

523

DPS ABORT PROGRAM (P70)

REV 02 12/03/69

++  
 PURPOSE: (1) TO CONTROL A PGNC'S CONTROLLED DPS ABORT FROM THE POWERED LANDING MANEUVER (P63, 64, 65, OR 66) WHEN REQUIRED.  
 +02 (SEE ASSUMPTION (1)).  
 +285

++  
 ASSUMPTIONS: (1) THIS PROGRAM WILL CONTROL A DPS ABORT IN ONE OF TWO WAYS:

(A) IF THE ALTITUDE IS GREATER THAN 25,000 FT, THIS PROGRAM WILL COMMAND MAXIMUM DPS THROTTLE, CONTINUE DPS THRUSTING, PERFORM AN ATTITUDE MANEUVER (USING THE RCS) TO THE CORRECT ATTITUDE TO CONTINUE THE ABORT ASCENT, AND COMPLETE THE ABORT ASCENT TO INSERT THE LM ON AN ABORT ORBIT.

++  
 +02 (B) IF THE ALTITUDE IS LESS THAN 25,000 FT, THIS PROGRAM WILL COMMAND MAXIMUM DPS THROTTLE AND ENTER A  
 +EDIT VERTICAL RISE PHASE WHICH WILL TERMINATE EITHER WHEN THE LM ALTITUDE EXCEEDS 25,000 FT. OR WHEN  
 ++ THE LM VERTICAL VELOCITY IS GREATER THAN 40 FT/SEC.

DURING THE VERTICAL RISE PHASE, THE VEHICLE IS MANEUVERED TO ALIGN THE LM +X AXIS WITH THE LOCAL VERTICAL (USING THE RCS), AND THE LM +Y AXIS NORMAL TO THE ANTICIPATED PITCH MANEUVER PLANE. THE PROGRAM WILL THEN PITCH THE LM TO THE CORRECT ATTITUDE FOR ASCENT, AND COMPLETE THE ABORT ASCENT TO INSERT THE LM ON AN ABORT ORBIT.

++  
 +02 (2) THE ABORT ORBIT IS DEFINED IN SECTION 5.4.3 OF R567.  
 +285  
 +EDIT (3) THE LM IS ON THE POWERED LANDING DESCENT SOMEWHERE BETWEEN DPS IGNITION FOR THE MANEUVER (P63) AND DPS SHUTDOWN  
 +02 ON THE LUNAR SURFACE (P65 OR P66).  
 ++

(4) THE CSM IS IN A NEAR CIRCULAR ORBIT AROUND THE MOON AT A NOMINAL ALTITUDE OF 60 NAUTICAL MILES. THE CSM IS MAINTAINING A PREFERRED TRACKING ATTITUDE FOR OPTICAL TRACKING OF AND RR TRACKING BY THE LM.

(5) THE IML IS ON AND ACCURATELY ALIGNED TO THE LANDING ORIENTATION. THE MOST RECENT IMU ALIGNMENT (FINE) TOOK PLACE DURING THE BRAKING PHASE PROGRAM (P63) PRIOR TO DPS IGNITION.

(6) THE LANDING RADAR (LR) IS ON AND WAS CHECKED OUT WHEN IN POSITION #1. THE LGC/LR OPERATION IS UNDER THE CONTROL OF THE DESCENT STATE VECTOR UPDATE ROUTINE (R12).

(7) THE RENDEZVOUS RADAR (RR) WAS ENERGIZED AND CHECKED OUT PRIOR TO SELECTION OF THIS PROGRAM.

(8) THE LANDING ANALOG DISPLAYS ROUTINE (R10) IS ENABLED UPON ENTRY TO THIS PROGRAM, HAVING BEEN ENABLED BY P63. R10 USE OF RR COUS IS INHIBITED BY THIS PROGRAM. R10 IS TERMINATED UPON TERMINATION OF AVERAGE G.

(9) THE DPS IS NOT THROTTLEABLE OVER THE WHOLE RANGE FROM ZERO TO MAXIMUM. IT MUST BE OPERATED EITHER AT MAXIMUM THROTTLE OR OVER A SPECIFIC THROTTLE RANGE OF LOWER SETTINGS. THESE THROTTLE SETTINGS ARE SPECIFIED IN SECTION 5 OF R567 AND ARE TOTAL THROTTLE SETTINGS, I.E.: THE SUM OF THE MANUAL SETTING (WHOSE MINIMUM IS 10 PERCENT) AND THE PGNC'S COMMANDED SETTING.

THIS PROGRAM ASSUMES THE THROTTLE CONTROL TO BE IN AUTO (THE DPS RECEIVES THE SUM OF THE MANUAL AND PGNC'S COMMANDED SETTINGS) AND THE MANUAL THROTTLE TO BE SET AT A LEVEL LESS THAN THAT REQUIRED BY THE LGC. THE LGC WILL COMMAND MAXIMUM THROTTLE FOR ALL DPS THRUSTING CONTROLLED BY THIS PROGRAM.

(10) THE X-AXIS OVERRIDE OPTION PROVIDES THE CREW WITH THE ABILITY TO EXERCISE MANUAL CONTROL ABOUT THE LM X AXIS WITH THE ATTITUDE CONTROLLER EVEN THOUGH THE PGNC'S ATTITUDE CONTROL MODE IS AUTO. WHEN THE CONTROLLER IS RETURNED TO DETENT THE PGNC'S DAMPS THE YAW RATE, STORES THE YAW ATTITUDE WHEN THE YAW RATE IS DAMPED, AND THEN MAINTAINS THAT ATTITUDE.

THE X-AXIS OVERRIDE OPTION IS ALWAYS AVAILABLE TO THE CREW EXCEPT WHEN THE LGC IS SPECIFYING A DESIRED YAW

ATTITUDE. THUS THE OPTION IS INHIBITED BY THIS PROGRAM ONLY IN THE CASE OF ASSUMPTION (1)(B) ABOVE, UNTIL THE COMPLETION OF THE PITCH MANEUVER TO THE ATTITUDE FOR THE ASCENT MANEUVER.

++  
+02  
+EDIT  
+  
+  
+  
+  
+  
+  
+  
+  
+02  
++

(11) IF A THRUSTING MANEUVER IS PERFORMED WITH THE GUIDANCE CONTROL SWITCH IN PGNS AND THE MODE CONTROL SWITCH IN AUTO, THE PGNS WILL CONTROL THE TOTAL VEHICLE ATTITUDE AND GENERATE EITHER MODE I OR MODE II ATTITUDE ERRORS AND VEHICLE ATTITUDE RATES (SEE ASSUMPTION (13)) FOR DISPLAY ON THE FCAI. THE CREW MAY EXERCISE CONTROL AROUND THE YAW AXIS ONLY WITH THE ACA (X-AXIS OVERRIDE) IF THE X-AXIS OVERRIDE CAPABILITY IS PERMITTED BY THE PROGRAM IN PROCESS. THIS MANUAL CONTROL WILL BE IN THE RATE COMMAND/ATTITUDE HOLD MODE.

IF A THRUSTING MANEUVER IS PERFORMED WITH THE GUIDANCE CONTROL SWITCH IN PGNS AND THE MODE CONTROL SWITCH IN ATTITUDE HOLD THE PGNS WILL HOLD THE VEHICLE ATTITUDE AND WILL GENERATE EITHER MODE I OR MODE II ATTITUDE ERRORS FOR DISPLAY ON THE FCAI. THE CREW MAY EXERCISE MANUAL ATTITUDE CONTROL ABOUT ALL VEHICLE AXES WITH THE ACA IN EITHER THE RATE COMMAND OR MINIMUM IMPULSE MODE DEPENDING UPON THE STATUS OF THE PULSES FLAG. IT IS STRONGLY RECOMMENDED THAT POWERED FLIGHT NOT BE ATTEMPTED IN THE MINIMUM IMPULSE MODE. THE PULSES FLAG IS SET OR RESET BY EXTENDED VERBS 76 (MINIMUM IMPULSE) AND 77 (RATE COMMAND) RESPECTIVELY. THE PULSES FLAG IS ALSO RESET BY P12, P40, P41, P42, P63, P70, P71 AND R40 AT MAIN ENGINE IGNITION. WITH THE EXCEPTION OF THESE CASES, MODE SELECTION IS ALWAYS BASED UPON THE LAST ENTRY MADE IN THE DSKY. DURING A THRUSTING MANEUVER IN PGNS/ATTITUDE HOLD MODE THE PGNS WILL NOT BE RESPONSIBLE IF REGISTER OVERFLOWS OCCUR WITHIN THE LGC.

(12) CONTROL OF THE LM DPS, RCS, AND APS IS TRANSFERRED FROM THE PGNS TO THE ABORT GUIDANCE SYSTEM (AGS) BY PLACING THE GUID CONT SWITCH FROM PGNS TO AGS.

THE AGS WILL BE CAPABLE OF TAKING OVER CONTROL OF THE LM DURING ANY PORTION OF THE LUNAR DESCENT OR ASCENT OR DURING EITHER OF THE ABORT PROGRAMS (P70 OR P71). THE AGS WILL GUIDE THE LM TO A SAFE ORBIT.

THE AGS MAY BE INITIALIZED BY THE LGC AT ANY TIME BY MANUAL SELECTION OF THE AGS INITIALIZATION ROUTINE (R47). IN THE EVENT THAT THE GUIDANCE CONTROL SWITCH IS CHANGED FROM PGNS TO AGS DURING A THRUSTING MANEUVER, THE LGC WILL CONTINUE COMPUTATION OF POSITION AND VELOCITY, THE DESIRED THRUST VECTOR, AND THE DESIRED ATTITUDE ERRORS; HOWEVER THE PGNS WILL NOT BE RESPONSIBLE IF REGISTER OVERFLOWS OCCUR WITHIN THE LGC.

(13) THE PGNS CAN GENERATE TWO TYPES OF ATTITUDE ERRORS FOR DISPLAY ON THE FCAI:

MODE I - SELECTED BY EXTENDED VERB 61. AUTOPILOT FOLLOWING ERRORS USED AS A MONITOR OF THE DAP'S ABILITY TO TRACK AUTOMATIC STEERING COMMANDS.

MODE II - SELECTED BY EXTENDED VERB 62. TOTAL ATTITUDE ERRORS USED TO ASSIST CREW IN MANUALLY MANEUVERING THE VEHICLE.

PGNS-DERIVED VEHICLE ATTITUDE RATES MAY ALSO BE DISPLAYED VIA SELECTION BY EXTENDED VERB 60.

MODE II ATTITUDE ERROR DISPLAYS ARE AUTOMATICALLY SELECTED AT THE BEGINNING OF R60. WITH THE EXCEPTIONS INDICATED IN ASSUMPTION (11) ABOVE, DISPLAY SELECTION IS ALWAYS BASED UPON THE LAST ENTRY MADE IN THE DSKY. FOR A MORE DETAILED DESCRIPTION OF THESE DISPLAYS REFER TO SECTION 3 OF R567 (PARA. 3.2.6.).

(14) THE LOAD DAP DATA ROUTINE (R03) WAS COMPLETED PRIOR TO DPS IGNITION FOR THE POWERED LANDING MANEUVER AND SHOULD NOT BE SELECTED DURING THIS PROGRAM.

(15) DURING DPS BURNS ONLY, THE PITCH-ROLL RCS JET AUTOPILOT (U AND V JETS) MAY BE DISABLED (V65) OR ENABLED (V75) BY EXTENDED VERB AS SHOWN. THIS CAPABILITY IS INTENDED TO BE USED TO PREVENT LM AND DESCENT STAGE THERMAL CONSTRAINT VIOLATIONS DURING CSM-CCKECK DPS BURNS (P40). THE CAPABILITY EXISTS DURING P63 AND P70 ALSO. PERFORMANCE OF FRESH START (V36E) WILL ALWAYS ENABLE THE PITCH-ROLL JETS.

(16) THIS PROGRAM MAY BE CALLED IN TWO WAYS:

(A) ABORT PUSHBUTTON - IF THE ABORT PUSHBUTTON IS USED DURING THE POWERED DESCENT IT WILL BE DETECTED BY THE ABORT DISCRETES MONITOR ROUTINE (R11). R11 WILL THEN CALL THIS PROGRAM.

(B) V37E70E - THIS PROGRAM MAY BE CALLED BY THE SAME PROCEDURE AS OTHER PROGRAMS ARE MANUALLY CALLED.

(17) THE LGC WILL NOT AUTOMATICALLY SELECT THE APS ABORT PROGRAM (P71) IF DPS FUEL EXHAUSTION OCCURS DURING EXECUTION OF P70. THE CREW MUST ANTICIPATE DPS FUEL EXHAUSTION AND SELECT P71 BY THE ABORT STAGE PUSHBUTTON OR BY V37E71E.

(18) THE ASTRONAUT MAY MONITOR THE FOLLOWING ADDITIONAL PARAMETERS DURING THIS PROGRAM BY KEYING IN V16N77E:

525

V16N77  
R1-TG  
R2-V(Y)  
R3-BLANK

WHERE:

TG - THE ESTIMATED TIME OF FLIGHT FROM THE PRESENT TIME TO THE ACCOMPLISHMENT OF THE ASCENT INJECTION CONDITIONS. POLARITY IS -. IN MINS AND SECS TO NEAREST SEC. MAX READING IS 59859.

V(Y) - THE MAGNITUDE OF THE LM VELOCITY COMPONENT NORMAL TO THE CSM ORBITAL PLANE. IN FPS TO NEAREST .1 FPS.

(19) THE ASTRONAUT MAY MONITOR THE FOLLOWING ADDITIONAL PARAMETERS AT ANY TIME DURING THIS PROGRAM AFTER TIG BY KEYING IN V16N85E:

V16N85  
R1-VGX(LM)  
R2-VGY(LM)  
R3-VGZ(LM)

FOR DEFINITIONS, SEE LOGIC BELOW.

(20) THE ASTRONAUT MAY OBSERVE THE FOLLOWING ADDITIONAL PARAMETERS DURING THIS PROGRAM BY KEYING IN V06N76E:

VC6N76  
R1-DOWNRANGE VELOCITY (VHR)  
R2-RADIAL VELOCITY (H DOT F)  
R3-CROSSRANGE

WHERE: DOWNRANGE VELOCITY - THE HORIZONTAL DOWNRANGE VELOCITY AT INJECTION.

RADIAL VELOCITY - THE RADIAL VELOCITY AT INJECTION (THIS VALUE WILL BE DRAWN FROM PAD-LOADED ERASABLE STORAGE LOCATION).

CROSSRANGE - THE DISTANCE BETWEEN THE LM ORBITAL PLANE AFTER INJECTION AND THE LM POSITION VECTOR AT TIG. (FOR THIS PROGRAM, THE CROSSRANGE VALUE IS RESTRICTED IN MAGNITUDE TO PAD-LOADED VALUE. PRESENTLY THE MAXIMUM ALLOWABLE VALUE IS CONSTRAINED TO BE 0.5 DEGREE (APPROXIMATELY 8 N.M.)).

PROG  
CONT

LGC

GROUND

CREW

(NOTE: ALL LOGIC IN  
THE LGC COLUMN DES-

(NOTE: ALL LOGIC IN

CRIBES BOTH THE DPS  
ABORT PROGRAM, P70,  
AND THE APS ABORT  
PROGRAM, P71. ONLY  
THAT LOGIC ASSOCIAT-  
ED WITH P70 IS PERT-  
INENT HERE HOWEVER.)

THE CREW COLUMN IS  
ONLY THAT ASSOCIATED  
WITH THE DPS ABORT  
PROGRAM, P70.)

CREW  
PROGRAM  
SELECTION

.  
.  
.  
.  
.

DO I WISH TO SELECT  
P70 BY ABORT PLSH-  
BUTTON OR DSKY  
ENTRY?

.DSKY                    .PUSH-  
.  
.  
.  
.  
.  
.  
.  
.  
.  
.  
.  
.

GO TO  
ABORT  
DISCRETES  
MONITOR  
ROUTINE  
(R11)

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

.....  
KEY IN DPS ABORT  
PROGRAM (P70)  
V37E70E  
-----

.NEW  
.PROGRAM  
.  
.  
.  
.

-----  
IS THE PROGRAM SE-  
LECTED ALREADY IN  
-----

#10

#20

#30

#40

#50

326

PROCESS?

.N Y.

IS ABORT ENABLE  
FLAG SET?

.Y N.

IS AVERAGE G  
FLAG SET?

.Y N.

TURN ON OPER-  
ATOR ERROR  
LIGHT

DOES OPERATOR ERROR  
LIGHT INDICATE THAT  
THIS PROGRAM WAS  
INCORRECTLY SELE-  
CTED?

.Y .N

EXIT

EXIT

"A"  
FROM ABORT  
DISCRETES  
MONITOR  
ROUTINE (R11)

"A"  
FROM ABORT  
DISCRETES  
MONITOR  
ROUTINE (R11)

++  
+O2  
+EDIT  
++

#60

#70

#80

#90

#100

START DPS ABORT PRO-  
GRAM (P70) OR APS  
ABORT PROGRAM (P71)  
AS DEFINED BY V37 OR  
R11 SELECTION. DIS-  
PLAY P70 OR P71 AS  
APPROPRIATE.

MONITOR DSKY:  
OBSERVE DISPLAY OF  
P70.

#110

IS THE PRESENT  
PROGRAM P71?

#120

N Y.

SET APS FLAG

#130

RESET LLLAGE FLAG

#140

RESET X-AXIS OVER-  
RIDE INHIBIT FLAG

636

1

(

(

529

++  
+02  
+EDIT  
++

-----  
RESET PULSES FLAG  
-----

#150

-----  
COMMAND ENGINE ON.  
(NOTE: IF TOTAL  
THRUST FAILURE HAS  
OCCURRED, MANUAL  
TRANSLATION MUST BE  
APPLIED PRIOR TO  
P70/71 SELECTION  
UNTIL P70/71 AUTOMA-  
TICALLY COMMANDS  
ENGINE ON.)  
-----

#160

-----  
SET LR BYPASS FLAG  
-----

#170

++  
+02  
+EDIT  
++

-----  
SET R10 FLAG, REMOVE  
DISPLAY INERTIAL  
DATA DISCRETE FROM  
THE CDUS, AND RE-  
START R10.  
-----

#180

-----  
SET 1.0 DEGREE  
DEADBAND  
-----

#190

++  
+  
+  
+  
+  
+  
+  
+  
+  
+  
+  
+  
+  
+  
+  
+  
+  
+

+  
+  
+  
+  
+  
+02  
+EDIT  
+  
+  
+  
+  
+02  
++

-----  
TERMINATE THRUST  
VECTOR CONTROL AND  
HOLD INERTIAL VEHI-  
CLE ATTITUDE.  
-----

#200

-----  
SET THE DELTA V  
COUNTER = 4 FOR USE  
BY R40  
-----

#220

-----  
ENABLE CURRENT GUID-  
ANCE DISPLAYS.  
-----

#230

-----  
RESET IDLE FLAG  
-----

-----  
RESET RCS FLAG  
-----

#240

320

(

(



531

-----  
SET 4 JET TRANS-  
LATION FLAG.  
-----

-----  
IS PRESENT PROGRAM  
P70?  
-----

.N                    Y.

-----  
• DEFINE INITIAL  
• TIG FOR ABORT  
• BURN TO BE  
• PRESENT TIME  
• MINUS ACTUAL TIG  
• FOR THE POWERED  
• DESCENT.  
-----

-----  
• SET APS ABORT  
• CONTINUATION FLAG  
-----

#250

#260

#270

#280

#290

RESEt ABORt ENABLE  
FLAG

#300

SET DELTA V MONI-  
TOR THRESHOLD TO  
ASCENT STAGE  
VALUES.

#310

IS APS ABORT  
CONTINUATION FLAG  
SET?

#320

N Y

#330

DEFINE INITIAL  
TGO FOR ABORT  
BURN TO BE  
TWICE THE TGO  
MOST RECENTLY  
COMPUTED.

#340

GC TC

"B"  
BELGW

#350

-----  
DEFINE INITIAL TGC  
FOR THE ABORT BURN  
TO BE PRESENT TIME  
MINUS ACTUAL TIG  
FOR POWERED DES-  
CENT.  
-----

#360

++  
+02  
+EDIT  
+02  
++

-----  
SET THE DESIRED  
RADIAL VELOCITY  
EQUAL TO  
PAD-LOADED VALUE  
-----

#370

-----  
COMPUTE CROSSRANGE  
DISTANCE USING  
PAD-LOADED VALUE  
RESTRICTION. I.E.:  
COMPLTE  
OUT-OF-PLANE (Y)  
IF |Y| < 0.5 DEG.,  
-----

#390



535  
+  
+  
+  
+  
+  
+  
+  
+  
+  
+  
+02  
++

SET ABORT  
TARGETING  
FLAG

SET THE ROTATION  
FLAG

SET DPS ENGINE  
THRITTLE TO MAXIMUM

OBSERVE DPS TO  
COME TO FULL  
THRUST:  
THRUST INDICATOR-  
LEFT SIDE: XX  
PERCENT OF MAX-  
IMUM CHAMBER  
PRESSURE, RIGHT  
SIDE: LGC  
THROTTLE COMMAND  
XX PERCENT FULL  
THRUST.

"B"  
FRGM  
ABOVE

HAVE PGNS CONTROL  
AND AUTO ATTITUDE  
CONTROL MCDRES BEEN  
SELECTED?

.Y N.

IS THE APS FLAG  
SET?

.Y N.

#450

#460

#470

#480

#490

#500

-----  
HAS THE AUTO  
THRATTLE MODE  
BEEN SELECTED?  
-----

.Y N.  
.  
.

POSS  
HOLD .  
.....  
SNAP .

FLASH VERB-  
NCUN TO RE-  
QUEST PLEASE  
PERFORM PGNS  
CONTROL, AUTC  
ATTITUDE CON-  
TRCL, AND AUTO  
THRATTLE (DPS  
ONLY) MODE SE-  
LECTION:  
V50N25  
R1-00203  
R2-BLANK  
R3-BLANK  
-----

MONITOR DSKY:  
DOES VERB-NOUN  
FLASH TO REQUEST  
PLEASE PERFORM PGNS  
CONTROL, AUTO ATTI-  
TUDE CONTROL, AND  
AUTO THRATTLE (DPS  
ONLY) MODE SELECTION  
INDICATE THAT MODE  
SELECTION IS INCOR-  
RECT?  
-----

.Y N.  
.  
.  
.  
.

