

523

DPS ABORT PROGRAM (P70)

REV 02 12/03/69

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 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

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 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.

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 +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.

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 +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).
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(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.

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+02
+EDIT
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+02
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(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 FDAI. 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 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 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

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

+
+
+
+
+
+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-
TGR 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 TGC
MOST RECENTLY
COMPUTED.

#340

GC TC

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.

#510

#520

HAVE REQUESTED
MODES BEEN SELEC-
TED?

.N Y.

#530

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

#540

WAIT FOR KEY-
BOARD ENTRY

KEY IN PROCEED

#550

526

#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)?

.Y N.

#630

RESET
ROTATION
FLAG

#640

RESET VERTICAL
RISE FLAG

#650

IS ROTATION
FLAG SET?

.Y N.

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

5th

GIMBAL ANGLES
AND DRIVE THE
ICDUS (USING
FINCCDOW) 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

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

542

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

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.
.

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

#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

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:

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(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.

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+O2
+EDIT
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(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.

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+O2
+EDIT
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(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

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+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, HOW-
EVER 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 ABCRT
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 ABCRT ENABLE
FLAG SET?

.Y .N .

IS AVERAGE G
FLAG SET?

.Y .N .

#50

#60

557

RESET ULLAGE FLAG

RESET X-AXIS OVER-
RIDE INHIBIT FLAG

RESET PULSES FLAG

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).

SET LR BYPASS FLAG

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

#130

#140

#150

#160

#170

++
+02
+EDIT
++

++
+C2
+
+
+
+
+
+
+
+
+
+
+
+
+
+

55c

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

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

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

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/

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

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

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

++
+G2
+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

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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 (θ) 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.

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 (GET).
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 STU-
RED TARGET PARA-
METERS, COMPUTE
THE PARAMETERS
ASSOCIATED WITH
CSI AND CCF AS
DESCRIBED IN SEC-
TION 5.4.2.2 OF
R567.

#360

ESTABLISH ALARM
IF:

(A) ON FIRST
ITERATION THERE
IS NO INTER-
SECTION OF
THE DESIRED LOS
AT TPI WITH THE
CIRCLE DESCRIB-
ED 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 ITERA-
TION COUNTER
EXCEEDS 15
WITHOUT AKRI-
VING AT A PRO-
BLEM 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

. 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
. 03B22)
. (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

GO TO
"A"
BELCW

#610

#620

HOLD
.....
SNAP

FLASH VERB-NOUN
TC 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)

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

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

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

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

#630

#640

317

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

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

HOLD . FLASH VERB-NOUN TO
MON . REQUEST RESPONSE AND
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 (θ) 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.

#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

"AM"
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)

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

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

#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

```

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

```

#350

```

-----
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

```

GO TO
"A"
BELOW

```

#370

```

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)
-----

```

#380

```

-----
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

. REGRD THESE
. VALUES FOR FUTURE

#400

#410

#420

#430

#440

608

-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
 CF 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

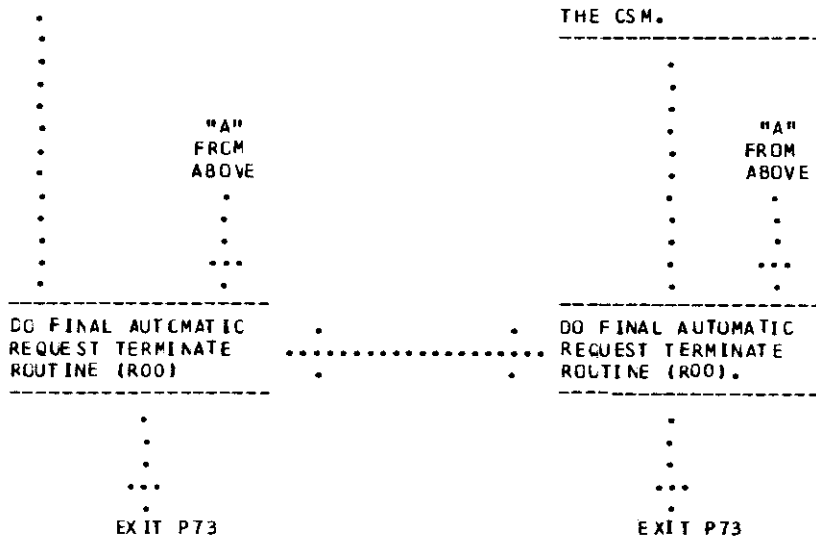
#510

#520

#530

#540

610



#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

SET UPDATE FLAG

SET TRACK FLAG

#30

#40

#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

617

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 TWO
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;
V06 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-
NOUN TO RE-
QUEST RESPONSE
AND DISPLAY

MONITOR DSKY:
OBSERVE
VERB-NOUN
FLASH TO RE-

#490

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

(NOTE: FOR DE-
FINITION SEE
ABCVE).

