STAR LIST

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

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

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CMC GENERAL

VERB LIST (Decimal)

01	Display Oct Compnt 1 (R1)
02	Display Oct Compnt 2 (R1)
03	Display Oct Compnt 3 (R1)
04	Display Oct Compnt 1, 2 (R1, R2)
05	Display Oct Compnt 1, 2, 3 (R1,R2,R3)
06	Display Decimal (R1 or R1, R2 or R1,R2,R3)
07	Display DP Decimal - (R1,R2)
11	Monitor Oct Compnt 1 (R1)
12	Monitor Oct Compnt 2 (R1)
13	Monitor Oct Compnt 3 (R1)
14	Monitor Oct Compnt 1, 2 (R1, R2)
15	Monitor Oct Compnt 1, 2, 3 (R1,R2,R3)
16	Monitor Decimal (R1 or R1,R2 or R1,R2,R3)
17	Monitor DP Decimal - (R1,R2)
21	Load Compnt 1 (R1)
22	Load Compnt 2 (R2)
23	Load Compnt 3 (R3)
24	Load Compnt 1, 2 (R1, R2)
25	Load Compnt 1, 2, 3 (R1, R2, R3)
27	Display Fixed Memory
30	Request Executive
31	Request Waitlist
32	Recycle Prog
33	Proceed Without DSKY inputs
34	Terminate Function
35	Test Lights
36	Request Fresh Start
37	Change Prog (Major Mode)
*40	Zero ICDU
41	Coarse Align CDU (N20 & N91)
42	Fine Align IMU
43	Load FDAI ATT Error needles
*44	Set Surface Flag
*45	Reset Surface Flag
*46	Activate DAP
*47	Set LM State Vector into CSM State Vector
48	Load DAP (R03)
49	Start Crew Defined MNVR(R62)
50	Please Perform
51	Please Mark
*52	Marked on offset landing site
53	Please Mark alternate LOS
54	Start REND backup sighting mark (R23)

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55 Increment CMC Time (Decimal)
*56 Terminate Tracking (P20)
57 FULTKFLG Display
*58 Reset Stick Flag and set V50 N18 flag
59 Please Calibrate
*60 Set N17 = N20
*61 Display DAP att error
*62 Display total att error (N22-N20)
*63 Display total astro att error (N17-N20)
64 Start S-band ant routine (R05)
*65 Verify Prelaunch Align Optics (CSM)
*66 Set CSM State Vector into LM State Vector
67 W-Matrix RSS Error Display
*69 Restart
70 Update Liftoff Time (P27)
71 Univ Update-BLOCK ADR (P27)
72 Univ Update-SINGLE ADR (P27)
73 Update CMC Time (Octal) (P27)
*74 Initialize erasable dump via downlink
*75 Backup Liftoff
*78 Update prelaunch azimuth
*80 Update LM State Vector
*81 Update CSM State Vector
82 Start Orbit Param Disp (R30)
83 Start REND Param Display No. 1 (R31)
85 Start REND Param Display No.2 (R34)
*86 Reject REND backup sighting mark
*87 Set VHF range flag
*88 Reset VHF range flag
89 Start REND Final ATT Routine (R63)
90 Request REND out of plane display (R36)
91 Compute Banksum
*93 Enable W matrix initialization
*94 Enable CISLUNAR Tracking recycle
*96 Terminate integration and go to P00
(Select P00 by V37 after use of V96)
97 SPS Thrust Fail (R40)
99 Enable engine ignition

*Callable with other extended verb in use and does not lock out other extended verbs

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NOUN LIST (Decimal)

01	Specify Machine Address (Fract) (R1,R2,R3)	.XXXXX
02	Specify Machine Address (Whole) (R1,R2,R3)	XXXXX.
03	Specify Machine Address (R1,R2,R3)	.01°
05	Angular Error/Diff	.01°
06	Option Code (R1 & R2)	OCTAL
07	BIT operator: Address,BIT ID, Action	OCTAL
08	Alarm Data	OCTAL
09	Alarm Codes	OCTAL
10	Channel to be Specified (R1)	OCTAL
11	TIG (CSI)	hrs,min,.01sec
12	Option code (R1&R2)	OCTAL
13	TIG (CDH)	hrs,min,.01sec
14	VC/O (R1) (P15)	FPS
15	Increment Machine Address (R1)	OCTAL
16	Time of event	hrs,min,.01sec
17	Astronaut total att	R,P,Y .01°
18	Auto Maneuver	R,P,Y .01°
20	Present ICDU Angles	R,P,Y .01°
21	PIPA PULSES X,Y,Z	Pulses
22	New ICDU Angles	R,P,Y .01°
24	Delta CMC Clock Time	hrs,min,.01sec
25	Checklist (please perform)	OCTAL
26	Prio/Delay, ADRES, BBCON(R1,R2 & R3)	OCTAL
27	Self-Test on/off sw	OCTAL
29	X SM LAUNCH Azimuth	.01°
30	Target Code(Gyrocomp verif)	
31	Time of rdvz W-mat.init.	hrs,min,.01sec
32	Time from Perigee	hrs,min,.01sec
33	Time of Ignition (TIG)	hrs,min,.01sec
34	Time of Event	hrs,min,.01sec
35	Time from Event	hrs,min,.01sec
36	Time of CMC Clock	hrs,min,.01sec
37	TIG (TPI)	hrs,min,.01sec
38	State Vector Time	hrs,min,.01sec
39	Δ Time of Transfer	hrs,min,.01sec

