

PURPOSE: (1) TO ACCEPT TARGETING PARAMETERS OBTAINED FROM A SOURCE(S) EXTERNAL TO THE CMC AND COMPUTE THEREFROM THE REQUIRED VELOCITY AND OTHER INITIAL CONDITIONS REQUIRED BY THE CMC FOR EXECUTION OF THE DESIRED MANEUVER. THE TARGETING PARAMETERS INSERTED INTO THE CMC ARE THE TIME OF IGNITION(TIG) AND THE IMPULSIVE DELTA V ALONG CSM LOCAL VERTICAL AXES AT TIG.

(2) TO DISPLAY TO THE ASTRONAUT AND THE GROUND CERTAIN SPECIFIC DEPENDENT VARIABLES ASSOCIATED WITH THE DESIRED MANEUVER FOR APPROVAL BY THE ASTRONAUT/GROUND.

ASSUMPTIONS- (1) THE TARGET PARAMETERS (TIG AND DELTA V(LV)) MAY HAVE BEEN LOADED FROM THE GROUND DURING A PRIOR EXECUTION OF P27.

(2) THE EXTERNAL DELTA V FLAG IS SET DURING THIS PROGRAM TO DESIGNATE TO THE THRUSTING PROGRAM THAT EXTERNAL DELTA V STEERING IS TO BE USED.

(3) THE ISS NEED NOT BE ON TO COMPLETE THIS PROGRAM.

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

PROG CONT	CMC	GROUND	CREW	CHECKLIST	TIME	TOTAL TIME
			.CREW PROG. .SELECTION . . . .			
START EXTERNAL DELTA V PROGRAM (P30) DISPLAY PROGRAM 30	.	.....	EXTERNAL DELTA V PROGRAM (P30) V37E 30E			#10
		.	MONITOR DSKY: OBSERVE DISPLAY OF PROGRAM 30			
	.					#20
SET TRACK FLAG (SEE P20)	.					
	.					
	.					
	.					

-----  
SET UPDATE  
FLAG (SEE P20)  
-----

#30

.....  
FLASH VERB-NOUN TO  
REQUEST RESPONSE AND  
DISPLAY TIC:

V06 N33  
P1-TIC-HRS  
P2-TIC-MIN  
P3-TIC-SEC

HOLD .  
.....  
SNAP .

-----  
MONITOR OSKY:  
OBSERVE VERB-NOUN  
FLASH TO REQUEST  
RESPONSE AND DISPLAY  
OF TIC.  
-----

#40

-----  
TIC-TIME OF  
IGNITION (GET).  
IN HRS, MIN, SEC  
TO NEAREST .01 SEC.  
-----

-----  
AM I SATISFIED WITH  
THIS VALUE?  
-----

Y. N

-----  
RECORD THIS  
VALUE  
-----

#50

#60

-----  
WAIT FOR KEYBOARD  
ENTRY

-----  
KEY IN PROCEED  
-----

#70

-----  
TERMINATE FLASH UPON  
RECEIPT OF PROCEED  
OR NEW DATA

-----  
KEY IN V255 AND  
LOAD THE DESIRED  
TIC.  
-----

#80

-----  
0 NEW  
1 DATA  
2  
3  
4  
5  
6  
7  
8  
9  
A  
B  
C  
D  
E  
F  
G  
H  
I  
J  
K  
L  
M  
N  
O  
P  
Q  
R  
S  
T  
U  
V  
W  
X  
Y  
Z  
[  
]  
^  
\_  
`  
~  
-----  
STORE NEW DATA  
-----

HOLD . . . . . FLASH VERB-NOUN TO  
 ..... REQUEST RESPONSE  
 SNAP . . . . . DISPLAY THREE STORED  
 COMPONENTS OF DELTA  
 V(LV):  
 V06NR1  
 R1-DELTA VX (LV)  
 R2-DELTA VY (LV)  
 R3-DELTA VZ (LV)

DELTA VX (LV):  
 COMPONENT OF  
 IMPULSIVE DELTA V AT  
 TIG ALONG (RXV)XP. IN  
 FPS TO NEAREST .1  
 FPS.

DELTA VY (LV):  
 COMPONENT OF  
 IMPULSIVE DELTA V AT  
 TIG ALONG VXR, IN FPS  
 TO NEAREST .1 FPS.

DELTA VZ (LV):  
 COMPONENT OF  
 IMPULSIVE DELTA V AT  
 TIG ALONG -R. IN FPS  
 TO NEAREST .1 FPS

WHERE R IS CSM GEO-  
 CENTRIC (EARTH ORBIT)  
 OR SELF-CENTRIC  
 (LUNAR ORBIT) RADIUS  
 VECTOR AND V IS CSM  
 INERTIAL VELOCITY  
 VECTOR AT TIG.

MONITOR DSKY:  
 OBSERVE VERB-NOUN  
 FLASH TO REQUEST  
 RESPONSE AND DISPLAY  
 OF THREE STORED  
 COMPONENTS OF  
 IMPULSIVE DELTA V  
 ALONG CSM LOCAL  
 VERTICAL AXES AT  
 TIG.

AM I SATISFIED WITH  
 THESE VALUES?

.Y .N

#90

#100

#110

#120

#130

-----  
WAIT FOR KEYBOARD  
ENTRY

-----  
KEY IN  
PROCEED  
-----

#140

-----  
TERMINATE FLASH UPON  
RECEIPT OF PROCEED  
OR NEW DATA

-----  
KEY IN V25E AND  
LOAD THE DESIRED  
COMPONENTS OF  
DELTA V  
-----

#150

-----  
.P            .NEW  
.P            .DATA  
.D            .  
.C            .  
.F            .  
.E    STORE NEW DATA  
.D            .  
-----

#160

-----  
RESET UPDATE FLAG  
(SEE P20)  
-----

-----  
SET EXTERNAL DELTA V  
FLAG  
-----

#170

-----  
BASED ON THE STORED  
TARGET PARAMETERS  
COMPUTE NECESSARY  
DEPENDENT VARIABLES  
FOR EVALUATION OF THE  
THRUSTING MANEUVER  
INCLUDING PERIGEE/  
PERILUNE ALTITUDE,  
APOGEE/APOLUNE  
ALTITUDE AND DELTA V  
REQUIRED (SEE SECT-  
ION 5.3.3.3.1 OF  
P577.  
-----

#180

#190

HOLD .....  
 SNAP .....  
 -----  
 FLASH VERB-NOUN TO  
 REQUEST RESPONSE AND  
 DISPLAY CALCULATED  
 THRUSTING PARAMETERS:  
 V06 N42  
 R1-APD ALT  
 R2-PER ALT  
 R3-DELTA V

-----  
 MONITOR OSKY:  
 OBSERVE VERB-NOUN  
 FLASH TO REQUEST  
 RESPONSE AND DISPLAY  
 OF CALCULATED  
 THRUSTING PARAMETERS  
 -----

APD ALT - ALTITUDE  
 OF APOGEE ABOVE THE  
 LAUNCH PAD RADIUS  
 (EARTH ORBIT) OR  
 ALTITUDE OF THE  
 APOLUNE ABOVE THE  
 LUNAR RADIUS AT THE  
 MOST RECENTLY DE-  
 FINED LANDING SITE  
 (LUNAR ORBIT). IN  
 NAUTICAL MILES TO  
 THE NEAREST .1 NM.

#200

PER ALT - ALTITUDE  
 OF PERIGEE ABOVE THE  
 LAUNCH PAD RADIUS  
 (EARTH ORBIT) OR  
 ALTITUDE OF THE  
 PERILUNE ABOVE THE  
 LUNAR RADIUS AT THE  
 MOST RECENTLY DE-  
 FINED LANDING SITE  
 (LUNAR ORBIT). IN  
 NAUTICAL MILES  
 TO THE NEAREST  
 .1 NM.

#210

DELTA V - MAGNITUDE  
 OF IMPULSIVE DELTA V  
 VECTOR AT TIG. IN FPS  
 TO NEAREST .1 FPS

#220

NOTE: IF APD ALT OR  
 PER ALT EXCEEDS  
 SCALE, THE DISPLAY  
 WILL BE 9999.9 NM

#230

-----  
 IS A GROUND STATION  
 AVAILABLE FOR CON-  
 FIRMATION OF THESE  
 PARAMETERS?  
 -----

Y. N

++  
 +10  
 +  
 +  
 +10  
 ++  
 PCR  
 524

#240

-----  
 MONITOR CMC ..... COORDINATE  
 DOWNLINK TELE- . . . EVALUATION OF  
 METRY OF APD . . . THE CMC COMPU-  
 ALT, PEP ALT . . . TED PARAMETERS  
 AND DELTA V RE- . . . WITH THE  
 QUIRED, COORDI- . . . GROUND  
 NATE EVALUATION  
 OF CMC COMPUTED  
 PARAMETERS WITH  
 ASTRONAUT  
 -----

#250

-----  
 . . . SELECT ONE OF THE  
 . . . FOLLOWING FIVE  
 . . . ALTERNATIVES:

#260

. . . (1) IF THE CALCULATED DATA IS  
 . . . SATISFACTORY,  
 . . . PERFORM THE THRU-  
 . . . STING MANEUVER  
 . . . USING THE CMC  
 . . . CALCULATED PARA-  
 . . . METERS WITHOUT  
 . . . GROUND CONFIRMA-  
 . . . TION.

#270

. . . (2) IF THE CALCULATED DATA IS NOT  
 . . . SATISFACTORY AD-  
 . . . JUST THE CALCULA-  
 . . . TED PARAMETERS BY  
 . . . RESELECTING P30  
 . . . AS NECESSARY AND  
 . . . CHANGING THE  
 . . . LOADED AIM PARA-  
 . . . METERS UNTIL CMC  
 . . . COMPUTED PARAMET-  
 . . . ERS ARE SATISFAC-  
 . . . TORY. THEN

#280

. . . PERFORM THE THRU-  
 . . . STING MANEUVER.  
 . . . (3) REMAIN AT  
 . . . THIS POINT IN THE  
 . . . CMC PROGRAM UNTIL  
 . . . GROUND COORDINA-  
 . . . TION IS AVAILABLE

#290

. . . (4) SELECT A NEW  
 . . . PROGRAM AS DE-  
 . . . STIRED UNTIL  
 . . . GROUND COORDINA-  
 . . . TION IS AVAILABLE  
 . . . THEN RESELECT  
 . . . P30, LEAVE AIM  
 . . . PARAMETERS

#300



LOAD NEW AIM  
PARAMETERS FROM  
THE GROUND VIA  
THE CMC UPLINK,  
OR BY CREW  
DSKY INPUT.  
OBSERVE NEW AIM  
PARAMETERS, ETC.  
(4) TERMINATE  
P30 BY SELECT-  
ING A NEW PRO-  
GRAM AS DESIRED  
AND PERFORM THR-  
USTING MANEUVER  
USING BACKUP  
PROCEDURES.

#360

#370

- 1.
- 2.
- 3.
4. ....
- .
- .
- .

#380

-----  
WAIT FOR KEYBOARD  
ENTRY.

-----  
KEY IN PROGRAM  
SELECTION AS  
DESIRED

V37E--E

-----  
GO TO PROGRAM  
SELECTED.

#390

-----  
EXIT P30

#400



TERMINATE FLASH UPON  
RECEIPT OF PROCEED  
OR NEW PROGRAM.

-----  
KEY IN  
PROCEED  
-----

#410

-----  
.P . NEW  
.R . PROGRAM  
.D .  
.C .  
.E  
.E GO TO PROGRAM  
.D SELECTED. VIA  
ROUTINE R00  
-----

#420

.....  
EXIT P30

#430

-----  
IS REFSMMAT FLAG  
SET?

-----  
.Y .N  
. .  
. .  
-----

#440

-----  
COMPUTE IMU MID-  
DLE GIMBAL ANGLE  
AT TIG FOR THE  
PRESENT IMU OR-  
IENTATION WITH  
THE CSM +X AXIS  
ALIGNED WITH THE  
INITIAL THRUST  
VECTOR.  
-----

#450

-----  
. SET MGA DISPLAY  
. IN R3 (BELOW) =  
. -00002.  
-----

#460

HOLD  
MON

FLASH VERB-NOUN TO  
REQUEST RESPONSE AND  
DISPLAY MARK CTRS  
TFI AND MGA:  
V1A-M45  
R1-MARK CTRS  
R2-TFI  
R3-MGA

MONITOR DISK:  
RESERVE VERB-NOUN  
FLASH TO REQUEST  
RESPONSE AND DISPLAY  
OF MARK CTRS, TFI,  
AND MGA

MARK CTRS - THE NUM-  
BER OF MARKS PROCES-  
SED BY THE PENDEZ-  
VOUS DATA PROCESSING  
ROUTINE (R22) (REFER  
TO ASSUMPTION 19) OF  
2201. THE REGISTER  
WILL DISPLAY XXYY  
WHERE THE TWO MOST  
SIGNIFICANT DIGITS  
IS THE VHF RANGING  
MARKS COUNTER AND  
THE TWO LEAST SIGNI-  
FICANT DIGITS IS THE  
OPTICS MARK COUNTER.

NOTE: THE OPTICS  
MARK COUNTER DOES  
NOT DISTINGUISH BE-  
TWEEN BACK-UP AND  
PRIMARY MARKS.

TFI - TIME FROM  
TIC, IN MIN AND SEC  
TO NEAREST SEC.  
MAXIMUM READING IS  
50850. (- BEFORE  
+ AFTER TIC.)

MGA-MIDDLE GIMBAL  
ANGLE AT TIC IF  
+X OSM AXIS IS  
ALIGNED WITH INITIAL  
THRUST DIRECTION.  
SIGN IS ALWAYS +  
EXCEPT WHEN THE IMJ  
IS NOT ALIGNED THE  
VALUE IS -00002. IN  
DEGREES TO NEAREST  
.01 DEGREE

#470

#480

#490

#500

#510



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PURPOSE: (1) TO ACCEPT TARGETING PARAMETERS OBTAINED FROM A SOURCE(S) EXTERNAL TO THE CMC AND COMPUTE THEREFROM THE REQUIRED VELOCITY AND OTHER INITIAL CONDITIONS REQUIRED BY THE CMC FOR EXECUTION OF THE DESIRED MANEUVER. THE TARGETING PARAMETERS INSERTED INTO THE CMC ARE THE TIME OF IGNITION(TIG), ECSTEER, THE TARGET VECTOR, AND THE TIME FROM TIG UNTIL THE TARGET IS TO BE REACHED (DELTA T TRANS).

(2) TO DISPLAY TO THE ASTRONAUT AND THE GROUND CERTAIN SPECIFIC DEPENDENT VARIABLES ASSOCIATED WITH THE DESIRED MANEUVER FOR APPROVAL BY THE ASTRONAUT/GROUND.

++  
ASSUMPTIONS: (1) THE TARGET PARAMETERS (TIG, TARGET VECTOR, ECSTEER AND DELTA T TRANS) HAVE BEEN LOADED FROM THE GROUND DURING A PRIORITY EXECUTION OF P27.

