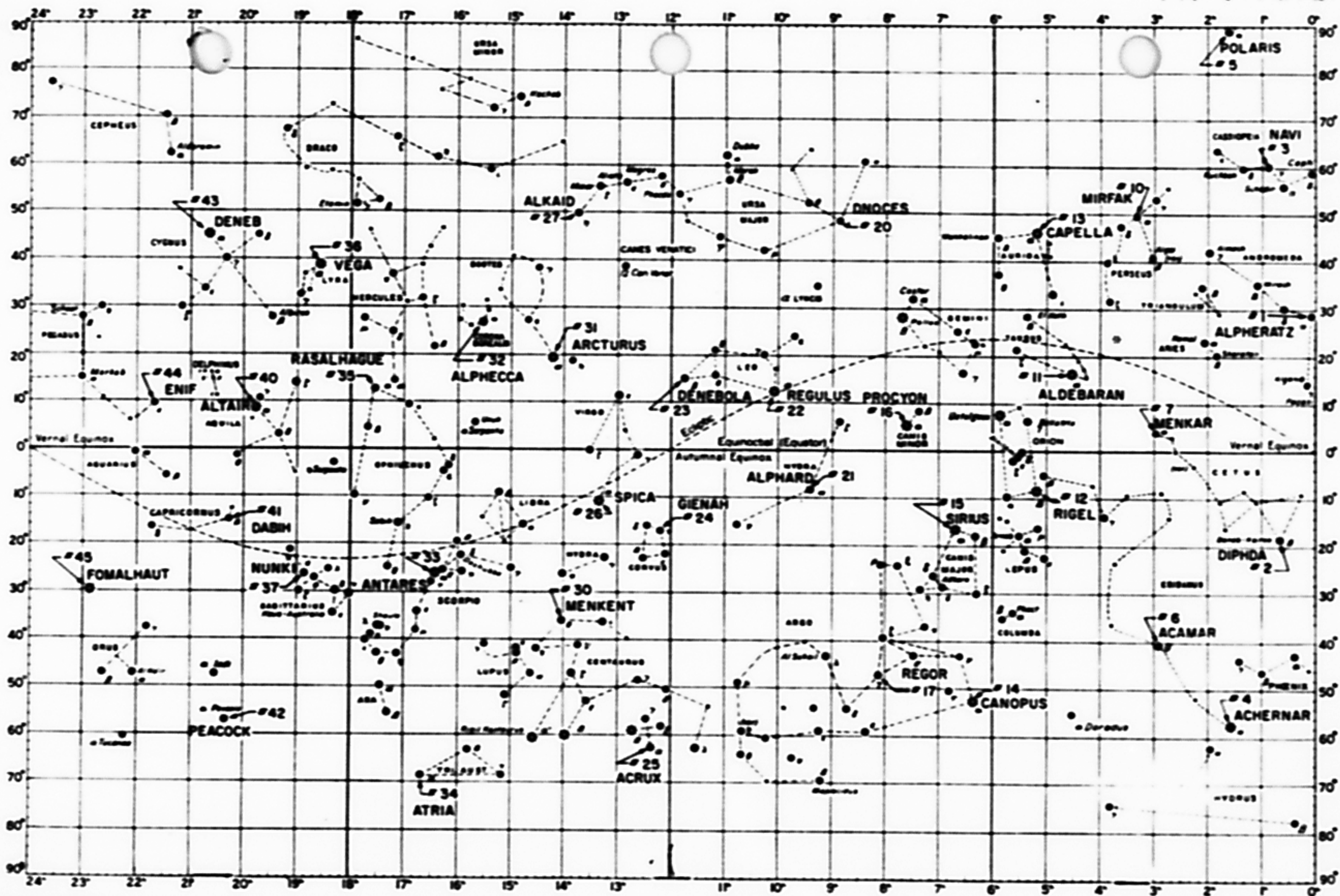
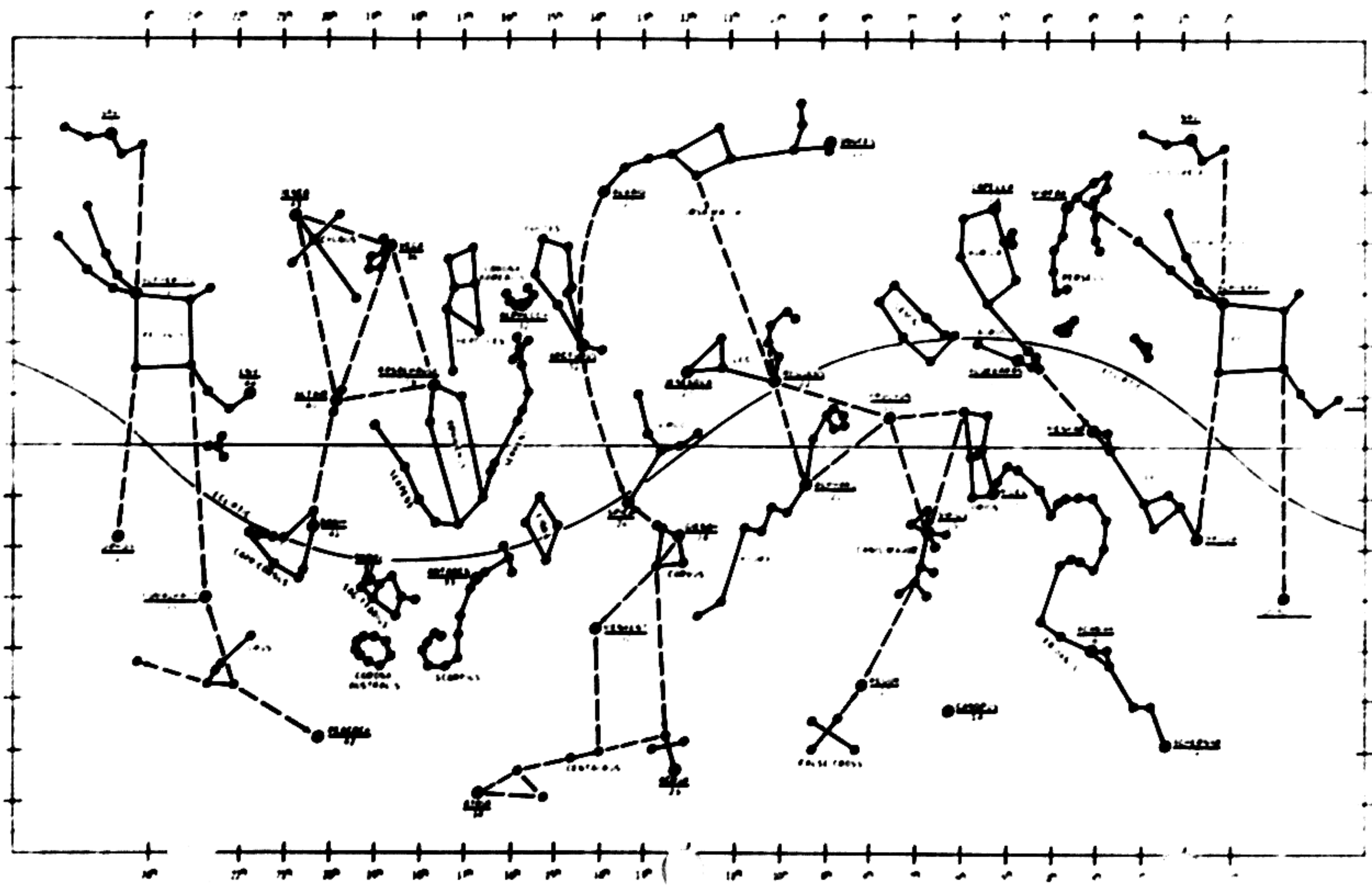


*FRO*

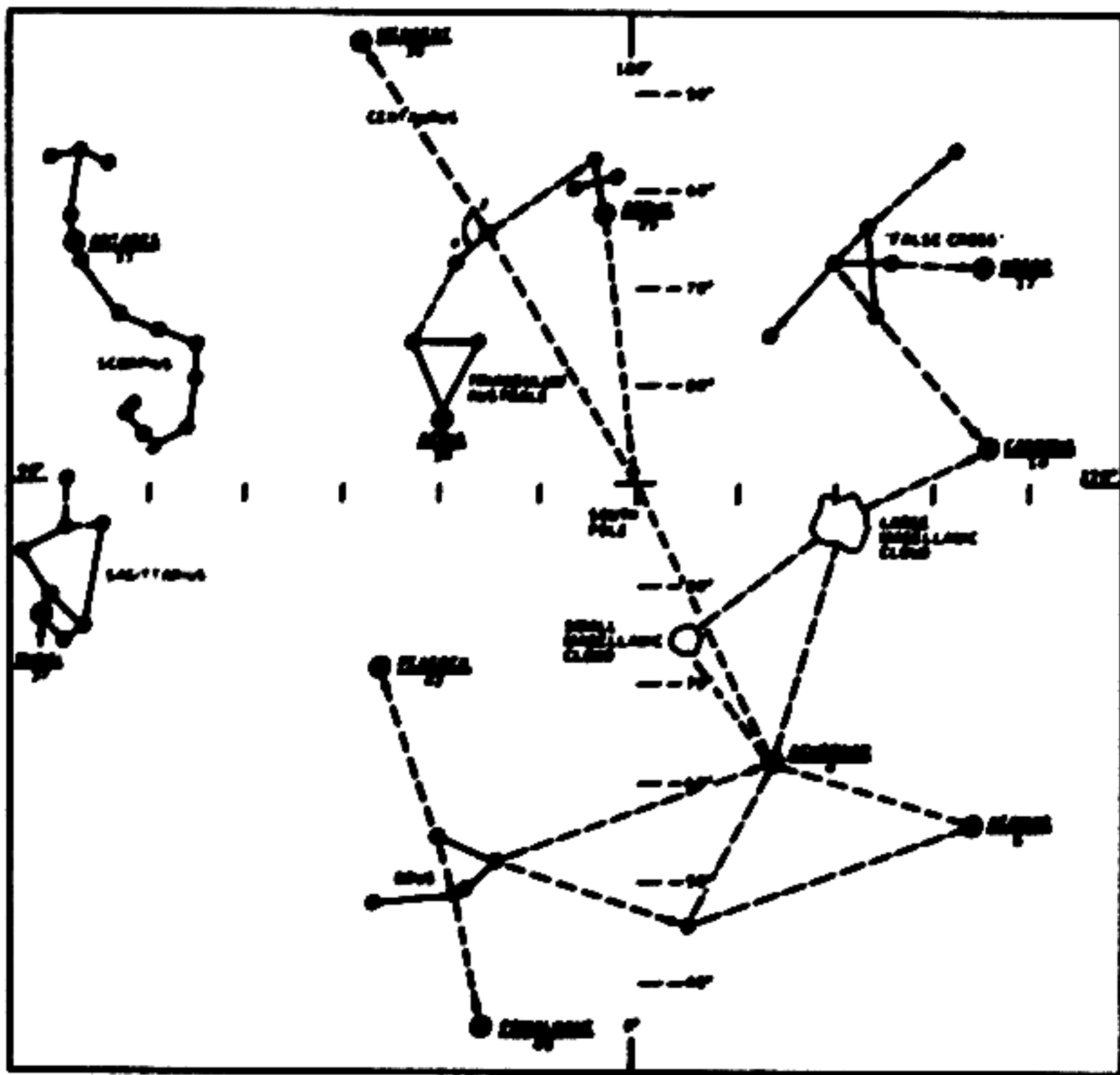
<b>APOLLO 12</b>	
<b>LM G&amp;N DICTIONARY</b>	
<b>PART NO</b>	<b>S/N</b>
<b>SKB32100075-361</b>	<b>1002</b>



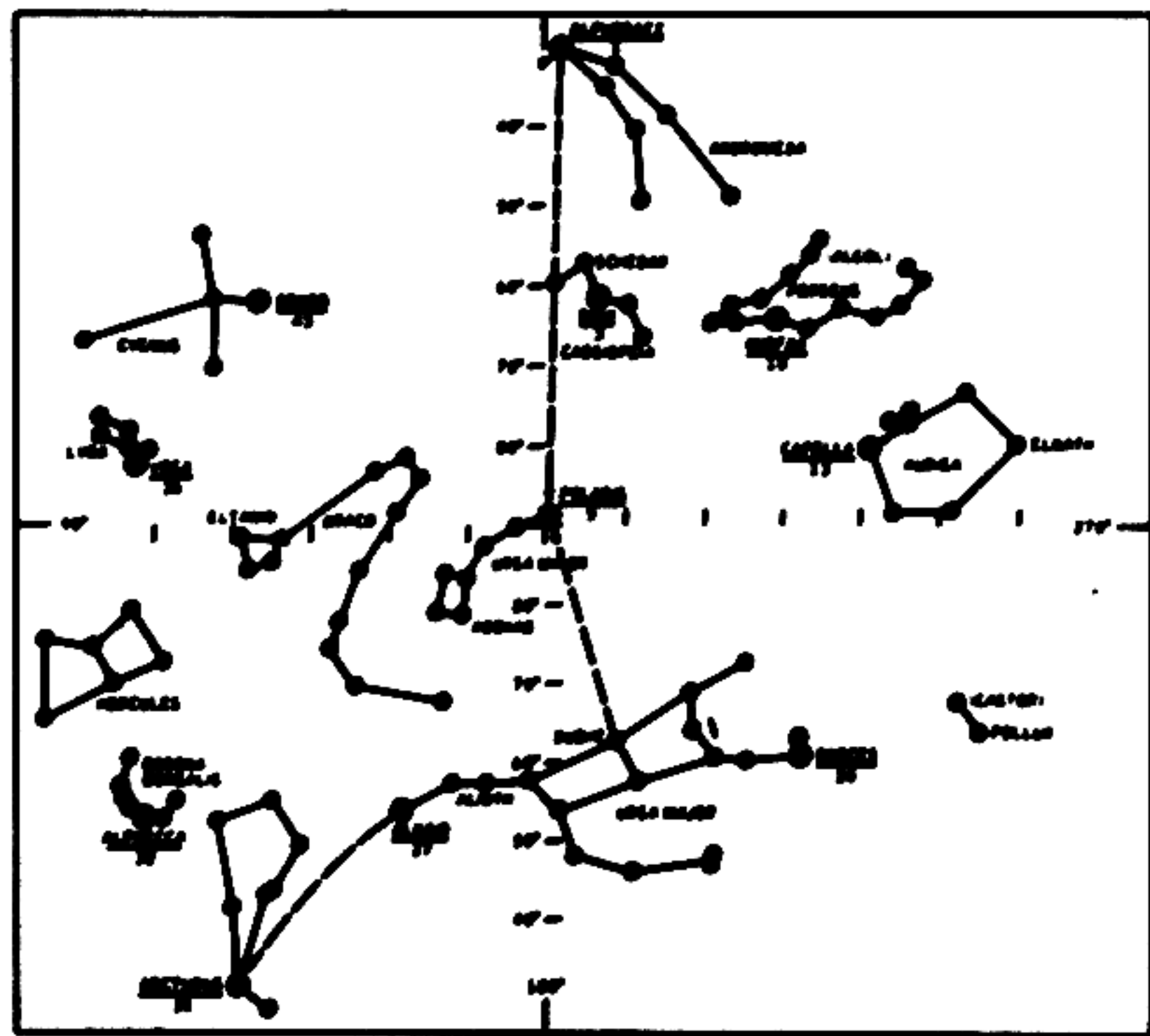


LM-6

Basic Date October 6, 1969  
Changed \_\_\_\_\_



SOUTHERN STARS



NORTHERN STARS

PGNS-1

STAR LIST

	<u>STAR NAME</u> (Numerical)	<u>STAR NAME</u> (Alphabetical)	
<u>NO</u>			<u>NO</u>
00	Planet	Acamar	6
1	Alpheratz	Achernar	4
2	Diphda	Acrux	25
3	Navi	Aldebaran	11
4	Achernar	Alkaid	27
5	Polaris	Alphard	21
6	Acamar	Alphecca	32
7	Menkar	Alpheratz	1
10	Mirfak	Altair	40
11	Aldebaran	Antares	33
12	Rigel	Arcturus	31
13	Capella	Atria	34
14	Canopus	Canopus	14
15	Sirius	Capella	13
16	Procyon	Dabih	41
17	Regor	Deneb	43
20	Dnoces	Denebola	23
21	Alphard	Diphda	2
22	Regulus	Dnoces	20
23	Denebola	Earth	47
24	Gienah	Enif	44
25	Acrux	Fomalhaut	45
26	Spica	Gienah	24
27	Alkaid	Menkar	7
30	Menkent	Menkent	30
31	Arcturus	Mirfak	10
32	Alphecca	Moon	50
33	Antares	Navi	3
34	Atria	Nunki	37
35	Rasalhague	Peacock	42
36	Vega	Planet	00
37	Nunki	Polaris	5
40	Altair	Procyon	16
41	Dabih	Rasalhague	35
42	Peacock	Regor	17
43	Deneb	Regulus	22
44	Enif	Rigel	12
45	Fomalhaut	Sirius	15
46	Sun	Spica	26
47	Earth	Sun	46
50	Moon	Vega	36

STARS, PROG

Basic Date October 6, 1969

Changed

PGNS-2

STARS, PROG

PROGRAMS

NO.

00	LGC Idle
06	LGC Power Down
12	Powered Ascent
20	Rendezvous Navigation
21	Ground Track Determination
22	Lunar Surface Navigation
25	Preferred Tracking Attitude
27	LGC Update
30	External $\Delta V$
32	CSI Pre-Thrust
33	CDH Pre-Thrust
34	TPI Pre-Thrust
35	TPM Pre-Thrust
40	DPS Thrust
41	RCS Thrust
42	APS Thrust
47	$\Delta V$ Monitor
51	IMU Orientation Determination
52	IMU Realign
57	Lunar Surface Align
63	Braking Phase
64	Approach Phase
65	Landing Phase (Auto)
66	Landing Phase (ROD)
67	Landing Phase (MANUAL)
68	Landing Confirmation
70	DPS Abort
71	APS Abort
72	CSM CSI Targeting
73	CSM CDH Targeting
74	CSM TPI Targeting
75	CSM TPM Targeting
76	Target $\Delta V$

Basic Date October 6, 1969

Changed

VERBS

01	Display Octal Comp 1 in R1
02	Display Octal Comp 2 in R1
03	Display Octal Comp 3 in R1
04	Display Octal Comp 1&2 in R1&R2
05	Display Octal Comp 1,2&3 in R1,R2&R3
06	Display Decimal in R1 or R1,R2 or R1, R2,R3
07	Display DP Decimal in R1&R2
11	Monitor Octal Comp 1 in R1
12	Monitor Octal Comp 2 in R1
13	Monitor Octal Comp 3 in R1
14	Monitor Octal Comp 1&2 in R1&R2
15	Monitor Octal Comp 1,2&3 in R1,R2&R3
16	Monitor Decimal in R1 or R1,R2 or R1,R2,R3
17	Monitor DP Decimal in R1&R2
21	Load Component 1 in R1
22	Load Component 2 in R2
23	Load Component 3 in R3
24	Load Component 1&2 in R1&R2
25	Load Component 1&2&3 in R1&R2&R3
27	Display Fixed Memory
30	Request Executive (P00 only)
31	Request Waitlist (P00 only)
32	Recycle
33	Proceed
34	Terminate
35	Test Lights (P00 only)
36	Request Fresh Start
37	Change Program
40	Zero CDU's (Specify N20 or N72)
41	Coarse Align CDU's (Specify N20 or N72)
42	Fine Align IMU
43	Load FDAI Error Needles (test only)
44	Terminate Continuous Designate (V41N72 Option 2)
47	Initialize AGS (R47)
48	Load DAP Data (R03)
49	Start Crew Defined Maneuver (R62)
50	Please Perform
52	Mark X

VERBS

Basic Date October 6, 1969Changed

VERBS

- 53 Mark Y
- 54 Mark X or Y
- 55 Increment LGC Time (Decimal)
- 56 Terminate Tracking (P20,P22,&P25)
- 57 Call LR Update
- 58 Inhibit LR Update
- 59 Command LR To Pos. 2 (Don't Use In Ave G)
- 60 Display Attitude Rates On Error Needles (NON AGS)
- 61 Display DAP Attitude Error
- 62 Display Total Attitude Error
- 63 Start RR/LR Self-Test
- 64 Start S-Band Antenna Routine (R05)
- 65 Disable U,V Jets During DPS Burns
- 66 Set LM State Vector into CSM State Vector
- 67 W-Matrix Monitor
- 69 Cause Restart
- 70 Update Liftoff Time (P27)
- 71 Universal Update Load Block Addresses (P27)
- 72 Universal Update Load Singular Addresses(P27)
- 73 Update LGC Time (Octal) (P27)
- 74 Initialize Eraseable Dump via Downlink
- 75 Enable U,V Jets During DPS Burns
- 76 Set Min Impulse Mode in DAP
- 77 Set Rate Command/Attitude Hold Mode in DAP
- 78 Start LR Spurious Test (R77)
- 79 Stop LR Spurious Test (R77)
- 80 Update LM State Vector
- 81 Update CSM State Vector
- 82 Request Orbit Parameter Display (R30)
- 83 Rendezvous Parameter Display (R31)
- 85 Display RR LOS Az and El
- 89 Start Rendezvous Final Attitude Maneuver (R63)
- 90 Request Rendezvous Out of Plane Display (R36)  
(Non Ave G)
- 91 Display Banksum (P00 Only)
- 92 Start IMU Performance Test (P07) (non-flight)
- 93 Enable W-Matrix Initialization (Clear Rend<sup>er</sup>)
- 95 Inhibit State Vector Update (P20 or P22)
- 96 Interrupt Integration and Go to P00
- 97 Perform Engine Fail Procedure (R40)
- 99 Enable Engine Ignition

Basic Date October 6, 1969

Changed \_\_\_\_\_



NOUN LIST V - Can Be Called At Any Time For Valid Data

01V	Address to be Specified (Frac)		.XXXXX
02V	Address to be Specified (Whole)		XXXXX.
03	Address to be Specified (Degree)		.01°
04	Gravity Error Angle		.01°
05	Angular Error/Difference		.01°
06	Option Code		Octal
	Desired Option		Octal
	Data		Octal
07	Flag Word Operator	ECADR	Octal
		BIT ID	Octal
		Action	Octal
08V	Alarm Data		Octal
09V	Alarm Codes		Octal
10V	Channel to be Specified		Octal
11	TIG CSI/T(APOAPSIS)	hrs,min,.01sec	
12	Option Code (Extended Verbs Only)		Octal
	Desired Option		Octal
13	TIG CDH	hrs,min,.01sec	
14	Checklist (Internal to LGC)		XXXXX.
15	Increment Address		Octal
16	Time of Event (Extended Verbs Only)	hrs,min,.01sec	
18	Desired Maneuver To FDAI RPY Angles		.01°
20V	ICDU Angles Y,P,R (OG,IG,MG)		.01°
21V	PIPA PULSES		XXXXX.
22	New ICDU Angles Y,P,R,(OG,IG,MG)		.01°
24	Delta Time For LGC Clock	hrs,min,.01sec	
25	Checklist (Used With V50)		Octal
26	Prio/Delay, ADRES, BBCON		Octal
27V	Self Test ON/OFF		
32	Time From Perigee	hrs,min,.01sec	
33	TIG	hrs,min,.01sec	
34	Time of Event	hrs,min,.01sec	
35	Time From Event	hrs,min,.01sec	
36V	LGC Clock Time	hrs,min,.01sec	
37	TIG TPI	hrs,min,.01sec	
38	Time of State Being Integrated	hrs,min,.01sec	
40	Time From Ignition/Cutoff		min-sec
	VG		.1fps
	ΔV (Accumulated)		.1fps

Basic Date October 6, 1969  
Changed           

NOUNS

PGNS-6

41	Target Azimuth (Non-Flight)		.01°
	Elevation		.001°
42	Apogee		.1nm
	Perigee		.1nm
	ΔV (Required)		.1fps
43	Latitude (+North)		.01°
	Longitude (+East)		.01°
	Altitude		.1nm
44	Apogee		.1nm
	Perigee		.1nm
	TFF		min-sec
45V-R1	Marks		XXXXX.
	TFI Of Next/From Last Burn		min-sec
	MGA		.01°
46V	Digital Autopilot Configuration		Octal
47V	LM Weight		lbs
	CSM Weight		lbs
48V	Engine Gimbal Pitch Trim (+ Only)		.01°
	Engine Gimbal Roll Trim (+ Only)		.01°
49	ΔR		.1nm
	ΔV		.1fps
	Source Code		0000X.
51	S-Band Antenna		
		Pitch	.01°
		Yaw	.01°
52	Central Angle of Active Vehicle		.01°
54	Range		.01nm
	Range Rate		.1fps
	Theta		.01°
55	No. of Apsis Crossings (or Precision Offsets)		0000X.
	Elevation Angle		.01°
	Central Angle		.01°
56	RR LOS Azimuth		.01°
	Elevation		.01°
58	Perigee Alt. (Post TPI)		.1nm
	ΔV TPI		.1fps
	ΔV TPF		.1fps
59	ΔV LOS Fwd/Aft (+FWD)		.1fps
	ΔV LOS Rt/Left (+RT)		.1fps
	ΔV LOS Up/Dn (+DN)		.1fps

