35

PURPOSE: (1) TO PROVIDE A PROGRAM TO FULFILL THE FOLLOWING REQUIREMENTS:

(A) PROVIDE AN INDICATION TO THE CREW THAT THE CMC IS ENGAGED IN NO CONTROL OR COMPUTATIONAL OPERATIONS WHICH MIGHT REQUIRE CONSIDERATION FOR COORDINATION WITH OTHER CREW TASKS IN PROGRESS.

(B) TO MAINTAIN THE GNCS IN A CONDITION WHERE MANUAL ATTITUDE MANEUVERS CAN BE MADE BY THE CREW WITH MINIMAL CONCERN FOR THE GNCS (SEE ASSUMPTION 3).

(C) MAINTAIN THE CMC IN A CONDITION OF READINESS FOR ENTRY INTO OTHER PROGRAMS.

(2) TO UPDATE THE CSM AND LM STATE VECTORS EVERY FOUR TIME STEPS.

++
ASSUMPTIONS: (1) THE IMU MAY OR MAY NOT BE ON. IF ON, THE IMU IS INERTIALLY STABILIZED BUT NOT NECESSARILY ALIGNED TO AN ORIENTATION WHICH IS KNOWN TO THE CMC.
++
EDIT

(2) IF NON-GNCS CONTROLLED ATTITUDE MANEUVERS ARE MADE BY THE CREW CARE MUST BE TAKEN TO AVOID IMU GIMBAL LOCK. THE IMU GIMBAL ANGLES MAY BE MONITORED BY OBSERVING THE ICDUS (V16 N20) OR BY MONITORING THE FDAI BALL.

(3) DURING THIS PROGRAM THE CMC ERASABLE STORAGE MAY BE INITIALIZED BY KEYING IN V36E (FRESH START). THIS WOULD BE DONE ONLY AT INITIAL CMC STARTUP OR WHEN THE CONTENT OF THE CMC ERASABLE STORAGE IS IN QUESTION. IF THIS ENTRY IS PERFORMED, THE CMC'S KNOWLEDGE OF THE PRESENT STATE VECTOR AND THE PRESENT IMU ORIENTATION (REFSMMAT) IS INVALIDATED.

(4) THE PROGRAM IS MANUALLY SELECTED BY THE ASTRONAUT BY DSKY ENTRY.

PCR
507
++
+04 AND 05
++
EDIT

(5) THIS PROGRAM IS AUTOMATICALLY SELECTED BY V96E, WHICH MAY BE DONE DURING ANY PROGRAM. STATE VECTOR INTEGRATION IS PERMANENTLY INHIBITED FOLLOWING V96E. NORMAL INTEGRATION FUNCTIONS WILL RESUME AFTER SELECTION OF ANY PROGRAM OR EXTENDED VERB. P00 INTEGRATION WILL RESUME WHEN P00 IS RESELECTED. USAGE OF V96 CAN CAUSE INCORRECT W-MATRIX AND STATE VECTOR SYNCHRONIZATION.

```
 PROG          CMC           GROUND         CREW                          CHECKLIST       TIME      TOTAL
 CONT                                                                                               TIME


              . CMC PROG                     . CREW PROG
              . SELECTION                    . SELECTION
              .                              .
              .                              .
             ...                            ...
              .                              .
   --------------------                    --------------------
   START CMC IDLING      .                  KEY IN CMC IDLING
   PROGRAM 00          ....................PROGRAM (P00)
   DISPLAY PROGRAM 00    .                     V37E 00E                                           #10
                                           --------------------
                                                 .
                                                 .
                                                 .
                                                 .
                                                 .
                                                 .
```

```
                                                          .
                                                          .
                                                          .
                                                          .
                                                 .  -------------------
                              ....................  MONITOR DSKY:
                                                 .  OBSERVE DISPLAY OF
                                                    PROGRAM 00
          -------------------                       -------------------
                    .
                    .
                    .
++        -------------------
+         IS QUIT FLAG SET?
+04       -------------------
+                   .N      .Y
+                   .       .
+                   .       .
+                   .    -------
+04                 .    RESET
+                   .    QUIT
+                   .    FLAG
+                   .
+                   .    -------
+                   .       .
+                   .       .
+PCR                .       .
+507                .    -------
+                   .    AWAIT
+                   .    ASTRO-
+                   .    NAUT
+04                 .    ACTION
++                  .    -------
                    .
      ........      .
      .      .      .
      .   -------------------
      .   EXTRAPOLATE PERMAN-
      .   ENT STATE VECTORS
      .   FORWARD TO PRESENT
++    .   TIME EVERY 4 TIME
+05   .   STEPS. SEE SECTION
++    .   5. FIG 5.12-1
 EDIT .   -------------------
      .             .
      .             .
      .             .
      .             .
      .             .
      .   -------------------
      .   IS THERE A REQUEST
      .   FOR A NEW PROGRAM?
      .   -------------------
      .     .N        .Y
      .     .         .
      .     .         .
      .......         .
                      .
                      .
                      .
                      .
                      .
                      .
```

EXIT P00
AND GO TO
PROGRAM
SELECTED
VIA P00

CHANGE CONTROL NOTES

REV 03 PCR MIT 66
REV 04 PCR 507

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PURPOSE: (1) TO INITIALIZE THE PLATFORM FOR THE PRELAUNCH PROGRAMS.

(2) TO PROVIDE AN INITIAL STABLE MEMBER ORIENTATION FOR GYRO COMPASSING (P02).

ASSUMPTIONS: (1) THE PROGRAM IS MANUALLY SELECTED BY DSKY ENTRY.

(2) ERASABLE LOCATIONS HAVE BEEN PROPERLY INITIALIZED.(AZIMUTH, +1; LATITUDE, +1; LAUNCHAZ, +1; IMU COMPENSATION PARAMETERS)

```
 PROG          CMC                GROUND          CREW                                    CHECKLIST            TIME      TOTAL
 CONT                                                                                                                     TIME


                                                       .CREW
                                                       .PROGRAM
                                                       .SELECTION
                                                       .
                                                      ...
                                                       .
          ------------------     .                 ------------------
          START INITIALIZATION ....................KEY IN INITIALIZA-
          PROGRAM (P01)          .                 TION PROGRAM (P01)                                                    #10
          DISPLAY PROGRAM 01                         V37E01E
                                                   ------------------

                                                   ------------------
                                                .  MONITOR DSKY:
                               ..................  OBSERVE DISPLAY OF
                                                .  PROGRAM 01
          ------------------                       ------------------
                   .                                                                                                     #20
                   .
                   .
          ------------------
          COMMAND ISS ZERO
          CDU ROUTINE
          ------------------
                   .
                   .
                   .
                   .                                                                                                     #30
                   .
                   .
                   .
                   .
                   .
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                    .
                    .
                    .
                    .
                    .
          -------------------
++        WAIT ABOUT 10
+04       SECONDS
++        -------------------
                    .
                    .
                    .
          -------------------                 .   -------------------
          TURN ON "NO ATT"    ................... OBSERVE "NO ATT"
          LIGHT                               .   LIGHT ON
          -------------------                     -------------------
                    .
                    .
                    .
          -------------------
          COMMAND COARSE ALIGN
          IN ISS.
          COARSE ALIGN TO
          DESIRED PLATFORM
          ORIENTATION
          -------------------
                    .
                    .
                    .
          -------------------
          REMOVE COARSE ALIGN
          COMMAND (RELEASE
          PLATFORM).
          -------------------
                    .
                    .
                    .
          -------------------                 .   -------------------
          TURN OFF "NO ATT"   ................... OBSERVE "NO ATT"
          LIGHT                               .   LIGHT OFF
          -------------------                     -------------------
                    .
                    .
                    .
          -------------------                     -------------------
          TERMINATE PROGRAM 01                .   MONITOR DSKY:
          AND GO TO PRELAUNCH ................... OBSERVE TERMINATION
          OR SERVICE - GYRO                   .   OF P01 AND DISPLAY
          COMPASSING PROGRAM                      OF P02
          (P02)                                   -------------------
          -------------------                             .
                    .                                     .
                    .                                     .
                   ...                                   ...
                    .                                     .
                 EXIT P01                              EXIT P01
```

CHANGE CONTROL NOTES

REV 04   PCR 206   00110000

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PRELAUNCH OR SERVICE - GYRO COMPASSING PROGRAM (P02)   LOGIC   REV 04   11/27/68

PURPOSE: (1) TO PROVIDE THE PROPER STABLE MEMBER ORIENTATION FOR LAUNCH.

ASSUMPTIONS: (1) THIS PROGRAM MAY BE INTERRUPTED TO PERFORM THE PRELAUNCH OR SERVICE - OPTICAL VERIFICATION OF GYROCOMPASSING PROGRAM (P03).

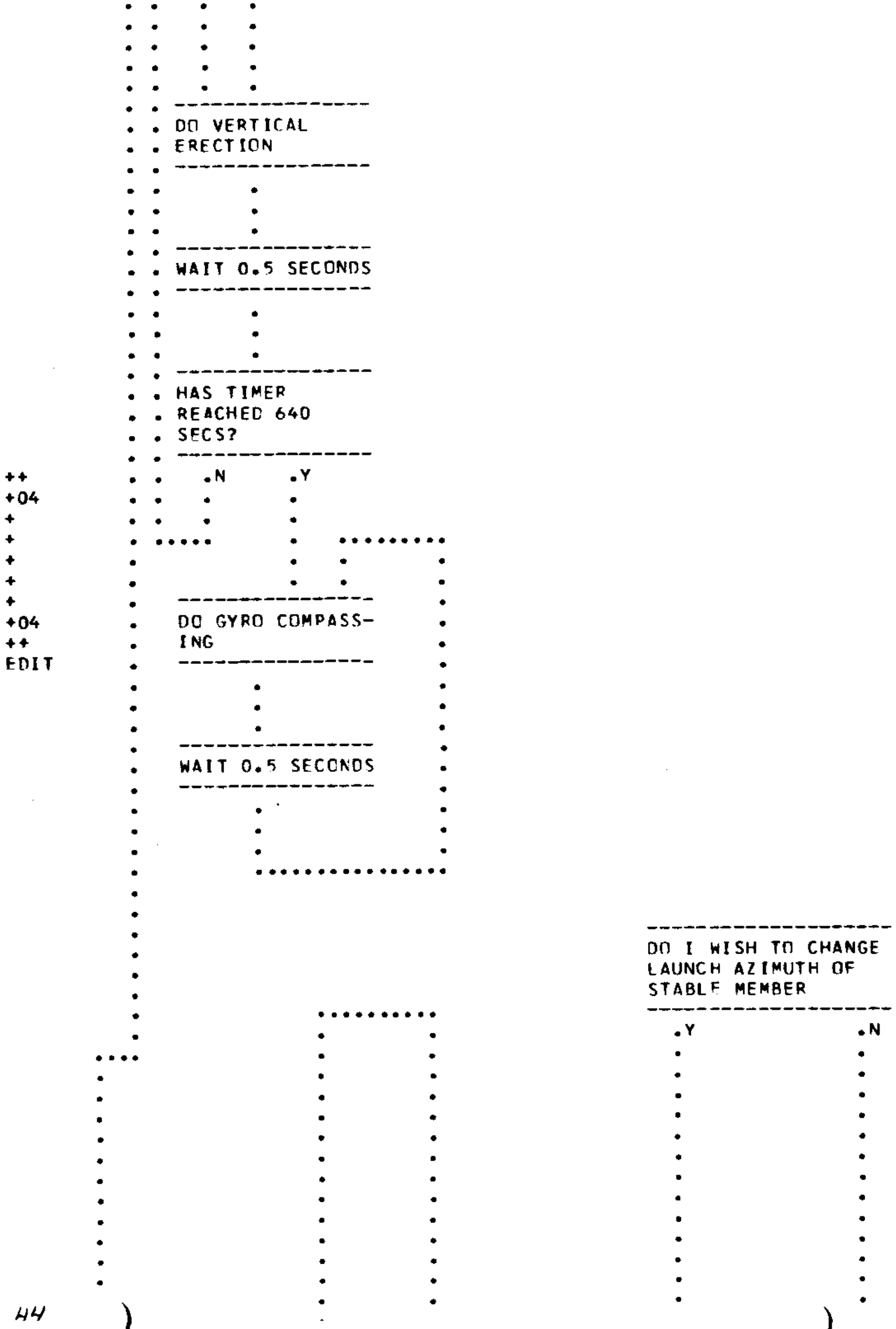
(2) V75 WILL BE KEYED IN AND DISPLAYED DURING THIS PROGRAM TO PERMIT CREW BACKUP OF THE LIFTOFF DISCRETE.

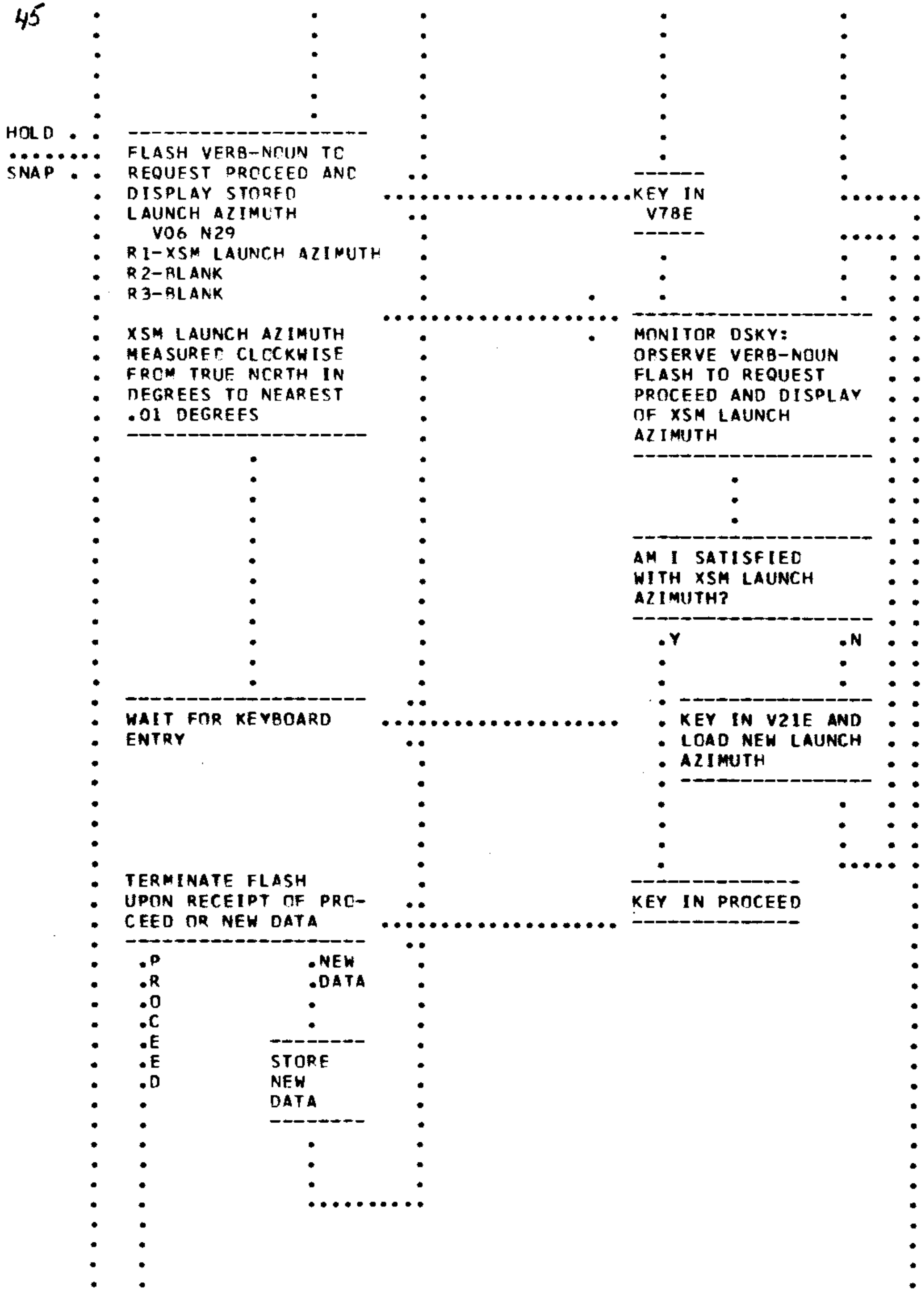
(3) THE PROGRAM IS AUTOMATICALLY SELECTED BY THE INITIALIZATION PROGRAM (P01).

(4) THIS PROGRAM HAS THE CAPABILITY (VIA V78E) TO CHANGE LAUNCH AZIMUTH OF THE STABLE MEMBER WHILE GYROCOMPASSING.

```
  PROG             CMC               GROUND              CREW                                CHECKLIST              TIME       TOTAL
  CONT                                                                                                                           TIME


                    .AGC
                    .PROG
                    .SELECTION
                    .
                   ...
                    .
          --------------------                      --------------------
          START PRELAUNCH OR                    .   MONITOR DSKY:
          SERVICE-GYRO         .................... OBSERVE DISPLAY OF                                                        #10
          COMPASSING PROGRAM                    .   PROGRAM 02
          (P02)                                     --------------------
          DISPLAY PROGRAM 02
          --------------------
          .         .
          .         .
          .         .
          .   ----------------
          .   SET TIMER
          .   ----------------                                                                                            #20
          .         .
          .         .
          .         .
          .         .
          .         .
          . .....   .
          . .   .   .
          . .   .   .
          . .   .   .
          . .   .   .
          . .   .   .
          . .   .   .
          . .   .   .
```


DO VERTICAL ERECTION
WAIT 0.5 SECONDS
HAS TIMER REACHED 640 SECS?
N
Y
++
+04
+
+
+
+
+
+04
++
EDIT
DO GYRO COMPASS-ING
WAIT 0.5 SECONDS
DO I WISH TO CHANGE LAUNCH AZIMUTH OF STABLE MEMBER
Y
N



FLASH VERB-NOUN TO REQUEST PROCEED AND DISPLAY STORED LAUNCH AZIMUTH
V06 N29
R1-XSM LAUNCH AZIMUTH
R2-BLANK
R3-BLANK

KEY IN V78E

XSM LAUNCH AZIMUTH MEASURED CLOCKWISE FROM TRUE NORTH IN DEGREES TO NEAREST .01 DEGREES

MONITOR DSKY: OBSERVE VERB-NOUN FLASH TO REQUEST PROCEED AND DISPLAY OF XSM LAUNCH AZIMUTH

AM I SATISFIED WITH XSM LAUNCH AZIMUTH?

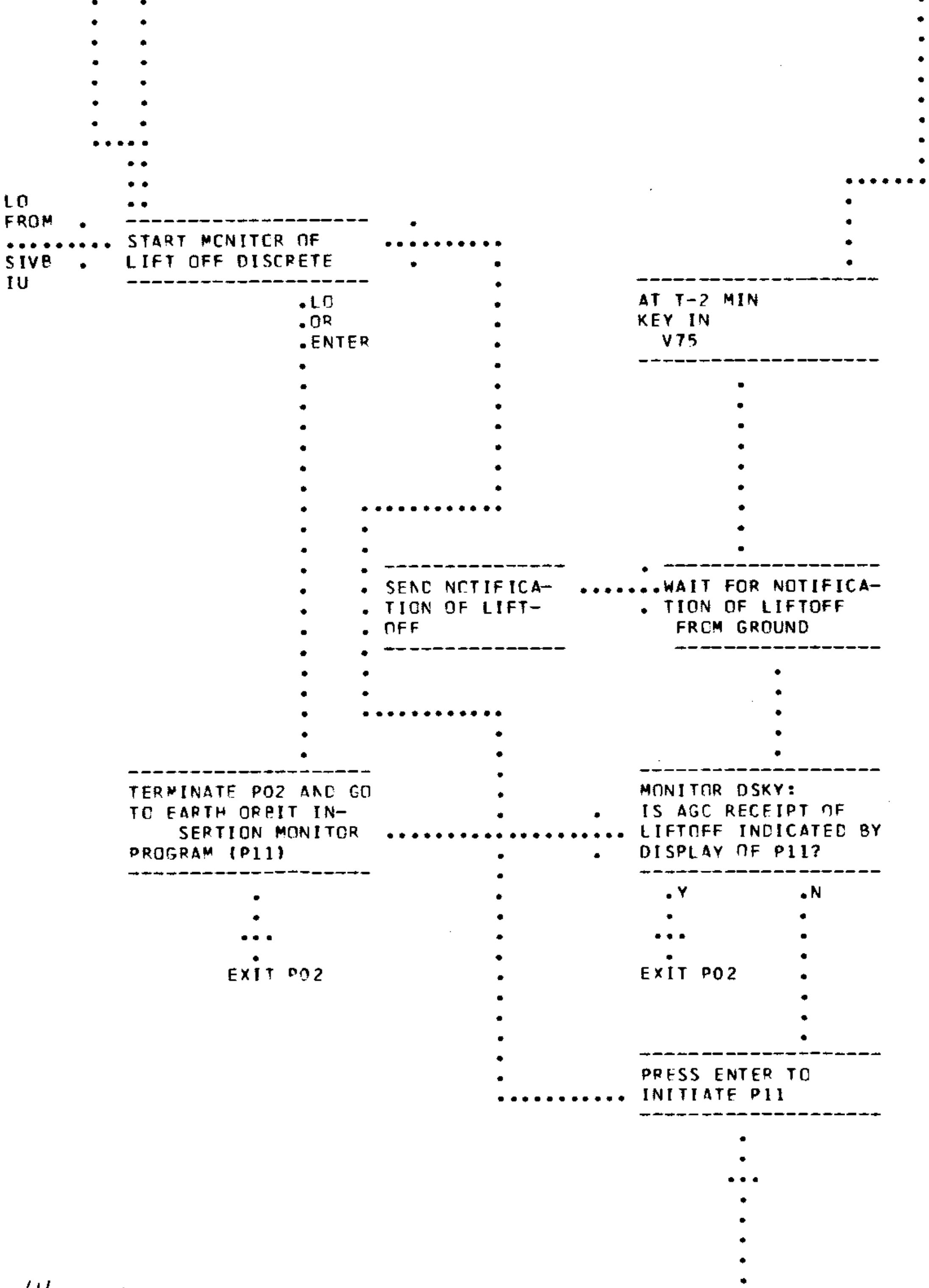
WAIT FOR KEYBOARD ENTRY

KEY IN V21E AND LOAD NEW LAUNCH AZIMUTH

TERMINATE FLASH UPON RECEIPT OF PROCEED OR NEW DATA

KEY IN PROCEED

STORE NEW DATA


LO FROM SIVB IU
START MONITOR OF LIFT OFF DISCRETE
LO OR ENTER
AT T-2 MIN KEY IN V75
SEND NOTIFICATION OF LIFT-OFF
WAIT FOR NOTIFICATION OF LIFTOFF FROM GROUND
TERMINATE P02 AND GO TO EARTH ORBIT INSERTION MONITOR PROGRAM (P11)
MONITOR DSKY: IS AGC RECEIPT OF LIFTOFF INDICATED BY DISPLAY OF P11?
Y
N
EXIT P02
EXIT P02
PRESS ENTER TO INITIATE P11

47

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EXIT P02
```

CHANGE CONTROL NOTES

REV 04   EDITORIAL

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PRELAUNCH OR SERVICE - OPTICAL
VERIFICATION OF GYRO COMPASSING
(P03)

LOGIC REV 08 07/12/68

PURPOSE: (1) TO PROVIDE AN OPTICAL CHECK FOR VERIFICATION OF ALIGNMENT OF THE STABLE MEMBER OF THE ISS DURING GYRO COMPASSING PRIOR TO LAUNCH.

ASSUMPTIONS: (1) THE PROGRAM IS MANUALLY SELECTED BY DSKY ENTRY.

(2) THE ASTRONAUT HAS ZEROED THE OPTICS JUST PRIOR TO PROGRAM (P03) SELECTION.

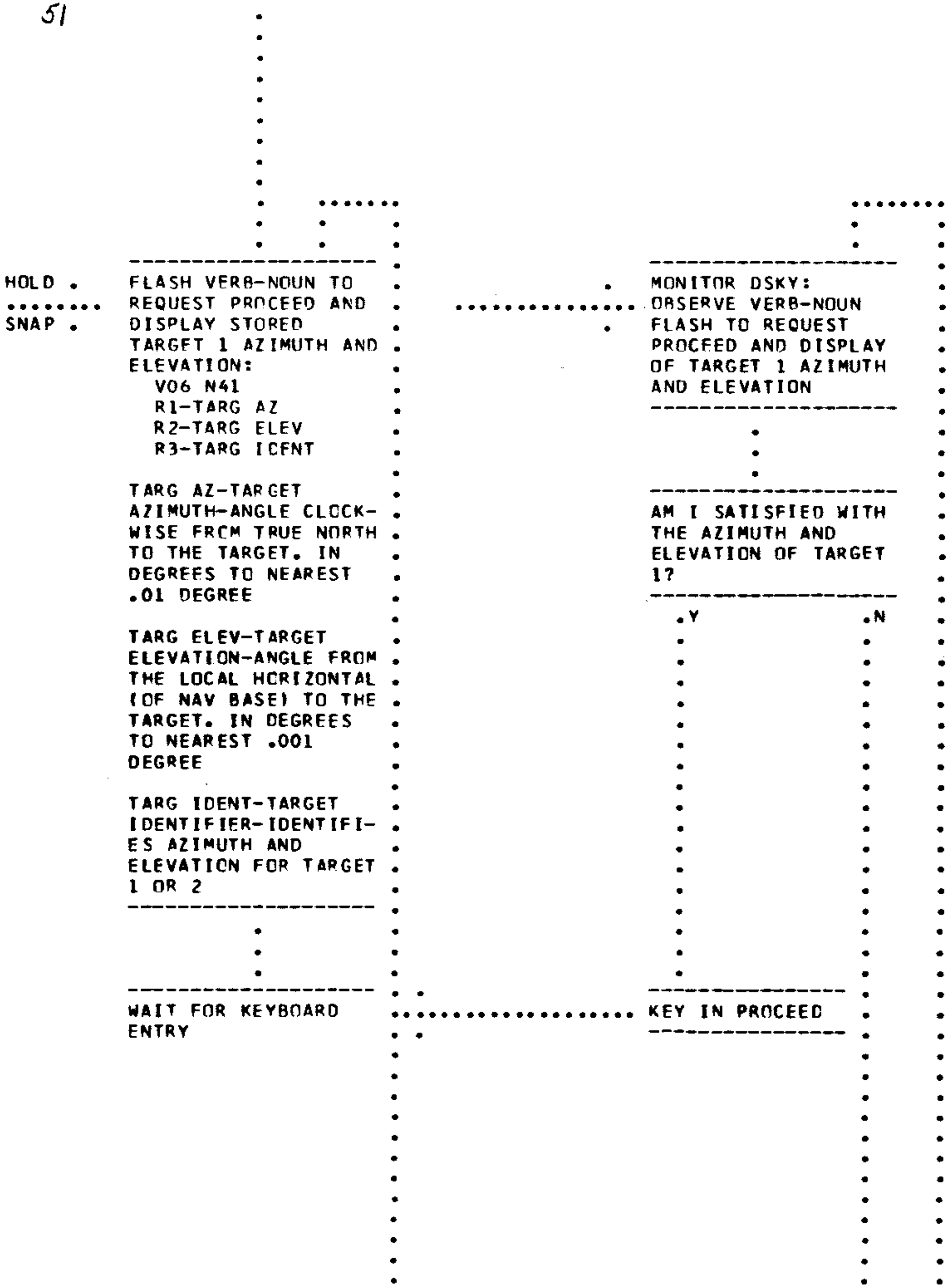
(3) A MINIMUM OF 45 MINUTES BETWEEN V78E AND P03 (V65E) INSURES PROPER DAMPING OF TRANSIENTS.

```
++
+08        (4) IN ORDER TO PREMATURELY TERMINATE THIS PROGRAM AND RETURN TO P02 THE ASTRONAUT MAY KEY IN V34E ON ANY FLASHING
+08            DISPLAY
++
```

```
 PROG        CMC              GROUND          CREW                          CHECKLIST        TIME     TOTAL
 CONT                                                                                                  TIME



                                               .CREW
                                               .PROGRAM
                                               .SELECTION
                                               .
                                              ...
                                               .
          -------------------     .          ------------------
          IS PROGRAM P02       ................... KEY IN PRELAUNCH OR
          OPERATING?              .          SERVICE - OPTICAL                                   #10
          -------------------                VERIFICATION OF
            .Y           .N                  GYRO COMPASSING
            .            .                   PROGRAM (P03)
            .            .                      V65E
            .            .                   ------------------
            .            .
            .            .
            .            .
            .            .
            . ---------------        .       ------------------                                  #20
            . SET OPERATOR     ..................  OBSERVE OPERATOR
            . ERROR LIGHT ON         .       ERROR LIGHT ON
            . ---------------                ------------------
            .                                     .
            .                                     .
            .                                     .
            .                                     .
            .                                     .
            .                                     .
            .                                     .
            .                                     .
            .                                     .
            .                                               .
            .                                               .
            .                                               .
            .                                               .
            .                                               .
            . ----------------   .                  --------------------
            . RESET OPERATOR   .....................PRESS RESET TO TURN
            . ERROR LIGHT        .                  OFF OPERATOR ERROR
            . ----------------                      LIGHT
            .      .                                --------------------
            .      .                                       .
            .      .                                       .
            .      .                                       .
            .     ...                                     ...
            .      .                                       .
            .     EXIT                                    EXIT
            .
            .
          --------------------                      --------------------
          START PRELAUNCH OR                    .   MONITOR DSKY:
          SERVICE-OPTICAL      .....................OBSERVE DISPLAY OF
          VERIFICATION OF                       .   PROGRAM 03
          GYRO COMPASSING                           --------------------
          PROGRAM (P03).
          DISPLAY PROGRAM 03
          --------------------
          .         .
          .         .
          .         .
          .         .    .......
          .         .    .     .
          .   ---------------- .
          .   CONTINUE GYRO    .
          .   COMPASSING       .
          .   ---------------- .
          .         .          .
          .         .          .
          .         .          .
          .   ---------------- .
          .   WAIT 0.5         .
          .   SECONDS          .
          .   ---------------- .
          .              .     .
          .              .     .
          .              .......
          .
          .
          --------------------
          SET TARG IDENT TO
          00001 IN R3 OF NOUN 30
          --------------------
                    .
                    .
                    .
++        --------------------
+08       PASTE V05N30 AND
+         THEN V06N41 (DO NOT
+08       OVERWRITE R3)
++        --------------------
                    .
                    .
                    .
                    .
                    .
```



HOLD . SNAP .

FLASH VERB-NOUN TO REQUEST PROCEED AND DISPLAY STORED TARGET 1 AZIMUTH AND ELEVATION:
  V06 N41
  R1-TARG AZ
  R2-TARG ELEV
  R3-TARG IDENT

TARG AZ-TARGET AZIMUTH-ANGLE CLOCKWISE FROM TRUE NORTH TO THE TARGET. IN DEGREES TO NEAREST .01 DEGREE

TARG ELEV-TARGET ELEVATION-ANGLE FROM THE LOCAL HORIZONTAL (OF NAV BASE) TO THE TARGET. IN DEGREES TO NEAREST .001 DEGREE

TARG IDENT-TARGET IDENTIFIER-IDENTIFIES AZIMUTH AND ELEVATION FOR TARGET 1 OR 2

WAIT FOR KEYBOARD ENTRY

MONITOR DSKY: OBSERVE VERB-NOUN FLASH TO REQUEST PROCEED AND DISPLAY OF TARGET 1 AZIMUTH AND ELEVATION

AM I SATISFIED WITH THE AZIMUTH AND ELEVATION OF TARGET 1?

KEY IN PROCEED

```
                               .                                     .     .
                               .                                     .     .
                               .                                     .     .
                               .                                     .     .
                               .                    --------------------   .
          TERMINATE FLASH UPON . .                  KEY IN V21E,V22E, OR   .
          RECEIPT OF PROCEED   .................... V24E AND LOAD NEW      .
          OR NEW DATA          . .                  DATA                   .
          -------------------- .                    --------------------   .
          .P        .NEW       .                                    .      .
          .R        .DATA      .                                    .      .
          .O        .          .                                    .      .
          .C        .          .                                    ........
          .E     ------------- .
          .E     DISPLAY AND   .
          .D     STORE NEW     .
          .      DATA          .
          .      ------------- .
          .              .     .
          .              .     .
          .              .......
          .
          .
          --------------------
          SET TARG IDENT TO
          00002 IN R3 OF NOUN
          30
          --------------------
                    .
                    .
                    .
++        --------------------
+08       PASTE V05N30 AND
+         THEN V06N41 (DO NOT
+08       OVERWRITE R3)
++        --------------------
                    .
                    .
                    .
                    .
                    .    .......                                  ..........
                    .    .     .                                  .        .
                    .    .     .                                  .        .
          -------------------- .                    --------------------   .
HOLD  .   FLASH VERB-NOUN TO   .                .   MONITOR DSKY:          .
......... REQUEST PROCEED AND  .................... OBSERVE VERB-NOUN      .
SNAP  .   DISPLAY STORED       .                .   FLASH TO REQUEST       .
          TARGET 2 AZIMUTH AND .                    PROCEED AND DISPLAY    .
          ELEVATION:           .                    OF TARGET 2 AZIMUTH    .
            V06 N41            .                    AND ELEVATION          .
            R1-TARG AZ         .                    --------------------   .
            R2-TARG ELEV       .                            .              .
            R3-TARG IDENT      .                            .              .
                               .                            .              .
                               .                            .              .
                               .                            .              .
                               .                            .              .
                               .                            .              .
                               .                            .              .
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                     .                            .              .
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                     .                            .              .
                     .                            .              .
                     .                            .              .
                     .                            .              .
TARG AZ-TARGET       .                    --------------------   .
AZIMUTH-ANGLE CLOCK- .                    AM I SATISFIED WITH    .
WISE FROM TRUE NORTH .                    THE AZIMUTH AND        .
TO THE TARGET. IN    .                    ELEVATION OF TARGET    .
DEGREES TO NEAREST   .                    2?                     .
.01 DEGREE           .                    --------------------   .
                     .                      .Y             .N    .
TARG ELEV-TARGET     .                      .              .     .
ELEVATION-ANGLE FROM .                      .              .     .
THE LOCAL HORIZONTAL .                      .              .     .
(OF NAV BASE) TO THE .                      .              .     .
TARGET. IN DEGREES   .                      .              .     .
TO NEAREST .001      .                      .              .     .
DEGREE               .                      .              .     .
                     .                      .              .     .
TARG IDENT-TARGET    .                      .              .     .
IDENTIFIER-IDENTIFI- .                      .              .     .
ES AZIMUTH AND       .                      .              .     .
ELEVATION FOR TARGET .                      .              .     .
1 OR 2               .                      .              .     .
-------------------- .                      .              .     .
          .          .                      .              .     .
          .          .                      .              .     .
          .          .                      .              .     .
-------------------- . .                  ----------------  .     .
WAIT FOR KEYBOARD    .................... KEY IN PROCEED    .     .
ENTRY                . .                  ----------------  .     .
                     .                                     .     .
                     .                                     .     .
                     .                                     .     .
                     .                    --------------------   .
TERMINATE FLASH UPON . .                  KEY IN V21E,V22E,      .
RECEIPT OF PROCEED   .................... OR V24E AND LOAD NEW   .
OR NEW DATA          . .                  DATA                   .
-------------------- .                    --------------------   .
      P.  .NEW       .                                  .        .
      R.  .DATA      .                                  .        .
      O.  .          .                                  .        .
      C.  .          .                                  ..........
      E. ----------- .
      E. DISPLAY AND .
      D. STORE NEW   .
       . DATA        .
       . ----------- .
       .       .     .
       .       .     .
       .       .......
       .
       .
       .
       .
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```

