Selection Input (STEM), Ident. K25, Mod. AA

B. Programmed and documented by: Jackie LaVine, System Development Corporation, February, 1963.

PURPOSE

STEM is a 1604 subroutine used by the SENDXXXX functions to generate prepass telemetry mode selection messages. The data for these messages are obtained from punched cards and converted to the standard telemetry message format acceptable by the TM computer at remote stations. The messages are used to notify the tracking stations as to which mode is desired by the STA and can also include any processing changes to modify algorithm parameters. The completed messages and appropriate header messages are placed on the 1604/Bird Buffer transfer tape by the SWRTOUT program.

USAGE

A. Calling Sequence

```
L       RTJ         STEM
        00    0     N
L+1     Error Return
L+2     Normal Return
```

where: N = zero if input is from cards, or tape unit number 4, 5, 6, 7, 8, 11, or 12 if input is in the form of a prestored tape.

B. Card Inputs

STEM will accept the input data in the form of the free field card format from either the card reader or prestored tape. The following is a list of the items which are on the card.

a) Telemetry card identification
b) Vehicle number
c) Revolution number
d) Station identification
e) Telemetry mode

f) Telemetry type
   1 = FM/FM
   2 = PAM
   3 = PCM
g) Patchboard number
h) Process indicator
   1 = process this ident.
   0 = do not process this ident.
i) Point type
   2 = fixed format
   3 = events
j) Identification number
k) Location of first word relative to the frame
l) The number which must be added to item 11 to obtain the second word address
m) Compression algorithm number
n) Parameter 1
o) Parameter 2
p) Parameter 3
q) Parameter 4

A full description of all items is presented in the latest revision to TM-(L)-834 (Reference 2).

The telemetry card identification may be any assortment of up to four alphanumeric characters. Its purpose is to aid in identifying the card (type), and is not used by STEM. All other items may be decimal or octal numbers (an octal number must be followed by a "B"). The revolution number is the only value which contains a decimal point. Only items one through seven must always be on the card, however, if any additional items are required none may be omitted. All of the items on the card must be in the above sequence. The word "END" must follow the last parameter on the last card in the deck.

Any number of cards will be read, however, all the parameters pertaining to one message must be contained on one card. Prior to operation the deck must be ordered with a primary sort on revolution number and a secondary sort on station number. Figure 13 contains a more detailed example of the card input formats.

C. On-Line Printouts

1. As each card is read it will be printed on-line.
2. An error return from the INPUT program will result in one of the following messages:

   ERROR RETURN FROM INPUT - END OF FILE READ
   ERROR RETURN FROM INPUT - CARD READER NOT READY
   ERROR RETURN FROM INPUT - TAPE UNIT N NOT READY
   ERROR RETURN FROM INPUT SUBROUTINE Q = NNN LOCATION NNNNN
   TAPE READ ERROR RETURN FROM INPUT
   CARD READ ERROR RETURN FROM INPUT

   Following each of the above will be the message, "PRESS START TO CONTINUE - SET JUMP KEY 1 PRESS START TO TERMINATE PROCESSING"
3. If an item on an input card is not acceptable, one of the following messages will follow the card in error.

   PARAMETER N EXCEEDS LIMITS
   FORMAT ERROR IN PARAMETER N

   The program will halt after the printout to allow for operator interaction. The card in error may be corrected and re-entered into the card reader, or ignored if desired. Pressing the start switch will cause the program to ignore the card and start processing the next card. Activating jump key 1 before pressing start will terminate the processing of inputs and cause STEM to return to the SENDXXXX program via the error return.

4. If STEM is not able to produce a day and month from the information in the acquisition table the following message will be printed and a zero day and month will be used in the header.
INPUT DAY/MONTH ILLEGAL WILL CONTINUE WITHOUT IT

5. An error return from SWRTOUT will result in the following message.
ERROR RETURN FROM SWRTOUT - PRESS START TO CONTINUE - SET JUMP KEY 1 - PRESS START TO TERMINATE PROCESSING

D. Error Return

The only error return to SENDXXXX is described under 3. above.

E. Tape Assignments

The input card deck may be prestored on tape and mounted on unit 4, 5, 6, 7, 8, 11 or 12. If the unit number found in the calling sequence is not one of these, the following message will be printed.
TAPE UNIT N ILLEGAL - PUT PRESTORE TAPE ON UNIT 7 - PRESS START TO CONTINUE

F. Output Formats

1. Header Messages

Whenever a station number, revolution number or vehicle number on a card differs from the preceding card a new header message is put on the transfer tape. The format of this Hollerith message is as follows:

| | |
|---|---|
| word 1 | 1604-BB |
| word 2 | TRANSFER |
| word 3 | DATA (station number) day month |
| word 4 | (rev. number)(vehicle number) |
| word 5 | 12 bit complement checksum, left justified |

The parameters in the parenthesis are obtained from the input card. The day and month used in the header are converted from

the machine time associated with the revolution and station number found in the Acquisition Table.

2. Telemetry Mode Message Format

The telemetry message will be generated in the format of 12 bits per message word. These words will be packed from left to right into 48-bit 1604 cells. As each message is generated it is transferred to the SWRTOUT program.

The format of the message is as follows:

| | |
|---|---|
| 7777 | |
| SS30 | S's = station identification (binary) |
| 30NN | N's = number of words in message less one (binary) |
| AAVV | A's = telemetry type |
| VVVV | V's = vehicle number (4-bit BCD) |
| RRRR | R's = revolution number in 10th of a rev |
| RRRR | (4-bit BCD) |
| MMMM | M's = telemetry mode (binary) |
| PPPP | P's = patchboard number (4-bit BCD) |
| IIII | bit 11 = process indicator |
| | bit 10-9 = point type |
| | bit 8-0 = identification number of telemetry point |
| LLLL | L's = location in octal of first word in core |
| | relative to the frame |
| DDDD | D's = the number which must be added to the |
| | L's tc obtain the second word address |
| CCCC | C's = the compression algorithm number |
| XXXX | X's = the parameters required by the algorithm |
| XXXX | as specified by items 14 - 17 on the |
| XXXX | input card |
| XXXX | |
| CKSM | The checksum will follow the PPPP entry if items IIII through XXXX are not contained on the input card. |

3. Mode of Results

As each message is generated it will be transferred to the SWRTOUT program. When a block of messages is ready SWRTOUT will put them on the 1604/BB transfer tape. (See reference 1.) STEM does not transfer an "end of input" message to SWRTOUT.

METHOD

When the SENDXXXX program is notified that telemetry mode selection messages are to be generated, it will set up a calling sequence for STEM to do the actual processing of inputs. STEM will use the INPUT program to read the cards or tape and to convert the parameters from Hollerith to binary. As each card is read, STEM will call the OUTPUT program to print the card images on-line.

Limit checks are made on all parameters which are described under restrictions. If an error is found an appropriate message is printed on-line.

A record is kept of the station number, revolution number and vehicle number on each card. When any of these differ from the preceding card STEM will generate a new header message and transfer it to SWRTOUT before the telemetry mode message is transferred.

The day and month used in the header message are determined from the information in ACQTBL. Each entry in ACQTBL is examined until one with the station and revolution number corresponding to the message is found. The related machine time of rise is stored in TAU and MACGUT is called to determine a day and month. If no entry can be found in ACQTBL, STEM will use the day and month from the previous message. If no previous messages were generated, the machine time of last orbit update will be used. If this is not available, a zero day and month will be placed in the header.

When the "END" card is found, STEM will process the information on the card and exit to SENDXXXX via the normal return.

RESTRICTIONS

1. The accuracy of the program is only limited by the subroutines it uses.
2. The subroutines used by STEM are: INPUT, OUTPUT, OUTERR, FIX, FLOAT, OCTBCD, MACGUT, and SWRTOUT.
3. The input deck must be sorted by station number within revolution number. This also applies to a deck which is to be prestored and entered via tape. No checks will be made for cards out of sequence.
4. The MTCII control program, the RIPOOL and ACQTBL must be in core.
5. Index registers 1, 2, 3 and 5 are used and restored.
6. The limit checks made on the input parameters are as follows:
   a) Station identification must be in RIPOOL.
   b) Telemetry type is either 1, 2 or 3.
   c) Vehicle number is 4 or less digits.
   d) Revolution number contains a decimal point and is four or less digits.
   e) Telemetry mode does not exceed 7777 octal.
   f) Patchboard number does not exceed three digits.
   g) Process indicator is 1 or 0.
   h) Point type is 1, 2 or 3.
   i) Identification number is three or less digits.
   j) Parameters one through four do not exceed four octal digits each.

STORAGE REQUIREMENTS

| | | |
|---|---|---|
| Program | 294 | cells |
| Constants | 21 | cells |
| Temporary storage | 63 | cells |
| Hollerith images | 63 | cells |
| TOTAL | 441 | cells |

The final storage requirements, program constants and timing will be presented in the STEM Milestone 11 document.

VALIDATION TESTS

A. Inputs

An experimental deck of input cards were used to test STEM. Four of these are listed in Figure 14 with the resulting outputs.

B. Procedures

A test program was used to take the place of a SENDXXXX function. It set up the calling sequence to STEM and made appropriate printouts for an error return or a normal return from STEM.

A separate test program was used which manufactured the various conditions which can exist upon an error return from the INPUT program. Because the results of this test are not pertinent to the user they will not be presented in this document.

C. Results

The results are tabulated in Figure 14 in the form of the messages SWRTOUT writes on the 1604/BB transfer tape.

A card which was found to be in error is accompanied with an error printout only.

D. Limits of Test

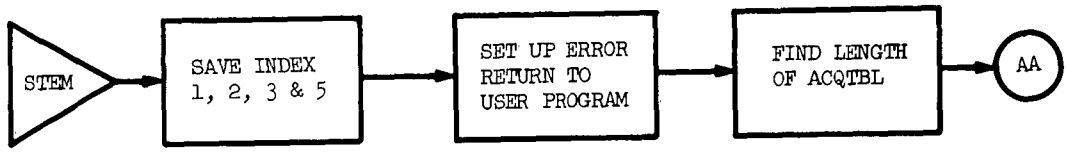
The tests results presented in this document are only the positive type. The extensive tests which were made to check error printouts from other subroutines are not included.

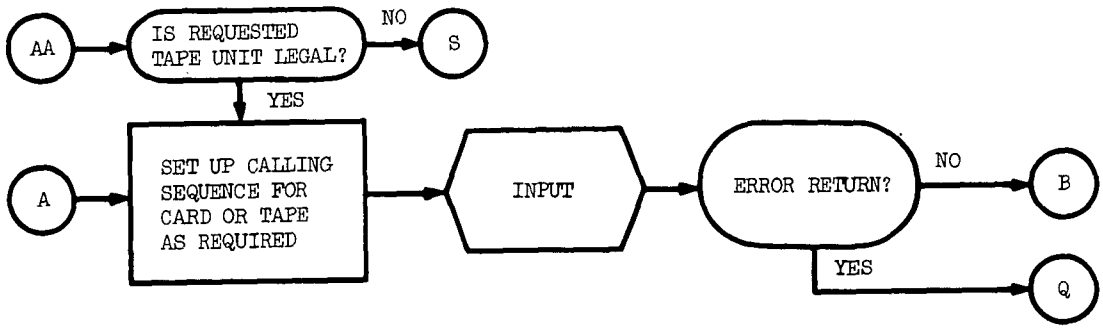
REFERENCES

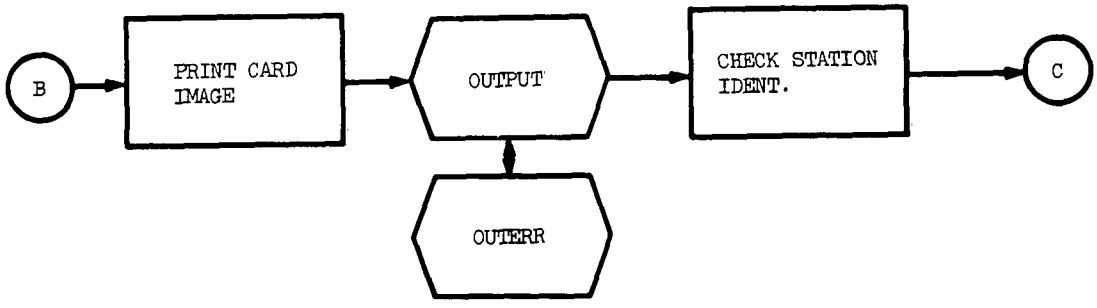
1. TM-891/001/00, Combined Milestone 3-4 for the 1604 Augmentation Communication Programs, 20 December 1962, System Development Corporation.
2. TM-(L)-834/000/01A, Bird Buffer Combined Milestone 3 and 4, 11 February 1963, System Development Corporation. Telemetry Mode Message Format, page 30-31.
3. TM-(L)-840/000/01, New and Modified 1604 Computer Programs in Support of Augmentation, Milestone 3, 25 January 1963, System Development Corporation. Acquisition Table Format, page 11.

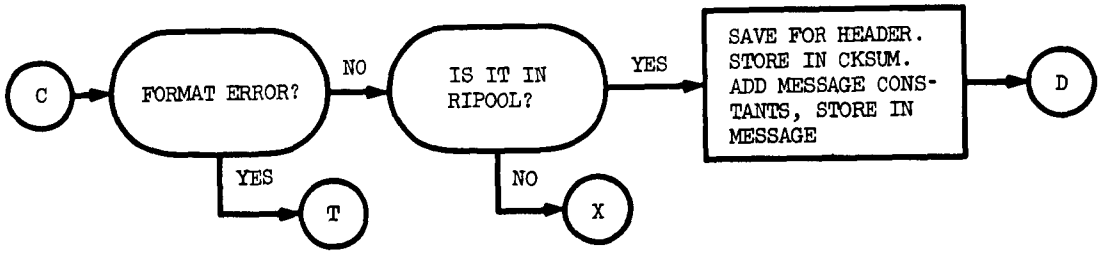
4. TM-(L)-705/032/00, SCF Computer Program Systems Manual Utility Programs, Generalized Input Routine (INPUT), 2 January 1963, (AFCPL Catalog Number 75025).
5. TM-(L)-715/032/00, Utility Program Descriptions, Milestone 11, Output Error Routine (OUTERR), 7 December 1962, (AFCPL Catalog Number 75249).
6. TM-714/004/00, General Purpose Satellite Computer Program Description, Milestone 11, Convert Machine Time to Universal Time and System Time (MACGUT), 18 May 1962. (AFCPL Catalog Number 75088).
7. TM-(L)-715/007/00, Utility Program Descriptions, Milestone 11, Octal to BCD Conversion (OCTBCD), 2 May 1962, System Development Corporation. (AFCPL Catalog Number 75033).
8. TM-(L)-705/013/00, SCF Computer Program Systems Manual Utility Programs, Convert from Floating Point to Fixed (FIX), 11 September 1962, System Development Corporation. (AFCPL Catalog Number 75018).
9. TM-(L)-705/014/00, SCF Computer Program Systems Manual Utility Programs, Fixed to Floating Point Conversion (FLOAT), 11 September 1962, System Development Corporation. (AFCPL Catalog Number 75019).
10. TM-(L)-705/033/00, SCF Computer Program Systems Manual Utility Programs, Generalized Output Routine (OUTPUT), 16 January 1963, (AFCPL Catalog Number 75035).

FLOW DIAGRAMS



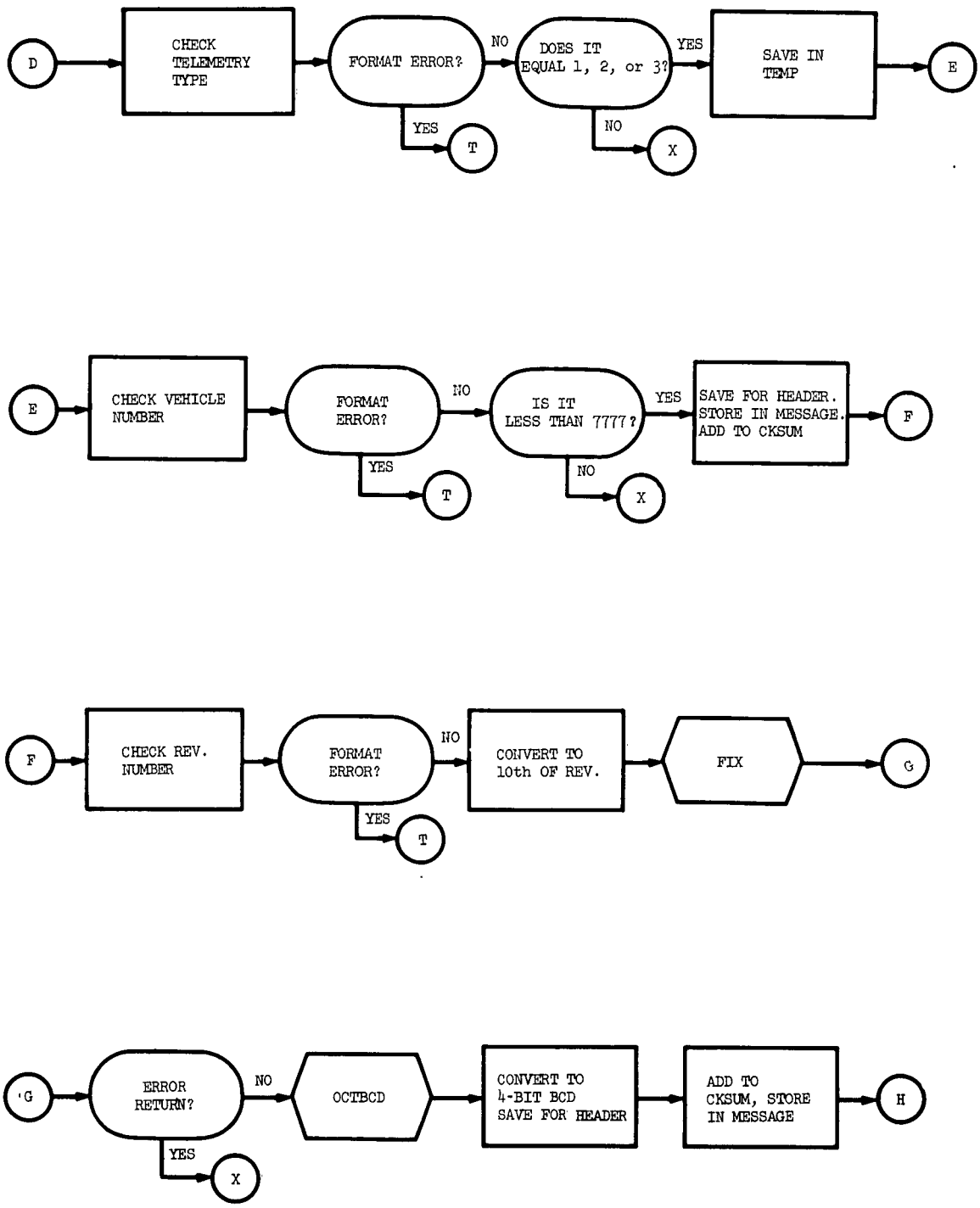

D
CHECK TELEMETRY TYPE
FORMAT ERROR?
NO
YES
T
DOES IT EQUAL 1, 2, or 3?
YES
NO
X
SAVE IN TEMP
E
E
CHECK VEHICLE NUMBER
FORMAT ERROR?
NO
YES
T
IS IT LESS THAN 7777?
YES
NO
X
SAVE FOR HEADER. STORE IN MESSAGE. ADD TO CKSUM
F
F
CHECK REV. NUMBER
FORMAT ERROR?
NO
YES
T
CONVERT TO 10th OF REV.
FIX
G
G
ERROR RETURN?
NO
YES
X
OCTBCD
CONVERT TO 4-BIT BCD SAVE FOR HEADER
ADD TO CKSUM, STORE IN MESSAGE
H

**Figure 8.**

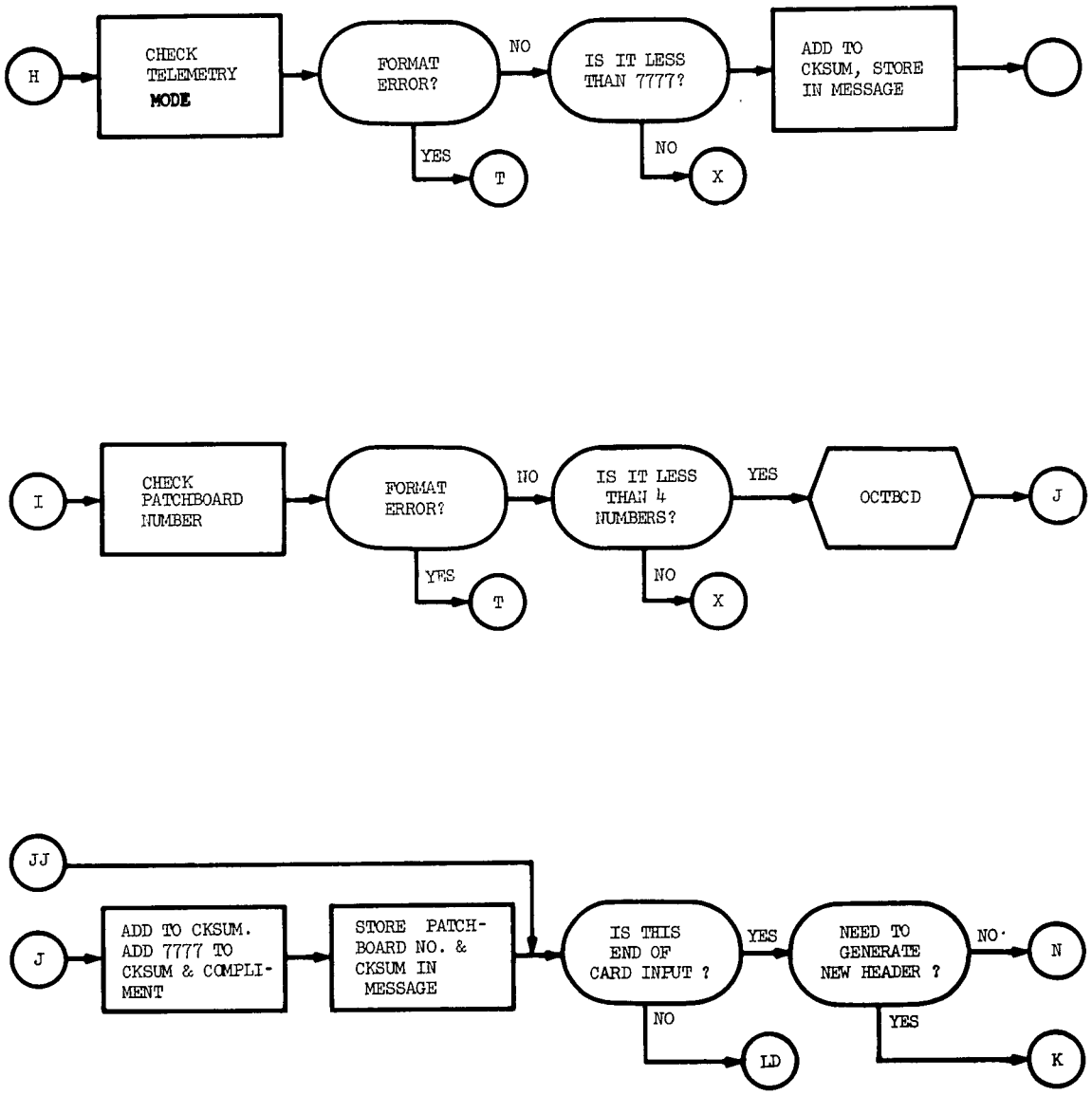

H
CHECK TELEMETRY MODE
FORMAT ERROR?
NO
YES
T
IS IT LESS THAN 7777?
NO
X
ADD TO CKSUM, STORE IN MESSAGE
I
CHECK PATCHBOARD NUMBER
FORMAT ERROR?
NO
YES
T
IS IT LESS THAN 4 NUMBERS?
YES
NO
X
OCTBCD
J
JJ
J
ADD TO CKSUM. ADD 7777 TO CKSUM & COMPLIMENT
STORE PATCHBOARD NO. & CKSUM IN MESSAGE
IS THIS END OF CARD INPUT ?
YES
NO
LD
NEED TO GENERATE NEW HEADER ?
NO
N
YES
K

