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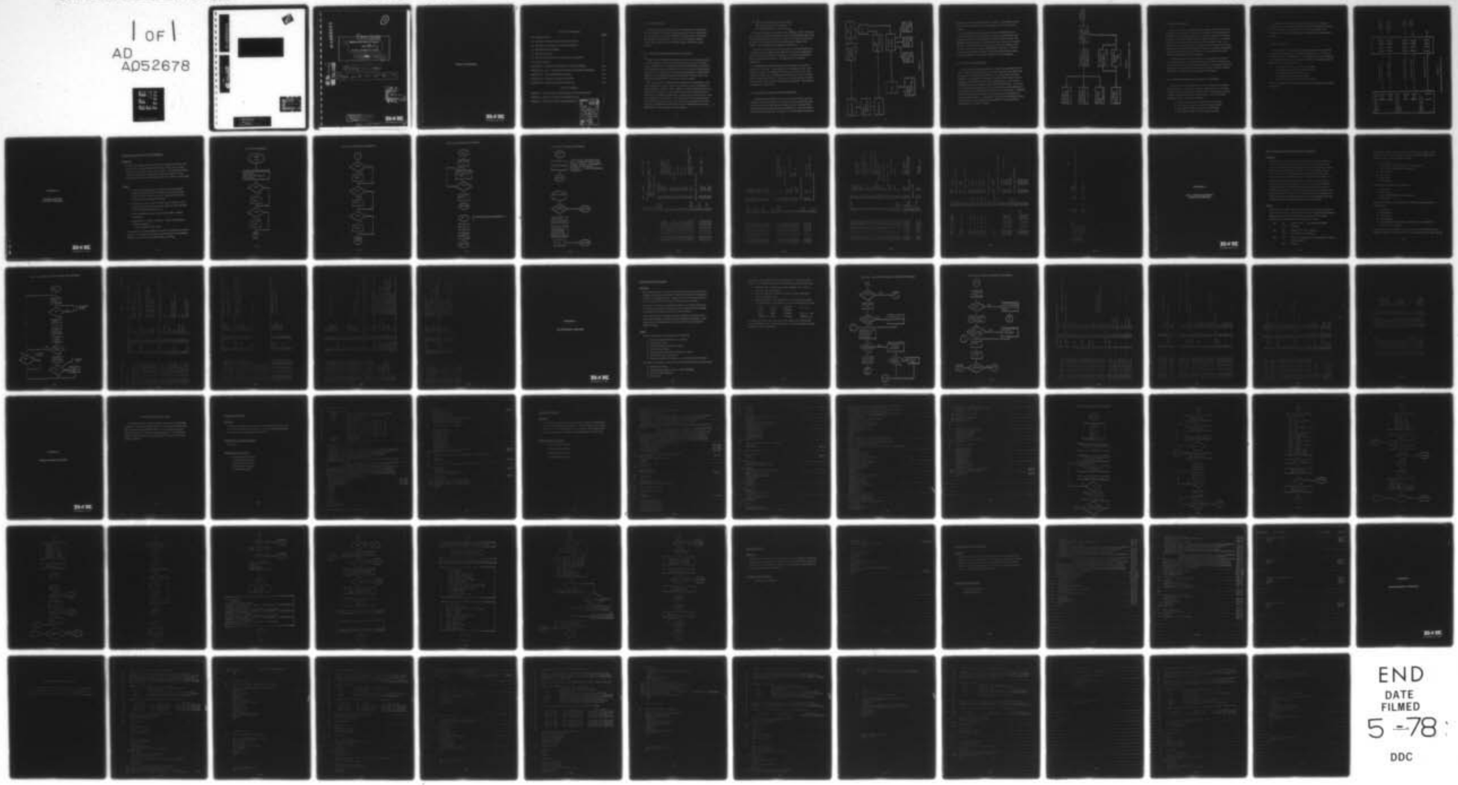

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DYNAMICS, INC.

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1.0 INTRODUCTION

B-K Dynamics' activities during the second quarter (15 January 1975 to 15 April 1975) have been focused on two areas: preparation of hardware for the interim STINGER simulation and conversion of the STINGER simulation to the ASC's hybrid computer system. This report summarizes the work performed during the above period.

2.0 INTERIM STINGER SIMULATION ACTIVITIES

BKD's interim STINGER simulation activities have been associated with readying the hardware for data transmission between the major system components (i.e. SDS/9300 to AD-4 and SDS/9300 to GE/3010). AD-4 linkage hardware, including the AD-4 converter and hybrid interface unit, was exercised and evaluated for performance. Sample/hold amplifiers were calibrated and data transmitted from the AD-4 to the IRSS using the SDS/9300. These tests were successful.

During the quarter, IRSS interface operation was intermittent. Extensive testing was done to discover the source of errors generated in data exchanges. Grounds, power supplies and other potential sources of noise were investigated. The problem was finally resolved by the replacement of several marginal gates, relocation of driver/receiver cards to the GE/3010's CPU chassis, and modification of the ground system. In the course of the above activities, software was generated for use in checking the SDS/9300 to GE/3010 link and the SDS/9300 to AD-4 link. Specifically, three programs were developed:

- A general purpose AD-4 test routine,
- An AD-4 discrete test routine, and
- A GE/3010 interface test routine.

The general purpose AD-4 test routine contains an ADC read loop and a register read/write loop along with three additional buffer areas for storing programs for the AD-4. Code for the AD-4 is entered in the buffers and executed from the SDS/9300 under sense switch control. The program is documented in Appendix A.

The AD-4 discrete test routine provides a convienent method for verifying that the 16 input and 16 output lines between the SDS/9300 and the AD-4 are operating. In addition it verifies the operation of DGS's and DGC's on the AD-4. The program is described in Appendix B.

The SDS/9300 to GE/3010 interface test program verifies the operation of that link. The program has two options for data transmitted. A count from 000000_8 to 177777_8 in increments of 1 bit is normally transmitted and optionally a pattern of all ones alternating with all zeroes may be sent. The data is transmitted from the SDS/9300 to the GE/3010 and then read back and compared. The program is described in Appendix C.

3.0 STINGER CONVERSION TO ASC EQUIPMENT

Converting the STINGER real-time simulation from the interim system to the ASC equipment has required replacing IBM-7094 software functions with equivalent CDC-6600 functions, and IBM-DOS interface operations with equivalent DADIOS ADC, DAC and discrete word handling capabilities. In Figure 1 the relationship of hardware

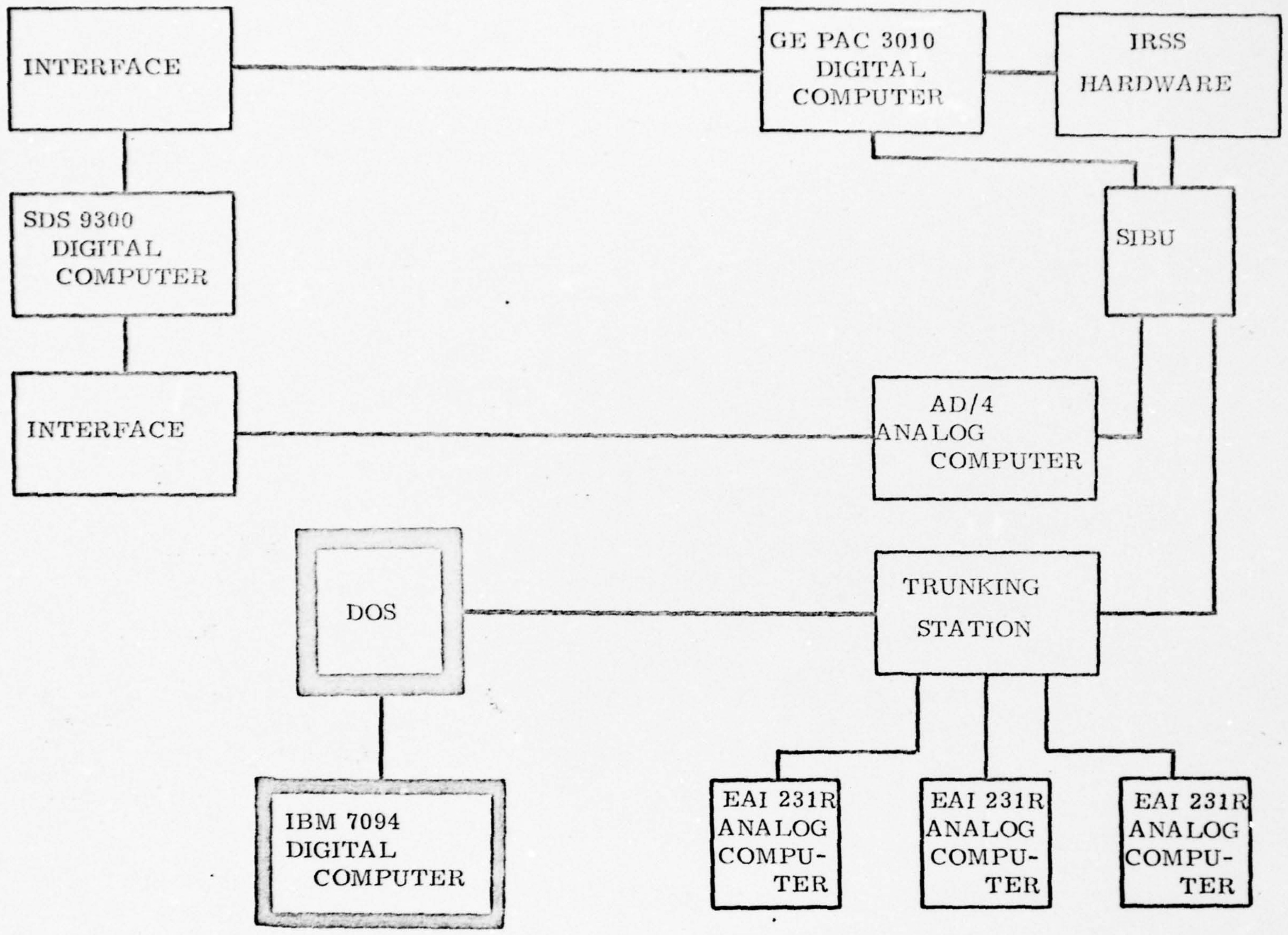

INTERFACE
SDS 9300 DIGITAL COMPUTER
INTERFACE
GE PAC 3010 DIGITAL COMPUTER
IRSS HARDWARE
SIBU
AD/4 ANALOG COMPUTER
TRUNKING STATION
DOS
IBM 7094 DIGITAL COMPUTER
EAI 231R ANALOG COMPU-TER
EAI 231R ANALOG COMPU-TER
EAI 231R ANALOG COMPU-TER

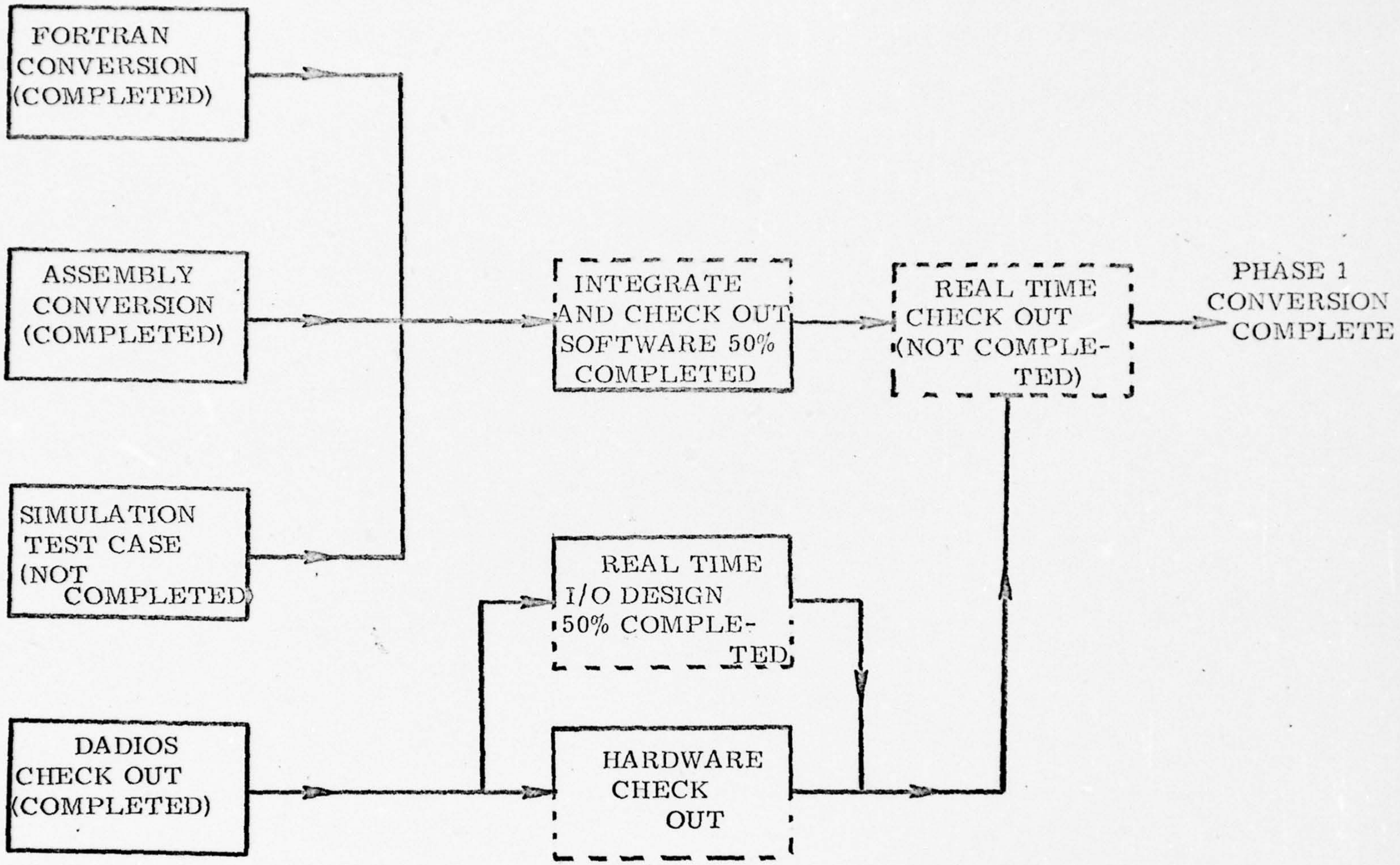
FIGURE 1

THE INTERIM STINGER REAL TIME SIMULATION elements in the interim simulation are shown. The elements which are affected in this phase of the conversion are outlined in heavy borders.

To date STINGER software conversion and DADIOS checkout routines have both been completed. In addition a preliminary real-time I/O design has been developed based on results obtained from DADIOS checkout studies. The final real-time checkout will require extensive hardware/software test and the successful integration of the new software with the existing STINGER simulation. The flow chart in Figure 2 shows the interrelationship between these tasks. The tasks outlined in solid lines represent those completed.

3.1 SOFTWARE CONVERSION

The interim STINGER simulation has approximately 2500 lines of code written for the IBM/7094. Of this code approximately 2000 lines of code are in FORTRAN and 500 lines are in MAP (7094 assembly language). Converting this software to the CDC-6600 required minor changes to the FORTRAN code and a completely new code written in FORTRAN hybrid to replace the IBM-7094 assembly code. Conversion of the assembly language portion of the code has been accomplished by 1) generating a flow chart from the MAP code, 2) rewriting in FORTRAN hybrid the equilivent functions and 3) incorporating the appropriate real-time input/output. In Appendix D the equilivent FORTRAN hybrid code is given. The statements labeled SOFT-T are modifications pertaining to the software testing.



FORTRAN CONVERSION (COMPLETED)
ASSEMBLY CONVERSION (COMPLETED)
SIMULATION TEST CASE (NOT COMPLETED)
DADIOS CHECK OUT (COMPLETED)
INTEGRATE AND CHECK OUT SOFTWARE 50% COMPLETED
REAL TIME I/O DESIGN 50% COMPLE-TED
HARDWARE CHECK OUT
REAL TIME CHECK OUT (NOT COMPLE-TED)
PHASE 1 CONVERSION COMPLETE

FIGURE 2

PHASE 1 STINGER CONVERSION TASK

3.2 SOFTWARE TEST

In order to reduce real-time software testing all new software will be tested in three steps: First, the new software will be simulated in non-real-time using special software to simulate real-time functions. Secondly, the software will be tested in pseudo real-time, a real-time test which uses only the most critical real-time loop. Then, if the previous tests are successful, the software will be tested in real-time. Evaluation of software test results will consist primarily of comparing interim STINGER data acquired from current simulation runs with results obtained from the new software.

In Appendix D the software necessary for simulating real-time events is presented. The special tasks which simulate hardware I/O are identified in card columns 73 through 80 by the designator SOFT-T. Other tasks which correct inconsistencys between the FTH. compiler and FTHH. are denoted by the designator SOFT-MOD.

3.3 SYSTEM SOFTWARE AND INTERFACE CHECKOUT

Prior to real-time simulation the system software and interface must be verified. This type of testing is important for 1) verifying status of the real-time system software and 2) checking the accuracy of ADCs, DACs and discrete communication. The test routines completed thus far include the following:

- Verification of discretes from AD-4 to CDC-6600.
- Verification of discretes from CDC-6600 to AD-4.
- Verification of ADCs from AD-4 to CDC-6600.
- Verification of DACs from CDC-6600 to AD-4.

In addition to establishing equipment status prior to real-time simulation, these test procedures are also used for isolating hardware or software failures in the interface system. In Appendix E the checkout programs are presented with an explanation of usage given in the code.

3.4 REAL-TIME I/O

The real-time I/O operations previously handled by the IBM-DOS are now implemented on the CDC-6600/DADIOS system. These new I/O task have been implemented in the FORTRAN hybrid code (Appendix D). These modifications will provide the STINGER simulation with the following hybrid linkage hardware:

- 16 Logic trunks from AD-4 to CDC-6600.
- 16 Logic trunks from CDC-6600 to AD-4.
- 16 DACs from CDC-6600 to AD-4.
- 16 ADCs from AD-4 to CDC-6600.
- 3 Interrupt lines from AD-4 to CDC-6600.

The AD-4 trunkline and ASFISS trunking station assignments are shown in Figure 3.

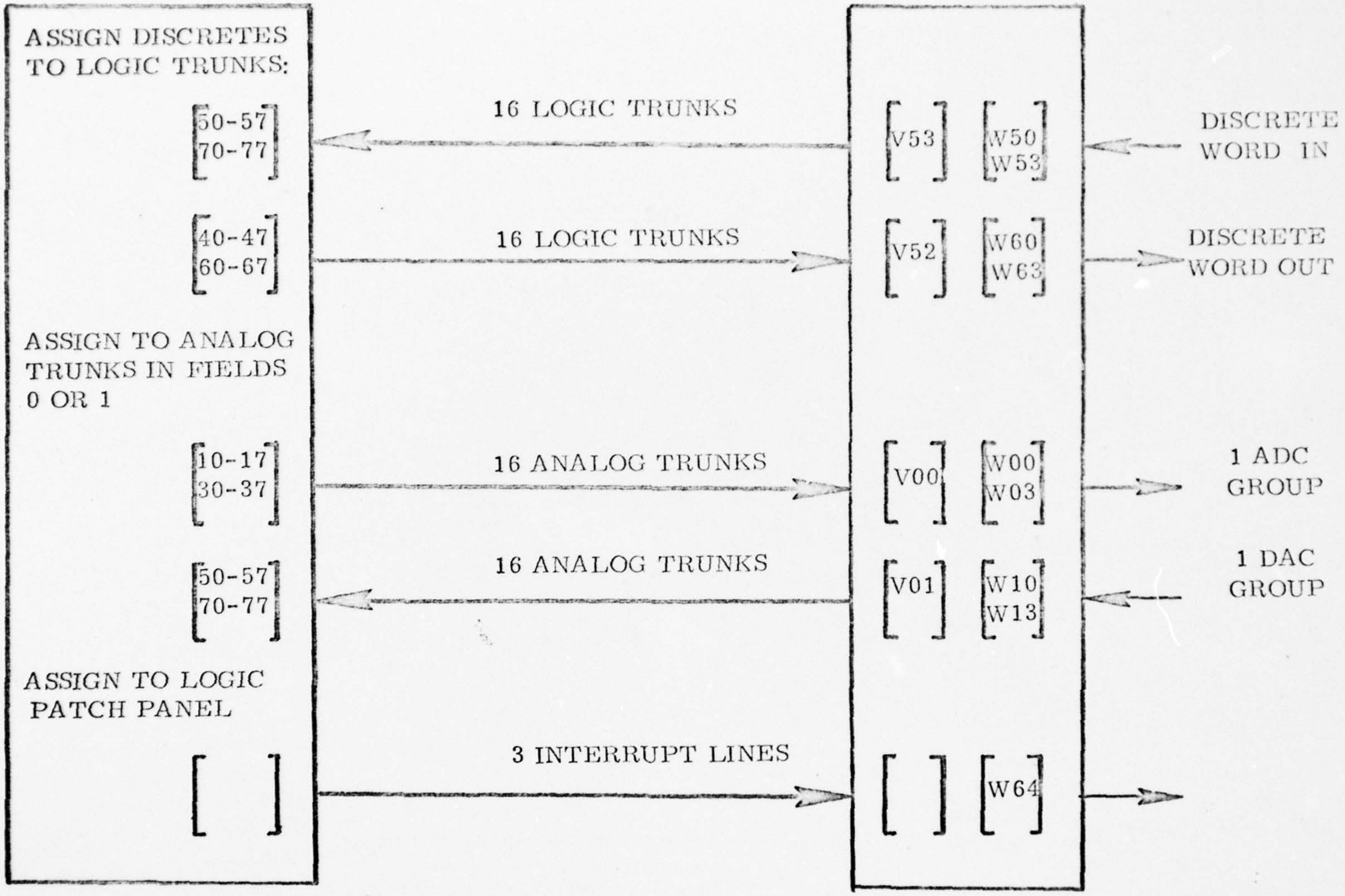


FIGURE 3

DADIOS PATCHING REQUIREMENTS

APPENDIX A

GENERAL PURPOSE
AD/4 TEST PROGRAM

GENERAL PURPOSE AD-4 TEST PROGRAM

PURPOSE

The General Purpose AD-4 Test Program permits the user to execute up to five separate AD-4 routines (e.g. ADC read, register read/write etc.) under sense switch control. The program contains a register read/write routine and an ADC read routine. Three other program areas are available for the user to enter his own code.

