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.

(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 ICOS (V16 N2O) OR BY MONITORING THE FPAI BALL.

(3) DURING THIS PROGRAM THE CMC ERASABLE STORAGE MAY BE INITIALIZED BY KEYING IN V96E (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 (PEESMMA) IS INVALIDATED.

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

PROCEDURE

<table>
<thead>
<tr>
<th>CONT.</th>
<th>CMC</th>
<th>GROUND</th>
<th>CREW</th>
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<tbody>
<tr>
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<td>CHECKLIST</td>
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</tbody>
</table>

- CMC PROC
- SELECTION

- CREW PROC
- SELECTION

START: CMC IDLING PROGRAM 90
DISPLAY PROGRAM 90

KEY IN CMC IDLING PROGRAM (900)
V27E 000

#10
EXIT PNO
AND GO TO
PROGRAM
SELECTED
VIA PNO

CHANGE CONTROL NOTES

REV 03  PCR 417  66
REV 04  PCR 507
Prelaunch or service - initialization program (PO1) Logic Rev 04 07/08/68

Purpose:
1. To initialize the platform for the prelaunch programs.
2. To provide an initial stable member orientation for gyro compassing (PO2).

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).

<table>
<thead>
<tr>
<th>Prog</th>
<th>CMC</th>
<th>Ground</th>
<th>Crew</th>
<th>Checklist</th>
<th>Time</th>
<th>Total Time</th>
</tr>
</thead>
</table>

- Crew
- Program
- Selection

* * *

---

Start initialization program (PC1)
Display program 01

---

Key in initialization program (PO1)

---

Monitor DSKY:
Observe display of program 01

---

Command ISS zero
CCU routine
**PC 1/COLossus**

---

WAIT ABOUT 10 SECONDS

---

TURN ON "NO ATT" LIGHT. OBSERVE "NO ATT" LIGHT ON

---

COMMAND COARSE ALIGN IN ISS. COARSE ALIGN TO DESIRED PLATFORM ORIENTATION

---

REMOVE COARSE ALIGN COMMAND (RELEASE PLATFORM)

---

TURN OFF "NO ATT" LIGHT. OBSERVE "NO ATT" LIGHT OFF

---

TERMINATE PROGRAM 01 AND GO TO PRE-LAUNCH OR SERVICE - GYRO COMPASSING PROGRAM (P02)

---

MONITOR DSKY: OBSERVE TERMINATION OF P01 AND DISPLAY OF P02

---

EXIT P01
CHANGE CONTROL NOTES

REV 04   PCR 206

OG110000
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**PRELAUNCH OR SERVICE - CYRO COMPASSING PROGRAM (PO2)**

**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 (PO3).
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 (PO1).
4. This program has the capability (via V70E) to change launch azimuth of the stable member while gyrocompassing.

<table>
<thead>
<tr>
<th>PROG</th>
<th>CONT</th>
<th>CMG</th>
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</tbody>
</table>

- AGC
- PROG
- SELECTION

`--------------------------`  `--------------------------`
| START PRELAUNCH OR      | MONITOR DSKY:     |
| SERVICE-GYRO           | OBSERVE DISPLAY OF |
| COMPASSING PROGRAM    | PROGRAM 02        |
| (PO2)                  |                   |
| DISPLAY PROGRAM 02     |                   |

- #10
- #20
HOLD
SNAP

FLASH VERB-NOUN TO REQUEST PROCEED AND DISPLAY STORED LAUNCH AZIMUTH
Y06 N29
R1-XSM LAUNCH AZIMUTH
R2-ALANK
R3-ALANK

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?

Y N

WAIT FOR KEYBOARD ENTRY

KEY IN V21E AND LOAD NEW LAUNCH AZIMUTH

TERMINATE FLASH UPON RECEIPT OF PROCEED OR NEW DATA

P NEW
R DATA
D E E STORE
C NEW DATA

KEY IN PROCEED

PO2/COLOSSUS
START MONITOR OF LIFT OFF DISCRETE

LO FROM SIVB IU

LO OR ENTER

AT T-2 MIN KEY IN W75

SEND NOTIFICATION OF LIFT-OFF

WAIT FOR NOTIFICATION OF LIFTOFF FROM GROUND

TERMINATE PO2 AND GO TO EARTH ORBIT INSERTION MONITOR PROGRAM (P11)

MONITOR DSKY: IS AGC RECEIPT OF LIFTOFF INDICATED BY DISPLAY OF P11?

Y N

EXIT PO2

PRESS ENTER TO INITIATE P11
**PURPOSE:**

1. To provide an optical check for verification of alignment of the starable member of the ISS during gyro compassing prior to launch.

**ASSUMPTIONS:**

1. The program is manually selected by OSK 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.
4. In order to prematurely terminate this program and return to P02 the astronaut may key in V34E on any flashing display.

<table>
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</tr>
</thead>
</table>

- **CREW**
- **PROGRAM**
- **SELECTION**

---

Is program P02 operating?  

- **Y**  
- **N**

---

Key in prelaunch or service - optical verification of gyro compassing program (P03) V65E

---

Set operator error light on

---

Observe operator error light on

---

PO3/COLOSSUS
HOLD
SNAP

FLASH VERB-NOUN TO REQUEST PROCEED AND DISPLAY STORED TARGET 1 AZIMUTH AND ELEVATION:

VO6 N41
R1-TARG AZ
R2-TARG ELEV
R3-TARG ICFNT

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 IDENTIFI-ES 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?

Y N

WAIT FOR KEYBOARD ENTRY

KEY IN PROCEED
TARG AZ-TARGET
AZIMUTH-ANGLE CLOCK-WISF 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

---

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

---

Y N

---

KEY IN PROCEED

---

TERMINATE FLASH UPON RECEIPT OF PROCEED OR NEW DATA

---

P NEW
R DATA
O
C
E
E DISPLAY AND N STORE NEW DATA

---

#190
#190
#200
#210
#220
WAS SIGHTING SATISFACTORY?

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

CALCULATE SM MISALIGNMENT
TERMINATE P03
AND REDISPLAY
P02. CONTINUE
GYRO COMPASSING.

TORQUE 2 GYRO PER
ERROR

TERMINATE P03 AND
REDISPLAY P02.
CONTINUE GYRO
COMPASSING.