++  
EDIT (2) THE EXTERNAL DELTA V FLAG IS RESET DURING THIS PROGRAM TO DESIGNATE TO THE THRUSTING PROGRAM THAT LAMBERT STEERING IS TO BE USED.

(3) THE ISS NEED NOT BE ON TO COMPLETE THIS PROGRAM.

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

PROG CONT	CMC	GROUND	CREW	CHECKLIST	TIME	TOTAL TIME
			.CREW PROG. .SELECTION . . . .			
-----		.	-----			
START GENERAL LAM- BERT MANEUVER PROGRAM (P31) DISPLAY PROGRAM 31	.....		KEY IN GENERAL LAM- BERT MANEUVER (P31) V37E 31E			#10
			. . .			
		.	-----			
		.....	MONITOR DSKY: OBSERVE DISPLAY OF PROGRAM 31			
-----			-----			
	. . . . . . . . .		. . . . . . . .			#20

SET TRACK FLAG  
(SEE P20)

SET UPDATE FLAG  
(SEE P20)

FLASH VERB-NOUN TO  
REQUEST RESPONSE AND  
DISPLAY TIG:

V06 N33  
R1-TIG-HRS  
R2-TIG-MIN  
R3-TIG-SEC

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

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

CONFIRM WITH THE  
GROUND THAT THIS IS  
THE CORRECT VALUE.

RECORD THIS  
VALUE

KEY IN PROCEED

WAIT FOR KEYBOARD  
ENTRY

TERMINATE FLASH UPON  
RECEIPT OF PROCEED

P.  
R.  
O.  
C.  
E.  
F.  
D.

#30

#40

#50

#60

#70

.....  
-----  
RESFT UPDATE FLAG  
(SEE P20).  
-----

#80

.....  
-----  
BASED ON THE STORED  
TARGET PARAMETERS  
COMPUTE NECESSARY  
DEPENDENT VARIABLES  
FOR EVALUATION OF THE  
THRUSTING MANEUVER  
INCLUDING PERIAPSIS  
ALTITUDE, APOAPSIS  
ALTITUDE AND DELTA V  
REQUIRED (DEFINED  
BELOW).  
-----

#90

.....  
-----  
.....  
.....  
.....

#100

HOLD .  
.....  
SNAP .  
-----  
FLASH VERB NOUN TO  
REQUEST RESPONSE AND  
DISPLAY DELTA V(LV):  
V06N81  
R1-DELTA VX (LV)  
R2-DELTA VY (LV)  
R3-DELTA VZ (LV)

-----  
MONITOR DSKY:  
OBSERVE VERB-NOUN  
FLASH TO REQUEST  
RESPONSE AND DISPLAY  
OF DELTA V(LV)  
COMPONENTS.  
-----

#110

DELTA VX - IMPULSIVE  
COMPONENT OF DELTA V  
AT TIG ALONG (RXV)  
XR - IN FPS TO NEAR-  
EST .1 FPS

.....  
-----  
CONFIRM WITH THE  
GROUND THAT THESE  
ARE THE CORRECT  
PARAMETERS.  
-----

#120

DELTA VY IMPULSIVE  
COMPONENT OF DELTA V  
AT TIG ALONG VXR IN  
FPS TO NEAREST  
.1 FPS

DELTA VZ IMPULSIVE  
COMPONENT OF DELTA V  
AT TIG ALONG -R IN  
FPS TO NEAREST  
.1 FPS

#130

WHERE R IS THE CSM  
GEOCENTRIC (EARTH  
ORBIT) OR SELENCEN-  
TRIC (LUNAR ORBIT)  
RADIUS VECTOR AND V  
IS THE CSM INERTIAL  
VELOCITY VECTOR AT  
TIG.

-----  
.  
.  
.  
-----  
WAIT FOR KEYBOARD  
ENTRY

-----  
TERMINATE FLASH UPON  
RECEIPT OF PROCEED

.....  
-----  
KEY IN PROCEED

#140

-----  
HOLD . . . . . FLASH VERB-NOUN TO  
SNAP . . . . . REQUEST RESPONSE AND  
DISPLAY CALCULATED  
THRUSTING PARAMETERS:  
V06 N42  
R1-AP0 ALT  
R2-PER ALT  
R3-DELTA V

-----  
MONITOR DSKY:  
OBSERVE VERB-NOUN  
FLASH TO REQUEST  
RESPONSE AND DISPLAY  
OF CALCULATED  
THRUSTING PARAMETERS

#150

#160

AP0 ALT - ALTITUDE  
OF APOGEE ABOVE THE  
LAUNCH PAD RADIUS  
(EARTH ORBIT) OR  
ALTITUDE OF THE APO-  
LUNE ABOVE THE LUNAR  
RADIUS AT THE MOST  
RECENTLY DEFINED  
LANDING SITE (LUNAR  
ORBIT). IN NAUTICAL  
MILES TO NEAREST  
.1 NM.

#170



PER ALT - ALTITUDE  
OF PERIGEE ABOVE THE  
LAUNCH PAD RADIUS  
(EARTH ORBIT) OR  
ALTITUDE OF THE  
PERILUNE ABOVE THE  
LUNAR RADIUS AT THE  
MOST RECENTLY DEFIN-  
ED LANDING SITE  
(LUNAR ORBIT), IN  
NAUTICAL MILES TO  
THE NEAREST .1 NM.

#180

DELTA V - MAGNITUDE  
OF IMPULSIVE DELTA V  
VECTOR AT TIG, IN FPS  
TO NEAREST .1 FPS

#190

PCR  
524  
++  
+15  
++

NOTE: IF PER ALT OR  
APO ALT EXCEEDS  
SCALE, THE DISPLAY  
WILL BE 9999.9 NM

.....  
-----  
. IS A GROUND STATION  
. AVAILABLE FOR CON-  
. FIRMATION OF THESE  
. PARAMETERS?  
-----

.Y .N

#200

-----  
COORDINATE  
EVALUATION OF  
CMC COMPUTED  
PARAMETERS .....  
WITH ASTRONAUT

-----  
COORDINATE  
EVALUATION OF  
THE CMC COMPU-  
TED PARAMETERS  
WITH THE  
GROUND  
-----

#210

-----  
. SELECT ONE OF THE  
. FOLLOWING FOUR  
. ALTERNATIVES:  
-----

. (1) PERFORM THE  
. THRUSTING MANEU-  
. VER USING THE CMC  
. CALCULATED PARA-  
. METERS WITHOUT  
. GROUND CONFIRMA-  
. TION.

#220

(2) REMAIN AT  
THIS POINT IN THE  
CMC PROGRAM UNTIL  
GROUND CO-ORDINA-  
TION IS AVAILABLE

#230

(3) SELECT A NEW  
PROGRAM AS DE-  
SIRED UNTIL  
GROUND CO-ORDINA-  
TION IS AVAILABLE  
THEN RESELECT  
P31.

#240

(4) SELECT A NEW  
PROGRAM AS DE-  
SIRED AND PERFORM  
THRUSTING MANEU-  
VER USING BACKUP  
PROCEDURE.

#250

.2 .1.  
..... 3.  
..... 4.

ARE THESE  
PARAMETERS  
SATISFACTORY  
FOR USE BY THE  
CMC FOR THE  
THRUSTING  
MANEUVER?

#260

N. Y.

#270

SELECT ONE OF  
THE FOLLOWING  
TWO ALTERNA-  
TIVES:

```

(1) SELECT THE
CMC UPDATE
PROGRAM (P27).
LOAD NEW AIM
PARAMETERS FROM
THE GROUND VIA
THE CMC UPLINK,
OR BY CREW
DSKY INPUT.
OBSERVE NEW AIM
PARAMETERS,ETC.

```

#280

```

(2) TERMINATE
P31 BY SELECT-
ING A NEW PRO-
GRAM AS DESIRED
AND PERFORM THR-
USTING MANEUVER
USING BACKUP
PROCEDURES.
-----

```

#290

```

1.
2.

```

#300

```

-----
WAIT FOR KEYBOARD
ENTRY.

```

```

-----
KEY IN PROGRAM
SELECTION AS
DESIRED
V37E--E
-----

```

#310

```

.
.
.
.
.
.
.
.
EXIT P31

```

#320

```

-----
TERMINATE FLASH UPON
RECEIPT OF PROCEED
OR NEW PROGRAM.

```

```

-----
KEY IN PROCEED
-----

```

```

-----
P.      . NEW
R.      . PROGRAM
D.      .
C.      .
E.      .
E.      GO TO PROGRAM
D.      SELECTED.
-----

```

#330

EXIT P31

#340

-----  
IS THE REFSMMAT  
FLAG SET?  
-----

.Y .N  
.  
.

-----  
COMPUTE IMU .  
MIDDLE GIMBAL .  
ANGLE AT TIG .  
FOR THE PRESENT .  
IMU ORIENTATION .  
WITH THE CSM +X- .  
AXIS ALIGNED WITH .  
THE INITIAL .  
THRUST VECTOR. .  
-----

#350

. SET MGA DISPLAY  
. IN R3(BELCW) =  
. -00.002  
-----

#360

#370

HOLD . FLASH VERB-NOUN TO  
..... REQUEST RESPONSE AND  
MON . DISPLAY MARK CTRS,  
TFI AND MGA:  
V16 N45  
R1-MARK CTRS  
R2-TFI  
R3-MGA

-----  
MONITOR DSKY:  
OBSERVE VERB-NOUN  
FLASH TO REQUEST  
RESPONSE AND DISPLAY  
OF MARK CTRS, TFI  
AND MGA  
-----

#380

MARK CTRS - THE  
NUMBER OF MARKS  
PROCESSED BY THE  
RENDEZVOUS DATA PRO-  
CESSING ROUTINE  
(R22) (REFER TO  
ASSUMPTION (8) OF  
P20). THE REGISTER  
WILL DISPLAY XXBXX  
WHERE THE TWO MOST  
SIGNIFICANT DIGITS  
IS THE VHF RANGING  
MARK COUNTER AND THE  
TWO LEAST SIGNIFI-  
CANT DIGITS IS THE  
OPTICS MARK COUNTER.  
NOTE: THE OPTICS  
MARK COUNTER DOES  
NOT DISTINGUISH  
BETWEEN BACK-UP AND  
PRIMARY MARKS.

#390

TFI - TIME FROM  
TIG. IN MIN AND SEC  
TO NEAREST SEC.  
MAXIMUM READING IS  
59859. (- BEFORE,  
+ AFTER TIG)

#400

MGA-MIDDLE GIMBAL  
ANGLE AT TIG IF  
+X CSM AXIS IS  
ALIGNED WITH INITIAL  
THRUST DIRECTION.  
SIGN IS ALWAYS +  
EXCEPT WHEN THE IMU  
IS NOT ALIGNED THE  
VALUE IS -0002. IN  
DEGREES TO NEAREST  
.01 DEGREE

#410

#420

-----  
. . .  
. . .  
. . .  
-----  
WAIT FOR KEYBOARD  
ENTRY

-----  
. . . . .  
. . . . .  
. . . . .  
-----  
KEY IN PROCEED

-----  
TERMINATE FLASH UPON  
RECEIPT OF PROCEED

#430

.....  
RESET EXTERNAL DELTA  
V FLAG  
-----

.....  
DO ROUTINE RCO  
-----

.....  
EXIT

.....  
-----  
IF TIME AND  
LOCATION .  
PERMIT, .....  
ASSIST .  
ASTRONAUT IN  
SELECTION OF  
PROPULSION  
SYSTEM. AT .  
THIS TIME, .....  
OR EARLIER .  
IF POSSIBLE.  
THE ASTRONAUT  
MUST LEARN  
OF THE SYS-  
TEM USED IN  
MCC COMPU-  
TATIONS OF  
DATA LOAD  
-----

.....  
DO ROUTINE ROO  
NOTE: CONSIDERING  
VALUE OF DELTA V,  
FUEL AVAILABLE,  
STATUS OF PROPULSION  
HARDWARE, AND TIME  
AVAILABLE TO REALIGN  
THE IMU TO AVOID  
GIMBAL LOCK SELECT  
A PROPULSION SYSTEM  
TO PERFORM THE MANE-  
UVFR. (SPS-P40, RCS-  
P41)  
-----

.....  
EXIT

#440

#450

#460

CHANGE CONTROL NOTES

RFV 12           PCR MIT 34  
REV 13           PCR MIT 66  
REV 14           PCR 206  
REV 15           PCR 524  
RFV 16           PCR 206 EDITORIAL

PURPOSE: (1) TO CALCULATE THE REQUIRED DELTA V AND OTHER INITIAL CONDITIONS REQUIRED BY THE CMC FOR EXECUTION OF THE TRANSFER PHASE INITIATION MANEUVER, GIVEN:

(A) TIME OF IGNITION TIG (TPI) OR THE ELEVATION ANGLE (E) OF THE CSM/LM LOS AT TIG(TPI)

(B) CENTRAL ANGLE OF TRANSFER (CENTANG) FROM TIG(TPI) TO INTERCEPT TIME (TIG(TPF)).

(2) TO CALCULATE TIG (TPI) GIVEN E OR E GIVEN TIG (TPI).

(3) TO DISPLAY TO THE ASTRONAUT AND THE GROUND CERTAIN DEPENDENT VARIABLES ASSOCIATED WITH THE MANEUVER FOR APPROVAL BY THE ASTRONAUT/GROUND.

(4) TO STORE THE TPI TARGET PARAMETERS FOR USE BY THE DESIRED THRUSTING PROGRAM.

ASSUMPTIONS: (1) THE PROGRAM MUST BE DONE OVER A TRACKING STATION FOR REAL TIME GROUND PARTICIPATION IN AGC DATA INPUT AND OUTPUT. AGC COMPUTED VARIABLES MAY BE STORED FOR LATER VERIFICATION BY THE GROUND. THESE STORAGE CAPABILITIES ARE LIMITED ONLY TO THE PARAMETERS FOR ONE THRUSTING MANEUVER AT A TIME.

(2) 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. (HOWEVER, IF THE UPDATE FLAG IS NOT SET THE MARKS WILL NOT BE INCORPORATED). SEE P20 FOR DETAILED DESCRIPTION.

(3) ONCE THE PARAMETERS REQUIRED FOR COMPUTATION OF THE MANEUVER HAVE BEEN COMPLETELY SPECIFIED, THE VALUE OF THE ACTIVE VEHICLE CENTRAL ANGLE OF TRANSFER IS COMPUTED AND STORED. THIS NUMBER WILL BE AVAILABLE FOR DISPLAY TO THE ASTRONAUT THROUGH THE USE OF V06N52.

THE ASTRONAUT WOULD CALL THIS DISPLAY TO VERIFY THAT THE CENTRAL ANGLE OF TRANSFER OF THE ACTIVE VEHICLE IS NOT WITHIN 170 TO 190 DEGREES. IF THE ANGLE IS WITHIN THIS ZONE THE ASTRONAUT SHOULD REASSESS THE INPUT TARGETING PARAMETERS BASED UPON DELTA V AND EXPECTED MANEUVER TIME.