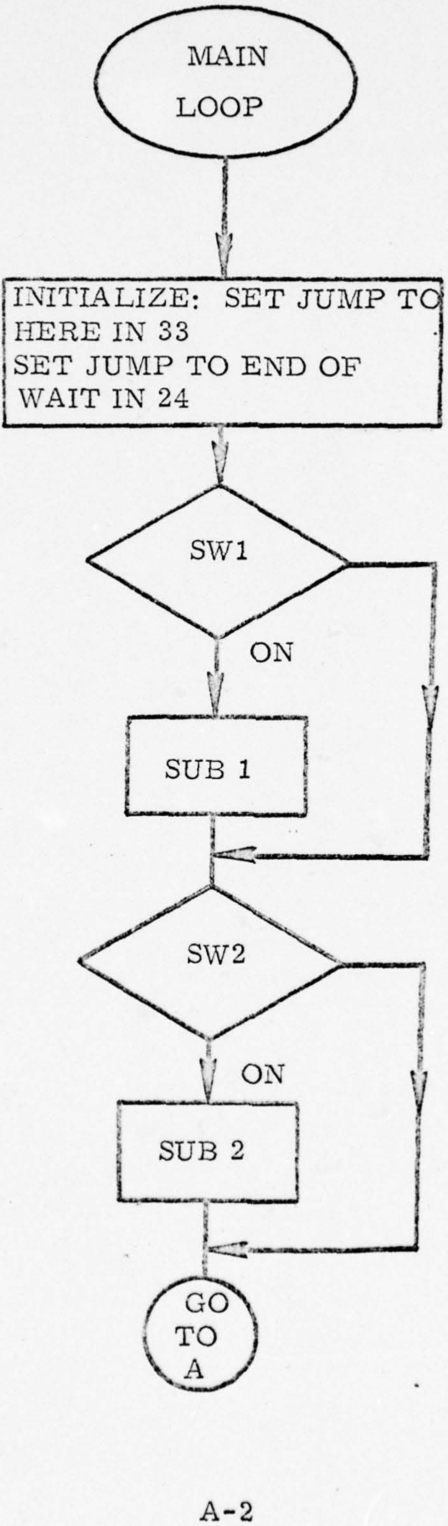
USAGE

- Five AD-4 command lists are defined at locations Q2100, 02200, 02400 and 02500. The first word of each list consists of the word count of that list. Subsequent words are the actual AD-4 command list words.
- If switch n is on, then list n will be sent. However, if the word count is LE 0 for a given list, that list is not sent even if the corresponding switch is on.
- New command lists may be added to the deck or loaded separately.
- OPERATION. Load the program. To run it perform the following sequence:

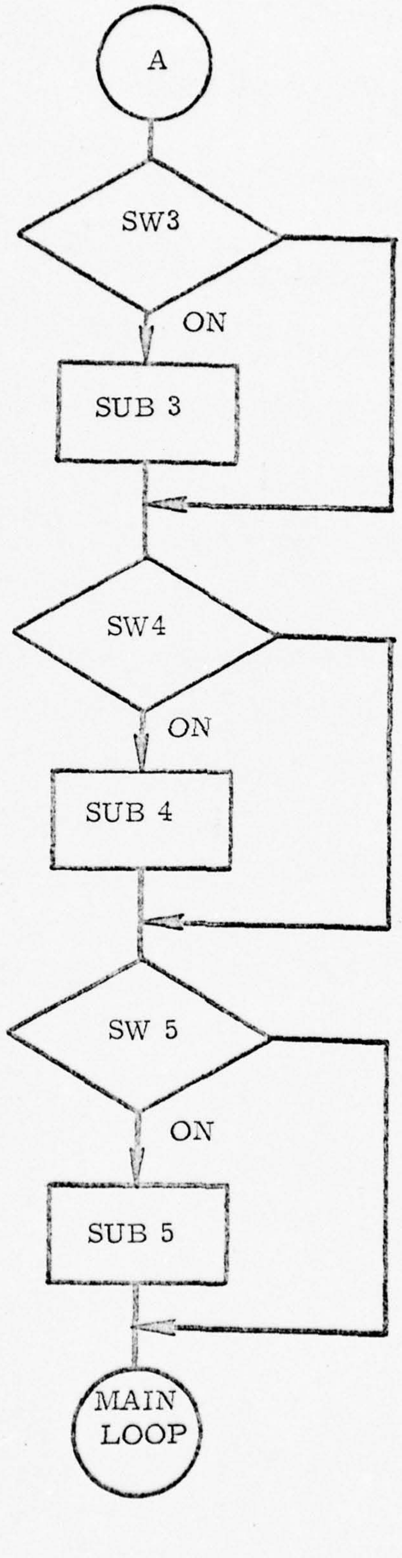
  IDLE, RESET, RUN, INT33

If one pass is desired set SS6 then set SSn for execution of the AD-4 program. The program will loop at location 01127 when complete. Results will be stored at locations 60000_8 to 60100_8.

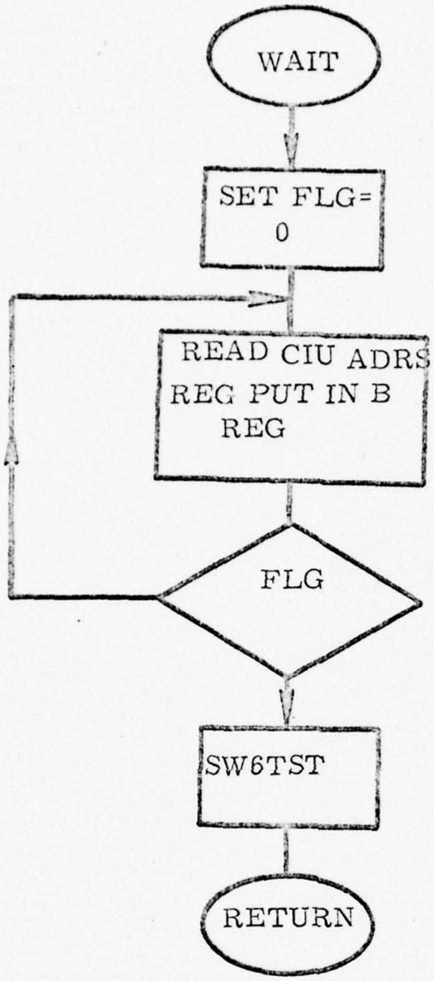
AD/4 TEST PROGRAM

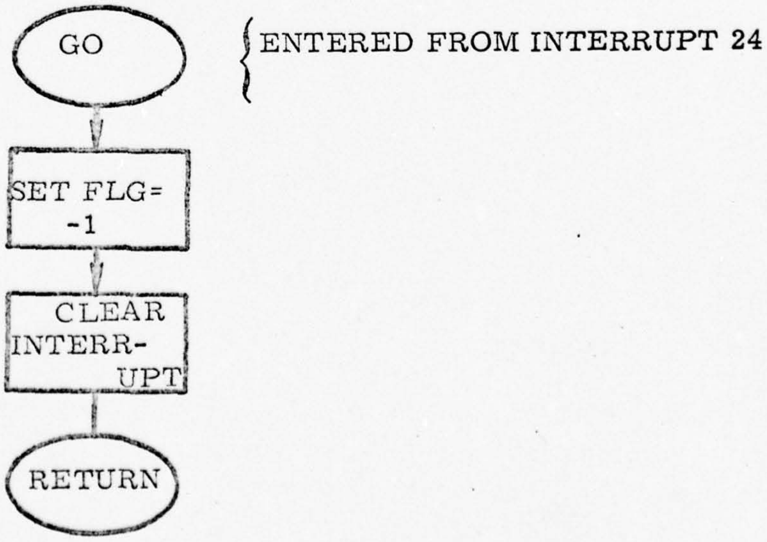

MAIN LOOP
INITIALIZE: SET JUMP TO HERE IN 33
SET JUMP TO END OF WAIT IN 24
SW1
ON
SUB 1
SW2
ON
SUB 2
GO TO A

AD/4 TEST PROGRAM CONTINUED

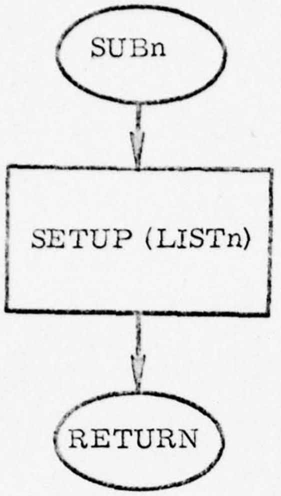


AD/4 TEST PROGRAM CONTINUED

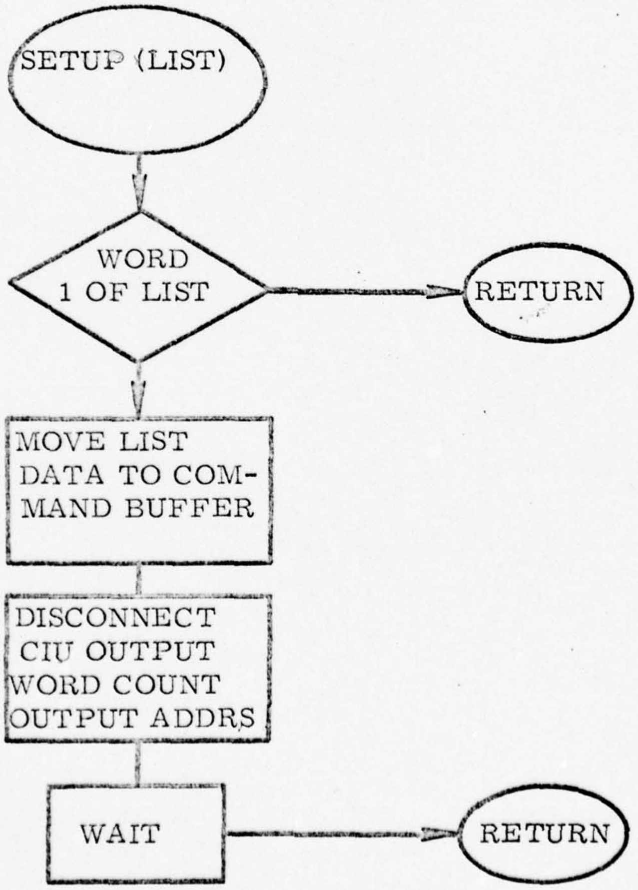




AD/4 TEST PROGRAM CONTINUED



LIST IS THE ADDRESS OF AN AD-4 COMMAND LIST IN THE FORM: WORD 1 = NUMBER OF WORDS TO TRANSFER
WORD Z n+1 AD-4 COMMANDS OR DATA



```
01000                            1          AØRG   01000           START AT 01000
                                 2 *
                                 3 *      AD/4 TEST
                                 4 *         WILL TRANSMIT FIVE DIFFERENT AD/4
                                 5 *         CØMMAND LISTS TØ THE AD/4
                                 6 *         CØMMAND
                                 7 *         UNDER SWITCH CØNTRØL
                                 8 *
                                 9 EØM1     ØPD    020276600
                                10 EØM2     ØPD    020276700
01000  0 0 16 01021             11 STRT     LDA    TRP24           SET UP INTERRUPT
01001  0 0 76 00024             12          STA    024               LØCATIØN 24
01002  0 0 16 01020             13          LDA    TRP33           SET UP CØNSØLE
01003  0 0 76 00033             14          STA    033               INT 033
01004  00220002                 15          EIR                    ENABLE INT SYS
01005  0 224 0040               16          SWT    040             CHK SW1
01006  0 0 03 01022             17          BRM    SUB1
01007  0 224 0020               18          SWT    020         CHK SW2
01010  0 0 03 01026             19          BRM    SUB2
01011  0 224 0010               20          SWT    010             CHK SW3
01012  0 0 03 01032             21          BRM    SUB3
01013  0 224 0004               22          SWT    004             CHK SW4
01014  0 0 03 01036             23          BRM    SUB4
01015  0 224 0002               24          SWT    002             CHK SW5
01016  0 0 03 01042             25          BRM    SUB5
01017  0 0 10 00000             26          NØP                    IN CASE A PATCH IS NEEDED
01020  0 0 01 01000             27 TRP33    BRU    STRT            LØØP ALSØ LØC 033
01021  0 0 03 01062             28 TRP24    BRM    GØ              LØC 024
                                29 *
                                30 *      SUBRØUTINES FØR EACH LIST
                                31 *
01022  0 0 00 00000             32 SUB1     PZE    0
01023  0 0 03 01066             33          BRM  ->SETUP           TRANSMIT LIST 1
01024  0 0 00 02100             34          PZE    BUF1
01025  0 0 41 01022             35          BRR    SUB1
01026  0 0 00 00000             36 SUB2     PZE    0
01027  0 0 03 01066             37          BRM    SETUP
01030  0 0 00 02200             38          PZE    BUF2
```

```
01031  0 0 41 01026             BRR    SUB2
01032  0 0 00 00000     SUB3    PZE    0
01033  0 0 03 01066             BRM    SETUP
01034  0 0 00 02300             PZE    BUF3
01035  0 0 41 01032             BRR    SUB3
01036  0 0 00 00000     SUB4    PZE    0
01037  0 0 03 01066             BRM    SETUP
01040  0 0 00 02400             PZE    BUF4
01041  0 0 41 01036             BRR    SUB4
01042  0 0 00 00000     SUB5    PZE    0
01043  0 0 03 01066             BRM    SETUP
01044  0 0 00 02500             PZE    BUF5
01045  0 0 41 01042             BRR    SUB5

                        *
                        *       WAIT L00P
                        *
01046  0 0 00 00000     FLG     PZE    0                  FLAG T0 C0MMUNICATE
01047  0 0 00 00000     WAIT    PZE    0                    WITH INTRPT RTNE
01050  0 0 77 01046             STZ    FLG                SET FLG>0
01051  0 0 10 00000             N0P
01052  0 2 02 76702             E0M2    2       READ CIU ADRS CNTR
01053  0 0 33 01117             PIN    PNTR
01054  0 0 14 01117             LDB    PNTR
01055  0 0 53 01046             SKN    FLG                SEE IF INT 024 YET
01056  0 0 01 01051             BRU    WAIT+2             N0
01057  0 0 10 00000             N0P                       YES
01060  0 0 03 01126             BRM    SW6TST             TEST SW6
01061  0 0 41 01047             BRR    WAIT
                        *
                        *       INTERRUPT 024 R0UTINE
                        *
01062  0 0 00 00000     G0      PZE    0
01063  0 0 73 01046             SKR    FLG                SET FLG NEG
01064  0 0 10 00000             N0P
01065  1 0 57 01062             BRC    *G0                CLEAR INTRPT + RET
                        *
                        *       SETUP R0UTINE T0 XMIT DATA
                        *
```

```
01066  0 0 00 00000      77 SETUP    PZE     0
01067  0 0 71 01066      78          MP0     SETUP
01070  1 0 16 01066      79          LDA     *SETUP
01071  0 0 76 01117      80          STA     PNTR              ADRS 0F LIST
01072  1 0 16 01117      81          LDA     *PNTR             W0RD C0UNT
01073  0 0 46 01120      82          SKG     ZER0
01074  0 0 41 01066      83          BRR     SETUP             RETURN IF LE ZER0
01075  0 0 76 01121      84          STA     WC                W0RD C0UNT
01076  0 0 13 01122      85          MRG     M2                CREATE INDEX REG L0AD
01077  1 40 7 0100       86          C0PY    (5,1)             PUT IN X1
01100  0 0 16 01117      87          LDA     PNTR
01101  0 0 13 01123      88          MRG     X1                CREAT INDRCT INDEXED
01102  0 0 76 01117      89          STA     PNTR                REF
01103  1 0 26 01117      90          LDP     *PNTR             L0AD 2 W0RDS 0F LIST
01104  0 1 75 60000      91          STD     BUFFER,1          ST0RE IN BUFFER
01105  0 1 57 01103      92          BRX     $-2,1     L00P UNTIL D0NE
01106  0 2 02 76702      93          E0M2     2         DISC0NNECT CIU
01107  0 0 31 01124      94          P0T     STPIT
01110  0 2 02 76602      95          E0M1     2       0UTPUT W0RD C0UNT
01111  0 0 31 01121      96          P0T     WC
01112  0 2 02 76702      97          E0M2    2     0UTPUT CNTRL + ADRS
01113  0 0 31 01125      98          P0T     BUFADR
01114  0 0 03 01047      99          BRM     WAIT              WAIT F0R INTRPT
01115  0 0 10 00000     100          N0P
01116  0 0 41 01066     101          BRR     SETUP             RETURN
01117  0 0 00 00000     102 PNTR     PZE     0
01120  0 0 00 00000     103 ZER0     PZE     0
01121  0 0 00 00000     104 WC       PZE     0

01122  1 3 76 00000     105 M2       STA     *0,3              INDX INCR>-2
01123  0 1 00 00000     106 X1       HLT     0,1               INDX REG 1
01124  1 0 00 00000     107 STPIT    HLT     *0                DISC CIU P0TW0RD
01125  0 2 00 60001     108 BUFADR   HLT     BUFFER+1,2        CIU ADRS P0TW0RD
                        109 *
                        110 *        SWITCH 6 TEST
                        111 *
01126  0 0 00 00000     112 SW6TST   PZE     0
01127  0 224 0001       113          SWT     001               L00P IF
01130  0 0 01 01127     114          BRU     $-1                 SWITCH 6 0N
```

```
01131  0 0 10 00000         115          NØP
01132  0 0 41 01126         116          BRR     SW6TST
                            117 *
                            118 *          SET CØNSØLE INTRPT 033
                            119 *
00033                       120          AØRG    033
00033  0 0 01 01000         121          BRU     STRT
                            122 *
                            123 *          SET FIVE BUFFERS EMPTY
                            124 *
02100                       125          AØRG    02100
02100  0 0 00 00000         126 BUF1     PZE     0
02200                       127          AØRG    02200
02200  0 0 00 00000         128 BUF2     PZE     0
02300                       129          AØRG    02300
02300  0 0 00 00000         130 BUF3     PZE     0
02400                       131          AØRG    02400
02400  0 0 00 00000         132 BUF4     PZE     0
02500                       133          AØRG    02500
02500  0 0 00 00000         134 BUF5     PZE     0
                            135 *
                            136 *          ØUTPUT BUFFER AREA
                            137 *
60000                       138          AØRG    060000
60000                       139 BUFFER   RES     0100
                            140 *
                            141 *          AN AD/4 REGISTER READ/WRITE RØUTINE
                            142 *
02100                       143          AØRG    02100
02100  0 0 00 00004         144          PZE     END1-$          WØRD CØUNT
02101  0 0 00 01022         145          PZE     01022
02102  0 0 00 06223         146          PZE     06223
02103  0 0 00 01426         147          PZE     01426
02104  25252525             148 END1     DATA    025252525
                            149 *
                            150 *          AN AD/4 ADC READ RØUTINE
                            151 *
02200                       152          AØRG    02200
02200  0 0 00 00013 2b      153          PZE     END2-$
02201  0 0 00 01022         154          PZE     01022
02202  0 0 00 06220         155          PZE     06220
02203  0 0 00 02444         156          PZE     02444
02204  0 0 00 01022         157          PZE     01022
```

```
                                                                        DATE
02205  0 0 00 06220        158          PZE    06220
02206  0 0 00 03447        159          PZE    03447
02207  25252525            160          DATA   025252525,025252525,025252525,025252525
02210  25252525
02211  25252525
02212  25252525
02213  25252525            161 END2     DATA   025252525
       00001000            162          END    STRT
```

APPENDIX B

AD/4 - SDS/9300 DISCRETES CHECK OUT PROGRAM

AD/4 - SDS/9300 DISCRETES CHECK OUT PROGRAM

PURPOSE

This program writes a 16 bit word into the AD/4 control register 0 and reads back a 16 bit word from the AD/4 sense line register 0. This is accomplished by the SDS/9300 via the direct memory access ports and the remote hybrid interface. The word written and the word read back to the SDS/9300 should be equal if the AD/4 logic board is patched so that DGC 1 goes to DGS 1, DGC 2 to DGS 2, etc.