EXIT P03

CHANGE CONTROL NOTES

LOGIC REV 06  PCR 011  46
LOGIC REV 07  PCR 435
LOGIC REV 08  PCR 206
LOGIC REV 09  PCR 493
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 CTK 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 (V36E) 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 CONT**  **CMC**  **GROUND**  **CREW**  **CHECKLIST**  **TIME**  **TOTAL TIME**

<table>
<thead>
<tr>
<th>CREW PROG</th>
<th>SELECTION</th>
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<tbody>
<tr>
<td><strong>------</strong></td>
<td><strong>-------</strong></td>
</tr>
<tr>
<td>START CMC</td>
<td></td>
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<tr>
<td>POWER DOWN</td>
<td></td>
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<tr>
<td>PROGRAM (P06)</td>
<td></td>
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<tr>
<td>DISPLAY PROGRAM 06</td>
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</tbody>
</table>

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**V37E 06E**

---

**MONITOR DSKY:**

**OBSERVE DISPLAY**

**OF PROGRAM 06**
TERMINATE FLASH UPON RECEIPT OF PROCEED

-------------------

* PROCEED
* STANDBY
* ENTER

* OR
* V34E
* OR
* V32E

* ...

EXIT
EARTH ORBIT INSERTION MONITOR PROGRAM (P11)

PURPOSE:

1. To indicate to the astronaut that the CMC has received the liftoff discrete.

2. To generate an attitude error indication on the FDI 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.

<table>
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</table>

- CMC PROG
- SELECTION

START ECI MONITOR PROGRAM (P11) DISPLAY PROGRAM 11

MONITOR DSKY:

- OBSERVE DISPLAY OF PROGRAM 11

SEND EFFECTIVE TIME OF LIFTOFF ON DOWNLINK

- VERIFY AUTOMATIC START OF DIGITAL EVENT TIMER

*06 ZERO CMC CLOCK

++

**P11/COLOSSUS**
UPDATE TEPHEM TO
TIME OF LIFTOFF

CALL AVERAGE
G INTEGRATION
WITH DELTA V
INTEGRATION

TERMINATE GYRO-
COMPASSING

COMPUTE INITIAL
STATE VECTOR

COMPUTE REFSMMAT

SET REFSMMAT FLAG

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 TEL (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 TEL + TF2 (TF2 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) FOAI ATTITUDE ERROR NEEDLES AS INDICATION OF CMC COMPUTATIONS OF INSERTION.

BALL INDICATES INITIAL VEHICLE ROLLOUT AND THEN GRADUAL PITCH-OVER.

(B) OSKY:

R1 - VI INCORRECT R2 - H DCT follows NOMINAL HISTORY R3 - H INCREASING

-------------

HOLD

-------------

DISPLAY ON OSKY:

VO6 N62 R1 - VI R2 - H DCT R3 - H

VI - INERTIAL VELOCITY MAGNITUDE, IN FPS TO NEAREST FPS

H DCT - RATE OF CHANGE OF VEHICLE ALTITUDE ABOVE LAUNCH PAC RADUS, 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 TO PROGRAM SELECTED
VIA R00

----------------------------------
KEY IN V37EXXE

----------------------------------
EXIT P11

CHANGE CONTROL NOTES

LOGIC REV 5     PCR 3
LOGIC REV 6     PCR 206
TP1 SEARCH PROGRAM (P17)

PURPOSE:

1. TO ACCEPT A DESIRED TIME OF TRANSFER PHASE INITIATION (TITP1) AS A DSKY INPUT FROM THE ASTRONAUT, AND TO COMPUTE THEREFROM THE PARAMETERS ASSOCIATED WITH A MINIMUM ENERGY, SAFE PERIAPSIS TRANSFER MANEUVER AT TITP1 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 TITP1.

3. TO DISPLAY TO THE ASTRONAUT THE PARAMETERS ASSOCIATED WITH THE TRANSFER (TP1 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 OPS 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 TP1 MANEUVER SELECT THE TRANSFER PHASE INITIATION (TP1) PROGRAM (P34).

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

<table>
<thead>
<tr>
<th>PROGRAM</th>
<th>CMC</th>
<th>GROUND</th>
<th>CREW</th>
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START TP1 SEARCH PROGRAM (P17).

KEY IN TP1 SEARCH PROGRAM (P17) V37E17E

MONITOR DSKY: OBSERVE DISPLAY OF PROGRAM 17.

P17/COLOSSUS
SET TRACK FLAG (SEE P20)

SET UPDATE FLAG (SEE P20)

SET ACTIVE VEHICLE FLAG TO CSM.

"A"

HOLD

SNAP

FLASH VERB- NOUN TO REQUEST RESPONSE AND DISPLAY TIGITPI:
  V0643?
  R1-TIGITPI-HRS
  R2-TIGITPI-MINS
  R3-TIGITPI-SECS
  TIGITPI-TIME OF TPI IGNITION (GET), IN HRS, MINS, SECS TO NEAREST .01 SEC.

MONITOR DSKY:
  OBSERVE VERB- NOUN FLASH TO REQUEST RESPONSE AND DISPLAY OF TIGITPI.

AM I SATISFIED WITH THESE VALUES?
  Y
  N

RECORD THIS VALUE.
WAIT FOR KEYBOARD ENTRY

TERMINATE FLASH UPON RECEIPT OF PROCEED OR NEW DATA

- PROCEED
- NEW DATA

STORE DATA

RESET UPDATE FLAG

COMPUTE VEHICLE POSITIONS AT TG1(TPI) AND SELECT NORMINAL SEARCH OPTION AS FOLLOWS:
IF ACTIVE VEHICLE IS ABOVE PASSIVE VEHICLE (NEGATIVE DELTA ALTITUDE) SELECT OPTION 00001.
IF ACTIVE VEHICLE IS BELOW PASSIVE VEHICLE (POSITIVE DELTA ALT) SELECT OPTION 00002

SET UPDATE FLAG

KEY IN PROCEED

KEY IN V25E AND LOAD THE DESIRED TG1(TPI)

#80

#90

#100

#110

#120
HOLD

FLASH VERB-NOUN TO
REQUEST RESPONSE AND
DISPLAY TPI PARAM-
ETERS:

V047N72
R1-DELT ANG(TPI)
R2-DELT ALT(TPI)
R3-SEARCH OPTION

DELT ANG(TPI) - CENT-
RAL ANGLE AROUND THE
EARTH CR 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
BEETWEEN THE POSITION
VECTORS OF THE ACT-
IVE AND PASSIVE VE-
HICLES AT TIG(TPI).
IN NAUTICAL MILES TO
THE NEAREST .1 N.
POLARITY INDICATES
THE PASSIVE VEHICLE
IS ABOVE (+) OR BE-
LOW (-) THE ACTIVE
VEHICLE.