-----  
HAVE REQUESTED  
MODES BEEN SELEC-  
TED?  
-----

.N Y.  
.  
.

-----  
SET GUIDANCE  
CONTROL SWITCH  
TO PGNS, ATTI-  
TUDE CONTROL  
SWITCH TO  
AUTO, AND  
THRATTLE  
SWITCH TO AUTO.  
-----

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

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

#510

#520

#530

#540

#550

526

531

TERMINATE  
FLASH UPON  
RECEIPT OF  
PROCEED OR  
ENTER

-----  
KEY IN ENTER  
-----

#560

-----  
.E .P  
.N .R  
.T .C  
.E .C  
.R .E  
. .E  
. .D  
. .  
.....  
.

#570

-----  
SET DPS ENGINE  
THROTTLE TO MAXIMUM

-----  
OBSERVE DPS TO  
COME TO FULL  
THRUST: THRUST  
INDICATOR-LEFT  
SIDE: XX PERCENT  
OF MAXIMUM CHAM-  
BER PRESSURE,  
RIGHT SIDE: LGC  
THROTTLE COMMAND  
XX PERCENT FULL  
THRUST.  
-----

#580

-----  
CALCULATE THE PRE-  
SENT DESIRED THRUST  
VECTOR TO ACCOMPLISH  
THE ABORT ASCENT  
CONDITIONS (REFER  
SECTION 5.4.3 OF  
R567)

++  
+OZ  
+EDIT  
++

#590

-----  
IS THE VERTICAL RISE  
FLAG SET?

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

#600

#610

IS H GREATER THAN  
25,000 FT?

.Y N.

SET X-AXIS  
OVERRIDE IN-  
HIBIT FLAG

#620

IS H DOT  
GREATER  
THAN 40  
FPS (UP)?

#630

.Y N.

RESET  
ROTATION  
FLAG

#640

RESET VERTICAL  
RISE FLAG

#650

IS ROTATION  
FLAG SET?

.Y N.

338



539

#660

SET TXC  
EQUAL TO PRE-  
SENT TIME +12  
SECONDS.

#670

IS T PRESENT  
GREATER THAN  
TXQ?

.N            Y.

#680

IS THE ROTATION  
FLAG SET?

.N            Y.

#690

IS THE LM  
X-AXIS WITH-  
IN 90 DEG-  
REES OF THE  
DESIRED LM  
X-AXIS?

.Y            N.

#700

IS THE  
PRESENT  
LM X-AXIS  
WITHIN 30  
DEGREES  
OF LOCAL  
VERTICAL

(UP)?

.Y N.

RESET THE  
ROTATION  
FLAG

RESET X-AXIS  
OVERRIDE  
INHIBIT FLAG

CALCULATE THE RE-  
QUIRED ICCU/GIMBAL  
ANGLES AND DRIVE  
THE ICCUS (USING  
FINDCCUW) TO  
ALIGN THE LM +X  
AXIS WITH THE  
DESIRED THRUST  
VECTOR TO ACC-  
OMPLISH THE  
ABCRT ASCENT,  
THE LM +Y AXIS  
HORIZONTAL, AND  
THE LM +Z AXIS  
DOWN.

CALCULATE THE  
REQUIRED ICCU/

#710

#720

#730

#740

#750

540

5<sup>th</sup>

GIMBAL ANGLES  
AND DRIVE THE  
ICDUS (USING  
FINCCDUS) TO  
ALIGN THE LM  
+X AXIS WITH  
THE PRESENT  
LOCAL VERTICAL  
(UP), THE LM  
+Y AXIS NORMAL  
TO THE ANTI-  
CIPATED PITCH  
MANEUVER PLANE  
FOR THE ASCENT  
AND THE LM +Z  
AXIS DOWN-  
RANGE.

#760

#770

TEMP  
HOLD

MGN

-----  
DISPLAY ON DSKY:  
V06N63  
R1-VI  
R2-H DOT  
R3-H

-----  
MONITOR DSKY:  
OBSERVE DISPLAY  
OF VI, H DOT, AND H.  
-----

#780

VI - MAGNITUDE OF LM  
INERTIAL VELOCITY  
WITH RESPECT TO THE  
REFERENCE COORDINATE  
SYSTEM. IN FPS TO  
NEAREST .1 FPS.

#790

H DOT - THE PRESENT  
RATE OF CHANGE OF  
ALTITUDE (H). POLA-  
RITY INDICATES DES-  
CENT (-) OR ASCENT  
(+). IN FT/SEC TO  
NEAREST .1 FT/SEC.

H - THE PRESENT  
ALTITUDE OF THE LM  
ABOVE THE LM POSI-

#800

TION VECTOR AT THE  
DESIGNATED LANDING  
SITE. CLARITY IS +  
FOR ALTITUDES  
GREATER THAN THE  
ABOVE RADIUS. IN  
FEET TO NEAREST  
FOOT.

#810

..... MONITOR DSKY, FDAI,  
AND OUT THE WINDOW;

(A) IF H IS  
GREATER THAN  
+25000 THE  
PGNCS WILL MANEU-  
VER THE LM TO THE  
CORRECT ATTITUDE  
TO PERFORM THE  
ASCENT ABORT.

#820

(B) IF H IS LESS  
THAN +25000 THE  
X-AXIS OVERRIDE  
OPTION IS INHI-  
BITED. THE PGNCS  
WILL MANEUVER THE  
LM TO LOCAL VER-  
TICAL (LM +X AXIS  
UP) AND YAW THE  
LM SC WINDOWS ARE  
DOWNRANGE. THE  
LOCAL VERTICAL  
ATTITUDE WILL BE  
MAINTAINED UNTIL  
H IS GREATER THAN  
+25000 OR H DOT  
IS GREATER THAN  
+00400 AT WHICH  
TIME THE PGNCS  
WILL MANEUVER  
(PITCH) THE LM TO  
THE CORRECT ATTI-

#830

#840

543

TUDE TO PERFORM  
THE ASCENT ABORT  
AND THEN THE  
X-AXIS OVERRIDE  
OPTIGN IS  
RESTORED.

#850

THE ABOVE MANEUVERS  
WILL BE DONE WITH  
THE RCS WITH THE DPS  
AT FULL THRUST.

#860

·  
·  
·

MONITOR DPS  
THRUSTING:

1. DSKY:

R1-VI  
SHOULD BE  
INCREASING

#870

R2- H DOT  
SHOULD REMAIN +.

R3-H SHOULD  
INCREASE

2. FDAI-ATT. ERRORS  
SHOULD BE LESS THAN  
OR EQUAL TO XX  
DEGREE

#880

ATT RATES SHOULD BE  
LESS THAN OR EQUAL  
TO XX DEGREE/SEC.

3. THRUST INDICATOR  
LEFT SIDE: XX PER-  
CENT MAX CHAMBER  
PRESSURE,  
RIGHT SIDE: LGC  
THROTTLE COMMAND XX  
PERCENT FULL THRUST.

#890

IDENTIFY EARLY,  
NORMAL, OR LATE  
ENGINE CUTOFF FROM  
ASSESSMENT OF DSKY  
DISPLAYS.

#900

-----  
.E .L .N  
.A .A .O  
.R .T .R  
.L .E .M  
.Y . . .  
. .C .C  
.C .U .U  
.U .T .T  
.T .C .G  
.O .F .F  
.F .F .F  
. . .  
. . .  
.... . . .  
.

#910

SEE DPS/APS  
THRUST FAIL  
ROUTINE (R40)  
FOR REQUIRED  
RESPONSE

#920

-----  
PUSH ENGINE STGP  
PUSH BUTTON  
-----

#930

-----  
GO TO BACKUP  
PROCEDURES.  
-----

-----  
IS TG LESS THAN  
4 SEC?  
-----

#940

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

-----  
CALL ENGINE OFF COM-  
MAND AT COMPUTED  
-----

#950

544

5#5

REQUIRED TIME.  
-----

·  
·  
·

SET IDLE FLAG  
-----  
-----

·  
·  
·

WAIT UNTIL COMPUTED  
TIME OF CUTOFF  
-----

·  
·  
·

COMMAND ENGINE OFF  
-----  
-----

·  
·  
·

ZERO OPS AUTO  
THRATTLE  
-----

·  
·  
·

COMMAND ZERO ATTITUDE  
RATES  
-----

·  
·  
·

SET DEADBAND  
TO PREVIOUS VALUE  
DEFINED BY R03  
-----

·  
·  
·  
·  
·  
·  
·  
·  
·  
·  
·  
·  
·  
·  
·  
·  
·  
·  
·  
·  
·

#960

#970

#980

#990

#1000

MAINTAIN VG  
COMPUTATIONS AFTER  
CUTOFF FOR PCSSIELE  
NULLING BY RCS  
TRIMMING MANEUVER

#1010

DISARM EPS

"D"  
FROM R40

#1020

COMMAND ZERO  
ATTITUDE RATES

#1030

SET DEADBAND  
TO PREVIGLS  
VALUE DEFINED  
BY R03

#1040

RESET LLLAGE  
FLAG

546



#1050

5.4.4  
++  
+02  
+EDIT  
++

SET RCS FLAG

#1060

HCLD

MON

FLASH VERB-NOUN TO  
REQUEST PROCEED  
AND MAINTAIN DISPLAY  
OF VI, H DOT, AND H.

V16 N63

R1 - VI

R2 - H DOT

R3 - h

MONITOR DSKY:  
OBSERVE VERB-NOUN  
FLASH TO REQUEST  
PROCEED AND DISPLAY  
OF VI, H DOT, AND H.

#1070

RECORD THESE VALUES  
AS DESIRED.

#1080

WAIT FOR KEYBOARD  
ENTRY  
TERMINATE FLASH UPON  
RECEIPT OF PROCEED,  
RECYCLE, OR  
TERMINATE

KEY IN PROCEED

#1090

.P .T .R  
.R .E .E  
.G .K .C  
.C .M .Y  
.E .I .C



549

STEERING LOOPS  
DURING EACH COMPUTA-  
TION CYCLE. IN FPS  
TO NEAREST .1 FPS.

(NOTE: THIS MANEUVER  
IS AT THE OPTION OF  
THE CREW.)  
(NOTE: TRANSLATION  
WILL BE 4 JET UNLESS  
R03 IS PERFORMED TO  
SPECIFY 2 JET.)

#1150

THE ORBITAL PARA-  
METER DISPLAY ROUT-  
INE (R30) MAY BE  
SELECTED AT THIS  
TIME (V82E) TO  
MONITOR CONTINUOUSLY  
UPDATED VALUES OF  
APO ALT, PER ALT,  
AND TFF.

#1160

WAIT FOR KEYBOARD  
ENTRY  
TERMINATE FLASH UPON  
RECEIPT OF PROCEED,  
RECYCLE, OR  
TERMINATE

KEY IN PROCEED

#1170

.P .T .R  
.R .E .E  
.O .R .C  
.C .M .Y  
.E .I .C  
.E .N .L  
.D .A .E  
. .T .  
. .E .

"C"  
FROM

#1180

.  
. .  
. .  
. .  
. . ABOVE  
. .  
. .  
. .  
. .  
. .

#1190

-----  
SET DEACBAND  
TO PREVIOUS VALUE  
DEFINED BY R03  
-----

#1200

.  
. .  
-----  
RESET ABORT ENABLE  
FLAG  
-----

#1210

.  
. .  
. .  
. .  
. .  
. .  
-----  
DO FINAL AUTOMATIC  
REQUEST TERMINATE  
ROUTINE (R00)

. .  
.....  
. .

-----  
DO FINAL AUTOMATIC  
REQUEST TERMINATE  
ROUTINE (R00)

#1220

.  
. .  
. .  
EXIT P70/P71

.  
. .  
. .  
EXIT P70

#1230

CHANGE CONTRCL NOTES

REV 00 PCR 13,31  
REV 01 PCR 70,85,86,164,234,258,259,419,472,475,476,536,539,542,568,613,617  
REV 00(LUM 1A) PCR 260,270,697,708,757  
REV 01(LUM 1B) PCR 279,838,840,841,845,847, EDITORIAL  
REV 02(LUM 1C) PCR 285,893, EDITORIAL

550

APS ABORT PROGRAM (P71)

REV 02 12/03/69

## PURPOSE:

(1) TO CONTROL A PGNC CONTROLLED APS ABORT FROM THE POWERED LANDING MANEUVER (P63, 64, 65, OR 66) OR A DPS ABORT (P70) WHEN REQUIRED (SEE ASSUMPTION (1)).

++  
+G2  
+285

## ASSUMPTIONS:

(1) THE PROGRAM WILL CONTROL AN APS ABORT IN ONE OF TWO WAYS:

++

(A) IF THE ALTITUDE IS GREATER THAN 25,000 FT, THIS PROGRAM WILL IGNITE THE APS, CONTINUE APS THRUSTING, PERFORM AN ATTITUDE MANEUVER (USING THE RCS) TO THE CORRECT ATTITUDE TO CONTINUE THE ABORT ASCENT, AND COMPLETE THE ABORT ASCENT TO INSERT THE LM ON AN ABORT ORBIT.

(B) IF THE ALTITUDE IS LESS THAN 25,000 FT, THIS PROGRAM WILL IGNITE THE APS, CONTINUE APS THRUSTING, ENTER A VERTICAL RISE PHASE WHICH WILL TERMINATE EITHER WHEN THE LM ALTITUDE EXCEEDS 25,000 FT. OR WHEN THE LM VERTICAL VELOCITY IS GREATER THAN 40 FT/SEC. DURING THE VERTICAL RISE PHASE THE VEHICLE IS MANEUVERED IN ORDER TO ALIGN THE LM +X AXIS WITH THE LOCAL VERTICAL (USING THE RCS) AND THE LM +Y AXIS NORMAL TO THE ANTICIPATED PITCH MANEUVER PLANE. THE PROGRAM WILL THEN PITCH THE LM TO THE CORRECT ATTITUDE FOR ASCENT, AND THEN COMPLETE THE ABORT ASCENT TO INSERT THE LM ON AN ABORT ORBIT.

++  
+02  
+EDIT  
++

(2) THIS PROGRAM DOES NOT CHECK TO SEE IF THE DPS HAS BEEN STAGED. THUS IF P71 IS SELECTED VIA V37 AND THE DESCENT STAGE HAS NOT BEEN MANUALLY STAGED THIS PROGRAM MAY COMMAND ENGINE ON (ASSUMPTION 1A OR 1B ABOVE). IN SUCH CASES THE COMMAND WILL GO TO THE DPS.

++  
+02  
+EDIT  
++

(3) THE ABORT CRBIT IS DEFINED IN SECTION 5.4.3 OF R567.

(4) THE CSM IS IN A NEAR CIRCULAR ORBIT AROUND THE MOON AT A NOMINAL ALTITUDE OF 60 NAUTICAL MILES. THE CSM IS MAINTAINING A PREFERRED TRACKING ATTITUDE FOR OPTICAL TRACKING OF AND RR TRACKING BY THE LM.

(5) THE IMU IS ON AND ACCURATELY ALIGNED TO THE LANDING SITE ORIENTATION. THE MOST RECENT IMU ALIGNMENT (FINE) TOOK PLACE DURING THE BRAKING PHASE PROGRAM (P63) PRIOR TO DPS IGNITION.

(6) THE LANDING RADAR (LR) IS ON AND WAS CHECKED OUT WHEN IN POSITION #1. THE LGC/LR OPERATION IS UNDER THE CONTROL OF THE DESCENT STATE VECTOR UPDATE ROUTINE (R12).

(7) THE RENDEZVOUS RADAR (RR) WAS ENERGIZED AND CHECKED OUT PRIOR TO SELECTION OF THIS PROGRAM.

(8) THE LANDING ANALOG DISPLAYS ROUTINE (R10) IS ENABLED UPON ENTRY TO THIS PROGRAM, HAVING BEEN ENABLED BY P63. R10 USE OF THE RR CDUS IS INHIBITED BY THIS PROGRAM. R10 IS TERMINATED UPON TERMINATION OF AVERAGE G.

(9) THE X AXIS OVERRIDE OPTION PROVIDES THE CREW WITH THE ABILITY TO EXERCISE MANUAL CONTROL ABOUT THE LM X AXIS WITH THE ATTITUDE CONTROLLER EVEN THOUGH THE PGNC ATTITUDE CONTROL MODE IS AUTO. WHEN THE CONTROLLER IS RETURNED TO DETENT THE PGNC DAMPS THE YAW RATE, STORES THE YAW ATTITUDE WHEN THE YAW IS DAMPED, AND THEN MAINTAINS THAT ATTITUDE.

THE X-AXIS OVERRIDE OPTION IS ALWAYS AVAILABLE TO THE CREW EXCEPT WHEN THE LGC IS SPECIFYING A DESIRED YAW ATTITUDE. THUS THE OPTION IS INHIBITED BY THIS PROGRAM ONLY IN THE CASE OF ASSUMPTION (1) (B) ABOVE, UNTIL THE COMPLETION OF THE PITCH MANEUVER TO THE ATTITUDE FOR THE ASCENT MANEUVER.

(10) IF A THRUSTING MANEUVER IS PERFORMED WITH THE GUIDANCE CONTROL SWITCH IN PGNS AND THE MODE CONTROL SWITCH IN AUTO, THE PGNC WILL CONTROL THE TOTAL VEHICLE ATTITUDE AND GENERATE EITHER MODE I OR MODE II ATTITUDE ERRORS

++ AND VEHICLE ATTITUDE RATES (SEE ASSUMPTION (12)) FOR DISPLAY ON THE FDAI. THE CREW MAY EXERCISE CONTROL AROUND THE YAW  
+02 AXIS ONLY WITH THE ACA (X-AXIS OVERRIDE) IF THE X-AXIS OVERRIDE CAPABILITY IS PERMITTED BY THE PROGRAM IN PROCESS.  
+EDIT THIS MANUAL CONTROL WILL BE IN THE RATE COMMAND/ATTITUDE HOLD MODE.  
+ IF A THRUSTING MANEUVER IS PERFORMED WITH THE GUIDANCE CONTROL SWITCH SET AT PGNS AND THE MODE CONTROL SWITCH IN  
+ ATTITUDE HOLD THE PGNS WILL HOLD THE VEHICLE ATTITUDE AND WILL GENERATE EITHER MODE I OR MODE II ATTITUDE ERRORS  
+ FOR DISPLAY ON THE FDAI. THE CREW MAY EXERCISE MANUAL ATTITUDE CONTROL ABOUT ALL VEHICLE AXES WITH THE ACA IN EITHER  
+ THE RATE COMMAND OR MINIMUM IMPULSE MODE DEPENDING UPON THE STATUS OF THE PULSES FLAG. IT IS STRONGLY RECOMMENDED THAT  
+ POWERED FLIGHT NOT BE ATTEMPTED IN THE MINIMUM IMPULSE MODE. THE PULSES FLAG IS SET OR RESET BY EXTENDED VERBS 76  
+ (MINIMUM IMPULSE) AND 77 (RATE COMMAND) RESPECTIVELY. THE PULSES FLAG IS ALSO RESET BY P12, P40, P41, P42, P63, P70,  
+ P71, AND R40 AT MAIN ENGINE IGNITION. WITH THE EXCEPTION OF THESE CASES, MODE SELECTION IS ALWAYS BASED UPON THE  
+02 LAST ENTRY MADE IN THE DSKY. DURING A THRUSTING MANEUVER IN THE PGNS/ATTITUDE HOLD MODE THE PGNS WILL NOT BE  
++ RESPONSIBLE IF REGISTER OVERFLOWS OCCUR WITHIN THE LGC.

(11) CONTROL OF THE LM DPS, RCS, AND APS IS TRANSFERRED FROM THE PGNS TO THE ABORT GUIDANCE SYSTEM (AGS) BY PLACING THE GUID CONT SWITCH FROM PGNS TO AGS.

THE AGS WILL BE CAPABLE OF TAKING OVER CONTROL OF THE LM DURING ANY PORTION OF THE LUNAR DESCENT OR ASCENT OR DURING EITHER OF THE ABORT PROGRAMS (P70 OR P71). THE AGS WILL GUIDE THE LM TO A SAFE ORBIT.

THE AGS MAY BE INITIALIZED BY THE LGC AT ANY TIME BY MANUAL SELECTION OF THE AGS INITIALIZATION ROUTINE (R47).

IN THE EVENT THAT THE GUIDANCE CONTROL SWITCH IS CHANGED FROM PGNS TO AGS DURING A THRUSTING MANEUVER, THE LGC WILL CONTINUE COMPUTATION OF POSITION AND VELOCITY, THE DESIRED THRUST VECTOR, AND THE DESIRED ATTITUDE ERRORS, HOWEVER THE PGNS WILL NOT BE RESPONSIBLE IF REGISTER OVERFLOWS OCCUR WITHIN THE LGC.

(12) THE PGNS CAN GENERATE TWO TYPES OF ATTITUDE ERRORS FOR DISPLAY ON THE FDAI;

MODE I - SELECTED BY EXTENDED VERB 61. AUTOPILOT FOLLOWING ERRORS USED AS A MONITOR OF THE DAP'S ABILITY TO TRACK AUTOMATIC STEERING COMMANDS.

MODE II - SELECTED BY EXTENDED VERB 62. TOTAL ATTITUDE ERRORS USED TO ASSIST CREW IN MANUALLY MANEUVERING THE VEHICLE.

++ PGNS-DERIVED VEHICLE ATTITUDE RATES MAY ALSO BE DISPLAYED VIA SELECTION BY EXTENDED VERB 60.  
+02 MODE II ATTITUDE ERROR DISPLAYS ARE AUTOMATICALLY SELECTED AT THE BEGINNING OF R60. WITH THE EXCEPTIONS INDICATED IN  
+EDIT ASSUMPTION (10) ABOVE, DISPLAY SELECTION IS ALWAYS BASED UPON THE LAST ENTRY MADE IN THE DSKY.  
+02 FOR A MORE DETAILED DESCRIPTION OF THESE DISPLAYS REFER TO SECTION 3 OF R567, PARA. 3.2.6.  
++

(13) THE LOAD DAP DATA ROUTINE (R03) WAS COMPLETED PRIOR TO DPS IGNITION FOR THE POWERED LANDING MANEUVER AND SHOULD NOT BE SELECTED DURING THIS PROGRAM.