(4) THE OPERATION OF THE PROGRAM UTILIZES THE FOLLOWING FLAGS:

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

FINAL FLAG - SELECTS FINAL PROGRAM DISPLAYS AFTER CREW HAS SELECTED THE FINAL MANEUVER COMPUTATION CYCLE.

EXTERNAL DELTA V FLAG - RESET BY THIS PROGRAM WHICH DESIGNATES THAT LAMBERT STEERING IS REQUIRED FOR EXECUTION OF THIS MANFUVER BY THE THRUSTING PROGRAM SELECTED AFTER COMPLETION OF THIS PROGRAM.

++ (5) THERE IS NO REQUIREMENT FOR ISS OPERATION DURING THIS PROGRAM UNLESS AUTOMATIC STATE VECTOR UPDATING IS  
+13 DESIRED BY THE RENDEZVOUS NAVIGATION PROGRAM (P20).  
++

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

.CREW PRG.  
.SELECTION  
.  
. . .  
.

-----  
START TRANSFER PHASE  
INITIATION PROGRAM  
(P34) DISPLAY PROGRAM P34  
----- . . . . .  
KEY IN TRANSFER  
PHASE INITIATION  
PROGRAM (P34)  
----- #10

-----  
MONITOR DSKY:  
OBSERVE DISPLAY OF  
PROGRAM 34  
-----  
.  
.  
.

-----  
SET ACTIVE VEHICLE  
FLAG TO CSM  
-----  
.  
.  
.

-----  
SET ECSTEER =1  
-----  
.  
.  
.

++  
+13  
++  
EDIT  
"A"  
.  
.  
.  
.  
.  
.  
.  
.  
.  
.  
.

-----  
RESET COMP E FLAG  
-----  
.  
.  
.

-----  
.  
.  
.  
.  
.  
.  
.  
.  
.  
.  
.  
.  
.  
.  
.  
.



175

P34/COLOSSUS  
P34/SUNDANCE  
P34/LUMINARY

-----  
SET TRACK FLAG  
(SEE P20)  
-----

-----  
SET UPDATE FLAG  
(SEE P20)  
-----

#60

"AM"

#70

HOLD . . . . . FLASH VERB-NOUN TO  
..... . . . . REQUEST RESPONSE AND  
SNAP . . . . . DISPLAY TIG(TPI):  
          V06N37  
          R1-TIG (TPI)-HRS  
          R2-TIG (TPI)-MIN  
          R3-TIG (TPI)-SEC

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

#80

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

-----  
AM I SATISFIED WITH  
THIS VALUE?  
(NOTE: THIS PROGRAM  
ALWAYS REQUIRES AN  
INITIAL VALUE OF  
TIG(TPI) WHICH IS  
WITHIN 30 MINUTES  
OF THE ACTUAL VALUE  
EVEN IF TIG (TPI) IS  
TO BE CALCULATED  
FROM A SPECIFIED E.)  
-----

#90

          .Y          .N.

#100

P34/COLOSSUS  
P34/SUNDANCE  
P34/LUMINARY

RECORD THIS  
VALUE.

#110

WAIT FOR KEYBOARD  
ENTRY

KEY IN PROCEED

TERMINATE FLASH UPON  
RECEIPT OF PROCEED  
OR NEW DATA

KEY IN V25E AND  
LOAD THE DESIRED  
TIG

#120

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

#130

HOLD . FLASH VERB-NOUN TO  
..... REQUEST RESPONSE AND  
SNAP . DISPLAY E AND  
CENTANG:  
V06 N55  
R1-BLANK  
R2-F  
R3-CENTANG

MONITOR DSKY:  
OBSERVE VERB-NOUN  
FLASH TO REQUEST  
RESPONSE AND DISPLAY  
OF E AND CENTANG:

#140

E-ELEVATION ANGLE  
BETWEEN THE CSM/LM  
LOS AND THE CSM  
LOCAL HORIZONTAL AT  
TIG(TPI) REFERENCED  
TO THE DIRECTION OF  
FLIGHT (SEE SECTION  
5.4.4.2 OF R577  
FOR DETAILED DESCRIP-  
TION). FROM 0 TO

DO I WISH TO HAVE  
THE CMC CALCULATE E?

#150

.Y .N  
.  
IS P2=  
0000)?

360 IN DEGREES TO  
NEAREST .01 DEGREE.

CENTANG-THE ORBITAL  
CENTRAL ANGLE OF THE  
PASSIVE VEHICLE  
DURING TRANSFER FROM  
TIG(TPI) TO TIME OF  
INTERCEPT. IN  
DEGREES TO NEAREST  
.01 DEGREE.

-----  
WAIT FOR KEYBOARD  
ENTRY

.....  
.

-----  
.Y .N

-----  
KEY IN V22E  
AND LOAD  
+00000E  
IN R2  
-----

#160

#170

-----  
AM I SATISFIED  
WITH THE PRESENT  
VALUE OF E?  
-----

.Y .N

-----  
KEY IN V22E  
AND LOAD THE  
DESIRED E IN  
R2.  
-----

#180

#190

-----  
RECORD THIS VALUE  
-----

#200

-----  
AM I SATISFIED WITH  
THE PRESENT VALUE OF  
CENTANG?  
-----

.Y .N

#210

KEY IN V23E AND  
LOAD THE DESIRED  
CENTANG IN R3.

#220

RECORD THIS VALUE.

TERMINATE FLASH  
RECEIPT OF PROCEED  
OR NEW DATA

KEY IN PROCEED

#230

.P . NEW  
.R . DATA  
.Q .  
.C .  
.E . STORE DATA  
.E .  
.D .

#240

IS E SPECIFIED TO  
BE +00000?

.N . Y.  
. .  
. .

#250

. SET COMP E FLAG

++  
+13  
++  
EDIT

```

. .
. .
. .
. .
. .
..... "B"
. .
. .
. .
. .

```

"B"

#260

-----  
. RESET UPDATE  
. FLAG.  
-----

...

-----  
. IS COMP E FLAG  
. SET?  
-----

-----  
DID I SPECIFY E  
TO BE +00000?  
-----

#270

```

. .N . Y.
. .
. .

```

```

. Y . N.
.
.
.
.
.
.
.
.
.
.
.
.
.
.
.

```

-----  
. COMPUTE E FOR  
. SPECIFIED  
. TIG(ITPI)  
-----

#280

POSS  
HOLD .  
.....  
SNAP .

```

. FLASH VERB-
. NOUN TO RE-
. QUEST RESPONSE
. AND DISPLAY
. CALCULATED E:
. V06 N55
. R1-BLANK
. R2-E
. R3-CENTANG

```

```

.
.....
.

```

-----  
MONITOR DSKY:  
OBSERVE  
VERB-NOUN  
FLASH TO RE-  
QUEST RESPON-  
SE AND DIS-  
PLAY OF CAL-  
CULATED E.  
-----

#290

-----  
. (NOTE: FOR DE-  
. FINITION SEE  
. ABOVE).  
-----

-----  
RECORD THIS  
VALUE  
-----

#300

-----  
WAIT FOR KEY-  
BOARD ENTRY

-----  
KEY IN PRO-  
CEED.

#310

TERMINATE  
FLASH UPON  
RECEIPT OF  
PROCEED

.P  
.R  
.D  
.C  
.E  
.E  
.D

#320

-----  
RESET FINAL  
FLAG

++  
+13  
+13  
++  
EDIT

#330

-----  
COMPUTE TIG  
(TPI) FOR THE  
SPECIFIED F.  
ESTABLISH  
ALARM IF NO  
SOLUTION CAN  
BE REACHED

.N .A  
.O .L  
.A .A  
.L .R  
.A .M  
.R .

#340

POSS  
HOLD .  
.....  
SNAP .

-----  
M FLASH VERB-  
NCUN TO  
REQUEST RE-  
SPONSE AND  
DISPLAY  
ALARM CODE:  
V05N09  
R1-  
R2-  
R3-  
EXPECTED  
ALARM CODE  
AT THIS  
TIME IS

-----  
MONITOR DSKY:  
DOES ALARM  
CODE DISPLAY  
INDICATE THAT  
NO SOLUTION  
CAN BE  
REACHED?

.Y N.

#350

#360

00611

WAIT FOR  
KEYBOARD  
ENTRY

TERMINATE  
FLASH UPON  
RECEIPT OF  
PROCEED

GO TO  
"A"  
ABOVE

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

(NOTE: FOR DE-  
FINITION SEE  
ABOVE).

RETURN TO  
START OF  
PROGRAM  
AND ADJUST  
INPUT PARA-  
METERS.  
KEY IN  
PROCEED.

GO TO  
"A"  
ABOVE

MONITOR DSKY:  
OBSERVE  
VERB-NCUN  
FLASH TO RE-  
QUEST RE-  
SPONSE AND  
DISPLAY OF  
CALCULATED  
TIG(TPI).

RECORD THIS  
VALUE

#370

#380

#390

#400

POSS  
HOLD .  
.....  
SNAP .

-----  
• WAIT FOR KEY-  
• BOARD ENTRY

-----  
• KEY IN  
• PROCEED

#410

• TERMINATE  
• FLASH UPCN  
• RECEIPT CF  
• PROCEED.

• P  
• R  
• O  
• C  
• E  
• E  
• C  
•  
•

#420

-----  
• BASED ON STORED  
• TARGET PARAMETERS  
• COMPUTE THE PARA-  
• METERS ASSOCIATED  
• WITH TPI AND  
• TPF AS DESCRIBED  
• IN SECTION  
• 5.4.4.2 OF R577.

#430

++  
+13  
+  
+  
+13  
++  
PCN  
582

#440

POSS  
HOLD .  
.....  
SNAP .

-----  
• FLASH VERB-NOUN  
• TO REQUEST RE-  
• SPONSE AND DIS-  
• PLAY CALCULATED  
• PER ALT, DELTA  
• V(TPI), AND DELTA  
• V(TPF):  
• VO6N58  
• R1-PER ALT  
• R2-DELTA V(TPI)  
• R3-DELTA V(TPF)

-----  
• MONITOR DSKY:  
• OBSERVE VERB-  
• NOUN FLASH TO  
• REQUEST RESPONSE  
• AND DISPLAY OF  
• CALCULATED PER  
• ALT, DELTA  
• V(TPI), AND  
• DELTA V(TPF).

#450

#460



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

#470

. DELTA V(TPI)-RE-  
 . QUIRED IMPULSIVE  
 . DELTA V TO ACCOM-  
 . PLISH TPI MANEU-  
 . VER AT TIG(TPI).  
 . IN FPS TO NEAREST  
 . .1 FPS.

#480

. DELTA V(TPF)-RE-  
 . QUIRED IMPULSIVE  
 . DELTA V TO ACCOM-  
 . PLISH TPF MANEU-  
 . VER AT TIME OF  
 . INTERCEPT. IN FPS  
 . TO NEAREST .1 FPS.

-----  
 RECORD THESE  
 VALUES  
 -----

#490

-----  
 . WAIT FOR KEYBOARD  
 . ENTRY

-----  
 KEY IN PROCEED  
 -----

#500

. TERMINATE FLASH  
 . UPON RECEIPT OF  
 . PROCEED

-----  
 . IS THE FINAL FLAG  
 . SET?

-----  
 IS THIS THE  
 FINAL PASS  
 THROUGH THIS  
 PROGRAM?  
 -----

#510

. .N . Y.  
 . . . .  
 . . . . . . . . . .  
 . . . . . . . . . .  
 . . . . . . . . . .  
 . . . . . . . . . .  
 . . . . . . . . . .  
 . . . . . . . . . .  
 . . . . . . . . . .

. .Y . N.  
 . . . .  
 . . . . . . . . . .  
 . . . . . . . . . .  
 . . . . . . . . . .  
 . . . . . . . . . .  
 . . . . . . . . . .  
 . . . . . . . . . .

```

++
+13 SET UP-
+ DATE
+13 FLAG
++ (SEE
PCN P20)
582

```

#520

```

++
+13 RESET NEW
+ TARGET
+13 FLAG
++
EDIT

```

#530

```

POSS
HOLD .
.....
SNAP .

```

```

FLASH VERB-
NOUN TO RE-
QUEST RESPONSE
AND DISPLAY
CALCULATED
COMPONENTS OF
DELTA V(LV)
FOR TPI:
V06N81
R1-DELTA
VX(LV)
R2-DELTA
VY(LV)
R3-DELTA
VZ(LV)

```

```

MONITOR DSKY:
OBSERVE
VERB-NOUN
FLASH TO RE-
QUEST RES-
PONSE AND
DISPLAY OF
DELTA V(LV)
FOR TPI

```

#540

```

DELTA VX(LV)-
COMPONENT OF
IMPULSIVE
DELTA V AT
TIG(TPI) ALONG
(RXV)XR. IN
FPS TO NEAREST
.1 FPS.

```

```

AM I SATIS-
FIED WITH
THESE VALUES?
(NOTE: CREW
HAS THE OP-
TION AT THIS
TIME TO RE-
DEFINE THE
DELTA V(LV)
COMPONENTS
FOR THE SUB-
SEQUENT THRU-
STING MANEU-
VER. THIS
CAPABILITY
WILL NORMALLY
BE EXERCISED
TO CORRECT
OUT OF PLANE-
NESS BY FIRST
SELECTING THE

```

#550

```

DELTA VY(LV)-
COMPONENT OF
IMPULSIVE
DELTA V AT
TIG(TPI) ALONG
VXR. IN FPS TO
NEAREST .1 FPS

```

```

DELTA VZ(LV)-
COMPONENT OF

```

#560

```

DELTA VZ(LV)-
COMPONENT OF

```

#570

IMPULSIVE  
DELTA V AT  
TIG(TPI) ALONG  
-R. IN FPS TO  
NEAREST .1 FPS

WHERE P IS THE  
CSM GEOCENTRIC  
(EARTH ORBIT)  
OR SELENOCENTRIC  
(LUNAR ORBIT) RADIUS  
VECTOR AND V  
IS THE CSM INERTIAL VELOCITY  
VECTOR AT TIG(TPI).

WAIT FOR KEY-  
BOARD ENTRY

TERMINATE  
FLASH UPON RE-  
CEIPT OF PRO-  
CEED OR NEW  
DATA

.P .NEW  
.R .DATA  
.N  
.C  
.E STORE DATA  
.E  
.D

RENDEZVOUS  
OUT OF PLANE  
DISPLAY ROUTINE (R36)  
(V90E), AND  
THEN MODIFY-  
ING DELTA  
VY(LV).

.Y N.

KEY IN V25E.  
AND LOAD  
THE DESIRED  
VALUES.

RECORD THESE  
VALUES

KEY IN  
PROCEED.

#580

#590

#600

#610

#620

-----  
SET THE  
NEW TARGET  
FLAG.  
-----

#630

-----  
IS THE NEW  
TARGET FLAG  
SET?  
-----

#640

.N .Y

-----  
CALCULATE  
NEW TARGET  
VECTOR  
BASED ON  
NEWLY  
LOADED  
DELTA  
V(LV) FOR  
TPI.  
-----

#650

-----  
RESET EXTERNAL  
DELTA V FLAG.  
-----

#660

++  
+13  
++  
EDIT

POSS  
HOLD .  
.....  
SNAP .

