

MASTER

APOLLO 13	
CSM ENTRY CHECKLIST	
PART NO.	S/N
SKB32100082 - 305	1001

OVERALL TIME LINE EI 142+40

(36+10) check d. heat cm ACS
 1. 10+30
 1. 10+40
 1. 10+60
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 1. 10+100
 1. 10+120
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137+10
5+30

EARTH RCS ALIGN
MCC-7 RCS
man. to sm jettitude (in plane).
cm ready to sm sep

4+30
(44+40)
2+30

cm ready to sm. jet
sm jet - photo (cm att man only) pit 1/2 up -
cm FULL pwa up. (Align plot.)

1+30
 (141+30)
 1+00

men to LM Jett att. (up and down)
 LM Jett closed vent valve open
 Fennell press.

LM Jett
 men entry att stor check
 (night entry moon jet

Ph:hs.

2. 70mm DC 1.55/66 80mm (A13)
3400/1000 film (R n S) Temp. 1m
2m7 DC/EC/BW3400/FS.6/250

Lm 16 Dac 1/2 pin pack (A.S) ~~1/2 pin pack~~
 pr. 3 25 mm lens 12 pin/2cc.
 Lm/Dac/16/GEX) f8 1/250

0117 1170 154 / 250 / 05X (A3) 1170 514
 1112 f. 2 150

Basic Date OCTOBER 20, 1969
 Changed

APOLLO

[illegible]

130
135
140

CREW LOG

TIME	REMARKS
	CSM timeline)
EI-6:30 (136:10)	LM PAD 3 CSM PAD
	LM SM JET AT
	MOON VIEW AT
	SUN VIEW AT
	LM JET AT
	CSM COARSE ALIGN for LM AT
	COARSE ALIGN to for entry
	ONE MANUAL ^{ONLINE} REPROGRAM
	1) LM JET 2. MOON VIEW
	3. END ENTRY
	✓ POSTAL WORK CHANGESTERS
	✓ Grow Center
	✓ Floodlights - Fixed
	✓ Floodlights - Pilot
	✓ Floodlights - Head
	✓ EPS MNA, & MNB green
250	✓ Bath PWR entry & PWR - closed
	✓ Bath B PWR entry & PWR - closed
	✓ Bath C PWR entry & PWR - closed
5	✓ Bath CHARGE BAT A - closed
	✓ Bath CHARGE BAT B CHG - closed
	✓ MAIN BUS TIE AC & DC - ON (verify)
	✓ Bath BAT RELAY BUS BAT A & B - closed
	✓ Bath EPS SENSOR SIG MNA & MNB - closed
275	✓ Bath MNA BAT C - closed

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Basic Date
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OCTOBER 20, 1969

APOLLO 12

5c 4.0
5d 3.7
6A 3.8
6B 4.1
6C 4.2
6D 3.8

Basic Date
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OCTOBER 20, 1969

APOLLO

TIME	REMARKS
276	✓ Bath Bath PWR entry 3 & 4 - green
5	✓ Bath Bath PWR entry MNB - closed
382	✓ Prim H ₂ O Cont valve - AUTO
	✓ H ₂ O Cont valve - AUTO
	✓ Perform CSM RCS precheck
	✓ Entry CL pg 1-5 steps 55-57
	5 ✓ Bath CFW MNB - closed
	2 ✓ Bath PWR - 1
5	✓ Bath EPS Sensor Unit DC BUS A & B - closed
3	✓ Bath BUS A & B - Reset then center
E-5:05 (137:35)	✓ In making earth terminator align
EI-5: (137:45)	✓ MCC7 - show MNA
EI-4:40 (138:00)	✓ Perform step 39 of page E 1-6
	✓ MNA RCS 1ST Step 4-1 of page E 1-6
EI-4:20 (136:40)	✓ Verify LM configured for RCS hot line
5	✓ Bath GSN IMU HEATER & MNB - closed
1	✓ Bath NORM (2) - AC/DC back
7	✓ Bath LOGIC DWR 2/3 - ON
2	✓ Bath CHD - ON
	✓ Bath CM RCS CK per step 4 page E 1-6
	✓ Bath back PWR

VEHICLE PREPARATION

501 CREW

SUPERCIRCULAR ENTRY

PRE-ENTRY ATTITUDE

CREW LOG

TIME	REMARKS
✓ 8	SEC PRO ARM (2) - ACM
	LM makes + x of 1/2 1/5, but order nap
	LM makes grab pull man
8	SECS PRO ARM (2) - OFF
	SECS LOGIC (2) - OFF
	LM pitches up - captures SM & photo
	Keel out of window 5
EI-3:00 (187:40)	LM moves to MOON VIEW PT
	CM optics at zero, zero inch man
	✓ GEN COMP MNB - closed
	✓ V37 R 6 on DECK - E will get 00062
	then PRO till DECK BLINKS
	✓ (DO NOT PERMANENTLY)
EI-2:30 (187:10)	✓ ESS JUST MNA - closed
	✓ GEN INU HYE MNA - closed
	✓ LM PWR 1 & 2 - open wait for
	✓ GEN COMPUTER MNA - closed
215	✓ MNB DAT BUS B - closed
	✓ INU PWR 1, 2 & 3 - closed
5	✓ DAT RLY BUS DAT A & B - closed
	✓ INU CONT 1, 2 & 3 - closed
3	✓ INU 1 - MNA

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Basic Date OCTOBER 20, 1969

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APOLLO 12

Basic Date OCTOBER 20, 1969

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APOLLO

TIME	REMARKS
3	✓ INU AC BUS 1 - ON
	✓ INU 1 AC BUS 2 - ON
5	✓ EPS SENS SIG AC1 & AC2 - closed
	✓ EPS SENS UNIT AC1 & AC2 - closed
	✓ CN MNA - closed
3	✓ INU BUS 1 & 2 - Reset then
225	✓ FL BUS MNA & MNB - closed
	✓ CTS MNA & MNB - closed
4	✓ ECOMP GPI - AC1
	✓ ECOMP GPI - AC2
3	✓ ED NORM XANDER - PRIM
	✓ DE SE - NORM
	✓ DND - NORM
	✓ TLM END RESET - RESET then NORM
2	✓ TLM CMC - ACCEPT
275	✓ FL & PL MNA & MNB - closed
	Configure for Comm on PL 6, 9, 10
5	✓ INU MNA & MNB - closed
	✓ OPS MNA & MNB - closed
	✓ GEN DND AC1 & AC2 - closed
	✓ GEN DND - AC2
	✓ INU CMC PWR UP - GFC & CFC
	delete
	add →
E-2:15 (188:25)	Kind guess P27 update, closing SV, V66 & info, enter for

VEHICLE PREPARATION

SUPERSTICHART ENTRY

PRE-ENTRY ATTITUDE

137
137

CREW LOG

TIME	REMARKS
	✓ Perform IMU Purge per GSC pg. 2-1
	✓ Perform Optics Purge per pg. 2-3
	229 ✓ MNA A - closed
	Set mission timer (ADC) from CRC
	P-2989 Alignment Sequence when at MAX VIEW
	P-271-20 ✓ M20 = Load PAD Course Align to
	for Manual view ATB
	✓ V40120E
	✓ Set Refl to Mag per GSC 7-1 step 3
	✓ X137E S2E 0001
	Course align
	Mark on Moon (+ in center)
	LM moves to Sun away att. ^{good set} sun filter
	when thru mag with SCT
	→ pulse trigger the N93 0605-0800
	LM moves to Set att -
	WATCH MOVE TO AVOID GIMLOCK
	LM GOES TO mode, att held
	27.5 ✓ MNA BAT BUS A - close
	✓ MNB BAT C - close
E-1:30	CLOSE OUT and HATCH INSTALLATION
(141:10)	Close LM Hatch, close dump valve

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AT VIEW

Basic Date: OCTOBER 20, 1969
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APOLLO 12

Basic Date: OCTOBER 20, 1969
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APOLLO

TIME	REMARKS
	✓ High Shot & alert on Hatch
	✓ Integrity ch. checks
	✓ Support. O ₂ - ON
	✓ MN REG (2) - Open
	✓ H ₂ O / GLX TRK PRES & REG - BOTH
	✓ EMER CABIN PRES - BOTH
	✓ SUIT DEMAND REG - BOTH
5	✓ ECS XDCOR GP 1 & 2, MNA
	✓ MNB (91) - CLOSE
	✓ ECS XNICAL TEMP MNA & MNB close
4	✓ DEIM ECS GLX PUMP - 1 AC1
	Finish tunnel vent - verify
	scrub pres
(141:20)	
E1-1:20	
7	✓ BHAG 1 PUR - WARM UP
E1-1:10	✓ Perform ECS PURGE per GSC pg. 2-4
(141:30) 4	✓ BOIT COMP 2 - AC1
2	✓ VSC CONT - SOS
	MNA ATT SW - Rods removed from drops
3	✓ Perform CDC align
8	✓ PIR PUR DIET 1 & 2 MNA & MNB
	✓ H ₂ O DICE (2) - MNA & MNB

VEHICLE PREPARATION

SUPERSTRUCTURE ENTRY

PRE-ENTRY ACTIVITIES

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Basic Date OCTOBER 20, 1969
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April 10 1920

APOLLO

TIME	REMARKS
S	cl- ECS WASTE HTR/LINE DUMP HTR (2) - closed
:	Sun Comp 2 - OFF
(192:10)	
EJ-30	SEDS LOGIC (2) - ON
T	BLOC # 2 PAIR - ON
	PWR PAIR - BOTH
	Activate primary loop
EJ-10	Enter efcordist page 2-2 D61

LUNAR RETURN VEHICLE PREPARATION

- 1 INITIAL STOWAGE COMPLETED
- 2 CMC & ISS START UP pg G/2-1 & 2
- 3 SCS POWER UP pg G/2-4
- 4 P51 - IMU ORIENTATION pg G/6-1
- 5 LOAD DAP
V48E 11102, 01111, PRO, PRO, PRO
- 6 -06:00h LAST MCC DECISION
- 7 -05:35h NO COMM - P52 & NAV SIGHTINGS
- 8 DON MAE WESTS & FOOT RESTRAINTS
- 9 ~~ACTIVATE VHF FOR COMM CHECKS~~
- 10 ~~VERIFY DSE POWERED~~
~~cb S-BD-FM-XMTR/DSE-(2) — close (verify)~~
- 11 -04:30h P27 (SV, REFSMMAT), MNVR
& ENTRY PAD UPDATES
- 12 -04:15h P52 - IMU REALIGN pg G/6-2
(: :) (OPTION 1)
- 13 P37 (NO COMM ONLY) (no comm opt. 2 at EE time)
- 14 ECS CKS
02 SUPPLY REFILL pg S/1-7
PGA verification, (if suited) S/1-11
ECS Monitor Ck pg S/1-5
(382) EVAP H2O CONT PRI vlv - AUTO
EVAP H2O CONT SEC vlv - AUTO
SUIT HEAT EXCH SEC GLY - FLOW
- 15 EPS CKS #1, 3, 4 (5 if req'd) pg S/1-2

Changed

USM 109

VEHICLE PREPARATION

SUPERCIRCULAR ENTRY

PRE-ENTRY ATTITUDE

USM 109

VEHICLE PREPARATION

CREW LOG

16 SPS CK (If req'd) pg S/1-1
 17 RCS CKS
 SM RCS Monit Ck pg S/1-1
 CM RCS Monit Ck pg S/1-1

18 C&W SYS CK pg S/1-17

19 CMC SELF CK pg G/2-3

20 DSKY COND LT TEST pg G/1-23

21 -03:45h MIDCOURSE MANEUVER
 P30 - EXT AV
 -03:15h P40/41 - SPS/RCS THRUSTING
 -03:00h MIDCOURSE (#7) BURN
 Key V66E

-02:00h LOGIC SEQUENCE CK
 (8) cb SECS LOGIC (2) - close (verify)
 cb SECS ARM (2) - close
 cb ELS (2) - close
 ELS LOGIC - on (up)
 ELS - AUTO
 Coordinate next 3 steps with MSFN
 SECS LOGIC (2) - on (up)
 MSFN confirm GO for PYRO ARM as req'd
 SECS LOGIC (2) - OFF
 cb SECS ARM (2) - open
 ELS LOGIC - OFF
 ELS - MAN
 cb ELS (2) - open

22 NO COMM NAV SIGHTINGS

23 ~~MANVR TO SUPERCIRCULAR ENTRY ATT~~ ° PITCH
 V62E

24 V49E

25 F-06-22 DESIRED FINAL GMBL ANGLES (.01°)
 LOAD ENTRY ATT PAD ANGLES
 PRO

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

PRO
 (MAN) SC CONT - SCS
 MNVR to 28

27 06 18 AUTO MNVR TO FDAI RPY ANGLES (.01°)

28 F 50 18 REQUEST TRIM (.01°)
 (TRIM) Go to 26
 (BYPASS) ENTR

29 -00:55 ~~Select best S-BD Omni Ant~~
~~S-BAND OMNI - OMNI B~~
 BORESIGHT & SXT STAR CHECK
 OPT MODE - CMC
 OPT ZERO - OFF

V41 N91E

F 21 92 SHAFT, TRUN (.01°, .001°)
 Load SXTS angles

41 OPTICS DRIVE

CHECK SXT STAR
 OPT ZERO - ZERO
 CHECK BORESIGHT STAR (If avail)

30 -01:35h P52 - IMU REALIGN pg G/6-2 (OPTION 3)
 Record gyro torquing angles

R _____
 P _____
 Y _____

*If > 1°, recycle P52
 If confirmed, use SCS for EMS Entry
 Drive Optics to 90° shaft angle
 OPTICS PWR - OFF

31 (: :) GDC ALIGN
 If drift > 10°/hr, change rate source

Basic Date 3/9/70

Changed

3/27/70

Changed

CSM 105

CSM 109

EARTH/POST LANDING

LUNAR ENTRY PAD

SUPERCIRCULAR ENTRY

PRE-ENTRY ATTITUDE

32 01:15h
-2:301-4
EMS ENTRY CHECK

- EMS FUNC - OFF
- (8) cb EMS (2) - close
- EMS MODE - STBY
- EMS FUNC - EMS TEST 1 (wait 5 sec)
- EMS MODE - NORMAL (wait 10 sec)
- Check ind lts - off
- RANGE ind - 0.0
- Slew hairline over notch
in self-test pattern
- EMS FUNC - EMS TEST 2 (wait 10 sec)
- .05G lt - on (all others out)
- EMS FUNC - EMS TEST 3
- .05G lt - on
- RSI lower lt - on (10 sec later)
- Set RANGE counter to 58 nm±0.0
- EMS FUNC - EMS TEST 4
- .05G lt - on (all others out)
- G-V trace within pattern to lwr rt corner @9G
- RANGE ind counts down to 0±0.2
- EMS FUNC - EMS TEST 5
- .05G lt - on
- RSI upper lt - on (10 sec later)
- RANGE ind - 0.0
- Scribe traces vertical line 9g to 0.28±0.1
- ALIGN SCROLL TO ENTRY PATTERN (on 37K ft sec line)
- EMS FUNC - RNG SET
- G-V scroll assy traces vert. line 0.28g to 0±0.1
- EMS, MODE - STBY

33 PRIMARY WATER EVAP ACTIVATION

- GLY EVAP H2O FLOW - AUTO
- GLY EVAP STM PRESS - AUTO
- PRI ECS GLY PUMP - AC1 (verify)

33A SET UP CAMERA

CM4/DAC/18/CIN - BRKT, MIR

(f16, 250, 7) 6 fps, 8 min, MAG K

(B2)

34

use only
of primary
files35 (OPTION)
-6:30

Basic Date - 3/9/70

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Basic Date - 2/27/70

Changed

36

WASTE MGMT DRAIN VALV OFF

Remove + stow URA, urine

transfer hose and urine

filter.

37 (-00-50m)
-6:10

38

1-5
SEC WATER EVAP ACTIVATION

- ECS IND sel - SEC
- SEC COOL LOOP PUMP - AC2
- GLY DISCH SEC PRESS - 39-51 psig
- SEC COOL LOOP EVAP - EVAP
- SEC GLY EVAP OUT TEMP - 38 - 50.5°F

SUIT CKT HT EXCH - BYPASS 20 sec, OFF

ECS IND sel - PRIM

CM RCS PREHEAT

Note: If sys test mtr 5c,d,6a,b,c,d all read 3.9 vdc (28°F) or more, omit preheat

- (8) ✓ cb RCS LOGIC (2) - close
- ✓ CM RCS LOGIC - on (up)
- (8) ✓ cb CM RCS HTRS (2) - close
- (101) ✓ CM RCS HTRS - ON (LMP Confirm)
- (20 min or til lowest rdg is 3.9 vdc) (Monitor Manf press for press drop)

NOT MORE THAN 20 MIN!

FINAL STOWAGE

- OPTICS - lowest
- ORDEAL
- (377) GLY TO RAD SEC vlv - BYPASS (verify)
- Verify EVA COUCH STRUT disengaged
- (382) Cool pnl installed
- Y-Y struts (2) extended
- Stow Data Box R-12
- Attach both strut unlock lanyards
- Check for water in tunnel area
- Stow gas separator & Cl injector (A1)

TERM. CM RCS PREHEAT

- (101) ✓ CM RCS HTRS - OFF
- ✓ CM RCS LOGIC - OFF
- (8) ✓ cb CM RCS HTR (2) - open

SYSTEMS TEST PANEL CONFIGURATION

- SYS TEST METER - 4B (BAT RLY BUS 3.4-4.1 vdc)
- (101) CM RCS HTRS - OFF (verify)
- WASTE H2O DUMP HTR - OFF

(101) URINE DUMP HTR - OFF

(100) LEB FLOOD & INTGL LIGHTING - OFF

39

PYRO, BATT CK

- (250) ☒ cb PYRO A SEQ A - close (verify)
☒ cb PYRO B SEQ B - close (verify)
 DC IND - PYRO BAT A(B) **37.0, 36.9**
 *If PYRO BAT A(B) < 35 vdc *
 (250) *cb PYRO A(B) seq A(B) - open *
 cb PYRO A(B) BAT BUS A(B) TO PYRO
 * BUS TIE - close *

- (275) ~~cb MNA BAT C - close~~
~~cb MNB BAT C - close~~
~~DC IND - MNB~~
 PNL 8 - All cb's closed except:
☒ EDS BAT (3) - open (verify)
☒ PL VENT - open (verify)
☒ FLOAT BAG (3) - open (verify)
☒ SPS P&Y (4) - open
☒ CM RCS HTRS (2) - open (verify)
☒ LOCKING PROBE (2) - open (verify)
☒ DIRECT ULLAGE (2) - open
~~CM RCS HTR QUAD MNA - open~~
~~CM RCS HTR QUAD MNB - open~~

40 (: :) FINAL GDC DRIFT CK (if req'd)
 If drift >10°/hr, Suspect GDC, Do not
 use RSI & FDAI #2

41 - 4:40

CM RCS ACTIVATION

- (8) ☒ cb SECS ARM (2) - close (verify)
☒ SECS LOGIC (2) - on(up)
~~MSFN confirm GO for PYRO ARM~~
☒ SECS PYRO ARM (2) - ARM
☒ CM RCS PRPLNT 1&2 tb(2) - gray (verify)
☒ CM RCS PRESS - ON
☒ RCS IND sw - CMI, then 2
 He PRESS stabilizes at 3300 - 3500
 psia after 15 minutes **3250, 2200**
☒ MANF PRESS 287-302 psia
☒ SECS PYRO ARM (2) - SAFE

42 -00:45m

P27 & ENTRY PAD UPDATE

SUPERCIRCULAR ENTRY

1

Set DET (up, to EI)

2 - 0:55

EMS INITIALIZATION

~~cb EMS (3) - close~~

- *Scroll not on 37K:*
 EMS FUNCT - TEST 5
 Slew scroll to 37K

EMS FUNCT - RNG SET (verify)
 SET RNG TO PAD DATA RNG
 EMS FUNC - Vo SET
 Slew Scroll to Pad Data VIO
 EMS MODE - STBY (verify)
 EMS FUNC - ENTRY

RSI ALIGNMENT

FDAI SOURCE - ATT SET
 ATT SET - GDC
 EMS ROLL - on (up)
 GDC ALIGN pb - push & hold
 YAW THUMBWHEEL - Position RSI thru
 45° & back to LIFT UP
 GDC ALIGN pb - release
 EMS ROLL - OFF
 Align GDC to IMU

4 - 4:30

CM RCS CHECK

- ☒ AUTO RCS A/C ROLL (4) - OFF (verify)
☒ cb RCS LOGIC (2) - close (verify)
~~SC CONT - SCS~~
~~MAN ATT (3) - MIN-IMP Acc CMD~~
☒ RCS TRANSFER - CM
☒ AUTO RCS SEL (RING 1) - MNA
☒ AUTO RCS SEL (RING 2) - MNB
☒ cb SCS B/D ROLL, P&Y MNA (3) - open
☒ TEST RING 2 THRUSTERS
☒ cb SCS B/D ROLL, P&Y MNA (3) - close
☒ cb SCS B/D ROLL, P&Y MNB (3) - open
☒ TEST RING 1 THRUSTERS
☒ cb SCS B/D ROLL, P&Y MNB (3) - close
~~RCS TRANS - SM~~
~~MAN ATT (3) - RATE CMD~~
~~SE CONT - CMC/AUTO~~

3/9/70

Basic Date

Changed

Changed

109

VEHICLE PREPARATION

5 30:00m MN BUS TIE (2) - ON
(-30:00) TAPE RCDR - REWIND

6 35:00m SEPARATION CK LIST
(-25:00)

delete

cb ELS BAT (2) - close (verify)
PRIM GLY TO RAD - BYPASS (pull)
REPRESS PKG vlv - FILL to 865-935,
then ON
02 SM SUPPLY vlv - OFF
SURGE TK - ON (verify)
CAB PRESS REL vlv (2) - NORM
ABORT SYS PRPLNT - RCS CMD (verify)
SM RCS SEC PRPLNT FUEL PRESS (4) - ON
VHF AM A&B - off (ctr)
HI GAIN ANT PWR - OFF
FC PUMPS (3) - OFF
FC 2 MNA - OFF
Verify Loads Balanced
S BD PWR AMP - LOW
~~S BD ANT OMNI - best~~
cb ECS RAD CONT/HTR (2) - open
cb WASTE H2O/URINE DUMP HTR (2) - open
cb RAD HTRS OVLD (2) - open
POT H2O HTR - OFF
GLY EVAP TEMP IN - MAN

NOON
MNVR TO HORIZON CHECK ATT

MNVR TO PAD ATT

R (0°)

P (265°)

Y (0°)

S-BAND OMNI - OMNI C

P61 - ENTRY PREP

1

E-19
MIN.

V37E 61E (AVE G ON)

142:20

05 09 01427 - ROLL REVERSED
*05 09 01426 - IMU UNSAT *

2 F 06 61 IMPACT LAT, LONG, HDS UP/DN (+/-)
41:30m (.01°, .01°, +00001)
(-18:30) PRO

3 F 06 60 GMAX, V400K, GAMMA EI (.01G, fps, .01°)
Record
GMAX _____
V400K _____
GAMMA EI _____
PRO

4 F 16 63 RTOGO (.1nm) _____ PAD _____
VIO (fps) _____ PAD _____
TFE(min-sec) _____
If NO COMM, Set RTOGO & VIO in EMS
& initialize (use values at EI-19 for
(ACCEPT) PRO proper no comm end bias)
(RECYCLE) V32E to 3

P62 - CM/SM SEP & PRE-ENTRY MNVR

delete

5 F 50 25 00041 REQUEST CM/SM SEP
43:00m COMPARE PITCH ATT WITH PAD DATA _____
(-17:00) If not +5°, G&N NO GO
YAW - 45° OUT-OF-PLANE (LEFT) (315°)
RATE - HIGH
ATT DB - MIN
MAN ATT(3) - RATE CMD
SC CONT - SCS/FREE
BMAG MODE (3) - ATT1/RATE 2
MN BUS TIE (2) - ON (verify)
PRIM GLY TO RAD - BYPASS (verify)
EMS MODE - STBY (verify)
CM RCS LOGIC - on (up)
SECS LOGIC (2) - on(up)(verify)
SECS PYRO ARM (2) - on (up)

45:00m
(-15:00)

CM/SM SEP (2) - ON
If docking ring still on:
CSM/LM FNL SEP (2) - on(up)(verify)

CREW LOG

SUPERCIRCULAR ENTRY

EARTH/POST LANDING

LOUNGE ENTRY PAD

PRE-ENTRY ALTITUDE

CSM

Basic Date 2/9/70

Changed 3-27-70

Basic Date

Changed

VEHICLE PREPARATION

CREW LOG

SUPERCIRCULAR ENTRY

(258°P)

50:00m
(-10:00)
(236°P)

(: :)

Dark
Horiz

(40:46:50)

- 6 F 06 61 IMPACT LAT, LONG, HDS/DN (.01°, .01°, -00001)
PRO (CMC Guidance)
MAN ATT (3) - MIN IMP (if desired)
- 7 POSS 06 22 FINAL ATT DISP, RPY (.01°)
(Only if X-axis beyond 45° of Vel vector)
- 8 06 64 G, VI, RTOGO (.01G, fps, .1nm)
FDAI SCALE - 5/5
ROT CONTR PWR DIR (2) - MNA/MNB
TAPE RCDR - HBR/RCD/FWD

pix of moon set?

MAN ATT (3) - MIN IMP
BMAG MODE (3) RATE 2
C&W MODE - CM
RCS TRNFR - CM
CM RCS MANF PRESS - 287-302 psia
CM RCS LOGIC - OFF
SECS PYRO ARM (2)-SAFE
Monitor VMA/B:

If <25 vdc go to EMERG

- POWERDOWN pg

AUTO RCS SEL A/C ROLL (4) - OFF (verify)
cb SCS B/D ROLL, P & Y MNB (3) - open
AUTO RCS SEL CM 1(6)-MNA (verify)
YAW back to 0°

PITCH TO HORIZ TRACK ATT

ROLL - 0° (LIFT UP)

PITCH - 400K Horiz Mark (31.7°)

YAW - 0°

ATT DB - MAX

EMS DATA - Verify

EMS FUNC - ENTRY (verify)

EMS MODE - NORMAL

MAINT HORIZ TRK

MAN ATT (3) - RATE CMD

PRO (Act ENTRY DAP Att Hold)

2-4

57:37
58:00m
(-02:00)
(-2:23)

E

2-5

hazards
HORIZ CHECK

Pitch error needle goes toward
zero approaching .05G time

If CMC is GO:

MAN ATT (3) - RATE CMD (verify)
SC CONT - CMC/AUTO

*If DAP NO GO: *
* SC CONT - SCS*
* FLY BETA *
*If CMC NO GO: *
* SC CONT - SCS*
* FLY EMS *

P64 - ENTRY POST .05G

(If no P64 at .05G +5 sec & .05G Lt - on,
GNCS NO GO)

Start DAC

9 (158°P at 400K) RTOGO AT .05G AGREES WITH EMS-verify
(RRT=0:00) HORIZ CHECK
.05G lt - on (EMS START)

.05G time

(+0 :)

(: :)

(152°P at .05G)

TURN SBD PWR AMP -HI

* No EMS START within 3 sec: *
* EMS MODE - BACKUP/VHF RNG *

.05G sw - on (up)

EMS ROLL - on (up)

06 74 BETA, VI, G (.01°, fps, .01G)

NOTE: To monitor N68, (BETA, VI, HDOT)
Key V16 N68E

Compare RSI & FDAI

If CMC or PAD cmds Lift DN,

MNVR Lift DN (Lift UP at 1.5 G)

EMS GO/NO GO

G-V Plot within limits

Monitor G-meter for

convergence with pad data (Do)

CMC is NO GO if commanding

>+90° when G >6.52

Go to 13 (P67) or continue

Basic Date - 3/9/70

Changed - 4/2/70

Changed

CSM 10

EARTH/POST LANDING

LONGMAN ENTRY PAD

PRE-ENTRY ATTITUDE
TIMELINE

P65 - ENTRY - UP CONT (VL>18K fps)

10 F 16 69
min is .19BETA (.01°) _____
DL (.01G) _____ PAD _____
VL (fps) _____ PAD _____

IF NO AGREEMENT:

*SC CONT - SCS *

*FLY EMS *

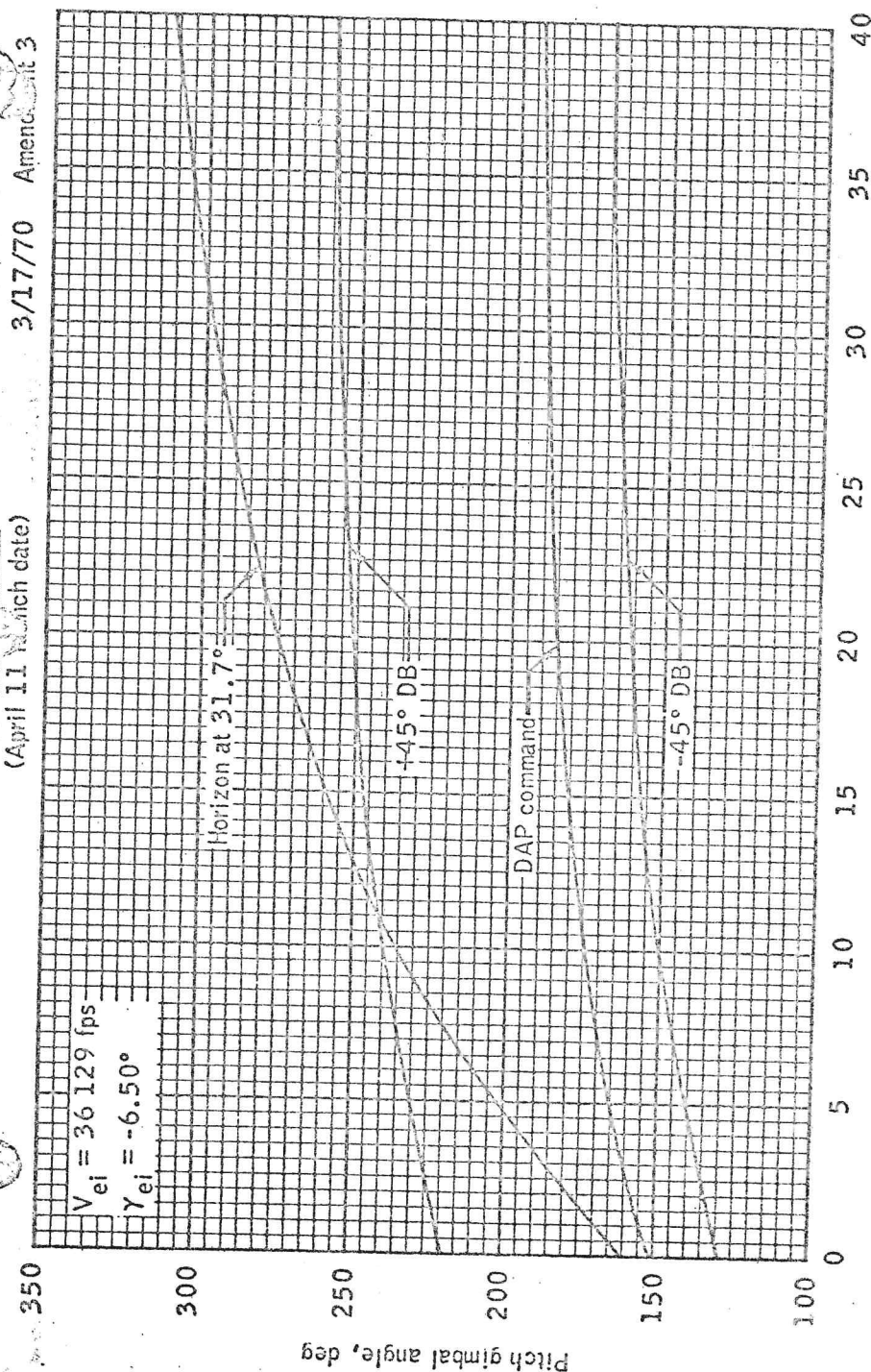
PRO

11 06 74 BETA, VI, G (.01°, fps, .01G)
(V<VL+500 fps & RDOT Neg) Go to 13

P66 - ENTRY - BALLISTIC (D<DL)

12 06 22 DESIRED GMBL ANGLES RPY (.01°)
Monitor horiz $\pm 12^\circ$ of 31.7° mark

* P67 - ENTRY - FINAL PHASE (AUTO AT .2G)

13 06 66 BETA, CRSRNG ERR, DNRNG ERR
+ is north & long (.01°, .1nm, .1nm)
BETA will be $\pm 15^\circ$ until R3 > ~~9~~ -45 NM
Monitor lift vector on RSI & FDAI
CM RCS: change rings when HE PRESS <1150 psiaF 16 67 RTGO, LAT, LONG (Vrel=1000fps)
sign invalid (.1nm, .01°, .01°)
SC CONT - SCS
RTGO NEG - LIFT UP
RTGO POS - LIFT DOWN
Monitor altimeter
Record LAT, LONG & VOICE TO RECY at 10K'
Record EMS RTGO
EMS MODE - STBY
EMS FUNC - OFF
DAC - fll *for photos** if P65-67:
V16 N68 (P, V, h)
fly lift down to h=0
return s/c cont. to CMCBasic Date 1/9/70
Changed 2-27-70
Changed 3/27/70
(April 11 launch date)

IF MAIN OR PYRO BUS
LOST USE RHC'S
FOR BURN, NOT
DUMP SW

CABIN PRESS REL vlv (2) - CLOSE
CM RCS LOGIC - on (up)
CM PRPLNT - DUMP (burn audible)
Monitor CM RCS 1&2 for He press decrease
NO BURN or PRESS DECREASE
* USE BOTH RHC'S *
*DO NOT FIRE PITCH JETS *

CM PRPLNT-PURGE

*CM RCS He DUMP PB - PUSH *

RHC (2) - 30 secs, No PITCH

Stow DAC

STRUT LOCKS (4) - UNLOCK

If night landing:

cb FLOAT BAG #3, FLT/PL (1 cb)-close

PL BCN LT - LOW

cb FLT & PL BAT BUS A,B,&BAT C (3)-close

cb FLT & PL MNA & B (2) - open

cb RAD HTR OVLD (2) - open (verify)

cb SPS P&Y (4) - open (verify)

cb BAT RELAY BUS (2) - open

3K'

CM RCS PRPLNT (2) - OFF (terminates purge)

CABIN PRESS REL vlv (RH) - DUMP

ELS AUTO (verify)

ELS LOGIC - ON (verify)

FLOOD Lts - POST LDG

800'

CAB PRESS RELF vlv - CLOSE (latch off)

MN BUS TIE (2) - OFF

POSTLANDINGSTABILIZATION, VENTILATION, COMMUNICATIONS

1

Stabilization after landing

cb MAIN REL PYRO (2) - close

MAIN RELEASE - on (up)

SECS PYRO ARM (2) - SAFE

SECS LOGIC (2) - OFF

No contact with recovery forces

*VHF AM A&B - off (ctr) *

*VHF AM RCV ONLY - A *

cb PL VENT - close

cb FLOAT BAG (3) - close

cb UPRIGHT SYS COMPRESS (2) - close

If Stable II:

FLOAT BAG(3)-FILL till 2 min after
upright, then - OFF

VHF AM A/B & BCN - OFF while inverted

If Stable I:

After 10 Min Cooling Period,

FLOAT BAG (3) - FILL 7 min, then OFF.

Post Stabilization And Ventilation

PL BCN LT - BCN LT LOW

PL VENT vlv - UNLOCK (Pull) *after bags are full*

Remove PL VENT Exh Cover

PL VENT - HIGH or LOW

If req'd:

PL DYE MARKER - ON

*Deploy auxiliary dye marker *

Release restraints

cb MNA BAT BUS A & BAT C (2) - open

cb MNB BAT BUS B & BAT C (2) - open

cb FLT & PL BAT C - open

cb PYRO A SEQ A - open

cb PYRO B SEQ B - open

*EACH HR - CHECK DC VOLTS $\geq$ 27.5 V *

*If Not: *

* cb FLT & PL-BAT BUS A&B (2) -open*

* cb FLT & PL BAT C (1) - close *

* GO TO LOW POWER CHECKLIST *

Unstow and install PLV DISTRIB DUCT

Deploy grappling hook and line if req'd

UNAIDED EGRESS PROCEDURESPREPARATION

Disconnect umbilicals

Neck dams on (if suited)

Configure couch(s) - 270°

Armrests stowed

Unstow survival kits

Connect lanyards, (green to S/C, white to crew)

STABLE I

PL VENT - OFF

cb Pnl 250 (all) - open

Basic Date 3/9/70

Changed 3-27-70

Changed

CS 109

5 G

5 G

5 G

5 G

5 G

5 G

5 G

5 G

5 G

5 G

5 G

5 G

5 G

5 G

5 G

5 G

EARTH/POST LANDING

3-4

- Charge hatch counterbalance
- Open side hatch
- ACTR HNDL SEL - N
- Remove raft from kit No. 2
- Put raft overboard & pull inflation lanyard
- Pass kits to raft
- Egress, inflate life vest, board raft
- *If no ventilation - CM 02 supply ~1 hr*

STABLE II

- cb CREW STA AUDIO (3) open
- PWR (3) - OFF
- SUIT PWR (3) - OFF
- PRESS EQUAL vlv - OPEN
- Remove & stow hatch
- Put survival rucksacks down tunnel
- Exit feet first; when clear of S/C inflate water wings
- Remove life raft from kit No. 2 and inflate
- *If no ventilation - CM 02 supply ~1 hr*

POST LANDING COMMUNICATIONS

- VHF ANT-RECY (verify)
- VHF BCN - ON (verify)
- If no contact with recovery forces perform VHF BEACON Check
- MONITOR VHF BEACON transmission with VHF AM B Rcvr and/or Survival Transceiver
- *VHF Beacon not operating *
- *connect Survival Transceiver to ant *
- *cable conn P112 behind VHF ant access pnl*
- *and place radio in BCN mode *

LOW POWER CHECKLIST

- VHF BCN - OFF
- VHF AM (3) - RCV
- FLOOD LTS - OFF
- VHF AM A&B - off (ctr)
- VHF AM RCV ONLY - A (verify)
- COUCH LIGHTS - OFF
- POSTLANDING VENT SYS: minimize use
- SURV RADIO - plug into VHF BCN ANT cable
- conn P112 behind VHF ant access pnl & turn radio on in BCN mode

CREW LOG

SUPERCIRCULAR ENTRY

PRE-ENTRY ATTITUDE
TIMELINE

3/9/70

Basic Date

Changed

PSM 109

3/9/70

Basic Date

Changed

CSM 109

MOON 360

CONST G-STRM
VR NADIR

CDU ENTRY ALIGN 31/23 R 041 P 015 Y 024
EMC NOT EXIT PATTERN maintain moon chck. at until main set 360

LUNAR ENTRY											LUNAR ENTRY											AREA
M	I	D	P	A	C						M	I	D	P	A	C						R 0.05 G
X	X	X	0	0	0						X	X	X	0	0	0						P 0.05 G
X	X	X	1	5	3						X	X	X	1	5	2						Y 0.05 G
X	X	X	0	0	0						X	X	X	0	0	0						GET N3R
1	4	2	3	8	1	7					1	4	2	3	8	1	9					Pitch CK
X	X	X	1	7	8						X	X	X	1	7	8						LAT N61
-	0	2	1	6	6						-	0	2	1	6	6						LONG
-	1	6	5	3	7						-	1	6	5	3	7						MAX G
X	X	X	0	6	7						X	X	X	0	6	2						V400K N60
+	3	6	2	1	1						+	3	6	2	1	1						y400K
-	0	0	6	5	1						-	0	0	6	2	0						RTGO EMS
+	1	1	6	9	9						+	1	1	1	9	7						VIO
+	3	6	2	9	2						+	3	6	2	9	1						RRT
1	4	2	4	0	4	0					1	4	2	4	0	4	6					RET 0.05 G
X	X	0	0	2	8						X	X	0	0	3	0						DL MAX
+	0	0									+	0	0									N69
+	0	0									+	0	0									DL MIN
+											+											VL MAX
+											+											VL MIN
X	X	X	4	0	0						X	X	X	4	0	0						DO
X	X	0	2	0	4						X	X	0	2	0	0						RET VCIRC
X	X	0	0	1	7						X	X	0	0	1	9						RETBBO
X	X	0	3	2	2						X	X	0	3	3	8						RETEBO
X	X	0	8	1	4						X	X	0	7	8	9						RETDRO
X	X	X	X	3	3						X	X	X	X								SXTS
+	3	5	3	1	0						+											SFT
+	2	9	9	0	0						+				0	0						TRN
X	X	0	0	8	8						X	X	X									BSS
X	X	0	0	4							X	X										SPA
X	X	X	0	4							X	X	X									SXP
X	X	X	X	0	8						X	X	X	X	0	8						LIFT VECTOR

Vega - 274-222
Gillies 274-222
Dumb

MASTER

APOLLO 13	
CSM SYSTEMS CHECKLIST	
PART NO.	S / N
SKB32100082 - 311	1001

TELECOMM PROCEDURES

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2. LM INTERFACE

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3-1

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4-1

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5-1

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7. CREW LOG

Basic Date 19/70
Changed 3-23-70

Basic Date 19/70
Changed 11/29/70

CSM

CSM 1

P_c - predicted 103.5 pre X-over
(2 back. & incr) 105.0 post "

Unbalance predictions

-100 to -50 pre
+100 after

He pres LOI 3600 → 1600
TEI 1600 → 850

Basic Date
Changed

CSN 409

1-1

SYSTEMS MANAGEMENT

PROPULSION SYSTEM

SPS MONITORING CHECK

SPS PRPLNT TK TEMP ind - +45 to +75°F

*IF < 45°F, SPS LINE HTRS - A *

*IF > 75°F, SPS LINE HTRS - off (ctr) *

SPS PRESS IND sw - He, N2A, & N2B

SPS PRPLNT TK PRESS ind

He 3900 psia max

N2A 2900 psia max

N2B 2900 psia max

SPS PRESS IND sw - He

FUEL & OXID PRESS ind - 170 to 195 psia

SPS ENG INJ VLVS (4) - CLOSE

SPS OXID, FUEL & UNBAL QTY - record

OXID FLOW VLV PRIM - PRIM

SPS He VLV (1&2) - AUTO, tb - bp

SM RCS MONITORING CHECK

SM RCS PRPLNT tb (8) - gray

SM RCS He 1 & 2 tb (8) - gray

RCS IND sel - SM A, B, C, D

PKG TEMP - 115°-175°F (C/W 75°-205°)

He PRESS - record

MANF PRESS - 178-192 psia (C/W 145-215 psia)

He TK TEMP - record

PRPLNT QTY - record

When MANF PRESS < 150 psia

RCS SEC FUEL PRESS A (B, C, D) - OPEN

CM RCS MONITORING CHECK

CM RCS PRPLNT tb (2) - gray

RCS IND sw - CM 1, 2

He TEMP - 60-90°F

He PRESS - 4100-4200 psia

MANF PRESS - 80-105 psia

EPS SYSTEM

- 1 Cryogenic Pressure - Quantity Check
H2 PRESS (2) - 225-260 psia
O2 PRESS (2) - 865-935 psia
SURGE TK PRESS - 865-935 psia
H2 QTY (2) - record
O2 QTY (2) - record
CRYO FANS - OFF; ON as req'd
- 2 FC Power Plant Check
FC HTRS (3) - on (up)
FC REACT tb (3) - gray
FC IND sel - 1, 2, 3
H2 FLOW - 0.03-0.15 lb/hr
O2 FLOW - 0.25-1.2 lb/hr
MOD SKIN TEMP - 390-450°F
MOD COND EXH TEMP - 150-175°F
FC pH HI tb - gray
FC RAD TEMP LO tb - gray
FC REACS & RAD cb (6) - out, all others in(verify)
- 3 D-C Voltage-Amperage Check
MN BUS TIE (2) - OFF (verify)
FC MNA tb - 1 & 2 gray, 3 bp
FC MNB tb - 1 bp, 2 bp, & 3 gray
FC 1, 2, & 3 (RECORD AMPS)
MAIN BUS A, B, (26.5-31 vdc - Record)
BAT BUS A, B, & BAT C (31.5-38 vdc < 3 amp)
PYRO BAT A, B (36.5 - 37.5 vdc)
DC IND sel - MNB
SYS TEST 4B (BAT RLY BUS - 3.4-4.1 vdc)
SYS TEST 4A (BAT COMPT PRESS - <1.5 vdc)
(NA until 1st Vent)
If >1.5: BAT VENT vlv -
VENT (to ~0) then CLOSED
If LM PWR - CSM
SYS TEST (2) - 4D (LM PWR - 0.5-3.2 vdc)
- 4 A-C VOLTS - 113 to 117 all phases

Basic Date 3/1/70
ChangedBasic Date 3/9/70
ChangedCSM 1
CSM 209

- 5 Battery Charging BAT A(B).
MAIN BUS TIE A/C (B/C) - OFF
cb BAT BUS A & B PYRO BUS TIE - open (verify)
cb BAT C BAT BUS A & B - open (verify)
cb BAT RLY BUS BAT A(B) - open
DC IND sel - BAT CHARGER
BAT CHARGE - A(B,C)
DC VOLTS - 37.5-39.5 vdc
BAT CHARGE - OFF at 39.5 vdc or 100% recharge
cb BAT RLY BUS BAT A(B) - closed
SYS TEST - 4A (BAT VENT <1.5)
If >1.5: BAT VENT vlv -
VENT (to ~0) then CLOSED
SYS TEST - 4B
- 6 Fuel Cell Power Plant Purging.
A O2 PURGING
FC IND sw - 1(2,3)
FC PURGE 1(2,3) - O2 (2 min)
FC FLOW - O2 Flow incr 0.6 lb/hr
M/A FC 1(2,3) - On/RSET
FC PURGE - 1(2,3) - OFF
B H2 PURGING
H2 PURGE LINE HTR - ON, 20 min prior to purge
FC IND sw - 1(2,3)
FC PURGE 1(2,3) - H2 (1 min, 20 sec)
FC H2 FLOW - Flow incr 0.67 lb/hr
(will exceed C/W limit)
M/A FC 1(2,3) - On/RSET
FC PURGE - 1(2,3) - OFF
After 10 minutes:
H2 PURGE LINE HTR - OFF
- 7 H2 or O2 Quantity Balance Correction
ON LOW Tank, H2 or O2 HTRS 1(2) - OFF, *within 5%*
THEN AUTO, WHEN BALANCED

- 8 FUEL CELL SHUTDOWN (APPLICABLE FC)
- cb FC REACS - close
 - FC REAC - OFF
 - FC HTRS - OFF
 - FC PUMPS - OFF
 - cb FC PUMPS AC - open
 - AT Tskin <200° F
 - H2 PURGE LINE HTR - ON (for 20 min)
 - FC PURGE - O2 (TIL O2 PRESS = N2 PRESS)
 - FC PURGE - H2 (TIL PRESS STABILIZES)
 - FC PURGE - OFF
 - H2 PURGE LINE HTR - OFF
 - cb FC PURGE - open
- 9 FUEL CELL SWITCHING
- PRIOR TO DISCONNECTING, INSURE THAT AT LEAST ONE FUEL CELL IS POWERING EACH MAIN BUS
Possible MA & FC DISCONNECT lt
- 10 INVERTER CHANGEOVER
- A One inverter on each AC bus at all times (if available)
 - B If all three AC bus ties for the same bus are on, inverter power to that bus may be lost
 - C When switching DC power on inverter 3, pause in OFF position
- 11 CRYO O2 & H2 MANUAL FAN OPERATION
- H2 & O2 FANS - ON (seq at 1 sec intervals for 1 min each)
- a. Prior to every SPS or SIVB ΔV
 - b. Presleep
 - c. Postsleep

CAUTION

If CRYO PRESS lt on, do not turn off fan until lt extinguishes

100-90 4hr.
80-50 8hr.
450 NR.