NOUNS

Basic Date October 6, 1969

Changed \_\_\_\_\_

## PGNS-7

60	V (Horizontal) (Always +)	.1fps
	H DOT (+ Increasing H)	.1fps
	H	ft
61	TG	min-sec
	TFI	min-sec
	Crossrange	.1nm
62	VI	.1fps
	TFI	min-sec
	$\Delta V$ Accumulated	.1fps
63	VI	.1fps
	H DOT (+ Increasing H)	.1fps
	H	ft
64	TR/LPD	Sec/deg
	H DOT (+ Increasing H)	.1fps
	H	ft
65V	Sampled LGC Time, Hrs	hrs
	Min	min
	Sec	.01sec
66V-R2	LR Slant Range	ft
	LR Position	00001/00002
67	LR VX	fps
	VY	fps
	VZ	fps
68	Slant Range to LS	.1nm
	TG Braking	min-sec
	LR Alt-Comp Alt ( $\Delta$ Alt)	ft
69	Ldg Site Correction Comp Z,X,Y	ft
70	AOT Detent/Star Code	Octal
71	AOT Detent/Star Code	Octal
72V	RR Trunnion Angle	.01°
	RR Shaft Angle	.01°
73	Desired RR Trunnion Angle	.01°
	Desired RR Shaft Angle	.01°
74	TFI	min-sec
	Yaw	.01°
	Pitch	.01°
75	$\Delta H$ (CDH)	.1nm
	$\Delta T$ (CDH-CSI/TPI-CDH)(Modular 60)	min-sec
	$\Delta T$ (TPI-CDH/TPI-Nom TPI)(Modular 60)	min-sec
76	V (HOR)	.1fps
	V (VERT)	.1fps
	Crossrange	.1nm

Basic Date October 6, 1969  
 Changed - October 17, 1969

PGNS-8

77	$\Delta T$ to Engine Cutoff		min-sec
	Velocity Normal To CSM Plane		.1fps
78	RR Range		.01nm
	RR Range Rate		fps
	TFI		min-sec
79	Cursor Angle		.01°
	Spiral Angle		.01°
	Detent Position		0000X
80	Data Indicator		XXXXX.
	Omega		.01°
81	$\Delta V_X$ (LV) (+ Fwd)		.1fps
	$\Delta V_Y$ (LV) (+ Rt)		.1fps
	$\Delta V_Z$ (LV) (+ Dn)		.1fps
82	$\Delta V_X$ (LV) (+ Fwd)		.1fps
	$\Delta V_Y$ (LV) (+ Rt)		.1fps
	$\Delta V_Z$ (LV) (+ Dn)		.1fps
83	$\Delta V_X$ (LM) (+ Up)		.1fps
	$\Delta V_Y$ (LM) (+ Rt)		.1fps
	$\Delta V_Z$ (LM) (+ Fwd)		.1fps
84	$\Delta V_X$ (Other Vehicle) + (RXV)XR		.1fps
	$\Delta V_Y$ (Other Vehicle) + (VXR)		.1fps
	$\Delta V_Z$ (Other Vehicle) + (-R)		.1fps
85	VGX (LM) (+ Up)		.1fps
	VGY (LM) (+ Rt)		.1fps
	VGZ (LM) (+ Fwd)		.1fps
86	VGX (LV) (+ Fwd)		.1fps
	VGY (LV) (+ Rt)		.1fps
	VGZ (LV) (+ Dn)		.1fps
87	Backup Optics LOS Azimuth (+ Rt)		.01°
	Elevation (+ Up)		.01°
88	Celestial Body Vector	X	.XXXXX
		Y	.XXXXX
		Z	.XXXXX
89	Latitude (+ North)		.001°
	Longitude/2 (+ East)		.001°
	Altitude		.01nm
90	Rendezvous Out of Plane Parameter Y		.01nm
		YDOT	.1fps
		PSI	.01°
91	Alt		10nm
	Vel		fps
	Flt Path Angle		.01°

Basic Date - October 6, 1969

Changed

PGNS-9

93	Δ Gyro Torquing Angles	X	.001°
		Y	.001°
		Z	.001°
97	System Test Inputs		XXXXX.
98	System Test Results		XXXXX.
			.XXXXX
			XXXXX.
99	W-Matrix: RMS Position		ft
	RMS Velocity		.1fps
	Radar Bias Angle		mr

V50 N25 CHECKLIST CODES

<u>RT Code</u>	<u>FUNCTION</u>
00013	Key In Normal Or Gyro Torque Coarse Align
00014	Recheck or Exit Fine Align Option
00015	Star Acquisition
00062	Power Down LGC
00201	Select RR LGC Mode
00203	Select PGNS, AUTO,&AUTO THROTTLE
00205	Slew RR For Manual Acquisition
00500	Switch LR Antenna to Position 1

N06 or N12 OPTION CODES

00001	Specify IMU Orientation	1 = Preferred 2 = Nominal 3 = REFSMAT 4 = Landing Site
00002	Specify Vehicle	1 = LM 2 = CSM
00003	Specify Tracking Attitude	1 = Preferred 2 = Other
00004	Specify Radar	1 = RR, 2 = LR
00006	Specify RR Coarse Align Option	1 = Lock On 2 = Continuous Designate
00010	Specify Alignment Mode	0 = Anytime 1 = REFSMAT + 1G 2 = 2 Bodies 3 = 1 Body + 1G

CHECKLIST CODES  
ALARMS

Basic Date October 6, 1969  
Changed

PGNS-10

00012	Specify CSM Orbit Option	1 = No Orbit Change
		2 = Change Orbit To Pass Over LM

V05 N09 ALARM CODES

- 20105 P \*\*AOT Mark System In Use  
Reselect P5X
- 00107 P More Than 5 Mark Pairs (5 Marks On Surface)  
Continue
- 00111 P Mark Missing  
Restart Mark Sequence
- 00112 P Mark or Mark Reject Not Being Accepted  
Continue
- 00113 H No Inbits  
Continue
- 00114 P Mark Made But Not Desired  
Mark Correct Axis (X or Y) Continue
- 00115 P No Marks in Last Pair to Reject  
Continue
- 00206 P Zero Encode Not Allowed With Coarse  
Align & Gimbal Lock  
Coarse Align To 0,0,0 Then V40N20E
- 00207 P/H ISS Turn On Request Not Present For 90 sec  
CB(11) IMU OPR - Open, Wait 3 Min, & Reclose  
If Alarm Recurs And No ISS Warning, Continue
- 00210 P/H IMU Not Operating  
CB(11) IMU OPR - Open, Wait 3 Min, & Reclose  
V36E, Consult MSFN, Continue
- 00211 H Coarse Align Error  
If P51, P52, or P57 in Progress, Record Gyro  
Torquing Angles and Perform Fine Align  
Check in P52, P57  
If P51 or P52 Not In Progress  
Reduce Spacecraft Drift, Continue
- 00212 H PIPA Fail, But PIPA is Not Being Used  
Go to ISS MALFUNCTION PROCEDURES
- 00213 H IMU Not Operating With Turn-On Request  
See 00210
- 00214 P/H Program Using IMU When Turned OFF  
Terminate Program

October 6, 1969

Basic Date \_\_\_\_\_

Changed \_\_\_\_\_

CHECKLIST CODES  
ALARMS

LM-6

## PGNS-11

00217 H Bad Return From Stall Routine  
Reinitiate Current Program  
If Alarm Recurs, ISS Mode  
Switching Failure

00220 P IMU Not Aligned  
Align or If Aligned, Set REFSMMAT FLAG

00401 I Desired Gimbal Angles Yield Gimbal Lock  
Call N22, MNVR if MGA 85° or Realign IMU

00402 P FINDCDUM Routine Not Controlling Attitude  
GUID CONT - AGS

00404 I Defined Star Not Available In Any Detent  
See P57/6

00405 I Two Stars Not Available  
See P52/6

00421 I W-Matrix Overflow  
Notify MSFN

20430 I \*\*Acceleration Overflow In Integration  
Notify MSFN

00501 I RR Antenna Out of Present Mode Limits  
See P20/8

00502 I Bad Radar Gimbal Angle Input  
Redo V41N72

00503 I Radar Antenna Designate Fail  
See P20/8 or P22/5

00510 P Radar Auto Discrete Not Present  
RR Mode - LGC, Continue  
CB(11) RR(2) - CLOSE

00511 P LR Not In Pos1 (P63) or 2(P64)  
LDG ANT-DES (Hover) Wait 10 sec,AUTO

00514 P RR Out Of Auto Mode While In Use  
RR MODE - LGC or V56E

00515 H RR CDU Fail Discrete Present  
Notify MSFN, Continue

00520 P/H RADARUPT Not Expected At This Time  
Continue

00521 I Could Not Read Radar, See P20/8

00522 P LR Position Change

00523 P LR Ant Not In Position 2, V58E, PRO  
LDG ANT - HOVER

00525 I  $\Delta$ THETA >3°  
See P20/8 or P22/5

00526 I Range >400 Miles.Terminate P20

Basic Date — October 6, 1969  
Changed — October 24, 1969

LM-6

PGNS-12

- 00527 I LOS Not In Mode II Coverage (P22) or  
Vehicle Mnvr Required (P20)  
Terminate If P22  
In P20, Mnvr
- 00530 I LOS Not In Mode II Coverage On Surface  
After 600 sec  
Reselect P22
- 00600 I Imaginary Roots On First Iteration  
See P32/4 or P72/4
- 00601 I Perigee Altitude (Post CSI) <35,000 ft  
(Lunar Orbit)  
See P32/4 or P72/4
- 00602 I Perigee Altitude (Post CDH) <35,000 ft  
(Lunar Orbit)  
See P32/4 or P72/4
- 00603 I CSI To CDH Time 10 Min  
See P32/4 or P72/4
- 00604 I CDH To TPI Time <10 Min Or TIG CDH > TIG TPI  
See P32/4 or P72/4
- 00605 I Number Of Iterations > 15  
Program Cannot Converge On CSI Solution  
See P32/4 or P72/4
- 00606 I  $\Delta V$  Exceeds Max  
See P32/4 or P72/4
- 20607 I \*\*No Solution From Time-Theta or Time-Radius
- 00611 I No TIG For Given Elevation Angle  
See P33/2, P34/3, P73/4, P74/2
- 00701 I Illegal Option Code Selected  
V32E Reselect Option
- 00777 H PIPA Fail Caused The ISS Warning  
Go To ISS Malfunction Procedure
- 01102 H LGC Self Test Error  
Call N08 & Record For MSFN
- 21103 I \*\*Unused CCS Branch Executed  
Copy N08, Notify MSFN, Continue
- 31104 H \*Delay Routine Busy  
Reselect Extended Verb
- 01105 H Downlink Too Fast  
If Alarm Recurs, Downlink Failure
- 01106 H Uplink Too Fast  
If Alarm Recurs, Uplink Failure

Basic Date - October 6, 1969

Changed \_\_\_\_\_



- 01107 H Phase Table Failure  
Perform: 1. V74 LGC DOWNLINK  
2. P27 As Necessary  
3. V48 As Necessary  
4. Reestablish REFSMMAT via P51  
If FRESH START Recurs, LGC FAILURE
- 31201 P \*Executive Overflow - No Vac. Areas  
Reselect Extended Verb or Continue Program
- 31202 P \*Executive Overflow - No Core Sets  
See 31201
- 31203 P/I \*Waitlist Overflow - Too Many Tasks  
See 31201
- 21204 P/I \*\*Waitlist, Var Delay, Fix delay, Longcall,  
Or Delay Job Called With Zero Or Negative  
 $\Delta T$   
Copy N08, Notify MSFN, Continue
- 31206 P \*Two Jobs Try To Sleep in PINBALL  
See 31201
- 31207 P \*No Vac Area For Marks  
Reselect P51 or P52
- 31210 P \*Two Routines Using Device at Same Time  
Reselect Extended Verb or Prog When Device  
No Longer In Use  
Record N08, Notify MSFN, Continue
- 31211 P \*Illegal Interrupt of Extended Verb  
Reselect P51 or P52
- 01301 I ARCSIN-ARCCOS Input Angle Too Large  
Copy N08, Notify MSFN, Continue
- 21302 I \*\*SQRT Called With Negative Argument  
See 01301
- 01406 I Bad Return From Rootpsrs  
(\* 21406 - Occurs In P63 Ign Algorithm)
- 01407 P VG Increasing  
See P40/IGN or P42/IGN
- 01410 P/I Unintentional Overflow in Guidance,  
Contact MSFN
- 01412 I Descent Ignition Algorithm Non-Converging  
Consult MSFN
- 21501 P \*\*Illegal Internal Use of PINBALL  
See 01301
- 31502 P \*Illegal Flashing Display  
See 01301
- 01520 P V37 Request Not Permitted At This Time  
Reselect V37

Basic Date October 6, 1969Changed           

LM-6

PGNS-14

- 01600 H Overflow in Drift Test  
Perform V36E
- 01601 H Bad IMU Torque
- 01703 P TIG Slipped
- 01706 P P40 Selected But Staged  
P42 Selected But Not Staged  
See P40/1 or P42/1
- 32000 P \*DAP Still In Progress At Next TIMES/RUPT  
RSET, GUID CONT - AGS Then PGNS; If Alarm  
Rekurs, V36E, Reinitialize LGC
- 02001 I Jet Failures Have Disabled Y-Z Trans  
Change Quad Isol Valve or Use  
Alternate Control Mode
- 02002 I Jet Failures Have Disabled X Trans  
See 02001
- 02003 I Jet Failures Have Disabled P Rotation  
See 02001
- 02004 I Jet Failures Have Disabled U-V Rotation  
See 02001
- 03777 H ICDU Fail Caused the ISS Warning  
Go to ISS Malfunction Procedures
- 04777 H ICDU, PIPA Fails Caused the ISS Warning  
Go to ISS Malfunction Procedures
- 07777 H IMU Fail Caused The ISS Warning  
Go to ISS Malfunction Procedures
- 10777 H IMU, PIPA Fails Caused The ISS Warning  
Go to ISS Malfunction Procedures
- 13777 H IMU, ICDU Fails Caused The ISS Warning  
Go to ISS Malfunction Procedures
- 14777 H IMU, ICDU, PIPA Fails Caused The ISS Warning  
Go to ISS Malfunction Procedures

\*Generates Software Restart (3XXXX)

\*\*Abort Code, Program Goes To R00. (2XXXX)

- P - Procedure Caused Alarm
- I - Input Data Caused Alarm
- H - Hardware Status Caused Alarm

Alarms for V05N09

- R1 First Alarm After RSET
- R2 Second Alarm After RSET
- R3 Most Recent Alarm

October 6, 1969

Basic Date \_\_\_\_\_  
Changed \_\_\_\_\_

LM-6

# RECOV-1

## GENERAL SYSTEM CHECKOUT

- 1 Go To P00 By One of the Following:  
V37E 00E or  
V96E or  
V36E V96E (Wait 15 sec Before P00E )

Simultaneously Press RSET And  
MARK REJECT (GO JAM)

V37E 00E

## REASONABLENESS CHECK

- 1 V82 With Both Options
- 2 V83
- 3 P21 NAV CHECK
- 4 P52 Check Auto Optics Positioning  
IF NOMINAL:  
Continue  
IF NOT NOMINAL:  
Perform P27 Update
- 5 LGC SELF-TEST

## P06 (F 50 25 00062)

- 1 PRO to STBY Then  
PRO to F 37 or  
V21 N10E, 13E, 0E  
V37E 00E
- 2 V37E 51E  
PRO  
V37E 00E
- 3 V25 N07E, 77E, 10000E, 1E

Basic Date October 6, 1969  
Changed October 24, 1969



6 16 77 TG,V(Y) (min-sec,.1fps)  
 N85E

7 16 85 VG XYZ (LM) (.1fps)

VGX=200fps SYS A MAIN SOV - OPEN  
 SYS B MAIN SOV - OPEN  
 SYS A ASC FEED 2-CLOSE  
 SYS B ASC FEED 2-CLOSE  
 CRSFD -CLOSE

VGX=100fps, ENG ARM - OFF

APS  
 OFF

NULL COMPONENTS  
 KEY REL

8 F 16 63 VI,HDOT,H (.1fps,ft)  
 ABORT STAGE - Reset  
 ENG STOP - Push Then Reset

Note VI \_\_\_\_\_  
 HDOT \_\_\_\_\_  
 H \_\_\_\_\_  
 PRO

9 F 16 85 VG XYZ (LM) (.1fps)  
 (DISPLAY ORB PARAM) V82E To 10  
 (TERM) PRO To 11

10 F 16 44 APO ALT, PER ALT, TFF (.1nm,min-sec)

Note HA \_\_\_\_\_  
 HP \_\_\_\_\_  
 TFF \_\_\_\_\_  
 PRO To 9

11 F 37

Basic Date \_\_\_\_\_ October 6, 1969  
 Changed \_\_\_\_\_

P20 RENDZ NAV

- 1           V37E 20E  
 (TO TERM-V56E)  
 (SV OPTION, V80E LM, V81E CSM, V95E NONE)
- 2 (If Pointing Error  $<10^\circ$ , To 4; Mnr With No Display)  
 F 50 18   REQUEST MNVR TO FDAI RPY ANGLES   (.01°)  
 (AUTO or TRIM) GUID CONT - PGNS  
           MODE CONT: PGNS - AUTO  
           PRO  
 (MAN)   MODE CONT: PGNS - ATT HOLD  
           MNVR  
           PRO To 2  
 (BYPASS) ENTR To 4 (To 9 If Entered From  
                           9 Via V32E)  
                           (To 6 If Entered From  
                           6 Via ENTR)
- 3       06 18   AUTO MNVR TO FDAI RPY ANGLES   (.01°)  
 Monitor Auto Mnr To 2
- 4           RR MODE: LGC To 7  
                   (To 8 If Entered From 6  
                   or 9 via PRO)  
           SLEW or AUTO To 5
- 5       F 50 25   00201 RR ACQ MODE  
 (AUTO)       RR MODE LGC  
           PRO To 4  
 (MAN)       ENTR
- 6       F 50 25   00205 SLEW RR For LOCK-ON  
 (LOCK)       RR MODE-LGC:  
           NO TRACK Lt - Off, Wait 10 sec  
           PRO To 4  
 (NO LOCK) MNVR  
           ENTR To 2
- \*F 05 09 501 RR OUT OF MODE LIMITS\*  
 \*            (REQUEST MNVR) V32E To 2\*

Basic Date October 6, 1969  
 Changed

7 F 50 72 TRUN, SHFT (.01°)  
 Confirm Main Lobe Lock-On  
 (ACQUIRE MAIN LOBE)  
 RR MODE - SLEW  
 Slew To Peak AGC  
 RR MODE - LGC  
 (ACCEPT) PRO

8 NO TRACK LITE

OUT DSKY BLANKS, RR TAKING MARKS  
 (RAW RR DATA) V16N78E R, RDOT, TFI  
 (.01nm, fps, min-sec)  
 KEY REL

\*F 05 09 00525 SV/RR LOS >3° \*  
 \* PRO \*  
 \*F 06 05 SV/RR LOS (.01°) \*  
 \* (REJECT) CK SIDE LOBE \*  
 \* RR MODE-LGC \*  
 \* V32E To 7 \*  
 \* (UPDATE) PRO To 8 \*  
 \* \* \*  
 \*F 06 49 ΔR, ΔV, Code(.1nm, .1fps, \*  
 \* 0000X) \*  
 \* X=1, RANGE \*  
 \* X=2, RDOT \*  
 \* X=3, SHAFT } \*  
 \* X=4, TRUN } \*  
 \* (REJECT PARTIAL MARK) V32E To 8 \*  
 \* (REJECT TOTAL MARK) V34E To 8 \*  
 \* (MAN ACQ) RR MODE - SLEW \*  
 \* Acquire \*  
 \* RR MODE - LGC \*  
 \* V32E To 4 \*  
 \* (UPDATE) PRO To 8 \*  
 \* \* \*  
 \*F 50 18 (MNVR REQUEST) Go To 2 \*

ON NO LOCK  
 F 05 09 00503 RR NO DATA GOOD 30 SEC(or Desig.  
 Fail)  
 (REDESIG) V32E To 4  
 (SEARCH) PRO To 9

Basic Date October 6, 1969  
 Changed

PGNS-20

```

*V05 N09E 00521 Could Not Read Radar *
*                KEY REL To 7 *
*      00515 RR CDU FAIL DISCRETE *
*                PRESENT *
*                KEY REL To 7 *
*      00501 RR Ant. Out Of Mode Limits*
*                RR To + Z *

```

```

9   F 16 80   RR AUTO SEARCH, SEARCH CODE,      (.01°)
      R1  00000-SEARCH 42 sec/scan
      11111-LOCK ON
      R2  LOS/+Z
      (LOCK) PRO To 2
      (NO LOCK OR MAN ACQ) SLEW RR For LOCK-ON
      RR MODE - LGC
      NO TRACK Lt-Out, To 9
      (MNVR) V32E To 2

```

P21 GROUND TRACK DETERMINATION

```

1   F 04 06   V37E 21E
      R1 00002, SPECIFY VEHICLE
      R2 00001 LM
      00002 CSM
      PRO

2   F 06 34   GET LAT, LONG                      (hrs,min,.01sec)
      (Zero For Present Time)
      PRO

3   F 06 43   LAT, LONG, ALT                      (.01°, .1nm)
      (N91 CALL) N91E
      F 06 91 ALT, VEL, FLT PATH }
      (10nm, fps, .01°)
      KEY REL
      (INCREMENT GET 10 min) V32E To 2
      (TERM) PRO

```

4 F 37

Basic Date October 6, 1969

Changed



P22 LUNAR SURFACE NAVIGATION

1

V95E  
V37E22E  
(To TERM-V56E)  
(SV OPTION, V81E CSM, V95E NONE)  
F 04 06 R1 00012 CSM ORBIT OPTION  
R2 00001 CSM WILL NOT CHANGE  
ORBIT  
00002 CSM WILL CHANGE ORBIT

(OPT 1) To 3  
(OPT 2) PRO To 2

2

F 06 33 TIG ASC (hrs,min,.01 sec)  
PRO

3

V83E, Rng <400, PRO, PRO  
V16N38E  
When N38 = Present time and remains equal:  
V24N01E, 3424E  
Load MSFN supplied octal acq. time  
RR MODE - LGC To 5  
- SLEW or AUTO TRACK To 4

4

F 50 25 R1 00201 RR AUTO REQUEST  
RR MODE - LGC  
PRO

\*PROG Lt-On \*  
\*F 05 09 00530 CSM NOT IN MODE II\*  
\* LIMITS YET \*  
\* (WAIT FOR CSM) PRO \*  
\* V37E 22E \*  
\* (TERM) V56E \*

5

NO TRACK Lt:

OUT DSKY BLANKS, RR TAKING MARKS  
(P22 Continues To Run In Background)

Basic Date October 6, 1969  
Changed October 23, 1969

LM-6

PGNS-22

(RAW RR DATA) V16N78E R,RDOT,TFI  
 (.01nm, fps, min-sec)  
 KEY REL

```

    *F 05 09 00525 SV/RR LOS >3°      *
    *          PRO                       *
    *F 06 05 SV/RR LOS (.01°)          *
    *          (REJECT) CHECK SIDE LOBE *
    *          RR MODE - LGC           *
    *          V32E To 5                *
    *          (UPDATE) PRO To 3 or below *
    *F 06 49 ΔR,ΔV,Code(.1nm,.1fps,    *
    *          0000X)                   *
    *          X=1, RANGE                *
    *          X=2, RDOT                 *
    *          (UPDATE) PRO To 5         *
    *          (REREAD) V32E To 5       *
    
```

ON

```

    F 05 09 00503 RR DESIG FAIL
    (REDESIGN) ENTR To 3
    (SEARCH) PRO To 6
    (TERM) V56E
    
```

```

    6 F 16 80 RR AUTO SEARCH, SEARCH CODE (.01°)
    R1 00000 Search (42 sec/scan)
    11111 LOCK-ON
    R2 LOS/+Z (.01°)
    (NO LOCK) V56E
    (LOCK) PRO To 3
    
```

```

    *PROG Lt-On      *
    *V05N09E 00527 CSM OUT *
    *          OF MODE II LIMITS*
    *          (TERM) V56E      *
    
```

Basic Date. ) October 6, 1969

Changed \_\_\_\_\_

P25 PREFERRED TRACKING ATT

1 V37E 25E  
 (To TERM - V56E)  
 F 50 18 REQUEST MNVR TO FDAI RPY ANGLES (.01°)  
 (AUTO or TRIM) GUID CONT - PGNS  
 MODE CONT: PGNS - AUTO  
 PRO  
 (MAN) MODE CONT: PGNS - ATT HOLD  
 MNVR  
 PRO To 1  
 (BYPASS) ENTR To 3

2 06 18 AUTO MNVR TO FDAI RPY ANGLES (.01°)  
 Monitor Auto Mnvr, To 1

3 P25 Continues To Run  
 In Background Until Terminated  
 (RAW RR DATA) V16N78E R,RDOT,TFI  
 (.01m,fps,min-sec)  
 KEY REL

P27 LGC MANUAL UPDATE

1 (NOTE: For Auto Update, If V33 N02  
 Displayed Key PRO; If V21 N02  
 or N01 Displayed Key V34E)

2 V37E 00E

3 IF AGS OPERATING, 563 + 00000E

4 V70E Update Lift Off Time  
 or V71E Load Consec Data  
 or V72E Load Singular Data  
 or V73E Increment LGC Time  
 (Update Form Will Format Index Number,  
 Address, Data & Component Identifier  
 To Be Usable With The Following Pro-  
 cedure)

Basic Date October 6, 1969  
 Changed

PGNS-24

- 5 F 21 01 R3 ADDRESS (Initially 1173)  
LOAD DATA IN R1 E (R3 Increments)
- 6 F 21 01 Repeat Step 5 For All Data
- 7 F 21 02 R3 Goes To 1167 When Data Load Complete

TO REVIEW DATA

V01 NOTE, T173E

R1 Data

N15E (R3 1174)

ENTR Verify Data For Remaining  
Comps.