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40	TF GETI/TFC	min-sec
	VG	.1 FPS
	ΔV (Accumulated)	.1 FPS
41	Target	Azimuth .01°
		Elevation .001°
		Ident 0000X
42	Apogee Alt (HA)(RLS/Pad)	.1 NM
	Perigee Alt (HP) (RLS/Pad)	.1 NM
	ΔV (Required)	.1 FPS
43	Lat	.01° (+ North)
	Long	.01° (+ East)
	Alt (RLS/Pad)	.1 NM
44	Apogee Alt (HA) (RLS/Pad)	.1 NM
	Perigee Alt (HP)(N50)(RLS/Pad)	.1 NM
	TFF	min-sec
45	Marks	XXBXX
	TF GETI	min-sec
	MGA	.01°
46	DAP Config (R1&R2)	OCTAL
47	CSM weight	LBS
	LM Weight	LBS
48	Pitch Trim	.01°
	Yaw Trim	.01°
49	ΔR	.01 NM
	ΔV	.1 FPS
	SOURCE CODE (1 optics,2 VHF)	0000X.
50	ΔR (miss distance)	.1 NM
	Perigee Alt (HP)(RLS/Pad)	.1 NM
	TFF	min-sec
51	RHO	.01°
	GAMMA	.01°
52	CENTANG (active veh)	.01°
53	RANGE	.01 NM
	RANGE RATE	.1 FPS
	PHI (lcl horiz)	.01°
54	Range	.01 NM
	Range Rate	.1 FPS
	Theta (lcl horiz)	.01°
55	Precision offset	CODE
	E(ELEV ANGLE)	.01°
	CENTANG (passive veh)	.01°

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58	HP alt (post TPI) (RLS/Pad)	.1 NM
	ΔV (TPI)	.1 FPS
	ΔV (TPF)	.1 FPS
59	ΔV LOS 1	.1 FPS
	ΔV LOS 2	.1 FPS
	ΔV LOS 3	.1 FPS
60	G Max	.01 G
	V Pred	FPS
	Gamma EI	.01°
61	Impact Lat	.01° (+ North)
	Impact Long	.01° (+ East)
	Head Up/Down	+/-00001 (+ Heads up)
62	VI-Inertial Vel Mag	FPS
	H Dot-Alt Rate	FPS
	H-Alt (RLS/Pad)	.1 NM
63	RTGO from 0.05 G To Splash	.1 NM
	VIO, Predicted Iner Vel	FPS
	TFE, time from .05G	min-sec
64	Drag Acceleration	.01 G
	VI, Inertial Velocity	FPS
	RTOGO to Target	.1 NM
65	Sampled CMC Time (fetched in interrupt)	hrs,min,.01 sec
66	Beta, CMD Bank Angle	.01°
	CRSRNG Error	.1 NM
	DNRNG Error	.1 NM
67	RTOGO to Target	.1 NM
	Lat, Present Position	.01° (+ North)
	Long, Present Position	.01° (+ East)
68	Beta, CMD Bank Angle	.01°
	VI, Inertial Vel.	FPS
	H Dot, Alt Rate	FPS
69	Beta	.01°
	DL	.01 G
	VL	FPS
70	Star Code(before mark)	OCTAL
	LMK Data	OCTAL
	Horiz data	OCTAL

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71	Star code (after mark)	OCTAL
	LMK Data	OCTAL
	Horiz data	OCTAL
73	ALT (P21) (RLS/Pad)	10 NM
	VEL (P21)	FPS
	GAMMA (P21)	.01°
74	BETA, CMD Bank Angle	.01°
	VI, Inertial Velocity	FPS
	Drag Acceleration	.01 G
75	ΔH (CDH)	.1 NM
	ΔT	min-sec
	ΔT	min-sec
78	Axis YAW	.01°
	Axis PITCH	.01°
	OMICRON	.01°
79	P20 opt 2 rate	.0001°/sec
	P20 deadband	.01°
80	TF GETI/TFC	min-sec
	VG	FPS
	ΔV (Accumulated)	FPS
81	ΔVX,Y,Z (lcl vert)	.1 FPS
82	ΔVX,Y,Z (LV) CDH	.1 FPS
83	ΔVX,Y,Z (Body Control Axis)	.1 FPS
84	ΔVX,Y,Z (Other Vehicle)	.1 FPS
85	VGX,Y,Z (Body Control Axis)	.1 FPS
86	ΔVX,Y,Z (lcl vert)	FPS
87	Opt Calib Data - Shaft (R1)	.01°
	Trunnion(R2)	.001°
88	Planet X	.XXXXX
	Y	.XXXXX
	Z	.XXXXX
89	Landmark - Lat	.001° (+ North)
	Long/2	.001° (+ East)
	Alt (Mean lunar radius)	.01 NM
90	REND out of Y (Active)	.01 NM
	Plane para Y DOT (Active)	.1 FPS
	Y DOT (Passive)	.1 FPS
91	OCDU Angles Shaft (R1)	.01°
	Trunnion (R2)	.001°
92	New OCDU Angles Shaft (R1)	.01°
	Trunnion (R2)	.001°