ECS PERIODIC VERIFICATION

- 1 ECS MONITORING CHECK
- CABIN ΔP - -1 to -3.5 in. H2O
 - O2 FLOW - 0.2-0.45 lb/hr (after changeover)
 - O2 SURGE TANK PRESS - 865-935 psia
 - REPRESS O2 >865 psia
 - PRIM RAD tb - gray
 - *If PRIM RAD tb - 2 *
 - * ECS RAD FLOW AUTO CONT - 1 until *
 - * tb gray, then AUTO *
 - ECS RAD TEMP PRIM IN - 67-97°F
 - ECS RAD TEMP PRIM OUT - -20° to +63°F (-20° to 97°F for lunar orb)
 - PRIM GLY EVAP TEMP OUT - 38-50.5°F
 - PRIM GLY DISCH PRESS - 40-52 psig
 - SUIT TEMP - 45-70°F w/o evap; 45-55°F with evap
 - CABIN TEMP - 70-80°F
 - SUIT PRESS/CABIN PRESS - 4.7-5.3 psia
 - PART PRESS CO2 < 7.6 mm Hg
 - SUIT COMP ΔP - 0.3-0.4 psid
 - PRIM GLY ACCUM QTY 30-65%
 - *If <30% - PRIM ACCUM FILL vlv - *
 - * ON (Until 40-55%) *
 - POT H2O QTY - 10-100%
 - WASTE H2O QTY - 25-85%
 - *If >85% - Dump*
- 2 ECS PERIODIC REDUNDANT COMPONENT CK
- Suit Compressor
 - Sw to other compr
 - SUIT COMPR ΔP ind - 0.3-0.4 psid
 - Main O2 Regulators
 - MAIN REG B vlv - close
 - EMER CABIN PRESS sel - 1
 - PUSH TO TEST PB - PUSH (O2 FLOW INC)
 - MAIN REG B vlv - open
 - MAIN REG A vlv - close
 - EMER CABIN PRESS sel - 2
 - PUSH TO TEST PB - PUSH (O2 FLOW INC)
 - MAIN REG A vlv - open
 - EMER CABIN PRESS sel - BOTH (OFF if all suited)

Basic Date 3/9/70
Changed

Basic Date 3/9/70
Changed

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CABIN PRESS - 3.0-3.25 psia
 CAB PRESS REL vlv (RH) - BOOST/ENTRY
 O2 FLOW - 0.24 lb/hr
 SUIT PRESS - 3.5-4.0 psia
 CAB PRESS REL vlv (RH) - DUMP
 CABIN PRESS - 0.0 psia (within 6 min)
 CAB PRESS REL vlv (2) - NORMAL (latch on)

14 SUIT CKT H2 PURGE

DIRECT O2 vlv - OPEN for 1 min
 O2 FLOW - 1.0 lb/hr (pegged)
 O2 FLOW HI lt - on
 MASTER ALARM pb/lt (3) - on, push
 DIRECT O2 vlv - CLOSE
 O2 FLOW HI lt - out
 O2 FLOW - 0.2 lb/hr

15 CABIN COLD SOAKACTIVATE

SUIT HT EXCH SEC GLY vlv - FLOW
 EVAP H2O CONT SEC vlv - AUTO
 GLY TO RAD SEC vlv - BYPASS (verify)
 SUIT CKT HT EXCH - BYPASS (20sec), then OFF
 ECS IND sel - SEC
 SEC COOL LOOP PUMP - AC2
 GLY DISCH SEC PRESS - 39-51 psig
 SEC ACCUM QTY - 30-55%
 SEC COOL LOOP EVAP - EVAP
 SEC GLY EVAP OUT TEMP - 38-50.5°F
 ECS IND - PRIM
 PRIM ECS RAD OUT TEMP - >-20°F
 IF <-20°F, DEACTIVATE

DEACTIVATE

SUIT CKT HT EXCH - ON (20 sec), then OFF
 SEC COOL LOOP EVAP - RESET 1 min min, then OFF
 SEC COOL LOOP PUMP - OFF
 EVAP H2O CONT SEC vlv - OFF (AUTO for ENTRY)

16 ACTIVATE PRIMARY EVAP
 GLY EVAP H2O FLOW - AUTO
 GLY EVAP STM PRESS - AUTODEACTIVATE PRIMARY EVAP

GLY EVAP H2O FLOW - off (ctr)
 GLY EVAP STM PRESS AUTO - MAN
 GLY EVAP STM PRESS INCR - INCR for 1 minute

PRIM EVAP RESERVICE

GLY EVAP STM AUTO - MAN
 GLY EVAP STM INCR - INCR
 for 1 min

Wait 15 min

GLY EVAP H2O FLOW - ON
 for 2 min, then AUTO
 GLY EVAP STM AUTO - AUTO

17 ACTIVATE SEC EVAP

SEC EVAP H2O CONT - AUTO
 SEC COOL LOOP EVAP - EVAP
 SEC COOL LOOP PUMP - AC1

DEACTIVATE SEC EVAP

SEC COOL LOOP EVAP - RESET for 1 minute
 SEC EVAP H2O CONT - OFF
 SEC COOL LOOP PUMP - OFF *wait for evap temp to rise*

18 POTABLE WATER CHLORINATION

Check WASTE TK qty; if <15%,
 no chlorination if evaporators operating.
 Check POT TK qty; if >90%,
 withdraw 8 oz of water
 Unstow chlorination unit
 Remove chlor port cap
 Attach needle assembly to injection port
 Insert chlorine ampoule into casing
 Connect knob assembly & rotate (CW) until
 piston contacts ampoule
 Install ampoule assembly on needle assembly
 (push & turn CW)
 Rotate knob (CW) until ampoule is empty
 (3 times for half empty if H2O quantity <50%)

Basic Date 3/2/70
 Changed

Basic Date 7/9/70
 Changed

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1-24

For the following mission phases select the NORMAL LUNAR CONFIGURATION plus the specified deltas:

- A COAST AWAKE
S BD AUX TAPE - off (ctr)
TAPE RCDR FWD - off (ctr)
~~NIAM VOICE - ON~~
- B COAST ASLEEP
S BD SQUELCH - ENABLE
S BD AUX TAPE - off (ctr)
S BD NORM MODE VOICE - off (ctr)
1 HI GAIN OPERATION:
P, Y = +40, 270 (ROLL RIGHT)
P, Y = -40, 90 (ROLL LEFT)
HI GAIN ANT BEAM - NARROW
HI GAIN ANT TRACK - REACQ
S BD ANT - HI GAIN
2 OMNI OPERATIONS:
S BD ANT - OMNI
S BD ANT OMNI - B
TAPE RCDR FWD - off (ctr)
- C LUNAR ORBIT AWAKE
USE NORMAL LUNAR CONFIGURATION
- D LUNAR ORBIT ASLEEP
S BD SQUELCH - ENABLE
HI GAIN ANT TRACK - REACQ
HI GAIN ANT BEAM - NARROW
HI GAIN ANT P, Y, = _____
- E VHF RANGING, VOICE
VHF AM B - DUPLEX
VHF RNG - on (up)
VHF RCV ONLY - B DATA (MINIMIZES CREW SWITCHING)
- F VHF LM-CSM VOICE DATA
VHF AM A - SIMPLEX
VHF RCV ONLY - B DATA

S
1-25

- G CONTINGENCY
VHF AM A - SIMPLEX
VHF AM B - SIMPLEX
- H RELAY MODE (LM VOICE TO MSFN)
Voice Relay (With VHF Ranging)
MODE - VOX (Pnl 10)
VOX SENS tw - 5
S BD - OFF
INTERCOM - OFF
VHF AM - T/R
AUDIO CONT - BU
MODE - VOX (Pnl 9)
VOX SENS tw - as req
S BD MODE VOICE - RELAY
VHF AM B - DUPLEX
VHF RNG - on (up)
- Voice Relay (With LM LBR PCM record)
MODE - VOX (Pnl 10)
VOX SENS tw - 5
S BD - OFF
INTERCOM - OFF
VHF AM - T/R
AUDIO CONT - BU
MODE - VOX
VOX SENS tw - as req
S BD MODE VOICE - RELAY
VHF AM A - SIMPLEX
VHF RCV ONLY - B DATA
- I LUNAR STAY
VHF AM B - DUPLEX
VHF AM - RCV (Pnl 9)
HI GAIN ANT BEAM - NARROW
HI GAIN ANT TRACK - REACQ
HI GAIN ANT P, Y, = _____
S BD SQUELCH - ENABLE

Basic Date 3/9/70
Changed
Basic Date 3/9/70
Changed

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LM INTERFACE

COMMUNICATIONS AREA

SAFE OF AREA

S
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GENERAL

PRESLEEP CHECKLIST

CREW STATUS REPORT (MEDICATION)
ONBOARD READOUTS
CYCLE O2 & H2 FANS
CHLORINATE POTABLE WATER
VERIFY:

WASTE MNGMT OVBD DRAIN - OFF
WASTE STOW VENT vlv - CLOSED
EMERGENCY CABIN PRESS - BOTH
SURGE TANK O2 vlv - ON
REPRESS PKG O2 vlv - OFF
LM TUNNEL VENT vlv - LM/CM AP - *LM ON*
"E" MEMORY DUMP *OFF - w/o LM*
CONFIGURE COMMUNICATIONS (S/1-24)

POST SLEEP CHECKLIST

CREW STATUS REPORT (SLEEP & RADIATION)
CONSUMABLES UPDATE
CYCLE O2 & H2 FANS
CONFIGURE COMMUNICATIONS (S/1-24)

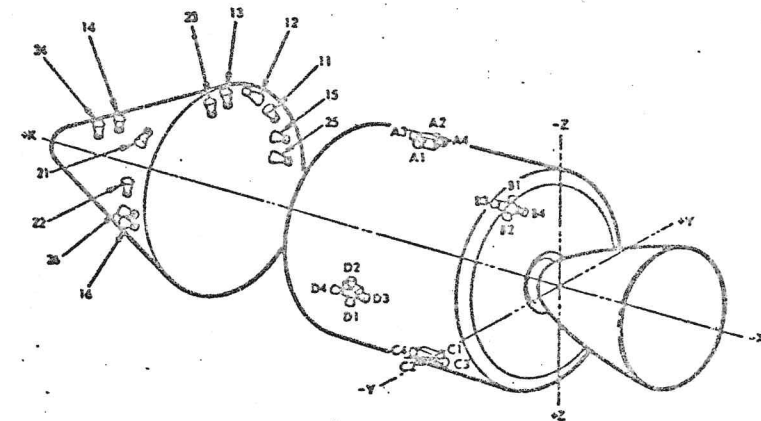
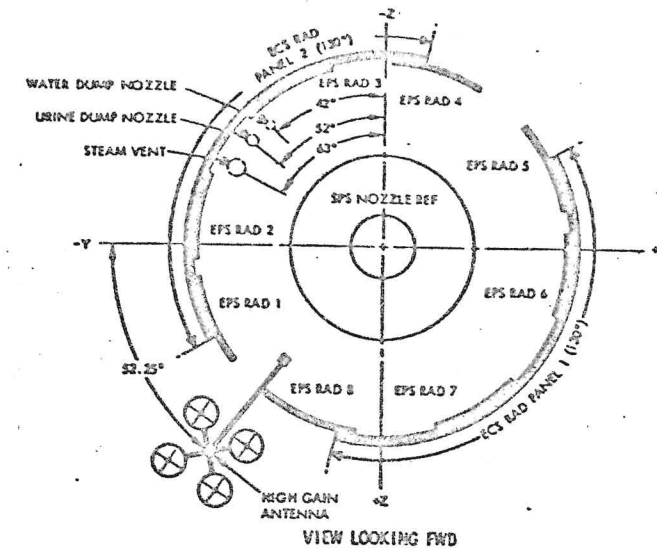
Basic Date 9/70
Changed

Basic Date 3/9/70
Changed

CSM 10

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SM RCS CODE

FIRST DIGIT: SYSTEM (1 OR 2)
SECOND DIGIT: 1, 2 (+, -ROLL) 3, 4 (+, -PITCH) 5, 6 (+, -YAW)

SM RCS CODE

1 AND 2 ARE ROLL ENGINES
3 AND 4 ARE A/C PITCH OR S/D YAW ENGINES
1 AND 3 = ROTATION, 2 AND 4 = ROTATION

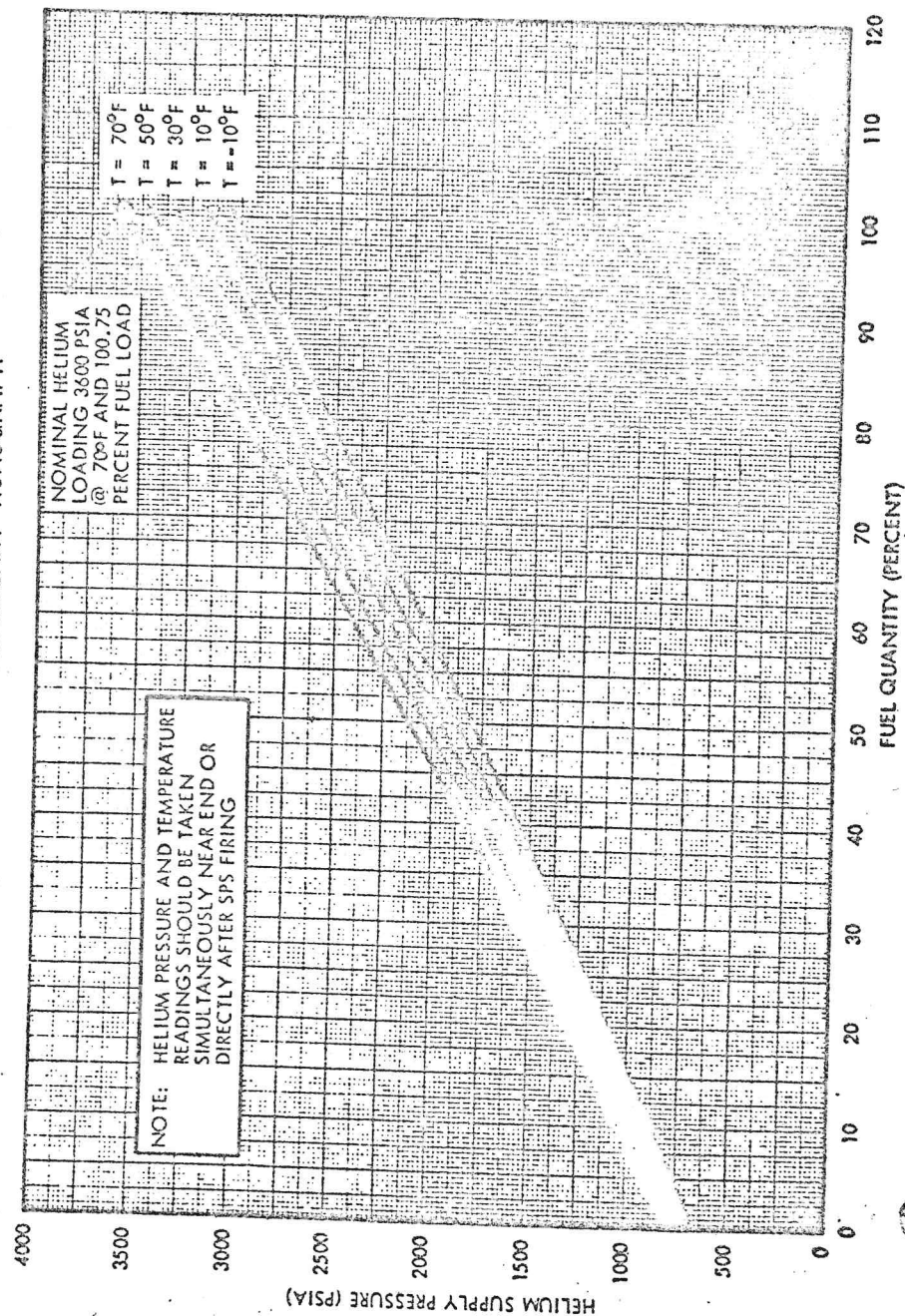
RCS Engines, Vent, and Radiator Location

IM INTERFACE

COMPUTING ERROR DATA

SAFETY OF APEX

SPS PROPELLANT NOMOGRAPH

Basic Date 19/70
ChangedBasic Date 19/70
Changed 1-23-70

CSM 10

LM INTERFACE

1 IVT TO LM (CHECKOUT, TLC)

At 2 hours prior to IVT to LM:

TUNL VENT vlv - LM/CM AP

Verify LM/CM AP ≥ 1.7 psid*LM/CM AP < 1.7 psid *

*TUNL VENT vlv - VENT *

* till LM/CM AP ≥ 1.7 psid*

Couches: CDR - 0°, CMP - 0°, LMP - 180°

TUNL LTS - ON

Equalize CM/TUNL pressure (Decal)

Verify LM/CM AP < 0.2

Remove hatch & stow (Decal) (3)

Remove probe & stow (Decal) (4)

Remove drogue & stow (Decal) (5)

Read docking tunnel index angle -2.0°

Open LM hatch

Transfer the following to LM:

✓ Box of tissues A1

✓ Vacuum brush, hose and A8

suit hose interconnect 16mm LS. CAMERA SYSTEM

✓ 16mm magazines (8) R13/A8 AB

✓ 70mm magazines HBW (3) R13

✓ 70mm magazines HCEX (2) R13

LMP Transfer to LM (6)

At LM request

LM PWR - RESET, then OFF

SYS TEST - 4D

SYS TEST ind - 0 volts

Perform comm checks with LM

At LM request

LM PWR - CSM

SYS TEST - 4D

SYS TEST ind - 0.5 - 3.2 volts

LMP Transfer to CSM (6A)

Close LM hatch

Install drogue (Decal) (8)

Install probe (Decal) (9)

Install CM hatch (Decal) (11)

TUNL VENT vlv - LM/CM AP

TUNL LTS - OFF

10 PRELOAD PROBE (Decal)

PRELOAD SEL LEVER - rotate CCW (parallel to orange stripe)

PRELOAD HNDL - torque (CW) to release

Verify capture latches engaged (CDR)

PRELOAD HNDL - Push inboard to detent

- pos 45° to support beam

PRELOAD SEL LEVER - mid position

Verify CAPTURE LATCH RLSE HNDL LOCK is locked
(orange stripe not visible)

11 HATCH INSTALLATION (Decal)

Align Hatch in tunnel

ACTR HNDL SEL - unstow, set to L

- push to stop

Verify gearbox disconnect socket - L

*If latches cannot be closed: *

GEARBOX DISCONNECT - 180° CCW (tool B)

*AUX LATCH DRIVE - LATCH (113° CW) *

*Verify hatch latched, remove tool B *

*(Cannot remove hatch from LM side) *

ACTR HNDL SEL - stow

- push to stow

PRESS EQUAL vlv - CLOSED (CW)

(C)

12 HATCH INTEGRITY CHECK (Decal)

Verify LM Hatch Closed, DUMP vlv - AUTO (CDR)

Verify CABIN PRESS ind - 4.7-5.3 psi

TUNL VENT vlv - TUNL VENT for 30-sec UNTIL LM/CM AP=9.0

- LM/CM AP, check AP

- Recycle to TUNL VENT until AP>3.5

Press on LM tunnel 1.5-2 (1/2-1 min)

*Cannot vent tunnel: *

* If O2 FLOW ind increases, open hatch, *

* wipe seal surfaces, close hatch *

* If O2 FLOW ind does not increase, dump *

* tunnel through LM during reg check *

* Monitor LM/CM AP & flow to check *

* integrity *

HATCH
2

Basic Date 19/70
Changed

Basic Date 3/170
Changed

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Verify LM/CM AP ind constant (+.2) at last value
for 2 min

Verify O2 FLOW ind - no increase

Before Undocking only:

TUNL VENT vlv - LM TUNL VENT

for 10 min, then LM/CM AP

Verify LM/CM AP >4.0 (pegged)

TUNL VENT vlv - OFF

TUNNEL LIGHTS - OFF

Before Jettison only:

TUNL VENT vlv - TUNL VENT (at least 10 min)

TUNNEL LIGHTS - OFF

13 DOCKING LATCH RELEASE (Decal)

(H) (I)

Release Button - depress

Latch Hndl - pull one or two strokes until bungee
recocks

Verify latch hook rotated inboard
to clear LM ring

* Hook does not release *

* AUX REL (yellow) - push *

* cock latch *

Verify/push latch hndl outboard
against latch hook

14 SOFT UNDOCKING

PROBE EXT/DREL - EXT/DREL (momentarily)

Verify probe is extended and LM attached

Allow motion to damp (5 sec)

PROBE EXT/DREL - EXT/DREL and hold (<20sec)

After 2 sec:

Thrust -X (4 jet) for 4 sec

After probe/drogue disengaged:

PROBE EXT/DREL - OFF

15 MALFUNCTION LIST

DOCKING

A Positive Indication of No Capture

THC -X withdraw to formation

flight distance

- PROBE EXT/DREL - EXT/DREL for 5 sec

- RETR

- PROBE EXT/DREL tb (2) - gray (verify)

- Attempt redocking as before

7 LM JETTISON

1 FINAL IVT TO CSM

CDR Verify FWD DUMP vlv - AUTO
 CMP 02 PRESS IND sw - SURGE TK
 Verify CRYO 02 PRESS ind - 865-935 psia
 REPRESS PKG vlv - OFF
 DIRECT 02 vlv - OPEN until CAB PRESS 5.5 psia
 then CLOSE until 02 FLOW <.5
 lb/hr
 - OPEN adjust 02 FLOW - 0.6 lb/hr
 TUNL VENT vlv - LM/CM AP
 LM/CM AP ind - +4 psid (pegged)
 PRESS EQUAL vlv - OPEN until LM/CM AP ind -
 ~3 psid then CLOSE
 Monitor LM/CM AP ind for 3 min and verify
 AP stable
 PRESS EQUAL vlv - OPEN
 Remove hatch and stow (Decal) (3)
 Verify docking latches (at least 3)
 Remove & temp stow PROBE & DROGUE (Decal)
 Transfer to CDR at his request:
 Probe
 Drogue
 Helmet Stowage bags
 Glove bags
 Decontamination bags

Receive from LM & stow:

Item	CM Stowage Location
Helmets (gloves inside) (2)	Upper Equip Bay
SRC's (2)	B5, B6
Hasselblad magazines (5)	R13
ISA	A1
Tote bag	A7/A11
Lunar Surface Hasselblad	A8
16 mm mags (6)	R13
CSRC	} B1 (in B1 bag)
CSCC	
16 mm mags (2)	

Transfer B5 & B6 containers to LM

2 POO, V49, Load LM jett attitude:

F 06 22: R____, P____, Y____

SC CONT - CMC

CMC MODE - AUTO

BMAG MODE (3) - RATE 2

PRO

PRO (Auto mnvr to jett att)

CDR transfer to CM

CM Jettison articles to LM

WARNING

No Urine/Feces

All opened food must be treated
 and stored in Beta bag

LMP Close LM hatch

Transfer to CSM

CMP DIRECT 02 vlv - close (CW)

Unstow & install forward hatch (DECAL) (11)

Perform hatch integrity check (DECAL) (12)

cb SECS ARM (2) - close

SECS LOGIC (2) - on (up)

Obtain GO from MSFN

SECS PYRO ARM (2) - ARM

③ At Jett Attitude:

ENTR

EMS FUNC - AV SET/VHF RNG

EMS AV ctr - +100 fps

EMS FUNC - AV

BMAG MODE (3) - ATT 1/RATE 2

ATT DB- MIN

RATE - LOW

SC CONT - SCS

Load DAP N46:

R1= 11102, R2= 01111

(-01:00m) V37E 47E 10/02 1111

EMS MODE - NORMAL

Auto RCS (16) - MNA/MNB

TWC PWR - ON

LM INTERFACE

CONTINGENCY EVA

SAFE OF APEX

4 CSM/LM FINAL SEP (2) - ON (.4 fps sep)
 PRO- P41 - SECS PYRO ARM (2) - SAFE
 SECS LOGIC (2) - OFF
 cb SECS ARM (2) - open
 SC CONT - CMC
 BMAG MODE (3) - RATE 2
 MNVR (180°, 90° ORDEAL, 0°)

5 SEP (2 jet +Z 1.0 fps)
 PRO (POO)

6 EMS MODE - STBY
 EMS FUNCT - OFF
 SC CONT - ~~SCS-CMC~~
 MAN ATT (3) - ~~MAN-ATT~~ RATE CMD
 Track LM GO ORB RATE (P≈93° ORDEAL)
 P20, V77 at 1 mile
 THC PWR - OFF
 AUTO RCS Roll (4) - OFF
 7 Empty PGA (2) pockets
 Move watch (2) from PGA to arm
 Stow PGA (2)
 All wash hands thoroughly

LM INTERFACE

3/9/70
 3-23-70
 Basic Date
 Changed

3/9/70
 Basic Date
 Changed

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CONTINGENCY EVA

CM PREP FOR CONTINGENCY EVA

- 1 C & R SUIT FLOW - OFF
- 2 C & R 02 hoses interconnected with A-1 interconnects
- 3 Center hoses stowed in tunnel, right hoses secured to tunnel MDC hand straps
- 4 EVA Stabilizer Strut installed
- 5 TSB's installed on R&L Girth Ring and LEB
- 6 Jackscrews (A-1) Fully opened/ Tool Kit
- 7 Tool Kit (A-1) Snapped to RH Girth Ring
- 8 Hatch Counterbalance (Engage/Disengaged) (Pull Pip Pin, stow in TSB)
- 9 MDC Ingress Bar (Stowed/Unstowed)

FINAL CABIN PREP

- 1 Depress tunnel, if req'd
- 2 Stow optics
- 3 Stow COAS
- 4 Stow cameras and bkt in TSB
- 5 Set up comm panels
- 6 PGA Bag - Remove/Secure (tie side straps to fwd straps)
- 7 Unstow couch straps - (2) PGA Bag
- 8 Center couch - Remove/Stow under LH couch
- 9 Marmon Clamps - Closed and locked
- 10 Stow Hand Controllers (Translation to Y-Y Strut, Rotation to Translation Strut, Rotation to RH TSB)
- 11 L and R Couch - Stow foot, leg, and seat pans
- 12 LH X-X Strut - Connected/Disconnect and tie off

STORAGE

CONTINGENCY EVA

SAFE OF APPEX

Perform CM RCS pressurization & CM/SM
Separation together at which time ARM
PYRO's in the following manner:
SECS PYRO ARM (B) - SAFE (verify)
SECS PYRO ARM (A) - ARM

To Jettison Apex Cover At 24K':
SECS PYRO ARM (B) - ARM

STEP A

cb ELS/CM-SM SEP BAT A - close
cb ELS/CM-SM SEP BAT B - open (verify)

If MSFN GO, Go to STEP B

If Still Apex Cover Jettison,

cb ELS/CM-SM SEP BAT B - close
cb ELS/CM-SM SEP BAT A - open
SECS LOGIC (2) - OFF, then ON

MSFN confirm GO,

cb ELS/CM-SM SEP BAT A - open (verify), close
at or after apex cover jettison at 24K'
Continue normal entry

STEP B

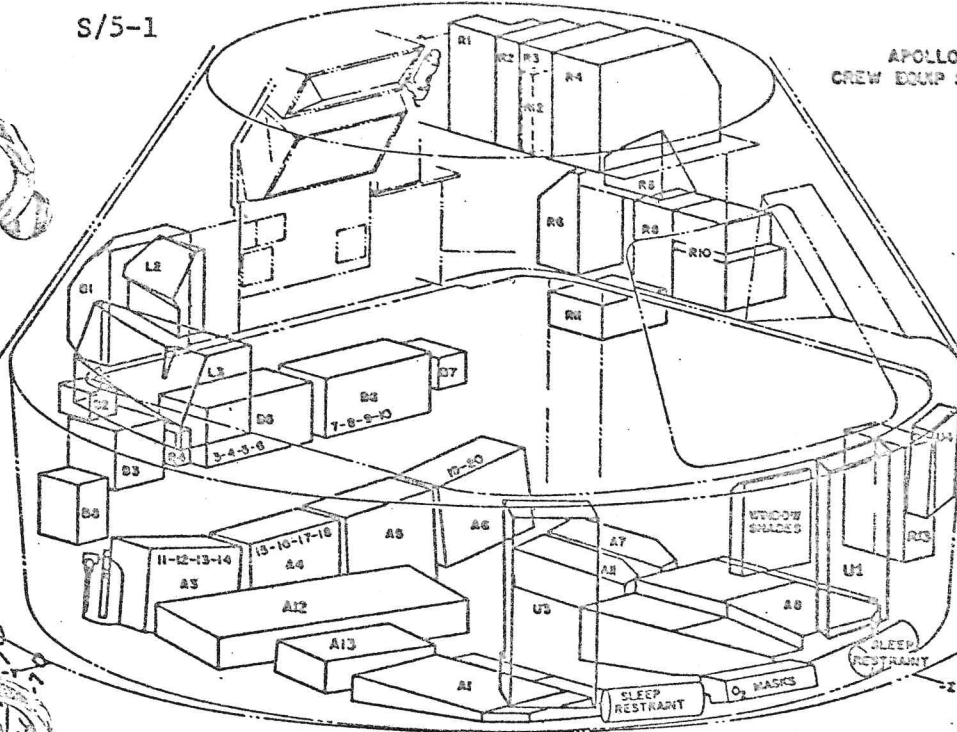
cb ELS/CM-SM SEP BAT B - open (verify), close
at or after apex cover jettison at 24K'
Continue normal entry

STEP C

cb SECS LOGIC A - open (verify), close
at or after apex cover jettison at 24K'
Continue normal entry

STEP D

cb SECS LOGIC B - open (verify), close
at or after apex cover jettison at 24K'
Continue normal entry



STORAGE

Basic Date 3/9/70
Changed

Basic Date 3/9/70
Changed

- | | | | |
|----|--|-------------------------------------|---------|
| 1 | Cabin Fan Filter Bag | A5 | PGA BAG |
| 1 | Cabin Vent QD | R6 | |
| 1 | CCU Cable, Spare | L2 | |
| 1 | CCU Control Head, Spare | L2 | |
| 1 | Chlorination Equipment | B4, B8, A1, B7 | |
| 1 | COAS | Above LH Window | |
| 2 | Bulbs | U3 | |
| 1 | Filter | U3 A3 | |
| 20 | CO ₂ Absorbers | 4-B2, 4-A4, 2-A6, 4-B5, 4-B6, 2-ECU | |
| 1 | CO ₂ Absorber Ground Cable | L2 | |
| 4 | CWG | 3-A8, 1-A1 | |
| 4 | CWG Elect. Adapters | A8 | |
| 1 | Camera, 16mm L.S. W/Mag, Lens, Handle, Battery Pack, RCU Bracket | A8 (LM Xfr) | |
| 1 | Camera, 16mm W/Mag | B3 | |
| 10 | Mag | 5-B2, 5-B8 | |
| 7 | Mag | 5-R-13 (LM Xfr), 2-A8 (LM XFR) | |
| 1 | Power Cable | B3 | |
| 1 | ea Lens, 5mm, 18mm, 75mm | B3 | |
| 1 | Mirror | B3 | |
| 1 | Bracket | U3 | |
| 1 | Sextant Adapter | A5 | |
| 1 | Fuse, Spare | R3 (Data Kit) | |
| 1 | Camera, 70mm Resseau, Mag & Spare Mag | A13 | |
| 1 | Camera, 70mm W/Mag | B3 | |
| 6 | Mag | 1-A8, 5-A13 | |
| 5 | Mag | R-13, (LM Xfr) | |
| 1 | Bracket, 80/250 | A1 | |
| 1 | Bracket, 500 | A11 | |
| 1 | Lens, 250 | U4 | |
| 1 | Lens, 500 | A11 | |
| 1 | Remote Cable | A11 | |
| 1 | Intervalometer | U4 | |
| 1 | PCM Cable | L2 | |
| 1 | Camera Hycon (CTC) W/Mag | A12 | |
| 1 | Mag | A13 | |
| 1 | Control Box | A13 | |
| 2 | Cables | A12 | |

LM INTERFACE

CONTINGENCY EVA

SAFE OF APEX
COVER JETT

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STOWAGE

LM INTERFACE

CONTINGENCY EVA

SAFE OF APEX

COVER JETT

1	Camera, TV & Ringsight	A7
1	Monitor	A6
2	Cables	A6
1	Bracket	A6
2	Data Card Kit	R3 (1-12 to LM)
1	Eyepatch	Data Kit
6	Data Clips	Data Kit
2	Master Covers	Data Kit
11	Decontamination Bags	A8, U1
3	Diapers (PCS)	A8 U1
1	Docking Target	U3
1	Exerciser	A8
30	Fecal Bags	R10
1	Flight Data File	B1, R2, R3, R12
1	Fire Extinguisher	A3
2	Food	B1, L3
1	Gas Separator	A1
4	Glare Shades	R1
3	Helmet & Accessory Bags	R6
2	Handhold, G&N	R1
3	Headrest Pads	A5
3	Heel Restraints	A5
1	Helmet Shield	PGA Bag
3	Inflight Coveralls	PGA Bag
1	Jettison Bag	R13
2	Liquid Cooled Garments	U1
3	Lightweight Headsets	A8
1	Maintenance Kit	A8
1	Medical Kit	R8
1	Monocular	U4
3	O ₂ Screen Caps	PGA Bag
3	O ₂ Mask	Under Repress Rack
3	O ₂ Interconnect	2-A1, 1-side A8
2	Fenlight	A1
3	PGA Elect Covers	PGA Bag
3	FLV Ducts	A1
10	PPK	3-A8, 1-R1, 1-R2
1	Radiation Meter	G&N Panel
3	Roll-on-cuff	R11
5	Rope	A5
1	Side Hatch Dump Equipment	R10
3	Sleep Restraint	UEB
1	Snag Line	A1
1	Spotmeter	A5
2	Sun Filters, G&N	R1
1	S-178 Shade	Window Shade Bag
1	Sea Dye Marker	A1
32	Springs, Snaps, Clips	Curtain in front B5, B6
2	Survival Kits	R4
3	Strap, Couch	PGA Bag
6	Strap, Utility	R5
2	Strap, Probe	A1
1	Tone Booster	Under A3
1	Tape	R5-R6
2	Tape Recorder	1-B3, 1-R1
4	Tape Cassettes & Batteries	U4
11	Tape Cassettes & Batteries (pre-recorded)	R1
3	Temporary Stowage Bags	A1
1	Timer	A5
7	Tissue Dispenser	5-A1, 2-A8
1	Tool "E"	L2
1	Tool Kit	A1
3	Towels	A1
1	UCLA Clamps	PGA Bag
3	Urine Hose & Suit Adapter	Under A6
3	Urine Transfer System	R11
3	Urine Filters	R5
1	UTS Receiver, Spare	R11
1	Urine Receptacle	A3
1	Vacuum Hose, 2 Brushes, & Interconnect	Side A8
5	Window Shades	On Repress Rack

S
5-3

ENTRY STOWAGE CHANGES FROM EARTH LAUNCH

A. (LM to CM XFER) ADDITIONS

QTY	NOMENCLATURE	CM STOWAGE LOCATION/VOLUME
1	PPK, 1 FLAG KIT	A13 (IN CABIN FAN FILTER BAG)
2	PPK's	R13
1	DSEA	R13
1	SRC #1	B6 (In Decontam. Bag From A8)
1	SRC #2	B5 (In Decontam. Bag From A8)

NOTE: Solar Wind 1 Ea. and Weigh Bag 1 Ea.
IN SRC

1	Contingency Sample	B1 (In Decontam. Bag From A8)
1	CSC Cassette	B1 (In Decontam. Bag From A8)

B. (CM to LM XFER) - Final Docking - Off Load

QTY	NOMENCLATURE	CM STOWAGE LOCATION/VOLUME
1	B5 Container W/4 CO ₂ Absorbers	From B5
1	B6 Container W/4 CO ₂ Absorbers	From B6
1	Docking Probe	From Tunnel
1	Jettison Stowage Bag	From R13

C. Relocations - For Re-Entry

QTY	NOMENCLATURE	LAUNCH STOW	RE-ENTRY STOW
3	Helmet Stowage Bags	3 Ea. R6	1 Ea. R6/B1/L3
3	Accessory Bags	3 Ea. R6	1 Ea. R6/B1/L3
3	ICG	PGA Container	3 Ea. On Crew
3	Headrest Pad	3 Ea. A5	3 Ea. On Couch
3	Heel Restraint	3 Ea. A5	3 Ea. On Crew
4	CWG Elect. Adapter	4 Ea. A8	3 Ea. On Crew 1 Ea. A8
3	CWG Elect. Adapter Cover	3 Ea. PGA Cont.	3 Ea. On PGA
1	Panel Indicator/ Noun List	1 Ea. Installed	1 Ea. Data Card Kit
2	PGA-EV	2 Ea. On Crew	2 Ea. PGA Container

Basic Date 3/9/70
Changed 4/2/70Basic Date 3/17/70
Changed 3/23-70

CSM 109

CSM 109

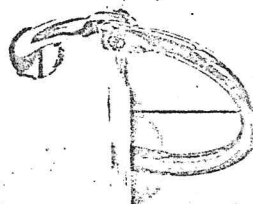
Close Passes Mr PC

per. du Inventers

Per du Bat Relv Bu

Bat ties off

Four Entries P/L A, B, C oper



APOLLO 13

CSM UPDATES

PART NO.