**Figure 9.**

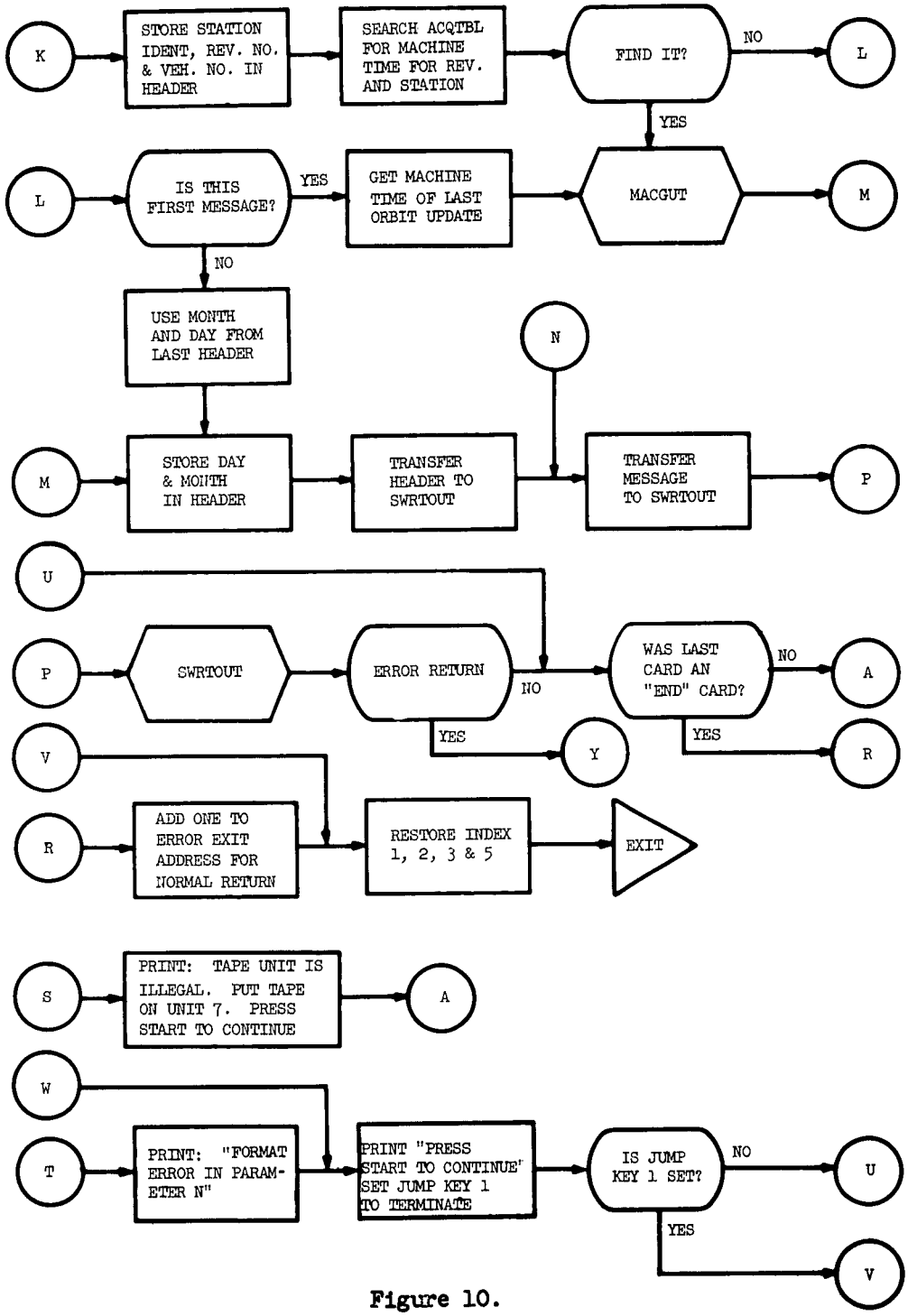

K
STORE STATION IDENT, REV. NO. & VEH. NO. IN HEADER
SEARCH ACQTBL FOR MACHINE TIME FOR REV. AND STATION
FIND IT?
NO
L
YES
L
IS THIS FIRST MESSAGE?
YES
GET MACHINE TIME OF LAST ORBIT UPDATE
MACGUT
M
NO
USE MONTH AND DAY FROM LAST HEADER
N
M
STORE DAY & MONTH IN HEADER
TRANSFER HEADER TO SWRTOUT
TRANSFER MESSAGE TO SWRTOUT
P
U
P
SWRTOUT
ERROR RETURN
NO
WAS LAST CARD AN "END" CARD?
NO
A
YES
Y
YES
R
V
R
ADD ONE TO ERROR EXIT ADDRESS FOR NORMAL RETURN
RESTORE INDEX 1, 2, 3 & 5
EXIT
S
PRINT: TAPE UNIT IS ILLEGAL. PUT TAPE ON UNIT 7. PRESS START TO CONTINUE
A
W
T
PRINT: "FORMAT ERROR IN PARAM-ETER N"
PRINT "PRESS START TO CONTINUE" SET JUMP KEY 1 TO TERMINATE
IS JUMP KEY 1 SET?
NO
U
YES
V

Figure 10.

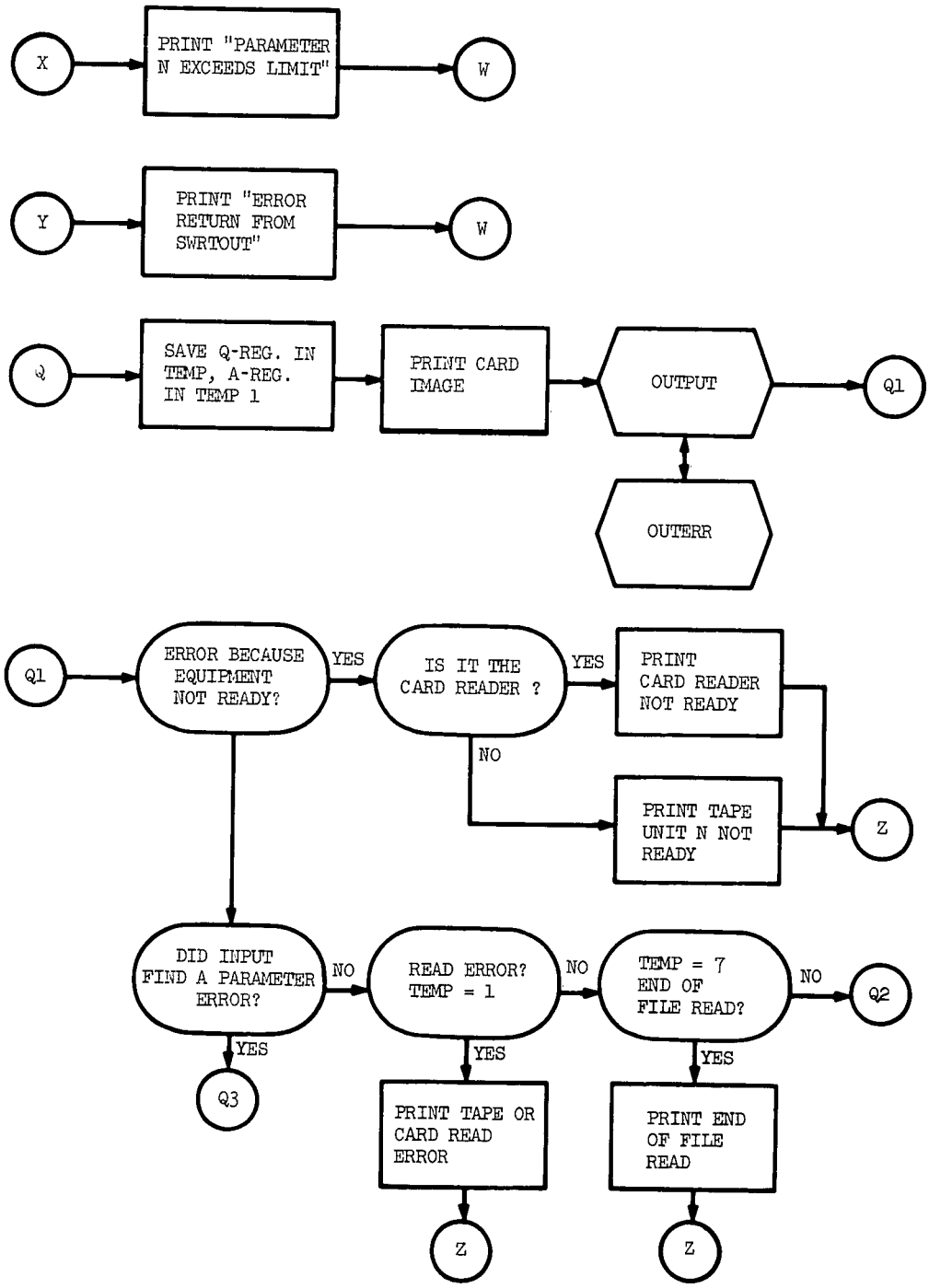

X
PRINT "PARAMETER N EXCEEDS LIMIT"
W
Y
PRINT "ERROR RETURN FROM SWRTOUT"
W
Q
SAVE Q-REG. IN TEMP, A-REG. IN TEMP 1
PRINT CARD IMAGE
OUTPUT
Q1
OUTERR
Q1
ERROR BECAUSE EQUIPMENT NOT READY?
YES
IS IT THE CARD READER ?
YES
PRINT CARD READER NOT READY
NO
PRINT TAPE UNIT N NOT READY
Z
DID INPUT FIND A PARAMETER ERROR?
NO
READ ERROR? TEMP = 1
NO
TEMP = 7 END OF FILE READ?
NO
Q2
YES
Q3
YES
PRINT TAPE OR CARD READ ERROR
YES
PRINT END OF FILE READ
Z
Z

**Figure 11.**

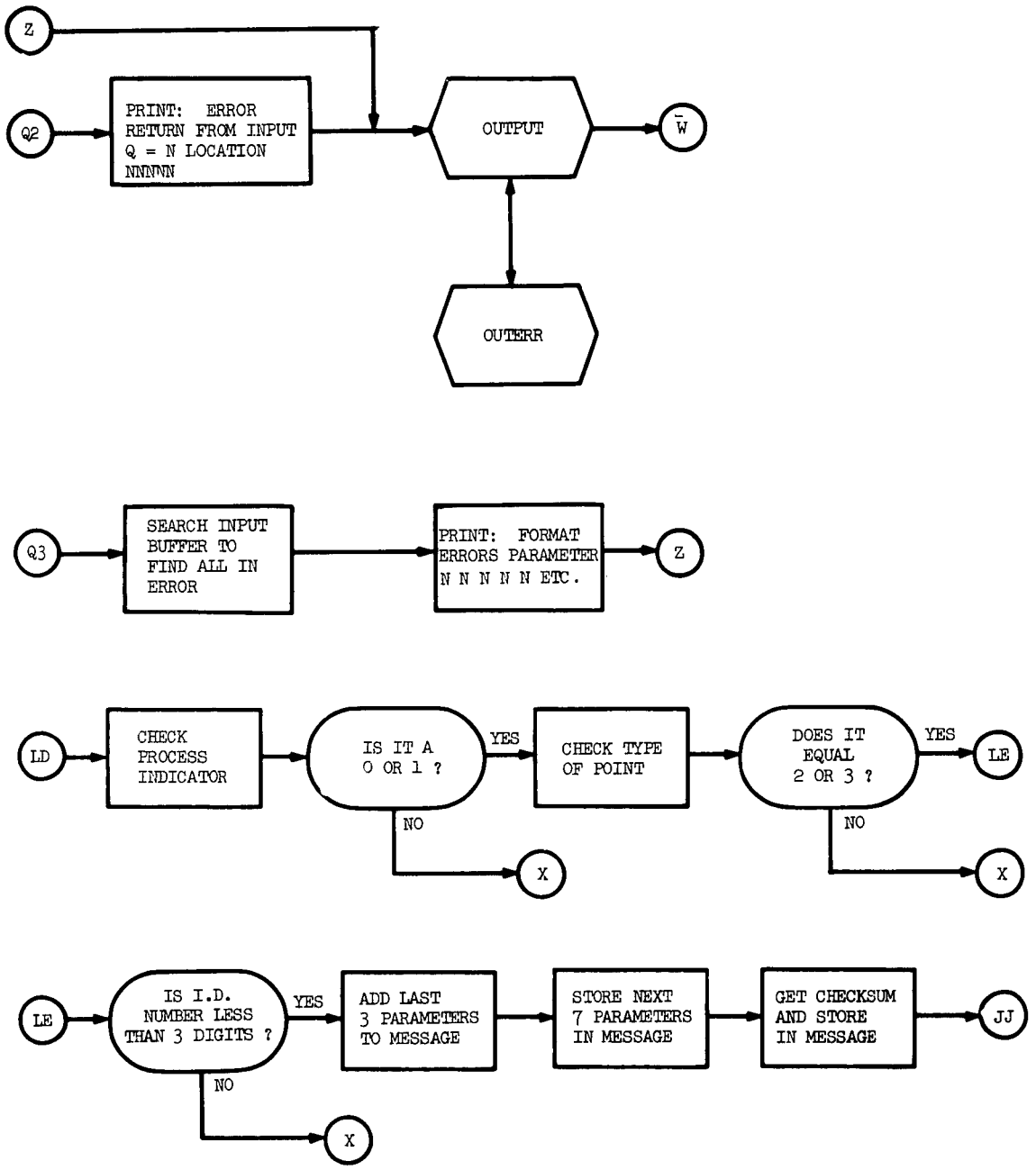

Z
Q2
PRINT: ERROR RETURN FROM INPUT Q = N LOCATION NNNNN
OUTPUT
W
OUTERR
Q3
SEARCH INPUT BUFFER TO FIND ALL IN ERROR
PRINT: FORMAT ERRORS PARAMETER N N N N N ETC.
Z
LD
CHECK PROCESS INDICATOR
IS IT A 0 OR 1 ?
YES
NO
X
CHECK TYPE OF POINT
DOES IT EQUAL 2 OR 3 ?
YES
LE
NO
X
LE
IS I.D. NUMBER LESS THAN 3 DIGITS ?
YES
NO
X
ADD LAST 3 PARAMETERS TO MESSAGE
STORE NEXT 7 PARAMETERS IN MESSAGE
GET CHECKSUM AND STORE IN MESSAGE
JJ

**Figure 12.**

INPUT CARD FORMAT

1. Minimum information required:
   TLEM VVVV RRR.R SS MMMM AA PPPP

2. Complete input card:
   TLEM VVVV RRR.R SS MMMM AA PPPP
   N T IDT LLLL DDDD CCCC PAR1 PAR2
   PAR3 PAR4 END
   where: TLEM = any 4 identifying characters
   VVVV = vehicle number
   RRR.R = revolution number
   SS = station number
   MMMM = telemetry mode
   AA = telemetry type, 1 = FM/FM, 2 = PAM/FM
   3 = PCM/FM
   PPPP = patchboard number
   N = process indicator (1 or 0)
   T = type of point (2 or 3)
   IDT = identification number
   LLLL = relative location of first word (LLLLB if octal)
   DDDD = increment to obtain location of second word
   CCCC = compression algorithm number (decimal)
   PAR1 = parameter 1 required by CCCC
   PAR2 = parameter 2 required by CCCC
   PAR3 = parameter 3 required by CCCC
   PAR4 = parameter 4 required by CCCC

   The word "END" may follow PPPP or PAR4 but must appear on the last card in the input deck.

   Any item may be expressed in octal by following the value with a "B".

Figure 13.

TEST INPUTS AND RESULTS

CARD
STEM 2406 2.4 5 1 2 7 1 2 123 0002 0003 0004 0005 0006
0002 0001
HEADER
1604-BB TRANSFER DATA 05 23 10 0000004400022246
7240000000000000
MESSAGE
7777053030210202 2246000000440001 0007617300020003
0004000500060002 0001402400000000

CARD
STEM 2406 8.1 2 2 1 5 1 9 23
PARAMETER 8 EXCEEDS LEGAL LIMIT
(telemetry type must be 1, 2 or 3)

CARD
STEM 1234 10.0 2 32 2 11
HEADER
1604-BB TRANSFER DATA 02 23 10 00000652 00011064
7620000000000000
MESSAGE
7777023030110201 1064000006520040 0021231600000000

CARD
STEM 1234 9.1 1 8 2 8 0 2 7 9 8 7 1001 2002B 67B 77B END
HEADER
1604-BB TRANSFER DATA 01 23 10 00000221 00011064
MESSAGE
7777013030210201 1064000002210010 0001020 700110010
0007175120020067 0077442500000000

NOTE: If trailing parameters are omitted from the card the completed message will contain whatever parameters were on the preceding card.

Figure 14.

IDENTIFICATION

A. Title: Write Change Tape (SWRTOUT), Ident. K35, Mod. AB

B. Programmed: R. C. Wise, System Development Corporation, 1 February 1963

C. Documented: R. C. Wise, System Development Corporation, 15 February 1963

PURPOSE

SWRTOUT produces a tape for later use by the program SMERGE to produce an updated transfer tape. The tape contains messages input to SWRTOUT and operated upon by SWRTOUT. SWRTOUT accepts individual or grouped messages until a block of these messages is built. It then adds a checksum and writes the messages on a magnetic tape.

USAGE

A. Calling Sequence

```
L       RTJ     SWRTPIT
            N       B
L+1     Error Return
L+2     Normal Return
```

where: "N" is the number of words in buffer starting at location "B".

B. Parameters

"N" is the number of words to be accepted by SWRTOUT. "N" occupies bits 15 to 23 of location L. If "N" is zero, SWRTOUT will terminate operations by calling SMERGE.

"B" is the starting location of the first message SWRTOUT is to accept.

"B" occupies bits 0 to 14 of location L.

C. On-Line Messages

SWRTOUT has two messages, both are printed on the on-line 1612.

1. PLEASE MOUNT WRITE TAPE FOR SWRTOUT ON TAPE 18, AND HIT START.
2. UNRECOVERABLE ERROR IN SWRTOUT - MOUNT NEW TAPE 18 AND REINITIATE PREVIOUS FUNCTION . . .

Message 1 occurs the first time SWRTOUT is entered.

Message 2 occurs if there is persistent write parity or write length error, the change tape is too short, or a commanding message cannot be verified.

D. Tape Assignments

SWRTOUT uses tape 18 (unit 1, cabinet 2, channel 5/6) for the change tape.

E. Input Formats

The individual messages are described in Reference A.

Grouped messages must have each individual message begin left justified in the 1604 word. Only like messages (i.e., same message code) may be grouped.

F. Output - the Change Tape

The Change tape is an intermediate tape produced by SWRTOUT for the use of SMERGE.

It is a single file tape, each record is a message block. Message blocks concerning a given vehicle, station,revolution are separated by a header record specifying the vehicle, station and revolution. Maximum record size is 512 words.

CHANGE TAPE FORMAT

| | |
|---|---|
| Header | $V_1\ R_j\ S_k$ |
| BLOCK | A $(V_1\ R_j\ S_k)$ |
| BLOCK | B $(V_1\ R_j\ S_k)$ |
| BLOCK | C $(V_1\ R_j\ S_k)$ |
| Header | $V_1\ R_m\ S_n$ |
| BLOCK | B $(V_1\ R_m\ S_n)$ |
| Header | $V_o\ R_p\ S_q$ |
| BLOCK | A $(V_o\ R_p\ S_q)$ |

BLOCK B ($V_o$ $R_p$ $S_q$)

BLOCK C ($V_o$ $R_p$ $S_q$)

EOF

G. Error Return

The error return in the SWRTOUT calling sequence is not used, but must be present as SWRTOUT returns to L+2 for a normal return.

When an unrecoverable error occurs, SWRTOUT informs the operator of the error and halts. No restart is possible - the previous function must be reinitiated.

METHOD

SWRTOUT is entered by the user program with an RTJ instruction followed by two parameters; the "B" parameter specifying the location of the input message block and the "N" parameter specifying the number of words in the message block ($1 \leq N \leq 511$).

SWRTOUT will make the following checks.

1. If buffer is empty, transfer input to buffer.
2. If buffer is not empty
   a. If message type input is same as buffer type
      1) If number of words input plus number of words in buffer is greater than 511 words, write the buffer and transfer input to buffer.
      2) Transfer input to buffer
   b. Write the buffer and transfer input to buffer

If SWRTOUT writes the buffer on the Change Tape, a complement checksum of the buffer will be added to the record written. If a block consists of commanding messages, SWRTOUT will reread the record and verify the block, using a word-by-word comparison of a one word input buffer and the original message.

If the conditions for writing the output buffer are not met, SWRTOUT will immediately return to the user program after transferring the message block to its own output buffer.

Upon receipt of the "end of input" flag, SWRTOUT will empty its buffer, write an end of file, and transfer to SMERGE via the COPII successor call. The Change Tape will be rewound.

All error recoveries will be attempted four times before an error message is given.

RESTRICTIONS

A. SWRTOUT uses tape 18 (unit 3, cabinet 2, channel 5/6).
B. Interrupt is locked out by SWRTOUT.
C. Only one type of message may be in a message block.
D. Messages must start left justified in a 1604 word and must be an integral number of 1604 words; i.e., trailing zero bits are used to complete the 1604 word when necessary.
E. An index register cannot be used in specifying the starting location of a message block.
F. Header messages must precede sets of message blocks.
G. SWRTOUT has a time dependent processing loop and should not be stepped.
H. SWRTOUT uses TAPE, PRINT1612, CALL.

TIMING

The timing of SWRTOUT is dependent upon the tape unit and the length of the records. The computational time is negligible.

STORAGE

| | |
|---|---|
| Program | 102 |
| Buffer | 513 |
| TOTAL | 615 |

TRANSFER FUNCTION

| Area | Operation |
|---|---|
| SWRTOUT | Disable interrupt. Set up exit. If this is initial entry, go to REW. |
| SWR1 | Get input parameters. If "N" parameter is zero, go to finis. |
| SWR2 | Set up index for transfer of data. If buffer is empty, go to INBUF. |
| CHKIN | If input message type differs from buffer go to OUTPUT (a SBR). If number of words to be input plus number of words in buffer is greater than buffer length (511), go to OUTPUT. |
| INBUF | Transfer input to buffer. Clear buffer, empty flag. Go to EXIT. |
| REW | Request a write tape on unit 18, rewind the tape. Go to SWR3. |
| SWR3 | Clear initial flag. go to SWR1. |
| FINIS | If buffer is empty, go to WEF. Go to OUTPUT |
| WEF | Write an End-of-file on tape 18. Rewind tape 18. Transfer control to SMERGE via MTCII's CALL. |
| OUTPUT (A SBR) | Compute complement checksum for buffer and store as last word of buffer.<br>Write buffer on tape. If any error after four tries, go to TER.<br>Was last record commanding?<br>No - go to INIT<br>Yes- go to VERIF |

| Area | Operation |
|---|---|
| VERIF | Backspace 1 record, read record into 1 word buffer. Compare against record written. If cannot compare with four tries, go to ERR. |
| INIT | Initialize buffer flags and indices. Return |
| TER | Print message to operator and Stop. |
| ERR | |
| EXIT | Return to user. |

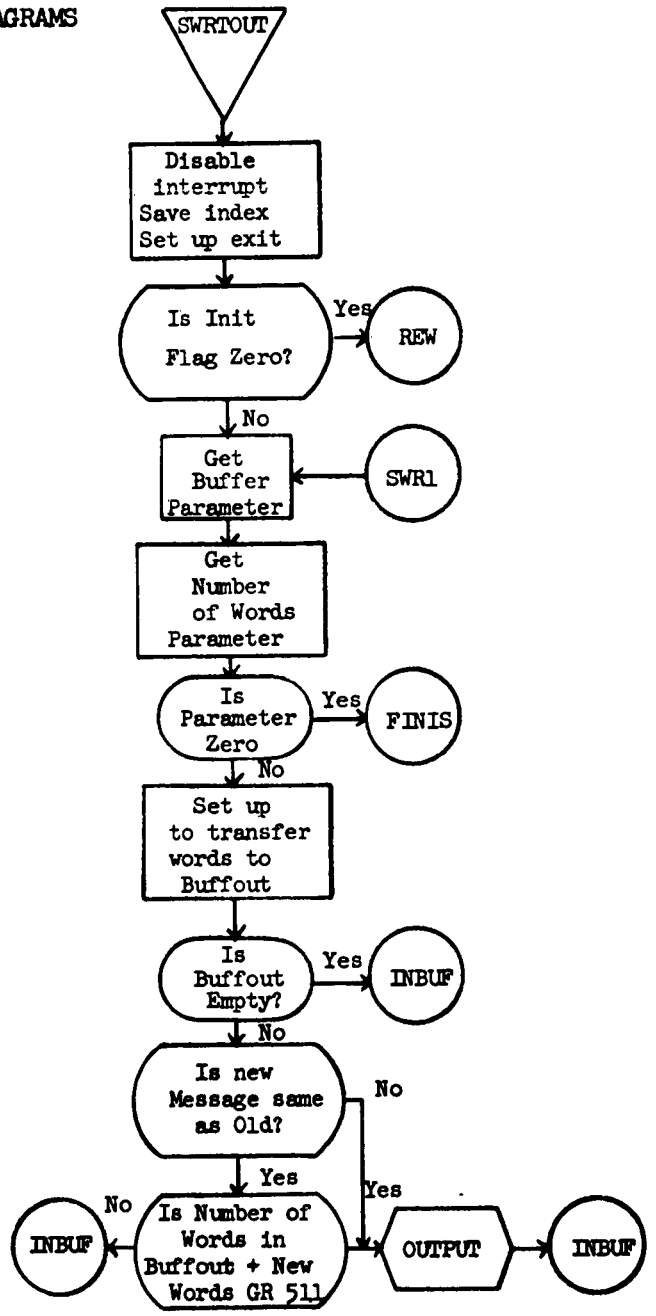
VALIDATION TESTS

SWRTOUT was validated by using a driver function to input messages of varying types and lengths. These messages were written on the Change Tape and the Change Tape was sorted by SMERGE and a new Transfer tape was produced. The Transfer tape was dumped and the dump checked for the desired result.