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93	Delta Gyro Angles X,Y,Z	.001°
94	OCDU ANGLES (R56 & R23)	
	R1 SHAFT	.01°
	R2 TRUNNION	.001°
95	TF GETI/TFC (P15)	min-sec
	VG (P15)	FPS
	VI (P15)	FPS
96	Y (CSM)	.01 NM
	Y DOT (CSM)	.1 FPS
	Y DOT (LM)	.1 FPS
97	System Test Inputs	XXXXX.
		XXXXX.
		XXXXX.
98	System Test Results	XXXXX.
		.XXXXX
		XXXXX.
99	POS ERR	1 FT
	VEL ERR	.1 FPS
	OPTION Code	0000X.

V05 N09 ALARM CODES

00110 Mark reject has been entered but ignored
Continue

00113 No inbits (chan 16)
Continue; if alarm recurs use MDC DSKY.

00114 More marks made than desired
Continue

00115 V41 N91 keyed with OPTICS MODE not in CMC
OPTICS MODE - CMC and OPTICS ZERO - OFF

00116 Optics switch altered before 15 sec zero time elapsed
OPTICS ZERO - ZERO (15 sec).

00117 V41 N91 keyed but CMC has reserved OCDU (from start of gimbal test in P40 until termination of TVC functional allocation of the "optics" CDU Driving Output)
V41 N91 not yet available

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00120 Optics torque has been requested
but optics have not been zeroed
since last FRESH START or RESTART
OPTICS ZERO - OFF then ZERO (15 sec).

00121 In 0.05 sec following mark, an ICDU
changed by more than 0.033°
Repeat MK.

(m)00205 PIPA saturated
Use SCS control (G&N 12).

00206 The IMU zero routine has been
entered with both the GMBL LOCK
lt and NO ATT lt on
Coarse align to 0,0,0 Reselect V40E

(m)00207 ISS turn-on request not present for
90 sec
Redo IMU turn on (G&N 12).

(m)00210 The IMU is not operating
Redo IMU turn on. If alarm recurs,
perform fresh start (V36E).
Consult MSFN. (G&N 12).

(m)00211 Coarse align error
If P51(3)/52(4) in progress record gyro
torquing angles and perform fine align
check in P52(4).
Otherwise, see G/1-24. (G&N 12).

(m)00212 PIPA fail, but PIPA is not being used
PIPA BIAS check (G&N 6/8).

(m)00213 IMU not operating with turn-on request
See 00210

00214 Program using IMU when turned OFF
See 00210 or exit program.

(m)00217 IMU coarse align or pulse torque
difficulty has occurred
If code 211 also, perform
211 cure only
Reinitiate current program.
If alarm recurs, terminate use of
ISS (G&N 12).

00220 IMU orientation unknown
Align or if aligned set REFSMMAT flag.

00401 Desired middle gimbal angle is excessive
Call N22 - maneuver if MGA < 85° or
realign IMU.

00402 Second MINKEY pulse torque must be done

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00404 Target out of view (90 deg test)
(G/3-6,3-11,6-3,7-16)

00405 Acceptable star pair is not available
(G/6-3,6-6)

00406 Rend navigation not operating
Select P20 (opt. 0 or 4) or continue.

00421 W-matrix overflow
Notify MSFN but continue.
W-matrix automatically reinitialized at next mark.

00600 No solution on first iteration in P31 or P32/72
(G/4-6,4-8)

00601 Post CSI Perigee/lune alt <85nm/ 5.8nm
(G/4-6,4-8)

00602 Post CDH Perigee/lune alt <85nm/ 5.8nm
(G/4-6,4-8)

00603 Time from TIG (CSI) to TIG (CDH)
<10 min
(G/4-6,4-8)

00604 Time from TIG (CDH) to TIG (TPI)
<10 min
(G/4-6,4-8)

00605 Number of iterations exceeds loop maximum
(G/4-6,4-8,4-15,4-16)

00606 ΔV (CSI) has been >1000 fps for last two iterations
(G/4-6,4-8)

00611 No TIG for given ELEV angle
(G/4-10,4-12)

00612 State vector in wrong sphere of influence at TIG
(G/4-15)

00613 Reentry angle out of limits
(G/4-16)

(m)00777 ISS warning caused by PIPA fail
(G&N 6).

01102 CMC self test error
(G/2-3)

(m)01105 Downlink too fast
Rset. If alarm recurs DOWNLINK FAILURE.
(G&N 12).

(m)01106 Uplink too fast
Rset. If alarm recurs UPLINK FAILURE. (G&N 12).

(m)01107 Phase table failure-assume erasable memory is destroyed
If Comm: 1. V74 CMC DOWNLINK
2. P27 As Necessary.
3. V48 As Necessary (V46).
4. Reestablish REFSMMAT via P51 As Necessary.
If FRESH START recurs, CMC FAILURE (SSR-3).
If no Comm, pg G/9-1

01301 Arcsin or arccos input is greater than one
Notify MSFN, continue.

(m)01407 VG increasing
(G&N 12).