S / N

SKB32100082 - 330

1001

P30 MANEUVER

21/23 SET STARS		M	C	C	2		PURPOSE
		SPS 169N					PROP/GUID
		+	6	3	6	3	4 WT N47
R ALIGN	2 8 8	+	0	0	0	9	6 P TRIM N48
P ALIGN	2 0 5	-	0	0	0	2	3 Y TRIM
Y ALIGN	0 3 4	+	0	0	0	3	0 HRS GETI
		+	0	0	0	4	0 MIN N33
		+	0	4	9	0	0 SEC
ULLAGE-No		-	0	0	2	1	7 ΔV_X N81
		-	0	0	0	1	7 ΔV_Y
		-	0	0	0	8	0 ΔV_Z
Lowt 33499		X	X	X	0	8	0 R
		X	X	X	1	6	4 P
		X	X	X	3	2	6 Y
AVDMS -34		+		N/A			H _A N44
Perigee 60				N/A			H _P
HORIZON/WINDOW		+	0	0	2	3	2 ΔV_T
		X	X	X	0	0	3 BT
		X	0	0	1	8	5 ΔV_C
		X	X	X	X	4	4 SXTS
		+	1	3	5	9	0 SFT
		+	2	8	1	0	0 TRN
		X	X	X			BSS
		X	X				SPA
		X	X	X			SXP
OTHER			0				LAT N61
							LONG
		+					RTGO EMS
		+					V10
							GET 0.05G

Basic Date January 5, 1970
Changed

P30 MANEUVER

P30 UPDATE

31-23 SET STARS			P	L	Y	B	P	PURPOSE
R ALIGN	2	8	8	S	P	5	G	N
P ALIGN	2	0	5	+	6	3	3	5
Y ALIGN	0	3	4	+	0	0	0	7
				-	0	0	0	2
				+	0	0	0	7
				+	0	0	0	2
				+	0	3	3	0
				+	0	2	1	2
				-	0	1	4	1
				-	0	2	5	4
				X	X	X	1	4
				X	X	X	3	1
				X	X	X	0	5
				+			N/A	
				+	0	0	2	2
				+	0	3	6	0
				X	X	X	0	5
				X	0	3	5	6
				X	X	X	X	3
				+	3	5	2	7
				+	1	5	0	0
				X	X	X		N/A
				X	X			N/A
				X	X	X		N/A
				-	0	2	3	2
				-	1	6	5	0
				+	1	1	4	7
				+	3	6		7
				1	6	6	5	4

ULLAGE NONE

HORIZON/WINDOW

OTHER SPs Docked
LM WP 33499

GET 0.05G

Basic Date January 5, 1970

Changed

Basic Date January 5, 1970

Changed

P30 MANEUVER

SET STARS			P	L	Y	B	P	PURPOSE
R ALIGN				S	P	5	G	N
P ALIGN				+	6	3	3	5
Y ALIGN				+	0	0	0	7
				-	0	0	0	2
				+	0	0	0	7
				+	0	0	0	2
				+	0	3	3	0
				+	0	2	1	2
				-	0	1	4	1
				-	0	2	5	4
				X	X	X	1	4
				X	X	X	3	1
				X	X	X	0	5
				+			N/A	
				+	0	0	2	2
				+	0	3	6	0
				X	X	X	0	5
				X	0	3	5	6
				X	X	X	X	3
				+	3	5	2	7
				+	1	5	0	0
				X	X	X		N/A
				X	X			N/A
				X	X	X		N/A
				-	0	2	3	2
				-	1	6	5	0
				+	1	1	4	7
				+	3	6		7
				1	6	6	5	4

ULLAGE

HORIZON/WINDOW

OTHER

GET 0.05G

P30 UPDATE

P30 MANEUVER

SET STARS	Monitor PC+2					PURPOSE
						PROP/GUID
	+					WT N47
R ALIGN		0	0			P TRIM N48
P ALIGN		0	0			Y TRIM
Y ALIGN	+	0	0			HRS GETI
	+	0	0	0		MIN N33
	+	0				SEC
ULLAGE						ΔV_X N81
						ΔV_Y
						ΔV_Z
	X	X	X			R
	X	X	X			P
	X	X	X			Y
	+					H _A N44
						H _P
	+					ΔVT
HORIZON/WINDOW	X	X	X			BT
	X					ΔVC
	X	X	X	X		SXTS
	+				0	SFT
	+				0 0	TRN
	X	X	X			BSS
	X	X				SPA
	X	X	X			SXP
OTHER	-	0	2	1.6	5	LAT N61
	-	1	6	5.0	0	LONG
	+	1	1	6	3.5	RTGO EMS
	+	3	1	2	9	V10
	1	4	2	8	2	GET 0.05G

Basic Date January 5, 1970
Change

Basic Date January 5, 1970
Changed

P30 MANEUVER

SET STARS	Monitor PC+2					PURPOSE
						PROP/GUID
	+					WT N47
R ALIGN		0	0			P TRIM N48
P ALIGN		0	0			Y TRIM
Y ALIGN	+	0	0			HRS GETI
	+	0	0	0		MIN N33
	+	0				SEC
ULLAGE						ΔV_X N81
						ΔV_Y
						ΔV_Z
	X	X	X			R
	X	X	X			P
	X	X	X			Y
	+					H _A N44
						H _P
	+					ΔVT
HORIZON/WINDOW	X	X	X			BT
	X					ΔVC
	X	X	X	X		SXTS
	+				0	SFT
	+				0 0	TRN
	X	X	X			BSS
	X	X				SPA
	X	X	X			SXP
OTHER	-	0	2	1.6	5	LAT N61
	-	1	6	5.0	0	LONG
	+	1	1	6	3.5	RTGO EMS
	+	3	1	2	9	V10
	1	4	2	8	2	GET 0.05G

P22 IDMY TOCXYING

P27 IDMY DATA

P27 IDMY DATA

P30 UPDATE

SET STARS		Monitor Acc 5				PURPOSE	
						PROP/GUID	
R ALIGN	_____	+				WT	N47
P ALIGN	_____		0	0		P _{TRIM}	N48
Y ALIGN	_____		0	0		Y _{TRIM}	
		+	0	0		HRS	GETI
		+	0	0	0	MIN	N33
		+	0			SEC	
ULLAGE	_____					ΔV_X	N81
	_____					ΔV_Y	
	_____					ΔV_Z	
		X	X	X		R	
		X	X	X		P	
		X	X	X		Y	
		+				H _A	N44
						H _P	
		+				ΔVT	
HORIZON/WINDOW	_____	X	X	X		BT	
	_____	X				ΔVC	
		X	X	X	X	SXTS	
		+				SFT	0
		+			0	TRN	0
		X	X	X		BSS	
		X	X			SPA	
		X	X	X		SXP	
OTHER	_____	-	0	2	1	LAT	N61
	_____	-	1	6	5	LONG	3
		+	1	1	6	RTGO	EMS
		+	3	6	2	V10	9
			1	4	2	GET	0.05G

Basic Date January 5, 1970

Changed

January 5, 1970

Basic Date January 5, 1970

Changed

P30 MANEUVER

SET STARS						PURPOSE	
						PROP/GUID	
R ALIGN	_____	+				WT	N47
P ALIGN	_____		0	0		P _{TRIM}	N48
Y ALIGN	_____		0	0		Y _{TRIM}	
		+	0	0		HRS	GETI
		+	0	0	0	MIN	N33
		+	0			SEC	
ULLAGE	_____					ΔV_X	N81
	_____					ΔV_Y	
	_____					ΔV_Z	
		X	X	X		R	
		X	X	X		P	
		X	X	X		Y	
		+				H _A	N44
						H _P	
		+				ΔVT	
HORIZON/WINDOW	_____	X	X	X		BT	
	_____	X				ΔVC	
		X	X	X	X	SXTS	
		+				SFT	0
		+			0	TRN	0
		X	X	X		BSS	
		X	X			SPA	
		X	X	X		SXP	
OTHER	_____		0			LAT	N61
	_____					LONG	
		+				RTGO	EMS
		+				V10	

P27 UPDATE

P27 UPDATE													
PURP		V		V		V							
GET		:		:		:							
304	01	INDEX		INDEX		INDEX							
	02												
	03												
	04												
	05												
	06												
	07												
	10												
	11												
	12												
	13												
	14												
	15												
	16												
	17												
	20												
	21												
	22												
	23												
	24												
N34		HRS	X	X	X			X	X	X			
		MIN	X	X	X	X		X	X	X	X		
NAV CHECK		SEC	X	X				X	X				
N43		LAT		0					0				
		LONG											
		ALT	+	0				+	0				

Basic Date January 5, 1970

Change

Basic Date January 5, 1970

Changed

P37 BLOCK DATA

L0+15													
0	1	8	0	0									
X	5	6	2	2	X								
X	-	1	6	5	X								
0	4	7	0	7									
0	2	5	0	0									
X	5	1	1	9	X								
X	-	1	6	5	X								
0	7	1	0	8									
0	3	5	0	0		0	3	5	0	0			
X	7	7	3	3	X	7	8	8	3				
X	-	1	6	5	X	-	1	5	5				
0	7	0	3	6		0	6	9	5	4			
0	4	5	0	0									
X	6	2	0	8	X								
X	-	1	6	5	X								
0	9	4	5	2									
0	6	0	0	0		0	6	0	0	0			
X	5	9	1	3	X	6	0	7	9				
X	-	1	6	5	X	-	1	5	3				
1	1	8	5	3		1	1	5	0	4			
X						X							
X						X							
X						X							
X						X							

GETI

ΔVT

LONG

GET_{400K}

GETI

ΔVT

LONG

GET_{400K}

GETI

ΔVT

LONG

GET_{400K}

GETI

ΔVT

LONG

GET_{400K}

GETI

ΔVT

LONG

GET_{400K}

GETI

ΔVT

LONG

GET_{400K}

GETI

ΔVT

LONG

GET_{400K}

P22 LDMK TRACKING

P37 BLOCK DATA

E. O. BLOCK DATA

E. O. BLOCK DATA

LAT _____
LONG/2 _____
ALT _____

Basic Date:

Changed:

Changed.

NASA — MSC

TIME GET	TARGET NO. WINDOW, N/S	ID, FRAME NOS. CAMERA SETTINGS	REMARKS
32:00:00	MIX P 101.0 P 090.0 Y 000.0	DAC ON SET WITH MAG G (VHED) - 3 PHOTO	1 each @ 5, 20, & 60 SEC. TAG EXPOSURE
	HGA P - 23 Y 893	NOMPTC FROM TO DISC RATES	USE / HYPOGN NOS P + 31917 A - 20123 R ₃ 455075 3 photo track @ 5, 20, 60 sec time EXP NEW DORIES SHUT 0000.8° TRON 12.5° TRIP 2 SEC BURSTS @ 24-75 BEFORE & AFTER
49:30	also during	PTC	
49:45	Use P52	R1 ± 34202 R2 ± 07378 R3 ± 89719	
	Expect AOS at Ball of 45 and LOS at 155		
	Note null if visible		

PHOTO LOG

PHOTO LOG

[illegible]

Basic Date January 5, 1970

Changed:

PHOTO LOG

TIME GET	TARGET NO. WINDOW, N/S	ID, FRAME NOS. CAMERA SETTINGS	REMARKS
	2 L10H	Christie	
		grey tops	
	2	LCGS	
	1	LM one card cut about	
		1 1/2 for ramp	
Proc for reading DESE PROP TANK TEMP			
POLK - PROP/DS ENG AND CD - CLOSE			
CSM POTABLE WATER MAY BE ABOUT EMPTY - EST.			

PHOTO LOG

TIME GET	TARGET NO. WINDOW, N/S	ID, FRAME NOS. CAMERA SETTINGS	REMARKS
			- Burns - AGS (Power up AGS)
			Coars in Front Window place Earth
			in center of cross
			AGS dial 400+5 E 400+0
			GUID cont AGS
			Mode cont ATT Hold
			ATT Control. Roll pulse Pitch pulse
			Yaw mode control
			Use TTCA Control pitch and roll
			Eng Simble off
			10% thrust
			Start and stop normal
			10 sec ullage + x trans section
			cut off based on time.

Basic Date January 5, 1970

Changed

PNUU LUG

TIME GET	TARGET NO. WINDOW, N/S	ID, FRAME NOS. CAMERA SETTINGS	REMARKS
LANDING -	500 miles south of Samoa	0800 LOCAL	
	WX FST 150 / 0 2 WIND 5 FT. 15 KNOTS		
	HELD TO SOMOA, OVERCITE STAY, THEN DIRECT TO EFD		
MIDCOURSE @	107:00:00 EST @ 7 FPS. IF PTC	FOLDS THEY MAY	
	DELAY TILL LAYER. WE ARE IN CORRIDOR NOW AT FB=7.2		
	107:00:00 MCC. a little out of		
	the center		

22 LDMK TRACKING

P27 UPDATE

P31 BLACK DATA

PHOTO LOG

TIME GET	TARGET NO. WINDOW, N/S	ID, FRAME NOS. CAMERA SETTINGS	REMARKS
PWR UP CDS BULL			
CB ROL (16) INV 2 - CLOSE			
CB ROL (11) PER DISP - GASTY & CDR FINE CLOSE			
CB ROL (11) ACBUS A - GASTY & CDR FINE CLOSE			
WIDEN DR VZ1 NOIE			
3011E			
CPE			
BEFORE BORD - RING - DB			
VZ1 NOIE			
3011E			
200E			
<u>BURN RULES -</u>			
1. Thrust monitor 77% or below			
2. DPS PROP PRESS $\angle$ 160 PSI			
3. Fuel/Ox AP $\geq$ 25 PSI AS VERIFIED BY GROUND			
4. ATT ERR $\pm$ 10° except for start transient			
5. RATE LIMITS $\pm$ 10 %			
6. SHUTDOWN WITH FOLLOWING ALARMS			
EXG CMDL, IS WITH PLUG ALARM, RBC, CES DC,			
AND INVERTER AFTER SWITCHING			
7. IF DURING BURN ENG SHUTDOWNS WITH 1197 FLASHING			
PRO, ULLAGE, START PB-PUSH, DES ENG CMD OVRD - OFF			
8. ROAT BURN P014 LING 112 4630 FOR ADD 21.75			
9. AGS FOR BACKUP RATE BACKUP			
10. FREE RETURN - LAND 152 02 00			
NO INDIAN OCEAN			
11. NO TRIM REQUIREMENTS			
12. NON UPDARK 17300			

Basic Date January 5, 1970

Changed

Basic Date January 5, 1970

Changed

TIME GET	TARGET NO. WINDOW, N/S	ID, FRAME NOS. CAMERA SETTINGS	REMARKS
Activate Sband Ant			
1. Complete Scan 2, 3, 4 of Acies			
2. V/A R. P3 Y angle			
3. Last Ste on Pul 16			
Disregard.			
<u>RR PARKING PROC</u>			
(1) CB16 EPS INV 2 - CLOSE			
(2) CB11 ACBUS A BUSTIE INV 2 - CLOSE (3) AL 14 - VERIFY INV 2			
(4) CB11 RR(2) CLOSE (5) RR RELEASE/HANDLE (6) PUL 3 - RR(2)			
(7) V/A N72E 100000 x 28300 (8) WIDE WIDE			
WIDE 16 22 (9) CB(11) - RR(2) - OPEN (10) VERB GFE			
(11) CB 16 - EPS INV 2 - OPEN			
<u>FOR AOT LIGHT</u>			
(1) CB 16 - EPS INV 2 - CLOSE			
(2) CB(11) - ACBUS A AOT LAMP CLOSE (3) AFTER ALIGNMENT			
CB 16 - EPS INV 2 - OPEN (4) CB(11) - ACBUS A AOT LAMP - OPEN			
(5) CB(11) - ACBUS A BUSTIE INV 2 - OPEN			

22 LDMK TRACKING

P27 UPDATE

P37 BLOCK DATA

PHOTO LOG

TIME GET	TARGET NO. WINDOW, N/S	ID, FRAME NOS. CAMERA SETTINGS	REMARKS
	Backups Comm Mode		
	Pull Pur Amp ch Pnl 16		
	DN Voice BV		
	No contact return.		
	Used after TTCA to decrease roll		
1600 SMT	Remove UOH connectors from CSM to prevent swelling.		
74:00:00	ROT SUN ✓ DETENT 2 - RR OUT OF WAY PS2. AUTOMNVR	in within 1 Degree PLAT IS OR FORMNVR IF A STAR WILL BE GIVEN FOR ADDITIONAL IF NO GO WITH GET AN EARTH HALE UNIT	
	P2+2 STILL LOOKS LIKE 900PS TO PUT US IN MID PAC @ 14.2 HRS.		
74:00:00	SUN CHECK 31120	2° EAST, 3/4 LIGHTED	
75:00:00	R ₁ +45423 R ₂ +19053 R ₃ +08262	R ₁ +32120 R ₂ -34155 R ₃ -17370	

Basic Date January 5, 1970

Changed

Basic Date January 5, 1970

Changed

1855
CST

TIME GET	TARGET NO. WINDOW, N/S	ID, FRAME NOS. CAMERA SETTINGS	REMARKS
		20	
	Order - proc. for obtaining H ₂ O		
	1.) Repress Phys al - off		
	2.) Emer cabin press - off		
	3.) Direct O ₂ - off		
	4.) Demand Reg (E) - off		
	5.) H ₂ O Accum (pre 384) - off		
	6.) Main reg A & B - open		
	7.) H ₂ O Gly-th inlet 3 outlet - open		
	8.) Desicing H ₂ O - momentarily pressure change tanks - take out H ₂ O until pressure has decayed.		
	Pnl 11 Annun/Dark/Component - close		
	Pnl 16 Annun/Dark/Component - close		
	To roll crew monitor of Prog alarm etc. to Roby.		

TIME GET	TARGET NO. WINDOW, N/S	ID, FRAME NOS. CAMERA SETTINGS	REMARKS
64:00	Flight Plan Update		
63:00	- LMP sleep		
69:00	LMP, CDE, CMP act		
70:00	CDE, CMP sleep		
76:00	Get awake		
76:30-77:00	P52		
78:30	Load P30 and align		
	AGS to PGNS		
79:25	- DPS Burn		
64:42	Procedure for Pur. Reduction (Pur Amp off)		
	1. Bernald - off		
	2. LBR (was H ₁)		
	3. DN Voice BU (was Voice)		
	4. Pur Amp - Prim		
	5. Pul 16 ch pur amp - open		
	6. Range function on - off		

Basic Date January 5, 1970

Changed

PTC Procedure

1. GUID CONT-PGNS
2. MODE CONT att held
3. V76 E
4. Man. to PTC att 20 P90 Y { R₁ P
R₂ P
R₃ R
5. Mode cont auto
6. V16 N20 monitor rates
7. Rates less than 10/sec in each axis double
- * * * thrust
8. V25 NOTE 1257 E 252 E 1 E
9. V77 E V48 E 22110 P90 V34 E
10. V16 N20 E monitor rates
11. Rates less than 0.1/sec in all axes V76 E
12. MODE Control att hold then 30
13. Clicks of right yaw to start man.

← Yaw at 0 start roll then pitch →

Status.

MCC GET 104 00 4 to 6/sec

Consumables.

1. 1498 amp hours. (61 hrs. 24.5/hr.) after pur. burn 14 hrs (500 amp)
2. 215 # H₂O (61 hrs. 3.5/hr. avail) (after pur. burn 3.2/2.7#)
Does not include PLS and CSM
3. using CSM 15 cans (192 hrs.) (Lm 44 hrs. remain)
4. O₂ 44# in Lm (.36/hr 120 hrs.)
5. RCS A 62% B 62% only 22% for PTC
6. DPS 1190'/sec DV
7. CSM EPS - 99 amp hrs. est.

• APOLLO 13

FLIGHT PLAN

PART NO.

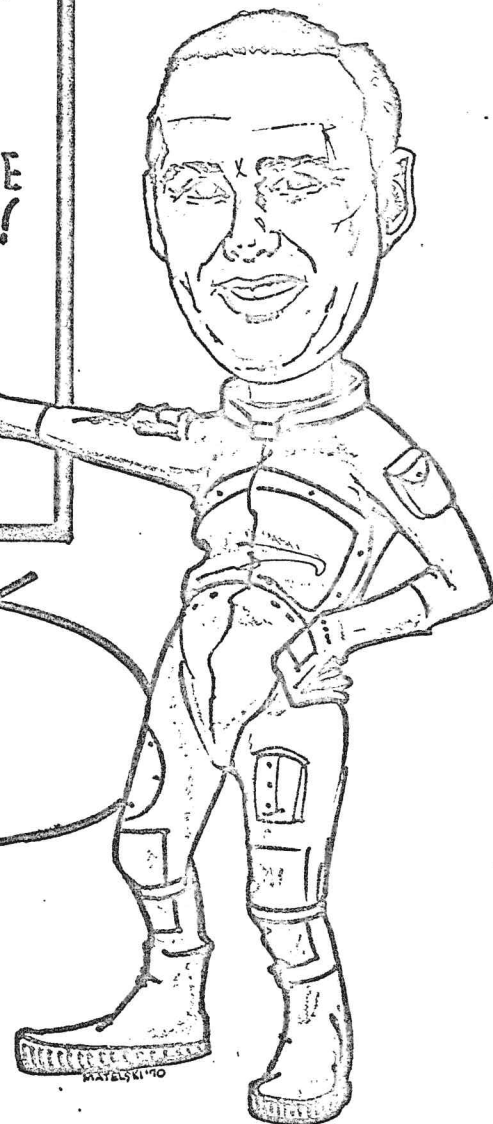
S / N

SKB32100082 - 350

1001

- 1-IT ISNT DIRTY BEACH SAND!
- 2-LET'S GET RID OF ALL THE OLD ATTITUDES!
- 3-ANY IMPROVEMENTS ARE TO BE FOR THE BETTER!
- 4-IF WE HAVE PLENTY OF FUEL...IT DOESN'T HURT TO MANEUVER
- 5-IN THE BEGINNING!

REPEAT
AFTER ME...



FLIGHT PLAN

NOTES

DUMP DSE

UPLINK TO CM
CSM S.V. & V66
UPDATE TO CSM
TLI PAD
TLI +90 MIN
ABORT PAD
P37 (L/O+8) PAD

GO/NO-GO FOR PYRO
ARM

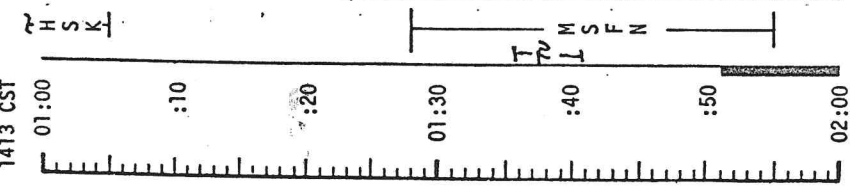
SCS ATT REF COMPARISON CK
EXTEND DOCKING PROBE

TV (MILR) 01:36 TO 01:41

GO/NO-GO FOR PYRO ARM (CUE MSFN)
LOGIC ON
TLI PREPARATION CHECKLIST
GDC ALIGN
PYRO ARM

AS A GENERAL RULE,
EXCEPT DURING TEC,
UPLINK THE STATE
VECTOR TO THE CSM
SLOT AND TRANSFER
IT VIA V66 TO THE
LM SLOT IN ORDER TO
HAVE REDUNDANT STATE
VECTORS ONBOARD

1413 CST



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL) A	MARCH 30, 1970	01:00 - 02:00	1/E.O.	3-2

MSC Form 29 (May 69)

FLIGHT PLANNING BRANCH

FLIGHT PLAN

TLI
BURN TABLE

P OR Y RATES	ATT DEVIATION	SHUTDOWN TIME	RESIDUALS
10°/SEC SHUTDOWN	+45° SHUTDOWN	BT + 6 SEC & V ₁ = PAD VALUE	NO TRIM

TABLE 3-1
3-2A

MCC-H

1513 CST

FLIGHT PLAN

NOTES

— O₂ flow Hi - 2:12

GO/NO-GO

GO/NO-GO FOR TLI
TB-6 (02:25:49.65)

P47 - THRUST MONITOR

TLI

TIG: 02:35:27.65
BT: 5 MIN 55.7 SEC

P00 - CMC IDLING
V66 - TRANS CSM SV TO LM SLOT
TLI BURN STATUS REPORT
CDR - TRANS TO CENTER COUCH, CMP - LEFT COUCH
LMP - RIGHT COUCH
WASTE STOWAGE VENT - CLOSED
DIRECT O2 VLV-OPEN, UNTIL CABIN IS 5.7 PSI, THEN CLOSE
GDC ALIGN
SIVB MNVRS TO SEP ATT
(2:56:25)

R 358 OMNI C
P 140
Y 320

AT SECO: S-IVB INERTIAL
AT SECO+2 MIN 31 SEC:
S-IVB TO LOCAL
HORIZONTAL ORB RATE,
HEADS DOWN

DUMP DSE

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	02:00 - 03:00	1/TLC	3-3

MCC-H

1613 CST

GO/NO GO FOR T & D

ACTIVATE AND LOAD DAP N46 (11103, 11111)
LOAD DOCKING GIMBAL ANGLES
CSM SEP PREPARATION

CSM/SIVB SEP GET:03:06)

CSM MNVR TO DOCK ATT (03:10)

HGA TRACK - REACQ

HGA BEAM - (WHSE) DAP 11102

TV (GDS) 03:15 TO 04:23 CM4/TV - PEAK, BRKT (f 22)
VISUALLY INSPECT AND PHOTOGRAPH SIVB AND LM

DOCK GET: 03:16

R 302 HGA
P 320 P -S
Y 040 Y 297

T&D MNVR
+X FOR 3 SEC ($\Delta V \sim 0.5$ FPS),
AFTER 15 SEC PITCH UP AT
2.0°/SEC. V49 AUTO MNVR
TO DOCKING ATT. NULL
TRANSLATION AND RATES,
+X FOR 4 SEC ($\Delta V \sim 0.7$ FPS)

CAMERA SETTINGS FOR
TRANSPPOSITION/DOCKING:
CM2/DAC/18/CEX-BRKT,
MIR(f8,250,7)12fps,
0.7 MAG (5 MIN) MAG A
CM/EL/80 CEX - SPOT
(f8,250,FOCUS)10, MAG L

CAMERA SETTINGS FOR
LM EJECTION:

CM 2/DAC/18/CEX - BRKT,
MIR (f8,250,7) 6 fps,
0.3 MAG (5 MIN) MAG A

SPRING ACTUATOR
 $\Delta V \sim 0.8$ FPS. 5 SEC
AFTER EJECTION THERE
IS A 4 JET RCS -X
TRANSLATION FOR 3 SEC
($\Delta V \sim 0.4$ FPS). TOTAL
 $\Delta V \sim 1.2$ FPS.

TIG: 04:01
BT: 3 SEC
AVR: 0.4 FPS
ULLAGE: N/A
ORBIT: N/A

GO/NO GO FOR
PYRO ARM AND
CSM/LM EJECTION

(TLI CUTOFF +
1HR 20 MIN)

BEGIN CSM/LM CABIN PRESSURE EQUALIZATION
CDR:CONFIGURE FOR LM EJECTION

TUNNEL PRESSURE INTEGRITY CHECK
REMOVE AND TEMPORARILY STOW TUNNEL HATCH

VENT DOCKING PROBE

LM UMBILICAL CONNECTION

REINSTALL TUNNEL HATCH

LM TUNNEL VENT VLV - LM/CM AP

LEAVE TUNNEL EQUALIZATION VALVE CLOSED

CYCLE O₂ & H₂ FANS

S-IVB NON PROPULSIVE VENT START (GET: 03:41)

GO/NO-GO PYRO ARM (CUE MSFN)

LOGIC ON

LOAD DAP N46 (21101, 11111)

PYRO ARM

P47 - THRUST MONITOR

PHOTOGRAPH LM EJECTION

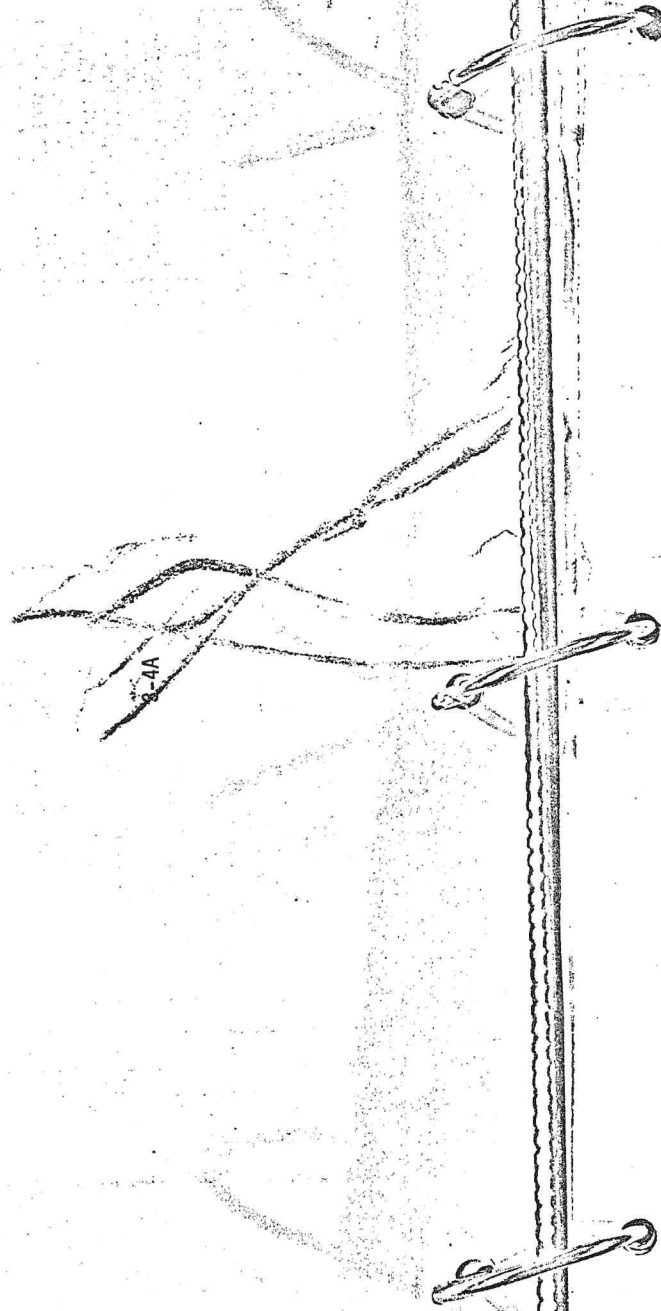
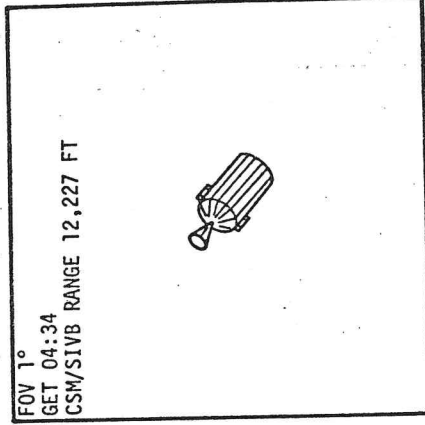
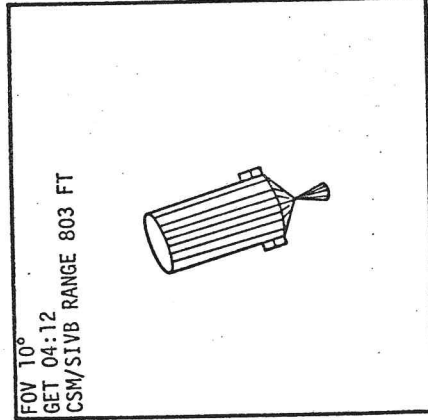
S-IVB VENT COMPLETE (GET: 03:56)

CSM/LM EJECTION - 4+01+00

CHC CONT

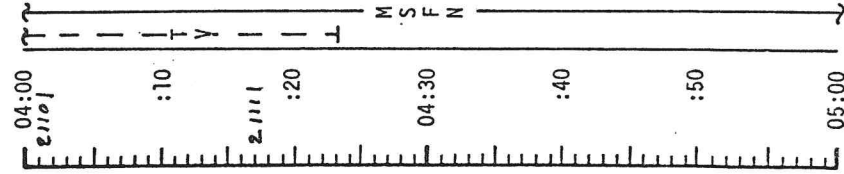
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	03:00 - 04:00	1/TLC	3-4

DETAILED TIMELINE



MCC-H

1713 CST



P00, V66 - TRANS CSM S.V. TO LM SLOT
MNVR TO ACQUIRE S-IVB IN HATCH
WINDOW (04:12) R 094 OMNI D
P 323
Y 355

S-IVB APS EVASIVE MNVR (GET = 04:14) (GROUND COMMAND)
ΔV: 9.4 FPS [FLIGHT PLAN]
LOAD DAP, N46 (21111, 11111)

BATTERY CHARGE, BATTERY B
S-IVB MNVRs TO PROPELLANT DUMP ATT (GET: 04:24)
MNVR TO P52 ATT R 052 HGA
(04:25) P 234 P -10
Y 010 Y 350

S-IVB CONTINUOUS H2 VENT ON (GET: 04:31)
S-IVB LOX DUMP (GET: 04:30) -SECURE HGA-

HGA TRACK MAN
HGA PITCH 52°
HGA YAW 270°

DOFF & STOW
PGA's

TRANSFER ITEMS OUT
OF PGA POCKETS

*More time required
for doffing and
stowing suits*

NOTES

THE S-IVB 80° YAW MNVR
IS PLANNED FOR LM EJECT-
ION +3 MIN. THE MNVR
WILL NOT BE STARTED UN-
TIL CREW REPORTS GOOD
EJECTION. THE S-IVB
EVASIVE MNVR WILL NOT
BE STARTED UNTIL THE
CREW HAS THE S-IVB IN
SIGHT.

NOTE: DURING TLC
HGA IS REQUIRED ONLY
FOR TD&E, TV TRANS-
MISSIONS AND MCC'S.
THE ANTENNA WILL BE
STOWED AT OTHER
TIMES.

LOX DUMP ΔV
= 28.1 FPS

S/C INTERIOR PHOTO-
GRAPHY AT CREW
OPTION

CM/DAC/5/CIN-
SPOT (f2.8, 60, fixed)
6 fps, 1 mag MAG J

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL) 1	MARCH 16, 1970	04:00 - 05:00	1/TLC	3-5

FLIGHT PLAN

PREPARE FOR LAUNCH VEHICLE
SYSTEMS PERFORMANCE
DEBRIEFING AT 25 HRS.
SEE QUESTIONS ON PAGE 3-21

NOTES

MCC-H

1813 CST

05:00
2/1/71

:10

:20

20101
05:30

:40

:50

06:00

UPLINK TO CSM
DESIRED ORIENTATION
(PTC)
ZERO TRUNION BIAS

P52 - IMU REALIGN
OPTION 1 - PREFERRED
(PTC ORIENT)
GYRO TORQUE

REPORT GYRO TORQUING ANGLES

GDC ALIGN

STARS
SA
TA

140 (20101, 11111)

P52 IMU REALIGN
N71: 35.44
N05: ---.01
N93: ---
X + -1.75
Y + -1.72
Z - -0.12
GET ---5:30:40

P 37 PAD ASSUMES
NO MCC-1

SECURE MGA
MGA TRACK - MAN
MGA PITCH - 52
MGA YAW 200

UPDATE TO CSM
P37 PAD (L/0+15)

WHF A SIMPLEX - OFF
VERIFY WASTE STORAGE VENT VALVE - VENT
Cryo fan - off chlc surge th - represent plug

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	05:00 - 06:00	1/TLC	3-6

MCC-H

1913 CST

06:00
20101

:10

:20

06:30

:40

:50

07:00

FLIGHT PLAN

MNVR TO OPTICS CALIBRATION ATT
LOAD DAP, N46 (21101, 11111)
P23 - Cislunar Navigation
OPTICS CALIBRATION STAR 4 0
P00
V49 - MNVR TO SIGHTING ATT
STAR/EARTH HORIZON
P23 - Cislunar Navigation
LOAD W MATRIX (R1 + 8 0 0 0) (R2 + 0 0 0 7 0)

R 147 OMNI B
P 340
Y 0
R 159
P 297
Y 0

1. STAR 33 EFH (R3 00120)
2. STAR 221 ENH (R3 00110)
N88: (R1 +39954) (R2 -26599) (R3 -14003)
3. STAR 125 EFH (R3 00120)
N88: (R1 -03957) (R2 -36365) (R3 -34088)
-12736 -87323 -28123
4. STAR 40 ENH (R3 00110)
5. STAR 42 ENH (R3 00110)

ANTARES
DELTA CAPRICORNI
THETA SCORPII
ALTAIR Aurigae
PEACOCK

O₂ FUEL CELL PURGE
WASTE WATER DUMP
IF NO MCC-1

NOTES

S-IVB APS MCC-1
GET: 06:00
AV ~3 FPS
Cal - 88997 (.03)

3 MARKS ON EACH STAR
INCORPORATE P23
MARK DATA AND
UPDATE ONBOARD
STATE VECTOR

331 06 49 38.6 ΔL
ΔV 12.4 ΔV
ΔV 2.6 ΔV
ΔL 53 ΔV
ΔV 1.2 ΔV
ΔL 3.2 ΔV
ΔV 9
125 ΔL 70 ΔL 30.3
ΔV 7.3 ΔV 12.4
ΔL 17 ΔL 2.3
ΔV 1 ΔV 2
ΔL 7 ΔL 2.3
ΔV 1 ΔV 2
42 ΔL 358 ΔL 6.1
ΔV 9.2 ΔV 2.5
ΔL 22.1
ΔV 6.7

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	06:00 - 07:00	1/TLC	3-7

MCC-H

2013 CST

FLIGHT PLAN

07:00
20101

UPDATE TO CSM
QUADS TO DISABLE
FOR PTC (LOWEST
QUANTITY PRLNT)

RECORD PHOTO
TIMES ON CREW
MARK.

MNR TO PTC ATTITUDE
PREPARE FOR EARTH WEATHER
PHOTOGRAPHY
CM /EL/250/CEX - RING
(FTT, 250, ∞) 10

P 90
Y 0

PHOTOGRAPH EARTH
1 FRAME EVERY 20
MIN FOR 3 HOURS.
MCC-H WILL RECORD
PRECISE
TIMES
FOR EACH
FRAME ON
CREW MARK

MAG L
FRAME 17① 0717 45 cms

EAT PERIOD

M S F N

PTC
P 90, Y 0② 0739 48 cmsEARTH
WEATHER
PHOTOGRAPHY

up from no sun blind
nearest sec

NOTES

GO TO PTC ATTITUDE
AND NULL RATES TO
+ 0.5° DB. DISABLE
TWO ADJACENT QUADS.
MONITOR FOR 20 MIN-
UTES THEN SELECT
+ 30° DB AND 0.3°/SEC
RATE, THEN DISABLE
THE REMAINING QUADS
AFTER SPIN UP.

record GET & FWD
Quads A and B

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	07:00 - 08:00	1/TLC	3-8

MCC-H

2113 CST

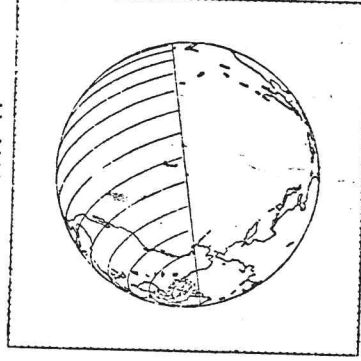
FLIGHT PLAN

08:00
PTC

DEACTIVATE PRIMARY EVAPORATOR
GLY EVAP H2O FLOW - OFF (CTR)
GLY EVAP STM PRESS AUTO - MAN
GLY EVAP STM PRESS INCR - INCR FOR 1 MIN

SELECT NORMAL LUNAR COMM EXCEPT:
S-BD AUX TAPE - OFF
TAPE RCDR FWD - OFF

GET 8 HRS F.O.V. 10°

PTC
P 90, Y 0EARTH
WEATHER
PHOTOGRAPHY

110H CANISTER CHANGE
(3 INTO A, STOW 1 IN B5) - 9:13:00

NOTES

③ 8+42
Case file #20

④ 9+03+12 #21
Quads No. 21

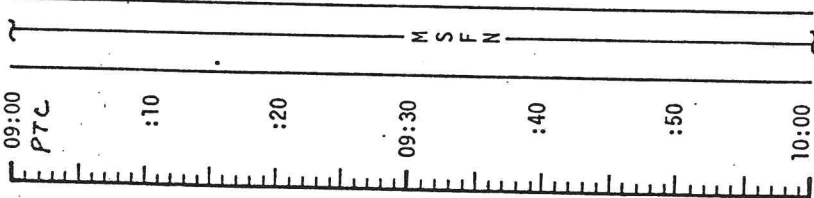
S-IVB MCC-2 APPROX
09:00 GET, ΔV IS
NOMINALLY ZERO

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	08:00 - 09:00	1/TLC	3-9

FLIGHT PLAN

2213 CST

MCC-M



125N07E
1331E
7E
E

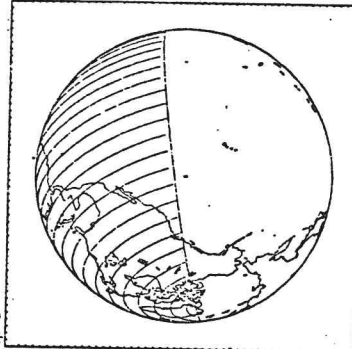
P23 V37 entered into
Confidence about 16 sec
optics started into

NOTES
Weather pass
9:26:13L
Counter #322

APS 11108C
~ 09:19
AVR 45 ops

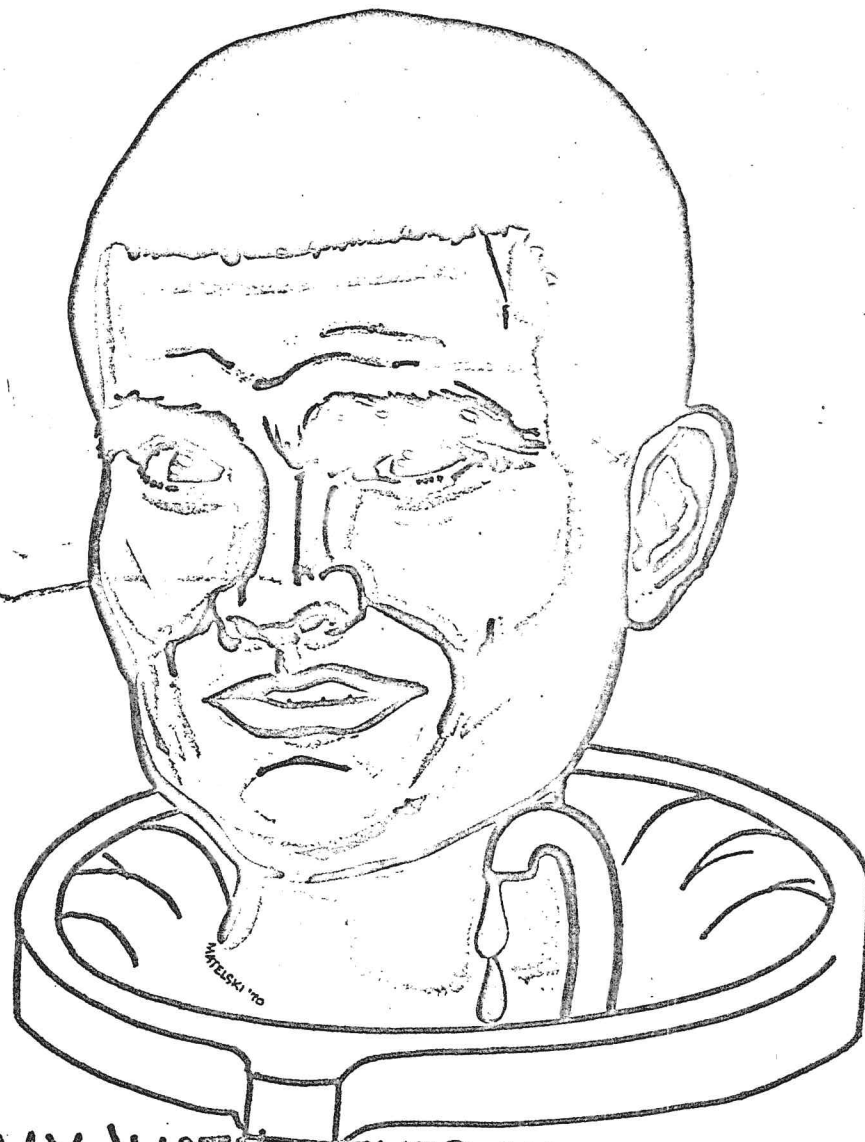
PTC
P 90, Y 0

GET 10 HRS F.O.V. 11°



EARTH
WEATHER
PHOTOGRAPHY

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL) A	MARCH 16, 1970	09:00 - 10:00	1/TLC	3-10

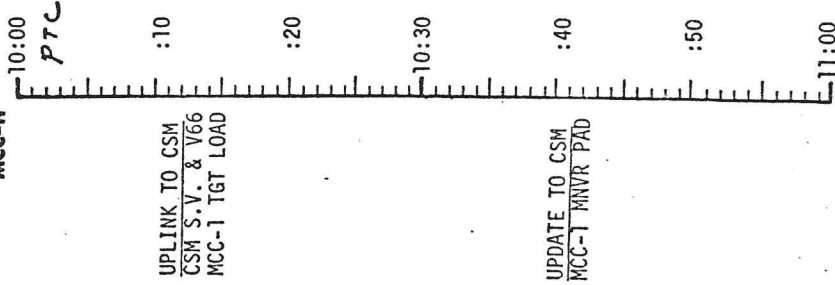


MY 'UCTA' NEVER SEEMS TO FILL!