Execution of the program automatically results in a test of all bit patterns between 0_8 and 77776_8. If an error is detected the 9300's B-register display will blink off-and-on 25 times and the next bit pattern will be tested. In addition to blinking the B-register an error message is printed on the TTY. To examine the error condition the program must be stopped and the contents of location 60005 (what was written) compared to location 60015 (what was read back).

USAGE

The program has three options, all of which are accessed by control panel sense switches. These options provide an unconditional program pause, a pause if error is detected and a bypass of TTY output. Specifically the options and their usage are as follows:

SS3	ON	Pause if read ≠ write (pauses at 60130)
	OFF	Continue
SS5	ON	Bypass TTY error message
	OFF	Print TTY error message
SS6	ON	Program unconditional pause (pauses in a loop at 60001 to 60002)
	OFF	Continue

To load the "binary deck" the user should follow these steps. First, put binary deck on back of Utility Library Program and load card reader. Second, on the computer console;

1. Press Idle.
2. Press Reset (then Press Load on card reader).
3. Press Clear Flags and Clear together.
4. Press Reset.
5. Press Run.
6. Press SS4.
7. Press Cards.

To execute the program do the following:

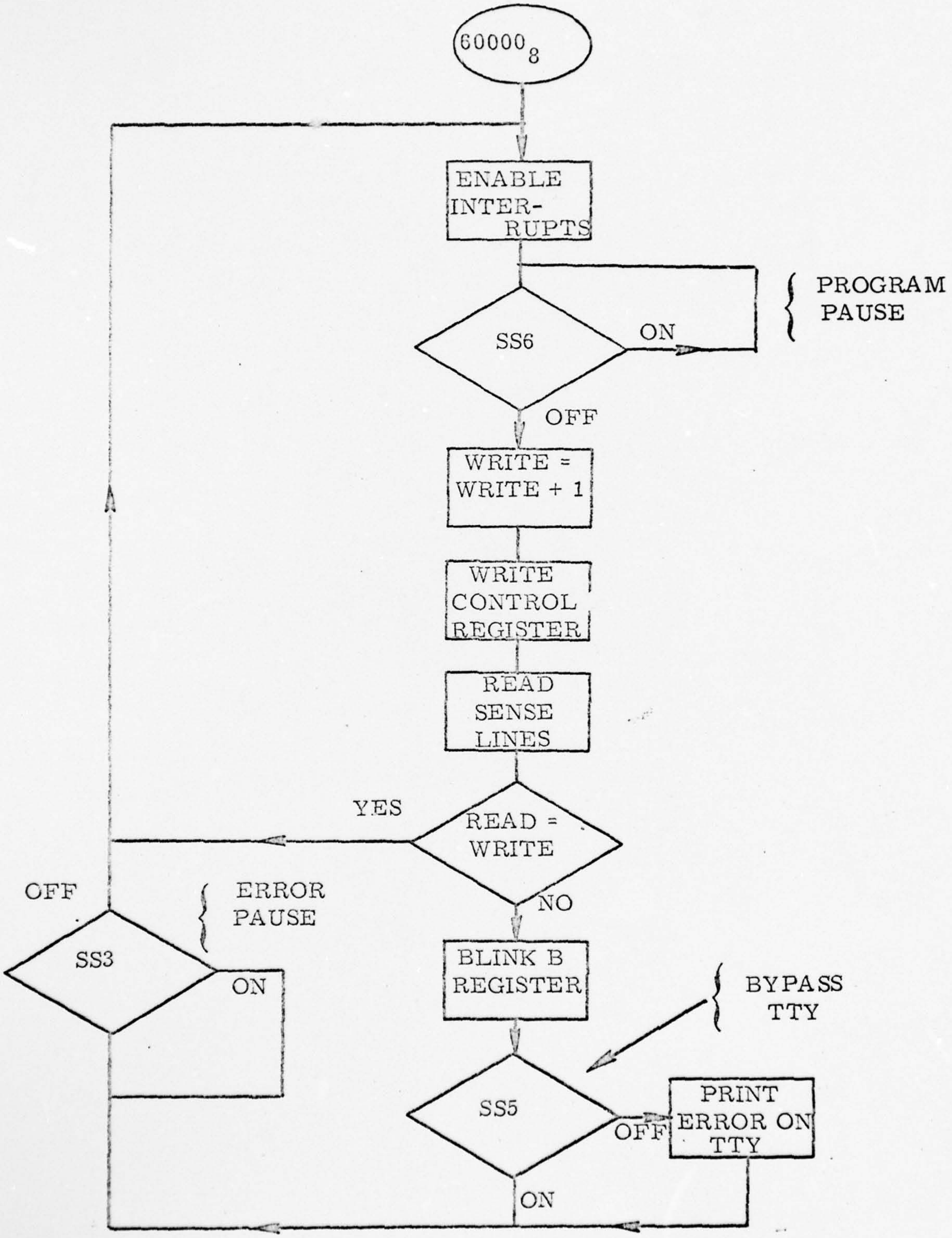
1. Press Idle.
2. Press Reset.
3. Enter BRU 60000_8 in the accumulator.
4. Press Run.

To use the Utility Library Program for displaying data locations do the following:

1. Press Idle.
2. Press Reset.
3. Press Run.
4. Press INT32.
5. On the keyboard enter SNAP___XXXXX, where XXXXXis the location to be displayed.

To re-enter the test program at any time after using the Utility Library Program repeat the steps required for program execution (as shown above).

AD/4 - SDS/9300 DISCRETES CHECK OUT PROGRAM



```
READ AND WRITE DISCRETES                                                      DATE                    PAGE  0001

△META9300 SI,LØ,BØ                                                                        RTM
                                  1 * WRITE AD4 CONTRL REG 0 AND READ BACK AD4 SENSE LINE REG 0
   60000                          2 START   AØRG    060000
   60000  00220002                3         EIR                     ENABLE INTERUPTS
   60001  0 224 0001              4         SWT     01              USE SSW 6 TØ PAUSE
   60002  0 0 01 60001            5         BRU     $-1             PAUSE UNTILL SSW 6 IS ØFF
   60003  0 0 10 00000            6         NØP
                                  7 ***********************************************************
   60004  0 0 71 70003            8 INCR    MPØ     070003          INCREMENT WRITE BY ØNE
   60005  0 0 71 70005            9         MPØ     070005
   60006  0 0 16 70005           10         LDA     070005
   60007  0 0 45 66006           11         SKE     MAX             IF WRITE GT MAX SET TØ ZERØ
   60010  0 0 01 60016           12         BRU     REWR            MAX WRITE HAS NØT BEEN REACHED
   60011  0 0 16 70016           13         LDA     =000000         MAX WRITE HAS BEEN REACHED
   60012  0 0 76 70003           14         STA     070003          SET WRITE EQ ZERØ
   60013  0 0 76 70005           15         STA     070005          SET WRITE EQ ZERØ
   60014  0 0 10 00000           16         NØP
   60015  0 0 10 00000           17         NØP
                                 18 ***********************************************************
   60016  0 0 16 66004           19 REWR    LDA     INT1            PREPARE INTERUPT RETURN
   60017  0 0 76 00024           20         STA     024
   60020  20276602               21         DATA    020276602       EØM
   60021  0 0 31 66000           22         PØT     WCW
   60022  20276702               23         DATA    020276702       EØM
   60023  0 0 31 66001           24         PØT     SADDW
   60024  0 0 01 60024           25         BRU     $               WAIT LØØP FØR AD4
   60025  0 0 57 60026           26 ENDW    BRC     $+1             CLEAR INTERUPT
   60026  0 0 16 66005           27         LDA     INT2            PREPARE INTERUPT RETURN
   60027  0 0 76 00024           28         STA     024
   60030  20276602               29         DATA    020276602       EØM
   60031  0 0 31 66002           30         PØT     WCR
   60032  20276702               31         DATA    020276702       EØM
   60033  0 0 31 66003           32         PØT     SADDR
   60034  0 0 01 60034           33         BRU     $               WAIT LØØP FØR AD4
   60035  0 0 57 60036           34 ENDR    BRC     $+1             CLEAR INTERUPT
```

```
                               35 ************************************************************
60036   0 0 16 70005           36          LDA      WRITEB+5        TEST FØR WRITE EQUAL READ
60037   0 0 45 70015           37          SKE      READB+5
60040   0 0 01 60044           38          BRU      PRINT           READ NØT EQUAL TØ WRITE
60041   0 0 01 60000           39          BRU      START           READ EQUALS WRITE
60042   0 0 10 00000           40          NØP
60043   0 0 10 00000           41          NØP
                               42 ************************************************************
60044   0 224 0002             43 PRINT    SKT      02              USE SSW 5 TØ STØP BLINKING LIGHTS
60045   0 0 01 60067           44          BRU      BLINK           BLINK B REGISTER
60046   0 0 01 60047           45          BRU      TYPE            TYPE ERRØR MESSAGE AND BLIK B REG
60047   0 02 1 02641           46 TYPE     TYP      *0,1,4
60050   0 02 0 14240           47          EØM      014240
60051   0 0 31 60054           48          PØT      AMSG
60052   0 20 14000             49          CAT      0
60053   0 0 01 60052           50          BRU      $-1
60054   0 0 05 20055           51 AMSG     ADD      MSG-040000
60055   52255151               52 MSG      TEXT     40, ERRØR IN AD4 DISCRETES
60056   46516031
60057   45602124
60060   04602431
60061   62235125
60062   63256260
60063   60606060
60064   60606060
60065   60606060
60066   60606060
                               53 ************************************************************
60067   0 0 16 70016           54 BLINK    LDA      =00000          INITIALIZE LØØP COUNTER
60070   0 0 76 66007           55          STA      LØØPS
60071   0 0 14 70017           56 LØØP     LDB      =077777         BLINK B REGISTER ØN
60072   0 0 16 70016           57          LDA      =000000
60073   0 0 76 66010           58          STA      LØNS
60074   0 0 16 70020           59          LDA      =07777
60075   0 0 10 00000           60 LØN      NØP
60076   0 0 10 00000           61          NØP
60077   0 0 10 00000           62          NØP
60100   0 0 10 00000           63          NØP
60101   0 0 10 00000           64          NØP
```

```
60102   0 0 71 66010               MPØ     LØNS
60103   0 0 45 66010               SKE     LØNS
60104   0 0 01 60075               BRU     LØN
60105   0 0 14 70016               LDB     =000000         BLINK B REGISTER ØFF
60106   0 0 16 70016               LDA     =000000
60107   0 0 76 66011               STA     LØFFS
60110   0 0 16 70020               LDA     =07777
60111   0 0 10 00000       LØFF    NØP
60112   0 0 10 00000               NØP
60113   0 0 10 00000               NØP
60114   0 0 10 00000               NØP
60115   0 0 10 00000               NØP
60116   0 0 71 66011               MPØ     LØFFS
60117   0 0 45 66011               SKE     LØFFS
60120   0 0 01 60111               BRU     LØFF
60121   0 0 71 66007               MPØ     LØØPS
60122   0 0 16 70021               LDA     =025            MAXIMUM CØUNT
60123   0 0 45 66007               SKE     LØØPS
60124   0 0 01 60071               BRU     LØØP            BLINK LØØP NØT FINISHED
60125   0 0 10 00000               NØP
60126   0 0 10 00000               NØP
                           ***********************************************************
60127   0 0 10 00000               NØP
60130   0 224 0010                 SWT     010             USE SSW 3 FØR AUTØ STØP AT ERRØR
60131   0 0 01 60130               BRU     $-1
60132   0 0 10 00000               NØP
60133   0 0 01 60000               BRU     START           BLINK LØØP IS FINISHED
                           ***********************************************************
66000                              AØRG    066000          DATA FØR PRØGRAM
66000   00000006           WCW     DATA    06              WØRD CØUNT FØR WRITE
66001   20070000           SADDW   DATA    020070000       STARTING ADDRESS FØR WRITE
66002   00000006           WCR     DATA    06              WØRD CØUNT FØR READ
66003   20070010           SADDR   DATA    020070010       STARTING ADDRESS FØR READ
66004   0 0 01 60025       INT1    BRU     ENDW            INTERUPT RETURN FRØM TRAP TØ 24
66005   0 0 01 60035       INT2    BRU     ENDR            INTERUPT RETURN FRØM TRAP TØ 24
66006   00077776           MAX     DATA    077776          MAXIMUM VALUE ØF CØNTRØL WØRD
66007                      LØØPS   RES     01              CØRRENT LØØP CØUNT FØR BLINK LIGHT
66010                      LØNS    RES     01              CYCLES ØF LIGHT ØFF
66011                      LØFFS   RES     01              CYCLES ØF LIGHT ØFF
                           ***********************************************************
```

```
70000                     105 WRITEB ABRG     070000       DATA FOR DMA WRITE
70000   00001021          106        DATA     01021        WRITE IN IRC
70001   00000020          107        DATA     020          ANALOG RUN MODE
70002   00001050          108        DATA     01050        WRITE INTO CLR
70003   00000000          109        DATA     0000000      FIRST WORD WRITTEN IN CLR
70004   00001050          110        DATA     01050        WRITE INTO CLR
70005   00000000          111        DATA     0000000      SECOND WORD WRITTEN INTO CLR
                          112 ***************************************************************
70010                     113 READB  ABRG     070010       DATA FOR DMA READ
70010   00001021          114        DATA     01021        WRITE INTO IRC
70011   00000020          115        DATA     020          ANALOG RUN MODE
70012   00001460          116        DATA     01460        READ SENSE LINES
70013                     117        RES      01           FIRST WORD READ ON SENSE LINES
70014   00001460          118        DATA     01460        READ SENSE LINES
70015                     119        RES      01           SECOND WORD READ ON SENSE LINES
                          120        END
70016   00000000
70017   00077777
70020   00007777
70021   00000025
```

APPENDIX C

3010 DIAGNOSTIC PROGRAM

B&K
DYNAMICS, INC.

3010 DIAGNOSTIC PROGRAM

PURPOSE

The program writes and reads back blocks of 23 words from locations $FEOO_{16}$ to $FFCO_{16}$ in 3010 core. Each pass the pattern being transmitted is incremented by one. The pattern is incremented from zero to 177777_8 and reset to zero when the high count is reached.

If an error is detected in a block the contents of the 9300 read buffer is printed along with data pattern that was transmitted (see example). To suppress the compare function set sense switch 1.

Every $10,000_8$ passes through the blocks $FEOO_8$ to $FFCO_8$ a print is made (see example) to indicate that the program is operating. (This may be effectively suppressed by loading $7777\ 7777_8$ into location STOPC (60130_8).

USAGE

To load the program into memory do the following:

1. Put BKD program loader card in hopper.
2. Ready card reader.
3. On the console, push Idle then Reset.
4. Clear register lights.
5. Hold down Clear and Clear Flags for 1 second.
6. Press Reset, Run, and Cards.
7. Program counter will stop at _____ indicating load completed.

To execute the program which has been previously loaded do the following:

1. Press Idle, Reset.
2. With register display set to B, enter 00160200_8.
3. Clear the 3010 interface.
4. Press Run.

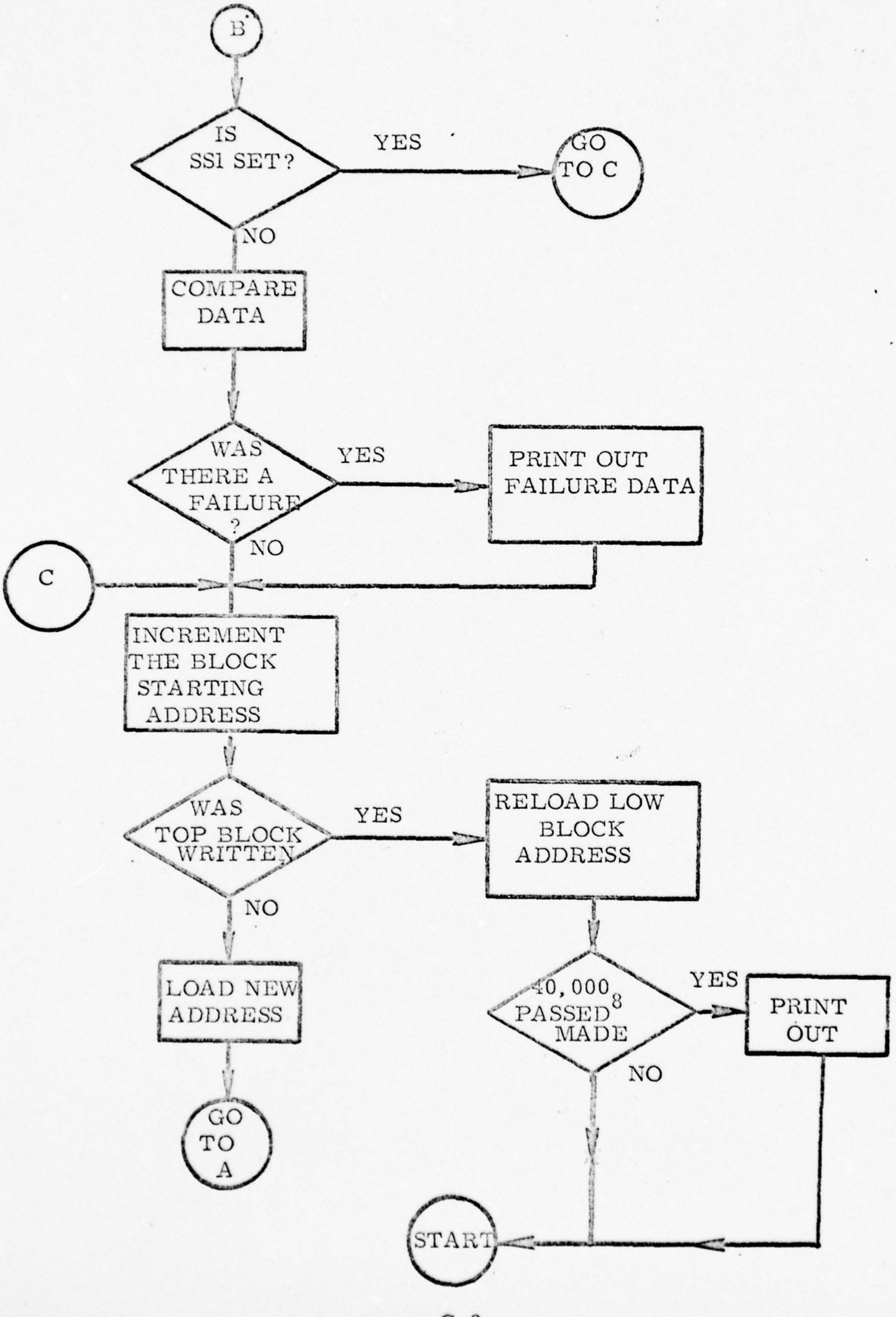
To suppress data comparison set sense switch 1. To halt set sense switch 6. To modify block length the following changes must be made.

1. LASTLOC (loc. 60117_8) must contain 60040_8 + No. words in the block to be transmitted.
2. WC1 (loc. 60112_8) and WC2 (loc. 60113_8) must contain (No. words transmitted + 1)$_8$.
3. INCR (loc. 60114) must contain (2 X No. Words)$_8$ in the block to be transmitted. For example - to do a 4 word transfer, enter:

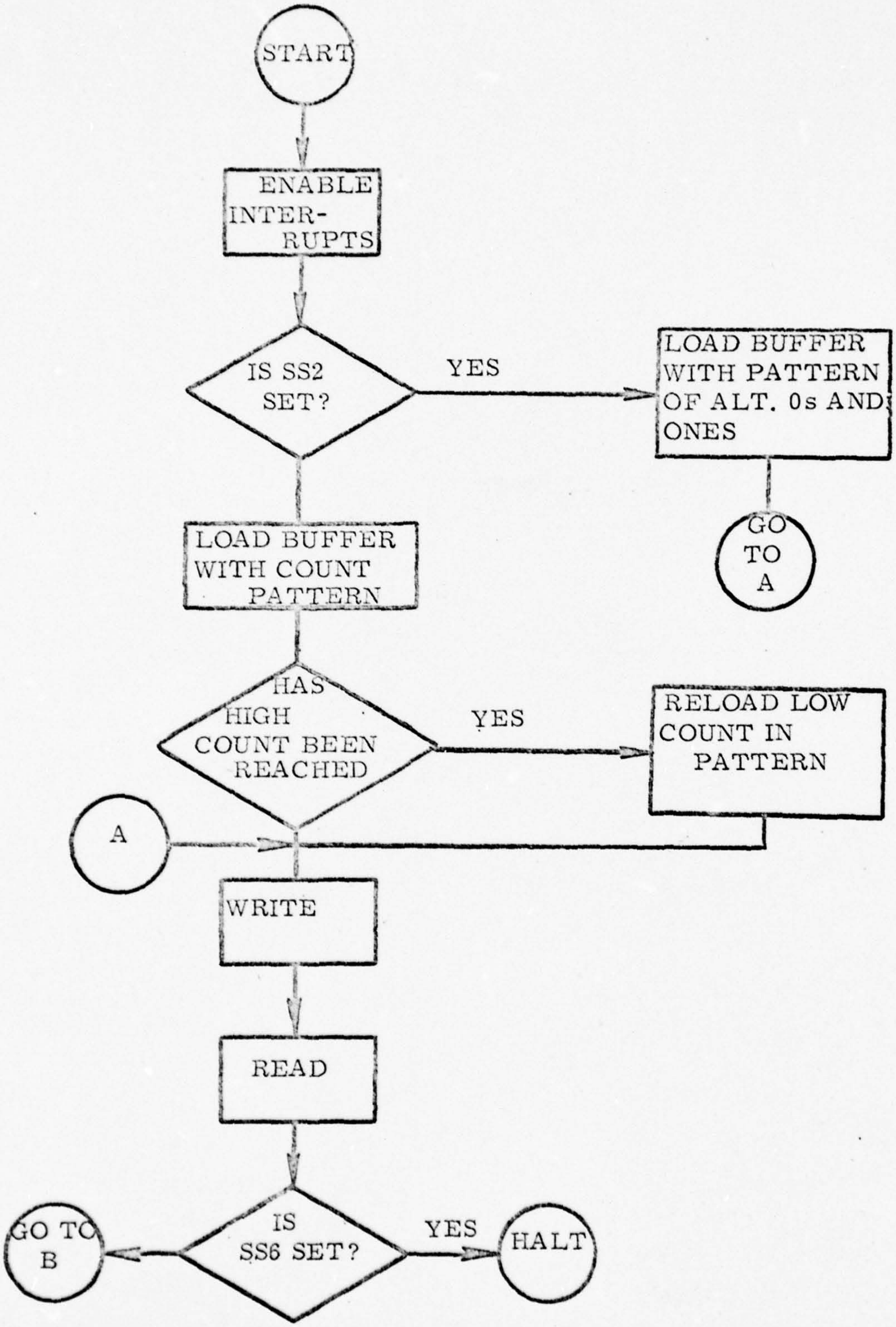
WC1	60112	00000005	($4_8 + 1_8$)
WCZ	60113	00000005	
INCR	60114	00000010	(2_8 X 4_8 = 10)
LASTLOC	60117	00060044	($60040_8 + 4_8$)

To change the pattern low count load LCNT (60105) with XXXXXXXX where XXXXXXXX is the desired low count. Note the program normally counts from zero to 00177777.