SEARCH OPTION - AN OP-
TION CODE TO CONTRAL
CMC SEARCH FOR TERMIN-
INAL PHASE
DEFINITION:
00001-CMC SEARCHES
TO DEFINE A TERMINAL
PHASE WHERE THE REN-
DEZVOUS INTERCEPT
OCCURS AT A CENTRAL
ANGLE LESS THAN 10C
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)?

\[ \text{N} \] \[ \text{Y} \]

KEY IN RECYCLE
\[ V32F \]

GO TO "A" ABOVE

DO I WISH TO CHANGE THE SEARCH OPTION DISPLAYED?

\[ \text{N} \] \[ \text{Y} \]

RECORD THESE VALUES

KEY IN PROCEED
POS
MOLD
SNAP

--- ALARM ---

SET UP
DATE FLAG
(SEE P20)

SET UP
DATE FLAG
(SEE P20)

--- ALARM ---

POSS
MOLD
SNAP

--- ALARM ---

MONITOR DISK
TO REQUEST RE-
SPONSE AND DIS-
PLAY PROGRAM
ALARM CODE,
V05NO9
R1-
R2-
R3-

EXPECTED ALARM
CODE AT THIS
TIME IS 00124

--- ALARM ---

WAIT FOR KEY-
BOARD ENTRY

TERMINATE FLASH
UPON RECEIPT OF
RECYCLE

--- ALARM ---

TO ADJUST TIG
(TPI) AND/OR THE
SEARCH OPTION
KEY IN RECYCLE
V32E

--- ALARM ---

**E**
**C**
**V**
**C**
**L**
**E**

GO TO
"A"

ABOVE
HOLD

SNAP: FLASH VERB-NOUN TO REQUEST RESPONSE AND DISPLAY CALCULATED TERMINAL PHASE
PARAMETERS:
VO6N58
R1-PER ALT
R2-DELTA V(ITPI)
R3-DELTA V(ITPF)

PER ALT-ALTITUDE OF PERIGEE ABOVE LAUNCH RADIUS (EARTH ORBIT) OR ALTITUDE OF PERILUNE ABOVE THE MOST RECENTLY DEFINED LANDING SITE RADIUS (LUNAR ORBIT) AFTER TPI MANEUVER IN NAUTICAL MILES TO NEAREST .1 NM.

DELTA V(ITPI)-REQUI-R ED IMPULSIVE DELTA V TO ACCOMPLISH TPI MANEUVER AT TIP. IN FPS TO NEAREST .1 FPS.

DELTA V(ITPF)-REQUI-R ED IMPULSIVE DELTA V TO ACCOMPLISH TPF MANEUVER AT TIME OF INTERCEPT. POLARITY INDICATES ACTIVELY VEHICLE ASCENDING (+) OR DESCENDING (-) TO INTERCEPT. IN FPS TO NEAREST .1 FPS.

WAIT FOR KEYBOARD ENTRY.

MONITOR DSky:
OBSERVE VERB-NOUN FLASH TO REQUEST RESPONSE AND DISPLAY OF CALCULATED TERMINAL PHASE PARAMETERS.

DO I WISH TO ADJUST TIP(TPI) AND/CR THE SEARCH OPTION?

N Y

2 N

RECORD THESE VALUES.

P17/COLOSSUS
PURPOSE:
(1) TO CONTROL THE CSM ATTITUDE AND OPTICS TO ACQUIRE THE LM IN THE XEY FIELD AND TO POINT THE CSM TRANSPODOR AT THE LM OR TO CONTROL THE CSM ATTITUDE TO ACQUIRE THE LM ALONG THE XY AXIS BASED ON THE OPTION CODE CHOSEN.
(2) TO UPDATE EITHER THE LM OR CSM STATE VECTOR (AS SPECIFIED BY THE ASTRONAUT BY OSKY ENTRY) ON THE BASIS OF OPTICAL TRACKING DATA AND/OR VAP RANGE DATA.

ASSUMPTIONS:
(1) THE LM MUST BE ON AND ALIGNED IN ORDER TO PERFORM THIS PROGRAM.
(2) THE CNCS IS IN CONTROL OF THE VEHICLE IN THE AUTO MODE IN THE NOMINAL CASE. IF THE ASTRONAUT TAKES OVER CONTROL OF THE VEHICLE WITH CNCS THE CSM WILL REMAIN AT THE ATTITUDE IT IS DRIVEN TO, REGARDLESS OF WHERE SELECTION THE CNCS WILL CALCULATE THE PREDETERMINED TRACKING ATTITUDE AND THE 4X-AXIS TRACKING ATTITUDE.
(3) ROUTINE ROB HAS BEEN PERFORMED PRIOR TO SELECTION OF THIS PROGRAM. IN ORDER FOR THE CNCS TO PERFORM THE AUTOMATIC ATTITUDE MANEUVERS THE ASTRONAUT SHOULD KEY IN VAP AT SOME TIME PRIOR TO THE FIRST MANEUVER.
(4) THE LM IS MAINTAINING A PREDETERMINED TRACKING ATTITUDE TO CORRECTLY ORIENT THE OPTICAL DECOY.
(5) THE OPERATION OF THE PROGRAM INCLUDES THE FOLLOWING FLAGS:

PENETRATIVE FLG.--CONTROLS THE PERMANENT TERMINATION OF THE TOTAL PENETRATIVE NAVIGATION PROCESS. THIS PROGRAM WILL ONLY RUN IF PROGRAM OPERATING WHEN THIS FLAG IS SET, SET BY PB02, SELECT, RESET BY SELECTION OF CMC INITIATION PROGRAM/PAD, THE PENETRATIVE NAVIGATION PROGRAM (P20). THE PENETRATIVE NAVIGATION PROGRAM (P20), OP BY VAP Host, KEYING IN OF VAPs WILL IMMEDIATELY TERMINATE P20 UNLESS A NAVIGATION REQUIREMENT IS BEING PROCESSED IN WHICH CASE IT WILL HOLD UNTIL COMPLETION OF THE INCORPORATION AND THEN TERMINATE P20.

TRACK FLG.--CONTROLS THE TEMPORARY TERMINATION OF THE TOTAL PENETRATIVE NAVIGATION PROCESS. RESET OF THIS FLG. INTERRUPTS THE AUTOMATIC ATTITUDE MANEUVER/OPTICS POINTING PROCESS, AS WELL AS THE STATE VECTOR UPDATE PROCESS. THE SET OF THIS FLG. ENABLES ALL THESE PROCESSORS. SET BY PB17, 20, 30, 31, 34, 35, 36, 39, 74, 75, 76, 77, 78, TO SELECTION, RESET BY AN VAP/EXE

UPDATE FLG.--CONTROLS THE TEMPORARY TERMINATION OF THE STATE VECTOR UPDATE PROCESS ONLY. SET BY PB17, 20, 30, 31, 34, 35, 36, 39, 74, 75, 77, 78, TO SELECTION, RESET BY ANY VAP/EXE AND IT IS ALSO RESET AND SET DURING THE DETERMINANT CONJUGATIONS TO PROTECT ERASABLE MEMORY.

PREDETERMINED ATTITUDE FLG.--DEFINED WHICH ATTITUDE THE SPACECRAFT IS TO BE ALIGNED TO BY P01, SET BY TURN ON OF PB01, PB02, PB06, PB75.