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                 .
                 .
                 .
                 .
          --------------------
          COMPUTE LCS TO
          TARGET NUMBER ONE
          AND DRIVE OPTICS,
          IF ALLOWED.
          --------------------
                 .
                 .
                 .
        .......  .                                               .......
        .     .  .                                               .     .
        .     .  .                                               .     .
        . --------------------                     --------------------.
HOLD  . . FLASH VERB TO                         .  MONITOR DSKY:       .
......... REQUEST PLEASE MARK  ................... OBSERVE VERB        .
SNAP  . .   V5IN BLANK                          .  FLASH TO REQUEST    .
++      .   R1-BLANK                               PLEASE MARK         .
+07     .   R2-BLANK                               --------------------.
+       .   R3-BLANK                                      .            .
+       .                                                 .            .
+07     . --------------------                            .            .
++      .           .                                     .            .
        .           .                                     .            .
        .           .                              --------------------.
        .           .                              SELECT CMC OPTICS   .
        .           .                              MODE, OBSERVE SXT   .
        .           .                              DRIVE (OPTIONAL).   .
        .           .                              --------------------.
        .           .                                     .            .
        .           .                                     .            .
        .           .                                     .            .
        .           .                              --------------------.
        .           .                              SELECT MANUAL OPTICS.
        .           .                              MODE                .
        .           .                              --------------------.
        .           .                                     .            .
        .           .                                     .            .
        .           .                                     .            .
        . --------------------                     --------------------.
        . WAIT FOR MARK          .   MARK          WHEN SIGHTING ON    .
        . TERMINATE FLASH UPON ................... TARGET 1 IS SATIS-  .
        . RECEIPT OF MARK        .                 FACTORY PRESS MARK  .
        . --------------------                     BUTTON              .
        .           .                              --------------------.
        .           .                                     .            .
        .           .                                     .            .
        .           .                                     .            .
        . --------------------                            .            .
        . STORE MARK DATA                                 .            .
        . --------------------                            .            .
        .           .                                     .            .
        .           .                                     .            .
        .           .                                     .            .
        .           .                                     .            .
        .           .                                     .            .
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        .           .                                     .            .
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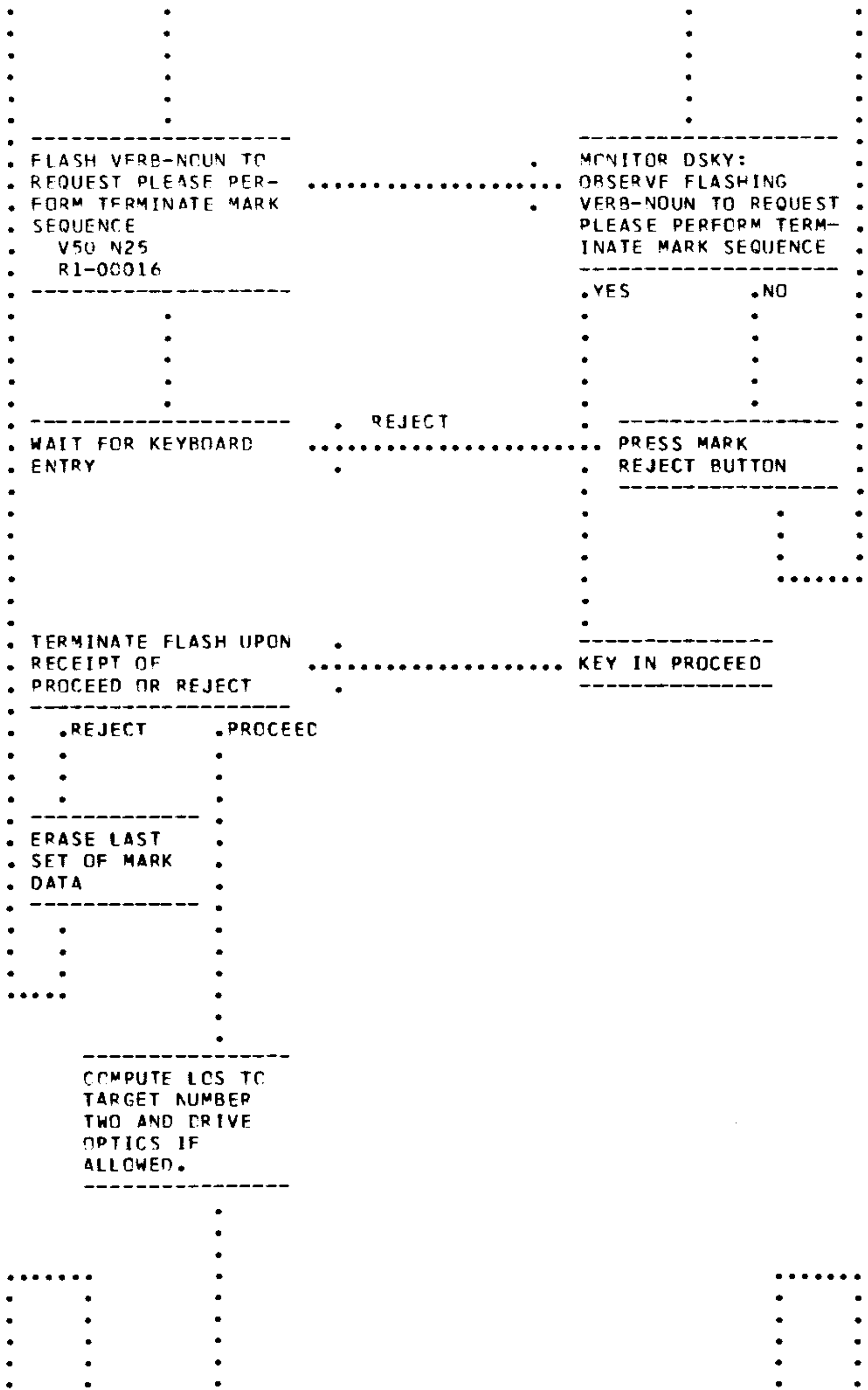
FLASH VERB-NOUN TO REQUEST PLEASE PERFORM TERMINATE MARK SEQUENCE V50 N25 R1-00016
MONITOR DSKY: OBSERVE FLASHING VERB-NOUN TO REQUEST PLEASE PERFORM TERMINATE MARK SEQUENCE
YES
NO
WAIT FOR KEYBOARD ENTRY
REJECT
PRESS MARK REJECT BUTTON
TERMINATE FLASH UPON RECEIPT OF PROCEED OR REJECT
KEY IN PROCEED
REJECT
PROCEED
ERASE LAST SET OF MARK DATA
COMPUTE LOS TO TARGET NUMBER TWO AND DRIVE OPTICS IF ALLOWED.

```
        .     .         .                                          .     .
        .     .         .                                          .     .
        .     .         .                                          .     .
        .     .         .                                          .     .
        . --------------------                      -------------------- .
HOLD  . . FLASH VERB TO                         .   MONITOR DSKY:        .
......... REQUEST PLEASE MARK  .................... OBSERVE VERB         .
SNAP  . .   V51N BLANK                          .   FLASH TO REQUEST     .
++      .   R1-BLANK                                PLEASE MARK          .
+07     .   R2-BLANK                                -------------------- .
+       .   R3-BLANK                                        .            .
+07     . --------------------                              .            .
++      .           .                                       .            .
        .           .                                       .            .
        .           .                               -------------------- .
        .           .                               SELECT CMC OPTICS    .
        .           .                               MODE. OBSERVE SXT    .
        .           .                               DRIVE (OPTIONAL)     .
        .           .                               -------------------- .
        .           .                                       .            .
        .           .                                       .            .
        .           .                                       .            .
        .           .                               -------------------- .
        .           .                               SELECT MANUAL OPTICS .
        .           .                               MODE                 .
        .           .                               -------------------- .
        .           .                                       .            .
        .           .                                       .            .
        .           .                                       .            .
        . --------------------                      -------------------- .
        . WAIT FOR MARK          .  MARK            WHEN SIGHTING ON     .
        . TERMINATE FLASH UPON .................... TARGET 2 IS SATIS-   .
        . RECEIPT OF MARK        .                  FACTORY PRESS MARK   .
        . --------------------                      BUTTON               .
        .           .                               -------------------- .
        .           .                                       .            .
        .           .                                       .            .
        .           .                                       .            .
        . --------------------                              .            .
        . STORE MARK DATA                                   .            .
        . --------------------                              .            .
        .           .                                       .            .
        .           .                                       .            .
        .           .                                       .            .
        . --------------------                      -------------------- .
        . FLASH VERB-NOUN TO                    .   MONITOR DSKY:        .
        . REQUEST PLEASE       .................... OBSERVE FLASHING     .
        . PERFORM TERMINATE                     .   VERB-NOUN TO REQUEST .
        . MARK SEQUENCE                             PLEASE PERFORM       .
        .    V50 N25                                TERMINATE MARK       .
        .    R1-00016                               SEQUENCE             .
        . --------------------                      -------------------- .
        .           .                                       .            .
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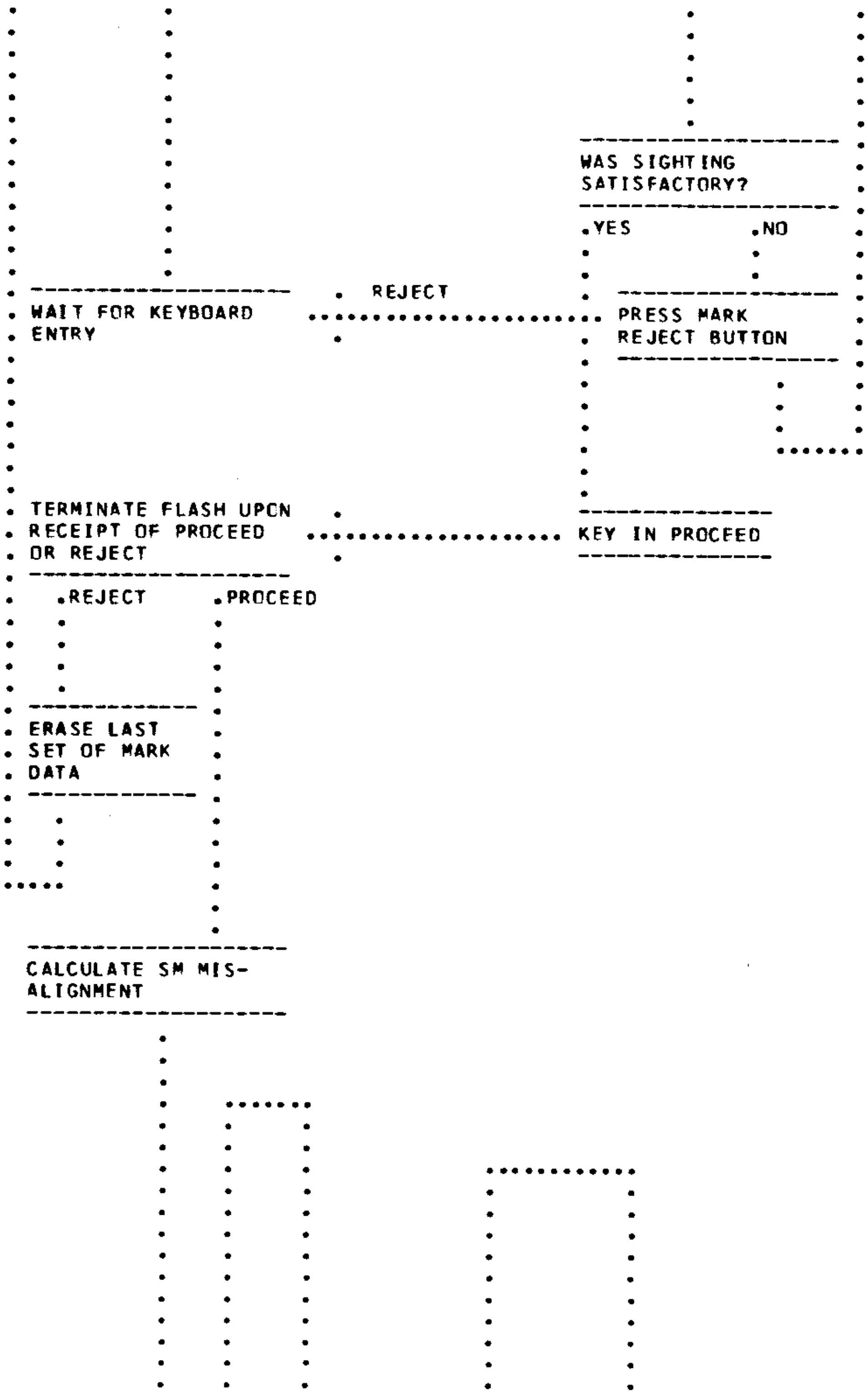
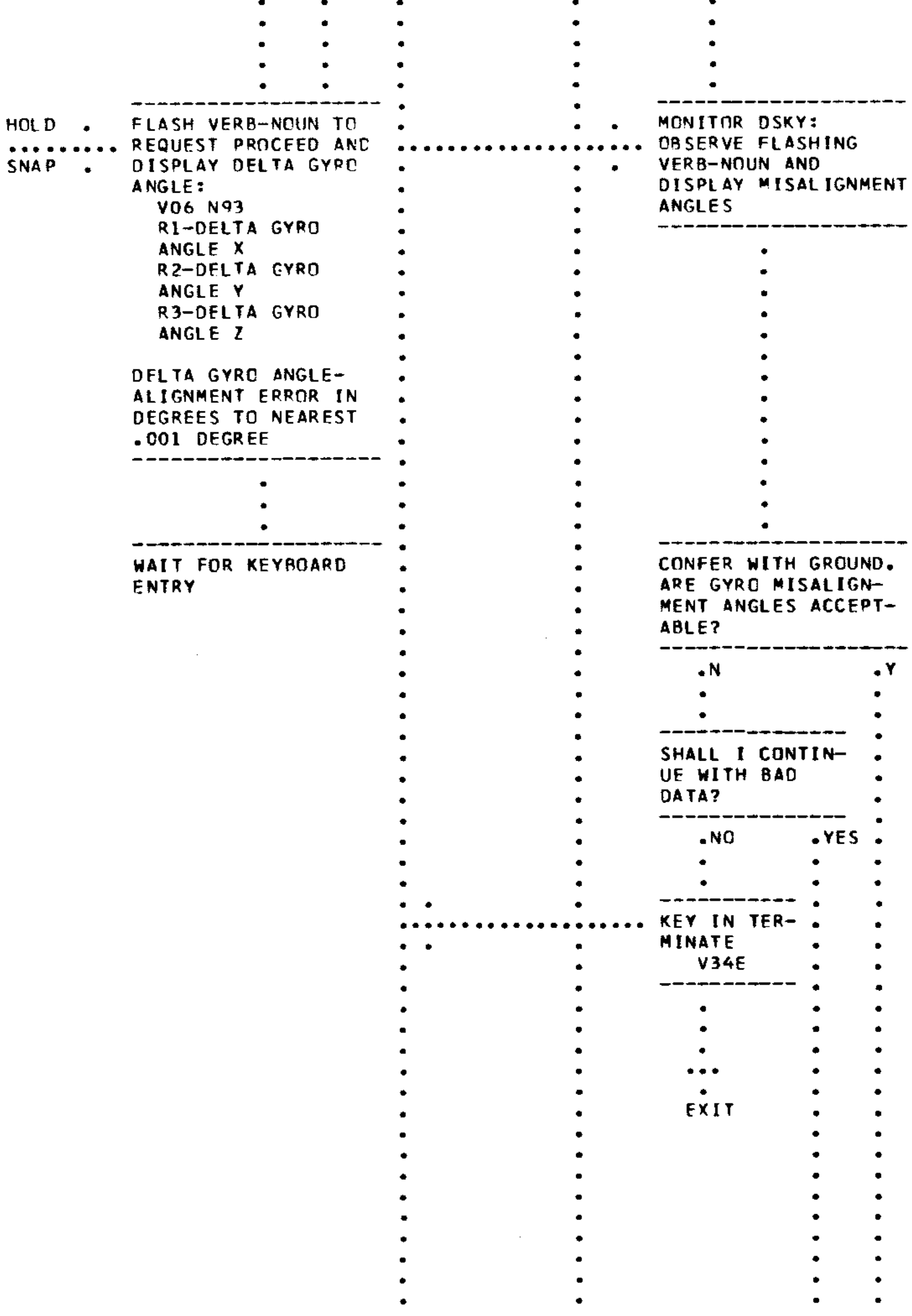
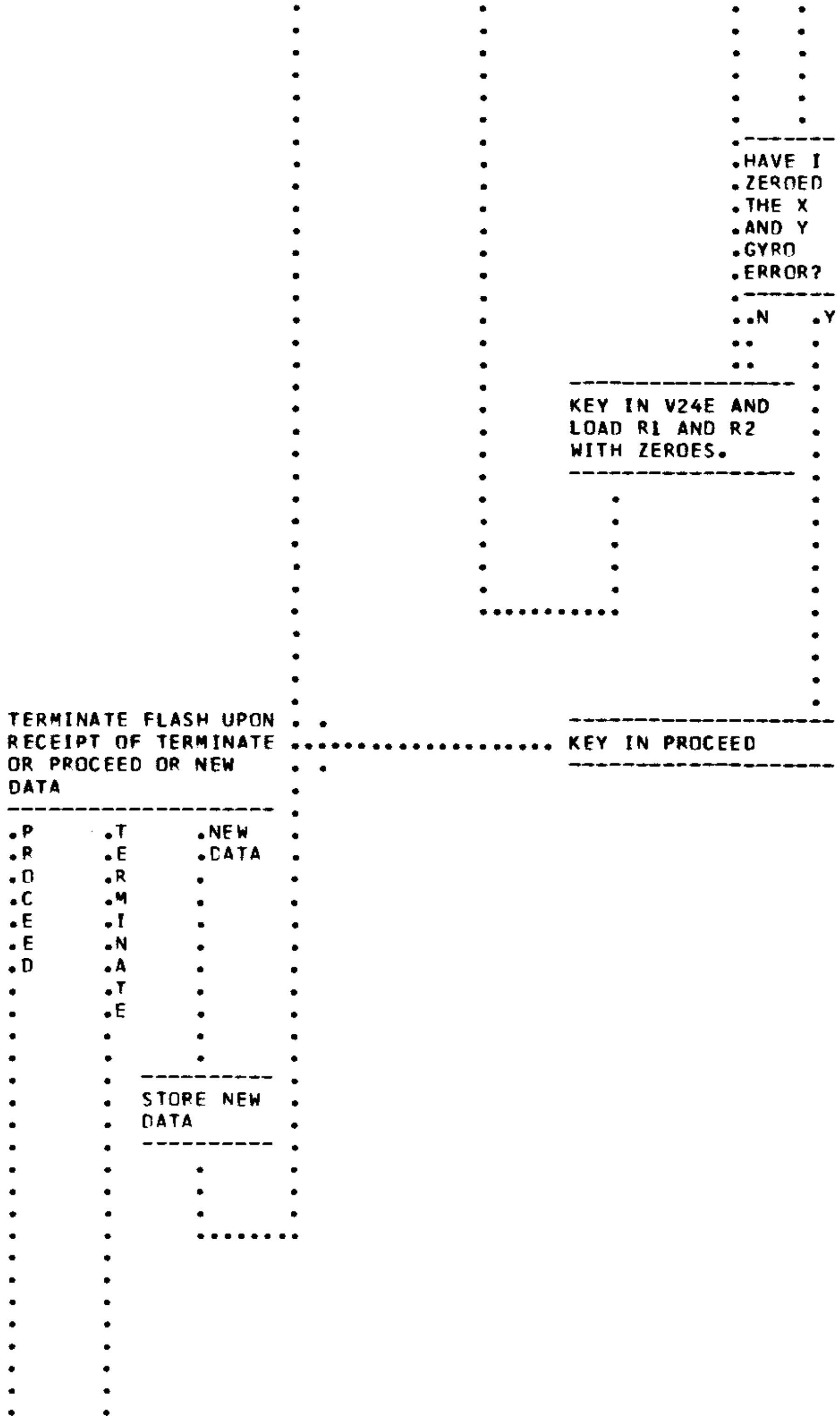
```


WAS SIGHTING SATISFACTORY?
YES
NO
REJECT
WAIT FOR KEYBOARD ENTRY
PRESS MARK REJECT BUTTON
TERMINATE FLASH UPON RECEIPT OF PROCEED OR REJECT
KEY IN PROCEED
REJECT
PROCEED
ERASE LAST SET OF MARK DATA
CALCULATE SM MIS-ALIGNMENT


HOLD
SNAP
FLASH VERB-NOUN TO REQUEST PROCEED AND DISPLAY DELTA GYRO ANGLE:
V06 N93
R1-DELTA GYRO ANGLE X
R2-DELTA GYRO ANGLE Y
R3-DELTA GYRO ANGLE Z
DELTA GYRO ANGLE- ALIGNMENT ERROR IN DEGREES TO NEAREST .001 DEGREE
MONITOR DSKY: OBSERVE FLASHING VERB-NOUN AND DISPLAY MISALIGNMENT ANGLES
WAIT FOR KEYBOARD ENTRY
CONFER WITH GROUND. ARE GYRO MISALIGNMENT ANGLES ACCEPTABLE?
N
Y
SHALL I CONTINUE WITH BAD DATA?
NO
YES
KEY IN TERMINATE V34E
EXIT


HAVE I ZEROED THE X AND Y GYRO ERROR?
N
Y
KEY IN V24E AND LOAD R1 AND R2 WITH ZEROES.
KEY IN PROCEED
TERMINATE FLASH UPON RECEIPT OF TERMINATE OR PROCEED OR NEW DATA
PROCEED
TERMINATE
NEW DATA
STORE NEW DATA

```
.      .
.      .
.      .
.      .
. --------------
. TERMINATE P03
. AND REDISPLAY
. P02. CONTINUE
. GYRO COMPAS-
. SING.
. --------------
.      .
.      .                                  #550
.      .
.     ...
.      .
.   EXIT P03
.
.
.
--------------------
TORQUE Z GYRO PER
ERROR                                     #560
--------------------
          .
          .
          .
--------------------
TERMINATE P03 AND
REDISPLAY P02.
CONTINUE GYRO
COMPASSING.
--------------------                      #570
          .
          .
          .
         ...
          .
       EXIT P03
```

CHANGE CONTROL NOTES

```
LOGIC REV 06   PCR MIT 66
LOGIC REV 07   PCR 435
LOGIC REV 08   PCR 206
               PCR 493
```

CMC POWER DOWN PROGRAM (P06) LOGIC REV 08 07/08/68

PURPOSE: (1) TO TRANSFER THE CMC FROM THE OPERATE TO THE STANDBY CONDITION.

ASSUMPTIONS: (1) WHEN THIS PROGRAM IS TURNED ON THE ASTRONAUT MUST POWER DOWN THE CMC TO STANDBY.

(2) THE NORMAL CONDITION OF READINESS OF THE GNCS WHEN NOT IN USE IS STANDBY. ALL THE G/N CKT BKRS (PANEL 5) ARE CLOSED, THE IMU AND OPTICS G/N POWER SWITCHES (LEB PANEL 100) ARE OFF AND THE CMC STANDBY LIGHT (DSKY) IS ON. IN THIS CONDITION THE IMU IS IN STANDBY WITH ONLY HEATER POWER ON, OPTICS POWER IS OFF AND THE CMC IS IN STANDBY.

(3) A POSSIBLE CONDITION OF READINESS OF THE GNCS WHEN NOT COMPLETELY ON IS THE SAME AS STANDBY (2) ABOVE, EXCEPT THE CMC STANDBY LIGHT ON THE MAIN AND LEB DSKYS IS OFF. IN THIS CONFIGURATION THE CMC IS RUNNING FOR COMPUTATIONAL PURPOSES THAT DO NOT REQUIRE THE IMU OR OPTICS.

(4) IF THE COMPUTER POWER IS SWITCHED OFF IT WILL BE NECESSARY TO PERFORM A COMPUTER FRESH START (V36)E TO INITIALIZE THE ERASABLE STORAGE. THE CMC UPDATE PROGRAM (P27) WOULD HAVE TO BE DONE TO UPDATE THE STATE VECTOR AND COMPUTER CLOCK TIME.

(5) THE CMC IS CAPABLE OF MAINTAINING AN ACCURATE VALUE OF GROUND ELAPSED TIME (GET) FOR ONLY 23 HRS WHEN IN THE STANDBY MODE. IF THE CMC IS NOT BROUGHT OUT OF THE STANDBY CONDITION TO THE RUNNING CONDITION (SEE (3) ABOVE) AT LEAST ONCE WITHIN 23 HOURS THE CMC VALUE OF GET MUST BE UPDATED.

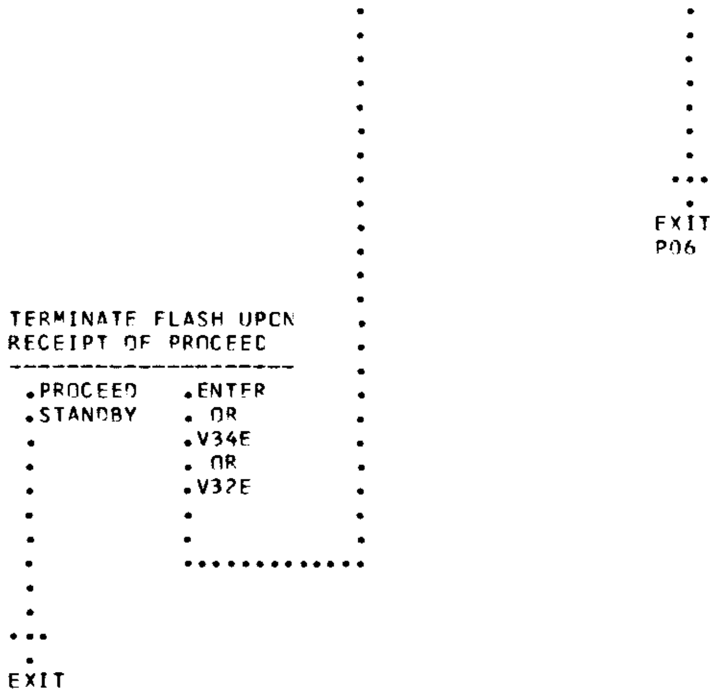
(6) THE PROGRAM IS SELECTED BY THE ASTRONAUT BY DSKY ENTRY.

```
 PROG          CMC               GROUND             CREW                               CHECKLIST           TIME     TOTAL
 CONT                                                                                                                TIME

                                                      . CREW PROG
                                                      . SELECTION
                                                      .
                                                      .
                                                     ...
                                                      .
         ------------------                  -------------------
         START CMC                            KEY IN CMC POWER
         POWER DOWN          .                DOWN PROGRAM (P06)
         PROGRAM (P06)       ................... V37E 06E                                                         #10
         DISPLAY PROGRAM 06  .                -------------------


                                             -------------------
                                          .   MONITOR DSKY:
                             ................ OBSERVE DISPLAY
                                          .   OF PROGRAM 06
         ------------------                  -------------------
                 .                                    .                                                          #20
                 .                                    .                                     P06/COLOSSUS
                 .                                    .                                     P06/SUNDANCE
                 .                                    .                                     P06/LUMINARY
```

```
                   .                                       .
                   .                                       .
                   .                                       .
         ------------------                                .
         RESET REFSMMAT FLAG                               .
         ------------------                                .
                   .                                       .
                   .                                       .
         ------------------                                .
         RESET RENDEZVOUS                                  .
         FLAG                                              .
         ------------------                                .
                   .                                       .
++                 .                                       .
+08                .                                       .
++                 .                                       .
         ------------------                                .
         STORE CMC CLOCK TIME.                             .
         ------------------                                .
                   .                                       .
                   .                                       .
                   .    ..........                         .
                   .    .        .                         .
                   .    .        .                         .
         ------------------      .                 ------------------
HOLD.    FLASH VERB-NOUN TO      .                 MONITOR DSKY:
.......  REQUEST PLEASE PER-     .               . OBSERVE VERB-NOUN
SNAP.    FORM CMC POWER DOWN: .................... FLASH TO REQUEST
              V50 N25            .               . PLEASE PERFORM CMC
              R1-00062           .                 POWER DOWN
              R2-BLANK           .                 ------------------
              R3-BLANK           .                         .
         ------------------      .                         .
                   .             .                         .
                   .             .                         .
         ------------------      .                         .
         WAIT FOR KEYBOARD       .                         .
         ENTRY                   .                         .
                                 .                         .
                                ..                 ------------
                              ........................ PRESS PROCEED
                                ..                 BUTTON AND
                                 .                 HOLD DEPRESS-
                                 .                 ED UNTIL
                                 .                 STANDBY LIGHT
                                 .                 COMES ON.
                                 .                 ------------
                                 .                       .
                                 .                       .
                                 .                       .
```


EXIT
P06
TERMINATE FLASH UPON
RECEIPT OF PROCEED
PROCEED
STANDBY
ENTER
OR
V34E
OR
V32E
EXIT

CHANGE CONTROL NOTES

LOGIC REV 07 PCR MIT 66
LOGIC REV 08 PCR NASA 206

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EARTH ORBIT INSERTION MONITOR PROGRAM (P11) LOGIC REV 06 07/08/68

PURPOSE: (1) TO INDICATE TO THE ASTRONAUT THAT THE CMC HAS RECEIVED THE LIFTOFF DISCRETE.

(2) TO GENERATE AN ATTITUDE ERROR INDICATION ON THE FDAI ERROR NEEDLES, SCALED FOR THE 50/15 SETTING; FROM LIFTOFF TO THE BEGINNING OF PITCHOVER/ROLLOUT THE ATTITUDE ERROR IS EQUAL TO THE DIFFERENCE BETWEEN THE CURRENT VEHICLE ATTITUDE AND THE ATTITUDE STORED AT LIFTOFF. DURING PITCHOVER/ROLLOUT THE ATTITUDE ERROR IS EQUAL TO THE DIFFERENCE BETWEEN THE CURRENT VEHICLE ATTITUDE AND THE CMC NOMINAL COMPUTATION OF VEHICLE ATTITUDE BASED ON THE STORED POLYNOMIALS IN PITCH AND ROLL.

(3) TO DISPLAY CMC COMPUTED TRAJECTORY PARAMETERS.

ASSUMPTIONS: (1) THE PROGRAM IS NORMALLY AUTOMATICALLY SELECTED BY THE GYRO COMPASSING PROGRAM (P02) WHEN THE CMC RECEIVES THE LIFTOFF DISCRETE FROM THE SIVB. IN THE BACKUP CASE IT WOULD HAVE BEEN SELECTED BY KEYING IN V75 ENTER AS NOTED EARLIER IN P02.

(2) THE ORBIT PARAMETER DISPLAY ROUTINE IS AVAILABLE BY KEYING IN V82E.

```
  PROG           CMC              GROUND           CREW                             CHECKLIST            TIME      TOTAL
  CONT                                                                                                              TIME


                   . CMC PROG
                   . SELECTION
                   .
                  ...
                   .
         ------------------                       ------------------
         START EOI MONITOR                   .    MONITOR DSKY:
         PROGRAM (P11)      ..................... OBSERVE DISPLAY OF
         DISPLAY PROGRAM 11                  .    PROGRAM 11
         ------------------                       ------------------                                                #10
                   .                                      .
                   .                                      .
                   .                                      .
         ------------------                       ------------------
         SEND EFFECTIVE TIME                      VERIFY AUTOMATIC
         OF LIFTOFF ON                            START OF DIGITAL
         DOWNLINK                                 EVENT TIMER
         ------------------                       ------------------
                   .
                   .                                                                                                #20
                   .
++       ------------------
+06      ZERO CMC CLOCK
++       ------------------
                   .
                   .
                   .
                   .
                   .
                   .
                   .
                   .
                  .
                  .
                  .
                  .
                  .
         ------------------
         UPDATE TEPHEM TO
         TIME OF LIFTOFF                                                                  #30
         ------------------
                  .
                  .
                  .
         ----------------
         CALL AVERAGE
         G INTEGRATION
         WITH DELTA V
         INTEGRATION
         ----------------                                                                 #40
                  .
                  .
                  .
         ----------------
         TERMINATE GYRO-
         COMPASSING
         ----------------
                  .
                  .
                  .                                                                       #50
         ------------------
         COMPUTE INITIAL
         STATE VECTOR
         ------------------
                  .
                  .
                  .
         -----------------
         COMPUTE REFSMMAT
         -----------------                                                                #60
                  .
                  .
                  .
         -----------------
         SET REFSMMAT FLAG
         -----------------
                  .
                  .
                  .
         ------------------                                                               #70
         STORE LIFTOFF
         ATTITUDE
         ------------------
                  .
                  .
                  .
                  .
                  .
                  .
                  .
                  .
                  .
                  .
                  .
                  .
                  .
```

CALL ROUTINE TO LOAD ICDU DACS WITH PITCH, ROLL, AND YAW ATTITUDE ERRORS DERIVED FROM PRESENT ATTITUDE AND STORED LIFTOFF ATTITUDE UNTIL PRESENT TIME EQUALS TE1 (STORED IN ERASABLE MEMORY) AT WHICH TIME THE STORED LIFTOFF ATTITUDE IS REPLACED BY THE SOLUTION TO THE STORED 6TH ORDER BOOST POLYNOMIAL.

AT TIME TE1 + TE2 (TE2 IS STORED IN ERASABLE MEMORY) SHUT OFF BOOST POLYNOMIAL AND HOLD ATTITUDE ERROR NEEDLES CONSTANT AT TERMINAL ERROR.

AT 163.84 SECS SHUT OFF ROUTINE TO LOAD ICDU DACS.

MONITOR:

(A) FDAI ATTITUDE ERROR NEEDLES AS INDICATION OF CMC COMPUTATIONS OF INSERTION.

BALL INDICATES INITIAL VEHICLE ROLLOUT AND THEN GRADUAL PITCHOVER.

(B) DSKY:
R1-VI INCREASING
R2-H DOT FOLLOWS NOMINAL HISTORY
R3-H INCREASING

HOLD

MON

DISPLAY ON DSKY:
V06 N62
R1 - VI
R2 - H DOT
R3 - H

VI-INERTIAL VELOCITY MAGNITUDE. IN FPS TO NEAREST FPS

H DOT - RATE OF CHANGE OF VEHICLE ALTITUDE ABOVE LAUNCH PAD RADIUS. IN FPS TO NEAREST FPS

```
                                                 .
                                                 .
                                                 .
                                                 .
H-VEHICLE ALTITUDE                               .
ABOVE THE LAUNCH                                 .
PAD RADIUS. IN NAUTI-                            .
CAL MILES TO                                     .
NEAREST .1 NM                                    .
--------------------                     --------------------
                                         VERIFY SATURN
                                         SHUT DOWN
                                         --------------------
                                                 .
                                                 .
                                                 .
--------------------    .          .     --------------------
TERMINATE P11 AND GO ..................... KEY IN V37EXXE
TO PROGRAM SELECTED     .          .     --------------------
VIA R00                                          .
--------------------                             .
         .                                       .
         .                                       .
         .                                       .
        ...                                     ...
         .                                       .
      EXIT P11                                EXIT P11
```

CHANGE CONTROL NOTES

LOGIC REV 5   PCR 3
LOGIC REV 6   PCR 206

PURPOSE: (1) TO ACCEPT A DESIRED TIME OF TRANSFER PHASE INITIATION (TIG(TPI)) AS A DSKY INPUT FROM THE ASTRONAUT, AND TO COMPUTE THEREFROM THE PARAMETERS ASSOCIATED WITH A MINIMUM ENERGY, SAFE PERIAPSIS TRANSFER MANEUVER AT TIG(TPI) AND THE RESULTANT RENDEZVOUS INTERCEPT.