FLIGHT PLAN

EMS ACCEL NULL BIAS TEST (REPORT) 10:1.8

2313 CST
MCC-H



NOTES

⑥ 9:47:11 Counter #23

⑦ 10:08:40 #24

⑧ 10:31:00 #25

⑨ 10:53:00 #26

P52 IMU REALIGN
N71: 20.27
N05: 0.00
N93: 0.00
X: -1.23
Y: -1.13
Z: -1.02
GET: 10:40:15

PTC
P 90, Y 0

EARTH WEATHER PHOTOGRAPHY

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	10:00 - 11:00	1/TLC	3-11

DETAILS:

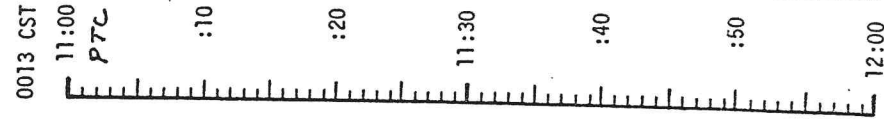
MCC-1
BURN TABLE

P OR Y RATES	ATT DEVIATION	SHUTDOWN TIME	RESIDUALS
10°/SEC TAKEOVER	±10° TAKEOVER	BT + 1 SEC	IF < 2FPS, TRIM X AXIS TO 0.2FPS IF > 2FPS, NO TRIM

TABLE 3-2
3-11A

MCC-H

FLIGHT PLAN



P30 - EXTERNAL ΔV

20101 if mcc
V49 - MNVR TO BURN ATT
P40/41 - SPS/RCS THRUST
SXT STAR CHECK

~~0₂ FUEL CELL PURGE~~ IF NOT PERFORMED
~~WASTE WATER DUMP~~ AT 06:55

GDC ALIGN

Limit

V66 - TRANSFER CSM SV TO LM SLOT
MCC-1 BURN STATUS REPORT

REPORT: LM/CM ΔP 1228
WASTE STORAGE VENT VLV - CLOSE (Δ8HRS FROM VENT)
VENT BATTS UNTIL SYSTEM TEST METER (4A) = 0

**EARTH WEATHER
PHOTOGRAPHY**

#10
11/15/00
Event #27

TIG: 11:41:25
BT: NOM. ZERO
ΔVR: NOM ZERO
ULLAGE: NONE
ORBIT: N/A

OT 11:37:20

anatomy 28

NOTES

[illegible]

*ITEMS TO BE
REPORTED TO MSFN
MCC-1 WILL BE
DELAYED TO MCC-2
IF PROPELLANT COST
IS NOT PROHIBITIVE

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	11:00 - 12:00	1/TLC	3-12

FLIGHT PLAN

0113 CST

MCC-H

UPDATE TO CSM
QUADS TO DISABLE
FOR PTC (LOWEST
QUANTITY PRPLNT)

MNVR TO PTC ATT P 90
Y 0

START PTC

:10

:20

12:30

EAT PERIOD

:40

:50

13:00

PRESLEEP CHECKLIST

PTC
P 90, Y 0

NOTES

ΔH for P23 off port 17km
Sub # Helium even 15 sec
min -

ONBOARD READOUT

BAT C	37
PYRO BAT A	37
PYRO BAT B	37
RCS A	94
B	95
C	93
D	96
DC IND SEL - MNA OR B	

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	12:00 - 13:00	1/TLC	3-13

MCC-H

0213 CST

FLIGHT PLAN

13:00

PTC

:20

:40

14:00

:20

:40

15:00

REST PERIOD
(10 HOURS)

PTC
P 90, Y 0

NOTES

DURING REST PERIOD
TWO CREWMEN IN
REST STATIONS AND
ONE IN COUCH

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	13:00 - 15:00	1/TLC	3-14

MCC-M

0413 CST

FLIGHT PLAN

NOTES



REST PERIOD
(10 HOURS)

PTC
P 90 Y Q

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	15:00 - 17:00	1/TLC	3-15



DETAILED

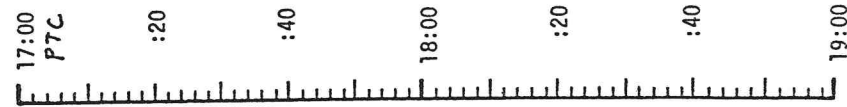


MCC-H

0613 CST

FLIGHT PLAN

NOTES



M S F N

REST PERIOD
(10 HOURS)

PTC
P 90 Y 0

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	17:00 - 19:00	1/TLC	3-16

FLIGHT PLAN

1213 CST

MCC-H

UPDATE TO CSM
CONSUMABLES
FLIGHT PLAN

23:00

PTC

:10

:20

23:30

:40

:50

24:00

POSTSLEEP CHECKLIST

LIQH CANISTER CHANGE
(4 INTO B, STOW 2 IN B5)

BATTERY CHARGE, BATTERY A

EAT PERIOD

PTC

P 90, Y 0

NOTES

CSM CONSUMABLES UPDATE

GET: 23:00

RCS TOTAL 1121

QUAD A 274 B 236

C 274 D 287

H₂ TOTAL 83%, 86%

O₂ TOTAL 87%, 87%

.65 psi

REPORT LM/CM ΔP

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	23:00 - 24:00	2/TLC	3-19

MCC-H

1313 CST

FLIGHT PLAN

24:00

PTC

:10

:20

24:30

:40

:50

25:00

P52 IMU REALIGN
OPTION 3 REFSMMAT
(PTC ORIENT)

REPORT GYRO TORQUING ANGLES

GDC ALIGN

NOTES

P52 IMU REALIGN

N71: 31.36

N05: 000.41

N93:

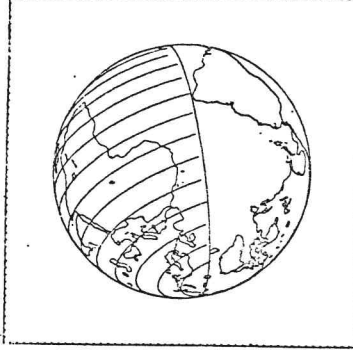
- X 00.283

- Y 00.161

+ Z 06.403

GET 023:47:30

GET 25 HRS F.O.V. 5°



PTC

P 90, Y 0

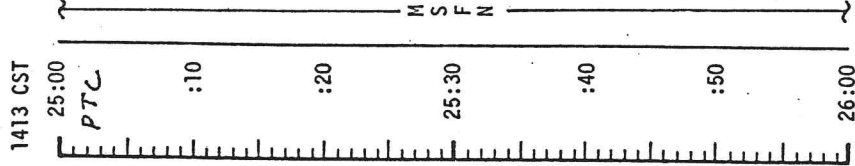
LMF put out on by self

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	24:00 - 25:00	2/TLC	3-20

FLIGHT PLAN

LAUNCH VEHICLE SYSTEMS
PERFORMANCE DEBRIEFING

SVI 25mg lost at 5:32



1. Were there any significant changes in noise level between stages of powered flight?
2. Were there any significant changes in noise/vibration level during a single stage of powered flight?
3. Were there any unexpected acceleration transients experienced at initiation of IGN, SII CECO, MAX Q or M/R shift for both SII and S-IVB?
4. After SC separation, describe the conditions of the IU thermal shroud. Was there any looseness?
5. How was ground/SC comm at ignition/liftoff time region relative to vibration and acoustic environments?
6. Describe any visible venting or suspected leak after separation.
7. When, and at what distance, was the S-IVB seen for the last time?
8. Are there any comments relative to S-IVB/IU TLI guidance cutoff conditions (predicted vs actual SC display)?

1. Curb say no light amp. my client wanted to make sure

2. Curb say no light amp. my client wanted to make sure

3. Curb say no light amp. my client wanted to make sure

4. Curb say no light amp. my client wanted to make sure

5. Curb say no light amp. my client wanted to make sure

6. Curb say no light amp. my client wanted to make sure

7. Curb say no light amp. my client wanted to make sure

8. Curb say no light amp. my client wanted to make sure

9. Curb say no light amp. my client wanted to make sure

10. Curb say no light amp. my client wanted to make sure

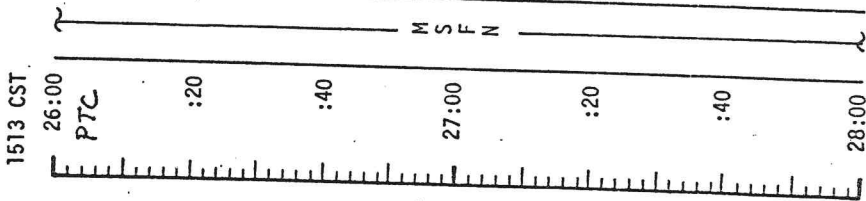
11. Curb say no light amp. my client wanted to make sure

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	25:00 - 26:00	2/TLC	3-21

D SVI 444 mg - vibration trans

FLIGHT PLAN

LAUNCH VEHICLE SYSTEMS
PERFORMANCE DEBRIEFING



1. Were there any significant changes in noise level between stages of powered flight?
2. Were there any significant changes in noise/vibration level during a single stage of powered flight?
3. Were there any unexpected acceleration transients experienced at initiation of IGN, SII CECO, MAX Q or M/R shift for both SII and S-IVB?
4. After SC separation, describe the conditions of the IU thermal shroud. Was there any looseness?
5. How was ground/SC comm at ignition/liftoff time region relative to vibration and acoustic environments?
6. Describe any visible venting or suspected leak after separation.
7. When, and at what distance, was the S-IVB seen for the last time?
8. Are there any comments relative to S-IVB/IU TLI guidance cutoff conditions (predicted vs actual SC display)?

1. Curb say no light amp. my client wanted to make sure

2. Curb say no light amp. my client wanted to make sure

3. Curb say no light amp. my client wanted to make sure

4. Curb say no light amp. my client wanted to make sure

5. Curb say no light amp. my client wanted to make sure

6. Curb say no light amp. my client wanted to make sure

7. Curb say no light amp. my client wanted to make sure

8. Curb say no light amp. my client wanted to make sure

9. Curb say no light amp. my client wanted to make sure

10. Curb say no light amp. my client wanted to make sure

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	26:00 - 28:00	2/TLC	3-22

D SVI 444 mg - vibration trans

DETAILS

FLIGHT PLAN

MCC-H

1713 CST



UPLINK TO CSM
GO/NO-GO MCC-2
MCC-2 TGT LOAD

UPDATE TO CSM
GO/NO-GO MCC-2
MCC-2 MNVR PAD

M S F N

EAT PERIOD

PTC
P90, Y 0

P52 - IMU REALIGN
OPTION 3 - REFSMAT
(PTC ORIENT)

REPORT GYRO TORQUING ANGLES
STOP PTC
EMS ACCEL NULL BIAS TEST (REPORT)
H₂ PURGE LINE HTS ON
P30 EXTERNAL ΔV

V4B (20101, 01111) Load wts
V49 - MNVR TO BURN ATT

R HGA
P P
V V

P52 IMU REALIGN
N71: 30.12
N05: 000.01
N93: X-00.084
Y-10.075
Z-40.0146
GET 027:00:30

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	28:00 - 30:00	2/TLC	3-23

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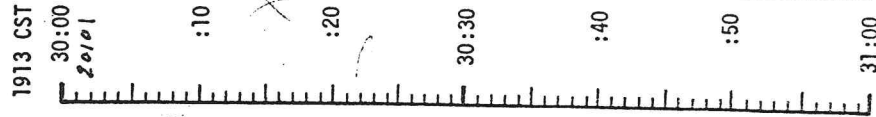
STUDY

MCC-2
BURN TABLE

P OR Y RATES	ATT DEVIATION	SHUTDOWN TIME	RESIDUALS
10°/SEC TAKEOVER	+10° TAKEOVER	BT + 1 SEC	IF<2FPS, TRIM X AXIS TO 0.2FPS IF<2FPS, NO TRIM

TABLE 3-3
3-23 A

NOTES



P40 - SPS THRUST ✓
SXT STAR CHECK ✓

TV (GDS) 30:15 TO 30:45
CM4/TV-AVG (f5.6)H₂ & O₂ FUEL CELL PURGE

WASTE WATER DUMP ✓

H₂ PURGE LINE HEATERS - OFF ✓

NOTE: MCC-2 WILL
BE ACCOMPLISHED
ON BANK A ONLY

GDC ALIGN

TLI CUTOFF
+ 28 HRS

MCC-2

V66 - TRANSFER CSM SV TO LM SLOT
MCC-2 BURN STATUS REPORT

TIG: 30:40:49
BT: 2.2 SEC
ΔVR: 15.1 FPS
ULLAGE: - NONE
ORBIT: N/A

*ITEMS TO BE
REPORTED TO MSFN

ATTITUDE FOR MCC-2
BURN IS CONSTRAINED
IN ROLL FOR HGA
ACQUISITION FOR TV
AND BY SXT STAR CHECK

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	30:00 - 31:00	2/TLC	3-24

DETAILED

FLIGHT PLAN

NOTES

3 MARKS EACH STAR

INCORPORATE P23
MARK DATA AND
UPDATE ONBOARD
STATE VECTOR

opt: +5927
Col: 15927

OMNI B

MNVR TO OPTICS CALIBRATION ATT R 147 P 340
P23-CISLUNAR NAVIGATION Y 0
OPTICS CALIBRATION STAR 4 0

P00 V49 - MNVR TO SIGHTING ATT R 136 P 307
STAR/EARTH HORIZON Y 0

P23 - CISLUNAR NAVIGATION Y 0
LOAD W MATRIX (R1 + 4 5 0 0 0) (R2 + 0 0 0 0 5)

1. STAR 37 EFH (R3 00120) NUNKI

2. STAR 221 ENH (R3 00110) DELTA CAPRICORNI
N88: (R1 +39954) (R2 -26599) (R3 -14003)

3. STAR 42 EFH (R3 00120) DELTA SAGITTARI
N88: (R1 +03605) (R2 -43220) (R3 -24861)

4. STAR 45 ENH (R3 00110) FORALHAUT ENIF GET 30 HRS F.O.V. 4°

5. STAR 77 EFH (R3 00120) KAUS AUST
N88: (R1 +03986) (R2 -41062) (R3 -28249)

STAR 37 Δx 1.2 Δy 0.0 Δz 0.5
STAR 221 Δx 0.5 Δy 10.3 Δz 1.5
STAR 42 Δx 1.0 Δy 0.8 Δz 0.5
STAR 44 Δx 3.7 Δy 3.6 Δz 2.1

STAR 45 Δx 0.0 Δy 0.0 Δz 0.0
STAR 77 Δx 0.0 Δy 0.0 Δz 0.0

omit wrong N88
readily corrected



H2(N01) lead
88 31:59:48

omit wrong N88
readily corrected

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	31:00 - 32:00	2/TLC	3-25

2113 CST

FLIGHT PLAN

NOTES

MCC-H
UPDATE TO CSM
QUADS TO DISABLE
FOR PTC (LOWEST
QUANTITY PRPLNT)

32:00
20101
PTC

MANEUVER TO PTC ATTITUDE P 90
START PTC V 0
S-BAND ANT - OMNI B ON MCC CUE

SECURE HGA
HGA TRACK - MAN
HGA PITCH -52°
HGA YAW 270°
CHECK BAT VENT (TEST METER 4A)

chk ability to darken s/c

R-101
P-090
Y-0

Beane # ?
Diablo Quads
Card D.

144 vented to 5 ft
-375 ft/sec

Have stable s/c
for photos

PTC
P 90 Y 0

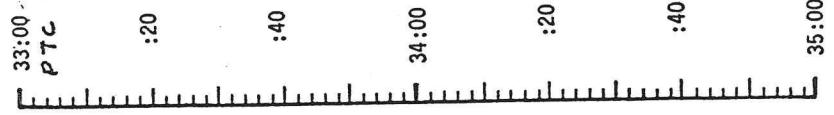
Diablo Card D

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (ADDT)	MARCH 16, 1970	32:00 - 33:00	2/TLC	3-26

FLIGHT PLAN

MCC-H

2213 CST



chk mounting of cameras
DAC ✓
FL ✓
SFO ✓
DC ✓
LTC ✓

NOTES

LOI MINUS 5 HR
 FLYBY IS A
 CIRCUMLUNAR
 TRAJECTORY TO THE
 PRI MPL AND
 WITH A PERILUNE
 BETWEEN 60 AND
 1500 NM.

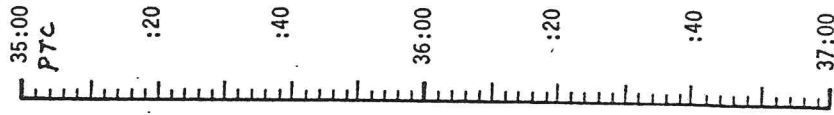
PTC
 P 90 Y 0

UPDATE TO CSM
 LOI MINUS 5 HR
 FLYBY

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	33:00 - 35:00	2/TLC	3-27

MCC-H

0013 CST



L10H CANISTER CHANGE ✓
 (5 INTO A, STOW 3 IN B5)

REPORT LM/CM ΔP — 0.9 psi

UPLINK TO CSM
 CSM S.V. & V66

EAT PERIOD

PRESLEEP CHECKLIST

NOTES

ONBOARD READOUT	
BAT C	37
PYRO BAT A	37
PYRO BAT B	37
RCS A	97 1/2
B	97
C	96
D	97
DC IND SEL - MNA OR B	

PTC
 P 90 Y 0

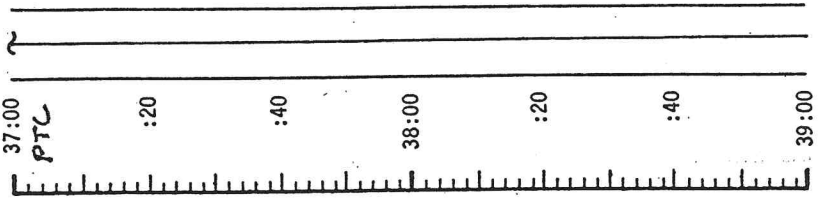
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	35:00 - 37:00	2/TLC	3-28

DETAILED

FLIGHT PLAN

MCC-H

0213 CST



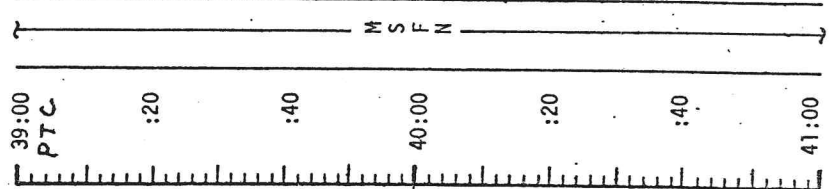
NOTES

DURING REST PERIOD
TWO CREWMEN IN
REST STATIONS AND
ONE IN COUCH

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	37:00 - 39:00	2/TLC	3-29

MCC-H

0413 CST



FLIGHT PLAN

NOTES

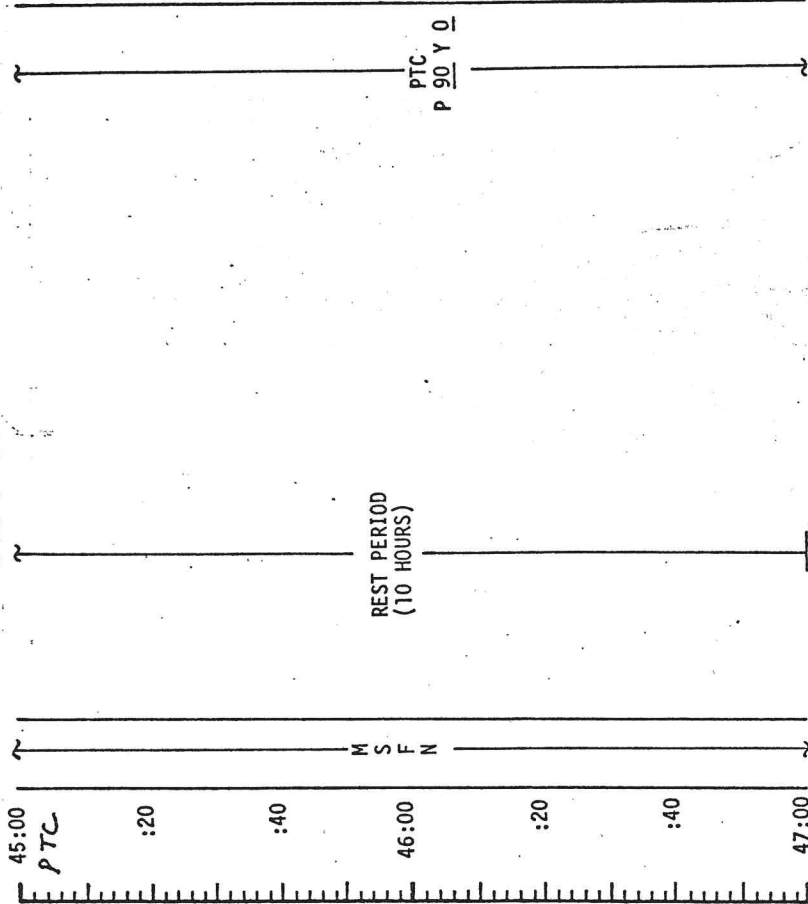
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	39:00 - 41:00	2/TLC	3-30

MCC-H

1013 CST

FLIGHT PLAN

NOTES



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	45:00 - 47:00	2/TLC	3-33

MCC-H

1213 CST

FLIGHT PLAN

CSM CONSUMABLES UPDATE	
GET:	47:00
RCS TOTAL	109.6
QUAD A	270 B 278
C	270 D 278
H ₂ TOTAL	16%
O ₂ TOTAL	81%

POST SLEEP CHECKLIST

EAT PERIOD

L10H CANISTER CHANGE
(6 INTO B, STOW 4 IN B5)

REPORT LM/CM ΔP 1.0 psi

H₂ tank pressure off at 47:42 P 90 Y 0

NOTES

RAD - Reading 02026
Step - CDE - 5th
CMP - 6th
LMP - 9th
O₂ No 2 tank pressure failed after
Cup battery -

UPDATE TO CSM
CONSUMABLES
FLIGHT PLAN

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	47:00 - 49:00	3/TLC	3-34

MCC-H

FLIGHT PLAN

before coming out of gyro, always SRT and call up 16 N91
all of jitter caused by gyro slow

NOTES

P52 - IMU REALIGN
OPTION 3 - REFSMMAT
(PTC ORIENT)

P52 IMU REALIGN

N71: 23.3 2-

N05: 000.000

N93:

X+000.785

Y+000.011

Z+000.131

GET 49:09:35

REPORT GYRO TORQUING ANGLES

GET 50 HRS F.O.V. 3°



P52 plumb line
case photo log
formal.

Bennett's Comet

H₂M₂ Nester S/LH₂M₂ Nester auto

optics per 27/49154

PTC
P 90 Y 0

Heise took one hour to share
suggest a band for him next time.

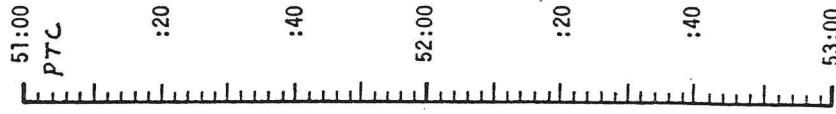
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	49:00 - 51:00	3/TLC	3-35

MCC-H

1613 CST

FLIGHT PLAN

NOTES



EAT PERIOD

- Batt charge (B)

Lm Taseel vent valve

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	51:00 - 53:00	3/TLC	3-36

MCC-H

FLIGHT PLAN

1813 CST

53:00
PTC

:20

:40

54:00

:20

:40

55:00

M S F N

UPLINK TO CSM
CSM S.V. & V66
MCC-3 TGT LOAD
UPDATE TO CSM
GO/NO-GO MCC-3
MCC-3 MNVR PAD

Start 1m entry jnr. (57.00)

*Do not
P52 - IMU REALIGN
OPTION 3 REFSMAT
(PTC ORIENT)*

CONTINUE PTC IF MCC-3 IS NOT PERFORMED
REPORT GYRO TORQUING ANGLES

P90 EXTERNAL AV O2

PTC
P 90, Y 0

FUEL CELL PURGE AND
WASTE WATER DUMP
SCHEDULED AT 55:08
WILL BE DELAYED
TO 57:50 IF MCC-3
IS NOT PERFORMED.

P52 IMU REALIGN
N71: ---
N05: ---
N93: ---

*Don't X
57:50
WASTE WATER DUMP
at 57:08
F.C. PURGE
W GET*

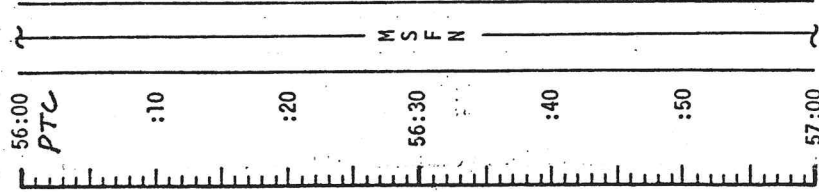
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	53:00 - 55:00	3/TLC	3-37

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FLIGHT PLAN

MCC-H

2113 CST



NOTES

LUNAR PHOTOGRAPHY
AT CREW OPTION
CM/EL/80 or 250/BW-
RING(f5.6,250,∞)10
MAG P
CM/EL/80 or 250/CEX-
RING(f5.6,250,∞)10
MAG L

PTC
P 90, Y 0

PTC

PS2 (option 3)

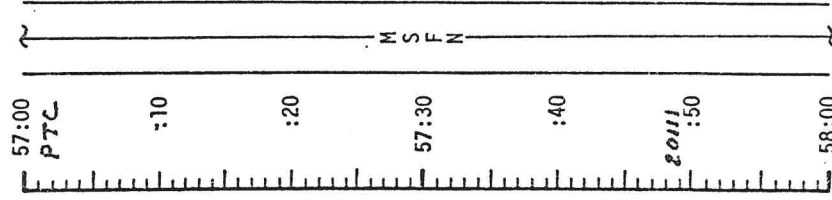
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	56:00 - 57:00	3/TLC	3-39

Old activities in support of
LM UT moved to 3 hrs.

MCC-H

UPLINK TO CSM
ΔH (IF REQUIRED)

2213 CST



FLIGHT PLAN

Do at 59:00

PRESSURIZE CSM TO 5.7 PSIA
PRESSURIZE LM

T EPHM: V05N01 1706E
COPY IN LM ACTIVATION CHECKLIST (ACT 33)

R 00011
R 05253
R 33366

PTC
P 90, Y 0

CLEAR TUNNEL OF
CM HATCH
INSPECT TUNNEL &
DOCKING LATCHES
REMOVE PROBE & DROGUE

TV (GDS) 58:00 TO 58:30
CM TV-AVG (f5.6)

LOAD DAP, N46 (22111, 11111)

STOP PTC ROLL AT 22:05.

MCA-P 21 Y 170
23 267

NOTES

ΔH DETERMINED
FROM STAR/EARTH
HORIZON SIGHTINGS
WILL BE UPLINKED
IF IT DIFFERS FROM
ΔH IN E-MEMORY
BY MORE THAN 5.0 KM

O2 FUEL CELL PURGE
& WASTE WATER DUMP
@ 57:50 IF NOT
PERFORMED AT 55:08

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	57:00 - 58:00	3/TLC	3-40

FLIGHT PLAN

MCC-H

LM

CSM

CMP

2313 CST

58:00

58:10

58:20

58:30

58:40

58:50

59:00

TEMPORARILY STOW
PROBE & DROGUE

ACTIVATION CHECKLIST

LMP

OPEN LM HATCH
RECORD AND REPORT DOCKING
TUNNEL INDEX ANGLE
IVT TO LM

IVT TO LM

ASSIST CDR

Transfer film and data package.

LM
FAMILIARIZATION

LM
FAMILIARIZATION

v40 (2010, 1111)

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	58:00 - 59:00	3/TLC	3-41

FLIGHT PLAN

CSM

CMP

MNVR TO PTC ATTITUDE
START PTC
S-BAND ANT-OMNI B
(ON MCC CUE)
SECURE HGA

PTC
P 90 Y 0

0013 CST

59:00

PTC

:10

:20

59:30

:40

:50

60:00

CDR

LM
FAMILIARIZATION

LM

LMP

LM
FAMILIARIZATION

IVT TO CSM

IVT TO CSM

CLOSE LM HATCH

CMP:
INSTALL PROBE AND DROGUE
INSTALL CM HATCH
LM TUNNEL VENT VALVE - LM/CM ΔP

FLIGHT PLAN

MCC-H

UPDATE TO CSM
QUADS TO DISABLE
FOR PTC (LOWEST
QUANTITY PRPLNT)

Bennett?
Shot down in line
per FC #1

Close West, right
FC #3

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	59:00 - 60:00	3/TLC	3-42

MCC-H

FLIGHT PLAN

0113 CST

60:00

PTC

:10

:20

60:30

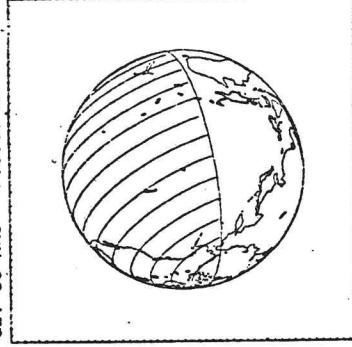
:40

:50

61:00

L10H CANISTER CHANGE
(7 INTO A, STOW 5 IN B6)

GET 60 HRS F.O.V. 3°



M S F N

EAT PERIOD

PTC
P 90, Y 0DURING REST PERIOD
TWO CREWMEN IN
REST STATIONS AND
ONE IN COUCH.

NOTES

ONBOARD READOUT

BAT C _____
 PYRO BAT A _____
 PYRO BAT B _____
 RCS A _____
 B _____
 C _____
 D _____

DC IND SEL - MNA OR B

PRESLEEP CHECKLIST

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	60:00 - 61:00	3/TLC	3-43

MCC-H

FLIGHT PLAN

0213 CST

61:00

PTC

:20

:40

62:00

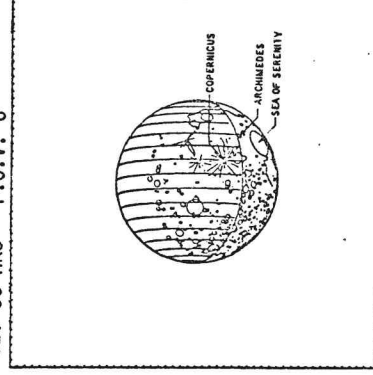
:20

:40

63:00

REST PERIOD
(9 HOURS)

GET 60 HRS F.O.V. 6°

PTC
P 90, Y 0

NOTES

CSM

Panel 5 - 1m PMN open
 1m PMN over rest and release

11 and 16 Trans Luner from the close
 16 ASE 13CA contact closed
 18 Dec 13RA contact closed
 14 Batt the normal feed on
 Batt 1, 2, 3, 4 over rest top
 normal feed off
 Batt 1, 2, 3, 4 normal feed off

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	61:00 - 63:00	3/TLC	3-44

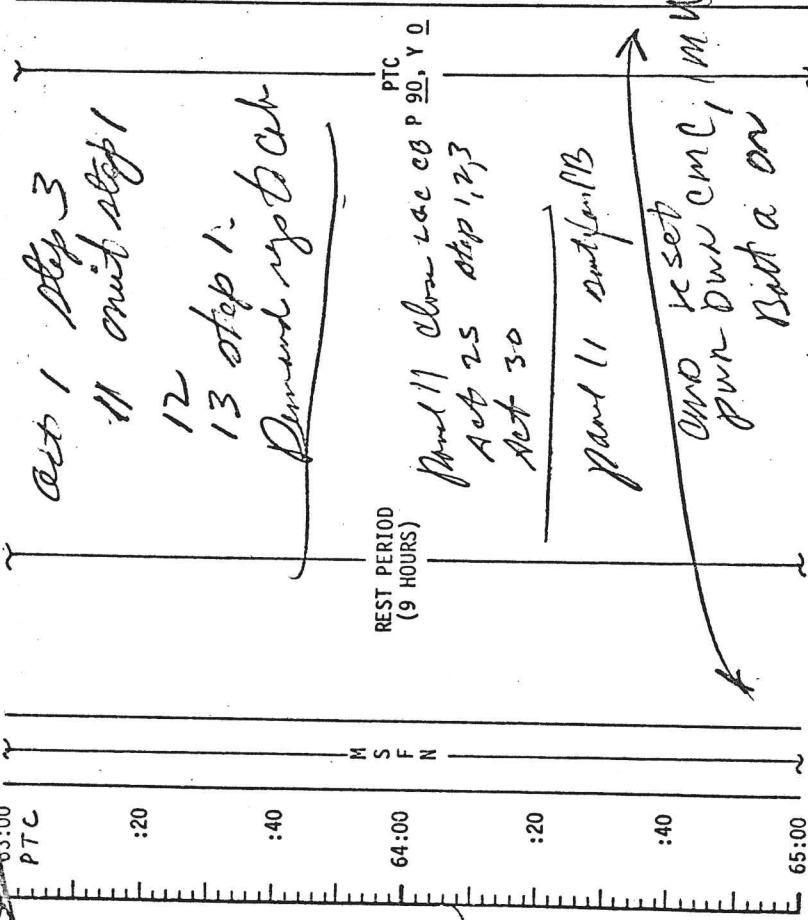
MCC-H

0413 CST
03:00

FLIGHT PLAN

NOTES

1:10

Imp ~~SL~~

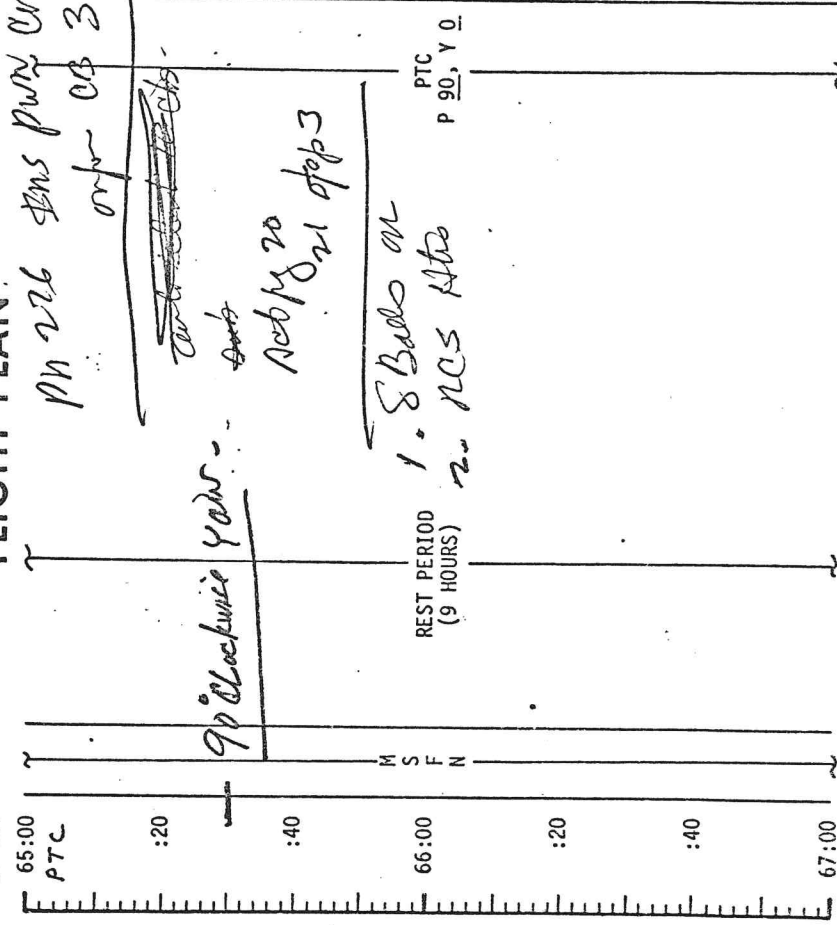
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	63:00 - 65:00	3/TLC	3-45

MCC-H

0613 CST

FLIGHT PLAN

NOTES

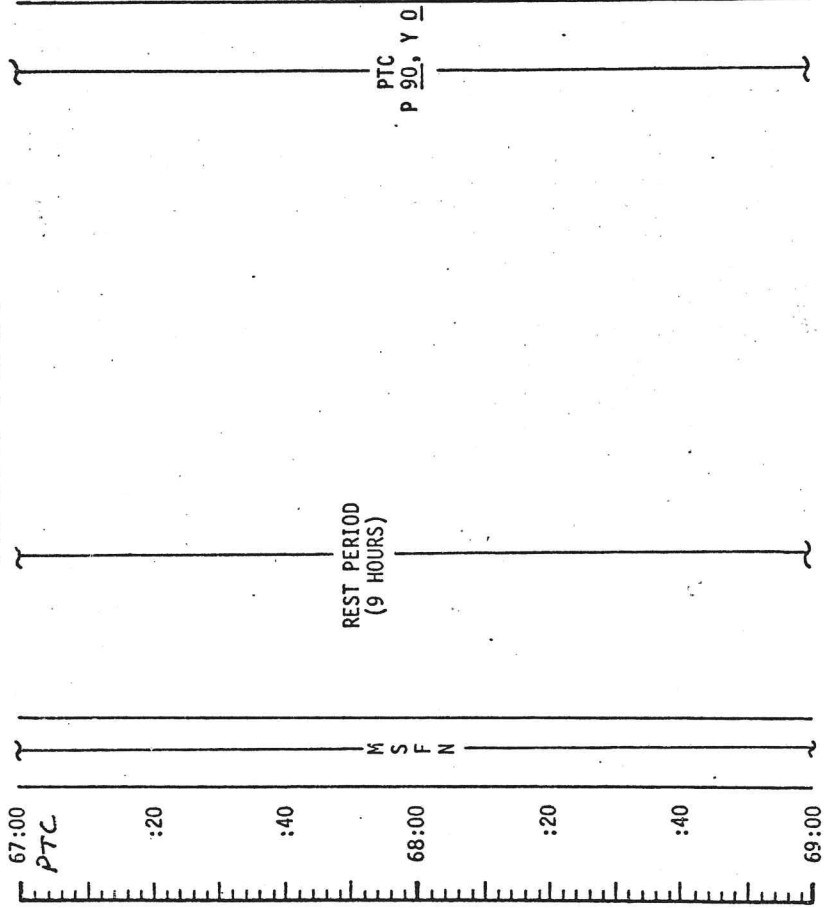


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	65:00 - 67:00	3/TLC	3-46

MCC-H

FLIGHT PLAN

0813 CST



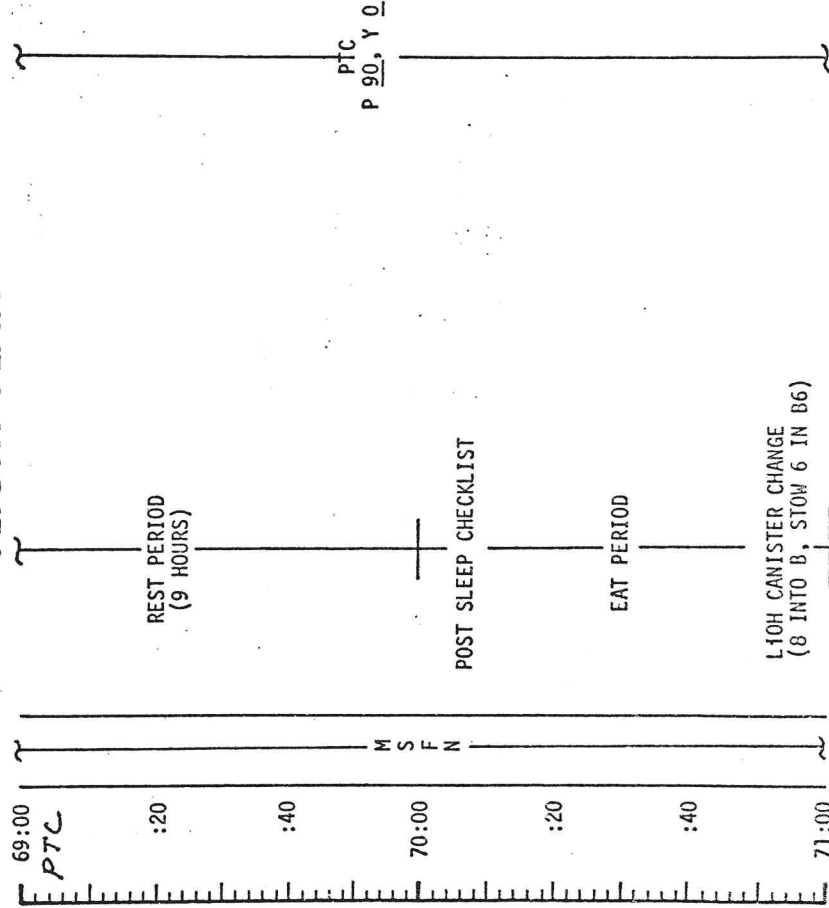
NOTES

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	67:00 - 69:00	3/TLC	3-47

MCC-H

FLIGHT PLAN

1013 CST



NOTES

IF MCC4 IS NOT
PERFORMED, CREW
AWAKE TIME IS
73 HRS.

CSM CONSUMABLES UPDATE	
GET: ---:---	---
RCS TOTAL	---
QUAD A	B ---
C	D ---
H ₂ TOTAL	---
O ₂ TOTAL	---

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	69:00 - 71:00	3-4/TLC	3-48

MCC-H

UPLINK TO CSM
CSM S.V. & V66
MCC-4 TGT LOAD

UPDATE TO CSM
MCC-4 MNVR PAD
CONSUMABLES
FLIGHT PLAN
PERICYNTHION +2HR
ABORT PAD

FLIGHT PLAN

1213 CST



P52 IMU REALIGN
OPTION 3-REFSMAT
(PTC ORIENT)

REPORT GYRO TORQUING ANGLES STOP PTC AT
BURN ROLL ATT

P30 EXT. ΔV MCC 4

LOAD DAP, N46 (20101,01111) MCC 4 only

V49 MNVR TO BURN ATT

NOTES

PERICYNTHION +2 HR
ABORT PAD TARGETED
FOR A FAST RETURN
TO MPL.

P52 IMU REALIGN	
N71:	---
N05:	---
N93:	---
X	---
Y	---
Z	---
GET	---

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	71:00 - 72:00	4/TLC	3-49

Paul 11

- 1) top row - overall close.
- 2) second row - close 1st - close 1st 6-10 left of too volume - open all from there on.
- 3) low row

4) new

open 1st 5
close 1st - 10
close att div
close actw Pans
Seg Cond 1
open all others
close 1st 5
open cabin fan!
close 3 physical pump ch
open all from 1st 5
open all

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close IMU slowly
1 MW open

1575 - open X two bad loads
open One A sea
One A sea Cont

FLIGHT PLAN

MCC-4
BURN CHART

P OR Y RATES	ATT DEVIATION	SHUTDOWN TIME	RESIDUALS
10°/SEC TAKEOVER	±10° TAKEOVER	BT + 1 SEC	TRIM X AXIS ONLY TO 1.0 FPS

TABLE 3-5
3-49A

MCC-H

1313 CST

72:00
PTC

:10

LOI - 5 HRS

GDC ALIGN

M S F N

72:30

:40

:50

73:00

FLIGHT PLAN

P40/41 - SPS/RCS THRUST
SXT STAR CHECK

TIG: 72:24:53
BT: NOM ZERO
ΔVR: NOM, ZERO
ULLAGE: N/A
ORBIT: N/A

V66-TRANSFER CSM SV TO LM SLOT
MCC 4 BURN STATUS REPORT
REPORT LM/CM ΔP

LOAD DAP, N46 (20111, 01111)
BATTERY CHARGE, BATTERY A

NOTES

BURN STATUS REPORT		ΔTIG	BT	V gx										
X	X													
X	X													
TRIM					R	P	Y	V gx	V gy	V gz	ΔV C	FUEL *	OX *	UNBAL
X	X	X			X	X	X					X	X	X
X	X	X			X	X	X					X	X	X
X	X	X			X	X	X					X	X	X

*ITEMS TO BE
REPORTED TO MSFN

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	72:00 - 73:00	4/TLC	3-50

MCC-H

1413 CST

FLIGHT PLAN

PRE LOI SEC GLY LOOP CHECK

ECS IND SW - SEC

SEC GLY TO RAD VLV - NORM

SEC COOL LOOP PUMP - ACT

GLY DISCHARGE SEC PRESS-39-51 PSIA

ACCUM SEC QTY IND-30-55%

SEC EVAP TEMP OUT - DECREASE

(VERIFY FLOW)

SEC COOL LOOP PUMP - OFF (CTR)

SEC GLY TO RAD VLV - BYPASS

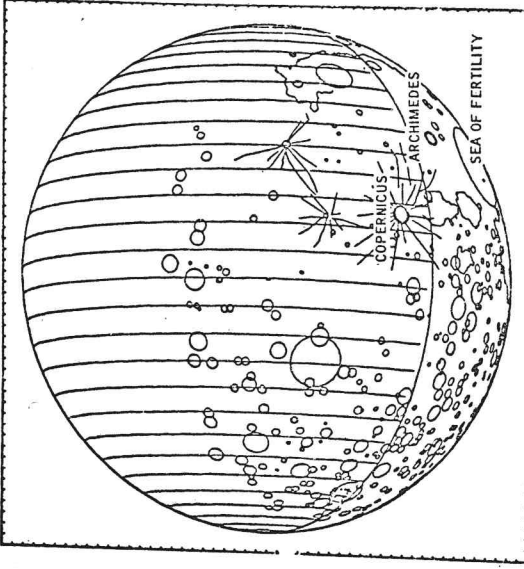
ECS IND SW - PRIMARY

*Go back and
chk items since
69:00*

NOTES

IF NO MCC-4, CREW
WILL BE AWAKENED
AT 73:00. THE
CREW WILL PICK
UP THE P52 AND
BAT CHARGE NOM-
INALLY SCHEDULED
AT 71:20 AND
72:37 RESPECTIVELY
AND PROCEED WITH
SCHEDULED ACTIVITIES
AT 73:00.