STICK FLG.--RESET BY EXECUTION OF A PROGRAM CHANGE VIA P00 AND BY VAP. SET BY TAKING THE OUT OF DETENT WHEN THE SC CONTROL SWITCH IS CNCS AND WHEN THE highly NOT CLOCKWISE, CNCS DRIVE IS NOT PERFORMED IF THE STICK FLG IS SET.

STATE VECTOR FLG.--DEFINED WHICH STATE VECTOR WILL BE UPDATED BY SIGHTING MARKS AND VAP RANGING. SET TO LM BY PB0, TURN ON AND VAP, SET TO CSM BY VAP.
1A

W DAACE DATA MAY BE ENABLED (RESET RENDOFLAG) IN ANY OF THE FOLLOWING WAYS:

(A) KEYING IN OF VERR 036

(B) COMPUTER REFRESH START (KEYING IN OF VERR 37E)

(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. THIS PROGRAM IS SELECTED BY THE ASTRONAUT BY ORSKY ENTRY. IT MAY BE TERMINATED BY THE SELECTION OF THE CM P22 PROGRAM (PDD), THE POWER DOWN PROGRAM (P01), OR THE ORBITAL NAVIGATION PROGRAM (P22) OR BY V46E. NO SELECTION WILL TERMINATE P20 AND ANY OTHER PROGRAM IN PROCESS AND ESTABLISH P00. THIS PROGRAM IS DESIGNED TO OPERATE AUTOMATICALLY AND SIMULTANEOUSLY WITH ANOTHER PROGRAM WITHOUT REQUIRING USE OF THE ORSKY UNLESS NON-NOMINAL CIRCUMSTANCES REQUIRE CM COMMUNICATION WITH THE ASTRONAUT. IF V46E IS KEYED INTO THE ORSKY AND P00 IS THE ONLY PROGRAM RUNNING, ROUTINE P00 WILL BE INITIATED.

9. THERE IS A RENDOZVES OPTICS MARK COUNTER USED IN THE CM TO COUNT THE NUMBER OF OPTICS MARKS USED TO CHANGE EITHER STATE VECTOR AND THERE IS A RENDOZVES VHF RANGING MARK COUNTER USED IN THE CM TO COUNT THE NUMBER OF VHF RANGING MARKS USED TO CHANGE EITHER STATE VECTOR.

THese COUNTERS ARE TERMINATED BY SEVERAL DISTINCT EVENTS, THEY ARE:

(A) KEYING IN OF V37E2CE (INITIATION OF P21).

(B) COMPLETION OF THE TARGET DELTA V PROGRAM (P7E).

(C) SELECTION OF A NEW PROGRAM FROM A PROGRAM WHICH HAD TERMINATED ON AVERAGE 6 (SEE P00 LOGIC).

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

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

10. SUMMARY OF EXTENDED VERRS ASSOCIATED WITH THE PROGRAM:

V46E - SET SURFACE FLAG - CAUSES TRACKING OF THE LANDING SITE BASED ON THE STORED LANDING SITE

V46E - SET SURFACE FLAG - CAUSES TRACKING OF THE LM BASED ON THE LM STATE VECTOR

V46E - DO P23 - ALLOWS BACK-UP MARKING ON THE LM.


V67E - DO P21 - ALLOWS OPTICS MARKING ON THE LM.

V5AE - SET STICK FLAG - ALLOW AUTO MANEUVERS

V76E - W-MATRIX RSS ERROR DISPLAY

V76F - SET PREFERRED ATTITUDE FLAG - DRIVE TO PREFERRED ATTITUDE

V77F - SET PREFERRED ATTITUDE FLAG - DRIVE TO AXIAL ATTITUDE

V80F - SET STATE VECTOR FLAG TO LM. DATA WILL UPDATE LM STATE VECTOR

V81F - SET STATE VECTOR FLAG TO CSM. DATA WILL UPDATE CSM STATE VECTOR

V82F - SET VHF RANGE FLAG - ALLOWS P22 TO ACCEPT RANGE DATA.

V93F - SET ORSKYFLAG - CAUSE INITIALIZATION OF W MATRIX FOR RENDOZVES AT NEXT DATA INCORPORATION.