(14) THIS PROGRAM MAY BE CALLED IN TWO WAYS:

(A) ABORT STAGE PUSHBUTTON - IF THE ABORT STAGE PUSHBUTTON IS USED DURING THE POWERED DESCENT OR THE DPS ABORT PROGRAM (P70), IT WILL BE DETECTED BY THE ABORT DISCRETES MONITOR ROUTINE (R11). R11 WILL THEN CALL THIS PROGRAM.

(B) V37E71E - THIS PROGRAM MAY BE CALLED BY THE SAME PROCEDURE AS OTHER PROGRAMS ARE MANUALLY CALLED.

(15) THE ASTRONAUT MAY MONITOR THE FOLLOWING ADDITIONAL PARAMETERS DURING THIS PROGRAM BY KEYING IN V16N77E:

(A) V16N77  
R1-TG  
R2-V(Y)  
R3-BLANK

WHERE: TG - THE ESTIMATED TIME OF FLIGHT FROM THE PRESENT TIME TO THE ACCOMPLISHMENT OF THE ASCENT INJECTION CONDITIONS. POLARITY IS -. IN MINS AND SECS TO NEAREST SEC. MAX READING IS 598.59.

V(Y) - THE MAGNITUDE OF THE LM VELOCITY COMPONENT NORMAL TO THE CSM ORBITAL PLANE. IN FPS TO NEAREST 0.1 FPS.

553

(16) THE ASTRONAUT MAY MONITOR THE FOLLOWING ADDITIONAL PARAMETERS AT ANY TIME DURING THIS PROGRAM AFTER TIG BY KEYING IN V16N85E;

V16N85  
R1-VGX(LM)  
R2-VGY(LM)  
R3-VGZ(LM)

FOR DEFINITION SEE LOGIC BELOW.

(17) THE ASTRONAUT MAY OBSERVE THE FOLLOWING ADDITIONAL PARAMETERS DURING THIS PROGRAM BY KEYING IN V06N76E:

V06N76  
R1-DOWNRANGE VELOCITY (WHF)  
R2-RADIAL VELOCITY (H DOT F)  
R3-CROSSRANGE

WHERE:

DOWNRANGE VELOCITY - THE HORIZONTAL DOWNRANGE VELOCITY AT INJECTION.

RADIAL VELOCITY - THE RADIAL VELOCITY AT INJECTION (THIS VALUE WILL BE STORED IN A PAD-LOADED ERASABLE LOCATION).

CROSSRANGE - THE DISTANCE BETWEEN THE LM ORBITAL PLANE AFTER INJECTION AND THE LM POSITION VECTOR AT TIG. (FOR THIS PROGRAM, THE CROSSRANGE VALUE IS RESTRICTED IN MAGNITUDE TO PAD-LOADED VALUE. PRESENTLY THE MAXIMUM ALLOWABLE VALUE IS CONSTRAINED TO BE 0.5 DEGREE (APPROXIMATELY 8 N.M.)).

PROG  
CONT

LGC  
(NOTE: ALL LOGIC IN THE LGC COLUMN DESCRIBES BOTH THE DPS ABORT PROGRAM, P70, AND THE APS ABORT PROGRAM, P71. ONLY THAT LOGIC ASSOCIATED WITH P71 IS PERTINENT HERE HOWEVER.)

GROUND

CREW

(NOTE: ALL LOGIC IN THE CREW COLUMN IS ONLY THAT ASSOCIATED WITH THE APS ABORT PROGRAM, P71.)

#10

.CREW  
.PROGRAM  
.SELECTION

#20

-----  
DO I WISH TO SELECT  
P71 BY ABORT STAGE  
PUSHBUTTON OR DSKY  
ENTRY?  
-----

.DSKY .PUSHBUTTON

#30

.  
. .  
. .  
. .  
. GC TO ABORT  
. DISCRETES  
. MONITOR  
. ROUTINE (R11)  
. .  
. .

#40

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

-----  
KEY IN APS ABORT  
PROGRAM (P71)  
V37E71E  
-----

.NEW  
.PRUG

-----  
IS THE PROGRAM  
SELECTED ALREADY IN  
PROCESS?  
-----

.N .Y .

-----  
IS ABORT ENABLE  
FLAG SET?  
-----

.Y .N .

-----  
IS AVERAGE G  
FLAG SET?  
-----

.Y .N .

#50

#60



555

.  
.  
.  
.  
.  
.  
.  
.

.  
.  
.  
.  
.

#70

-----  
TURN LN OPERATOR  
ERROR LIGHT  
-----

.....  
DOES OPERATOR ERROR  
LIGHT INDICATE THAT  
THIS PROGRAM WAS IN-  
CORRECTLY SELECTED?  
-----

.Y .N

.  
.  
.  
.  
.  
.  
.  
.  
.

.  
.  
.  
.  
.  
.

#80

EXIT

EXIT

++  
+02  
+EDIT  
++

.  
.  
.  
.  
.  
.  
.  
.  
.  
.  
.

.  
.  
.  
.  
.  
.  
.  
.  
.  
.  
.

#90

"A"  
FROM ABORT  
DISCRETES  
MONITOR  
ROUTINE  
(R11)

"A"  
FROM ABORT  
DISCRETES  
MONITOR  
ROUTINE  
(R11)

#100

-----  
START OPS ABORT PRO-  
GRAM (P70) OR APS  
ABORT PROGRAM (P71)  
AS DEFINED BY V37  
OR R11 SELECTION.  
DISPLAY P70 OR P71  
AS APPROPRIATE  
-----

.....  
MONITOR DSKY:  
OBSERVE DISPLAY OF  
P71  
-----

.  
.  
.

.  
.  
.  
.  
.  
.  
.  
.

#110

-----  
IS THE PRESENT  
PROGRAM P71?  
-----

.N .Y.

-----  
SET APS FLAG  
-----

#120

.  
.  
.  
.  
.  
.  
.  
.  
.  
.  
.

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

RESET ULLAGE FLAG

#130

RESET X-AXIS OVER-  
RIDE INHIBIT FLAG

++  
+02  
+EDIT  
++

RESET PULSES FLAG

#140

COMMAND ENGINE ON.  
(NOTE: IF TOTAL  
THRUST FAILURE HAS  
OCCURRED, MANUAL  
TRANSLATION MUST BE  
APPLIED PRIOR TO  
P70/71 SELECTION  
UNTIL P70/71 AUTO-  
MATICALLY COMMANDS  
ENGINE ON).

#150

SET LR BYPASS FLAG

#160

SET R10 FLAG. REMOVE  
DISPLAY INERTIAL  
DATA DISCRETE FROM  
THE CDLS, AND RE-

++  
+C2

#170

556

557  
+  
+  
+  
+  
+  
+EDIT  
++

START R10.

.  
.  
.

SET 1.0 DEGREE  
DEADBAND

++  
+02  
+EDIT  
+02  
++

.  
.  
.  
.  
.

TERMINATE THRUST  
VECTOR CONTROL AND  
HOLD INERTIAL VEH-  
ICLE ATTITUDE.

.  
.  
.

SET THE DELTA V  
COUNTER =4 FOR USE  
BY R4C

.  
.  
.  
.

ENABLE CURRENT  
GUIDANCE DISPLAYS

.  
.  
.  
.

RESET IDLE FLAG

.  
.  
.

++  
+02  
+EDIT  
++

RESET RCS FLAG

.  
.  
.  
.  
.

#180

#190

#200

#210

#220

-----  
SET 4 JET TRANS-  
LATION FLAG  
-----

#230

-----  
IS PRESENT PROGRAM  
P7C?  
-----

#240

.N                    Y.  
.  
.  
.  
.  
.

-----  
DEFINE INITIAL TGC  
FOR ABORT  
BLRN TC BE  
PRESENT TIME MINUS  
ACTUAL TIG FOR THE  
POWERED DESCENT.  
-----

#250

-----  
SET APS ABORT  
CONTINUATION FLAG  
-----

#270

-----  
RESET ABORT ENABLE  
FLAG  
-----

#280

557

-----  
SET DELTA V MON-  
ITOR THRESHOLD TC  
ASCENT STAGE  
VALUES.  
-----

#290

-----  
IS APS ABORT  
CONTINUATION FLAG  
SET?  
-----

#300

.N            Y.  
.  
.

-----  
. DEFINE INITIAL  
. TGO FOR ABORT  
. BLRN TC BE  
. TWICE THE TGO  
. MOST RECENTLY  
. COMPLETED.  
-----

#310

.....  
GO TO  
"B"  
BELCH

#320

-----  
DEFINE INITIAL  
TGO FOR THE ABORT  
-----

BURN TO BE PRES-  
ENT TIME MINUS  
ACTUAL TIG FOR  
POWERED DESCENT.

#330

++  
+Q2  
+EDIT  
+Q2  
++

-----  
SET THE DESIRED  
RACIAL VELOCITY  
EQUAL TO PAD-LOADED  
VALUE

#350

-----  
COMPUTE CROSS-RANGE  
DISTANCE USING  
PAD-LOADED VALUE  
RESTRICTION.  
I.E. :  
COMPUTE  
CUT-OF-PLANE (Y)  
IF |Y| < 0.5 DEG.,  
XRANGE = -Y  
IF |Y| > 0.5 DEG.,  
XRANGE = 0.5 DEG.  
SGN (-Y)

#360

-----  
SET VERTICAL RISE  
FLAG

#370

56<sup>1</sup>

```

*+
+02
+893
+-----
+      .
+      .
+      .
+      .
+      .
+-----
+      .
+      .
+      .
+
+ IS THETA > THETA
+
+ CRITICAL?
+ (IS THE ANGLE OF
+ ABCRT INITIATION TOO
+ LARGE?)
+-----
+      . N      . Y .
+      .      .
+      .
+-----
+
+ SELECT ONE-
+ ORBIT RENDEZVOUS
+ PARAMETERS
+ (J1,K1)
+-----
+
+      .
+      .
+      .
+-----
+
+ . SELECT TWO-
+ . ORBIT RENDEZVOUS
+ . PARAMETERS
+ . (J2,K2)
+-----
+
+      .
+      .
+      .
+-----
+
+ . SET ABCRT
+ . TARGETING
+ . FLAG
+-----
+
+
+02
+
+ SET THE ROTATION
+ FLAG
+-----
+
+      .
+      .
+      .
+      .
+      .
+      .
+      .
+      .
+      .
+      .
+      .
+      .
+      .
+
+-----

```

```

#380
#390
#400
#410
#420
#430

```

SET DPS ENGINE  
THRUSTLE TO  
MAXIMUM

"B"  
FROM ABOVE

HAVE PGNS CONTROL  
AND AUTO ATTITUDE  
CONTROL MODES BEEN  
SELECTED?

.Y N.

IS THE APS FLAG  
SET?

.Y N.

HAS THE AUTO  
THRUSTLE MODE  
BEEN SELECTED?

.Y N.

#440

#450

#460

#470

362







565

. . . . .  
HIBIT FLAG.  
-----  
. . . . .  
-----  
. . IS H DOT  
. . GREATER THAN  
. . 40 FPS (LP)?  
-----  
. . .Y .N  
. . . . .  
-----  
. . RESET THE  
. . ROTATION FLAG  
-----  
. . . . .  
-----  
. . RESET VERTICAL  
. . RI SE FLAG  
-----  
. . . . .  
-----  
. . IS THE ROTATION  
. . FLAG SET?  
-----  
. . .Y N.  
. . . . .  
-----  
. . SET TX0  
. . EQUAL TO PRE-  
. . SENT TIME +12  
. . SECONDS .  
-----  
. . . . .  
-----  
. . IS T PRESENT  
. . GREATER THAN TXC?  
-----  
. . .N .Y  
. . . . .  
. . . . .  
. . . . .

#580

#590

#600

#610

#620

#630

-----  
IS THE ROTATION  
FLAG SET?  
-----

.N            Y.

#640

-----  
IS THE LM  
X-AXIS WITHIN  
30 DEGREES OF  
THE DESIRED  
LM X-AXIS?  
-----

.Y            N.

#650

-----  
IS THE  
PRESENT LM  
X-AXIS  
WITHIN 30  
DEGREES OF  
LOCAL VER-  
TICAL (UP)?  
-----

.Y            N.

#660

-----  
RESET THE RO-  
TATION FLAG  
-----

#670

-----  
RESET  
X-AXIS  
OVERRIDE  
INHIBIT  
FLAG  
-----

#680

-----  
CALCULATE THE  
REQUIRED ICOL/  
-----

567

GIMBAL ANGLES AND  
DRIVE THE ICCUS  
(USING FINDCDW)  
TO ALIGN THE LM  
+X AXIS WITH THE  
DESIRED THRUST  
VECTOR TO ACCOM-  
PLISH THE ASCENT,  
THE LM +Y  
AXIS HORIZONTAL  
AND THE LM +Z  
AXIS DOWN.

#690

.  
.  
.

#700

. CALCULATE THE RE-  
. QUIREDCICU/GIMBAL  
. ANGLES AND DRIVE  
. THE ICCUS (USING  
. FINDCDW) TO  
. ALIGN THE LM +X  
. AXIS WITH THE  
. PRESENT LCCAL  
. VERTICAL (UP),  
. THE LM +Y AXIS  
. NORMAL TO THE  
. ANTICIPATED PITCH  
. MANEUVER PLANE  
. FOR THE ASCENT,  
. AND THE LM +Z  
. AXIS DOWNRANGE.

#710

.  
.  
.  
.  
.  
.  
.  
.  
.  
.

#720

TEMP  
HOLD

MON

-----  
DISPLAY ON DSKY:  
VC6N63  
R1-VI  
R2-H CCT  
R3-H

-----  
MONITOR DSKY:  
OBSERVE DISPLAY  
OF VI, H DOT, AND H.  
-----

#730

VI - MAGNITUDE OF LM  
INERTIAL VELOCITY  
WITH RESPECT TO THE  
REFERENCE COORDINATE  
SYSTEM. IN FPS TO  
NEAREST .1 FPS.

#740

H DOT - THE PRESENT  
RATE OF CHANGE OF  
ALTITUDE (H). POLA-  
RITY INDICATES DES-  
CENT (-) OR ASCENT  
(+). IN FT/SEC TO  
NEAREST .1 FT/SEC.

#750

H - THE PRESENT  
ALTITUDE OF THE LM  
ABOVE THE LM POSI-  
TION VECTOR AT THE  
DESIGNATED LANDING  
SITE. POLARITY IS +  
FOR ALTITUDES  
GREATER THAN THE  
ABOVE RADIUS. IN  
FEET TO NEAREST  
FOOT.

#760

..... MONITOR OSKY, FCAI  
AND OUT THE WINDOW:

(A) IF H IS  
GREATER THAN  
+25000 THE  
PGNCS WILL MANEU-  
VER THE LM TO THE  
CORRECT ATTITUDE  
TO PERFORM THE  
ASCENT ABORT.

#770

(B) IF H IS  
LESS THAN  
+25000, THE  
X-AXIS OVERRIDE

#780

56

OPTICN IS INHI-  
BITED. THE PGNC S  
WILL MANEUVER THE  
LM TO LOCAL VER-  
TICAL (LM +X AXIS  
UP) AND YAW THE  
LM SC WINDOWS ARE  
DOWNRANGE. THE  
LOCAL VERTICAL  
ATTITUDE WILL BE  
MAINTAINED UNTIL  
H IS GREATER THAN  
+25000 OR H OCT  
IS GREATER THAN  
+00400 AT WHICH  
TIME THE PGNC S  
WILL MANEUVER  
(PITCH) THE LM TO  
THE CORRECT ATI-  
TITUDE TO PERFORM  
THE ASCENT ABORT  
AND THEN THE  
X-AXIS OVERRIDE  
OPTICN IS  
RESTORED.

#790

#800

THE ABOVE MANEUVERS  
WILL BE DONE WITH  
THE RCS.

---

#810

•  
•  
•  
•  
•  
•  
•  
•  
•  
•  
•  
•  
•  
•  
•  
•  
•  
•

#820

---

MONITOR APS  
THRUSTING:





571

THRUST FAIL  
ROUTINE (R40)  
FOR REQUIRED  
RESPONSE

#880

-----  
PUSH ENGINE STOP  
PUSH BUTTON  
-----

-----  
GO TO BACKUP  
PROCEDURES.  
-----

#890

-----  
IS TG LESS THAN 4  
SECONDS?  
-----

.Y                    N.

#900

-----  
CALL ENGINE OFF COM-  
MAND AT COMPUTED  
REQUIRED TIME.  
-----

#910

-----  
SET IDLE FLAG  
-----

#920

-----  
WAIT UNTIL COMPUTED  
TIME OF CUTOFF.  
-----

#930

COMMAND ENGINE OFF

COMMAND ZERO  
ATTITUDE RATES

SET DEADBAND TO  
PREVIOUS VALUE  
DEFINED BY RC3

MAINTAIN VG  
COMPUTATIONS AFTER  
CUTOFF FOR POSSIBLE  
NULLING BY RCS  
TRIMMING MANUEVER

DISARM APS

#10 #  
FROM  
R40

#940

#950

#960

#970

#980

512

572

.  
. .  
. .  
. .  
...  
.

-----  
COMMANC  
ZERC  
ATTITUDE  
RATES  
-----

.  
. .  
. .  
. .

-----  
SET DEAD-  
BAND TO  
PREVIOUS  
VALUE DE-  
FINED BY  
R03  
-----

.  
. .  
. .  
. .

-----  
RESET  
ULLAGE  
FLAG  
-----

.  
. .  
. .

++  
+Q2  
+EDIT  
++

-----  
SET RCS FLAG  
-----

.  
. .  
. .  
. .

HGLD .  
.....  
MON .

-----  
FLASH VERB-NCUN TC  
REQUEST PROCEED  
AND MAINTAIN DISPLAY  
-----

-----  
MONITOR DSKY:  
OBSERVE VERB-NCUN  
FLASH TC REQUEST  
PROCEED AND DISPLAY  
-----

#990

#1000

#1010

#1020

OF VI, H DOT, AND H.  
V16 N63  
R1 - VI  
R2 - H DOT  
R3 - h

OF VI, H DOT, AND H.

#1030

RECORD THESE VALUES  
AS DESIRED.

#1040

WAIT FOR KEYBOARD  
ENTRY  
TERMINATE FLASH UPON  
RECEIPT OF PROCEED,  
RECYCLE, OR  
TERMINATE

KEY IN PROCEED

#1050

.P .T .R  
.R .E .E  
.O .R .C  
.C .M .Y  
.E .I .C  
.E .N .L  
.D .A .E  
. .T .  
. .E .

#1060

GC TC  
"C"  
BELOW

#1070

++  
+Q2  
+EDIT  
++

COMMAND ZERO  
ATTITUDE ERRORS

574

575

#1080

-----  
SET .3 DEGREE DEAD-  
BAND  
-----

#1090

HOLD . . . . . FLASH VERB-NOUN TO  
..... REQUEST RESPONSE AND  
MON . . . . . DISPLAY COMPONENTS  
          CF VG(LM):  
          V16 N85  
          R1-VGX(LM)  
          R2-VGY(LM)  
          R3-VGZ(LM)

-----  
MONITOR DSKY:  
OBSERVE VERB-NOUN  
FLASH TO REQUEST  
RESPONSE AND DISPLAY  
COMPONENTS OF VG(LM)  
-----

#1100

-----  
COMPONENTS OF THE  
PRESENT VG VECTOR  
RESOLVED ALONG THE  
LM X, Y, AND Z AXES.  
THE VG VECTOR WILL  
BE UPDATED BY THE  
STEERING LOOPS  
DURING EACH COMPLA-  
TION CYCLE. IN FPS  
TO NEAREST .1 FPS.  
-----

-----  
TO NULL OUT VG  
COMPONENTS COMMAND  
MANUAL TRANSLATIONS  
AND ROTATIONS.  
(NOTE: THIS MANEUVER  
IS AT THE OPTION OF  
THE CREW.)  
(NOTE: TRANSLATION  
WILL BE 4 JET UNLESS  
R03 IS PERFORMED TO  
SPECIFY 2 JET.)  
-----

#1110

-----  
THE ORBITAL PARA-  
METER DISPLAY ROUT-

#1120



517

DEFINED BY R03

RESET AECRT ENABLE  
FLAG

DO FINAL AUTOMATIC  
REQUEST TERMINATE  
ROUTINE (R00)

EXIT #70/P71

DO FINAL AUTOMATIC  
REQUEST TERMINATE  
ROUTINE (R00)

EXIT P71

#1180

#1190

#1200

CHANGE CONTROL NOTES

- REV 00 PCR 13,31
- REV 01 PCR 70,85,86,164,234,258,259,419,472,475,  
476,536,542,568,613,617
- REV 00(LUM 1A) PCR 260,270,657,708,757
- REV 01(LUM 1B) PCR 279,838,840,841,845,847,EDITORIAL
- REV 02(LUM 1C) PCR 285,893, EDITORIAL

THIS PAGE INTENTIONALLY LEFT BLANK



CSM CO-ELLIPTIC SEQUENCE INITIATION (CSI) TARGETING  
PROGRAM (P72)

REV 02 12/03/69

PURPOSE:

- (1) TO CALCULATE PARAMETERS ASSOCIATED WITH THE FOLLOWING CONCENTRIC FLIGHT PLAN MANEUVERS FOR CSM EXECUTION OF THE MANEUVERS UNDER THE CONTROL OF THE CMC; THE CO-ELLIPTIC SEQUENCE INITIATION (CSI) AND THE CONSTANT DELTA ALTITUDE MANEUVER (CDH).
- (2) TO CALCULATE THESE PARAMETERS BASED UPON MANEUVER DATA APPROVED AND KEYED INTO THE LGC BY THE ASTRONAUT.
- (3) TO DISPLAY TO THE ASTRONAUT AND THE GROUND DEPENDENT VARIABLES ASSOCIATED WITH THE CONCENTRIC FLIGHT PLAN MANEUVERS FOR APPROVAL BY THE ASTRONAUT/GROUND.