(2) TO PROVIDE THE ASTRONAUT WITH THE OPTION OF DEFINING TO THE CMC THE INITIAL TRANSFER TRAJECTORY SEARCH SECTOR FOR CENTRAL ANGLES EITHER GREATER THAN OR LESS THAN 180 DEGREES FROM THE POSITION OF THE ACTIVE VEHICLE (CSM) AT TIG (TPI).

(3) TO DISPLAY TO THE ASTRONAUT THE PARAMETERS ASSOCIATED WITH THE TRANSFER (TPI AND INTERCEPT).

ASSUMPTIONS: (1) IF P20 IS IN OPERATION WHILE THIS PROGRAM IS OPERATING THE ASTRONAUT MAY HOLD AT ANY FLASHING DISPLAY AND TURN ON THE RENDEZVOUS SIGHTING MARK ROUTINE (EITHER R21 OR R23) AND TAKE OPTICS MARKS AND/OR HE MAY ALLOW VHF RANGING MARKS TO ACCUMULATE. SEE P20 FOR DETAILED DESCRIPTION.

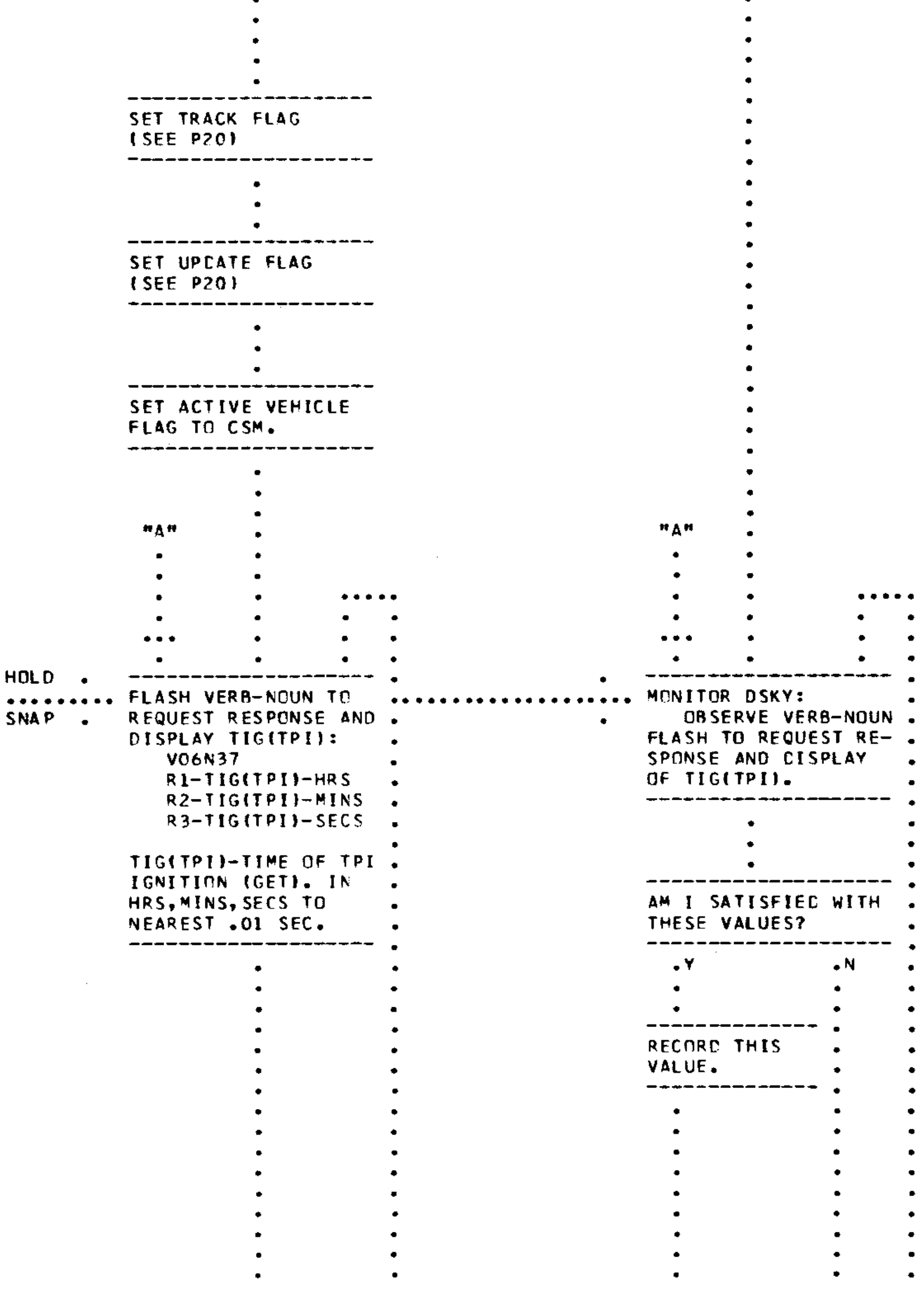
(2) THE OPERATION OF THIS PROGRAM UTILIZES THE ACTIVE VEHICLE FLAG WHICH DESIGNATES THE VEHICLE WHICH IS DOING THE RENDEZVOUS THRUSTING MANEUVERS TO THE PROGRAM WHICH CALCULATES THE MANEUVER PARAMETERS. SET AT THE START OF EACH RENDEZVOUS PRE-THRUSTING PROGRAM.

(3) TO EXECUTE THE TPI MANEUVER SELECT THE TRANSFER PHASE INITIATION (TPI) PROGRAM (P34).

(4) THIS PROGRAM IS SELECTED BY THE ASTRONAUT BY DSKY ENTRY.

```
 PROG         CMC                GROUND           CREW                              CHECKLIST          TIME    TOTAL
 CONT                                                                                                           TIME


                                                    . CREW
                                                    . PROGRAM
                                                  ...SELECTION
                                                    .
      -------------------                        -------------------
      START TPI SEARCH        .                  KEY IN TPI SEARCH
      PROGRAM (P17).        .................... PROGRAM (P17)
                              .                     V37E17E
                                                 -------------------
                                                    .                                                          #10
                                                    .
                                                    .
                                           .     -------------------
                            .................... MONITOR DSKY:
                                           .        OBSERVE DISPLAY
      DISPLAY PROGRAM 17                         OF PROGRAM 17.
      -------------------                        -------------------
              .                                     .
              .                                     .
              .                                     .                                                          #20
              .                                     .
              .                                     .
              .                                     .
              .                                     .
```



SET TRACK FLAG
(SEE P20)

SET UPDATE FLAG
(SEE P20)

SET ACTIVE VEHICLE
FLAG TO CSM.

FLASH VERB-NOUN TO
REQUEST RESPONSE AND
DISPLAY TIG(TPI):
V06N37
R1-TIG(TPI)-HRS
R2-TIG(TPI)-MINS
R3-TIG(TPI)-SECS

TIG(TPI)-TIME OF TPI
IGNITION (GET). IN
HRS,MINS,SECS TO
NEAREST .01 SEC.

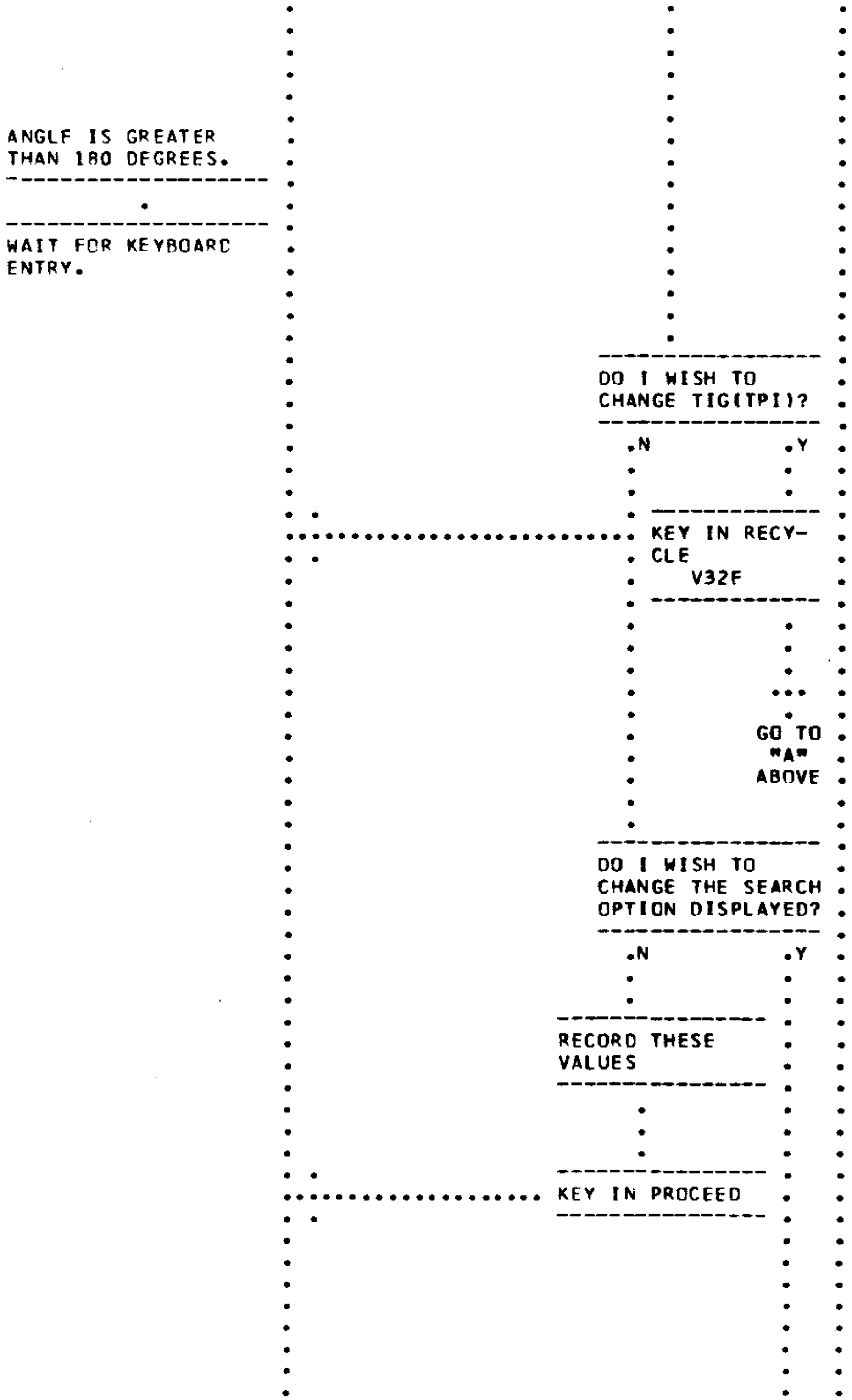
MONITOR DSKY:
OBSERVE VERB-NOUN
FLASH TO REQUEST RE-
SPONSE AND DISPLAY
OF TIG(TPI).

AM I SATISFIED WITH
THESE VALUES?

RECORD THIS
VALUE.

```
          .          .                      .            .     .
          .          .                      .            .     .
          .          .                      .            .     .
          .          .                      .            .     .
          .          .                      .            .     .
          .          .                      .            .     .
-------------------- . .                  -------------- .     .
WAIT FOR KEYBOARD    .................... KEY IN PROCEED .     .
ENTRY                . .                  -------------- .     .
                     .                                   .     .
                     .                                   .     .
                     .                         --------------- .
TERMINATE FLASH UPON . .                       KEY IN V25E AND .
RECEIPT OF PROCEED   ......................... LOAD THE DESIR- .
OR NEW DATA          . .                       ED TIG(TPI)     .
-------------------- .                         --------------- .
 .PROCEED    .NEW    .                                   .     .
 .           .DATA   .                                   .     .
 .           .       .                                   .......
 .        ---------- .
 .        STORE DATA .
 .        ---------- .
 .           .       .
 .           .       .
 .           .........
 .
 .
--------------------
RESET UPDATE FLAG
--------------------
 .
 .
 .
--------------------
COMPUTE VEHICLE
POSITIONS AT
TIG(TPI) AND SELECT
NOMINAL SEARCH OP-
TION AS FOLLOWS:
IF ACTIVE VEHICLE IS
ABOVE PASSIVE VEH-
ICLE (NEGATIVE DELTA
ALTITUDE) SELECT
OPTION 00001.
IF ACTIVE VEHICLE IS
BELOW PASSIVE VEHICLE
(POSITIVE DELTA ALT)
SELECT OPTION 00002
--------------------
          .
          .
          .
--------------------
SET UPDATE FLAG
--------------------
          .
          .
          .
          .      .....                                     .....
          .      .   .                                     .   .
          .      .   .                                     .   .
          .      .   .                                     .   .
          .      .   .                                     .   .
          .      .   .                                     .   .
```

```
                    .      .   .                                    .   .
                    .      .   .                                    .   .
                    .      .   .                                    .   .
                    .      .   .                                    .   .
HOLD  .   -------------------- .               .   -------------------- .
......... FLASH VERB-NOUN TO   ................... MONITOR DSKY:          .
SNAP  .   REQUEST RESPONSE AND .               .      OBSERVE VERB-NOUN .
          DISPLAY TPI PARA-    .                   FLASH TO REQUEST     .
          METERS:              .                   RESPONSE AND DISPLAY .
             V06N72            .                   OF TPI PARAMETERS.   .
             R1-DELT ANG(TPI)  .                   -------------------- .
             R2-DELT ALT(TPI)  .                           .            .
             R3-SEARCH OPTION  .                           .            .
                               .                           .            .
          DELT ANG(TPI)-CENT-  .                           .            .
          RAL ANGLE AROUND THE .                           .            .
          EARTH OR MOON AT TIG .                           .            .
          (TPI) BETWEEN THE    .                           .            .
          ACTIVE AND PASSIVE   .                           .            .
          VEHICLES. POLARITY   .                           .            .
          INDICATES ACTIVE VE- .                           .            .
          HICLE IS BEHIND (-)  .                           .            .
          OR AHEAD OF (+)      .                           .            .
          PASSIVE VEHICLE. IN  .                           .            .
          DEGREES TO NEAREST   .                           .            .
          .01 DEGREE.          .                           .            .
                               .                           .            .
          DELT ALT(TPI)-THE    .                           .            .
          MAGNITUDE OF THE     .                           .            .
          ALTITUDE DIFFERENCE  .                           .            .
          BETWEEN THE POSITION .                           .            .
          VECTORS OF THE ACT-  .                           .            .
          IVE AND PASSIVE VE-  .                           .            .
          HICLES AT TIG(TPI).  .                           .            .
          IN NAUTICAL MILES TO .                           .            .
          THE NEAREST .1 NM.   .                           .            .
          POLARITY INDICATES   .                           .            .
          THE PASSIVE VEHICLE  .                           .            .
          IS ABOVE (+) OR BE-  .                           .            .
          LOW (-) THE ACTIVE   .                           .            .
          VEHICLE.             .                           .            .
                               .                           .            .
          SEARCH OPTION-AN OP- .                           .            .
          TION CODE TO CONTROL .                           .            .
          CMC SEARCH FOR TERM- .                           .            .
          INAL PHASE           .                           .            .
          DEFINITION:          .                           .            .
            00001-CMC SEARCHES .                           .            .
          TO DEFINE A TERMINAL .                           .            .
          PHASE WHERE THE REN- .                           .            .
          DEZVOUS INTERCEPT    .                           .            .
          OCCURS AT A CENTRAL  .                           .            .
          ANGLE LESS THAN 180  .                           .            .
          DEGREES FROM THE     .                           .            .
          ACTIVE VEHICLE POS-  .                           .            .
          ITION AT TIG(TPI).   .                           .            .
                  OR           .                           .            .
            00002-SAME AS      .                           .            .
          00001 EXCEPT CENTRAL .                           .            .
                               .                           .            .
                               .                           .            .
                               .                           .            .
                               .                           .            .
```


ANGLE IS GREATER THAN 180 DEGREES.
WAIT FOR KEYBOARD ENTRY.
DO I WISH TO CHANGE TIG(TPI)?
N
Y
KEY IN RECYCLE V32F
GO TO "A" ABOVE
DO I WISH TO CHANGE THE SEARCH OPTION DISPLAYED?
N
Y
RECORD THESE VALUES
KEY IN PROCEED

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```
          --------------------
           .NO         .ALARM
           .ALARM      .
           .           .
           .           .
          ---------  ---------
          SET UP-    SET UP-
          DATE FLAG  CATE FLAG
          (SEE P20)  (SEE P20)
          ---------  ---------
           .           .
           .           .
           .           .
POSS       .  ----------------                  .   --------------------
HOLD  .    .  FLASH VERB-NOUN  .....................MONITOR DSKY:
.........  .  TO REQUEST RE-                    .      DOES PROGRAM
SNAP  .    .  SPONSE AND DIS-                       ALARM INDICATE THAT
           .  PLAY PROGRAM                          CMC CAN FIND NO SOL-
           .  ALARM CODE.                           UTION.
           .     V05N09                             --------------------
           .     R1-                                .N             .Y
           .     R2-                                .              .
           .     R3-                                .              .
           .                                        .              .
           .  EXPECTED ALARM                        .              .
           .  CODE AT THIS                          .              .
           .  TIME IS 00124                         .              .
           .  ----------------                      .              .
           .        .                               .              .
           .        .                               .              .
           .        .                               .              .
           .  ----------------                      .              .
           .  WAIT FOR KEY-                         .              .
           .  BOARD ENTRY                           .              .
           .                                        .              .
           .                                        .              .
           .                                        .  -----------------
           .  TERMINATE FLASH    .                  .  TO ADJUST TIG
           .  UPON RECEIPT OF  ........................(TPI) AND/OR THE
           .  RECYCLE.           .                  .  SEARCH OPTION
           .  ----------------                      .  KEY IN RECYCLE
           .          .R                            .  V32E
           .          .E                            .  -----------------
           .          .C                            .            .
           .          .Y                            .            .
           .          .C                            .            .
           .          .L                            .           ...
           .          .E                            .            .
           .           .                            .          GO TO
           .           .                            .           "A"
           .          ...                           .          ABOVE
           .           .                            .
           .                                        .
           .                                        .
           .                                        .
           .                                        .
           .                                        .
           .                                        .
           .                                        .
           .                                        .
           .                                        .
           .                                        .
           .                                        .
           .         GO TO                          .
           .          "A"                           .
           .         ABOVE                          .
           .                                        .
           .                                        .
HOLD  .   --------------------                   .  --------------------
......... FLASH VERB-NOUN TO    ...................  MONITOR DSKY:
SNAP  .   REQUEST RESPONSE AND                   .     OBSERVE VERB-NOUN
          DISPLAY CALCULATED                        FLASH TO REQUEST
          TERMINAL PHASE                            RESPONSE AND DISPLAY
          PARAMETERS:                               OF CALCULATED TER-
             V06N58                                 MINAL PHASE
             R1-PER ALT                             PARAMETERS.
             R2-DELTA V(TPI)                        --------------------
             R3-DELTA V(TPF)                                 .
                                                             .
          PER ALT-ALTITUDE OF                                .
          PERIGEE ABOVE LAUNCH                      --------------------
          PAD RADIUS (EARTH                         DO I WISH TO ADJUST
          ORBIT) OR ALTITUDE                        TIG(TPI) AND/OR THE
          OF PERILUNE ABOVE                         SEARCH OPTION?
          THE MOST RECENTLY                         --------------------
          DEFINED LANDING SITE                               .N      .Y
          RADIUS (LUNAR ORBIT)                               .       .
          AFTER TPI MANEUVER                                 .       .
          IN NAUTICAL MILES TO                               .       .
          NEAREST .1 NM.                                     .       .
                                                             .       .
          DELTA V(TPI)-REQUIR-                      -------------    .
          ED IMPULSIVE DELTA V                      RECORD THESE     .
          TO ACCOMPLISH TPI                         VALUES.          .
          MANEUVER AT TIG                           -------------    .
          (TPI). IN FPS TO                                   .       .
          NEAREST .1 FPS.                                    .       .
                                                             .       .
          DELTA V(TPF)-REQUIR-                               .       .
          ED IMPULSIVE DELTA V                               .       .
          TO ACCOMPLISH TPF                                  .       .
          MANEUVER AT TIME OF                                .       .
          INTERCEPT. POLARITY                                .       .
          INDICATES ACTIVE                                   .       .
          VEHICLE ASCENDING                                  .       .
          (+) OR DESCENDING                                  .       .
          (-) TO INTERCEPT.                                  .       .
          IN FPS TO NEAREST .1                               .       .
          FPS.                                               .       .
          --------------------                               .       .
                    .                                        .       .
                    .                                        .       .
                    .                                        .       .
          --------------------  .                   ----------------.
          WAIT FOR KEYBOARD     ...................  KEY IN PROCEED  .
          ENTRY.                .                   ----------------.
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                                                                    .
          TERMINATE FLASH UPON   .                        --------------
          RECEIPT OF PROCEED,  .....................      KEY IN RECYCLE
          OR RECYCLE.            .                           V32E
          --------------------                            --------------
           .P             .R                                         .
           .R             .E                                         .
           .O             .C                                         .
           .C             .Y                                        ...
           .E             .C                                         .
           .E             .L                                       GO TO
           .D             .E                                        "A"
           .              .                                        ABOVE
           .              .
           .             ...
           .              .
           .            GO TO
           .             "A"
           .            ABOVE
           .
           .
HOLD  .   --------------------                  .   --------------------
......... FLASH VERB-NOUN TO   ....................  MONITOR DSKY:
SNAP  .   REQUEST RESPONSE AND                  .      OBSERVE VERB-NOUN
          DISPLAY CALCULATED                        FLASH TO REQUEST
          PER CODE AND CENTANG:                     RESPONSE AND DISPLAY
             V06N55                                 OF PER CODE AND
             R1-PER CODE                            CENTANG.
             R2-BLANK                               --------------------
             R3-CENTANG                                     .
                                                            .
          PER CODE-DEFINES                                  .
          WHEN PERIGEE/PERI-                                .
          LUNE WILL OCCUR REL-                              .
          ATIVE TO TIG(TPI)                                 .
          AND TIME OF INTER-                                .
          CEPT.                                             .
             00001-INDICATES                                .
             PERIGEE/PERILUNE                               .
             WILL OCCUR BETWEEN                             .
             TPI AND TPF.                                   .
                                                            .
             00002-INDICATES                                .
             PERIGEE/PERILUNE                               .
             WILL OCCUR AFTER                               .
             INTERCEPT (BEYOND                              .
             THE RENDEZVOUS                                 .
             POINT).                                        .
                                                            .
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                                                   .
CENTANG-THE ORBITAL                       --------------------
CENTRAL ANGLE OF THE                      DO I WISH TO ADJUST
PASSIVE VEHICLE                           TIG(TPI) AND/OR THE
DURING TRANSFER FROM                      SEARCH OPTION?
TIG(TPI) TO TIME                          --------------------
OF INTERCEPT. IN                                   .N       .Y              #450
DEGREES TO THE NEAR-                               .        .
EST .01 DEGREES.                                   .        .
--------------------                      -----------------.
          .                               RECORD THESE      .
          .                               VALUES            .
          .                               -----------------.
          .                                        .        .
          .                                        .        .
          .                                        .        .
--------------------    .                 ---------------   .              #460
WAIT FOR KEYBOARD     ................... KEY IN PROCEED    .
ENTRY.                  .                 ---------------   .
                                                            .
                                                            .
                                                            .
                                                            .
TERMINATE FLASH UPON    .                       -------------
RECEIPT OF PROCEED,   ......................... KEY IN RECYCLE
OR RECYCLE.             .                         V32E                       #470
--------------------                            -------------
 .P              .R                                         .
 .R              .E                                         .
 .O              .C                                         .
 .C              .Y                                        ...
 .E              .C                                         .
 .E              .L                                       GO TO
 .D              .E                                        "A"
 .               .                                        ABOVE
 .               .
 .              ...                                                          #480
 .               .
 .             GO TO
 .              "A"
 .             ABOVE
 .
 .
 .
--------------------    .         .       --------------------
DO ROUTINE R00        ...................  DO ROUTINE R00                    #490
--------------------    .         .       --------------------
          .                                        .
          .                                        .
          .                                        .
         ...                                      ...
          .                                        .
        EXIT                                     EXIT
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CHANGE CONTROL NOTES

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LOGIC REV 08  PCR MIT 66
LOGIC REV 09  EDITORIAL
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PURPOSE: (1) TO CONTROL THE CSM ATTITUDE AND OPTICS TO ACQUIRE THE LM IN THE SXT FIELD AND TO POINT THE CSM TRANSPONDER AT THE LM OR TO CONTROL THE CSM ATTITUDE TO ACQUIRE THE LM ALONG THE +X AXIS BASED ON THE OPTION CODE CHOSEN.

(2) TO UPDATE EITHER THE LM OR CSM STATE VECTOR (AS SPECIFIED BY THE ASTRONAUT BY DSKY ENTRY) ON THE BASIS OF OPTICAL TRACKING DATA AND/OR VHF RANGE DATA.

ASSUMPTIONS: (1) THE IMU MUST BE ON AND ALIGNED IN ORDER TO PERFORM THIS PROGRAM.

(2) THE GNCS IS IN CONTROL OF THE VEHICLE IN THE AUTO MODE IN THE NOMINAL CASE. IF THE ASTRONAUT TAKES OVER CONTROL OF THE VEHICLE WITH RHC THE CSM WILL REMAIN AT THE ATTITUDE IT IS DRIVEN TO. REGARDLESS OF MODE SELECTION THE GNCS WILL CALCULATE THE PREFERRED TRACKING ATTITUDE AND THE +X-AXIS TRACKING ATTITUDE.

(3) ROUTINE R03 HAS BEEN PERFORMED PRIOR TO SELECTION OF THIS PROGRAM, IN ORDER FOR THE GNCS TO PERFORM THE AUTOMATIC ATTITUDE MANEUVERS THE ASTRONAUT SHOULD KEY IN V46E AT SOME TIME PRIOR TO THE FIRST MANEUVER.

(4) THE LM IS MAINTAINING A PREFERRED TRACKING ATTITUDE TO CORRECTLY ORIENT THE OPTICAL BEACON.

(5) THE OPERATION OF THE PROGRAM INCLUDES THE FOLLOWING FLAGS:

RENDEZVOUS FLAG- CONTROLS THE PERMANENT TERMINATION OF THE TOTAL RENDEZVOUS NAVIGATION PROCESS. THIS PROGRAM WILL ONLY RUN OR RESUME RUNNING WHEN THIS FLAG IS SET. SET BY P20 SELECTION. RESET BY SELECTION OF CMC IDLING PROGRAM(P00), CMC POWER DOWN PROGRAM(P06), THE ORBITAL NAVIGATION PROGRAM (P22), THE CISLUNAR NAVIGATION PROGRAM (P23), OR BY V56E. THE KEYING IN OF V56E WILL IMMEDIATELY TERMINATE P20 UNLESS A NAVIGATION MEASUREMENT IS BEING PROCESSED IN WHICH CASE IT WILL HOLD UNTIL COMPLETION OF THE INCORPORATION AND THEN TERMINATE P20.

TRACK FLAG- CONTROLS THE TEMPORARY TERMINATION OF THE TOTAL RENDEZVOUS NAVIGATION PROCESS. RESET OF THIS FLAG INTERRUPTS THE AUTOMATIC ATTITUDE MANEUVER/OPTICS POINTING PROCESS, AS WELL AS THE STATE VECTOR UPDATE PROCESS. THE SET OF THIS FLAG ENABLES ALL THESE PROCESSES. SET BY P17, 20, 30, 31, 34, 35, 38, 39, 74, 75, 76, 77, 78, 79 SELECTION. RESET BY AN V37EXXE

UPDATE FLAG- CONTROLS THE TEMPORARY TERMINATION OF THE STATE VECTOR UPDATE PROCESS ONLY. SET BY P17, 20, 30, 31, 34, 35, 38, 39, 74, 75, 77, 78, 79 SELECTION. RESET BY ANY V37EXXE AND IT IS ALSO RESET AND SET DURING THE PRETHRUST COMPUTATIONS TO PROTECT ERASABLE MEMORY.

PREFERRED ATTITUDE FLAG-DEFINES WHICH ATTITUDE THE SPACECRAFT IS TO BE ALIGNED TO BY R61. SET BY TURN ON OF P20, OR V76E. RESET BY V77E.

STICK FLAG - RESET BY EXECUTION OF A PROGRAM CHANGE VIA R00 AND BY V58E. SET BY TAKING RHC OUT OF DETENT WHEN THE SC CONTROL SWITCH IS CMC AND WHEN THE THC IS NOT CLOCKWISE. CDU RATE DRIVE IS NOT PERFORMED IF THE STICK FLAG IS SET.

STATE VECTOR FLAG - DEFINES WHICH STATE VECTOR WILL BE UPDATED BY SIGHTING MARKS AND VHF RANGING. SET TO LM BY P20 TURN ON AND V80E. SET TO CSM BY V81E.

PCR 606 ++ +22 ++ VHF RANGE FLAG - SET BY V87E, RESET BY V88E, AND BY ANY EXECUTION OF A PROGRAM CHANGE VIA R00. ALLOWS AUTOMATIC VHF RANGE DATA TO BE USED BY THE RENDEZVOUS DATA PROCESSING ROUTINE (P22).

(6) THIS PROGRAM IS SELECTED BY THE ASTRONAUT BY DSKY ENTRY. IT MAY BE TERMINATED BY THE SELECTION OF THE CMC IDLING PROGRAM (P00), CMC POWER DOWN PROGRAM (P06), THE ORBITAL NAVIGATION PROGRAM (P22), THE CISLUNAR NAVIGATION PROGRAM (P23) OR BY V56E. P00 SELECTION WILL TERMINATE P20 AND ANY OTHER PROGRAM IN PROCESS AND ESTABLISH P00. ALL OTHER PROGRAMS SELECTED WILL CHANGE THE PROGRAM NUMBER DISPLAYED ON THE DSKY BUT WILL NOT TERMINATE P20. THIS PROGRAM IS DESIGNED TO OPERATE AUTOMATICALLY AND SIMULTANEOUSLY WITH ANOTHER PROGRAM WITHOUT REQUIRING USE OF THE DSKY UNLESS NON-NOMINAL CIRCUMSTANCES REQUIRE CMC COMMUNICATION WITH THE ASTRONAUT. IF V56E IS KEYED INTO THE DSKY AND P20 IS THE ONLY PROGRAM RUNNING, ROUTINE R00 WILL BE INITIATED.

(7) W MATRIX INITIALIZATION FOR RENDEZVOUS MAY BE ENABLED (RESET RENDWFLAG) IN ANY OF THE FOLLOWING WAYS:

(A) KEYING IN OF VERB 93E

(B) COMPUTER FRESH START (KEYING IN OF VERB 36E)

(C) STATE VECTOR UPDATE FROM THE GROUND

(D) STATE VECTOR CALCULATION MADE DURING ENTRANCE TO P22, OR P23.

(E) CHANGES TO INITIALIZATION PARAMETERS IN V67

(8) THERE IS A RENDEZVOUS OPTICS MARK COUNTER USED IN THE CMC TO COUNT THE NUMBER OF OPTICS MARKS USED TO CHANGE EITHER STATE VECTOR AND THERE IS A RENDEZVOUS VHF RANGING MARK COUNTER USED IN THE CMC TO COUNT THE NUMBER OF VHF RANGING MARKS USED TO CHANGE EITHER STATE VECTOR.

THESE COUNTERS ARE ZEROED BY SEVERAL DISTINCT EVENTS, THEY ARE:

(A) KEYING IN OF V37E20E (INITIATION OF (P20)).

(B) COMPLETION OF THE TARGET DELTA V PROGRAM (P76).

(C) SELECTION OF A NEW PROGRAM FROM A PROGRAM WHICH HAD TURNED ON AVERAGE G (SEE R00 LOGIC).

(D) INITIALIZATION OF THE W MATRIX FOR RENDEZVOUS (FOR ANY REASON, SEE ASSUMPTION 7).