PDC/COLOSSUS
INCOMPLETE SUMMARY OF ADDITIONAL DATA OR JOBS AVAILABLE WHILE THIS PROGRAM IS OPERATING:
P17 - AVAILABLE BY KEYING IN V37E17E
P19 - AVAILABLE BY KEYING IN V37E19E
P30 - AVAILABLE BY KEYING IN V37E30E
P31 - AVAILABLE BY KEYING IN V37E31E
P34 - AVAILABLE BY KEYING IN V37E34E
P35 - AVAILABLE BY KEYING IN V37E35E
P37 - AVAILABLE BY KEYING IN V37E37E
P39 - AVAILABLE BY KEYING IN V37E39E
P40 - AVAILABLE BY KEYING IN V37E40E
P41 - AVAILABLE BY KEYING IN V37E41E
P42 - AVAILABLE BY KEYING IN V37E42E
P43 - AVAILABLE BY KEYING IN V37E43E
P45 - AVAILABLE BY KEYING IN V37E45E
P46 - AVAILABLE BY KEYING IN V37E46E
P47 - AVAILABLE BY KEYING IN V37E47E
P48 - AVAILABLE BY KEYING IN V37E48E
P50 - AVAILABLE BY KEYING IN V37E50E
P51 - AVAILABLE BY KEYING IN V37E51E
P54 - AVAILABLE BY KEYING IN V37E54E
P55 - AVAILABLE BY KEYING IN V37E55E
P76 - AVAILABLE BY KEYING IN V37E76E
P77 - AVAILABLE BY KEYING IN V37E77E
P78 - AVAILABLE BY KEYING IN V37E78E
P79 - AVAILABLE BY KEYING IN V37E79E
P80 - AVAILABLE BY KEYING IN V37E80E
P81 - AVAILABLE BY KEYING IN V37E81E
P82 - AVAILABLE BY KEYING IN V37E82E
P83 - AVAILABLE BY KEYING IN V37E83E
P84 - AVAILABLE BY KEYING IN V37E84E
P85 - AVAILABLE BY KEYING IN V37E85E
P86 - AVAILABLE BY KEYING IN V37E86E
P87 - AVAILABLE BY KEYING IN V37E87E
P88 - AVAILABLE BY KEYING IN V37E88E
P89 - AVAILABLE BY KEYING IN V37E89E
P90 - AVAILABLE BY KEYING IN V37E90E
P91 - AVAILABLE BY KEYING IN V37E91E
P92 - AVAILABLE BY KEYING IN V37E92E
P93 - AVAILABLE BY KEYING IN V37E93E
P94 - AVAILABLE BY KEYING IN V37E94E
P95 - AVAILABLE BY KEYING IN V37E95E
P96 - AVAILABLE BY KEYING IN V37E96E
P97 - AVAILABLE BY KEYING IN V37E97E
P98 - AVAILABLE BY KEYING IN V37E98E
P99 - AVAILABLE BY KEYING IN V37E99E
N20 - AVAILABLE BY KEYING V16N20E
N21 - AVAILABLE BY KEYING V16N21E
N22 - AVAILABLE BY KEYING V16N22E
N23 - AVAILABLE BY KEYING V16N23E
N24 - AVAILABLE BY KEYING V16N24E
N25 - AVAILABLE BY KEYING V16N25E
N26 - AVAILABLE BY KEYING V16N26E
N27 - AVAILABLE BY KEYING V16N27E
N28 - AVAILABLE BY KEYING V16N28E
N29 - AVAILABLE BY KEYING V16N29E
N30 - AVAILABLE BY KEYING V16N30E
N31 - AVAILABLE BY KEYING V16N31E
N32 - AVAILABLE BY KEYING V16N32E
N33 - AVAILABLE BY KEYING V16N33E
N34 - AVAILABLE BY KEYING V16N34E
N35 - AVAILABLE BY KEYING V16N35E
N36 - AVAILABLE BY KEYING V16N36E
N37 - AVAILABLE BY KEYING V16N37E
N38 - AVAILABLE BY KEYING V16N38E
N39 - AVAILABLE BY KEYING V16N39E
N40 - AVAILABLE BY KEYING V16N40E
N41 - AVAILABLE BY KEYING V16N41E
N42 - AVAILABLE BY KEYING V16N42E
N43 - AVAILABLE BY KEYING V16N43E
N44 - AVAILABLE BY KEYING V16N44E
N45 - AVAILABLE BY KEYING V16N45E
N46 - AVAILABLE BY KEYING V16N46E
N47 - AVAILABLE BY KEYING V16N47E
N48 - AVAILABLE BY KEYING V16N48E
N49 - AVAILABLE BY KEYING V16N49E
N50 - AVAILABLE BY KEYING V16N50E
N51 - AVAILABLE BY KEYING V16N51E
N52 - AVAILABLE BY KEYING V16N52E
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N85 - AVAILABLE BY KEYING V16N85E
N86 - AVAILABLE BY KEYING V16N86E
N87 - AVAILABLE BY KEYING V16N87E
N88 - AVAILABLE BY KEYING V16N88E
N89 - AVAILABLE BY KEYING V16N89E
N90 - AVAILABLE BY KEYING V16N90E
N91 - AVAILABLE BY KEYING V16N91E
N92 - AVAILABLE BY KEYING V16N92E
N93 - AVAILABLE BY KEYING V16N93E
N94 - AVAILABLE BY KEYING V16N94E
N95 - AVAILABLE BY KEYING V16N95E
N96 - AVAILABLE BY KEYING V16N96E
V46E - AVAILABLE BY KEYING IN V46E
V60 - AVAILABLE BY KEYING IN V60E
V61 - AVAILABLE BY KEYING IN V61E
V62 - AVAILABLE BY KEYING IN V62E
V63 - AVAILABLE BY KEYING IN V63E
V98F - AVAILABLE BY KEYING IN V98E

---

START RENDEZVOUS NAVIGATION PROGRAM (720) DISPLAY 920

---

KEY IN RENDEZVOUS NAVIGATION PROGRAM (720) V37E20F

---

1A
ZERO THE REMOVED VHF RANGE MARK COUNTER.

EXTRAPOLATE PERMANENT STATE VECTORS (LM AND CSM) TO THE PRESENT TIME USING PRECISION INTEGRATION.

IS TRACK FLAG SET?
  Y  
  N
  
  
  
  ***
  
  
  EXIT

IS THE REPWMAT FLAG SET?
  Y  
  N
  
  
  ***
  
  
  EXIT

1A
CALL THE RENDEZVOUS DATA PROCESSING ROUTINE (R22)

---

THE RENDEZVOUS DATA PROCESSING ROUTINE IS NOW AUTOMATIC

---

SET R61 COUNTER EQUAL TO ZERO.

---

SET L4 TARGETフラグ FOR USE BY AUTOMATIC POSITIONING ROUTINE (R22).

---

DO TRACKING ATTITUDE ROUTINE (R61) WHICH WILL CALL ATTITUDE MANEUVER ROUTINE (R60).

---

DO TRACKING ATTITUDE ROUTINE (R61) WHICH WILL CALL ATTITUDE MANEUVER ROUTINE (R60).
THIS PAGE INTENTIONALLY LEFT BLANK
GROUND TRACK DETERMINATION PROGRAM (P21)  

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.

------------------------------------------------------------------

START GROUND TRACK DETERMINATION PROGRAM (P21), DISPLAY PROGRAM 21

KEY IN GROUND TRACK DETERMINATION PROGRAM (P21)
V37E21E

MONITOR DSKY: OBSERVE DISPLAY OF PROGRAM 21

------------------------------------------------------------------

P21/COLOSSUS
P21/LUMINARY
HOLD

FLASH VERB-NOUN TO REQUEST RESPONSE AND DISPLAY T LAT LONG:
VO6 N34
R1-T LAT LONG-HRS
R2-T LAT LONG-MINS
R3-T LAT LONG-SECS

T LAT LONG - TIME
(GET) AT WHICH LAT AND LONG OF VEHICLE POSITION IS DESIRED IN HRS, MINS, SECS TO NEAREST .01 SEC.

WAIT FOR KEYBOARD ENTRY

TERMINATE FLASH UPON RECEIPT OF NEW DATA OR PROCEED

*NEW
*DATA
*STORE
*NEW

P
R
C
E
C

MONITOR DSKY:
OBSERVE VERB-NOUN
FLASH TO REQUEST RESPONSE AND DISPLAY OF T LAT LONG. AM I SATISFIED WITH THIS TIME?

N Y

KEY IN PROCEED

KEY IN V25E AND LOAD DESIRED T LAT LONG.

*NEW
*DATA
*STORE
*NEW
CALCULATE LATITUDE, LONGITUDE AND ALTITUDE OF VEHICLE AT
T LAT LONG

HOLD SNAP

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.
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

TERMINATE FLASH UPON RECEIPT OF RECYCLE OR PROCEED

- R
- E
- C
- Y
- E
- L
- E
- D

INCREMENT T-LAT-LONG BY 10 MIN.