GET 72 HRS F.O.V. 6°

73:00
PTC
2011

RELONG DAY - 3112D

PWR UP CDA FDAI

P-52 - SWN CHECK

PRESSURIZE CSM TO 5.4 PSI

CHECK SPD ALIGNMENT

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	73:00 - 74:00	4/TLC	3-51

MCC-H

1513 CST

FLIGHT PLAN

NOTES

74:00

2011

:10

:20

74:30

2011

:50

2011

75:00

UPLINK TO CSM
CSM S.V. & V66
(PRELIMINARY)
LOI TGT LOAD
(PRELIMINARY)
DESIRED ORIENTATION
(LDG SITE)

UPDATE TO CSM
LOT MNRV PAD
(PRELIMINARY)
TEI 1 & 4 PAD

PRESSURIZE LM

(IN CASE OF LOT ABORT)

LM TUNNEL VENT VALVE - OPEN UP

CHECK MISSION TIMER AGAINST ENG CLOCK

*121 NOIE
3011E
99E*

MNRV TO MOON VIEW ATT (74:25) - 369 R - 0 HGA
711 P - 073 P - 69 - 9-30
(WATCH WINDOW)

320 Y - 0 Y - 0 2 83

FDAI θ 083°
 ψ 060°
 κ 272°

*V49 R+27100
R+35500
R+33000*

TEI 1 & 4 PADS
ASSUMES NO DOI

V48 (20101, 11111)

P52 IMU REALIGN
OPTION 1 - PREFERRED
(LDG SITE ORIENT)
GYRO TORQUE

REPORT GYRO TORQUING ANGLES
V48 (20111, 11111)

STARS

SA

TA

P52 IMU REALIGN

N71: ---
N05: ---
N93: ---
X ---
Y ---
Z ---
GET ---

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	74:00 - 75:00	2/TLC	3-52

MCC-H

FLIGHT PLAN

NOTES

LUNAR PHOTOGRAPHY
AT CREW OPTION
CM-/EL/80 or 250/BW-
RING(f5.6,250,∞)10
MAG P
CM-/EL/80 or 250/CEX-
RING(f5.6,250,∞)10
MAG L

MNVR TO BURN ATT
EXCEPT FOR ROLL
(75:40)
90
R 180 HGA
P 272 P -88
Y 357 Y 172

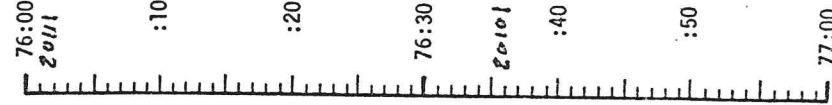
MAP UPDATE REV 1
LOS :
180° :
AOS :

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	75:00 - 76:00	4/TLC	3-53

MCC-H

UPDATE TO CSM
SUBSOLAR POINT
REV 1
LOI MNVR PAD
UPLINK TO CSM
CSM S.V. & V66
LOI TGT LOAD

1713 CST



FLIGHT PLAN

PRE LOI SYSTEMS CHECKS:
C&W CHECK
CM RCS CHECK
SM RCS CHECK
SPS PERIODIC MONITOR
ECS PERIODIC MONITOR
EMS ΔV AND ACCEL NULL BIAS TEST (REPORT)
VERIFY PUGS - INCREASE

P30-EXT ΔV
P40-SPS THRUST
LOAD DAP N46 (20101) (01111)
ROLL TO BURN ATT
(76:40)
OMNI D
SXT STAR CHECK
R 0
P 272
Y 357

NOTES

SUBEARTH POINT
REV 1
3.215W
0.868N

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	76:00 - 77:00	4/TLC	3-54

FLIGHT PLAN

LOI
BURN TABLE

P OR Y RATES	ATT DEVIATION	SHUTDOWN TIME	RESIDUALS
10°/SEC TAKEOVER	+10° TAKEOVER	BT + 10 SEC	DO NOT TRIM

TABLE 3-6
LOI ABORT TABLE

MODE I (DPS ONLY)	MODE II (DPS ONLY)	MODE III (DPS ONLY)
0-1 MIN 45 SEC ΔV_m 0-750 (TIGHT)	1 MIN 45 SEC TO 2 MIN 50 SEC ΔV_m 750-1245 (LOOSE)	3 MIN 50 SEC 5 MIN 57 SEC (CUTOFF) ΔV_m 1700-2815 (TIGHT)
LOI + 2 HR. MCC-H TARGET OR CREW CHART (NO COMM)	DPS_1 @ LOI + 2 HR DPS_2 @ LOI + 1 REV MCC-H TARGET	DPS @ LOI + 1 REV MCC-H TARGET

TABLE 3-7

3-54B

REVISION A

TIGHT SPS LIMITS
FUEL - OXID DELTA P GREATER THAN 20 PSI
CONFIRMED BY LOW PC
PROP TANK PRESS LESS THAN 160 PSI CON-
FIRMED BY LOW PC
PC LESS THAN 80 PSI OR DECAYS 10 PSI
DURING THE BURN
ANY BALL VALVE FAILS TO OPERATE, OR
CLOSES PREMATURELY, SHUT DOWN THE
GOOD BANK AND (A) IF THRUST CEASES-
ABORT (B) IF THRUST CONTINUES-
REENABLE BOTH BANKS AND CONTINUE

NOTE: IF THE FIRST BANK SELECTED FAILS TO
OPERATE UNDER G & N CONTROL, ATTEMPT
TO START THAT BANK UNDER SCS CONTROL.
IF THE BANK STARTS UNDER SCS CONTROL,
CONTINUE THE BURN AND EVALUATE G & N
STEERING. IF THE BANK FAILS TO START
UNDER SCS CONTROL, INHIBIT LOI.

LOOSE SPS LIMITS

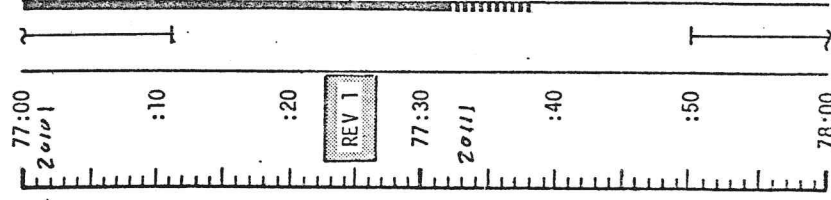
PC LESS THAN 70 PSI CONFIRMED BY OTHER
CUES
PROP TANK PRESS LESS THAN 115 PSI CONFIRM-
ED BY LOW PC

PHYSIOLOGICAL INDICATIONS OF ERRATIC
ENGINE PERFORMANCE (VIBRATION, POPPING,
ETC.)

FLIGHT PLAN

MCC-H

1813 CST



VERIFY DSE MOTION AT LOS

GDC ALIGN

LOI

V66 TRANSFER CSM SV TO LM SLOT
V40 2011, 1111

SET ORBITAL (~1157m)

MNVR TO COMM ATT (77:45)

DUMP DSE

LOI BURN STATUS REPORT

BURN STATUS REPORT		NOTE	
X	X	ΔTIG **	
X	X	BT**	
		V gx	
		R	
		P	
		V	
		V gx	
		V gy	
		V gz	
		ΔV C	
X	X	FUEL *	
X	X	OX *	
X	X	UNBAL	

NOTE: LOI will be
started on BANK B.
BANK A will be turned
on 2 to 5 sec after
ignition

TIG: 77:24:53
BT: 5 MIN 56.5 SEC
ΔVR: 2815.3
ULLAGE: NONE
ORBIT: 168.3 x 57.0

R 0 HGA
P 160 P -24
Y 0 Y 180

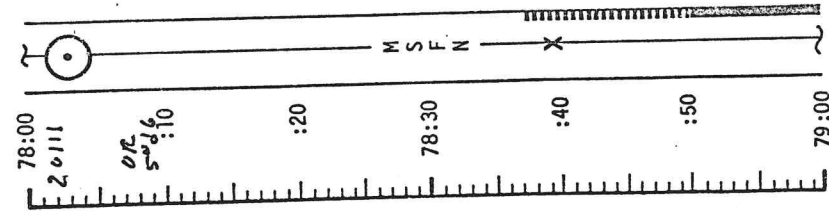
* ITEMS TO BE
REPORTED TO MSFN
** REPORT IF OFF
MORE THAN ONE
SECOND
*** REPORT IF >0.2 FPS
S-IVB LUNAR IMPACT
(GET 77:48) LAT 2-6°S,
LONG 27-7°W 30.0

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	77:00 - 78:00	4/1	3-55

MCC-H

1913 CST

FLIGHT PLAN



NOTES

A HEAVY LINE UNDER A PITCH ATTITUDE (P 215/) INDICATES AN ORDEAL (L/H) ANGLE.

MAP UPDATE REV	2
LOS	:
180°	:
AOS	:

MAP UPDATE REV 2

LOS :
180° :
AOS :

V64 ACQUIRE MSFN

EAT PERIOD

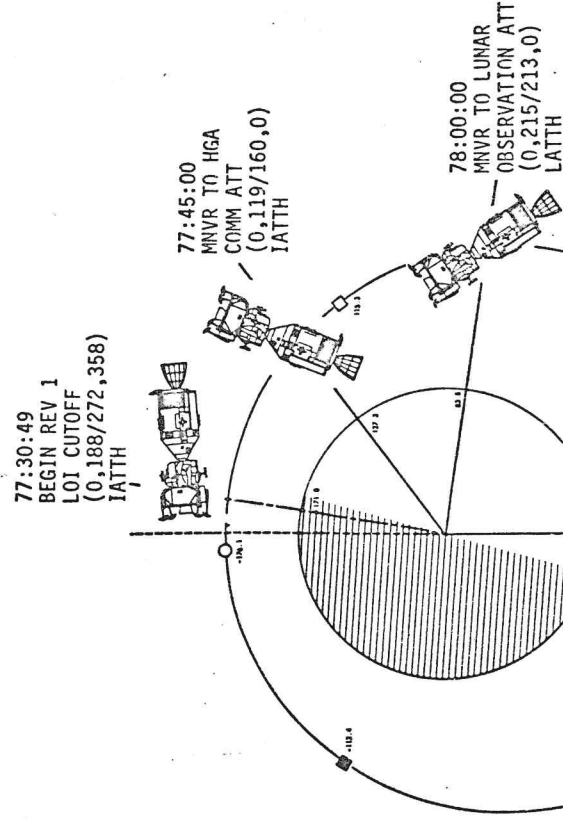
UPDATE TO CSM
LDMK TRK PAD REV 2

MSFN

P52 op 13

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	78:00 - 79:00	4/1	3-56

REV 1



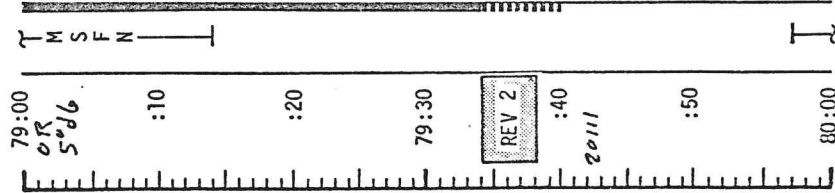
LEGEND:

□	MSFN AOS, LOS
○	S/C SUNRISE, SUNSET
⊕	SUBEARTH POINT
(R,LHP/INP,Y)	
IATTH	INERTIAL ATTITUDE HOLD
LATTH	LOCAL ATTITUDE HOLD

REVISION A

MCC-H

2013 CST



LOI + 2 HRS

FLIGHT PLAN

H₂ PURGE LINE HTRS-ON

VERIFY DSE MOTION AT LOS

CONFIGURE FOR NORMAL LUNAR COMM
S-BD AUX TAPE - DN VOICE BU
TAPE RCDR FWD - FWD

H₂ & O₂ FUEL CELL PURGE
WASTE WATER DUMP
H₂ PURGE LINE HTRS - OFF

Stop 0.6 rate at p=302

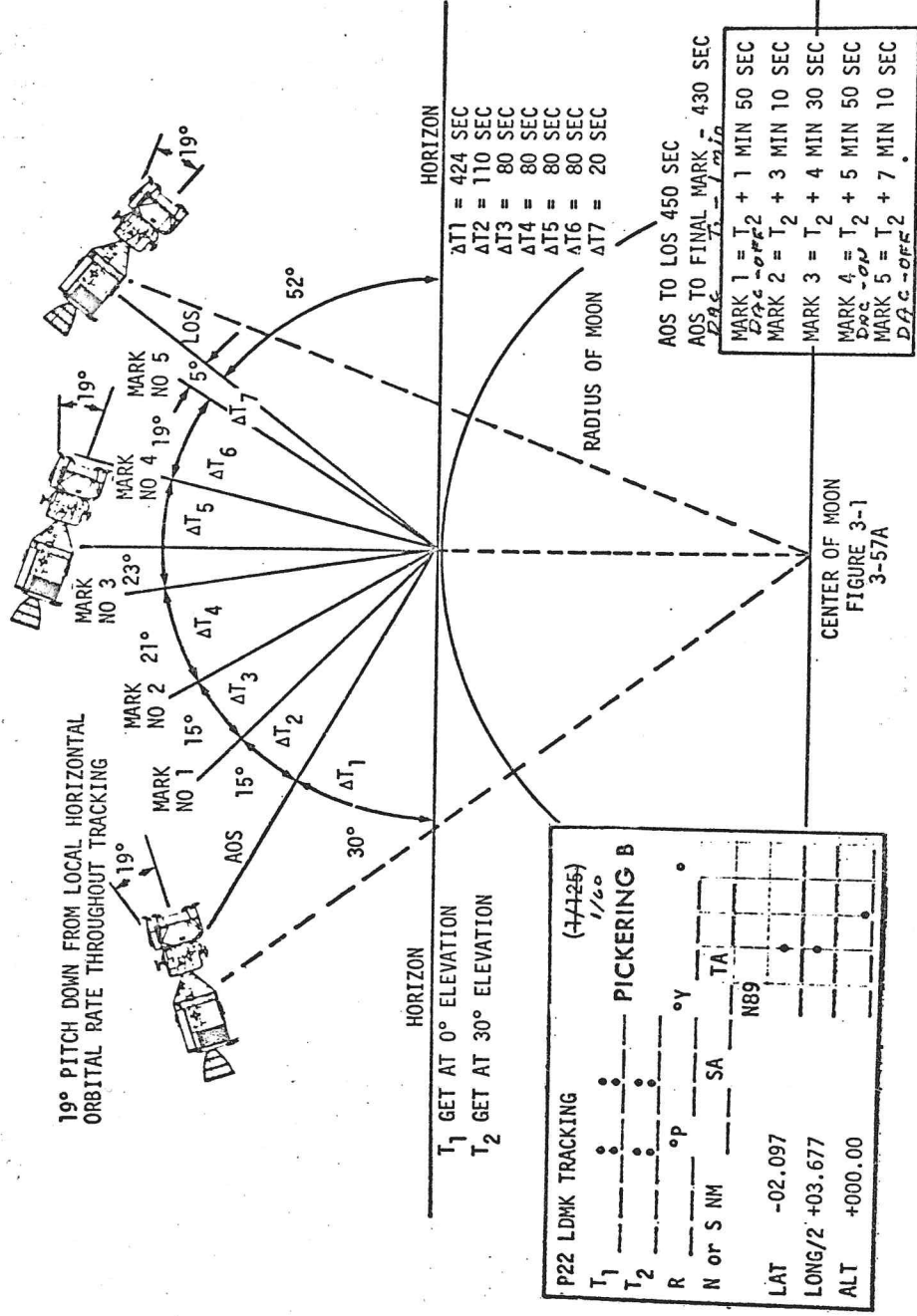
lock for 211 rays

OMNI D

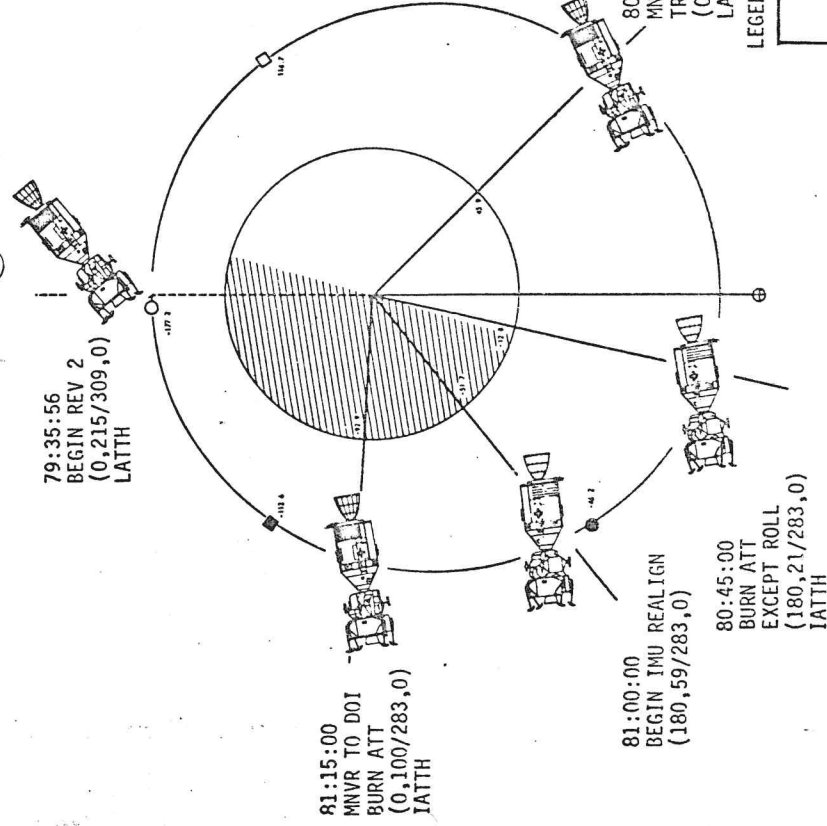
NOTES

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	79:00 - 80:00	4/2	3-57

CSM LANDMARK TRACKING PROFILE (60 x 170NM ORBIT)



REV 2



79:35:56
BEGIN REV 2
(0,215/309,0)
LATTH

81:15:00
MNVR TO DOI
BURN ATT
(0,100/283,0)
LATTH

80:45:00
BURN ATT
EXCEPT ROLL
(180,21/283,0)
LATTH

80:22:00
MNVR TO LDMK
TRKNG ATT
(0,341/302,0)
LATTH

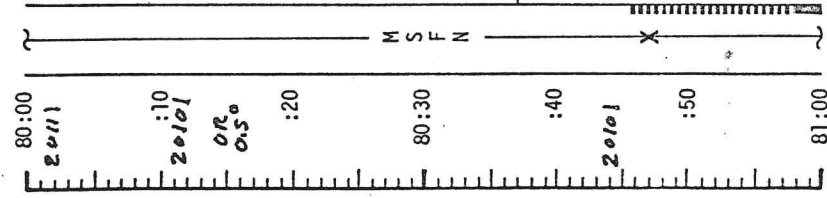
LEGEND:

- MSFN AOS, LOS
- S/C SUNRISE, SUNSET
- ⊕ SUBEARTH POINT

(R,LHP/INP,Y).
LATTH - INERTIAL ATTITUDE HOLD
LATTH - LOCAL ATTITUDE HOLD

MCC-H

2113 CST



MSFN
RECORD PCM LBR ON
DSE DURING P22

DUMP DSE
UPLINK TO CSM
CSM S.V. & V66
DOI TARGET LOAD

UPDATE TO CSM
DOI MNVR PAD &
AOS TIME
TEI 5 PAD
H-2 TIMES

FLIGHT PLAN

V48 (20101,11111)
MNVR TO LDMK TRK ATT (80:22)
60 ORB RATE V77 -0.0507
+0000.50
+1111.1/60
CM/DAC/SXT/CEX - (FIXED, 1/25, FIXED) 1 fps
MAG C % FILM

OMNI D
R 0
P 341/302
Y 0

START DAC @ T2-1 MIN
STOP DAC AFTER MARK 1
LDMK IS AT 23°
SUN ANGLE
START DAC AFTER MARK 4
STOP DAC AFTER MARK 5

D12
TRACK LDMK PICKERING B
80 SEC BETWEEN MARKS
5 MARKS
DO NOT PRO ON FINAL N89

MNVR TO BURN ATT R 180 HGA
EXCEPT FOR ROLL P 283 P -83 ?
BY 80:45 Y 0 Y 2 ?

LOAD DAP FOR TWO JET ULLAGE
(20111) (11111)

CMP - PRE DOI SYSTEMS CHECKS
C&W CHECK
CM RCS CHECK
SPS PERIODIC MONITOR CHECK
ECS PERIODIC MONITOR CHECK

EMS AV AND ACCEL NULL
BIAS TEST (REPORT)

MAP UPDATE REV 3
LOS : : : :
180° : : : :
AOS : : : :
P52 IMU REALIGN
N71: : : :
N05: : : :
N93: : : :
X : : : :
Y : : : :
Z : : : :
GET : : : :

TEI 5 PAD
ASSUMES NOMINAL
DOI ACCOMPLISHED

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL) 5	MARCH 16, 1970	80:00 - 81:00	4/2	3-58

MSC Form 20 (May 60)

FLIGHT PLANNING BRANCH

FLIGHT PLAN

DOI
BURN TABLE

P OR Y RATES	ATT DEVIATIONS	SHUTDOWN TIME	RESIDUALS
10°/SEC TAKEOVER	+ 10° TAKEOVER	BT + 1 SEC	TRIM X TO WITHIN 1 FPS * DO NOT TRIM Y & Z

*IF OVERBURN IS >2.2 FPS PITCH 180 AND TRIM RCS IF <10, SPS IF ≥10.

AT AOS AFTER DOI, THE REQUIREMENT FOR THE BAILOUT MANEUVER WILL BE DETERMINED BY EVALUATION OF THE THREE TRAJECTORY MONITORING SOURCES. THESE SOURCES--PGNS, EMS, AND MSFN--WILL BE EXAMINED WITH THE FOLLOWING CRITERIA:

1. IF MSFN RADAR DATA IS VALID AND REASONABLE, A STAY VOTE FROM MSFN IS REQUIRED TO REMAIN IN THE LOW ORBIT.

2. IF MSFN RADAR DATA IS INVALID OR UNAVAILABLE, THE FOLLOWING CRITERIA APPLIES:
A. 2 OUT OF 2 STAY VOTES REQUIRED TO REMAIN IN THE LOW ORBIT.
B. 1 OF 1 STAY VOTE REQUIRED TO REMAIN IN THE LOW ORBIT.

- (1) THE EMS VOTE IS NO STAY IF THE EMS INDICATES A 12FPS OVERSPEED AFTER TRIMMING THE PGNS.
- (2) THE MSFN VOTE IS NO STAY IF THE INCOMING RADAR DATA INDICATES CLOSEST APPROACH ALTITUDE OF EQUAL TO OR LESS THAN 1.0 MI ABOVE THE LUNAR TERRAIN. THIS ALTITUDE CORRESPONDS TO A PERICYNTHION ALTITUDE OF 3.6 MI AND DOPPLER RESIDUALS AT AOS OF -32 CYCLES PER SECOND.

TABLE 3-8
3-58A

REVISION A

FLIGHT PLAN

MCC-H

2213 CST

81:00
20101

PIPA BIAS CHECK

GO/NO-GO FOR DOI

P52 IMU REALIGN
OPTION 3 REFSMMAT
(LDG SITE ORIENT)

DRAFT CHECK

REPORT GYRO TORQUING ANGLES

P30 EXT ΔV

P40 SPS THRUST

MNVR TO BURN ATT (81:15)

SXT STAR CHECK

VERIFY DSE MOTION AT LOS

R 0 OMNI C

P 283

Y 0

NOTES

BURN STATUS REPORT

X X X

X X X

X X X

X X X

X X X

X X X

X X X

X X X

X X X

X X X

X X X

X X X

X X X

X X X

X X X

X X X

X X X

X X X

X X X

X X X

X X X

X X X

X X X

X X X

X X X

X X X

X X X

X X X

X X X

X X X

X X X

X X X

X X X

X X X

X X X

X X X

TIG: 81:45:20

BT: 23.1 SEC

AVR: 212.9

ULLAGE: 2 JET 19 SEC

ORBIT: 57.4x7.1 NM

GDC ALIGN 0, 180, 0

DOI

V66 TRANSFER CSM SV TO LM SLOT

MNVR TO BAILOUT BURN ATT
(82:00) ~12 min

R 0

P 053

Y 0

GDC 0, 310, 0

*ITEMS TO BE REPORTED
TO MSFN

**REPORT IF OFF MORE
THAN 1 SEC

***REPORT IF >0.2 FPS

Record off deviation

MISSION EDITION

APOLLO 13 FINAL (APRIL)

DATE

MARCH 16, 1970

TIME

81:00 - 82:00

DAY/REV

4/3

PAGE

3-59

MCC-M

2313 CST

82:00
20101

:10

STAY/BAILOUT

:20

82:30
20111

:40

:50

DUMP DSE

83:00

HGA P -47, Y 0
DOI BURN STATUS REPORT
REPORT DOI ATTITUDE DEVIATIONS TO MSFN

P47-THRUST MONITOR

BAILOUT BURN IF REQ'D

EQUALIZE CM/LM PRESSURE

TUNNEL VENT VALVE - LM PRESS

MNVR TO LANDMARK TRACK ATT

BY 82:35 (~11 min)

V48 (20111, 1111)

TTG: 82:20:20
GT: 12.8 SEC
AVR: 120 FPS
ULLAGE: 2 JET 19 SEC
ORBIT: N/A

R 350 OMI D

P 295

Y 0

MAP UPDATE REV 4

LOS : - : - : -

180° : - : - : -

AOS : - : - : -

LMK H-2

T-HOR

TCA-20SEC

LAT: -03.033

ALT: +00000

P22 ORB NAV
MONITOR LMK
NO MARKS

LONG/2 -02.383

MNVR TO P52 (82:54 (~7 min))

P52 - IMU REALIGN
OPTION 3 - REFSMAT
(LDG SITE ORIENT)

R 280 HGA
P 295
Y 0

P -72
Y 1

P52 IMU REALIGN

N71: - : - : -

N05: - : - : -

N93: - : - : -

X - : - : -

Y - : - : -

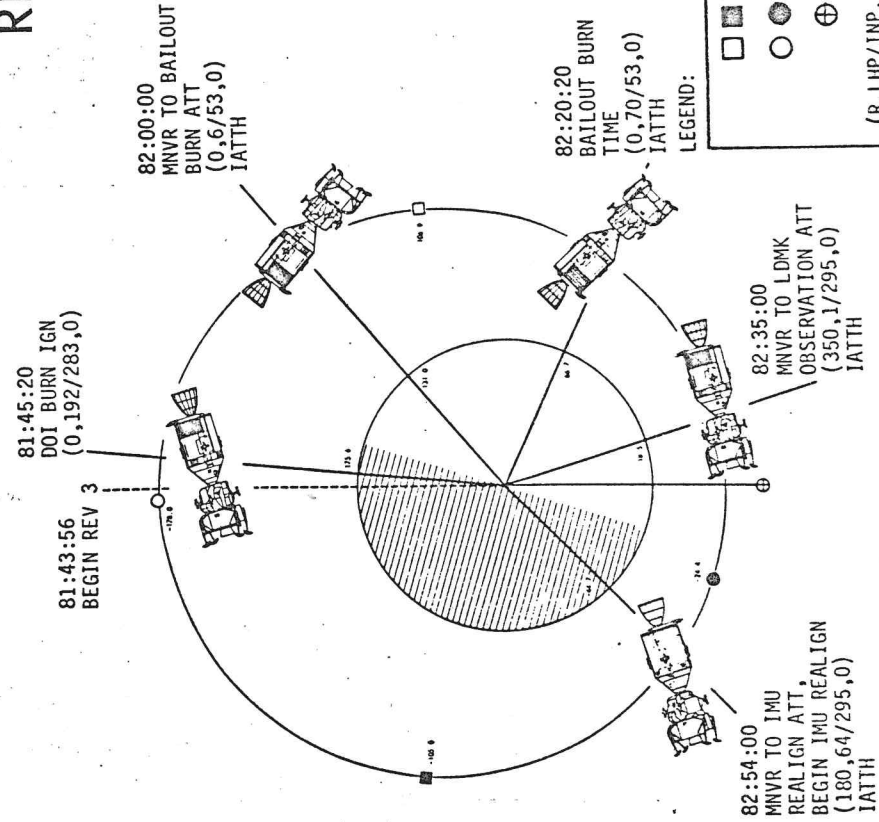
Z - : - : -

GET - : - : -

REPORT GYRO TORQUING ANGLES

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	82:00-83:00	4/3	3-60

REV 3



3-60A

REVISION A

MCC-H

FLIGHT PLAN

NOTES

UPLINK TO CSM
CSM S.V. & V66
PLANE CHANGE TGT LOAD
DESIRED ORIENT
(PLANE CHANGE)

UPDATE TO CSM
MNR PAD
(PLANE CHANGE)
CONSUMABLES
FLIGHT PLAN
TEI 42 PAD

2213 CST
153:00

M S F N

:10

:20

153:30

1010:40

REV 40

:50

154:00

POSTSLEEP CHECKLIST

MNR TO P52-ATT

(153:15)

R-098, P-274, Y-315

HGA P-20, Y-253,250

P52 IMU REALIGN
OPTION 3 - REFSMAT
(LIFT OFF ORIENT)

P52 IMU REALIGN
OPTION 1 - PREFERRED
(PLANE CHANGE ORIENT)
GYRO TORQUE

V48 (1010Z, 1111)

P30 - EXT ΔV

V49 MNR TO BURN ATT
(153:50)

P40 SPS THRUST
SXT STAR CK

CSM CONSUMABLES UPDATE

GET: ---

RCS TOTAL ---

QUAD A --- B ---

C --- D ---

H₂ TOTAL ---

O₂ TOTAL ---

VERIFY DSE MOTION AT LOS

STARS ---

SA ---

TA ---

TEI 42 ASSUMES
PLANE CHANGE 2

MAP UPDATE REV 40

LOS : ---

180° : ---

AOS : ---

P52 IMU REALIGN

N71: ---

N05: ---

N93: ---

X ---

Y ---

Z ---

GET : ---

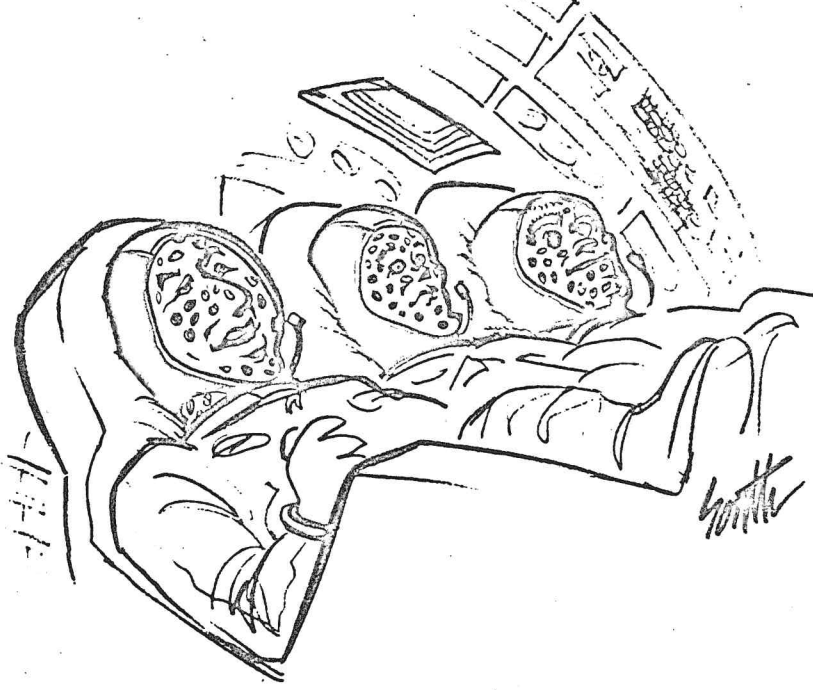
R 0 GMT-A

P 0

Y 45

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 16, 1970	153:00 - 154:00	7/39-40	3-119

"NO, DOC. WE FEEL JUST FINE!"



FOOD LOG

INTERLOG

FOOD LOG

CONSUMABLES

STATE VECTOR

DATE MARCH 23, 1970

APOLLO 13

FLIGHT DATA FILE

APOLLO XIII - (MATTINGLY - WHITE VELCRO)

CHECK ITEM EATEN

MEAL	Day 1, 5, 9	Day 2, 6, 10	Day 3, 7, 11	Day 4, 8	
A	Peaches Canadian Bacon & Applesauce Bacon Squares (8) Scrambled Eggs Grapefruit Drink Cinnamon Toast (4) Orange Drink Coffee (B)	Pears Bacon Squares (8) Scrambled Eggs Grapefruit Drink Coffee (B)	Peaches Canadian Bacon & Applesauce Sugar Coated Corn Flakes Grape Drink Coffee (B)	Apricots Bacon Squares (8) Scrambled Eggs Orange-G.F. Drink Coffee (B)	148
B	Potato Soup Beef & Gravy WP Jellied Candy Brownies (4) Grape Drink	Frankfurters WP Cranberry-Orange Chocolate Pudding Orange-G.F. Drink ONE SLICE BREAD CASSOP	Cream of Chicken Soup Bread Slice Sandwich Spread WP Chocolate Bar P.A.-G.F. Drink PECANS (B)	Chicken & Rice Soup Meatballs with Sauce WP Caramel Candy Orange Drink	317111
C	Pea Soup Chicken & Rice Date Fruitcake (4) P.A.-G.F. Drink	Spaghetti & Meat Pork & Scalloped Potatoes Apricots Orange Drink	Chicken Stew Turkey & Gravy WP Butterscotch Pudding Grapefruit Drink	Spaghetti & Meat Beef Stew Banana Pudding Grape Punch	

WP = WET PACK

LMP
FOOD LOGCMP
FOOD LOG

DATE MARCH 23, 1970

APOLLO 13

FLIGHT DATA FILE

APOLLO XIII - (HAISE - BLUE VELCRO)

CHECK ITEM EATEN

MEAL	Day 1, 5, 9	Day 2, 6, 10	Day 3, 7, 11	Day 4, 8
A	Peaches Sausage Patties Cinnamon Toast (4) Orange Drink Coffee (B)	Pears Bacon Squares (8) (1) Scrambled Eggs Cocoa Grapefruit Drink	Peaches Corn Flakes Graham Cracker Cubes (4) Grape Drink Coffee (B)	Apricots Bacon Squares (8) Scrambled Eggs Cocoa Orange-G.F. Drink
B	Chicken Salad Beef & Gravy WP Jellyed Candy Grape Drink	Frankfurters WP Cranberry-Orange Chocolate Pudding Orange-G.F. Drink CHEESE CUBES ONE SLICE BREAD CTSUP	Cream of Chicken Soup Bread Slice Sandwich Spread WP Chocolate Bar P.A.-G.F. Drink PECANES (3)	Chicken & Rice Soup Meatballs with Sauce WP Caramel Candy Orange Drink
C	Potato Soup Chicken & Rice Date Fruitcake (4) P.A.-G.F. Drink	Spaghetti with Meat Pork & Scalloped Potatoes Gingerbread (4) Orange Drink	Chicken Stew Turkey & Gravy WP Butterscotch Pudding Grapefruit Drink	Tuna Salad Beef Stew Chocolate Pudding Grape Punch

WP = NET PACK

LMP
FOOD LOG

- ① NEED VELCRO ON BREAD SLICE PACKAGES.
- ② THE CABLE ROUTE INTERFERES WITH PANTRY DOOR - DANGER OF DAMAGING CABLE.
- ③ RECOMMEND SHOULDER STRAPS OR SLEEP RESTRAINT WHEN SLEEPING IN COUCH.
- ④ CAN OF HAM SALAD WAS VERY MESSY - MOISTURE ALL IN TOP OF CAN. BASIC MIXTURE TOO DRY TO SPREAD
- ⑤ SAW FLASH OF RT SIDE WINDOW WITH SIC. STAGING. AFTER SIC STAGING A LOT OF DEBRIS WAS SEEN OUT FRONT WHICH WE SUBSEQUENTLY FLEW THROUGH.

We are now starting our 45th pass across the face of our friend, the moon.

Before leaving in another two hours, we would like to have a "show and tell" about some of the features on the moon that are particularly

interesting along our ground track.

One's first impression of the moon is that it lacks the variety found on earth, and I'm afraid we inadvertently fostered this thought with our

"dirt beach sand" description on Apollo 8 two Christmas' ago. The fact is we are used to seeing Earth's blue seas, white clouds, green valleys

and the Moon, in contrast, severely lacks color. We left the emphasis

off the variety of structures we can see below us which match an Earth

that had never seen water. There are highlands and the large, relatively

flat plains, called mares or seas. Overlying this simple picture are

mountains and ridge systems formed by ejecta from large impact craters.

Our landing site in Fra Mauro lies within a set of ridges interpreted

to be ejecta from the huge Imbrian basin over 300 miles to the north. Then

there are features that look like volcanic cones, rilles that look like dry

beds, the crater chains that lie tangentially to larger craters, central

- ① NEED VELCRO ON BREAD SLICE PACKAGES.
- ② THE CABLE ROUTE INTERFERES WITH PANTRY DOOR - DANGER OF DAMAGING CABLE.
- ③ RECOMMEND SHOULDER STRAPS OR SLEEP RESTRAINT WHEN SLEEPING IN COUCH.
- ④ CAN OF HAM SALAD WAS VERY MESSY - MOISTURE ALL IN TOP OF CAN. BASIC MIXTURE TOO DRY TO SPREAD
- ⑤ SAW FLASH OF RT SIDE WINDOW WITH SIC. STAGING. AFTER SIC STAGING A LOT OF DEBRIS WAS SEEN OUT FRONT WHICH WE SUBSEQUENTLY FLEW THROUGH.

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there are features that look like volcanic cones, rilles that look like dry

beds, the crater chains that lie tangentially to larger craters, central

APOLLO 13

LM DATA CARD BOOK

PART NO.

S/N

SKB32100082 - 387

10 01

DATE MARCH 24, 1970

LM ACTIVATION CARD

DAP PAD									
	+	3	3	7	3	1	LM WT		
	+	3	7	5	0	0	CSM WT		
	+	0	0	4	7	6	GMBL		
	+	0	0	5	7	2			
GYRO TORQUING									
							R1		
							R2		
							R3		
V05 N20									
GET 97 :							LM	R1	
								R2	
								R3	
							CSM	R1	
								R2	
								R3	
GET 98 :							LM	R1	
								R2	
								R3	
							CSM	R1	
								R2	
								R3	
GET :							LM	R1	
								R2	
								R3	
							CSM	R1	
								R2	
								R3	

LM DATA CARD BOOK

APOLLO 13 FLIGHT DATA FILE

PAGE 1

S-BD									
P	(+112)	AOS	(97	:	21	:			
Y	(+34)			:		:			
P	(+130)	AOS	(99	:	10	:			
Y	(+40)			:		:			
P	()	AOS	(	:		:			
Y	()			:		:			
K FACTOR									
AGS									
+			+	6	0	4	2	7	224
+			+	2	9	4	0	2	225
+			+	6	0	4	6	9	226
-			-	0	1	7	1	8	305
-			-	5	4	5	0	0	662
-			-	3	1	7	0	1	673
									540
									541
									542
									544
									545
									546

UNDOCK/SEP GET

(99 : 16 : 21)

IMPACT PAD

P76/P27

CDU/PLANE CHANGE

LUNAR SURFACE

ABORT/ASCENT

PDI 1/PDI 1 ABOR ALT CK/PDI RULES

PDI 2/PDI 2 ABORT PDI 0/NO PDI +12

ACTIVATION

GYRO DRIFT COMP

GYRO DRIFT COMPENSATION

AT COMPUTATION	
N93 PRO TIME	_____
PREVIOUS TORQ TIME	_____
AT	_____
HRS	_____
BIAS SHIFT	
N93	_____
X	_____
Y	_____
Z	_____
GYRO DRIFT	
X	_____
Y	_____
Z	_____
PROCEDURES	
V25N01E	_____
1460E	_____
NBDX XXXXXE	_____
NBDY XXXXXE	_____
NBDZ XXXXXE	_____

DATE MARCH 17, 1970

DATE MARCH 17, 1970

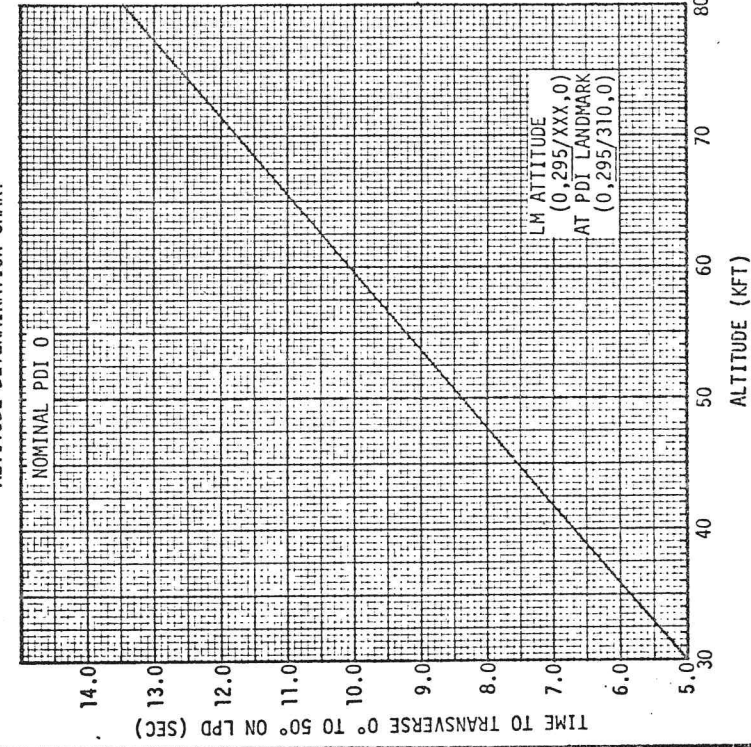
LM DATA CARD BOOK

LM DATA CARD BOOK

ALTITUDE CHECK/PDI RULES CARD

PDI RULES											
- NO ULLAGE-NO GO FOR PDI. - NO IGNITION DELAY 2 SEC THEN START PB-PUSH; THEN SET DES ENG OVRD-ON AT 5 SEC. - T/W > 1.6 AND DSKY CHANGES > 18 fps/2 SEC. - ATT/RATE < 5°/SEC. - ΔH WITHIN LIMITS > 10 SEC AND NOT OUT OF LIMITS > 60 SEC. - DATA GOOD AT > 10,000 FT. - IF NO THROTTLE DOWN BY P64 +15 SEC-ABORT. - BINGO FUEL 1 MIN 34 SEC AFTER LOW LEVEL OR WHEN FUEL QTY < 2% UNLESS LANDING IMMINENT.											
NOTE: FOR FLASHING LR ALT OR VEL LIGHTS THAT ARE PRECEDED BY A STEADY LR LIGHT, CYCLE THE RADAR TEST SWITCH.											
CSM CIRC BURN											
P76											
+	0	0	+	0	0	1	0	0	HRS	N33	
+	0	0	0	+	0	0	0	3	5	MIN	TIG
+	0	0	+	0	0	0	5	0	0	SEC	
			+	0	0	0	6	9	0	ΔVX	N84
			+	0	0	0	0	0	0	ΔVY	
			+	0	0	1	4	0	ΔVZ		
CSM HA/HIP											
CMC		/		LGC		/		V82		OPT 2	

ALTITUDE DETERMINATION CHART



PREPARED BY FPRB/OPS
MISSION APOLLO 13, FEBRUARY 3, 1970

PDI 1/PDI 1 ABORT ALT CK/PDI RULES ACTIVATION
 PDI 2/PDI 2 ABORT 1 0/NO PDI +12. 'YRO DRIFT COMP

Y
LUNAR SURFACE
PORT/ASCENT
CDH/PLANE CHANGE
CSI

CDH/PLANE CHANGE CARD[illegible][illegible]

YDOT			
CSM (N90)	PGNS (N90)	AGS (270)	
(-)	(-)	()	
—	—	—	—
(-)	(-)	()	—
—	—	—	—

RESIDUALS	
PGNS	AGS
ΔVX	ΔVX
ΔVY	ΔVY
ΔVZ	ΔVZ

[illegible]

CRITERIA IS $\dot{\lambda}=2\text{fps}$, $\dot{z}=6\text{fps}$
PRIORITY OF SOLUTIONS-PGNS, AGS, CMC
CHARTS.

A. RR AGREES WITH VHF WHERE
 $\Delta R = \frac{R}{R} + 0.5\text{NM}$, ΔR IS ALWAYS ≥ 1
100

IF TWO OF THREE SOLUTIONS
AGREE, BURN THE PRIORITY
SOLUTION.