KEY REL To 7

TO CHANGE DATA

Load Comp Identifier XX E

Correct Data E

Go To 7

TO ACCEPT UPDATE

V33E

8 P00 Displayed

Basic Date October 6, 1969  
Changed

P30 EXTERNAL ΔV

- 1 F 06 33 V37E 30E (hrs,min,.01sec)  
TIG  
PRO
- 2 F 06 81 ΔV XYZ(LV) (.1fps)  
PRO
- 3 F 06 42 HA, HP, ΔV (.1rm,.1fps)  
PRO
- 4 F 16 45 M, TFI, MGA (marks,min-sec,.01°)  
SET EVENT TIMER TO TFI  
PRO (MGA Set To -00002 If No  
REFSMAT Set)

5 F 37

P32 CSI PRETHRUST

- 1 F 06 11 V37E 32E (hrs,min,.01sec)  
TIG (CSI)/T(APOAPSIS)  
PRO  
If Zero, T (APOAPSIS) Displayed
- 2 F 06 55 APSIS CDH, TPI ELEVATION ANGLE, (+0000X,.01°)  
R3,0000Y  
For Y≠0,CDH At CSI+  
Multiple Of 180° Specified  
By R1(X)  
PRO
- 3 F 06 37 TIG (TPI) (hrs,min,.01sec)  
PRO
- 4 F 16 45 MARKS, TFI,-00001 (marks,min-sec)  
(RECYCLE) V32E To 5  
(TERM MARKING) PRO

P30-P35

Basic Date October 6, 1969

Changed

PGNS-26

```

*F 05 09 00600 No Intersection On      *
*                               First Iteration      *
* 00601 POST CSI ALT <35,000 ft*
* 00602 POST CDH ALT <35,000 ft*
* 00603 TIG(CDH)-TIG(CSI)<10mi
* 00604 TIG(TPI)-TIG(CDH)<10min*
* 00605 NO SOL IN 15 TRIES      *
* 00606 ΔV CSI >1000fps In 2      *
*                               Iterations      *
*                               V32E To 1 Adjust Inputs *
    
```

P30-P35

```

5   F 06 75   ΔH(CDH),ΔT (CDH-CSI),ΔT(TPI-CDH)
      PRO                               (.1mm,min-sec)

6   F 06 81   ΔV XYZ (LV) CSI (.1fps)
      (For Out-of-Plane Corr In Final Comp ONLY)
      V90E
      F 06 16   GET EVENT (hrs,min,.01sec)
      PRO
      F 06 90   Y,YDOT,PSI (.01mm,.1fps,.01°)
      Record YDOT _____
      PRO
      (Insert Neg YDOT In R2 Of ΔV CSI)
      PRO

7   F 06 82   ΔV XYZ (LV) CDH (.1fps)
      PRO (If Recycling To 4)

8   F 16 45   MARKS,TFI,MGA (-00002 If No REFSMMAT Set)
      (marks,min-sec,.01°)
      SET EVENT TIMER TO TFI
      PRO

9   F 37
    
```

Basic Date October 6, 1969  
 Changed \_\_\_\_\_

P33 CDH PRETHRUST

1 F 06 13 V37E 33E  
TIG (CDH) (hrs,min,.01sec)  
PRO

2 F 16 45 MARKS,TFI, -00001 (marks,min-sec)  
(RECYCLE) V32E To 3  
(TERMINATE MARKING) PRO

\*F 05 09 00611 NO TIG FOR \*  
\* SPECIFIED ANGLE \*  
\* (REDO)V32E To 1 \*  
\* (CONTINUE) PRO To 3 \*

3 F 06 75  $\Delta H(CDH), \Delta T(TPI-CDH), \Delta T(TPI-NOMTPI)$   
PRO (.1m,min-sec)

4 F 06 81  $\Delta V XYZ (LV) CDH$  (.1fps)  
(For Out-of-Plane Corr in Final Comp ONLY)

V90E  
F 06 16 GET EVENT (hrs,min,.01sec)  
PRO

F 06 90 Y,YDOT,PSI (.01m,.1fps,.01°)  
Record YDOT  
PRO

(Insert Neg YDOT in R2 of  $\Delta V CDH$ )  
PRO (If Recycling To 2)

5 F 16 45 MARK,TFI,MGA (-00002 If No REFSMMAT Set)  
(marks,min-sec,.01°)  
SET EVENT TIMER TO TFI  
PRO

6 F 37

P34 TPI PRETHRUST

1 F 06 37 V37E 34E  
TIG (TPI) (hrs,min,.01sec)  
PRO

Basic Date October 6, 1969  
Changed

PGNS-28

2 F 06 55 N, ELEVATION ANGLE, CENTRAL ANGLE  
 (0000X, .01°)  
 (00000 In R2 To Calc Elevation  
 Angle At TIG Time)  
 PRO

3 F 16 45 MARKS, TFI, -00001 (marks,min-sec)  
 (RECYCLE) V32E  
 (TERMINATE MARKINGS) PRO

\*F 05 09 00611 NO TIG\*  
 \* FOR \*  
 \* SPECIFIED \*  
 \* ANGLE \*  
 \* PRO To 1 \*

4 F 06 37 TIG (TPI) (hrs,min,.01sec)  
 PRO  
 (If Elevation Angle Computed By LGC  
 This Display Will Be Replaced By  
 F 06 55  
 PRO To 5)

5 F 06 58 HP, ΔV(TPI), ΔV(TPF) (.1nm,.1fps)  
 PRO (If Recycling To 7)

6 F 06 81 ΔV XYZ (LV) TPI (.1fps)  
 PRO

7 F 06 59 ΔV XYZ (LOS) TPI (.1fps)  
 PRO (If Recycling To 3)

8 F 16 45 MARKS, TFI, MGA (-00002 If No REFSMMAT Set)  
 (marks,min-sec,.01°)  
 SET EVENT TIMER TO TFI  
 PRO

9 F 37

P35 TPM PRETHRUST

1 F 16 45 MARK, TFI, -00001 (marks,min-sec)  
 (RECYCLE) V32E To 3  
 (TERM MARKING) PRO

Basic Date October 6, 1969  
 Changed \_\_\_\_\_



PGNS-29

- 2 F 06 81 ΔV XYZ (LV) TPM (.1fps)  
PRO
- 3 F 06 59 ΔV XYZ (LOS) TPM (.1fps)  
PRO (If Recycling To 1)
- 4 F 16 45 MARKS,TFI,MGA (-00002 If No REFSHAT Set)  
(marks,min-sec,.01°)  
SET EVENT TIMER TO TFI  
PRO

5 F 37

P40 DPS THRUST

GUID CONT	-PGNS
THR CONT	-AUTO
MAN THROT	-CDR
BAL CPL	-ON
ENG GMBL	-ENABLE
DES ENG CMD OVRD	-OFF
TTCA (Both)	-THROT (Min)
PRPLNT QTY MON	-DES 1
PRPLNT TEMP/PRESS MON	-DES 1
HELIUM MON	-SUPCRIT PRESS
DAP	-Set

1 V37E 40E

\*F 05 09 01706 LM Staged\*  
\* (TERM) V37E42E, or \*  
\* Reload DAP \*

- F 50 18 REQUEST MNVR TO FDAI RPY ANGLES (.01°)  
(AUTO or TRIM) GUID CONT - PGNS  
MODE CONT: PGNS - AUTO  
PRO  
(MAN) MODE CONT: PGNS - ATT HOLD  
MNVR  
PRO To 1  
(BYPASS) ENTR To 3

2 06 18 AUTO MNVR TO FDAI RPY ANGLES (.01°)  
Mon Auto MNVR To 1

Basic Date October 6, 1969  
Changed                     

LM-6

P40-P47

PGNS-30

3 06 40 TFI, VG, VM (min-sec, .1fps)  
 MASTER ARM - ON (1st BURN)  
 SET EVENT TIMER TO TFI

\*PROG Lt - On \*  
 \*V05 N09E 01703 TIG SLIPPED\*  
 \* RSET, KEY REL \*

-:35 DSKY BLANKS  
 ENG ARM - DES

-:30 06 40 (AVE G ON)

-:15 VERIFY ΔVM (R3) <00005

-:07.5 Verify +X ULLAGE

-:05 F 99 40 ENG ON ENABLE  
 (AUTO) PRO (IGN WHEN TFI=:00sec)  
 (BYPASS) ENTR To DPS OFF

IGN 06 40 TFC, VG, ΔVM (min-sec, .1fps)

\*F 97 40 \*  
 \* (RECYCLE ΔV MON) PRO \*  
 \* (RECYCLE) ENTR To TIG -5 \*  
 \* (TERM) ENG ARM-OFF V34E To 5\*  
 \* \*  
 \* PROG Lt-On \*  
 \* V05N 09E 01407 VG INCREAS- \*  
 \* \* ING \*  
 \* TERM BURN OR SWITCH \*  
 \* TO AGS \*

DPS OFF F 16 40 TFC, VG, ΔVM (min-sec, .1fps)  
 ENG STOP - Push  
 ENG ARM - OFF  
 PRO

P40-P47

Basic Date October 6, 1969  
 Changed

LM-6

PGNS-31

4 F 16 85 VG XYZ (LM) (.1fps)  
 NULL COMPONENTS  
 PRO

5 F 37 MASTER ARM -OFF  
 ENG STOP -Reset  
 PRPLNT QTY MON -OFF  
 HELIUM MON -OFF

P41 RCS THRUST

TTCA (CDR) - JETS  
 EVENT TIMER- Set  
 DAP - Set

1 F 50 18 V37E 41E  
 REQUEST MNVR TO FDAI RPY ANGLES (.01°)  
 (AUTO or TRIM) GUID CONT - PGNS  
 MODE CONT: PGNS - AUTO

PRO  
 (MAN) MODE CONT: PGNS - ATT HOLD

MNVR  
 PRO To 1  
 (BYPASS) ENTR To 3

2 06 18 AUTO MNVR TO FDAI RPY ANGLES (.01°)  
 Mon Auto Mmvr To 1

3 16 85 VG XYZ (LM) (.1fps)  
 \*PROG Lt - On \*  
 \*V05N 09E 01703 TIG SLIPPED\*  
 \*RSET, KEY REL \*

MODE CONT: PGNS - ATT HOLD

-:35 DSKY BLANKS

-:30 16 85 (AVE G ON)

:00 F 16 85 VG XYZ (LM) (.1fps)  
 NULL COMPONENTS  
 PRO

4 F 37

Basic Date October 6, 1969  
 Changed

PGNS-32

P42 APS THRUST

HELIUM MON -ASC PRESS 2  
PRPLNT TEMP/PRESS MON -ASC  
TTCA (CDR) -JETS  
DAP -Set

1

V37E 42E

\*F 05 09 01706 LM NOT STAGED \*  
\* (TERM) V34E \*  
\* (BYPASS) PRO To 1, Man Stage\*  
\* At -:30 \*

2

F 50 18 REQUEST MNVR TO FDAI RPY ANGLES (.01°)  
(AUTO or TRIM) GUID CONT - PGNS  
MODE CONT: PGNS - AUTO  
PRO  
(MAN) MODE CONT: PGNS - ATT HOLD  
MNVR  
PRO To 1  
(BYPASS) ENTR To 3

3

06 18 AUTO MNVR TO FDAI RPY ANGLES (.01°)  
Mon Auto Mvr To 1

\*PROG Lt - On \*  
\*V05N 09E 01703 TIG SLIPPED \*  
\* RSET, KEY REL \*

4

06 40 TFI, VG, VM (min-sec, .1fps)  
EVENT TIMER-SET

-:35 DSKY BLANKS  
ENG ARM-ASC

-:30  
06 40 (AVE G ON)

-:15 Verify ΔVM (R3) <00005

Basic Date October 6, 1969  
Changed \_\_\_\_\_

-:05  
 F 99 40 ENG ON ENABLE  
 -:03.5 Verify +X ULLAGE  
 (V34E NO ULLAGE, ENG ARM-OFF, To 5)  
 (AUTO)PRO (IGN WHEN TFI=:00 sec)  
 (BYPASS) ENTR To APS OFF

IGN 06 40 TFI, VG, ΔVM (min-sec, .1fps)

\*F 97 40 \*  
 \*(RECYCLE ΔV MON) PRO \*  
 \*(RECYCLE) ENTR TO TIG -5 \*  
 \*(TERMINATE) ENG ARM-OFF \*  
 \* V34E To 5 \*

APS OFF F 16 40 TFC, VG, ΔVM (min-sec, .1fps)  
 ENG ARM - OFF  
 PRO  
 HELIUM MON - OFF

5 F 16 85 VG XYZ (LM) (.1fps)  
 NULL COMPONENTS  
 PRO

6 F 37

P47 ΔV MONITOR

1 V37E 47E  
 (20 sec Delay Minimum)  
 F 16 83 ΔV XYZ (LM) (.1fps)  
 (EXIT) PRO  
 (RECYCLE) V32E (Zeroes N83 Display)

2 F 37

Basic Date October 6, 1969  
 Changed \_\_\_\_\_

P51 IMU ORIENTATION

CB(11) AC BUS B: AOT LAMP-Close

- 1  
 F 50 25 V37E 51E  
 R1 00015 MNVR TO ACQ STARS  
 (To Coarse Align IMU To 0,0,0-ENTR)  
 41 22 All Zeroes  
 PRO
- 2  
 F 01 71 R1 00CDE (C)DETENT (DE)STAR CODE  
 C 1-L, 2-F, 3-R, 4-RR, 5-CL, 6-LR  
 7-COAS(+00000, +00000)FWD  
 (+00000, +09000)OVHD  
 PRO  
 (For C=7)  
 F 06 87 AZ,EL (.01°)  
 PRO
- 3  
 F 54 71 MARK X(52) and Y(53)  
 PRO  
 (For DE=00  
 F 06 88 CELESTIAL BODY VECTOR  
 Load Vector Values  
 PRO)  
 (After 1st Star) To 2  
 (After 2nd Star) To 4
- 4  
 F 06 05 R1 STAR ANGLE DIFFERENCE (.01°)  
 (RECYCLE) V32E To 1  
 PRO
- 5  
 F 37 CB(11) AC BUS B: AOT LAMP-Open

P52 IMU REALIGN

- 1  
 CB(11) AC BUS B: AOT LAMP-Close  
 V37E 52E  
 F 04 06 R1 00001 IMU ALIGN OPT  
 R2 00001 PREF (0,0,0 Specified Attitude)  
 PRO To 4  
 2 NOM (LV At Specified Time)  
 PRO To 2  
 3 REFSMAT PRO To 6  
 4 LANDING SITE PRO To 2

Basic Date October 6, 1969  
 Changed \_\_\_\_\_

PGNS-35

- 2 F 06 34 GET ALIGN (hrs,min,.01sec)  
 (0,0,0 For Present Time)  
 (TLAND FOR OPT 4)  
 (OPT 2) PRO To 4  
 (OPT 4) PRO To 3
- 3 F 06 89 LAT, LONG/2, ALT (.001°, .01nm)  
 PRO
- 4 F 06 22 NEW ICDU ANGLES OG, IG, MG (.01°)  
 (IF MGA NEAR GIMBAL LOCK, MNVR, Then V32E To 4)  
 PRO
- 5 F 50 25 R1 00013 (COARSE ALIGN)  
 (NORMAL) PRO To 6 NO ATT Lt-On Then Off  
 (GYRO TORQUE) MODE CONT (PGNS)-ATT HOLD  
 V76E  
 ENTR
- 16 20 PRESENT ICDU ANGLES OG, IG, MG (.01°)  
 When Torquing Complete To 14
- 6 F 50 25 R1 00015 SELECT STAR ACQUISITION MODE  
 MNVR If Necessary  
 (PICAPAR) PRO
- \*F 05 09 00405 NO PAIR \*  
 \*(CREW SPECIFY) PRO To 7 \*  
 \*(PICAPAR) V32E To 6 \*  
 (MAN ACQ) ENTR
- 7 F 01 70 R1 00CDE (C)DETENT (DE)STAR CODE  
 C 0 COAS CALIBRATION 1-L, 2-F, 3-R,  
 4-RR, 5-CL, 6-LR  
 7-COAS(+00000, +00000)FWD  
 (+00000, +09000)OVHD  
 (TERM) V34E  
 PRO  
 (For C=0 or 7  
 F 06 87 AZ, EL (.01°)  
 PRO)  
 (For DE=00  
 F 06 88 CELESTIAL BODY VECTOR  
 Load Vector Values  
 PRO)

Basic Date October 6, 1969  
 Changed

PGNS-36

- 8 F 50 18 REQUEST MNVR TO FDAI RPY ANGLES (.01°)  
 (AUTO OR TRIM) GUID CONT: PGNS  
 MODE CONT: PGNS - AUTO  
 PRO  
 (MAN) MODE CONT: PGNS - ATT HOLD  
 MNVR  
 PRO To 8  
 (BYPASS) ENTR To 10 (If COAS CALIB, Go to 7)
- 9 06 18 AUTO MNVR TO FDAI RPY ANGLES (.01°)  
 Mon Auto Mmvr To 8
- 10 F 01 71 R1 OOCDE (C)DETENT (DE)STAR CODE  
 PRO  
 (For C=7  
 F 06 87 AZ,EL (.01°)  
 PRO)
- 11 F 54 71 MARK X(52) and Y(53)  
 (After 1st Star) PRO To 7  
 (After 2nd Star) PRO To 12  
 (Redefine Star) ENTER To 10  
 (For DE=00  
 F 06 88 CELESTIAL BODY VECTOR  
 Load Vector Values  
 PRO)
- 12 F 06 05 STAR ANGLE DIFFERENCE (.01°)  
 (REJECT) V32E To 14  
 (ACCEPT) PRO
- 13 F 06 93 GYRO ANGLES X,Y,Z (.001°)  
 (TORQUE) V76E  
 PRO  
 (NO TORQUE) V32E To 14
- 14 F 50 25 R1 00014  
 (RECHECK) PRO To 6  
 (EXIT) ENTR
- 15 F 37 CB(11) AC BUS B: AOT LAMP-Open

Basic Date October 6, 1969

Changed                     

LM-6



RAPID IMU REALIGN

**NOTE: This Procedure Assumes A Good  
AGS Alignment**

- 1 Fly Spacecraft to 0°,0°,0° On AGS Inertial Ball**
- 2 V41 N20E  
E,E,E, (Coarse Align IMU To 0°,0°,0° Body)**
- 3 V40 N20  
Verify 0°,0°,0° On AGS Ball - ENTR  
(Releases Platform and Recovers PGNS  
Control Modes)  
Wait 15 sec**
- 4 V37E 51E  
PRO On First Display (Sets Drift Flag)  
V37E 00E**
- 5 V25 N07E  
77E, 10000E, 1E (Sets REFSMAT FLAG)**
- 6 Perform P52, Option 3 (AUTO OPTICS  
Are Good)**

**NOTE: If Loss of Alignment is Due  
To Temporary Loss of CDR's  
BUS, Update LGC Clock With  
V55 To Complete Recovery.**

Basic Date October 6, 1969  
Changed

P57 LUNAR SURFACE ALIGNMENT

1

V37E57E

\*PROG Lt - On \*  
 \*V05N09E 00210 IMU \*  
 \* NOT ON \*  
 \*CB(11) PGNS: IMU OPR - Close\*  
 \*RSET & KEY REL, P57E \*

F 04 06 R1 00001 IMU ALIGN OPT  
 R2 00001 PREF PRO To 3  
 3 REFSMMAT PRO To 3  
 4 LANDING SITE PRO To 2

2 F 06 34 T ALIGN (hrs,min,.01sec)  
 (LDG SITE) T ALIGN = 0,0,0 For Present Time  
 PRO

3 F 05 06 R1 00010 SPECIFY ALIGNMENT TECHNIQUE (A/T)  
 R2 0000X  
 X = 0 Stored Attitude or REFSMMAT  
 1 REFSMMAT & Gravity  
 2 Celestial Bodies (2)  
 3 Gravity & Celestial Body (1)  
 R3 00CDO  
 C = 0 No REFSMMAT Defined  
 1 REFSMMAT Defined  
 D = 0 No Stored Attitude  
 1 Stored Attitude Available

(A/T 1 or 3) PRO To 4  
 (A/T 0 or 2) PRO To 13

\*PROG Lt - On \*  
 \*F 05 09 00701 REFSMMAT OR \*  
 \* ATTITUDE NOT AVAILABLE\*  
 \*(CHANGE A/T) V32E To 3 \*  
 \*(TERM) V34E, Select New Prog \*

Basic Date October 6, 1969  
 Changed

PGNS-39

4           **Determination of Lunar Gravity**  
**ATTITUDE MON - PGNS**  
**V16N20E Monitor Coarse Align           (.01°)**  
              R1 +04200  
              R2 +31800  
              R3 +03525  
**NO ATT Lt - On Then Off (Twice)**  
              \*PROG Lt - On                 \*  
              \*V05N09E 00211 & 00217\*

**KEY REL**

5    **F 06 04    (+) GRAVITY ERROR ANGLE           (.01°)**  
              **(RECYCLE) V32E To 4**  
              **(TERM) V34E, Select New Prog**  
              **PRO (If A/T = 00001 or 00003**  
              **Go To 13)**

6    **F 01 70    R1 00CDE (C) DETENT (DE) STAR CODE**  
              **(DETENT) 1-L, 2-F, 3-R, 4-RR, 5-CL, 6-LR**  
              **PRO (Go to 8 If DE >45 or = 00)**

              \*PROG Lt - On                 \*  
              \*F 05 09 00404 Defined Star\*  
              \*            Not Available In   \*  
              \*            Any Detent           \*  
              \*(CREW SPECIFY) PRO To 8       \*  
              \*(LGC CALC N79) V32E To 6     \*

7    **F 06 79    CURSOR, SPIRAL, POSITION CODE           (.01°)**  
              **(REDEFINE STAR) V32E To 6**  
              **PRO**

              \*PROG Lt - On                 \*  
              \*V05N09E                       \*  
              \* 20105 AOT Mark System\*  
              \*     In Use                    \*  
              \* 31207 No VAC Area           \*  
              \*     For Marks                \*  
              \* 31211 Illegal                \*  
              \*     Interrupt of            \*  
              \*     Extended Verb           \*  
              \*V37E XXE                     \*

Basic Date October 6, 1969  
 Changed

PGNS-40

- 8 F 01 71 R1 OOCDE (C) DETENT, (DE) STAR CODE PRO
- 9 F 54 71 MARK X OR Y  
(REDEFINE STAR) ENTER To 8 MARK
- 10 F 06 79 CURSOR, SPIRAL, POSITION CODE (.01°)  
(TERM) V34E, Select New Prog  
(RECYCLE) V32E To 9  
(MARKS COMPLETE) PRO

(FOR DE = 00  
F 06 88 CELESTIAL BODY VECTOR  
Load Vector Values  
PRO)

(After First Star) To 6 (If Option 00003  
To 11)  
(After Second Star) To 11

- 11 F 06 05 STAR ANGLE DIFFERENCE (.01°)  
(REJECT) V32E To 14  
(ACCEPT) PRO  
(TERM) V34E
- 12 F 06 93 GYRO TORQUING ANGLES X,Y,Z (.001°)  
(REJECT) V32E To 14  
(ACCEPT) PRO To 13a  
(TERM) V34E