REFERENCES

1. TM-891/001/00, 1604 Augmentation Communication Programs, Milestone 3-4, 20 December 1962, System Development Corporation.

FLOW DIAGRAMS



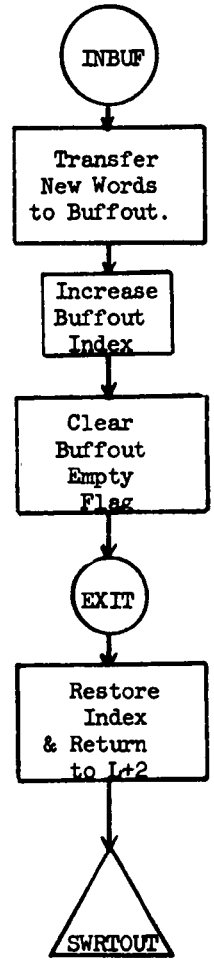




Figure 15.

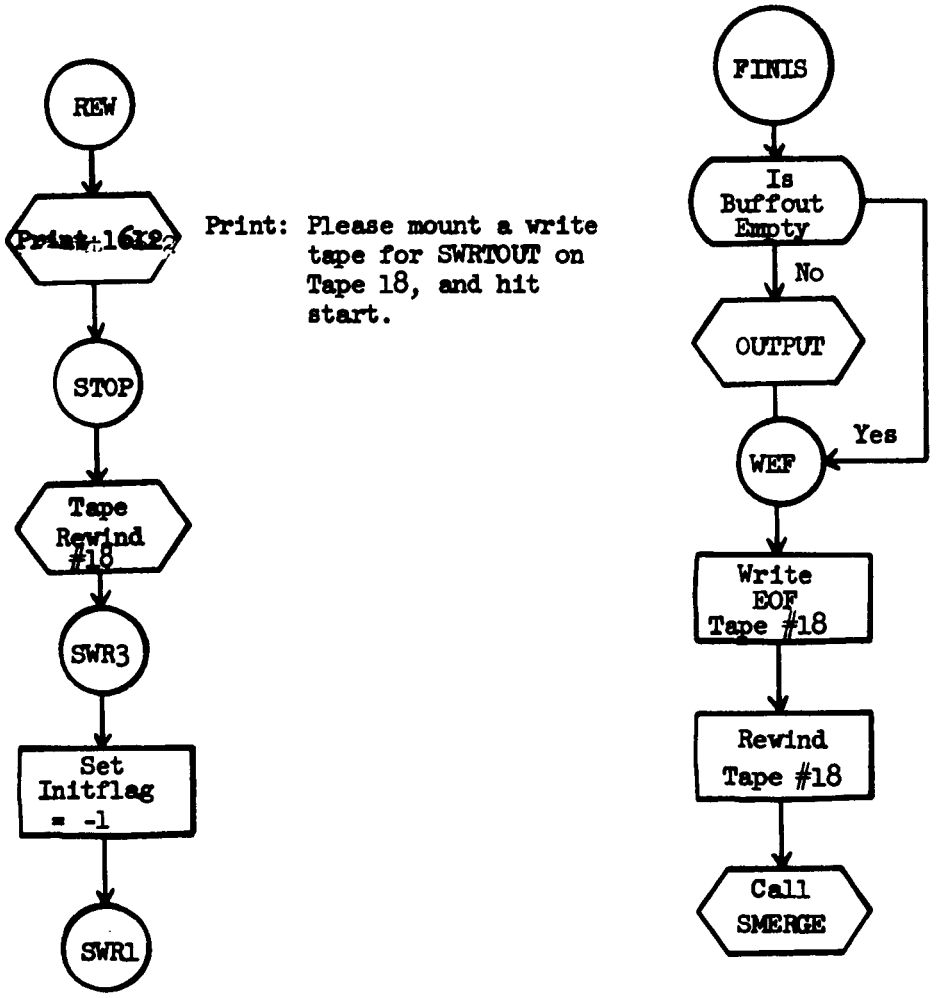
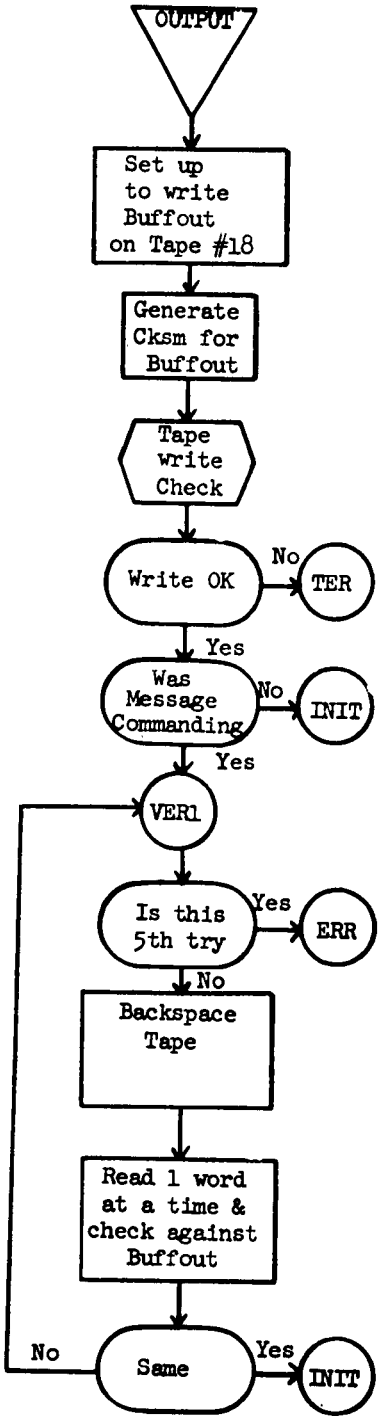
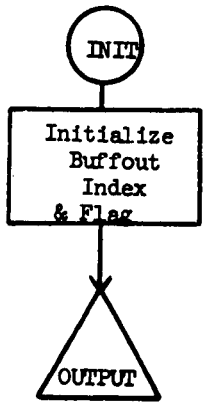
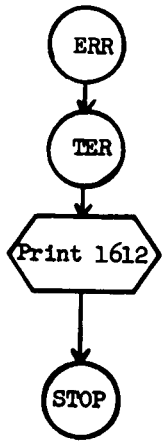

REW
Print 16K2
STOP
Tape Rewind #18
SWR3
Set Initflag = -1
SWR1
Print: Please mount a write tape for SWRTOUT on Tape 18, and hit start.
FINIS
Is Buffout Empty
No
OUTPUT
Yes
WEF
Write EOF Tape #18
Rewind Tape #18
Call SMERGE

Figure 16.




Print: Unrecoverable error in SWRTOUT. Mount new tape & reinitiate previous function.

Figure 17.

IDENTIFICATION

A. Title: Merge Change and Transfer Tapes (SMERGE), Ident. K42, Mod. AA

B. Programmed and documented by: H. J. Frieden, 24 January 1963, System Development Corporation

PURPOSE

SMERGE produces an updated 1604-160A Transfer tape and a duplicate Backup tape from the existing Transfer tape and the Change tape prepared by SWRTOUT. Initially, the existing Transfer tape contains only an end-of-file mark and the first updated Transfer tape consists of the information on the Change tape sorted into order of message type within station within revolution within vehicle. Thereafter, the existing Transfer tape is the updated Transfer tape from the last time SMERGE was operated.

USAGE

A. Calling Sequence

SMERGE is called by a standard COPII calling sequence with no parameters required. It is normally called by SWRTOUT via the successor call function.

B. Tapes Required

1. Unit 16 contains the old Transfer tape or a tape with an initial end-of-file. After it has been read, SMERGE prints a message to replace it with a blank tape, and then halts. The blank becomes the new Transfer tape.
2. Unit 17 contains the old Backup tape. At the beginning of SMERGE, a message to replace the tape on unit 17 with a blank is printed, followed by a halt. This blank becomes the new Backup tape.
3. Unit 18 contains the Change tape written by SWRTOUT. At the end of SMERGE, a message to replace with the SCHOPS tape is printed, followed by a halt.

C. Expected On-Line Printer Messages

After printing each message, SMERGE will first space up the paper to facilitate the reading of the message, and then halt. Press start when ready to continue.

1. REMOVE BACKUP TRANSFER TAPE ON UNIT 17, AND MOUNT BLANK
2. REMOVE OLD TRANSFER TAPE ON UNIT 16, AND MOUNT BLANK
3. REMOVE RINGS FROM NEW TRANSFER AND BACKUP TAPES ON UNITS 16 AND 17
4. IF SCHOPS REQUESTS ARE FORTHCOMING, MOUNT SCHOPS TAPE ON UNIT 18.

D. Error Messages

1. In case of a read error on the old Transfer tape,
   UNRECOVERABLE READ ERROR ON UNIT 16
2. In case of read error after the old Transfer tape was removed,
   UNRECOVERABLE READ ERROR ON UNIT **
   MOUNT OLD TRANSFER TAPE ON UNIT 16 AND CONTINUE
3. UNRECOVERABLE WRITE ERROR ON UNIT **, MOUNT NEW TAPE AND CONTINUE
4. END OF TAPE REACHED ON UNIT **, MOUNT LONGER TAPE AND CONTINUE
5. PARITY ERROR ON CHANGE TAPE, JOB ABANDONED
6. CHECKSUM ERROR ON CHANGE TAPE, JOB ABANDONED
7. RECORD ON CHANGE TAPE LONGER THAN 512 WORDS, JOB ABANDONED
8. RECORD ON CHANGE TAPE HAS ILLEGAL FORMAT, JOB ABANDONED

If the Change tape is in error, it must be regenerated. Mount the old Backup and Transfer tapes and re-run all programs which were used to generate the Change tape.

E. Change Tape Format

1. Maximum record size is 512 words.
2. Header Records
   a. A Header Record is identified by a first word of 01061204 40626220.
   b. Vehicle number, in 4-bit BCD, is in the fourth word, bits 0-15.

c. Revolution number, in 4-bit BCD, is in the fourth word, bits 24-39.

d. Station number, in binary, is in the third word, bits 12-17.

3. Message Records

a. A Message Record is identified by 7777 in bits 36-47 of the first word.

b. Message type, in binary, is in the first word, bits 24-29. A message type of 00 is illegal.

c. The message is for the vehicle, revolution, and station of the preceding Header Record.

4. The tape is ended by an end-of-file mark.

F. Transfer Tape Fromat

The Transfer tape has the same format as the Change tape, but it is ordered by message type within station within revolution within vehicle. Any message block on the existing Transfer tape which has a corresponding entry on the Change tape is replaced by the new information.

G. Backup Tape Format

The Backup tape is a copy of the Transfer tape.

METHOD

SMERGE will initially request the operator to remove the old Backup tape and mount a blank. All tapes are then rewound. Changes will be read into memory from the Change tape until an end-of-file is reached or until memory is filled.

The changes will then be sorted into order of message type within station within revolution within vehicle. An indirect sort will be used to limit the amount of data movement.

The Transfer tape will then be merged with the changes in memory, writing the updated tape on the unit which held the old Backup tape. Any message block on the existing transfer tape which has a corresponding entry on the Change tape will be replaced by the new

information. New message blocks for a particular vehicle, revolution, and station will be added in order of message type.

At the end of the first pass, the operator will be requested to remove the old Transfer tape and mount a blank. Additional merges will be required if the information on the Change tape could not all fit in memory at one time. The input and output tapes for the merge would alternate between the Transfer and Backup tapes. When the final merge is done, the updated Transfer tape will be copied onto the Backup tape and SMERGE will request the operator to file protect the new tapes before returning to COP.

If an unrecoverable read error occurs on the Change tape, no recovery is possible. If an unrecoverable read error occurs on the first pass over the Transfer tape, SMERGE will ask the operator to mount the Backup tape and will start over. If an unrecoverable read error occurs on a subsequent pass, SMERGE will ask the operator to mount the old Transfer tape and will start over. An unrecoverable write error will cause SMERGE to return to the beginning of the current merge, after asking the operator to mount a new output tape.

RESTRICTIONS

A. Tape number 16 must be an existant Transfer tape or a tape initialized by IRT.

B. The code for message type cannot be 00.

C. All records for a particular vehicle, revolution, station, and message type must appear contiguously on the Change tape. Otherwise, the results will depend on whether or not the information on the Change tape can all fit in memory at one time.

TIMING

The time for the memory sort of the records on the Change tape depends on the number of records, their initial order, and the type of records. 1000 records could take from 5-35 seconds, with an average time of 10-15 seconds.

The time to read the Change tape, merge the changes with the existing Transfer tape, and copy the Transfer tape onto the Backup tape, will be limited by the speed of the tapes.

STORAGE REQUIREMENTS

| | | |
|---|---|---|
| Program | 440 | cells |
| Constants | 113 | cells |
| Storage | 23539 | cells |

VALIDATION TESTS

A Change tape and Transfer tape were prepared, and mounted on units 18 and 16. SMERGE was operated and produced a new Transfer tape on unit 16. Detailed information will be presented in the Milestone 11 document.

REFERENCE

1. TM-891/001/00, 1604 Augmentation Communication Programs, Milestone 3-4, 20 December 1962, System Development Corporation.

FLOW DIAGRAMS

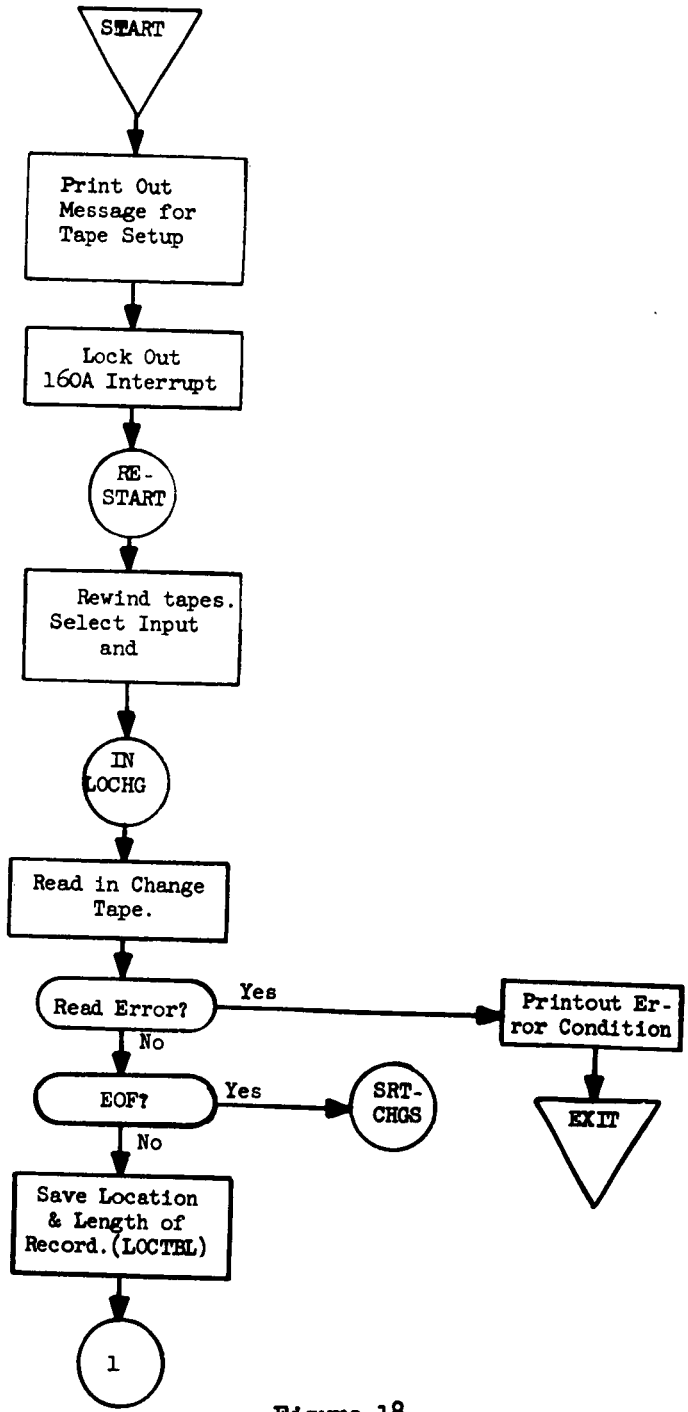
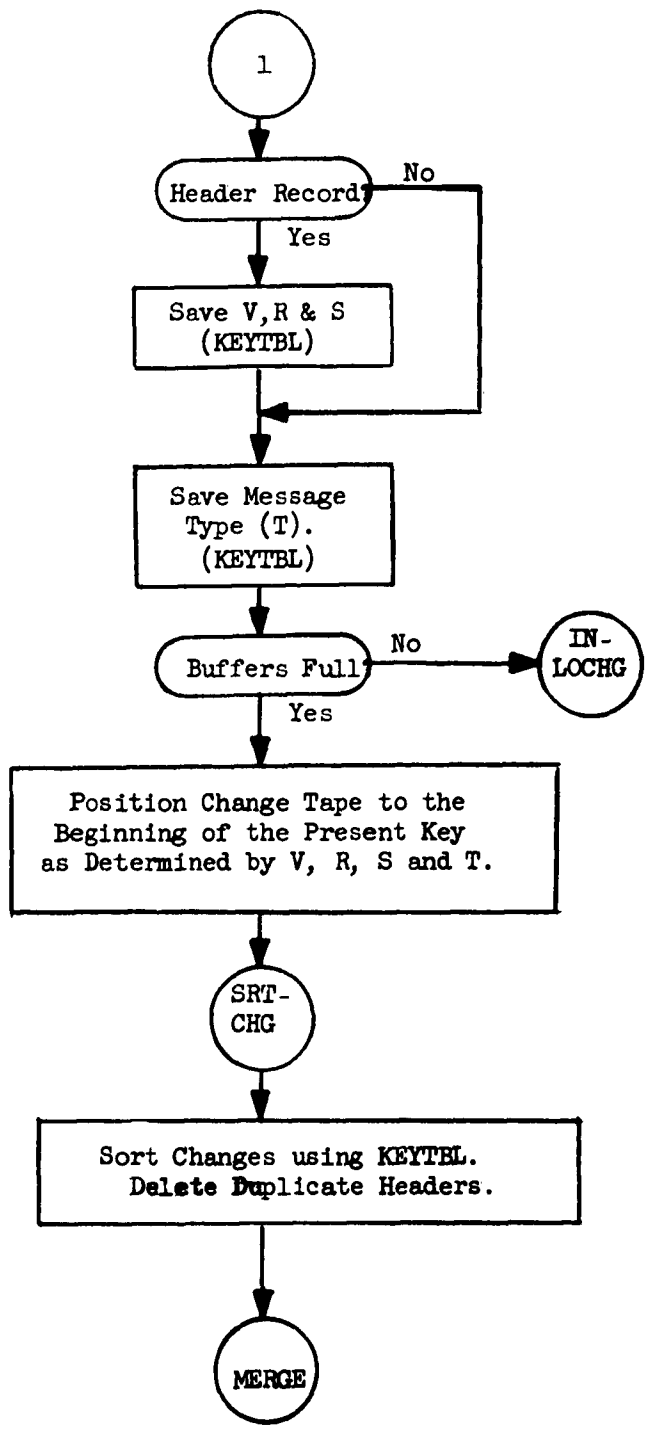



Figure 18.


1
Header Record?
No
Yes
Save V,R & S (KEYTBL)
Save Message Type (T). (KEYTBL)
Buffers Full?
No
IN-LOCHG
Yes
Position Change Tape to the Beginning of the Present Key as Determined by V, R, S and T.
SRT-CHG
Sort Changes using KEYTBL. Delete Duplicate Headers.
MERGE

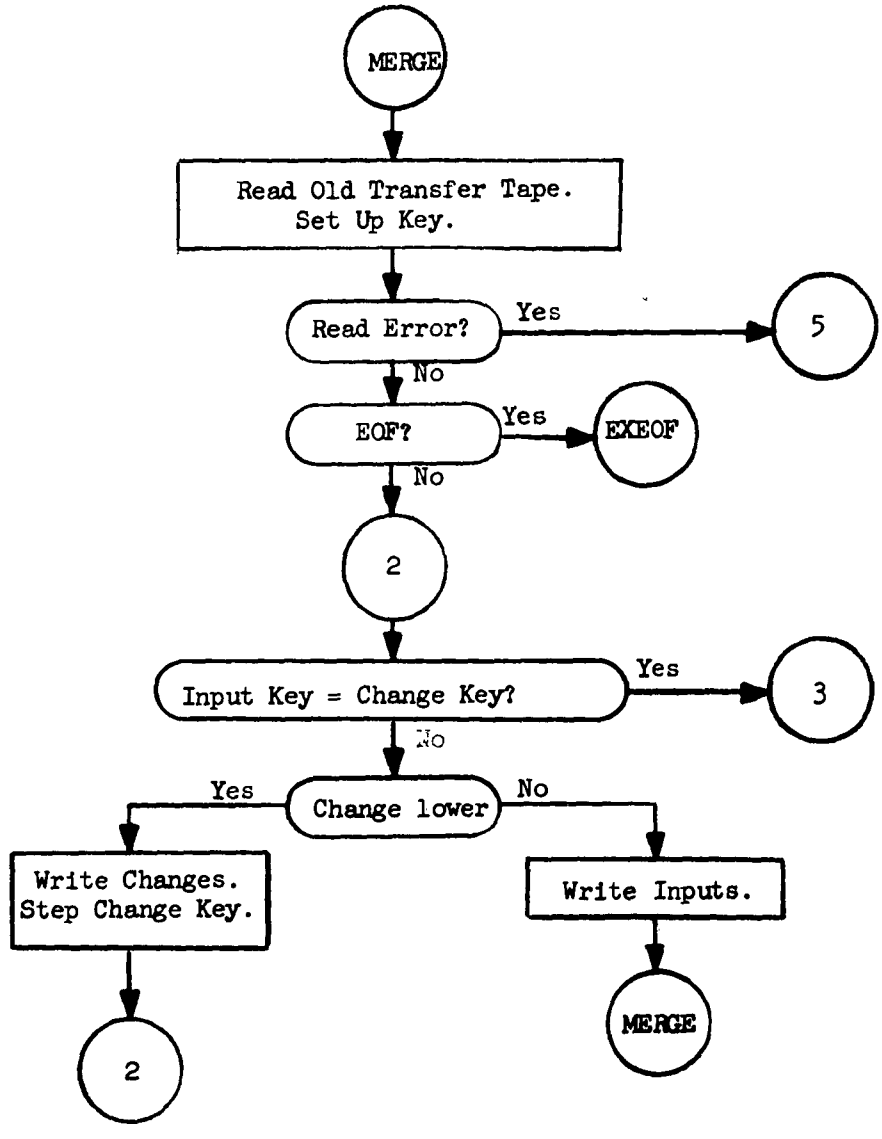

MERGE
Read Old Transfer Tape.
Set Up Key.
Read Error?
Yes
5
No
EOF?
Yes
EXEOF
No
2
Input Key = Change Key?
Yes
3
No
Yes
Change lower
No
Write Changes.
Step Change Key.
Write Inputs.
2
MERGE

Figure 20.