-----  
FLASH VERB-NOUN  
TO REQUEST RE-  
SPONSE AND DIS-  
PLAY DELTA V(LCS)  
FOR TPI:  
V06N59  
R1-DELTA V1(LCS)  
R2-DELTA V2(LCS)  
R3-DELTA V3(LCS)  
-----

-----  
MONITOR DSKY:  
OBSERVE VERB-  
NOUN FLASH TO  
REQUEST RESPONSE  
AND DISPLAY OF  
DELTA V(LCS).  
-----

#670

DELTA V(LOS)-LINE  
OF SIGHT COMPO-  
NENTS IN FPS TO  
NEAREST .1 FPS.

#680

(NOTE: FOR DEFINI-  
TION SEE SEC-  
TION 5.4.4.2 OF  
R577)

-----  
RECORD THESE VALUES  
-----

-----  
WAIT FOR KEYBOARD ..... KEY IN PROCEED  
ENTRY

#690

++  
+13  
++  
EDIT

TERMINATE FLASH  
UPON RECEIPT OF  
PROCEED.

#700

-----  
IS THE FINAL FLAG  
SET?

.N                    Y.

-----  
SET MGA DISPLAY  
IN R3(BELOW)  
= -00001.

#710

-----  
IS PEFSMMAT FLAG  
SET?

.Y                    N.

#720

```

    .
    .
    .
    .
    .
    .
    .-----
    . COMPUTE IMU
    . MIDDLE GIMBAL
    . ANGLE AT TIG
    . (TFI) FOR THE
    . PRESENT IMU
    . ORIENTATION
    . WITH THIS VE-
    . HICLE'S +X
    . AXIS ALIGNED
    . WITH THE
    . INITIAL
    . THRUST VECTOR
    .
    .
    .
    .
    .
    .
  
```

#730

```

    .
    .
    .
    .-----
    . SET MGA DIS-
    . PLAY IN R3
    . (BELOW) =
    . -00002.
    .
    .
    .
    .
    .
  
```

#740

```

HOLD . FLASH VERB-NOUN TO
..... REQUEST RESPONSE AND
MON . DISPLAY MARK CTRS
      TFI AND MGA;
      V16N45
      R1 - MARK CTRS
      R2 - TFI
      R3 - MGA
  
```

```

-----
. MONITOR DSKY:
. OBSERVE VERB-NOUN
. FLASH TO REQUEST
. RESPONSE AND DISPLAY
. OF MARK CTRS, TFI
. AND MGA.
-----
  
```

#750

```

MARK CTRS - THE NUM-
BER OF MARKS PROCES-
SED BY THE RENDEZ-
VOUS DATA PROCESSING
ROUTINE (R22) (REFER
TO ASSUMPTION (8) OF
P20). THE REGISTER
WILL DISPLAY XX9XX
WHERE THE TWO MOST
SIGNIFICANT DIGITS
IS THE VHF RANGING
MARK COUNTER AND THE
TWO LEAST SIGNIFI-
CANT DIGITS IS THE
OPTICS MARK COUNTER.
NOTE: THE OPTICS
MARK COUNTER DOES
NOT DISTINGUISH BE-
TWEEN BACK-UP AND
  
```

#760

#770

PRIMARY MARKS.

TFI-TIME FROM  
TIG(TPI). IN MIN AND  
SEC TO NEAREST SEC.  
MAX READING IS  
59859. SIGN IS  
- BEFORE + AFTER  
TIG(TPI).

MGA-MIDDLE GIMBAL  
ANGLE AT TIG(TPI) IF  
CSM +X AXIS IS ALIG-  
NED WITH INITIAL  
THRUST DIRECTION.  
SIGN IS ALWAYS +  
EXCEPT:

(A) WHEN DISPLAY-  
ED AT ANY TIME  
OTHER THAN THE  
LAST PASS THROUGH  
THE PROGRAM THE  
VALUE IS -00001

(B) ON THE LAST  
PASS WHEN THE IMU  
IS NOT ALIGNED  
THE VALUE IS  
-00002.  
IN DEGREES TO THE  
NEAREST .01 DE-  
GREES.

.....  
-----  
WAS THIS THE LAST  
PASS THROUGH THE  
PROGRAM?  
-----

.Y N.

.....  
-----  
DO I WISH TO  
TERMINATE THE  
MARKING PROCESS  
AND DO THE FINAL  
PASS THROUGH THE  
PROGRAM?  
-----

.Y N.

.....  
-----  
WAIT FOR KEYBOARD  
ENTRY ..... KEY IN PROCEED.  
-----

TERMINATE FLASH  
UPON RECEIPT OF  
PROCEED OR RECYCLE

.....  
-----  
KEY IN RECYCLE  
V32E  
-----

.P .R  
.R .E  
.Q .C  
.C .Y  
.E .C  
.E .L  
.D .F  
. .  
. .  
. .  
. .

.....  
-----  
GO TO  
"R"  
ABOVE  
-----

#780

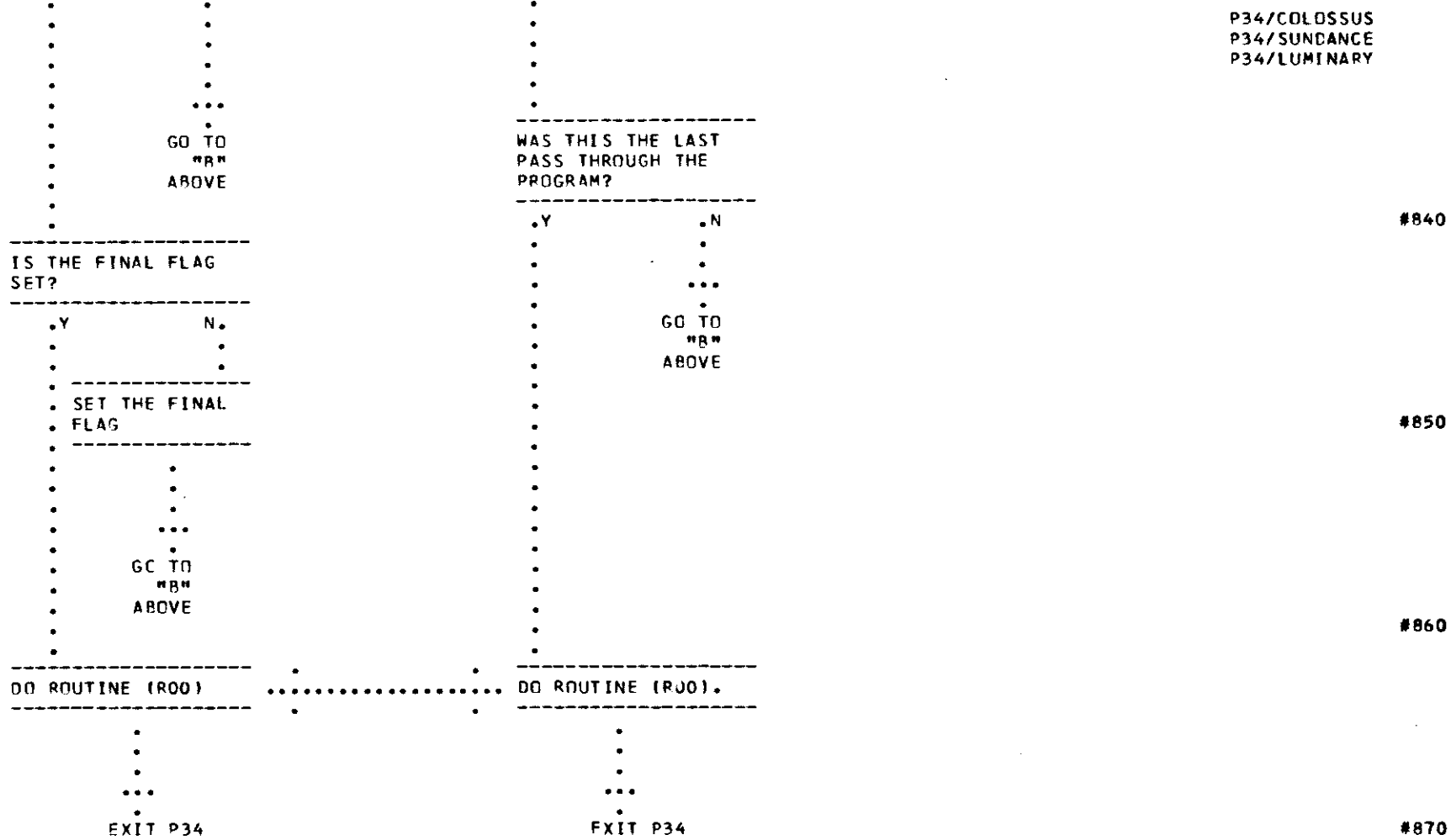
#790

#800

#810

#820

#830



CHANGE CONTROL NOTES

REV 09	PCR MIT 34
REV 10	CARDS MISPLACED - REV 09 =REV 10
REV 11	PCR MIT 66
REV 12	PCR 206
REV 13	EDITORIAL PCR 206
	PCN 5R2



TRANSFER PHASE MIDCOURSE (TPM) PROGRAM (P35)

LOGIC REV 13 12/26/68

PURPOSE: (1) TO CALCULATE THE REQUIRED DELTA V AND OTHER INITIAL CONDITIONS REQUIRED BY THE CMC FOR CSM EXECUTION OF THE NEXT MIDCOURSE CORRECTION OF THE TRANSFER PHASE OF AN ACTIVE CSM RENDEZVOUS.

ASSUMPTION: (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 P21 OR R23) AND TAKE OPTICS MARKS AND/OR HE MAY ALLOW VHF RANGING MARKS TO ACCUMULATE, SEE P20 FOR DETAILED DESCRIPTION.

(2) ONCE THE PARAMETERS REQUIRED FOR COMPUTATION OF THE MANEUVER HAVE BEEN COMPLETELY SPECIFIED, THE VALUE OF THE ACTIVE VEHICLE CENTRAL ANGLE OF TRANSFER IS COMPUTED AND STORED. THIS NUMBER WILL BE AVAILABLE FOR DISPLAY TO THE ASTRONAUT THROUGH THE USE OF VOAN52.

THE ASTRONAUT WOULD CALL THIS DISPLAY TO VERIFY THAT THE CENTRAL ANGLE OF TRANSFER OF THE ACTIVE VEHICLE IS NOT WITHIN 170 TO 190 DEGREES. IF THE ANGLE IS WITHIN THIS ZONE THE ASTRONAUT SHOULD REASSESS THE INPUT TARGETTING PARAMETERS BASED UPON DELTA V AND EXPECTED MANEUVER TIME.

(3) THE OPERATION OF THIS PROGRAM UTILIZES THE FOLLOWING FLAGS:

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

EXTERNAL DELTA V FLAG - RESET BY THIS PROGRAM WHICH DESIGNATES THAT LAMBERT STEERING IS REQUIRED FOR EXECUTION OF THIS MANEUVER BY THE THRUSTING PROGRAM SELECTED AFTER COMPLETION OF THIS PROGRAM.

FINAL FLAG - SELECTS FINAL PROGRAM DISPLAY AFTER CREW HAS SELECTED THE FINAL MANEUVER COMPUTATION CYCLE.

(4) THE TIME OF INTERCEPT (T(INT)) WAS DEFINED BY PREVIOUS COMPLETION OF THE TRANSFER PHASE INITIATION (TPI) PROGRAM (P34) AND IS PRESENTLY AVAILABLE IN CMC STORAGE.

(5) THE ISS NEED NOT BE ON TO COMPLETE THIS PROGRAM.

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

PROC  
CONT

CMC

GROUND

CREW

CHECKLIST

TIME

TOTAL  
TIME

.CREW  
.PROG  
.SELECTION

•

•

•

•

•

•

•

•

•

•

035/01/ISSUS  
035/SUNDRANCE  
035/ILLUMINACY

-----  
START TRANSFER PHASE  
MIDCOURSE (TPM)  
PROGRAM (P35).  
DISPLAY PROGRAM 35.

-----  
KEY IN TRANSFER  
PHASE MIDCOURSE  
(TPM) PROGRAM (P35)  
V37E 35E  
-----

#10

-----  
MONITOR DSKY:  
OBSERVE DISPLAY OF  
PROGRAM 35  
-----

#20

-----  
SET ACTIVE VEHICLE  
FLAG TO CSM  
-----

-----  
SET ECSTEER =1  
-----

#30

-----  
RESET FINAL FLAG  
-----

#40

-----  
SET TRACK FLAG (SEE  
P20)  
-----

-----  
SET UPDATE FLAG  
(SEE P20)  
-----

#50

-----  
"A"  
-----

#60



#110

DO LAMBERT ROUT-  
INE TO CALCULATE  
THE REQUIRED VEL-  
OCITY FOR THE  
MIDCOURSE COR-  
RECTION.

W A W

#120

IS THE FINAL FLAG  
SET?

IS THIS THE FINAL  
PASS THROUGH THIS  
PROGRAM?

#130

N Y

Y N

SET UPDATE  
FLAG

#140

POSS  
HOLD  
.....  
SNAP

FLASH VERR-  
NOUN TO REQ-  
UEST RESPONSE  
AND DISPLAY  
CALCULATED  
COMPONENTS OF  
DELTA V(LV)  
FOR TPM:  
V06N81  
R1-DELTA  
VX(LV)  
R2-DELTA  
VY(LV)  
R3-DELTA  
VZ(LV)

MONITOR  
DSKY:  
OBSERVE  
VERR-NOUN  
FLASH TO  
REQUEST RE-  
SPONSE AND  
DISPLAY OF  
DELTA V(LV)  
FOR TPM

#150

DELTA VX(LV)-  
COMPONENT OF  
IMPULSIVE  
DELTA V AT  
TIG(TPM)  
ALONG (PXV)

AM I SATIS-  
FIED WITH  
THESE  
VALUES?  
(NOTE: CREW  
HAS THE CO-  
ORDINATION AT

#160



#220

RECORD  
THESE  
VALUES

TERMINATE  
FLASH UPON  
RECEIPT OF  
PROCEED OR  
NEW DATA

KEY IN  
PROCEED.

#230

P NEW  
P DATA  
D  
C  
F  
F STOP  
D NEW  
DATA

#240

SET NEW  
TARGET  
FLAG.

#250

IS THE NEW  
TARGET FLAG SET?

#260

N Y

CALCUL-  
ATE NEW  
TARGET  
VECTOR  
BASED  
ON  
NEWLY  
LOADED  
DELTA V  
(LV)

#270

++  
+13

POSS  
HOLD

.....  
SNAP

FOR  
TDM.