(E) SELECTION OF RETURN TO EARTH PROGRAM (P37)

(9) SUMMARY OF EXTENDED VERBS ASSOCIATED WITH THE PROGRAM:

V44E - SET SURFACE FLAG-CAUSES TRACKING OF THE LANDING SITE BASED ON THE STORED LANDING SITE
V45E - RESET SURFACE FLAG-CAUSES TRACKING OF THE LM BASED ON THE LM STATE VECTOR
V54E - DO R23 - ALLOWS BACK-UP MARKING ON THE LM.
V56E - RESET THE RENDEZVOUS FLAG. CAUSES TERMINATION OF P20.
V57E - DO R21 - ALLOWS OPTICS MARKING ON THE LM.
V58E - RESET STICK FLAG - ALLOW AUTO MANEUVERS
V67E - W-MATRIX RMS ERROR DISPLAY
V76E - SET PREFERRED ATTITUDE FLAG - DRIVE TO PREFERRED ATTITUDE
V77E - RESET PREFERRED ATTITUDE FLAG - DRIVE TO +X-AXIS ATTITUDE
V90E - SET STATE VECTOR FLAG TO LM. DATA WILL UPDATE LM STATE VECTOR
V91E - SET STATE VECTOR FLAG TO CSM. DATA WILL UPDATE CSM STATE VECTOR
V87E - SET VHF RANGE FLAG - ALLOWS R22 TO ACCEPT RANGE DATA.
V88E - RESET VHF RANGE FLAG - STOPS ACCEPTANCE OF RANGE DATA.
V93E - RESET RENDWFLAG - CAUSE INITIALIZATION OF W MATRIX FOR RENDEZVOUS AT NEXT DATA INCORPORATION

6

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INCOMPLETE SUMMARY OF ADDITIONAL DATA OR JOBS AVAILABLE WHILE THIS PROGRAM IS OPERATING:
     P17 - AVAILABLE BY KEYING IN V37E17E
     P30 - AVAILABLE BY KEYING IN V37E30E
     P31 - AVAILABLE BY KEYING IN V37E31E
     P34 - AVAILABLE BY KEYING IN V37E34E
     P35 - AVAILABLE BY KEYING IN V37E35E
     P38 - AVAILABLE BY KEYING IN V37E38E
     P39 - AVAILABLE BY KEYING IN V37E39E
     P74 - AVAILABLE BY KEYING IN V37E74E
     P75 - AVAILABLE BY KEYING IN V37E75E
     P76 - AVAILABLE BY KEYING IN V37E76E
     P77 - AVAILABLE BY KEYING IN V37E77E
     P78 - AVAILABLE BY KEYING IN V37E78E
     P79 - AVAILABLE BY KEYING IN V37E79E
     R03 - AVAILABLE BY KEYING IN V48E
     R30 - AVAILABLE BY KEYING IN V82E
     R31 - AVAILABLE BY KEYING IN V83E
     R34 - AVAILABLE BY KEYING IN V85E
     N09 - AVAILABLE BY KEYING IN V15N09E
     N20 - AVAILABLE BY KEYING V16N20E
     N22 - AVAILABLE BY KEYING V16N22E
     N36 - AVAILABLE BY KEYING V16N36E
     N91 - AVAILABLE BY KEYING V16N91E
     N92 - AVAILABLE BY KEYING V16N92E
     N95 - AVAILABLE BY KEYING V16N95E
     N96 - AVAILABLE BY KEYING V16N96E
     V46E- AVAILABLE BY KEYING IN V46E
     V60 - AVAILABLE BY KEYING V60E
     V61 - AVAILABLE BY KEYING V61E
     V62 - AVAILABLE BY KEYING V62E
     V63 - AVAILABLE BY KEYING V63E
     V96E- AVAILABLE BY KEYING V96E
```

```
PROG         CMC              GROUND            CREW                                 CHECKLIST         TIME       TOTAL
CONT                                                                                                              TIME


                                                          .CREW
                                                          .PROGRAM
                                                          .SELECTION
                                                          .
                                                         ...
                                                          .
      --------------------                    --------------------
      START RENDEZVOUS      .                 KEY IN RENDEZVOUS
      NAVIGATION PROGRAM   ...................NAVIGATION PROGRAM                                                 #10
      (P20).                .                 (P20)
      DISPLAY P20                               V37E20E                                             1A
                                              --------------------
```

```
                                      .   --------------------
                     .................... MONITOR DSKY:
                                      .       OBSERVE DISPLAY
                                          OF P20
--------------------                      --------------------
          .
          .
          .
--------------------                  .   --------------------
DO IMU STATUS CHECK  .................... DO IMU STATUS CHECK
ROUTINE (R02)                         .   ROUTINE (R02)
--------------------                      --------------------
          .
          .
          .
--------------------
SET THE PREFERRED
ATTITUDE FLAG
--------------------
          .
          .
          .
--------------------
SET THE STATE VECTOR
FLAG TO THE LM
--------------------
          .
          .
          .
--------------------
SET TRACK FLAG
--------------------
          .
          .
          .
          .
--------------------
SET UPDATE FLAG
--------------------
          .
          .
          .
--------------------
SET RENDEZVOUS FLAG
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          .
          .
          .
--------------------
ZERO THE RENDEZVOUS
OPTICS MARK COUNTER.
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                 .
--------------------
ZERO THE RENDEZVOUS
VHF RANGING MARK
COUNTER.
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                 .
                 .
                 .
--------------------
EXTRAPOLATE PERMA-
NENT STATE VECTORS
(LM AND CSM) TO THE
PRESENT TIME USING
PRECISION INTEGRA-
TION.
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                 .
                 .
                 .
   REDO          .
   P20           .
      .          .
      .          .
      .          .
   ...           .
      .          .
--------------------
IS TRACK FLAG SET?
--------------------
      .Y            .N
      .             .
      .             .
      .           ...
      .             .
      .           EXIT
      .
      .
--------------------
IS THE REFSMMAT FLAG
SET?
--------------------
      .Y     .N
      .      .
      .      .
      .    ...
      .      .
      .    EXIT
      .
      .
      .
      .
      .
      .
      .
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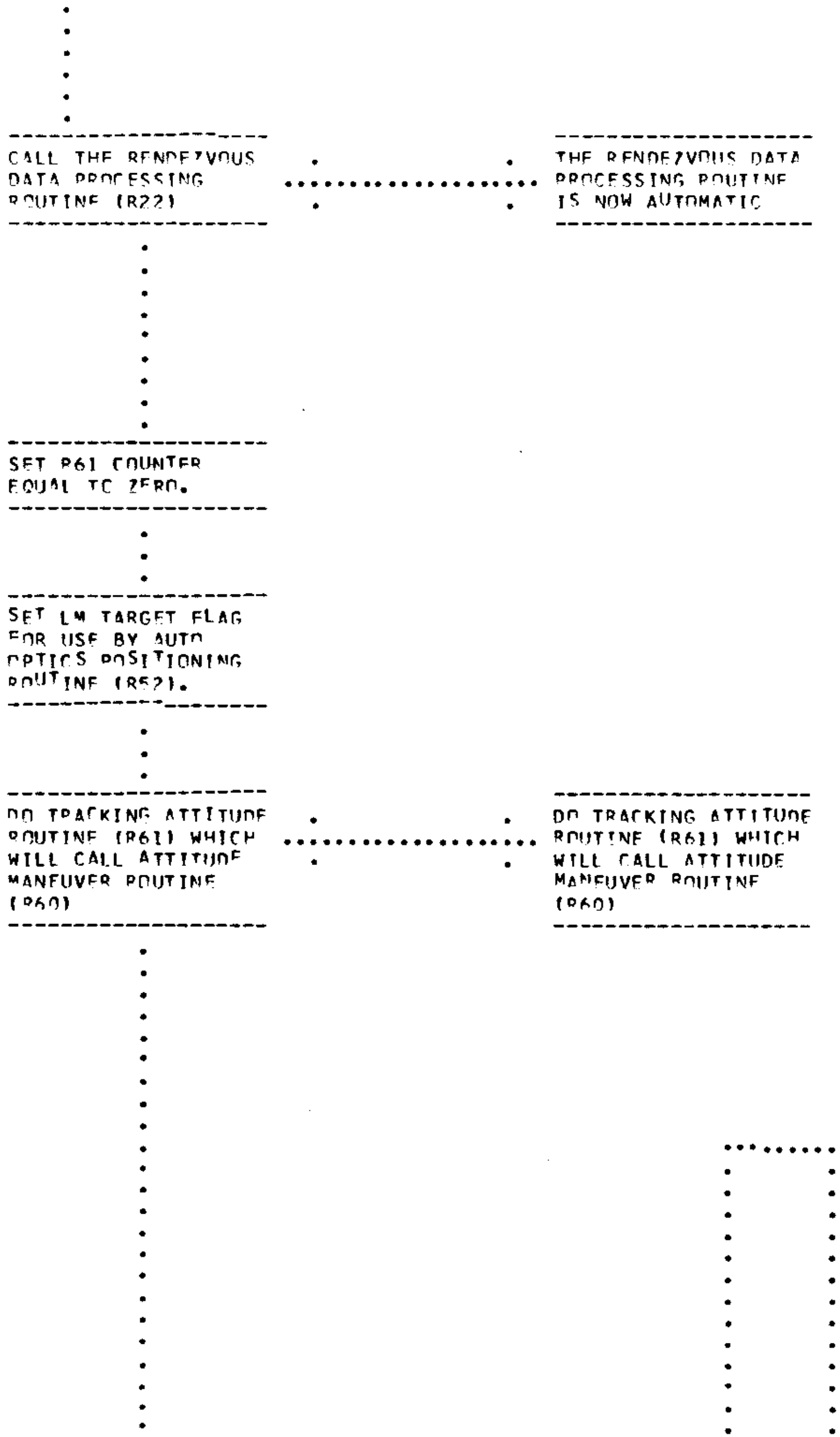
      .
      .
      .
```

++
+22
++
PCR
606


CALL THE RENDEZVOUS DATA PROCESSING ROUTINE (R22)
THE RENDEZVOUS DATA PROCESSING ROUTINE IS NOW AUTOMATIC
SET R61 COUNTER EQUAL TO ZERO.
SET LM TARGET FLAG FOR USE BY AUTO OPTICS POSITIONING ROUTINE (R52).
DO TRACKING ATTITUDE ROUTINE (R61) WHICH WILL CALL ATTITUDE MANEUVER ROUTINE (R60)
DO TRACKING ATTITUDE ROUTINE (R61) WHICH WILL CALL ATTITUDE MANEUVER ROUTINE (R60)

#130

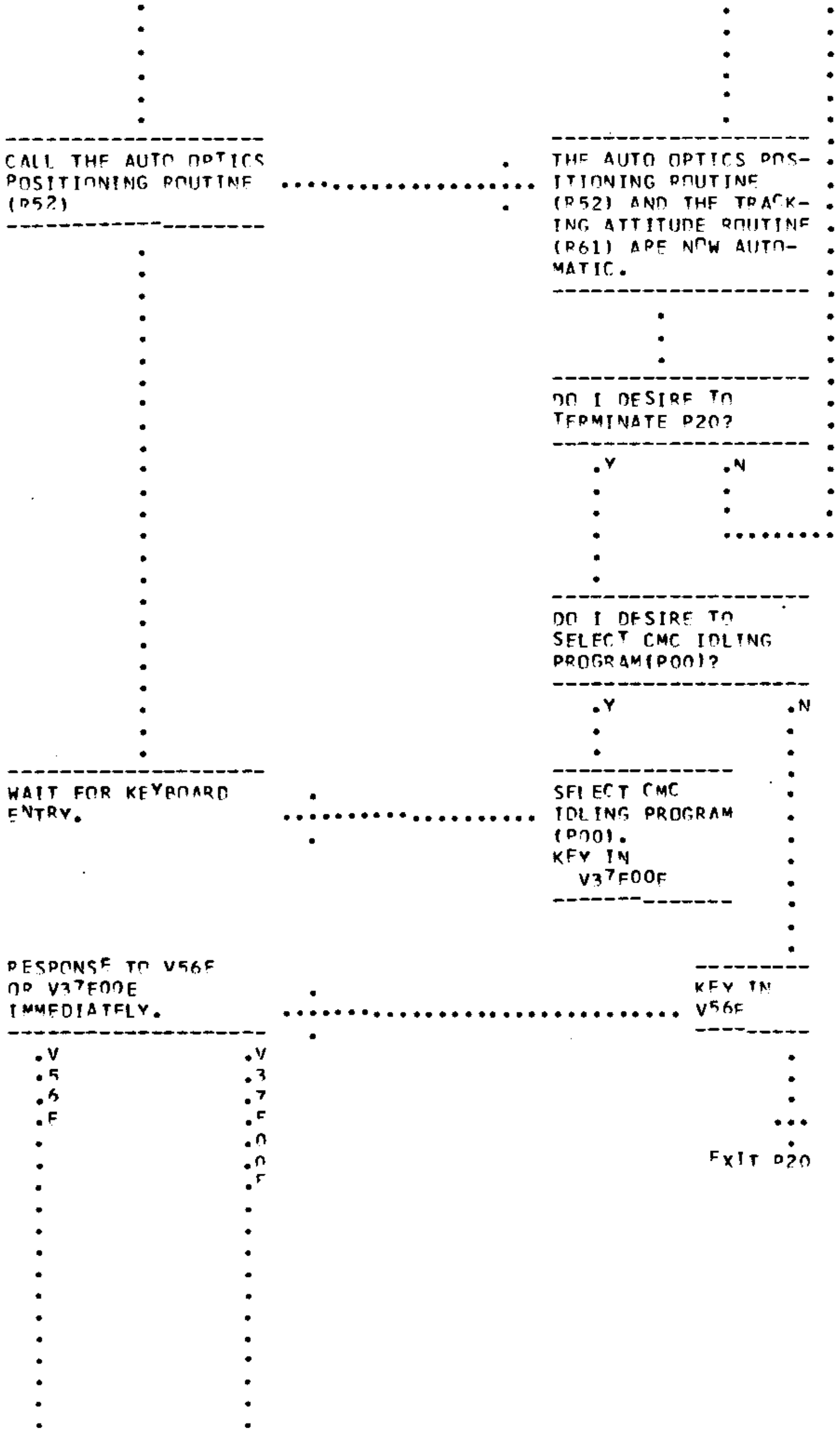
#140

#150

#160

++
+22
++
PCR
606

#170


CALL THE AUTO OPTICS POSITIONING ROUTINE (R52)
THE AUTO OPTICS POSITIONING ROUTINE (R52) AND THE TRACKING ATTITUDE ROUTINE (R61) ARE NOW AUTOMATIC.
DO I DESIRE TO TERMINATE P20?
Y
N
DO I DESIRE TO SELECT CMC IDLING PROGRAM(P00)?
Y
N
WAIT FOR KEYBOARD ENTRY.
SELECT CMC IDLING PROGRAM (P00). KEY IN V37E00E
RESPONSE TO V56E OR V37E00E IMMEDIATELY.
KEY IN V56E
V56E
V37E00E
EXIT P20

#180

#190

#200

#210

#220

1A

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  .                .
  .                .
  .                .
  .                .
  .   --------------                      --------------------
  .   GO TO CMC                        .  OBSERVE
  .   IDLING PROGRAM .......................DISPLAY OF P00.
  .   (P00) VIA R00                    .  --------------------
  .   (NOTE: P00                                   .
  .   WILL TERMINATE                               .
  .   THE RENDEZVOUS,                             ...
  .   TRACK, AND UP-                               .
  .   DATE FLAGS AND                           EXIT P20
  .   ALSO THE AUTO
  .   OPTICS POSI-
  .   TIONING ROU-
  .   TINE (R52))
  .   AND THE RENDZ-
  .   VOUS DATA PRO-
  .   CESSING ROUT-
  .   INE (R22)
  .   --------------
  .               .
  .               .
---------         .
TERMINATE         .
THE REN-          .
DEZVOUS,          .
TRACK,            .
AND, UP-          .
DATE              .
FLAGS AND         .
THE AUTO          .
OPTICS            .
POSITION-         .
ING ROU-          .
TINE              .
(R52)             .
AND THE           .
RENDEZ-           .
VOUS DATA         .
PROCESS-          .
ING ROUT-         .
INE (R22)         .
---------         .
  .               .
  .               .
  .               .
---------         .
IS P20 THE        .
ONLY PRO-         .
GRAM RUN-         .
NING?             .
---------         .
  .Y   .N         .
  .    .          .
  .    .          .
  .   ...        ...
  .    .          .
  .    .          .
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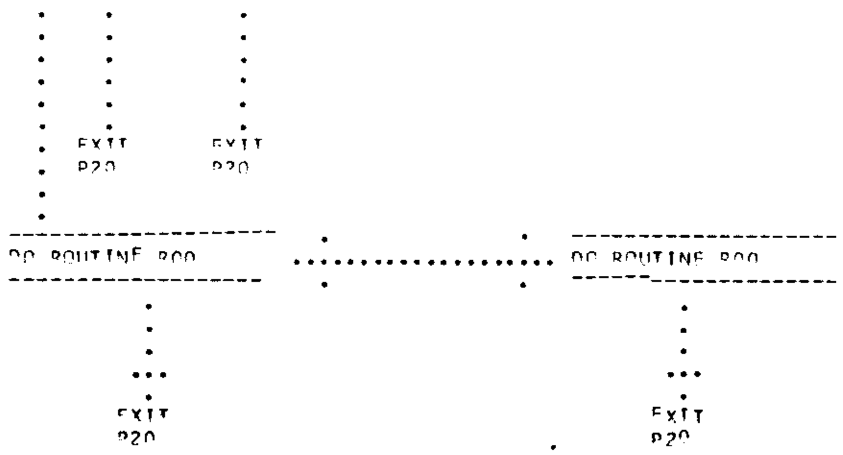
  .    .          .
  .    .          .
```

13


EXIT
P20
EXIT
P20
DO ROUTINE R00
DO ROUTINE R00
EXIT
P20
EXIT
P20

#290

#290

CHANGE CONTROL NOTES

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LOGIC REV 18  PCR NASA 147
LOGIC REV 19  PCR MIT 66
LOGIC REV 20  PCR      468
              PCR      206
              PCR      465
LOGIC REV 21  PCN      579
LOGIC REV 22  PCR      605
```

1A

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GROUND TRACK DETERMINATION PROGRAM (P21)   LOGIC   REV 06   07/08/68

PURPOSE: (1) TO PROVIDE THE ASTRONAUT DETAILS OF HIS GROUND TRACK WITHOUT THE NEED FOR GROUND COMMUNICATION.

ASSUMPTIONS: (1) THE PROGRAM IS SELECTED BY THE ASTRONAUT BY DSKY ENTRY.

(2) THIS PROGRAM MAY BE SELECTED WHILE THE CSM IS IN EITHER EARTH OR LUNAR ORBIT TO DEFINE THE GROUND TRACK OF EITHER THE LM OR CSM.

(3) THIS PROGRAM ASSUMES THE VEHICLE WHOSE GROUND TRACK PARAMETERS ARE CALCULATED TO REMAIN IN FREE FALL FROM THE PRESENT TIME UNTIL T LAT LONG.

```
  PROG             CMC               GROUND              CREW                                CHECKLIST              TIME       TOTAL
  CONT                                                                                                                          TIME


                                                             .CREW
                                                             .PROGRAM
                                                             .SELECTION
                                                             .
                                                            ...
                                                             .
          --------------------                      --------------------
          START GROUND TRACK      .                 KEY IN GROUND TRACK
          DETERMINATION         ................... DETERMINATION
          PROGRAM (P21).          .                 PROGRAM (P21)                                                          #10
          DISPLAY PROGRAM 21                           V37E21E
                                                    --------------------
                                                             .
                                                             .
                                                             .
                                                    --------------------
                                                 .  MONITOR DSKY:
                                ...................: OBSERVE DISPLAY OF
                                                 .  PROGRAM 21
          --------------------                      --------------------                                                   #20
                     .                                       .
                     .                                       .
                     .                                       .
                     .      ........                         .        .....
                     .      .      .                         .        .   .
                     .      .      .                         .        .   .
                     .      .      .                         .        .   .
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                     .      .      .                         .        .   .
                     .      .      .                         .        .   .
                     .      .      .                         .        .   .
                     .      .      .                         .        .   .
                     .      .      .                         .        .   .                                     P21/COLOSSUS
                     .      .      .                         .        .   .                                     P21/LUMINARY
```

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              .      .      .                         .        .   .
              .      .      .                         .        .   .
              .      .      .                         .        .   .
              .      .      .                         .        .   .
              .      .      .                         .        .   .
    --------------------    .                 -------------------- .
    FLASH VERB-NOUN TO      .                 MONITOR DSKY:        .
    REQUEST RESPONSE AND    .         .         OBSERVE VERB-NOUN  .
    DISPLAY OPTION CODE     .   .........     FLASH TO REQUEST     .
    FOR ASSUMED VEHICLE     .         .       RESPONSE AND DISPLAY .
    (LM OR CSM)             .                 OF OPTION CODE FOR   .
       V04 N06              .                 ASSUMED VEHICLE      .
       R1 00002             .                 (LM OR CSM).         .
       R2 0000X             .                 -------------------- .
       R3 BLANK             .                         .            .
                            .                         .            .
    R1 IS THE OPTION        .                         .            .
    CODE FOR ASSUMED        .                 -------------------- .
    VEHICLE.                .                 IS THE ASSUMED       .
                            .                 OPTION CORRECT?      .
    R2 IS THE ASSUMED       .                 -------------------- .
    OPTION:                 .                  .Y             .N   .
       00001 - THIS         .                  .              .    .
               VEHICLE      .                  .              .    .
       00002 - OTHER        .                  .              .    .
               VEHICLE      .                  .              .    .
    --------------------    .                  .              .    .
              .             .                  .              .    .
              .             .                  .              .    .
              .             .                  .              .    .
    --------------------    .                 --------        .    .
    WAIT FOR KEYBOARD       .      .          KEY IN          .    .
    ENTRY                   .   ...........   PROCEED         .    .
                            .      .          --------        .    .
                            .                                 .    .
                            .                                 .    .
                            .                    ------------------.
                            .                    KEY IN V22E       .
                            .      .             AND LOAD THE      .
                            .   ...........      DESIRED OPTION    .
    TERMINATE FLASH UPON    .      .             INTO R2           .
    RECEIPT OF PROCEED      .                    ------------------.
    OR NEW DATA.            .                                 .    .
    --------------------    .                                 .    .
         .P        .NEW     .                                 .    .
         .R        .DATA    .                                 ......
         .O        .        .
         .C      -------    .
         .E      STORE      .
         .E      NEW        .
         .D      DATA       .
         .       -------    .
         .           .      .
         .           .      .
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     .  .  . . .                                            .   .        . .
     .  .  . . .                                            .   .        . .
HOLD .. . --------------------                      -------------------- . .
......... FLASH VERB-NOUN TO                 .      MONITOR DSKY:        . .
SNAP .. . REQUEST RESPONSE AND     .............    OBSERVE VERB-NOUN    . .
     .  . DISPLAY T LAT LONG:                .      FLASH TO REQUEST     . .
     .  .    V06 N34                                RESPONSE AND DISPLAY . .
     .  .    R1-T LAT LONG-HRS                      OF T LAT LONG. AM I  . .
     .  .    R2-T LAT LONG-MIN                      SATISFIED WITH THIS  . .
     .  .    R3-T LAT LONG-SECS                     TIME?                . .
     .  .                                           -------------------- . .
     .  . T LAT LONG - TIME                                 .N     .Y    . .
     .  . (GET) AT WHICH LAT                                .      .     . .
     .  . AND LONG OF VEHICLE                               .      .     . .
     .  . POSITION IS DESIRED                               .      .     . .
     .  . IN HRS, MINS, SECS                                .      .     . .
     .  . TO NEAREST .01 SEC.                               .      .     . .
     .  . --------------------                              .      .     . .
     .  .          .                                        .      .     . .
     .  .          .                                        .      .     . .
     .  .          .                                        .      .     . .
     .  . --------------------                              .  --------- . .
     .  . WAIT FOR KEYBOARD          .                      .  KEY IN    . .
     .  . ENTRY                ...........                  .  PROCEED   . .
     .  .                            .                      .  --------- . .
     .  .                                                   .            . .
     .  .                                                   .            . .
     .  . TERMINATE FLASH UPON                      -------------------- . .
     .  . RECEIPT OF NEW DATA        .              KEY IN V25E AND LOAD . .
     .  . OR PROCEED           ..........           DESIRED T LAT LONG.  . .
     .  . --------------------       .              -------------------- . .
     .  .    .NEW   .P                                          .        . .
     .  .    .DATA  .R                                          .        . .
     .  .    .      .C                                          .        . .
     .  . ------    .C                                          .......... .
     .  . STORE     .E                                                     .
     .  . NEW       .E                                                     .
     .  . DATA      .D                                                     .
     .  . ------    .                                                      .
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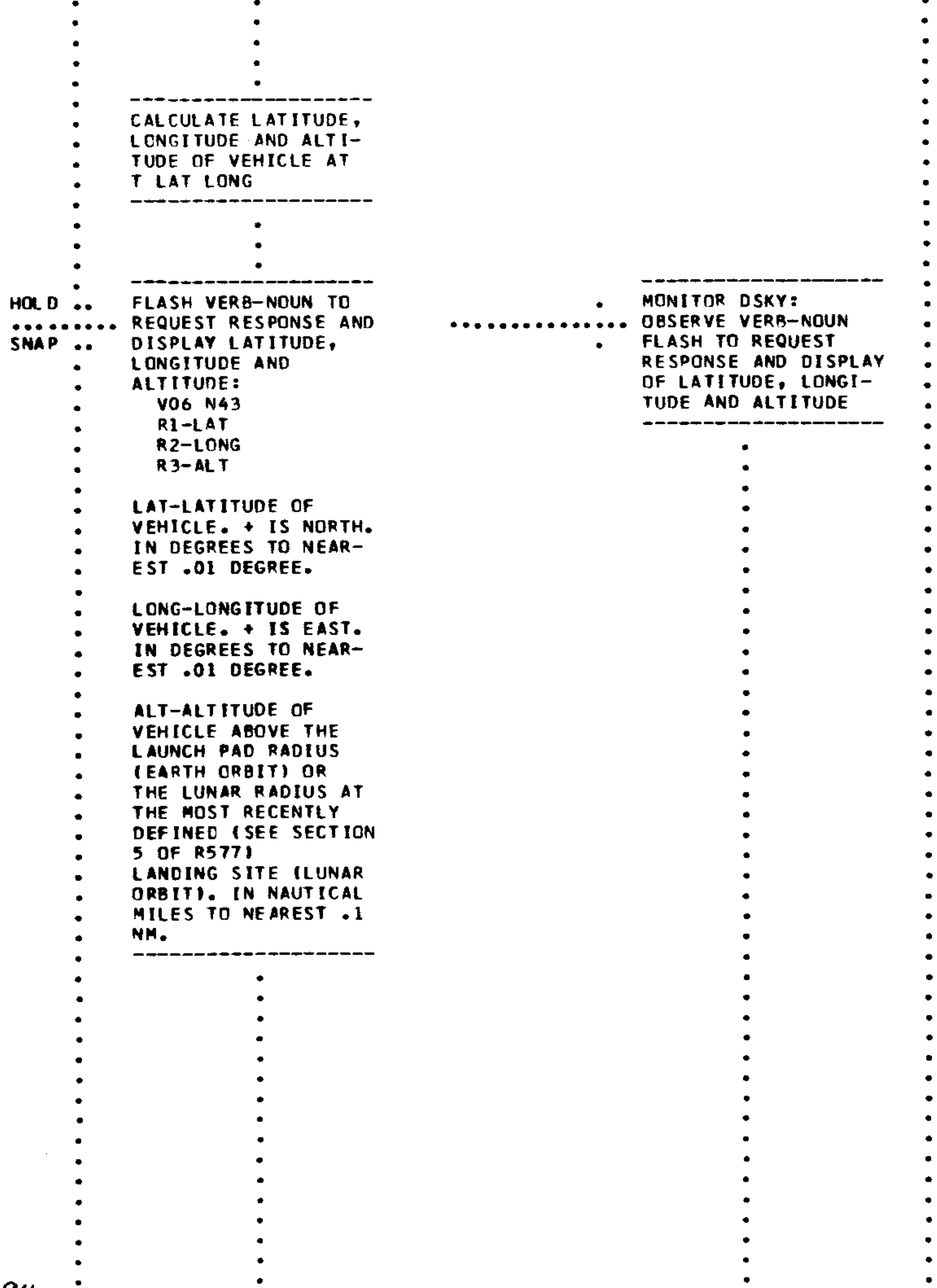


CALCULATE LATITUDE, LONGITUDE AND ALTITUDE OF VEHICLE AT T LAT LONG

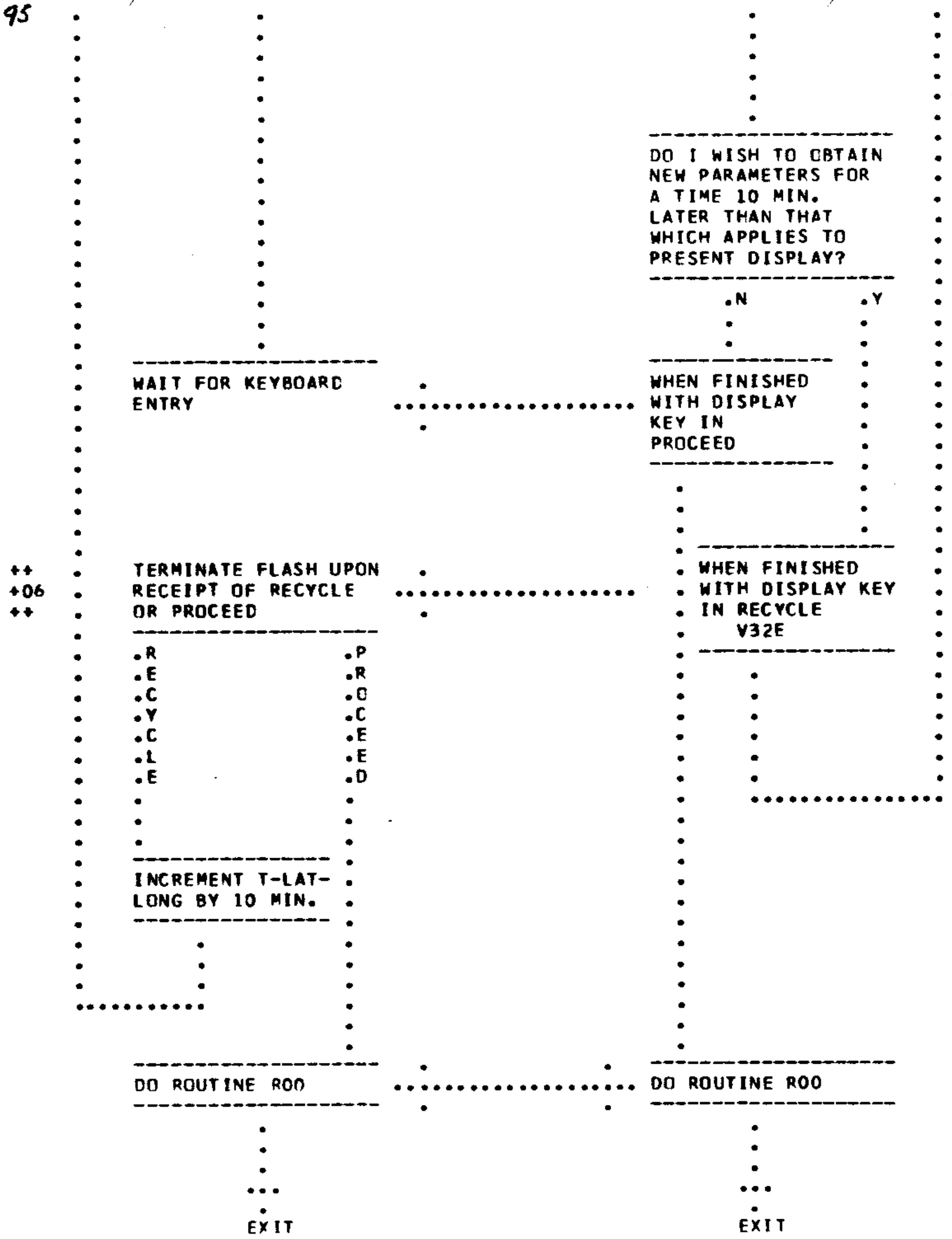
FLASH VERB-NOUN TO REQUEST RESPONSE AND DISPLAY LATITUDE, LONGITUDE AND ALTITUDE:
V06 N43
R1-LAT
R2-LONG
R3-ALT

LAT-LATITUDE OF VEHICLE. + IS NORTH. IN DEGREES TO NEAREST .01 DEGREE.

LONG-LONGITUDE OF VEHICLE. + IS EAST. IN DEGREES TO NEAREST .01 DEGREE.

ALT-ALTITUDE OF VEHICLE ABOVE THE LAUNCH PAD RADIUS (EARTH ORBIT) OR THE LUNAR RADIUS AT THE MOST RECENTLY DEFINED (SEE SECTION 5 OF R577) LANDING SITE (LUNAR ORBIT). IN NAUTICAL MILES TO NEAREST .1 NM.

MONITOR DSKY: OBSERVE VERB-NOUN FLASH TO REQUEST RESPONSE AND DISPLAY OF LATITUDE, LONGITUDE AND ALTITUDE


DO I WISH TO OBTAIN NEW PARAMETERS FOR A TIME 10 MIN. LATER THAN THAT WHICH APPLIES TO PRESENT DISPLAY?
N
Y
WAIT FOR KEYBOARD ENTRY
WHEN FINISHED WITH DISPLAY KEY IN PROCEED
++
+06
++
TERMINATE FLASH UPON RECEIPT OF RECYCLE OR PROCEED
WHEN FINISHED WITH DISPLAY KEY IN RECYCLE V32E
RECYCLE
PROCEED
INCREMENT T-LAT-LONG BY 10 MIN.
DO ROUTINE R00
DO ROUTINE R00
EXIT
EXIT

LOGIC REV 6   PCR 206

PURPOSE:

(1) TO LOCATE AND TRACK A LANDMARK SUITABLE FOR NAVIGATION PURPOSES.

(2) TO OBTAIN SIGHTING MARKS ON THE CHOSEN LANDMARK.

(3) TO CALCULATE THE ORBITAL PARAMETER CHANGES GENERATED BY THE LANDMARK SIGHTING MARKS.

(4) TO DISPLAY THE ORBITAL PARAMETER CHANGES GENERATED BY THE FIRST SIGHTING MARK ON A LANDMARK, FOR DECISION BY THE NAVIGATOR/GROUND AS TO THE VALIDITY OF THE LANDMARK AND NAVIGATION PROCESS PRIOR TO INCORPORATION OF STATE VECTOR CHANGES AS A RESULT OF THE SIGHTING MARKS.

(5) TO PROVIDE UPDATED COORDINATES OF THE KNOWN LANDMARKS.

(6) TO PROVIDE COORDINATES OF UNKNOWN LANDMARKS.

(7) TO TRACK A PRELOADED LANDING SITE.

(8) TO PROVIDE COORDINATES OF A NEW LANDING SITE(TREATED AS AN UNKNOWN LANDMARK)

(9) TO PROVIDE COORDINATES OF AN OFFSET LANDING SITE.

(10) TO POINT THE OPTICS ALONG AN ADVANCED ORBIT GROUND TRACK FOR THE PURPOSE OF TRACKING AND MAPPING A NEW LANDING SITE.

ASSUMPTIONS:

(1) THERE ARE 25 KNOWN LUNAR LANDMARKS STORED IN FIXED MEMORY IN THE CMC AND ONE LANDMARK MAY BE STORED IN ERASABLE MEMORY IN THE CMC. THE LANDMARK STORED IN ERASABLE MEMORY IS REFERRED TO AS THE LANDING SITE AND IS DESIGNATED BY LANDMARK CODE NUMBER 01, THIS CODE IS AVAILABLE FOR LUNAR LANDMARK STORAGE ONLY.

(2) THERE ARE TWO TYPES OF LANDMARK TRACKING METHODS:

(A) "KNOWN" LANDMARK TRACKING - THE TRACKING OF AN EARTH LANDMARK MADE KNOWN TO THE CMC BY LATITUDE, LONGITUDE OVER 2, AND ALTITUDE AND THE TRACKING OF A LUNAR LANDMARK MADE KNOWN TO THE CMC BY ITS LANDMARK CODE NUMBER OR BY LATITUDE, LONGITUDE OVER 2, AND ALTITUDE.

(B) "(UNKNOWN)" LANDMARK TRACKING - THE TRACKING OF A LANDMARK OR SURFACE FEATURE IDENTIFIED TO THE CMC AS AN UNKNOWN LANDMARK, ONE WHOSE COORDINATES ARE NOT KNOWN.

(3) THERE ARE TWO TYPES OF LANDING SITE MAPPING METHODS, IN EITHER CASE THE LANDING SITE COORDINATES MAY BE STORED IN CMC MEMORY (REFER TO ASSUMPTION 1), THEY ARE:

(A) LANDING SITE DESIGNATION - TRACK AND MARK ON AN UNKNOWN LANDMARK. STORE THE RESULTING COORDINATES IN LANDMARK CODE 01. IF MAPPING ONLY IS DESIRED, I.E. NO STATE VECTOR CALCULATION OR CORRECTIONS, THE ASTRONAUT NEED TAKE ONLY ONE MARK.

(B) LANDING SITE OFFSET - WHILE TRACKING AND MARKING ON A PRIMARY LANDMARK (KNOWN OR UNKNOWN), POINT THE
++ OPTICS SLOS AT THE CHOSEN LANDING SITE AND MARK IT ONCE, (AT LEAST ONE MARK ON THE PRIMARY LANDMARK MUST
+10 HAVE BEEN MADE PRIOR TO THIS), THEN CONTINUE MARKING ON THE PRIMARY LANDMARK. STORE THE RESULTING
++ COORDINATES OF THE OFFSET LANDING SITE IN LANDMARK CODE 01. THE ASTRONAUT HAS TWO WAYS OF DEFINING TO
PCN THE CMC WHICH MARK WAS MADE ON THE OFFSET LANDING SITE. THEY ARE:
552

1. KEY IN V52E AFTER MARKING ON THE OFFSET LANDING SITE. THIS WILL SET THE INDEX OF OFFSET DESIGNATOR EQUAL TO THE VALUE OF THE MARK COUNTER.

2. SIMPLY MARK ON THE OFFSET LANDING SITE BUT MAKE A MENTAL NOTE OF WHICH MARK IN THE SEQUENCE IT WAS AND THEN SET THE INDEX OF OFFSET DESIGNATOR TO THAT VALUE WHEN IT IS DISPLAYED FOLLOWING THE SIGHTING MARK ROUTINE.

(4) ACQUISITION OF A LANDMARK MAY BE AIDED BY THE CMC BY USE OF THE AUTOMATIC OPTICS POSITIONING ROUTINE (R52). CARE SHOULD BE EXERCISED WHEN AN UNKNOWN LANDMARK IS CHOSEN TO KEEP THE OPTICS OUT OF THE CMC MODE TO AVOID POSSIBLE PROGRAM ALARMS.

(5) ACQUISITION OF A PRELOADED LANDING SITE MAY BE AIDED BY KEYING LANDMARK CODE 01 INTO THE V05N70 DISPLAY FOR USE BY THE AUTOMATIC OPTICS POSITIONING ROUTINE (R52). TO IMPROVE THESE COORDINATES REFER TO ASSUMPTION 3.

(6) DURING LUNAR ORBIT WHILE IN THE CMC IDLING PROGRAM (P00) THE LUNAR LANDMARK SELECTION ROUTINE (R35) IS AVAILABLE TO AID THE CREW IN THE SELECTION OF APPROPRIATE LANDMARKS PRIOR TO THE SELECTION OF THIS PROGRAM.

(7) THE GROUND TRACK DETERMINATION PROGRAM (P21) IS AVAILABLE TO AID THE CREW IN CHOOSING APPROPRIATE LANDMARKS PRIOR TO SELECTION OF THIS PROGRAM.

(8) THE GROUND TRACK DETERMINATION PROGRAM (P21) IS AVAILABLE TO THE CREW FOLLOWING THIS PROGRAM TO PROVIDE UPDATED GROUND TRACK INFORMATION.

(9) POSSIBLE ATTITUDE CONTROL METHODS MIGHT BE AS FOLLOWS (IN ALL CASES CARE MUST BE TAKEN TO MONITOR POSSIBLE IMPENDING IMU GIMBAL LOCK).

(A) MANUAL CONTROL BY THE PILOT OR NAVIGATOR WITH THE ROTATIONAL HAND CONTROLLER.

(B) MANUAL RATE CONTROL BY THE NAVIGATOR WITH THE MINIMUM IMPULSE CONTROL IN THE GNC FREE MODE.

(10) THE PROGRAM MAY BE PERFORMED WITH SIVB ATTACHED IF THE LAUNCH VEHICLE GUIDANCE SWITCH IS PLACED IN THE CMC POSITION THEREBY PERMITING SIVB ATTITUDE CONTROL WITH THE ROTATIONAL HAND CONTROLLER. GNC A/P CONTROL IS REQUIRED IN THIS CASE.

(11) THE IMU MUST BE ON AND ALIGNED IN ORDER TO COMPLETE THIS PROGRAM.

(12) SELECTION OF THIS PROGRAM WILL TERMINATE THE RENDEZVOUS NAVIGATION PROGRAM (P20).

(13) THE PROGRAM IS SELECTED BY THE ASTRONAUT BY DSKY ENTRY.