DO ROUTINE ROD

DO ROUTINE ROD

EXIT

EXIT
ORBITAL NAVIGATION PROGRAM (P22)  LOGIC  REV 11  11/26/60

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.
(R) 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 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 THE CMC WHICH MARK WAS MADE ON THE OFFSET LANDING SITE. THEY ARE:

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 PRELACED LANDING SITE MAY BE AIDED BY KEYING LANDMARK CODE 01 INTO THE VOSNJ0 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 IMPELLING IMM Pole 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 PERMITTING 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.
<table>
<thead>
<tr>
<th>PROG CONT</th>
<th>CMC</th>
<th>GROUND</th>
<th>CREW</th>
<th>CHECKLIST</th>
<th>TIME</th>
<th>TOTAL TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td></td>
<td><strong>CREW PROG.</strong></td>
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<td><strong>SELECTION</strong></td>
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<td></td>
<td></td>
<td><strong>START ORBITAL NAVIGATION PROGRAM (P22) DISPLAY PROGRAM 22</strong></td>
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<td></td>
<td></td>
<td></td>
<td><strong>KEY IN ORBITAL NAVIGATION PROGRAM (P22) V37E22E</strong></td>
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<td></td>
<td></td>
<td></td>
<td><strong>MONITOR DSKY: OBSERVE DISPLAY OF PROGRAM 22</strong></td>
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<td></td>
<td><strong>DO IMU STATUS CHECK ROUTINE (RO2)</strong></td>
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<td><strong>DO IMU STATUS CHECK ROUTINE (RO2)</strong></td>
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<td></td>
<td></td>
<td><strong>RESET THE RENDEZVOUS FLAG</strong></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>COMPUTE ANGLE BETWEEN Y AND V X R.</strong></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>THIS ANGLE IS THE MAGNITUDE OF THE MAXIMUM POSSIBLE MIDDLE GIMBAL ANGLE ASSUMING THE SC Y AXIS IS KEPT IN THE ORBIT PLANE.</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

P22/COLOSSUS
++ RESET REMWFLAG
++  (SEE P20)

PCN 580

------------

FLASH VERR-NOU 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 NEAR-
EST .01 DEG.

------------

MONITOR DSKY:
OBSERVE VERR-NOU
FLASH TO REQUEST RE-
SPONSE 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 PER-
MITS.

Y N

------------

WAIT FOR KEYBOARD
ENTRY:

------------

HAS THE ISS BEEN
ALIGNED IN THE
PAST 3 HOURS?

Y N

------------

ADVISE CREW
ON ANTI-
PATED G+N
ERRORS AND
SUBSEQUENT
PROCEDURES

SHALL I BYPASS
IMU ALIGNMENT?

Y N
SELECT IMU
REALIGN (P52).
WHEN COMPLETE,
RESELECT THIS
PROGRAM.

TERMINATE FLASH UPON
RECEIPT OF PROCEED
OR NEW PROGRAM.

KEY IN PROCEED

CONTROL ATTITUDE
FOR LANDMARK
ACQUISITION

SET THE INDEX OF
OFFSET DESIGNATOR
EQUAL TO ZERO.

RESET MARK DATA
VALID BIT FOR INFOR-
MATION TO DOWNLINK.

SEE BELOW
IS THE SPACECRAFT IN LUNAR ORBIT?

* N

* Y

GO TO "A" BELOW

---

LUNAR ORBIT

---

POSS

HOLD

FLASH VERB NOUN TO

REQUEST RESPONSE AND

SNAP

DISPLAY LMK CODE:

VOSN70
R1-BLAKE
R2-ABCD
R3-BLANK

A=1 IF KNOWN LMK
A=2 IF UNKNOWN LMK,
B= INDEX OF OFFSET
DE-LMK ID NC N

++ NOTE: THE PROBABLE
PCN OPTIONS ARE:
594

DE=00
LANDMARK
KNOWN BUT
NOT STORED
IN CMC
MEMORY

DE=00
LANDMARK
KNOWN AND
STORFD

---

MONITOR DSK:Y
OBSERVE VERB NOUN
FLASH TO REQUEST
RESPONSE AND DISPLAY
LMK CODE.
TO HAVE THE AUTOMAT-
IC OPTICS POSITION-
NING ROUTINE (R52)
POINT ALONG THE
GROUND TRACK OF AN
ADVANCED ORBIT AND
60 DEGREES AHEAD OF
THE SPACECRAFT
CHANGE THE LANDMARK
CODE TO PX (WHERE P
>3 AND X DEFINES HOW
MANY ORBITS AHEAD
ARE DESIRED). THIS
CODE IS USED ONLY BY
THE AUTOMATIC OPTICS
POSITIONING ROUTINE
(R52) AT THIS TIME.
A=7. DE NOT MEANINGFUL:
UNKNOWN LANDMARK.

DO I WISH TO NAVI-
GATE ON AN UNKNOWN
LANDMARK?

Y  N

DO I DESIRE THE
USE OF THE AUTO-
MATIC OPTICS
POSITIONING
ROUTINE (R521)
TO AID IN ACQUI-
SION?

N  Y

DO I WISH TO
NAVIGATE ON
THIS LAND-
MARK?

Y  N

SET OP-
TICS
MODE
SWITCH
TO MAN-
UAL.

WAIT FOR KEYBOARD
ENTRY

KEY IN V22E AND
LOAD NEW
LMK CODE

P22/COLOSSUS
WAIT FOR KEYBOARD ENTRY

AM I SATISFIED WITH THESE VALUES?
.Y .N

KEY IN PROCEED

KEY IN V25E AND LOAD LMK PARAMETERS:

TERMINATE FLASH UPON RECEIPT OF PROCEED OR NEW DATA

N P
E R
W D
A C
T E
A D

STORE NEW DATA

SET SIGHTING FLAG TO LMK FOR USE BY SIGHTING MARK AND AUTO OPTICS POSITIONING Routines.
SET MARK INDEX TO 5
FOR USE BY SIGHTING
MARK ROUTINE (R53)

DO AUTO OPTICS
POSITIONING ROUTINE (R52).
INCLUDES SIGHT-
ING MARK ROUTINE
(R53).

DO AUTO OPTICS
POSITIONING ROUTINE (R52).
INCLUDES SIGHT-
ING MARK ROUTINE
(R53).

FLASH VERB-NOUN
HOLD TO REQUEST RESPONSE
AND DISPLAY LMK DATA
SNAP V05 N71
R1-BLANK
R2-ARDE
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?

.Y .N

MAKE SURE B COR-
RESPONDS TO THE
MARK MADE ON THE
OFFSET LANDING
SITE OR IS SET TO

P22/COLOSSUS
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 UPON RECEIPT OF PROCEED OR NEW DATA

KEY IN PROCEED

P22/COLOSSUS
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
POS

FLASH VERB-NOUN
TO REQUEST RESPONSE AND DISPLAY
LMK COORDINATES:

VO6 N89
R1=LAT
R2=LONG/2
R3=ALT

R1=LAT IS LATITUDE 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 ALTITUDE OF LMK
ABOVE THE FISCHER ELLIPSOID
FOR EARTH AND MEAN LUNAR RADIUS
FOR MOON. IN NAUTICAL MILES
TO THE NEAREST .01 NM.