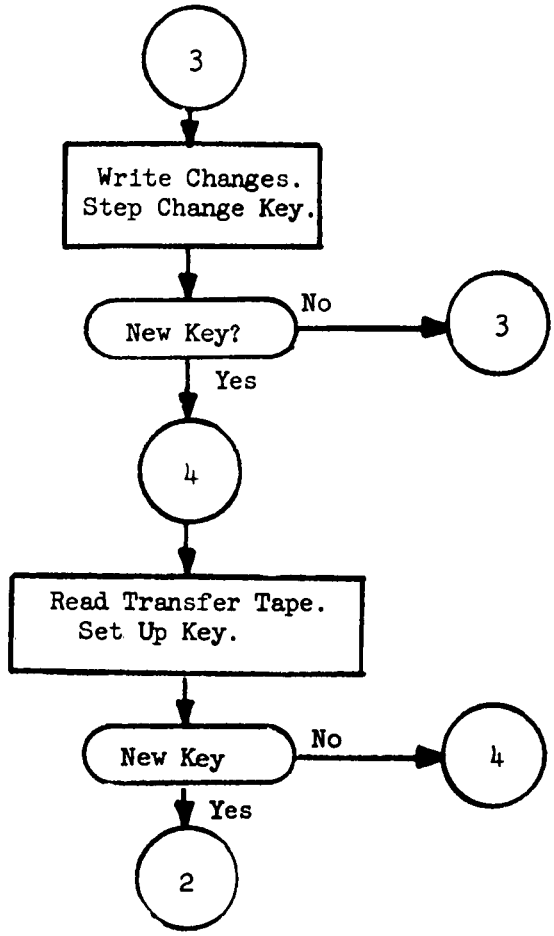

3
Write Changes.
Step Change Key.
New Key?
No
3
Yes
4
Read Transfer Tape.
Set Up Key.
New Key
No
4
Yes
2

Figure 21.

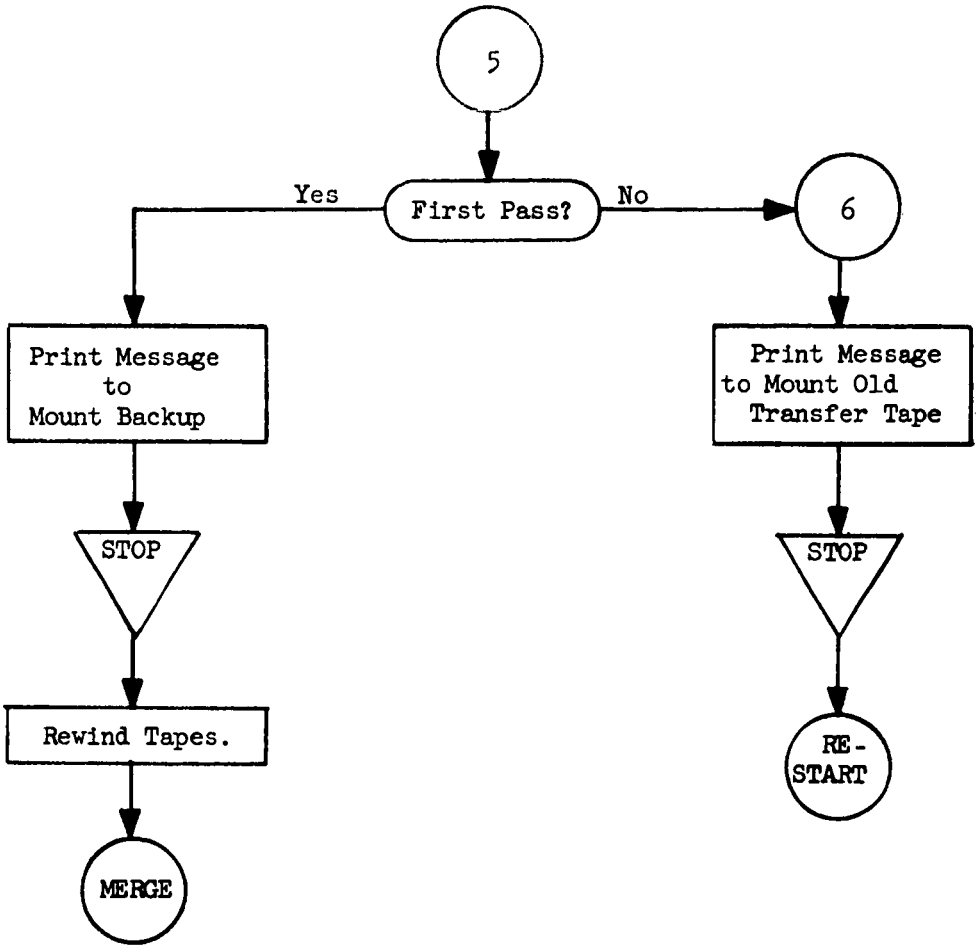

5
First Pass?
Yes
No
6
Print Message to Mount Backup
Print Message to Mount Old Transfer Tape
STOP
STOP
Rewind Tapes.
RE-START
MERGE

Figure 22.

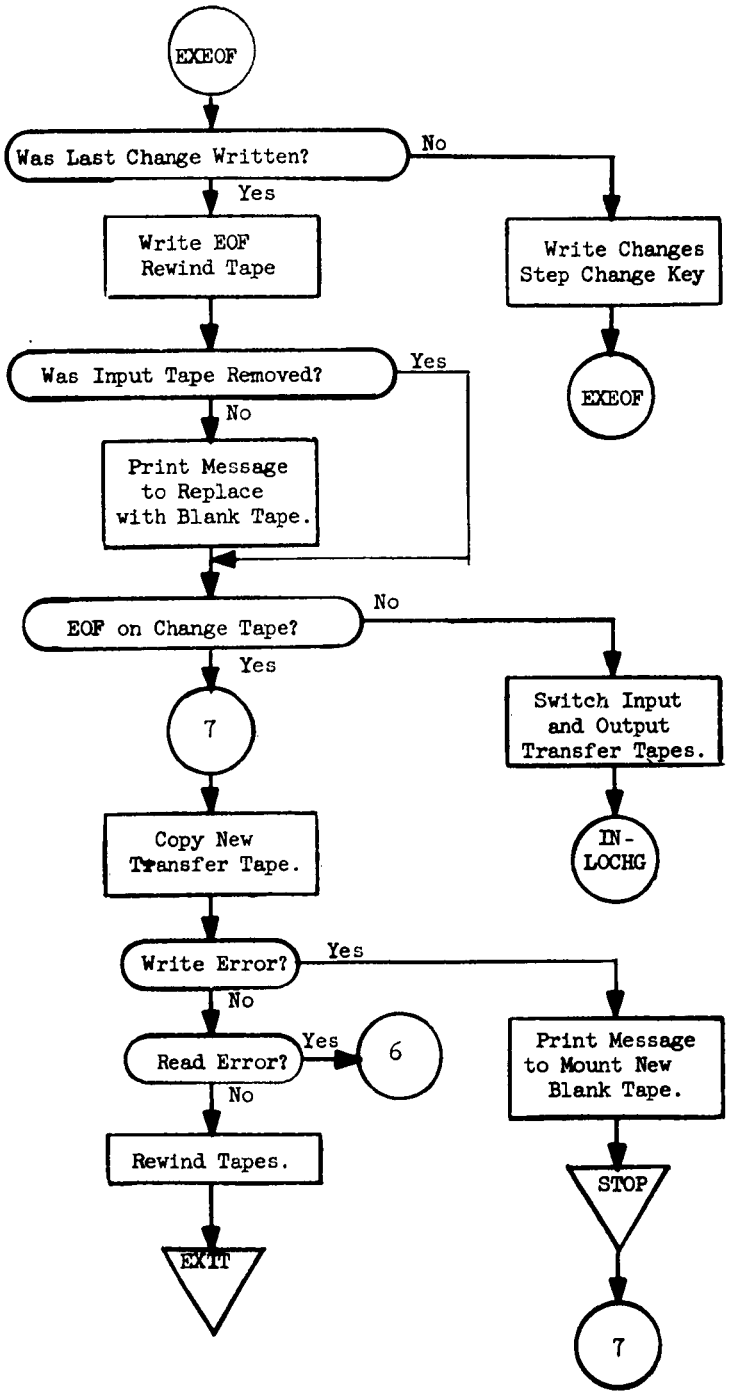

EXEOF
Was Last Change Written?
No
Yes
Write EOF
Rewind Tape
Write Changes
Step Change Key
EXEOF
Was Input Tape Removed?
Yes
No
Print Message
to Replace
with Blank Tape.
EOF on Change Tape?
No
Yes
7
Switch Input
and Output
Transfer Tapes.
IN-
LOCHG
Copy New
Transfer Tape.
Write Error?
Yes
No
Read Error?
Yes
6
No
Print Message
to Mount New
Blank Tape.
Rewind Tapes.
STOP
EXIT
7

Figure 23.

IDENTIFICATION

A. Title: 1604 to Bird Buffer Communication (SBRDTLK), Ident. K34, Mod. AD

B. Programmed: S. A. Gardner, System Development Corporation, 18 January 1963

C. Documented: S. A. Gardner, System Development Corporation

PURPOSE

To provide the communication link between the 1604 and Bird Buffer (160A) computers via a tape control unit operating in the satellite mode.

USAGE

A. Operating Procedures

1. Initiating the "TRANSMIT" Mode

When the Bird Buffer reads a control card which will necessitate the acquisition of new prepass data, command messages, or SCHOPS messages from the 1604, or the transmittal of accumulated tracking and vehicle time data to the 1604, the Bird Buffer to 1604 communication routine (SIBBTC) will be operated. SIBBTC will send an interrupt signal through the tape cabinet (which must be in satellite mode) to the 1604, which, if interrupt has not been locked out*, will cause MTCII to execute its interrupt servicing routine. MCTII will acknowledge the interrupt by setting a flag which may be sensed and cleared by the 160A.

At this point, MTCII will give the 1604 operator the option of whether or not to enter the "TRANSMIT" mode, i.e., operate SBRDTLK. The operator may elect not to operate SBRDTLK, in which case MTCII will return to whatever was interrupted. Otherwise, MTCII will notify the 160A (by setting the same flag) that SBRDTLK will operate.

* Interrupt is locked out when: a) loading a program; b) reading cards; c) in interrupt routine; d) operating SBRDTLK.

If the interrupt occurred during the operation of some program, the execution of SBRDTLK obviates the termination of that program; hence, if it is desired to complete the interrupted function, it must be started from scratch after SBRDTLK. The typewriter messages from MTCII notify the operator of the possible options, and announce when SBRDTLK is starting and finished.

2. Operating in the "TRANSMIT" Mode
   As soon as program control is given to SBRDTLK, it will initiate a core-to-core transfer of a control message from the 160A to determine what particular data transfers are to be made. All operations are requested by such control messages (formats in Figure 34.); no function cards are required. When SBRDTLK has completed the desired operation, it will return control to MTCII.

B. Parameters
   All necessary parameters (type of data, direction of transfer, vehicle number, etc.) are embedded within the control messages which are exchanged between the two computers.

C. Tape Assignments
   1. 1604 to Bird Buffer Transfer Tape = channels 5 and 6, cabinet 2, units 1 and 2 (logically numbered 16 and 17). These tapes are duplicates; the prepass tape and the backup prepass tape.
   2. SCHOPS Tape - channels 5 and 6, cabinet 2, unit 3 (logically numbered 18).
   3. Bird Buffer to 1604 Transfer Tape - channels 5 and 6, cabinet 2, unit 4 (logically numbered 19). This is the input tape for tracking and vehicle time data.
   4. At times, a blank may be needed; it will share the drive used by the SCHOPS tape (18).

D. On-Line Messages (Console Typewriter)*

1. REMOVE SLJ 2 SETTING
   This is typed by MTCII when preparing to give the operator the option of whether or not to enter the "Transmit" mode.
2. SET SLJ 2 IF TRANSMIT MODE IS NOT TO BE INITIATED
   Typed by MTCII if interrupt occurred during the COPII control cycle. After delaying about 17 seconds, MTCII will test jump key 2; if not set, SBRDTLK will operate.
3. SET SLJ 2 IF CURRENT PROGRAM IS TO BE INTERRUPTED BY THE 160A AND NOT COMPLETED
   Typed by MTCII if interrupt occurred during program operation. After delaying about 17 seconds, MTCII will test jump key 2; if set, SBRDTLK will operate.
4. TRANSMIT MODE IS BEGINNING
   Typed by MTCII must before giving program control to SBRDTLK.
5. LOAD VEHICLE XXXX ON UNITS 16, 17 CONTINUE
   Typed by SBRDTLK (followed by a halt) due to:
   a. SIBBTC has requested data for a vehicle which is not on the transfer tapes currently mounted. This will require a restart from the Bird Buffer side.
   b. SBRDTLK is ready to update the prepass tapes, but the wrong ones are mounted. Load and continue.
6. READY TAPE UNIT XX, CONTINUE
   Typed by SBRDTLK (followed by a halt); ready the specified tape and continue.
7. LOAD SCHOPS ON UNIT 18, CONTINUE
   Typed by SBRDTLK (followed by a halt) because SIBBTC has requested SCHOPS data and the tape currently on unit 18 is not

* Under certain circumstances, MTCII may print on the on-line printer that an I/O unit is not ready.

the SCHOPS tape. This will require a restart from the Bird Buffer side.

8. BLANK ON UNIT XX, CONTINUE
   Typed by SBRDTLK (followed by a halt) due to:
   a. The Bird Buffer to 1604 Transfer tape (19) is full, which may require a restart from the Bird Buffer side if a delay in excess of thirty seconds occurs.
   b. A scratch tape (18) is needed for updating the prepass tapes. Load and continue.
9. READY TO COPY UPDATE - LOAD BLANK ON UNIT 16, SWITCH 17/18 CONTINUE
   Typed by SBRDTLK (followed by a halt) when ready to write a new prepass tape. Tape 18 will become the new backup tape on unit 17; the old backup tape on 17 should be switched to unit 18 (it may be needed again in the event that message 10, below, occurs next).
10. PARITY ON UNIT 17 - RELOAD PREPASS ON UNIT 16, SWITCH 17/18. RAISE JUMP KEY 1 TO TRY UPDATE AGAIN.
    Typed by SBRDTLK (followed by a halt) when parity persists while reading the new backup tape. The old prepass tape should be reloaded on unit 16, the old backup tape should be switched from 18 to 17, and a new blank on 18 might be desirable. If jump key 1 is raised upon continuing, SBRDTLK will start the update processing over again. Otherwise, it will housekeep and return control to MTCII.
11. BIRD BUFFER CONTROL LOST - JOB ABORTED
    Typed by SBRDTLK due to persistent parity errors in core-to-core transfers, or a delay in excess of thirty seconds on the Bird Buffer side. Control returns to MTCII.
12. REQUESTED DATA NOT AVAILABLE - JOB ABORTED
    Typed by SBRDTLK when SIBBTC has requested data for a rev,

station, or data type which is not present on the transfer tapes. Control returns to MTCII.

13. LAST DATA FROM BB FOR WRONG 1604 - JOB ABORTED
Typed by SBRDTLK after receiving data from a different Bird Buffer than the one it started communicating with; control returns to MTCII.

14. PARITY ON UNIT XX
Typed by SBRDTLK due to parity or checksum errors when attempting to read or write a tape. Program continues.

15. PART OF REQUESTED DATA COULD NOT BE SENT DUE TO PARITY
Typed by SBRDTLK when one or more records from the transfer tapes (or SCHOPS tape) could not be read successfully, resulting in the bad data being skipped and not transmitted to the Bird Buffer. Although this should occur very rarely, if ever, the tapes involved should be regenerated and the Bird Buffer function which required the data should be rerun to obtain all requested data.

16. PARITY ON BOTH PREPASS TAPES DURING UPDATE - RECORD DELETED
Typed by SBRDTLK when the same record (or records) could not be read successfully from either the prepass or backup tapes (units 16 and 17); the bad record was skipped. As with message 15, this should occur very rarely, if ever; no recovery possible except for complete regeneration of the prepass tapes.

17. UPDATE SUCCESSFUL - DISCARD OLD PREPASS TAPES
Typed by SBRDTLK after successfully updating the prepass tapes. The tapes currently mounted on units 16 and 17 are the new prepass tapes. The old backup tape on unit 18 may be used as a scratch tape, if desired.

18. TRANSMIT MODE IS TERMINATED
RESTORE SLJ 2 SETTING
Typed by MTCII immediately after the operation of SBRDTLK.

E. Error Returns

Any errors discovered by SBRDTLK will result in one of the printouts described above. If the program halts, one of messages 5 through 10 should have been typed to notify the operator of corrective action; if no message was typed, the only recovery possible is to clear interrupt lockout and reinitiate the function from the Bird Buffer side.

F. Data Formats

Control messages, data messages, and transfer tape formats may be found in Figures 34, 35, and 36, respectively.

METHOD

The only special technique in SBRDTLK which deserves clarification is the method of direct transfer employed; i.e., core-to-core transmission. Two flip-flops in the tape cabinet, Flag 1 and Flag 2, are used as follows. SBRDTLK gives read or write control to the 160A for every direct transfer and then initiates an input or output. As soon as SIBBTC senses read or write control, it executes the corresponding output or input. When the transfer is complete, SIBBTC notifies SBRDTLK by setting Flag 2, which SBRDTLK then clears. The data-receiving computer then sets Flag 1 to signify that the data was received error-free. If Flag 1 is not set within 500 milliseconds (the data did not sumcheck properly), the data-sending computer will start the direct transfer again. See limitation A, below.

RESTRICTIONS

A. If the completion of any core-to-core transfer exceeds thirty seconds, or if any data fails to sumcheck properly after five successive transfers of the same data, both SIBBTC and SBRDTLK will abort, with appropriate printouts (message 11).

B. SBRDTLK assumes that the input, or tracking tape (19), is positioned in one of two places:

1. After the double end-of-file if the tape is not a new one.
2. After the single end-of-file if the tape is a new one.

SBRDTLK will leave the tracking tape positioned after the double end-of-file.

No assumptions are made about the other tapes (16-18); SBRDTLK will rewind and examine them to ensure the proper tapes are loaded for any particular operation. It will leave all but the tracking tape rewound.

C. All blank tapes for use by SBRDTLK must have been initialized by IRT, to start with an end-of-file.

D. Two MTCII subroutines, INFLEX and TAPEIO, are used by SBRDTLK.

E. Prior to operating SBRDTLK, the transfer tapes must have been written at least once by SWRTOUT or SMERGE.

F. Maximum record size "readable" by SBRDTLK is 512 words including the record checksum.

TIMING

Since SBRDTLK does no data reduction and a minimum of data formatting, its timing is essentially a function of data storage and retrieval to and from tapes; i.e., the time required for tape manipulation. There are, however, two time factors which should be mentioned again. As discussed in Method, above, there exists a 500 millisecond (maximum) delay while waiting for SIBBTC to sumcheck the last message received by the 160A; and, as mentioned in Limitation A, above, there also exists a thirty second (maximum) delay while waiting for the last direct transfer initiated to go to completion.

STORAGE REQUIREMENTS

| | | |
|---|---|---|
| Program | 450 | words |
| Storage | 1190 | words |
| TOTAL | 1640 | words |

TRANSFER FUNCTION

A. SBRDTLK performs the following while in the "real-time Transmit" mode.

1. Communicates with the Bird Buffer by means of control messages (Figure 34).
2. In response to control message A, receives pass data (tracking and vehicle time data) for vehicle V, Revolutions $R_i$, and records the data on the Bird Buffer to 1604 Transfer tape (19).
3. In response to control message B, transmits prepass data from the 1604 to Bird Buffer Transfer tape (16,17) for the requested vehicle, revolution (all if not specified), and station (all if not specified).
4. In response to control message D, transmits real-time commands from the 1604 to Bird Buffer Transfer tape for the requested vehicle, revolution (all if not specified), and station (all if not specified).
5. In response to control message C, transmits scheduling data from the SCHOPS tape (18) for the requested station (all if not specified).
6. Verifies data by checksums, from tape and from the Bird Buffer, with the additional requirement that all command data sent to the Bird Buffer be sent back to the 1604 for bit-by-bit verification with the original data.
7. Notifies the Bird Buffer and 1604 operator of error conditions.

B. SBRDTLK performs the following operation while in the "update Transmit" mode.

1. In response to control message E, which signifies termination of "real-time Transmit" mode, SBRDTLK deletes all prepass data from the 1604 to Bird Buffer Transfer Tapes (16,17) for vehicle V, revolutions $R_j$ ($0 < R_j < R_i$). See A.2, above.
2. Verifies data by checksums from tape and notifies the 1604 operator of error conditions.

VALIDATION

Validation test inputs are described in Figure 37 .

REFERENCES

1. TM-(L)-834/000/01, Bird Buffer Combined Milestone 3 and 4, 17 December 1962, System Development Corporation.
2. TM-891/001/00, Combined Milestone 3-4 for the 1604 Augmentation Communication Programs, 20 December 1962, System Development Corp.
3. *N-(L)-19081/017/00 and N-(L)-19081/017/00A, Milestone 7 Operating Instructions for SBRDTLK, 1604 to Bird Buffer Communication Routine, 21 January 1963, System Development Corporation.
4. *N-(L)-19081/013/01, Milestone 7 Operating Instructions for SIBBTC, Bird Buffer to Computer Communications, 28 January 1963, System Development Corporation.

* N (Notes) are internal SDC documents and are ordinarily not released to outside companies.

FLOW DIAGRAMS

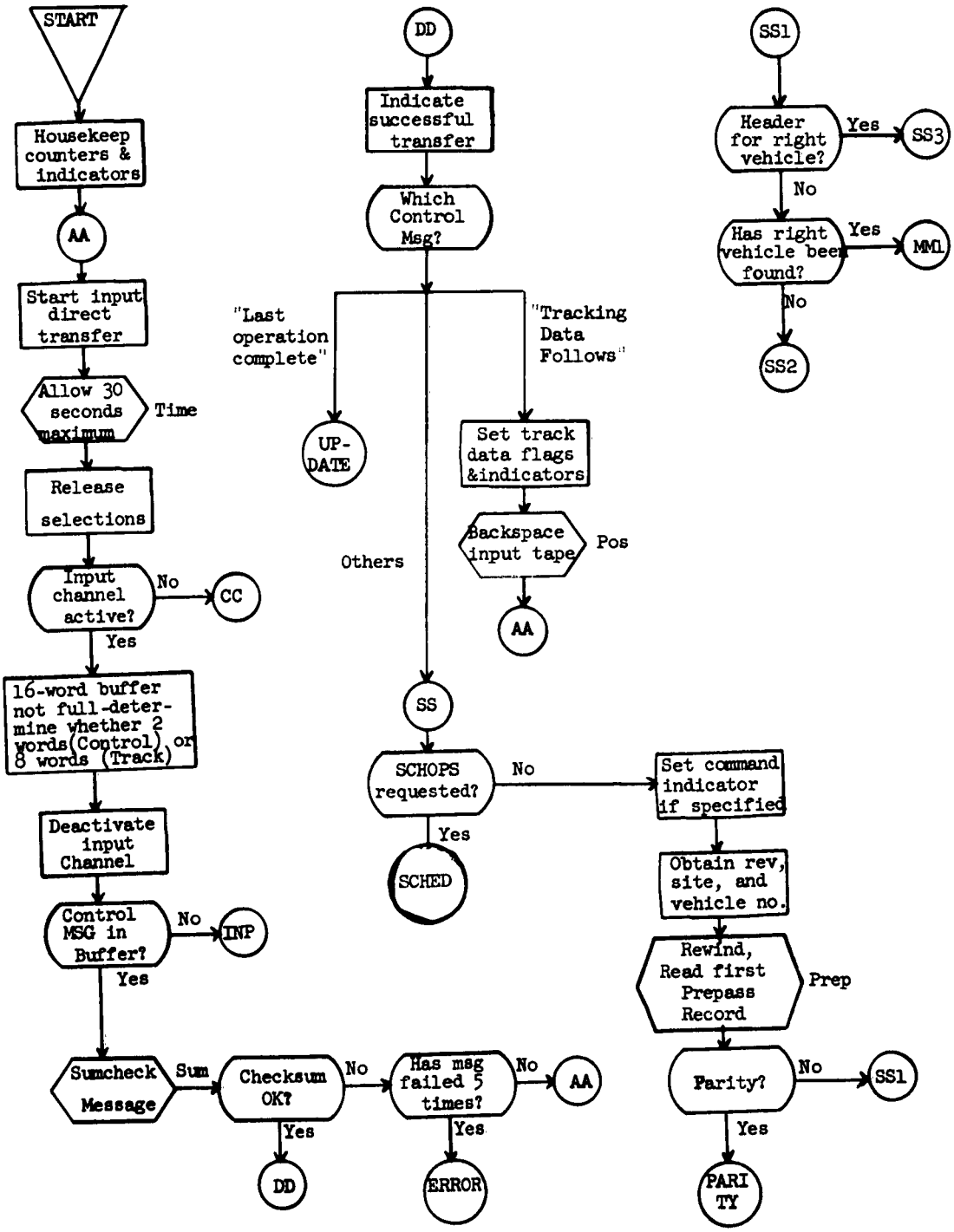



Figure 24.