```
 PROG           CMC              GROUND            CREW                                 CHECKLIST             TIME       TOTAL
 CONT                                                                                                                     TIME


                                                        . CREW PROG.
                                                        . SELECTION
                                                       ...
                                                        .
        -------------------                     -------------------
        START ORBITAL          .                KEY IN ORBITAL
        NAVIGATION          ................... NAVIGATION PROGRAM
        PROGRAM (P22)          .                (P22)
        DISPLAY PROGRAM 22                      V37E22E
                                                -------------------                                             #10
                                                        .
                                                        .
                                                        .
                                              . -------------------
                            ................... MONITOR DSKY:
                                              . OBSERVE DISPLAY
                                                OF PROGRAM 22
        -------------------                     -------------------
                  .
                  .                                                                                             #20
                  .
                  .
        -------------------                     -------------------
        DO IMU STATUS CHECK    .              . DO IMU STATUS CHECK
        ROUTINE (R02)       ................... ROUTINE (R02)
        -------------------    .              . -------------------
                  .
                  .
                  .
                  .                                                                                             #30
        -------------------
        RESET THE RENDEZVOUS
        FLAG
        -------------------
                  .
                  .
                  .
        -------------------
        COMPUTE ANGLE BE-
        TWEEN Y AND V X R.                                                                                      #40
             -SM    -   -
        THIS ANGLE IS THE
        MAGNITUDE OF THE
        MAXIMUM POSSIBLE
        MIDDLE GIMBAL ANGLE
        ASSUMING THE SC X
        AXIS IS KEPT IN THE
        ORBIT PLANE.
        -------------------
                  .                                                                                             #50
                  .
                  .
                  .
                  .
                  .
                  .
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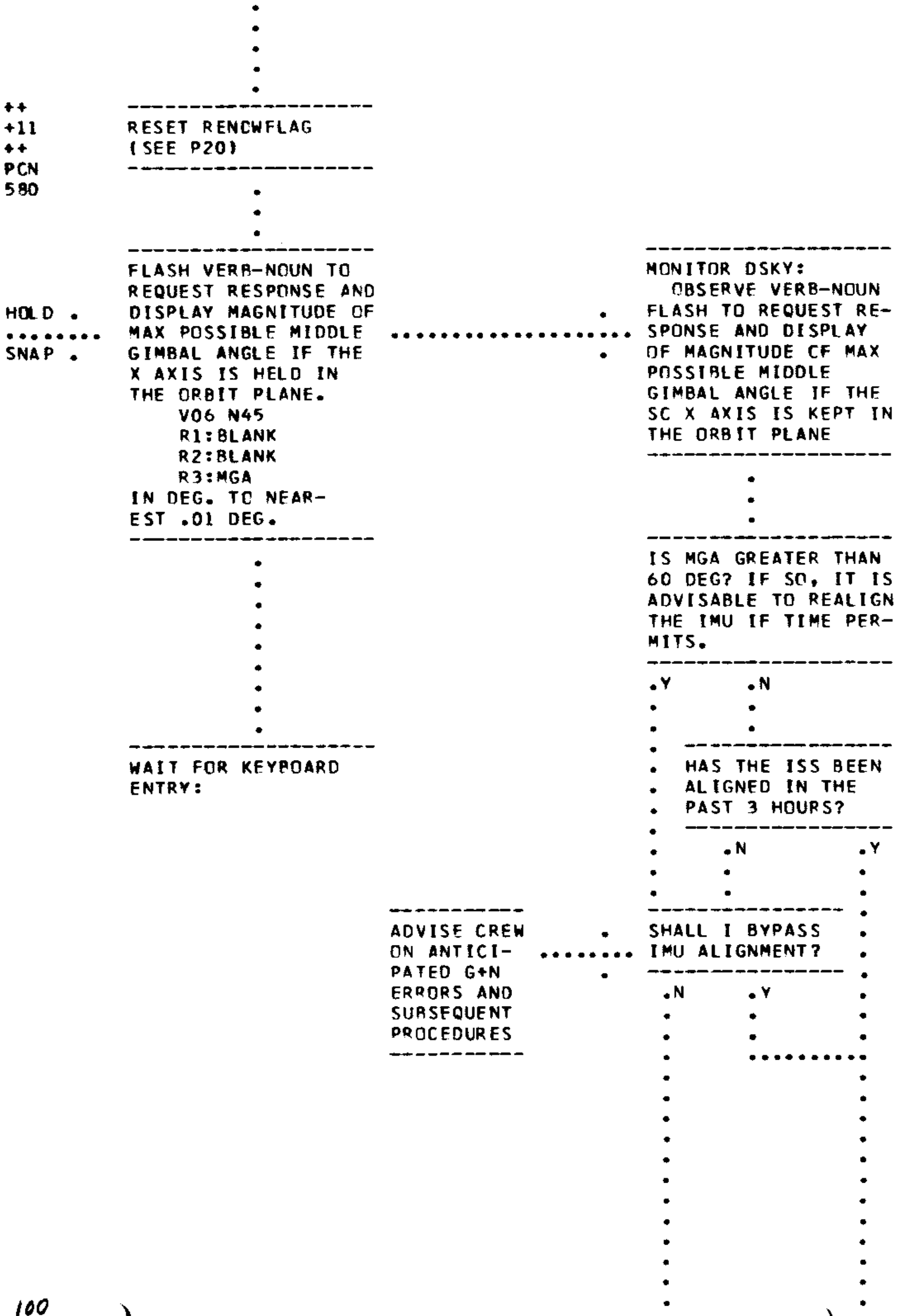

RESET RENDWFLAG (SEE P20)

FLASH VERB-NOUN TO REQUEST RESPONSE AND DISPLAY MAGNITUDE OF MAX POSSIBLE MIDDLE GIMBAL ANGLE IF THE X AXIS IS HELD IN THE ORBIT PLANE.
V06 N45
R1:BLANK
R2:BLANK
R3:MGA
IN DEG. TO NEAREST .01 DEG.

MONITOR DSKY:
OBSERVE VERB-NOUN FLASH TO REQUEST RESPONSE AND DISPLAY OF MAGNITUDE OF MAX POSSIBLE MIDDLE GIMBAL ANGLE IF THE SC X AXIS IS KEPT IN THE ORBIT PLANE

IS MGA GREATER THAN 60 DEG? IF SO, IT IS ADVISABLE TO REALIGN THE IMU IF TIME PERMITS.

WAIT FOR KEYBOARD ENTRY:

HAS THE ISS BEEN ALIGNED IN THE PAST 3 HOURS?

SHALL I BYPASS IMU ALIGNMENT?

ADVISE CREW ON ANTICIPATED G+N ERRORS AND SUBSEQUENT PROCEDURES

```
                                          .                .
                                          .                .
                                          .                .
                                          .                .
                                          .                .
                                          .                .
                                         ----------------  .
                                         SELECT IMU        .
                                         REALIGN (P52).    .
                                         WHEN COMPLETE,    .
                                         RESELECT THIS     .
                                         PROGRAM.          .
                                         ----------------  .
                                                .          .
                                                .          .
                                               ...         .          #110
                                                .          .
                                            EXIT P22       .
                                                           .
                                                           .
                                                           .
                                                           .
TERMINATE FLASH UPON                     --------------------
RECEIPT OF PROCEEC     .
OR NEW PROGRAM       ................... KEY IN PROCEED
--------------------   .                 --------------------
  .P           .NEW                             .                     #120
  .R           .PRCG                            .
  .O           .                                .
  .C          ...                               .
  .E           .                         --------------------
  .E          EXIT                       CONTROL ATTITUDE
  .D          P22                        FOR LANDMARK
  .                                      ACQUISITION
  .                                      --------------------
  .                                                                   #130
  .
  .     "A"
  .  SEE BELOW
  .      .
  .      .
  .      .
  .     ...
  .      .
--------------------
SET THE INDEX OF
OFFSET DESIGNATOR                                                     #140
EQUAL TO ZERO.
--------------------
          .
          .
          .
--------------------
RESET MARK CATA
VALID BIT FCR INFCR-
MATION TO DCWNLINK.
--------------------                                                  #150
          .
          .                                 "A"
          .                              SEE BELOW
          .                                 .
          .                                 .
          .                                 .
          .                                 .
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```
                    .                                        .
                    .                                        .
                    .                                        .
                    .                                        .
                    .                                        .
                    .                                       ...
                    .                                        .
          --------------------                      --------------------
          IS THE SPACECRAFT                         IS THE SPACECRAFT IN
          IN LUNAR ORBIT?                           LUNAR ORBIT?
          --------------------                      --------------------
              .N            .Y                          .Y            .N
              .             .                           .             .
              .             .                           .             .
             ...            .                           .            ...
              .             .                           .             .
            GO.TO           .                           .          GO.TO
             "B"            .                           .           "B"
            BELOW           .                           .          BELOW
                            .                           .
                            .                           .
                            .                       --------------------
                            .                       LUNAR ORBIT
                            .                       --------------------
                            .                                .
                            .                                .
                            .                                .
        .....               .                                .       ......
        .   .               .                                .       .    .
        .   .               .                                .       .    .
POSS    . --------------------                      --------------------  .
HOLD .  . FLASH VERB NOUN TO                        MONITOR DSKY:         .
......... REQUEST RESPONSE AND              .       OBSERVE VERB NOUN     .
SNAP .  . DISPLAY LMK CODE:         ..........      FLASH TO REQUEST      .
        .    V05N70                         .       RESPONSE AND DISPLAY  .
        .    R1-BLANK                               LMK CODE.             .
        .    R2 ABCDE                               TO HAVE THE AUTOMAT-  .
        .    R3-BLANK                               IC OPTICS POSITION-   .
        .                                           ING ROUTINE (R52)     .
        . A=1 IF KNOWN LMK                          POINT ALONG THE       .
        . A=2 IF UNKNOWN LMK.                       GROUND TRACK OF AN    .
        . B= INDEX OF OFFSET                        ADVANCED ORBIT AND    .
        .    DESIGNATOR                             60 DEGREES AHEAD OF   .
        . C= NOT USED IN THIS                       THE SPACECRAFT        .
        .    PROGRAM                                CHANGE THE LANDMARK   .
++      . DE-LMK ID NO N                            CODE TO PX (WHERE P   .
+11     .                                           >3 AND X DEFINES HOW  .
++      . NOTE: THE PROBABLE                        MANY ORBITS AHEAD     .
PCN     .       OPTIONS ARE:                        ARE DESIRED). THIS    .
594     .     A=1. DE=00-                           CODE IS USED ONLY BY  .
        .          LANDMARK                         THE AUTOMATIC OPTICS  .
        .          KNOWN BUT                        POSITIONING ROUTINE   .
        .          NOT STORED                       (R52) AT THIS TIME.   .
        .          IN CMC                           --------------------  .
        .          MEMORY                                    .            .
        .     A=1. DE>00-                                    .            .
        .          LANDMARK                                  .            .
        .          KNOWN AND                                 .            .
        .          STORED                                    .            .
        .                                                    .            .
        .                                                    .            .
        .                                                    .            .
        .                                                    .            .
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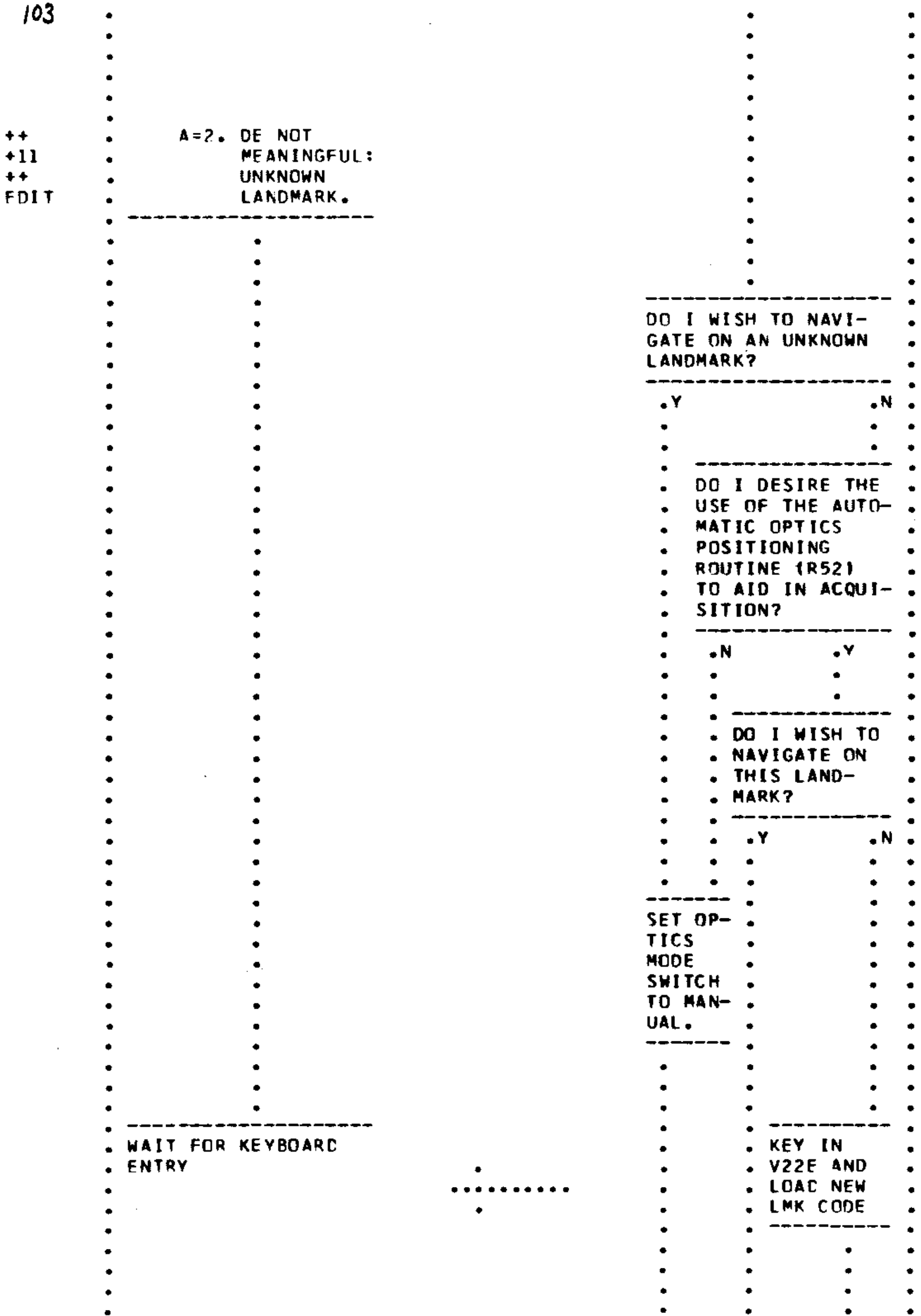
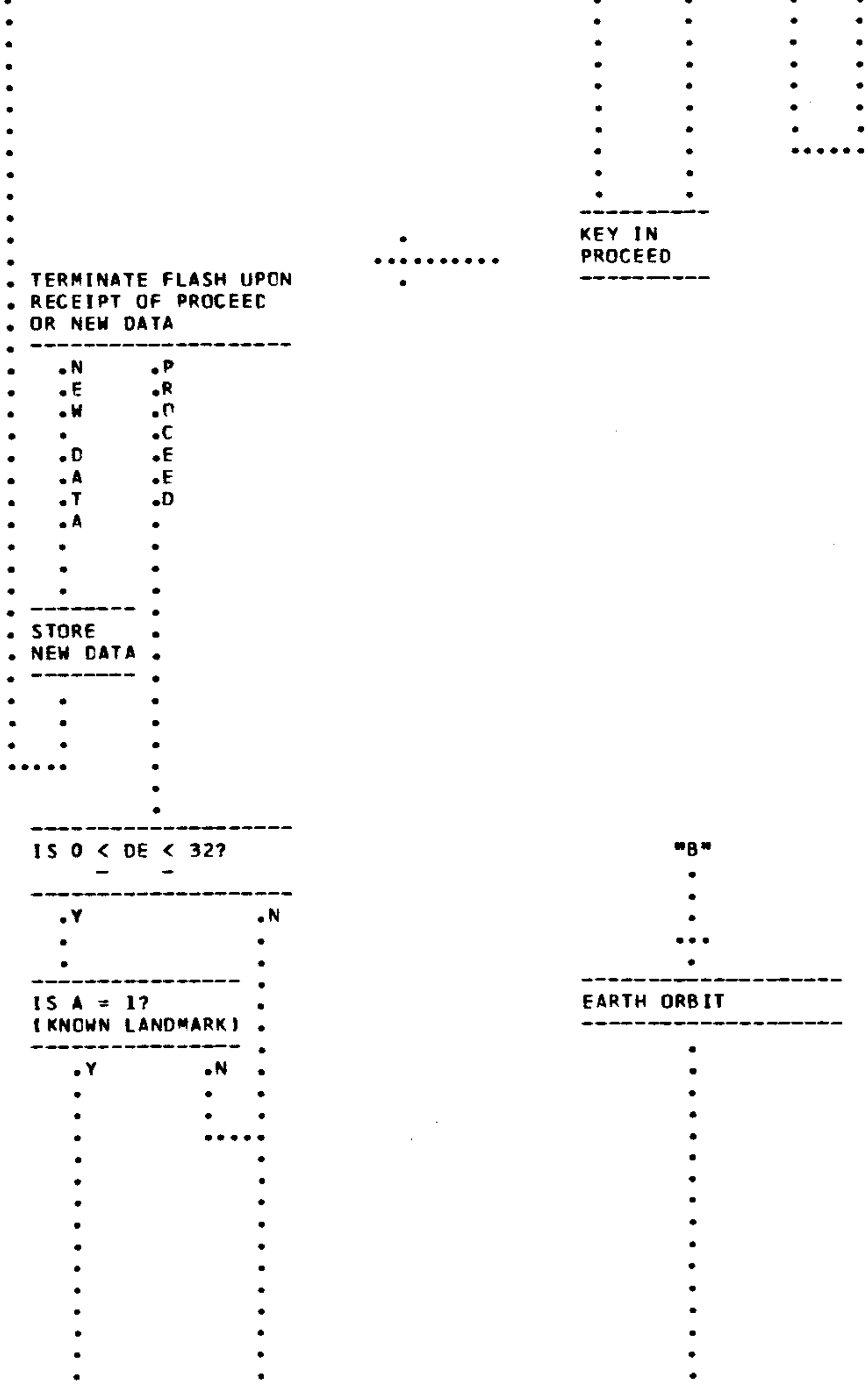

++
+11
++
EDIT
A=2. DE NOT MEANINGFUL: UNKNOWN LANDMARK.
DO I WISH TO NAVIGATE ON AN UNKNOWN LANDMARK?
Y
N
DO I DESIRE THE USE OF THE AUTOMATIC OPTICS POSITIONING ROUTINE (R52) TO AID IN ACQUISITION?
N
Y
DO I WISH TO NAVIGATE ON THIS LANDMARK?
Y
N
SET OPTICS MODE SWITCH TO MANUAL.
WAIT FOR KEYBOARD ENTRY
KEY IN V22E AND LOAD NEW LMK CODE
#220
#230
#240
#250
#260


KEY IN PROCEED
TERMINATE FLASH UPON RECEIPT OF PROCEED OR NEW DATA
NEW DATA
PROCEED
STORE NEW DATA
IS 0 ≤ DE ≤ 32?
Y
N
IS A = 1? (KNOWN LANDMARK)
Y
N
"B"
EARTH ORBIT

```
             .             .                                .
             .             .                                .
             .             .                                .
             .             .                                .
             .             .                                .
             .             .                                .
          ---------------  .                                .
          IS DE > 0?       .                                .
          (STORED LANDMARK).                                .
          ---------------  .                                .
                  .N   .Y  .                                .
                  .    .   .                                .
                  .    .   .                                .
                  .    .....                                .
                  .        .                                .
              "B" .        .                                .
               .  .        .                                .
        ....   .  .        .                                .   ..........
        .  .   .  .        .                                .   .        .
        .  .  ... .        .                                .   .        .
        .  .   .  .        .                                .   .        .
        . ---------------  .                       --------------------  .
POSS    . FLASH VERB-NOUN  .               .       MONITOR DSKY:         .
HOLD .  . TO REQUEST RESP- .        ..........     OBSERVE VERB-NOUN     .
......... ONSE AND DISPLAY .               .       FLASH TO REQUEST      .
SNAP .  . LMK COORDINATES: .                       RESPONSE AND DISPLAY  .
        . V06 N89          .                       LMK COORDINATES FOR   .
        .   R1-LAT         .                       USE ONLY BY THE AUT-  .
        .   R2-LONG/2      .                       OMATIC OPTICS POSIT-  .
        .   R3-ALT         .                       IONING ROUTINE (R52)  .
        .                  .                       AT THIS TIME.         .
        . R1-LAT IS LATI-  .                       --------------------  .
        . TUDE OF LMK IN   .                                .            .
        . DEG TO NEAREST   .                                .            .
        . .001 DEGREE, +   .                                .            .
        . IS NORTH         .                       --------------------  .
        .                  .                       DO I WISH TO NAVI-    .
        .                  .                       GATE ON AN UNKNOWN    .
        . R2-LONG/2 IS     .                       LANDMARK?             .
        . LONGITUDE OF     .                       --------------------  .
        . LMK DIVIDED BY   .                       Y.             .N     .
        . 2. IN DEGREES    .                        .             .      .
        . TO NEAREST .001  .                        .             .      .
        . DEGREE, + IS     .                        . -----------------  .
        . EAST             .                        . DO I DESIRE THE    .
        .                  .                        . USE OF THE AUTO-   .
        . R3-ALT IS ALTI-  .                        . MATIC OPTICS       .
        . TUDE OF LMK      .                        . POSITIONING ROU-   .
        . ABOVE THE FISCH- .                        . TINE (R52) TO AID  .
        . ER ELLIPSOID     .                        . IN ACQUISITION?    .
        . IN EARTH ORBIT   .                        . -----------------  .
        . ABOVE THE MEAN   .                        .  .N         .Y     .
        . LUNAR RADIUS FOR .                        .  .          .      .
        . LUNAR ORBIT      .                        .  .          .      .
        . IN NAUTICAL      .                       ------------   .      .
        . MILES TO THE     .                       SET OPTICS     .      .
        . NEAREST .01 NM.  .                       MODE SWITCH    .      .
        . ---------------  .                       TO MANUAL.     .      .
        .     .            .                       ------------   .      .
        .     .            .                        .             .      .
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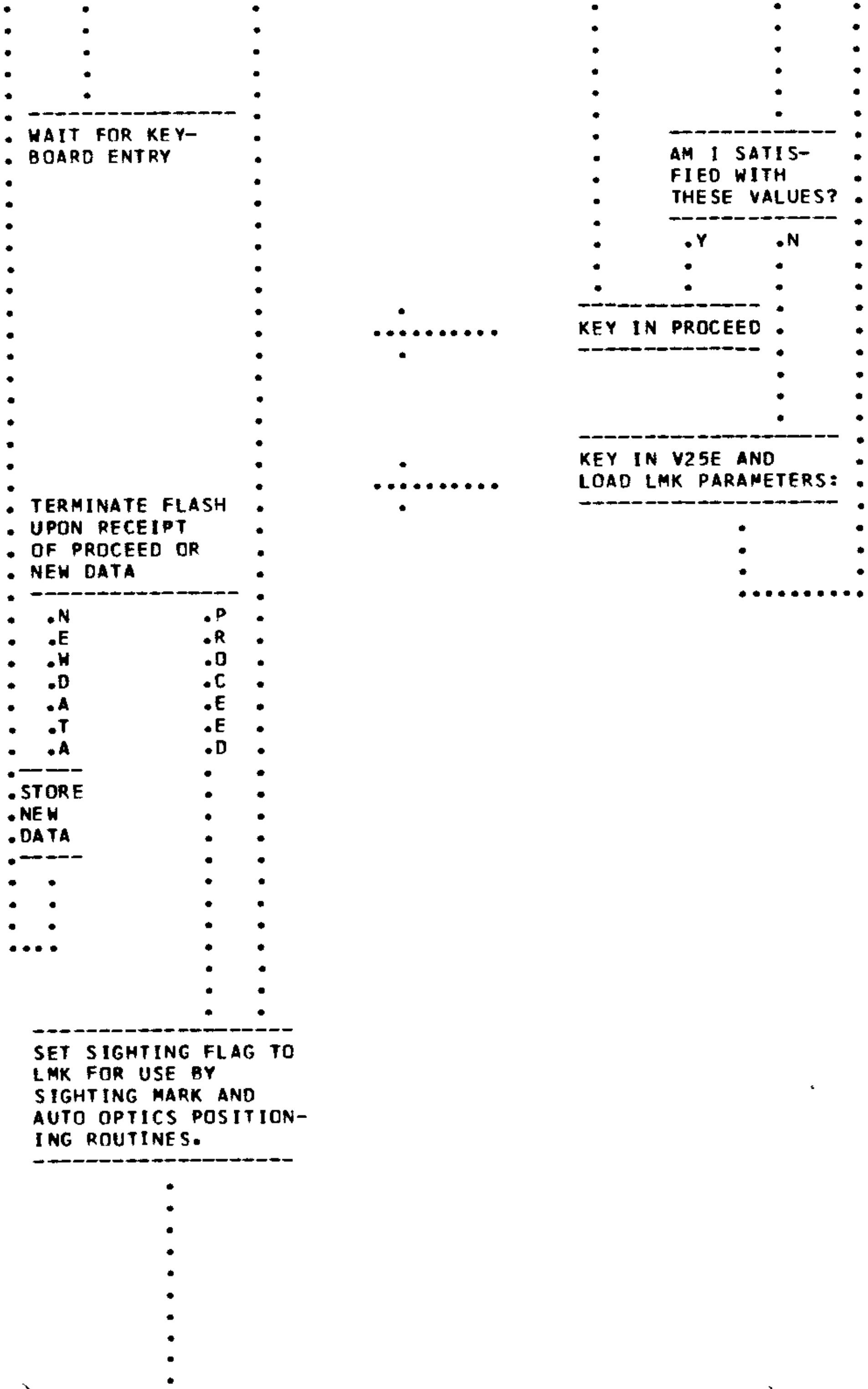
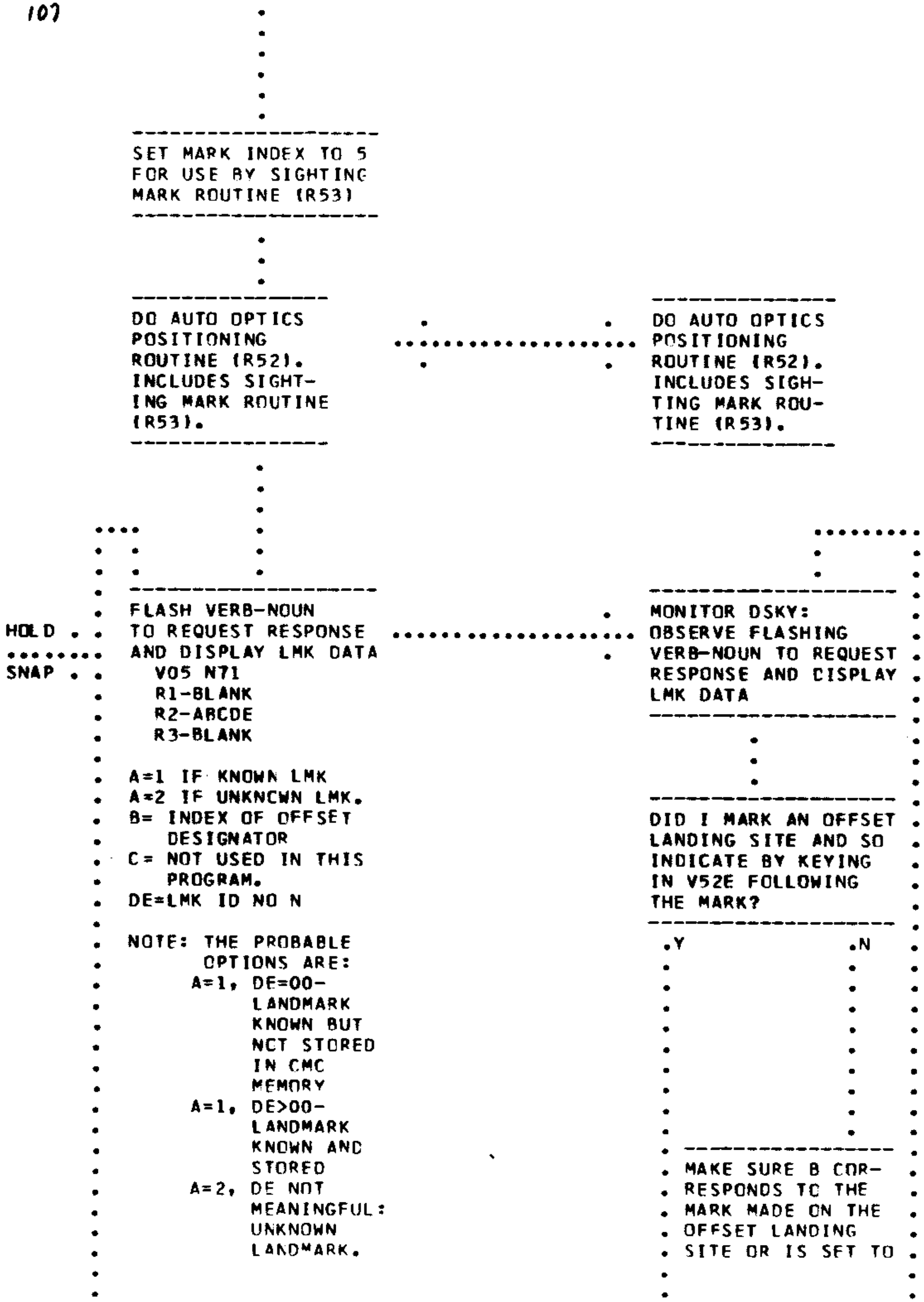

WAIT FOR KEY-
BOARD ENTRY
AM I SATIS-
FIED WITH
THESE VALUES?
Y
N
KEY IN PROCEED
KEY IN V25E AND
LOAD LMK PARAMETERS:
TERMINATE FLASH
UPON RECEIPT
OF PROCEED OR
NEW DATA
NEWDATA
PROCEED
STORE
NEW
DATA
SET SIGHTING FLAG TO
LMK FOR USE BY
SIGHTING MARK AND
AUTO OPTICS POSITION-
ING ROUTINES.



SET MARK INDEX TO 5 FOR USE BY SIGHTING MARK ROUTINE (R53)

DO AUTO OPTICS POSITIONING ROUTINE (R52). INCLUDES SIGHTING MARK ROUTINE (R53).

DO AUTO OPTICS POSITIONING ROUTINE (R52). INCLUDES SIGHTING MARK ROUTINE (R53).