SDS/9300 to GE/3010 INTERFACE CHECKOUT PROGRAM



9300/3010 INTERFACE PROGRAM CONTINUED


START
ENABLE INTER-RUPTS
IS SS2 SET?
YES
LOAD BUFFER WITH PATTERN OF ALT. 0s AND ONES
GO TO A
LOAD BUFFER WITH COUNT PATTERN
HAS HIGH COUNT BEEN REACHED
YES
RELOAD LOW COUNT IN PATTERN
A
WRITE
READ
IS SS6 SET?
YES
HALT
GO TO B

```
                                                                          RTM
                            1 *3010/9300 INTERFACE DIAGNOSTIC PROGRAM
60200                       2          ABRG     060200
60200  00220002             3 START    EIR
60201  0 224 0020           4          SWT      020                SET SS 2 TO WRITE ALT ONES AND ZEROES
60202  0 0 01 60327         5          BRU      PATSEQ
                            6 * LOAD PATTERN IN WRITE BUFFER (STARTS AT 60001)
60203  0 0 16 60121         7 LOAD     LDA      FADD
60204  0 0 76 60122         8          STA      TEMPA
60205  0 0 16 60102         9          LDA      PATTRN
60206  0 0 76 60123        10          STA      TEMPP
60207  1 0 76 60122        11 BACK     STA      *TEMPA
60210  0 0 71 60122        12        MPO        TEMPA
60211  0 224 0020          13          SWT      020
60212  0 0 01 60340        14          BRU      ZAO
60213  0 0 16 60122        15 ZOBAC    LDA      TEMPA
60214  0 0 46 60124        16          SKG      LADD
60215  0 0 01 60217        17          BRU      CYCLE
60216  0 0 01 60221        18          BRU      PCHK
60217  0 0 16 60123        19 CYCLE    LDA      TEMPP
60220  0 0 01 60207        20          BRU      BACK
60221  0 0 71 60102        21 PCHK     MPO      PATTRN
60222  0 0 16 60102        22          LDA      PATTRN
60223  0 0 46 60103        23          SKG      HCNT               HIGH COUNT REACHED
60224  0 0 01 60240        24          BRU      WRITE              GO TO WRITE / READ
60225  0 0 16 60104        25          LDA      LCNT               RESET COUNTER TO LOW COUNT
60226  0 0 76 60102        26          STA      PATTRN
60227  0 0 01 60240        27          BRU      WRITE
                           28 *WRITE/READ MEMORY
60240                      29          ABRG     060240
60240  0 0 16 60105        30 WRITE    LDA      RET1
60241  0 0 76 00020        31          STA      020
60242  20276604            32          DATA     0020276604
60243  0 0 31 60111        33          POT      WC1
60244  20276704            34          DATA     0020276704
60245  0 0 31 60107        35          POT      SA1
60246  0 0 01 60246        36          BRU      $
60247  0 0 16 60106        37          LDA      RET2
60250  0 0 76 00020        38          STA      020
60251  20276604            39          DATA     0020276604
60252  0 0 31 60112        40          POT      WC2
60253  20276704            41          DATA     0020276704
60254  0 0 31 60110        42          POT      SA2
```

```
60255  0 0 01 60255     43          BRU     $
60256  0 0 10 00000     44          NOP
60257  0 224 0001       45          SWT     001          SET SS6 TO HALT
60260  0 0 00 00000     46          HLT
60261  0 0 01 60271     47          BRU     INCPT
                        48 * INCREMENT THE BLOCK STARTING ADDRESS
60262  0 0 16 60000     49 INCRM    LDA     WBA
60263  0 0 05 60113     50          ADD     INCR
60264  0 0 44 60117     51          SKL     MTOP


60265  0 0 01 60310     52          BRU     ARELD        GO TO MEMORY ADDR RELOAD ROUTINE
60266  0 0 76 60000     53          STA     WBA
60267  0 0 76 60040     54         STA      RBA
60270  0 0 01 60240     55          BRU     WRITE
60271  0 224 0040       56 INCPT    SWT     040          SET SS1 TO SUPPRESS COMPARE AND PRINT
60272  0 0'01 60262     57          BRU     INCRM
                        58 * COMPARE DATA WRITTEN WITH DATA READ
60273  0 0 16 60114     59 CMPAR    LDA     WSTA
60274  0 0 76 60100     60          STA     TWSTA
60275  0 0 16 60115     61          LDA     RSTA
60276  0 0 76 60101     62          STA     TRSTA
60277  1 0 16 60100     63 CAGN     LDA     *TWSTA
60300  1 0 45 60101     64          SKE     *TRSTA
60301  0 0 01 60323     65          BRU     PRINT
60302  0 0 71 60100     66          MPO     TWSTA
60303  0 0 71 60101     67          MPO     TRSTA
60304  0 0 16 60101     68          LDA     TRSTA
60305  0 0 45 60116     69          SKE     LSTLOC       QUIT IF LAST LOCATION
60306  0 0 01 60277     70          BRU     CAGN
60307  0 0 01 60262     71          BRU     INCRM
                        72 * MEMORY BLOCK ADDRESS RELOAD
60310  0 0 16 60120     73 ARELD    LDA     LBSA
60311  0 0 76 60000     74          STA     WBA
60312  0 0 76 60040     75          STA     RBA
60313  0 0 71 60127     76          MPO     PCNTR
60314  0 0 16 60127     77          LDA     PCNTR
60315  0 0 45 60130     78          SKE     STOPC
60316  0 0 01 60200     79          BRU     START
60317  0 0 03 02106     80          BRM     02106
60320  0 0 77 60127     81          STZ     PCNTR
```

```
60321  0 0 71 60127          82          MPO      PCNTR
60322  0 0 01 60200          83          BRU      START
                             84 * ENTRY TO UTILITY PRINT ROUTINE
60323  0 0 76 60071          85 PRINT    STA      RBA+25
60324  0 0 03 02106          86          BRM      02106
60325  0 0 77 60071          87          STZ      RBA+25
60326  0 0 01 60262          88          BRU      INCRM
                             89 *SET INITIAL PATTRN TO ZERO OR ONE
60327  0 0 16 60133          90 PATSEQ   LDA      PATRNT
60330  0 0 76 60102          91          STA      PATTRN
60331  0 0 45 60131          92          SKE      ZEROS
60332  0 0 01 60336          93          BRU      X
60333  0 0 16 60132          94          LDA      ONES
60334  0 0 76 60133          95          STA      PATRNT
60335  0 0 01 60203          96          BRU      LOAD
60336  0 0 77 60133          97 X        STZ      PATRNT
60337  0 0 01 60203          98          BRU      LOAD
                             99 * ALTERNATE THE PATTRN FROM ONES TO ZEROES
60340  0 0 16 60123         100 ZAO      LDA      TEMPP
60341  0 0 45 60132         101          SKE      ONES
60342  0 0 01 60345         102          BRU      Z
60343  0 0 77 60123         103          STZ      TEMPP
60344  0 0 01 60213         104          BRU      ZOBAC

60345  0 0 16 60132         105 Z        LDA      ONES
60346  0 0 76 60123         106          STA      TEMPP
60347  0 0 01 60213         107          BRU      ZOBAC
60000                       108          ABRG      060000
                            109 * DATA BUFFER WRITE
60000  00177000             110 WBA      DATA     0177000
60001                       111          RES      035
                            112
                            113 * DATA BUFFER READ
60040                       114          ABRG     060040
60040  00177000             115 RBA      DATA     0177000
60041                       116          RES      035
60076  00060000             117 WSA      DATA     060000
60077  00060040             118 RSA      DATA     060040
```

```
60100  0 0 00 00000     119 TWSTA   PZE
60101  0 0 00 00000     120 TRSTA   PZE
60102  00000001         121 PATTRN  DATA    01
60103  00177777         122 HCNT    DATA    000177777
60104  00000000         123 LCNT    DATA    000000000
60105  05760247         124 RET1     DATA   005760247
60106  05760256         125 RET2     DATA   005760256
60107  20060000         126 SA1     DATA    020060000
60110  20060040         127 SA2     DATA    020060040
60111  00000030         128 WC1     DATA    030
60112  00000030         129 WC2     DATA    030
60113  00000056         130 INCR    DATA    056
60114  00060001         131 WSTA    DATA    060001
60115  00060041         132 RSTA    DATA    060041
60116  00060067         133 LSTLOC  DATA    060067
60117  00177700         134 MTOP     DATA   0177700
60120  00177000         135 LBSA    DATA    0177000
60121  00060001         136 FADD     DATA   060001
60122  0 0 00 00000     137 TEMPA   PZE
60123  0 0 00 00000     138 TEMPP   PZE
60124  00060031         139 LADD    DATA    060031
60125  0 0 00 00000     140 TBSAW   PZE
60126  0 0 00 00000     141 TBSAR   PZE
60127  0 0 00 00000     142 PCNTR   PZE
60130  00040000         143 STOPC   DATA    040000
60131  00000000         144 ZEROS   DATA    000000000
60132  00177777         145 ONES    DATA    000177777
60133  00177777         146 PATRNT  DATA    000177777
                        147         END
```

APPENDIX D

FORTRAN HYBRID SOFTWARE

FORTRAN HYBRID SOFTWARE

This Appendix contains the real-time software for the STINGER simulation. The code presented here was converted from IBM-7094 MAP into CDC-6600 FORTRAN hybrid. The statements denoted SOFT-T pertain to the software test proceedures. The statements denoted SOFT-MOD correct inconsistencies between the FTN. and FTHH. compilers.

SUBROUTINE FLIGHT

PURPOSE

This program serves as a driver for the STINGER real-time code. The program initializes parameters, reserves DADIOS equipment and transfers initial conditions to the AD-4.

DESCRIPTION OF PARAMETERS

(see code)

SUBROUTINES REQUIRED

- SUBROUTINE ADFOUR
- SUBROUTINE SIMRUN
- SUBROUTINE REALT
- SUBROUTINE BHOLD
- SUBROUTINE RES

```
      SUBROUTINE FLIGHT
C
C     PROGRAM VARIABLES
C        MAXBIT          MAXIMUM BITS CONVERTED IN INPUT SENSE LINE
C        BIT(I)          BIT CONVERSION OF INPUT SENSE LINE
C        IIN             INPUT SENSE LINE
C        IOUT            OUTPUT SENSE LINE
C                        SENSE LINE 0 = 0000000000000001 =   1
C                        SENSE LINE 1 = 0000000000000010 =   2
C                        SENSE LINE 2 = 0000000000000100 =   4
C                        SENSE LINE 3 = 0000000000001000 =   8
C                        SENSE LINE 4 = 0000000000010000 =  16
C                        SENSE LINE 5 = 0000000000100000 =  32
C                        SENSE LINE 6 = 0000000001000000 =  64
C                        SENSE LINE 7 = 0000000010000000 = 128
C                        SENSE LINE 8 = 0000000100000000 = 256
C        LAUNCH(I)       DAC VARIABLES
C        ADIN(I)         ADC VARIABLES
C        IWRITE          IF IWRITE = 1, WRITE COMMENTS
C
      REAL MAN(200),MISSED(7),MISS,LAUNCH
      INTEGER WMAN
      DIMENSION FIN(10),TS(30)
      EQUIVALENCE (TS(1), TMAS(1)),(MAN(1),XMAN(1)),(MISSED(1),XMISS(1))
      EQUIVALENCE (FIN(1),DX),(FIN(2),DY),(FIN(3),DZ),(FIN(4),DT)
      EQUIVALENCE (FIN(5),XDOT),(FIN(6),YDOT),(FIN(7),ZDOT)
      EQUIVALENCE (FIN(8),XXX),(FIN(9),YYY),(FIN(10),ZZZ)
      COMMON/EXTRA/IT1,KCK,ICR2,IDA3,IND,INDEX
      COMMON/COMA/LEVEL,IPTS,XXS(50),XDTGO,YDTGO,ZDTGO,RLB,COSE,SPO,RI,
     *GAM,EDOT,THETAL,RN,
     *                   PPX(50),PPY(50),PPZ(50),TIME(50),TMAS(30),XDTGMS(30)
     *                  ,YDTGMS(30),ZDTGMS(30),XMAN(4,50),XMISS(7),NT
     *                  ,XCOMP,YCOMP,ZCOMP,TAMA(30),DELTAR(30),VM(30),G,GGG
     *,XDO,YDO,ZDO,DXG,DYG,DZG,S2,S3,S4,S5,XDM(30),YDM(30),ZDM(30),
     *RLBK,SCALEP,F1,F2,F3,G1,G2,G3,XC,YC,ZC,S1,RRR,SR,SPL,CTL,STL,
     *CPL,A1,VTI,XE(30),YE(30),ZE(30),ZALT,NERR,CLA,NPX,NX,CLAA(10),
     *PHO,ARG,AAA,SCALET,TREAL,TMA(30),XTA,YTA,ZTA,SCALEV,QMM(10),QM
     *,SA,CA,VMX(50),VMY(50),VMZ(50)
      COMMON/INTCOM/IBIT(60),MAXBIT,IWRITE
      COMMON/ZADC1/ADIN(10)                                             SOFT-MOD
      COMMON/ZDAC1/LAUNCH(11)                                           SOFT-MOD
      COMMON/ZODIS2/IOUT                                                SOFT-MOD
      COMMON/ZIDIS2/IIN                                                 SOFT-MOD
      LEVEL=7
      IT1=1
      KCK=-1
      ICR2=29
      IDA3=0
      IND=0
      INDEX=0
      MAXBIT=16
      IOUT=0
      IWRITE = 1
      DO 3 I=1,MAXBIT
    3 IBIT(I)=0
C
C     WAIT FOR STATIC CHECK COMPLETE ( BIT 5 )
```

```
    1 CONTINUE
      CALL ADFOUR                                                      SOFT-T
      CALL SIMRUN(ISTAT)
      WRITE(6,2000)ISTAT
      IF(ISTAT.GT.0)STOP
      CALL REMARK(17H JOB IN REAL TIME)
      IF(IBIT(5).NE.1)GO TO 1
      IF(IWRITE.EQ.1)WRITE(6,3000)
C
C     MOVE OUTPUT DATA TO DACS
C
      LAUNCH(1)=XDTGO
      LAUNCH(2)=YDTGO
      LAUNCH(3)=ZDTGO
      LAUNCH(4)=RLB
      LAUNCH(5)=COSE
      LAUNCH(6)=SPO
      LAUNCH(7)=RI
      LAUNCH(8)=GAM
      LAUNCH(9)=EDOT
      LAUNCH(10)=THETAL
      LAUNCH(11)=RN
      WRITE(6,5001)(LAUNCH(II),II=1,11)                                SOFT-T
 5001 FORMAT(8H LAUNCH=,11F5.2)                                        SOFT-T
C
C     SEND STATUS BIT TO AD/4 INDICATING ICS SENT ( BIT 4 )
C
      IOUT=16
      CALL ADFOUR                                                      SOFT-T
C
C     WAIT FOR RAMP UP SIGNAL FROM AD/4 (BIT 6)
C
    2 CONTINUE
      CALL ADFOUR                                                      SOFT-T
      IF(IBIT(6).NE.1)GO TO 2
      IF(IWRITE.EQ.1)WRITE(6,4000)
C
      CALL REALT                                                       SOFT-T
      CALL BHOLD
 2000 FORMAT(18H REAL TIME STATUS=,O2)
 3000 FORMAT(22H STATIC CHECK COMPLETE)
 4000 FORMAT(23H RAMP UP SIGNAL RECIVED)
      RETURN
      END
```

SUBROUTINE REALT

PURPOSE

This program contains the real-time digital computer computations required for the STINGER simulation. Program inputs are received from the AD-4 via DADIOS ADCs and discretes. The program outputs are transmitted to the AD-4 via DADIOS DACs and discretes.

SUBROUTINES REQUIRED

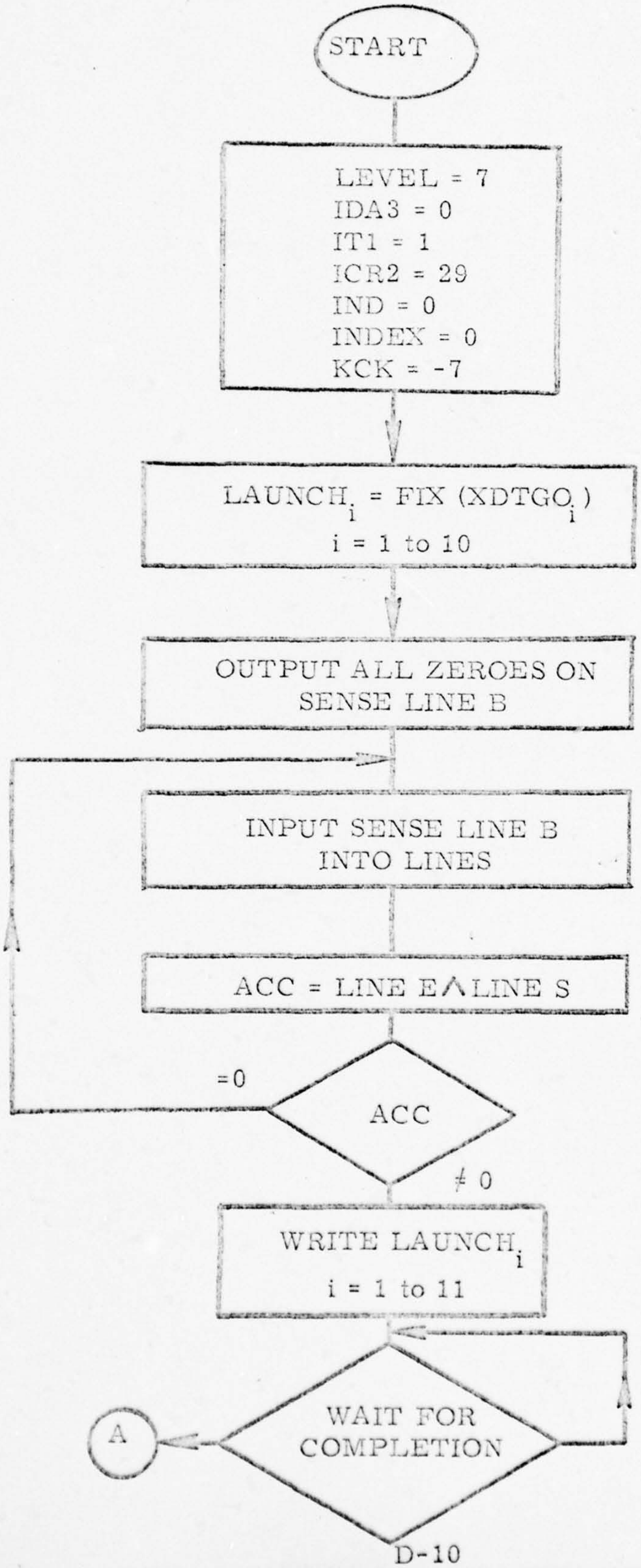
- SUBROUTINE SIMSTOP
- SUBROUTINE SIMHOLD
- SUBROUTINE ADFOUR
- SUBROUTINE SIMIDLE