ASSUMPTIONS:

- (1) AT A SELECTED TPI TIME THE LINE OF SIGHT BETWEEN THE CSM AND THE LM IS SELECTED TO BE A PRESCRIBED ANGLE ( $\theta$ ) FROM THE HORIZONTAL PLANE DEFINED AT THE CSM POSITION.
- (2) THE TIME BETWEEN CSI IGNITION AND CDH IGNITION MUST BE COMPUTED TO BE GREATER THAN 10 MINUTES FOR SUCCESSFUL COMPLETION OF THE PROGRAM.
- (3) THE TIME BETWEEN CDH IGNITION AND TPI IGNITION MUST BE COMPUTED TO BE GREATER THAN 10 MINUTES FOR SUCCESSFUL COMPLETION OF THE PROGRAM.
- (4) CDH DELTA V IS SELECTED TO MINIMIZE THE VARIATION OF THE ALTITUDE DIFFERENCE BETWEEN THE ORBITS.
- (5) CSI BURN IS DEFINED SUCH THAT THE IMPULSIVE DELTA V IS IN THE CSM HORIZONTAL PLANE AT CSI IGNITION.
- (6) THE PERICENTER ALTITUDE OF THE ORBIT FOLLOWING CSI AND CDH MUST BE GREATER THAN 35,000 FT (LUNAR ORBIT) OR 85 NM (EARTH ORBIT) FOR SUCCESSFUL COMPLETION OF THIS PROGRAM.
- (7) THE CSI AND CDH MANEUVERS ARE ASSUMED TO BE PARALLEL TO THE PLANE OF THE LM ORBIT, HOWEVER CREW MODIFICATION OF DELTA V(LV) COMPONENTS MAY RESULT IN AN OUT-OF-PLANE CSI MANEUVER.
- (8) LGC COMPUTED VARIABLES MAY BE STORED FOR LATER VERIFICATION BY THE GROUND. THESE STORAGE CAPABILITIES ARE NORMALLY LIMITED ONLY TO THE PARAMETERS FOR ONE THRUSTING MANEUVER AT A TIME EXCEPT FOR CONCENTRIC FLIGHT PLAN MANEUVER SEQUENCES.
- (9) THE RENDEZVOUS RADAR MAY OR MAY NOT BE USED TO UPDATE THE LM OR CSM STATE VECTORS FOR THIS PROGRAM. IF RADAR USE IS DESIRED THE RADAR WAS TURNED ON AND LOCKED ON THE CSM BY PREVIOUS SELECTION OF P20. RADAR SIGHTING MARKS WILL BE MADE AUTOMATICALLY APPROXIMATELY ONCE A MINUTE WHEN ENABLED BY THE TRACK AND UPDATE FLAGS. THE RENDEZVOUS TRACKING MARK COUNTER IS ZEROED BY THE SELECTION OF P20 AND AFTER EACH THRUSTING MANEUVER.
- (10) THERE IS NO REQUIREMENT FOR ISS OPERATION DURING THIS PROGRAM UNLESS AUTOMATIC STATE VECTOR UPDATING IS DESIRED BY THE RENDEZVOUS NAVIGATION PROGRAM (P20). IF SELECTED, P20 WILL DEFINE THE STATUS OF THE ISS.
- (11) THIS PROGRAM IS SELECTED BY THE ASTRONAUT BY DSKY ENTRY.

PRCG

LGC

GROUND

CREW



-----  
SET TRACK FLA,  
-----

# 50

-----  
SET TIG (CSI) TO:  
+CC000  
+CC000  
+00000  
-----

# 60

HOLD .

SNAP .

-----  
FLASH VERB-NOUN TO  
REQUEST RESPONSE AND  
DISPLAY STORED TIG  
(CSI):  
V06 N11  
R1-TIG(CSI)-HRS  
R2-TIG(CSI)-MINS  
R3-TIG(CSI)-SECS  
-----

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

-----  
MONITOR DSKY:  
OBSERVE VERB-NOUN  
FLASH TO REQUEST  
RESPONSE AND DISPLAY  
OF STORED TIG (CSI)  
(NOTE: INITIALLY  
THIS VALUE WILL BE:  
+00000  
+00000  
+00000)  
-----

# 70

# 80

-----  
DO I WISH TO DISPLAY  
TIME OF APDAPSIS?  
(I.E.: IS THIS AN  
ABORT FROM LUNAR  
LANDING?)  
(NOTE: IF THIS OP-  
TION IS CHOSEN FOR  
THE NORMAL MISSION,  
TIG(CSI) WILL BE

# 90

++  
+02  
+EDIT  
++

TARGETED TO OCCUR  
AT APOAPSIS UNLESS  
THE APOAPSIS TIME  
IS REPLACED BY SOME  
OTHER TIME.)

#100

.Y .N

AM I SATISFIED  
WITH THIS VALUE?

.Y .N

#110

REGRD THIS  
VALUE FOR FU-  
TURE TRANS-  
MISSION TO THE  
CSM.

#120

WAIT FOR KEYBOARD  
ENTRY

KEY IN PROCEED

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

KEY IN V25E  
AND LOAD DESIRED  
TIG(CSI).

#130

.P .T .NEW  
.R .E .DATA  
.O .R .  
.C .M .  
.E .I  
.E .N STORE DATA  
.C .A

GO TO

HAS A CALL BEEN MADE  
FOR COMPUTATION OF  
T(APOAPSIS)?  
(NOTE: THE LGC WILL  
RESPOND TO A NEGA-  
TIVE LOAD IN THE  
SAME FASHION THAT IT

#140

MAN  
BELCH

WOULD RESPOND TO A  
ZERO LOAD.)

#150

.N .Y

IS THE VALUE OF TIG  
(CSI) NOW STORED =  
+00000  
+C0000  
+CCCC0

#160

OR IS TIG (CSI) A  
NEGATIVE NUMBER?

.N .Y

COMPUTE  
T(APOAPSIS)  
AND STORE IN  
TIG (CSI)

#170

#180

HOLD  
.....  
SNAP

FLASH VERB-NOUN TO  
REQUEST RESPONSE AND  
DISPLAY STORED N, E,  
AND CENTANG.

V06 N55  
R1-N  
R2-E  
R3-CENTANG

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

#190

++  
+02  
+EDIT

N - THE FUTURE APSE-  
DAL CROSSING  
(APOGEE OR PERIGEE)  
(APCLONE OR PERI-

AM I SATISFIED WITH  
THESE VALUES?

++  
+  
+  
+  
+  
++

LUNE)) OF THE ACTIVE  
VEHICLE AT WHICH  
TIG(CDH) SHOULD  
OCCUR.  
00001=FIRST,  
00002=SECOND, ETC.

E - ELEVATION ANGLE  
THE ANGLE BETWEEN  
THE CSM/LM LCS AND  
THE CSM LOCAL HORIZ-  
ONTAL PLANE AT TIG  
(TPI) REFERENCED TO  
THE DIRECTION OF  
FLIGHT (SEE SECTION  
5.4.2.2 OF R567 FOR  
DETAILED DES-  
CRIPTION) IN DEGREES  
TO NEAREST .01  
DEGREE.

++  
+02  
+EDIT  
+  
+  
+02  
++

CENTANG - THE ORBI-  
TAL CENTRAL ANGLE OF  
THE PASSIVE VEHICLE  
DURING TRANSFER FROM  
TIG(TPI) TO TIME OF  
INTERCEPT. IN DEG-  
REES TO NEAREST .01  
DEGREE.

(NOTE: IN THIS CASE  
CENTANG (R3) IS USED  
ONLY AS AN OPTION  
CODE BY THE LGC. FOR  
ANY VALUE OF CENTANG  
OTHER THAN 00000 THE  
LGC WILL CALCULATE  
THE CDH PARAMETERS  
FOR A TIG(CDH) AT  
N(180 DEGREES) FROM  
THE CSI MANEUVER  
WHERE N IS SPECIFIED  
IN R1. REFER SECTION  
5.4.2.2 OF R567.)

++  
+02  
+EDIT  
++

-----  
WAIT FOR KEYBOARD  
ENTRY

(NOTE: R3 WILL ORI-  
GINALLY BE DISPLAYED  
AS 00000. IF THE  
CREW WISHES TO EXER-  
CISE THE N(180 DEG-  
REES) OPTION FOR CDH  
MANEUVER DEFINITION,  
LOAD ANY NUMBER  
OTHER THAN 00000 IN  
R3. REFER SECTION  
5.4.2.2 OF R567.)

-----  
.Y .N  
-----  
RECORD THESE  
VALUES FOR FUTURE  
TRANSMISSION TO  
THE CSM.  
-----

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

#200

#210

#220

#230

#240

#250

585

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

-----  
KEY IN V25E  
AND LOAD THE  
DESIRED PARA-  
METERS  
-----

.P .T .NEW  
.R .E .DATA  
.D .R  
.C .M  
.E .I  
.E .N  
.D .A STORE DATA

GC TO  
"A"  
BELCW

#260

#270

HOLD

.....  
SNAP . . . . . FLASH VERB-NOUN TO  
REQUEST RESPONSE AND  
DISPLAY STORED TIG  
(TPI):

VC6 N37  
R1-TIG(TPI)-HRS  
R2-TIG(TPI)-MINS  
R3-TIG(TPI)-SECS

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

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

#280

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

#290

.Y .N

-----  
RECORD THIS VA-  
LUE FOR FUTURE  
-----

TRANSMISSION  
TO THE CSM.

#300

-----  
WAIT FOR KEYBOARD  
ENTRY

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

#310

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

-----  
KEY IN V25E  
AND LOAD THE  
DESIRED TIG (TPI)  
-----

-----  
P T NEW  
R E DATA  
D R  
C M  
E I  
E N STORE DATA  
D A  
T  
E  
-----

#320

GC TO  
"A"  
BELOW

#330

-----  
RESET FINAL  
FLAG

#340

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

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

#350



587  
-----  
BASED ON THE STORED TARGET PARAMETERS, COMPUTE THE PARAMETERS ASSOCIATED WITH CSI AND CDF AS DESCRIBED IN SECTION 5.4.2.2 OF R567.

#360

ESTABLISH ALARM IF:

(A) ON FIRST ITERATION THERE IS NO INTERSECTION OF THE DESIRED LOS AT TPI WITH THE CIRCLE DESCRIBED IN SECTION 5.4.2.2 OF R567.

#370

(ALARM CODE 00600)

#380

(E) ON ANY TWO CONSECUTIVE ITERATIONS THE MAGNITUDE OF DELTA (VCSI) IS GREATER THAN 1000 FPS.

#390

(ALARM CODE 00606)

(C) THE ITERATION COUNTER EXCEEDS 15 WITHOUT ARRIVING AT A PROBLEM SOLUTION.

#400

(ALARM CODE 00605)

(L) PERICENTER

ALT (POST CSI)  
IS LESS THAN  
35,000 FT.  
(LUNAR ORBIT)  
OR 85 NM (EARTH  
ORBIT).  
(ALARM CODE  
00601)

#410

(E) PERICENTER  
ALT (POST CDH)  
IS LESS THAN  
35,000 FT  
(LUNAR ORBIT)  
OR 85 NM (EARTH  
ORBIT) (ALARM  
CODE 00602)

#420

(F) TIG(CDH) -  
TIG(CSI) IS  
LESS THAN 10  
MIN. (ALARM  
CODE 00603)

(G) TIG(TPI) -  
TIG(CDH) IS  
LESS THAN 10  
MIN. OR COMP-  
UTED CDH TIME  
IS GREATER THAN  
INPUT TPI TIME.  
(ALARM CODE  
00604).

#430

-----  
.N .A  
.U .L  
. .A  
.A .R  
.L .M  
.A .  
.R .  
.M .

#440

POSS  
HOLD  
.....  
SNAP

-----  
FLASH VERB-  
NOUN TO RE-  
QUEST RESPON-  
SE AND DIS-

-----  
MONITOR DSKY:  
DOES ALARM CODE  
DISPLAY INDICATE  
COMPUTATIONAL

#450

577

PLAY ALARM  
CODE:  
V05 N09  
R1-XXXXX  
R2-XXXXX  
R3-XXXXX

DIFFICULTY?

-----  
Y N

++  
+02  
+EDIT  
+  
+ 02  
++

THE EXPECTED  
ALARM CODES  
AT THIS TIME  
ARE 00600  
THRUUGH  
00606.

#460

-----  
WAIT FOR  
KEYBOARD  
ENTRY

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

#470

-----  
TERMINATE  
FLASH UPON  
RECEIPT OF  
PROCEED, KE-  
CYCLE, OR  
TERMINATE

#480

-----  
.T .R .P  
.E .E .R  
.R .C .D  
.M .Y .C  
.I .C .E  
.N .L .E  
.A .E .D  
.T .  
.E . . . . .

#490

GC TG

"A"  
BELCH

#500

IS THE FINAL  
FLAG SET?

N Y.

SET UPDATE  
FLAG

#510

FLASH VERB-NOUN  
TO REQUEST RES-  
PONSE AND DISPLA  
Y.  
DELTA ALT (CDH),  
DELTA T(CSI/CDH)  
AND DELTA T(CDH/  
TPI);  
VC6 N75  
R1-DELTA ALT  
(CDH)  
R2-DELTA T(CSI/  
CDH)  
R3-DELTA T(CDH/  
TPI)

MONITOR DSKY:  
OBSERVE VERB-  
NOUN FLASH TO RE-  
QUEST RESPONSE  
AND DISPLAY OF  
DELTA ALT (CDH)  
DELTA T (CSI/CDH)  
AND DELTA T (CDH/  
TPI).

#520

#530

DELTA ALT(CDH) -  
THE ALTITUDE BE-  
TWEEN THE ACTIVE  
AND PASSIVE VE-  
HICLE ORBITS AT  
TIG(CDH). SIGN IS  
PLUS WHEN THE AC-

#540

HOLD .  
.....  
SNAP .

. TIVE VEHICLE IS  
. BELOW THE PASSIVE  
. VEHICLE. IN NAUT-  
. ICAL MILES TO  
. NEAREST .1 NM.

#550

. DELTA T(CSI/CDH)-  
. TIG(CDH) MINUS  
. TIG(CSI). COM-  
. PUTED IN HRS, MINS  
. AND SECS OF WHICH  
. ONLY THE MINS AND  
. SECS ARE DISPLAY-  
. ED. TC NEAREST  
. SEC.

#560

. DELTA T(CDH/TPI)-  
. TIG(TPI) MINUS  
. TIG(CDH).  
. COMPUTED IN HRS,  
. MINS AND SECS OF  
. WHICH ONLY THE  
. MINS AND SECS ARE  
. DISPLAYED.

#570

. TC NEAREST SEC.  
. (NOTE: R2 AND R3  
. ARE MODULARIZED TO  
. THE HOUR, I.E.,  
. 63 MINS 22 SECS  
. IS DISPLAYED AS  
. G3B22)  
. (NOTE: TIG(CDH)  
. IS AVAILABLE BY  
. KEYING IN  
. V06N13.)

#580

-----  
. RECORD THESE  
. VALUES FOR FUTURE  
. TRANSMISSION TO  
. THE CSM.  
-----

#590

-----  
. WAIT FOR KEYBOARD  
. ENTRY

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

#600

. TERMINATE FLASH  
. UPON RECEIPT OF

PROCEED, RECYCLE,  
OR TERMINATE

.P	.T	.R
.R	.E	.E
.U	.R	.C
.C	.M	.Y
.E	.I	.C
.E	.N	.L
.C	.A	.E
.	.T	.
.	.E	.....

#610

GO TO  
"A"  
BELCW

#620

HOLD  
.....  
SNAP

FLASH VERB-NOUN  
TO REQUEST RES-  
PONSE AND DISPLAY  
CALCULATED COM-  
PCNENTS OF DELTA  
V(LV) FOR CSI;  
V06 N81  
R1-DELTA VX(LV)  
R2-DELTA VY(LV)  
R3-DELTA VZ(LV)

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

#630

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

AM I SATISFIED  
WITH THESE  
VALUES?  
(NOTE: CREW HAS  
THE OPTION AT  
THIS TIME TO RE-  
DEFINE THE DELTA  
V(LV) COMPONENTS  
FOR THE SUBSEQ-  
UENT THRUSTING

#640

DELTA VY(LV) -  
COMPONENT OF IM-  
PULSIVE DELTA V

. AT TIG(CSI) ALONG  
. VXR. IN FPS TO  
. NEAREST .1 FPS.

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

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

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

. TERMINATE FLASH  
. UPON RECEIPT OF  
. PROCEED, TERMIN-  
. ATE, OR NEW DATA

-----  
. P . T . NEW  
. R . E . DATA  
-----

. MANEUVER. THIS  
. CAPABILITY WILL  
. NORMALLY BE EXER-  
. CISED TO CORRECT  
. CUT-OF-PLANENESS  
. BY FIRST SELECT-  
. ING THE RENDEZ-  
. VOUS OUT-OF-PLANE  
. DISPLAY ROUTINE  
. (R36) (V90E) AND  
. THEN MODIFYING  
. DELTA VY(LV).  
. HOWEVER IT MUST  
. BE REMEMBERED  
. THAT THE R36 CAL-  
. CULATION IS BASED  
. UPON AN ACTIVE  
. LM.

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

-----  
. KEY IN V25E  
. AND LOAD DE-  
. Sired DELTA V  
. VALUES  
-----

-----  
. RECORD THESE  
. VALUES FOR FUTURE  
. TRANSMISSION TO  
. THE CSM.  
-----

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

#650

#660

#670

#680

#690

#700





595

DELTA VZ(LV) -  
COMPONENT OF IM-  
PULSIVE DELTA V  
AT TIG(CDH) ALONG  
-R. IN FPS TO  
NEAREST .1 FPS

TRANSMISSION TO  
THE CSM.  
(NOTE: UNLIKE  
DELTA V(LV) FOR  
CSI ABOVE, THESE  
VALUES CANNOT BE  
WRITTEN OVER.)

#750

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

#760

WAIT FOR KEYBOARD  
ENTRY

KEY IN PROCEED

#770

TERMINATE FLASH  
UPON RECEIPT OF  
PROCEED, RECYCLE,  
OR TERMINATE

.P .T .R  
.R .E .E  
.O .R .C  
.C .M .Y  
.E .I .C  
.E .N .L  
.D .A .E

#780

GO TO  
"A"  
BELOW

#790

IS THE FINAL FLAG  
SET?

.N Y.

#800

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

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

HOLD . FLASH VERB-NOUN TO  
..... REQUEST RESPONSE AND  
MON . DISPLAY M, TFI AND  
MGA;  
V16N45  
R1-M  
R2-TFI  
R3-MGA

M - THE NUMBER OF  
MARKS MADE SINCE THE  
RR TRACKING MARK  
COUNTER WAS ZEROED  
(SEE ASSUMPTION 6  
OF P20)

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

MGA-THE MIDDLE GIM-  
BAL ANGLE DISPLAY  
IS NOT PERTINENT TO  
THIS PROGRAM.  
THEREFORE;

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

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

.Y . N.

-----  
. DO I WISH TO  
. TERMINATE THE  
. MARK PROCESS AND  
. DO THE FINAL PASS  
-----

#810

#820

#830

#840

597

(A) WHEN DISPLAY-  
ED AT ANY TIME  
OTHER THAN THE  
LAST PASS THROUGH  
THE PROGRAM THE  
VALUE IS -0001

(B) ON THE LAST  
PASS THE VALUE IS  
-0002.

THROUGH THE  
PROGRAM?

.Y .N

#850

#860

WAIT FOR KEYBOARD  
ENTRY

KEY IN PROCEED.

TERMINATE FLASH UPON  
RECEIPT OF PROCEED,  
TERMINATE, OR RECYCLE

KEY IN RECYCLE  
V32E

#870

.P .T .R  
.R .E .E  
.O .R .C  
.C .M .Y  
.E .I .C  
.E .N .L  
.D .A .E

GO TO  
"A"  
BELOW

WAS THIS THE LAST  
PASS THROUGH THE  
PROGRAM?

#880

IS THE FINAL FLAG  
SET?

.Y .N

#890

SET THE FINAL  
FLAG

#900



CSM CONSTANT DELTA ALTITUDE (CDH)  
TARGETING PROGRAM (P73)

REV 03 12/03/69

PURPOSE:

(1) TO CALCULATE PARAMETERS ASSOCIATED WITH THE CONCENTRIC FLIGHT PLAN MANEUVERS WITH THE EXCEPTION OF CO-ELLIPTIC SEQUENCE INITIATION (CSI) FOR CSM EXECUTION OF THE MANEUVERS UNDER CONTROL OF THE CMC. THE CONCENTRIC FLIGHT PLAN MANEUVERS ARE THE CO-ELLIPTIC SEQUENCE INITIATION (CSI), THE CONSTANT DELTA ALTITUDE MANEUVER (CDH), THE TRANSFER PHASE INITIATION (TPI), AND THE TRANSFER PHASE FINAL (TPF) OR BRAKING MANEUVER.

(2) TO CALCULATE THESE PARAMETERS BASED UPON MANEUVER DATA APPROVED AND KEYED INTO THE LGC BY THE ASTRONAUT.

(3) TO DISPLAY TO THE ASTRONAUT AND THE GROUND DEPENDENT VARIABLES ASSOCIATED WITH THE CONCENTRIC FLIGHT PLAN MANEUVERS FOR APPROVAL BY THE ASTRONAUT/GROUND.

ASSUMPTIONS:

(1) THIS PROGRAM IS BASED UPON PREVIOUS COMPLETION OF THE CO-ELLIPTIC SEQUENCE INITIATION (CSI) TARGETING PROGRAM (P72). THEREFORE:

(A) AT A SELECTED TPI TIME THE LINE OF SIGHT BETWEEN THE CSM AND THE LM WAS SELECTED TO BE A PRESCRIBED ANGLE ( $\theta$ ) FROM THE HORIZONTAL PLANE DEFINED AT THE CSM POSITION.

(B) THE TIME BETWEEN CSI IGNITION AND CDH IGNITION WAS COMPUTED TO BE GREATER THAN 10 MINUTES.

(C) THE TIME BETWEEN CDH IGNITION AND TPI IGNITION WAS COMPUTED TO BE GREATER THAN 10 MINUTES.

(D) THE VARIATION OF THE ALTITUDE DIFFERENCE BETWEEN THE ORBITS WAS MINIMIZED.

(E) CSI BURN WAS DEFINED SUCH THAT THE IMPULSIVE DELTA V WAS IN THE CSM HORIZONTAL PLANE AT CSI IGNITION.

(F) THE PERICENTER ALTITUDES OF THE ORBITS FOLLOWING CSI AND CDH WERE COMPUTED TO BE GREATER THAN 35,000 FT. (LUNAR ORBIT) OR 85 NM (EARTH ORBIT).