AM I SATISFIED WITH THESE VALUES?

Y  N

WAIT FOR KEYBOARD ENTRY

KEY IN PROCEED
IS THE KNOWN FLAG RESET?

EDIT

Y N

COMPUTE AND STORE LMK LOCATION FROM FIRST MARK DATA

EDIT

COMPUTE ORBIT PARAMETERS AND LANDMARK COORDINATE CHANGES AS A RESULT OF THIS SIGHTING MARK

IS K = 0?

Y N

HOLD SNAPSHOT TO REQUEST RESPONSE AND DISPLAY ORBIT PARAMETER CHANGES:

MONITOR OSKY: OBSERVE VERB NOUN FLASH TO REQUEST RESPONSE AND DISPLAY OF ORBIT PARAMETER CHANGES

ARE ORBIT PARAMETER CHANGES ACCEPTABLE FOR INSERTION INTO CMC CALCULATION OF POSITION AND VELOCITY?

Y N

P22/COLLOSSUS
SIGHTING DATA IN N.M. TO NEAREST 0.1 N.M.

DELTA V-MAGNITUDE DIFFERENCE BETWEEN THE VELOCITY VECTOR BEFORE AND AFTER INCORPORATION OF THE LANDMARK SIGHTING DATA IN FPS TO THE NEAREST .1 FPS.

WAIT FOR KEYBOARD ENTRY

TERMINATE FLASH UPON RECEIPT OF PROCEED OR RECYCLE.

---

R
E
C
Y
C
L
E
E
C

---

GO TO "A" ABOVE

---

SET K = 1
UPDATE CMG STATE
VECTOR AND COMPUTE
REVISED LANDMARK
COORDINATES

IS THERE DATA IN THE
OFFSET DESIGNATOR
LOCATION?

MAP THE OFFSET
LANDING SITE

DID I DESIGNATE AN
OFFSET LANDING SITE
FROM A PRIMARY LAND-
MARK BY USE OF V52E
FOLLOWING A MARK?

POSS
HOLD
SNAP

R1=LAT
R2=LONG/2
R3=ALT

R1=LAT IS LATITUDE
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 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 keyboard entry

________________________

shall these coordinates be stored in CMC memory and be defined as the landing site (landmark code 01)?

note 1: if these coordinates are stored, 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 landmark code 01 location.

note 2: the capability of storing the landing site is only available for lunar landmarks. for this reason the astronaut
THE PROGRAM WILL COME TO THIS POINT FROM A V34E ON ANY FLASHING DISPLAY.

DO ROUTINE (ROO)  ---  DO ROUTINE (ROO)

EXIT P22

CHANGE CONTROL NOTES

LOGIC REV 07  PCR MIT 64
LOGIC REV 08  PCR MIT 116
LOGIC REV 09  PCR MIT 83
LOGIC REV 09  PCR 206
LOGIC REV 10  PCN 552
LOGIC REV 11  PCN 580
PCN 594
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.
(10) A STAR SERIAL 0 WILL GIVE PARITY FAILURE, AND LANDMARK SERIAL 01 WILL NOT WORK.
(11) THE PROGRAM IS SELECTED BY THE ASTRONAUT BY DSKY ENTRY.

<table>
<thead>
<tr>
<th>PROG CONT</th>
<th>CMC</th>
<th>GROUND</th>
<th>CREW</th>
<th>CHECKLIST</th>
<th>TIME</th>
<th>TOTAL TIME</th>
</tr>
</thead>
</table>

..CREW PROG.
..SELECTION

P23/COLOSSUS
START CISLUNAR MID-COURSE NAVIGATION PROGRAM (P23)
DISPLAY P23

KEY IN CISLUNAR MID-COURSE 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)

++

++

RESET V94 FLAG

EDIT

PCR

206

"B"

P23/COLOSSUS

120
IS REFSWAT FLAG SET?

Y  N

---

DO OPTICS CALIBRATION ROUTINE, R57

---

RESET R57 FLAG

---

IS THE IMU ON AND ALIGNED?

Y  N

---

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

---

#60

#70

#80

#90

#100
STAR IDENTIFICATION:
R1=000XX FOR ID
NUM. OF STAR USED

LANDMARK IDENTIFICATION:
R2=ABCDE WHERE
A AND B=NOT USED
C=1 FOR EARTH LMK
C=2 FOR MOON LMK
DE=LANDMARK ID NUMBER
R2=00000 FOR HMR. MEAS.

HORIZON IDENTIFICATION:
R3=000DD WHERE
C=1 FOR EARTH HMR.
C=2 FOR MOON HMR.
D=1 FOR NEAR HORIZON
D=2 FOR FAR HORIZON
R3=00000 FOR LMK MEAS.

---
DO I INTEND TO DO THE SIGHTING MANUALLY?
THIS DATA WILL BE USED AT THIS TIME FOR THE AUTOMATIC TRACKING MANEUVER AND BY THE AUTOMATIC OPTICS POSITIONING ROUTINE (R52) ONLY. IF IT IS INTENDED TO DO MANUAL ACQUISITION THIS DISPLAY NEED NOT BE REVIEWED. IT WILL BE REDISPLAYED PRIOR TO STATE VECTOR CALCULATION.

---
SET OPTICS MODE SWITCH TO MANUAL

---
AM I SATISFIED WITH THIS DATA?

---
RECORD MEASUREMENT IDENTIFICATION DATA IN FLIGHT DATA BOOK IF DESIRED

---
POSS
HOLD
SNAP

FLASH VERB-NCUN
TO REQUEST RE-
SPONSE AND DIS-
PLAY LMK DATA
V06 NB9

R1: LAT
R2: LONG/2
R3: ALT

LAT=LATITUDE
OF LMK IN DEG
TO NEAREST .001
DEG
+ IS NORTH

LONG/2=LONGI-
ITUDE OF LMK DI-
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)

AM I SATISFIED
WITH THIS DATA?