-----  
RESET THE EXTER-  
NAL DELTA V FLAG.  
-----

-----  
FLASH VERR-NOUN  
TO REQUEST RE-  
SPONSE AND DIS-  
PLAY DELTA V (LOS)  
FOR TDM:  
V06NS9  
R1-DELTA  
V1(LOS)  
R2-DELTA  
V2(LOS)  
V3-DELTA  
V3(LOS)

DELTA V(LOS)-  
LINE OF SIGHT  
COMPONENTS IN FPS  
TO THE NEAREST  
.1 FPS.  
(NOTE: FOR DEFIN-  
ITION SEE SECTION  
5.4.4.3 OF P577.)  
-----

-----  
WAIT FOR KEYBOARD  
ENTRY

-----  
MONITOR DSKY:  
OBSERVE VERR-  
NOUN FLASH TO RE-  
QUEST RESPONSE  
AND DISPLAY OF  
DELTA V (LOS).  
-----

-----  
RECORD THESE  
VALUES.  
(NOTE: UNLIKE  
DELTA V(LV) FOR  
TDM ABOVE, THESE  
VALUES CANNOT BE  
WRITTEN OVER.)  
-----

-----  
KEY IN PROCEED  
-----

#280

#290

#300

#310

#320







MGA-MIDDLE GIMBAL  
ANGLE AT YIG(TPM) IF  
CSM + X AXIS IS ALIG-  
NED WITH INITIAL  
THRUST DIRECTION.  
SIGN IS ALWAYS +  
EXCEPT:

(A) WHEN DISPLAY-  
ED AT ANY TIME  
OTHER THAN THE  
LAST PASS THROUGH  
THE PROGRAM THE  
THE VALUE IS  
-00001

(B) ON THE LAST  
PASS WHEN THE IMU  
IS NOT ALIGNED  
THE VALUE IS  
-00002. IN DEGREES  
TO THE NEAREST .01  
DEGREES.

.....  
DO I WISH TO  
TERMINATE THE  
MARK PROCESS AND  
DO THE FINAL PASS  
THROUGH THE PRO-  
GRAM?

.....  
.Y N.  
.....

#430

#440

#450

.....  
WAIT FOR KEYBOARD  
ENTRY

.....  
KEY IN PROCEED.  
.....

.....  
TERMINATE FLASH UPON  
RECEIPT OF PROCEED  
OR RECYCLE

.....  
KEY IN RECYCLE  
V32F  
.....

#460

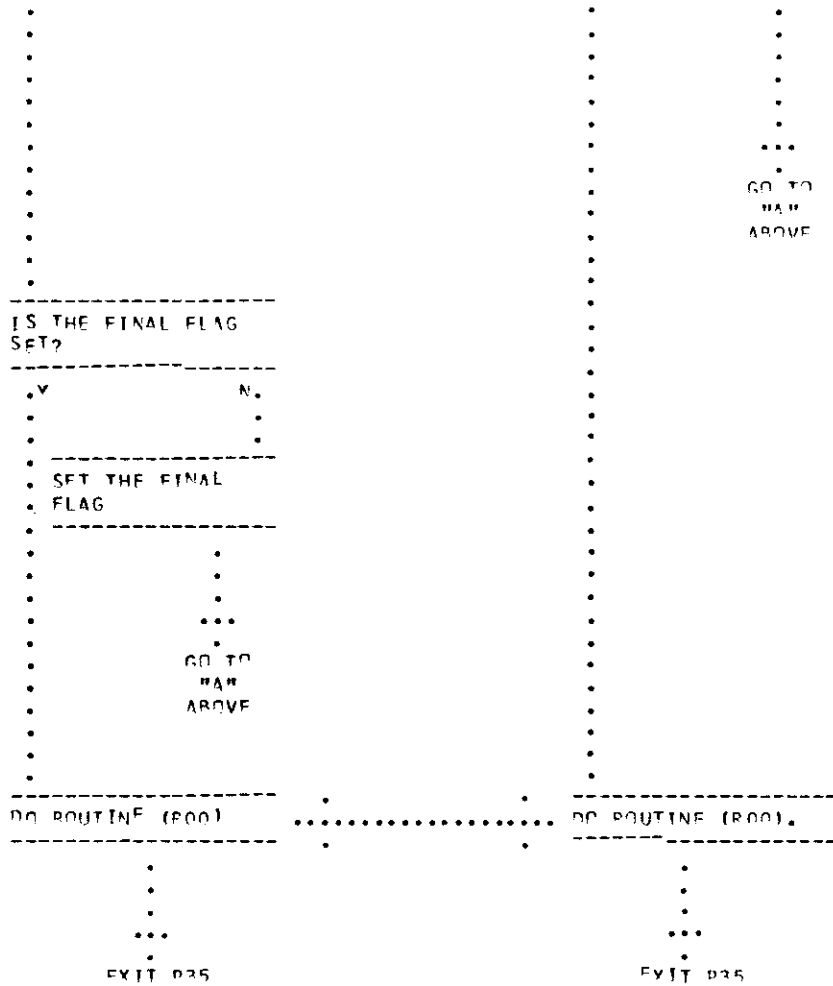
.....  
.P .P  
.R .F  
.D .C  
.C .Y  
.E .C  
.F .L  
.D .F  
.....

.....  
GO TO  
"A"  
ABOVE  
.....

#470

.....  
WAS THIS THE LAST  
PASS THROUGH THE  
PROGRAM?  
.....

.....  
.Y N.  
.....



P35/CROSSUS  
 P35/SUNDANCE  
 P35/LUMINARY

#480

#490

#500

#510

CHANGE CONTROL NOTES

- REV 2 BCR - MIT 34
- REV 10 BCR - MIT 66
- REV 11 BCR - 206
- REV 12 BCR 206 EDITORIAL
- REV 13 EDITORIAL

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RETURN TO EARTH (P37)

LOGIC REV 23 11/27/68

- PURPOSE:
- (1) THIS PROGRAM WILL COMPUTE A RETURN TO EARTH TRAJECTORY PROVIDING THE CSM IS OUTSIDE THE LUNAR SPHERE OF INFLUENCE AT THE TIME OF IGNITION.
  - (2) THIS PROGRAM COMPUTES AND DISPLAYS A PRELIMINARY SERIES OF PARAMETERS BASED ON A CONIC TRAJECTORY AND;
    - A. ASTRONAUT SPECIFIED TIME OF IGNITION.
    - B. ASTRONAUT SPECIFIED MAXIMUM CHANGE IN VELOCITY.
    - C. ASTRONAUT SPECIFIED RE-ENTRY ANGLE.
- THESE PARAMETERS ARE:
- (A) TIME FROM IGNITION TO REENTRY.
  - (B) REENTRY INERTIAL VELOCITY.
  - (C) REENTRY FLIGHT PATH ANGLE.
  - (D) LATITUDE OF SPLASH.
  - (E) LONGITUDE OF SPLASH.
  - (F) DELTA V (LV)
- (3) WHEN THE INITIAL DISPLAY IS SATISFACTORY TO THE ASTRONAUT, THE PROGRAM RECOMPUTES THE SAME DATA USING APPLICABLE PERTURBATIONS TO THE CONIC TRAJECTORY, AND DISPLAYS THE NEW VALUES.
  - (4) UPON FINAL ACCEPTANCE BY THE ASTRONAUT, THE PROGRAM COMPUTES AND STORES THE TARGET PARAMETERS FOR RETURN TO EARTH FOR USE BY SPS PROGRAM (P40) OR RCS PROGRAM (P41).
  - (5) BASED UPON SPECIFIED PROPULSION SYSTEM THE FOLLOWING ARE DISPLAYED:
    - (A) MIDDLE GIMBAL ANGLE AT IGNITION.
    - (B) TIME OF IGNITION (TIG).
    - (C) TIME FROM IGNITION (TFI).
- ASSUMPTIONS:
- (1) THIS PROGRAM ASSUMES THAT CONTACT WITH THE GROUND IS UNAVAILABLE, AND IS COMPLETELY SELF CONTAINED.
  - (2) THE ISS NEED NOT BE ON TO COMPLETE THIS PROGRAM.
  - (3) IF VALUE OF VPRED ENTERED IN NOUN 60 IS LESS THAN THE MINIMUM REQUIRED TO RETURN TO EARTH, THE DELTA V REQUIRED VECTOR WILL BE COMPUTED BASED ON A MINIMUM VALUE. IF VALUE ENTERED IS GREATER THAN THE MINIMUM REQUIRED TO RETURN TO EARTH THEN THE ASTRONAUT DESIRED VALUE WILL BE USED TO COMPUTE THE DELTA V REQUIRED VECTOR. THE COMPUTED DELTA V REQUIRED VECTOR WILL BE DISPLAYED IN NOUN R1.

- (4) THE DAP DATA LOAD ROUTINE SHOULD BE PERFORMED PRIOR TO COMPLETION OF THIS PROGRAM (SEE CREW COLUMN BELOW).
- (5) THIS PROGRAM IS SELECTED BY THE ASTRONAUT BY DSKY ENTRY.

PROG CONT	CMC	GRUND	CREW	CHECKLIST	TIME	TOTAL TIME
				.CREW PROG. .SELECTION		
			.			
			.....			
			.			
			-----			
	START RETURN TO	.	KEY IN RETURN TO			
	EARTH PROGRAM (P37)	.....	EARTH PROGRAM (P37)			#10
	DISPLAY PROGRAM 37	.	V37E 37E			
			-----			
			.			
			.			
			.			
			-----			
		.	MONITOR DSKY:			
		.....	OBSERVE DISPLAY OF			#20
		.	PROGRAM 37			
			-----			
		.	.			
		.	.			
		.	.			
		-----	-----			
++	SET ECSTEER = .5					
+22						
++						
PCR						
521						
	.		.			
	.		.			
	.		.			
	"A"		"A"			#30
	.		.			
	.		.			
	.		.			
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	.		.			
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	.		.			
	.		.			

204 )

)

205

FLASH VERB-NOUN TO  
REQUEST RESPONSE AND  
DISPLAY TIG:

V06 N33  
R1-TIG-HRS  
R2-TIG-MIN  
R3-TIG-SEC

HOLD .  
.....  
SNAP .

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

WAIT FOR KEYBOARD  
ENTRY

TERMINATE FLASH UPON  
RECEIPT OF PROCEED  
OR NEW DATA

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

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

AM I SATISFIED WITH  
THIS VALUE?

.Y .N

RECORD THIS  
VALUE

KEY IN PROCEED

KEY IN V25E AND  
LOAD THE DESIRED  
TIG.

#40

#50

#60

#70

#80

HOLD .  
 .....  
 SNAP .

FLASH VERB-NOUN TO  
 REQUEST RESPONSE AND  
 DISPLAY VPRED AND  
 GAMMA EI:  
 V06 N60  
 R1-BLANK  
 R2-VPRED  
 R3-GAMMA EI

MONITOR DSKY:  
 OBSERVE VERB-NOUN  
 FLASH TO REQUEST  
 RESPONSE AND DISPLAY  
 OF VPRED AND GAMMA  
 EI

#90

VPRED-MAXIMUM ALLOW-  
 ABLE CHANGE IN  
 VELOCITY IN FPS TO  
 NEAREST FPS

#100

GAMMA EI-FLIGHT PATH  
 ANGLE BETWEEN INER-  
 TIAL VELOCITY VECTOR  
 AND THE LOCAL HOR-  
 IZONTAL AT THE ENTRY  
 INTERFACE ALTITUDE  
 OF 400,000 FT ABOVE  
 THE FISCHER ELLIP-  
 SOID, IN DEGREES TO  
 THE NEAREST .01 DEG.  
 MINUS INDICATES  
 FLIGHT PATH IS BE-  
 LOW THE HORIZONTAL  
 PLANE.

#110

NOTE: IF ZERO IS  
 LOADED COMPUTATION  
 WILL BE SOLVED TO  
 HIT CENTER OF ENTRY  
 CORRIDOR, OTHERWISE  
 COMPUTATION WILL BE  
 SOLVED TO HIT ANGLE  
 ENTERED.

#120

AM I SATISFIED WITH  
 THESE VALUES?  
 NOTE: IN ORDER TO  
 HAVE THE CMC COMPUTE  
 A MINIMUM ENERGY  
 (MINIMUM FUEL) RE-  
 TURN TO EARTH MAN-  
 EUVER THE ASTRONAUT  
 SHOULD LOAD ALL  
 ZEROS INTO R2.  
 IN ORDER TO HAVE THE  
 CMC COMPUTE A TRAJ-  
 ECTORY WHICH WILL  
 HIT THE CENTER OF  
 THE ENTRY CORRIDOR  
 THE ASTRONAUT SHOULD  
 LOAD ALL ZERO'S INTO

#130

#140



```

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.
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.
.
.
.
.
.
.

```

-----  
WAIT FOR KEYBOARD  
ENTRY

-----  
TERMINATE FLASH UPON  
RECEIPT OF PROCEED  
OR NEW DATA

```

.P      .NEW
.R      .DATA
.O      .
.C      .
.E      -----
.E      STORE DATA
.D      -----
.
.
.
.
.
.
.

```

-----  
BASED ON ASTRONAUT  
INPUTS USE CONIC  
SECTION METHOD TO  
COMPUTE NECESSARY  
DEPENDENT VARIABLES  
FOR EVALUATION OF  
THRUSTING MANEUVER  
INCLUDING ENTRY LAT,  
LCNG, FLIGHT PATH  
ANGLE, VELOCITY,  
AND TIME TO ENTRY.  
ESTABLISH ALARM  
IF-

(A) STATE VECTOR  
AT TIG IS IN MOON'S  
SPHRE CF INFLUENCE.  
STORE ALARM CODE 612.

(B) SOLUTION DOES  
NOT CONVERGE DUE TO  
EXCESSIVE ITERATIONS.  
STORE ALARM CODE 605.

.....  
.

.....  
.

R3.

```

-----
.Y          .N
.
.
.
-----

```

-----  
KEY IN PROCEED  
-----

-----  
KEY IN V22E, V23E,  
OR V25E AND LOAD  
THE DESIRED VALUES.  
-----

```

.
.
.
.
.
.
.
.
.
.

```

#150

#160

#170

#180

#190

(C) DESIRED  
FLIGHT PATH ANGLE  
NOT REACHED.  
STORE ALARM CODE 613

#200

.N .A  
.O .L  
. .A  
.A .R  
.L .M  
.A .  
.R .  
.M .

#210

NRW

#220

-----  
. RECCMPUTE  
. NECESSARY  
. DEPENDENT  
. VARIABLES  
. FOR PERFORM-  
. ING THRUST-  
. ING MANEUVER  
. USING PRECI-  
. SION INTEG-  
. RATION  
. ESTABLISH  
. ALARM IF -  
. (A) SOLUTION  
. DOES NOT  
. CONVERGE DUE  
. TO EXCESSIVE  
. ITERATIONS.  
. STORE ALARM  
. CODE 605.  
. (B) DESIRED  
. FLIGHT PATH  
. ANGLE NOT  
. REACHED.  
. STORE ALARM  
. CODE 613.  
-----

#230

#240

.A .N  
.L .P  
.A .  
.R .A  
.M .L  
. .A  
. .R  
. .  
. .  
. .  
. .  
. .