B. RR DOES NOT AGREE WITH VHF.
MSFN ISOLATES FAILED SYSTEM.

C. V90<5fps-NO BURN.

263 ΔVY (CDH) ΔVY (NOW) 270

N81 CDH		CSM SOLUTION (CHANGE SIGN)	
$\frac{\Delta V_X}{(+0.0)}$	$\frac{YDOT\ N90}{(+0.0)}$	$\frac{\Delta V_X}{\Delta V_Y}$	$\frac{\Delta V_Z}{\Delta V_Y}$
•	•	•	•
•	(-)	•	•
•	(-)	•	•

$\frac{\Delta H}{(15.0)}$ $\frac{\Delta T}{(41:27)}$ $\frac{TPI}{SLIP}$ $(0:00)$	$\frac{402}{\Delta H}$ $\frac{450}{\Delta Vx}$ $\frac{452}{\Delta Vz}$
$\frac{\Delta H}{(15.0)}$ $\frac{\Delta T}{(41:27)}$ $\frac{TPI}{SLIP}$ $(0:00)$	$\frac{402}{\Delta H}$ $\frac{450}{\Delta Vx}$ $\frac{452}{\Delta Vz}$

DATE, MARCH 30, 1970

DATE **MARCH 30, 1970**

LM DATA CARD BOOK

LM DATA CARD BOOK

TPI CARD

[illegible]
$$0.733 \frac{\text{FPS}}{\text{NM RMS}}$$

BURN RULES

CRITERIA IS $\dot{X}=2fps$, $\dot{Y}=5fps$,
PRIORITY OF SOLUTIONS-PGNS, AGS, CMC, CHARTS.

A. RR AGREES WITH VHF WHERE
$$\Delta R = \frac{R}{100} + 0.5NM, \Delta R \text{ IS ALWAYS } \geq 1NM$$

IF TWO OF THREE SOLUTIONS AGREE,
BURN THE PRIORITY SOLUTION.

B. RR DOES NOT AGREE WITH VHF.
MSFN ISOLATES FAILED SYSTEM.

MAX N49 (0.8,5.0)		RESIDUALS						
		PGNS			AGS			
PGNS	AGS			ΔV_X	N85		ΔV_X	500
				ΔV_Y			ΔV_Y	501
				ΔV_Z			ΔV_Z	502

PONDS	TIG (139;45;41)	HP (43.3)	N58 TPI $\frac{\Delta V}{\Delta V}$ (24.7)	$\frac{\Delta V}{\Delta V}$ TPF (31.5)	N81 TPI $\frac{\Delta VX}{(+21.9)}$ $\frac{\Delta VY}{(+0.1)}$ $\frac{\Delta VZ}{(-11.0)}$	N59 TPI $\frac{\Delta VF^+ / A^-}{(24.5)}$ $\frac{\Delta VR^+ / L^-}{(+0.1)}$ $\frac{\Delta VD^+ / U^-}{(-0.1)}$	AOS
	:	:	:	:	.	.	
	:	:	:	:	.	.	
	:	:	:	:	.	.	
	:	:	:	:	.	.	
373 TIG				$\frac{267}{\Delta V} \frac{\Delta V}{\Delta V}$ TPI+TPF	CSM SOLUTION (CHANGE SIGN) $\frac{\Delta VX}{\Delta V}$ $\frac{\Delta VY}{\Delta V}$ $\frac{\Delta VZ}{\Delta V}$	CSM SOLUTION $\frac{\Delta VX}{- \Delta VY}$ $\frac{\Delta VZ}{\Delta V}$	
	(+0585.8)				.	.	
					.	.	
					.	.	

AGS SV
IMPACT PAD

TPI
P76/P27

ASC SV IMPACT PAD TDT P76/P27 CSI W/PLANE CHANGE LUNAR SURFACE PDI 1/PDI 1 ABORT CK/PDI RULES PDI 2/PDI 2 ABORT ACTIVATION WRO DRIFT COMP

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ANUN/D

LMP SLEEP 63:00 for 6 hr

ODS/COMP EAT 69:00

LMP AWAKE 70:00

ODS/COMP SLEEP 76:00

" " AWAKE 76:00

PS1 & PS2 76:30 - 72:00

78:30 LOAD P-30 & ALLEN AGS TO PLANS

79:25:265776

81:00 - 82:00 EAT

ALL

Biomed OFF
Lo Bit Rate - (hi)
DWN Voice Back up - (voice)
PWR AMP - PRIM
16 PWR AMP CB - OPEN
TARGE FURCT SW - OFF
MSFN SHAVE HEAR US if they can't
hear us close PWR AMP 00

AUTO CABIN

VIGN20
0 - 267.5
ψ - -4.5
+00120
+26750
+00450

DATE MARCH 17, 1970

LM DATA CARD BOOK

NASA MSC

1. Repress Pkg Vln. Off
2. Emer Cab Press - off
3. Direct O2 - off
4. Demand Reg. Off
5. Side H2O/1500/1500 - off
6. Main Reg A & B - open
7. H2O Gly tank near panel - open
8. For Water - momentarily pressure surge - back - take out H2O as reqd.

S Band from Rec OFF
S MI to PMA

Consumables
H2O 1500/161
O2 272 lbs
Wt Off good
AMPHES 199 lbs
entry angle hours 6.24

Bel lost X tie
1 Bit rate - low
2 Voice funct - Dwn Vln
3. Pwr amp 80 - open
4 wry funct - reg wry
Very phys. heart rel
left in main fr
Quod pksting 85° 44'
cm ACS inj 44° 21'
West shell - some down
5 MCE
4 1/2 sm jett
cm pwr up
1 hr LM jett
1 SUTED SATON
use 2m coar de h moc
body ans align (Acs 000)
AGS back act to fly to
pt aim ans at mcm
will give 200N for
down side

4.56.8
1/250

APOLLO 13

LM MALFUNCTION
PROCEDURES

PART NO.

S/N

SKB32100076 - 386

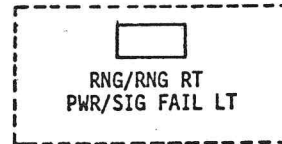
1001

G&C
DISPLAYS

G & C DISPLAYS MALFUNCTION INDEX

- 1 FDAI ATT ERR ABNORMAL
- 1a AGS ATT ERROR ZERO
- 1b AGS ATT ERROR NON ZERO
- 2 FDAI TOTAL ATT ABNORMAL
- 2a FDAI OFF FLAG APPEARS
- 3 RATE DISPLAY ABNORMAL
- 4 RATE GYRO TEST FAILS

5

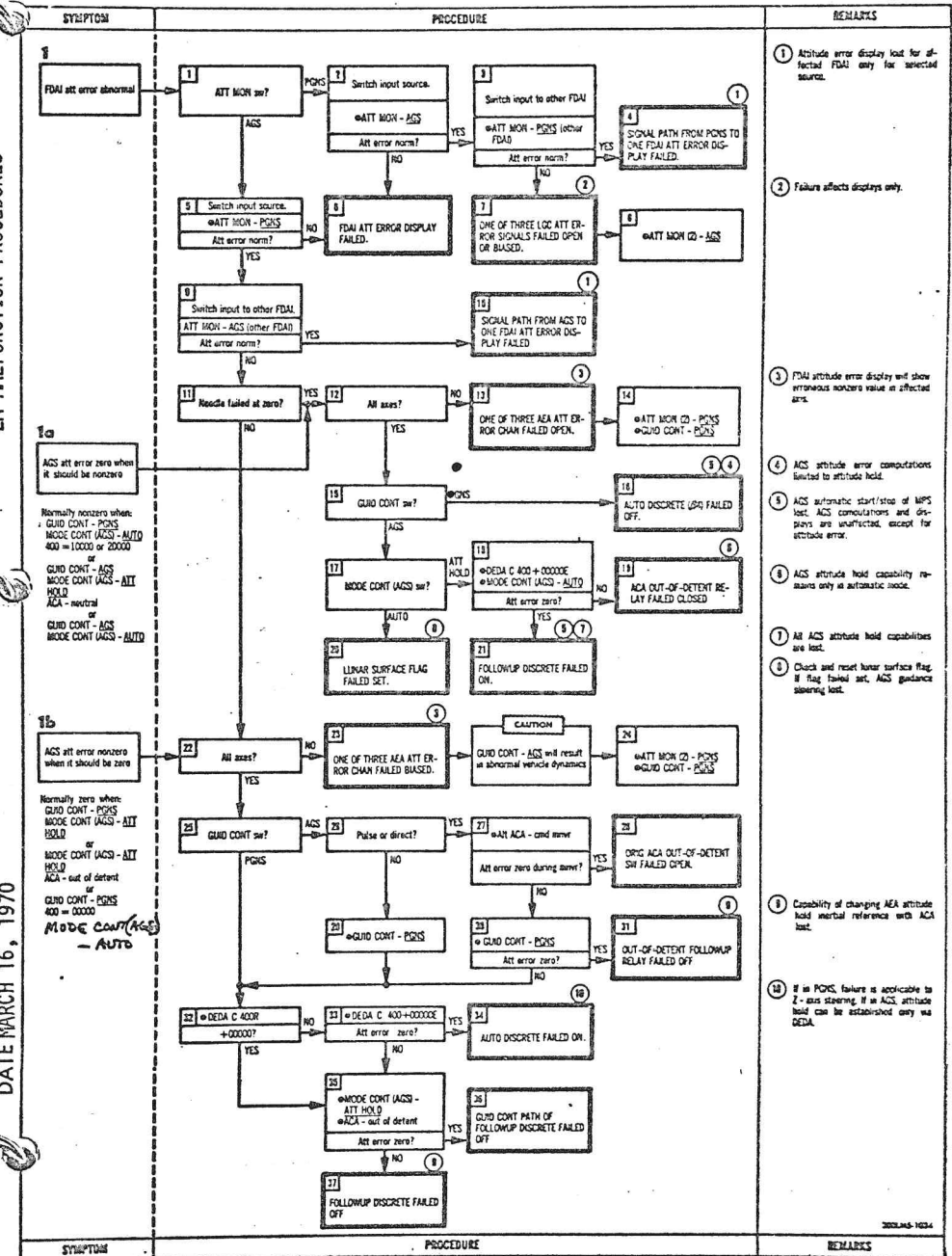


SOURCE MOCAT
DATE MARCH 16, 1970

SOURCE LM AOH
DATE MARCH 16, 1970

LM MALFUNCTION PROCEDURES

LM MALFUNCTION PROCEDURES



1
THRU
3

4
THRU
5

RCS , APS , DPS , CES , AGS , PNGS , EPS

G&C
DISPLAYS

LMA790-3-LM
APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
2 FDAl total att abnormal 2a FDAl OFF flag appears	1 FDAl OFF flag visible? YES → 2 ORDEAL pnt e/FDAl 1 (2) affected FDAl - att position (POS RATE or POS TL) FDAl moves? YES → 3 FDAl OFF FLAG FAILED NO → 4 ORDEAL operating? YES → 7 ORDEAL pnt e/FDAl 1 & 2 - POS TL Total att display norm? YES → 8 ORDEAL FAILURE NO → 9 e/Place FDAl's on att inertial sources Both FDAl's agree? YES → 10 JTO OR MANUAL INVR PROBLEM NO → 11 Abnormal total att? DOCK KNOW → 12 Compare gimbal angles e/AGE e/16 ACDE e/min to 0.0.0. DSKY & POSK total att agree? YES → 13 Switch input e/ATT MON - ACS Total att norm? YES → 14 FDAl TOTAL ATT DISPLAY FAILED NO → 15 Switch input e/ATT MON - POSK Total att norm? YES → 16 CDU ZERO FROM LGC FAILED NO → 17 Switch input to other FDAl e/ATT MON - POSK (other FDAl) Total att norm? YES → 18 ONE FDAl TOTAL ATT DISPLAY INTERCONNECT FAILURE FROM POSK NO → 19 ACS/IMU alignment just completed? YES → 20 Orig symptom present in one axis only? YES → 21 IMU/FDAl INTERFACE FAILED NO → 22 Switch input to other FDAl e/ATT MON - ACS (other FDAl) Total att norm? YES → 23 AEA/FDAl INTERFACE FAILED NO → 24 e/ATT MON (2) - ACS CAUTION FDAl that displays symptom can be driven from one source only. 25 ONE FDAl TOTAL ATT DISPLAY INTERCONNECT FAILURE FROM ACS 26 e/ATT MON (2) - POSK	1 Orbital rate and inertial total attitude displays are identical 1 minute per orbital period. Waiting 1 minute resolves possible ambiguity. 2 Failure may be confined to ORDEAL resolves to only one FDAl. 3 LM did not achieve desired automatic or manual maneuver. 4 ACS - IMU alignment capability lost. Align ACS by backup method. 5 Failure includes one of six IMU output lines or GASTA failure. 6 Failure includes: One of six AEA output channels failed. One of three AEA return lines failed.
3 Rate display abnormal	1 Both FDAl rate ind agree? YES → 2 Stabilize LM via out the window indication e/Compare rate needles with vehicle motion Ind rate > LM motion? YES → 3 RATE CYRO FAILED ON NO → 4 ATCA/RATE CYRO INTERFACE FAILED OPEN 5 FDAl RATE NEEDLE FAILURE 6 RATE CYRO FAILED ON 7 RATE SCALE SW FAILED OPEN 8 ACS may be selected only if ATT CONT affected and - PULSE or DIR	1 Rate display lost. Possible needle movement may be due to vibration. 2 Maximum rate displayed > 5°/second.

300LAS-1019

SOURCE LM AOH
DATE MARCH 16, 1970

SOURCE LM AOH
DATE MARCH 16, 1970

LMA790-3-LM
APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
4 Rate gyro test fails	1 Both FDAl rate ind agree? YES → 2 RATE NEEDLE FAILURE NO → 3 Any rate needle remains at zero? YES → 4 Needles at zero? ALL → 5 TEST VOLTAGE LOST, OR CYRO TEST POS RT SW OR CYRO TEST POS RT SW FAILED OPEN ONE → 6 CYRO TEST POS RT SW FAILED CLOSED TWO → 7 CYRO TEST POS RT SW FAILED OPEN 8 Rate needles deflect in one direction only? YES → 9 CYRO TEST POS RT SW FAILED CLOSED NO → 10 All rate needles peg in both directions? YES → 11 RATE SCALE SW FAILED OFF NO → 12 Dynamic ck e/GUID CONT - ACS e/MODE CONT (ACS - ATT) e/ATT CONT (2) - MODE CONT e/ACA - cmd move in axis e/Monitor for smooth rate with damping Response norm? YES → 13 RATE CYRO FAILED IN AFFECTED AXIS NO → 14 e/ATT CONT (affected axis) - PULSE or DIR e/GUID CONT - POSK	1 Test all three axes in both directions. 2 Assumption: RATE SCALE - 25°/SEC but switch failed open when test was run. Failure results in selection of 5°/second scale. 3 ACS rate command lost for affected axis. If roll or pitch, ACS DPS burn capability lost.
5 RNG/RNG RT per/sig fail	1 Ch for short e/ (11) FLT DISP: RNG/RNG RT or e/AC BUS A: RNG/RNG RT - open & cannot be reset? YES → 2 RANGE & RANGE RATE IND SHORTED NO → 3 Remove power to ind. e/Other ch - open 4 Ch for open e/ (11) FLT DISP: RNG/RNG RT - open Per/sig fail it - off? YES → 5 e/ (11) FLT DISP: RNG/RNG RT - open e/AC BUS A: RNG/RNG RT - open Per/sig fail it - off? YES → 6 RANGE & RANGE RATE IND FAILED DUE TO OPEN NO → 7 RR range & range rate can be displayed on DSKY as backup to RANGE & RANGE RATE ind. 8 Verify status of ind-driving source YES → 9 e/Select att display source when operating. For which display source of per/sig fail it - off? RR ONLY → 10 RR OUTPUT FAILED OR OPEN IN LINE TO RANGE & RANGE RATE IND. RR & LR OR ACS → 11 LR OR ACS OUTPUT TO RANGE & RANGE RATE IND FAILED 12 FAILURE BETWEEN MODE SEL SW & RANGE IND 13 e/Correct source malfunction.	1 Light is normally on when power is supplied and indicator is not used by ACS, LR, or RR. If in error signal goes to zero, light goes on. Light may flash randomly if range rate is < 10 f/s. Neither condition indicates malfunction. 2 RR range and range rate may be displayed if: a. RR locked on to CSMA. b. PDS not in process. c. RGA in process by VES30. d. RGA in process by VES30. e. LGC in process by VES30. f. WAG (if PDS) in process. g. LM attitude (N) - DECA 337. h. LM attitude rate - DECA 367. i. LM - CSMA range - DECA 317. j. LM - CSMA range rate - DECA 440. 3 Alternative display sources: a. RR range, range rate - N78. b. RR in process by VES30. c. LGC range, range rate - B - W54. d. RGA in process by VES30. e. WAG (if PDS) in process. f. LM attitude (N) - DECA 337. g. LM attitude rate - DECA 367. h. LM - CSMA range - DECA 317. i. LM - CSMA range rate - DECA 440.

300LAS-1016

4
THRU
5

EPS
PNGS
AGS
CES
DPS
APS
RCS

1 LGC

1a RESTART

2 ISS

3 TEMP

4 GIMBAL LOCK

5 TRACKER

6 ALT

7 VEL

8 RNDZ RDR

8a NOTRACK

SSR-1 LGC SELF TEST

LM MALFUNCTION PROCEDURES

SOURCE MOCATA
DATE MARCH 16, 1970

SOURCE LM AOH
DATE MARCH 16, 1970

FLM MALFUNCTION PROCEDURES

1

SYSTEM

LOG

RED

Light on at:
LOG prime power fails
Scaler fails
Counter fails

PROCEDURE

1 Light on continuously? NO → 2 TRANSIENT CONDITION → 3 MSFN & crew monitor LOG & evaluate performance. YES → 4 @GUID CONT - ACS → 5 Power up. → 6 Can LOG be powered up? NO → 7 LSC FAILURE. YES → 8 Input chain ck. → 9 @V11 WICE. → 10 DSKY operational? YES → 11 Q, I, A, S, in A of R1? NO → 12 CHEA OR DSKY RELAY FAILURE. YES → 13

1a

RESTART

YELLOW

Lighted by:
Pantry failure
TRUPT lock
To trap
Night watchman or
Voltage failure

11 LOG R - on? YES → 12 @GUID CONT - ACS → 13 LSC FAILURE → 14 If time permits: perform LOG self-test to determine whether any LOG capability remains. → 15 LOG TEST. NO → 15 DSKY RELAY FAILURE

2

ISS

RED

Light on at:
BAU fails
ICDU fails
PPA fails during thrust

1 PROG R - on? YES → 2 Display sturn code → 3 @VCS ICSE. → 4 @error alarm codes. → 5 ISS & PROG its remove off? YES → 6 TRANSIENT ISS CONDITION → 7 Verify failure with MSFN before switching to alt guidance sys. If MSFN is unavailable, trackdown without switching guidance. NO → 8

8 @GUID CONT - ACS

Main code?

0377 → 9

0477 → 10

1077 → 11

1377 → 12

1477 → 13

9 7.6.9

10 7.6.14

11 7.6.14

12 7.6.14

13 7.6.14

7 ICDU A/D ck. → 8 @V16 ICSE. → 9 @diver LHM. → 10 Yaw - 0°. → 11 Pitch - 0°. → 12 Roll - 0°. → 13 @V40 ICSE - Zero CDU's. → 14 Compare POSIS total art display with ICDS display. → 15 POSIS FDI & DSKY registers agree? YES → 16 ICDU A/D ck. → 17 @R000 CONT. → 18 @RCHS - 0°. → 19 @V376 DGE. → 20 @V43E. → 21 FL V211 R22. → 22 @V400 angles. → 23 R1 + 00325. → 24 R2 + 00325. → 25 R3 + 00325. → 26 POSIS FDI art wordies reloaded values? YES → 27 LSC INPUT CHAIN FAILURE. NO → 28 ICDU A/D SECTION FAILED.

8 PPA ck. → 9 @V16 ICSE. → 10 Any register zero or > 300 counts/aw? YES → 11 PPA FAILURE. NO → 12

14 Stab loop ck. → 15 @Establish alt hold. → 16 @V16 ICSE. → 17 Compare POSIS & ACS FDI: total art & DSKY readouts. → 18 POSIS FDI art total art or R1, R2, A3 drifting? YES → 19 BAU FAILED. NO → 20

REMARKS

1 Transient condition could have existed either in LOG or CHEA.

2 DSKY relay that turns on LOG R displays gyro barping and PPA capability failure. LOG monitoring at control of both TVC and ACS at those maneuvers test.

3 Attempt reprogramming LOG by seq and reducing ch (11) POSIS LOG/DSKY.

4 Readout of 0, 1, 4, 5 indicates LOG fail signal to CHEA.

5 ch (11) S/C AEA - close

6 Subsequent ISS malfunction indicators test.

7 Following sturn codes are generated by tested failures:
0477 - PPA and ICDU failure
1077 - PPA and ICDU failure
1377 - BAU and ICDU failure
1477 - PPA, BAU, and ICDU failure
If any of these alarm codes occur, proceed sequentially to each of steps listed. A "NO" answer to each step indicates that transient failure was generated.

8 LOG monitoring and control of diverting test.

9 ch (11) S/C AEA - close

10

Function	Examining	A/D	D.A.
Free align	NO	YES	
Course align	NO	NO	
Alt error signal	NO	NO	
Total art to FDI	YES	YES	
Simble angles to LOG	NO	YES	
BAU stab loop	YES	YES	
Dry mode	YES	YES	
BAU failure-divertor current	YES	YES	
Course align at general lock	NO	YES	

11 LOG can perform functions not requiring BAU inputs. After each diverting maneuver, state vectors must be updated via P27.

SYSTEM

PROCEDURE

REMARKS

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100

SR-1

RCS	APS	DPS	CES	AGS	COMM	EPS
-----	-----	-----	-----	-----	------	-----

LMA790-3-LM
APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
3 TEMP YELLOW Light on if IMU Temp out of limits $<125^{\circ}\text{F}$ $>134^{\circ}\text{F}$	1. TEMP - off? 2. TEMP - on? 3. TEMP - on? 4. TEMP - on? 5. TEMP - on? 6. TEMP - on? 7. TEMP - on? 8. TEMP - on? 9. TEMP - on? 10. TEMP - on? 11. TEMP - on? 12. TEMP - on? 13. TEMP - on? 14. TEMP - on? 15. TEMP - on? 16. TEMP - on? 17. TEMP - on? 18. TEMP - on? 19. TEMP - on? 20. TEMP - on?	1. RI readout of 0, 1, 2, 3 indicates IMU temperature is within limits. 2. ON & CS performance will be unaffected by IMU out-of-tolerance temperature for at least 15 minutes. Critical maneuvers can be conducted within this time. IMU data loop and velocity measurements will be degraded after this time. 3. Subsequent IMU out-of-tolerance temperature indications are lost.
4 GIMBAL LOCK YELLOW Light on if MGA > 70	1. GIMBAL LOCK - off? 2. GIMBAL LOCK - on? 3. GIMBAL LOCK - on? 4. GIMBAL LOCK - on? 5. GIMBAL LOCK - on? 6. GIMBAL LOCK - on? 7. GIMBAL LOCK - on? 8. GIMBAL LOCK - on? 9. GIMBAL LOCK - on? 10. GIMBAL LOCK - on? 11. GIMBAL LOCK - on? 12. GIMBAL LOCK - on? 13. GIMBAL LOCK - on? 14. GIMBAL LOCK - on? 15. GIMBAL LOCK - on? 16. GIMBAL LOCK - on? 17. GIMBAL LOCK - on? 18. GIMBAL LOCK - on? 19. GIMBAL LOCK - on? 20. GIMBAL LOCK - on?	1. LGC commands coarse align when MGA $\geq 85^{\circ}$. 2. GIMBAL LOCK is unusable for monitoring.
5 TRACKER YELLOW Light on if data - good is lost or RR CDU fails while RR is under LGC control	1. TRACKER - off? 2. TRACKER - on? 3. TRACKER - on? 4. TRACKER - on? 5. TRACKER - on? 6. TRACKER - on? 7. TRACKER - on? 8. TRACKER - on? 9. TRACKER - on? 10. TRACKER - on? 11. TRACKER - on? 12. TRACKER - on? 13. TRACKER - on? 14. TRACKER - on? 15. TRACKER - on? 16. TRACKER - on? 17. TRACKER - on? 18. TRACKER - on? 19. TRACKER - on? 20. TRACKER - on?	1. NO TRACK IT may also be on, but does not represent malfunction if lock-on has not been achieved. 2. Occurs without NO TRACK IT. LGC will not process RR data.

300LAS-1017

SOURCE LM AOH
DATE MARCH 16, 1970

SOURCE LM AOH
DATE MARCH 16, 1970

LMA790-3-LM
APOLLO OPERATIONS HANDBOOK

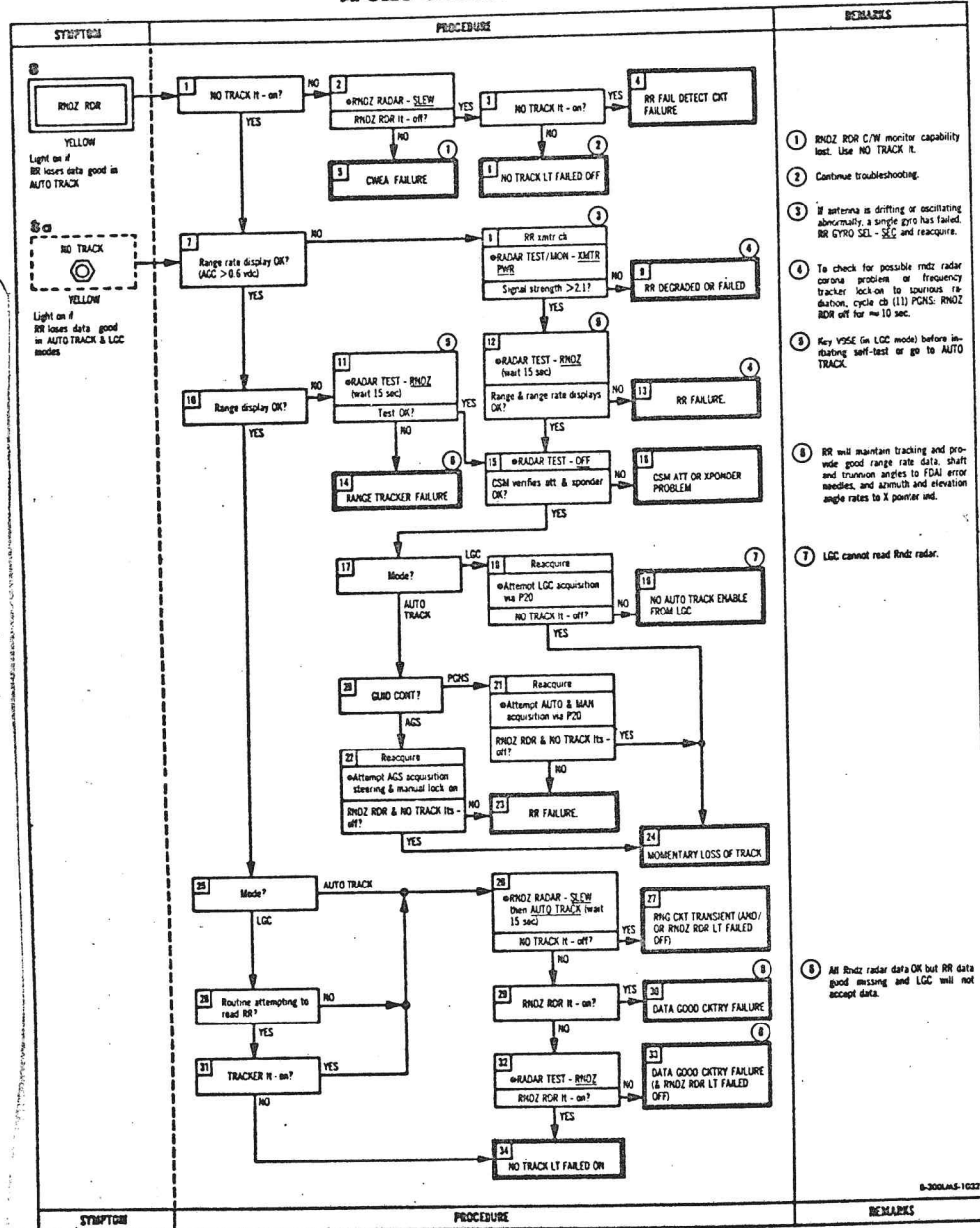
SYMPTOM	PROCEDURE	REMARKS
6 ALT YELLOW Light on steady if: LR range data-good discrete not present when LGC tries to read LR altitude (R12) Expected at: High altitudes Off-nominal altitudes (including "batty down") Zero Doppler Light flashing if: LR altitude reasonableness test failed below high-gate (R12) Expected at: Loran discontinuities Zero Doppler	1. ALT - off? 2. ALT - on? 3. ALT - on? 4. ALT - on? 5. ALT - on? 6. ALT - on? 7. ALT - on? 8. ALT - on? 9. ALT - on? 10. ALT - on? 11. ALT - on? 12. ALT - on? 13. ALT - on? 14. ALT - on? 15. ALT - on? 16. ALT - on? 17. ALT - on? 18. ALT - on? 19. ALT - on? 20. ALT - on?	1. Expected zero Doppler response. LR antenna position No. 1 - about 7000 to 5000 feet. LR antenna position No. 2 - about 250 to 150 feet. 2. Altitude reasonableness test is performed only after high gate. 3. Time limitations below high gate may not permit test. 4. Assumption: R04 is not running. 5. Possible data interface failure. 6. LR self-test cannot determine cause. Symptom may be temporary due to causes such as those listed in SYMPTOM column. 7. Capability of updating LGC with LR data is lost. 8. If transmitter corona is suspected, or PGVCS LGC RDR - cycle. 9. If transmitter power or receiver sensitivity for beam No. 1, 2, or 3 is degraded, altitude data-good may be late.
7 VEL YELLOW Light on steady if: LR velocity data-good discrete not present when LGC tries to read LR velocity (R20) Expected at: High altitudes Off-nominal altitudes (including "batty down") Zero Doppler Light flashing if: LR velocity reasonableness test failed (R12) Expected at: Loran discontinuities Near-zero Doppler LR antenna stuck between positions (at higher altitudes)	1. VEL - off? 2. VEL - on? 3. VEL - on? 4. VEL - on? 5. VEL - on? 6. VEL - on? 7. VEL - on? 8. VEL - on? 9. VEL - on? 10. VEL - on? 11. VEL - on? 12. VEL - on? 13. VEL - on? 14. VEL - on? 15. VEL - on? 16. VEL - on? 17. VEL - on? 18. VEL - on? 19. VEL - on? 20. VEL - on?	1. Expected zero Doppler response. LR antenna position No. 1 - about 7000 to 5000 feet. LR antenna position No. 2 - about 250 to 150 feet. 2. Velocity reasonableness test is performed when velocity < 5000 fts/sec (alt time). 3. Assumption: R04 is not running. 4. Possible data interface failure. 5. Possible impact on ability to use altitude data. 6. LR self-test cannot determine cause. Symptom may be temporary due to causes such as those listed in SYMPTOM column. 7. Unless results are obvious, test is inconclusive without report of assumed from MSTR. 8. There is no onboard capability for distinguishing between failures. Continue and monitor other data sources. If data-good discrete interface failed, LR data is not processed. 9. If transmitter power or receiver sensitivity for beam No. 1, 2, or 3 is degraded, velocity data-good may be late. If beam No. 1 and/or 2 is affected, altitude data will also be late. 10. If transmitter corona is suspected, or PGVCS LGC RDR - cycle.

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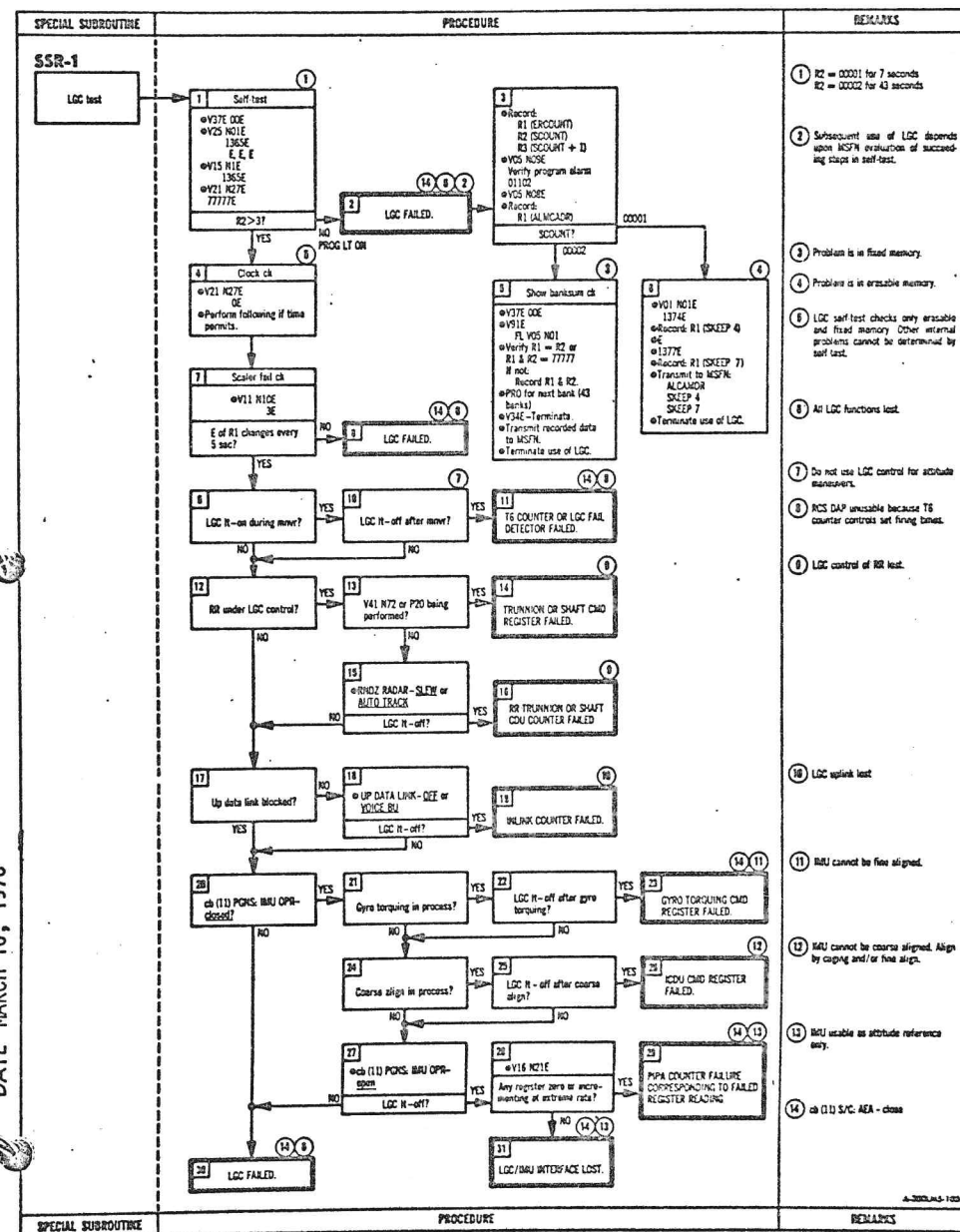


FLM MALFUNCTION PROCEDURES

FILM MALFUNCTION PROCEDURES

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PINGS G&C DISPLAYS

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LM MALFUNCTION PROCEDURES

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AGS PNGS C&C DISPLAYS

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AGS

DEDA RESPONSE ABNORMAL

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SYMPTOM	PROCEDURE	REMARKS
1 AGS Light on if: ASA power supplies out of tolerance ASA heater fails on fact-wired at 150° ± 5° AEA fails to complete minor cycle within 20 milliseconds AEA test mode discrete signals failure condition Light latches on when AEA failure is detected. O₂/H₂O QTY MON must be set to C/W RESET position to unlatch.	1 PONS available? NO → 2 MODE CONT UACS - ATT HOLD YES → 3 QUID CONT - PONS → 4 AEA self-test ck. DEDA C 412R DEDA responds? NO → 5 AEA POWER SUPPLY FAILED. YES → 6 +10000 displayed within 5 to 30 sec? NO → 7 AEA self-test DEDA C 412+000000 DEDA C 412R +10000 displayed within 5 to 30 sec? NO → 8 ACS SELF-TEST DETECTED FAILURE. YES → 9 O₂/H₂O QTY MON - C/W RESET ACS warn IT - off? YES → 10 TRANSIENT CONDITION TRIGGERING SELF-TEST FAIL DISCRETE NO → 11 Ch for AEA-induced latchup O₂/H₂O QTY MON - C/W RESET ACS warn IT - off? YES → 12 In-flight gyro & accel calib DEDA C 400+500000 or if PONS unavailable: DEDA C 400+700000 ASA performs OK? YES → 13 C/WEA FAILED. NO → 14 AEA MAY HAVE EXPERIENCED A RESTART → 15 MSFN verifies ASA heater operation. ASA heater OK? YES → 16 ASA HEATER FAILURE NO → 17 Update & align AEA. Reconfigure 400 & 410 through 417 as required. → 18 ASA POWER SUPPLY FAILED → 19 ACS (16) S/C ASA - open	1 ACS test 2 ACS self test status 412 = 12000 X = 0 Test not complete X = 1 Test successful X = 3 Logic test failure X = 4 Memory test failure X = 7 Logic and memory test failure 3 ACS operations not recommended 4 O₂/H₂O QTY MON performs latch-up release when set to C/W RESET 5 For PONS unavailable C 400+70000 checks accelerometer only 6 AEA restart changes 470 to -72000, 800 and 410 through 417 to +00000
2 DEDA response abnormal	1 Registers remain blank? YES → 2 DEDA FAILURE NO → 3 OPR ERR N-on? YES → 4 CLR → 5 OPR ERR IT - off? YES → 6 OPR ERR LT FAILED OFF. NO → 7 DEDA controls freeze, but can be returned to normal via CLR pb? YES → 8 OPR ERR LT FAILED ON. NO → 9 DEDA FAILURE 10 DEDA FAILURE	1 Readout and enter functions are lost. ACS flight displays are available but will become less and less reliable due to inability to be updated, aligned or calibrated. 2 OPR ERR display lost 3 MSFN can confirm DEDA readouts a. For following failures, ACS DEDA capability is unaffected EL segments HOLD pb open b. For following failures, readout and enter capability is lost CLR pb closed Digit pb closed ENTR pb closed HOLD pb closed READOUT pb closed ACS flight displays are available but will become less and less reliable due to inability to be updated, aligned or calibrated c. The pb capability is lost for following failures Digit pb open ENTR pb open or - pb open *ACS can no longer be aligned, updated, or calibrated. AEA readouts via SXX entry are lost.