01426 IMU unsatisfactory
Realign or use SCS.

01427 IMU reversed
Note FDAI operation is inverted.

01520 V37 request not permitted at this time
Wait till COMP ACTY lt.
not on continuously - reselect V37 or if P62-67, select P00 and then desired program.

01600 Overflow in drift test
This is gnd test alarm only.

01601 Bad IMU torque abort
See 01600

01703 Insufficient time for integration. TIG slipped
(G/5-3,5-16)

(m)03777 ISS warning caused by ICDU fail
(G&N 6)

(m)04777 ISS warning caused by ICDU & PIPA fail
(G&N 6)

(m)07777 ISS warning caused by IMU fail
(G&N 6)

(m)10777 ISS warning caused by IMU & PIPA fail (G&N 6)

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(m)13777 ISS warning caused by IMU & ICDU fail
(G&N 6)

(m)14777 ISS warning caused by IMU,ICDU & PIPA fail
(G&N 6)

**20430 Orbital integration has been terminated to avoid possible infinite loop.
Notify MSFN.
Probable S.V. uplink required

**20607 No solution to conic subroutine
Reselect program.

**20610 Alt at specified TIG in P37 < 400K ft
Reselect P37 and decrease TIG.

**21204 Negative or zero time waitlist call.
If ave-g or ext. vb. on, continue.
Otherwise reselect program.

**21206 Second job attempts to go to sleep via keyboard and display program
See 21204.

**21210 Second attempt is made to stall
Reselect program
Do not attempt use of IMU while CMC is using it.

**21302 SQRT called with negative argument
See 21204

**21501 Keyboard and display alarm during internal use
See 21204

**21502 Illegal flashing display
See 21204

**21521 P01 selected and P11 has already been performed
Select correct program

*31104 Delay routine busy
Reselect extended verb or continue with program.
Notify MSFN.

*31201 Executive overflow - no vac area
Reselect Extended Verb and/or Continue Program.

*31202 Executive overflow - no core sets
See 31201

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*31203 Waitlist overflow - too many tasks
See 31201
*31211 Illegal interrupt of extended verb
Reselect extended verb after optics marking is completed.
(m) - Malf procedure indicated
**(2xxxx) - Generates restart (no lt), F37 (POODOO)
*(3xxxx) - Restart (no lt) and program continues (i.e. attempted recovery)(BAILOUT)
NOTE - All **alarms act as *type if they occur when Ave-g is on or display type extended verb is active

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V50 N25 CHECKLIST CODES

R1 Code	ACTION	FUNCTION
00013	Key in	Gyro Torque Option (P52,54)
00014	Key in	Fine Align Option
00015	Perform	Celestial Body Acq
00016	Key in	Terminate Mark Sequence
00017	Perform	MINKEY Rendezvous
00020	Perform	MINKEY PC pulse torquing
00041	Switch	CM/SM SEP to UP
00062	Key	CMC to STBY
00202	Perform	3-axis MNVR
00204	Key in	Engine gimbal test opt

V04 N06 (N12)OPTION CODES

R1 Code	Purpose	Input for R2
00001	Specify IMU Orientation	1=PREF, 2=NOM 3=REFS, 4=LDG SITE
00002	Specify vehicle	1=CSM, 2=LM
00004	Specify FULTKFLG setting	0=VHF and optics, 1=VHF or optics
00007	Specify Propulsion System	1=SPS, 2=RCS
00024	Specify P20 mode	0=Rndz., VECPOINT 1=Celestial body, VECPOINT 2=Rotate 4=Rndz., 3-axis 5=Celestial body, 3-axis

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MONITOR DATA IN ERASABLE MEMORY

```
1              V11 N01E (OCTAL ADD) E
2    F 11 01   R1 DATA R3 OCTAL ADD
3              N15E (For next succeeding word)
4              ENTR (For each succeeding word)
```

FLAG WORD SET/RESET

```
1              V25N 07E
     F 21 07   (LOAD FLAG WORD ADDRESS) E
2    F 22 07   (LOAD BIT CODE)* ENTR
3    F 23 07
          (SET BIT)   Key 1E
          (RESET BIT) Key 0E
```

*To determine code:
Find bit in chart
Number above bit (4,2 or 1) is code.
(Used in correct octal position)
For more than one bit, add codes.

Examples:

Bit	Code
3	4
6	40
7	100
15&13	50000

CHANGE DATA IN ERASABLE MEMORY

```
               V21 N01E (ADDRESS) E
     F 21 01   R3 ADDRESS
               Load New Data in R1 E
               N15E (For next succeeding word)
               ENTR (For each succeeding word)
```