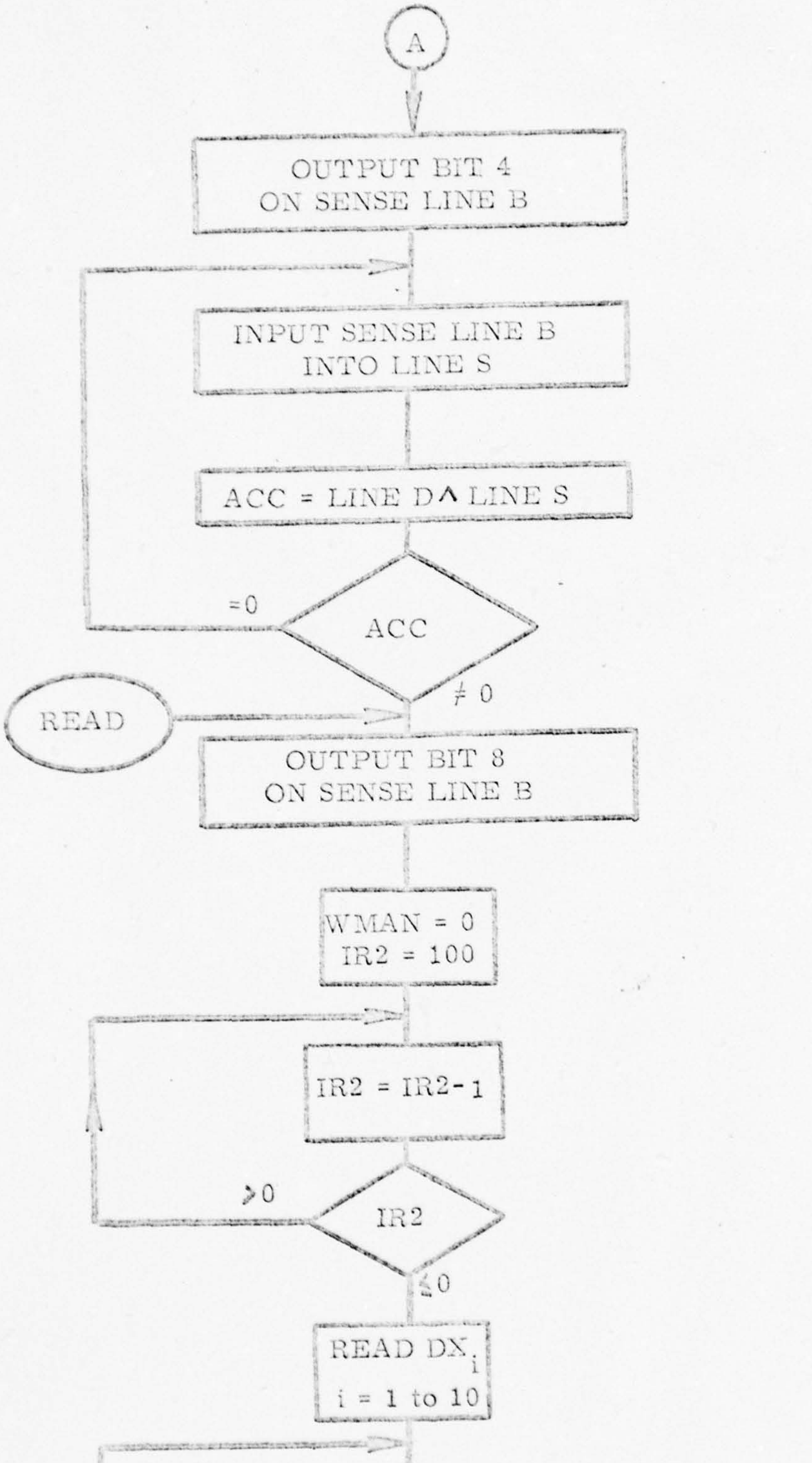
```
      SUBROUTINE REALT
      REAL MAN(200),MISSED(7),MISS,LAUNCH
      INTEGER WMAN
      DIMENSION FIN(10),TS(30)
      EQUIVALENCE (TS(1), TMAS(1)),(MAN(1),XMAN(1)),(MISSED(1),XMISS(1))
      EQUIVALENCE (FIN(1),DX),(FIN(2),DY),(FIN(3),DZ),(FIN(4),DT)
      EQUIVALENCE (FIN(5),XDOT),(FIN(6),YDOT),(FIN(7),ZDOT)
      EQUIVALENCE (FIN(8),XXX),(FIN(9),YYY),(FIN(10),ZZZ)
      COMMON/EXTRA/IT1,KCK,ICR2,IDA3,IND,INDEX
      COMMON/COMA/LEVEL,IPTS,XXS(50),XDTGO,YDTGO,ZDTGO,RL3,COSE,SPO,RI,
     *GAM,EDOT,THETAL,RN,
     *                 PPX(50),PPY(50),PPZ(50),TIME(50),TMAS(30),XDTGMS(30)
     *                ,YDTGMS(30),ZDTGMS(30),XMAN(4,50),XMISS(7),NT
     *                ,XCOMP,YCOMP,ZCOMP,TAMA(30),DELTAR(30),VM(30),G,GGG
     *,XDO,YDO,ZDO,DXG,DYG,DZG,S2,S3,S4,S5,XDM(30),YDM(30),ZDM(30),
     *RLBK,SCALEP,F1,F2,F3,G1,G2,G3,XC,YC,ZC,S1,RRR,SR,SPL,CTL,STL,
     *CPL,A1,VTI,XE(30),YE(30),ZE(30),ZALT,NERR,CLA,NPX,NK,CLAA(10),
     *PHO,ARG,AAA,SCALET,TREAL,TMA(30),XTA,YTA,ZTA,SCALEV,QMM(10),QM
     *,SA,CA,VMX(50),VMY(50),VMZ(50)
      COMMON/INTCOM/IBIT(60),MAXBIT,IWRITE
      COMMON/ZADC1/ADIN(10)                                             SOFT-MOD
      COMMON/ZDAC1/LAUNCH(11)                                           SOFT-MOD
      COMMON/ZIDIS2/IIN                                                 SOFT-MOD
      COMMON/ZODIS2/IOUT                                                SOFT-MOD
C
C     WAIT FOR FRAME SYNC FROM IRSS ( BIT 8)
 1000 CALL ADFOUR                                                        SOFT-T
      IF(IBIT(8).NE.1)GO TO 1000
      WMAN=0
      MAX=50
C
C     READ ADCS
C
      DO 2 I=1,10
    2 FIN(I)=ADIN(2)
      CALL ADFOUR                                                        SOFT-T
C
C     SCALE ADCS
C
      DO 3 I=1,3
    3 FIN(I)=FIN(I)*SCALEP
      IF(XXS(INDEX+1).GT.DX)GO TO 5
C
C     GO TO 3 CHANNEL MODE
C
C     OUTPUT BIT 3 TO AD/4
C
      IOUT=8
      CALL ADFOUR                                                        SOFT-T
C
      PPX(INDEX+1)=FIN(1)
      PPY(INDEX+1)=FIN(2)
      PPZ(INDEX+1)=FIN(3)
      TIME(INDEX+1)=FIN(4)
      VMX (INDEX+1)=FIN(5)
      VMY (INDEX+1)=FIN(6)
      VMZ (INDEX+1)=FIN(7)
      WMAN=7
      IDA3=1
C
C     CKMISS
C
    5 CONTINUE
      IF(DT/10.0.LE.G)GO TO 10
      SKK=GGG+1.0
      KCK=1
      MISS=DX*XDOT+DY*YDOT+DZ*ZDOT
      IF(MISS.LE.0.0)GO TO 10
      MISSED(1)=FIN(1)
      MISSED(2)=FIN(2)
      MISSED(3)=FIN(3)
      MISSED(4)=FIN(4)
      MISSED(5)=FIN(5)
      MISSED(6)=FIN(6)
      MISSED(7)=FIN(7)
 3000 CONTINUE
C
C     SYSTEM HOLD (SEND BIT 7 TO AD/4)
      IOUT=128
      CALL ADFOUR                                                   SOFT-T
C
C     RETURN TO BATCH JOB
C
      CALL SIMSTOP
      RETURN                                                        SOFT-T
C     CKTIME
C
   10 CONTINUE
      IF(LEVEL.GT.0)GO TO 1000
      IF(DT.LT.TS(1))GO TO 1000
      LEVEL=0
   20 CONTINUE
      IF(DT.LE.TS(30-ICR2))GO TO 30
      IT1=IT1+1
      IF(IT1.EQ.NT) GO TO 25
      IF(ICR2.LE.1)GO TO 25
      ICR2=ICR2-1
      GO TO 20
   25 CONTINUE
      LEVEL=7
      GO TO 1000
C
   30 CONTINUE
      IT2=IT1+1
      IF(WMAN.EQ.0)GO TO 100
      IND=IND+1
      IF(MAX.LT.IND)GO TO 100
      MAN(4*IND-3)=DT
  100 CONTINUE
C
C     CALC
C
      DIV=TS(IT2)-TS(IT1)
      RATIO=(DT-TS(IT1))/DIV
```

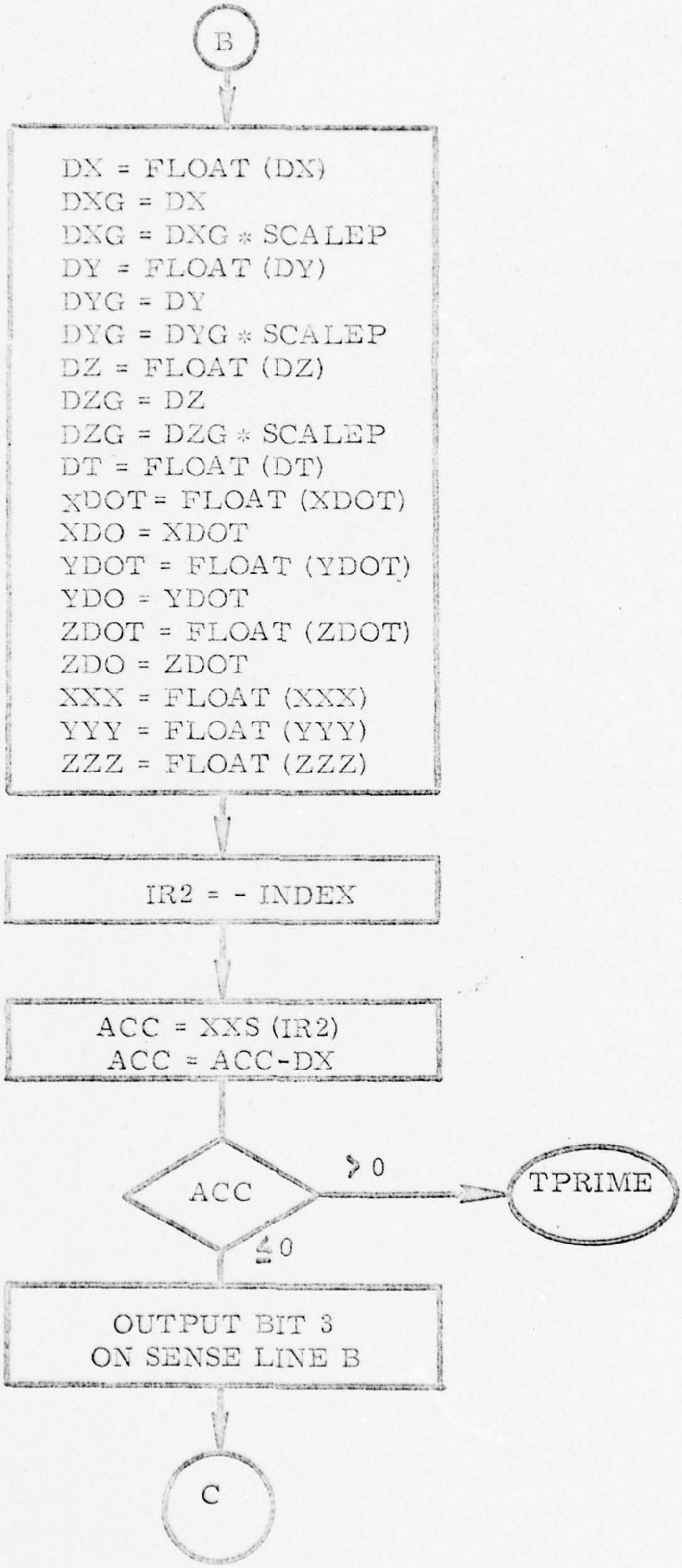
```
XCOMP=XDTGMS(IT1)+RATIO*(XDTGMS(IT2)-XDTGMS(IT1))
XC=XDM(IT1)+RATIO*(XDM(IT2)-XDM(IT1))
YCOMP=YDTGMS(IT1)+RATIO*(YDTGMS(IT2)-YDTGMS(IT1))
YC=YDM(IT1)+RATIO*(YDM(IT2)-YDM(IT1))
ZCOMP=ZDTGMS(IT1)+RATIO*(ZDTGMS(IT2)-ZDTGMS(IT1))
ZC=ZDM(IT1)+RATIO*(ZDM(IT2)-ZDM(IT1))
TREAL=DT*SCALET
IF(KCK.LT.0)SSK=1.0+GGG*TREAL/G
IF(IOA3.GT.0)GO TO 200
AAA=0.003894*ZALT+1116.89
VTI=SQRT(XC*XC+YC*YC+ZC*ZC)
IF(VTI.LT.338.0)GO TO 200
ARG=0.00003*ZALT
PHO=0.00237692*EXP(ARG)
QM=VTI/AAA
NPX=2
NX=8
CALL INTERP(QM,QMM,CLAA,NX,NPX,CLA,NERR)
CALL INTERP(TREAL,TMA,XE,NT,NPX,XTA,NERR)
CALL INTERP(TREAL,TMA,YE,NT,NPX,YTA,NERR)
CALL INTERP(TREAL,TMA,ZE,NT,NPX,ZTA,NERR)
A1=XTA*XTA+YTA*YTA+ZTA*ZTA
A1=0.01745329*4.637084242*SQRT(A1)/(PHO*VTI*VTI*CLA)
SA=SIN(A1)
CA=COS(A1)
XXX=XXX*20475.0/SKK
YYY=YYY*20475.0/SKK
ZZZ=ZZZ*20475.0/SKK
RRR=XXX*XXX+YYY*YYY+ZZZ*ZZZ
RRR=VTI*SQRT(RRR)
F1=S2*XXX-YYY*SPL+S3*ZZZ
F2=XXX*S4+YYY*CPL+ZZZ*S5
F3=CTL*ZZZ-STL*XXX
SR=SQRT(XC*XC+YC*YC)
S1=CA+S4/SR*ZC
G1=S1*XC
G2=S1*YC
G3=ZC*CA-SA*SR
E111=(F1*G1+F2*G2+F3*G3)/RRR
COSE=1.0-E111*E111
RLB=SQRT(COSE)
RLB=RLB*RLBK/SCALET
COSE=E111/1.02375
RC1=SQRT(F1*F1+F2*F2)
RC1=F2/RC1
RCB=ACOS(RC1)
RCX=-RC1
RCY=-SIN(RCB)
IF(F1.GE.0.0)RCY=-RCY
F11=(F2*G3-F3*G2)/VTI
F22=(G1*F3-G3*F1)/VTI
F33=(G2*F1-G1*F2)/VTI
FCR=SQRT(F11*F11+F22*F22+F33*F33)
G11=F11*RCX
G22=F22*RCY
C111=(G11+G22)/FCR
T111=ACOS(C111)
```

```
      IF(F33.GE.0.0)GO TO 155
      IF(T111.LT.1.570796326)GO TO 156
      TRP=1.570796326+T111
      GO TO 159
  155 TRP=1.570796326-T111
      GO TO 159
  156 TRP=T111-4.71238898
  159 SPO=TRP/SCALET
  210 CONTINUE
C
C     HERE
C
      IF(WMAN.EQ.0)GO TO 2000
      IF(MAX.LE.IND)GO TO 2000
      MAN(4*IND-2)=XCOMP
      MAN(4*IND-1)=YCOMP
      MAN(4*IND)=ZCOMP
      INDEX=INDEX+1
      IF(INDEX.GT.IPTS)GO TO 3000
 2000 CONTINUE
C
C     UPDATE THE DACS
C
      LAUNCH(1)=XCOMP
      LAUNCH(2)=YCOMP
      LAUNCH(3)=ZCOMP
      LAUNCH(4)=RLB
      LAUNCH(5)=COSE
      LAUNCH(6)=SPO
      LAUNCH(7)=RI
      LAUNCH(8)=GAM
      LAUNCH(9)=EDOT
      LAUNCH(10)=THETAL
      LAUNCH(11)=RN
      WRITE(6,5001)(LAUNCH(II),I=1,11)                                  SOFT-T
 5001 FORMAT(8H LAUNCH=,11F5.2)                                         SOFT-T
 1000 CALL SIMIOLE
      GO TO 1001                                                        SOFT-T
      END
```

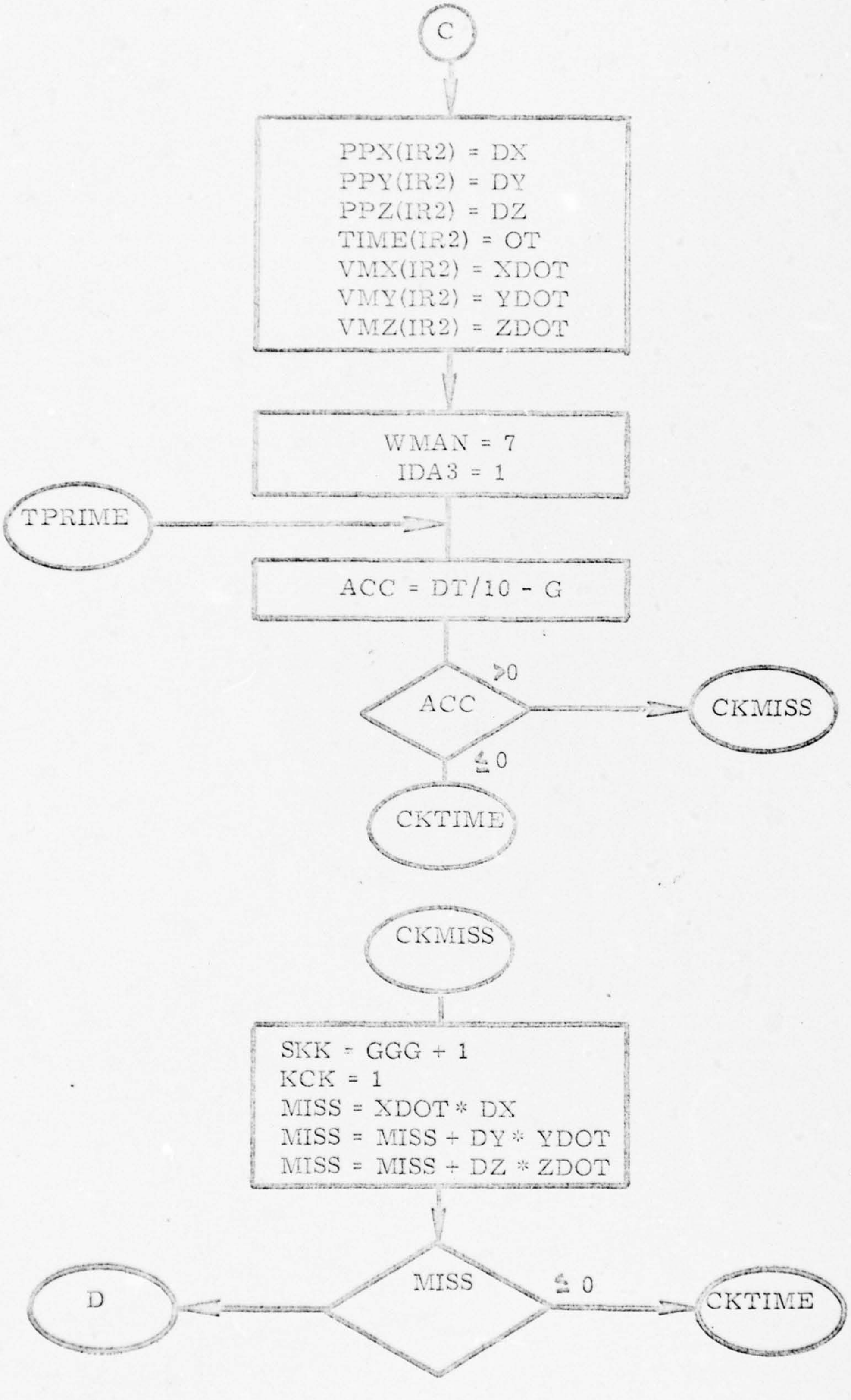
SUBROUTINES FLIGHT AND REALT

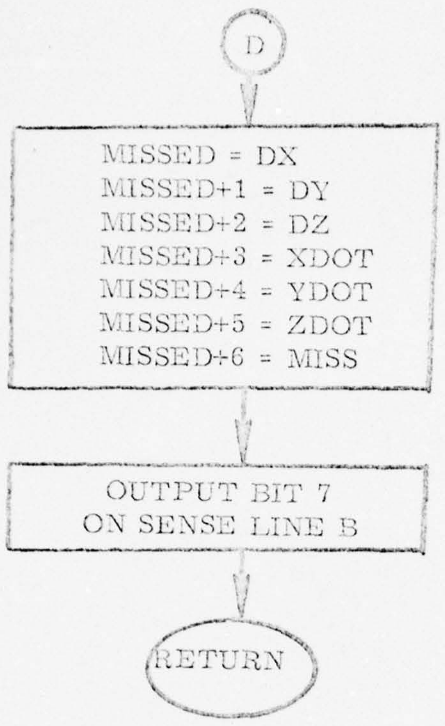


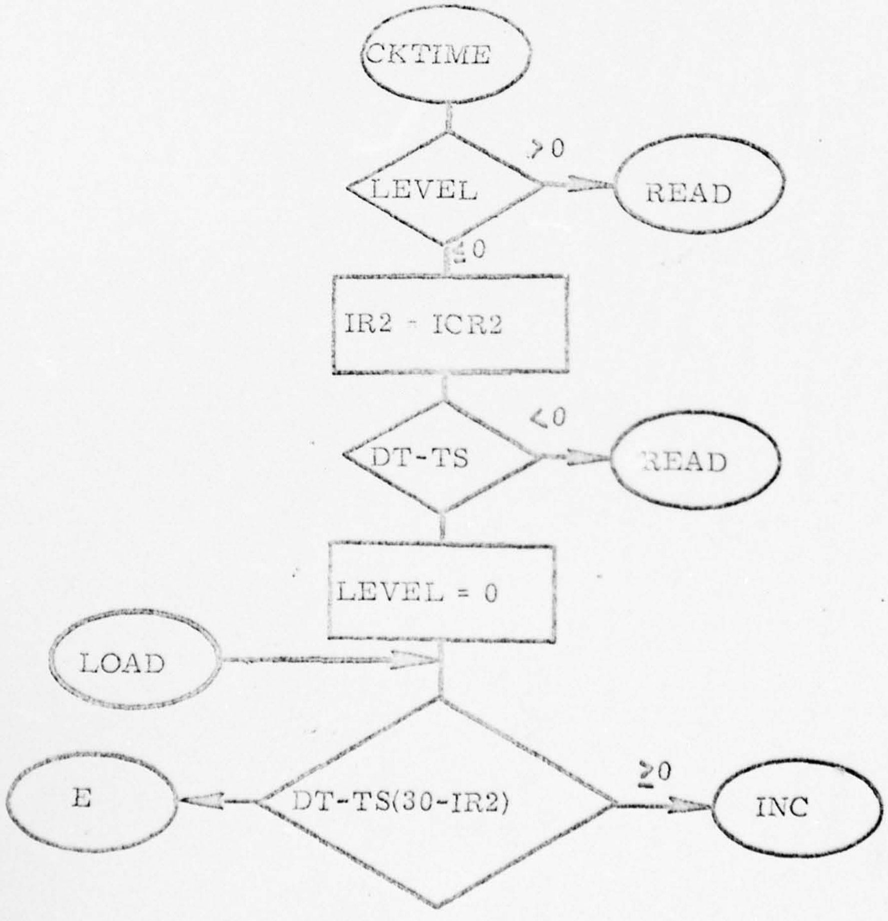

A
OUTPUT BIT 4
ON SENSE LINE B
INPUT SENSE LINE B
INTO LINE S
ACC = LINE D ^ LINE S
=0
ACC
≠ 0
READ
OUTPUT BIT 8
ON SENSE LINE B
WMAN = 0
IR2 = 100
IR2 = IR2 - 1
>0
IR2
≤0
READ DX_i
i = 1 to 10
WAIT FOR
COMPLETION
B