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CES MALFUNCTION INDEX

- 1 ABNORMAL VEHICLE DYNAMICS (NON-MPS)
- 2 LM DRIFTS OUT OF DEADBAND
- 3 PGNS MINIMUM IMPULSE (V76) COMMANDS ABNORMAL
- 4 AGS PULSE OR DIRECT COMMANDS ABNORMAL
- 5 PROPORTIONAL MODE COMMANDS ABNORMAL
- 6 TTCA COMMANDS ABNORMAL
- 7 ABNORMAL DYNAMICS DURING MPS THRUSTING

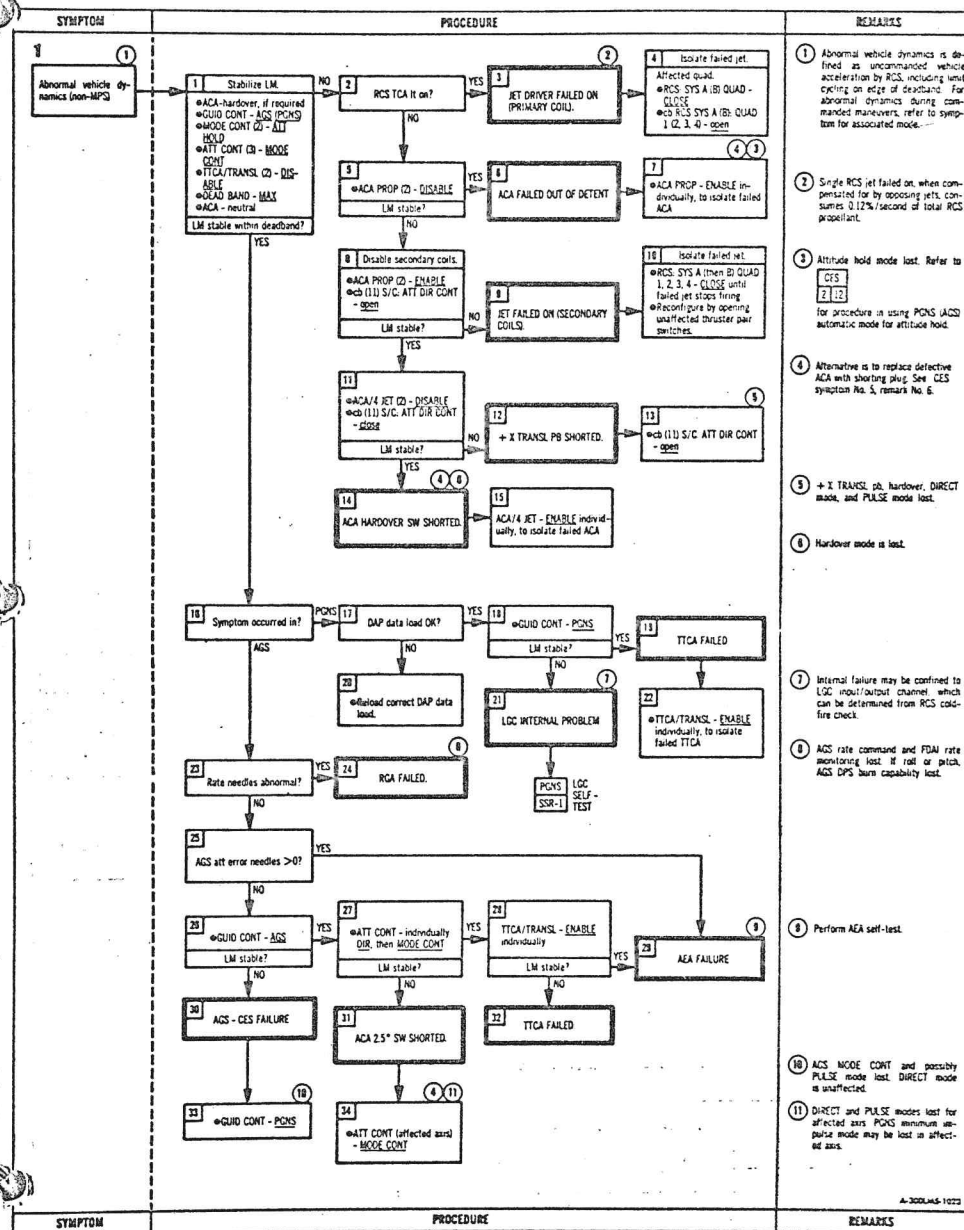
ENG GMBL

- 9 NO MPS SHUTDOWN
- 9a PREMATURE MPS IGNITION
- 10 NO MPS IGNITION AT TIG = 0
- 11 ENG THRUST AND CMD THRUST IND DO NOT AGREE

PRE AMPS

CES AC

CES DC

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DPS

APS

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APOLLO OPERATIONS MANUAL		REMARKS
SYMPTOM	PROCEDURE	
2 1 LM drifts out of deadband	1 ACA hardware, if required GUID CONT SW? POKGS 2 DEAD BAND - MIN MODE CONT (AGS) - ATT HOLD ATT CONT (C) - MODE CONT Select FDAI's on all sources. Observe att errors. ACA - cmd + & - in all axes. Any motion? NO ENABLE VOLTAGE TO ABORT PREAMPS LOST 4 GUID CONT - POKGS 3 All axes respond? YES 6 ACA - neutral FDAI failing to establish new reference? AGS DRIVEN 4 AGS OUT-OF-DETECT RELAY FAILED CLOSED NO 7 GUID CONT - AGS DEAD BAND - MIN MODE CONT (AGS) - ATT HOLD ATT CONT (C) - MODE CONT Select FDAI's on all sources. Observe att errors. ACA - cmd + & - in all axes ACA - neutral Error needles on both FDAI's establish new reference? YES 2 ENABLE VOLTAGE TO PRIMARY PREAMPS LOST 7 NO ATT HOLD INHIB SUPPLIED TO LGC 15 POKGS att hold 8 ACA - neutral FDAI's failing to establish new reference? BOTH 11 ACA OUT-OF-DETECT SW SHORTED 14 Guidance mode desired? AGS 18 AGS att hold DEAD C 400 + 000000 MODE CONT (AGS) - AUTO To establish new reference & mmr MODE CONT (AGS) - ATT HOLD ATT CONT (C) - as desired ACA - mmr When mmr complete: MODE CONT (AGS) - AUTO ATT CONT (C) - MODE CONT NO 12 Establish POKGS att hold mode GUID CONT - POKGS ACA - mmr LM responds? YES 6 POKGS OUT-OF-DETECT RELAY FAILED CLOSED 18 Guidance mode desired? POKGS 20 GUID CONT - AGS	1 Procedure is applicable to POKGS or AGS attitude hold mode only. 2 RCS control lost for affected position of GUID CONT SW if ATCA circuit breaker for associated guidance system opened, a return to that system for control is impossible. 3 Only AGS PULSE and DIRECT control are available in affected axis. 4 Out of detect signal to ACA is always present. 5 MODE CONT (POKGS) - QEF momentarily to allow CDU's to be driven to existing LM orientation. If not set to QEF, LM will be driven to attitude previously stored in CDU's LM will drift about X-axis unless X-axis override is locked out. To inhibit: Y25 NO7E R1 1107E R2 1107E R3 1E 6 Out-of-detect signal to LGC is always present. 7 POKGS RCS control may be available in AUTO.
3 POKGS minimum impulse (N7G) cmds abnormal	1 Coupled motion? YES 2 GUID CONT - AGS ATT CONT - PULSE ACA - cmd mmr Coupled motion? YES 3 DRIVER FAILED OFF NO 4 ATT CONT - DIR lets fire? YES 5 ACA 2.5 SW FAILED CLOSED NO 6 ACA - cmd mmr in affected axis lets fire? YES 8 LGC PROBLEM NO 10 ACA 2.5 SW FAILED OPEN 7 LGC PROBLEM (OUTPUT CHANG) 1 Isolate failed jet by DSKY entry.	1 DSKY entries to inhibit jet: W25 NO7E FL Y25 NO7 Load R1 1257E if vertical jet 1260E if horizontal jet FL Y25 NO7 Load R2 with octal code that identifies failed jet. 1U-100E 1A-1E 1D-200E 4D-2E 1F-4E 4F-2E 1L-200E 1R-100E 2U-20E 3U-4E 2D-40E 3D-10E 2A-10E 3A-1E 2L-20E 3L-40E FL Y25 NO7 Load R3 1E W48E W49E W24E - Terminate 2 If problem is in pitch or roll, LPO lost. 3 LGC minimum impulse AGS PULSE and one-half of DIRECT authority lost for affected ACA

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4 ACS pulse or direct cmds abnormal	1 Excessive or uncommanded rates? YES → 2 Symptom occurred in? NO → 7 ATT ACA - cmd mvr 2 PULSE → 3 Prop mvr 3 ATT CONT (2) - MODE CONT ACA - cmd mvr Response norm? NO → 4 ATCA FAILURE YES → 5 ACA 2.5 SW FAILED CLOSED 5 → 6 ATT CONT (2) - MODE CONT 6 → 7 7 Response norm? YES → 8 ACA 2.5 SW FAILED OPEN NO → 11 ACA 2.5 SW FAILED OPEN 11 → 12 Symptom occurred in? 12 PULSE → 13 Prop mvr 13 ATT CONT (2) - MODE CONT ACA - cmd mvr Response norm? YES → 14 PULSE MODE ENABLE RELAY FAILED (TYP K19) NO → 15 JET FAILED OFF (SEQ) 14 → 15 15 JET DRIVER/PREAMP FAILED OFF	1 Affected ass may be available in PGAS if preamp failed. 2 One-half of DIRECT authority lost for affected ACA. 3 LOC minimum impulse, ACS PULSE and one-half of DIRECT authority lost for affected ACA. 4 ACS PULSE mode lost for affected ass.
5 Prop cmds abnormal	1 ACA - hardware, if required ACA PROP - DISABLE ATT ACA - cmd prop mvr Response norm? YES → 2 Orig symptom no mvr? NO → 3 Coupled motion? 2 YES → 3 ACA PROP CONT FAILED NO → 4 PROP CONT TRANSDUCER HUNG UP OUT OF NEUTRAL 3 YES → 5 GUID CONT - ACS (PONS) 5 ACA - cmd + & - in affected ass Response norm? YES → 6 PONS - RCS (CES - RCS) INTERFACE FAILURE NO → 7 JET DRIVER FAILED OFF 6 → 7 7 YES → 8 JET DRIVER FAILED OFF 8 GUID CONT sw? PONS → 9 S & C CONT ASSYS RELAY FAILED OPEN OR LOC PROP INPUT PROBLEM OR OPEN CIRCUIT IN ONE ACA 9 → 10 10 → 11 Excessive rates? 11 YES → 12 GUID CONT PONS 12 Perform rate gyro test. Successful? YES → 13 SUMMING AMPLIFIER SHORTED NO → 14 ACA FAILED 13 → 14 14 → 15 15	1 Prop control lost for affected ACA. 2 Failure may be single or multiple. 3 Failure could be open LOC output channel, summing amplifier, pulse rate module or preamplifier. 4 Prop control lost for affected guidance system. DIRECT and PULSE control unaffected. 5 If symptom is present in both guidance modes, malfunction may be open circuit in one ACA. 6 To remove ACA and replace with shoring plug: wcd 111: S/C ATT DIR CONT - open ACA PONS - open wcd 110: S/C ACA PONS - open wcd 111: COMW CDR - open for LAMP ACA or wcd 110: COMW SE - open for LAMP ACA ACA PROP (2) - DISABLE AUDIO CONT (2) - NORM On suspected ACA wcd 117: 175 - disconnect wcd 117: 178 - disconnect Install shoring plug on 1709 wcd 117: 1709 - disconnect Since vehicle attitude control is lost during switch over use of this procedure during controlled flight is not recommended. 7 PONS and DIRECT control unaffected. PULSE control may be available in ACS. 8 DIRECT control unaffected. Prop control may be OR in alternative guidance system. 9 FDI rate displays lost.

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SYMPTOM	PROCEDURE	REMARKS
6 TTCA ends abnormal	1 Gain cont & apply ΔV • ACA - gain att cont • ATT TTCA - apply ΔV as needed Response norm? 2 • ACA - gain att cont • GUID CONT - ACS PGNS • TTCA - apply ΔV as needed Response norm? 3 • GUID CONT - PGNS (ACS) • MODE CONT (2) - ATT HOLD • ATT CONT (2) - MODE CONT • ACA - cmd single-axis prop mnt Response? 4 ENABLE VOLTAGE TO PRIMARY (ABORT) PREAMPS FAILED 5 Cold-free TTCA • RCS SYS A & B QUAD 1, 2, 3, 4 - open • V111 NOISE JTE R1 = 3800X • TTCA - cmd - 8 - translation in each direction: Up 3750X Down 3750X Right 3750X Left 3750X Forward 3750X Att 3750X • RCS SYS A & B QUAD 1, 2, 3, 4 - close • ch (11) INST CMEA - open then close R1 correct in all directions? 6 RET DRIVER CKT FAILED OPEN 7 Affected THRUSTER PAIR - CLOSE 8 Failure occurred in? PGNS AGS 9 OPEN CKT IN ± 15V LINE FROM ATCA 10 LGC PROBLEM PGNS SSR-1 LGC TEST 11 RELAY BETWEEN TTCA & CES FAILED 12 TTCA SW FAILED OPEN 13 Use alt TTCA for translation.	1 Abnormal response will be lack of (or subnormal) ΔV or abnormal limit cycling. 2 RCS control for affected guidance system lost. 3 Resetting ch (11) INST CMEA causes MASTER ALARM and HEATER II-on. Reset HEATER II. 4 Because translation is single-jet, expect at least twice thrusting time to achieve ΔV. 5 LGC problems may be confined to input/output channel failure, which can be determined from RCS cold-free test in step 5. 6 Translation capability in AGS lost. 7 Applicable to AGS control only.
7 Abnormal dynamics during MPS thrusting	1 Eng? DPS 2 Stabilize LM • ACA - hardware, as required • GUID CONT - AGS Can LM be controlled? 3 ENG GMBL II-on? YES 4 Cont being regained? YES 5 GUID CONT on? PGNS 6 Stabilize LM • ACA - hardware, as required • GUID CONT - AGS 7 LGC FAILURE 8 Reset light • ENG GMBL - OFF, then ENABLE 9 GDA FAILURE 10 PGNs available? YES 11 Stabilize LM • ACA - hardware, as required • GUID CONT - PGNS 12 AGS/CES FAILURE 13 Regain control • ENG GMBL - OFF • GUID CONT - PGNS • Reduce throttle or terminate thrusting. 14 Stabilize LM • ACA hardware, as required BAL CPL - ON? 15 BAL CPL - ON LM stable? 16 Select DIRECT mode. • ATT CONT (affected axis) - OFF 17 RGA FAILED 18 AEA/ASA FAILED 19 Manually control affected axis.	1 Assumption: All DPS burns are initiated in PGNS. 2 Perform AEA self-test AGS 114 3 Possible RCS TCA R.

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SYMPTOM	PROCEDURE	REMARKS
8 ENG GMBL YELLOW Light on if there is discrepancy between gimbal drive signal & gimbal response signal	1 DPS firing? YES 2 CES DC or INVERTER II-on? YES 3 GDA POWER FAILURE 4 Monitor RCS for excessive consumption. 5 RCS thruster firing and/or FDAI error needles oscillate around one edge of 1" deadband? YES 6 TRANSIENT DRIVE SIGNAL OR CMEA FAILURE 7 Select all inverter if INVERTER II-on • ch (11) EPS INV I - close • INVERTER - I 8 Eng armed? NO 9 GDA/DECA FAILURE 10 ENG GMBL - OFF 11 CMEA FAILURE 12 ENG GMBL II - off? 13 GDA/DECA FAILURE 14 Deactivate DPS. • ENG GMBL - OFF • ENG ARM - OFF • Confirm gimbal position with MSFN 15 TRANSIENT DRIVE SIGNAL	1 Light is inhibited when ENG ARM - OFF. 2 Mission rules dictate crew action. Continuation of powered descent will result in abnormal RCS fuel consumption and possible violation of thermal constraints. 3 It is possible to distinguish between these failures by resetting ENG GMBL II (ENG GMBL - OFF, then ENABLE). 4 C/W monitoring of GDA lost. 5 It may be possible to reset gimbal position using alternative guidance system and MSFN information.
9 No MPS shutdown	1 Manual shutdown • Eng STOP pb - push • ENG ARM - OFF • Verify ABORT (ABORT STAGE) pb - reset Eng shuts down? 2 Eng? APS 3 Remove power • ch S/C AELD (2) - open 4 Remove power • ch (11) S/C DECA PWR - open • ch (11) S/C DES ENG OVRO - open 5 DOUBLE FAILURE IN CES 6 Subsequent ACS burns • Use ENG ARM as off-on eng cont 7 GUID CONT on? PGNS 8 Ch AEA eng status • DECA C 343R Readout = or -? 9 AEA ISSUING ENG - ON CMD 10 Eng symptom premature ignition? YES 11 ATT MON - AGS • MODE CONT (2) - ATT HOLD Att errors zero? 12 AGS ENG FOLLOWUP DISCRETE FAILED 13 Ch LGC eng status • V01 NOISE JTE R1 = AD00X A = 2? 14 S/C ASSTS RELAY FAILED 15 Subsequent burns • Use ENG ARM as on-off eng cont 16 ENG ON - OFF CMD PROBLEM 17 Subsequent PGNS burns • Use ENG ARM as on-off eng cont	1 Assumption: Burn was terminated on premature ignition (except during lunar ascent). Whether crew will reattempt burn at TIG will be mission rule. 2 Failure of MPS to shut down automatically will also result from failure of ch (11) S/C ENG ARM. If this circuit breaker is open manual starts and stops will be required for subsequent burns. Delay arming engine until TIG. 3 AGS attitude hold and automatic on-off capability lost. 4 AGS - controlled burns unaffected.

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SYMPTOM	PROCEDURE	REMARKS
10 No MPS ignition at TIG = 0	1 Manual start Eng START pb - push Eng starts? YES → 2 AUTO ON - OFF CTRY FAILURE NO → 4 Redundant arming signal ABORT pb - push (DPS) ABORT STAGE pb - push (APS) Eng starts? YES → 3 ENG ARM SW CTRY FAILURE NO → 7 DECA POWER OR RELAY K10 FAILED 3 Manual shutdown When burn complete: Eng STOP pb - push Eng ARM - pull Verify ABORT (ABORT STAGE) pb - reset 8 Subsequent burns: DPS - Arm via ABORT pb APS - Arm via ABORT STAGE pb Use auto eng-on cmd for ignition 2 Subsequent DPS burns: DPS ENG CMD DYNO - ON at TIG	1 Failure of MPS to start and stop automatically will also result from failure of cb (15) S/C ENG ARM. If this circuit breaker is open, manual starts and stops will be required for subsequent burns. Delay arming engine until TIG. 2 MSFN will advise if maximum thrust /fixed gumbal DPS starts are expected. No APS burns are possible due to double CES failure. If descent engine override is used to start first DPS burn supercritical helium may not be pressurized.
11 ENG THRUST & CMD THRUST ind do not agree off schedule > 7%	1 FTP? YES → 2 Early throttle down to 10% NO → 5 AUTO LOGIC OUTPUT LOW 8 Advance TTCA until ENG THRUST ind = FTP 2 YES → 3 CMD still FTP? YES → 4 DECA RELAY FAILED NO → 7 Throttle up & attempt to match ENG THRUST & CMD THRUST ind. 5 YES → 6 ENG THRUST & CMD THRUST ind both low? YES → 9 Use alt TTCA MAN THROT - other position ENG THRUST ind = CMD THRUST ind? YES → 12 TTCA FAILED NO → 13 MANUAL LOGIC FAILED OR DEGRADED DPS/HARDWARE 9 YES → 10 Use alt TTCA MAN THROT - other position ENG THRUST ind = CMD THRUST ind? YES → 12 TTCA FAILED NO → 13 MANUAL LOGIC FAILED OR DEGRADED DPS/HARDWARE 12 YES → 14 Wait for throttle down 13 YES → 15 Throttle down occur? YES → 16 ENG THRUST, CMD THRUST, & T/W ind remain static/off schedule? YES → 17 ENG THRUST or CMD THRUST ind static while other ind & T/W ind norm? YES → 18 AUTO LOGIC FAILED NO → 21 Switch to manual throttle & fly manual profile 16 YES → 17 ENG THRUST or CMD THRUST ind static while other ind & T/W ind norm? YES → 18 AUTO LOGIC FAILED NO → 21 Switch to manual throttle & fly manual profile 17 YES → 19 ENG THRUST ind - 10% CMD THRUST ind - FTP BOTH ind - 10% → 20 ENG THRUST & CMD THRUST ind < CMD THRUST ind BOTH ind - FTP → 22 Use alt TTCA MAN THROT - other position ENG THRUST ind = CMD THRUST ind? YES → 23 TTCA FAILED NO → 26 Throttle up CMD THRUST ind decr? YES → 27 MANUAL LOGIC FAILED NO → 28 DEGRADED DPS/HARDWARE 20 YES → 21 Switch to manual throttle & fly manual profile 23 YES → 24 CMD THRUST ind = FTP? YES → 25 AUTO LOGIC FAILED TO FTP NO → 26 Throttle up CMD THRUST ind decr? YES → 27 MANUAL LOGIC FAILED NO → 28 DEGRADED DPS/HARDWARE 25 YES → 26 Throttle up CMD THRUST ind decr? YES → 27 MANUAL LOGIC FAILED NO → 28 DEGRADED DPS/HARDWARE 27 YES → 28 DEGRADED DPS/HARDWARE	1 DPS thrust erosion is expected to decrease command thrust = 1% below timeline and engine thrust = 5% below timeline. With maximum abnormal propellant pressures, 7% difference could be nominal. 2 MSFN monitors DPS performance. 3 DPS should not be operated for more than 25 seconds in nonthrottleable range.

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SYMPTOM	PROCEDURE	REMARKS
12 PRE AMPS YELLOW Light on if either - 47-VDC power supply is out of tolerance	1 CES AC it-on? YES → 2 ONE OR BOTH - 47-VDC PREAMP BIAS POWER SUPPLIES FAILED NO → 3	1 Sporadic jet firings are possible if both power supplies failed.
13 CES AC RED Light on if ATCA a-c power supplies are out of tolerance	1 Reset light & perform rate gyro test. QUID CONT - PCNS GYRO TEST POS RT - POS RT Observe rate needles & light. CES AC it remains on? YES → 4 CWEA FAILURE NO → 2 Rate displays null? YES → 3 SINGLE-PHASE ATCA POWER SUPPLY FAILED NO → 5 Reinitialize CWEA cb 116 INST CWEA - open then close CES AC it remains off? YES → 6 TRANSIENT CONDITION NO → 7 Make small inner via PCNS rate mode Rate inds > 0? YES → 8 POWER SUPPLY VOLTAGE OUT OF TOLERANCE (1.4V OR 3.4V OR 1.0 OF 3.0 FAILED) NO → 9 POWER TO RATE GYRO FAILED	1 If ACS is in control, true CES a-c failure causes loss of damping. 2 ACS control of LM lost but AEA remains for computation purposes only. 3 RW usable only in LOC mode. Shift and Inman power lost in SLEW and AUTO TRACK. 4 Subsequent CES a-c monitoring lost. 5 Resetting cb 116 INST CWEA causes MASTER ALARM and HEATER it-on. Reset HEATER it. 6 Rate gyro assembly will probably not restart after shutdown. 7 FDAI rate needles are invalid.
14 CES DC RED Light on if ATCA d-c power supplies are out of tolerance	1 Reset light QUID CONT - PCNS GYRO TEST POS RT - POS RT CES DC it remains on? YES → 5 CWEA FAILURE NO → 2 Reinitialize CWEA cb 116 INST CWEA - open then close CES DC it remains off? YES → 6 TRANSIENT CONDITION NO → 3 Staged? YES → 4 ATCA POWER SUPPLY 1.5V 3.5V AND OR 4.3V FAILED NO → 7 Enable throttle actuator Eng STOP pb - push Eng ARM - pull MSFN reports throttle at max? YES → 8 3.5V ATCA POWER SUPPLY FAILED NO → 9 4.3V OR 4.3V ATCA POWER SUPPLY FAILED	1 Resetting cb 116 INST CWEA causes MASTER ALARM and HEATER it-on. Reset HEATER it. 2 ACS attitude control lost. 3 Subsequent APS burns should be started manually. 4 Subsequent CES d-c monitoring lost. 5 This transient condition may have caused throttle to lock in 100% position. Cycle cb AC BUS A, DECA GEAR, and or check throttle position with MSFN. 6 DPS and APS operation is normal in PCNS. 7 DPS fixed at maximum throttle with gumbal locked.

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LM MALFUNCTION PROCEDURES

LM MALFUNCTION PROCEDURES

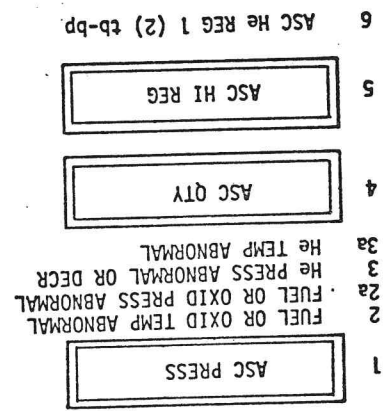
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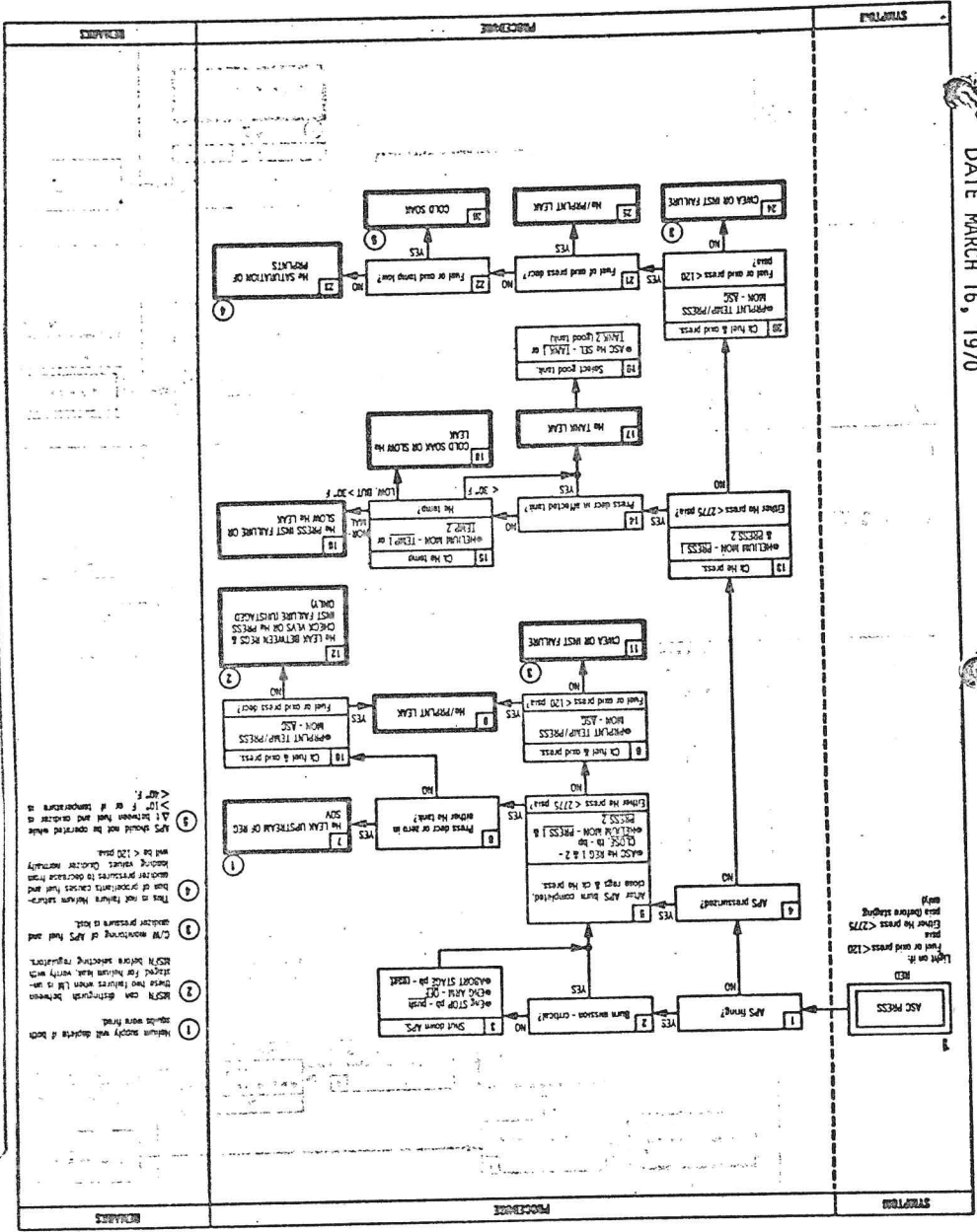


APS V DPS CEC AGS V PNGS V G&C V

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LM MALFUNCTION PROCEDURES

LM MALFUNCTION PROCEDURES



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- 1 ASC PRESS
- 2 FUEL OR OXID TEMP ABNORMAL
- 2a FUEL OR OXID PRESS ABNORMAL
- 3 He PRESS ABNORMAL OR DECR
- 3a He TEMP ABNORMAL
- 4 ASC QTY
- 5 ASC HI REG
- 6 ASC He REG 1 (2) tb-bp.

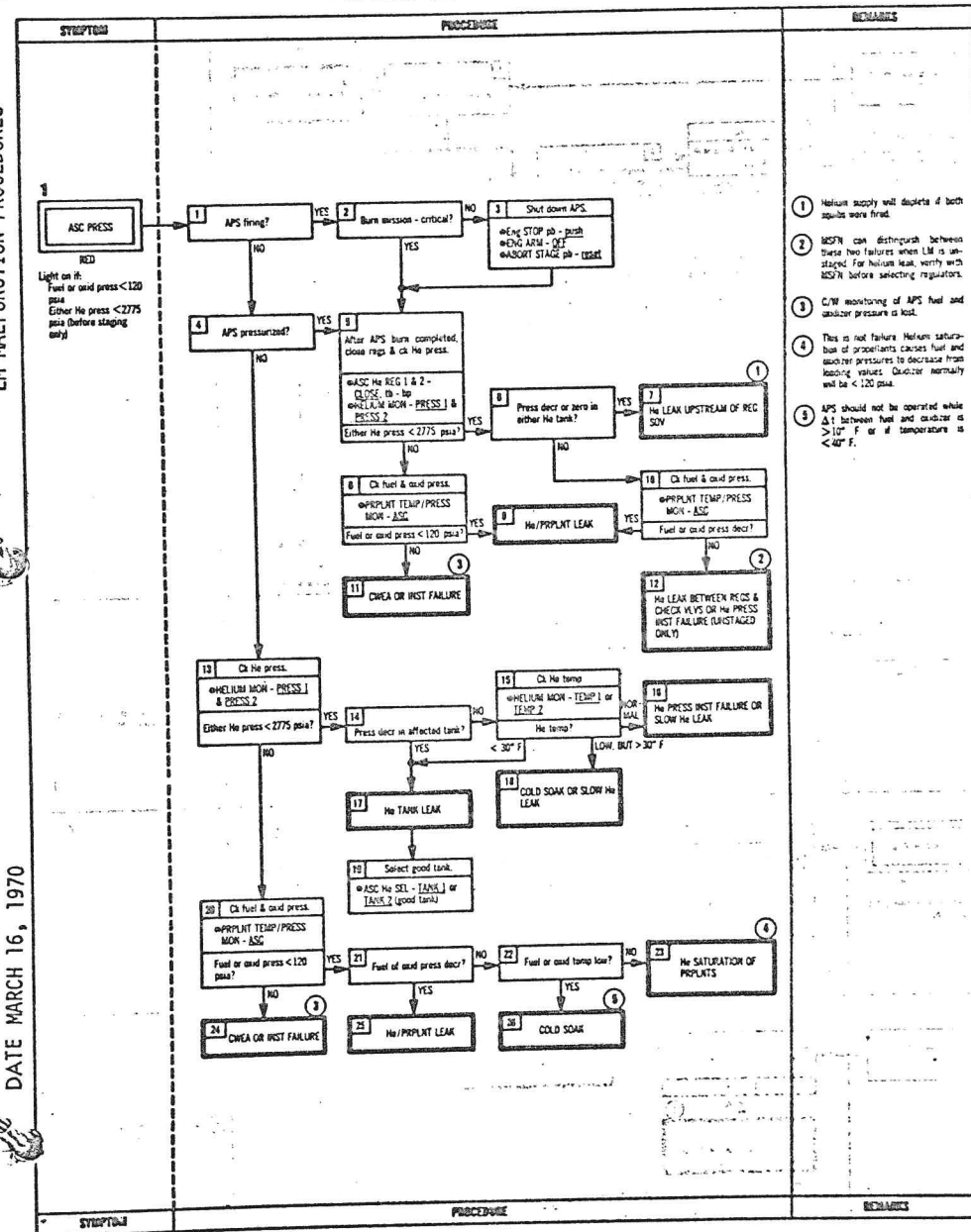
LM MALFUNCTION PROCEDURES

SOURCE MOCATA
DATE MARCH 16, 1970

LM MALFUNCTION PROCEDURES

SOURCE LM AOH
DATE MARCH 16, 1970

LMA790-3-LM
APOLLO OPERATIONS HANDBOOK



1
THRU
6

LMA790-3-LM
APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
2 Fuel or acid temp abnormal > 50°F < 50°F Fuel/acid ΔT > 10°F 2a Fuel or acid press abnormal Pressurized: > 203 psia < 170 psia Unpressurized: < 110 psia (fuel) (g 50°F) < 70 psia (acid) (g 50°F) Fuel/acid ΔP > 10 psia	1 Fuel (acid) press abnormal? NO 2 TEMP INST FAILURE OR COLD SOAK YES 3 Check and 4 Accent fuel or acid temp abnormal? YES 5 HEAT SOAK OR COLD SOAK NO 6 NO FAILURE 7 APS pressurized? YES 8 Close regts. NO 9 ASC He REG 1 & 2 - CLOSE 10 APS PRESS LT 11 ASC PRESS LT	
3 He press abnormal or door > 2300 psia < 2500 psia 3a He temp abnormal > 80°F < 50°F	1 Check and 2 Press? HIGH 3 Check He and He temp high? NO 4 PRESS INST FAILURE YES 5 APS pressurized? YES 6 Close regts. NO 7 APS PRESS LT 8 He press low or door? NO 9 TEMP INST FAILURE YES 10 HEAT SOAK 11 ASC PRESS LT	
4 ASC QTY YELLOW Light on when burn time < 10 sec.	1 APS firing? YES 2 Terminate APS/RCS interconnect. NO 3 CHECK FAILURE 4 APS PRESS LT 5 ASC PRESS LT	① C/W indication of when to close ASC FEED valves test.
5 ASC He REG YELLOW Light on if He anal press > 220 psia	1 Close regts. 2 ASC He REGS FAILED OPEN (DOUBLE FAILURE) 3 When fuel & acid press < 220 psia: ASC He REG 1 & 2 - OPEN; He - gray individually to isolate failed reg 4 CHECK/INST FAILURE 5 Open ASC regts. 6 ASC He REG 1 & 2 - OPEN; He - gray	
6 ASC He REG 1 CO th - hp	1 ASC He REG 1 CO - OPEN 2 He REG SOV UNLATCHED 3 TB - gray? 4 TB INST FAILURE OR He REG SOV FAILED CLOSED	① MSFN can distinguish between these two failures.

LM MALFUNCTION PROCEDURES

LM MALFUNCTION PROCEDURES

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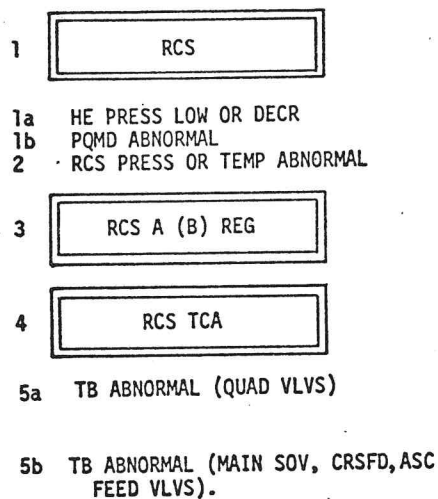
SOURCE LM AOH
DATE MARCH 16, 1970

SOURCE MOCATA
DATE MARCH 16, 1970

APS
DPS
CLS
AGS
PNCS
G&C
DISPLAYS

RCS / CAMERA / HTRS / ED / ECS / COMM / EPS

RCS MALFUNCTION INDEX



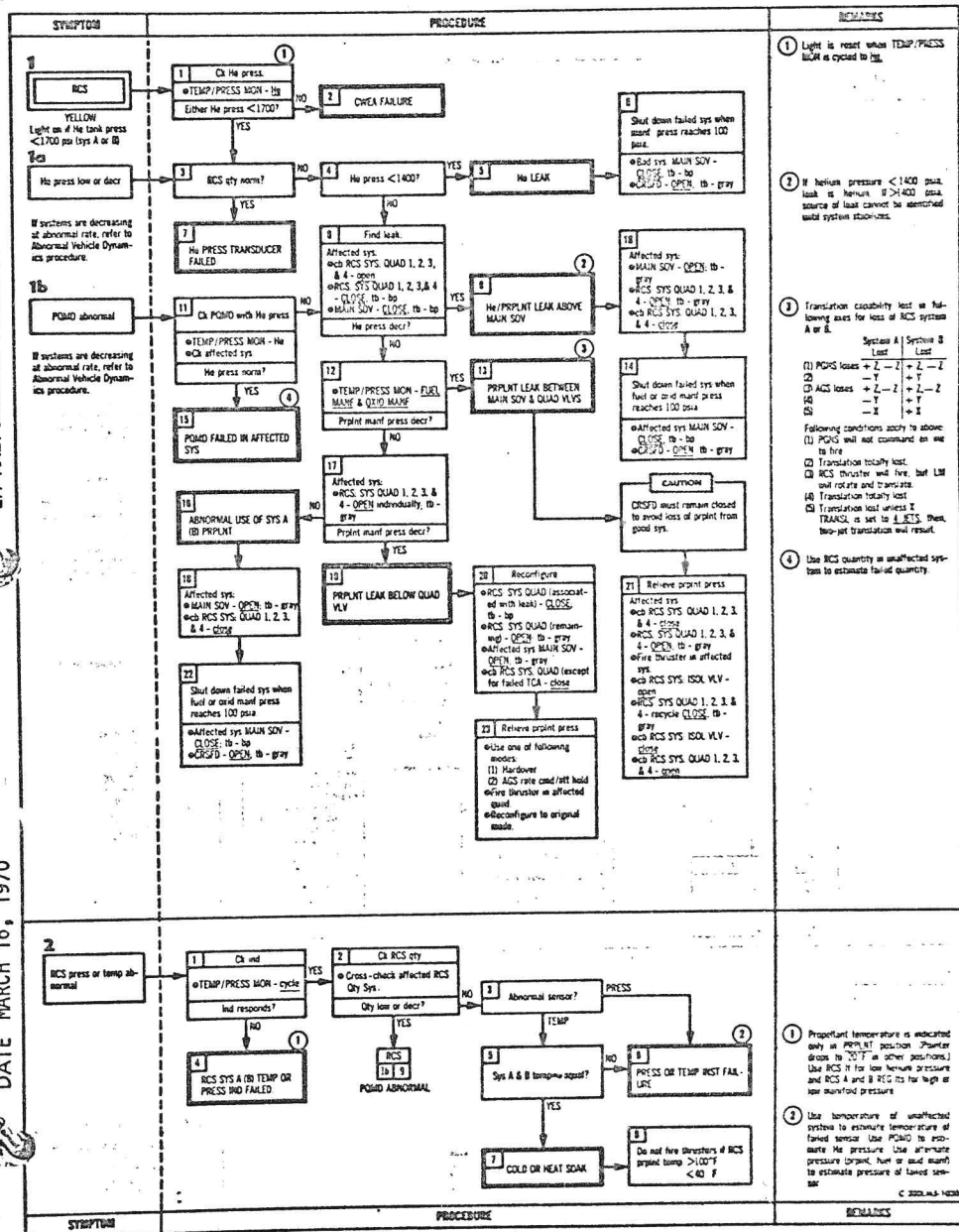
FLM MALFUNCTION PROCEDURES

SOURCE MOCATA
DATE MARCH 16, 1970

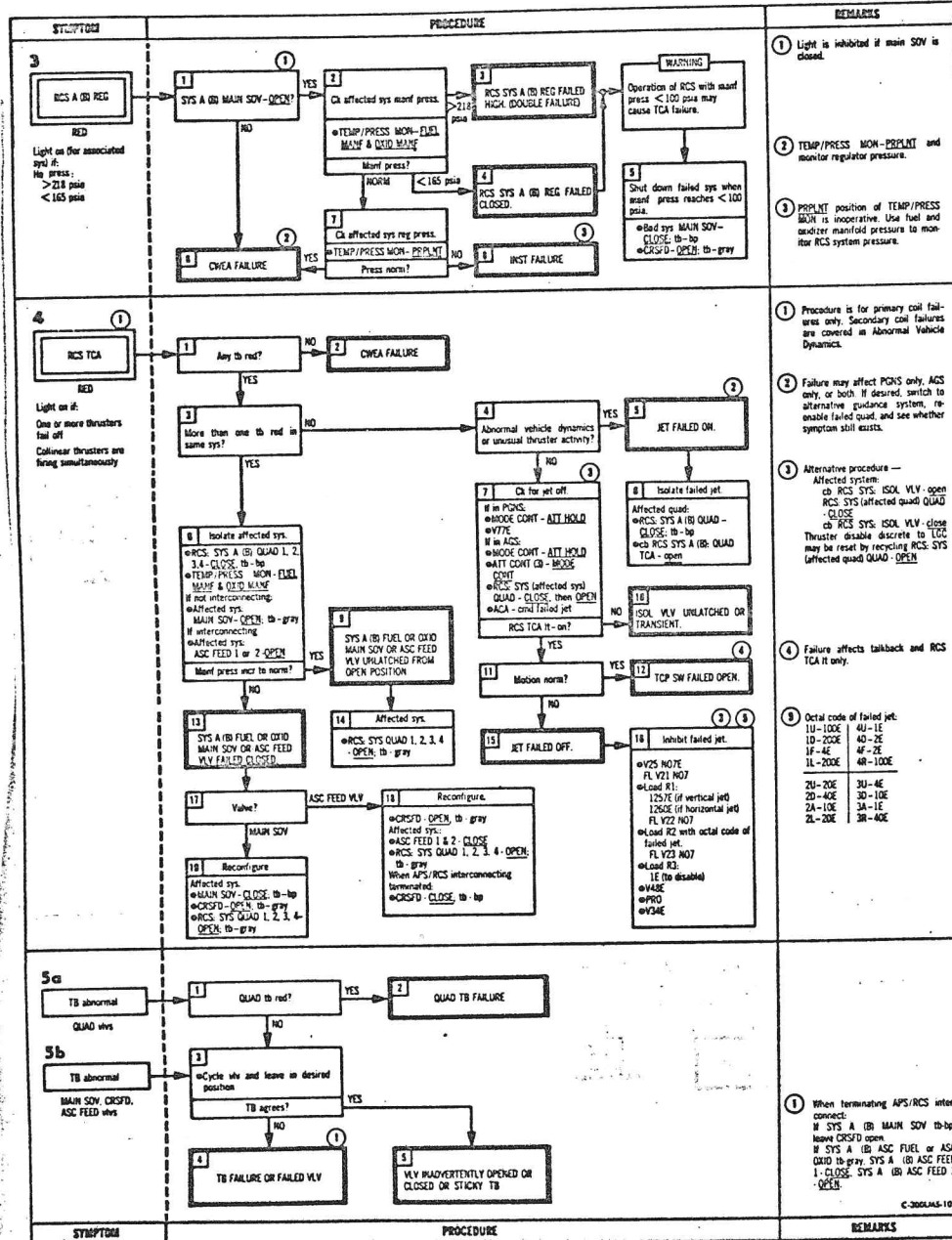
ALARM MALFUNCTION PROCEDURES

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DATE MARCH 16, 1970

LMA790-3-LM
APOLLO OPERATIONS HANDBOOK



LMA790-3-LM
APOLLO OPERATIONS HANDBOOK



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LM MALFUNCTION PROCEDURES

LM MALFUNCTION PROCEDURES

G&C
PNC
ACS
CES
DPS
APS
RCS

EPS
COMM
ECS
ED
HTRS
CAMERA
EMU

EPS MALFUNCTION INDEX

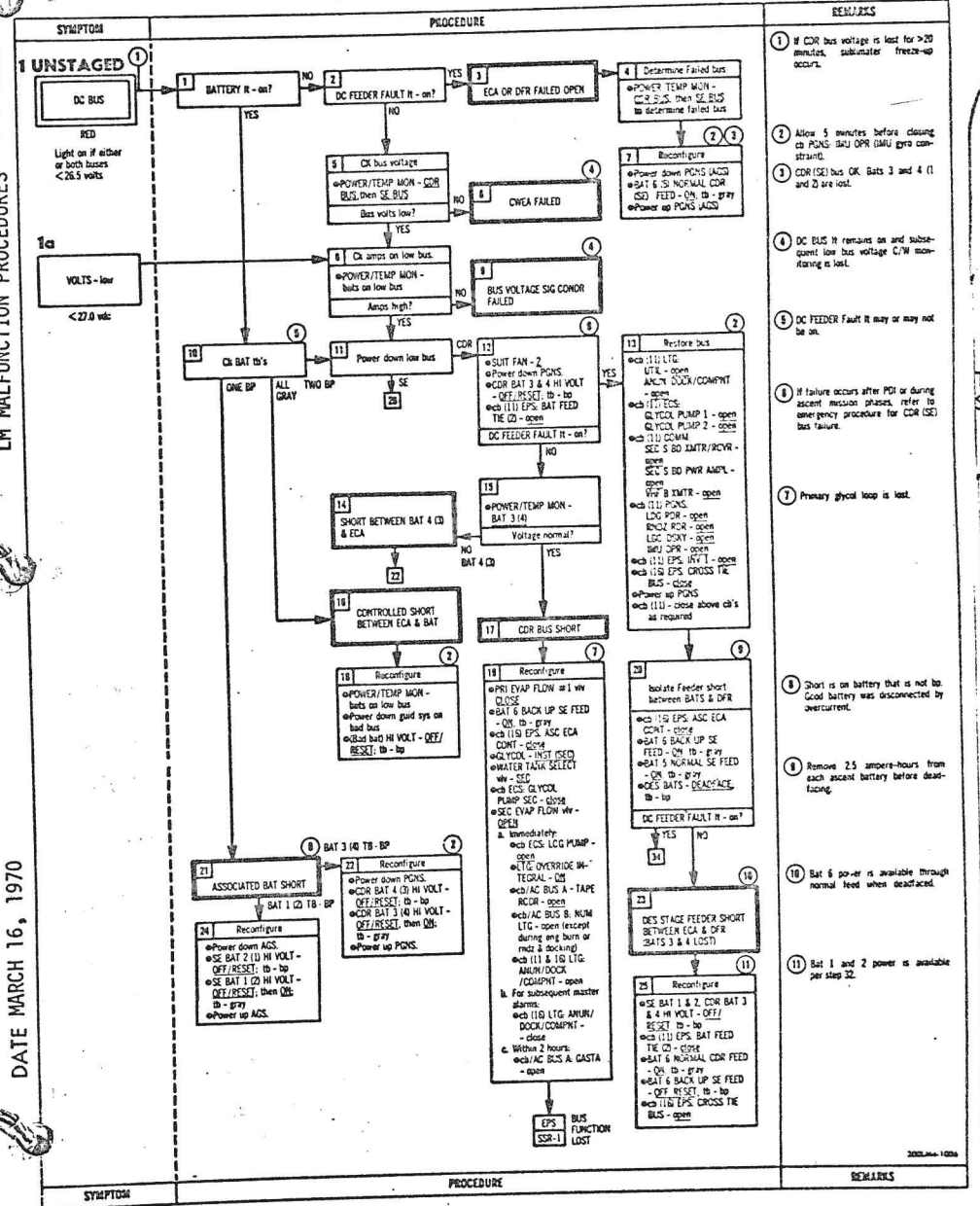
1	UNSTAGED	DC BUS
1a	UNSTAGED	VOLTS - LOW
2	STAGED	DC BUS
3	UNSTAGED	BATTERY
4	STAGED	BATTERY
5	UNSTAGED	BAT TB ABNORMAL
6		INVERTER
6a		AC VOLTAGE HIGH
SSR-1		BUS FUNCTIONS LOST

LM MALFUNCTION PROCEDURES

SOURCE MOCATA
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DATE MARCH 16, 1970

LMA790-3-LM
APOLLO OPERATIONS HANDBOOK



1 THRU 1a

2 THRU 5

6 THRU SSR-1

EMU, CAMERA, HTRS, ED, ECS, COMM

LMA790-3-LM
APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
3 UNSTAGED BATTERY Light on R: Bat overtemperature $\geq 145^\circ\text{F}$ Bat reverse current > 10 amp for 4 to 6 sec Bat overcurrent > 150 to 200 amp	1. Check all bat ID's. Any ID's lit? 2. Check short. POWER/TEMP MON - faulty bat. Volts low? 3. Attempt reset. Faulty bat HI VOLT - OFF/RESET, then ON. Bat stays on line? 4. TRANSIENT ECA PROBLEM. 5. ECA FAILED. 6. Check bat fault. POWER/TEMP MON - all bat positions. BAT FAULT II - on? 7. SHORT BETWEEN BAT & ECA. Faulty bat HI VOLT - OFF/RESET, ID - lit. 8. CMEA FAILED. 9. Bad BAT - OFF/RESET, ID - lit. VOLTS norm? 10. YES. Bad BAT HI VOLT - OFF/RESET, ID - gray. BAT FAULT II - on? 11. NO. TEMPORARY RELAY CLOSURE IN ECA. 12. RELAY FAILED IN ECA. 13. BAT LOST.	1. Bat C/W monitoring capability lost. 2. Failure affects C/W indications only. 3. Subsequent battery - malfunction monitoring capability lost. However, BAT FAULT II operates normally.
4 STAGED BATTERY Light on R: Bat overtemperature $\geq 145^\circ\text{F}$ Bat reverse current > 10 amp for 4 to 6 sec Bat overcurrent > 150 to 200 amp	1. POWER/TEMP MON - BAT 5 lit. 2. Bat drops & volts norm? 3. INST OR ECA RELAY FAILED. 4. CMEA FAILURE. 5. OVERTEMPERATURE OR REVERSE CURRENT BAT LOST.	1. Bat C/W monitoring capability lost. 2. Monitor battery for decreasing voltage. If voltage starts to decrease, remove battery from line and power bus from backup feed. 3. Reverse current only if buses are bad.
5 UNSTAGED Bat ID abnormal	1. Check amps. POWER/TEMP MON - affected bat. Amps zero? 2. Attempt reset. Faulty bat HI VOLT - OFF/RESET, then ON. Amps zero? 3. ECA FAILED. 4. ECA RELAY CONTACT OR ITS FAILURE. 5. INADVERTENT BAT TRIP OR TRANSIENT ECA FAILURE.	