(G) THE CSI AND CDH MANEUVERS WERE ASSUMED TO BE PARALLEL TO THE PLANE OF THE LM ORBIT, HOWEVER CREW MODIFICATION OF DELTA V (LV) COMPONENTS MAY HAVE RESULTED IN AN OUT-OF-PLANE CSI MANEUVER.

UNLESS THE INPUTS TO THIS PROGRAM ARE CHANGED FROM THOSE VALUES INSERTED IN P72, THE CALCULATED PARAMETERS FOR THE REMAINING MANEUVERS OF THE CONCENTRIC FLIGHT PLAN WILL VARY FROM THOSE ORIGINALLY CALCULATED AND DISPLAYED ONLY DUE TO THE CONTINUOUS RADAR UPDATING OF THE LM OR CSM GREAT.

(2) LGC COMPUTED VARIABLES MAY BE STORED FOR LATER VERIFICATION BY THE GROUND. THESE STORAGE CAPABILITIES ARE NORMALLY LIMITED ONLY TO THE PARAMETERS FOR ONE THRUSTING MANEUVER AT A TIME EXCEPT FOR CONCENTRIC FLIGHT PLAN MANEUVER SEQUENCES.

(3) THE RENDEZVOUS RADAR MAY OR MAY NOT BE USED TO UPDATE THE LM OR CSM STATE VECTORS FOR THIS PROGRAM. IF RADAR USE IS DESIRED THE RADAR SHOULD HAVE BEEN TURNED ON AND LOCKED ON THE CSM BY PREVIOUS SELECTION OF P20. RADAR SIGHTING MARKS WILL BE MADE AUTOMATICALLY APPROXIMATELY ONCE A MINUTE WHEN ENABLED BY THE TRACK AND UPDATE FLAGS. THE RENDEZVOUS TRACKING MARK COUNTER IS ZEROED BY THE SELECTION OF P20 AND AFTER EACH THRUSTING MANEUVER.

(4) THERE IS NO REQUIREMENT FOR ISS OPERATION DURING THIS PROGRAM UNLESS AUTOMATIC STATE VECTOR UPDATING IS DESIRED BY THE RENDEZVOUS NAVIGATION PROGRAM (P20). IF SELECTED, P20 WILL DEFINE THE STATUS OF THE ISS.

(5) THIS PROGRAM IS SELECTED BY THE ASTRONAUT BY OSKY ENTRY.

PROG  
CONT

LGC

GROUND

CREW

. CREW  
. PROGRAM  
. SELECTION  
. .  
. .

-----  
START CSM CONSTANT .  
DELTA ALTITUDE (CDH) .....  
TARGETING PROGRAM .  
(P73)  
DISPLAY P73

-----  
KEY IN CSM CONSTANT  
DELTA ALTITUDE (CDH)  
TARGETING PROGRAM  
(P73) V37E 73E  
-----

#10

.....  
MONITOR DSKY:  
OBSERVE DISPLAY OF  
P73  
-----

#20

-----  
RESET ACTIVE VEHICLE  
FLAG  
-----

#30

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

#40

-----  
SET TRACK FLAG  
-----

LOG

#50

```

HOLD . FLASH VERB-NOUN TO
      REQUEST RESPONSE AND
      DISPLAY STORED TIG
SNAP . (CDH):
        VC6 N13
        R1-TIG(CDH)-HRS
        R2-TIG(CDH)-MIN
        R3-TIG(CDH)-SECS

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

```

#60

```

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

AM I SATISFIED WITH
THIS VALUE?

```

#70

```

      .Y      .N
      .
      .
      .
RECORD TIG(CDH)
FOR FUTURE
TRANSMISSION
TO THE CSM

```

#80

```

WAIT FOR KEYBOARD
ENTRY
      KEY IN PROCEED

```

#90

```

TERMINATE FLASH UPON
RECEIPT OF PROCEED,
TERMINATE, OR NEW
DATA
      KEY IN V25E
      AND LOAD
      DESIRED TIG
      (CDH)

```

#100

```

.P .T .NEW
.R .E .DATA
.O .R .
. . .
. . .
. . .
. . .
. . .
. . .

```





603  
+  
+  
+  
+  
+  
++

. ESTABLISH ALARM  
. ESTABLISH ALARM  
. IF NO SOLUTION  
. CAN BE REACHED

.N .A  
.C .L  
. .A  
.A .R  
.L .N  
.A  
.R  
.M

#160

POSS  
HOLD .  
.....  
SNAP .

FLASH VERB-  
NCUN TO RE-  
QUEST RESPON-  
SE AND DIS-  
PLAY ALARM  
CODE CC611;  
V05N09  
R1-XXXXX  
R2-XXXXX  
R3-XXXXX

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

.N .Y.

#170

#180

IS IT POSSIBLE  
THAT READJUST-  
MENT OF TIG  
(CDH) MIGHT  
PROVIDE A SOL-  
UTION? DO I  
WISH TO ATT-  
EMPT TO READ-  
JUST TIG(CDH)?

.N .Y.

#190

WAIT FOR KEY-  
BOARD ENTRY

KEY IN RE-  
CYCLE  
V32E

#200

#210

DO I WISH TO  
ATTEMPT TO DE-  
FINE CDH  
MANEUVER ANY-  
WAY, REALIZING  
THAT DELTA T  
(CDH/TPI) AND  
DELTA T (TPI/  
TPI) ARE NOT  
ACCURATE?  
(NOTE: SEE DE-  
FINITION OF  
THE DELTA  
TIMES IN LGC  
LOGIC COLUMN  
DISPLAY OF  
N75 BELOW).

#220

.Y N.

#230

TERMINATE  
FLASH UPON  
RECEIPT OF  
PROCEED, RE-  
CYCLE OR TER-  
MINATE

KEY IN  
PROCEED

KEY IN  
TERMINATE  
V34 E

#240

.P .T .R  
.R .E .E  
.D .R .C  
.C .M .Y  
.E .I .C  
.E .N .L  
.D .A .E  
.T  
.E

GO TO  
"A"  
BELOW

#250

GO TO

605

"A"  
BELOW

IS FINAL FLAG  
SET?

.N . Y.

SET UPDATE  
FLAG

#260

#270

HOLD .  
.....  
SNAP .

FLASH VERB-NOUN  
TO REQUEST RES-  
PCASE AND DISPLAY  
DELTA ALT (CDH),  
DELTA T(CDH/TPI)  
AND DELTA T(TPI/  
TPI);  
V06 N75  
R1-DELTA ALT  
(CDH)  
R2-DELTA T(CDH/  
TPI)  
R3-DELTA T(TPI/  
TPI)

MONITOR DSKY:  
OBSERVE VERB-  
NOUN FLASH TO RE-  
QUEST RESPONSE  
AND DISPLAY OF  
DELTA ALT (CDH)  
DELTA T (CDH/TPI)  
AND DELTA T (TPI/  
TPI).

#280

#290

DELTA ALT(CDH) -  
THE ALTITUDE BE-  
TWEEN THE ACTIVE  
AND PASSIVE VE-  
HICLE ORBITS AT  
TIG(CDH). SIGN IS  
+ WHEN THE ACTIVE

#300

. VEHICLE IS BELOW  
. THE PASSIVE  
. VEHICLE. IN NAU-  
. TICAL MILES TO  
. NEAREST .1 NP.

. DELTA T(CDH/TPI)-  
. TIG(TPI) AS DE-  
. FINED BY THIS  
. PROGRAM MINUS  
. TIG(CDH). COM-  
. PUTED IN HRS,  
. MINS, AND SECS OF  
. WHICH ONLY THE  
. MINS AND SECS  
. ARE DISPLAYED. TO  
. NEAREST SEC.

. DELTA T(TPI/TPI)-  
. TIG(TPI) AS DE-  
. FINED BY THIS  
. PROGRAM MINUS TIG  
. (TPI) AS DEFINED  
. EARLIER BY P72.  
. COMPLETED IN HRS,  
. MINS, AND SECS OF  
. WHICH ONLY THE  
. MINS AND SECS ARE  
. DISPLAYED. TO  
. NEAREST SEC.  
. (NOTE: R2 AND R3  
. ARE MODULARIZED  
. TO THE HOUR, I.E.  
. 63 MINS 22 SECS  
. IS DISPLAYED AS  
. C3B22)

#310

#320

#330

#340

-----  
. RECORD THESE  
. VALUES FOR FUTURE  
. TRANSMISSION TO  
. THE CSM.  
-----

606

607

#350

WAIT FOR KEYBOARD  
ENTRY

KEY IN PROCEED

TERMINATE FLASH  
UPON RECEIPT OF  
PROCEED, RECYCLE,  
OR TERMINATE

.P .T .R  
.R .E .E  
.O .R .C  
.C .M .Y  
.E .I .C  
.E .N .L  
.D .A .E  
. .T .  
. .E .

#360

#370

GO TO  
"A"  
BELOW

#380

HOLD  
.....  
SNAP .

FLASH VERB-NOUN  
TO REQUEST RES-  
PONSE AND DISPLAY  
CALCULATED COM-  
PONENTS OF DELTA  
V(LV) FOR CDH;  
V06 N81  
R1-DELTA VX(LV)  
R2-DELTA VY(LV)  
R3-DELTA VZ(LV)

MONITOR DSKY:  
OBSERVE VERB-  
NOUN FLASH TO  
REQUEST RE-  
SPONSE AND DIS-  
PLAY OF DELTA  
V (LV) FOR CDH

#390

DELTA VX(LV) -  
COMPONENT OF IM-  
PULSIVE DELTA V

AM I SATISFIED  
WITH THESE

AT TIG(CDH) ALONG  
(RXV)XR. IN FPS  
TO NEAREST .1  
FPS.

DELTA VY(LV) -  
COMPONENT OF IM-  
PULSIVE DELTA V  
AT TIG(CDH) ALONG  
VXR. IN FPS TO  
NEAREST .1 FPS.

DELTA VZ(LV) -  
COMPONENT OF IM-  
PULSIVE DELTA V  
AT TIG(CDH) ALONG  
-R. IN FPS TO  
NEAREST .1 FPS

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

-----  
WAIT FOR KEYBOARD  
ENTRY

VALUES?  
(NOTE: CREW HAS  
THE OPTION AT  
THIS TIME TO  
REDEFINE THE  
DELTA V (LV)  
COMPONENTS FOR  
THE SUBSEQUENT  
THRUSTING MAN-  
EUVER. THIS  
CAPABILITY WILL  
NORMALLY BE  
EXERCISED TO  
CORRECT OUT-OF-  
PLANENESS BY  
FIRST SELECTING  
THE RENDEZVOUS  
OUT-OF-PLANE  
DISPLAY ROUTINE  
(R36)(V90E) AND  
THEN MODIFYING  
DELTA VY (LV).  
HOWEVER IT MUST  
BE REMEMBERED  
THAT THE R36  
CALCULATION IS  
BASED UPON AN  
ACTIVE LM.

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

KEY IN V25E  
AND LOAD DE-  
SIRED DELTA  
V VALUES

-----  
RECORD THESE  
VALUES FOR FUTURE

#400

#410

#420

#430

#440

608

TRANSMISSION TO  
THE CSM.

KEY IN PROCEED

#450

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

.P .T .NEW  
.R .E .DATA  
.D .R  
-----  
.C .M STORE DATA  
.E .I  
-----  
.E .N  
.D .A  
. .T  
. .E

#460

GO TO  
"A"  
BELOW

#470

IS FINAL FLAG SET?

.N .Y  
. .  
.

SET MGA DISPLAY  
IN R3 (BELGW)  
= -CCCC1.

#480

SET MGA DISPLAY  
IN R3 (BELGW) =

#490

-00002.

HOLD . FLASH VERB-NOUN TO  
..... REQUEST RESPONSE AND  
MON . DISPLAY M, TFI AND  
MGA;

V16N45  
R1-M  
R2-TFI  
R3-MGA

M - THE NUMBER OF  
MARKS MADE SINCE THE  
RR TRACKING MARK  
COUNTER WAS ZEROED  
(SEE ASSUMPTION 6  
OF P20)

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

THE MIDDLE GIMBAL  
ANGLE DISPLAY IS NOT  
PERTINENT TO THIS  
PROGRAM. THEREFORE:

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

(B) ON THE LAST  
PASS THE VALUE IS  
-00002.

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

WAS THIS THE LAST  
PASS THROUGH THE  
PROGRAM?

.Y N.

DO I WISH TO  
TERMINATE THE  
MARK PROCESS AND  
DO THE FINAL PASS  
THROUGH THE  
PROGRAM?

.Y N.

#500

#510

#520

#530

#540

610



WAIT FOR KEYBOARD  
ENTRY

KEY IN PROCEED.

TERMINATE FLASH UPON  
RECEIPT OF PROCEED,  
TERMINATE, OR  
RECYCLE

KEY IN RECYCLE  
V32E

#550

.P .T .R  
.R .E .E  
.D .R .C  
.C .M .Y  
.E .I .C  
.E .N .L  
.D .A .E  
. .T .  
. .E .

#560

GC TC  
"AM"  
BELOW

WAS THIS THE LAST  
PASS THROUGH THE  
PROGRAM?

#570

IS THE FINAL FLAG  
SET?

.Y .N

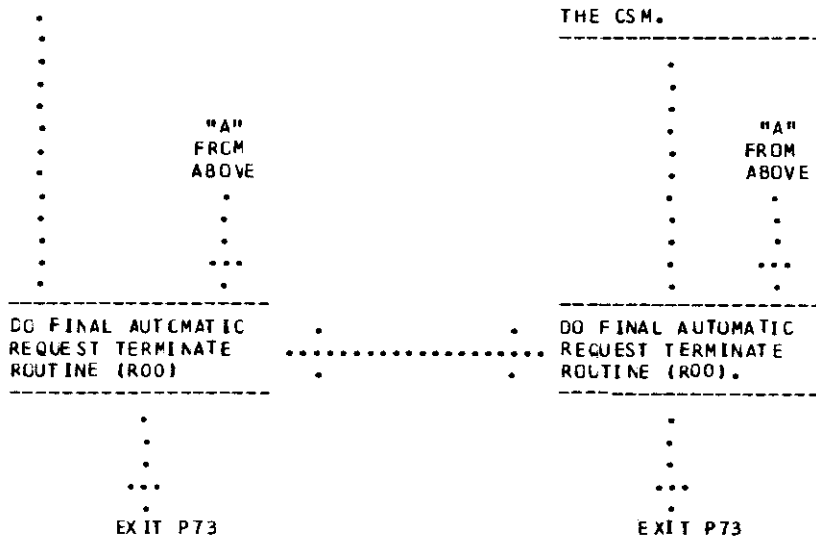
.Y N.

#580

SET THE FINAL  
FLAG

#590

TRANSMIT ALL MANEU-  
VER PARAMETERS TC



#600

#610

CHANGE CONTROL NOTES

LOGIC REV 01 PCR 540,623  
REV 02 PCR 752, EDITORIAL  
REV 03 ECITGRIAL

612



.PROGRAM  
.SELECTION

-----  
START CSM TRANSFER  
PHASE INITIATION  
(TPI) TARGETING  
PROGRAM (P74)  
DISPLAY P74

-----  
KEY IN CSM TRANSFER  
PHASE INITIATION  
(TPI) TARGETING  
PROGRAM (P74)  
V37E 74E  
-----

#10

-----  
MONITOR DSKY:  
OBSERVE DISPLAY OF  
P74  
-----

#20

-----  
RE SET ACTIVE VEHICLE  
FLAG  
-----

#30

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

#40

-----  
SET TRACK FLAG  
-----

#50

614

615

HOLD . FLASH VERB-NCUN TC  
 ..... REQUEST RESPONSE AND  
 SNAP . DISPLAY STORED TIG  
 (TPI) CALCULATED  
 FROM PREVIOUS  
 PROGRAMS:  
 VC6 N37  
 R1-TIG (TPI)-HRS  
 R2-TIG (TPI)-MIN  
 R3-TIG (TPI)-SEC  
  
 TIG(TPI)-TIME OF TPI  
 IGNITION (GET).  
 IN HRS, MIN, SEC  
 TO NEAREST .01 SEC.

MONITOR DSKY:  
 OBSERVE VERB-NCUN  
 FLASH TO REQUEST  
 RESPONSE AND DISPLAY  
 OF TIG (TPI)  
 STORED FROM PREVIOUS  
 PROGRAMS.

#60

#70

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.)

#80

.Y N.  
 .  
 .

RECORD THIS  
 VALUE FOR FUTURE  
 TRANSMISSION TO  
 THE CSM.

#90

WAIT FOR KEYBOARD  
 ENTRY

KEY IN PROCEED

#100

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

-----  
KEY IN V25E AND  
LOAD THE DESIRED  
TIG  
-----

-----  
.P .T .NEW  
.R .E .DATA  
.C .R  
.C .M  
.E .I STORE DATA  
.E .N  
.D .A  
. .T  
. .E  
. .  
. .  
. .  
GO TO  
"A"  
BELCW  
-----

-----  
DEFINE CENTANG = 130  
DEGREES FOR DISPLAY  
BELCW  
-----

-----  
SET N=0  
-----

HOLD .  
.....  
SNAP .

-----  
FLASH VERB-NCUN  
TO REQUEST RES-  
PCASE AND DISPLAY  
OF N, STICRED E, AND  
-----

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

#110

#120

#130

#140

616

417

CENTANG:  
VCE N55  
R1-N  
R2-E  
R3-CENTANG

OF N, STORED E AND  
CENT ANG:

#150

++  
+02  
+EDIT  
++

N-THE FLTURE AP-  
SIDAL CROSSING  
(AFCCENTER OR  
PERICENTER) OF THE  
ACTIVE VEHICLE AT  
WHICH TIG(CCH)  
SHOULD OCCUR.  
00001=FIRST  
00002=SECCND  
ETC.

#160

(NOTE:  
IN THIS CASE, N IS  
THE NUMBER OF TAR-  
GET OFFSETS. WHEN  
N IS ZERO, USE  
CONIC INTEGRATION  
TO DETERMINE THE  
INITIAL POSITION  
AND VELOCITY OF  
THE TARGET AT IN-  
TERCEPT TIME. WHEN  
N IS NON-ZERO, USE  
PRECISION INTEGRA-  
TION AND THE IN-  
DICATED NUMBER OF  
OFFSETS.)

#170

00000-KEPLER  
CONIC IN-  
TEGRATION  
WITH NO  
TARGET  
OFFSET

#180

00001-PRECISION  
INTEGRA-  
TION WITH  
ONE TARGET  
OFFSET

#190

00002-PRECISION  
INTEGRATION

WITH TWC  
TARGET  
OFFSETS

ETC.)

E-ELEVATION ANGLE  
BETWEEN THE CSM/  
LM LCS AND THE  
CSM LOCAL HORI-  
ZONTAL AT TIG  
(TPI) REFERENCED  
TO THE DIRECTION  
OF FLIGHT (SEE  
SECTION 5.4.2 OF  
R567 FOR DETAILED  
DESCRIPTION). IN  
DEGREES TO NEAREST  
.01 DEGREE.

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

DO I WISH THE LGC TO  
CALCULATE E?

.N .Y

#200

#210

#220

#230

WAIT FOR KEYBOARD  
ENTRY

KEY IN V21E AND  
LOAD N AS DE-  
SIRED IN R1, AND  
KEY IN V22E AND  
LOAD +00000 IN  
R2, AND KEY IN  
V23E AND LOAD  
CENTANG AS  
DESIRED IN  
R3.

#240

618



#250

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

.Y            N.

#260

-----  
KEY IN V21E  
AND LOAD N AS  
DESIRED IN  
R1, AND  
KEY IN V22E  
AND LOAD  
E AS DESIRED  
IN R2, AND  
KEY IN V23E  
AND LOAD  
CENTANG  
AS DESIRED  
IN R3.  
-----

#270

#280

-----  
RECORD THIS VALUE  
FOR FUTURE TRANS-  
MISSION TO THE CSM.  
-----

#290

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

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

.P    .T        .NEW  
.R    .E        .DATA

++  
+02  
+EDIT  
++



#350

-----  
IS CCMP E FLAG  
SET?  
-----

.Y .N

-----  
COMPUTE E FOR  
SPECIFIED  
TIG(TPI)  
-----

#360

POSS  
HOLD  
-----  
SNAP

-----  
FLASH VERB-  
NOUN TO RE-  
QUEST RESPONSE  
AND DISPLAY  
CALCULATED E;  
VO6 N55  
R1-N  
R2-E  
R3-CENT ANG  
-----

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

#370

++  
+02  
+EDIT  
++

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

-----  
RECORD THIS  
VALUE FOR FU-  
TURE TRANS-  
MISSION TO  
THE CSM.  
-----

#380

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

-----  
KEY IN PRO-  
CEED.  
-----

-----  
TERMINATE  
FLASH UPON  
-----

#390

RECEIPT OF  
PROCEED, RECY-  
CLE, OR TERMI-  
NATE

#400

.T .P R.  
.E .R E.  
.R .O C.  
.M .C Y.  
.I .E C.  
.N .E L.  
.A .C E.  
.T  
.E

#410

GC TO  
"AM"  
BELOW

#420

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

#430

.N .A  
.C .L  
.A .A  
.A .R  
.L .M  
.A  
.R

POSS  
HOLD  
-----  
SNAP

M FLASH VERB-  
NOON TO  
REQUEST RE-  
SPCNSE AND  
DISPLAY  
ALARM CODE:  
V05NCS  
R1-  
R2-  
R3-

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

#440

.Y N.

EXPECTED  
ALARM  
CODE FOR  
THIS CON-  
DITION IS  
00611.

#450

WAIT FOR  
KEYBOARD  
ENTRY

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

#460

TERMINATE  
FLASH UPON  
RECEIPT OF  
PROCEED,  
RECYCLE, OR  
TERMINATE

.T .P .R  
.E .R .E  
.R .O .C  
.M .C .Y  
.I .E .C  
.N .E .L  
.A .D .E  
.T .  
.E .

#470

GC TC  
"A"  
BELCH

#480

POSS  
HOLD  
.....  
SNAP

FLASH VERB-  
NCUN TC RE-  
QUEST RESPONSE  
AND DISPLAY

MONITOR DSKY:  
OB SERVE  
VERB-NOUN  
FLASH TC RE-

#490

CALCULATED  
TIG(TPI):  
V06N37  
R1-TIG(TPI)  
-HRS  
R2-TIG(TPI)  
-MINS  
R3-TIG(TPI)  
-SECS.