#250

209

++
+23
+
POSS
HOLD
SNAP
+23
++
PCR
206
EDIT

Main column of dots and dashes for program flow, including a small 'M' and a horizontal cross of dots.

MONITOR DSKY: IS THERE AN ALARM CODE DISPLAY INDICATING COMPUTATIONAL DIFFICULTY?
.Y .N
RETURN TO START OF PROGRAM AND ADJUST INPUT PARAMETERS. KEY IN RECYCLE V32E
.R
.E
.C
.Y
.C
.L
.E
GO TO "A" ABOVE

#260

#270

#280

#290

#300

#310

HOLD .  
.....  
SNAP .

FLASH VERB-NOUN TO  
REQUEST RESPONSE AND  
DISPLAY COMPUTED  
DATA

V06 N61  
R1-IMPACT LAT  
R2-IMPACT LONG  
R3-BLANK

IMPACT LAT-LATITUDE  
OF CALCULATED IMPACT  
POINT. IN DEGREES TO  
NEAREST .01 DEG. +  
IS NORTH

IMPACT LONG-LONGI-  
TUDE OF CALCULATED  
IMPACT POINT. IN  
DEGREES TO NEAREST  
.01 DEG. + IS EAST

WAIT FOR KEYBOARD  
ENTRY

TERMINATE FLASH UPON  
RECEIPT OF PROCEED  
OR RECYCLE

P. .R  
R. .E  
O. .C  
C. .Y  
E. .C  
E. .L  
D. .E

GO TO  
"A"  
ABOVE

MONITOR DSKY:  
OBSERVE VERB-NOUN  
FLASH TO REQUEST  
RESPONSE AND DISPLAY  
OF S/C ENTRY DATA

AM I SATISFIED  
WITH THESE VALUES?

.Y .N

RECORD THESE  
VALUES.

KEY IN PROCEED

RETURN TO START  
OF PROGRAM AND  
ADJUST INPUT  
PARAMETERS KEY  
IN RECYCLE  
V32E

GO TO  
"A"  
ABOVE

#320

#330

#340

#350

#360

```

-----
FLASH VERB-NOUN TO
REQUEST RESPONSE AND
DISPLAY DELTA T

```

HOLD .  
.....  
SNAP .

```

TRANS:
V06 N39
R1-DELTA T TRANS-
HRS
R2-DELTA T TRANS-
MINS
R3-DELTA T TRANS-
SECS

```

```

DELTA T TRANS - TIME
REQUIRED FOR TRANS-
FER FROM TIG TO TIME
OF REENTRY AT 400,000
FT. ALT. (REFERENCED
TO FISCHER ELLIPSCID)
IN HRS, MINS, SEC TO
NEAREST .01 SEC.

```

```

-----
MONITOR DSKY:
OBSERVE VERB-NOUN
FLASH TO REQUEST
RESPONSE AND DISPLAY
OF DELTA T TRANS

```

#370

```

-----
AM I SATISFIED
WITH THIS VALUE?

```

#380

```

      .Y      .N
      .      .
      .      .
      .      .

```

```

-----
RECORD THIS
VALUE.

```

#390

```

-----
WAIT FOR KEYBOARD
ENTRY

```

```

-----
KEY IN PROCEED

```

```

-----
RETURN TO START
OF THIS PROGRAM
AND ADJUST INPUT
PARAMETERS KEY IN
RECYCLE
V32E

```

#400

```

-----
TERMINATE FLASH UPON
RECEIPT OF PROCEED
OR RECYCLE

```

```

-----
.P      .R
.R      .F
.D      .C
.C      .Y
.E      .C
.F      .L
.D      .E
.
.
.....
.
.
.
.

```

```

-----
      .
      .
      .
      ...
      .
GO TO
"A"
ABOVE

```

#410

GO TO  
"A"  
ABOVE

#420

```

-----
HOLD . FLASH VERB-NOUN TC
..... REQUEST RESPONSE AND .....
SNAP . DISPLAY VPRED AND
      GAMMA EI:
        V06 N60
        R1-BLANK
        R2-VPRED
        R3-GAMMA EI
  
```

```

-----
MONITOR DSKY:
OBSERVE FLASH TO
REQUEST RESPONSE AND
DISPLAY OF ENTRY
PARAMETERS
-----

```

#430

```

VPRED - PREDICTED
INERTIAL VELOCITY
AT THE ENTRY INTER-
FACE (400,000 FT
ABOVE THE FISCHER
ELLIPSOID) IN FPS TO
THE NEAREST FPS
  
```

```

-----
AM I SATISFIED
WITH THESE VALUES?
-----

```

#440

```

GAMMA EI - SEE ABOVE
DISPLAY FOR DEFINI-
TION
-----

```

```

.Y .N
. .
. .
. .

```

```

-----
. RETURN TO
. START OF
. THIS PRO-
. GRAM AND
. ADJUST
. INPUT
. PARAMETERS
. KEY IN
. RECYCLE
. V32E
-----

```

#450

```

-----
WAIT FOR KEYBOARD
ENTRY

```

```

-----
RECORD THESE
VALUES.
-----

```

#460

```

.....
GO TO
"A"
ABOVE

```

#470

TERMINATE FLASH UPON  
RECEIPT OF PROCEED  
OR RECYCLE

-----  
KEY IN PROCEED  
-----

P. .R  
R. .E  
D. .C  
C. .Y  
E. .C  
E. .L  
D. .E  
. .  
. .  
. .  
. .  
. .  
. .  
GO. TO  
"A"  
ABOVE  
. .  
. .

#480

#490

HOLD .  
.....  
SNAP .

FLASH VERB-NOUN TO  
REQUEST RESPONSE AND  
DISPLAY THREE STORED  
COMPONENTS OF  
DELTA V(LV):  
V06 NB1  
R1-DELTA VX(LV)  
R2-DELTA VY(LV)  
R3-DELTA VZ(LV)

-----  
MONITOR DSKY:  
OBSERVE VERB-NOUN  
FLASH TO REQUEST RE-  
SPONSE AND DISPLAY  
OF THREE STORED  
COMPONENTS OF IMPUL-  
SIVE DELTA V ALONG  
CSM LOCAL VERTICAL  
AXES AT TIG

#500

DELTA VX(LV)-COMPO-  
NENT OF IMPULSIVE  
DELTA V AT TIG ALONG  
(RXV)XR. IN FPS TO  
NEAREST .1 FPS

DELTA VY(LV)-COMPO-  
NENT OF IMPULSIVE  
DELTA V AT TIG ALONG  
VXR. IN FPS TO NEAR-  
EST .1 FPS

#510

DELTA VZ(LV)-COMPO-  
NENT OF IMPULSIVE  
DELTA V AT TIG ALONG  
-R. IN FPS TO NEAR-  
EST .1 FPS

-----  
RECORD THESE VALUES.  
-----

#520

WHERE R IS CSM  
GEOCENTRIC RADIUS  
VECTOR AND V IS CSM  
INERTIAL VELOCITY  
VECTOR AT TIG.

-----  
          .  
          .  
          .  
-----  
WAIT FOR KEYBOARD  
ENTRY

-----  
KEY IN PROCEED  
-----

#530

-----  
TERMINATE FLASH UPON  
RECEIPT OF PROCEED  
-----

.P  
.R  
.O  
.C  
.E  
.E  
.D  
.  
.

#540

-----  
WAS THIS THE FIRST  
PASS THROUGH THE  
PROGRAM?  
-----

-----  
WAS THIS THE FIRST  
PASS THROUGH THE  
PROGRAM?  
-----

#550

.N            .Y  
.  
.  
.  
.  
.  
GO TO  
  "8"  
ABOVE

.Y            .N  
.  
.  
.  
.  
.  
GO TO  
  "8"  
ABOVE

#560

-----  
SET CMC ASSUMED  
OPTION IN R2  
(BELOW) TO  
00001  
-----

#570

214 )



HOLD .  
.....  
SNAP .

FLASH VERB-NOUN TO  
REQUEST RESPONSE AND  
DISPLAY OPTION CODE  
FOR PROPULSION  
SYSTEM OPTION:  
V04 N06  
R1-00007  
R2-0000X  
R3-BLANK

R1-IS THE OPTION  
CODE FOR ASSUMED  
PROPULSION SYSTEM  
OPTION

R2- IS CMC ASSUMED  
OPTION

00001-SPS PROPULSION  
SYSTEM

00002-RCS PROPULSION  
SYSTEM

WAIT FOR KEYBOARD  
ENTPY

MONITOR DSKY:  
OBSERVE VERB-NOUN  
FLASH TO REQUEST  
RESPONSE AND DISPLAY  
OF OPTION CODE FOR  
PROPULSION SYSTEM  
OPTION

AM I SATISFIED WITH  
THE CMC ASSUMED  
OPTION?

.Y .N  
.  
.  
.

PRIOR TO PRO-  
CEEDING ON THIS  
DISPLAY THE DAP  
DATA LOAD ROUT-  
INE (R03)  
SHOULD HAVE  
BEEN COMPLETED  
IN ORDER THAT  
THIS PROGRAM  
USE THE CORRECT  
VALUES FOR  
WEIGHT AND, IN  
THE CASE OF  
RCS, NUMBER OF  
JETS TO BE USED  
DURING COMPUTA-  
TION OF TIME  
OF BURN.

KEY IN  
PROCEED

#580

#590

#600

#610

#620

TERMINATE FLASH UPON  
RECEIPT OF PROCEED  
OR NEW DATA

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

-----  
KEY IN V22E  
AND LOAD THE  
DESIRED OP-  
TION  
-----

#630

#640

-----  
BASED ON THRUST  
OPTION TAKE THRUST  
PARAMETERS AND  
RECCMPUTE TIG  
-----

#650

HOLD . FLASH VERB-NOUN TO  
..... RFQUEST RESPONSE AND  
SNAP . DISPLAY TIG  
V06 N33  
R1-TIG-HRS  
R2-TIG-MIN  
R3-TIG-SEC

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

#660

-----  
TIG-TIME OF IGNI-  
TION (GET).  
IN HRS, MIN, SEC TO  
NEAREST .01 SEC  
-----

#670

-----  
RECORD DATA  
-----

-----  
WAIT FOR KEYBOARD  
ENTRY

-----  
KEY IN PROCEED  
-----

#680

TERMINATE FLASH UPON  
RECEIPT OF PROCEED

- .P
- .R
- .C
- .C
- .E
- .E
- .D
- .
- .
- .

#690

IS REFSMMAT FLAG  
SET?

- .Y .N
- .
- .

#700

COMPUTE IMU GIMBAL  
ANGLES AT IGNIT-  
IGN FOR THRUST  
ALONG CSM +X AXIS

- .
- .
- .
- .
- .
- .
- .
- .
- .
- .
- .

#710

- . SET MGA
- . DISPLAY IN
- . R3(BELOW)
- . = -00002

HOLD . FLASH VERB-NOUN TO  
..... REQUEST RESPONSE AND  
MON . DISPLAY MANEUVER

- DATA:
- V16 N45
- R1-MARK CTRS
- R2-TFI
- R3-MGA

MARK CTRS-NOT MEAN-  
INGFUL TO THIS  
PROGRAM.

MONITOR DSKY:  
OBSERVE VERB-NCUN  
FLASH TO REQUEST  
RESPONSE AND DISPLAY  
OF TFI AND MGA

#720

#730

TFI - TIME FROM TIG.  
IN MIN AND SEC TO  
NEAREST SEC.  
MAXIMUM READING IS  
59859 (- BEFORE +  
AFTER TIG)

MGA:MIDDLE GIMBAL  
ANGLE AT TIG IF  
+X CSM AXIS IS  
ALIGNED WITH INITIAL  
THRUST DIRECTION.  
SIGN IS ALWAYS +  
EXCEPT WHEN THE IMU  
IS NOT ALIGNED THE  
VALUE IS -00002. IN  
DEGREES TO NEAREST  
.01 DEGREE

#740

-----  
.  
.  
.  
-----  
WAIT FOR KEYBOARD  
ENTRY

-----  
KEY IN PROCEED  
-----

#750

-----  
TERMINATE FLASH UPON  
RECEIPT OF PROCEED  
-----

#760

.P  
.R  
.C  
.C  
.F  
.E  
.D  
.  
.

#770

-----  
RESET EXTERNAL DELTA  
V FLAG  
-----

#780

.  
.  
.  
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.  
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.  
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## PURPOSE:

- (1) TO CALCULATE THE REQUIRED DELTA V AND OTHER INITIAL CONDITIONS REQUIRED BY THE CMC FOR CSM EXECUTION OF THE FIRST PHASE OF THE STABLE ORBIT RENDEZVOUS MANEUVER. GIVEN:
  - (A) TIME OF IGNITION (TIG).
  - (B) CENTRAL ANGLE OF TRANSFER (CENTANG) FROM TIG TO INTERCEPT TIME.
  - (C) THE OFFSET OF THE STABLE ORBIT POINT SPECIFIED AS A DISTANCE ALONG THE PASSIVE VEHICLE ORBIT.
- (2) TO CALCULATE THE REQUIRED DELTA V AND OTHER INITIAL CONDITIONS REQUIRED BY THE CMC FOR CM EXECUTION OF THE SECOND PHASE OF THE STABLE ORBIT RENDEZVOUS MANEUVER. GIVEN:
  - (A) A RESPECIFICATION OF 1(A) ABOVE.
  - (B) AN OPTIONAL RESPECIFICATION OF 1(B) ABOVE.
- (3) TO CALCULATE THESE PARAMETERS BASED UPON MANEUVER DATA APPROVED AND KEYED INTO THE CMC BY THE ASTRONAUT.
- (4) TO DISPLAY TO THE ASTRONAUT AND THE GROUND CERTAIN DEPENDENT VARIABLES ASSOCIATED WITH THE MANEUVER FOR APPROVAL BY THE ASTRONAUT/GROUND.
- (5) TO STORE THE SOR PHASE 1 AND PHASE 2 TARGET PARAMETERS FOR USE BY THE DESIRED THRUSTING PROGRAM.

## ASSUMPTIONS:

- (1) THE STABLE ORBIT POINT IS DEFINED AS THE FINAL POSITION (AT COMPLETION OF SECOND PHASE) OF THE ACTIVE VEHICLE RELATIVE TO THE PASSIVE VEHICLE.
- (2) CMC COMPUTED VARIABLES MAY BE STORED FOR LATER VERIFICATION BY THE GROUND. THESE STORAGE CAPABILITIES ARE LIMITED ONLY TO THE PARAMETERS FOR ONE THRUSTING MANEUVER AT A TIME EXCEPT FOR STABLE ORBIT RENDEZVOUS MANEUVER SEQUENCES.
- (3) 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 P21 OR P23) AND TAKE OPTICS MARKS AND/OR HE MAY ALLOW VHF RANGING MARKS TO ACCUMULATE. SEE P20 FOR DETAILED DESCRIPTION.
- (4) ONCE THE PARAMETERS REQUIRED FOR COMPUTATION OF THE MANEUVER HAVE BEEN COMPLETELY SPECIFIED, THE VALUE OF THE ACTIVE VEHICLE CENTRAL ANGLE OF TRANSFER IS COMPUTED AND STORED. THIS NUMBER WILL BE AVAILABLE FOR DISPLAY TO THE ASTRONAUT THROUGH THE USE OF V06N52.  
THE ASTRONAUT WOULD CALL THIS DISPLAY TO VERIFY THAT THE CENTRAL ANGLE OF TRANSFER OF THE ACTIVE VEHICLE IS NOT WITHIN 170 TO 190 DEGREES. IF THE ANGLE IS WITHIN THIS ZONE THE ASTRONAUT SHOULD REASSESS THE INPUT TARGETTING PARAMETERS BASED UPON DELTA V AND EXPECTED MANEUVER TIME.
- (5) THE OPERATION OF THIS PROGRAM UTILIZES THE FOLLOWING FLAGS.