FLASH VERB-NOUN TO REQUEST RESPONSE AND DISPLAY LMK DATA
  V05 N71
  R1-BLANK
  R2-ABCDE
  R3-BLANK

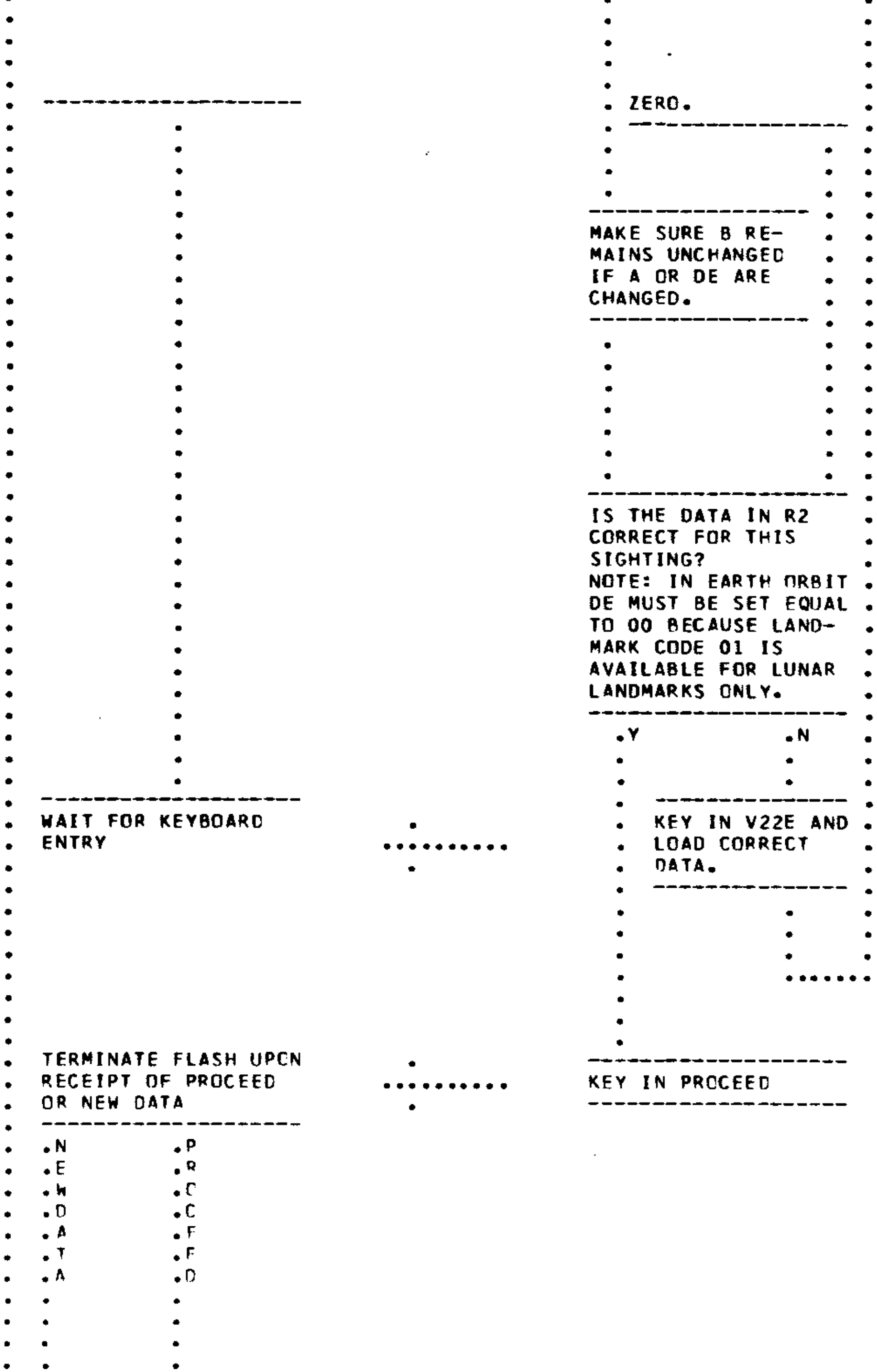
A=1 IF KNOWN LMK
A=2 IF UNKNOWN LMK.
B= INDEX OF OFFSET DESIGNATOR
C= NOT USED IN THIS PROGRAM.
DE=LMK ID NO N

NOTE: THE PROBABLE OPTIONS ARE:
A=1, DE=00- LANDMARK KNOWN BUT NOT STORED IN CMC MEMORY
A=1, DE>00- LANDMARK KNOWN AND STORED
A=2, DE NOT MEANINGFUL: UNKNOWN LANDMARK.

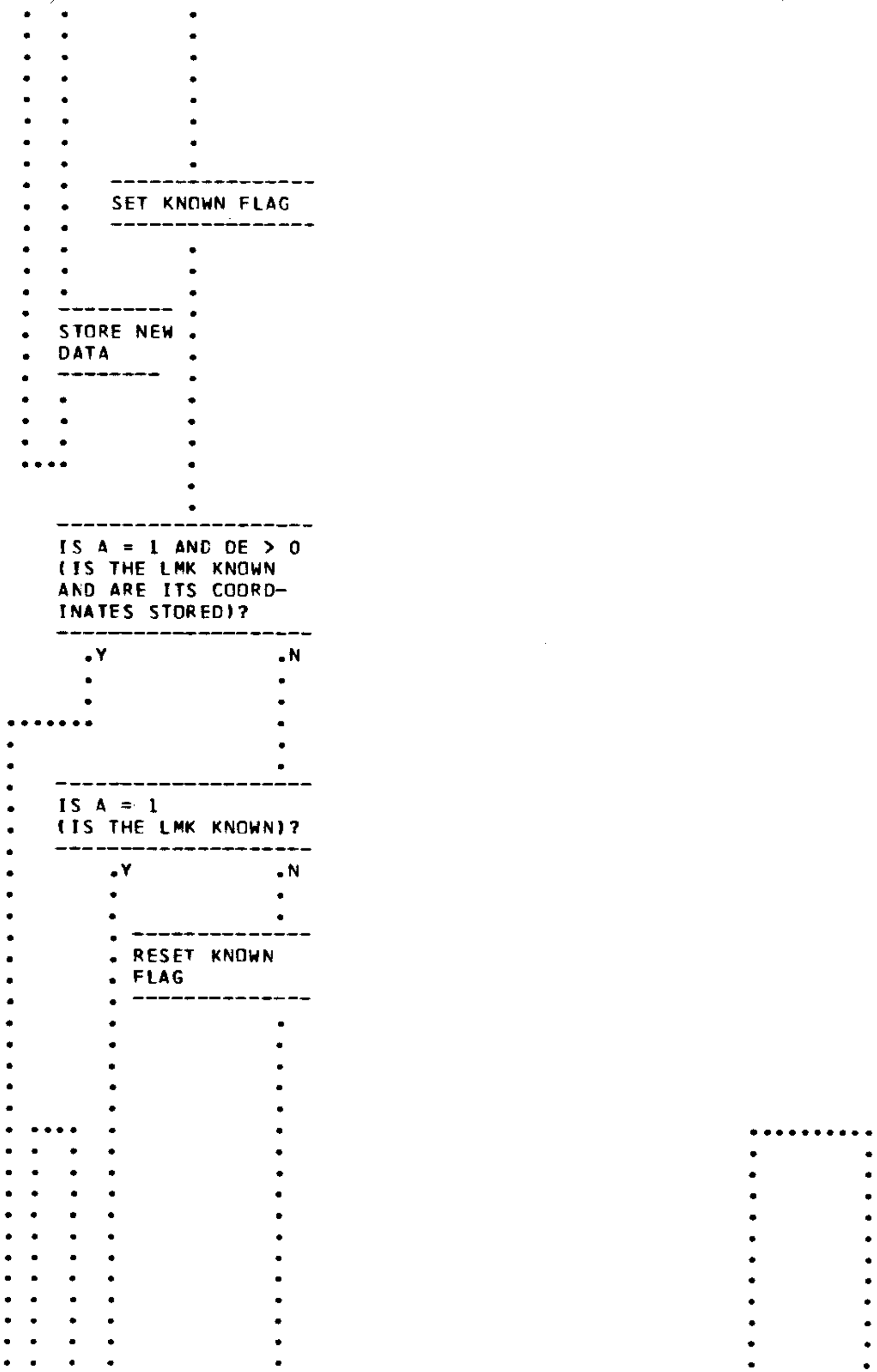
MONITOR DSKY: OBSERVE FLASHING VERB-NOUN TO REQUEST RESPONSE AND DISPLAY LMK DATA

DID I MARK AN OFFSET LANDING SITE AND SO INDICATE BY KEYING IN V52E FOLLOWING THE MARK?

MAKE SURE B CORRESPONDS TO THE MARK MADE ON THE OFFSET LANDING SITE OR IS SET TO

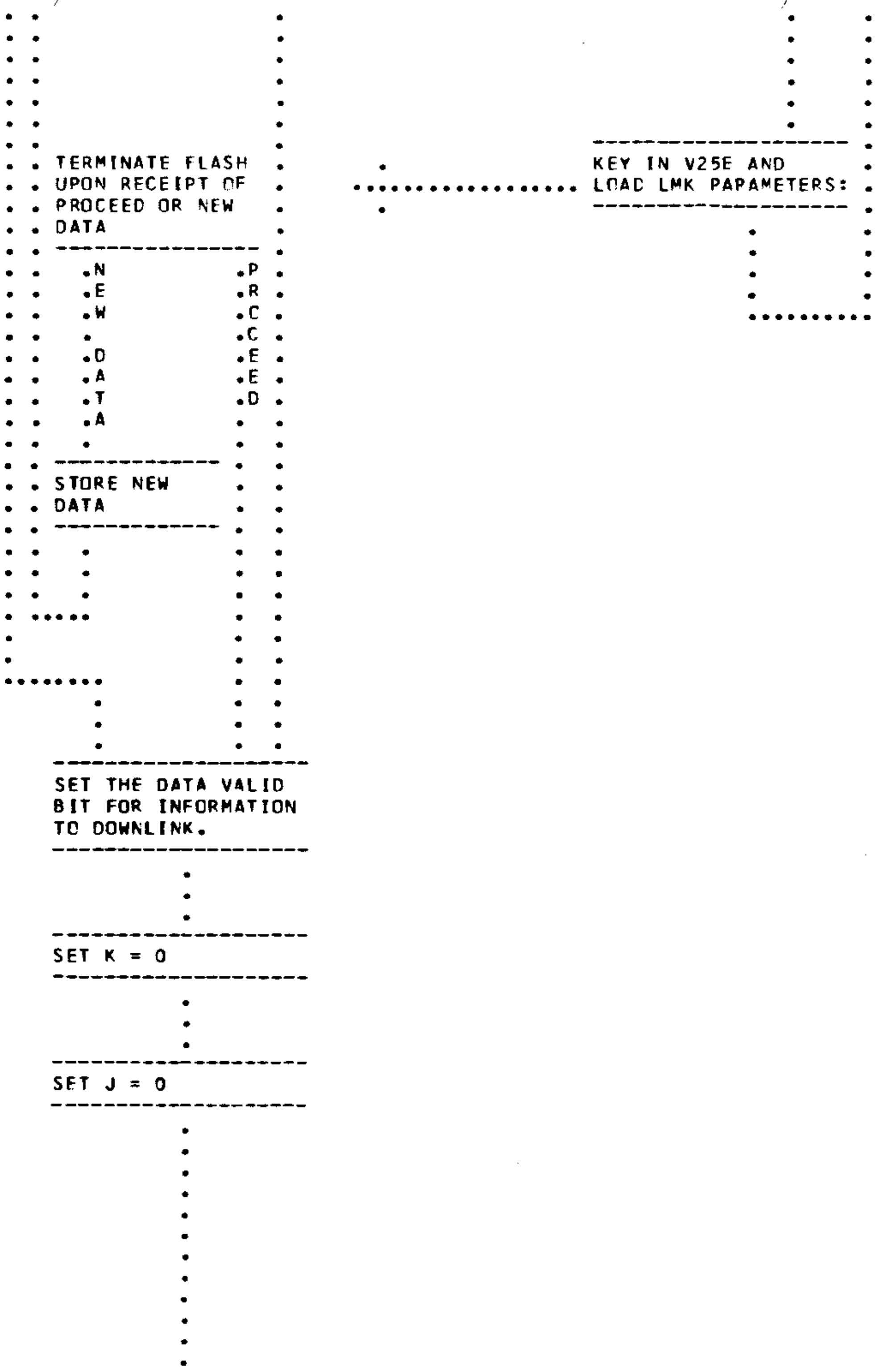

ZERO.
MAKE SURE B REMAINS UNCHANGED IF A OR DE ARE CHANGED.
IS THE DATA IN R2 CORRECT FOR THIS SIGHTING?
NOTE: IN EARTH ORBIT DE MUST BE SET EQUAL TO 00 BECAUSE LANDMARK CODE 01 IS AVAILABLE FOR LUNAR LANDMARKS ONLY.
Y
N
WAIT FOR KEYBOARD ENTRY
KEY IN V22E AND LOAD CORRECT DATA.
TERMINATE FLASH UPCN RECEIPT OF PROCEED OR NEW DATA
KEY IN PROCEED
NEWDATA
PRCCFFD

08


SET KNOWN FLAG
STORE NEW DATA
IS A = 1 AND DE > 0 (IS THE LMK KNOWN AND ARE ITS COORDINATES STORED)?
Y
N
IS A = 1 (IS THE LMK KNOWN)?
Y
N
RESET KNOWN FLAG

```
      . .  .  .            .                                    .        .
      . .  .  .            .                                    .        .
      . .  .  .            .                                    .        .
      . .  .  .            .                                    .        .
      . . ---------------- .                       --------------------- .
POSS  . . FLASH VERB-NOUN  .               .       MONITOR DSKY:         .
HOLD .. . TO REQUEST RESP- .        ..........     OBSERVE VERB-NOUN     .
......... ONSE AND DISPLAY .               .       FLASH TO REQUEST      .
SNAP .. . LMK COORDINATES: .                       RESPONSE AND DISPLAY  .
      . . V06 N89          .                       LMK COORDINATES       .
      . .   R1-LAT         .                       --------------------- .
      . .   R2-LONG/2      .                                .            .
      . .   R3-ALT         .                                .            .
      . .                  .                                .            .
      . . R1=LAT IS LATI-  .                                .            .
      . . TUDE OF LMK IN   .                                .            .
      . . DEG TO NEAREST   .                                .            .
      . . .001 DEGREE,     .                                .            .
      . . + IS NORTH       .                                .            .
      . .                  .                                .            .
      . . R2=LONG/2 IS     .                                .            .
      . . LONGITUDE OF LMK .                                .            .
      . . DIVIDED BY 2.    .                                .            .
      . . IN DEGREES TO    .                                .            .
      . . NEAREST .001     .                                .            .
      . . DEGREE + IS EAST .                                .            .
      . .                  .                                .            .
      . . R3=ALT IS ALTI-  .                                .            .
      . . TUDE OF LMK      .                                .            .
      . . ABOVE THE FIS-   .                                .            .
      . . CHER ELLIPSOID   .                                .            .
      . . FOR EARTH AND    .                                .            .
      . . MEAN LUNAR RADI- .                                .            .
      . . US FOR MOON. IN  .                                .            .
      . . NAUTICAL MILES   .                                .            .
      . . TO THE NEAREST   .                                .            .
      . . .01 NM.          .                                .            .
      . . ---------------- .                                .            .
      . .    .             .                       --------------------- .
      . .    .             .                       AM I SATISFIED WITH   .
      . .    .             .                       THESE VALUES?         .
      . .    .             .                       --------------------- .
      . .    .             .                               Y.      .N    .
      . . ---------------- .                                .      .     .
      . . WAIT FOR KEY-    .                                .      .     .
      . . BOARD ENTRY      .                                .      .     .
      . .                  .                                .      .     .
      . .                  .                                .      .     .
      . .                  .     .                 --------------  .     .
      . .                  .   ................... KEY IN PROCEED  .     .
      . .                  .     .                 --------------  .     .
      . .                  .                                       .     .
      . .                  .                                       .     .
      . .                  .                                       .     .
      . .                  .                                       .     .
      . .                  .                                       .     .
      . .                  .                                       .     .
      . .                  .                                       .     .
      . .                  .                                       .     .
      . .                  .                                       .     .
      . .                  .                                       .     .
      . .                  .                                       .     .
      .                    .                                       .     .
```

III


TERMINATE FLASH UPON RECEIPT OF PROCEED OR NEW DATA
NEW DATA
PROCEED
STORE NEW DATA
KEY IN V25E AND LOAD LMK PARAMETERS:
SET THE DATA VALID BIT FOR INFORMATION TO DOWNLINK.
SET K = 0
SET J = 0

++
+11
++
PCN
580

```
                    .
                    .
                    .
                    .
                    .
                    .
        ......      .
        .    .      .
        .    .      .
        . --------------------
        . SET J = J+1
        . --------------------
        .           .
        .           .
        .           .
        . --------------------
        . IS J GREATER THAN
        . THE MARK COUNTER?
        . --------------------
        .           .N     .Y
        .           .      .
        .           .      ......
        .           .           .
        .           .           .
        . --------------------  .
        . GET JTH MARK DATA     .
        . FROM CMC STORAGE      .
        . --------------------  .
        .           .           .
        .           .           .
        .           .           .
        . --------------------  .
        . IS J = INDEX OF OFF-  .
        . SET DESIGNATOR?       .
        . --------------------  .
        .    .Y        .N       .
        .    .         .        .
        .    .         .        .
        . -----------  .        .
        . STORE MARK   .        .
        . IN OFFSET    .        .
        . DESIGNATOR   .        .
        . LCCATION     .        .
        . ------------ .        .
        .    .         .        .
        .    .         .        .
        .    .         .        .
        ......         .        .
        .              .        .
        .              .        .
++      .      ---------------  .
+11     .      IS THIS THE      .
+       .      FIRST MARK?      .
+       .      ---------------  .
+       .              .Y   .N  .
+       .              .    .   .
+       .              .    .   .
+       .              .    .   .
+       .              .    .   .
+       .              .    .   .
+       .              .    .   .
+       .              .    .   .
+       .              .    .   .
+                      .    .   .
+  113  .              .    .   .
+       .              .    .   .
+       .              .    .   .                                                                             P22/COLOSSUS
+       .              .    .   .
+       .              .    .   .
+       .              .    .   .
+       . ------------------.   .
+       . IS THE KNOWN FLAG .   .                                                                                           #740
+11     . RESET?            .   .
++      . ------------------.   .
EDIT    .    .Y         .N  .   .
        .    .          .   .   .
        .    .          .   .   .
        . ------------- .   .   .
        . COMPUTE AND   .   .   .
        . STORE LMK     .   .   .
        . LOCATION FROM .   .   .
        . FIRST MARK    .   .   .                                                                                           #750
        . DATA          .   .   .
        . ------------- .   .   .
        .     .         .   .   .
++      .     .         .   .   .
+11     .     .         .   .   .
++      .     .         .   .   .
EDIT    .     .         .   .   .
        . --------------------  .
        . COMPUTE ORBIT PARA-   .
        . METERS AND LANDMARK   .                                                                                           #760
        . COORDINATE CHANGES    .
        . AS A RESULT OF THIS   .
        . SIGHTING MARK         .
        . --------------------  .
        .          .           .
        .          .           .
        .          .           .
        . --------------------  .
        . IS K = 0?             .
        . --------------------  .                                                                                           #770
        .    .Y            .N   .
        .    .             .    .
        .    .             .    .
POSS    . ---------------- .    .                   --------------------
HOLD .  . FLASH VERB NOUN  .    .               .   MONITOR DSKY: OB-
......... TO REQUEST RES-  .    .   ............... SERVE VERB NOUN
SNAP .  . PONSE AND DIS-   .    .               .   FLASH TO REQUEST
        . PLAY ORBIT PARA- .    .                   RESPONSE AND DISPLAY
        . METER CHANGES:   .    .                   OF ORBIT PARAMETER
        .                  .    .                   CHANGES                                                                 #780
        .    V06N49        .    .                   --------------------
        .    R1-DELTA R    .    .                           .
        .    R2-DELTA V    .    .                           .
        .    R3-BLANK      .    .                           .
        .                  .    .                   --------------------
        . DELTA R-MAGNI-   .    .                   ARE ORBIT PARAMETER
        . TUDE OF THE      .    .                   CHANGES ACCEPTABLE
        . DIFFERENCE BE-   .    .                   FOR INSERTION INTO
        . TWEEN THE POSI-  .    .                   CMC CALCULATION OF
        . TION VECTOR      .    .                   POSITION AND VELO-                                                      #790
        . BEFORE AND AFTER .    .                   CITY?
        . INCORPORATION OF .    .                   --------------------
        . THE LANDMARK     .    .                    .Y            .N
        .                  .    .                    .             .                                          P22/COLOSSUS
        .                  .    .                    .             .
        .                  .    .                    .             .
.                  .    .                     .            .
.                  .    .                     .            .
.                  .    .                     .            .
.                  .    .                     .            .
.                  .    .                     .            .
. SIGHTING DATA IN .    .                     .            .
. N.M. TO NEAREST  .    .                     .            .
. 0.1 N.M.         .    .                     .            .
.                  .    .                     .            .
. DELTA V-MAGNI-   .    .                     .            .
. TUDE OF THE      .    .                     .            .
. DIFFERENCE BE-   .    .                     .            .
. TWEEN THE VELO-  .    .                     .            .
. CITY VECTOR BE-  .    .                     .            .
. FORE AND AFTER   .    .                     .            .
. INCORPORATION OF .    .                     .            .
. THE LANDMARK     .    .                     .            .
. SIGHTING DATA IN .    .                     .            .
. FPS TO THE NEAR- .    .                     .            .
. EST .1 FPS.      .    .                     .            .
. ---------------- .    .                     .            .
.           .      .    .                     .            .
.           .      .    .                     .            .
.           .      .    .                     .            .
. ---------------- .    .     .             -------------- .
. WAIT FOR KEY-    .    .   ..........      KEY IN PROCEED .
. BOARD ENTRY      .    .     .             -------------- .
.                  .    .                                  .
.                  .    .                                  .
.                  .    .                                  .
.                  .    .     .                   --------------
. TERMINATE FLASH  .    .   ..........            KEY IN RECYCLE
. UPON RECEIPT OF  .    .     .                       V32E
. PROCEED OR RE-   .    .                         --------------
. CYCLE.           .    .                                  .
. ---------------- .    .                                  .
.   .R      .P     .    .                                  .
.   .E      .R     .    .                                 ...
.   .C      .O     .    .                                  .
.   .Y      .C     .    .                                 GO TO
.   .C      .E     .    .                                 "A"
.   .L      .E     .    .                                 ABOVE
.   .E      .D     .    .
.   .       .      .    .
.  ...      .      .    .
.   .       .      .    .
.  GO TO    .      .    .
.  "A"      .      .    .
.  ABOVE    .      .    .
.                  .    .
.           .      .    .
. ---------------- .    .
. SET K = 1        .    .
. ---------------- .    .
.           .      .    .
.           .      .    .
.           .      .    .
.           .      .    .
.           .      .    .
.           .      .    .
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        .           .      .    .
        .           .      .    .
        .           .      .    .
        .           .      .    .
        . --------------------  .
        . UPDATE CMC STATE      .
        . VECTOR AND COMPUTE    .
        . REVISED LANDMARK      .
        . COORDINATES           .
        . --------------------  .
        .           .           .
        .           .           .
        .           .           .
        .............           .
                                .
                                .
                       ..........
                       .
                       .
          --------------------
          IS THERE DATA IN THE
          OFFSET DESIGNATOR
          LOCATION?
          --------------------
            .N          .Y
            .           .
            .           .
            . ----------------
            . MAP THE OFFSET
            . LANDING SITE
            . ----------------
            .           .
            .           .
            .           .
            .           .                           --------------------
            .           .                           DID I DESIGNATE AN
            .           .                           OFFSET LANDING SITE
            .           .                           FROM A PRIMARY LAND-
            .           .                           MARK BY USE OF V52E
            .           .                           FOLLOWING A MARK?
            .           .                           --------------------
            .           .                             .YES            .NO
            .           .                             .               .
            .           .                             .               .
          --------------------                        .  ---------------
          FLASH VERB-NOUN TO                          .  MONITOR DSKY:
          REQUEST RESPONSE AND             .          .  OBSERVE VERB-
          DISPLAY POTENTIAL         ...........       .  NOUN FLASH TO
          LANDING SITE COORDI-          .  .          .  REQUEST RES-
POSS      NATES                         .             .  PONSE AND DIS-
HOLD  .      V06 N89                    .             .  PLAY OF THE
........     R1-LAT                     .             .  LANDMARK COOR-
SNAP  .      R2-LONG/2                  .             .  DINATES ON
             R3-ALT                     .             .  WHICH I WAS
                                        .             .  MARKING.
          R1=LAT IS LATITUDE            .             .  ---------------
          OF LMK IN DEG TO              .             .               .
          NEAREST .001 DEGREE           .             .               .
          + IS NORTH                    .           ----------------- .
                                        .                             .
                                        .                             .
                                        .                             .
```

```
                              .                            .
                              .                            .
                              .                            .
                              .                            .
                              .                            .
                              .           MONITOR DSKY:    .
R2=LONG/2 IS LONGI-           .           OBSERVE VERB-    .
TUDE OF LMK DIVIDED           .       .   NOUN FLASH TO    .
BY 2. IN DEGREES TO           ........... REQUEST RESPONSE .
NEAREST .001 DEGREE                   .   AND DISPLAY OF   .
+ IS EAST                                 THE OFFSET LAND- .
                                          ING SITE COORDI- .
                                          NATES.           .
                                          ---------------- .
                                            .              .
R3=ALT IS ALTITUDE                          .              .
OF LMK ABOVE THE                            .              .
FISCHER ELLIPSOID                           .              .
FOR EARTH AND MEAN                          .              .
LUNAR RADIUS FOR                            .              .
MOON. IN NAUTICAL                           .              .
MILES TO THE NEAREST                        .              .
.01 NM.                                     .              .
--------------------                        .              .
          .                                 .              .
          .                                 .              .
          .                                 .              .
    ----------------                        .              .
    WAIT FOR KEY-                           .              .
    BOARD ENTRY                             .              .
                                            .              .
                                            .              .
                                            .              .
                                            .              .
                                          --------------------
                                          SHALL THESE COORDIN-
                                          ATES BE STORED IN
                                          CMC MEMORY AND BE
                                          DEFINED AS THE LAND-
                                          ING SITE (LANDMARK
                                          CODE 01)?
                                          NOTE1: IF THESE CO-
                                          ORDINATES ARE STOR-
                                          ED, THE PREVIOUSLY
                                          STORED COORDINATES
                                          OF THE LANDING SITE
                                          WILL BE ERASED. IF
                                          THEY ARE NOT STORED
                                          THE PREVIOUSLY
                                          STORED LANDING SITE
                                          COORDINATES WILL BE
                                          SAVED IN THE LAND-
                                          MARK CODE 01
                                          LOCATION.
                                          NOTE2: THE CAPABIL-
                                          ITY OF STORING THE
                                          LANDING SITE IS ONLY
                                          AVAILABLE FOR LUNAR
                                          LANDMARKS. FOR THIS
                                          REASON THE ASTRONAUT
                                          SHOULD ALWAYS KEY
                                          EITHER V32E OR V34E
                                          ON THIS DISPLAY
                                          WHEN IN EARTH ORBIT.
                                          --------------------
                                            .YES           .NO
                                            .              .
                                            .              .
                       .                  ---------------- .
                     .................... KEY IN PROCEED   .
                       .                  ---------------- .
                                            .              .
                                            .              .
                                            .              .
    TERMINATE FLASH    .                    .  ---------------
    UPON RECEIPT OF  ....................   .  KEY IN RECYCLE
    PROCEED OR         .                    .  V32E
    RECYCLE                                 .  ---------------
    ----------------                        .              .
      .R         .P                         .              .
      .E         .R                         .              .
      .C         .C                        ...            ...
      .Y         .C                         .              .
      .C         .E                       GO TO          GO TO
      .L         .E                        "A"            "A"
      .E         .D                       ABOVE          ABOVE
      .          .
      .          .
     ...         .
      .          .
    GO TO        .
     "A"         .
    ABOVE        .
                 .
                 .
--------------------
STORE THESE COORDIN-
ATES AS UPDATED
LANDING SITE
PARAMETERS.
--------------------
          .
          .
          .
         ...
          .
        GO TO
         "A"
      ABOVE


                                                 V34E
                                                  .
                                                  .
                                                  .
                                                  .
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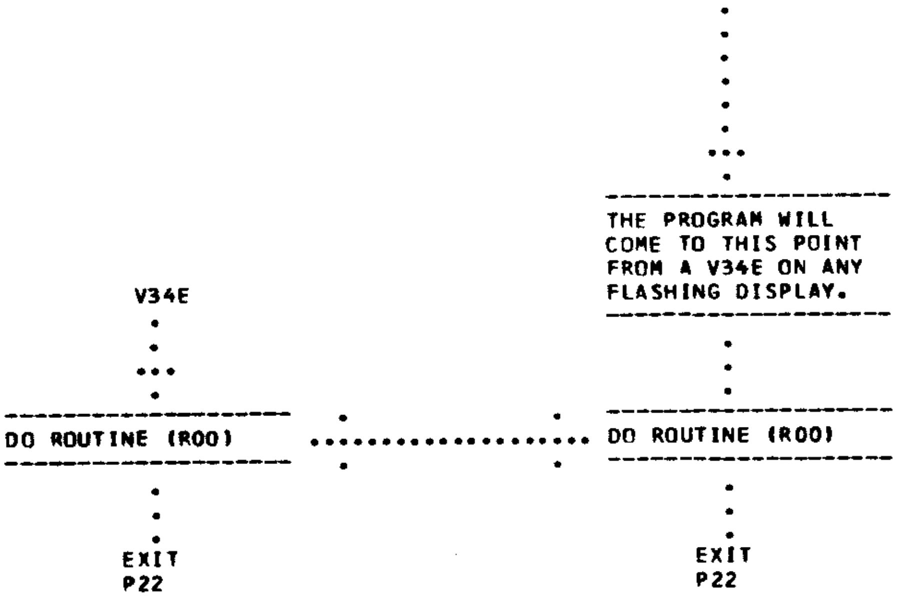
THE PROGRAM WILL COME TO THIS POINT FROM A V34E ON ANY FLASHING DISPLAY.
V34E
DO ROUTINE (R00)
DO ROUTINE (R00)
EXIT P22
EXIT P22

#1020

#1030

CHANGE CONTROL NOTES

LOGIC REV 07	PCR MIT 66
LOGIC REV 08	PCR MIT 116 PCR MIT 83
LOGIC REV 09	PCR 206
LOGIC REV 10	PCN 552
LOGIC REV 11	PCN 580 PCN 594

CISLUNAR MIDCOURSE NAVIGATION PROGRAM (P23) LOGIC REV 14 11/27/68

PURPOSE: (1) TO DO MIDCOURSE NAVIGATION BY INCORPORATION OF STAR/EARTH AND STAR/MOON OPTICAL MEASUREMENTS.

ASSUMPTIONS: (1) THIS PROGRAM DOES NOT REQUIRE THAT THE IMU BE ON.

(2) IF THE IMU IS NOT ALIGNED THE ASTRONAUT MUST ACQUIRE THE STAR/LMK OR STAR/HOR MANUALLY.

(3) (A) IF THE IMU IS ALIGNED THE ASTRONAUT MAY ACQUIRE THE LMK/HOR AUTOMATICALLY.

(B) IF THE IMU IS ALIGNED THE ASTRONAUT MAY ACQUIRE THE STAR AUTOMATICALLY.

(C) IF THE IMU IS ON THE ASTRONAUT MUST TAKE APPROPRIATE PRECAUTIONS TO PREVENT POSSIBLE IMU GIMBAL LOCK.

(4) PRIOR TO EACH MARK THE PROGRAM WILL CALL FOR AN OPTICS CALIBRATION WHICH MAY BE DONE OR BYPASSED DEPENDENT UPON THE STABILITY HISTORY OF THE CALIBRATION (SEE PURPOSES AND ASSUMPTIONS OF R57).

(5) TO PERFORM THE MARK THE ASTRONAUT SHOULD FINALLY SELECT MINIMUM IMPULSE CONTROL (EITHER GNCS OR SCS) AND THE OPTICS SHOULD BE IN MANUAL IN ORDER TO MAINTAIN THE FIX.

(6) THE OPTICS SHOULD BE ON FOR 15 MINUTES PRIOR TO MARKING.

(7) THE CMC DOES NOT CHECK FOR MOON/EARTH OCCULTATION OR SUN BRIGHTNESS IN THIS PROGRAM

(8) THIS PROGRAM IS DESIGNED FOR ONE MAN OPERATION WITHIN THE CONSTRAINTS OF MODE SWITCHING WHILE IN THE LEB.

++ (9) THE SIGHTING IS ON THE BODY FOR WHICH THE STATE VECTOR IS DEFINED.
+14
++ (10) A STAR SERIAL 0 WILL GIVE PARITY FAILURE, AND LANDMARK SERIAL 01 WILL NOT WORK.
EDIT

(11) THE PROGRAM IS SELECTED BY THE ASTRONAUT BY DSKY ENTRY.