QUEST RE-  
SPONSE AND  
DISPLAY OF  
CALCULATED  
TIG(TPI).

#500

(NOTE: FOR DE-  
FINITION SEE  
ABCVE).

RECORD THIS  
VALUE FOR  
FUTURE TRANS-  
MISSION  
TO THE CSM.

#510

WAIT FOR KEY-  
BOARD ENTRY

KEY IN  
PROCEED

TERMINATE  
FLASH UPON  
RECEIPT OF  
PROCEED, RE-  
CYCLE, OR  
TERMINATE

#520

.P .T .R  
.R .E .E  
.D .R .C  
.C .M .Y  
.E .I .C  
.E .N .L  
.D .A .E  
.T  
.E

#530

GC TO  
"A"  
BELCW

#540

BASED ON STORED  
TARGET PARAMETERS

624

625

COMPLTE THE PARA-  
METERS ASSOCIATED  
WITH TPI AND  
TPF AS DESCRIBED  
IN SECTION  
5.4.2.4 OF R567.

#550

RESET EXTERNAL  
DELTA V FLAG

#560

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)

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

#570

PER ALT-ALTITUDE  
OF POST TPI PERI-  
GEE 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). IN NAUTI-  
CAL MILES TO

#580

#590

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

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 FOR FUT-  
URE TRANSMISSION  
TO THE CSM.

#600

WAIT FOR KEYBOARD  
ENTRY

KEY IN PROCEED

#610

TERMINATE FLASH  
UPON RECEIPT OF  
PROCEED, RECYCLE,  
OR TERMINATE

.P .T .R  
.R .E .E  
.C .R .C  
.C .M .Y  
.E .I .C  
.E .N .L  
.D .A .E  
. .T .  
. .E .

#620

GO TO  
"A"  
BELOW

#630

IS THE FINAL FLAG  
SET?

.N Y.

IS THIS THE  
FINAL PASS  
THROUGH THIS  
PROGRAM?

.Y N.

#640

626



627

SET UPDATE  
FLAG

#650

RESET NEW  
TARGET FLAG

#660

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)  
  
DELTA VX(LV)-  
COMPONENT OF  
IMPLSIVE  
DELTA V AT  
TIG(TPI) ALONG  
(RXV)XR. IN

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

#670

#680

AM I SATIS-  
FIED WITH  
THESE VALUES?  
(NOTE: CREW  
HAS THE OP-  
TION AT THIS  
TIME TO RE-  
DEFINE THE

#690

FPS TO NEAREST  
.1 FPS.

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

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

WHERE R IS THE  
CSM GEOCENTRIC  
(EARTH CRBIT)  
OR SELENOGEN-  
TRIC (LUNAR  
ORBIT) RADII  
VECTOR AND V  
IS THE CSM IN-  
ERTIAL VELO-  
CITY VECTOR AT  
TIG(TPI).

WAIT FOR KEY-  
BOARD ENTRY

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  
RENDEZVOUS  
OUT-OF-PLANE  
DISPLAY ROU-  
TINE (R36)  
(V9CE), AND  
THEN MODIFY-  
ING DELTA  
VY(LV).  
HOWEVER IT  
MUST BE RE-  
MEMBERED THAT  
THE R36  
CALCULATION  
IS BASED UPON  
AN ACTIVE LM).

.Y N.

KEY IN V25E  
AND LOAD  
THE DESIRED  
DELTA V  
VALUES.

RECORD THESE  
VALUES FOR FU-

#700

#710

#720

#730

#740

628



#800

-----  
SET NEW  
TARGET  
FLAG  
-----

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

.N            Y.

-----  
CALCULATE  
NEW TAR-  
GET VEC-  
TOR BASED  
ON NEWLY  
LOADED  
DELTA  
V(LV) FOR  
TPI.  
-----

#810

#820

#830

HOLD .  
.....  
SNAP .

-----  
FLASH VERB-NOUN  
TO REQUEST RE-  
SPACE AND DIS-  
PLAY DELTA V(LCS)  
FOR TPI;  
-----

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

VC6N59  
 R1-DELTA V1(LOS).  
 R2-DELTA V2(LCS).  
 R3-DELTA V3(LOS).

DELTA V (LOS).

#840

(NOTE: FOR DEFINITION SEE SECTION 5.4.2.4 OF R567)

RECORD THESE VALUES FOR FUTURE TRANSMISSION TO THE CSM.

DELTA V(LCS)-EACH COMPONENT IN FPS TO NEAREST .1 FPS.

#850

WAIT FOR KEYBOARD ENTRY

KEY IN PROCEED

#860

TERMINATE FLASH UPON RECEIPT OF PROCEED, RECYCLE, OR TERMINATE

.P	.T	.R
.R	.E	.E
.G	.R	.C
.C	.M	.Y
.E	.I	.C
.E	.N	.L
.D	.A	.E
.	.T	.
.	.E	.....

#870

GO TO "A" BELOW

#880

IS THE FINAL FLAG SET?

.N .Y

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

#890

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

"B"  
FROM  
ABOVE

#900

HOLD . FLASH VERB-NOUN TO  
..... REQUEST RESPONSE AND  
MON . DISPLAY OF M, TFI  
AND MGA;  
V16M45  
R1 - M  
R2 - TFI  
R3 - MGA

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

#910

M-THE NUMBER OF  
MARKS MADE SINCE THE  
RR TRACKING MARK  
COUNTER WAS ZEROED  
(SEE ASSUMPTION 6  
OF P20.)

#920

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

WAS THIS THE LAST  
PASS THROUGH THE  
PROGRAM?

.Y N.

#930

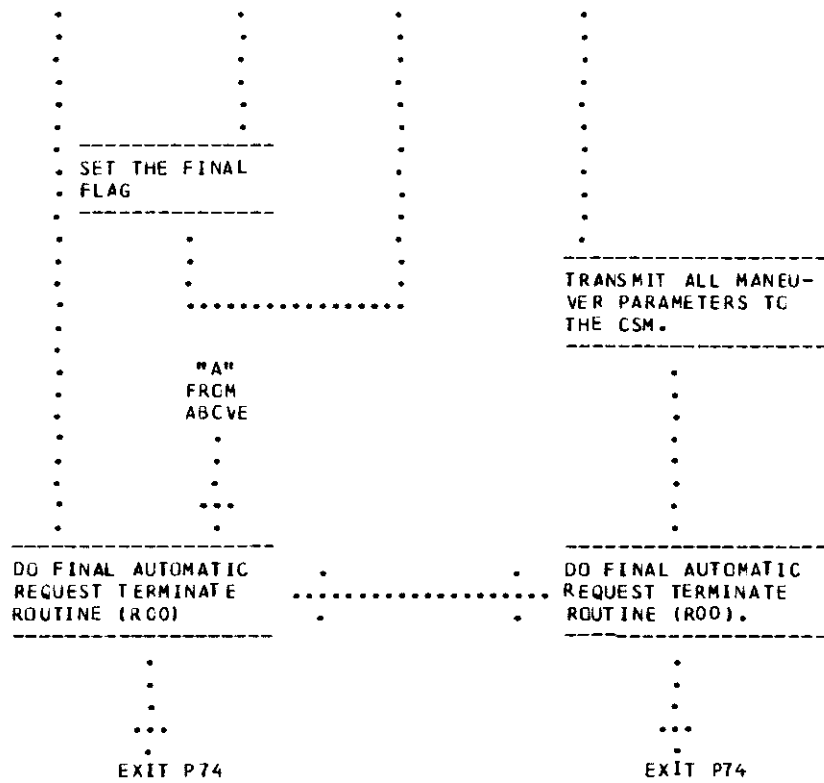
++  
+C2  
+EDIT

MGA-THE MIDDLE GIMBAL  
ANGLE IS NOT PERTIN-  
ENT TO THIS PROGRAM.

DO I WISH TO  
TERMINATE THE

632





#990

#1000

#1010

CHANGE CONTROL NOTES

REV 01 PCR 627  
REV 00(LUM 1A) PCR 268  
REV 01(LUM 1B) PCR 812.2  
REV 02 EDITORIAL

634





MONITOR DSKY  
OBSERVE DISPLAY OF  
P75

#20

RESET ACTIVE VEHICLE  
FLAG

#30

SET UPDATE FLAG

#40

SET TRACK FLAG

RESET FINAL FLAG

#50

RESET UPDATE FLAG

#60

DEFINE TIG(MID)=  
T + "FTIGINC"

636

```

. MIN.
. (NOTE: THE VALUE
. "PTIGINC" IS IN
. ERASABLE STORAGE,
. HAVING BEEN LOAD-
. ED PRIOR TO
. LAUNCH OR BY P27)
-----
.
.
.

```

#70

```

. EXTRAPOLATE CSM
. STATE VECTOR TO
. TIG(MID)
-----
.
.
.

```

#80

```

. EXTRAPCLATE LM
. STATE VECTOR TO
. T(INT) (NOTE:
. REFER ASSUMPTION
. (3) ABOVE).
-----
.
.
.

```

#90

```

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

```

#100

```

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

```

```

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

```

.N      Y.

```

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

```

.Y      N.

#110

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

#120

-----  
RESET NEW  
TARGET FLAG  
-----

#130

POSS  
HOLD .  
.....  
SNAP .

-----  
FLASH VERB-  
NOUN TO REQ-  
UEST RESPONSE  
AND DISPLAY  
CALCULATED  
COMPONENTS OF  
DELTA V(LV)  
FOR TPM;  
VC6N81  
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  
DELTA V(LV)  
FOR TPM  
-----

#140

DELTA VX(LV)-  
COMPONENT OF  
IMPULSIVE  
DELTA V AT  
TIG(TPM)  
ALCNG (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 REDEFINE  
THE DELTA V  
(LV) COM-  
PONENTS FOR  
THE SUBSE-

#150

DELTA VY(LV)-  
COMPONENT OF

#160

638

. IMPULSIVE  
 . DELTA V AT  
 . TIG(TPM)  
 . ALONG VXR. IN  
 . FPS TO NEAR-  
 . EST .1 FPS  
  
 . DELTA VZ(LV)-  
 . COMPONENT CF  
 . IMPULSIVE  
 . DELTA V AT  
 . TIG(TPM)  
 . ALONG -R. IN  
 . FPS TO NEAR-  
 . EST .1 FPS  
  
 . WHERE R IS  
 . THE CSM GEO-  
 . CENTRIC  
 . (EARTH ORBIT)  
 . OR SELENO-  
 . CENTRIC  
 . (LUNAR ORBIT)  
 . RADIUS VECTOR  
 . AND V IS THE  
 . CSM INERTIAL  
 . VELOCITY  
 . VECTOR AT  
 . TIG(TPM).

.  
 .  
 .  
 .

.-----  
 . WAIT FOR KEY-  
 . BOARD ENTRY

. QUENT  
 . THRUSTING  
 . MANEUVER.  
 . THIS CAPA-  
 . BILITY WILL  
 . NORMALLY BE  
 . EXERCISED  
 . TO CORRECT  
 . OUT-OF-  
 . PLANENESS  
 . BY FIRST SE-  
 . LECTING THE  
 . RENDEZVOUS  
 . OUT-OF-  
 . PLANE DIS-  
 . PLAY ROU-  
 . TINE (R36)  
 . (V90E), AND  
 . THEN MODI-  
 . FYING DELTA  
 . VV(LV).  
 . HOWEVER IT  
 . MUST BE RE-  
 . MEMBERED  
 . THAT THE  
 . R36 CALCU-  
 . LATION IS  
 . BASED UPON  
 . AN ACTIVE  
 . LM.

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

.-----  
 . KEY IN  
 . V25E  
 . AND  
 . LOAD  
 . THE DE-  
 . Sired  
 . DELTA V  
 . VALUES.

.  
 .  
 .  
 .  
 .-----

. RECORD  
 . THESE

#170

#180

#190

#200

#210

643

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

#370

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

#380

HOLD . FLASH VERB-NOUN TO  
..... REQUEST RESPONSE AND  
MON . DISPLAY OF M, TFI  
AND MGA;  
V16N45  
R1-M  
R2-TFI  
R3-MGA

-----  
MONITOR DSKY:  
CBS ERVE VERB-NOUN  
FLASH TO REQUEST  
RESPONSE AND DISPLAY  
OF M, TFI AND MGA.  
(NOTE: ON FIRST PASS  
THROUGH, TFI WILL BE  
TIME FROM PREVICUS  
TIG COMPUTED BY  
P74).  
-----

#390

M-THE NUMBER OF  
MARKS MADE SINCE THE  
RR TRACKING MARK  
COUNTER WAS ZEROED  
(SEE ASSUMPTION 6 OF  
P20.)

#400

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

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

#410

MGA-THE MIDDLE GIM-  
BAL ANGLE DISPLAY IS  
NOT PERTINENT TO

.Y . N.  
.  
.

-----  
DO I WISH TO  
TERMINATE THE  
-----

VALUES FOR  
FUTURE  
TRANSMISS-  
ION TO THE  
CSM.

#220

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

KEY IN  
PROCEED

#230

.P .T .NEW  
.R .E .DATA  
.D .R .  
.C .M .  
.E .I -----  
.E .N STORE  
.D .A DATA  
.T -----  
.E .

#240

GO TO  
"A"  
BELOW

#250

HAS NEW DATA  
BEEN LOADED?  
(IS THE SUM  
OF ALL CHANG-  
ES TO ALL  
COMPONENTS,  
TREATING MOST  
SIGNIFICANT  
AND LEAST  
SIGNIFICANT  
HALVES AS  
SEPARATE

#260

640





TPM:  
V06N59  
R1-DELTA  
V1(LCS)  
R2-DELTA  
V2(LCS)  
R3-DELTA  
V3(LCS)

AND DISPLAY OF  
DELTA V (LOS).

#320

IN FPS TO NEAREST  
.1 FPS  
(NOTE: FOR DEFIN-  
ITION SEE SECTION  
5.4.2.5 OF R567).

RECORD THESE  
VALUES FOR FUTURE  
TRANSMISSION TO  
THE CSM.  
(NOTE: UNLIKE  
DELTA V(LV) FOR  
TPM ABOVE, THESE  
VALUES CANNOT BE  
WRITTEN OVER.)

#330

++  
+03  
+EDIT  
++

WAIT FOR KEYBOARD  
ENTRY  
TERMINATE FLASH  
UPON RECEIPT OF  
PROCEED.

KEY IN PROCEED

#340

.P .T .R  
.R .E .E  
.O .R .C  
.C .M .Y  
.E .I .C  
.E .N .L  
.D .A .E  
. .T .  
. .E .

#350

GO TO  
"A"  
BELOW

#360

IS THE FINAL FLAG  
SET?

.N .Y.

6+2

THIS PROGRAM.  
THEREFORE:

(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 THE VALUE IS  
-00002.

MARK PROCESS AND  
DO THE FINAL PASS  
THROUGH THE PRO-  
GRAM?

.Y N.

#420

#430

WAIT FOR KEY BOARD  
ENTRY

KEY IN PROCEED.

#440

TERMINATE FLASH UPON  
RECEIPT OF PROCEED,  
TERMINATE, OR RECY-  
CLE

KEY IN RECYCLE  
V32E

.P .T .R  
.R .E .E  
.O .R .C  
.C .M .Y  
.E .I .C  
.E .N .L  
.D .A .E  
. .T .  
. .E .

WAS THIS THE LAST  
PASS THROUGH THE  
PROGRAM?

.Y N.

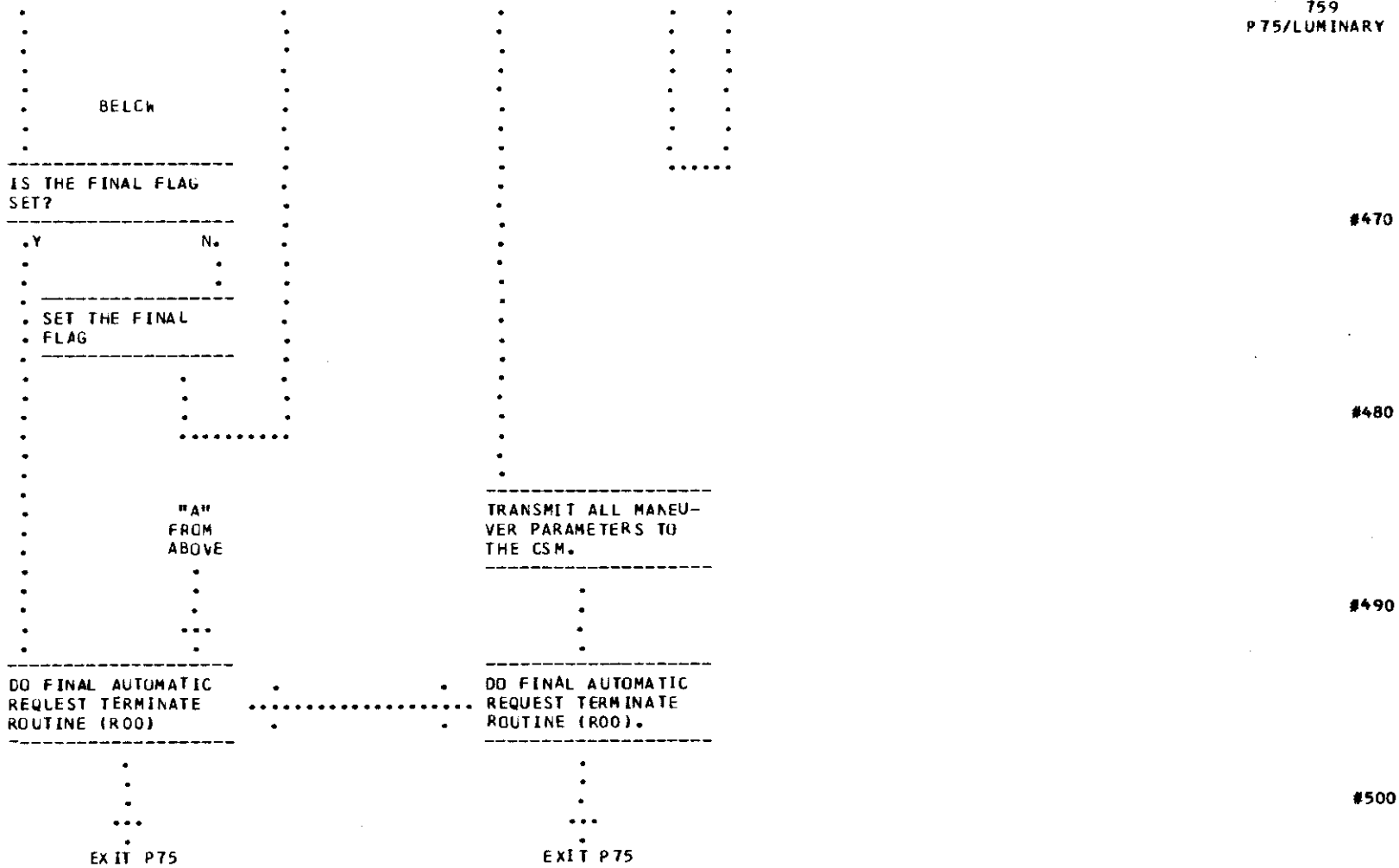
#450

#460

GC TC  
"A"

644

645



CHANGE CONTROL NOTES

LOGIC REV 01 PCN 502,627  
REV 02(LUM 1B) PCR 812.2, EDITORIAL  
REV 03 ECITCRIAL

THIS PAGE INTENTIONALLY LEFT BLANK

647

761

## TARGET DELTA V PROGRAM (P76)

REV 03 12/03/69

PURPOSE: (1) TO PROVIDE A MEANS OF NOTIFYING THE LGC THAT THE CSM HAS CHANGED ITS ORBITAL PARAMETERS BY THE EXECUTION OF A THRUSTING MANEUVER.

(2) TO PROVIDE TO THE LGC THE DELTA V APPLIED TO THE CSM TO ENABLE AN UPDATING OF THE CSM STATE VECTOR.

ASSUMPTIONS: (1) THE LM CREW HAS THE DELTA V TO BE APPLIED TO THE CSM IN LOCAL VERTICAL AXES AT A SPECIFIED TIG. THESE VALUES ARE DISPLAYED PRIOR TO TIG BY THE THRUSTING PROGRAMS (P40 AND P41 IN THE CMC). NO PROVISION IS MADE IN THESE THRUSTING PROGRAMS TO DISPLAY THE RESULTS OF THE MANEUVER IN A FORM USABLE BY THIS PROGRAM. IF THE BURN IS NOT NOMINAL AND THIS DELTA V IS NOT AS SPECIFIED OR IF TIG IS NOT AS ORIGINALLY SPECIFIED, CONSULT BACKUP PROCEDURES.

(2) IF THE RENDEZVOUS NAVIGATION PROGRAM (P20) OR THE LUNAR SURFACE NAVIGATION PROGRAM (P22) IS IN PROCESS THIS PROGRAM MUST BE SELECTED PRIOR TO THE CSM THRUSTING MANEUVER. THIS CAN BE ASSURED BY VOICE COMMUNICATION BETWEEN THE LM AND CSM.

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

PROG  
CONT

LGC

GROUND

CREW

.CREW  
.PROGRAM  
.SELECTION

...

.

-----  
START TARGET  
DELTA V PROGRAM  
(P76).  
DISPLAY P76  
-----.  
.....  
.-----  
KEY IN TARGET DELTA  
V PROGRAM (P76).  
V37E76E  
-----

#10

.  
.-----  
SET TRACK FLAG  
-----.  
.  
.  
.  
.  
.  
.  
.  
.  
.  
.  
.  
.  
.  
.  
..  
.  
.  
.  
.  
.  
.  
.  
.  
.  
.  
.  
.  
.  
.  
.

#20

```

HOLD . FLASH VERB-NOUN
..... TO REQUEST RESPONSE
SNAP . AND DISPLAY STORED
TIG(OV):
      V06A33
      R1-TIG(OV)-HRS
      R2-TIG(OV)-MINS
      R3-TIG(OV)-SECS

```

```

TIG(OV)-TIME OF
IGNITION (GET) FOR
DELTA V(OV). IN HRS,
MINS, SEC TO NEAREST
.01 SEC.

```

```

WAIT FOR KEYBOARD
ENTRY.