Basic Date October 6, 1969  
Changed     

P63-P68

PGNS-41

P63-P68

13 If Gyro Angles >5°  
F 06 22 ICDU ANGLES 0G,IG,MG (.01°)  
PRO  
NO ATT Lt - On Then Off  
If Gyro Angles <5°

13a Monitor Gyro Torquing  
V16N93E (.001°)  
KEY REL  
(If A/T 00002 OR 00003 & First Pass Through  
Step 13) To 6  
(If A/T 00001 & First Pass Through  
Step 13) Go To 11, (If A/T 00000, Go To 14)

14 F 50 25 R1 00014 RECHECK or EXIT FINE ALIGN  
(RECHECK, A/T 00002 or 00003 Only) PRO To 6  
(TERM) V34E To 16

Note: If Present A/T Is 00002 & A  
Previous P57 Used A/T 00001 or 00003,  
ENTER To Readout Present LM  
Lunar Position (Step 15)

15 F 06 89 LAT, LONG/2, ALT (.001°, .01nm)  
(TERM) V34E  
(ACCEPT) PRO

16 F 37

P63 BRAKING PHASE

1 V37E 63E  
\*PROG Lt-On \*  
\*V05N09E 01412 IGN \*  
\* ALGORITHM NOT \*  
\* CONVERGING \*  
\* (TERM) V37E00E \*  
\* \*

Basic Date October 6, 1969

Changed

PGNS-42

2 F 06 61 T6,TFI (min-sec)  
 R3, CROSSRANGE (-NORTH) (.1mm)  
 SET EVNT TMR TO 60-TFI  
 N33E  
 F 06 33 TIG (hrs,min,.01sec)  
 KEY REL  
 PRO

3 F 50 25 R1 00014 PERFORM IMU FINE ALIGN  
 (ACCEPT) PRO - See P52/6  
 (BYPASS) ENTR

4 F 50 18 REQUEST MNVR TO FDAI RPY ANGLES (.01°)  
 (AUTO or TRIM) GUID CONT: PGNS  
 MODE CONT: PGNS - AUTO  
 PRO  
 (MAN) MODE CONT: PGNS - ATT HOLD  
 MNVR  
 PRO To 4  
 (BYPASS) ENTR To 6

5 06 18 AUTO MNVR TO FDAI RPY ANGLES (.01°)  
 Mon Auto Mnr To 4

\*F 50 25 00500 LR \*  
 \* TO DESCENT POS \*  
 \*LDG ANT-DES, 10 sec, AUTO\*  
 \*PRO \*  
 \*F 50 25 00203 \*  
 \* GUID CONT - PGNS \*  
 \* MODE CONT(PGNS)-AUTO\*  
 \* THR CONT - AUTO \*  
 \* PRO \*  
 \* \*  
 \*PROG Lt - On \*  
 \*V05 N09E 01703 TIG \*  
 \* SLIPPED \*  
 \* V37E 00E EXIT P63 \*

Basic Date | October 6, 1969 |  
 Changed | |

PGNS-43

6 06 62 VI,TFI, VM (.1fps,min-sec,.1fps)

59:25 DSKY BLANKS  
ENG ARM - DES

59:30 06 62 AVE G ON

59:45 Verify  $\Delta VM$  (R3) <00005

59:55 F 99 62 ENG ON ENABLE  
VERIFY +X ULLAGE  
PRO  
(NO ULLAGE) V34E Exit P63

IGN 06 63 VI (.1fps)  
H DOT(-DESCENT) (.1fps)  
H(+ABOVE RLS) (ft)  
+:05 DES ENG CMD OVRD - ON

\*(DPS ABORT) ABORT - PUSH \*  
\*(APS ABORT) ABORT STAGE - PUSH\*

40,000 ft V57E  
F 06 68 SLANT RANGE, TG,  $\Delta H$ (LR-LGC)  
(.1nm, min-sec, ft)  
(UPDATE) PRO  
(EXIT V57) V34E (To 06 63)

F 50 68 SLANT RANGE, TG,  $\Delta H$  (LR-LGC)  
(.1nm, min-sec, ft)  
Verify  $\Delta H$  Decreasing  
(STOP UPDATE) ENTR (To 06 68)  
(CONTINUE UPDATE) PRO (To 06 63)

(MAN) MODE CONT:PGNS-ATT HOLD

October 6, 1969

Basic Date \_\_\_\_\_  
Changed \_\_\_\_\_

PGNS-44

\*ALT. & VEL Lt - On\*  
 \* RANGE/VELOCITY \*  
 \* NOT GOOD \*  
 \*PROGRAM Lt - On \*  
 \* V05N09E \*  
 \* 00511 LR Not in \*  
 \* Pos 1 \*  
 \*LDG ANT-DES,Wait \*  
 \* 10sec, Then AUTO \*

+08:30 P64 DISPLAYED

P64 APPROACH PHASE

1 P64 DISPLAYED

2 F 06 64 R1,TR/LPD, (sec-deg)  
 R2 H DOT(-For Descent) (.1fps)  
 R3 H(+ Landing Site Radius) (ft)

\*F 05 09 00523 LR DID NOT\*  
 \* ACHIEVE POS 2 \*  
 \*(CONTINUE) PRO \*  
 \* \* \*  
 \*(RECHECK) V32E \*  
 \* \* \*  
 \*(TERM R12) V34E \*

Monitor Attitude Change  
 To Enable Landing Site  
 Visibility.

(MAN) MODE CONT:PGNS-ATT HOLD  
 (TO USE LPD) PRO  
 (Nominal Landing Site) To 5 When TR=0

3 06 64 Observe Nominal Landing Site  
 Using LPD And N64 LPD Display.

Basic Date October 6, 1969  
 Changed



PGNS-45

4 Redesignate Landing Site  
As Desired (+Pitch Redesignates  
Landing Site Toward LM)

5 P65 DISPLAYED

P65 LANDING PHASE (AUTO)

1 P65 Displayed

2 F 06 60 V (HOR) (.1fps)  
H DOT (-Descent) (.1fps)  
H (+ >LANDING SITE RADIUS) (ft)

Monitor Attitude Maneuver To  
Local Vertical Attitude  
(+Z Downrange)

H DOT (R2)= -00030  
MODE CONT: PGNS-ATT HOLD  
or AUTO

(ROD LANDING) MODE CONT: PGNS-ATT HOLD  
ROD - Activate  
To P66

(MAN LANDING) TTCA - Advance Until:  
THRUST: CMD=10%  
THR CONT - MAN  
To P67

(AUTO LANDING) To 3

3 H(actual)= 5.6 ft LUNAR CONTACT Lt - On  
MODE CONTROL - ATT HOLD  
ENGINE STOP - Push  
PRO

TD+3:00

V37E 68E To P68

P66 LANDING PHASE (ROD)

1 P66 Displayed  
(From P67)TTCA-Retard Gradually  
THRUST IND(Left Side)-Monitor  
(Maintain Constant Thrust/  
Chamber Pressure)

Basic Date— October 6, 1969  
Changed—

LM-f

PGNS-46

2 F 06 60 V(HOR) (.1fps)  
H DOT(-Descent) (.1fps)  
H(+ >Landing Site Radius) (ft)  
ROD - Input ROD As Desired

(MAN LANDING) TTCA - Advance Until:  
THRUST IND: CMD=10%  
THR CONT - MAN  
To P67

3 H(Actual)=5.6 ft LUNAR CONTACT Lt - On  
ENGINE STOP - Push  
TD+3:00 PRO  
V37E 68E To P68

P67 LANDING PHASE (MANUAL)

1 P67 Displayed

2 F 06 60 V(HOR) (.1fps)  
H DOT (-Descent) (.1fps)  
H(+ >Landing Site Radius) (ft)  
(ROD LANDING) THR CONT - AUTO  
To P66

3 H(actual)=5.6 ft LUNAR CONTACT Lt - ON  
ENGINE STOP - Push  
TD+3:00 PRO  
V37E 68E To P68

P68 LANDING CONFIRMATION

1 V37E 68E

2 F 06 43 LAT(+NORTH),LONG(+EAST),ALT (.01°, .1nm)  
RECORD LAT \_\_\_\_\_ °  
LONG \_\_\_\_\_ °  
ALT \_\_\_\_\_ nm (Nominal zero)  
PRO

3 F 37

Basic Date October 6, 1969  
Changed \_\_\_\_\_

P70-P71

LM-6

PGNS-47

P70 DPS ABORT

1 ABORT-PUSH (From P63,64,65,66,67)  
 \*F 50 25 R1 00203 \*  
 \* GUID CONT - PGNS \*  
 \* MODE CONT: PGNS - AUTO\*  
 \* THR CONT - AUTO \*  
 \* PRO \*

2 06 63 VI,H DOT,H (.1fps,ft)  
 VI Increasing  
 H DOT Remains Positive  
 H Increasing

H<25000-Monitor Attitude Mnr To  
 Local Vertical With Windows  
 Downrange. X-axis Override  
 Inhibited.

H>25000-or H DOT >00400-Monitor Atti-  
 tude Mnr To Abort Attitude  
 With Windows Downrange.  
 X-axis Override Restored.

(To Monitor Time To Go And Crossrange Velocity)  
 V16 N77E

16 77 TG,V(Y) (min-sec,.1fps)  
 N85E

3 16 85 VG XYZ (LM) (.1fps)  
 (If Burn >400 sec,  
 PDI+6:20  
 DES REG (2) - CLOSE)  
 VGX = 100 fps  
 DES ENG CMD OVRD - OFF

DPS NULL COMPONENTS  
 OFF KEY REL

4 F 16 63 VI,H DOT, H (.1fps,ft)  
 ENG STOP - Push  
 ENG ARM - OFF  
 ABORT - Reset  
 PRO

Basic Date October 6, 1969  
 Changed October 31, 1969

LM-6

P70-P71

PGNS-47

P70 DPS ABORT

1 ABORT-PUSH (From P63,64,65,66,67)  
 \*F 50 25 R1 00203 \*  
 \* GUID CONT - PGNS \*  
 \* MODE CONT: PGNS - AUTO\*  
 \* THR CONT - AUTO \*  
 \* PRO \*

2 06 63 VI,H DOT,H (.1fps,ft)  
 VI Increasing  
 H DOT Remains Positive  
 H Increasing

H<25000-Monitor Attitude Mnr To  
 Local Vertical With Windows  
 Downrange. X-axis Override  
 Inhibited.

H>25000-or H DOT >00400-Monitor Atti-  
 tude Mnr To Abort Attitude  
 With Windows Downrange.  
 X-axis Override Restored.

(To Monitor Time To Go And Crossrange Velocity)  
 V16 N77E

16 77 TG,V(Y) (min-sec,.1fps)  
 N85E

3 16 85 VG XYZ (LM) (.1fps)  
 (If Burn >400 sec,  
 PDI+6:20  
 DES REG (2) - CLOSE)  
 VGX = 100 fps  
 DES ENG CMD OVRD - OFF

DPS NULL COMPONENTS  
 OFF KEY REL

4 F 16 63 VI,H DOT, H (.1fps,ft)  
 ENG STOP - Push  
 ENG ARM - OFF  
 ABORT - Reset  
 PRO

Basic Date - October 6, 1969  
 Changed - October 31, 1969

LM-6

P70-P71

PGNS-48

5 F 16 85 VG XYZ (LM) (.1fps)  
 (DISPLAY ORB PARAM) V82E  
 (TERM) PRO To 7

9 F 16 44 APO ALT,PER ALT,TFF (.1nm,min-sec)  
 RECORD APO ALT \_\_\_\_\_ nm,  
 PER ALT \_\_\_\_\_ nm,  
 TFF \_\_\_\_\_ min-sec  
 PRO To 5

7 F 37

P71 APS ABORT

1 ABORT STAGE -Push (From P63,64,65,  
 66,67,70)

\*F 50 25 R1 00203 \*  
 \* GUID CONT - PGNS \*  
 \* MODE CONT: PGNS - AUTO \*  
 \* PRO \*

APS  
 IGN 06 63 VI,H DOT,H (.1fps,ft)

ENG START - Push  
 ENG ARM - ASC  
 If ENG STOP Lt - On  
 ENG STOP - Reset  
 BAL CPL-ON  
 SYS A&B ASC FEED 2 (2) - OPEN  
 MAIN SOV(2)-CLOSE  
 CRSFD - OPEN

VI Increasing  
 H DOT Remains Positive  
 H Increasing

Basic Date October 6, 1969  
 Changed \_\_\_\_\_

**PGNS-49**

**H<25000-Monitor Attitude Mnr To Local Vertical With Windows Downrange. X-axis Override Inhibited.**  
**H>25000 or H DOT>00400-Monitor Attitude Mnr To Abort Attitude With Windows Downrange. X-axis Override Restored.**

**(To Monitor Time To Go And Crossrange Velocity)**  
**V16 N77E**

16 77 TG,V(Y) (min-sec,.1fps)  
 N85E

2 16 85 VG XYZ (LM) (.1fps)  
 VGX = 200 fps,  
 MAIN SOV (2) - OPEN  
 SYS A&B ASC FEED 2(2)-CLOSE  
 CRSFD-CLOSE  
 VGX - 100 fps,ENG ARM - OFF

\*NO Cutoff \*  
 \* ABORT STAGE - Reset\*

APS  
 OFF NULL COMPONENTS  
 KEY REL

3 F 16 63 VI,H DOT,H (.1fps,ft)  
 ENG STOP - Push Then Reset  
 PRO

4 F 16 85 VG XYZ (LM) (.1fps)  
 (DISPLAY ORB PARAM) V82E  
 (TERM) PRO To 6

5 F 16 44 APO ALT,PER ALT,TFF (.1nm,min-sec)  
 RECORD APO ALT \_\_\_\_\_ nm,  
 PER ALT \_\_\_\_\_ nm,  
 TFF \_\_\_\_\_ min-sec  
 PRO To 4

6 F 37

October 6, 1969  
 October 31, 1969  
 Basic Date  
 Changed

M-6

P72 CSM CSI TARGETING

1 F 06 11 V37E 72E  
 TIG (CSI)/T(APOAPSIS) (hrs,min,.01sec)  
 PRO  
 If Zero, T (APOAPSIS) Displayed

2 F 06 55 APSIS (CDH), E (+0000X,.01°)  
 R3, 0000Y  
 For Y ≠ 0, CDH At  
 CSI + Multiple Of 180°  
 Specified By RI(X)  
 PRO

3 F 06 37 TIG TPI (hrs,min,.01sec)  
 PRO

4 F 16 45 M,TFI,MGA (-00001) (marks,min-sec,.01°)  
 (RECYCLE) V32E  
 (TERMINATE MARKS) PRO

- \* F 05 09 00600 No Intersection On \*
- \* First Iteration \*
- \* 00601 POST CSI ALT <35,000 ft\*
- \* 00602 POST CDH ALT <35,000 ft\*
- \* 00603 TIG(CDH)-TIG(CSI)<10min\*
- \* 00604 TIG(TPI)-TIG(CDH)<10min\*
- \* 00605 NO SOL IN 15 TRIES \*
- \* 00606 ΔV (CSI) >1000 fps IN 2\*
- \* Iterations \*
- \* V32E To 1 Adjust Inputs \*

5 F 06 75 ΔH(CDH),ΔT(CDH-CSI),ΔT(TPI-CDH)  
 PRO (.1mm,min-sec)

6 F 06 81 ΔVXYZ (LV) (CSI) (.1fps)  
 PRO

7 F 06 82 ΔVXYZ (LV) (CDH) (.1fps)  
 PRO

Basic Date October 6, 1969  
 Changed

PGNS-51

8 F 16 45 M,TFI,MGA (-00002) (marks,min-sec,.01°)  
(RECYCLE) V32E To 5  
(TERMINATE) PRO To 9  
(FINAL PASS) SET EVENT TIMER TO TFI  
PRO, Transmit Parameters To CSM

9 F 37

P73 CSM CDH TARGETING

1 F 06 13 V37E 73E  
TIG CDH (hrs,min,.01sec)  
PRO To 4

2 F 06 75 ΔH(CDH),ΔT(TPI-CDH),ΔT(TIG TPI,P73-P72)  
PRO (.1mm,min-sec)

3 F 06 81 ΔVXYZ (LV) (CDH) (.1fps)  
(To Correct Out-Of-Plane Velocity)

V90E  
F 06 16 T EVENT (hrs,min,.01sec)  
PRO

F 06 90 Y,YDOT,PSI (.01mm,.1fps,.01°)  
(RECYCLE) V32E To (F 06 16)  
PRO

PRO

4 F 16 45 M,TFI,MGA (-00001) (marks,min-sec,.01°)  
(RECYCLE) V32E To 2  
(TERMINATE) PRO To 2  
(FINAL PASS) SET EVENT TIMER TO TFI  
PRO  
Transmit Parameters To CSM

\*F 05 09 00611 NO TIG FOR EL ANGLE\*  
\* (CONTINUE P73) PRO To 2  
\* (RECYCLE) V32E To 1 CHANGE TIG \*  
\* (TERMINATE) V34E To 5 \*

5 F 37

P72-P76

Basic Date October 6, 1969

Changed

LM-6



P74 CSM TPI TARGETING

- 1 F 06 37 V37E 74E  
TIG TPI (hrs,min,.01sec)  
PRO
- 2 F 06 55 N,E,CENTANG (0000X,.01°)  
PRO  
(To Calculate E At TIG Time)  
+00000 In R2
- \*(Calculate E Only) \*
- \*F 05 09 00611 NO SOL \*
- \* PRO To 1 Retarget\*
- 3 F 16 45 M,TFI,MGA (-00001) (marks,min-sec,.01°)  
(RECYCLE) V32E  
(TERMINATE MARKS) PRO  
(FINAL PASS,MGA,-00002) SET EVENT TIMER  
PRO To 8  
Transmit Parameters To CSM
- 4 F 06 37 TIG TPI (hrs,min,.01sec)  
PRO  
(If E Computed, This Display  
Replaced By V06N55 As In 2 Above)
- 5 F 06 58 HP,ΔV(TPI),ΔV(TPF) (.1mm,.1fps)  
PRO To 7 (Final Pass To 6)
- 6 F 06 81 ΔVXYZ (LV) (.1fps)  
PRO
- 7 F 06 59 ΔVXYZ(LOS) (.1fps)  
PRO To 3
- 8 F 37

Basic Date — October 6, 1969

Changed —

PGNS-53

P75 CSM TPM TARGETING

- 1           V37E 75E  
 F 16 45   M,TFI,MGA (-00001) (marks,min-sec,.01°)  
           (RECYCLE) V32E To 3  
           (TERMINATE MARKS) PRO
- 2    F 06 81   ΔVXYZ (LV)                   (.1fps)  
           PRO
- 3    F 06 59   ΔVXYZ(LOS)                   (.1fps)  
           PRO
- 4    F 16 45   M,TFI,MGA (-00001) (marks,min-sec,.01°)  
           (RECYCLE)V32E TO 3  
           (TERMINATE MARKS) PRO To 2  
           (FINAL PASS) (MGA,-00002) SET EVENT TIMER,  
           PRO, Transmit Parameters To CSM  
                   \*V06N52E R1, ACTCENT (.01°)  
                   \*If ACTCENT Between 170° And 190°  
                   \* V37E 75E Retarget
- 5    F 37

October 6, 1969

Basic Date  
 Changed

P76 TARGET ΔV

V37E 76E

- 1    F 06 33   TIG                                 (hrs,min,.01sec)  
           PRO
- 2    F 06 84   ΔV(LV) XYZ                         (.1fps)  
           PRO
- 3    F 37

V40 N20 ICDU ZERO

1                   V40 N20E  
                   \*PROG Lt - On                   \*  
                   \*V05 N09E 00206 ISS IN           \*  
                   \*    COARSE ALIGN & GIMBAL       \*  
                   \*                                    LOCK       \*  
                   \*Coarse Align To 0,0,0 Then   \*  
                   \*    Reselect V40 N20               \*  
                   NO ATT Lt - OFF

2                   Wait 15 sec Then Continue Program In  
   Progress

V41N20 COARSE ALIGN IMU

1                   V41N20E  
   F 21 22       LOAD NEW ICDU ANGLES 0,I,M       (.01°)

2                   41       COARSE ALIGN  
                   NO ATT Lt - On  
                   FDAI Torques

                                  \*PROG Lt - On                   \*  
                                   \*V05N09E 00211 COARSE       \*  
                                   \*                   ALIGN ERROR       \*  
                                   \*V16N22E Compare N22 With\*  
                                   \*                   N20               \*  
                                   \*Repeat V41N20               \*

V41N72 COARSE ALIGN RR

1                   RR MODE - LGC

2                   V41N72E  
   F 21 73       RR TRUN,SHAFT                   (.01°)  
                   Load Desired Trun and Shaft Angles

3                   F 04 12   R1 00006 SPECIFY RR FUNCTION  
                   R2 00001 LOCK ON CSM  
                   00002 CONT DESIGN  
                   PRO

Basic Date October 6, 1969  
 Changed \_\_\_\_\_

PGNS-55

4 41 COARSE ALIGN  
 (To Monitor Driving In CONT DESIG MODE)  
 V16N72E RR TRUN, SHAFT (.01°)

\*PROG Lt - On \*  
 \*V05N09E 00502 BAD ANGLE INPUTS\*  
 \* 00503 NO DATA GOOD IN \*  
 \* 30 SEC DESIGN \*  
 \* 00515 RR CDU FAIL \*  
 \* DISCRETE \*  
 \*(TERM CONT DESIGN) V44E \*

V42 GYRO TORQUING

1 V76E (IF MODE CONT (PGNS) - ATT HOLD)  
 V42E  
 F 21 93 GYRO ANGLES (XYZ) (.001°)  
 Load Desired Angles

2 42 FINE ALIGN  
 Gyro Torquing (NO ATT Lt - Off)

V43 FDAI BIAS CHECK

1 MODE CONT: PGNS - OFF

2 V37E00E

3 V43E  
 F 21 22 LOAD NEW ICDU ANGLES YPR (.01°)  
 FDAI Needles Deflect

4 ENTR  
 F 21 22 NEW ICDU ANGLES YPR (.01°)  
 Load (-) New ICDU Angles

5 43 Verify FDAI Needles Return To 0,0,0

Basic Date October 6, 1969  
 Changed \_\_\_\_\_

V40-V49

LM-6

V47 AGS INITIALIZATION

1 TLM-HI  
 V16N65E  
 16 65 LGC TIME (hr,min,.01sec)  
 377 + GET-PGNS/AGS BIAS TIME (.1min)  
 ENTR-(At Correct PGNS Time)

2 V47E  
 F 06 16 GET OF AGS CLOCK  
 Load PGNS/AGS TIME BIAS

3 414 +1

4 PRO (32 Sec Elapse Before Step 5  
 Appears If CDU Zero Is Issued,  
 Otherwise 20 Sec)

5 F 50 16 Downlink Complete  
 PRO

6 400+3 AGS/PGNS ALIGN

7 V83E  
 F 16 54 R,RDOT,THETA (.01nm,.1fps,.01°)

8 440R RANGE RATE (+2.5 fps) (.1fps)  
 PRO

V48 DAP CONFIGURATION

1 V48E  
 F 01 46 DAP CONFIGURATION (ABCDE)  
 (CONFIG) A 1- ASCENT  
 2- DESCENT  
 3- DOCKED  
 (X-TRANS) B 0-2 JET RCS A, 1-2 JET RCS B,  
 2-4 JET RCS A, 3-4 JET RCS B  
 (SCALE) C 0-Fine(4°/sec), 1-Normal (20°/sec)  
 (ATTDB) D 0-.3°, 1-1°, 2-5°  
 (RATE) E 0-.2°/sec, 1-.5°/sec, 2-2°/sec  
 3-10°/sec  
 PRO

Basic Date October 6, 1969  
 Changed

PGNS-57

- 2 F 06 47 LM WT, CSM WT (1b)  
PRO (Terminates If Staged)
- 3 F 06 48 ENGINE GIMBAL TRIM PITCH, ROLL (.01°)  
ENG GMBL - ENABLE  
ENG STOP - PUSH  
ENG ARM - DES  
(TRIM) PRO (ENG GMBL Lt - On  
When Gimbals Reach Limits)  
(EXIT) V34E
- 4 F 50 48 TRIM COMPLETE  
Continue Interrupted Program  
PRO  
ENG ARM - OFF (ENG GMBL Lt-OFF)  
ENG STOP - Reset

V49 CREW DEFINED MANEUVER

- 1 V37E00E
- 2 F 06 22 V49E  
NEW ICDU ANGLES YPR (.01°)  
PRO
- 3 F 50 18 REQUEST MNVR TO FDAI RPY (.01°)  
(AUTO OR TRIM) GUID CONT: PGNS  
MODE CONT: PGNS - AUTO  
PRO  
(MAN) MODE CONT: PGNS - ATT HOLD  
MNVR  
PRO To 3  
(BYPASS) ENTR (Exit V49)
- 4 06 18 AUTO MNVR TO FDAI RPY ANGLES  
Mon Auto Mnr To 3