WAIT FOR KEY-
BOARD ENTRY

MONITOR DSKY:
OBSERVE VERB-
NOUN FLASH TO
REQUEST RESPONSE
AND DISPLAY OF
LMK DATA IF A
NON-IDENTIFIED
LANDMARK WAS
CHosen

KEY IN
PROCEED
**MONITOR DSKY:**

OBSERVE VERB- NOUN
FLASH REQUESTING
PLEASE PERFORM AUTOMATIC MANEUVER

---

**DO I WISH TO HAVE**
THE GNCS COMPUTE THE
SPACECRAFT ATTITUDE
REQUIRED TO POINT
THE LOS AT THE
CHosen LMK/HOR AND
PERFORM THE ATTITUDE
MANEUVER ROUTINE (R60)?
THIS ATTITUDE WILL
BE COMPUTED (VEC-
POINT) TO POINT THE
LOS AT THE LMK/HOR BUT WILL NOT
CONSTRAIN THE ORIENT-
ATION ABOUT THAT
VECTOR (THE ORIENT-
ATION ABOUT THAT
VECTOR COULD RESULT
DO THE ATTITUDE MANEUVER ROUTINE (R60)

IS R57 FLAG SET?
  N
  Y

DO R57 OPTICS CALIBRATION ROUTINE

++
+14
PCN
571

SET R57 FLAG

DO THE AUTOMATIC OPTICS POSITIONING ROUTINE (R52) (CALLS R53)

NORMAL PREMATURE EXIT EXIT VIA

++
+13
DO V94 LOGIC GAS

DO R57 OPTICS CALIBRATION ROUTINE (WHEN LMK ACQUIRED)

DO R52 AUTOMATIC OPTICS POSITIONING ROUTINE. THE OPTICS POINTING PROCESS IS NOW AUTOMATIC AND WILL POINT THE SXT STAR LOS AT THE CHOSEN STAR UNTIL THE SIGHTING MARK ROUTINE (R53) IS
STAR IDENTIFICATION
R1=0XX FOR ID
NUM. OF STAP
USED

LANDMARK IDENTIFICATION
R2=ABCDE WHERE
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 IDENTIFICATION
R3=00000 WHERE
C=1 FOR EARTH
HOR.
C=2 FOR MOON
HOR.

D=1 FOR NEAR
HORIZON
D=2 FOR FAR
HORIZON
R3=00000 FOR
LMK MEAS.

--

IS THIS DATA CORRECT
FOR THE MARK I MADE?

Y
N

--

RECORD MEASURE-
MENT IDENTIFICATION
DATA IN FLIGHT DATA
BOOK IF DESIRED

--

WAIT FOR KEYBOARD
ENTRY

--

KEY IN
PROCEED

--
TERMINATE FLASH UPON RECEIPT OF PROCED OR NEW DATA

**P** NEW DATA
**R** NEW DATA
**D**
**C** STORE NEW DATA
**E**
**D**

WAS R3=0 (LMK MEASUREMENT?)
**N** (MOR) **Y** (LMK)

ARE R2(0) NON-ZERO (LMK IDENTIFIED)
**Y**
**N**

P23/COLOSSUS
SUBTPACT CALIBRATION
ANGLE (STORED BY
R57) FROM MEASURED
TRUUNION ANGLE.

RESET RENDWFLAG
SEE (P20).

COMPUTE STATE VECTOR
CHANGE DUE TO THE
MEASUREMENT

MOD.

FLASH VERB-NOUN TO
REQUEST RESPONSE AND
DISPLAY ORBITAL
PARAMETER CHANGES

MONITOR DSKY:

 V06 N49
 R1-DELTA R
 R2-DELTA V
 R3-BLANK

DETALE R-MAGNITUDE OF
THE DIFFERENCE
BETWEEN THE POSITION
VECTOR BEFORE AND
AFTER INCORPORATION
OF STAR MEASUREMENT
IN N. M. TO NEAREST
0.1 N. M.
DELTA V- MAGNITUDE OF THE DIFFERENCE BETWEEN THE VELOCITY VECTOR BEFORE AND AFTER INCORPORATION OF THE STAR MEASUREMENT DATA IN FEET/SEC TO NEAREST 0.1 FPS

---

ARE ORBITAL PARAMETER CHANGES ACCEPTABLE FOR INSERTION INTO CMC CALCULATIONS OF POSITION AND VELOCITY?

Y  N

---

WAIT FOR KEYBOARD ENTRY

---

TERMINATE SHARK ON RECEIPT OF PROCEED OR RECYLE

---

KEY IN RECYCLE V32E

---

GO TO "B" ABOVE

---

UPDATE CMC STATE VECTOR
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 1-8 INCLUSIVE INDIVIDUALLY SPECIFIED ERASABLE LOCATIONS (V72).

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

(4) UPDATE IS ALLOWED IN THE CSM WHEN THE CMC IS IN R00 OR POZ, AND IF THE DSKY IS AVAILABLE.

(5) THE UPTIL ACCEPT/MECH 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.
TERMINATE FLASH UPON RECEIPT OF TERMINATE OR INDEX

T
F
R
M
N
E
X

GO TO MAN DISPLAY INDEX VALUE IN RI AS IT IS LOADED

++

+07 IS INDEX LESS THAN +07 3 OR GREATER THAN ++ 20?

EDIT

Y
N

GO TO MAN ABOVE

STORE INDEX IN COMPNJMBR

...
CALCULATE ADDRESS FOR STORAGE OF NEXT DATA LOAD

"C" FROM BELOW

FLASH VERB/NOUN TO REQUEST LOAD OF DATA INTO CALCULATED ADDRESS SPECIFIED IN P3 AND DISPLAY: MONITOR DOWN-LINK:

HOLD V?1 NOI

 SNAP R1 BLANK

 R? UNCHANGED

 R? AAAAA


DO I WISH TO TERMINATE?

WAIT FOR KEYBOARD ENTRY

TRANSMIT TERMINATE VERB

GO TO "A" BELOW

TRANSMIT DATA
TERMINATE FLASH
| UPON RECEIPT OF
| TERMINATE OR DATA

Y
E
D
T
A
A
I
N

DISPLAY DATA
E IN P1 AS IT
IS LOADED

GO TO "A"
BELOW

IS THIS THE LAST
DATA LOAD? (UPLINK
COMPONENT COUNTER =
COMPNUM)

N
Y

"NO"
FROM
BELOW

FLASH VERB/NOUN TO
REQUEST LOAD OF
OCTAL IDENTIFIER
INTO MACHINE ADDRESS
NOUN FLASH TO
SPECIFIED IN P3 AND
REQUEST LOAD
OF OCTAL
IDENTIFIER

HOLD

DISPLAY:
V21 V02
P1 BLANK
P2 UNCHANGED
P3 AAAAA
TRANSFER DATA TO SPECIFIED BLOCK (V71) OR SPECIFIED ADDRESSES (V72)

... MAN FROM ABOVE ...

... TURN OFF UPTIL ACTIVITY LITE ...

... MONITOR DOWN-LINK: OBSERVE UPTIL ACTIVITY LITE OUT, REVERSION TO ORIGINAL DOWNLINK LIST, TERMINATION OF P27, AND RETURN TO P00 OR P02 ...

TERMINATE P27 AND GO TO PROGRAM WHICH WAS INTERRUPTED (P00 OR P02)

... EXIT P27 ...

CHANGE CONTROL NOTES