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

FINAL FLAG- SELECTS FINAL PROGRAM DISPLAYS AFTER THE CREW HAS SELECTED THE FINAL MANEUVER COMPUTATION CYCLE.

**1A**P38/CPL/ISSUS  
P38/LUMINARY

EXTERNAL DELTA V FLAG - RESET BY THIS PROGRAM WHICH DESIGNATES THAT LAMBERT STEERING IS REQUIRED FOR EXECUTION OF THIS MANEUVER BY THE THRUSTING PROGRAM SELECTED AFTER THE COMPLETION OF THIS PROGRAM.

- (6) THE SECOND PHASE OF THIS PROGRAM REQUIRES THE TIC INPUT BE BIASED AS A FUNCTION OF TPE AND ANY MIDCOURSE CORRECTIONS PERFORMED IN THE STABLE ORBIT MIDCOURSE (SOM) PROGRAM (P30)
- (7) THE ISS NEED NOT BE ON TO COMPLETE THIS PROGRAM.
- (8) THIS PROGRAM IS SELECTED BY THE ASTRONAUT BY DSKY ENTRY.

PROG CONT	CMC	GROUND	CREW	CHECKLIST	TIME	TOTAL TIME
			.CREW PROG .SELECTION . . . .			
----- START STABLE ORBIT RENDEZVOUS (SOR) PROGRAM (P38) DISPLAY P38 -----	.	.....	----- KEY IN STABLE ORBIT RENDEZVOUS (SOR) PROGRAM (P38) V37F 39F -----			#10
			. . .			
		.....	----- MONITOR DSKY: RESERVE DISPLAY OF PROGRAM 38 -----			#20
	. .		. . . . . . . . . . .			
----- SET ACTIVE VEHICLE FLAG TO CSM. -----						
	. .					
----- SET ECSTEER =1 -----						#30
	. . . . . . . . . .					



SET TRACK FLAG.  
(SEE P20)

#40

SET UPDATE FLAG.  
(SEE P20)

#50

HOLD .  
.....  
SNAP .

FLASH VERB-NOUN  
TO REQUEST RESPONSE  
AND DISPLAY TIG.  
V06 N33  
R1-TIG HRS.  
R2-TIG MIN.  
R3-TIG SEC.

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

#60

TIG - TIME OF IGNIT-  
ION (GET). IN HOURS  
MIN AND SEC TO NEAR-  
EST .01 SEC.

#70

AM I SATISFIED WITH  
THIS VALUE?

#80

RECORD THIS  
VALUE

#90

**1A**

# 1A

-----  
WAIT FOR KEYBOARD  
ENTRY.

-----  
KEY IN PROCEED

-----  
TERMINATE FLASH UPON  
RECEIPT OF PROCEED  
OR NEW DATA.

-----  
KEY IN V25F  
AND LOAD THE  
DESIRED TIG  
(SNP)

-----  
P NEW  
P DATA  
C  
C  
E  
E  
D  
-----  
STORE  
DATA  
-----

#110

#120

HOLD .  
.....  
SNAP .

-----  
FLASH VERB-NOUN TO  
REQUEST RESPONSE AND  
DISPLAY CENTANG  
V06 N55  
P1-BLANK  
P2-BLANK  
P3-CENTANG

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

#130

-----  
CENTANG- THE ORBITAL  
CENTRAL ANGLE OF THE  
PASSIVE VEHICLE DURING  
TRANSFER FROM  
TIG TO TIME OF INTERCEPT.  
IN DEGREES TO NEAREST .01  
DEGREES  
-----

#140

-----  
AM I SATISFIED WITH  
THIS VALUE?  
-----

.Y .N

-----  
RECORD THIS  
VALUE  
-----

#150

-----  
WAIT FOR KEYBOARD  
ENTRY.  
-----

-----  
KEY IN  
PROCEED  
-----

#160

-----  
TERMINATE FLASH UPON  
RECEIPT OF PROCEED  
OR NEW DATA  
-----

-----  
KEY IN V23F  
AND LOAD THE  
DESIRED  
CENTANG.  
-----

#170

.P .NEW  
.P .DATA  
.N .  
.C .  
.E .  
.E .  
.N .  
-----  
STORE  
DATA  
-----

#180

HOLD .  
.....  
SNAP .  
-----  
FLASH VERB-NOUN TO  
REQUEST RESPONSE AND  
DISPLAY OF ASSUMED  
STABLE ORBIT RENDEZ-  
VOUS PHASE OPTION:  
V04 M06  
01-0000F  
02-0000Y  
03-PLANK  
-----

-----  
MONITOR DSKY:  
OBSERVE VERB-NOUN  
FLASH TO REQUEST  
RESPONSE AND DISPLAY  
OF ASSUMED STABLE  
ORBIT RENDEZVOUS  
PHASE OPTION.  
-----

#190

**1A**

# 1A

R1 IS OPTION CODE  
FOR ASSUMED STABLE  
ORBIT RENDEZVOUS  
PHASE OPTION.

-----  
IS THIS PHASE OPTION  
CORRECT?  
-----

#200

R2 IS THE CMC ASSU-  
MED OPTION:

00001-FIRST PHASE-  
LOAD DELTA R  
CMC COMPUTES SPP  
PARAMETERS FOR  
FIRST PHASE.

00002-SECOND PHASE-  
NO ADDITIONAL  
DATA REQUIRED:  
CMC CALCULATES  
SPP PARAMETERS  
FOR SECOND PHASE.

.Y .N

#210

-----  
WAIT FOR KEYBOARD  
ENTRY

-----  
KEY IN  
PROCEED  
-----

#220

-----  
TERMINATE FLASH UPON  
RECEIPT OF PROCEED  
OR NEW DATA

-----  
KEY IN V22F  
AND LOAD DE-  
SIRFD OPTION  
CODE IN R2.  
-----

#230

.D .NEW  
.D .DATA  
.D  
.C  
.E STORE DATA  
.E  
.D

#240

-----  
IS PHASE OPTION =1?  
-----

-----  
DID I SPECIFY FIRST  
PHASE?  
-----

.Y .N

.Y .N

33

P38/COLOSSUS  
P38/LUMINARY

++  
+14  
+  
++  
PCN  
577

-----  
RESET UPDATE  
FLAG  
-----

-----  
CALCULATE  
T(FINAL)    GO TO  
             "A"  
             BELOW  
-----

-----  
GO TO  
"A"  
BELOW  
-----

#250

#260

++  
+14  
+  
++  
PCN  
577

-----  
SET UPDATE  
FLAG  
-----

#270

HOLD  
SNAP

-----  
FLASH VERB-NOUN  
TO REQUEST RES-  
PONSE AND DIS-  
PLAY OF DELTA R:  
-----

V06 N57  
R1-DELTA R  
R2-BLANK  
R3-BLANK

DELTA R- THE OFFSET  
OF THE STABLE  
ORBIT POINT, SPE-  
CIFIED AS THE DIS-  
TANCE ALONG THE  
PASSIVE VEHICLE  
ORBIT. REFER TO  
SECTION 5.4.4.5  
OF P577, FOR  
DETAILED DESCIP-  
TION. IN NM TO  
THE NEAREST .1 NM  
(+INDICATES STABLE  
ORBIT POINT BEHIND  
PASSIVE VEHICLE;  
- INDICATES AHEAD  
OF THE PASSIVE  
VEHICLE.)  
-----

-----  
MONITOR DSKY:  
RESERVE VERR-  
NOUN FLASH TO  
REQUEST RES-  
PONSE AND DIS-  
PLAY OF DELTA  
R.  
-----

#280

-----  
AM I SATISFIED  
WITH THIS  
VALUE?  
-----

.Y    .N

#290

#300

**1A**

P38/COLOSSUS  
P38/LUMINARY

# 1A

RECORD  
THIS  
VALUE

#310

WAIT FOR KEYBOARD  
ENTRY

KEY IN  
PROCEED

TERMINATE FLASH  
UPON RECEIPT OF  
PROCEED OR NEW  
DATA

KEY IN  
V21F  
AND LOAD  
DESIRED  
DELTA P

#320

STORE  
DATA

P  
P  
P  
C  
E  
F

#330

HOLD  
SNAP

FLASH VERB-NOUN TO  
REQUEST RESPONSE AND  
DISPLAY T(FINAL):

MONITOR OSKY:  
OBSERVE VERB-  
NOUN FLASH TO  
REQUEST RES-  
PONSE AND DIS-  
PLAY OF T  
(FINAL)

#340

V06N34  
P1-T(FINAL) HRS  
P2-T(FINAL) MIN  
P3-T(FINAL) SEC

T(FINAL) - TIME OF  
ARRIVAL AT STARLE  
ORBIT (G.F.T.) IN  
HOURS, MIN SEC TO  
THE NEAREST .01 SEC-  
ONDS.

#350

35

P3R/COLOSSUS  
P3R/LUMINARY

```

      .
      .
      .
      .
      .
      .
      .
      .
      .
      .
      .
-----
WAIT FOR KEYBOARD
ENTRY
  
```

```

      .
      .
      .
      .
-----
RECORD THIS
VALUE
-----
      .
      .
      .
      .
-----
KEY IN
PROCEED
-----
  
```

```

      .
-----
      .
-----
      .
  
```

#360

```

-----
TERMINATE FLASH UPON
RECEIPT OF PROCEED
-----

```

PROCEED

.....

"R"

```

      .
      .
      .
      .
      .
      .
      .
      .
      .
  
```

```

-----
RESET UPDATE FLAG.
-----

```

#370

#380

#390

```

-----
BASED ON STORED
TARGET PARAMETERS
COMPUTE THE
TRANSFER TRAJECTORY,
INITIAL CONDITIONS
AND THE NECESSARY
DEPENDENT VARIABLES
FOR EVALUATION OF
THE MANEUVER AS
DESCRIBED IN SECTION
5.4.4.5 OF P677
-----

```

#400

"R"

```

      .
      .
      .
      .
      .
      .
      .
      .
      .
  
```

**1A**

#410

P3R/COLOSSUS  
P3R/LUMINARY

1A

IS THE FINAL FLAG  
SET?

Y N  
SFT  
UPDATE  
FLAG.

#420

HOLD  
SNAP

FLASH VERR-NDIM  
TO REQUEST RESPONSE  
AND DISPLAY CALCULATED  
PER ALT, DELTA  
V(SOP) AND DELTA  
V(SOP-FINAL)

MONITOR DSKY:  
RESERVE VERR-  
NDIM FLASH TO  
REQUEST RESPONSE  
AND DISPLAY OF  
CALCULATED PER ALT,  
DELTA V(SOP), AND  
DELTA V(SOP-FINAL).

#430

V06 N5R  
R1-PER ALT(SOP)  
R2-DELTA V(SOP)  
R3-DELTA V(SOP-  
FINAL)

#440

PER ALT(SOP)-  
ALTITUDE OF  
PERIGEE ABOVE THE  
LAUNCH PAD RADIUS  
(EARTH ORBIT) OR  
ALTITUDE OF  
PERILUNE ABOVE  
THE LUNAR RADIUS  
AT THE MOST  
RECENTLY DESIGNED  
LANDING SITE  
(LUNAR ORBIT).  
IN NAUTICAL MILES  
TO NEAREST .1 NM.

RECORD  
THESE  
VALUES

#450

DELTA V (SOP)-  
REQUIRED IMPUL-  
SIVE DELTA V TO  
ACCOMPLISH THE  
MANEUVER AT TIC  
IN FPS TO NEAREST  
.1 FPS.

#460



37

DELTA V(SOR-FIN-  
AL) REQUIRED IM-  
PULSIVE DELTA V  
TO ACCOMPLISH SOR  
MANUEVER AT TIME  
OF INTERCEPT.  
IN FPS TO NEAREST  
.1 FPS.

#470

WAIT FOR KEYBOARD  
ENTRY.

#480

TERMINATE FLASH  
UPON RECEIPT OF  
PROCEED

KEY IN PROCEED

#490

PROCEED

HOLD  
SNAP

FLASH VERB NOUN TO  
REQUEST RESPONSE AND  
DISPLAY DELTA V(LV):  
V06N91  
R1-DELTA VY (LV)  
R2-DELTA VY (LV)  
R3-DELTA VZ (LV)

MONITOR DSKY:  
OBSERVE VERB-NOUN  
FLASH TO REQUEST  
RESPONSE AND DISPLAY  
OF DELTA V(LV)  
COMPONENTS.

#500

DELTA VX - IMPULSIVE  
COMPONENT OF DELTA V  
AT TIG ALONG (OXV)YR  
IN FPS TO NEAREST  
.1 FPS  
DELTA VY IMPULSIVE  
COMPONENT OF DELTA V  
AT TIG ALONG VYR IN  
FPS TO NEAREST  
.1 FPS  
DELTA VZ IMPULSIVE  
COMPONENT OF DELTA V  
AT TIG ALONG -R IN  
FPS TO NEAREST  
.1 FPS  
WHERE R IS THE GCM  
GEOCENTRIC (EARTH  
ORBIT) OR SCELNOCEN-

#510

1A

**1A**

#520

TRIC (LUNAR ORBIT)  
RADIUS VECTOR AND V  
IS THE GSM INERTIAL  
VELOCITY VECTOR AT  
TIG.

-----  
RECORD THESE  
VALUES  
-----

-----  
WAIT FOR KEYBOARD  
ENTRY  
-----

-----  
TERMINATE FLASH UPON  
RECEIPT OF PROCEED

-----  
KEY IN PROCEED  
-----

#540

P  
R  
O  
C  
E  
E  
D

-----  
RESET EXTERNAL  
DELTA V FLAG  
-----

#550

-----  
RESET  
FINAL  
FLAG  
-----

NaN

#560

-----  
RESET  
FINAL  
FLAG  
-----

#570

```

.      .      .
.      .      .
.      .      .
.      .      .
.      .      .
.      .      .

```

```

-----
IS FINAL FLAG SET?
-----

```

```

. N      . Y
.      .
.      .

```

```

-----
SET MGA
DISPLAY
IN R3
(BELOW)
=-00001
-----

```

```

.      .
.      .
.      .

```

```

-----
IS REFSMAT
FLAG SET?
-----

```

```

. N      . Y
.      .
.      .