```
 PROG        CMC          GROUND        CREW                          CHECKLIST       TIME     TOTAL
 CONT                                                                                           TIME



                                          .CREW PROG.
                                          .SELECTION
                                         ...
                                         .
                                         .
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                                         .
                                         .
                                         .
                                         .
                                         .
                                         .
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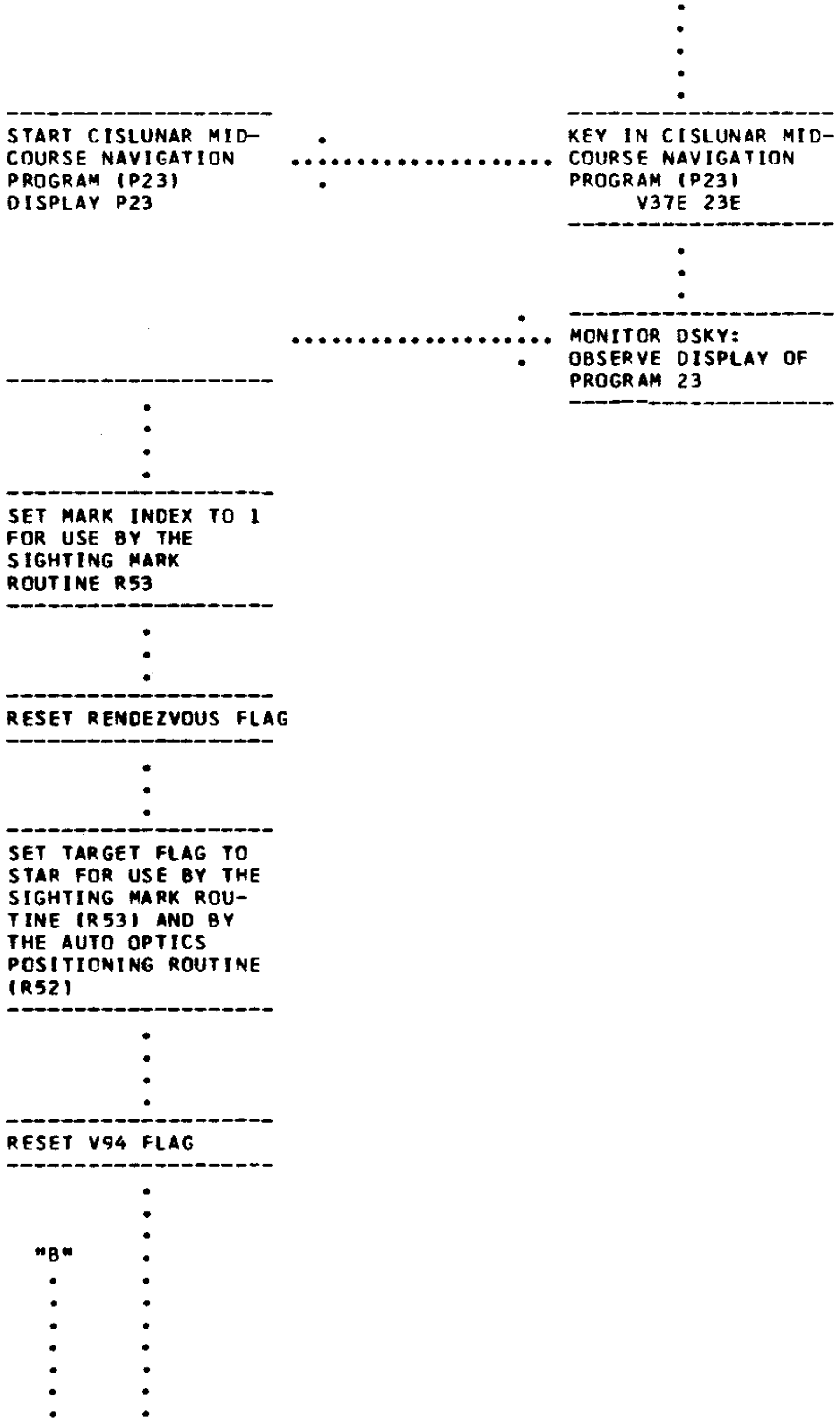


START CISLUNAR MIDCOURSE NAVIGATION PROGRAM (P23) DISPLAY P23

KEY IN CISLUNAR MIDCOURSE NAVIGATION PROGRAM (P23) V37E 23E

MONITOR DSKY: OBSERVE DISPLAY OF PROGRAM 23

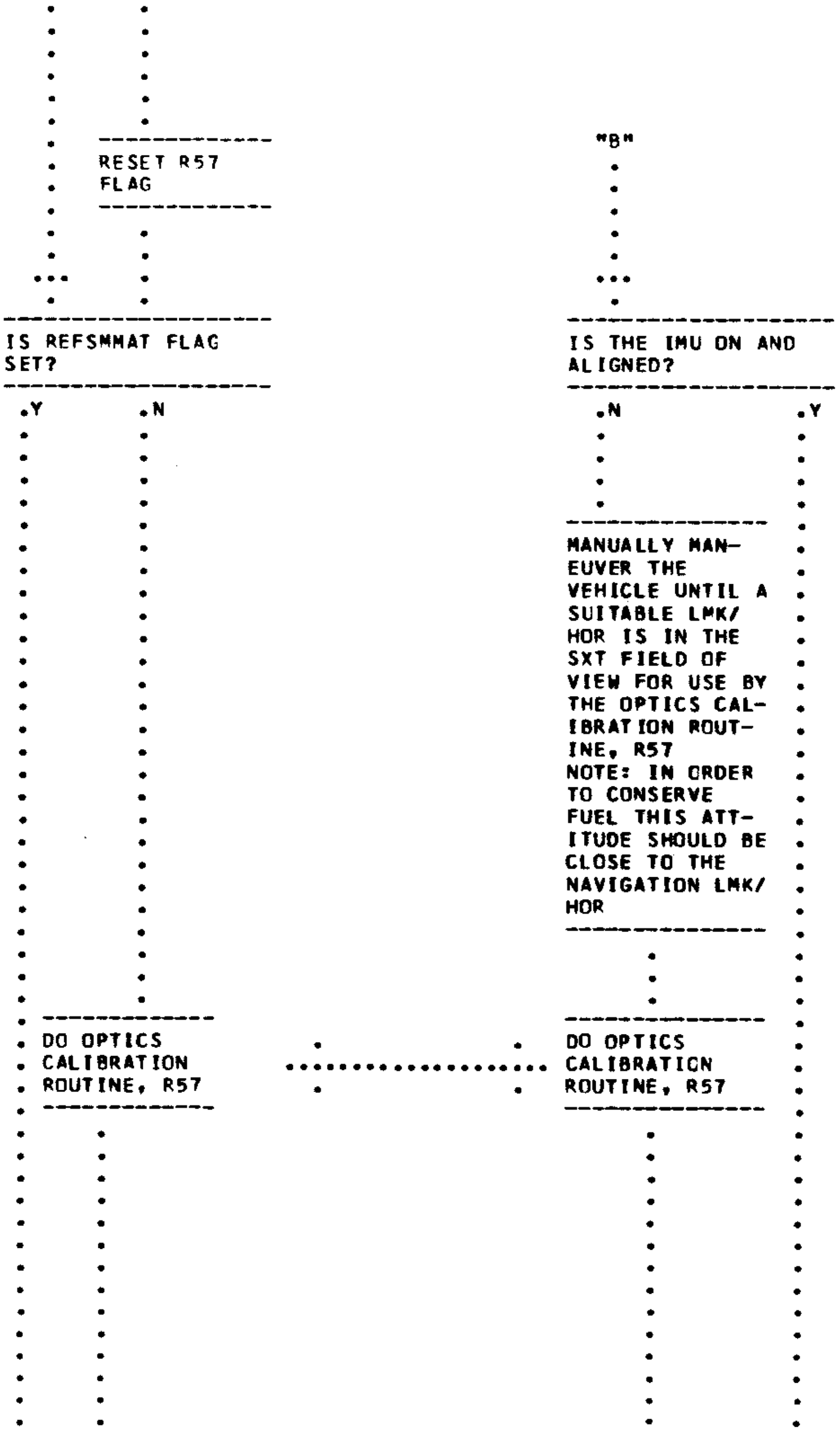
SET MARK INDEX TO 1 FOR USE BY THE SIGHTING MARK ROUTINE R53

RESET RENDEZVOUS FLAG

SET TARGET FLAG TO STAR FOR USE BY THE SIGHTING MARK ROUTINE (R53) AND BY THE AUTO OPTICS POSITIONING ROUTINE (R52)

++
+13
++
EDIT
PCR
206

RESET V94 FLAG


RESET R57 FLAG
"B"
IS REFSMMAT FLAG SET?
Y
N
IS THE IMU ON AND ALIGNED?
N
Y
MANUALLY MANEUVER THE VEHICLE UNTIL A SUITABLE LMK/HOR IS IN THE SXT FIELD OF VIEW FOR USE BY THE OPTICS CALIBRATION ROUTINE, R57
NOTE: IN ORDER TO CONSERVE FUEL THIS ATTITUDE SHOULD BE CLOSE TO THE NAVIGATION LMK/HOR
DO OPTICS CALIBRATION ROUTINE, R57
DO OPTICS CALIBRATION ROUTINE, R57

```
           .     .                                        .          .
           .     .                                        .          .
           .     .                                        .          .
           .     .                                        .          .
           . -------------       .              .  ---------------   .
           . DO SIGHTING       ....................DO THE SIGHTING   .
           . MARK ROUTINE,       .              .  MARK ROUTINE,     .
           . (R53).                                R53.              .                                                      #110
           . -------------                         MANUALLY MAN-     .
           .     .                                 EUVER THE         .
           .     .                                 VEHICLE UNTIL A   .
           .     .                                 SUITABLE LMK/     .
           .    ...                                HOR IS IN THE     .
           .     .                                 SXT FIELD OF      .
           .   GO TO                               VIEW. THEN,       .
           .    "A"                                BY USE OF MIN-    .
           .   BELOW                               IMUM IMPULSE      .
           .                                       CONTROL (GNCS     .                                                      #120
           .                                       OR SCS) AC-       .
           .                                       QUIRE THE LMK     .
           .                                       AND BY USE OF     .
           .                                       OPTICS CONTROL-   .
           .                                       LER SUPERIMPOSE   .
           .                                       THE NAVIGATION    .
           .                                       STAR PER CHECK-   .
           .                                       LIST.             .
           .                                       ---------------   .
           .                                              .          .                                                      #130
           .                                              .          .
           .                                              .          .
           .                                             ...         .
           .                                              .          .
           .                                           GO TO         .
           .                                            "A"          .
           .                                           BELOW         .
           .                                                         .
           .                                                         .
           .                                                         .                                                      #140
           .                                                         .
           .               .....                                     .
           .               .   .                                     . .....
           .               .   .                                     . .   .
           .               .   .                                     . .   .
           .               .   .                                     . .   .
           .               .   .                                     . .   .
           .               .   .                                     . .   .
POSS      -------------------- .                   --------------------    .
HOLD .    FLASH VERB-NOUN TO   .                   MONITOR DSKY:           .                                                #150
.......   REQUEST RESPONSE AND .                    OBSERVE VERB-NOUN      .
SNAP .    DISPLAY MEASUREMENT  .                .  FLASH TO REQUEST        .
          IDENTIFICATION       ....................RESPONSE AND DISPLAY    .
            V05 N70            .                .  OF MEASUREMENT          .
            R1-000DE (STAR ID) .                   IDENTIFICATION          .
            R2-ABCDE (LMK ID)  .                   --------------------    .
            R3-00CD0 (HOR ID)  .                            .              .
                               .                            .              .
                               .                            .              .
                               .                            .              .
                               .                            .              .
                               .                            .              .                                  P23/COLOSSUS
                               .                            .              .
                               .                            .              .
                               .                            .              .
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                     .                            .              .
                     .                            .              .
                     .                            .              .
                     .                            .              .
                     .                            .              .
                     .                            .              .
STAR IDENTIFICATION- .                            .              .
  R1=000XX FOR ID    .                   --------------------    .
     NUM. OF STAR    .                   DO I INTEND TO DO       .
     USED            .                   THE SIGHTING            .
                     .                   MANUALLY?               .
LANDMARK IDENTIFI-   .                   THIS DATA WILL BE       .
CATION               .                   USED AT THIS TIME       .
  R2=ABCDE WHERE     .                   FOR THE AUTOMATIC       .
                     .                   TRACKING MANEUVER       .
     A AND B-NOT     .                   AND BY THE AUTO-        .
             USED    .                   MATIC OPTICS            .
                     .                   POSITIONING ROUTINE     .
     C=1 FOR EARTH   .                   (R52) ONLY. IF IT IS    .
         LMK         .                   INTENDED TO DO MAN-     .
                     .                   UAL ACQUISITION THIS    .
     C=2 FOR MOON    .                   DISPLAY NEED NOT BE     .
         LMK         .                   REVIEWED. IT WILL BE    .
                     .                   REDISPLAYED PRIOR TO    .
     DE-LANDMARK ID  .                   STATE VECTOR            .
            NUMBER   .                   CALCULATION.            .
                     .                   --------------------    .
     R2=00000 FOR    .                      .Y             .N    .
        HOR. MEAS.   .                      .              .     .
                     .                      .              .     .
HORIZON IDENTIFI-    .                   ----------------  .     .
CATION               .                   SET OPTICS MODE   .     .
     R3=00CD0 WHERE  .                   SWITCH TO MANUAL  .     .
                     .                   ----------------  .     .
     C=1 FOR EARTH   .                      .              .     .
         HOR.        .                      .              .     .
                     .                      .              .     .
     C=2 FOR MOON    .                      .              .     .
         HOR.        .                      .              .     .
                     .                      .              .     .
     D=1 FOR NEAR    .                      .-----------------   .
         HORIZON     .                      .AM I SATISFIED      .
     D=2 FOR FAR     .                      .WITH THIS DATA?     .
         HORIZON     .                      .-----------------   .
                     .                      .   .Y         .N    .
     R3=00000 FOR    .                      .   .          .     .
        LMK MEAS.    .                      .   .          .     .
-------------------- .                      .------------  .     .
          .          .                      .RECORD MEAS-  .     .
          .          .                      .UREMENT IDEN- .     .
          .          .                      .TIFICATION    .     .
          .          .                      .DATA IN       .     .
          .          .                      .FLIGHT DATA   .     .
          .          .                      .BOOK IF       .     .
          .          .                      .DESIRED       .     .
          .          .                      .------------  .     .
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WAIT FOR KEYBOARD    . .                  KEY IN           .     .
ENTRY                .................... PROCEED          .     .
                     . .                  ----------       .     .
                     .                                     .     .
                     .                                     .     .
TERMINATE FLASH UPON . .                       --------------- .          #220
RECEIPT OF PROCEED   ......................... KEY IN V25E AND .
OR NEW DATA          . .                       LOAD NEW DATA   .
-------------------- .                         --------------- .
   .P     .NEW       .                               .           .
   .R     .DATA      .                               .           .
   .O     .          .                               .............
   .C    ----------- .
   .E    STORE NEW   .
   .E    DATA        .
   .D    ----------- .                                                    #230
   .          .      .
   .          .      .
   .          .      .
   .          ........
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WAS R3=0
(LMK MEASUREMENT?)                                                        #240
--------------------
  .N(HOR)    .Y(LMK)
  .          .
  .          .
  .  ---------------
  .  ARE R2(DE) NON-
  .  ZERO (LMK IDEN-
  .  TIFIED )
  .  ---------------
  .    .Y   .N                                                            #250
  .    .    .
  .    .    .
  .    .    .
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  .         .                                                             #260
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  .         .    .....                                ......
  .         .    .   .                                .    .           P23/COLOSSUS
  .         .    .   .                                .    .
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125

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            .         .     .   .                                .    .
POSS        .  ---------------  .                   ---------------   .
HOLD .      .  FLASH VERB-NOUN  .                .  MONITOR DSKY:     .
.......     .  TO REQUEST RE-   .  .................   OBSERVE VERB-  .
SNAP .      .  SPONSE AND DIS-  .                .  NOUN FLASH TO     .
            .  PLAY LMK DATA    .                   REQUEST RESPONSE  .
            .     V06 N89       .                   AND DISPLAY OF    .
            .                   .                   LMK DATA IF A     .
            .     R1: LAT       .                   NON-IDENTIFIED    .
            .     R2: LONG/2    .                   LANDMARK WAS      .
            .     R3: ALT       .                   CHOSEN            .
            .                   .                   ---------------   .
            .  LAT:-LATITUDE    .                            .        .
            .  OF LMK IN DEG    .                            .        .
            .  TO NEAREST .001  .                            .        .
            .  DEG              .                   ---------------   .
            .     + IS NORTH    .                   AM I SATISFIED    .
            .                   .                   WITH THIS DATA?   .
            .  LONG/2-LONGI-    .                   ---------------   .
            .  TUDE OF LMK DI-  .                     .Y         .N   .
            .  VIDED BY 2 IN    .                      .          .   .
            .  DEG TO NEAREST   .                      .          .   .
            .  .001 DEG         .                      .          .   .
            .     + IS EAST     .                      .          .   .
            .                   .                      .          .   .
            .  ALT-ALT OF LMK   .                      .          .   .
            .  IN NAUTICAL      .                      .          .   .
            .  MILES TO NEAR-   .                      .          .   .
            .  EST .01 N.M.     .                      .          .   .
            .  (FOR EARTH       .                      .          .   .
            .  ABOVE FISCHER    .                      .          .   .
            .  ELLIPSOID) (FOR  .                      .          .   .
            .  MOON ABOVE MEAN  .                      .          .   .
            .  LUNAR RADIUS)    .                      .          .   .
            .  ---------------  .                      .          .   .
            .       .           .                      .          .   .
            .       .           .                      .          .   .
            .       .           .                      .          .   .
            .  ---------------  .                   ------------  .   .
            .  WAIT FOR KEY-    .      .            KEY IN        .   .
            .  BOARD ENTRY      .    .............  PROCEED       .   .
            .                   .      .            ------------  .   .
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            .                  .                                 .   .
            .  TERMINATE FLASH .                              ------ .
            .  UPON RECEIPT OF .      .                       KEY IN .
            .  PROCEED OR NEW  .    ............              V25E   .
            .  DATA            .      .                       AND    .
            .  --------------- .                              LOAD   .
            .     .P     .NEW  .                              NEW    .
            .     .R     .DATA .                              DATA   .
            .     .O     .     .                              ------ .
            .     .C --------- .                               .     .
            .     .E STORE NEW .                               .     .
            .     .E DATA      .                               .......
            .     .D --------- .
            .     .     .      .
            .     .     .      .
            .     .     ........
            .     .
            .     .
            .     .
            .     .
POSS      --------------------                  .   --------------------
HOLD  .   FLASH VERB-NOUN TO         .............. MONITOR DSKY:
......... REQUEST PLEASE                              OBSERVE VERB-NOUN
SNAP  .   PERFORM GNCS AUTO-                    .   FLASH REQUESTING
          MATIC MANEUVER                            PLEASE PERFORM AUTO-
             V50 N25                                MATIC MANEUVER
                                                    --------------------
          R1-00202                                          .
          R2-BLANK                                          .
          R3-BLANK                                          .
          --------------------                              .
                    .                                       .
                    .                                       .
                    .                                       .
                    .                                       .
                    .                                       .
                    .                               --------------------
                    .                               DO I WISH TO HAVE
                    .                               THE GNCS COMPUTE THE
                    .                               SPACECRAFT ATTITUDE
                    .                               REQUIRED TO POINT
                    .                               THE LLOS AT THE
                    .                               CHOSEN LMK/HOR AND
                    .                               PERFORM THE ATTITUDE
                    .                               MANEUVER ROUTINE
                    .                               (R60)?
                    .                               THIS ATTITUDE WILL
                    .                               BE COMPUTED (VEC-
                    .                               POINT) TO POINT THE
                    .                               LLOS AXIS AT THE
                    .                               LMK/HOR BUT WILL NOT
                    .                               CONSTRAIN THE ORIEN-
                    .                               TATION ABOUT THAT
                    .                               VECTOR (THE ORIEN-
                    .                               TATION ABOUT THAT
                    .                               VECTOR COULD RESULT
                    .
                    .
                    .
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                     .                                                                                         P23/COLOSSUS
                     .
                     .
                     .
                     .                              IN IMU GIMBAL LOCK).                                                     #370
                     .                              --------------------
          --------------------                        .N             .Y
          WAIT FOR KEYBOARD                           .              .
          ENTRY                                       .              .
                                                    --------         .
                                  .                 KEY IN           .
                               ..................   ENTER            .
                                  .                 --------         .
                                                        .            .
                                                        .            .                                                       #380
                                                        .            .
          TERMINATE FLASH UPON    .                     .  -------------
          RECEIPT OF PROCEED   ...................      .  KEY IN
          OR ENTER                .                     .  PROCEED
          --------------------                          .  -------------
            .E             .P                           .        .
            .N             .R                           .        .
            .T             .O                           .        .
            .E             .C                           .        .
            .R             .E                           .        .                                                       #390
            .              .E                           .        .
            .              .D                           .        .
            .              .                            .        .
            .              .                            .        .
            .      "C"     .                            .        .
            .        .     .                            .        .
            .        .     .                            .        .
            .        .     .                            .        .
            .       ...    .                            .        .
            .        .     .                            .        .                                                       #400
            . ----------------                      ------------ .
            . INTEGRATE CSM                         MANUALLY     .
            . STATE VECTOR TO                       MANEUVER THE .
            . THE PRESENT                           VEHICLE      .
            . TIME.                                 UNTIL A      .
            . ----------------                      SUITABLE LMK .
            .              .                        /HOR IS IN   .
            .              .                        THE SXT      .
            .              .                        FIELD OF     .
++          . ----------------                      VIEW FOR USE .                                                           #410
+13         . CALCULATE THE                         BY THE       .
+           . ATTITUDE TO                           OPTICS CAL-  .
+           . POINT THE                             IBRATION     .
+           . LLOS AXIS AT THE                      ROUTINE, R57 .
+           . LMK OR HORIZON                        NOTE: IN     .
+           . USING THE POINT-                      ORDER TO     .
+           . ING VECTOR ROU-                       CONSERVE     .
+13         . TINE, REFER TO                        FUEL THIS    .
++          . SECTION 5.2.6.3                       ATTITUDE     .
520+        . OF R577.                              SHOULD BE    .                                                           #420
EDIT        . ----------------                      CLOSE TO THE . "C"
            .       .                               NAVIGATION   .  .
            .       .                               LMK/HOR      .  .
            .       .                               -----------  .  .
            .       .                                  .         .  .                                          P23/COLOSSUS
            .       .                                  .         .  .
            .       .                                  .         .  .
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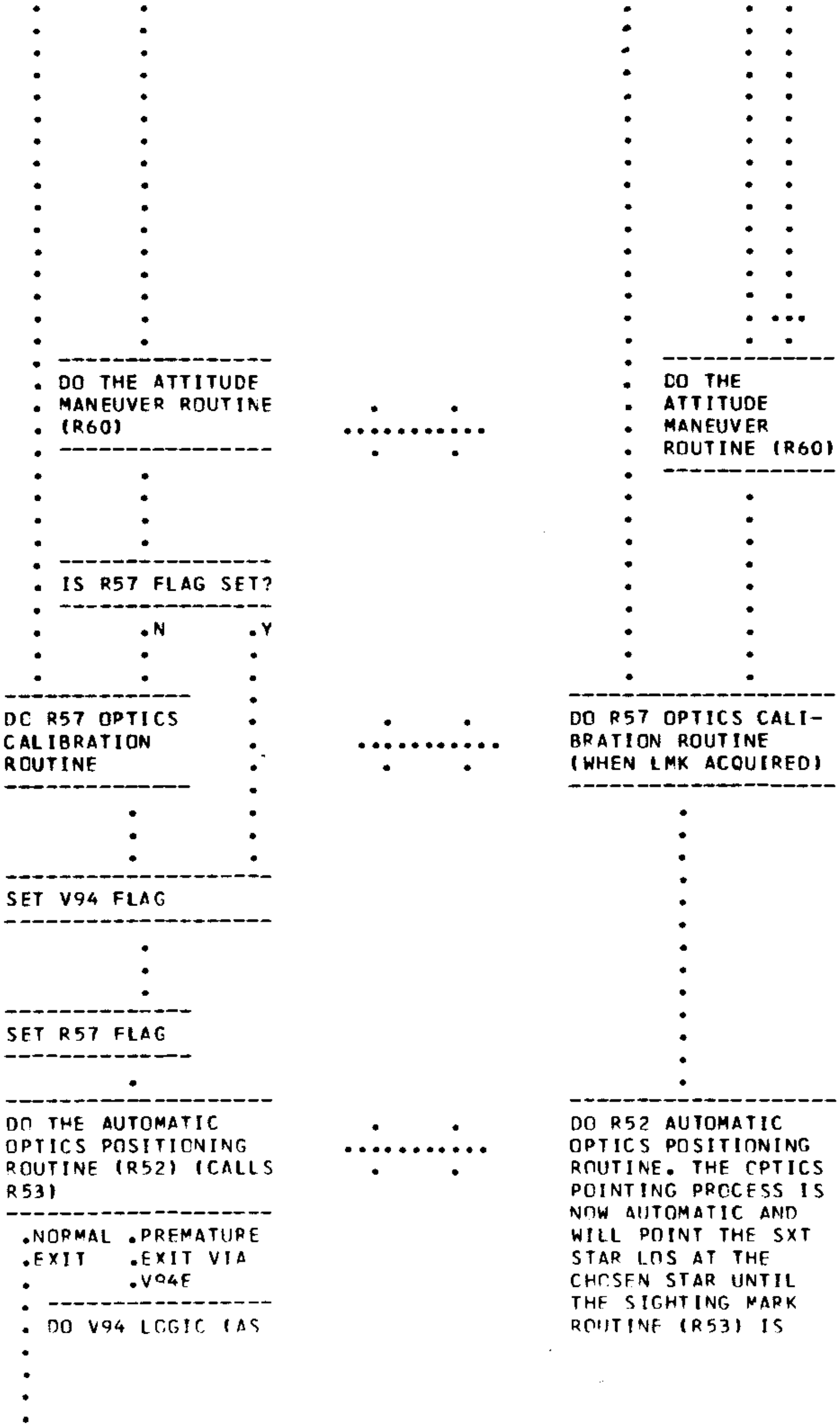
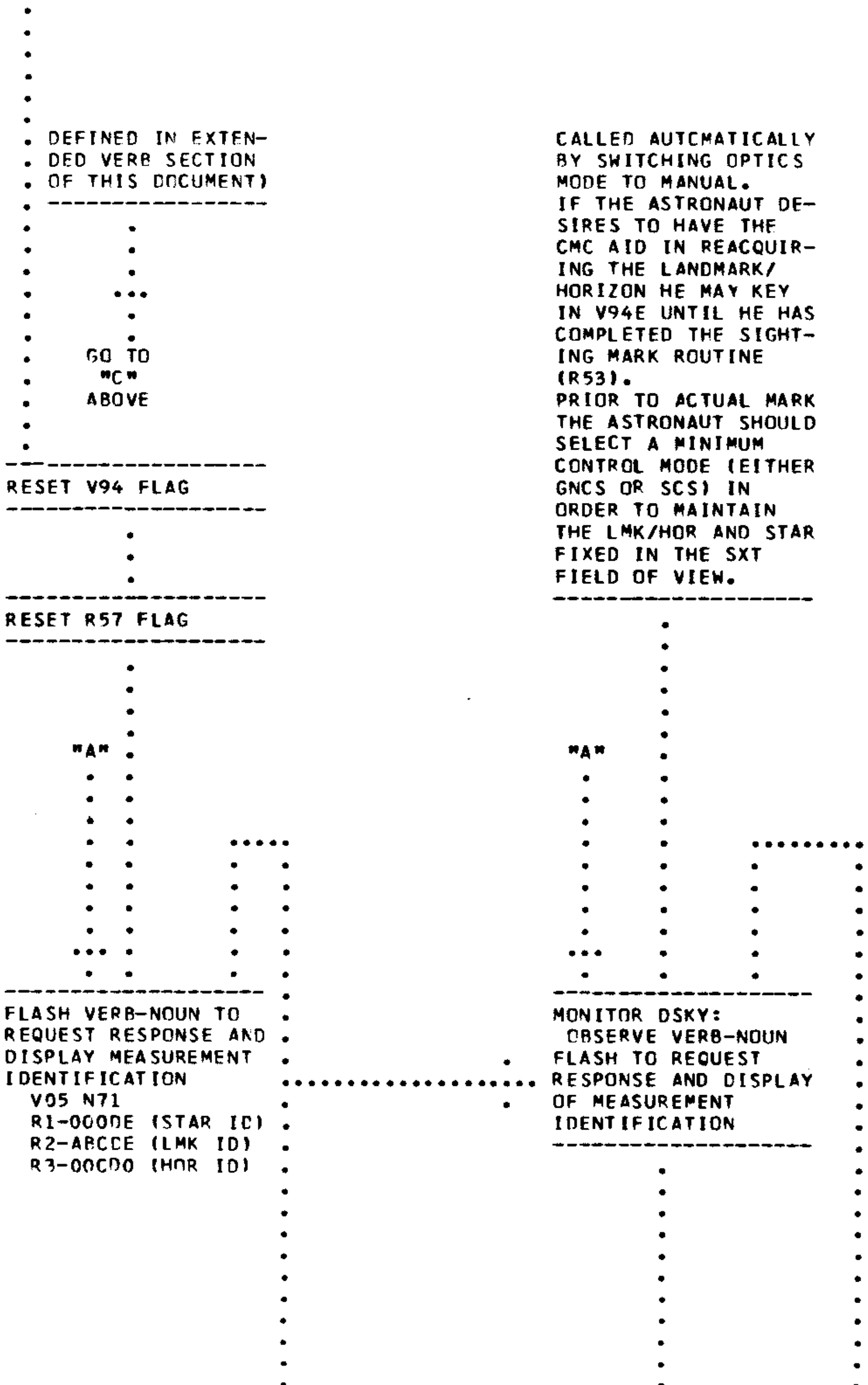

DO THE ATTITUDE MANEUVER ROUTINE (R60)
DO THE ATTITUDE MANEUVER ROUTINE (R60)
IS R57 FLAG SET?
N
Y
DC R57 OPTICS CALIBRATION ROUTINE
DO R57 OPTICS CALIBRATION ROUTINE (WHEN LMK ACQUIRED)
SET V94 FLAG
SET R57 FLAG
DO THE AUTOMATIC OPTICS POSITIONING ROUTINE (R52) (CALLS R53)
NORMAL EXIT
PREMATURE EXIT VIA V94E
DO V94 LOGIC (AS
DO R52 AUTOMATIC OPTICS POSITIONING ROUTINE. THE CPTICS POINTING PROCESS IS NOW AUTOMATIC AND WILL POINT THE SXT STAR LOS AT THE CHCSEN STAR UNTIL THE SIGHTING MARK ROUTINE (R53) IS

++
+14
++
PCN
571

++
+13
+
+
+
+

'19 +

EDIT
PCR
206



DEFINED IN EXTENDED VERB SECTION OF THIS DOCUMENT)

CALLED AUTOMATICALLY BY SWITCHING OPTICS MODE TO MANUAL.
IF THE ASTRONAUT DESIRES TO HAVE THE CMC AID IN REACQUIRING THE LANDMARK/HORIZON HE MAY KEY IN V94E UNTIL HE HAS COMPLETED THE SIGHTING MARK ROUTINE (R53).
PRIOR TO ACTUAL MARK THE ASTRONAUT SHOULD SELECT A MINIMUM CONTROL MODE (EITHER GNCS OR SCS) IN ORDER TO MAINTAIN THE LMK/HOR AND STAR FIXED IN THE SXT FIELD OF VIEW.

HOLD .
....
SNAP .

FLASH VERB-NOUN TO REQUEST RESPONSE AND DISPLAY MEASUREMENT IDENTIFICATION
V05 N71
R1-0000E (STAR ID)
R2-ABCDE (LMK ID)
R3-00CD0 (HOR ID)

MONITOR DSKY:
OBSERVE VERB-NOUN FLASH TO REQUEST RESPONSE AND DISPLAY OF MEASUREMENT IDENTIFICATION

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                      .                            .              .
                      .                            .              .
                      .                            .              .
                      .                            .              .
STAR IDENTIFICATION-  .                            .              .
  R1=000XX FOR ID     .                            .              .
     NUM. OF STAR     .                            .              .
     USED             .                   --------------------    .
                      .                   IS THIS DATA CORRECT    .
LANDMARK IDENTIFI-    .                   FOR THE MARK I MADE?    .
CATION                .                   --------------------    .
  R2=ABCDE WHERE      .                       .Y           .N     .
                      .                       .            .      .
     A AND B-NOT      .                       .            .      .
             USED     .                       .            .      .
                      .                       .            .      .
                      .                       .            .      .
     C=1 FOR EARTH    .                       .            .      .
         LMK          .                       .            .      .
     C=2 FOR MOON     .                       .            .      .
         LMK          .                       .            .      .
                      .                       .            .      .
     DE-LANDMARK ID   .                       .            .      .
        NUMBER        .                       .            .      .
                      .                       .            .      .
     R2=00000 FOR     .                       .            .      .
        HOR. MEAS.    .                       .            .      .
                      .                       .            .      .
HORIZON IDENTIFI-     .                       .            .      .
CATION                .                       .            .      .
  R3=00CD0 WHERE      .                       .            .      .
                      .                       .            .      .
     C=1 FOR EARTH    .                       .            .      .
         HOR.         .                       .            .      .
     C=2 FOR MOON     .                       .            .      .
         HOR.         .                       .            .      .
                      .                       .            .      .
     D=1 FOR NEAR     .                       .            .      .
         HORIZON      .                       .            .      .
     D=2 FOR FAR      .                   ---------------  .      .
         HORIZON      .                   RECORD MEASURE-  .      .
                      .                   MENT IDENTIFIC-  .      .
     R3=00000 FOR     .                   ATION DATA IN    .      .
        LMK MEAS.     .                   FLIGHT DATA      .      .
--------------------  .                   BOOK IF DESIRED  .      .
           .          .                   ---------------  .      .
           .          .                       .            .      .
           .          .                       .            .      .
           .          .                       .            .      .
--------------------  .                   ----------       .      .
WAIT FOR KEYBOARD     . .                 KEY IN           .      .
ENTRY                 ....................PROCEED          .      .
                      . .                 ----------       .      .
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TERMINATE FLASH UPON . .                       ---------------   .
RECEIPT OF PROCEED   ......................... KEY IN V25E AND   .
OR NEW DATA          . .                       LOAD NEW DATA     .
-------------------- .                         ---------------   .
   .P     .NEW       .                                    .      .
   .R     .DATA      .                                    .      .
   .O     .          .                                    ........
   .C    ----------- .
   .E    STORE NEW   .
   .E    DATA        .
   .D    ----------- .
   .      .          .
   .      .          .
   .      .          .
   .      ............
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   .
--------------------
WAS R3=0
(LMK MEASUREMENT?)
--------------------
  .N(HOR)    .Y(LMK)
  .          .
  .          .
  .  ---------------
  .  ARE R2(DE) NON-
  .  ZERO (LMK IDEN-
  .  TIFIED )
  .  ---------------
  .    .Y   .N
  .    .    .
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POSS        .  --------------- .                   ---------------- .
HOLD .      .  FLASH VERB-NOUN .               .   MONITOR DSKY:    .
.......     .  TO REQUEST RE-  ...................    OBSERVE VERB- .
SNAP .      .  SPONSE AND DIS- .               .   NOUN FLASH TO    .
            .  PLAY LMK DATA   .                   REQUEST RESPONSE .
            .     V06 N89      .                   AND DISPLAY OF   .
            .                  .                   LMK DATA IF A    .
            .     R1: LAT      .                   NON-IDENTIFIED   .
            .     R2: LONG/2   .                   LANDMARK WAS     .
            .     R3: ALT      .                   CHOSEN           .        #640
            .                  .                   ---------------- .
            .  LAT:-LATITUDE   .                           .        .
            .  OF LMK IN DEG   .                           .        .
            .  TO NEAREST .001 .                           .        .
            .  DEG             .                   ---------------- .
            .     + IS NORTH   .                   ARE THESE THE    .
            .                  .                   COORDINATES OF   .
            .  LONG/2-LONGI-   .                   THE LANDMARK I   .
            .  TUDE OF LMK DI- .                   MARKED ON?       .
            .  VIDED BY 2 IN   .                   ---------------- .        #650
            .  DEG TO NEAREST  .                     .Y         .N  .
            .  .001 DEG        .                     .          .   .
            .     + IS EAST    .                     .          .   .
            .                  .                     .          .   .
            .  ALT-ALT OF LMK  .                     .          .   .
            .  IN NAUTICAL     .                     .          .   .
            .  MILES TO NEAR-  .                     .          .   .
            .  EST .01 N.M.    .                     .          .   .
            .  (FOR EARTH      .                     .          .   .
            .  ABOVE FISCHER   .                     .          .   .        #660
            .  ELLIPSOID) (FOR .                     .          .   .
            .  MOON ABOVE MEAN .                     .          .   .
            .  LUNAR RADIUS)   .                     .          .   .
            .  --------------- .                     .          .   .
            .       .          .                     .          .   .
            .       .          .                     .          .   .
            .       .          .                     .          .   .
            .  --------------- .                   ------------ .   .
            .  WAIT FOR KEY-   . .                 KEY IN       .   .
            .  BOARD ENTRY     ................... PROCEED      .   .        #670
            .                  . .                 ------------ .   .
            .                  .                                .   .
            .                  .                                .   .
            .                  .                                .   .
            .  TERMINATE FLASH .                             ------ .
            .  UPON RECEIPT OF . .                           KEY IN .
            .  PROCEED OR NEW  ............................. V25E   .
            .  DATA            . .                           AND    .
            .  --------------- .                             LOAD   .
            .     .P     .NEW  .                             NEW    .        #680
            .     .R     .DATA .                             DATA   .
            .     .O     .     .                             ------ .
            .     .C --------- .                              .     .
            .     .E STORE NEW .                              .     .
            .     .E DATA      .                              .......
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            .     .D --------- .
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          SUBTRACT CALIBRATION
          ANGLE (STORED BY
          R57) FROM MEASURED
          TRUNNION ANGLE.
          --------------------
                    .
                    .
                    .
          --------------------
          RESET RENDWFLAG
          SEE (P20).
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                    .
                    .
          --------------------
          COMPUTE STATE VECTOR
          CHANGE DUE TO THE
          MEASUREMENT
          --------------------
                    .
                    .
                    .
          --------------------                  --------------------
HOLD.     FLASH VERB-NOUN TO                  .  MONITOR DSKY:
......    REQUEST RESPONSE AND ................. OBSERVE VERB-NOUN
SNAP.     DISPLAY ORBITAL                     .  FLASH TO REQUEST
          PARAMETER CHANGES                      RESPONSE AND CISPLAY
               V06 N49                           OF ORBITAL PARAMETER
             R1-DELTA R                          CHANGES
             R2-DELTA V                          --------------------
             R3-BLANK                                     .
                                                          .
          DELTA R-MAGNITUDE OF                            .
          THE DIFFERENCE                                  .
          BETWEEN THE POSITION                            .
          VECTOR BEFORE ANC                               .
          AFTER INCCRPORATICN                             .
          OF STAR MEASUREMENT                             .
          IN N. M. TO NEAREST                             .
          0.1 N. M.                                       .
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DELTA V- MAGNITUDE                                 .
OF THE CIFFERENCE                                  .
BETWEEN THE VFLCCITY                               .
VECTOR BEFORE AND                                  .
AFTER INCORPORATICN                                .
OF THE STAR MEASURE-                               .
MENT DATA IN FEET/                                 .
SEC TO NEAREST 0.1                                 .
FPS                                                .
--------------------                      -------------------
          .                               ARE ORBITAL PARAMET-
          .                               ER CHANGES ACCEPT-
          .                               ABLE FOR INSERTION
          .                               INTO CMC CALCULAT-
          .                               ICNS CF POSITION
          .                               AND VELOCITY?
          .                               --------------------
          .                                 . Y             .N
          .                                 .                .
          .                                 .                .
--------------------   .                  -------------      .
WAIT FOR KEYBOARD    ...................  KEY IN PROCEED     .
ENTRY                  .                  -------------      .
                                                             .
                                                             .
                                                             .
                                                       -------
TERMINATE FLASH ON                                     KEY IN
RECEIPT OF PROCEEC                                     RECYCLE
OR RECYCLE                                                V32E
--------------------                                   -------
  .P      .R                                              .
  .R      .E                                              .
  .O      .C                                              .
  .C      .Y                                             ...
  .E      .C                                              .
  .E      .L                                            GO TO
  .D      .E                                             "B"
  .       .                                             ABOVE
  .       .
  .      ...
  .       .
  .     GC TO
  .      "B"
  .     ABOVE
  .
  .
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UPDATE CMC
STATE VECTOR
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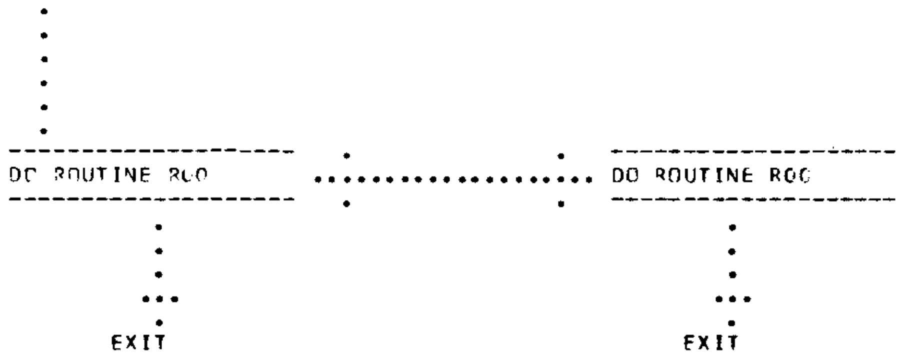
DO ROUTINE R00
DO ROUTINE R00
EXIT
EXIT

#790

#800

CHANGE CONTROL NOTES

REV 10	PCR NASA 84
REV 11	PCR MIT 66
REV 12	PCR 206
REV 13	PCN 520
REV 14	PCN 571
	PCR 206 EDITORIAL

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PURPOSE: (1) TO INSERT INFORMATION INTO THE CMC VIA THE DIGITAL UPLINK BY TRANSMISSION FROM THE GROUND OR VIA THE DSKY KEYBOARD BY CREW MANUAL INPUT.

ASSUMPTIONS: (1) THE CMC MUST BE IN THE OPERATE CONDITION. THE IMU MAY BE IN STANDBY OR OPERATE CONDITION.

(2) CMC UPDATES ARE OF FOUR CATEGORIES:

(A) PROVIDE AN UPDATE FOR CMC LIFTOFF TIME (V70).

(B) PROVIDE AN OCTAL INCREMENT FOR THE CMC CLOCK ONLY (V73).

(C) PROVIDE LOAD CAPABILITY FOR A BLOCK OF SEQUENTIAL ERASABLE LOCATIONS (1-18 INCLUSIVE LOCATIONS WHOSE ADDRESS IS SPECIFIED) (V71).

(D) PROVIDE LOAD CAPABILITY FOR 1-9 INCLUSIVE INDIVIDUALLY SPECIFIED ERASABLE LOCATIONS (V72).

(3) A COMPLETE DESCRIPTION OF THE CMC UPLINK FORMAT IS INCLUDED IN SECTION 2 OF R-577.

(4) UPDATE IS ALLOWED IN THE CSM WHEN THE CMC IS IN P00 OR P02, AND IF THE DSKY IS AVAILABLE.

(5) THE UPTEL ACCEPT/BLOCK SWITCH MUST BE IN ACCEPT FOR TELEMETRY UPDATE.

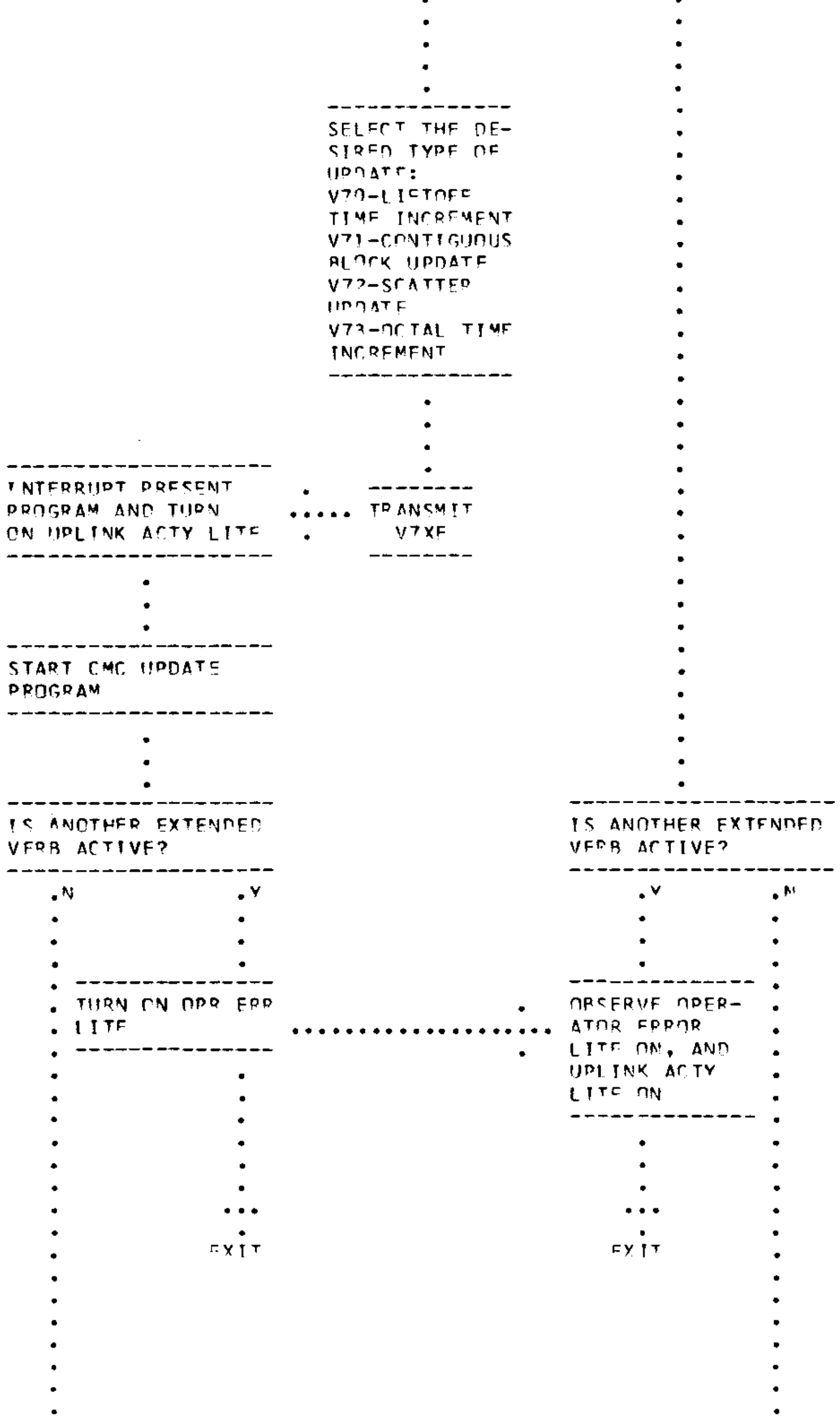
(6) THE PROGRAM IS MANUALLY SELECTED BY THE ASTRONAUT BY DSKY ENTRY OR BY THE GROUND BY UPLINK TRANSMISSION.

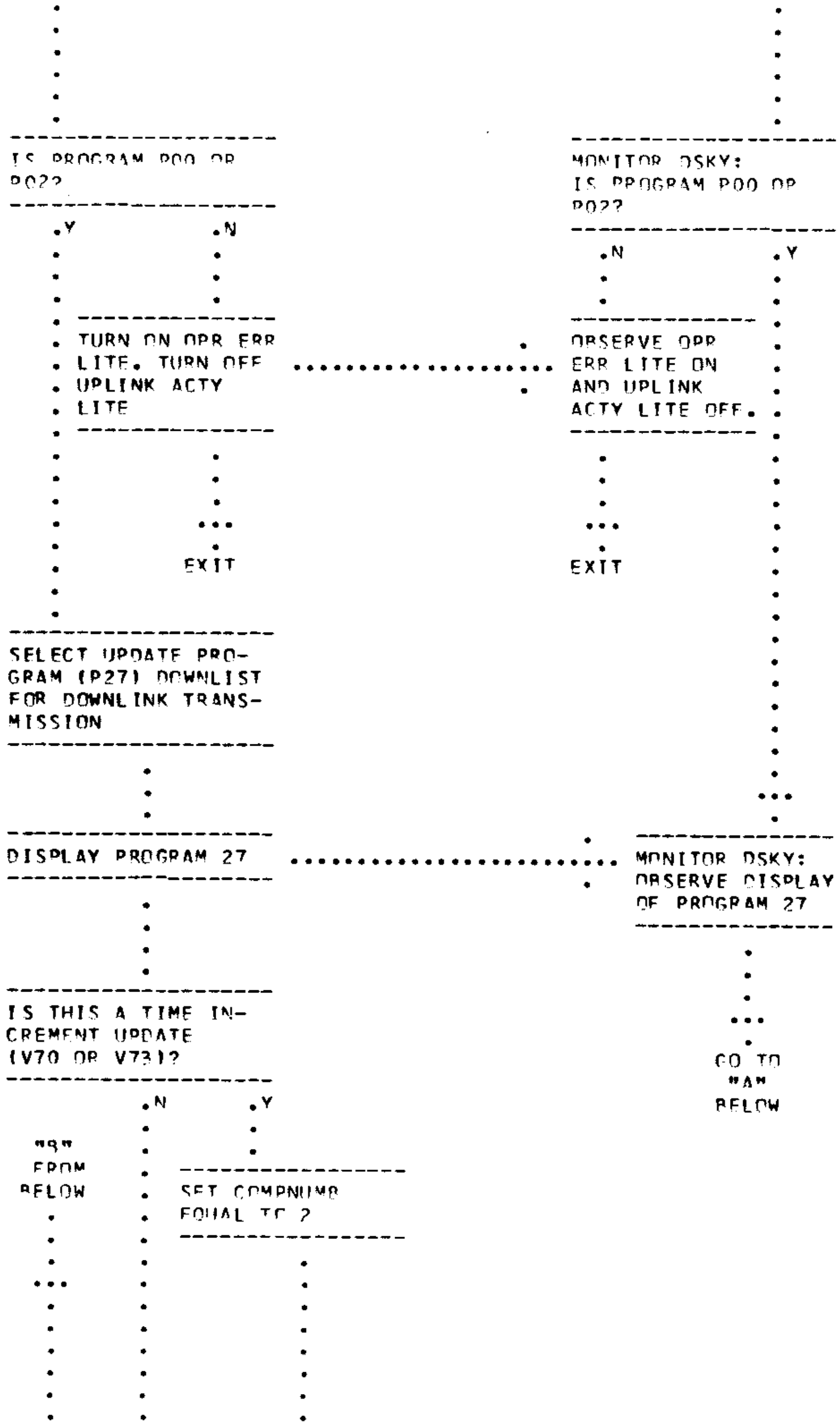
(7) THE AUTOMATIC MODE OF UPDATE IS PROGRAM SELECTION AND UPDATE VIA THE GROUND BY UPLINK TRANSMISSION. THE ONLY DIFFERENCE BETWEEN THIS AND MANUAL SELECTION BY THE ASTRONAUT IS THAT THE DSKY RESPONSES ARE KEYED IN BY THE ASTRONAUT RATHER THAN TRANSMITTED.