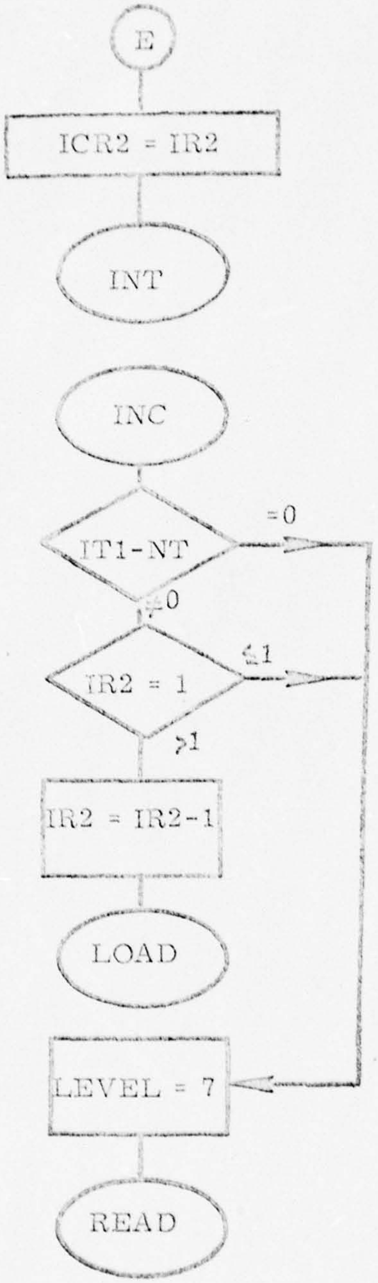


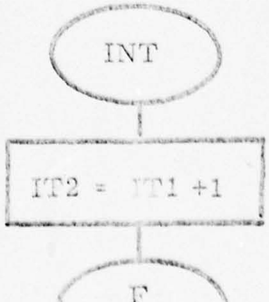
```
DX = FLOAT (DX)
DXG = DX
DXG = DXG * SCALEP
DY = FLOAT (DY)
DYG = DY
DYG = DYG * SCALEP
DZ = FLOAT (DZ)
DZG = DZ
DZG = DZG * SCALEP
DT = FLOAT (DT)
XDOT = FLOAT (XDOT)
XDO = XDOT
YDOT = FLOAT (YDOT)
YDO = YDOT
ZDOT = FLOAT (ZDOT)
ZDO = ZDOT
XXX = FLOAT (XXX)
YYY = FLOAT (YYY)
ZZZ = FLOAT (ZZZ)

IR2 = - INDEX

ACC = XXS (IR2)
ACC = ACC-DX
```

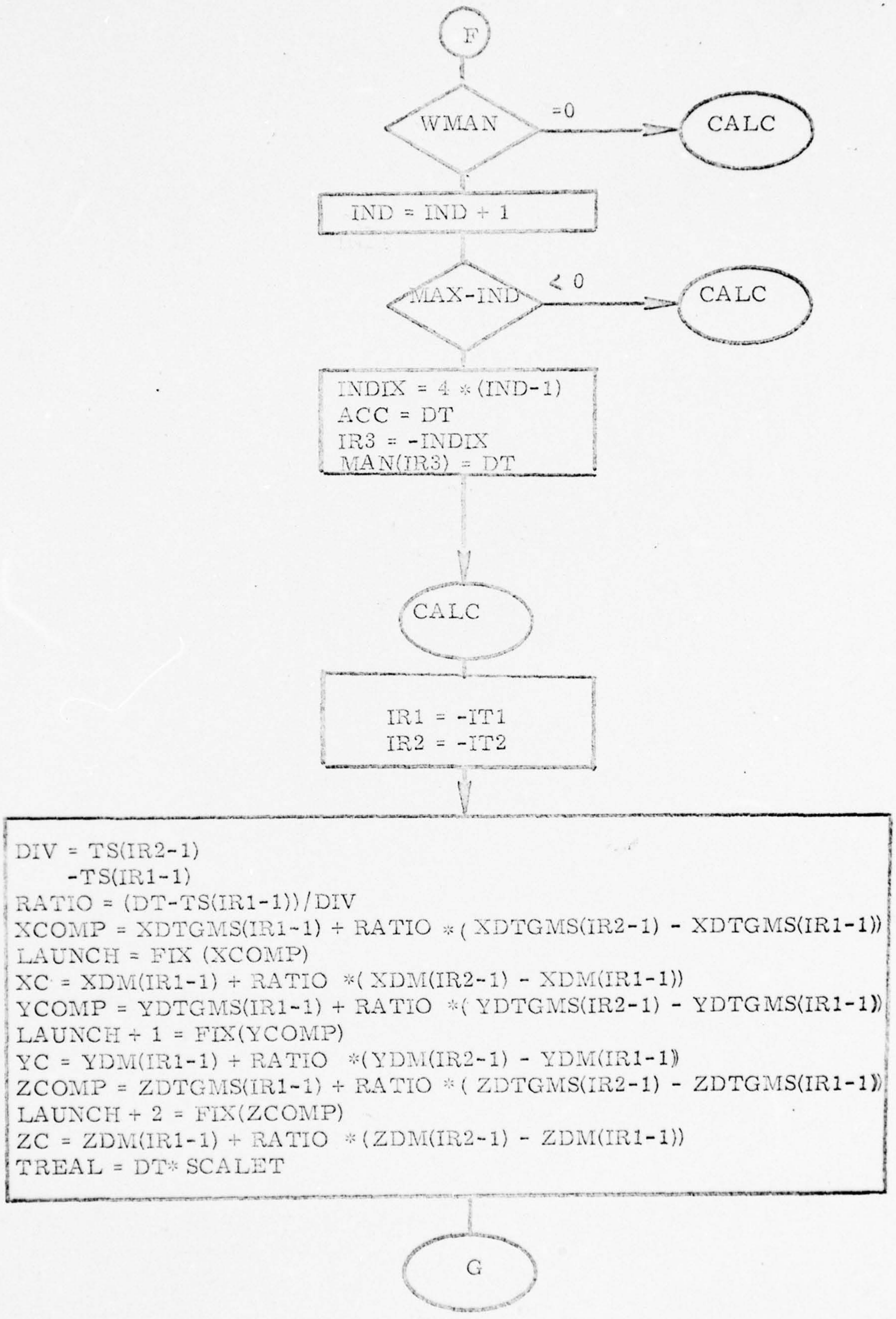

C
PPX(IR2) = DX
PPY(IR2) = DY
PPZ(IR2) = DZ
TIME(IR2) = OT
VMX(IR2) = XDOT
VMY(IR2) = YDOT
VMZ(IR2) = ZDOT
WMAN = 7
IDA3 = 1
TPRIME
ACC = DT/10 - G
ACC
>0
CKMISS
≤ 0
CKTIME
CKMISS
SKK = GGG + 1
KCK = 1
MISS = XDOT * DX
MISS = MISS + DY * YDOT
MISS = MISS + DZ * ZDOT
MISS
≤ 0
CKTIME
D


D
MISSED = DX
MISSED+1 = DY
MISSED+2 = DZ
MISSED+3 = XDOT
MISSED+4 = YDOT
MISSED+5 = ZDOT
MISSED+6 = MISS
OUTPUT BIT 7
ON SENSE LINE B
RETURN

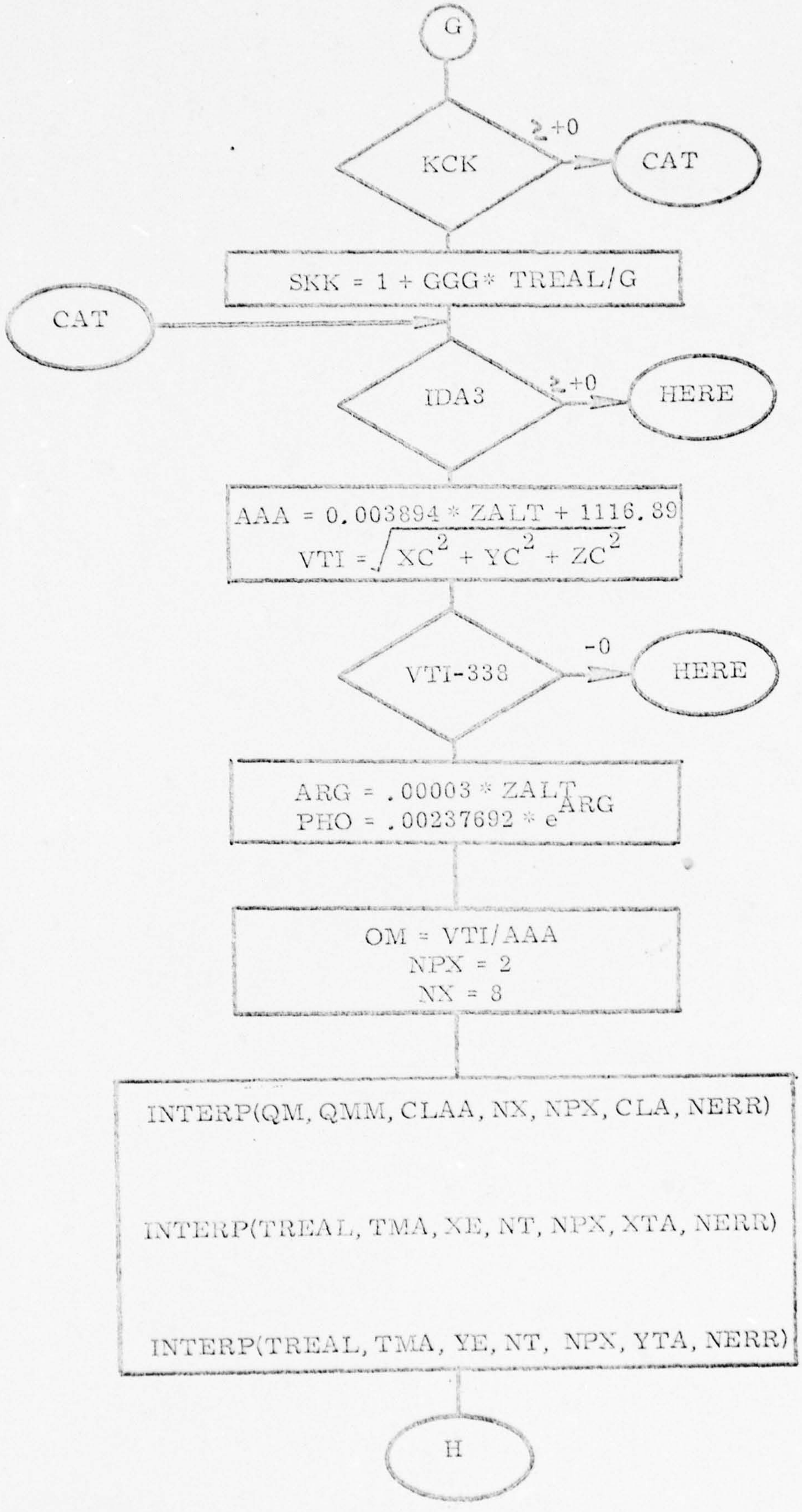

CKTIME
LEVEL
>0
READ
≤0
IR2 = ICR2
DT-TS
<0
READ
LEVEL = 0
LOAD
E
DT-TS(30-IR2)
≥0
INC

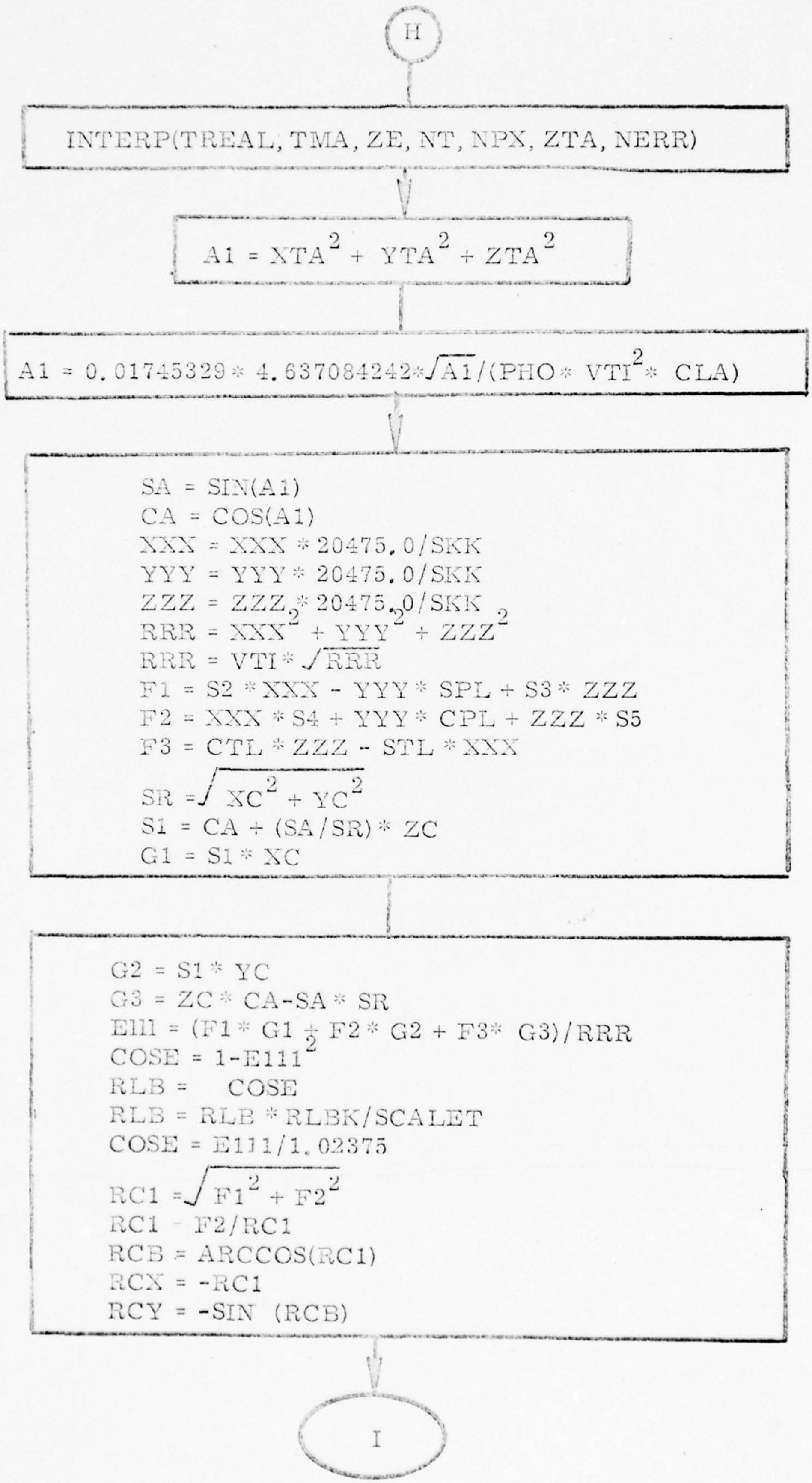

E
ICR2 = IR2
INT
INC
IT1-NT
=0
≠0
IR2 = 1
≤1
>1
IR2 = IR2-1
LOAD
LEVEL = 7
READ


INT
IT2 = IT1 +1
F



```
IND = IND + 1

INDIX = 4 *(IND-1)
ACC = DT
IR3 = -INDIX
MAN(IR3) = DT

IR1 = -IT1
IR2 = -IT2

DIV = TS(IR2-1)
    -TS(IR1-1)
RATIO = (DT-TS(IR1-1))/DIV
XCOMP = XDTGMS(IR1-1) + RATIO *( XDTGMS(IR2-1) - XDTGMS(IR1-1))
LAUNCH = FIX (XCOMP)
XC = XDM(IR1-1) + RATIO *( XDM(IR2-1) - XDM(IR1-1))
YCOMP = YDTGMS(IR1-1) + RATIO *( YDTGMS(IR2-1) - YDTGMS(IR1-1))
LAUNCH + 1 = FIX(YCOMP)
YC = YDM(IR1-1) + RATIO *(YDM(IR2-1) - YDM(IR1-1))
ZCOMP = ZDTGMS(IR1-1) + RATIO *( ZDTGMS(IR2-1) - ZDTGMS(IR1-1))
LAUNCH + 2 = FIX(ZCOMP)
ZC = ZDM(IR1-1) + RATIO *(ZDM(IR2-1) - ZDM(IR1-1))
TREAL = DT* SCALET
```


G
KCK
≥+0
CAT
SKK = 1 + GGG* TREAL/G
CAT
IDA3
≥+0
HERE
AAA = 0.003894 * ZALT + 1116.89
VTI = $\sqrt{XC^2 + YC^2 + ZC^2}$
VTI-338
-0
HERE
ARG = .00003 * ZALT
PHO = .00237692 * e^{ARG}
OM = VTI/AAA
NPX = 2
NX = 8
INTERP(QM, QMM, CLAA, NX, NPX, CLA, NERR)
INTERP(TREAL, TMA, XE, NT, NPX, XTA, NERR)
INTERP(TREAL, TMA, YE, NT, NPX, YTA, NERR)
H