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FLAGWORD BIT ASSIGNMENTS

APOLLO

FLAGWORD	ADDRESS	4	2	1	4	2	1	4	2	1	4	2	1	4	2	1
		BIT 15	BIT 14	BIT 13	BIT 12	BIT 11	BIT 10	BIT 9	BIT 8	BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1
0	74		JSWITCH	MIDFLAG	MOONFLAG	[illegible] [illegible]	ZMEASURE	NEEDLFLG	IMUSE	RNDVZFLG	[illegible] [illegible]	[illegible]	[illegible]	FREEFLAG	AMOONFLG	[illegible]
1	75	[illegible] [illegible]	STIKFLAG	ERADCOMP ERADFLAG	NODOP01	[illegible] ENG2FLAG	[illegible] TARG1FLG	[illegible] TARG2FLG	CSMUPDAT VEHUPFLG	UPDATFLG	[illegible]	TRACKFLG	MARKFLG	[illegible] SLOPESW	GUESSW	AVEGFLAG
2	76	DRIFTFLG	R21MARK	22DSPFLG	P21FLAG	STEERSW	SKIPVHF	IMPULSW	XDELVFLG	FIRSTFLG [illegible] ETPFLAG	FINALFLG	[illegible] AVFLAG	PFRATFLG	[illegible]	CALCMAN2	NODOV37 NODOFLAG
3	77	V50N18FL	GLOKFAIL	REFSMFLG	[illegible] LUNAFLAG	P22MKFLG	VFLAG	POOFLAG	PRECIFLG	CULTFLAG	ORBWFLAG	STATEFLG	[illegible] INTYPFLG	[illegible] VINTFLAG	[illegible] [illegible]	[illegible] DIM0FLAG
4	100	[illegible] MRKIDFLG	[illegible] PRIODFLG	[illegible] NRMIDFLG	PDSPFLAG	[illegible] MWAITFLG	[illegible] NWAITFLG	[illegible] MRKNVFLG	[illegible] NRMNVFLG	[illegible] PRONVFLG	PINBRFLG	[illegible] MRUPTFLG	[illegible] NRUPTFLG	[illegible] [illegible]	[illegible]	XDSPFLAG
5	101	DSKYFLAG	RETROFLG	SLOWFLG	[illegible] V59FLAG	[illegible] INCORFLG	[illegible]	DMENFLG	[illegible] COMPUTER	ENGONFLG	3AXISFLG	[illegible] [illegible]		NOSOLNSW SOLNSW	MGLVFLAG	RENDWFLG
6	102	DAPBIT1	DAPBIT2	ENTRYDSP [illegible]	CMDAPARM	GAMDIFSW	GONEPAST	RELVELSW	EGSW [illegible] [illegible]	NOSWITCH	HIND	INRLSW	LATSW	[illegible]	[illegible]	GYMDIF
7	103	[illegible]	[illegible]	IGNFLAG	ASTNFLAG	[illegible]	[illegible]	RVSW	[illegible] [illegible]		V37FLAG		UPLOCKFL	[illegible]	[illegible] [illegible]	[illegible]
8	104	[illegible]	[illegible]	[illegible]	CMOONFLG	LMOONFLG	[illegible]	[illegible]	SURFFLAG	INFINFLG	ORDERSW	APSESW	COGAFLAG	[illegible]	[illegible]	360SW
9	105	SWTOVER	[illegible]	V82EMFLG	MAXDBFLG	[illegible]	[illegible]	[illegible]	[illegible] [illegible]	[illegible]	[illegible] [illegible]	QUITFLAG	[illegible]	MID1FLAG	MIDAVFLG	AVEMIDSW
10	106	[illegible]	[illegible] [illegible]	[illegible] [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	AUTOSEQ		[illegible]	[illegible]	[illegible]	[illegible]	PCFLAG
11	107	S32.1F1	S32.1F2	S32.1F3A	S32.1F3B				AZIMFLAG	[illegible]	[illegible]					

MONITOR OF INPUT/OUTPUT CHANNELS

V11 N10E
F 11 10 (LOAD CHANNEL ADDRESS) E
R1 Octal Contents of Specified Channel

CHANNEL SET/RESET
Note: Only channel no's <30 may be used

1 V25N 07E
F 21 07 (LOAD CHANNEL NUMBER) E

2 F 22 07 (LOAD BIT CODE)* ENTR

3 F 23 07
(SET BIT) Key 1E
(RESET BIT) Key 0E

*To determine code:
Find bit in chart
Number above bit (4,2 or 1) is code.
(Used in correct octal position)
For more than one bit, add codes.
Examples:

Bit	Code
3	4
6	40
7	100
15&13	50000

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SC CONT/MODE AND OPTICS MODE OVERRIDE

V21 N1E, 374E, A00D0 ENTR

A=0: Use switches (SC CONT and CMC MODE)
A=1: CMC FREE
A=2: CMC HOLD
A=3: CMC AUTO
A=5,6 or 7: SCS
D=0: Use switches (OPTICS)
D=1: OPT CMC
D=2: OPT ZERO
D=3: OPT MAN