Basic Date October 6, 1969  
Changed

V55 INCREMENT LGC TIME

1  
 F 21 24 V55E  
 ΔT  
 Record  
 \_\_\_\_\_ (hrs)  
 \_\_\_\_\_ (min)  
 \_\_\_\_\_ (sec)  
 Load ΔT

V64 S-BAND ANTENNA

1  
 F 06 51 V64E  
 S-BD PITCH, YAW (.01°)  
 PRO

V67 W-MATRIX ERROR DISPLAY

1  
 F 06 99 V67E  
 POS ERR, VEL ERR, RADAR BIAS ERR (ft.,.1fps,  
 (REINITIAL) V25E, Load Values (mr)  
 PRO

V74 LGC DOWNLINK

1  
 V74E (42 sec)

V82 ORBIT PARAMETER DISPLAY

1  
 F 04 12 V82E (GO To 2 If AVE G-On)  
 R1 00002 SPECIFY VEHICLE  
 R2 00001 LM  
 00002 CSM  
 PRO

2  
 F 16 44 HA,HP,TFF (.1m,min-sec)  
 (UPDATE) V32E (Not Required If AVE G-On)  
 PRO

V83 RENDEZVOUS PARAMETER DISPLAY

1  
 F 16 54 V83E  
 R,RDOT,THETA (.01m,.1fps,.01°)  
 (EXIT) PRO

V55-V90

Basic Date October 6, 1969  
 Changed \_\_\_\_\_

LM-6

V85 RR LOS, ELEV DISPLAY

1 RR MODE - LGC

2 V85E  
F 16 56 AZ, ELEV (.01)°  
(TERM) PRO

V89 RENDEZVOUS FINAL ATTITUDE

1 V37E00E

2 V89E  
F 04 12 R1 00003 SPECIFY TRACKING ATTITUDE  
R2 00001 (+Z AXIS)  
00002 (+X AXIS)  
PRO

3 F 06 18 FINAL FDAI RPY ANGLES (.01)°  
(AUTO MNVR) PRO  
(RECALCULATE) V32E To 3

4 F 50 18 REQUEST MNVR TO FDAI RPY ANGLES (.01)°  
(AUTO OR TRIM) GUID CONT: PGNS  
MODE CONT: PGNS - AUTO  
PRO  
(MAN) MODE CONT: PGNS - ATT HOLD  
MNVR  
PRO To 4  
(BYPASS) ENTR (EXIT V89)

5 06 18 AUTO MNVR TO FDAI RPY ANGLES (.01)°  
Mon Auto Mvr To 4

V90 OUT-OF-PLANE DISPLAY

1 V90E  
F 06 16 GET EVENT (hrs,min,.01sec)  
(0, PRESENT TIME)  
PRO

2 F 06 90 Y,YDOT,PSI (.01nm,.1fps,.01)°  
(RECYCLE) V32E To 1  
(EXIT) PRO

V55-V90

October 6, 1969

Basic Date

Changed

LM-6



PGNS-60

PGNS TURN-ON AND SELF-TEST

1 If STBY Lt - On, PRO

2 CB(11) PGNS: IMU OPR - Close  
(NO ATT Lt - On 90 Sec)

3 F 88 88 V35E  
DSKY LIGHT CHECK  
(Master Alarm, LGC & ISS Warning,  
And ALL DSKY Lts - On, 8's In All  
Registers, Lts And DSKY Reset In 5 Sec)  
NO ATT Lt - Off (Wait 20 Sec)  
RSET

4 F 21 01 V25N01E 1365E  
E,E,E

5 15 01 V15 N01E 1365E  
R1, R2, R3 All Zero

6 15 01 V21 N27E 10E (Test Fixed And Erasable  
R1 Number Of Errors Memory)  
R2 Number Of Tests Started  
R3 Number Of Tests Successful  
(Test Successful If R2>3 Within 78 sec)

\*PROG Lt - On \*

\* V05N09E 01102 SELF-\*

\* TEST ERROR \*

\*N08E Record For MSFN \*

\* \*

\* R1 \_\_\_\_\_ \*

\* \*

\* R2 \_\_\_\_\_ \*

\* \*

\* R3 \_\_\_\_\_ \*

V21 N27E OE TERMINATE SELF TEST

Basic Date October 6, 1969  
Changed \_\_\_\_\_

PGNS T/O, ORDEAL,  
PIPA BIAS

PGNS-61

8 F 05 01 V91E BANKSUM  
 R1 SUM OF BANK  
 R2 BANK NO.  
 R3 BUGGER WORD  
 (NEXT BANK) PRO (If R2/R1 Record For MSFN)  
 (TERM) V34E

PGNS ORDEAL INITIALIZATION

1 CB(11) AC BUS B: ORDEAL - Close  
 FLIGHT DISPLAYS: ORDEAL - Close  
 FDAI 1 or 2 - ORB RATE  
 EARTH/LUNAR - LUNAR

2 F 04 12 V82E  
 R1 00002 SPECIFY VEHICLE  
 R2 00001 LM  
 PRO

3 F 16 44 HA,HP, TFF (.1mm,min-sec)  
 Average HA & HP  
 ALT SET - Set  
 PRO

4 F 16 54 V83E  
 R, RDOT, THETA (.01mm,.1fps,.01°)  
 MODE - HOLD/FAST  
 SLEW - To THETA  
 MODE - OPR/SLOW  
 PRO

PIPA BIAS CHECK

1 EVENT TIMER - Zero  
 Rates <.1°/sec With No Thruster Firing

2 V25N21E, E, E, E/EVENT TIMER - START

3 06 21 V06E  
 XYZ PIPA COUNTS (+XXXXX.)

4 At T+80sec - ENTR  
 T+80sec (X)R1 \_\_\_ (Y)R2 \_\_\_ (Z)R3 \_\_\_

PGNS T/O, ORDEAL,  
PIPA BIAS

Basic Date October 6, 1969  
Changed \_\_\_\_\_

PGNS-62

5

Calculate XYZ Bias:  
Take Last 3 Digits Of Displayed  
Bias And Add 2 Zeroes

X \_\_\_\_\_

Y \_\_\_\_\_

Z \_\_\_\_\_

6

V06N01E, 1452E (Review X Bias) E  
1454E (Review Y Bias) E  
1456E (Review Z Bias)

7

F 21 01 V21N01E  
LOAD 1452E(Calc X BIAS)E,E  
1454E(Calc Y BIAS)E,E  
1456E(Calc Z BIAS)E  
Same Sign As In Measured Bias In Step4

LGC CLOCK INITIALIZATION

1

06 65 V06N65  
ON CSM MARK - ENTR  
SAMPLED LGC TIME (hr,min,.01sec)  
RECORD  
\_\_\_\_\_(hrs)  
\_\_\_\_\_(min)  
\_\_\_\_\_(sec)  
COMPUTE CSM/LM ΔT

2

F 21 24 V55E  
LOAD ΔT (hr,min,.01sec)

Basic Date October 6, 1969  
Changed October 23, 1969

LGC CLOCK INIT.  
LR, RR SELF TEST



PGNS-64

- 9 F 04 12 V63E INITIATE RDR SELF TEST  
R1 +00004 SPECIFY RDR  
R2 +00001 RNDZ RDR  
V22E 2E LDG RDR  
PRO
- 10 F 16 66 SLANT RANGE, ANT POSITION  
R1 +08277 To +08297  
R2 +00002
- 11 F 16 66 LDG ANT - DES (10 sec)  
R2 +00001 (PROG Lt-On, V05N09E,00522 RSET)
- 12 F 16 66 LDG ANT - AUTO  
R2 +00001  
V34E
- 13 RDR TEST - OFF  
CB(11) PGNS: LDG RDR - Open

RNDZ RDR SELF TEST

- 1 VERIFY: CSM RCS THRUSTER B3 - OFF  
: RADAR XPONDER - OFF  
RNDZ RDR ANT - Released  
X-POINTERS (Both)-HI MULT  
RATE/ERR MON (Both) - RNDZ RADAR  
ATTITUDE MON (Both) - PGNS  
RNG/ALT MON - RNG/RNG RATE  
SHFT/TRUN - +50°  
RR MODE - SLEW  
TEMP MONITOR - RNDZ (+10° To +145°)
- 2 CB(11) AC BUS A: RNDZ RDR - Close  
: RNG/RNG RT/ALT/ALT RT-  
Close(Wait 30 sec)  
RR GYRO SEL - SEC  
CB(11) PGNS: RNDZ RDR - Close  
(NO TRACK Lt-On)  
FLIGHT DISPLAYS: RNG/RNG RT/ALT/ALT RT-  
Close

Basic Date October 6, 1969  
Changed NOVEMBER 5, 1969

PGNS-65

- 3 Slew Left To Mode I Region (18 sec)  
 Slew Right, Down, Left, Up (FDAI Needles  
 Right, Down, Left, Up)  
 SLEW RATE - LO  
 SHAFT/TRUN -  $+5^\circ$   
 Slew Right, Down, Left, Up (FDAI Needles  
 Right, Down, Left, Up)
- 4 RR MODE - AUTO TRACK  
 RADAR TEST-RNDZ RDR (Rng Rt Tape Drives To  
 -500fps, X-Pointers and FDAI Needles Vary  
 Between  $+5^\circ$ . After 12 sec, Rng Tape Drives  
 To 194, NO TRACK Lt - Out)
- 5 TEST MONITOR - AGC (1.0 To 1.8) (1.5)  
 - XMTR PWR (2.1 To 4.1) (3.7)  
 - SHAFT ERR (2.2 To 2.6@1/2cps)  
 - TRUN ERR (2.2 To 2.5@1/2cps)  
 - AGC
- 6 Set NORRMON Flag  
 V25 N07E  
 101E, 10E, 1E  
 RR MODE - LGC(NO TRACK Lt - On, Wait 10 sec)
- 7 F 04 12 V63E START RNDZ RDR SELF TEST  
 R1 00004 SPECIFY RADAR  
 R2 00001 RNDZ RADAR  
 PRO  
 NO TRACK Lt - Out After 12 sec
- 8 F 16 72 RR TRUN, SHAFT (.01°)  
 R1 Varying @1/2 cps  
 R2 Varying @1/2 cps  
 PRO
- 9 F 16 78 RNG, RNG RT, TFI (.01m, fps, min-sec)  
 R1 +195.30 To +195.70 (TM Within +1.2 of R1)  
 R2 -00480 To -00520 (TM=2 <R2)  
 R3 00:00
- 10 V34E

Basic Date ~~October 6, 1969~~  
 Changed ~~October 31, 1969~~

PGNS-66

11 RADAR TEST - OFF (NO TRACK Lt - On,  
X-Pntr-Center)

12 V40N72E RRCDU ZERO (10 sec)

13 SHFT/TRUN -  $\pm 50^\circ$   
V41N72E  
N73 R1 +04000  
R2 +04000  
N12 R2 00002  
V16N72E (Verify FDAI Needles Up & Right)  
V44E

14 SHFT/TRUN -  $\pm 5^\circ$   
RR GYRO SEL - PRIM  
V41N72E  
N73 R1 -00400  
R2 -00400  
N12 R2 00002  
V16N72E (Verify FDAI Needles)  
V44E

15 V41N72E  
N73 R1 +00000  
R2 +28300  
N12 R2 00002  
V16N72E

CB(11) PGNS: RNDZ RDR - Open  
AC BUS A: RNDZ RDR - Open  
V44E  
Notify CSM To Enable Thruster B3

Basic Date — October 6, 1969  
Changed — NOVEMBER 5, 1969

LGC THRUSTER INHIBIT

1

V25N07E  
(VERTICAL JET) 1257E  
(HORIZONTAL JET) 1260E  
XXXE (See Codes Below)

A1U - 100E	B4U - 1E
B1D - 200E	A4D - 2E
A1F - 4E	B4F - 2E
B1L - 200E	A4R - 100E
B2U - 20E	A3U - 4E
A2D - 40E	B3D - 10E
A2A - 10E	B3A - 1E
B2L - 20E	A3R - 40E

\* CAUTION \*  
\*Affected Quad Valve Must\*  
\*Be Open Before Next Step\*

2

1E

3

V48E  
PRO  
V34E

RR BIAS INITIALIZATION

1

V21N01E  
1700E,E  
N15E,E  
E,E  
E,E  
V93E

REVIEW DATA IN ERASABLE MEMORY

1

Perform During Any Flashing Display

2

F 01 01 V1 N1E OCTAL ADD E  
R3 OCTAL ADD, R1 (DATA)E

Basic Date\_ October 6, 1969  
Changed \_\_\_\_\_

THRUSTER INHIBIT,  
RR BIAS, E-MEM



3 N15E (For Next Succeeding Address)  
 ENTR (For Each Succeeding Address)

TO CHANGE DATA IN ERASABLE MEMORY

1  
 F 21 01 V21 N01E ADD E  
 R3 ADD  
 Load New Data In R1 E

2 N15E For Next Succeeding Address  
 Load New Data E  
 ENTR And Load New Data For Each  
 Succeeding Address E

MONITOR OF INPUT/OUTPUT CHANNELS

1  
 F 11 10 V11N10E  
 LOAD CHANNEL ADD E  
 R1 Octal Contents Of Specified Channel

LOAD OUTPUT CHANNELS

1  
 F 21 10 V21N10E  
 LOAD CHANNEL ADD E  
 R1 Load Octal Data E

FLAG WORD SET/RESET

1  
 F 21 07 V25 N07E  
 (Load FLAGWORD ADD) E

RMAX - VMAX LOAD

V24 N01E  
 2004E ( RMAX )  
 77776E  
 77776E

Basic Date — October 6, 1969  
 Changed — October 24, 1969

2 F 22 07 (Load FLAGWORD BIT CODE)E

<u>BIT</u>	<u>CODE</u>	<u>SET</u>	<u>RESET</u>
1	1	E= 1,3,5,7	E= 0,2,4,6
2	2	E= 2,3,6,7	E= 0,1,4,5
3	4	E= 4,5,6,7	E= 0,1,2,3
4	10	D= 1,3,5,7	D= 0,2,4,6
5	20	D= 2,3,6,7	D= 0,1,4,5
6	40	D= 4,5,6,7	D= 0,1,2,3
7	100	C= 1,3,5,7	C= 0,2,4,6
8	200	C= 2,3,6,7	C= 0,1,4,5
9	400	C= 4,5,6,7	C= 0,1,2,3
10	1000	B= 1,3,5,7	B= 0,2,4,6
11	2000	B= 2,3,6,7	B= 0,1,4,5
12	4000	B= 4,5,6,7	B= 0,1,2,3
13	10000	A= 1,3,5,7	A= 0,2,4,6
14	20000	A= 2,3,6,7	A= 0,1,4,5
15	40000	A= 4,5,6,7	A= 0,1,2,3

3 F 23 07 (Load 1-SET/0-RESET) E

4  
 01 01 To Verify Load:  
 VINIE, FLAGWORD ADD ENTR  
 R3 FLAGWORD ADD  
 R1 FLAGWORD CONTENT (See Table Above)

BINARY-TO-OCTAL CONVERSION

000-0	100-4
001-1	101-5
010-2	110-6
011-3	111-7

OCTAL-TO-DECIMAL CONVERSION

1-1	11-9	21-17	31-25	41-33
2-2	12-10	22-18	32-26	42-34
3-3	13-11	23-19	33-27	43-35
4-4	14-12	24-20	34-28	44-36
5-5	15-13	25-21	35-29	45-37
6-6	16-14	26-22	36-30	46-38
7-7	17-15	27-23	37-31	47-39
10-8	20-16	30-24	40-32	50-40

October 6, 1969

Basic Date  
 Changed

LM-6

Basic Date October 6, 1969  
Changed           

<u>FLAG</u>	<u>ADD</u>	<u>CODE (BIT)</u>	<u>SET (1) RESET(0)</u>	
P25 FLAG	74	400 (9)	<u>P25 Operating</u> <u>P25 Not Oper.</u>	<u>C=4,5,6,7</u> <u>C=0,1,2,3</u>
IMU	74	200 (8)	<u>IMU In Use</u> <u>IMU Not In Use</u>	<u>C=2,3,6,7</u> <u>C=0,1,4,5</u>
Rendezvous	74	100 (7)	<u>P20 Initiated</u> <u>P20 Terminated</u>	<u>C=1,3,5,7</u> <u>C=0,2,4,6</u>
Lock On	74	20 (5)	<u>RR Lock-ON Desired</u> <u>RR Lock-ON Not Desired</u>	<u>D=2,3,6,7</u> <u>D=0,1,4,5</u>
State Vector	75	200 (8)	<u>CSM S.V. Updated (V81)</u> <u>LM S.V. Updated (V80)</u>	<u>C=2,3,6,7</u> <u>C=0,1,4,5</u>
Update	75	100 (7)	<u>S.V. Update by Marks</u> <u>Allowed</u> <u>S.V. Update by Marks</u> <u>Not Allowed</u>	<u>C=1,3,5,7</u> <u>C=0,2,4,6</u>
Track	75	20 (5)	<u>Rndz Tracking Allowed</u> <u>Rndz Tracking Not Allowed</u>	<u>D=2,3,6,7</u> <u>D=0,1,4,5</u>

PGNS-70

FLAG LIST  
CHANNEL LIST

**FLAG LIST  
CHANNEL LIST**

Manual Acquire	76	10000 (13)	Enable man acq of CSM	A=1,3,5,7
			by RR	
			Enable auto acq of	A=0,2,4,6
			CSM by RR	
LOS CM	76	4000 (12)	LOS Being Computed (R21)	B=4,5,6,7
			LOS Not Being Computed (R21)	B=0,1,2,3
External V	76	200 (8)	Ext ΔV VG Computation	C=2,3,6,7
			Lambert VG Computation	C=0,1,4,5
Final	76	40 (6)	Final Pass Through Rndz Prog Comp	D=4,5,6,7
			Interim Pass Through Rndz Prog Comp	D=1,2,3,4
Active Veh	76	20 (5)	LM Active Veh	D=2,3,6,7
			CSM Active Veh	D=0,1,4,5
Preferred Attitude	76	10 (4)	Preferred Att Computed	D=1,3,5,7
			Preferred Att Not Computed	D=0,2,4,6
REFSMAT	77	10000 (13)	REFSMAT Good	A=1,3,5,7
			REFSMAT Not Good	A=0,2,4,6
No Throttle	101	4000 (12)	Inhibit Full Throttle	B=4,5,6,7
			Permit Full Throttle	B=0,1,2,3

PGNS-71

LM-6

Basic Date October 6, 1969  
Changed \_\_\_\_\_

Basic Date October 6, 1969  
 Changed          

3 Axis	101	40	Mnvr Specified By 3 Axis	D=4,5,6,7
		(6)	Mnvr Specified By 1 Axis	D=0,1,2,3
No RR Mon	101	10	Bypass RR Gmb1 Monitor	D=1,3,5,7
		(4)	Perform RR Gmb1 Monitor	D=0,2,4,6
W Matrix	101	1	W Matrix Valid For Flt Nav	E=1,3,5,7
		(1)	W Matrix Not Valid For Flt Nav	E=0,2,4,6
Attitude	102	1	LM Att Stored In LGC	E=1,3,5,7
		(1)	LM Att Not Stored In LGC	E=0,2,4,6
Remode	110	20000	LOS Within Other RR Ant Mode	A=2,3,6,7
		(14)	RR Mode Set To 2	A=0,1,4,5
Antenna	110	4000	RR Ant In Mode 2	B=4,5,6,7
		(12)	RR Ant In Mode 1	B=0,1,2,3
Designate	110	1000	Desired LOS Within Mode Lim	B=1,3,5,7
		(10)	Desired LOS Not Within Mode Lim	B=0,2,4,6
ACA Mode	111	40000	Min Impulse Enabled (V76)	A=4,5,6,7
		(15)	Rate Command Enabled (V77)	A=0,1,2,3

NON FLAGS

Mark/Reject	1307	10000 (13)	<u>Use of Mark X or Y</u> Use of Mark Reject	<u>A=1,3,5,7</u> A=0,2,4,6
AOT Mark Y	1307	2000 (11)	<u>After Use of Mark Y</u> After Mark X & Y or Mark Reject	<u>B=2,3,6,7</u> B=0,1,4,5
AOT Mark X	1307	1000 (10)	<u>After Use of Mark X</u> After Mark X & Y or Mark Reject	<u>B=1,3,5,7</u> B=0,2,4,6

PGNS-73

CHANNEL LISTING

CHANNEL	BIT	DSKY	FUNCTION
5 OUTPUT	1	E=1,3,5,7	JET 1 ON (B4U)
	2	E=2,3,6,7	JET 2 ON (A4D)
	3	E=4,5,6,7	JET 5 ON (A3U)
	4	D=1,3,5,7	JET 6 ON (B3D)
	5	D=2,3,6,7	JET 9 ON (B2U)
	6	D=4,5,6,7	JET 10 ON (A2D)
	7	C=1,3,5,7	JET 13 ON (A1U)
	8	C=2,3,6,7	JET 14 ON (B1D)
6 OUTPUT	1	E=1,3,5,7	JET 7 ON (B3A)
	2	E=2,3,6,7	JET 3 ON (B4F)
	3	E=4,5,6,7	JET 15 ON (A1F)
	4	D=1,3,5,7	JET 11 ON (A2A)
	5	D=2,3,6,7	JET 12 ON (B2L)
	6	D=4,5,6,7	JET 8 ON (A3R)
	7	C=1,3,5,7	JET 4 ON (A4R)
	8	C=2,3,6,7	JET 16 ON (B1L)
11 OUTPUT	1	E=1,3,5,7	ISS WARNING
	13	A=1,3,5,7	ENGINE ON
	14	A=2,3,6,7	ENGINE OFF
12 OUTPUT	1	E=1,3,5,7	ZERO RRCU
	4	D=1,3,5,7	COARSE ALIGN ENABLE
	5	D=2,3,6,7	ZERO ICDU
	9	C=4,5,6,7	+PITCH GMBL TRIM CMD
	10	B=1,3,5,7	-PITCH GMBL TRIM CMD
	11	B=2,3,6,7	+ROLL GMBL TRIM CMD
	12	B=4,5,6,7	-ROLL GMBL TRIM CMD
	13	A=1,3,5,7	LR POS CMD
	14	A=2,3,6,7	RR AUTO TRACK ENABLE
	15	A=4,5,6,7	ISS TURN ON DELAY COMPLETE
16 INPUT	3	E=4,5,6,7	MARK X
	4	D=1,3,5,7	MARK Y
	5	D=2,3,6,7	MARK REJECT
	6	D=4,5,6,7	+RATE OF DESCENT
	7	C=1,3,5,7	-RATE OF DESCENT

Basic Date October 6, 1969  
 Changed

PGNS-75

30 (INVERTED) INPUT	1	E=0,2,4,6	ABORT
	2	E=0,1,4,5	STAGE VERIFY
	3	E=0,1,2,3	ENG ARM
	4	D=0,2,4,6	ABORT STAGE
	5	D=0,1,4,5	AUTO THROTTLE
	6	D=0,1,2,3	DISPLAY INERTIAL DATA
	7	C=0,2,4,6	RR CDU FAIL
	9	C=0,1,2,3	IMU OPERATE
	10	B=0,2,4,6	G&N CONTROL OF S/C
	11	B=0,1,4,5	IMU CAGE
	12	B=0,1,2,3	ICDU FAIL
	13	A=0,2,4,6	IMU FAIL
	14	A=0,1,4,5	ISS TURN ON REQUEST
	15	A=0,1,2,3	TEMP IN LIMITS
	31 (INVERTED) INPUT	1	E=0,2,4,6
2		E=0,1,4,5	-PITCH MIN IMPULSE/-EL LPD
3		E=0,1,2,3	+YAW MIN IMPULSE
4		D=0,2,4,6	-YAW MIN IMPULSE
5		D=0,1,4,5	+ROLL MIN IMPULSE/+AZ LPD
6		D=0,1,2,3	-ROLL MIN IMPULSE/-AZ LPD
7		C=0,2,4,6	+X TRANSLATION
8		C=0,1,4,5	-X TRANSLATION
9		C=0,1,2,3	+Y TRANSLATION
10		B=0,2,4,6	-Y TRANSLATION
11		B=0,1,4,5	+Z TRANSLATION
12		B=0,1,2,3	-Z TRANSLATION
13		A=0,2,4,6	ATTITUDE HOLD
14		A=0,1,4,5	AUTO STAB
15		A=0,1,2,3	ACA OUT OF DETENT
32 (INVERTED)	1	E=0,2,4,6	JETS 2,4 FAILED
	2	E=0,1,4,5	JETS 5,8 FAILED
	3	E=0,1,2,3	JETS 1,3 FAILED
	4	D=0,2,4,6	JETS 6,7 FAILED
	5	D=0,1,4,5	JETS 14,16 FAILED
	6	D=0,1,2,3	JETS 13,15 FAILED
	7	C=0,2,4,6	JETS 9,12 FAILED
	8	C=0,1,4,5	JETS 10,11 FAILED
	9	C=0,1,2,3	GIMBAL NOT ENABLED
	10	B=0,2,4,6	GIMBAL FAILED
14	A=0,1,4,5	PROCEED	

Basic Date October 6, 1969  
 Changed \_\_\_\_\_



PGNS-76

33 (INVERTED)	2	E=0,1,4,5	RR PWR ON/AUTO
	3	E=0,1,2,3	RR RNG SCALE LOW
	4	D=0,2,4,6	RR DATA GOOD
	5	D=0,1,4,5	LR DATA GOOD
	6	D=0,1,2,3	LR POSITION 1
	7	C=0,2,4,6	LR POSITION 2
	8	C=0,1,4,5	LR VELOCITY DATA GOOD
	9	C=0,1,2,3	LR RNG SCALE LOW
	10	B=0,2,4,6	BLOCK UPLINK
	11	B=0,1,4,5	UPLINK TOO FAST
	12	B=0,1,2,3	DOWNLINK TOO FAST
	13	A=0,2,4,6	PIPA FAIL
	14	A=0,1,4,5	LGC WARNING
	15	A=0,1,2,3	OSCILLATOR ALARM

Basic Date      October 6, 1969  
 Changed

LM OR CSM S.V. READOUT

1

V83E

2

After intergration: V05N01E

CSM S.V.