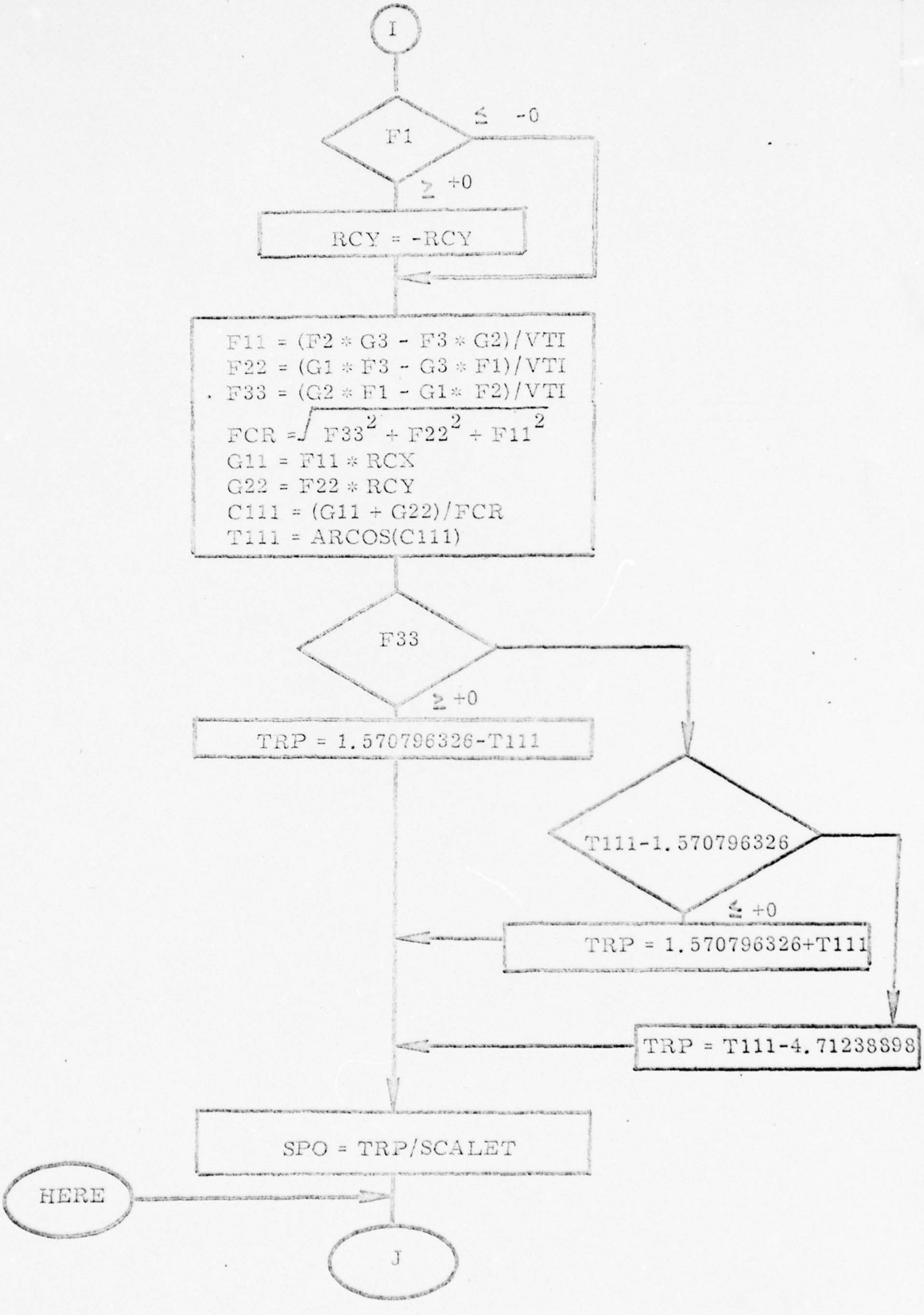
INTERP(TREAL, TMA, ZE, NT, NPX, ZTA, NERR)

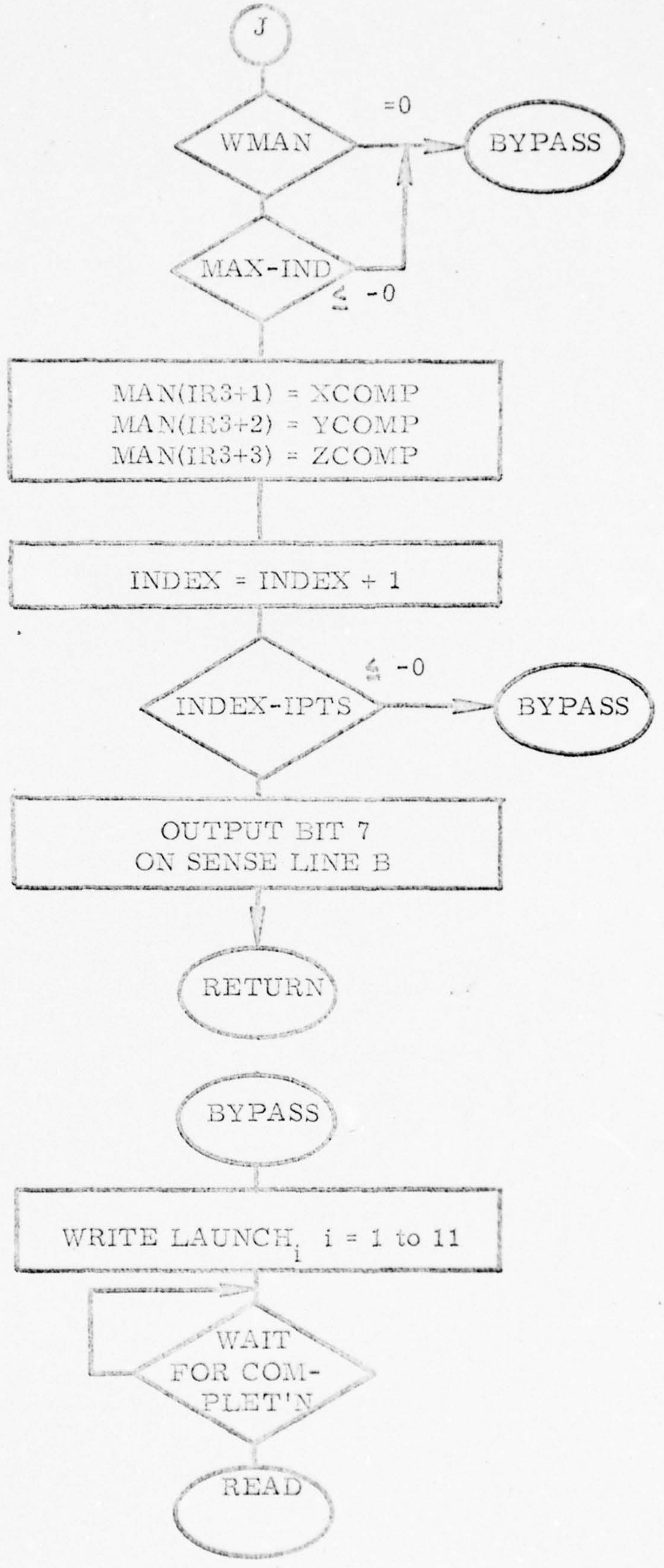
$A1 = XTA^2 + YTA^2 + ZTA^2$

$A1 = 0.01745329 * 4.637084242 * \sqrt{A1}/(PHO * VTI^2 * CLA)$

$SA = SIN(A1)$
$CA = COS(A1)$
$XXX = XXX * 20475.0/SKK$
$YYY = YYY * 20475.0/SKK$
$ZZZ = ZZZ * 20475.0/SKK$
$RRR = XXX^2 + YYY^2 + ZZZ^2$
$RRR = VTI * \sqrt{RRR}$
$F1 = S2 * XXX - YYY * SPL + S3 * ZZZ$
$F2 = XXX * S4 + YYY * CPL + ZZZ * S5$
$F3 = CTL * ZZZ - STL * XXX$
$SR = \sqrt{XC^2 + YC^2}$
$S1 = CA + (SA/SR) * ZC$
$G1 = S1 * XC$

$G2 = S1 * YC$
$G3 = ZC * CA-SA * SR$
$E111 = (F1 * G1 + F2 * G2 + F3 * G3)/RRR$
$COSE = 1-E111^2$
$RLB = \quad COSE$
$RLB = RLB * RLBK/SCALET$
$COSE = E111/1.02375$
$RC1 = \sqrt{F1^2 + F2^2}$
$RC1 - F2/RC1$
$RCB = ARCCOS(RC1)$
$RCX = -RC1$
$RCY = -SIN\ (RCB)$


I
F1
≤ -0
≥ +0
RCY = -RCY
F11 = (F2 * G3 - F3 * G2)/VTI
F22 = (G1 * F3 - G3 * F1)/VTI
F33 = (G2 * F1 - G1* F2)/VTI
FCR = $\sqrt{F33^2 + F22^2 + F11^2}$
G11 = F11 * RCX
G22 = F22 * RCY
C111 = (G11 + G22)/FCR
T111 = ARCOS(C111)
F33
≥ +0
TRP = 1.570796326-T111
T111-1.570796326
≤ +0
TRP = 1.570796326+T111
TRP = T111-4.71238898
SPO = TRP/SCALET
HERE
J


J
WMAN
=0
BYPASS
MAX-IND
≤ -0
MAN(IR3+1) = XCOMP
MAN(IR3+2) = YCOMP
MAN(IR3+3) = ZCOMP
INDEX = INDEX + 1
≤ -0
INDEX-IPTS
BYPASS
OUTPUT BIT 7
ON SENSE LINE B
RETURN
BYPASS
WRITE LAUNCH$_i$ i = 1 to 11
WAIT
FOR COM-
PLET'N
READ

SUBROUTINE BITS

PURPOSE

The 16 bit discrete word sent by the AD-4 to the CDC-6600 is converted into bits by this program. The discrete word is periodically reconverted and updated in a COMMON block. On completion of a conversion the high order bit is stored in IBIT(1).

SUBROUTINES REQUIRED

- SUBROUTINE SIMIDLE

```
      SUBROUTINE BITS
      COMMON/ZIDIS2/IIN                                                      SOFT-MOD
      COMMON/INTCOM/IBIT(60),MAXBIT
C
C     CONVERT IWORD TO BITS
C
      INTEGER OLDNUM
      DO 1 I=1,MAXBIT
    1 IBIT(I)=0
      OLDNUM=IIN
      I=1
    2 NEWNUM=OLDNUM/2
      IBIT(I)=OLDNUM-2*NEWNUM
      OLDNUM=NEWNUM
      I=I+1
      IF(OLDNUM.EQ.0.OR.I.LT.MAXBIT)GO TO 2
      CALL SIMIDLE
      RETURN                                                                  SOFT-T
      END
```

SUBROUTINE ADFOUR AND ADC

PURPOSE

These programs together simulate AD-4 functions required by the STINGER real-time simulation. The programs functions as a table-look-up of ADC data required by SUBROUTINE REALT and SUBROUTINE FLIGHT. In addition, the programs transfers discrete data to the aforementioned subroutines.

SUBROUTINES REQUIRED

- SUBROUTINE BITS
- SUBROUTINE ADC

```
      SUBROUTINE ADFOUR                                                 SOFT-T
      REAL MAN(200),MISSED(7),MISS,LAUNCH                               SOFT-T
      INTEGER WMAN                                                      SOFT-T
      DIMENSION FIN(10),TS(30)                                          SOFT-T
      EQUIVALENCE (TS(1), TMAS(1)),(MAN(1),XMAN(1)),(MISSED(1),XMISS(1))
      EQUIVALENCE (FIN(1),DX),(FIN(2),DY),(FIN(3),DZ),(FIN(4),DT)       SOFT-T
      EQUIVALENCE (FIN(5),XDOT),(FIN(6),YDOT),(FIN(7),ZDOT)             SOFT-T
      EQUIVALENCE (FIN(8),XXX),(FIN(9),YYY),(FIN(10),ZZZ)               SOFT-T
      COMMON/COMA/LEVEL,IPTS,XXS(50),XDTGO,YDTGO,ZDTGO,RLB,COSE,SPO,RI, SOFT-T
     *GAM,EDOT,THETAL,RN,                                               SOFT-T
     *               PPX(50),PPY(50),PPZ(50),TIME(50),TMAS(30),XDTGMS(30) SOFT-T
     *              ,YDTGMS(30),ZDTGMS(30),XMAN(4,50),XMISS(7),NT       SOFT-T
     *              ,XCOMP,YCOMP,ZCOMP,TAMA(30),DELTAR(30),VM(30),G,GGG SOFT-T
     *,XDO,YDO,ZDO,DXG,DYG,DZG,S2,S3,S4,S5,XDM(30),YDM(30),ZDM(30),     SOFT-T
     *RLBK,SCALEP,F1,F2,F3,G1,G2,G3,XC,YC,ZC,S1,RRR,SR,SPL,CTL,STL,     SOFT-T
     *CPL,A1,VTI,XE(30),YE(30),ZE(30),ZALT,NERR,CLA,NPX,NX,CLAA(10),    SOFT-T
     *PHC,ARG,AAA,SCALET,TREAL,TMA(30),XTA,YTA,ZTA,SCALEV,QMM(10),QM    SOFT-T
     *,SA,CA,VMX(50),VMY(50),VMZ(50)                                    SOFT-T
      COMMON/ZADC1/ADIN(10)                                           SOFT-MOD
      COMMON/ZDAC1/LAUNCH(11)                                         SOFT-MOD
      COMMON/ZODIS2/IOUT                                              SOFT-MOD
      COMMON/ZIDIS2/IIN                                               SOFT-MOD
      DATA ITIME/-100/                                                  SOFT-T
      ITIME=ITIME+1                                                     SOFT-T
C     STATIC CHECK OK                                                   SOFT-T
      IF(ITIME.EQ.-50)IIN=32                                            SOFT-T
C     SEND ICS                                                          SOFT-T
      IF(ITIME.EQ.-50)CALL ADC(ITIME)                                   SOFT-T
C     RAMP UP SIGNAL                                                    SOFT-T
      IF(ITIME.EQ.-40)IIN=64                                            SOFT-T
C                                                                       SOFT-T
      CALL BITS                                                         SOFT-T
C     UPDATE ADC                                                        SOFT-T
      CALL ADC(ITIME)                                                   SOFT-T
      RETURN                                                            SOFT-T
      END                                                               SOFT-T
      SUBROUTINE ADC(ITIME)                                             SOFT-T
      REAL MAN(200),MISSED(7),MISS,LAUNCH                               SOFT-T
      INTEGER WMAN                                                      SOFT-T
      DIMENSION FIN(10),TS(30)                                          SOFT-T
      EQUIVALENCE (TS(1), TMAS(1)),(MAN(1),XMAN(1)),(MISSED(1),XMISS(1))
      EQUIVALENCE (FIN(1),DX),(FIN(2),DY),(FIN(3),DZ),(FIN(4),DT)       SOFT-T
      EQUIVALENCE (FIN(5),XDOT),(FIN(6),YDOT),(FIN(7),ZDOT)             SOFT-T
      EQUIVALENCE (FIN(8),XXX),(FIN(9),YYY),(FIN(10),ZZZ)               SOFT-T
      COMMON/COMA/LEVEL,IPTS,XXS(50),XDTGO,YDTGO,ZDTGO,RLB,COSE,SPO,RI, SOFT-T
     *GAM,EDOT,THETAL,RN,                                               SOFT-T
     *                PPX(50),PPY(50),PPZ(50),TIME(50),TMAS(30),XDTGMS(30) SOFT-T
     *               ,YDTGMS(30),ZDTGMS(30),XMAN(4,50),XMISS(7),NT      SOFT-T
     *               ,XCOMP,YCOMP,ZCOMP,TAMA(30),DELTAR(30),VM(30),G,GGG SOFT-T
     *,XDO,YDO,ZDO,DXG,DYG,DZG,S2,S3,S4,S5,XDM(30),YDM(30),ZDM(30),     SOFT-T
     *RLBK,SCALEP,F1,F2,F3,G1,G2,G3,XC,YC,ZC,S1,RRR,SR,SPL,CTL,STL,     SOFT-T
     *CPL,A1,VTI,XE(30),YE(30),ZE(30),ZALT,NERR,CLA,NPX,NX,CLAA(10),    SOFT-T
     *PHO,ARG,AAA,SCALET,TREAL,TMA(30),XTA,YTA,ZTA,SCALEV,QMM(10),QM    SOFT-T
     *,SA,CA,VMX(50),VMY(50),VMZ(50)                                    SOFT-T
      COMMON/ZADC1/ADIN(10)                                            SOFT-MOD
      COMMON/ZDAC1/LAUNCH(11)                                          SOFT-MOD
      COMMON/ZODIS2/IOUT                                               SOFT-MOD
      COMMON/ZIDIS2/IIN                                                SOFT-MOD
C                                                                       SOFT-T
C     PROGRAM TO UPDATE ADC INPUTS                                      SOFT-T
C                                                                       SOFT-T
      DIMENSION A(10,500)                                               SOFT-T
      IF(ITIME.EQ.-50)KTIME=1                                           SOFT-T
      IF(ITIME.GE.0)KTIME=KTIME+1                                       SOFT-T
      IF(KTIME.GT.500)WRITE(6,1000)
C                                                                       SOFT-T
C                                                                       SOFT-T
C                                                                       SOFT-T
C     DEFINE THE A ARRAY HERE                                           SOFT-T
      IF (KTIME.GE.2) GO TO 101
      DO 50 I=1,10                                                      SOFT-T
      DO 50 KDUM=1,500                                                  SOFT-T
      A(KDUM,I)=0.0                                                     SOFT-T
   50 CONTINUE                                                          SOFT-T
  101 CONTINUE
C                                                                       SOFT-T
      DO 100 I=1,10                                                     SOFT-T
      ADIN(I)=A(KTIME,I)                                                SOFT-T
  100 CONTINUE                                                          SOFT-T
      RETURN                                                            SOFT-T
 1000 FORMAT(15H ERROR IN KTIME)                                        SOFT-T
      END                                                               SOFT-T
      SUBROUTINE SIMSTOP                                          SOFT-T
      RETURN                                                      SOFT-T
      END                                                         SOFT-T




      SUBROUTINE SHOLD                                            SOFT-T
      RETURN                                                      SOFT-T
      END                                                         SOFT-T




      SUBROUTINE SIMRUN(ISTAT)                                    SOFT-T
      ISTAT=0                                                     SOFT-T
      RETURN                                                      SOFT-T
      END                                                         SOFT-T




      SUBROUTINE SIMIDLE                                          SOFT-T
      RETURN                                                      SOFT-T
      END                                                         SOFT-T
```