```
  PROG             CMC                GROUND              CREW                                CHECKLIST             TIME       TOTAL
  CONT                                                                                                                          TIME



                                  --------------    --------------------
                                  NOTIFY CREW OF    VERIFY THAT UPDATE
                                  INTENTION TO    . WILL BE STAISFACTORY
                                  UPDATE. SPEC- ....W.R.T. TIME, WORK IN
                                  IFY PARAMETERS  . PROGRESS AND CMC
                                  AND COORDINATE    ACTIVITY.
                                  TIME.             --------------------
                                  --------------             .
                                         .                   .
                                         .                   .                                                                 #10
                                         .                   .
                                         .                   .
                                         .                   .
                                         .                   .
                                         .                   .
                                         .                   .                                                  P27/COLOSSUS
                                         .                   .                                                  P27/SUNDANCE
                                         .                   .                                                  P27/LUMINARY
```


SELECT THE DESIRED TYPE OF UPDATE:
V70-LIFTOFF TIME INCREMENT
V71-CONTIGUOUS BLOCK UPDATE
V72-SCATTER UPDATE
V73-OCTAL TIME INCREMENT
INTERRUPT PRESENT PROGRAM AND TURN ON UPLINK ACTY LITE
TRANSMIT V7XE
START CMC UPDATE PROGRAM
IS ANOTHER EXTENDED VERB ACTIVE?
N
Y
TURN ON OPR ERR LITE
EXIT
IS ANOTHER EXTENDED VERB ACTIVE?
Y
N
OBSERVE OPERATOR ERROR LITE ON, AND UPLINK ACTY LITE ON
EXIT


IS PROGRAM P00 OR P022?
Y
N
TURN ON OPR ERR LITE. TURN OFF UPLINK ACTY LITE
EXIT
SELECT UPDATE PROGRAM (P27) DOWNLIST FOR DOWNLINK TRANSMISSION
DISPLAY PROGRAM 27
IS THIS A TIME INCREMENT UPDATE (V70 OR V73)?
N
Y
"B" FROM BELOW
SET COMPNUMB EQUAL TO 2
MONITOR DSKY: IS PROGRAM P00 OR P022?
N
Y
OBSERVE OPR ERR LITE ON AND UPLINK ACTY LITE OFF.
EXIT
MONITOR DSKY: OBSERVE DISPLAY OF PROGRAM 27
GO TO "A" BELOW

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             .      .           .
             .      .           .
             .      .           .
             .      .           .
          --------------------  .
          FLASH VERB/NOUN TO    .
          REQUEST LOAD OF       .
          INDEX IN MACHINE      . --------------
          ADDRESS SPECIFIED IN  . MONITOR DOWN-
POSS      R3 AND DISPLAY:       .. LINK:
HOLD  .     V21 N01      ..........OBSERVE VERB/
.........   R1-BLANK            .. NOUN FLASH AND
SNAP  .     R2-UNCHANGED        . DISPLAY OF
            R3-AAAAA            . AAAAA
                                . --------------
          AAAAA-MEMORY LOCA-    .        .
          TION IN WHICH THE     .        .
          INDEX VALUE WILL BE   .        .
          LOADED. THE INDEX     . --------------
          VALUE REPRESENTS THE  . DO I WISH TO
          TOTAL NUMBER OF       . TERMINATE?
          NUMERIC VALUES TO BE  . --------------
          LOADED, INCLUDING     .    .Y      .N
          THE INDEX VALUE IT-   .    .       .
          SELF MINIMUM INDEX    .    .       .
          IS 3: MAXIMUM IS 20.  .    .       .
          --------------------  .    .       .
                    .           .    .       .
                    .           .    .       .
                    .           .    .       .
          --------------------  .    .       .
          WAIT FOR KEYBOARD     .    .       .
          ENTRY                 .    .       .
                                .    .       .
                                . ---------- .
                        .       . TRANSMIT   .
                      ........... TERMINATE  .
                        .       . V34E       .
                                . ---------- .
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                                . GO TO "A"  .
                                . BELOW      .
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                                .            .
                                .      ---------
                        .       .      TRANSMIT
                      ................ INDEX
                        .       .      VALUE
                           .    .      ---------
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                                .
          TERMINATE FLASH UPON  .
          RECEIPT OF TERMINATE  .
          OR INDEX              .
          --------------------  .
             .T           .I    .
             .E           .N    .
             .R           .D    .
             .M           .E    .
             .I           .X    .
             .N           .     .
             .A           .     .
             .T           .     .
             .E           .     .
             .            .     .
             .            .     .
            ...           .     .
             .     ---------    .
          GO TO "A"  DISPLAY    .
          BELOW      INDEX      .
                     VALUE IN   .
                     R1 AS IT   .
                     IS LOADED  .
                     ---------  .
                          .     .
                          .     .
                          .     .
++        -------------------   .
+07       IS INDEX LESS THAN    .
+07       3 OR GREATER THAN     .
++        20?                   .
EDIT      -------------------   .
             .Y          .N     .
             .           .      .
             .           .      .
            ...          .      .
             .           .      .
          GO TO "B"      .      .
          ABOVE          .      .
                         .      .
                         .      .
                  ------------  .
                  STORE INDEX   .
                  IN COMPNUMB   .
                  ------------  .
                         .      .
                         .      .
                         .      .
                    ......      .
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                    .           .
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       .  ---------------------
       .  CALCULATE ADDRESS
       .  FOR STORAGE OF NEXT
       .  DATA LOAD
       .  ---------------------
       .            .
       .            .
       .            .
       .    "C"     .
       .    FROM    .
       .   BELOW    .
       .     .      .
       .     .      .
       .     .      .
       .    ...     .
       .     .      .
       .  ---------------------   ---------------
       .  FLASH VERB/NOUN TO      MONITOR DOWN-
       .  REQUEST LOAD OF DATA    LINK:
       .  INTO CALCULATED       . OBSERVE VERB/
       .  ADDRESS SPECIFIED IN....NOUN FLASH TO
       .  R3 AND DISPLAY:       . REQUEST DATA
HOLD  ..    V21 N01               LOAD
.........   R1 BLANK              ---------------
SNAP  ..    R2 UNCHANGED                 .
       .    R3 AAAAA                     .
       .  ---------------------          .
       .            .             ---------------
       .            .             DO I WISH TO
       .            .             TERMINATE?
       .  ---------------------   ---------------
       .  WAIT FOR KEYBOARD           .Y   .N
       .  ENTRY                        .    .
       .                               .    .
       .                          --------- .
       .                .         TRANSMIT  .
       .              ........... TERMINATE .
       .                .         V34E      .
       .                          --------- .
       .                               .    .
       .                               .    .
       .                               .    .
       .                              ...   .
       .                               .    .
       .                          GO TO "A" .
       .                          BELOW     .
       .                                    .
       .                                    .
       .                .              ---------
       .              ................ TRANSMIT
       .                .              DATA
       .                               ---------
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       .
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        .
        . TERMINATE FLASH
        . UPON RECEIPT OF
        . TERMINATE OR DATA
        . --------------------
        .    .T           .D
        .    .E           .A
        .    .R           .T
        .    .M           .A
        .    .I           .
        .    .N           .
        .    .A  -------------
        .    .T  DISPLAY DATA
        .    .E  IN R1 AS IT
        .    .   IS LOADED
        .    .   -------------
        .    .            .
        .   ...           .
        .    .            .
        . GO TO "A"       .
        . BELOW           .
        .                 .
        .                 .
        . --------------------
        . IS THIS THE LAST
        . DATA LOAD? (UPLINK
        . COMPONENT COUNTER =
        . COMPNUMB)
        . --------------------
        .   .N      .Y
        .   .       .
        .   .       .
        ......      .    "D"
                    .    FROM
                    .   BELOW
                    .     .
                    .     .
                    .     .
                    .    ...
                    .     .
          --------------------    --------------
          FLASH VERB/NOUN TO      MONITOR DOWN-
          REQUEST LOAD OF         LINK:
          OCTAL IDENTIFIER      . OBSERVE VERB/
          INTO MACHINE ADDRESS....NOUN FLASH TO
          SPECIFIED IN R3 AND   . REQUEST LOAD
HOLD  .   DISPLAY:                OF OCTAL
.........   V21 N02               IDENTIFIER
SNAP  .     R1 BLANK              --------------
            R2 UNCHANGED                 .
            R3 AAAAA                     .
                                         .
                                         .
                                         .
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                                         .
                                         .
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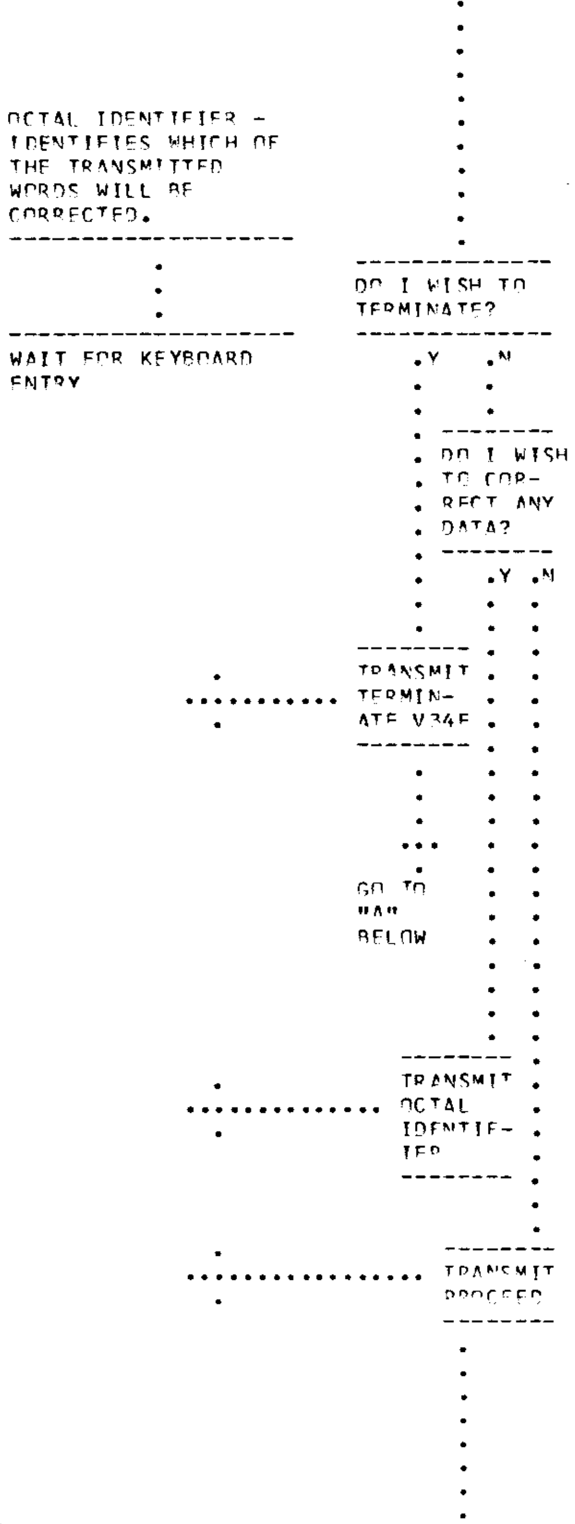
```


OCTAL IDENTIFIER - IDENTIFIES WHICH OF THE TRANSMITTED WORDS WILL BE CORRECTED.
WAIT FOR KEYBOARD ENTRY
DO I WISH TO TERMINATE?
Y
N
DO I WISH TO CORRECT ANY DATA?
Y
N
TRANSMIT TERMINATE V34E
GO TO "A" BELOW
TRANSMIT OCTAL IDENTIFIER
TRANSMIT PROCEED

```
                                .
                                .
                                .
                                .
                                .
                                .
TERMINATE FLASH UPON            .
RECEIPT OF TERMIN-              .
ATE, PROCEED, OR                .
XXE.                            .
--------------------            .
 .T     .P      .X              .
 .E     .R      .X              .
 .R     .O      .E              .
 .M     .C      .               .
 .I     .E      .               .
 .N     .E      .               .
 .A     .D      .               .
 .T     .       .               .
 .E     . ----------            .
 .      . IS XX GRE-            .
 .      . ATER THAN             .
...     . 0 AND EQU-            .
 .      . AL TO OR              .
GO TO   . LESS THAN             .
 "A"    . COMPNUMB              .
BELOW   . ----------            .
        .   .Y  .N              .
        .   .   .               .
        .   .   .               .
        .   .  ...              .
        .   .   .               .
        .   . GO TO             .
        .   . "D"               .
        .   . ABOVE             .
        .   .                   .
        .   .                   .
        . ----------            .
        . CALCULATE             .
        . ADDRESS OF            .
        . DATA LOAD             .
        . TO BE                 .
        . CORRECTED             .
        . ----------            .
        .      .                .
        .      .                .
        .      .                .
        .     ...               .
        .      .                .
        . GO TO "C"             .
        . ABOVE                 .
        .                     ...
        .                       .
---------------      .  --------------
INVERT VERIFLAG ........MONITOR DOWN-
---------------      .  LIST THAT PRO-
          .             CEED HAS BEEN
          .             SUCCESSFULLY
          .             RECEIVED
          .             --------------
          .
          .
          .
          .
          .
          .
          .
          .
          .
--------------------
IS THIS AN OCTAL
TIME INCREMENT
(V73)?
--------------------
   .Y             .N
   .              .
   .              .
   .              .....
   .                  .
   .                  .
----------------      .
WOULD THE INCRE-      .
MENT CAUSE THE        .
CMC CLOCK TO          .
OVERFLOW?             .
----------------      .
   .Y         .N      .
   .          .       .
   .          .       .
----------    .       .  --------------
TURN ON       .      ..  MONITOR DSKY:
OPERATOR   ............  OBSERVE OPER-
ERROR LITE    .      ..  ATOR LITE
----------    .       .  --------------
     .        .       .         .
     .        .       .         .
     .        .       .         .
    ...       .       .        ...
     .     ---------  .         .
GO TO "A"  INCREMENT  .   GO TO "A"
BELOW      CMC CLOCK  .   BELOW
           ---------  .
               .      .
               .      .
               .      .
              ...     .
               .      .
           GO TO "A"  .
           BELOW      .
                      .
                      .
          ............
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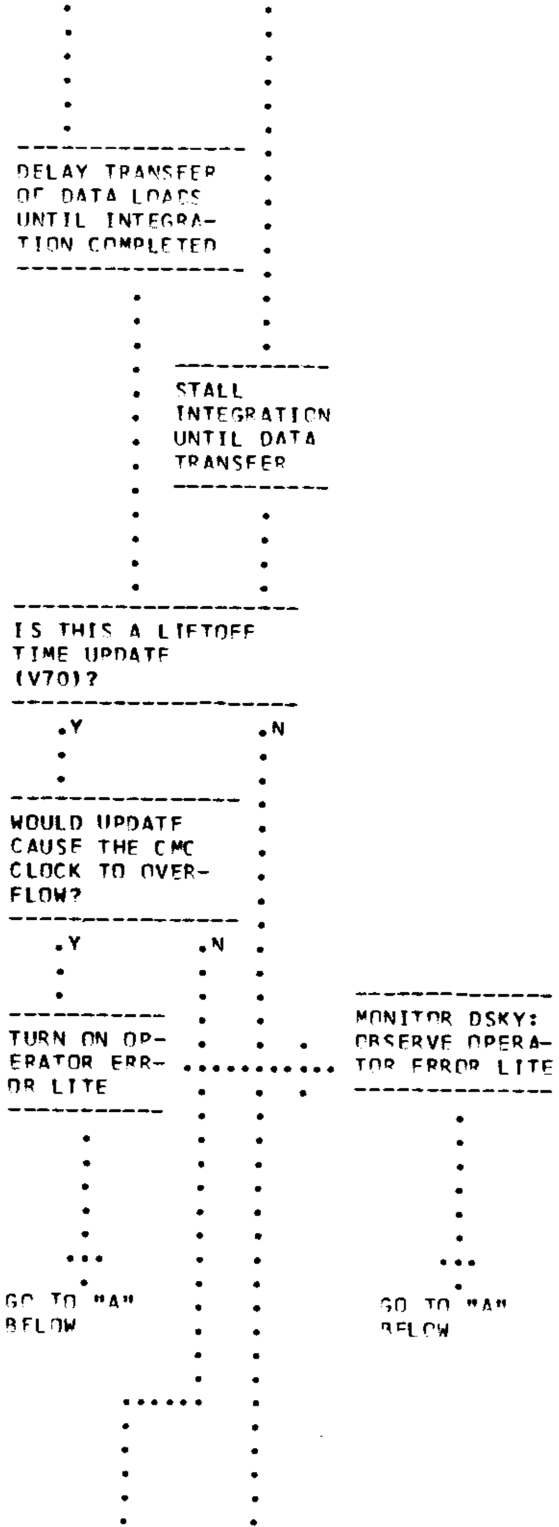
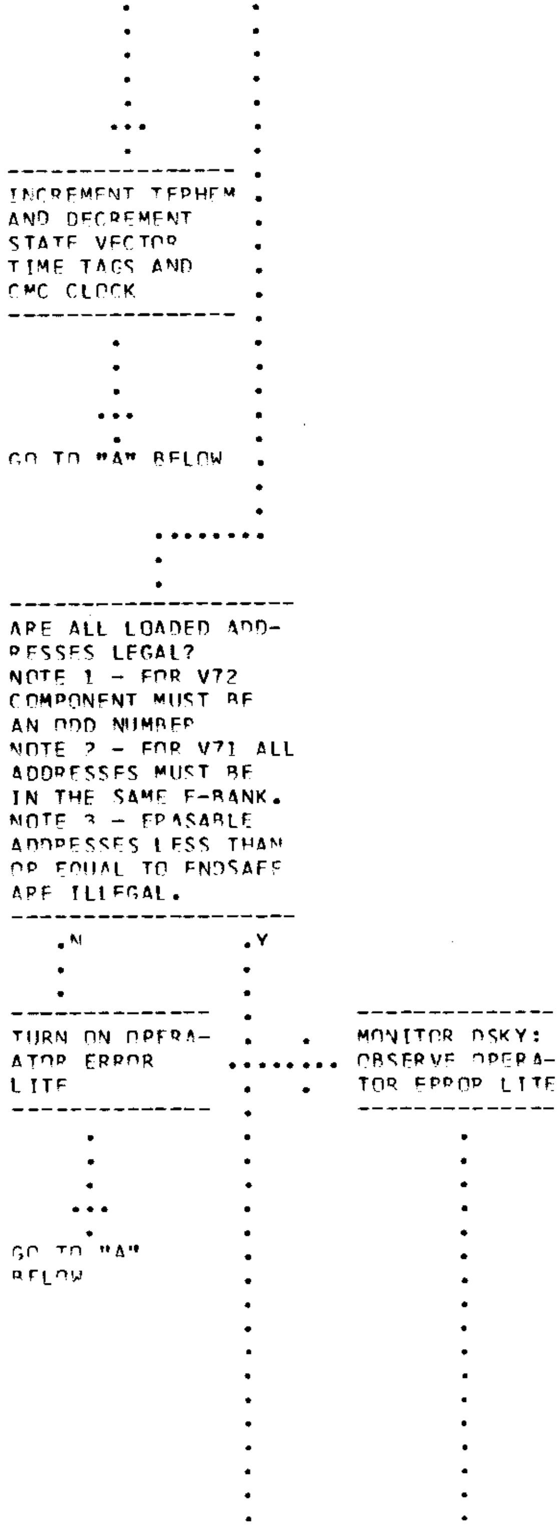
          .
--------------------
IS ORBITAL INTEGRA-
TION IN PROGRESS?
--------------------
   .Y             .N
   .              .
   .              .
   .              .
   .              .
   .              .
   .              .
   .              .
   .              .
```


DELAY TRANSFER OF DATA LOADS UNTIL INTEGRATION COMPLETED
STALL INTEGRATION UNTIL DATA TRANSFER
IS THIS A LIFTOFF TIME UPDATE (V70)?
Y
N
WOULD UPDATE CAUSE THE CMC CLOCK TO OVERFLOW?
Y
N
TURN ON OPERATOR ERROR LITE
MONITOR DSKY: OBSERVE OPERATOR ERROR LITE
GO TO "A" BELOW
GO TO "A" BELOW



INCREMENT TEPHEM AND DECREMENT STATE VECTOR TIME TAGS AND CMC CLOCK

GO TO "A" BELOW

ARE ALL LOADED ADDRESSES LEGAL?
NOTE 1 - FOR V72 COMPONENT MUST BE AN ODD NUMBER
NOTE 2 - FOR V71 ALL ADDRESSES MUST BE IN THE SAME E-BANK.
NOTE 3 - ERASABLE ADDRESSES LESS THAN OR EQUAL TO ENDSAFE ARE ILLEGAL.

TURN ON OPERATOR ERROR LITE

MONITOR DSKY: OBSERVE OPERATOR ERROR LITE

GO TO "A" BELOW

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                .              .
                .              .
                .              .
                .              .
                .              .
                .              .
--------------------           .
TRANSFER DATA TO               .
SPECIFIED BLOCK                .
(V71) OR SPECIFIED             .
ADDRESSES (V72)                .
--------------------           .
          .                    .
          .                    .
          .                    .
  "A"     .               "A"  .                 "A"
  FROM    .               FROM .                 FROM
  ABOVE   .              ABOVE .                ABOVE
   .      .               .    .                  .
   .      .               .    .                  .
   .      .               .    .                  .
  ...     .              ...  ...                ...
   .      .               .    .                  .
--------------------  . --------------    --------------------
TURN OFF UPTL ACT-  ....MONITOR DOWN-     MONITOR DSKY:
IVITY LITE            . LINK:             SUCCESSFUL UPDATE IS
--------------------    OBSERVE UPTL      INDICATED BY UPTL
          .             ACTIVITY LITE     ACTIVITY LITE OUT,
          .             OUT, REVERSION    OPERATOR ERROR LITE
          .             TO ORIGINAL       OUT, AND RETURN TO
--------------------  . DOWNLINK LIST,    P00 OR P02.
CHANGE DOWNLINK LIST....TERMINATION OF    --------------------
TO ORIGINAL           . P27, AND RE-
--------------------    TURN TO P00 OR
          .             P02.
          .             --------------
--------------------
TERMINATE P27 AND GO
TO PROGRAM WHICH WAS
INTERRUPTED (P00 OR
P02)
--------------------
          .
          .
          .
         ...
          .
        EXIT P27
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CHANGE CONTROL NOTES

REV 05   PCR MIT 66
REV 06   PCR 206
REV 07   EDITORIAL

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