```

```

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

```

```

.P .T NEW
.R .E DATA
.D .R
.C .M
.E .I
.E .N STORE DATA
.D .A
  .T
  .E
  ...
  .
  .
  .
  .
  .
  .
  .
  .
  .
  .
  .

```

```

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

```

```

IS THE VALUE
DISPLAYED THE
CORRECT TIME AT
WHICH THE CSM EXECU-
TED THE MANEUVER?

```

```

.Y .N
.
.
```

```

KEY IN PROCEED

```

```

KEY IN V25 E
AND LOAD THE
CORRECT TIG(OV).

```

#30

#40

#50

#60

#70

649

GO TO  
"A"  
BELOW

#80

HOLD . FLASH VERB-NOUN  
..... TO REQUEST RESPONSE  
SNAP . AND DISPLAY THREE  
STORED COMPONENTS OF  
DELTA V(OV).  
VC6N84  
R1-DELTA VX(OV)  
R2-DELTA VY(OV)  
R3-DELTA VZ(OV)

MONITOR DSKY  
OBSERVE VERB-NOUN  
FLASH TO REQUEST  
RESPONSE AND DISPLAY  
OF THREE STORED  
COMPONENTS OF DELTA  
V APPLIED TO THE  
OTHER VEHICLE (OV)  
ALONG LOCAL VERTICAL  
AXES AT TIG(OV).

#90

DELTA VX(OV)-  
COMPONENT OF DELTA V  
APPLIED TO THE OTHER  
VEHICLE AT TIG(OV)  
ALONG (RXV)XR. IN  
FPS TO NEAREST .1  
FPS.

WAIT UNTIL THE CSM  
CREW HAS TRANSMITTED  
THE VALUES OF THE  
DELTA V TO BE AP-  
PLIED AND THE TIME  
OF IGNITION AND  
THE THRUSTING MAN-  
EUVER HAS BEEN  
SUCCESSFULLY COM-  
PLETED.

#100

DELTA VY(OV)-  
COMPONENT OF DELTA V  
APPLIED TO THE OTHER  
VEHICLE AT TIG(OV)  
ALONG VXR. IN FPS TO  
NEAREST .1 FPS.

#110

DELTA VZ(OV)-  
COMPONENT OF DELTA V  
APPLIED TO THE OTHER  
VEHICLE AT TIG(OV)  
ALONG -R. IN FPS TO  
NEAREST .1 FPS.

#120

WHERE R IS ECCEN-  
TRIC (EARTH ORBIT)  
OR SELENCENTRIC

(LUNAR ORBIT) RADIUS  
VECTOR AND V IS THE  
CSM INERTIAL VEL-  
OCITY VECTOR AT  
TIG(OV).

.  
.  
.

WAIT FOR KEYBOARD  
ENTRY

ARE THE VALUES  
DISPLAYED THE  
CORRECT ONE S  
EXECUTED BY THE CSM?

.Y .N

KEY IN  
PROCEED

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

KEY IN V25E  
AND LOAD THE  
CORRECT DELTA  
V(OV).

.P .T NEW .  
.R .E DATA .  
.D .R .  
.C .M .  
.E .I .  
.E .N STORE DATA  
.D .A .

GO TO  
"A"

#130

#140

#150

#160

#170

450





·  
·  
·  
·  
·  
-----  
DO FINAL AUTOMATIC  
REQUEST TERMINATE  
ROUTINE (ROO).  
-----

·  
.....  
·

·  
·  
·  
·  
·  
-----  
DO FINAL AUTOMATIC  
REQUEST TERMINATE  
ROUTINE (ROO).  
-----

#220

·  
·  
·  
·  
·  
EXIT P76

·  
·  
·  
·  
·  
EXIT P76

#230

CHANGE CONTROL NOTES

LOGIC REV C1 PCR 468  
REV 02 (LUM 1B) PCR 826.2  
REV 03 (LUM 1C) PCR 863.2

632

653

4.4.10 LUMINARY ROUTINESTITLE

R00 FINAL AUTOMATIC REQUEST TERMINATE  
R01 ERASABLE AND CHANNEL MODIFICATION  
R02 IML STATUS CHECK  
R03 CAP DATA LOAD  
R04 RR/LR SELF TEST  
R05 S-BAND ANTENNA  
R09 R10/R11/R12 SERVICE  
R10 LANDING ANALOG DISPLAYS  
R11 ABORT DISCRETES MONITOR  
R12 DESCENT STATE VECTOR UPDATE  
R13 LANDING ALTG MODES MONITOR  
R20 LR/RR READ  
R21 RR DESIGNATE  
R22 RR DATA READ  
R23 RR MANUAL ACQUISITION  
R24 RR SEARCH  
R25 RR MONITOR  
R26 LUNAR SURFACE RR PRE-DESIGNATE  
R29 POWERED FLIGHT RR DESIGNATE  
R30 ORBIT PARAMETER DISPLAY  
R31 RENDEZVUS PARAMETER DISPLAY

R33 LGC/CMC CLOCK SYNCHRONIZATION  
R36 RENDEZVOUS CUT-OFF-PLANE DISPLAY  
R40 DFS/APS THRUST FAIL  
R41 STATE VECTOR INTEGRATION (MIC TO AVE)  
R47 AGS INITIALIZATION  
R50 COARSE ALIGN  
R51 INFLIGHT FINE ALIGN  
R52 AUTO OPTICS POSITIONING  
R53 AOT MARK  
R54 SIGHTING DATA DISPLAY  
R55 GYRO TORQUING  
R56 TERMINATE TRACKING  
R57 MARKRUPT  
R58 CELESTIAL BODY DEFINITION  
R59 LUNAR SURFACE SIGHTING MARK  
R60 ATTITUDE MANEUVER  
R61 PREFERRED TRACKING ATTITUDE  
R62 CREW-DEFINED MANEUVER  
R63 RENDEZVOUS FINAL ATTITUDE  
R65 FINE PREFERRED TRACKING ATTITUDE  
R76 EXTENDED VERB INTERLOCK  
R77 LR SPURICUS TEST



++  
+03  
+EDIT  
+  
+  
+  
+  
+03  
++

-----  
WAIT FOR KEYBOARD  
ENTRY  
-----  
TERMINATE FLASH UPON  
RECEIPT OF XXE  
-----

-----  
KEY IN DESIRED  
PROGRAM:  
XXE  
-----

#40

-----  
RECEIVE V37EXXE  
TC REQUEST NEW  
PROGRAM.  
-----

-----  
KEY IN DESIRED  
PROGRAM  
V37EXXE  
-----

#50

-----  
"A"  
ENTRY FROM  
V96 WITH  
PROGRAM POC.  
SPECIFIED  
-----

#60

-----  
IS THE IML BEING  
INITIALIZED?  
-----

.N                    Y.

#70

-----  
IS THE NEW PRO-  
GRAM P70?  
-----

.N                    Y.

636

GO TO DPS  
ABORT PROGRAM  
(F70)

EXIT ROO

IS THE NEW PRO-  
GRAM P71?

.N Y.

GO TO APS  
ABORT PROGRAM  
(P 71)

EXIT ROO

IS THE NEW PRO-  
GRAM FCC?

.Y N.

IS THE NO-DO-  
VERB-37 FLAG  
SET?

.N Y.

TURN ON  
PROGRAM  
ALARM LIGHT  
AND STCRE

MONITOR DSKY:  
CCES PROGRAM  
ALARM LIGHT COME  
ON INDICATING

#80

#90

#100

#110

#120

#130

ALARM CODE  
C1520

ABNORMAL ITY?

EXIT  
RCC

.Y N.

#140

KEY IN VOSN09E  
TO DISPLAY  
ALARM CODE. EX-  
PECTED ALARM AT  
THIS TIME IS  
G1520 INDICATING:

(1) THE IMU IS  
BEING IN-  
ITIALIZED

#150

(2) A PROGRAM  
OTHER THAN  
POO HAS  
BEEN SEL-  
ECTED AND  
A CHANGE  
OF PROGRAM  
IS DIS-  
ALLOWED AT  
THIS TIME  
(SEE R47  
AND DES-  
CRIPTION  
OF STATE  
VECTOR IN-  
TEGRATION  
SECTION  
5.6.11 OF  
R567.)

#160

(3) PO6 HAS AL-  
READY SET  
THE NO-DO-  
VERB-37 FLAG.

#170

DOES THE NEW  
PROGRAM EXIST?

.Y N.

EXIT

#180



659

ROO

-----  
IS THE DESIRED PRO-  
GRAM P70 OR P71?  
-----

.Y                    N.  
.

-----  
GO TO DESIRED  
PROGRAM.  
-----

.....  
EXIT ROO

#190

#200

-----  
TURN ON  
OPERATOR  
ERROR LIGHT  
-----

.....  
EXIT  
ROO

-----  
MONITOR DSKY:  
DOES OPERATOR  
ERROR LIGHT COME  
ON INDICATING THAT  
I HAVE SELECTED A  
PROGRAM THAT DOES  
NOT EXIST?  
-----

.N                    Y.  
.

#210

-----  
IS V37 FLAG SET?  
-----

.N                    Y.  
.

-----  
RESET AVERAGE G  
FLAG  
-----

-----  
SET DRIFT FLAG  
-----

#220

#230

SET NO R29 FLAG

#240

RESET LANDING  
ANALOG DISPLAYS  
FLAG

RESET MUNFLAG

#250

RESET V37 FLAG

#260

WAIT FOR ANY INTE-  
GRATION IN PROCESS  
TO FINISH

RESET 3-AXIS FLAG

#270

SET LR BYPASS FLAG

#280

660

661

```

-----
RESET FOLLOWING
FLAGS ASSOCIATED
WITH R12;
VX INHIBIT, FIGATE,
NC LR READ, R12
X-AXIS OVERRIDE, LR
PERMIT, VELOCITY
DATA, NO 511, READ
VELOCITY, RANGE
DATA, LPOS2,
V FLASH, AND H FLASH
-----

```

```

++
+03
+EDIT
+03
++

```

#290

```

-----
RESET R04 FLAG
-----

```

#300

```

-----
RESET GIMBAL
LOCK FLAG
-----

```

#310

```

-----
RESET MUNFLAG
-----

```

```

++
+03
+893
+
+
+
+
+

```

```

-----
RESET ABORT TARGET-
ING FLAG
-----

```

#320

```

-----
RESET X-AXIS OVER-
RIDE INHIBIT FLAG
-----

```

```

+03
++

```

#330

IS NEW PROGRAM PC0?

.Y            N.  
.  
.  
.

RESET CONTINU-  
CUS DESIGNATE  
FLAG AND  
DESIGNATE FLAG

#340

RESET NO-DC-VERB-  
37 FLAG.

#350

RESET RENDEZVOUS,  
P25, AND IMUSE  
FLAGS.

#360

IS THE RENDEZ-  
VOUS OR P25 FLAG  
SET?

.Y            N.  
.  
.  
.  
.  
.  
.

#370

RESET IMUSE  
FLAG

#380

SET IDLE FLAG

667



"B"  
BELOW

IS THE PRESENT PRO-  
GRAM P22?

.N . Y.

IS THE NEW PRO-  
GRAM P22?

.N . Y.

RESET RENDEZVUS,  
P25, AND IMUSE  
FLAGS

IS THE NEW PROGRAM  
P20 OR P25?

.Y . N.

IS EITHER P20  
OR P25 PRESENT-  
LY IN PROGRESS  
(EITHER IN FORE-  
GROUND OR BACK-  
GROUND)?

.Y . N.

GO TJ

"B"  
BELOW

IS THE NEW PROGRAM  
P22?

.N . Y.

IS THE NEW PROGRAM  
P20 OR P25?

.Y . N.

IS EITHER P20  
OR P25 PRESENT-  
LY RUNNING  
(EITHER IN THE  
FOREGROUND OR  
THE BACKGROUND)?

.Y . N.

GO TC

#440

#450

#460

#470

#480



"A"  
FROM  
ABOVE

-----  
RESUME P20/25 IN  
THE BACKGROUND AND  
START NEW PROGRAM  
IN THE FOREGROUND.  
-----

.....  
EXIT ROO

"B"  
FROM  
ABOVE

-----  
TERMINATE PRESENT  
PROGRAM IN PROCESS  
AND START NEW PRO-  
GRAM.  
-----

.....  
EXIT ROO

-----  
P20/25 WILL CON-  
TINUE IN THE BACK-  
GROUND.  
-----

"B"  
FROM  
ABOVE

-----  
GO TO NEW PROGRAM  
SELECTED.  
-----

.....  
EXIT ROO

#540

#550

#560

#570

#580

CHANGE CONTROL NOTES

LOGIC REV 01 - PCR 80, 86, 118, 137, 214, 453  
REV 02 (LUM 1B) PCR 793.2, EDITORIAL  
REV 03 (LUM 1C) PCR 393, EDITORIAL



ERASABLE AND CHANNEL MODIFICATION  
ROUTINE (R01)

REV 02 12/03/69

- PURPOSE: (1) TO PROVIDE MANUAL CAPABILITY OF CHANGING FLAGWORD BITS OR CHANNEL BITS.
- ASSUMPTIONS: (1) THIS PROCEDURE CAN BE PERFORMED AT ANY TIME.
- (2) THIS PROCEDURE IS NOT RESTRICTED TO FLAGWORDS OR CHANNELS BUT CAN MODIFY ANY LEGITIMATE ERASABLE LOCATION > 30.
- DESCRIPTION: (1) NOUN 07 WILL BE LOADED BY STANDARD DSKY TECHNIQUES, (E.G.: V25N07E).
- (2) NOUN 07 IS A THREE COMPONENT OCTAL NOUN WITH THE FOLLOWING DEFINITION:
- R1 = ECADR OF AN ERASABLE LOCATION >30 (E.G.: FOR FLAGWORD 8, R1 = 104), OR CHANNEL NUMBER. IF R1 < 30, CHANNEL IS ASSUMED.
- R2 = UP TO FIVE OCTAL DIGITS SPECIFYING BITS IN THE WORD TO BE SET (E.G.: 200 IS BIT 8).
- R3 = NON-ZERO (OR NON-BLANK) INDICATES A "1" IS TO BE SET INTO BIT POSITIONS SPECIFIED IN R2. ZERO OR BLANK INDICATES A "0".
- (3) AS AN EXAMPLE, SETTING OF BITS 1, 3 AND 13 TO "1" IN FLAGWORD 8 REQUIRES THE FOLLOWING SEQUENCE:
- ```
V25N07E
 104E
10005E
 1E
```
- RESETTING THE SAME BITS TO "0" REQUIRES THE SEQUENCE:
- ```
V25N07E
 104E
10005E
 0E
```
- (4) SETTING OF BIT 10 OF CHANNEL 12 TO "1" REQUIRES THE FOLLOWING SEQUENCE:
- ```
V25N07E
 12E
1000E
 1E
```
- RESETTING THE SAME BIT TO "0" REQUIRES THE SEQUENCE:
- ```
V25N07E
 12E
1000E
 0E
```

CHANGE CONTROL NOTES

LOGIC REV C0 PCR 79  
REV C1 EDITORIAL  
REV 02(LUM 1C) PCR 806.2, EDITORIAL

669

IMU STATUS CHECK ROUTINE (RC2)

REV 03 12/03/69

- PURPOSE: (1) TO CHECK WHETHER IMU IS ON AND, IF ON, WHETHER IT IS ALIGNED TO AN ORIENTATION KNOWN BY THE LGC.  
 (2) TO ESTABLISH A PROGRAM ALARM AND STORE AN ALARM CODE IF THE IMU IS OFF OR NOT ALIGNED TO AN ORIENTATION KNOWN BY THE LGC.
- ASSUMPTIONS: (1) THE ROUTINE IS AUTOMATICALLY SELECTED BY THE PROGRAM IN PROCESS.

PROG  
CONT

LGC

GROUND

CREW

.LGC  
.ROUTINE  
.SELECTION  
.  
.  
.

-----  
START IMU STATUS  
CHECK ROUTINE (R02)  
-----

#10

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

.Y .N  
.  
.  
.

#20

-----  
. IS THE ISS ON?  
-----

.Y .N  
.  
.  
.

-----  
. TURN ON PROGRAM  
. ALARM LIGHT BUT  
. DC NOT CHANGE  
. PRESENT DIS-

-----  
. MONITOR DSKY:  
. DOES PROGRAM  
. ALARM LIGHT INDICATE  
. THAT EITHER IMU IS

#30

++  
+03  
+EDIT  
+  
+  
+  
+  
+  
+  
+  
+  
+  
+  
+  
+  
+  
+03  
++

PLAY. (PROGRAM  
ALARM DISPLAY  
IF CALLED IS:  
V05N09  
R1-XXXXX  
R2-XXXXX  
R3-XXXXX  
EXPECTED ALARM  
CCDE IS 00210

NCT CN GR NOT  
ALIGNED?

-----  
TURN ON PROGRAM  
ALARM LIGHT BUT  
DO NOT CHANGE  
PRESENT DISPLAY.  
PROGRAM ALARM  
DISPLAY IF  
CALLED IS:  
V05N09  
R1-XXXXX  
R2-XXXXX  
R3-XXXXX  
EXPECTED ALARM  
CCDE AT THIS  
TIME IS 00220

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

CALL PROGRAM ALARM  
DISPLAY (V05N09)  
TO IDENTIFY ABNOR-  
MALITY. WHEN FIN-  
ISHED PUSH KEY  
RELEASE.

-----  
PRESS ALARM RESET  
TO RESET PROGRAM  
ALARM.  
-----

# 40

# 50

# 60

# 70

# 80



THIS PAGE INTENTIONALLY LEFT BLANK







675

++  
+03  
+EDIT  
+  
+  
+  
+03  
++

COCKED WITH CSM  
 B=0 2 JET TRANSLATION (RCS SYSTEM A)  
 B=1 2 JET TRANSLATION (RCS SYSTEM B)  
 B=2 4 JET TRANSLATION (RCS SYSTEM A)  
 B=3 4 JET TRANSLATION (RCS SYSTEM B)  
 C=0 FINE SCALING  
 ACA (4 DEG/SEC)  
 C=1 NORMAL SCALING  
 ACA (20 DEG/SEC)  
 D=0 ATT DEADBAND,  
 0.3 DEGREES  
 D=1 ATT DEADBAND,  
 1.0 DEGREE  
 D=2 ATT DEADBAND,  
 5.0 DEGREES.  
 E= KALC MANU RATE  
 0= .2 DEG/SEC  
 1= .5 DEG/SEC  
 2= 2 DEG/SEC  
 3= 10 DEG/SEC  
 NOTE: ACA SCALING AS SHOWN IS FOR LM ALONE.  
 IF THE LM IS DOCKED WITH THE CSM THESE VALUES ARE 10 TIMES LESS.

.....  
.  
.  
.

-----  
WAIT FOR KEYBOARD ENTRY

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

#80

#90

#100

#110

#120

KEY IN V21E AND  
LOAD DESIRED  
DATA CODE IN R1

#130

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

.P	.T	.NEW DATA
.R	.E	.
.C	.R	.
.C	.M	-----
.E	.I	STORE DATA
.E	.N	-----
.D	.A	.
.	.T	.
.	.E	.....

#140

GO TO  
"A"  
BELCH

#150

SET APS FLAG AND  
VARIOUS DAP PARA-  
METERS AND SWITCHES  
ON BASIS OF DISPLAY  
REGISTER.

#160

#170

676

HOLD . FLASH VERB-NOUN TO  
 ..... REQUEST RESPONSE AND  
 SNAP . DISPLAY STORED LM  
 WEIGHT AND CSM  
 WEIGHT;  
 V06 N47  
 R1- THIS VEHICLE  
 (LM) WEIGHT  
 R2- OTHER VEHICLE  
 (CSM) WEIGHT  
 R3- BLANK

WEIGHTS IN POUNDS TO  
 NEAREST POUND.

WAIT FOR KEYBOARD  
 ENTRY

MONITOR DSKY:  
 OBSERVE VERB-NOUN  
 FLASH TO REQUEST RE-  
 SPONSE AND DISPLAY  
 OF VEHICLE WEIGHTS.

AM I SATISFIED WITH  
 THESE VALUES?

.Y .N

KEY IN PROCEED  
 (NOTE: IF LM  
 WEIGHT (AND/OR  
 CSM WEIGHT IF  
 CSM HAS BEEN  
 DEFINED ABOVE  
 TO BE DOCKED)  
 DOES  
 NOT EXCEED  
 EMPTY WEIGHT  
 OF THE RESPEC-  
 TIVE VEHICLE  
 THIS DISPLAY  
 WILL NOT TERM-  
 INATE).  
 (NOTE: IF ATT-  
 ITUDE DEADBAND  
 IS PRESENTLY  
 SPECIFIED BY  
 A PROGRAM,  
 THAT DEADBAND  
 WILL NOW BE  
 OVERRIDEN BY

#180

#190

#200

#210

THE CREW-SPEC-  
IFIED VALUE.)

#220

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

#230

KEY IN V24E  
AND LOAD  
THE DESIRED  
PARAMETERS.

.P .T .NEW  
.R .E .DATA  
.O .R  
.C .M STORE DATA  
.E .I  
.E .N  
.D .A  
.T  
.E

#240

SET DEADBAND TO  
VALUE SELECTED  
ABOVE. CALL  
1/ACCS ROUTINE TO  
POSITION THE  
SWITCH CURVES IN  
THE LM-ALONE RCS  
CONTROL LOGIC.

#250

GO TO  
"A"  
BELOW

#260

IS LM WEIGHT GREATER  
THAN THE MINIMUM

678

WEIGHT (REFER SECTION 3 OF R567)?  
(NOTE: THE LGC WILL CHECK THE APS FLAG TO SELECT THE MINIMUM WEIGHT CRITERIA FOR EITHER THE DPS/APS OR APS ALONE.)

.Y .N

#270

IS THE CSM ATTACHED?

.N .Y

#280

IS THE CSM WEIGHT GREATER THAN THE MINIMUM WEIGHT (REFER SECTION 3 OF R567)?

.Y .N

#290

TRANSFER DATA TO DAP

#300

SET DEADBAND TO VAL-  
UE SELECTED ABOVE.  
CALL 1/ACCS ROUTINE  
TO RECOMPUTE THE  
FUNCTIONS OF MASS ON  
THE BASIS OF THE NEW  
VALUES AND TO REPC-  
SITION THE SWITCH  
CURVES FOR THE LM-  
ALONE RCS CONTROL  
LOGIC ON THE BASIS  
OF THE NEW DEADBAND.