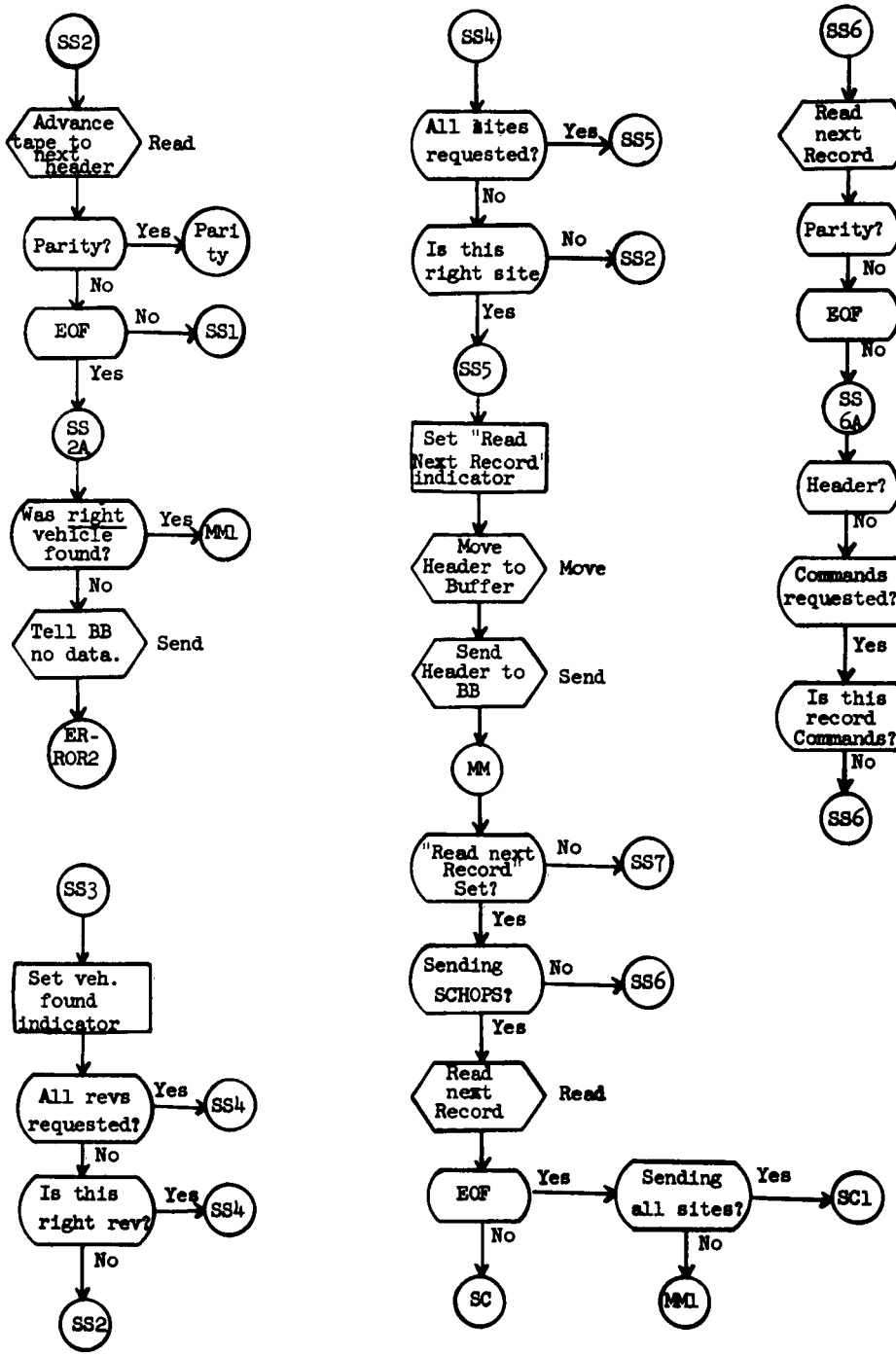

SS2
Advance tape to next header
Read
Parity?
Yes
Pari ty
No
EOF
No
SS1
Yes
SS 2A
Was right vehicle found?
Yes
MM1
No
Tell BB no data.
Send
ER-ROR2
SS3
Set veh. found indicator
All revs requested?
Yes
SS4
No
Is this right rev?
Yes
SS4
No
SS2
SS4
All sites requested?
Yes
SS5
No
Is this right site
No
SS2
Yes
SS5
Set "Read Next Record" indicator
Move Header to Buffer
Move
Send Header to BB
Send
MM
"Read next Record" Set?
No
SS7
Yes
Sending SCHOPS?
No
SS6
Yes
Read next Record
Read
EOF
Yes
Sending all sites?
Yes
SC1
No
SC
No
MM1
SS6
Read next Record
Read
Parity?
Yes
Pari-ty
No
EOF
Yes
MM1
No
SS 6A
Header?
Yes
SS1
No
Commands requested?
No
SS7
Yes
Is this record Commands?
Yes
SS7
No
SS6

Figure 25.

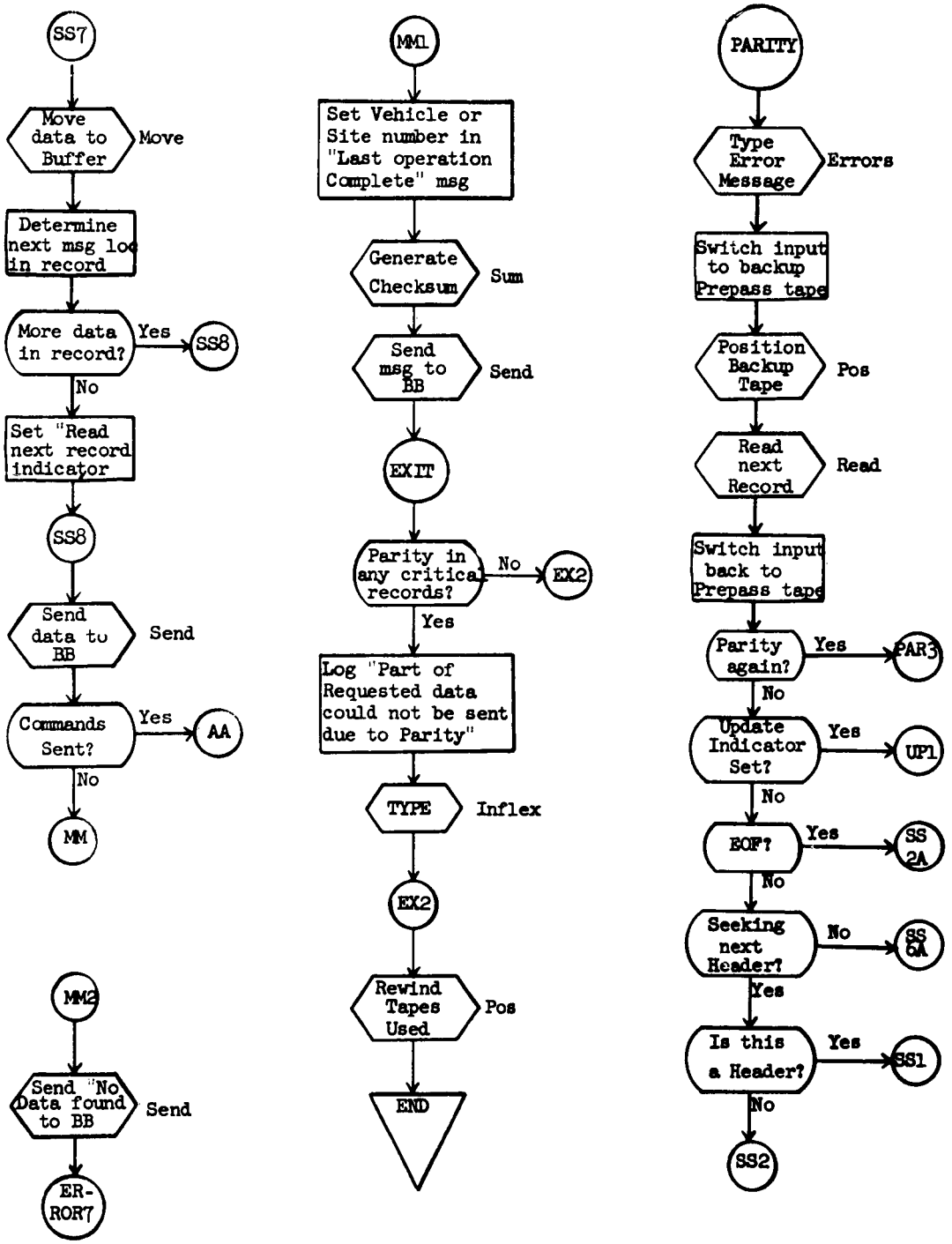

SS7
Move data to Buffer
Move
Determine next msg loc in record
More data in record?
Yes
SS8
No
Set "Read next record indicator
SS8
Send data to BB
Send
Commands Sent?
Yes
AA
No
MM
MM2
Send "No Data found to BB
Send
ER-ROR7
MM1
Set Vehicle or Site number in "Last operation Complete" msg
Generate Checksum
Sum
Send msg to BB
Send
EXIT
Parity in any critical records?
No
EX2
Yes
Log "Part of Requested data could not be sent due to Parity"
TYPE
Inflex
EX2
Rewind Tapes Used
Pos
END
PARITY
Type Error Message
Errors
Switch input to backup Prepass tape
Position Backup Tape
Pos
Read next Record
Read
Switch input back to Prepass tape
Parity again?
Yes
PAR3
No
Update Indicator Set?
Yes
UP1
No
EOF?
Yes
SS 2A
No
Seeking next Header?
No
SS 6A
Yes
Is this a Header?
Yes
SS1
No
SS2

Figure 26.

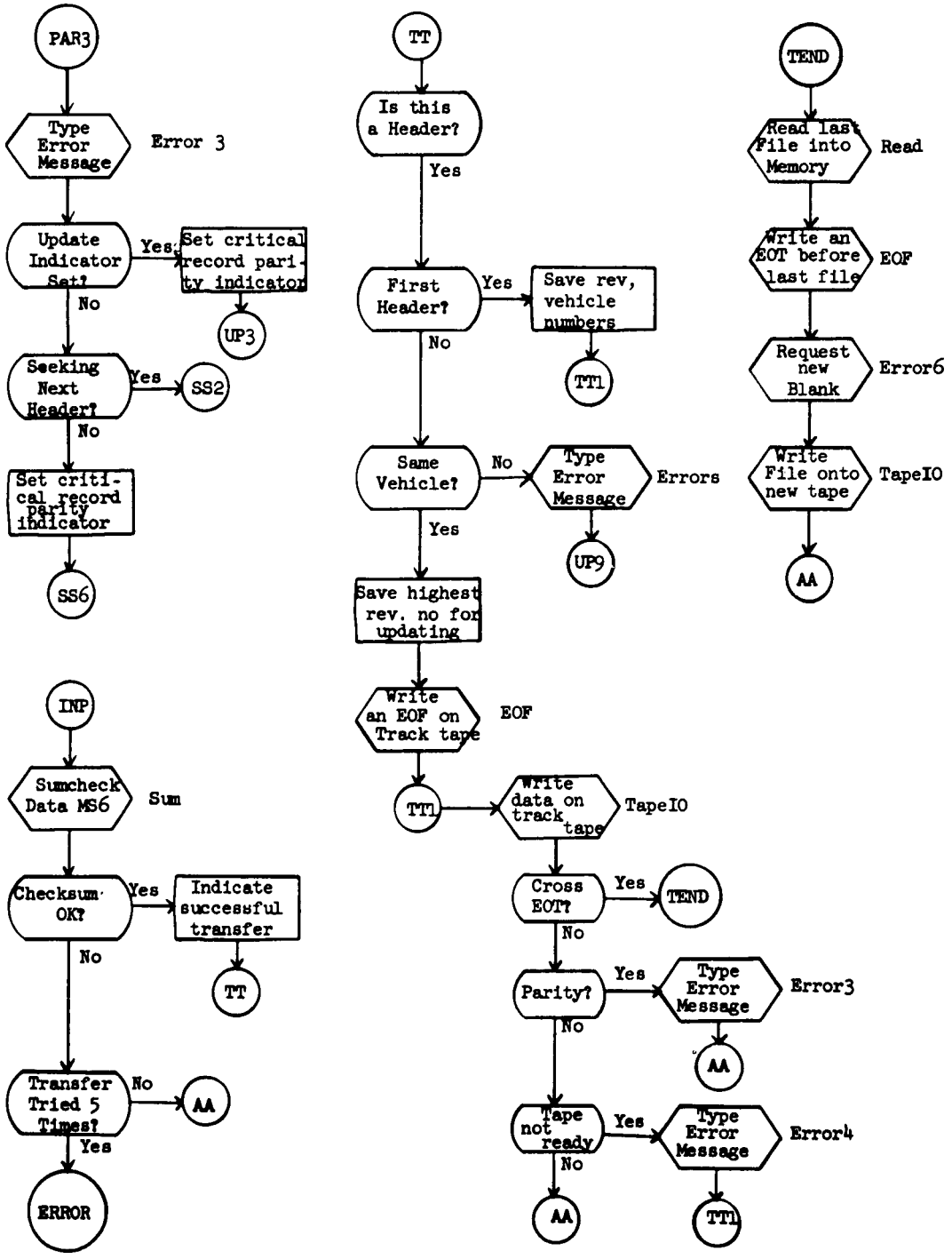

PAR3
Type Error Message
Error 3
Update Indicator Set?
Yes
Set critical record parity indicator
UP3
No
Seeking Next Header?
Yes
SS2
No
Set critical record parity indicator
SS6
INP
Sumcheck Data MS6
Sum
Checksum OK?
Yes
Indicate successful transfer
TT
No
Transfer Tried 5 Times?
No
AA
Yes
ERROR
TT
Is this a Header?
Yes
First Header?
Yes
Save rev, vehicle numbers
TT1
No
Same Vehicle?
No
Type Error Message
Errors
UP9
Yes
Save highest rev. no for updating
Write an EOF on Track tape
EOF
TT1
Write data on track tape
TapeIO
Cross EOT?
Yes
TEND
No
Parity?
Yes
Type Error Message
Error3
AA
No
Tape not ready
Yes
Type Error Message
Error4
TT1
No
AA
TEND
Read last File into Memory
Read
Write an EOT before last file
EOF
Request new Blank
Error6
Write File onto new tape
TapeIO
AA

Figure 27.

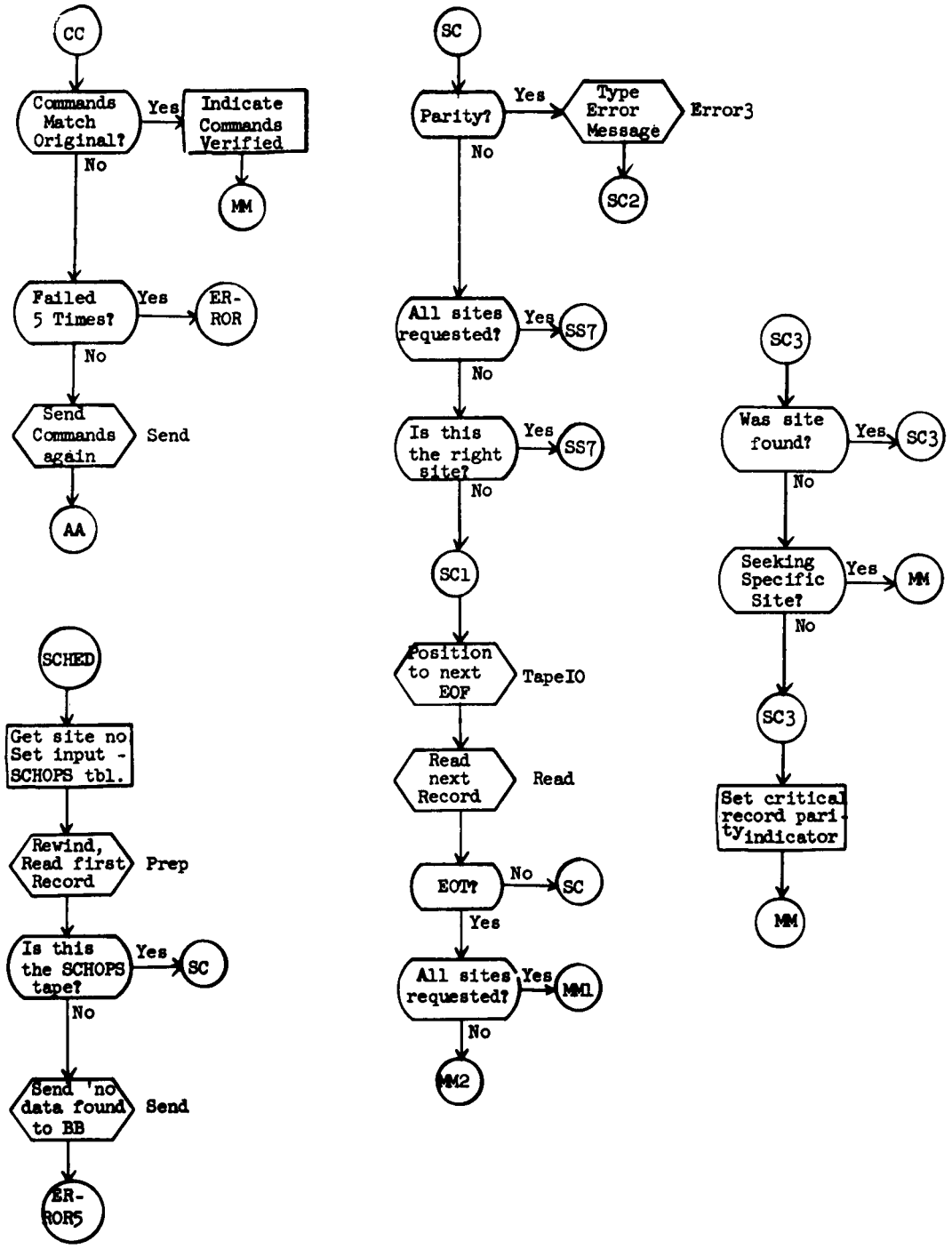

CC
Commands Match Original?
Yes
Indicate Commands Verified
No
MM
Failed 5 Times?
Yes
ER-ROR
No
Send Commands again
Send
AA
SCHED
Get site no Set input - SCHOPS tbl.
Rewind, Read first Record
Prep
Is this the SCHOPS tape?
Yes
SC
No
Send 'no data found to BB
Send
ER-ROR5
SC
Parity?
Yes
Type Error Message
Error3
No
SC2
All sites requested?
Yes
SS7
No
Is this the right site?
Yes
SS7
No
SC1
Position to next EOF
TapeIO
Read next Record
Read
EOT?
No
SC
Yes
All sites requested?
Yes
MM1
No
MM2
SC3
Was site found?
Yes
SC3
No
Seeking Specific Site?
Yes
MM
No
SC3
Set critical record parity indicator
MM

Figure 28.

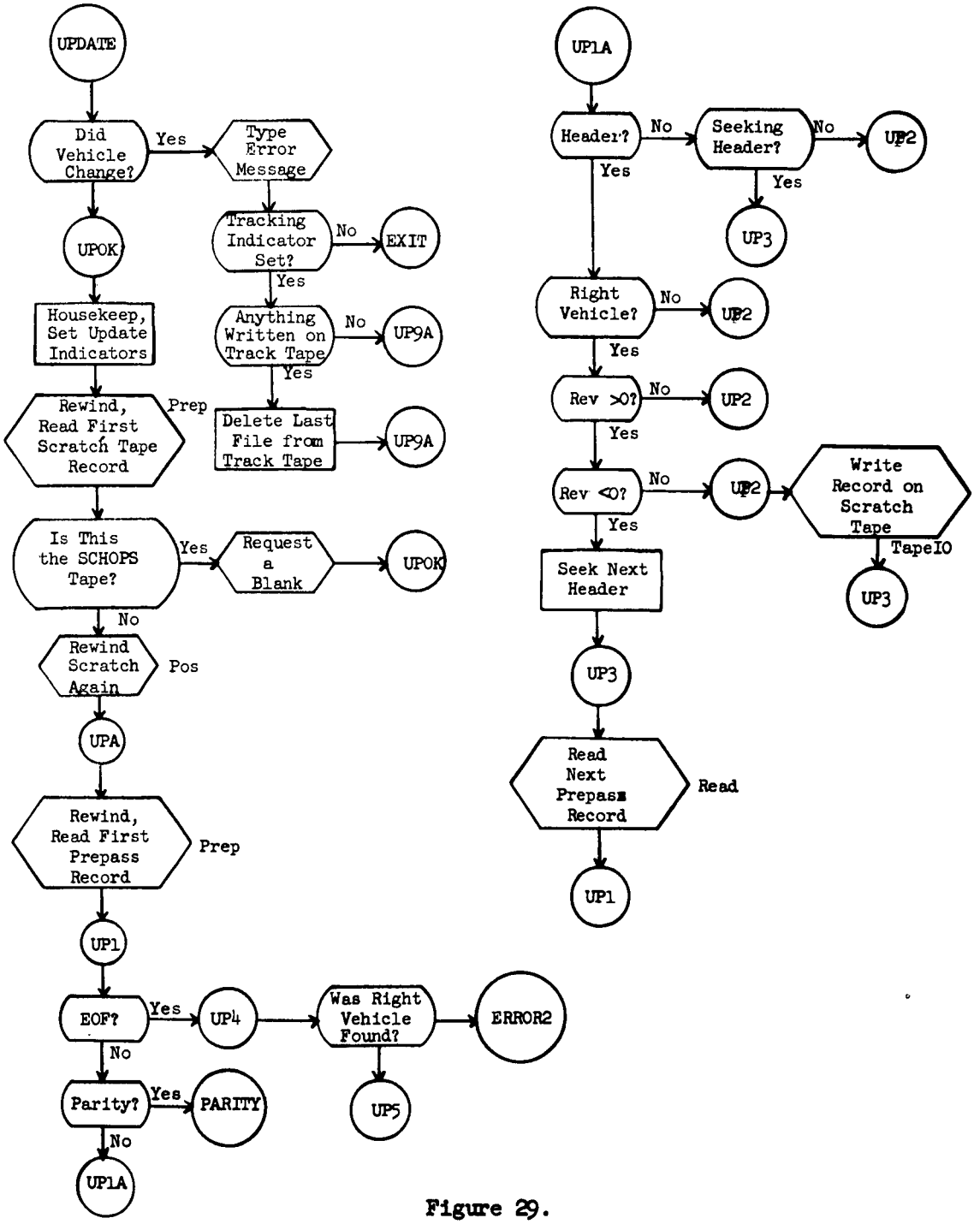

UPDATE
Did Vehicle Change?
Yes
Type Error Message
UPOK
Tracking Indicator Set?
No
EXIT
Yes
Housekeep, Set Update Indicators
Anything Written on Track Tape
No
UP9A
Yes
Rewind, Read First Scratch Tape Record
Prep
Delete Last File from Track Tape
UP9A
Is This the SCHOPS Tape?
Yes
Request a Blank
UPOK
No
Rewind Scratch Again
Pos
UPA
Rewind, Read First Prepass Record
Prep
UP1
EOF?
Yes
UP4
Was Right Vehicle Found?
ERROR2
No
Parity?
Yes
PARITY
UP5
No
UP1A
UP1A
Header?
No
Seeking Header?
No
UP2
Yes
Yes
UP3
Right Vehicle?
No
UP2
Yes
Rev >0?
No
UP2
Yes
Rev <0?
No
UP2
Write Record on Scratch Tape
TapeIO
Yes
Seek Next Header
UP3
UP3
Read Next Prepass Record
Read
UP1

Figure 29.