WAIT FOR KEY-
BOARD ENTRY

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

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

GC TO
"A"
BELCW

BASED ON STORED
TARGET PARAMETERS

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

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

KEY IN
PROCEED

#500

#510

#520

#530

#540

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?

IS THIS THE
FINAL PASS
THROUGH THIS
PROGRAM?

#640

.N Y.

.Y N.

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

SET NEW
TARGET
FLAG

#800

IS NEW TARGET
FLAG SET?

.N Y.

#810

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

#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

MONITOR DSKY
OBSERVE DISPLAY OF
P75

#20

RESET ACTIVE VEHICLE
FLAG

#30

SET UPDATE FLAG

SET TRACK FLAG

#40

RESET FINAL FLAG

#50

RESET UPDATE FLAG

DEFINE TIG(MID)=
T + "FTIGINC"

#60

636

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

b41

QUANTITIES,
NOT EQUAL TO
"0"?)

.N .Y.

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
TPM.

#270

#280

#290

#300

#310

HOLD .
.....
SNAP .

FLASH VERB-NOUN
TO REQUEST RESPON-
SE AND DISPLAY
DELTA V(LGS) FOR

MONITOR DSKY:
OBSERVE VERB-
NOUN FLASH TO RE-
QUEST RESPONSE

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

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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

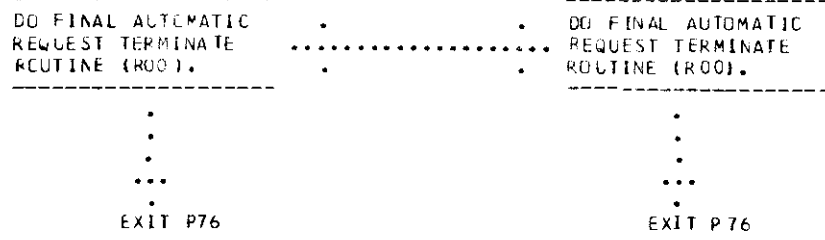
#140

#150

#160

#170

450



#220

#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
TO 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

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

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 (RO1)

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

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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= KALCMANU 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 PRO-
CEED

#80

#90

#100

#110

#120

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

#300

TRANSFER DATA TO DAP

#310

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

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-
TINLATION OF INTER-
RUPTED PROGRAM:

.....
MONITOR DSKY:
OBSERVE VERB-NOUN
FLASH TO REQUEST
PLEASE PERFORM CON-
TINUATION 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

685

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.
.
.
.
.
.
.
.
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

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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

"B"
BELCW

.Y .N
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

.A
.T
.E

.D

GO TO
"AM"
BELCH

#280

#290

READ RR RANGE
AND RANGE RATE
EVERY SECOND.
TRANSMIT THESE
QUANTITIES ON THE
DOWNLINK
(NOTE: WHENEVER A
RANGE OR RANGE RATE
MEASUREMENT IS OB-
TAINED FROM THE RR,
THE RR DATA GOOD
DISCRETE IS ALSO
CHECKED. IF IT IS
MISSING, THE TRACKER
FAIL ALARM IS
ACTUATED.)

#300

#310

POSS
HOLD
MON

FLASH VERB-NOUN TO
REQUEST RESPONSE AND
MONITOR RR CDU
ANGLES:
V16 N72
R1-TRUNNION
R2-SHAFT
R3-BLANK

MONITOR DSKY:
OBSERVE VERB-NOUN
FLASH TO REQUEST
RESPONSE AND MONITOR
OF RR CDU ANGLES.

#320

TRUNNION-360 MINUS
RR TRUNNION CDU
VALLE.
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

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

#490

GO TO
"A"
BELOW

#500

"B"
FROM
ABOVE

#510

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

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

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

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. .
. .
. .
. .

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

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704

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
.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


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

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#230

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-----
RESET EXTENDED VERB
ACTIVE FLAG
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EX IT
R05

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#240

CHANGE CONTRL NOTES

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LOGIC REV 01 PCR 15
LOGIC REV 02 (LUM 18) PCR 832.2
REV 03 EDITORIAL

```


#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

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