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CMC INPUT/OUTPUT CHANNELS

CHANNEL		NAME	4 BIT 15	2 BIT 14	1 BIT 13	4 BIT 12	2 BIT 11	1 BIT 10	4 BIT 9	2 BIT 8	1 BIT 7	4 BIT 6	2 BIT 5	1 BIT 4	4 BIT 3	2 BIT 2	1 BIT 1
CP	1	I			SHIFT PULSE			CP REGISTER L BITS 16-1									
	2	Q			SHIFT PULSE			CP REGISTER Q BITS 16-1									
	3	HISCALAR			SHIFT PULSE			HIGH ORDER SCALER CHANNEL BITS 14-1									
	4	LOSCALAR			SHIFT PULSE			LOW ORDER SCALER CHANNEL BITS 14-1									
OUT	5	PYJETS							S/M	+Z-YW	-Z+YW	-Z-YW	+Z+YW	+Z-P	-Z+P	-P	+P+Z
	6	ROLLJET							C/M	-YW-Z+P	+YW-Z-P	-YW-Z+P	+YW-Z+P	-P+Z	+P-Z-YW	-P+Z	+P-Z+YW
									S/M	+Y-R	-Y+R	-Y+R	+Y+R	+Z-R	-Z+R	-Z+R	+Z+R
									C/M					-R-YW+Z	+R+YW-Z	-R-YW-Z	+R+YW+Z
CP	7	SUPERSNI									FE7	FE6	FE5				
OUT	10	OUTO	RELAY ADDR 4	RELAY ADDR 3	RELAY ADDR 2	RELAY ADDR 1	RELAY BIT 11	RELAY BIT 10	RELAY BIT 9	RELAY BIT 8	RELAY BIT 7	RELAY BIT 6	RELAY BIT 5	RELAY BIT 4	RELAY BIT 3	RELAY BIT 2	RELAY BIT 1
	11	DSALMOUT			SPS ENGINE ON			CAUTION RESET	TEST CONNECTOR OUTBIT		OPERATOR ERROR LAMP	VN FLASH	KEY REL LAMP	TEMP CAUTION LAMP	UPLINK ACTY LAMP	COMP ACTY LAMP	ISS WARNING
	12	CHAN12	ISS TURNON DELAY COMPLETE	S/V B CUTOFF	S/V B INH SEQ STABY		DISABLE OPTICS DAC	ZERO OPTICS	S/V B TAKEOVER ENABLE	TVC ENABLE		ENABLE IMU ERROR COUNTER	ZERO IMU CDU S	COARSE ALIGN ENABLE		ENABLE OPT ERROR COUNTER	ZERO OPTICS CDU S
	13	CHAN13	ENABLE T6RUPT	RESET TRAP 32	RESET TRAP 31B	RESET TRAP 31A	ENABLE STANDBY	TEST ALARMS		RNAG CTR ENABLE	DNLINK WD ORD	BLOCK INLINK	INHIBIT COPLINK	RNG UNIT ACTY	RNG UNIT SEL A	RNG UNIT SEL B	RNG UNIT SEL C
	14	CHAN14	DRIVE CDUX	DRIVE CDUY	DRIVE CDUZ	DRIVE CDUT	DRIVE CDUS	GYRO ACTY	GYRO	GYRO	GYRO	GYRO ENABLE					OUTLINK ACTY
IN	15	MINKEY IN											MKEY5	MKEY4	MKEY3	MKEY2	MKEY1
	16	NAVKEY IN									MARK REJECT	MARK	MKEY5	MKEY4	MKEY3	MKEY2	MKEY1
	30	* CHAN30	TEMP IN LIMITS	ISS TURNON REQUEST	IMU FAIL	ICDU FAIL	IMU CAGE	SC CONTROL OF SAT	IMU OPERATE		OPTICS CDU FAIL		LIFT OFF	S/V B SEPARATE OR ABORT	SPS READY	SM/CM SEPARATE	ULLAGE THRUST PRESENT
	31	* CHAN31	G & N AUTOPILOT CONTROL	FREE	HOLD	-Z TRANS	+Z TRANS	-Y TRANS	+Y TRANS	X TRANS	+X TRANS	BMAG -ROLL	BMAG +ROLL	BMAG -YAW	BMAG +YAW	BMAG -PITCH	BMAG +PITCH
	32	* CHAN32		PROCEED			LM ATTACHED					MANUAL -ROLL	MANUAL +ROLL	MANUAL -YAW	MANUAL +YAW	MANUAL -PITCH	MANUAL +PITCH
	33	* CHAN33	OSC ALARM	COMPUTER WARNING	PIPA FAIL	DNLK TOO FAST	UPLINK TOO FAST	BLOCK UPLINK					CMC CTR OPTICS	ZERO OPTICS			
OUT	34	DNTM1							FIRST OF TWO WORDS								
	35	DNTM2							SECOND OF TWO WORDS								
* INVERTED LOGIC			15	14	13	12	11	10	9	8	7	6	5	4	3	2	1

VHF RNG DSKY DISPLAY
VHF RNG - on (up)
P20 - running in opt 0 or 4

V87E
V16 N02E
3703E
R1=XXX.XX nm
(max R1 = 163.83;
if R1 neg, RNG = 327.67 - |R1|)

G&N RECOVERY PROCEDURES

Recoveries:

if P06 inadvertently selected: (with F 50 25 00062)
1. a. Press PRO to STBY, press PRO
again to F 37
or b. V37E 00E
2. V37E 51E, PRO (set DRIFT flag)
V37E 00E
3. V25 N7E, 77E, 10000E, 1E (set REFSMMAT flag)

if V36 inadvertently keyed in:
1. V37E 51E, PRO (set DRIFT flag)
V37E 00E
2. V48
3. V46
4. Perform General System Checkout
as necessary

if GO JAM performed:
V74 when convenient, do procedure for
inadvertent V36

if Run-away PIPA during ave-G:
V36E before PRO on N85 or N83
to preserve CSM state vector.