LM S.V.

2137E

2167E

E,2142E

E,2172E

E,2117E

E,2104E

E,2122E

E,2107E

E,2113E

E,2113E

PRO

PRO

November 3, 1969

Basic Date

Changed

3

Transmit S.V. & Time Tag  
To CSM

LM OR CSM S.V. LOADING

1

V37E00E

V71E

21E

1501E

(CSM S.V.) 00002E, Plus Xmited Pad

(LM S.V.) 77775E, Plus Xmited Pad

V33E

AGS-1

AGS SELECTOR LOGIC LIST

<u>Address</u>	<u>Entry</u>	
400	+00000	Attitude Hold
	+10000	Auto Guidance Steering
	+20000	Z-Body Axis Steering
	+30000	IMU Align
	+40000	Lunar Align
	+50000	Body Axis Align
	+60000	Gyro and Accelerometer Calibration (302 sec, 32 sec)
	+70000	Inflight Accelerometer Only Calibration (32 sec)
407	+00000	Use Rotating External $\Delta V$ Reference Frame
	+10000	Freeze External $\Delta V$ in Inertial Space And Allow $\Delta V$ 's To Count
410	+00000	Orbit Insertion Routine
	+10000	CSI Routine
	+20000	CDH Routine
	+30000	TPI Search Routine
	+40000	TPI Execute Routine
	+50000	External $\Delta V$
411	+00000	DPS or RCS Engine Select
	+10000	APS Engine Selection
412	+00000	Reinitiate Test
	+10000	Test Successful
	+30000	Logic Test Fail
	+40000	Memory Test Fail
	+70000	Logic & Memory Test Fail
413	+00000	Normal Position
	+10000	Store Lunar Azimuth
414	+00000	Navigation Initialization Complete (AUTO)
	+10000	LM And CSM Navigation Initialization via PGNCS Downlinks
	+20000	LM Navigation Initial- ization via DEDA
	+30000	CSM Navigation Initial- ization via DEDA

AGS LOGIC

October 6, 1969

Basic Date -  
Changed

LM-6

AGS-2

415	+00000	Normal Position
	+10000	Store Z-axis Direction Cosines & Rng/Rng Rt Data in RDR Filter
416	+10000	For CSI Calculation Select CDH At 1/2 Orbital Period Following CSI
	+30000	For CSI Calculation Select CDH At 3/2 Orbital Period Following CSI
417	+00000	Normal Position
	+10000	Initialize Radar Filter
507	+00000	Z Body Points In Direction Of CSM When In Z-Body Axis Steering (400 set to +2)
	+10000	Z Body Points To Thrust Direction When (400 set to +2)
623	+00000	Z Body Parallel To CSM Orbit Plane When In Guidance Steering (400 set To +1)
	+10000	Z Body Parallel To Plane De- fined By WB When In Guidance Steering (400 set To +1)

Basic Date -- October 6, 1969  
 Changed -- NOVEMBER 5, 1969

AGS LOGIC

DEDA INPUT/OUTPUT LISTAddress

047	Sine of Landing Azimuth Angle	Octal
053	Cosine of Landing Azimuth Angle	Octal
223	Attitude Update Input	100 ft
224	Term In LM Desired Semi-major Axis $\alpha_L$ (O.I.)	100 ft
225	Lower Limit of $\alpha_L$ (O.I.)	100 ft
226	Upper Limit of $\alpha_L$ (O.I.)	100 ft
231	Radial Distance of Landing Site From Center of Moon	100 ft
232	Orbit Insertion Altitude	100 ft
233	Vertical Pitch Steering Altitude Threshold	100 ft
240	X Position Comp (LM)	100 ft
241	Y Position Comp (LM)	100 ft
242	Z Position Comp (LM)	100 ft
244	X Position Comp (CSM)	100 ft
245	Y Position Comp (CSM)	100 ft
246	Z Position Comp (CSM)	100 ft
254	LM Ephemeris Data (Epoch Time)	0.1 min
260	X Velocity Comp (LM)	.1fps
261	Y Velocity Comp (LM)	.1fps
262	Z Velocity Comp (LM)	.1fps
264	X Velocity Comp (CSM)	.1fps
265	Y Velocity Comp (CSM)	.1fps
266	Z Velocity Comp (CSM)	.1fps
272	CSM Ephemeris Data (Epoch Time)	0.1 min
274	Initial Update Time For Radar Filter	.1 min
275	Desired Update Time For TIG TPI (For CSI Calc Only)	.1 min
306	Target Time Of Node Prior To Rendezvous	.01 min
307	Time From TPI To Rendezvous	.01 min
310	Targeted TFI TPI (For TPI Search Routine)	.01 min
312	TPI Rendezvous Offset Time (Stable Orbit Rendezvous)	.01 min

DEDA INPUT/OUTPUT  
CONSTANTSBasic Date October 6, 1969  
Changed

AGS-4

316	Radar Range (R)	0.1 nm
373	AGS TIG CSI, CDH, TPI, TPM	0.1 min
377	AGS Computer Time (T)	0.1 min
404	$\Delta V_X$ (Use 470 For Readout)	Octal
405	$\Delta V_Y$ (Use 471 For Readout)	Octal
406	$\Delta V_Z$ (Use 472 For Readout)	Octal
450	$\Delta V_X$ (LV) (+Fwd)	.1fps
451	$\Delta V_Y$ (LV) (+Rt)	.1fps
452	$\Delta V_Z$ (LV) (+Dn)	.1fps
464	Vertical Pitch Steering, Attitude Rate Threshold	.1fps
465	Target Radial Rate at Insertion (Lower Limit)	.1fps
503	Radar Range Rate (RDOT) Input	.1fps
514	Components of Unit Vector	Octal
515	Used to PROVIDE Yaw	
516	Steering Out of CSM Orbit Plane (400,+10000;623,+10000)	Octal
534	Scale Factor for X Accelerometer	Octal
535	Scale Factor for Y Accelerometer	Octal
536	Scale Factor for Z Accelerometer	Octal
540	X Accel Bias Comp Coeff	.001 ft/sec <sup>2</sup>
541	Y Accel Bias Comp Coeff	.001 ft/sec <sup>2</sup>
542	Z Accel Bias Comp Coeff	.001 ft/sec <sup>2</sup>
544	X Gyro Bias Comp Coeff	.01°/hr
545	Y Gyro Bias Comp Coeff	.01°/hr
546	Z Gyro Bias Comp Coeff	.01°/hr
547	Lunar Align Azimuth Correction	Octal
574	Section Staging Flag(+ Not Staged)	Octal
604	Lunar Surface Flag(+ Not On Lunar Surface)	Octal
605	Desired cotangent of LOS at TPI (TAN LOS TPI)	Octal
607	HDOT Display Scale Factor	Octal
613	Central Angle Limit On TPI	Octal
616	Ullage Counter Value For Ullage Completion	2 sec

DEDA INPUT/OUTPUT  
CONSTANTS

Basic Date October 6, 1969

Changed

DEDA OUTPUT LISTAddress

211	Present Out-of CSM Orbit Plane Position	100 ft
263	Predicted Out-Of-Plane Velocity At TIG (CSI, CDH, TPI), Present Out of Plane O.I.	.1fps
267	$\Delta V$ To Be Gained (Except CDH)	.1fps
270	Present $V_y$ Out-of-CSM Orbit Plane Velocity ( $V_{yo}$ )	.1fps
277	Angle Between Local Horizon & Z Body Axis (In Plane)	.01°
303	Predicted LOS At TIG TPI (TPI mode)	.01°
303	LM/CSM Phase Angle at TIG (CSI,CDH) Present O.I.	-
310	Time To Next Maneuver (CSI,CDH,TPI)	0.01 min.
311	Time To Rndz (TPI)	0.01 min.
312	Target Offset Time (TPI)	0.01 min.
313	Time To Pericynthian	0.01 min.
314	$\Delta H$ Along LM Radial At TIG (CSI,CDH)	.1 nm
315	Predicted Altitude Of LM Apogee	0.1 nm
317	LM To CSM Range (R)	0.1 nm
337	LM Altitude (h)	0.1 nm
340	X Comp of LM Position	100 ft
341	Y Comp of LM Position	100 ft
342	Z Comp of LM Position	100 ft
344	X Comp of CSM Position	100 ft
345	Y Comp of CSM Position	100 ft
346	Z Comp of CSM Position	100 ft
347	Predicted Altitude At TIG (Except O.I.)	100 ft
357	Time To Burnout	fps/16
360	X Comp of LM Velocity	.1fps
361	Y Comp of LM Velocity	.1fps
362	Z Comp of LM Velocity	.1fps
364	X Comp of CSM Velocity	.1fps
365	Y Comp of CSM Velocity	.1fps
366	Z Comp of CSM Velocity	.1fps
367	LM Altitude Rate (H DOT)	.1fps
371	$\Delta V$ For CDH (Valid in CSI, Coast)	.1fps
371	$\Delta V$ Direct Trans + Braking (TPI)	.1fps

Basic Date October 6, 1969Changed       

LM-6

AGS-6

372	CSI To CDH $\Delta T$ (CSI)	.1 min
402	$\Delta H$ In Coelliptic Orbit (CSI,CDH)	.1nm
402	Predicted Hp (TPI)	.1nm
403	LM Perigee Attitude (Hp)	.1nm
423	Desired Final HDOT (Except TPI)	.1fps
427	Present LM HOR Velocity	.1fps
433	LM Velocity	.1fps
440	Range Rate Between LM and CSM (R DOT) (-Closing)	.1fps
470	$\Delta V_X$ Measured (LM) (+ Up) (Use 404 to zero)	.1fps
471	$\Delta V_Y$ Measured (LM) (+ Rt) (Use 405 to zero)	.1fps
472	$\Delta V_Z$ Measured (LM) (+ Fwd) (Use 406 to zero)	.1fps
477	Predicted HDOT At CSI, CDH, or TPI Time	.1fps
500	$\Delta V_{gx}$ (LM) (+Up)	.1fps
501	$\Delta V_{gy}$ (LM) (+Rt)	.1fps
502	$\Delta V_{gz}$ (LM) (+Fwd)	.1fps
612	Staging Sequence Counter	Octal
614	Ullage Counter	2 sec

DEDA ACCESSIBLE CONSTANTS LIST

Address

216 (2K3)	Value of LM Pericyynthion If Overflow In Orbital Eccentricity	100 ft
227 (4K10)	Factor In LM Desired Semi-major Axis $a_L$ (Orbit Insertion)	100 ft
230 (2K19)	$\Delta P$ Limiter	100 ft
453 (2K20)	P Iterator Convergence Check (TPI)	N.A.
454 (4K26)	VG Engine Cutoff Threshold	.1fps
466 (5K26)	Vgx Pseudo Attitude Hold Threshold	.1fps
473 (4K27)	Accumulated X-Velocity Bias	.1fps
506 (4K12)	Acceleration Threshold for Radial Jerk Set (Orbit Insertion)	Octal
523 (5K20)	Lower Limit Of Radial Jerk For Staged Vehicle (Orbit Insertion)	Octal

Basic Date October 6, 1969

Changed \_\_\_\_\_



AGS-7

526	(2K11)	Set Value Of Transfer Velocity (VT) (TPI)	Octal
527	(4K6)	Upper Limit Of Perdocted Radial Rate At Insertion (Orbit Insertion)	Octal
560	(5K14)	Upper Limit Of Radial Jerk (Orbit Insertion)	Octal
561	(5K16)	Upper Limit Of Out-Of-Plane Jerk (Orbit Insertion)	Octal
564	(5K18)	Lower Limit Of Radial Jerk For Unstaged Vehicle (Orbit Insertion)	Octal
566	(4K7)	Ascent Engine Pitch Cant Angle	Octal
601	(5K17)	Lower Limit Of Out-Of-Plane Jerk (Orbit Insertion)	Octal
602	(4K8)	Ascent Engine Roll Cant Angle	Octal
617	(1K30)	Gyro Calbrate Time	1 Count(2sec)
621	(1K37)	Accelerometer Calibrate Time	1 Count(2sec)
622	(4K23)	Attitude Hold At Abort Staging Threshold	1 Count(40 millisec)
627	(1K27)	Lunar Align Constant	Octal
630	(1K28)	Lunar Align Constant	Octal
631	(1K29)	Lunar Align Constant	Octal
634	(1K35)	Navigation Sensed Velocity Threshold	Octal
636	(2K1)	Lunar Gravitational Constant	Octal
637	(2K2)	Reciprocal Of Lunar Gravitational Constant	Octal
657	(4K25)	Vgx Engine Cutoff Threshold	Octal
660	(4K34)	Lower Limit Of Thrust Acceleration	Octal
661	(4K35)	Increment Ullage Counter Threshold	Octal
666	(4K21)	Scale Factor For Attitude Error	Octal

Basic Date — October 6, 1969  
 Changed —

AGS-8

ORBIT INSERTION

1      MODE CONT: AGS - ATT HOLD  
           GUID CONT - AGS  
           EVENT TIMER - SET

2      616+0 ZERO ULLAGE COUNTER LIMIT  
           232+(ORBIT INSERTION ALTITUDE)                   (100ft)  
           465+(ALTITUDE RATE AT INSERTION)               (.1fps)  
           224+(Semi-Major Axis Targeting Term)           (100ft)  
           225+( α Lower)                                   (100ft)  
           226+( α Upper)                                   (100ft)  
           227+(4K10)                                       (100ft)  
           410+0 ORBIT INSERTION ROUTINE

3      411+0 DES ENG OR RCS BURN  
           +1 ASC ENG BURN

4      623+0 Z-AXIS PARALLEL TO CSM ORBIT PLANE  
           +1 Z-AXIS PARALLEL TO SPECIFIED PLANE

5      If 623+1, Specify Plane  
           514+(X Component of Unit Vector)               (Octal)  
           515+(Y Component of Unit Vector)               (Octal)  
           516+(Z Component of Unit Vector)               (Octal)

6      400+1 GUIDANCE STEERING  
           501R ΔVGY(LM)                                   (.1fps)  
           502R ΔVGZ(LM)                                   (.1fps)  
           500R ΔVGX(LM)                                   (.1fps)

7      CONFIGURATION

	<u>DES</u>	<u>ASC</u>	<u>RCS</u>
<u>THR CONT</u>	<u>MAN</u>	-	-
MAN THROT	CDR	-	-
BAL CPL	ON	ON	ON
ATT/TRANSL	2 JET	2 JET	2 JET
TTCA (CDR)	THROT	JETS	JETS
DEADBAND	MIN	MIN	MIN
ABORT(STAGE)PB	RESET	RESET	RESET
ENG ARM	DES	ASC	OFF
MASTER ARM	ON(1st Burn Only)	ON(Un- staged)	OFF

Basic Date October 6, 1969

Changed \_\_\_\_\_

AGS PROG

LM-6

AGS-9

PRPLNT QTY MON	DES 1	OFF	OFF
PRPLNT TEMP/PRESS	DES 1	ASC	-
MON			
HELIUM MON	SUPCRIT	PRESS 2	-
	PRESS		
ENGINE STOP	-	-	PUSH

- 8 -30 FOR DPS BURNS  
 CB(11) STAB/CONT: DECA PWR - Close  
 CB(16) STAB/CONT: DES ENG OVRD - Close  
 ENG GMBL - ENABLE  
 FOR APS BURNS  
 CB(11) STAB/CONT: AELD - Close  
 CB(16) STAB/CONT: AELD - Close
  
- 9 -TBD MODE CONT: AGS - AUTO
  
- 10 00 ABORT (STAGE) - PUSH  
 IGNITION  
 When  $\Delta V > 50\text{fps}$ : BAL CPL - OFF
  
- 11 When Burn Complete  
 ABORT (STAGE) PB - RESET  
 407+0  
 410+5  
 451+0  
 (To Trim Out-of-Plane Comp)  
 263R  $\Delta VY$  (.1fps)  
 451 ( $\Delta VY$ ) (Same sign As 263)  
 407+1  
 NULL 501,502,500  
 (Null 501 After 502 for Out-of-Plane Trim)
  
- 12 MASTER ARM - OFF  
 ENG ARM - OFF  
 BAL CPL - ON  
 TTCA (CDR) - JETS  
 DEADBAND - MAX  
 PRPLNT QTY MON - OFF  
 HELIUM MON - OFF
  
- 13 616 + 00007

October 6, 1969  
 Basic Date \_\_\_\_\_  
 Changed \_\_\_\_\_

AGS-10

CSI

- 1      MODE CONT: AGS - ATT HOLD  
      GUID CONT - AGS
  
- 2      Wait until TIG-136 min  
      410 + 1 CSI Routine  
      373 + (TIG CSI)                   (.1 min)  
      275 + (TIG TPI)                   (.1 min)  
      605 + (COTAN LOS TPI)           (Octal)  
      451 + OE  
      416 + 1 CDH 1/2 Orbital Period After CSI  
          + 3 CDH 3/2 Orbital Periods After CSI
  
- 3      477R HDOT CSI                   (.1fps)
  
- 4      310R TFI CSI                   (.01 min)  
      EVENT TIMER - SET
  
- 5      If Time Available  
      372R  $\Delta T$  CSI To CDH           (.1min)  
      303R LM/CSM Phase Angle       (.01°)  
      371R  $\Delta V$  CDH                   (.1fps)  
      477R Predicted HDOT           (.1fps)  
      314R  $\Delta H$  At TIG               (.1nm)  
      402R  $\Delta H$  CDH                   (.1nm)
  
- 6      410 + 5 EXT  $\Delta V$   
      450R  $\Delta VX$  CSI                   (.1fps)  
      263R  $\Delta VY$  CSI                   (.1fps)  
      451 ( $\Delta VY$  CSI) (Same sign as 263) (.1fps)  
      452R  $\Delta VZ$  CSI                   (.1fps)  
      267R  $\Delta VG$  CSI                   (.1fps)
  
- 7      411 +0 DES ENG OR RCS BURN  
          +1 ASC ENG BURN
  
- 8      623 +0 Z-Axis Parallel to CSM Orbit Plane  
          +1 Z-Axis Parallel to Specified Plane

Basic Date — October 6, 1969  
Changed —

AGS-11

- 9 If 623 +1, Specify Plane  
 514 + (X Component of Unit Vector) (Octal)  
 515 + (Y Component of Unit Vector) (Octal)  
 516 + (Z Component of Unit Vector) (Octal)
- 10 400 +1 GUIDANCE STEERING (Z Axis Mnvr, 400+2,  
 507+1)
- 11 ATTITUDE CONTROL (3)-PULSE  
 MODE CONT: AGS - AUTO  
 Maneuver To Burn Attitude Then  
 ATTITUDE CONTROL (3)-MODE CONT

12 407 +0

13 501R ΔVGY (LM) (.1fps)  
 502R ΔVGZ (LM) (.1fps)  
 500R ΔVGX (LM) (.1fps)

14	<u>CONFIGURATION</u>	<u>DES</u>	<u>ASC</u>	<u>RCS</u>
	THR CONT	MAN	-	-
	MAN THROT	CDR	-	-
	BAL CPL	ON	ON	ON
	ATT/TRANSL	2 JET	2 JET	2 JET
	TTCA(CDR)	THROT	JETS	JETS
		(MIN THRUST)		
	DEADBAND	MIN	MIN	MIN
	ABORT(STAGE)	PUSH	PUSH	-
	ENG ARM	DES	ASC	OFF
	MASTER ARM	ON(1st Burn Only)	ON(Un- Staged)	OFF Only)
	PRPLNT QTY MON	DES 1	OFF	OFF
	PRPLNT TEMP/PRESS MON	DES 1	ASC	-
	HELIUM MON	SUPCRIT PRESS	PRESS 2	-
	ENGINE STOP	-	-	PUSH

Basic Date \_\_\_\_\_  
 Changed \_\_\_\_\_  
 October 6, 1969

AGS-12

- 15 -30 FOR DPS BURNS  
CB(11) STAB/CONT: DECA PWR-Close  
CB(16) STAB/CONT: DES ENG OVRD-Close  
ENG GMBL - ENABLE  
FOR APS BURNS  
CB(11) STAB/CONT: AELD-Close  
CB(16) STAB/CONT: AELD-Close
- 15 407 +1 (For RCS Burn Not +X LM)  
(X-Axis) 500R  
(Z-Axis) 502R
- 16 - :14 Start Ullage
- 17 :00 Ignition  
(RCS Burn) When  $\Delta VG < 15\text{fps}$ ,  
MODE CONTROL (AGS)-ATT HOLD
- 18 When Burn Complete:  
ABORT (STAGE) Reset  
NULL 501,502,500
- 19 410 +2 CDH Routine
- 20 MASTER ARM - OFF  
ENG ARM - OFF  
BAL CPL - ON  
TTCA(CDR) - JETS  
DEADBAND - MAX  
PRPLNT QTY MON - OFF  
HELIUM MON - OFF

Basic Date October 6, 1969

Changed

AGS-13

CDH

- 1       MODE CONT: AGS - ATT HOLD  
      GUID CONT - AGS
  
- 2       410 +2 CDH ROUTINE  
      373R TIG CDH (Adjust AGS TIG CDH  
      As Desired For New Solution)       (.1 min)
  
- 3       310R TFI CDH       (.01 min)  
      EVENT TIMER - SET
  
- 4       If Time Available Check The Following:  
      402R ΔH CDH       (.1nm)  
      423R HDOT CDH (Final)       (.1fps)  
      477R HDOT CDH       (.1fps)
  
- 5       410 +5 EXT ΔV  
      450R ΔVX CDH       (.1fps)  
      263R ΔVY CDH       (.1fps)  
      451 (ΔVY CDH) (Same Sign As 263)       (.1fps)  
      452R ΔVZ CDH       (.1fps)  
      267R ΔVG CDH       (.1fps)
  
- 6       411 +0 DES ENG OR RCS BURN  
      +1 ASC BURN
  
- 7       623 +0 Z-axis Parallel To CSM Orbit Plane  
      +1 Z-axis Parallel To Specified Plane
  
- 8       If 623 +1, Specify Plane  
      514 +(X Component of Unit Vector)  
      515 +(Y Component of Unit Vector)  
      516 +(Z Component of Unit Vector)

Basic Date    October 6, 1969

Changed

AGS-14

9 400 +1 GUIDANCE STEERING (Z-Axis,400+2,507+1)

10 ATTITUDE CONTROL (3)-PULSE  
 MODE CONT: AGS - AUTO  
 Maneuver To Burn Attitude Then  
 ATTITUDE CONTROL (3) - MODE CONT

11 407 +0

12 501R ΔVGY (LM) (.1fps)  
 502R ΔVGZ (LM) (.1fps)  
 500R ΔVGX (LM) (.1fps)

13	<u>CONFIGURATION</u>	<u>DES</u>	<u>ASC</u>	<u>RCS</u>
	THR CONT	MAN	-	-
	MAN THROT	CDR	-	-
	BAL CPL	ON	ON	ON
	ATT/TRANSL	2 JET	2 JET	2 JET
	TTCA(CDR)	THROT	JETS	JETS
		(MIN THRUST)		
	DEADBAND	MIN	MIN	MIN
	ABORT(STAGE)	PUSH	PUSH	-
	ENG ARM	DES	ACS	-
	MASTER ARM	ON(1st Burn Only)	ON(Un- Staged Only)	OFF
	PRPLNT QTY MON	DES 1	OFF	OFF
	PRPLNT TEMP/PRESS MON	DES 1	ASC	-
	HELIUM MON	SUPCRIT PRESS	PRESS 2	-
	ENGINE STOP	-	-	PUSH

Basic Date October 6, 1969  
 Changed \_\_\_\_\_



AGS-15

14 -30 For DPS Burns  
 CB(11) STAB/CONT: DECA PWR-Close  
 CB(16) STAB/CONT: DES ENG OVRD-Close  
 ENG GMBL-ENBL  
 For APS Burns  
 CB(11) STAB/CONT: AELD-Close  
 CB(16) STAB/CONT: AELD-Close