```

```

-----
SET MGA
DISPLAY
IN R3
(BELOW)
=-00002
-----

```

```

.      .
.      .
.      .

```

```

-----
. COMPUTE
. IMU MID-
. DLE GIM-
. BAL ANGLE
. AT TIC
. FOR THE
. PRESENT
. IMU ORIF-
. NTATION
. WITH THE
. CSM +X-
. AXIS ALI-
. GNED WITH
. THE IN-
. ITIAL
. THRUST
. VECTOR.
-----

```

```

.      .
.      .
.      .
.      .
.      .

```

```

" A "
.
.
.
.
.

```

#580

#590

#600

#610

#620



**1A**

#630

HOLD .  
.....  
MON .

FLASH VERR-NOUN TO  
REQUEST RESPONSE AND  
DISPLAY MARK CTRS,  
TFI, AND MGA.  
VIA N45  
R1 MARK CTRS  
R2 TFI  
R3 MGA

MONITOR DSKY:  
OBSERVE VERR-  
NOUN FLASH TO  
REQUEST RES-  
PONSE AND DISPLAY  
OF MARK CTRS,  
TFI, AND MGA.

#640

MARK CTRS - THE NUM-  
BER OF MARKS PROCES-  
SED BY THE RENDEZ-  
VOUS DATA PROCESSING  
ROUTINE (R2?) (REFER  
TO ASSUMPTION (9) OF  
P20). THE REGISTER  
WILL DISPLAY XXRX  
WHERE THE TWO MOST  
SIGNIFICANT DIGITS  
IS THE VHF PANGING  
MARK COUNTER AND  
THE TWO LEAST SIGNI-  
FICANT DIGITS IS THE  
OPTICS MARK COUNTER.

#650

NOTE: THE OPTICS  
MARK COUNTER DOES  
NOT DISTINGUISH RE-  
TWEEN BACK-UP AND  
PRIMARY MARKS.

#660

TFI-TIME FROM IGNIT-  
TION IN MIN AND  
SEC TO NEAREST  
SEC. MAX READING  
IS 59R59. (-BEFORE,  
AND + AFTER TIC.)

#670

MGA-MIDDLE GIMBAL  
ANGLE AT TIC(SOR) IF  
CSM +X-AXIS IS ALIG-  
NED WITH INITIAL  
THRUST DIRECTION.  
SIGN IS ALWAYS +  
EXCEPT:

#680

(A)WHEN DISPLAYED  
AT ANY TIME OTH-  
ER THAN THE LAST

PASS THROUGH THE  
PROGRAM THE  
VALUE IS -00001.  
(B) ON THE LAST PASS  
WHEN THE IMU IS  
NOT ALIGNED THE  
VALUE IS -00002.  
IN DEGREES TO  
THE NEAREST .01  
DEGREES.

#690

WAS THIS THE  
LAST PASS  
THROUGH THE  
PROGRAM?

#700

.Y .N

DO I WISH  
TO TERMIN-  
ATE THE  
MARK PRO-  
CESS AND DO  
THE FINAL  
PASS THRO-  
UGH THE  
PROGRAM?

#710

WAIT FOR KEYBOARD  
ENTRY

.Y .N

#720

KEY IN  
PROCEED

TERMINATE FLASH UPON  
RECEIPT OF RECYCLE  
OR PROCEED

KEY IN  
RECYCLE  
V32E

#730

.R .P  
.F .R  
.C .D  
.Y .C  
.C .F  
.L .F  
.F .D

GO TO

**1A**

**1A**

#740

GO TO  
"B"  
ABOVE

-----  
"B"  
ABOVE  
-----  
WAS THIS THE LAST  
PASS THROUGH THE  
PROGRAM?  
-----

IS FINAL FLAG SET?

•N

-----  
SET FINAL  
FLAG  
-----

GO TO  
"B"  
ABOVE

•Y

•N

GO TO  
"B"  
ABOVE

DO ROUTINE R00

DO ROUTINE R00

EXIT

EXIT

#750

#760

#770

#780

CHANGE CONTROL NOTES

LOGIC REV 2    PCR - MIT 34  
LOGIC REV 10    PCN - MIT 45  
LOGIC REV 11    PCR - MIT 66  
LOGIC REV 12    PCR 206  
LOGIC REV 13    PCR 206 EDITORIAL  
                  PCN 578  
LOGIC REV 14    PCN 577

STABLE ORBIT MIDCOURSE (SOM) PROGRAM (P39)

LOGIC REV 13 12/26/68

- PURPOSE:
- (1) TO CALCULATE THE REQUIRED DELTA V AND OTHER INITIAL CONDITIONS REQUIRED BY THE CMC FOR CSM EXECUTION OF THE NEXT POSSIBLE MIDCOURSE CORRECTION OF THE STABLE ORBIT TRANSFER PHASE OF AN ACTIVE CSM RENDEZVOUS.
  - (2) TO COMPUTE AND DISPLAY SUITABLE INFORMATION TO ENABLE THE CREW TO ENTER THE FINAL RENDEZVOUS PHASE AT THE CORRECT TIME TO COMPLETE THE REQUIRED THRUSTING MANEUVER.
- ASSUMPTIONS:
- (1) THE ISS NEED NOT BE ON TO COMPLETE THIS PROGRAM.
  - (2) 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 VME RANGING MARKS TO ACCUMULATE. SEE P20 FOR DETAILED DESCRIPTION.
  - (3) ONCE THE PARAMETERS REQUIRED FOR COMPUTATION OF THE MANEUVER HAVE BEEN COMPLETELY SPECIFIED, THE VALUE OF THE ACTIVE VEHICLE CENTRAL ANGLE OF TRANSFER IS COMPUTED AND STOPPED. THIS NUMBER WILL BE AVAILABLE FOR DISPLAY TO THE ASTRONAUT THROUGH THE USE OF VO6A52.  
THE ASTRONAUT WOULD CALL THIS DISPLAY TO VERIFY THAT THE CENTRAL ANGLE OF TRANSFER OF THE ACTIVE VEHICLE IS NOT WITHIN 170 TO 190 DEGREES. IF THE ANGLE IS WITHIN THIS ZONE THE ASTRONAUT SHOULD REASSESS THE INPUT TARGETTING PARAMETERS BASED UPON DELTA V AND EXPECTED MANEUVER TIME.
  - (4) THE OPERATION OF THIS PROGRAM UTILIZES THE FOLLOWING FLAGS.  
ACTIVE VEHICLE FLAG - DESIGNATES THE VEHICLE WHICH IS DOING RENDEZVOUS THRUSTING MANEUVERS TO THE PROGRAM WHICH CALCULATES THE MANEUVER PARAMETERS. SET AT THE START OF EACH RENDEZVOUS PRE-THRUSTING PROGRAM.  
EXTERNAL DELTA V FLAG-RESET BY THIS PROGRAM WHICH DESIGNATES THAT LAMBERT STEERING IS REQUIRED FOR EXECUTION OF THIS MANEUVER BY THE THRUSTING PROGRAM SELECTED AFTER COMPLETION OF THIS PROGRAM.  
FINAL FLAG - SELECTS FINAL PROGRAM DISPLAYS AFTER CREW HAS SELECTED THE FINAL MANEUVER COMPUTATION AND DISPLAY CYCLE.
  - (5) THE TIME OF INTERCEPT (T(INIT)) WAS DETERMINED BY PREVIOUS COMPLETION OF THE STABLE ORBIT RENDEZVOUS (SOR) PROGRAM (P38) AND IS PRESENTLY AVAILABLE IN CMC STORAGE.
  - (6) THIS PROGRAM IS SELECTED BY THE ASTRONAUT BY DSKY ENTRY.

PROC  
CNT

CMC

GROUND

CREW

CHECKLIST

TIME

TOTAL  
TIME

- CREW
- PROC
- SELECTION
- 
- 

PROC CNT	CMC	GROUND	CREW	CHECKLIST	TIME	TOTAL TIME
-----			-----	-----		
START STABLE ORBIT MIDCOURSE (SOM) PROGRAM (P39). DISPLAY PROGRAM 39.			KEY IN STABLE ORBIT MIDCOURSE (SOM) PROGRAM (P39) V37E39F			#10
			-----	-----		
				MONITOR DSKY: OBSERVE DISPLAY OF PROGRAM 39		#20
				-----		
-----				-----		
SET ACTIVE VEHICLE FLAG TO CSM						#30
-----				-----		
SET ECSTEEP =1						#40
-----				-----		
RESET FINAL FLAG						#50
-----				-----		
SET TRACK FLAG (SEE P20)						#50
-----				-----		
SET UPDATE FLAG (SEE P20)						#50
-----				-----		
-----				-----		
-----				-----		
-----				-----		
-----				-----		
-----				-----		
-----				-----		
-----				-----		
-----				-----		
-----				-----		
-----				-----		
-----				-----		
-----				-----		

P39/CD/CSMHS  
P39/LUMINARY







DO LAMBERT  
ROUTINE TO CAL-  
CULATE THE  
REQUIRED VELOCITY  
FOR MIDCOURSE  
CORRECTION.

#110

CALCULATE THRUST  
INITIAL CONDITION  
PARAMETERS REFER  
TO R577 SECTION  
S.4.4.5, FOR  
DEFINITION OF  
CALCULATIONS

#120

IS THE FINAL FLAG  
SET?

.N .Y  
. .  
. .

#130

SET THE  
UPDATE  
FLAG.

"A"

HOLD .  
.....  
SNAP .

FLASH VERB-NOUN  
TO REQUEST RESP-  
ONSE AND DISPLAY  
THREE STORED  
COMPONENTS OF  
DELTA (LV):  
V06NR1  
R1-DELTA VX(LV)  
R2-DELTA VY(LV)  
R3-DELTA VZ(LV)

MONITOR DSKY:  
OBSERVE VERB-NOUN  
FLASH TO REQUEST  
RESPONSE AND DISPLAY  
OF STORED COMPONENTS  
OF DELTA V(LV).

#140

#150

.  
 .  
 .  
 .  
 . DELTA VX (LVI):  
 . COMPONENT OF  
 . IMPULSIVE DELTA V  
 . AT TIG ALONG  
 . (PXV)XR, IN FPS  
 . TO NEAREST .1  
 . FPS.

.  
 . DELTA VY (LVI):  
 . COMPONENT OF  
 . IMPULSIVE DELTA V  
 . AT TIG ALONG VXR,  
 . IN FPS TO NEAREST  
 . .1 FPS.

.  
 . DELTA VZ (LVI):  
 . COMPONENT OF  
 . IMPULSIVE DELTA V  
 . AT TIG ALONG -R.  
 . IN FPS TO NEAREST  
 . .1 FPS

.  
 . WHERE R IS CSM  
 . GEOCENTRIC (EARTH  
 . ORBIT) OR SELEN-  
 . CENTRIC (LUNAR  
 . ORBIT) RADIUS  
 . VECTOR AND V IS  
 . CSM INERTIAL VEL-  
 . OCITY VECTOR AT  
 . TIG.

.-----  
 .  
 .  
 .  
 .-----

. WAIT FOR KEYBOARD  
 . ENTRY

.-----  
 . RECORD THESE  
 . VALUES  
 .-----

#160

#170

#180

#190

KEY IN PROCEED

TERMINATE FLASH  
UPON RECEIPT OF  
PROCEED

#200

.P  
.P  
.N  
.C  
.E  
.F  
.D

#210

RESET EXTERNAL  
DELTA V FLAG.

#220

++  
+13  
+13  
+  
++  
EDIT

IS FINAL FLAG SET?

.N .V  
.  
.

SET MGA DIS-  
PLAY IN R3  
(BELOW) =  
-00001.

#230

IS REFSMMAT  
FLAG SET?

#240

.Y .N  
.  
.

SET MGA  
DISPLAY IN  
R3 (BELOW)  
= -00002.

#250



TFI - TIME FROM TIG.  
IN MIN AND SEC TO  
NEAREST SEC.  
MAXIMUM READING IS  
50859. (-BEFORE  
+ AFTER TIG.)

MGA-MIDDLE GIMBAL  
ANGLE AT TIG IF +X  
CSM AXIS IS ALIGNED  
WITH INITIAL THRUST  
DIRECTION.  
SIGN IS ALWAYS +  
EXCEPT:  
(A) WHEN DISPLAYED  
AT ANY TIME OTHER  
THAN THE LAST PASS  
THROUGH THE PROGRAM  
THE VALUE IS -00001  
(B) ON THE LAST PASS  
WHEN THE IMU IS NOT  
ALIGNED THE VALUE IS  
-00002  
IN DEGREES TO NEAR-  
EST .01 DEGREE

-----  
WAIT FOR KEYBOARD  
ENTRY

.....  
.....  
.....

.....  
-----  
WAS THIS THE LAST  
PASS THROUGH THE  
PROGRAM?

#310

.Y .N  
.  
.

-----  
. DO I WISH TO TER-  
. MINATE THE MARK  
. PROCESS AND DO  
. THE FINAL PASS  
. THROUGH THE  
. PROGRAM?

#320

.Y .N  
.  
.

#330

-----  
KEY IN RECYCLE  
V32F

#340

.....  
.....  
.....  
GO TO  
"A"  
ABOVE

#350

TERMINATE FLASH UPON  
RECEIPT OF PROCEED  
OR RECYCLE

.R .P  
.E .P  
.C .D  
.V .C  
.C .F  
.L .F  
.F .D  
. .  
. .  
. .

IS THE FINAL  
FLAG SET?  
GO TO  
"A"  
ABOVE

.Y .N  
. .  
. .

SET THE  
FINAL FLAG.

. .  
. .  
. .  
. .  
GO TO  
"A"  
ABOVE  
. .  
. .  
. .

DO ROUTINE 000

. .  
. .  
. .  
. .  
EXIT  
000

IF TIME AND  
LOCATION PER-  
MIT ASSIST  
ASTRONAUT IN  
SELECTION OF  
PROPULSION  
SYSTEM

KEY IN PROCEED

WAS THIS THE LAST  
PASS THROUGH THE  
PROGRAM?

.Y .N  
. .  
. .  
. .  
. .  
GO TO  
"A"  
ABOVE

DO ROUTINE 000

(NOTE: CONSIDERING  
VALUE OF DELTA V,  
FUEL AVAILABLE, THE  
STATUS OF THE PRO-  
PULSION HARDWARE,  
AND THE POSSIBILITY  
OF GEMRAL LOCK  
SELECT A PROPULSION  
SYSTEM AND THE  
APPROPRIATE THROUST-  
ING PROGRAM(SPS-040,  
000-041) TO PERFORM  
A MANEUVER. COORDIN-  
ATE WITH GROUND IF  
REQUIRED.)

#360

#370

#380

#390

#400

-----  
.  
.  
.  
...  
.  
EXIT  
P39

CHANGE CONTROL NOTES

REV 08 PCR MIT 34  
REV 09 PCN MIT 45  
REV 10 PCR MIT 66  
REV 11 PCR 206  
REV 12 PCR 206 EDITORIAL  
REV 13 EDITORIAL