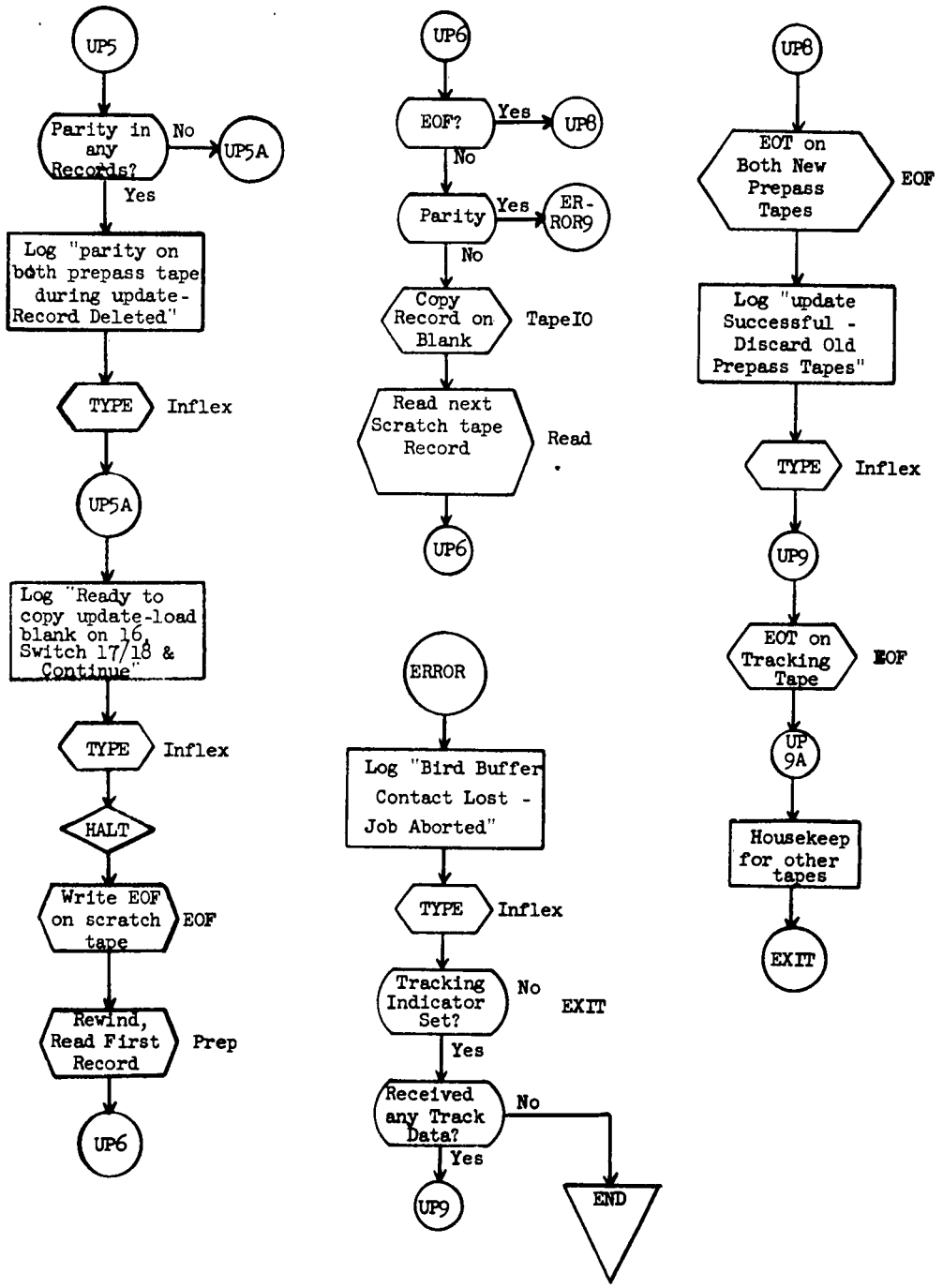

UP5
Parity in any Records?
No
UP5A
Yes
Log "parity on both prepass tape during update-Record Deleted"
TYPE
Inflex
UP5A
Log "Ready to copy update-load blank on 16, Switch 17/18 & Continue"
TYPE
Inflex
HALT
Write EOF on scratch tape
EOF
Rewind, Read First Record
Prep
UP6
UP6
EOF?
Yes
UP8
No
Parity
Yes
ER-ROR9
No
Copy Record on Blank
TapeIO
Read next Scratch tape Record
Read
UP6
ERROR
Log "Bird Buffer Contact Lost - Job Aborted"
TYPE
Inflex
Tracking Indicator Set?
No
EXIT
Yes
Received any Track Data?
No
Yes
UP9
END
UP8
EOT on Both New Prepass Tapes
EOF
Log "update Successful - Discard Old Prepass Tapes"
TYPE
Inflex
UP9
EOT on Tracking Tape
EOF
UP 9A
Housekeep for other tapes
EXIT

Figure 30.

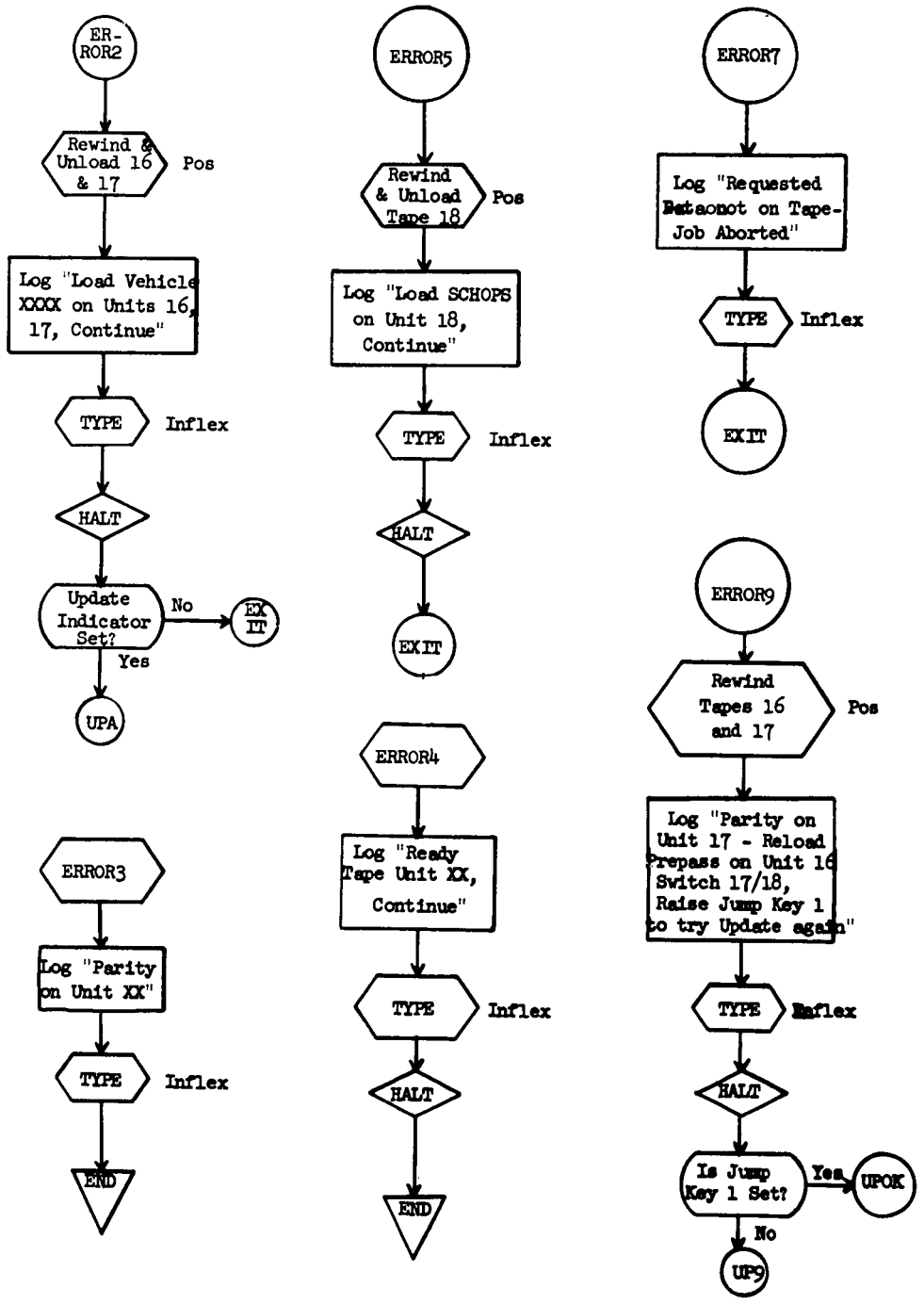

ER-
ROR2
Rewind & Unload 16 & 17
Pos
Log "Load Vehicle XXXX on Units 16, 17, Continue"
TYPE
Inflex
HALT
Update Indicator Set?
No
EX IT
Yes
UPA
ERROR3
Log "Parity on Unit XX"
TYPE
Inflex
END
ERROR5
Rewind & Unload Tape 18
Pos
Log "Load SCHOPS on Unit 18, Continue"
TYPE
Inflex
HALT
EXIT
ERROR4
Log "Ready Tape Unit XX, Continue"
TYPE
Inflex
HALT
END
ERROR7
Log "Requested Beacnot on Tape-Job Aborted"
TYPE
Inflex
EXIT
ERROR9
Rewind Tapes 16 and 17
Pos
Log "Parity on Unit 17 - Reload Prepass on Unit 16 Switch 17/18, Raise Jump Key 1 to try Update again"
TYPE
Inflex
HALT
Is Jump Key 1 Set?
Yes
UPOK
No
UP9

Figure 31.

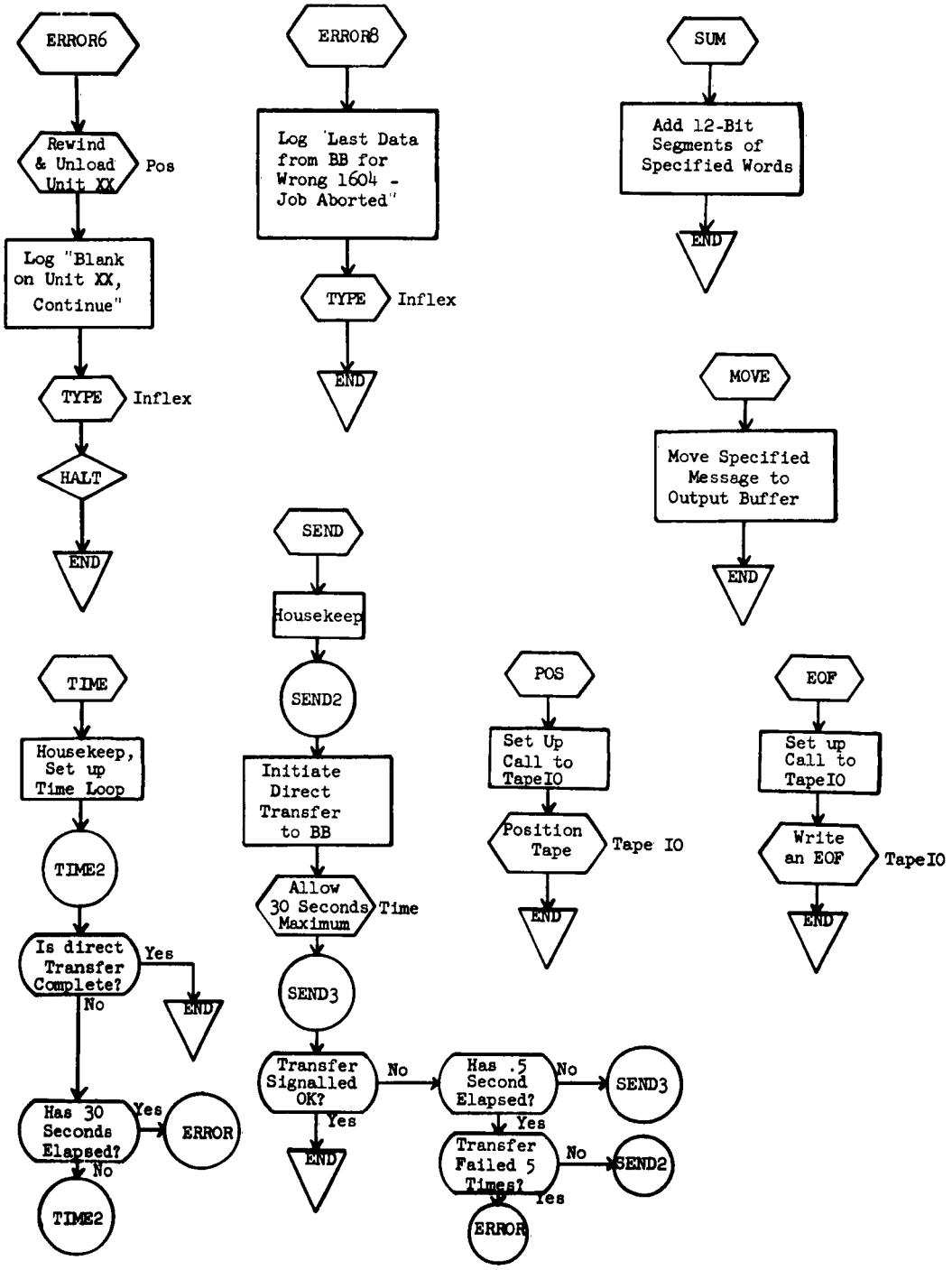

ERROR6
Rewind & Unload Unit XX
Pos
Log "Blank on Unit XX, Continue"
TYPE
Inflex
HALT
END
ERROR8
Log 'Last Data from BB for Wrong 1604 - Job Aborted"
TYPE
Inflex
END
SUM
Add 12-Bit Segments of Specified Words
END
MOVE
Move Specified Message to Output Buffer
END
TIME
Housekeep, Set up Time Loop
TIME2
Is direct Transfer Complete?
Yes
END
No
Has 30 Seconds Elapsed?
Yes
ERROR
No
TIME2
SEND
Housekeep
SEND2
Initiate Direct Transfer to BB
Allow 30 Seconds Maximum
Time
SEND3
Transfer Signalled OK?
No
Has .5 Second Elapsed?
No
SEND3
Yes
Yes
END
Transfer Failed 5 Times?
No
SEND2
Yes
ERROR
POS
Set Up Call to TapeIO
Position Tape
Tape IO
END
EOF
Set up Call to TapeIO
Write an EOF
TapeIO
END

Figure 32.

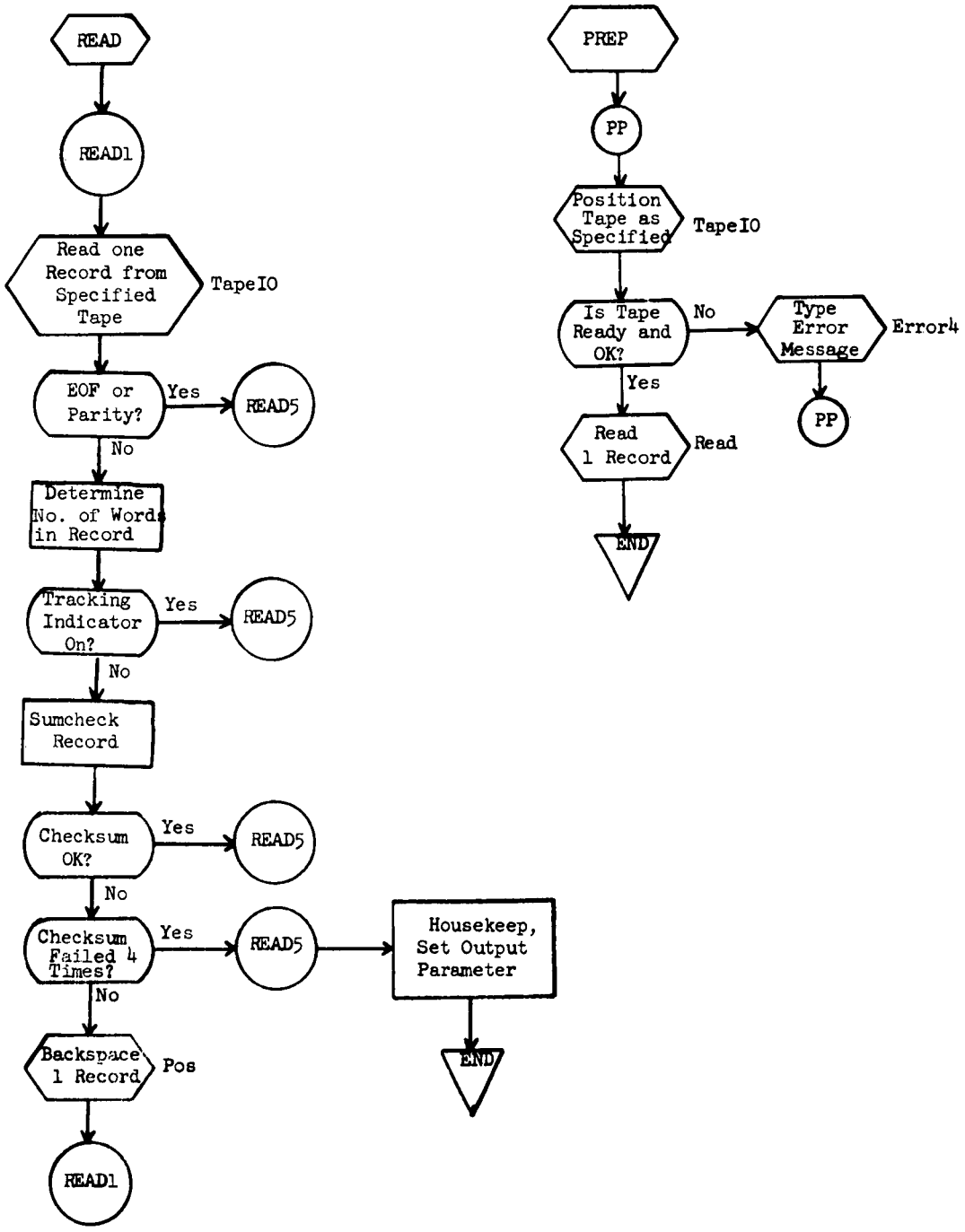

READ
READ1
Read one Record from Specified Tape
TapeIO
EOF or Parity?
Yes
READ5
No
Determine No. of Words in Record
Tracking Indicator On?
Yes
READ5
No
Sumcheck Record
Checksum OK?
Yes
READ5
No
Checksum Failed 4 Times?
Yes
READ5
Housekeep, Set Output Parameter
END
No
Backspace 1 Record
Pos
READ1
PREP
PP
Position Tape as Specified
TapeIO
Is Tape Ready and OK?
No
Type Error Message
Error4
PP
Yes
Read 1 Record
Read
END

**Figure 33.**

CONTROL MESSAGE FORMATS

All control messages are a fixed length of eight 12-bit words. Where less than eight words are shown in the following, the remaining words are all zeros.

A. "Pass Data Follows"

| Word | Octal | Meaning |
|---|---|---|
| 1st | 7777 | Header |
| 2nd | 0003 | Message length |
| 3rd | 0001 | Pass Data Follows |
| 4th | CKSM | Checksum |

This message is sent by the Bird Buffer to tell the 1604 that it is about to send tracking and vehicle time data.

B. "Transfer Prepass to Bird Buffer"

| Word | Octal | Meaning |
|---|---|---|
| 1st | 7777 | Header |
| 2nd | 0007 | Message length |
| 3rd | 0002 | Transfer Prepass to Bird Buffer |
| 4th | SSVV | Station ident; vehicle number |
| 5th | VVVV | in 4-bit BCD |
| 6th | RRRR | Rev. number in 4-bit BCD |
| 7th | RRRR | |
| 8th | CKSM | Checksum |

This message is sent by the Bird Buffer to request prepass data from the 1604. Station ident and/or rev number may be zero (unspecified).

Figure 34.

C. "Send SCHOPS Data"

| Word | Octal | Meaning |
|---|---|---|
| 1st | 7777 | Header |
| 2nd | 0005 | Message length |
| 3rd | 0003 | Send SCHOPS Data |
| 4th | 00SS | Station ident |
| 5th | 0000 | |
| 6th | CKSM | Checksum |

This message is sent by the Bird Buffer to request SCHOPS data from the 1604. Station ident may be zero (unspecified).

D. "Request 1604 Commands"

| Word | Octal | Meaning |
|---|---|---|
| 1st | 7777 | Header |
| 2nd | 0007 | Message length |
| 3rd | 0006 | Request 1604 commands |
| 4th | SSVV | Station ident; vehicle number in 4-bit BCD |
| 5th | VVVV | |
| 6th | RRRR | Rev number in 4-bit BCD |
| 7th | RRRR | |
| 8th | CKSM | Checksum |

E. "Last Operation Complete"

| Word | Octal | Meaning |
|---|---|---|
| 1st | 7777 | Header |
| 2nd | 0005 | Message length |
| 3rd | 1003 | Last Operation Complete |
| 4th | SSVV | Station ident; vehicle number in 4-bit BCD |
| 5th | VVVV | |
| 6th | CKSM | Checksum |

Figure 34.(cont.)

This message is sent by the Bird Buffer or the 1604 to indicate that all data has been transferred. If sent by the Bird Buffer, only the vehicle number portion of the 4th and 5th words are utilized. If sent by the 1604 after transmission of SCHOPS data, only the station ident, right-justified in the 4th word, is sent.

F. "No Data Found"

| Word | Octal | Meaning |
|---|---|---|
| 1st | 7777 | Header |
| 2nd | 0003 | Message length |
| 3rd | 1004 | Data requested was not found |
| 4th | CKSM | Checksum |

This message is sent by the 1604 to tell the Bird Buffer that the requested prepass, command, or SCHOPS data could not be found.

Figure 34.(cont.)

DATA MESSAGE FORMATS

A. Bird Buffer to 1604 data messages are a fixed length of 32 12-bit words; where less than 32 words are shown in the following, the remaining words are all zeros.

1. Header

| Word | Octal | Meaning |
|---|---|---|
| 1st | B B | |
| 2nd | - 1 | |
| 3rd | 6 0 | |
| 4th | 4 | |
| 5th | T R | BCD Identification |
| 6th | A N | |
| 7th | S F | |
| 8th | E R | |
| 9th | D | |
| 10th | A T | |
| 11th | A VV | Vehicle number in 4-bit BCD |
| 12th | VVVV | |
| 13th | SSXX | Station ident |
| 14th | XXXX | |
| 15th | XXXX | Ignored |
| 16th | XXXX | |
| 17th | RRRR | Rev number in 4-bit BCD |
| 18th | RRRR | |
| 19th | AMPM | AM/PM indicator |
| 20th | CKSM | Checksum |

**Figure 35.**

2. Tracking or Vehicle Time Data

| Word | Octal | Meaning |
|---|---|---|
| 1st | 7777 | Header |
| 2nd | SSDD | Station ident, message type (14 = tracking, 15 = vehicle time) |
| . | | |
| . | | |
| . | | |
| nth | CKSM | Checksum |

B. 1604 to Bird Buffer messages are a fixed length of 64 12-bit words; where less than 64 are shown in the following, the remaining words are all zeros.

1. Header

| Word | Octal | Meaning |
|---|---|---|
| 1st | 1 6 | BCD Identification |
| 2nd | 0 4 | |
| 3rd | - B | |
| 4th | B | |
| 5th | T R | |
| 6th | A N | |
| 7th | S F | |
| 8th | E R | |
| 9th | D | |
| 10th | A T | |
| 11th | A SS | Station ident |
| 12th | XXXX | Ignored |
| 13th | RRRR | Rev number in 4-bit BCD |
| 14th | RRRR | |
| 15th | OOVV | Vehicle number in 4-bit BCD |
| 16th | VVVV | |
| 17th | CKSM | Checksum |

Figure 35.(cont.)

2. Prepass Data (including Commands)

| Word | Octal | Meaning |
|---|---|---|
| 1st | 7777 | Header |
| 2nd | SSDD | Station, message type |
| . | | Format depends on message type |
| . | | |
| . | | |
| nth | CKSM | Checksum |

3. SCHOPS Data

| Word | Octal | Meaning |
|---|---|---|
| 1st | 7777 | Header |
| 2nd | SSDD | Station ident, message type (11 = text, 26 = schedules) |
| . | | |
| . | | |
| . | | |
| nth | CKSM | Checksum |

Figure 35.(cont.)

TRANSFER TAPE FORMATS

A. Bird Buffer to 1604 Transfer Tape (Tracking and Vehicle Time Data)

| | | |
|---|---|---|
| Header | $(V_1\ R_1\ S_1)$ | |
| Data Message | $(V_1\ R_1\ S_1)$ | (one message per record) |
| Data Message | $(V_1\ R_1\ S_1)$ | |
| Data Message | $(V_1\ R_1\ S_1)$ | |
| . | | |
| . | | |
| . | | |
| Data Message | $(V_1\ R_1\ S_1)$ | |
| EOF | | |
| Header | $(V_1\ R_1\ S_2)$ | |
| Data Message | $(V_1\ R_1\ S_2)$ | |
| . | | |
| . | | |
| . | | |
| Data Message | $(V_1\ R_1\ S_2)$ | |
| EOF | | |
| Header | $(V_1\ R_2\ S_1)$ | |
| Data Message | $(V_1\ R_2\ S_1)$ | |
| . | | |
| . | | |
| . | | |
| Data Message | $(V_1\ R_2\ S_1)$ | |
| EOF | | |

Figure 36.

Header ($V_X$ $R_Y$ $S_Z$)

Data Message ($V_X$ $R_Y$ $S_Z$)

.
.
.