-15 407 +1 (For RCS BURN Not Along +X)  
 (X-Axis) 500R  
 (Z-Axis) 502R

15 - :14 Start Ullage

16 00 IGNITION  
 (RCS Burn) When  $\Delta VG < 15\text{fps}$ ,  
 MODE CONTROL(AGS)-ATT HOLD

17 When Burn Complete  
 ABORT(STAGE) - Release  
 NULL 501, 502, 500 (fps)

18 MASTER ARM -OFF  
 ENG ARM -OFF  
 BAL CPL -ON  
 TTCA (CDR) -JETS  
 DEADBAND -MAX  
 PRPLNT QTY MON -OFF  
 HELIUM MON -OFF

Basic Date October 6, 1969  
 Changed



AGS-17

- 8 623 +0 Z-Axis Parallel To CSM Orbit Plane  
+1 Z-Axis Parallel To Specified Plane
- 9 If 623 +1, Specify Plane  
514 +(X-Component of Unit Vector)  
515 +(Y-Component of Unit Vector)  
516 +(Z-Component of Unit Vector)
- 10 400 +1 GUIDANCE STEERING (Z Axis, 400+2,507+1)

11 ATTITUDE CONTROL (3) - PULSE  
MODE CONT: AGS - AUTO  
Maneuver To Burn Attitude Then  
ATTITUDE CONTROL (3) - MODE CONT

12 407 +0

13 501R VGY (LM) (.1fps)  
502R VGZ (LM) (.1fps)  
500R VGX (LM) (.1fps)

14	<u>CONFIGURATION</u>	<u>DES</u>	<u>ASC</u>	<u>RCS</u>
	THR CONT	MAN	-	-
	MAN THROT	CDR	-	-
	BAL CPL	ON	ON	ON
	ATT/TRANS	2 JET	2 JET	2 JET
	TTCA (CDR)	THROT	JETS	JETS
	DEADBAND	MIN	MIN	MIN
	ABORT PB	PUSH	PUSH	-
	ENG ARM	DES	ASC	OFF
	MASTER ARM	ON(1st Burn Only)	ON(Un- Staged Only)	OFF
	PRPLNT QTY MON	DES 1	OFF	-
	PRPLNT TEMP/PRESS MON	DES 1	ASC	-
	HELIUM MON	SUPCRIT PRESS	PRESS 2	-
	ENGINE STOP	-	-	DEPRESS

Basic Date October 6, 1969  
Changed

AGS-18

15 -30 For DPS Burns  
CB(11) STAB/CONT: DECA PWR-Close  
CB(16) STAB/CONT: DES ENG OVRD-Close  
ENG GMBL-ENBL  
For APS Burns  
CB(11) STAB/CONT: AELD-CLOSE  
CB(16) STAB/CONT: AELD-CLOSE

-15 407 +1 (For RCS BURN Not In +X)  
(X-Axis) 500R  
(Z-Axis) 502R

16 -06 Start Ullage

17 00 IGNITION  
(RCS Burn)When  $\Delta VG < 15\text{fps}$ ,  
MODE CONTROL (AGS)-ATT HOLD

18 When Burn Complete  
ABORT(STAGE)PB - Release  
NULL 501, 502, 500 (fps)

19 410 +4 TPI EXECUTE

20 MASTER ARM -OFF  
ENG ARM -OFF  
BAL CPL -ON  
TTCA (CDR) -JETS  
DEADBAND -MAX  
PRPLNT QTY MON -OFF  
HELIUM MON -OFF

October 6, 1969

Basic Date

Changed

TPMRetargeting (Same Rndz Time)

- |   |   |                     |
|---|---|---------------------|
| 1 | 410 +3 TPI SEARCH<br>307 +( $\Delta T$ RNDZ TRANS)<br>(+02800 For 1st MCC)<br>(+01300 For 2nd MCC)<br>310 $\Delta T$ To TPM<br>410 +4 TPI EXECUTE | (.01min)            |
| 2 | If Time Available:<br>311R $\Delta T$ RDZ<br>277R THETA   | (.01 min)<br>(.01°) |
| 3 | 410 +5<br>407 +0 Ref Frame<br>267R VG MDC<br>407 +1 Freeze Ext $\Delta V$   | (.1fps)             |
| 4 | Null 501, 502, 500  |                     |

Basic Date      October 6, 1969  
 Changed

# AGS-20

## EXTERNAL ΔV

1	MODE CONT: AGS - ATT HOLD GUID CONT: AGS																																	
2	410 +5 EXTERNAL ΔV 450 + ΔVX (LV) <span style="float: right;">(.1fps)</span> 451 + ΔVY (LV) <span style="float: right;">(.1fps)</span> 452 + ΔVZ (LV) <span style="float: right;">(.1fps)</span>																																	
3	267R Total ΔV EVENT TIMER - SET																																	
4	411 +0 DES ENG OR RCS +1 ASC ENG																																	
5	400 +1 GUIDANCE STEERING (Z-Axis,400+2,507+1)																																	
6	ATTITUDE CONTROL (3) - PULSE MODE CONT: AGS - AUTO Maneuver To Burn Attitude Then ATTITUDE CONTROL (3) - MODE CONT																																	
7	407 +0																																	
8	501R ΔVGY (LM) <span style="float: right;">(.1fps)</span> 502R ΔVGZ (LM) <span style="float: right;">(.1fps)</span> 500R ΔVGX (LM) <span style="float: right;">(.1fps)</span>																																	
9	<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;"><u>CONFIGURATION</u></th> <th style="text-align: left;"><u>DES</u></th> <th style="text-align: left;"><u>ASC</u></th> <th style="text-align: left;"><u>RCS</u></th> </tr> </thead> <tbody> <tr> <td>THR CONT</td> <td>MAN</td> <td>-</td> <td>-</td> </tr> <tr> <td>MAN THROT</td> <td>CDR</td> <td>-</td> <td>-</td> </tr> <tr> <td>BAL CPL</td> <td>ON</td> <td>ON</td> <td>ON</td> </tr> <tr> <td>ATT/TRANS</td> <td>2 JET</td> <td>2 JET</td> <td>2 JET</td> </tr> <tr> <td>TTCA(CDR)</td> <td>THROT</td> <td>JETS</td> <td>JETS</td> </tr> <tr> <td>DEADBAND</td> <td>MIN</td> <td>MIN</td> <td>MIN</td> </tr> <tr> <td>ABORT(STAGE)</td> <td>PUSH</td> <td>PUSH</td> <td>-</td> </tr> </tbody> </table>	<u>CONFIGURATION</u>	<u>DES</u>	<u>ASC</u>	<u>RCS</u>	THR CONT	MAN	-	-	MAN THROT	CDR	-	-	BAL CPL	ON	ON	ON	ATT/TRANS	2 JET	2 JET	2 JET	TTCA(CDR)	THROT	JETS	JETS	DEADBAND	MIN	MIN	MIN	ABORT(STAGE)	PUSH	PUSH	-	
<u>CONFIGURATION</u>	<u>DES</u>	<u>ASC</u>	<u>RCS</u>																															
THR CONT	MAN	-	-																															
MAN THROT	CDR	-	-																															
BAL CPL	ON	ON	ON																															
ATT/TRANS	2 JET	2 JET	2 JET																															
TTCA(CDR)	THROT	JETS	JETS																															
DEADBAND	MIN	MIN	MIN																															
ABORT(STAGE)	PUSH	PUSH	-																															

Basic Date October 6, 1969  
 Changed

AGS-21

ENG ARM	DES	ASC	OFF
MASTER ARM	ON(1st Burn Only)	ON(Un- Staged Only)	OFF
PRPLNT QTY MON	DES 1	OFF	-
PRPLNT TEMP/PRESS MON	DES 1	ASC	-
HELIUM MON	SUPCRIT PRESS	PRESS 2	-
ENGINE STOP	-	-	DEPRESS

AGS MAN THRUST

10 -30 For DPS Burns  
 CB(11) STAB/CONT: DECA PWR-Close  
 CB(16) STAB/CONT: DES ENG OVRD-Close  
 ENG GMBL-ENBL  
 For APS Burns  
 CB(11) STAB/CONT: AELD-Close  
 CB(16) STAB/CONT: AELD-Close

-15 407 +1 (For RCS Burn Not Along +X)

11 -:06 Start Ullage

12 00 IGNITION  
 (RCS Burn) When  $\Delta VG < 15\text{fps}$ ,  
 MODE CONTROL (AGS) - ATT HOLD

13 When Burn Complete  
 ABORT(STAGE) - Release  
 NULL 501, 502, 500 (.1fps)

14 MASTER ARM -OFF  
 ENG ARM -OFF  
 BAL CPL -ON  
 TTCA(CDR) -JETS  
 DEADBAND -MAX  
 PRPLNT QTY MON -OFF  
 HELIUM MON -OFF

Basic Date — October 6, 1969  
 Changed —

AGS MAN THRUST

AGS MANUAL THRUST

- |   |  |   |
|---|--|---|
| 1 | GUID CONT<br>MODE CONT: AGS<br>ATT CONT RPY<br>DEADBAND<br>TTCA/TRANSL<br>TTCA(CDR)                            | -AGS<br>-ATT HOLD<br>-MODE CONT<br>-MIN<br>-ENABLE<br>-JETS |
| 2 | MNVR Vehicle To Desired Attitude (Align One<br>Of The Spacecraft Body Axes In The Desired<br>Thrust Direction) |   |
| 3 | 400 +0<br>MODE CONT: AGS - AUTO<br>404 +0<br>405 +0<br>406 +0  |   |
| 4 | Monitor $\Delta V$ Along Thrust Axis<br>X - 470R<br>Y - 471R<br>Z - 472R                                       | (.1fps)<br>(.1fps)<br>(.1fps)                               |
| 5 | Thrust Residuals   |   |
| 6 | Trim Residuals   |   |
|   | X - 470R<br>Null (TTCA Up/Dn)<br>(If Thrust Axis Acquire Desired $\Delta V$ )                                  | (.1fps)   |
|   | Z - 472R<br>Null (TTCA In/Out)<br>(If Thrust Axis Acquire Desired $\Delta V$ )                                 | (.1fps)   |

Basic Date October 6, 1969  
 Changed \_\_\_\_\_



AGS ACTIVATION & SELF TEST

1        AGS STATUS - STBY  
           (AGS Warn Lt - On)  
           CB(11) AC BUS B: AGS-Close  
           CB(16) STAB/CONT: AEA-Close  
           (AGS Warn Lt - Off)  
           AGS STATUS - OPERATE  
           (AGS Warn Lt - On)  
           02/H2O QTY MON - CWEA RESET  
           (AGS Warn Lt - Off)

2        000 +888888 (OPR ERR Lt - On)

3        123 -45679

4        412 +0 To Reinitiate Test  
           412R +1 SELF TEST SATISFACTORY  
               +3 LOGIC TEST FAILURE  
               +4 MEMORY TEST FAILURE  
               +7 LOGIC AND MEMORY TEST FAILURE

5        574 +0 DESCENT STAGE FLAG (+NOT STAGED)

6        604 +0 LUNAR SURFACE FLAG (+NOT ON  
                                   LUNAR SURFACE)

7        612R +0 STAGING SEQ COUNTER

AGS ACT, SELF-  
 TEST, CALIBRATION

Basic Date October 6, 1969  
 Changed

AGS CALIBRATION

- 1            Verify AGS In Standby/Operate For 25 min
  
- 2            Read And Record
 

540R X ACCEL BIAS	_____	(.001 ft/sec <sup>2</sup> )
541R Y	_____	(.001 ft/sec <sup>2</sup> )
542R Z	_____	(.001 ft/sec <sup>2</sup> )
544R X GYRO DRIFT COEFF	_____	(.01°/hr)
545R Y	_____	(.01°/hr)
546R Z	_____	(.01°/hr)
  
- 3            V16N20E
 

16 20 ICDU Angles 0,I,M	
CSM MNVR Until LM Angles:	292.5°
	338.0°
	337.0°

Rates <.075°/sec  
 Disable CSM & LM Thrusters  
 V40N20E
  
- 4            400 +6 CALIBRATE GYRO & ACCEL
 

Read And Record		
540R X ACCEL BIAS	_____	(.001 ft/sec <sup>2</sup> )
541R Y	_____	(.001 ft/sec <sup>2</sup> )
542R Z	_____	(.001 ft/sec <sup>2</sup> )

Values Should Not Change From Step 2  
 By More Than (.039) ft/sec<sup>2</sup> (.008nom)
  
- 5            400R +0 GYRO & ACCEL CALIBRATE COMPLETE (302 Sec)
 

Read And Record		
544R X GYRO DRIFT COEFF	_____	(.01°/hr)
545R Y	_____	(.01°/hr)
546R Z	_____	(.01°/hr)

Values Should agree with Step 2 Values  
 Within 2.0°/hr (Nominal 0.9)

AGS ACT, SELF TEST, CALIBRATION

Basic Date October 6, 1969  
 Changed October 24, 1969





AGS MANUAL STATE VECTOR UPDATE

1	RECORD LM DATA AND TIME	
2	240 +(LM X Position)	(100 ft)
3	241 +(LM Y Position)	(100 ft)
4	242 +(LM Z Position)	(100 ft)
5	260 +(LM X Velocity)	(.1fps)
6	261 +(LM Y Velocity)	(.1fps)
7	262 +(LM Z Velocity)	(.1fps)
8	254 +(LM Epoch Time)	(.1 min)
9	414 +20000E Update State Vector	
10	414R (+00000=Update Complete)	
11	RECORD CSM DATA AND TIME	
12	244 +(CSM X Position)	(100 ft)
13	245 +(CSM Y Position)	(100 ft)
14	246 +(CSM Z Position)	(100 ft)
15	264 +(CSM X Velocity)	(.1fps)
16	265 +(CSM Y Velocity)	(.1fps)
17	266 +(CSM Z Velocity)	(.1fps)
18	272 +(CSM Epoch Time)	(.1 min)
19	414 +30000E Update State Vector	
20	414R (+00000=Update Complete)	

Basic Date October 6, 1969  
 Changed           

LM-6

AGS MAN S.V.  
 BACK-UP ALIGN

BACK-UP RNDZ ALIGNMENT

- 1 Fly to 0° Roll, Z-Axis Toward CSM
- 2 400 +5
- 3 400 +0 DO NOT ENTER
- 4 When Wings Level (HORIZ REF) And Z-Axis Toward CSM Key ENTER And Note GET \_\_\_\_\_.
- 5 Coordinate with CSM To Adjust Ordeal (PITCH LM = 180° + PITCH CM)
- 6 Transmit GET of Align to MSFN

BACK-UP STAR ALIGNMENT

- 1 MODE CONT: AGS - ATT HOLD
- 2 MNVR To Place Star Set In AOT (FWD DETENT)
- 3 Position Prime Star In Center of Reticle
- 4 DEADBAND - MIN
- 5 Rotate Reticle To Place Either +X,+Y Line on Star #2
- 6 400 +5E  
400 +0E
- 7 RECORD & Report To MSFN Star Set, ID Line  
AOT Counter  

	(Star #1)
	(Star #2)
	(ID Line)
	(AOT Counter)
- 8 MNVR To FDAI Angles From MSFN
- 9 At New Attitude  
400 +5E  
400 +0E

Basic Date October 6, 1969  
Changed \_\_\_\_\_

AGS MAN S.V.:  
BACK-UP ALIGN

Basic Date October 6, 1969

Changed           

LM-6

P27 UPDATE (LM)													
V			V			V			PURP				
:			:			:			GET				
INDEX			INDEX			INDEX			1173	01			
										02			
										03			
										04			
										05			
										06			
										07			
										10			
										11			
										12			
										13			
										14			
										15			
										16			
										17			
										20			
										1213 21			
										22			
										23			
										1216 24			
X	X	X				X	X	X			N34	HR	
X	X	X	X			X	X	X	X			MIN	
X	X					X	X				NAV	CHECK SEC	
	0						0				N43	LAT	
												LONG	
+	0					+	0					ALT	

P27 UPDATE (LM)

P27 UPDATE

P27 UPDATE (LM)												
V			V			V			PURP			
:			:			:			GET			
INDEX			INDEX			INDEX			1173 01			
											02	
											03	
											04	
											05	
											06	
											07	
											10	
											11	
											12	
											13	
											14	
											15	
											16	
											17	
											20	
											1213 21	
											22	
											23	
											1216 24	
X	X	X				X	X	X			N34	HR
X	X	X	X			X	X	X	X			MIN
X	X					X	X				NAV	CHECK SEC
	0						0				N43	LAT
												LONG
+	0					+	0					ALT

Basic Date October 6, 1969  
 Changed \_\_\_\_\_

LM-6



P27 UPDATE (LM)

V			V			V			PURP			
:	:		:	:		:	:		GET			
INDEX			INDEX			INDEX			1173	01		
										02		
										03		
										04		
										05		
										06		
										07		
										10		
										11		
										12		
										13		
										14		
										15		
										16		
										17		
										20		
										1213 21		
										22		
										23		
										1216 24		
X	X	X				X	X	X			N34	HR
X	X	X	X			X	X	X	X			MIN
X	X					X	X					NAV CHECK SEC
	0						0				N43	LAT
												LONG
+	0					+	0					ALT

Basic Date October 6, 1969  
 Changed       

LM-6

P27 UPDATE (LM)

V			V			V			PURP		
:			:			:			GET		
INDEX			INDEX			INDEX					
									1173 01		
									02		
									03		
									04		
									05		
									06		
									07		
									10		
									11		
									12		
									13		
									14		
									15		
									16		
									17		
									20		
									1213 21		
									22		
									23		
									1216 24		
X	X	X				X	X	X	N34	HR	
X	X	X	X			X	X	X	X	MIN	
X	X					X	X			NAV CHECK SEC	
	0						0			N43	LAT
										LONG	
+	0					+	0			ALT	

Basic Date October 6, 1969  
 Changed \_\_\_\_\_

LM-b

P 30 LM MANEUVER

PURPOSE													
HR	N33		+	0	0				+	0	0		
MIN	TIG		+	0	0	0			+	0	0	0	
SEC			+	0			•		+	0			•
ΔVX	N81							•					•
ΔVY	LOCAL							•					•
ΔVZ	VERT							•					•
HA	N42		+					•	+				•
HP								•					•
AVR			+					•	+				•
BT			X	X	X		•		X	X	X		•
R	FDAI		X	X	X				X	X	X		
P	INER		X	X	X				X	X	X		
ΔVX	AGS	N86						•					•
ΔVY	AGS							•					•
ΔVZ	AGS							•					•
BSS			X	X	X				X	X	X		
SPA			X	X				•	X	X			•
SXP			X	X	X			•	X	X	X		•

REMARKS:

P30 UPDATE (LM)

Basic Date October 6, 1969  
 Changed \_\_\_\_\_

P30 LM MANEUVER

PURPOSE													
HR		N33	+	0	0				+	0	0		
MIN	TIG		+	0	0	0			+	0	0	0	
SEC			+	0					+	0			
ΔVX		N81											
ΔVY		LOCAL											
ΔVZ		VERT											
HA		N42	+						+				
HP													
AVR			+						+				
BT			X	X	X				X	X	X		
R		FDAI	X	X	X				X	X	X		
P		INER	X	X	X				X	X	X		
ΔVX	AGS	N86											
ΔVY	AGS												
ΔVZ	AGS												
BSS			X	X	X				X	X	X		
SPA			X	X					X	X			
SXP			X	X	X				X	X	X		

REMARKS:

P30 UPDATE (LM)

Basic Date October 6, 1969  
 Changed \_\_\_\_\_

LM-7

P 30 LM MANEUVER

PURPOSE												
HR	N33		+	0	0				+	0	0	
MIN	TIG		+	0	0	0			+	0	0	0
SEC			+	0			•		+	0		•
ΔVX	N81						•					•
ΔVY	LOCAL						•					•
ΔVZ	VERT						•					•
HA	N42		+				•		+			•
HP							•					•
AVR			+				•		+			•
BT			X	X	X		•		X	X	X	•
R	FDAI		X	X	X				X	X	X	
P	INER		X	X	X				X	X	X	
ΔVX	AGS	N86					•					•
ΔVY	AGS						•					•
ΔVZ	AGS						•					•
BSS			X	X	X				X	X	X	
SPA			X	X			•		X	X		•
SXP			X	X	X		•		X	X	X	•

REMARKS:

Basic Date October 6, 1969  
 Changed \_\_\_\_\_

P 30 LM MANEUVER

PURPOSE												
HR		N33	+	0	0				+	0	0	
MIN	TIG		+	0	0	0			+	0	0	0
SEC			+	0			•		+	0		•
ΔVX		N81						•				•
ΔVY		LOCAL						•				•
ΔVZ		VERT						•				•
HA		N42	+					•	+			•
HP								•				•
AVR			+					•	+			•
BT			X	X	X		•		X	X	X	•
R		FDAI	X	X	X				X	X	X	
P		INER	X	X	X				X	X	X	
ΔVX	AGS	N86						•				•
ΔVY	AGS							•				•
ΔVZ	AGS							•				•
BSS			X	X	X				X	X	X	
SPA			X	X				•	X	X		•
SXP			X	X	X			•	X	X	X	•

REMARKS:

Basic Date October 6, 1969

Changed

# AGS STATE VECTOR UPDATE

												PURP	
												240	
												241	
												242	
												260	
												261	
												262	
+						+						254	
												244	
												245	
												246	
												264	
												265	
												266	
+						+						272	

**REMARKS:**

Basic Date October 6, 1969  
 Changed           

**AGS STATE VECTOR**

# AGS STATE VECTOR UPDATE

												PURP	
												240	
												241	
												242	
												260	
												261	
												262	
+						+						254	
												244	
												245	
												246	
												264	
												265	
												266	
+						+						272	

**REMARKS:**

**AGS STATE VECTOR**

Basic Date October 6, 1969

Changed \_\_\_\_\_



# AGS STATE VECTOR UPDATE

												PURP	
												240	
												241	
												242	
												260	
												261	
												262	
+						+						254	
												244	
												245	
												246	
												264	
												265	
												266	
+						+						272	

REMARKS:

Basic Date October 6, 1969  
 Changed

# AGS STATE VECTOR UPDATE

												PURP	
												240	
												241	
												242	
												260	
												261	
												262	
+						+						254	
												244	
												245	
												246	
												264	
												265	
												266	
+						+						272	

**REMARKS:**

Basic Date October 6, 1969

Changed \_\_\_\_\_

# AGS STATE VECTOR UPDATE

											PURP	
											240	
											241	
											242	
											260	
											261	
											262	
+						+					254	
											244	
											245	
											246	
											264	
											265	
											266	
+						+					272	

**REMARKS:**

Basic Date October 6, 1969  
 Changed

Basic Date October 6, 1969  
 Changed NOVEMBER 3, 1969

VENUS HALF-UNIT VECTORS

GMT M:D:H	GET Hr	X vector	Y vector	Z vector
11:14:16	0	-.40935	-.26799	-.10306
11:14:21	5	-.40806	-.26969	-.10383
11:15:02	10	-.40672	-.27138	-.10461
11:15:07	15	-.40539	-.27306	-.10538
11:15:12	20	-.40406	-.27474	-.10614
11:15:17	25	-.40271	-.27641	-.10691
11:15:22	30	-.40136	-.27807	-.10767
11:16:03	35	-.40000	-.27973	-.10843
11:16:08	40	-.39864	-.28138	-.10919
11:16:13	45	-.39726	-.28303	-.10994
11:16:18	50	-.39588	-.28467	-.11069
11:16:23	55	-.39449	-.28630	-.11144
11:17:04	60	-.39309	-.28793	-.11219
11:17:09	65	-.39168	-.28955	-.11294
11:17:14	70	-.39027	-.29116	-.11368
11:17:19	75	-.38885	-.29277	-.11442
11:18:00	80	-.38742	-.29437	-.11516
11:18:05	85	-.38598	-.29596	-.11589
11:18:10	90	-.38454	-.29755	-.11663
11:18:15	95	-.38309	-.29913	-.11736
11:18:20	100	-.38163	-.30071	-.11809
11:19:01	105	-.38016	-.30227	-.11881
11:19:06	110	-.37869	-.30384	-.11954
11:19:11	115	-.37720	-.30539	-.12026
11:19:16	120	-.37571	-.30694	-.12098
11:19:21	125	-.37422	-.30848	-.12169