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if All 8's appear spontaneously on DSKY

1. V99 N99
2. V25 N01E
3. 00000E
4. +99999E
5. +99999E
6. +99999 CLR,CLR,CLR
7. 00000E
8. 00000E
9. 00000E

If OPR ERR, begin again

General System Checkout:

Get to P00 by one of the following:

1. V37E 00E
2. V96E
3. V36E, wait 15 sec, V96E
4. Simultaneously press & hold RESET and MARK REJECT (GO JAM), wait 15 sec, V37E 00E

OPT ZERO - OFF
OPT ZERO - ZERO

Check for Reasonableness

1. V82 with both options
2. V83
3. P21 NAV CHECK
4. P52 check auto optics positioning
   If nominal, continue; if not, perform P51
5. CMC Self Test

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MNVR Completion Time

1. DURING AUTO MNVR
   V4 N1 E
   3316 E
   RECORD R1 & R2
2. V24 N25 E
   LOAD STEP 1 R1 & R2 (OCTAL)
3. V6 N34 E (hrs., min., .01 Sec.)
   MNVR Completion Time - 1sec.

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DATE ~~12/8/71~~ 3/29/72

V35 - DSKY CONDITION LIGHT TEST

CMC - on

Note: CMC lt. on opens PIPA suspension loop which generates alarm 212 and may cause PIPA bias shift.

1 Key V37E 00E (required)
DSKY - P00

2 Key V35E

3 Monitor the following events
a. All DSKY condition lts - on

b. ISS warning lt - on
CMC warning lt - on

c. All DSKY numerical windows display "8". Sign positions in R1,R2, R3 show +, V, N windows flash

Wait 5 sec

d. All DSKY warning lts - off (except PROG if IMU on)

e. ISS lt - off
CMC lt - off
V, N quits Flashing

f. P00 will be displayed.

g. Key RSET
(Don't call ave. G for 15 sec)

V40 RE-KEY V40E
IF V37 within 10sec, key ~~V46E, V58E~~

V41 N91 COARSE ALIGN OCDU's

CMC - on
G/N PWR OPTICS - on
OPT MODE - CMC
OPT ZERO - OFF

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EXT VERBS

1		V37E00E
2		V41N 91E
3	F 21 92	SHAFT, TRUN NEW OCDU (.01°,.001°) Load desired shaft and trun
4	41	OPTICS DRIVE TO SPECIFIED ANGLES

V41 N20 COARSE ALIGN ICDU's
CMC - on
ISS - on

1		V41N 20E
2	F 21 22	NEW ICDU ANGLES RPY (.01°) Load desired ICDU angles
3	41	NO ATT lt - on *POSS PROG ALARM * *V5 N9E 211 Coarse align error* *Repeat V41 N20 *
4		V40E NO ATT lt - off Wait 10 sec
5		V37E XXE

V42 GYRO TORQUING
CMC MODE - FREE

1		V42E
	F 21 93	LOAD DELTA GYRO ANGLES (XYZ) (.001°) (In flight - 90° max)
2	42	NO ATT lt - off Monitor Gyro Torquing on FDAI

EXT VERBS

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V48 - DAP DATA LOAD & ACTIVATE PROCEDURE

1 V48E

F 04 46 R1 ABCDE*
R2 ABCDE

	VEHICLE CONFIG	QUAD A/C FOR X	QUAD B/D FOR X	ERR DEADBAND	RATE SELECT
R1	0=No DAP 1=CSM 2=CSM & LM 3=CSM & SIVB 6=CSM & LM (Ascent Stg only)	0=Fail A/C 1=Use A/C	0=Fail B/D 1=Use B/D	0= ±0.5° 1= ±5.0°	0=0.05°/sec 1=0.2°/sec 2=0.5°/sec 3=2.0°/sec
	Roll Quad Select	Quad A	Quad B	Quad C	Quad D
R2	0 = Use B/D 1 = Use A/C	0=Fail 1=Use	0=Fail 1=Use	0=Fail 1=Use	0=Fail 1=Use

PRO

2 F 06 47 CSM WT, LM WT (lbs,lbs)
Load correct values*
PRO

3 F 06 48 TRIM ENGINE GMBL (.01°)
Load correct values
PRO

4 If activation req'd (Changing to or from NO DAP or CSM & SIVB DAP):
CMC MODE - FREE
V46E

* For SPS burn w/Ascent Stage, A=1, & load total mass in R1 of N47

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V49 CREW DEFINED MANEUVER

CMC - on
ISS - on
SCS - operating

1 V37E 00E
V62E

2 V49E
F 06 22 NEW ICDU ANGLES RPY (.01°)
Load desired angles
PRO

3 F 50 18 REQ MNVR TO FDAI RPY ANGLES (.01°)
(AUTO) BMAG MODE (3) - RATE 2
SC CONT - CMC
CMC MODE - AUTO
PRO
(MAN) MNVR - To 5

4 06 18 AUTO MNVR TO FDAI RPY ANGLES (.01°)

5 F 50 18 REQ TRIM MNVR TO FDAI RPY ANGLES
(TRIM) PRO To 4
(BYPASS) ENTR

V54 BACKUP OPTICS MARK

P20 - running in opt. 0 or 4
and tracking

1 V54E

*PROG ALARM *
*V5 N9E - 00406 *
Not rend tracking

2 F 06 94 Backup SHAFT, TRUN (.01°,.001°)
Load angles
PRO

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3 F 53 45 PERFORM BACKUP MARK
MARKS, TFI, MGA or code
(marks,min-sec,.01°)
RHC - Align target on alt. LOS
ENTR (V86E to reject - within 7 sec)