Data Message ($V_X$ $R_Y$ $S_Z$)

EOF

EOF

B. 1604 to Bird Buffer Transfer Tape (Prepass and Command Data)

Header ($V_1$ $R_1$ $S_1$)

Data Block ($V_1$ $R_1$ $S_1$) (n messages per record)

Data Block ($V_1$ $R_1$ $S_1$)

.
.
.

Data Block

Header ($V_1$ $R_1$ $S_2$)

Data Block ($V_1$ $R_1$ $S_2$)

.
.
.

Header ($V_1$ $R_2$ $S_1$)

Data Block ($V_1$ $R_2$ $S_1$)

.
.
.

Header ($V_1$ $R_2$ $S_2$)

.
.
.

**Figure 36.(cont.)**

Header ($V_X$ $R_Y$ $S_Z$)

Data Block ($V_X$ $R_Y$ $S_Z$)

.
.
.

EOF

EOF

C. SCHOPS Tape

Data Block ($S_1$) (n messages per record)

Data Block ($S_2$)

Data Block ($S_3$)

.
.
.

Data Block ($S_n$)

EOF

EOF

Figure 36.(cont.)

VALIDATION

A short program was written to generate three dummy transfer tapes on the 1604 side (two prepass tapes and a SCHOPS tape); another tape containing dummy pass data was generated for the 160A side. SBRDTLK and SIBBTC were then exercised in the following order

Test 1 Request prepass data from the 1604 for:
Vehicle 2
Rev 1
All sites

Test 2 Request real-time commands from the 1604 for:
Vehicle 1
Rev 2
Site 2

Test 3 Request SCHOPS data from the 1604 for:
Site 5

Test 4 Request prepass data from the 1604 for:
Vehicle 1
All revs
Site 1

Test 5 Send Tracking data to the 1604 for:
Vehicle 1
Site 1, 2
Rev 1, 2, 3

Test 6 Send tracking data to the 1604 for:
Vehicle 2
Site 1, 2
Rev 1, 2, 3

**Figure 37.**

Required 1604 Programs

1. STAN - generates 1604 transfer tapes
2. MTCII - version containing 1607 satellite interrupt capability
3. SBRDTLK

Required 160A Programs

1. SSTL - reads track and vehicle time tape into 160A
2. SFCHEX - dumps data transmitted to 160A on the 166 printer
3. SIBBTC
4. Dummy program to use SIBBTC as a subroutine

Figure 37.(cont.)

IDENTIFICATION

A. Title: Read Bird Buffer/1604 Transfer Tape, (SRDTRK), Ident. K36 Mod. AB

B. Programmed and documented by: R. C. Wise, System Development Corporation, 18 January 1963

PURPOSE

The function of SRDTRK is to read specific information from the 160A-1604 transfer tape. The specific information is Tracking messages or Vehicle Time messages and is related to a particular station, vehicle, and revolution.

USAGE

A. Calling Sequence

```
1.  L     RTJ          SRDTRK      (calling sequence one)
          F            I
    L+1   S            V
                 R
    L+2   ERROR RETURN
    L+3   NORMAL RETURN
2.  L     RTJ          SRDTRK      (calling sequence two)
          F            I
    L+1   ERROR RETURN
    L+2   NORMAL RETURN
```

B. Input Parameters

The calling sequence parameters to SRDTRK are as follows:

F Function defines the operation of SRDTRK. "F" is in the lower opn field of word L.

The values and meanings of "F":

| Value | Meaning |
|---|---|
| 0 | Find file defined by "S", "V", "R" and read header into "I". |

| Value | Meaning |
|---|---|
| 1 | Read the next Tracking message of present file into "I". |
| 2 | Read the next Vehicle Time message of present file into "I". |
| 3 | Read the next message of present file into "I". |
| 4 | Position tape to end of data. |

I Input buffer specifies the starting location of the users input area. "I" is in the lower address of word L.

The "S", "V","R" parameters are used only with an "F" parameter of zero.

S Site code is the binary site number and is in the upper opn field of word L+1.

V Vehicle number is the 4-bit, BCD Vehicle Number and is in the upper B-term and M-term fields (18 bits, first 2 bits zero) of L+1.

R Revolution Number is the 4-bit, BCD Revolution Number in tenth of a revolution and is in the lower instruction step (24 bits, first 8 bits zero) of L+1.

C. The Bird Buffer to 1604 Transfer Tape

The transfer tape is a multi-file binary tape.

Each file consists of tracking and/or vehicle time messages, each message being an eight word record.

Each file pertains to a specific vehicle, station, and revolution and is begun with a header record specifying these parameters.

D. Output Parameters

SRDTRK returns to the user program with the error codes in the Q-register or normal codes in the A-register depending upon the type of exit performed.

1. Error Codes

| | |
|---|---|
| Q = -2 | Read length error |
| Q = -1 | Read parity error |
| Q = 1 | Cannot find data requested |

2. Normal Codes

| | |
|---|---|
| A = 0 | Message read |
| A = 1 | Header read |
| A = 2 | No more data (EOF found) |

E. Tape Assignment

SRDTRK uses tape 19 (unit 4, cabinet 2, channel 5/6) for the Bird Buffer to 1604 Transfer Tape.

METHOD

SRDTRK is initially entered by the user program with calling sequence one and an "F" (function) parameter of zero. SRDTRK will search the transfer tape for a file with a header record that contains matching information for the "S" (station), "V" (vehicle), and "R" (revolution number) parameters.

If the tape is positioned at the end of all data, it will rewind to the first file of data before any operation is begun.

The header record is read into the input buffer specified by the "I" (input buffer) parameter and SRDTRK returns to the user program at L+3 with the A-register set to plus one.

Three errors could occur during the initial operation of SRDTRK; a persistent read length error, a persistent parity error, or the data requested could not be found. If an error does occur, an exit is made to L+2 of the user program with an error flag in the Q-register.

Subsequent entries to SRDTRK are made by the user program with calling sequence two. SRDTRK will read a record of the type requested by the "F" parameter. If an end of file is encountered while reading, a flag is set in the A-register and an exit is made to L+2 of the user program.

A successful read also returns to L+2 in the user program with a flag in the A-register.

Error returns are made for persistent read length or parity errors.

The final entrance to SRDTRK must be made with calling sequence two and an "F" parameter of 4. This causes SRDTRK to position the tape to the end of data and release the interrupt disable which is set the first time SRDTRK is entered, thus allowing SBRDTLK to be operated.

RESTRICTIONS

A. Function 4 must be used.

B. Interrupt is disabled and enabled by SRDTRK.

C. The subroutine TAPE is used.

D. The Bird Buffer to 1604 Transfer tape must be mounted on unit 19.

TIMING

SRDTRK is dependent upon the timing of the tape unit and position of the requested data on the tape as well as the number of records on the tape. The computational time is negligible.

STORAGE

| | |
|---|---|
| Program | 104 |
| Constants | 8 |
| TOTAL | 112 |

VALIDATION TEST

A. Method

An ordered simulated transfer tape containing 3 messages per revolution, 3 revolutions per site, 2 sites per vehicle, and 2 vehicles is operated upon by SRDTRK.

A driver routine requests the following of SRDTRK.

1. Position to file defined by $V_1$, $S_2$, $R_1$.
2. Read all tracking messages (one at a time).
3. Position to file defined by $V_2$ , $S_1$ , $R_3$.

4. Read all time messages (one at a time).
5. Position to file defined by $V_1$, $S_3$, $R_3$.
6. Read all messages.
7. Position to file defined by $V_1$, $S_2$, $R_3$.
8. Read one tracking message.
9. Position to file defined by $V_2$, $S_1$, $R_2$.
10. Position to end of data.

All records read are printed on-line, and the listing is compared against the requested data.

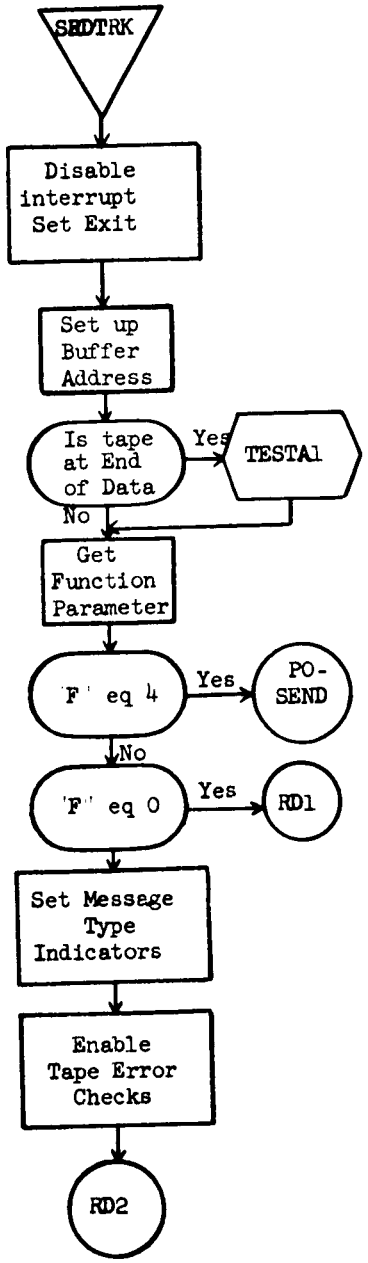
B. Results

To be described in Milestone 11.

REFERENCES

1. TM-891/001/00, Combined Milestone 3/4 for the 1604 Augmentation Communication Programs, System Development Corporation, 20 December 1962.

FLOW DIAGRAMS



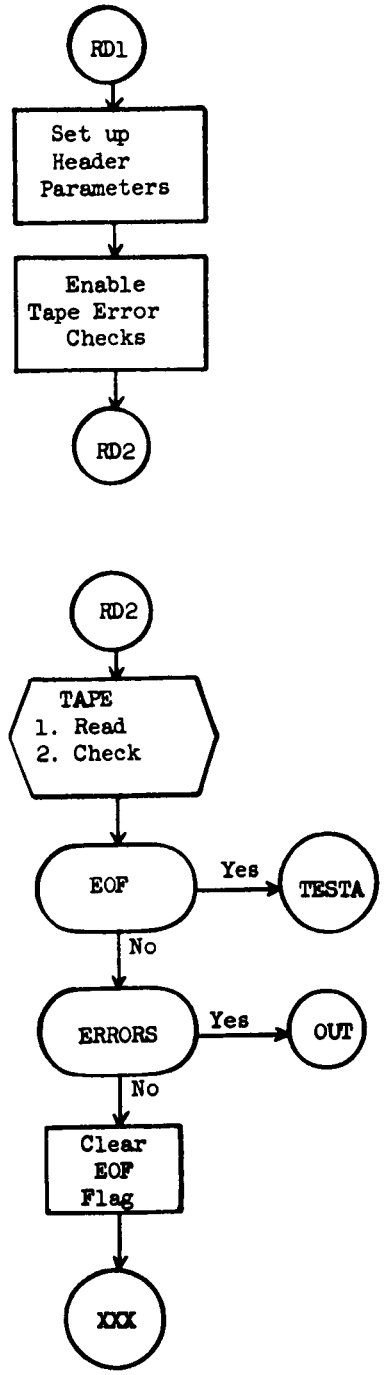




Figure 38.

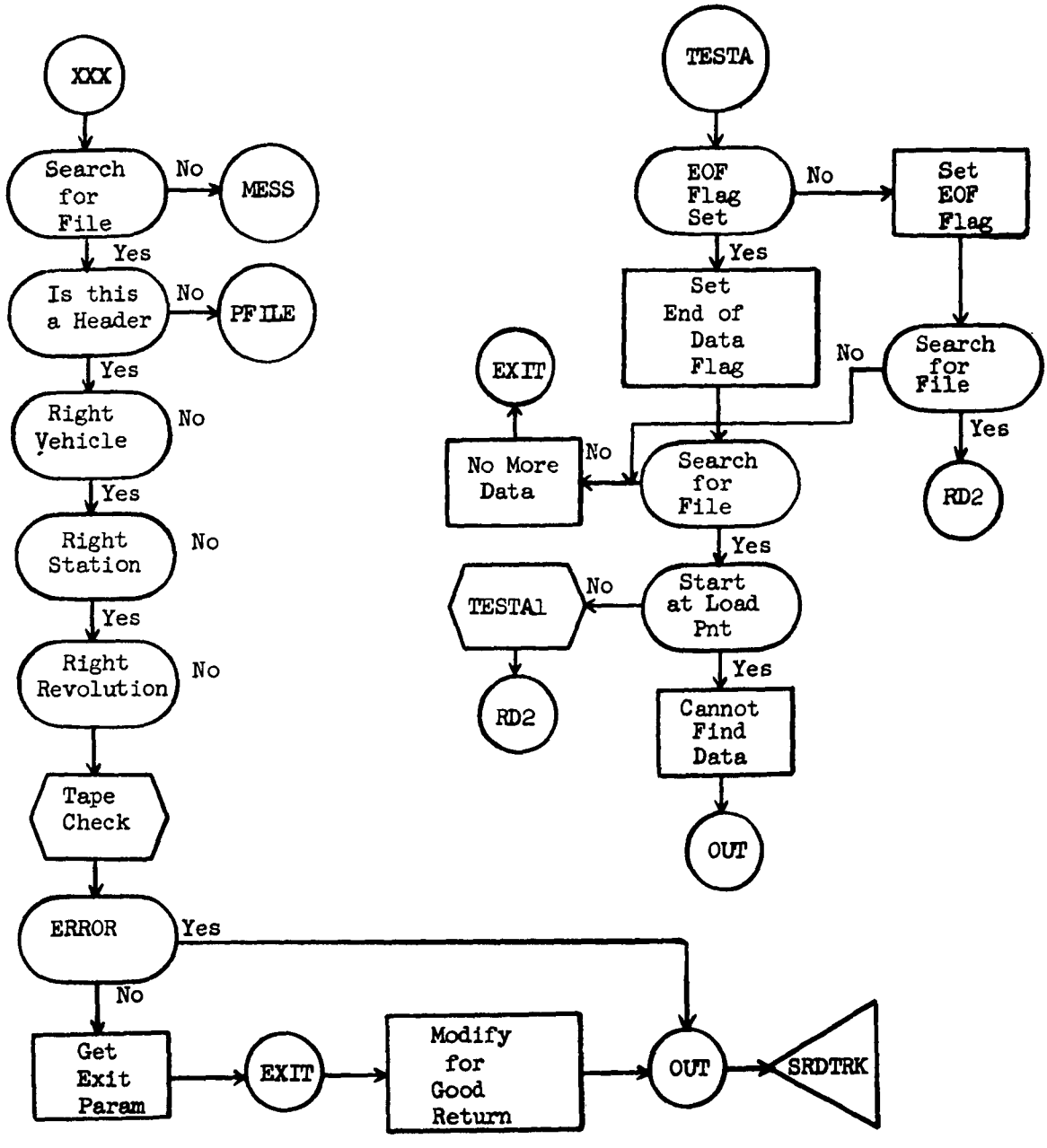

XXX
Search for File
No
MESS
Yes
Is this a Header
No
PFILE
Yes
Right Vehicle
No
Yes
Right Station
No
Yes
Right Revolution
No
Tape Check
ERROR
Yes
No
Get Exit Param
EXIT
Modify for Good Return
OUT
SRDTRK
TESTA
EOF Flag Set
No
Set EOF Flag
Yes
Set End of Data Flag
No
Search for File
Yes
RD2
EXIT
No More Data
No
Search for File
Yes
TESTA1
No
Start at Load Pnt
Yes
RD2
Cannot Find Data
OUT

Figure 39.

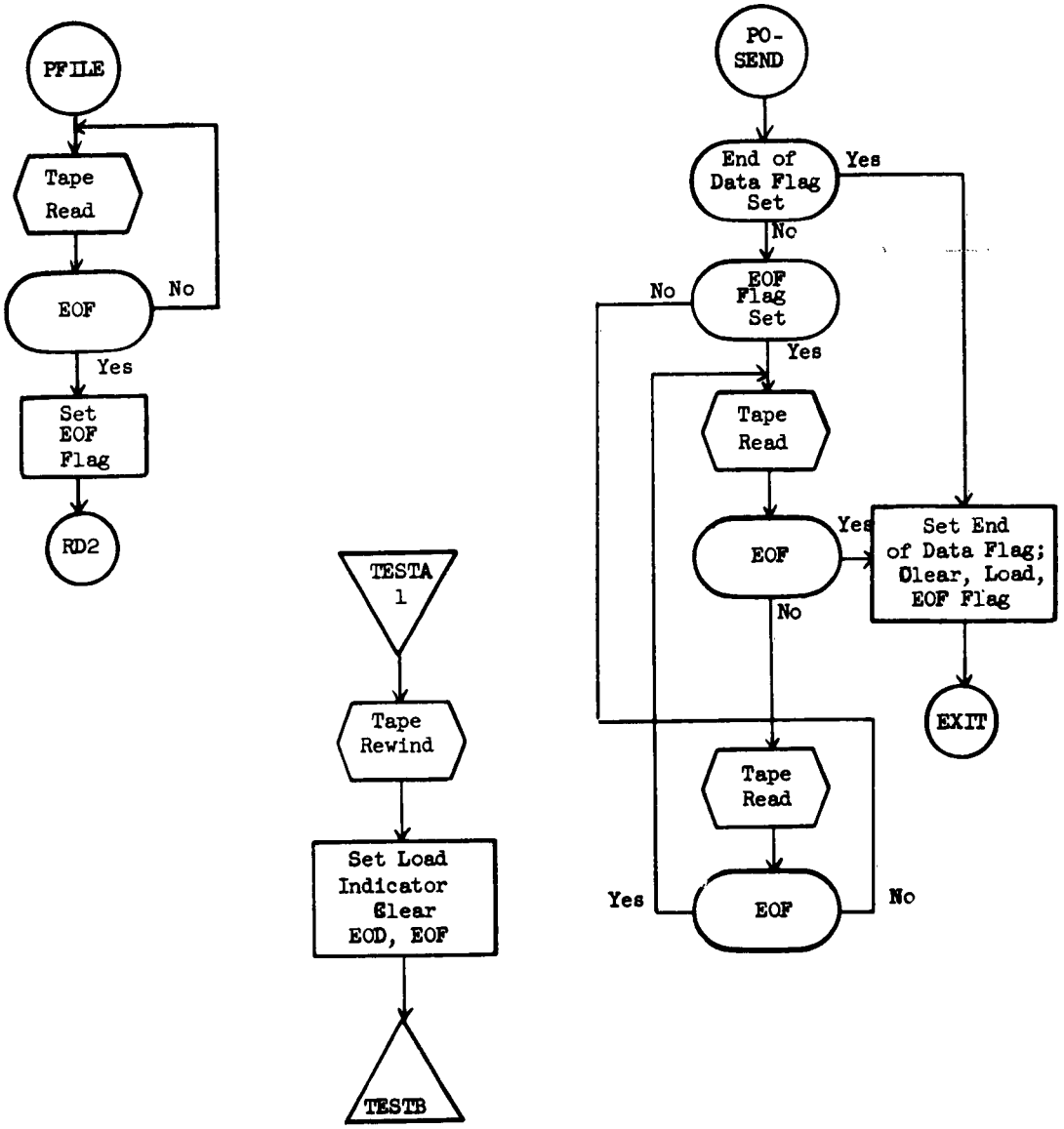

PFILE
Tape Read
EOF
No
Yes
Set EOF Flag
RD2
TESTA 1
Tape Rewind
Set Load Indicator Clear EOD, EOF
TESTB
PO-SEND
End of Data Flag Set
Yes
No
EOF Flag Set
No
Yes
Tape Read
EOF
Yes
Set End of Data Flag; Clear, Load, EOF Flag
No
EXIT
Tape Read
Yes
EOF
No

Figure 36.

IDENTIFICATION

A. Title: Generate Station Requirements Table (SREQTAB), Ident. H56, Mod. AB.

B. Programmed and documented: 15 February 1963, M. O'Flaherty, Mellonics Systems Development.

C. Reviewed: 1 March 1963, Nancy Speer, System Development Corporation.

PURPOSE

SREQTAB is the function that will be used in the augmented 1604 program system to generate, revise, and/or provide a BCD listing of the Station Requirements Table (Look Table) for off-line printing. In addition, this function can be used to list time and Earth-model constants, and the Station and Launch Pad Coordinate Tables.

USAGE

A. Available Options

The five options available with SREQTAB are: (1) to list only the Station Requirements Table; (2) to generate a new table; (3) to add to the table new station entries or individual requirements for existing entries; (4) to delete entire station entries from the table; and (5) to list time constants, Earth constants, the Launch Pad Coordinate Table, and the Station Coordinate Table. Options (2), (3), and (4) also provide automatically a BCD listing of the new or revised Station Requirements Table.

In options (2) and (3), each requirement for a station is entered on the function card as a four letter mnemonic word. The mnemonics used to represent the separate requirements are as follows:

| Mnemonic | Requirement |
|---|---|
| LIST | Listable station pass ephemeris |
| ANTE | Antenna driving ephemeris |
| TRAK | Tracking events message |
| COMM | Command events message |
| SPAC | Space Track message |
| BAKE | Baker-Nunn message |

The use of four letter mnemonics may necessitate several cards to input the entire requirements list. The COP capability of containing up to 100 parameters at one time can be used by indicating that the parameters are continued on the next card. This indication is given when the last parameter on the card is followed by at least one blank column and a dollar sign. If the parameters (including the vehicle number, option number, and station numbers) should exceed 100, the requirements may be divided conveniently and the function called twice. Note, however, that in the case where a new table is to be generated and the list of input parameters exceed 100, option (2) should be used to input the first portion of the list, but option (3) should be used to add the remainder.

To delete the requirements given for a station in the existing Station Requirements Table, the station entry must first be removed from the table by option (4), then added with new requirements by option (3).

B. Function Card Formats

The card formats for the five available options are listed below.

1. Options (1) and (5): BCD Listing Only

   *SREQTAB AAAA B

   where: AAAA = vehicle number

   B = 0, list Station Requirements Table

   = 4, list constants and coordinate tables

2. Options (2) and (3): Generate or Add to Table

(card 1) *SREQTAB AAAA B $SS_1$ $MMMM_{1_1}$ ...$MMMM_{1_i}$ ...$SS_n$ $MMMM_{n_1}$ ..$

(card 2) $MMMM_{n_i}$ $SS_{n+1}$...$MMMM_{n+1_i}$...$

⋮

(card j) ...$SS_{n+k}$...$MMMM_{n+k_i}$

where: AAAA = vehicle number

B = 1, generate new table containing the following list

2, add following list to existing table

$SS_n$ = station number

$MMMM_{n_i}$ = 1 to 6 mnemonic requirements for station n

card j = last parameter card for function request -- contains no dollar sign

NOTE: The requirements may be listed in any sequential order and it is not necessary to start each continuation card with a station number.

3. Option (4): Delete Stations From Table

*SREQTAB AAAA 3 $SS_1$ $SS_2$...$SS_n$

where: AAAA = vehicle number

$SS_n$ = station number for which all requirements are to be deleted

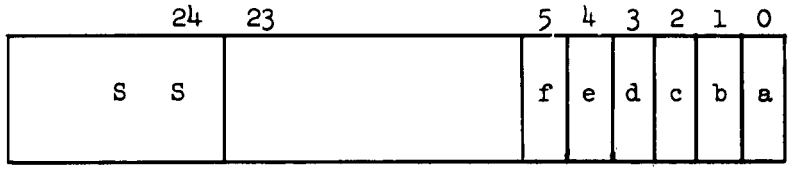
NOTE: A continuation card can be used if the number of stations to be removed exceeds the limits of the function card.

C. Outputs

1. Station Requirements Table Configuration.

The Station Requirements Table is located in file two of the Reset Tape, starting with cell 946 and the tag SRT. The table consists of fifty cells, each of which can be used to store the

requirements for one station. The format for each entry in the table is:




where: SS = station number (binary, right-justified to bit 24)

a = 1 = Listable station ephemeris

b = 1 = Antenna driving ephemeris

c = 1 = Tracking events message

d = 1 = Command event message

e = 1 = Space track message

f = 1 = Baker-Nunn message

All entries are packed at the beginning of the table with the rest of the table clear. When using options (2), (3), or (4) the new or revised table is output on the primary and secondary reset tapes upon completion of the function.

2. BCD Listings.

With options (1) through (4), the existing or resulting Station Requirements Table is written in BCD on tape unit 3. This listing contains the station number, station name, six binary digits (f through a), and the associated mnemonic tags in the format illustrated in Figure 45.

The time and Earth constants, Launch Pad Coordinate Table, and the Station Coordinate Table output by option (5) are written in BCD on tape unit 3 in the formats given in Figure 46. The time and Earth constants are listed by the tags and in the units given in the Reference and Intercommunication Pool.