GMT M:D:H	GET Hr	X vector	Y vector	Z vector
11:20:02	130	-.37271	-.31002	-.12241
11:20:07	135	-.37120	-.31154	-.12312
11:20:12	140	-.36968	-.31307	-.12383
11:20:17	145	-.36816	-.31458	-.12453
11:20:22	150	-.36662	-.31609	-.12524
11:21:03	155	-.36508	-.31759	-.12594
11:21:08	160	-.36353	-.31909	-.12664
11:21:13	165	-.36197	-.32058	-.12733
11:21:18	170	-.36041	-.32206	-.12803
11:21:23	175	-.35884	-.32353	-.12872
11:22:04	180	-.35726	-.32500	-.12941
11:22:09	185	-.35568	-.32646	-.13009
11:22:14	190	-.35408	-.32792	-.13078
11:22:19	195	-.35248	-.32937	-.13146
11:23:00	200	-.35087	-.33081	-.13214
11:23:05	205	-.34926	-.33224	-.13281
11:23:10	210	-.34764	-.33367	-.13349
11:23:15	215	-.34601	-.33509	-.13416
11:23:20	220	-.34437	-.33651	-.13483
11:24:01	225	-.34273	-.33792	-.13550
11:24:06	230	-.34107	-.33932	-.13616
11:24:11	235	-.33942	-.34071	-.13682
11:24:16	240	-.33775	-.34210	-.13748
11:24:21	245	-.33608	-.34348	-.13814
11:25:02	250	-.33440	-.34485	-.13879

\* Planet is within 15 degrees of the sun

PLANET VECTORS  
 NOV 14

# PLANET VECTORS

## NOV 14

### MAJIB HALF-UNIT VECTORS

GMT M:D:H	GET Hr	X vector	Y vector	Z vector
11:14:16	0	.30172	-.35270	-.17244
11:15:02	10	.30387	-.35803	-.17172
11:15:12	20	.30601	-.35655	-.17100
11:15:22	30	.30814	-.35506	-.17027
11:16:08	40	.31026	-.35356	-.16953
11:16:18	50	.31237	-.35205	-.16879
11:17:04	60	.31448	-.35053	-.16805
11:17:14	70	.31657	-.34900	-.16730
11:18:00	80	.31866	-.34746	-.16655
11:18:10	90	.32073	-.34591	-.16579
11:18:20	100	.32280	-.34435	-.16503
11:19:06	110	.32485	-.34278	-.16427
11:19:16	120	.32689	-.34120	-.16350
11:20:02	130	.32892	-.33961	-.16273
11:20:12	140	.33094	-.33802	-.16195
11:20:22	150	.33295	-.33641	-.16118
11:21:08	160	.33495	-.33480	-.16039
11:21:18	170	.33693	-.33318	-.15961
11:22:04	180	.33891	-.33155	-.15882
11:22:14	190	.34087	-.32991	-.15803
11:23:00	200	.34282	-.32827	-.15724
11:23:10	210	.34476	-.32662	-.15644
11:23:20	220	.34668	-.32496	-.15564
11:24:06	230	.34860	-.32329	-.15484
11:24:16	240	.35050	-.32161	-.15403
11:25:02	250	.35239	-.31993	-.15322

### JUPITER HALF-UNIT VECTORS

GMT M:D:H	GET Hr	X vector	Y vector	Z vector
11:14:16	0	-.45655	-.19071	-.07210
11:15:12	20	-.45595	-.19195	-.07263
11:16:08	40	-.45534	-.19318	-.07315
11:17:04	60	-.45474	-.19440	-.07367
11:18:00	80	-.45414	-.19562	-.07418
11:18:20	100	-.45353	-.19682	-.07469
11:19:16	120	-.45292	-.19802	-.07520
11:20:12	140	-.45232	-.19921	-.07570
11:21:08	160	-.45171	-.20039	-.07620
11:22:04	180	-.45110	-.20157	-.07670
11:23:00	200	-.45049	-.20274	-.07720
11:23:20	220	-.44988	-.20391	-.07769
11:24:16	240	-.44927	-.20507	-.07818

### SATURN HALF-UNIT VECTORS

GMT M:D:H	GET Hr	X vector	Y vector	Z vector
11:14:16	0	.41333	.26061	.08988
11:16:18	50	.41408	.26558	.08948
11:18:20	100	.41480	.26459	.08910
11:20:22	150	.41549	.26363	.08874
11:23:00	200	.41616	.26269	.08840
11:25:02	250	.41680	.26179	.08807

Basic Date October 6, 1969  
 Changed NOVEMBER 3, 1969

Basic Date October 6, 1969  
 Changed NOVEMBER 3, 1969

VENUS HALF-UNIT VECTORS			
g.e.t., hr	X vector	Y vector	Z vector
108.5	-.37881	-.30370	-.11945
110.5	-.37822	-.30432	-.11974
112.5	-.37763	-.30494	-.12003
114.5	-.37704	-.30556	-.12031
116.5	-.37645	-.30618	-.12060
118.5	-.37585	-.30679	-.12088
120.5	-.37526	-.30741	-.12117
122.5	-.37467	-.30802	-.12145
124.5	-.37407	-.30863	-.12173
126.5	-.37347	-.30924	-.12202
128.5	-.37287	-.30985	-.12230
130.5	-.37227	-.31046	-.12258
132.5	-.37167	-.31107	-.12286
134.5	-.37107	-.31167	-.12315
136.5	-.37047	-.31228	-.12343
138.5	-.36986	-.31288	-.12371
140.5	-.36926	-.31349	-.12399
142.5	-.36865	-.31409	-.12427
144.5	-.36804	-.31469	-.12455

JUPITER HALF-UNIT VECTORS			
GMT LO ____:____:____			
g.e.t., hr	X vector	Y vector	Z vector
108.5	-.45323	-.19739	-.07493
120.5	-.45288	-.19810	-.07523
132.5	-.45252	-.19881	-.07552
144.5	-.45216	-.19951	-.07582

**EARTH HALF-UNIT VECTORS**

<b>g.e.t., hr</b>	<b>X vector</b>	<b>Y vector</b>	<b>Z vector</b>	<b>g.e.t., hr</b>	<b>X vector</b>	<b>Y vector</b>	<b>Z vector</b>	<b>g.e.t., hr</b>	<b>X vector</b>	<b>Y vector</b>	<b>Z vector</b>
110.00	-.49993	.00176	-.00856	121.00	-.49676	-.04550	-.03409	132.00	-.48792	-.09192	-.05905
110.50	-.49991	-.00041	-.00973	121.50	-.49648	-.04764	-.03524	132.50	-.48739	-.09400	-.06016
111.00	-.49988	-.00256	-.01089	122.00	-.49619	-.04977	-.03638	133.00	-.48685	-.09608	-.06128
111.50	-.49984	-.00472	-.01206	122.50	-.49589	-.05189	-.03753	133.50	-.48629	-.09816	-.06239
112.00	-.49978	-.00688	-.01323	123.00	-.49557	-.05402	-.03868	134.00	-.48572	-.10023	-.06350
112.50	-.49972	-.00903	-.01439	123.50	-.49525	-.05615	-.03982	134.50	-.48515	-.10230	-.06461
113.00	-.49964	-.01119	-.01556	124.00	-.49491	-.05827	-.04096	135.00	-.48456	-.10437	-.06572
113.50	-.49955	-.01334	-.01672	124.50	-.49456	-.06039	-.04210	135.50	-.48396	-.10643	-.06683
114.00	-.49944	-.01549	-.01789	125.00	-.49420	-.06251	-.04324	136.00	-.48334	-.10849	-.06793
114.50	-.49933	-.01765	-.01905	125.50	-.49382	-.06462	-.04438	136.50	-.48272	-.11055	-.06903
115.00	-.49920	-.01980	-.02021	126.00	-.49344	-.06674	-.04552	137.00	-.48209	-.11261	-.07013
115.50	-.49907	-.02195	-.02138	126.50	-.49304	-.06885	-.04666	137.50	-.48144	-.11466	-.07123
116.00	-.49892	-.02409	-.02254	127.00	-.49263	-.07096	-.04779	138.00	-.48079	-.11670	-.07232
116.50	-.49875	-.02624	-.02370	127.50	-.49221	-.07307	-.04892	138.50	-.48012	-.11875	-.07342
117.00	-.49858	-.02839	-.02485	128.00	-.49178	-.07517	-.05005	139.00	-.47944	-.12079	-.07451
117.50	-.49839	-.03053	-.02601	128.50	-.49134	-.07728	-.05118	139.50	-.47875	-.12283	-.07560
118.00	-.49820	-.03268	-.02717	129.00	-.49089	-.07938	-.05231	140.00	-.47805	-.12486	-.07669
118.50	-.49799	-.03482	-.02832	129.50	-.49042	-.08147	-.05344	140.50	-.47734	-.12689	-.07777
119.00	-.49777	-.03696	-.02948	130.00	-.48994	-.08357	-.05456	141.00	-.47662	-.12892	-.07885
119.50	-.49753	-.03910	-.03063	130.50	-.48946	-.08566	-.05569	141.50	-.47589	-.13094	-.07994
120.00	-.49729	-.04123	-.03179	131.00	-.48896	-.08775	-.05681	142.00	-.47515	-.13296	-.08101
120.50	-.49703	-.04337	-.03294	131.50	-.48845	-.08984	-.05793	142.50	-.47439	-.13498	-.08209
								143.00	-.47363	-.13699	-.08316

Basic Date October 6, 1969  
 Changed - NOVEMBER 3, 1969

Basic Date October 6, 1969  
 Changed NOVEMBER 3, 1969

VENUS HALF-UNIT VECTORS

GHE M:D:H	GHT Hr	X vector	Y vector	Z vector
11:16:19	5	-.39559	-.29450	-.11095
11:17:00	5	-.39420	-.29363	-.11110
11:17:05	10	-.39280	-.28826	-.11234
11:17:10	15	-.39132	-.28984	-.11309
11:17:15	20	-.38994	-.29142	-.11383
11:17:20	25	-.38852	-.29310	-.11457
11:18:01	30	-.38713	-.29470	-.11531
11:18:06	35	-.38569	-.29629	-.11604
11:18:11	40	-.38424	-.29787	-.11678
11:18:16	45	-.38279	-.29945	-.11751
11:18:21	50	-.38133	-.30103	-.11824
11:19:02	55	-.37987	-.30259	-.11897
11:19:07	60	-.37838	-.30415	-.11968
11:19:12	65	-.37690	-.30571	-.12040
11:19:17	70	-.37541	-.30725	-.12112
11:19:22	75	-.37391	-.30880	-.12184
11:20:03	80	-.37240	-.31033	-.12255
11:20:08	85	-.37089	-.31186	-.12326
11:20:13	90	-.36937	-.31338	-.12397
11:20:18	95	-.36784	-.31489	-.12468
11:20:23	100	-.36631	-.31640	-.12538
11:21:04	105	-.36477	-.31790	-.12608
11:21:09	110	-.36321	-.31939	-.12678
11:21:14	115	-.36165	-.32088	-.12747
11:21:19	120	-.36009	-.32237	-.12817
11:22:00	125	-.35852	-.32383	-.12887

GHE M:D:H	GHT Hr	X vector	Y vector	Z vector
11:22:05	130	-.35694	-.32530	-.12955
11:22:10	135	-.35535	-.32674	-.13023
11:22:15	140	-.35375	-.32822	-.13092
11:22:20	145	-.35215	-.32966	-.13160
11:23:01	150	-.35054	-.33110	-.13228
11:23:06	155	-.34893	-.33254	-.13295
11:23:11	160	-.34730	-.33397	-.13363
11:23:16	165	-.34567	-.33539	-.13430
11:23:21	170	-.34403	-.33680	-.13497
11:24:02	175	-.34239	-.33820	-.13563
11:24:07	180	-.34074	-.33960	-.13630
11:24:12	185	-.33907	-.34100	-.13696
11:24:17	190	-.33741	-.34238	-.13762
11:24:22	195	-.33573	-.34376	-.13827
11:25:03	200	-.33405	-.34513	-.13892
11:25:08	205	-.33236	-.34650	-.13957
11:25:13	210	-.33067	-.34786	-.14022
11:25:18	215	-.32897	-.34921	-.14087
11:25:23	220	-.32725	-.35055	-.14151
11:26:04	225	-.32553	-.35189	-.14215
11:26:09	230	-.32381	-.35322	-.14279
11:26:14	235	-.32208	-.35454	-.14342
11:26:19	240	-.32034	-.35586	-.14406
11:27:00	245	-.31859	-.35717	-.14469
11:27:05	250	-.31684	-.35848	-.14531

\* Planet is within 1° degree of the sun.



# PLANET VECTORS

## NOV 16

### MARS HALF-UNIT VECTORS

GMT M:D:H	GMT Hr	X vector	Y vector	Z vector
11:16:19	0	.31259	-.35190	-.16872
11:17:05	10	.31469	-.35037	-.16797
11:17:15	20	.31679	-.34884	-.16722
11:18:01	30	.31887	-.34730	-.16647
11:18:11	40	.32095	-.34575	-.16571
11:18:21	50	.32301	-.34419	-.16495
11:19:07	60	.32506	-.34262	-.16419
11:19:17	70	.32710	-.34104	-.16342
11:20:03	80	.32913	-.33945	-.16265
11:20:13	90	.33115	-.33785	-.16187
11:20:23	100	.33316	-.33625	-.16110
11:21:09	110	.33515	-.33463	-.16031
11:21:19	120	.33714	-.33301	-.15953
11:22:05	130	.33911	-.33138	-.15874
11:22:15	140	.34107	-.32975	-.15795
11:23:01	150	.34302	-.32810	-.15715
11:23:11	160	.34495	-.32645	-.15636
11:23:21	170	.34688	-.32479	-.15556
11:24:07	180	.34879	-.32312	-.15475
11:24:17	190	.35069	-.32144	-.15395
11:25:03	200	.35258	-.31975	-.15314
11:25:13	210	.35446	-.31806	-.15232
11:25:23	220	.35633	-.31636	-.15151
11:26:09	230	.35818	-.31465	-.15069
11:26:19	240	.36003	-.31293	-.14987
11:27:05	250	.36186	-.31121	-.14904

### JUPITER HALF-UNIT VECTORS

GMT M:D:H	GMT Hr	X vector	Y vector	Z vector
11:16:19	0	-.45501	-.19385	-.07343
11:17:15	20	-.45441	-.19507	-.07395
11:18:11	40	-.45380	-.19628	-.07446
11:19:07	60	-.45320	-.19748	-.07497
11:20:03	80	-.45259	-.19868	-.07548
11:20:23	100	-.45198	-.19986	-.07598
11:21:19	120	-.45138	-.20104	-.07648
11:22:15	140	-.45077	-.20222	-.07697
11:23:11	160	-.45015	-.20339	-.07747
11:24:07	180	-.44954	-.20455	-.07796
11:25:03	200	-.44893	-.20571	-.07845
11:25:23	220	-.44831	-.20686	-.07894
11:26:19	240	-.44769	-.20801	-.07943

### SATURN HALF-UNIT VECTORS

GMT M:D:H	GMT Hr	X vector	Y vector	Z vector
11:16:19	0	.41410	.26556	.08948
11:18:21	50	.41482	.26457	.08910
11:20:23	100	.41551	.26361	.08874
11:23:01	150	.41617	.26267	.08839
11:25:03	200	.41681	.26177	.08805
11:27:05	250	.41743	.26088	.08773

Basic Date October 6, 1969  
 Changed NOVEMBER 3, 1969

Basic Date October 6, 1969  
 Changed NOVEMBER 3, 1969

VENUS HALF-UNIT VECTORS

g.e.t., hr	X vector	Y vector	Z vector
108.0	-.36437	-.31828	-.12622
110.0	-.36376	-.31887	-.12650
112.0	-.36314	-.31946	-.12677
114.0	-.36252	-.32005	-.12705
116.0	-.36191	-.32064	-.12733
118.0	-.36128	-.32123	-.12760
120.0	-.36066	-.32182	-.12788
122.0	-.36004	-.32241	-.12815
124.0	-.35942	-.32300	-.12842
126.0	-.35879	-.32358	-.12870
128.0	-.35817	-.32416	-.12897
130.0	-.35754	-.32475	-.12925
132.0	-.35691	-.32533	-.12952
134.0	-.35628	-.32591	-.12979
136.0	-.35565	-.32649	-.13006
138.0	-.35502	-.32707	-.13033
140.0	-.35439	-.32765	-.13061
142.0	-.35376	-.32823	-.13088
144.0	-.35313	-.32881	-.13115

JUPITER HALF-UNIT VECTORS

GMT LO \_\_\_:\_\_\_:\_\_\_

g.e.t., hr	X vector	Y vector	Z vector
108.0	-.45180	-.20021	-.07612
120.0	-.45144	-.20091	-.07641
132.0	-.45108	-.20161	-.07670
144.0	-.45072	-.20230	-.07700

EARTH HALF-UNIT VECTORS

G.e.t., hr	X vector	Y vector	Z vector	G.e.t., hr	X vector	Y vector	Z vector	G.e.t., hr	X vector	Y vector	Z vector
108.0	-.44449	-.19770	-.11556	119.0	-.41822	-.23757	-.13662	130.0	-.38762	-.27460	-.15605
108.5	-.44339	-.19956	-.11655	119.5	-.41692	-.23932	-.13754	130.5	-.38614	-.27621	-.15689
109.0	-.44229	-.20143	-.11754	120.0	-.41561	-.24106	-.13845	131.0	-.38464	-.27781	-.15773
109.5	-.44117	-.20329	-.11852	120.5	-.41429	-.24279	-.13937	131.5	-.38314	-.27941	-.15856
110.0	-.44005	-.20514	-.11950	121.0	-.41296	-.24452	-.14028	132.0	-.38163	-.28100	-.15939
110.5	-.43892	-.20699	-.12048	121.5	-.41163	-.24625	-.14118	132.5	-.38011	-.28258	-.16022
111.0	-.43777	-.20883	-.12145	122.0	-.41028	-.24797	-.14209	133.0	-.37859	-.28416	-.16104
111.5	-.43662	-.21067	-.12243	122.5	-.40893	-.24968	-.14298	133.5	-.37705	-.28573	-.16186
112.0	-.43546	-.21250	-.12339	123.0	-.40757	-.25138	-.14388	134.0	-.37551	-.28729	-.16267
112.5	-.43429	-.21433	-.12436	123.5	-.40620	-.25308	-.14477	134.5	-.37396	-.28885	-.16348
113.0	-.43311	-.21615	-.12532	124.0	-.40482	-.25478	-.14566	135.0	-.37240	-.29040	-.16429
113.5	-.43192	-.21796	-.12628	124.5	-.40343	-.25646	-.14655	135.5	-.37084	-.29194	-.16509
114.0	-.43072	-.21977	-.12724	125.0	-.40204	-.25814	-.14743	136.0	-.36927	-.29348	-.16589
114.5	-.42951	-.22158	-.12819	125.5	-.40063	-.25982	-.14831	136.5	-.36769	-.29501	-.16669
115.0	-.42829	-.22338	-.12914	126.0	-.39922	-.26149	-.14918	137.0	-.36610	-.29653	-.16748
115.5	-.42706	-.22517	-.13008	126.5	-.39780	-.26315	-.15005	137.5	-.36451	-.29804	-.16827
116.0	-.42583	-.22696	-.13103	127.0	-.39637	-.26480	-.15092	138.0	-.36290	-.29955	-.16905
116.5	-.42458	-.22874	-.13197	127.5	-.39493	-.26645	-.15178	138.5	-.36129	-.30105	-.16983
117.0	-.42333	-.23052	-.13290	128.0	-.39349	-.26810	-.15264	139.0	-.35968	-.30255	-.17061
117.5	-.42206	-.23229	-.13384	128.5	-.39203	-.26973	-.15350	139.5	-.35805	-.30403	-.17138
118.0	-.42079	-.23406	-.13477	129.0	-.39057	-.27136	-.15435	140.0	-.35642	-.30551	-.17215
118.5	-.41951	-.23582	-.13569	129.5	-.38910	-.27298	-.15520	140.5	-.35478	-.30698	-.17291
								141.0	-.35314	-.30845	-.17367

Basic Date October 6, 1969  
 Changed NOVEMBER 3, 1969

Basic Date November 10, 1969  
 Change November 11, 1969  
 STAR HALF-UNIT VECTORS

Star number (octal)	X	Y	Z
46 HAMA	.392C4	.239C1	.19794
47	.29402	.32311	-.24320
50 POLLUX	-.19246	.394EA	.23951
51	-.130C:	.1141A	-.46462
52	-.22788	.059C5	.44112
53	-.32441	-.05489	-.37A1A
54 RIGEL	-.189C4	-.15521	-.426C9
55 BELLATRIX	.01396	.49564	.06442
56	-.214CA	-.12572	-.434C1
57 BELLATRIX	.07A77	.49068	.05507
60	.06794	.43377	.23922
61	.055C9	.494EA	-.01064
62	.04520	.4976A	-.01708
63	-.04431	.47362	-.15401
64	-.0749A	.47369	.14139
65	-.10A54	.42363	-.24187
66	-.12945	.42856	-.2218A
67 CASTOR	-.16693	.390C1	.76463
70	-.14764	.20720	-.42043
71	-.18991	.21871	-.40755
72	-.27046	-.334C9	-.4190A
73	-.24850	-.35C51	-.43093
74	-.27137	-.06354	.41511
75	-.04936	-.39581	-.20149
76	-.03957	-.36365	-.34088
77	.03986	-.41067	-.28249
100	.25750	.00A5C	.42A51
101	.36464	.33084	-.33756
102	.38943	.11914	.2570A
103	.31919	.18A1C	.33577
104	.06424	.49585	.08279
105	.02937	.497C1	-.084C7
106	.0C413	.3538A	.35322
107	-.15441	.40A04	-.24426
110	-.1954C	.32997	-.32084
111	-.26488	.24041	-.34298
112	-.19372	.16757	-.42925
113	-.26627	.77130	.41715
114	-.26777	-.10107	.48998
115	-.09958	-.39167	.48129
116	-.00554	-.31126	.39126

Star number (octal)	X	Y	Z
117	.22075	-.31191	.9224A
120	.29937	-.16193	-.36631
121	.32963	-.11530	-.36593
122	.27293	.04A65	.41A33
123	-.29470	.0095A	.4C380
124	-.23342	-.3904A	-.16165
125	-.12736	-.39323	-.28133
126	.48730	.32467	.12955
127	-.33317	-.387C4	-.31477
130	.23289	.38921	.43336
131	.41214	.22140	.17443
132	.25259	.38052	.20348
133	.22482	.36C63	.26345
134	.19772	.32A57	.22089
135	.11712	.407C5	.27320
136	.11547	.48443	-.04465
137	.06716	.46762	-.17741
140	.05923	.47225	-.15320
141	.05637	.49412	-.05164
142	.04906	.46391	.18021
143	.03A68	.41227	-.28C24
144	.00404	.39A18	.3023A
145	-.06763	.31023	-.38625
146	-.13007	.37730	-.30121
147	-.23871	.38853	-.2C510
150	-.22129	.18374	-.40899
151	-.42438	.20149	.17096
152	-.30920	.10425	-.37885
153	-.45775	.09A22	.17664
154	-.45476	-.06555	-.19722
155	-.17729	-.02759	-.46670
156	-.49223	-.08710	-.01122
157	-.38035	-.09741	.31112
160	-.47351	-.12839	.05643
161	-.37A0A	-.1355A	-.29780
162	-.27183	-.123A4	-.4C09A
163	-.41732	-.22483	.159C5
164	-.30980	-.23959	.31C84
165	-.291C9	-.23079	-.33474
166	-.26007	-.218C3	-.36722
167	-.33804	-.29128	.22855
170	-.35561	-.32363	-.13713

STAR HALF-UNIT VECTORS

**STAR HALF-UNIT  
VECTORS**

Star number (octal)			
171	-.26736	-.25460	-.341C9
172	-.32474	-.37156	-.08357
173	-.22537	-.30218	-.32A47
174	-.27996	-.41C3A	.05A77
175	-.22966	-.38619	-.21941
176	-.22A74	-.41134	-.1CA75
177	-.09718	-.21720	.43975
200	-.17997	-.42840	.16369
201	-.16155	-.41017	-.22593
202	-.17717	-.45858	-.C511A
203	-.1453C	-.400C4	.2C241
204	-.10694	-.46934	-.12521
205	-.04576	-.27845	-.417C8
206	-.05413	-.3941A	-.30281
207	-.04275	-.31052	-.38720
210	-.04022	-.30255	.36573
211	-.03913	-.49687	.02951
212	.03605	-.43223	-.24F81
213	.05134	-.44850	-.21478
214	.11344	-.41823	-.24043
215	.15488	-.31743	.35390
216	.217C9	-.441C3	.05145
217	.27376	-.31718	.27856
220	.17572	-.15026	.44334
221	.39955	-.26559	-.14003
222	.22212	-.10770	-.42479
223	.42788	-.11003	.23412
224	.46814	-.11832	.12977
225	.20630	.11651	-.44C30
226	.41167	.2824A	-.02715
227	.26013	.27462	.32658
230	-.21684	.16592	-.41887
231	-.20482	.07265	-.45030
232	-.31753	-.00942	-.28612
233	-.11849	-.19051	-.44684
234	.13389	-.46A70	.11942
235	.13637	-.44619	-.17978
236	-.229C5	-.44537	-.02155

Basic Date: November 10, 1969

Changed \_\_\_\_\_