APPENDIX E

DADIOS CHECKOUT PROGRAMS

DADIOS CHECKOUT PROGRAMS

This appendix contains special programs for pre-real-time checkout. These programs provide a quick method of testing discretes, DACs and ADCs. Usage of each program is described in the computer code.

```
      PROGRAM TRDISI(OUTPUT,HFILE,TAPE6=OUTPUT)
C
C     PROGRAM TO INDIVIDUALLY TEST DADIOS DISCRETES FROM AD/4 TO
C     CDC/6600. THIS IS ACCOMPLISHED BY PATCHING LOGIC 1 TO THE DESIRED
C     AD/4 TRUNK LINES. EACH TIME THE  AD/4 PATCHING IS CHANGED THE
C     CDC/6600 RECORDS THE BIT PATTERN FOR COMPARISON. A RECORD OF THE
C     BIT PATTERNS IS AVAILABLE THROUGH OPERATOR AID OR THE LINE PRINTER
C
C     PROGRAM VARIABLES
C        IERR             ERROR CODE FOR RESERVATION
C                         0=NOERROR, GT.0=RESERVATION ERROR
C        ISTAT            REAL TIME MODE
C                         0=IN REAL TIME, ISTAT.GT.0 NOT IN REAL TIME
C        IDUM1            DISCRETE WORD TRANSMITTED FROM AD/4 TO CDC/6600
C        ICNT1            TIME SINCE LAST BIT WAS CHANGED (SECONDS)
C
C     DADIOS PATCHING REQUIREMENTS (ONE OF THE FOLLOWING)
C
C          TRUNKING                FORTRAN                   AD/4 LOGIC
C        V-50 TO W-50       FOR /IDIS2/1,IIDIS        TR00-TR07 AND TR20-TR27
C        V-50 TO W-51       FOR /IDIS2/2,IID S        TR00-TR07 AND TR20-TR27
C        V-52 TO W51       FOR /IDIS2/2,IIDIS         TR40-TR47 AND TR50-TR67
C        V-52 TO W50       FOR /IDIS2/1,IIDIS         TR40-TR47 AND TR50-TR67
C
      COMMON/INTCOM/ICNT1,IDUM1,ITEMP,IBIT(60)
      INTERRUPT(I=1,R=10,T=100000)
      COMMON/*IDIS2/2,IIDIS
C
C     INITIALIZATION
C
      ITEMP=0
      CALL RESERVE(IERR)
      ICNT1=0
      WRITE(6,1000)IERR
      IF(IERR.NE.0)STOP
C
C     REAL TIME
C
      CALL SIMRUN(ISTAT)
      WRITE(6,2000)ISTAT
      WRITE(6,6000)
      WRITE(6,5000)
      IF(ISTAT.GT.0)STOP
      CALL REMARK(17H JOB IN REAL TIME)
   25 CONTINUE
      CALL BHOLD
      CALL REMARK(15H RETURN TO MAIN)
      CALL OCTDIS( 5H BITS,IDUM1)
      CALL BITS
      WRITE(6,4000)IDUM1,IDUM1,(IBIT(KK),KK=1,16),ICNT1
      ICNT1=0
      CALL SIMGO
      GO TO 25
 1000 FORMAT(24H1RESERVATION ERROR CODE=,O20)
 2000 FORMAT(18H REAL TIME STATUS=,O20)
 4000 FORMAT(5X,O10,I10,5X,16I1,I10,*  TR=.....*)
 5000 FORMAT(*0            OCTAL    BASE TEN        ......BITS....          TIME*)
 6000 FORMAT(*0                            RECORD OF DATA RECIVED *)
      STOP
      END


      SUBROUTINE BITS
C
C     PROGRAM TO CONVERT  DISCRETE WORD TO BITS
C
      COMMON/INTCOM/ICNT1,IDUM1,IDUMY,IBIT(60)
      INTEGER OLDNUM
      MAXBIT=15
      DO 1 I=1,MAXBIT
    1 IBIT(I)=0
      OLDNUM=IDUM1
      DO 2 I=1,MAXBIT
      NEWNUM=OLDNUM/2
      IBIT(I)=OLDNUM-2*NEWNUM
      OLDNUM=NEWNUM
    2 CONTINUE
      IHALF=MAXBIT/2
      DO 3 I=1,IHALF
      ITEMP=IBIT(I)
      IBIT(I)=IBIT(MAXBIT+1-I)
    3 IBIT(MAXBIT+1-I)=ITEMP
      RETURN
      END


      SUBROUTINE SUB1
C
C     REAL TIME INTERRUPT SUBROUTINE
C
      COMMON/INTCOM/ICNT1,IDUM1,ITEMP
      COMMON/*IDIS2/2,IIDIS
      ICNT1=ICNT1+1
      IDUM1=IIDIS
      IF(ITEMP.EQ.IDUM1)GO TO 10
      ITEMP=IIDIS
      CALL SIMHOLD
   10 CONTINUE
      CALL SIMIDLE
      END


      RTREE TRDISI(0),SUB1(1)
      GLOBAL INTCOM
      END
      PROGRAM TRDISO(OUTPUT,HFILE,TAPE5=OUTPUT)
C
C     PROGRAM TO INDIVIDUALLY TEST DADIOS DISCRETES FROM CDC/6600 TO AD/4
C     THIS IS ACCOMPLISHED BY LETTING THE CDC/6600 SEND A BIT AND PAUSE.
C     THE BIT CAN THEN BE VERIFIED AT THE AD/4 CONSOLE BY APPRCPRIATE
C     PATCHING TO AN INDICTOR LIGHT ON THE DIGITAL LOGIC BOARD. THE NEXT,
C     AND EACH SUCCEDING, BIT IS RAISED BY A GO COMMAND GIVEN THROUGH DDS.
C
C     PROGRAM VARIABLES
C        IERR             ERROR CODE FOR RESERVATION
C.                        0=NOERROR, GT.0=RESERVATION ERROR
C        ISTAT            REAL TIME MODE
C                         0=IN REAL TIME, ISTAT.GT.0 NOT IN REAL TIME
C        IDUM1            DISCRETE WORD TRANSMITTED FROM CDC/6600 TO AD/4
C        ICNT1            TIME SINCE LAST BIT WAS CHANGED (SECONDS)
C
C     DADIOS PATCHING REQUIREMENTS (ONE OF THE FOLLOWING)
C
C          TRUNKING                FORTRAN                 AD/4 LOGIC
C        V-51 TO W-60        FOR /ODIS2/1,IODIS      TR10-TR17 AND TR30-TR37
C        V-53 TO W-60        FOR /ODIS2/1,IODIS      TR50-TR57 AND TR70-TR77
C        V-51 TO W-61        FOR /ODIS2/2,IODIS      TR10-TR17 AND TR30-TR37
C        V-53 TO W-61        FOR /ODIS2/2,IODIS      TR50-TR57 AND TR70-TR77
C
      COMMON/INTCOM/ICNT1,IDUM1,IBIT(60)
      INTERRUPT(I=1,R=20,T=100000)
      COMMON/*ODIS2/2,IODIS
C
C     INITIALIZATION
C
      ICNT1=0
      ICOUNT=0
      CALL RESERVE(IERR)
      WRITE(6,1000)IERR
      IF(IERR.NE.0)STOP
C
C     REAL TIME
C
      CALL SIMRUN(ISTAT)
      CALL REMARK(17H JOB IN REAL TIME)
      WRITE(6,2000)ISTAT
      IF(ISTAT.GT.0)STOP
      WRITE(6,6000)
      WRITE(6,5000)
   25 CONTINUE
      CALL BHOLD
      IDUM1=2**ICOUNT
      CALL BITS
      WRITE(6,4000)IDUM1,IDUM1,(IBIT(KK),KK=1,16),ICNT1
      ICOUNT=ICOUNT+1
      IF(ICOUNT.EQ.17)ICOUNT=0
C     PAUSE
C     CALL OCTDIS( 5H BITS,IDUM1)
C     CALL REMARK(15H RETURN TO MAIN)
      ICNT1=0
      CALL SIMGO
      GO TO 25
```

```
1000 FORMAT(24H RESERVATION ERROR CODE=,O20)
2000 FORMAT(18H REAL TIME STATUS=,O20)
4000 FORMAT(5X,O20,I10,5X,16I1,I10)
5000 FORMAT(*0          OCTAL    BASE TEN         ......BITS....         TIME*)
6000 FORMAT(*1                   RECORD OF DATA SENT *)
     STOP
     END


     SUBROUTINE SUB1
C
C    REAL TIME INTERRUPT SUBROUTINE
C
     COMMON/INTCOM/ICNT1,IDUM1,IBIT(50)
     COMMON/*ODIS2/2,IODIS
     ICNT1=ICNT1+1
     IODIS=IDUM1
     IF(ICNT1.GT. 5)CALL SIMHOLD
     CALL SIMIDLE
     END


     SUBROUTINE BITS
C
C    PROGRAM TO CONVERT  DISCRETE WORD TO BITS
     COMMON/INTCOM/ICNT1,IDUM1,IBIT(50)
     INTEGER OLDNUM
     MAXBIT=16
     DO 1 I=1,MAXBIT
   1 IBIT(I)=0
     OLDNUM=IDUM1
     DO 2 I=1,MAXBIT
     NEWNUM=OLDNUM/2
     IBIT(I)=OLDNUM-2*NEWNUM
     OLDNUM=NEWNUM
   2 CONTINUE
     IHALF=MAXBIT/2
     DO 3 I=1,IHALF
     ITEMP=IBIT(I)
     IBIT(I)=IBIT(MAXBIT+1-I)
   3 IBIT(MAXBIT+1-I)=ITEMP
     RETURN
     END


     $TREE TRDISO(0),SUB1(1)
     GLOBAL INTCOM
     END
```

```
      PROGRAM TRDISIO(OUTPUT,HFILE,TAPE6=OUTPUT)
C
C     PROGRAM TO TEST DISCRETE WORDS BETWEEN AD/4 AND CDC/6600. THIS
C     TASK IS ACCOMPLISHED BY TURNING AROUND BITS SENT BY THE CDC/6600
C     AND COMPARING THEM UPON RETURN. THE PROGRAM TEST ALL POSSIB_E BIT
C     PATTERNS FOR A 16 BIT LINE.
C
C     THE HIGH ORDER CDC-6600 BIT CORRESPONDS TO TR0X, WHERE X=0,2,4,6
C
C     PROGRAM VARIABLES
C        IERR            ERROR CODE FOR RESERVATION
C                        0=NOERROR, GT.0=RESERVATION ERROR
C        ISTAT           REAL TIME MODE
C                        0=IN REAL TIME, ISTAT.GT.0 NOT IN REAL TIME
C        IIDIS           CDC-6600 SENSE LINE DISCRETE(16 BIT)  IIDIS=IBACK
C        IODIS           CDC-6600 CONTROL LINE DISCRETE(16 BIT) IODIS=IOUT
C        MAX             DEC. EQUIVALENT OF 16 BITS ALL EQUAL ONE
C        LOOP            NUMBER OF INTERRUPTS BEFORE EQUALITY OF BITS
C        LINE            NUMBER OF LINES OF PRINTOUT IN EXECUTION
C
C     DADIOS PATCHING REQUIREMENTS (ONE IIDIS AND ONE IODIS)
C
C          TRUNKING              FORTRAN                     AD/4 LOGIC
C        V-50 TO W-50       FOR /IDIS2/1,IIDIS       TR00-TR07 AND TR20-TR27
C        V-52 TO W-50       FOR /IDIS2/1,IIDIS       TR40-TR47 AND TR60-TR67
C        V-50 TO W-51       FOR /IDIS2/2,IID S       TR00-TR07 AND TR20-TR27
C        V-52 TO W-51       FOR /IDIS2/2,IIDIS       TR40-TR47 AND TR60-TR67
C
C        V-51 TO W-60       FOR /ODIS2/1,IODIS       TR10-TR17 AND TR30-TR37
C        V-53 TO W-60       FOR /ODIS2/1,IODIS       TR50-TR57 AND TR70-TR77
C        V-51 TO W-61       FOR /ODIS2/2,IODIS       TR10-TR17 AND TR30-TR37
C        V-53 TO W-61       FOR /ODIS2/2,IODIS       TR50-TR57 AND TR70-TR77
C
C
      COMMON/INTCOM/IOUT,LOOP,MAX,IBACK
      INTERRUPT(I=1,R=10,T=500)
      COMMON/*IDIS2/2,IIDIS
      COMMON/*ODIS2/2,IODIS
      CALL RESERVE(IERR)
      WRITE(6,1000)IERR
      IF(IERR.NE.0)STOP
C
C     INITIALIZATION
C
      MAX=2**16-1
      IOUT=0
      LOOP=0
      LINES=0
C
C     REAL TIME
C
      CALL SIMRUN(ISTAT)
      WRITE(6,2000)ISTAT
      IF(ISTAT.GT.0)STOP
      CALL REMARK(17H JOB IN REAL TIME)
      WRITE(6,5000)
      WRITE(6,5000)
```

```
   25 CONTINUE
      CALL BHOLD
      WRITE(6,4000)IOUT,IOUT,IBACK,IBACK,LOOP
      CALL SIMGO
      GO TO 25
      LINES = LINES + 1
      IF(LINES.GT.200)STOP
      WRITE(6,3000)
      CALL REMARK(15H RETURN TO MAIN)
 1000 FORMAT(24H1RESERVATION ERROR CODE=,O20)
 2000 FORMAT(18H REAL TIME STATUS=,O20)
 3000 FORMAT(1H0,*PROGRAM TERMINATED NORMALLY*)
 4000 FORMAT(10X,O10,I15,5X,O10,I15,I15)
 5000 FORMAT(5X,* IOUT(OCTAL)   IOUT(DECIMAL)   IBACK(OCTAL)  IBACK(DECI
     1MAL)  LOOP(DECIMAL)*/)
 6000 FORMAT(///,35X,*ERRORS DETECTED*//)
      STOP
      END


      SUBROUTINE SUB1

C
C     REAL TIME INTERRUPT SUBROUTINE
C
      COMMON/INTCOM/IOUT,LOOP,MAX,IBACK
      COMMON/*IDIS2/2,IIDIS
      COMMON/*ODIS2/2,IODIS
      IODIS=IOUT
      IBACK=IIDIS
      IF(IOUT.NE.IBACK)GO TO 10
      IF(IOUT.EQ.MAX)IOUT=0
      IOUT=IOUT+1
      LOOP=0
   10 LOOP=LOOP+1
      IF(LOOP.EQ.10)CALL SIMHOLD
      CALL SIMIDLE
      END




      RFREE TRDISIO(0),SUB1(1)
      GLOBAL INTCOM
      END
      PROGRAM TRALGI(OUTPUT,HFILE,TAPE6=OUTPUT)
C
C     PROGRAM TO TEST DADIOS ADCS FROM AD/4 TO CDC/6600. THIS IS
C     ACCOMPLISHED BY PATCHING AN ANALOG SIGNAL TO THE DESIRED AD/4
C     TRUNK LINE. EACH TIME THE AD/4 SIGNAL CHANGES THE CDC/6600 RECORDS
C     THE NEW ANALOG SIGNAL.
C
C
C     PROGRAM VARIABLES
C        IERR             ERROR CODE FOR RESERVATION
C                         0=NOERROR, GT.0=RESERVATION ERROR
C        ISTAT            REAL TIME MODE
C                         0=IN REAL TIME, ISTAT.GT.0 NOT IN REAL TIME
C        PERCENT          PERCENT CHANGE REQUIRED IN ADC VALUE BEFORE NEW
C                         ADC VALUE IS RECORDED BY CDC/6600
C        LINE             NUMBER OF LINES OF PRINTOUT IN EXECUTION
C
C
C     NOTE ADCS  ARE IN GROUPS OF 16, 1-16, 17-32, 33-48, 49-64.
C     FLOATING POINT ANALOG SIGNALS ARE SCALED GE -1.0 AND LE +1.0.
C     INTEGER ANALOG SIGNALS ARE SCALED GE -32767 AND LE +32767(14 BIT).
C
C     DADIOS PATCHING REQUIREMENTS (ONE OF THE FOLLOWING)
C
C          TRUNKING                 FORTRAN                  AD/4 LOGIC
C       W-03 TO V-06      FOR /*ADC1/49,ADC       TR10-TR17 AND TR30-TR37
C
      COMMON/INTCOM/BACK,LOOP,PERCENT,TEMP
      INTERRUPT(I=1,R=10,T=5000)
      COMMON/*ADC1/49,ADC
C
C     INITIALIZATION
C
      PERCENT=.05
      LINE=0
      TEMP=0.0
      CALL RESERVE(IERR)
      WRITE(6,1000)IERR
      IF(IERR.NE.0)STOP
C
C     REAL TIME
C
      CALL SIMRUN(ISTAT)
      WRITE(6,2000)ISTAT
      IF(ISTAT.GT.0)STOP
      CALL REMARK(17H JOB IN REAL TIME)
      WRITE(6,5000)
   25 CONTINUE
      CALL BHOLD
      LINE=LINE+1
      IF(LINE.GT.200)STOP
      LOOP=0
      WRITE(6,3000)BACK,LOOP
      CALL SIMGO
      GO TO 25
 1000 FORMAT(24H1RESERVATION ERROR CODE=,O20)
 2000 FORMAT(18H REAL TIME STATUS=,O20)
```

```
    3000  FORMAT(5X,F10.4,I10)
    6000  FORMAT(*0      RECORD OF DATA RECIVED BY CDC/6600*//)
50          STOP
            END
```

```
            SUBROUTINE SUB1
    C
    C       REAL TIME INTERRUPT SUBROUTINE
    C
            COMMON/INTCOM/BACK,LOOP,PERCENT,TEMP
            COMMON/*ADC1/49,ADC
            LOOP=LOOP+1
            BACK=ADC
            PCHANGE=ABS(ABS(TEMP)-ABS(BACK))/ABS(TEMP)
            IF(PCHANGE.GT.PERCENT)GO TO 10
            TEMP=ADC
            CALL SIMHOLD
       10   CONTINUE
            CALL SIMIDLE
            END
```

```
           RTREE TRALGI(0),SUB1(1)
           GLOBAL INTCOM
           END
```

```
      PROGRAM TRALGO(OUTPUT,HFILE,TAPE6=OUTPUT)
C
C     PROGRAM TO INDIVIDUALLY TEST DADIOS DACS FROM CDC/6600 TO AD/4.
C     THIS IS ACCOMPLISHED BY LETTING THE CDC/6600 GENERATE A FUNCTION
C     F=F(TIME). THE FUNCTION CAN BE VERIFIED AT THE AD/4 CONSOLE BY
C     APPROPRIATE PATCHING TO A RECORDER.
C
C
C     PROGRAM VARIABLES
C        IERR               ERROR CODE FOR RESERVATION
C                           0=NOERROR, GT.0=RESERVATION ERROR
C        ISTAT              REAL TIME MODE
C                           0=IN REAL TIME, ISTAT.GT.0 NOT IN REAL TIME
C        TIME               INDEPENDENT VARIABLE WHICH IS PROPORTIONAL TO
C                           REAL TIME
C        DAC                THE DAC VARIABLE, NOTE OUT=DAC
C
C
C     NOTE DACS  ARE IN GROUPS OF 16, 1-16, 17-32, 33-48, 49-64.
C     FLOATING POINT ANALOG SIGNALS ARE SCALED GE -1.0 AND LE +1.0.
C     INTEGER ANALOG SIGNALS ARE SCALED GE -32767 AND LE +32767(14 BIT).
C
C     DADIOS PATCHING REQUIREMENTS (ONE OF THE FOLLOWING)
C
C          TRUNKING               FORTRAN                  AD/4 LOGIC
C        W-13 TO V-07      FOR /*DAC1/49,DAC        TR50-TR57 AND TR70-TR77
C
      COMMON/INTCOM/OUT,TIME,LOOP
      INTERRUPT(I=1,R=10,T=5000)
      COMMON/*DAC1/49,DAC
C
C     INITIALIZATION
C
      TIME=0.0
      CALL RESERVE(IERR)
      WRITE(6,1000)IERR
      IF(IERR.NE.0)STOP
C
C     REAL TIME
C
      CALL SIMRUN(ISTAT)
      WRITE(6,2000)ISTAT
      IF(ISTAT.GT.0)STOP
      CALL REMARK(17H JOB IN REAL TIME)
   25 CONTINUE
      CALL BHOLD
 1000 FORMAT(24H1RESERVATION ERROR CODE=,O20)
 2000 FORMAT(18H REAL TIME STATUS=,O20)
 3000 FORMAT(5X,F10.4,I10)
      STOP
      END
      SUBROUTINE SUB1
C
C     REAL TIME INTERRUPT SUBROUTINE
C
      COMMON/INTCOM/OUT,TIME,LOOP
      COMMON/*DAC1/49,DAC
      TIME=TIME+.01
      IF(TIME.GT.6.28)TIME=0.0
      OUT=SIN(TIME)
      DAC=OUT
      CALL SIMIDLE
      END




      ETREE TRALGO(0),SUB1(1)
      GLOBAL INTCOM
      END
      PROGRAM TRALGIO(OUTPUT,HFILE,TAPE6=OUTPUT)
C
C     PROGRAM TO TEST ANALOG SIGNALS BETWEEN AD/4 AND CDC/6600. THIS TASK
C     IS ACCOMPLISHED BY TURNING THE ANALOG SIGNAL AROUND AT THE AD/4 AND
C     COMPAREING DIFFERENCE UPON RETURN TO THE CDC/6600. THE PROGRAM TEST
C     FOR ERRORS GREATER THAN FIVE PERCENT.
C
C     NOTE ADCS AND DACS ARE IN GROUPS OF 16, 1-16, 17-32, 33-48, 49-64.
C     FLOATING POINT ANALOG SIGNALS ARE SCALED GE -1.0 AND LE +1.0.
C     INTEGER ANALOG SIGNALS ARE SCALED GE -32767 AND LE +32767(14 BIT).
C
C     PROGRAM VARIABLES
C        IERR           ERROR CODE FOR RESERVATION
C                       0=NOERROR, GT.0=RESERVATION ERROR
C        ISTAT          REAL TIME MODE
C                       0=IN REAL TIME, ISTAT.GT.0 NOT IN REAL TIME
C        OUT            THE DAC VARIABLE
C        BACK           THE ADC VARIABLE
C        PERCENT        MAXIMUM ALLOWABLE PERCENT ERROR
C        PERROR         ACTUAL COMPUTED PERCENT ERROR
C        LINE           NUMBER OF LINES OF PRINTOUT IN EXECUTION
C
C     DADIOS PATCHING REQUIREMENTS (AD/4 FIELD 3, 4TH GROUP ADC AND DAC)
C
C          TRUNKING             FORTRAN                   AD/4 LOGIC
C        W-03 TO V-06      FOR /*ADC1/49,ADC         TR10-TR17 AND TR30-TR37
C        W-13 TO V-07      FOR /*DAC1/49,DAC         TR50-TR57 AND TR70-TR77
C
C
      COMMON/INTCOM/OUT,LOOP,BACK,PERCENT,PERROR
      INTERRUPT(I=1,R=10,T=500)
      COMMON/*ADC1/49,ADC
      COMMON/*DAC1/49,DAC
C
C     INITIALIZATION
C
      PERCENT=.05
      OUT=0.0
      BACK=0.0
      LOCP=0
      LINE=0
      CALL RESERVE(IERR)
      WRITE(6,1000)IERR
      IF(IERR.NE.0)STOP
C
C     REAL TIME
C
      CALL SIMRUN(ISTAT)
      WRITE(6,2000)ISTAT
      IF(ISTAT.GT.0)STOP
      CALL REMARK(17H JOB IN REAL TIME)
   25 CONTINUE
      CALL BHOLD
      LINE=LINE+1
      IF(LINE.GT.200)STOP
      WRITE(6,4000)OUT,BACK,PERROR,LOOP
      CALL SIMGO
      GO TO 25
      WRITE(6,3000)
 1000 FORMAT(24H RESERVATION ERROR CODE=,O20)
 2000 FORMAT(18H REAL TIME STATUS=,O20)
 3000 FORMAT(1H0,*PROGRAM TERMINATED NORMALLY*)
 4000 FORMAT(5X,3F10.4,I10)
      STOP
      END


      SUBROUTINE SUB1
C
C     REAL TIME INTERRUPT SUBROUTINE
C
      COMMON/INTCOM/OUT,LOOP,BACK,PERCENT,PERROR
      COMMON/*ADC1/1,ADC
      COMMON/*DAC1/1,DAC
      DAC=OUT
      BACK=ADC
      PERROR=ABS((OUT-BACK)/OUT)
      IF(PERROR.GT.PERCENT)GO TO 10
      IF(OUT.GT.0.99)OUT=0.6
      OUT=OUT+.005
      LOOP=0
   10 LOOP=LOOP+1
      IF(LOOP.EQ.10)CALL SIMHOLD
      CALL SIMIDLE
      END


      TREE TRALGIC(0),SUB1(1)
      GLOBAL INTCOM
      END
```