3. On-Line Printer Comments.

If SREQTAB encounters an illegal mnemonic tag, that tag will be

printed out in the on-line message "xxxx ILLEGAL BCD TAG". SREQTAB will then continue until the function is complete, at which time the user may correct the error by operating SREQTAB with option (3).

When the function is completed, the statement "SREQTAB FUNCTION COMPLETED" is printed on-line.

RESTRICTIONS

A. Input Limitations

1. If, when generating a new table, the same station is input twice, two separate entries for that station will be set in the table.
2. If, when generating or adding to the table, the same mnemonic tag for a specified station is repeated, the repetitious requirement is merely ignored.

B. Environment

The subroutines RESET, OUTPUT, SUBERR, and RADDEG are used as well as RESETBL.

C. Hardware

The following equipments are used by SREQTAB and associated subroutines:

1607 tape units 2, 9, 10 (reset tapes), 3 (list tape) and 1 (Flight Support Tape)
1612 printer
533 card reader/punch
1604 computer

STORAGE REQUIREMENTS

SREQTAB requires the following storage space:

| | | |
|---|---|---|
| Program | 313 | cells |
| Constants | 80 | cells |
| Temporary Storage | 102 | cells |
| TOTAL | 495 | cells |

VALIDATION TEST

A. Inputs

After generating three nominal reset tapes for vehicle 1205, the following function cards were prepared:

```
*SREQTAB   1205   0
*SREQTAB   1205   1  1 LIST ANTE  2 LIST SPAC &
    3 LIST BAKE  4 LIST  5 LIST  6 LIST &
   31 LIST TRAK  39 LIST  33 LIST
*SREQTAB   1205  2  1 COMM  20 TRAK  ANTE
*SREQTAB  1205  3  33
*SREQTAB  1205  4
```

B. Procedure

The necessary tapes were loaded and peripheral equipments were readied. The deck of function cards was input via the on-line card reader.

C. Results

A listing of tape 3 showed that the first function card had generated the message "LOOK TABLE (NONE)". The next three function requests resulted in the Station Requirements Table illustrated in Figure 45. The last function card generated successfully the standard listings of time and Earth-model constants and the Launch Pad and Station Coordinate Tables.

D. Limits of Test

No errors or program restrictions were tested.

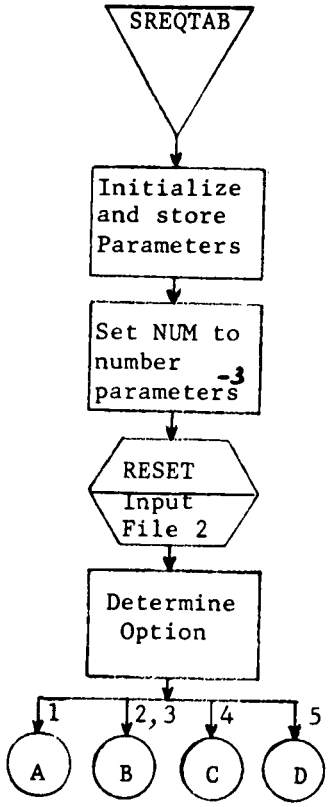
REFERENCES

1. TM-(L)-840/000/01, New and Modified 1604 Computer Programs in Support of Augmentation, Milestone 3, 25 January 1963, System Development Corporation.

2. TM-714/005/00, General Purpose Satellite Computer Program Descriptions, Milestone 11, Radian to Degree Conversion (RADDEG), 17 May 1962, System Development Corporation, AFCPL No. 75040.

3. TM-714/030/00, General Purpose Satellite Computer Program Descriptions, Milestone 11, Generate, Update, and Read the Reset Tape (RESET), 4 December 1962, System Development Corporation, AFCPL No. 75612.
4. LMSD-447578, page 50.06.01, Systems Manual Subroutine Description for SUBERR.
5. TM-(L)-705/033/00, SCF Computer Program Systems Manual, Utility Programs, Generalized Output Routine (OUTPUT), 16 January 1963, System Development Corporation, AFCPL No. 75035.

FLOW DIAGRAMS



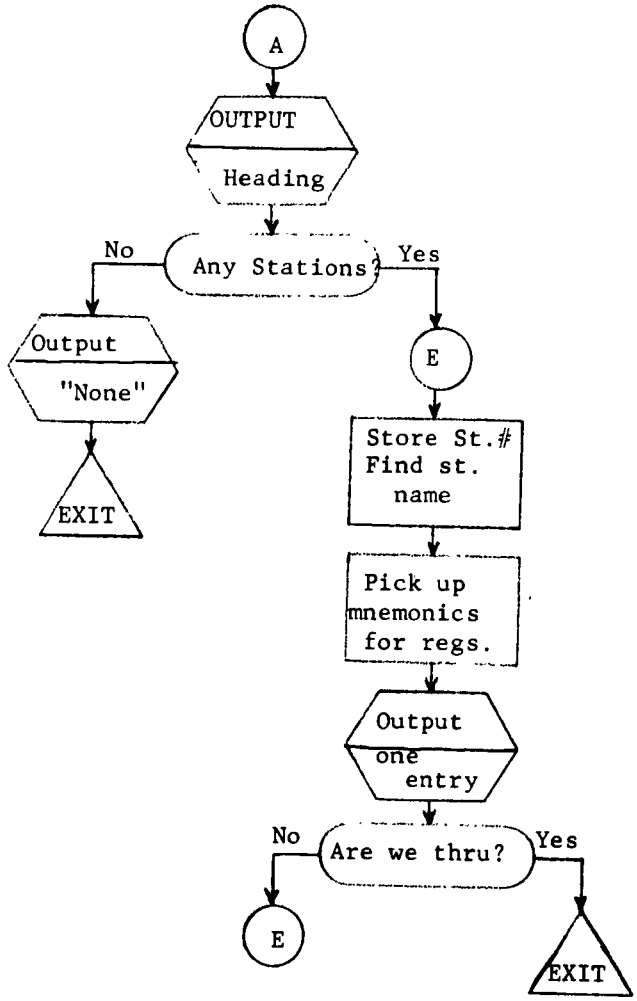




Figure 41.

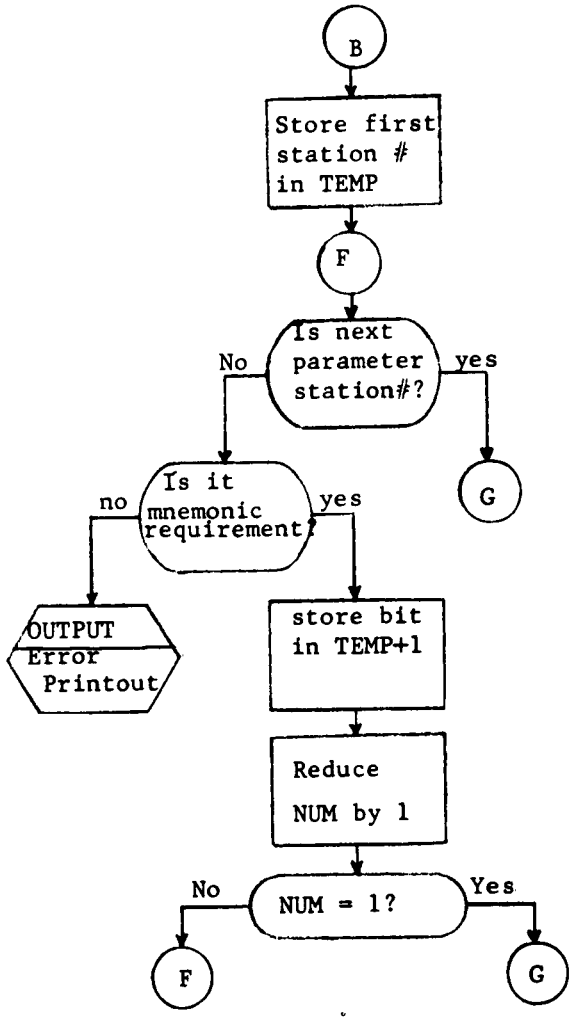

B
Store first station # in TEMP
F
Is next parameter station#?
No
yes
G
Is it mnemonic requirement?
no
yes
OUTPUT Error Printout
store bit in TEMP+1
Reduce NUM by 1
NUM = 1?
No
Yes
F
G

Figure 42.

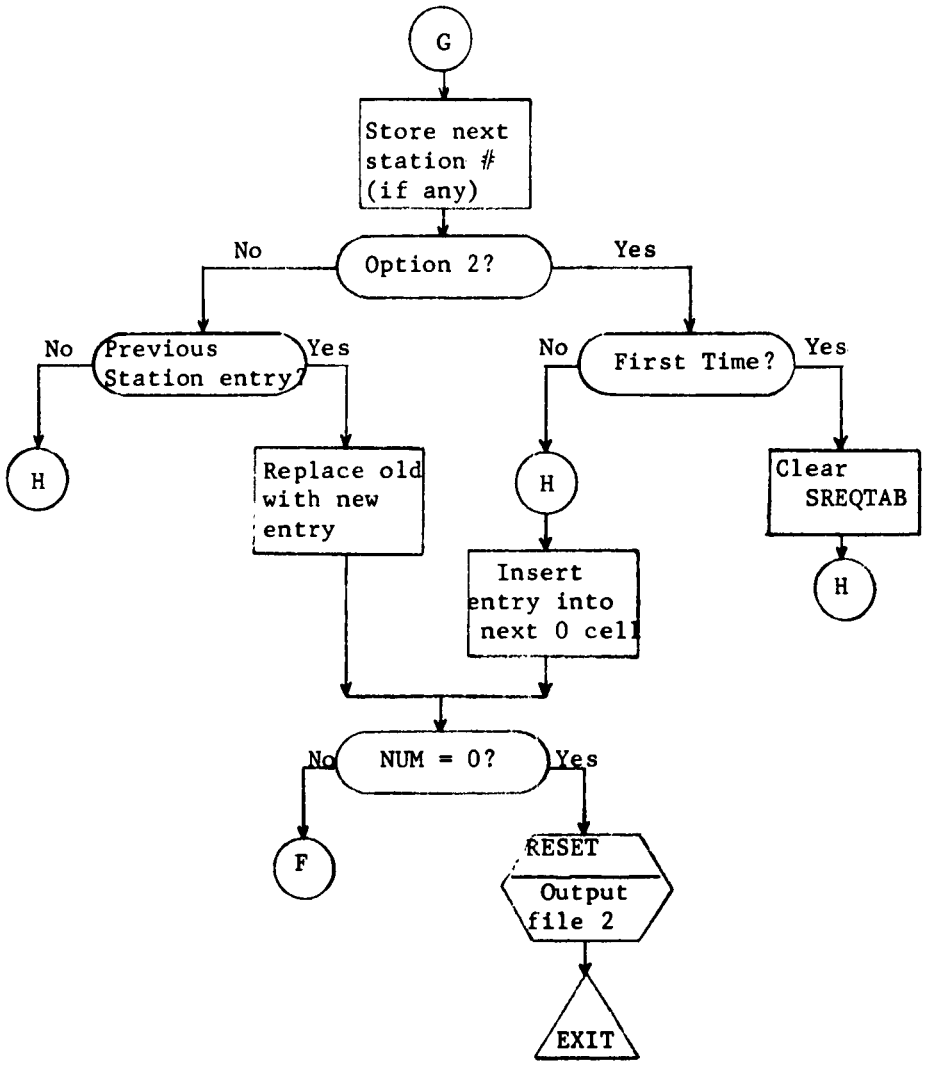

G
Store next station # (if any)
No
Option 2?
Yes
No
Previous Station entry?
Yes
No
First Time?
Yes
H
Replace old with new entry
H
Clear SREQTAB
Insert entry into next 0 cell
H
No
NUM = 0?
Yes
F
RESET
Output file 2
EXIT

Figure 43.

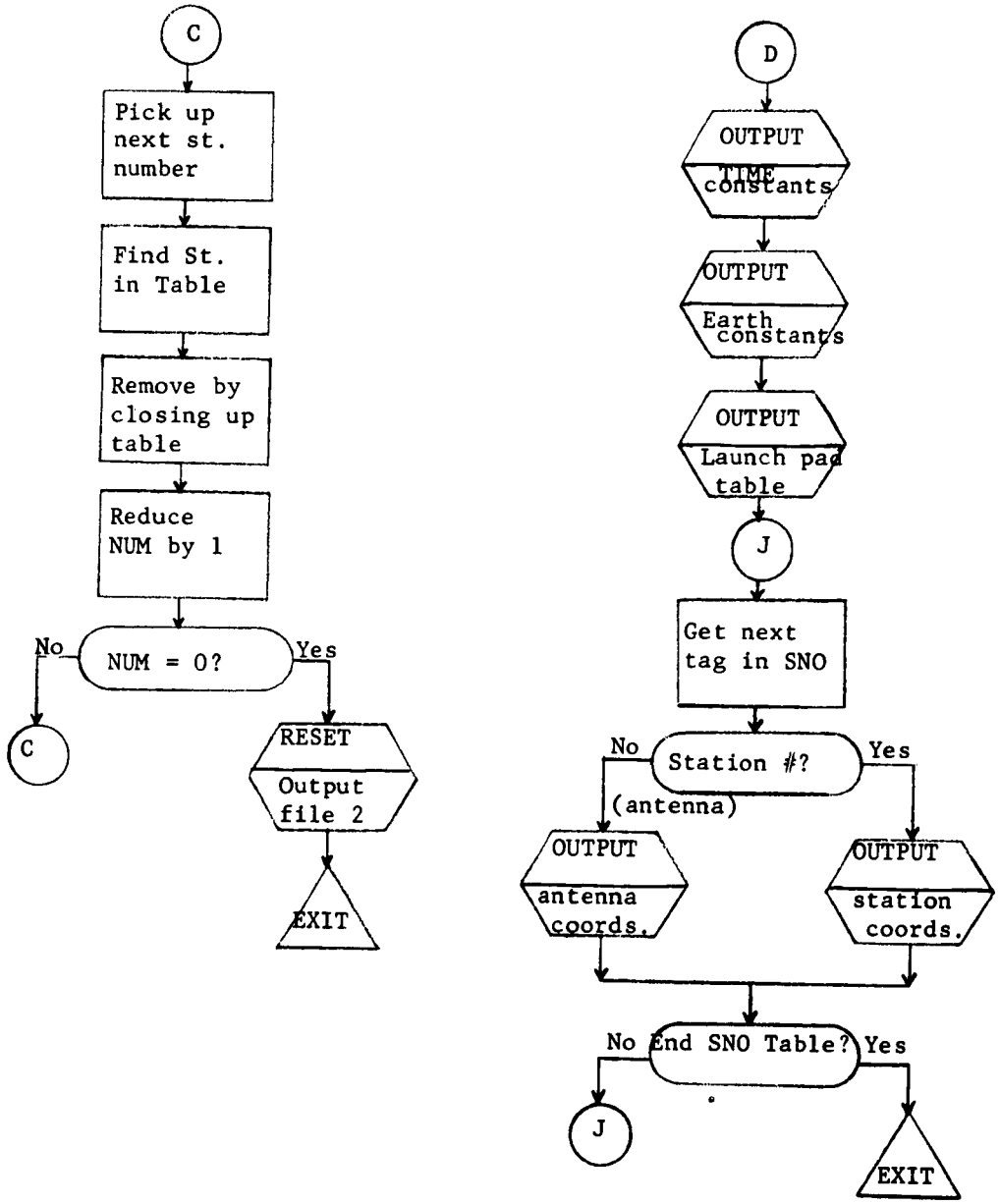

C
Pick up next st. number
Find St. in Table
Remove by closing up table
Reduce NUM by 1
No
NUM = 0?
Yes
C
RESET
Output file 2
EXIT
D
OUTPUT
TIME constants
OUTPUT
Earth constants
OUTPUT
Launch pad table
J
Get next tag in SNO
No
Station #?
Yes
(antenna)
OUTPUT
antenna coords.
OUTPUT
station coords.
No
End SNO Table?
Yes
J
EXIT

**Figure 44.**

The BCD listing of the Station Requirements Table will appear in the following format:

LOOK TABLE

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | COOK | 001011 | | | COMM ANTE | LIST |
| 2 | MUGU | 010001 | | SPAC | | LIST |
| 3 | ANNE | 100001 | BAKE | | | LIST |
| 4 | KODI | 000001 | | | | LIST |
| 5 | HULA | 000001 | | | | LIST |
| 6 | BOSS | 000001 | | | | LIST |
| 31 | COOK-A | 000101 | | | TRAK | LIST |
| 39 | THUL-A | 000001 | | | | LIST |
| 20 | HUNTS | 000110 | | | TRAK ANTE | |

Figure 45.

The output from option (5) is in the following format:

TIME CONSTANTS

| | |
|---|---|
| LFPA | XXX |
| MONTHB | XX |
| YEARB | XXXX |

EARTH CONSTANTS

| | |
|---|---|
| MU | X--X |
| AE | X--X |
| EE | X--X |
| OMEGA | X--X |
| JRE2 | X--X |
| DRE4 | X--X |

LAUNCH PAD COORDINATE TABLE

| NAME | LATITUDE | | LONGITUDE | | HEIGHT |
|---|---|---|---|---|---|
| | DEG. | MIN | DEG. | MIN | FEET |
| PAD | XX | XX | XX | XX | XX |
| PAD1 | XX | XX | XX | XX | XX |
| PAD2 | XX | XX | XX | XX | XX |
| PAD3 | XX | XX | XX | XX | XX |
| PAD4 | XX | XX | XX | XX | XX |
| PAD5 | XX | XX | XX | XX | XX |

Figure 46.

## STATION COORDINATE TABLE

| STATION NAMES | ANTENNA | STATION NO. | LATITUDE DEG | LATITUDE MIN | LONGITUDE DEG | LONGITUDE MIN | HEIGHT FEET | REFERENCE NORTH | LATITUDES SOUTH |
|---|---|---|---|---|---|---|---|---|---|
| COOK | | 1.0 | XX | XX | XX | XX | XX | XX | XX |
| | VERLORT | 1.1 | XX | XX | XX | XX | XX | | |
| | PRELORT | 1.5 | XX | XX | XX | XX | XX | | |
| MUGU | | 2.0 | XX | XX | XX | XX | XX | XX | XX |
| HULA | | 5.0 | XX | XX | XX | XX | XX | XX | XX |
| BOSS | | 6.0 | XX | XX | XX | XX | XX | XX | XX |
| | TLM-18 | 6.2 | XX | XX | XX | XX | XX | | |
| DONN | | 7.0 | XX | XX | XX | XX | XX | XX | XX |





Figure 47.

External Distribution List

Space Systems Division
(Contracting Agency)
Maj. C. R. Bond (SSOCD)
Maj. N. D. LaVally (SSOX)

6594th Aerospace Test Wing
(Contracting Agency)
Lt. Col. A. W. Dill (TWRD) (10)
Lt. Col. M. S. McDowell (TWRU)
TWACS (20)

PIR-E1 (Lockheed)
J. A. Boysen
N. N. Epstein
W. E. Moorman
G. F. Taylor
R. L. Vader
P. E. Williams

PIR-E2 (Philco)
J. A. Bean
J. A. Isaacs
R. Morrison
S. M. Stanley

PIR-E3 (LFE)
D. F. Criley
K. B. Williams

PIR-E4 (GE - Santa Clara)
D. Alexander

PIR-E4 (GE - Sunnyvale)
J. Farrentine
N. Kirby

PIR-E4 (GE - Box 8555)
J. S. Brainard
R. J. Katucki
J. D. Selby

PIR-E4 (GE - 3198 Chestnut)
J. F. Butler
C. A. Cummings
H. D. Gilman

PIR-E4 (GE - Bethesda)
A. Pacchioli

PIR-E4 (GE - Box 8661)
F. T. Clark
J. D. Rogers
W. R. Weinrich

PIR-E5 (Aerospace)
F. M. Adair
A. Bakst
J. W. Bengston
R. V. Bigelow
R. O. Brandsberg
L. H. Garcia
G. J. Hansen (3)
L. J. Kreisberg
M. L. Luther
T. R. Parkin
E. E. Retzlaff
H. M. Reynolds
D. Saadeh
R. G. Stephenson
D. D. Stevenson
V. White

6 March 1963

TM-(L)-1071/000/00

## Internal Distribution

| | |
|---|---|
| G. Wilson | 22101 |
| M. Winsor | 24137 |
| J. Winter | 24097 |
| R. Wise | 24051 |
| J. Wong | Sunnyvale |
| S. Zachte | 22076 |
| C. Zubris | 24075 |

## Internal Distribution

| | | | |
|---|---|---|---|
| D. Allfree | 22078 | R. Keyes | 20073 |
| J. Aldana | 24113 | J. Kneemeyer | 24065 |
| B. Alexander | 22083 | R. Knight | 24110 |
| N. Alperin | 24118 | R. W. Knight | 22095 |
| E. Armstrong | 24089 | L. Kolbo | 24139 |
| C. Becerra | 24082 | L. Laughlin | 20073 |
| D. Biggar | 24090 | J. LaVine | 20079 |
| R. Bilek | 24124 | H. Lewis | 24117 |
| L. Brenton | 22070 | J. Little | 20077 |
| B. Burke | 23014 | F. Long | 24122 |
| R. Burke | 23014 | | |
| C. Bustya | 22084 | G. Madrid | 24049 |
| M. Champaign | 24127 | G. Mahon | 22076 |
| D. Chesler | 22087 | R. Marshall | 24117 |
| C. Chiodini | 22078 | J. Marioni | 24076 |
| B. Ciaccia | 24082 | W. Martin | 24089 |
| R. Clements | 24132 | J. McKeown | 24121 |
| B. Cline | 24097 | J. Milanese | 24121 |
| J. Cogley | 24135 | J. Munson | 24048 |
| L. Conger | 22079 | G. Myers | 14056 |
| P. Cooley | 24083 | P. Nelson | 24075 |
| D. Crum | 24093 | L. Ngou | 25030 |
| L. DeCuir | 22096 | M. Olson | 24124 |
| W. Derango | 24082 | L. Padgett | 24085 |
| G. Dexter | 24128 | E. Patin | Sunnyvale |
| R. Disse | 24139 | D. Persico | 20076 |
| G. Dobbs | 24094 | T. Polk | 24103 |
| W. Dobrusky | 22125 | D. Reilly | 24085 |
| R. Dugas | 24105 | M. Rockwell | 22070 |
| R. Ellis | 24081 | C. Seacat | Sunnyvale |
| R. Ericksen | 24110 | H. Seiden | 22091 |
| H. Feldstein | 27013 | R. Scott | 24093 |
| C. Francis | 20075 | R. Shapiro | 25036 |
| M. Franks | 25030 | S. Shoel | 24123 |
| L. Friedman | 22083 | R. Skelton | 24127 |
| S. Gardner | 22053 | N. Speer | 20079 |
| V. Gergen | 24109 | E. Stone | 22116 |
| I. Greenwald | 24058 | M. Sweeney | 24057 |
| J. Haake | 24120 | W. Taber | 22053 |
| D. Henley | 24058 | T. Tennant | 27024 |
| C. Hill | 24057 | J. Thompson | 22077 |
| J. Hillhouse | 24049 | C. Toche | 24088 |
| H. Holzman | 22096 | R. Totschek | 24090 |
| G. Hudson | 22101 | A. Tucker | 24115 |
| R. Johnson | 24105 | A. Vorhaus | 24076 |
| P. Kastama | 24053 | S. Weems | 24126 |
| M. Katz | 24103 | G. West | Sunnyvale |
| F. Kayser | 25026 | G. P. West | 24094 |
| J. Keddy | 25026 | M. Weinstock | 22095 |
| D. Key | 24123 | B. Williams | 24091 |

UNCLASSIFIED

System Development Corporation,
Santa Monica, California
NEW AND MODIFIED 1604 COMPUTER PROGRAMS
IN SUPPORT OF AUGMENTATION MILESTONE 5
Scientific rept., TM(L)-1071/000/00,
by J. L. Little. 6 March 1963, 99p.
(Contract AF 19(628)-1648, Space Systems
Division Program, for Space Systems
Division, AFSC)

Unclassified report

DESCRIPTORS: Programming (Computers).
Satellite Networks.

Describes the new and modified 1604
Flight Support programs produced in UNCLASSIFIED

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support of Augmentation: 1) Station UNCLASSIFIED
Position (STPOS); 2) Telemetry
Mode Selection Input (STEM); 3) Write
Change Tape (SWRTOUT); 4) Merge Change
and Transfer Tapes (SMERGE); 5) 1604
to Bird Buffer Communication (SBRDTLK);
6) Read Bird Buffer/1604 Transfer Tape
(SRDTRK); and 5) Station Requirements
Table (SREQTAB).

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