#320

#330

IS APS FLAG SET?

Y. .N

GC TO  
"A"  
BELOW

IS THE DESCENT  
STAGE ATTACHED?

.N .Y

EXIT  
R03

#340

#350

POSS  
HOLD .  
.....  
SNAP .

FLASH VERB-NOUN  
TO REQUEST RESPONSE  
AND DISPLAY DPS  
ENGINE GIMBAL TRIM  
PARAMETERS;  
V06 N48  
R1 P-TRIM  
R2 R-TRIM  
R3 BLANK

MONITOR DSKY:  
OBSERVE VERB-NOUN  
FLASH TO REQUEST  
RESPONSE AND DISPLAY  
OF DPS ENGINE GIMBAL  
TRIM PARAMETERS.

#360

680



-----  
WAIT FOR KEY BOARD  
ENTRY.

-----  
KEY IN  
PROCEED

-----  
KEY IN TER-  
MINATE V34E

EX IT R03

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

-----  
KEY IN V24E  
AND LOAD THE  
DESIRED  
PARAMETERS.

-----  
.P .T .  
.R .E .  
.C .R .  
.C .M -----  
.E .I NEW  
.E .N DATA  
.D .A -----

-----  
GO TO  
"A"  
BELOW

-----  
PERFORM GIMBAL  
DRIVE TO TRIM

#420

#430

#440

#450

#460



POSITION.  
 (NOTE: THIS CRIVE  
 WILL NOT CONTINUE IF  
 MODE CONTROL SWITCH  
 IS OFF, GUID CONTROL  
 SWITCH IS AGS, THE  
 IMU COUS ARE NOT  
 USABLE, OR DURING A  
 FRESH START OR  
 RESTART.)

#470

POSS  
 HOLD .

.....  
 ++ .  
 +03 .  
 +EDIT  
 ++

FLASH VERB 50 (BUT  
 DO NOT CHANGE N)  
 TO REQUEST  
 PLEASE PERFORM CON-  
 TINUATION OF INTER-  
 RUPTED PROGRAM:

MONITOR DSKY:  
 OBSERVE VERB-NOUN  
 FLASH TO REQUEST  
 PLEASE PERFORM CONT-  
 INUATION OF INTER-  
 RUPTED PROGRAM:  
 (NOTE: THIS DISPLAY  
 WILL INDICATE THAT  
 THE GIMBAL TRIM PRG-  
 CESS HAS BEEN COM-  
 PLETED. IF THIS  
 DISPLAY DOES NOT  
 APPEAR AND THE DSKY  
 RESTART LIGHT IS ON  
 AN LGC RESTART HAS  
 OCCURRED AND THE  
 GIMBAL TRIM PRCESS  
 HAS BEEN PERMANENTLY  
 INTERRUPTED. IF SO  
 THIS ROUTINE MUST BE  
 RECALLED AND TRIM  
 PROCESS REPEATED)

#480

#490

#500

#510

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

.....  
-----  
KEY IN PROCEED,  
ENTER, OR TERMINATE.  
-----

#520

TERMINATE FLASH UPON  
RECEIPT OF PROCEED,  
TERMINATE, OR ENTER

-----  
.P .E .T  
.R .N .E  
.C .T .R  
.C .E .M  
.E .R .I  
.E . .N  
.D . .A  
. . .T  
. . .E  
. . .  
. . .  
"A"  
. FROM  
. ABOVE  
. . .  
. . .  
.....

#530

#540

-----  
RESET EXTENDED VERB  
ACTIVE FLAG AND NO  
MARKS ALLOWED FLAG  
-----

.....  
EXIT  
R03

#550

684

685

.  
.  
.  
.  
.  
.  
.  
.  
.  
.  
EXIT  
R03

837  
R03/LUMINARY

#560

CHANGE CONTROL NOTES

LOGIC REV 01 PCR 184,452,419,618  
REV 02(LUM 18) PCR 816, EDITORIAL  
REV 03 EDITORIAL

THIS PAGE INTENTIONALLY LEFT BLANK

RR/LR SELF TEST ROUTINE (R04)

REV 03 12/03/69

PURPOSE: (1) TO PROVIDE SUITABLE DSKY DISPLAYS AND LGC DOWNLINK INFORMATION TO SUPPORT THE SELF TESTS OF THE RENDEZVOUS RADAR (RR) OR THE LANDING RADAR (LR).

ASSUMPTIONS: (1) THIS ROUTINE IS MANUALLY SELECTED BY THE ASTRONAUT BY DSKY ENTRY (V63E) IN CONJUNCTION WITH MANUAL SELECTION OF THE APPROPRIATE RADAR SELF TEST AT THE LM CONSOLE (RADAR TEST SWITCH-RNDZ/OFF/LDG).

(2) THE ROUTINE CAN BE CALLED ONLY WHEN NO OTHER PROGRAM OR ROUTINE IS USING THE RR OR LR.

(3) THE RR HEATERS HAVE BEEN IN THE OPERATE POSITION AT LEAST 1 HOUR.

PROG  
CONT

LGC

GROUND

CREW

.CREW  
.ROUTINE  
.SELECTION

++  
+03  
+EDIT  
++

-----  
START RR/LR SELF  
TEST ROUTINE (R04)

-----  
KEY IN V63E  
-----

#10

-----  
IS THE NO R29 FLAG  
SET?

.Y                    N.

#20

-----  
IS THE R77 FLAG  
SET?

.N                    Y.

IS THE V37  
FLAG SET?

.N            Y.

#30

IS THE LR BY-  
PASS FLAG  
SET?

.Y            N.

#40

IS THE TRACK  
FLAG SET?

.N            Y.

#50

TURN ON OPERATOR  
ERROR LIGHT

EXIT  
RC4

MONITOR DSKY:  
DOES OPERATOR  
ERROR LIGHT INDICATE  
THAT THIS ROUTINE  
CANNOT BE SELECTED  
AT THIS TIME?

.Y            N.

#70

688







TERMINATE FLASH UPON  
RECEIPT OF PROCEED,  
TERMINATE, OR NEW  
CODE

KEY IN V22E AND  
LOAD THE DESIR-  
ED RADAR CODE  
IN R2

#180

.P .T .NEW  
.R .E .CODE  
.D .R .  
.C .M .  
.E .I .  
.E .N .  
.D .A STORE NEW  
.T CODE  
.E .

#190

GO TO  
"A"  
BELOW

#200

IS RADAR OPTION CODE  
00002?

#210

.Y .N  
. .  
. .  
GO TO  
"B"  
BELOW

#220

DID I SPECIFY RR OR  
LR?

#230

IS RR ALTO MCDE  
DISCRETE PRESENT?

RR . .LR  
. .  
. .  
GO TO

.Y .N

"B"  
BELCW

SEND RR AUTO  
TRACK ENABLE DIS-  
CRETE TO THE RR.

#240

POSS  
HOLD  
SNAP

FLASH VERB-NCUN  
TO REQUEST PLEASE  
PERFORM SELECTION  
OF RR AUTO MODE:  
V50N25  
R1-00201  
R2-BLANK  
R3-BLANK

MONITOR DSKY:  
IS VERB-NCUN  
FLASHING TO REQUEST  
SELECTION OF RR AUTO  
MODE?

#250

.Y .N

PUT RR MODE  
SWITCH TO LGC

#260

WAIT FOR KEYBOARD  
ENTRY.

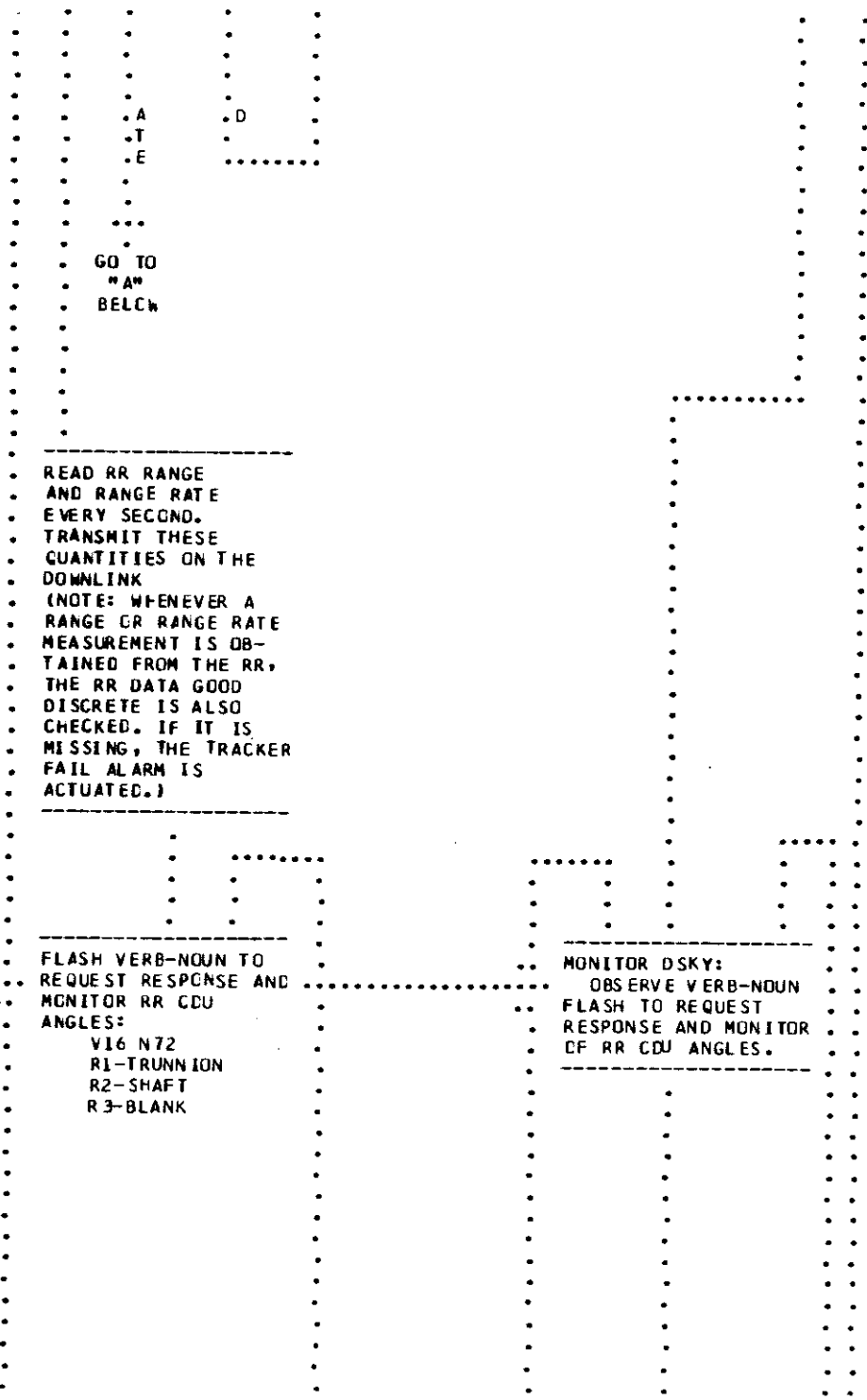
KEY IN PROCEED

TERMINATE FLASH  
UPON RECEIPT OF  
PROCEED OR TERMI-  
NATE

#270

.T .P  
.E .R  
.R .O  
.M .C  
.I .E  
.N .E

693



#280

#290

#300

#310

#320

TRUNNION-360 MINUS  
RR TRUNNION CDU  
VALUE.  
IN DEGREES TO NEAR-  
EST .01 DEGREE.  
(PLUS IS DEFINED AS  
A NEGATIVE ROTATION  
ABOUT LM +X AXIS.)

#330

SHAFT-RR SHAFT  
ANGLE. IN DEGREES  
TO NEAREST .01  
DEGREE.

#340

DO I WISH TO MONITOR  
RANGE AND RANGE  
RATE?

.Y .N  
.  
.

WAIT FOR KEYBOARD  
ENTRY.

#350

KEY IN PROCEED

DO I WISH TO  
TERMINATE THIS  
ROUTINE?

.Y .N  
.  
.

#360

KEY IN TERMINATE  
V34E

#370

694

695

TERMINATE FLASH UPON  
RECEIPT OF PROCEED,  
CR TERMINATE

.P .T  
.R .E  
.O .R  
.C .M  
.E .I  
.E .N  
.D .A  
.T  
.E

EXIT  
R04

#380

GO TO  
"A"  
BELOW

#390

POSS  
HOLD  
MON

FLASH VERB-NOUN TO  
REQUEST RESPONSE AND  
MONITOR RR RANGE,  
RANGE RATE, AND TFI:  
V16 N78  
R1-RANGE  
R2-RANGE RATE  
R3-TFI

MONITOR DSKY:  
OBSERVE VERB-NOUN  
FLASH TO REQUEST  
RESPONSE AND MONITOR  
OF RR RANGE,  
RANGE RATE, AND TFI.

#400

RANGE - RANGE  
(SIMULATED) TO CSM  
IN NAUTICAL MILES  
TO NEAREST .01 NM.

#410

++  
+03  
+EDIT

RANGE RATE - RANGE  
RATE (SIMULATED)  
BETWEEN LM AND CSM.  
IN FPS TO NEAREST  
FPS.  
TFI-TIME FROM TIG.  
IN MIN AND SEC TO

#420

NEAREST SEC. MAXIMUM  
READING IS 59859.  
(-BEFORE, + AFTER  
TIG) (NOTE: THE  
VALUE DISPLAYED IS  
NOT MEANINGFUL IN  
R04.)

DO I WISH TO TERM-  
INATE RADAR SELF  
TESTING?

.Y .N

#430

WAIT FOR KEYBOARD  
ENTRY

KEY IN TERMINATE  
V34E

EX IT  
R04

#440

DO I WISH TO PERFORM  
LR SELF TEST?

.Y .N

#450

DO I WISH TO  
MONITOR SHAFT  
AND TRUNNION  
ANGLES?

.Y .N

#460

#470

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

#480

TERMINATE FLASH UPON  
RECEIPT OF PROCEED,  
TERMINATE, OR RE-  
CYCLE.

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

.P        .T        .R  
.R        .E        .E  
.O        .R        .C  
.C        .H        .Y  
.E        .I        .C  
.E        .N        .L  
.D        .A        .E

GO TO  
"A"  
BELOW

"B"  
FROM  
ABOVE

-----  
READ LR PARAMETERS  
(RANGE, V(X), V(Y),

#490

#500

#510

AND V(Z)) EACH SECOND AND TRANSMIT CN  
DOWNLINK  
(NOTE: WHEN EACH PARAMETER IS  
OBTAINED FROM THE LR, THE APPLICABLE  
DATA GOOD DISCRETE IS ALSO CHECKED. IF  
IT IS MISSING, THE TRACKER FAIL ALARM  
IS ACTUATED.)

#520

DCES PRESENT LR POSITION AGREE WITH  
LR POSITION FLAG?

"B"  
FROM  
ABOVE

#530

.N            Y.

#540

TURN ON PROGRAM ALARM AND STORE  
ALARM CODE 00522.

MONITOR DSKY:  
DURING THE LR READ CYCLE, PROGRAM  
ALARM 00522 MAY OCCUR INDICATING  
THAT AN LR POSITION CHANGE HAS  
OCCURRED.

#550

PRESS ALARM RESET TO RESET PROGRAM  
ALARM.

#560

698



POSS  
HOLD  
MON

FLASH VERB-NOUN TO  
REQUEST RESPONSE AND  
MONITOR THE LR  
RANGE AND ANTENNA  
POSITION:

V16 N66  
R1-RANGE  
R2-POSITION  
R3-BLANK

RANGE - SIMULATED  
SLANT RANGE. IN FEET  
TO NEAREST FOOT

POSITION - PRESENT  
LANDING RADAR AN-  
TENNA POSITION  
(00001 OR 00002)

WAIT FOR KEYBOARD  
ENTRY.

TERMINATE FLASH UPON  
RECEIPT OF PROCEED  
OR TERMINATE

.P .T  
.R .E  
.O .R

MONITOR DSKY:  
OBSERVE VERB-NCUN  
FLASH TO REQUEST  
RESPONSE AND MONITOR  
THE LR RANGE AND  
ANTENNA POSITION.

DO I WISH TO MONITOR  
V(X), V(Y), AND  
V(Z)?

.Y .N

KEY IN PROCEED

DO I WISH TO  
TERMINATE THIS  
ROUTINE?

.Y .N

KEY IN TERMI-  
NATE  
V34E

#570

#580

#590

#600

#610

.C  
.E  
.E  
.D  
  
.M  
.I  
.N  
.A  
.T  
.E

EXIT  
R04

GC TO  
"A"  
BELOW

#620

#630

POSS  
HOLD  
MON

FLASH VERB-NOUN TO  
REQUEST RESPONSE AND  
MONITOR LR  
V(X), V(Y), AND V(Z):  
V16 N67  
R1-V(X)  
R2-V(Y)  
R3-V(Z)

MONITOR DSKY:  
OBSERVE VERB-NOUN  
FLASH TO REQUEST  
RESPONSE AND MONITOR  
OF LR V(X), V(Y),  
AND V(Z)

#640

V(X), V(Y), AND V(Z)-  
SIMULATED VELOCIT-  
IES. IN FPS TO NEAR-  
EST FPS

#650

DO I WISH TO TERM-  
INATE RADAR SELF  
TESTING?

Y. .N

#660

WAIT FOR KEYBOARD  
ENTRY

KEY IN TERMINATE  
V34E

700

EXIT  
R04

#670

DO I WISH TO PERFORM  
RR SELF TEST?

.Y .N

#680

DC I WISH TO  
MONITOR RANGE?

.Y .N

#690

KEY IN RECYCLE  
V32E

#700

TERMINATE FLASH UPON  
RECEIPT OF RECYCLE,  
PROCEED, OR TERMINATE

KEY IN PROCEED

#710

.P .T .R  
.R .E .E



703

.  
. .  
. .  
. .  
. .  
. .

-----  
RESET EXTENDED VERB  
ACTIVE FLAG AND NO  
MARKS ALLOWED FLAG  
-----

.  
. .  
. .  
. .  
. .  
EXIT  
R04

855  
R04/LUMINARY

#770

#780

CHANGE CONTROL NOTES

LOGIC REV 01 PCR 95, 406, 420, 490, 615  
LOGIC REV 02 (LUM 18) PCR 780, 817, EDITORIAL  
REV 03 EDITORIAL

R04/LUMINARY

THIS PAGE INTENTIONALLY LEFT BLANK

704

705

S-BAND ANTENNA ROUTINE (R05)

REV 03 12/03/69

PURPOSE: (1) TO COMPUTE AND DISPLAY THE TWO STEERABLE S-BAND ANTENNA GIMBAL ANGLES WHICH WILL POINT THE ANTENNA TOWARD THE CENTER OF THE EARTH.

++ ASSUMPTIONS: (1) THE IMU IS ON AND ALIGNED.

+03 +EDIT (2) THIS ROUTINE IS SELECTED BY THE ASTRONAUT BY DSKY ENTRY.

++

PROG CGNT

LGC

GROUND

CREW

.CREW ROUTINE SELECTION

START S-BAND ANTENNA ROUTINE (R05)

KEY IN V64E

++ +03 +EDIT +03 ++

#10

#20

DO EXTENDED VERB INTERLOCK ROUTINE (R76)

DO EXTENDED VERB INTERLOCK ROUTINE (R76)





707

EXIT  
R05

HOLD  
MDN

FLASH VERB-NOUN TO  
REQUEST RESPONSE AND  
MONITOR OF THE S-  
BAND ANTENNA GIMBAL  
ANGLES

V06 N51  
R1-ALPHA  
R2-BETA  
R3-BLANK

ALPHA-PITCH ANGLE.  
S-BAND ANTENNA PITCH  
GIMBAL ROTATION ABOUT  
THE BISECTOR OF THE  
ANGLE BETWEEN THE  
+Y AND-X AXIS. (-90  
< ALPHA < 270).

-  
IN DEGREES TO  
NEAREST .01 DEGREE.

BETA-YAW ANGLE. S -  
BAND ANTENNA YAW  
GIMBAL ROTATION  
ABOUT THE YAW GIM-  
BAL AXIS (FIXED TO  
THE ANTENNA).  
(-90 < BETA < 90).

-  
IN DEGREES TO  
NEAREST .01 DEGREE.

(NOTE: DISPLAY  
LIMITS ARE ANGLE  
CONVENTIONS RATHER  
THAN HARDWARE LIMITS  
(SEE SECTION 5.6.6

MONITOR DSKY:  
OBSERVE VERB-NOUN  
FLASH TO REQUEST  
RESPONSE AND MONITOR  
OF THE S-BAND  
ANTENNA PITCH AND  
YAW GIMBAL ANGLES  
REQUIRED TO POINT  
THE ANTENNA AT EARTH  
CENTER WITH THE LM  
AT ITS PRESENT POSI-  
TION AND ATTITUDE.

#90

#100

#110

#120

OF R567)).

.A  
.U  
.T  
.C  
.M  
.A  
.T  
.I  
.C  
.R  
.E  
.C  
.Y  
.C  
.L  
.E

#130

#140

WAIT FOR KEYBOARD  
ENTRY

CONSIDERING THE PRE-  
SENT POSITION AND  
ATTITUDE, DO THESE  
ANGLES YIELD AN UN-  
OBSTRUCTED ANTENNA  
LOS TO THE EARTH  
CENTER?

#150

Y.            .N  
:  
:

#160

SET AN-        DO I WISH  
TENNA TO       TO MAN-  
THESE        EUVER THE  
ANGLES        VEHICLE  
AND MON-  
ITOR THE  
DISPLAY  
TC ACH-  
IEVE AN  
UNOBSTRU-

#170







#30

DECREMENT PIP  
COUNTER BY 1

#40

SET UP TASK IC  
RECALL THIS ROU-  
TINE IN .25 SEC.

#50

++  
+03  
+EDIT  
+  
+  
+  
+  
+  
+  
+  
+  
+  
+  
+  
+  
+  
+  
+03  
++

#60

CHECK V FLASH  
FLAG AND H FLASH  
FLAG AND  
UPDATE VELG-  
CITY FAIL LIGHT

#70

712



THIS PAGE INTENTIONALLY LEFT BLANK