POSS F 06 49 ΔR, ΔV, source code
* (.01NM,.1fps,0000X)*
*(REJECT) V32E *
*(ACCEPT) PRO *

When marking complete:
PRO (return to Program in process)

V55 - CMC TIME UPDATE

1 V55E
F 21 24 LOAD Δ CMC TIME (hrs,min,.01sec)

V57 DISPLAY FULTKFLG CONDITION

1 V57E

2 F 04 12 R1 00004 Specify FULTKFLG setting
R2 00000 VHF and Optics working
00001 VHF or Optics working
Load desired value in R2
(If display erased upon ENTR,
verify by repeating V57)

PRO

V64 HI GAIN ANTENNA POINTING

1 V64E
F 06 51 RHO, GAMMA (.01°,.01°)
HGA TRACK - MAN
Set in required P&Y Angles
S BD ANT - HI GAIN
HGA TRACK - AUTO
PRO

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V67 - W-MATRIX ERROR DISPLAY

1 V67E
F 06 99 POS ERR, VEL ERR, OPT CODE (ft,.1fps)
R3 00001=Rend
(must do V93E to reinit.)
00002=Orbital
00003=Cislunar
00000=No Reinitialization

Load desired data
PRO

V74 CMC DOWNLINK

1 V74E (Places erasable memory on downlink)

V82 ORBIT PARAMETER DISPLAY

Note: If high CMC activity (e.g.P4Xw.Lambert)
POSS PROG ALARM and restart (no light)
-code 31201 or 31202 stored

1 V82E (If AVE G On, Go To 3)
F 04 12 R1 00002 Specify Vehicle
R2 00001 CSM
00002 LM
PRO

2 F 06 16 GET EVENT (hrs,min,.01sec)
Load desired time (present time,
use all zeroes)
PRO

3 F 16 44 HA, HP, TFF (.1nm,.1nm,min-sec)
(RECYCLE) V32E To 2 (Not Nec If AVE G On)
(ΔR-miss dist DISP-P11 & P00) N50E To 4
(TF PER) N32E To 5
(EXIT) PRO

4 F 16 50 ΔR (miss dist), HP, TFF(.1nm,.1nm,min-sec)
KEY RLSE To 3

5 F 16 32 TIME FROM PER (Useful only if TFF=-59B59)
(hrs,min,.01sec)
KEY RLSE To 3

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V83 RNDZ PARAMETER DISPLAY #1

Note: If high CMC activity (e.g.P3X or P7X w P20), POSS PROG ALARM and restart (no light)-code 31201 or 31202 stored
If alt above earth or moon >432 nm:
P23 running - do not key V83 (or 85)
P23 not running:
Wait for no integration (COMP ACTY not on continuously)
V96E (selects POO)
V83E (or 85E) - perform routine
V37E 00E

1 V83E
F 16 54 RANGE,RANGE RATE,THETA (.01nm,.1fps,.01°)
PRO

V85 - RNDZ PARAMETER DISPLAY #2

Note: See V83 restrictions

1 V85E
F 16 53 RANGE, RANGE RATE, PHI (.01nm,.1fps,.01°)
PRO

V87 - SET VHF RNG FLAG

VHF AM B - DUPLEX
VHF RNG - on (up)
P20 - running in opt. 0 or 4

1 V87E (starts VHF range sampling)

2 V88E (TERMINATE)
or V37E XXE

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V89 - RENDEZVOUS FINAL ATTITUDE

CMC - on
ISS - on
SCS - operating

1		V37E 00E V62E	
2		V89E	
	F 06 78	AXIS YAW, AXIS PITCH Load axis to be pointed at LM PRO	(.01°)
3	F 06 18	FINAL FDAI RPY ANGLES (AUTO MNVR) PRO (UPDATE DISPLAY) V32E	(.01°)
4	F 50 18	REQ MNVR TO FDAI RPY ANGLES (AUTO) BMAG MODE (3) - RATE 2 SC CONT - CMC CMC MODE - AUTO PRO (MAN) MNVR To 6	(.01°)
5	06 18	AUTO MNVR TO FDAI RPY ANGLES	(.01°)
6	F 50 18	REQ MNVR TO FDAI RPY ANGLES (TRIM) ALIGN SC about pointing axis PRO To 5 (BYPASS) ENTR	(.01°)

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V90 - OUT-OF-PLANE DISPLAY

1 V90E

F 06 16 GET EVENT (hrs,min,.01sec)
Load desired time (present time, use all zeroes)
PRO

2 F 06 96 Y(CSM),YDOT(CSM),YDOT(LM) (.01nm,.1fps,.1fps)

(RECYCLE) V32E to 1
(EXIT) PRO

V91 - COMPUTE BANKSUM
CMC - on (req)

1 V37E 00E

2 V91E

F 05 01 R1 - Sum of all cells in bank
R2 - Bank number
R3 - Bugger word
Verify R1=R2 or R1+R2=77777 (If not, rcd R2)

(NEXT BANK) PRO
(TERM) V34E

V93 - ENABLE W-MATRIX INITIALIZATION

1 V93E

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