A-300A-1009

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LM MALFUNCTION PROCEDURES

LM MALFUNCTION PROCEDURES

LMA790-3-LM
APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
6 INVERTER Light on R: Bus A-a-c voltage < 112 volts Frequency < 298 cps or > 402 cps	1. EL failed? 2. POWER/TEMP MON - AC BUS. VOLTS - green band? 3. Select all inverter. Each (1) EPS INV 1 - close. INVERTER 1 - off? 4. INVERTER NO. 2 FREQUENCY FAILURE. 5. Check AC BUS B: BUS TIE INV 1 - close. Check AC BUS A: BUS TIE INV 1 - open. INVERTER II - off? 6. INVERTER NO. 1 FEEDER SHORT. 7. CMEA OR SIG COND FAILURE. 8. Select all inverter. Check AC BUS B: BUS TIE INV 1 - close. Check AC BUS A: BUS TIE INV 1 - close. Check (1) EPS INV 1 - close. INVERTER 1 - off? 9. INVERTER II - off? 10. Select all inverter. Each (1) EPS INV 1 - close. INVERTER 1 - off? 11. INVERTER NO. 2 VOLTAGE FAILURE. 12. Check (1) EPS INV 2 - open. 13. Check AC BUS B: BUS TIE INV 1 - close. Check AC BUS A: BUS TIE INV 2 - open. INVERTER II - off? 14. Check AC BUS B: BUS TIE INV 1 - close. INVERTER II - off? 15. INVERTER NO. 2 FEEDER SHORT. 16. Check AC BUS B: BUS TIE INV 1 - close. Check AC BUS A: BUS TIE INV 1 - open. Numeric its brighter? 17. CMEA OR SIG COND FAILURE. 18. A-C BUS B SHORTED. 19. Check (1) EPS INV 2 - open. 20. A-C BUS A SHORTED. 21. Reconfigure. INVERTER 2. Check AC BUS A: BUS TIE INV 1 - open. Check AC BUS A: BUS TIE INV 2 - close. Check AC BUS A & B: BUS TIE INV 2 - close. Check (1) EPS INV 1 - open. 22. Reconfigure. INVERTER 2. Check AC BUS B: BUS TIE INV 1 - open. Check AC BUS A: BUS TIE INV 2 - close. Check AC BUS A & B: BUS TIE INV 2 - close. Check (1) EPS INV 1 - open.	1. Assumption: Inverter No. 2 is on. If inverter No. 1 is operating, replace all references to inverter No. 2 with inverter No. 1. 2. INVERTER II remains on. 3. Monitor a-c voltage on VOLTS and

6
THRU
SSR-1

300A-1010

EPS

PNGS

AGS

CES

DPS

APS

RCS

COMM

ECS

ED

HTRS

CAMERA

EMU

LMA790-3-LM
APOLLO OPERATIONS HANDBOOK

SPECIAL SUBROUTINE
SSR-1

Bas functions test

AC BUS B

AC BUS B: SE WIND HTR
He MON
DES QTY
S BO ANT
Auto/man ant slew
OROEAL
ACS
ACS ant mon
AOT LAMP OR
SE FDAO
NUM LTG
BUS TIE INV 2
BUS TIE INV 1

AC BUS A

AC BUS A: BUS TIE INV 2
BUS TIE INV 1
AC BUS VOLT
AC bus monitor
COR WIND HTR
TAPE RGR
AOT LAMP OR
RNOZ ROR
Auto/man ant slew
DECA CARL
QDA lock-up
Man throat
Thrust to 100%
INTG LTG
COR FDAO
GASTA
PGNS att & rate needles
RNG/RNG RT ALT/ALT RT meter

COR BUS

FLT DISP: OROEAL
COAS
COR FDAO & alt needles
GASTA
PGNS att & rate needles
RNG/RNG RT ALT/ALT RT meter
COR X-PNTR
MISSION TIMER
THRUST meter

RCS SYS A

ASC FEED 1
Last position
ASC FEED 2
Last position
ISOL VLV
Last position
QUAD 1 TCA
QUAD 2 TCA
QUAD 3 TCA
QUAD 4 TCA
All close
MAIN SOV
Last position

PROPUL: DES He REG/VENT

REG -- last position
VENT -- disabled
WTR: RNOZ ROR STBY heaters
RNOZ ROR OPR heaters
LDC ROR heater
AOT heater
DOCK WINDOW heater

INST: SIG CONDOR 1
Propellant 1's
Some meters
Some CMEA lts come on

STAB/CONT: ABORT STAGE (R, except no auto eng arm)

ATCA PGNS
LGC control of RCS
AELD OR
ENG CONT
DPS abort stage
ATT OR CONT
ENG START OVRO
Manual start
DECA PWR
DPS eng-on comm
DPS shuts down
Eng to 100% throttle
No auto-eng off

ED: LDC GEAR FLAG

LOGIC PWR A

LTC: AMU/DOCK/COMPNT

Lighting OR

PGNS: IAP OPR

ISU STBY
LGC/OSKY
RNOZ ROR
LDC ROR
SIG STR DISP

COMM: COR AUDIO center

VHF A RCVR
VHF B XMIT
SEC S BO XMIT/RCVR
SEC S BO PWR AMPL
UP DATA LINK

ECS: GLYCOL PUMP AUTO TRNFR

GLYCOL PUMP 1
GLYCOL PUMP 2
CABIN FAN 1
SUIT FAN 1

HEATERS RCS SYS A/B-1:

QUAD 1 heater
QUAD 2 heater
QUAD 3 heater
QUAD 4 heater

EPS: DES ECA CONT OR

DES ECA OR
ASC ECA CONT OR
ASC ECA OR
INV 1
DC BUS VOLT

LMP BUS

FLT DISP: EVENT TIMER/SE FDAO &
rate needles
SE X-PNTR

RCS SYS B

ASC FEED 1
Last position
ASC FEED 2
Last position
ISOL VLV
Last position
QUAD 1 TCA
QUAD 2 TCA
QUAD 3 TCA
QUAD 4 TCA
All close
CRSFD
Last position
TEMP/PRESS DISP FLAG
PGNS DISP
RCS qty
MAIN SOV
Last position

PROPUL: DISP/ENG OVRO LOGIC

MPS meters inoperative
PGNS
FUEL/OX qty
ASC He REG
Last position

INST: SIG CONDOR 2

EPS 1's
Some meters
Some CMEA lts come on
PCM/TE
TM XMT
Timing signals
SIG SENSOR
CMEA

STAB/CONT: DES ENG OVRO

ATCA (ACS)
ACS stab cont
ABORT STAGE (R, except no eng fire enable)
ATCA
RR-LGC mode lost
False TCA firings
AELD OR
Auto APS commands
ASA
ACS
ENG ARM
DPS/APS auto eng ON/OFF
DPS/APS shuts down
AEA
ACS

ED: LOGIC PWR B

LTC: MASTER ALARM
AMU/DOCK/COMPNT OR
TRACK light
FLOOD lighting

COMM: DISP

S-bd ant
SE AUDIO
VHF A XMIT
VHF B RCVR
PRIM S BO PWR AMPL
PRIM S BO XMIT/RCVR
S BO ANT
Auto/man ant slew
PAP
VHF RCV
S-BAND XMIT/RCV

TV

ECS: SUIT FLOW CONT

Turn-suit protection
SUIT/CABIN REPRESS
DISP
GLYCOL PUMP SEC
CABIN FAN 2
CABIN FAN CONT
CABIN REPRESS
Auto repress
SUIT FAN 2
SUIT FAN 3P
DIVERG VLV
Auto close
CO₂ SENSOR

EPS: DES ECA CONT OR

DES ECA OR
ASC ECA CONT OR
ASC ECA OR
INV 2
DC BUS VOLT
DISP
Volts/amps
TV's

CANR: SEQ

HTR RCS SYS A/B 2: S-BO ANT heater
DISP
QUAD 4 heater
QUAD 3 heater
QUAD 2 heater
QUAD 1 heater

LM MALFUNCTION PROCEDURES

LM MALFUNCTION PROCEDURES

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RCS
APS
DPS
CFS
AGS
PNGS
EPS

EMU
CAMERA
HTRS
ED
ECS
COMM

COMM MALFUNCTION INDEX

- 1 LOSS OF ICS
- 2 ONE CREWMAN HAS ABNORMAL (UNSELECTED) HOT MIKE
- 3 LOSS OF VHF VOICE COMM WITH CSM
- 4 LOSS OF S-BAND VOICE COMM
- 5

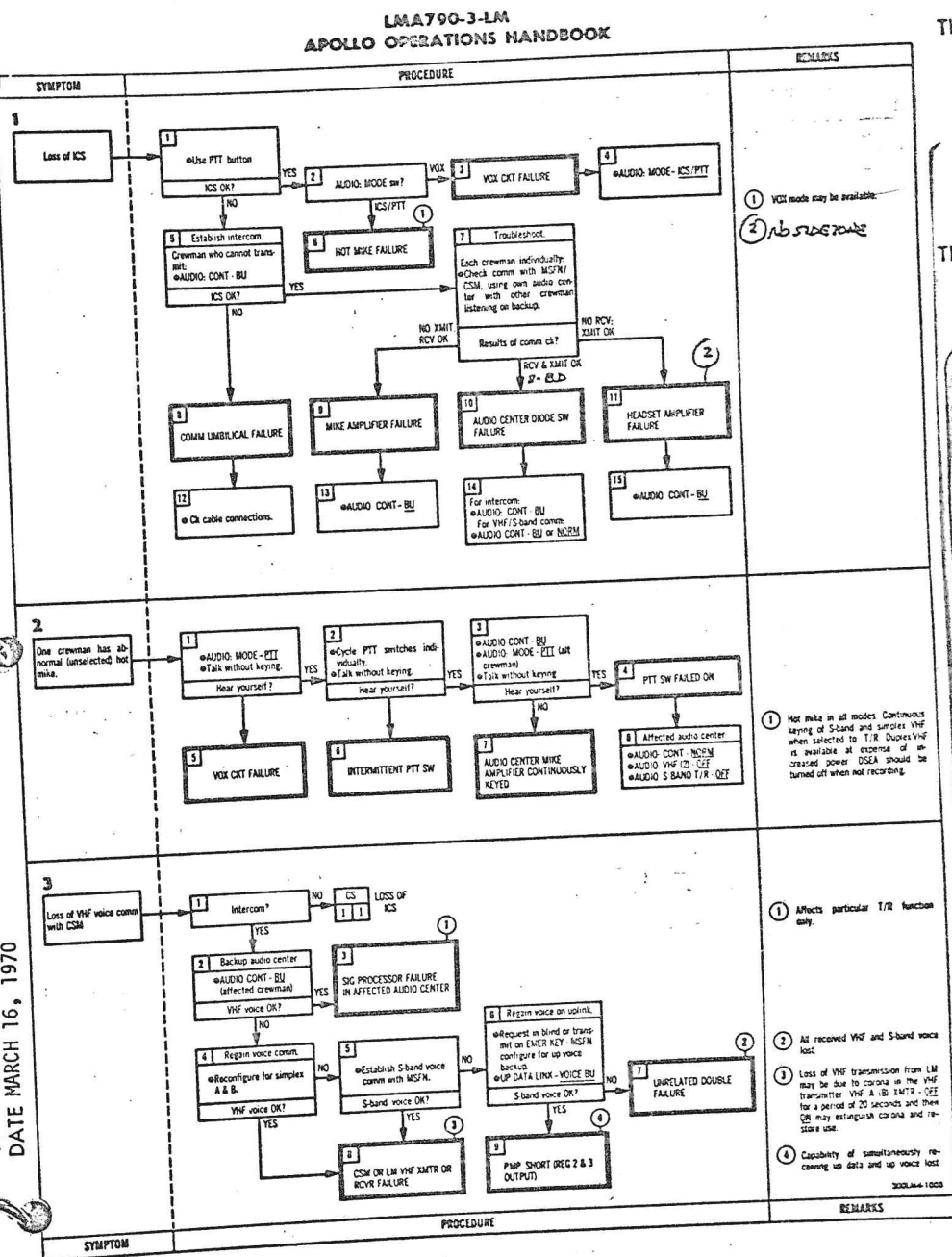
S BD RCVR
- 5a CANNOT ACQUIRE PHASE LOCK
- 6 MSFN REPORTS LOSS OF PCM. S-BAND VOICE OK
- 7 LOSS OF VOICE COMM WITH EVA (ONE MAN EVA)

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LM MALFUNCTION PROCEDURES

LM MALFUNCTION PROCEDURES



1 THRU 4

5 THRU 7

ECS

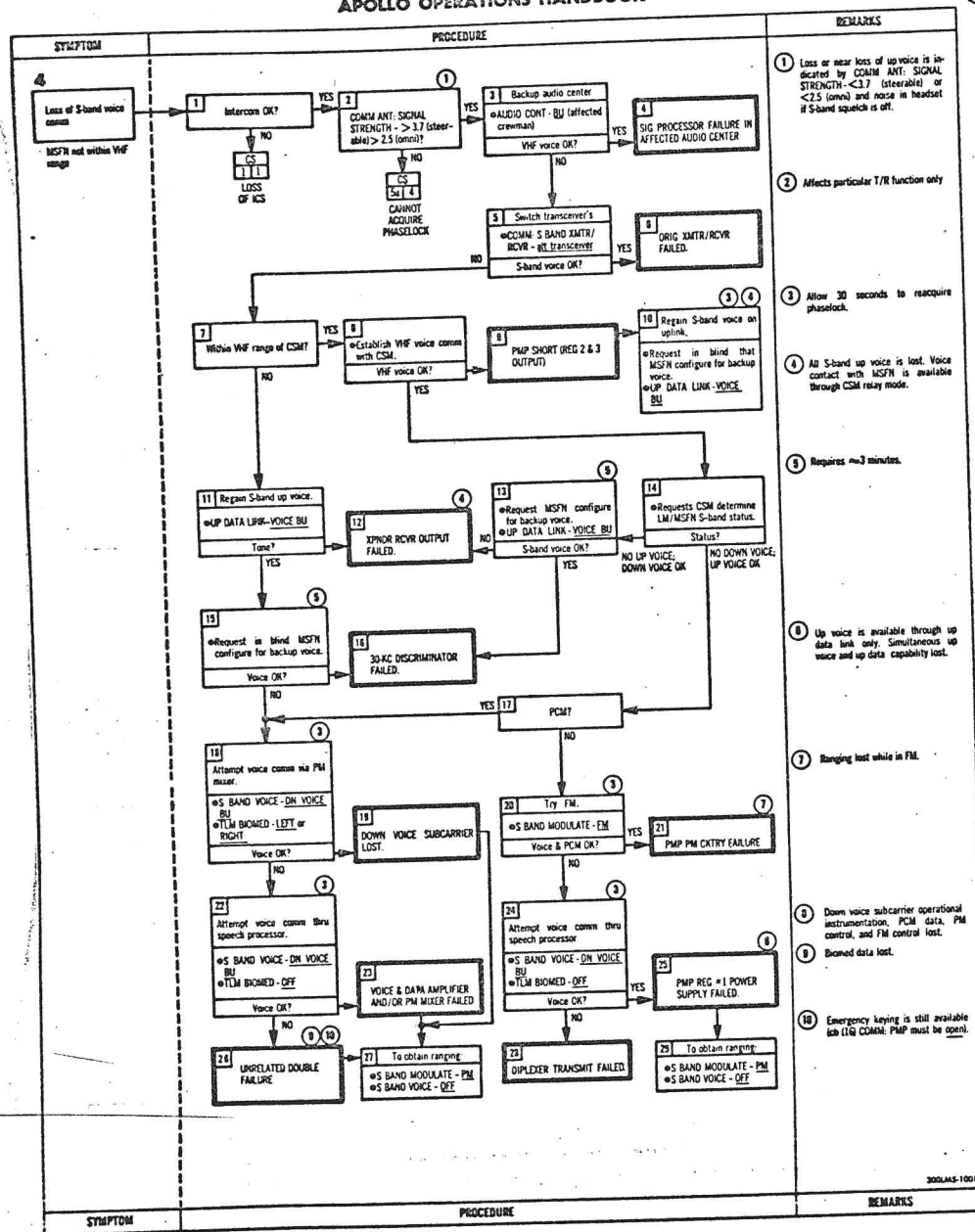
ED

HTRS

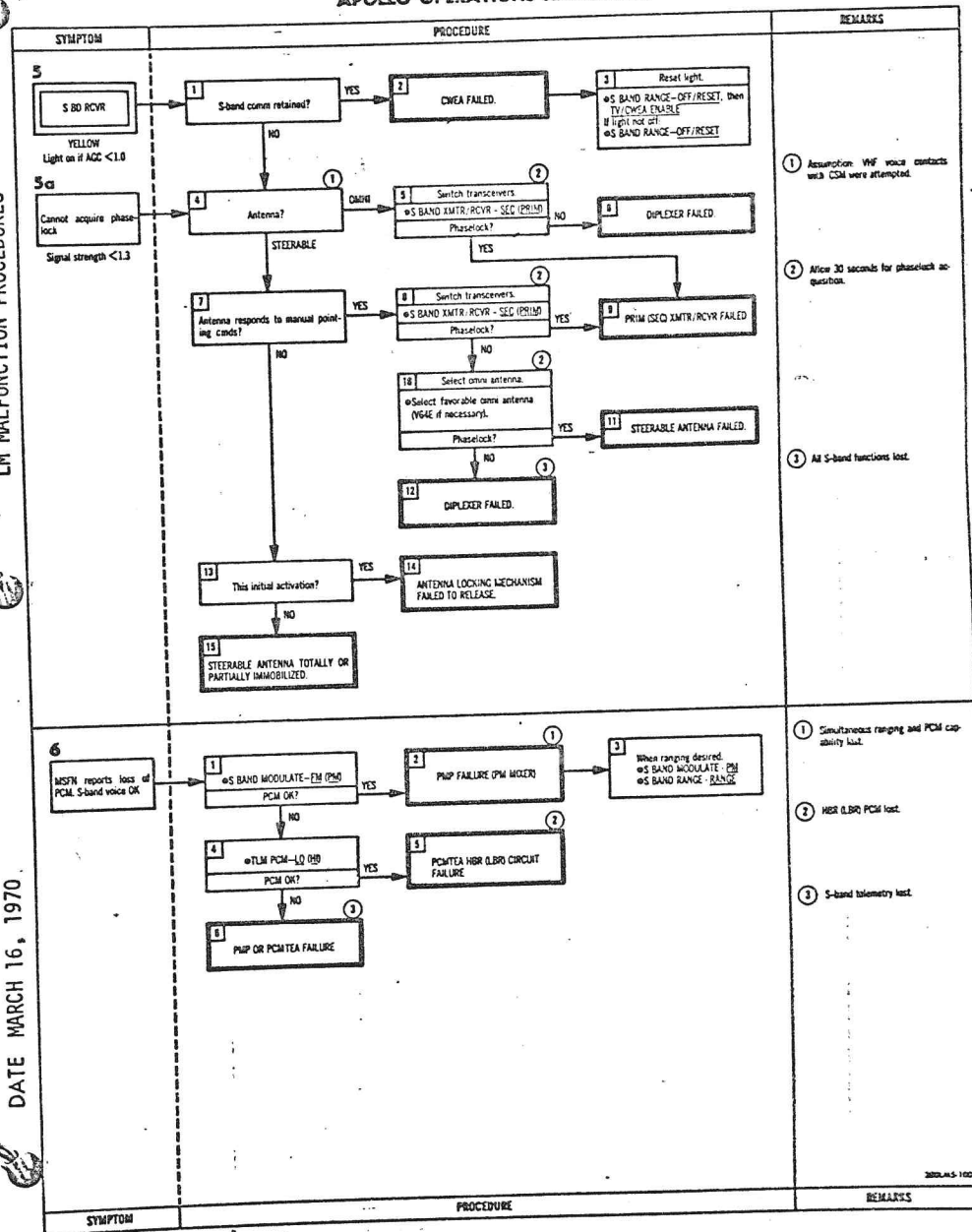
CAMERA

EMU

LMA790-3-LM
APOLLO OPERATIONS HANDBOOK



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5
THRU
7

ECS

ED

HTRS

CAMERA

EMU

RCS
APS
DPS
CES
AGS
COMM
EPS

LMA790-3-LM
APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
7 Loss of voice comm with EVA (one-way EVA)	1 MSFN/LM comm OK? YES 2 AUDIO CONT - BU BU audio center: RELAY ON 12 or 12 - RELAY OFF Comm OK? YES 3 AUDIO CENTER FAILURE NO 4 COMM CARRIER OR SUIT HARNESS FAILURE 5 6 7 8 9 10 11 12 13	1 EVA will wait at least 3 minutes following communications loss before changing modes. 2 Configures LM for transmission and reception on both VHF frequencies. 3 Loss of EMU data relay capability.

LM MALFUNCTION PROCEDURES

LM MALFUNCTION PROCEDURES

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300LMS-1051

ECS

ED

HTRS

EMU

CAMERA

EPS

COMM

AGS

CES

DPS

APS

KCS

ECS MALFUNCTION INDEX

- 1 WATER QTY
- 1a H₂O QUANTITY-LOW OR DECR ABNORMALLY
- 2 CABIN
- 2a CABIN PRESS-LOW OR DECR
- 3 CABIN PRESS - HIGH
- 4 SUIT/FAN
- 4a SUIT PRESS-LOW
- 5 SUIT PRESS-HIGH (EGRESS MODE)
- 6 O₂ QTY
- 6a O₂ QUANTITY - LOW OR DECR
- 7 ECS
- 7a SUIT FAN
- 7b H₂O SEP
- 7c CO₂
- 7d PART PRESS CO₂ - HIGH
- 7e GLYCOL

- 8 GLYCOL
- 8a GLYCOL TEMP - HIGH OR INCR
- 9 GLYCOL
- 10 GLYCOL PRESS LOW OR DECR

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LM MALFUNCTION PROCEDURES

LMA790-3-LM
APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
1 WATER QTY YELLOW Light on if: DES H₂O qty <16% Either ASC H₂O qty <95% (unstaged) ASC H₂O qty >15% 1a H₂O QUANTITY - low or decr abnormally	1 Using DES or ASC H₂O? 2 Ch ASC #2 H₂O tank 3 One tank steady & other decr? 4 CLOGGED FEED LINE FROM STEADY TANK 5 H₂O OR H₂O LEAK OR SENSOR FAILURE IN LOW TANK 6 Ch ASC tanks 7 H₂O qty <16%? 8 H₂O OR H₂O LEAK OR SENSOR FAILURE IN DES TANK 9 Ch ASC tanks 10 H₂O OR H₂O LEAK OR SENSOR FAILURE IN LOW TANK 11 Ch ASC tanks 12 Ch ASC tanks 13 Ch ASC tanks 14 Ch ASC tanks 15 Ch ASC tanks 16 Ch ASC tanks 17 Ch ASC tanks 18 Ch ASC tanks 19 Ch ASC tanks 20 Ch ASC tanks 21 Ch ASC tanks 22 Ch ASC tanks 23 Ch ASC tanks 24 Ch ASC tanks 25 Ch ASC tanks 26 Ch ASC tanks 27 Ch ASC tanks 28 Ch ASC tanks 29 Ch ASC tanks 30 Ch ASC tanks 31 Ch ASC tanks 32 Ch ASC tanks 33 Ch ASC tanks 34 Ch ASC tanks 35 Ch ASC tanks 36 Ch ASC tanks 37 Ch ASC tanks 38 Ch ASC tanks 39 Ch ASC tanks 40 Ch ASC tanks 41 Ch ASC tanks 42 Ch ASC tanks 43 Ch ASC tanks 44 Ch ASC tanks 45 Ch ASC tanks 46 Ch ASC tanks 47 Ch ASC tanks 48 Ch ASC tanks 49 Ch ASC tanks 50 Ch ASC tanks 51 Ch ASC tanks 52 Ch ASC tanks 53 Ch ASC tanks 54 Ch ASC tanks 55 Ch ASC tanks 56 Ch ASC tanks 57 Ch ASC tanks 58 Ch ASC tanks 59 Ch ASC tanks 60 Ch ASC tanks 61 Ch ASC tanks 62 Ch ASC tanks 63 Ch ASC tanks 64 Ch ASC tanks 65 Ch ASC tanks 66 Ch ASC tanks 67 Ch ASC tanks 68 Ch ASC tanks 69 Ch ASC tanks 70 Ch ASC tanks 71 Ch ASC tanks 72 Ch ASC tanks 73 Ch ASC tanks 74 Ch ASC tanks 75 Ch ASC tanks 76 Ch ASC tanks 77 Ch ASC tanks 78 Ch ASC tanks 79 Ch ASC tanks 80 Ch ASC tanks 81 Ch ASC tanks 82 Ch ASC tanks 83 Ch ASC tanks 84 Ch ASC tanks 85 Ch ASC tanks 86 Ch ASC tanks 87 Ch ASC tanks 88 Ch ASC tanks 89 Ch ASC tanks 90 Ch ASC tanks 91 Ch ASC tanks 92 Ch ASC tanks 93 Ch ASC tanks 94 Ch ASC tanks 95 Ch ASC tanks 96 Ch ASC tanks 97 Ch ASC tanks 98 Ch ASC tanks 99 Ch ASC tanks 100 Ch ASC tanks	1 Quantity in low tank unknown. 2 C/W monitoring of H₂O quantity lost. 3 MCFM can check for transducer failure by reading descent tank pressure (274501P). 4 MCFM can distinguish between failures when WATER TANK SELECT is set to ASC for 1 hour.
2 CABIN RED Light on if cabin press <4.65 to 3.70 psia 2a CABIN PRESS low or decr <4.6 psia	1 Ch ECS CABIN REPRESS - closed? 2 Ch ECS CABIN REPRESS - open? 3 CABIN PRESS - low? 4 Ch ECS CABIN REPRESS - open? 5 Ch ECS CABIN REPRESS - open? 6 Ch ECS CABIN REPRESS - open? 7 Ch ECS CABIN REPRESS - open? 8 Ch ECS CABIN REPRESS - open? 9 Ch ECS CABIN REPRESS - open? 10 Ch ECS CABIN REPRESS - open? 11 Ch ECS CABIN REPRESS - open? 12 Ch ECS CABIN REPRESS - open? 13 Ch ECS CABIN REPRESS - open? 14 Ch ECS CABIN REPRESS - open? 15 Ch ECS CABIN REPRESS - open? 16 Ch ECS CABIN REPRESS - open? 17 Ch ECS CABIN REPRESS - open? 18 Ch ECS CABIN REPRESS - open? 19 Ch ECS CABIN REPRESS - open? 20 Ch ECS CABIN REPRESS - open? 21 Ch ECS CABIN REPRESS - open? 22 Ch ECS CABIN REPRESS - open? 23 Ch ECS CABIN REPRESS - open? 24 Ch ECS CABIN REPRESS - open? 25 Ch ECS CABIN REPRESS - open? 26 Ch ECS CABIN REPRESS - open? 27 Ch ECS CABIN REPRESS - open? 28 Ch ECS CABIN REPRESS - open? 29 Ch ECS CABIN REPRESS - open? 30 Ch ECS CABIN REPRESS - open? 31 Ch ECS CABIN REPRESS - open? 32 Ch ECS CABIN REPRESS - open? 33 Ch ECS CABIN REPRESS - open? 34 Ch ECS CABIN REPRESS - open? 35 Ch ECS CABIN REPRESS - open? 36 Ch ECS CABIN REPRESS - open? 37 Ch ECS CABIN REPRESS - open? 38 Ch ECS CABIN REPRESS - open? 39 Ch ECS CABIN REPRESS - open? 40 Ch ECS CABIN REPRESS - open? 41 Ch ECS CABIN REPRESS - open? 42 Ch ECS CABIN REPRESS - open? 43 Ch ECS CABIN REPRESS - open? 44 Ch ECS CABIN REPRESS - open? 45 Ch ECS CABIN REPRESS - open? 46 Ch ECS CABIN REPRESS - open? 47 Ch ECS CABIN REPRESS - open? 48 Ch ECS CABIN REPRESS - open? 49 Ch ECS CABIN REPRESS - open? 50 Ch ECS CABIN REPRESS - open? 51 Ch ECS CABIN REPRESS - open? 52 Ch ECS CABIN REPRESS - open? 53 Ch ECS CABIN REPRESS - open? 54 Ch ECS CABIN REPRESS - open? 55 Ch ECS CABIN REPRESS - open? 56 Ch ECS CABIN REPRESS - open? 57 Ch ECS CABIN REPRESS - open? 58 Ch ECS CABIN REPRESS - open? 59 Ch ECS CABIN REPRESS - open? 60 Ch ECS CABIN REPRESS - open? 61 Ch ECS CABIN REPRESS - open? 62 Ch ECS CABIN REPRESS - open? 63 Ch ECS CABIN REPRESS - open? 64 Ch ECS CABIN REPRESS - open? 65 Ch ECS CABIN REPRESS - open? 66 Ch ECS CABIN REPRESS - open? 67 Ch ECS CABIN REPRESS - open? 68 Ch ECS CABIN REPRESS - open? 69 Ch ECS CABIN REPRESS - open? 70 Ch ECS CABIN REPRESS - open? 71 Ch ECS CABIN REPRESS - open? 72 Ch ECS CABIN REPRESS - open? 73 Ch ECS CABIN REPRESS - open? 74 Ch ECS CABIN REPRESS - open? 75 Ch ECS CABIN REPRESS - open? 76 Ch ECS CABIN REPRESS - open? 77 Ch ECS CABIN REPRESS - open? 78 Ch ECS CABIN REPRESS - open? 79 Ch ECS CABIN REPRESS - open? 80 Ch ECS CABIN REPRESS - open? 81 Ch ECS CABIN REPRESS - open? 82 Ch ECS CABIN REPRESS - open? 83 Ch ECS CABIN REPRESS - open? 84 Ch ECS CABIN REPRESS - open? 85 Ch ECS CABIN REPRESS - open? 86 Ch ECS CABIN REPRESS - open? 87 Ch ECS CABIN REPRESS - open? 88 Ch ECS CABIN REPRESS - open? 89 Ch ECS CABIN REPRESS - open? 90 Ch ECS CABIN REPRESS - open? 91 Ch ECS CABIN REPRESS - open? 92 Ch ECS CABIN REPRESS - open? 93 Ch ECS CABIN REPRESS - open? 94 Ch ECS CABIN REPRESS - open? 95 Ch ECS CABIN REPRESS - open? 96 Ch ECS CABIN REPRESS - open? 97 Ch ECS CABIN REPRESS - open? 98 Ch ECS CABIN REPRESS - open? 99 Ch ECS CABIN REPRESS - open? 100 Ch ECS CABIN REPRESS - open?	1 C/W monitoring of cabin pressure is lost. Monitor CABIN PRESS. 2 Automatic cabin-repressurization capability lost. Automatic closing of SUIT GAS DIVERTER. If lost, CABIN PRESS will decrease. If this failure, cabin pressure would be at 5.4 psia, if unstaged. Configure to egress mode. 3 If unstaged, or if staged and ascent O₂ quantity is sufficient to make up cabin pressure. CABIN REPRESS will - MANUAL - when cabin pressure is normal. If not, configure to egress mode per step 1.8.

1 THRU 3

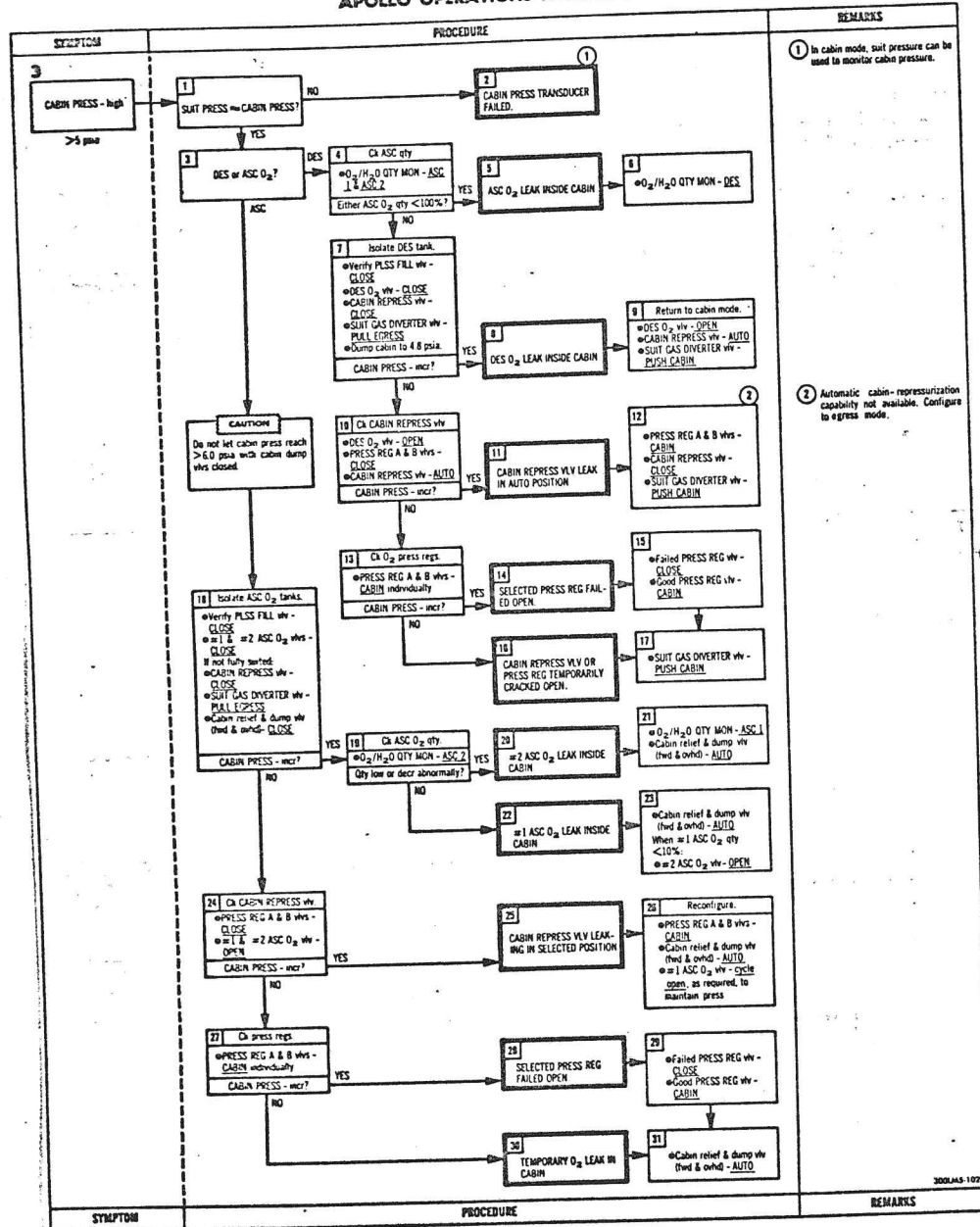
4 THRU 6a

7 THRU 8a

9 THRU 10

EMU CAMERA HTRS ED

LMA790-3-LM APOLLO OPERATIONS HANDBOOK



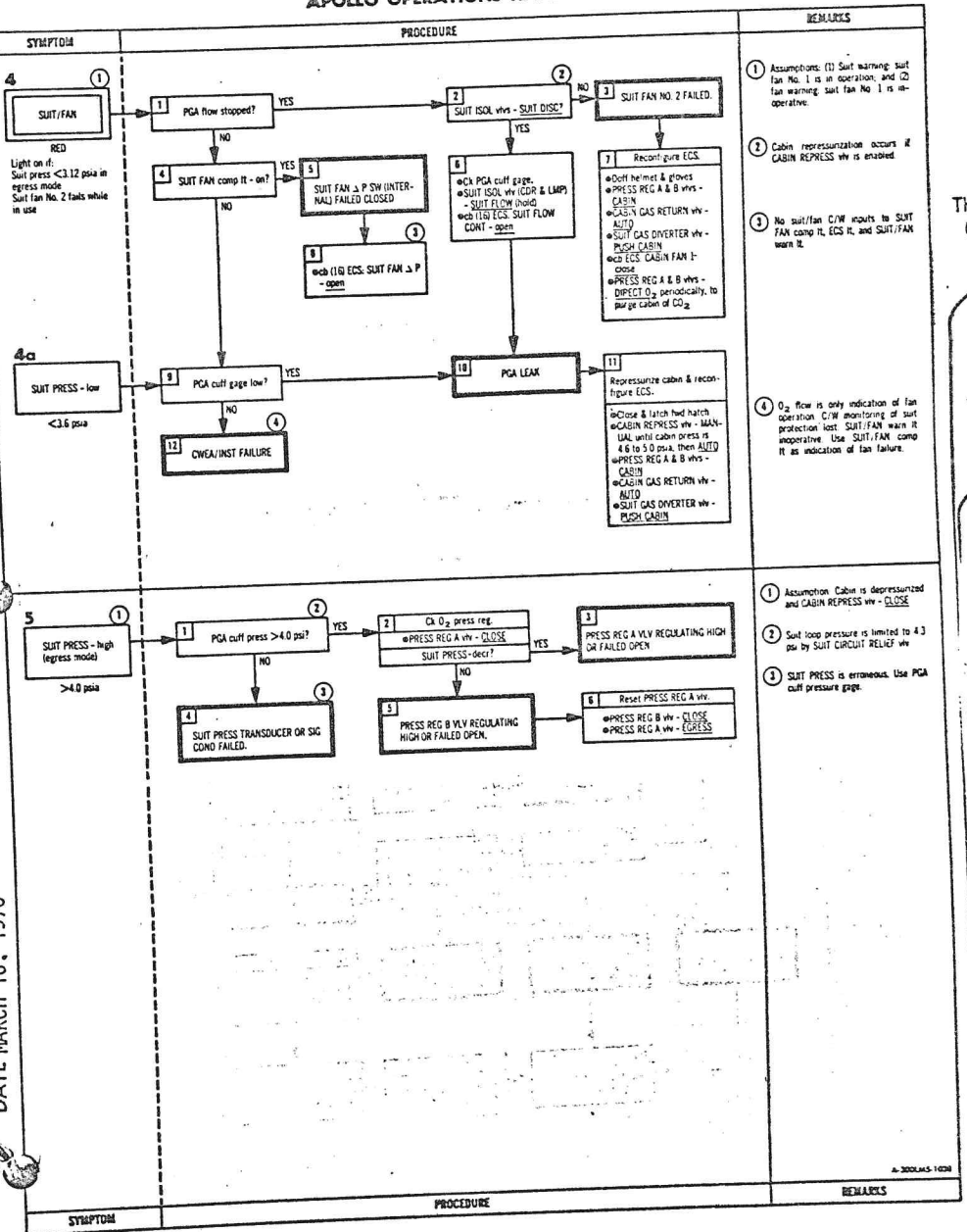
LM MALFUNCTION PROCEDURES

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LM MALFUNCTION PROCEDURES

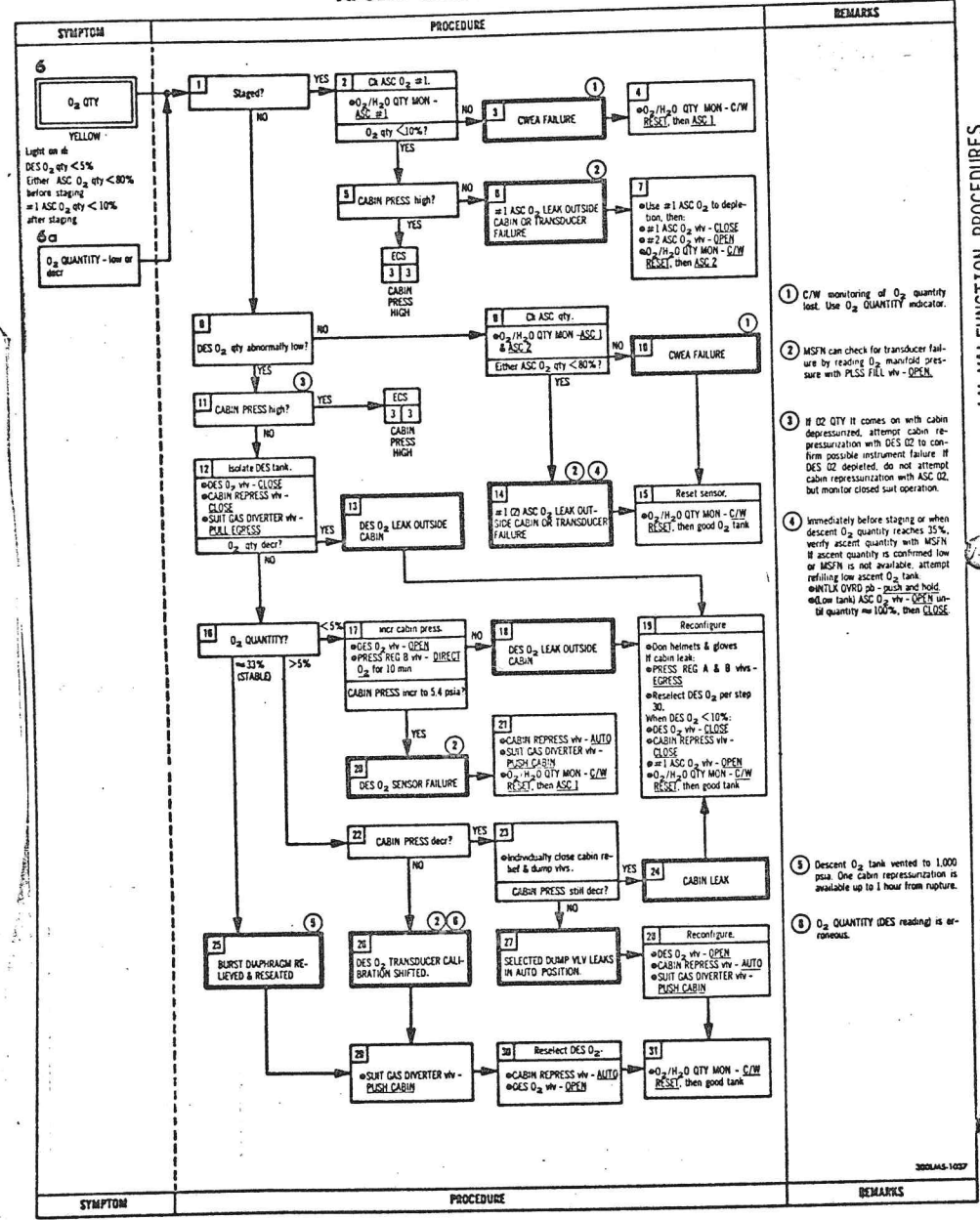
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LMA790-3-LM APOLLO OPERATIONS HANDBOOK



EMU , CAMERA , HTRS , ED

LMA790-3-LM
APOLLO OPERATIONS HANDBOOK

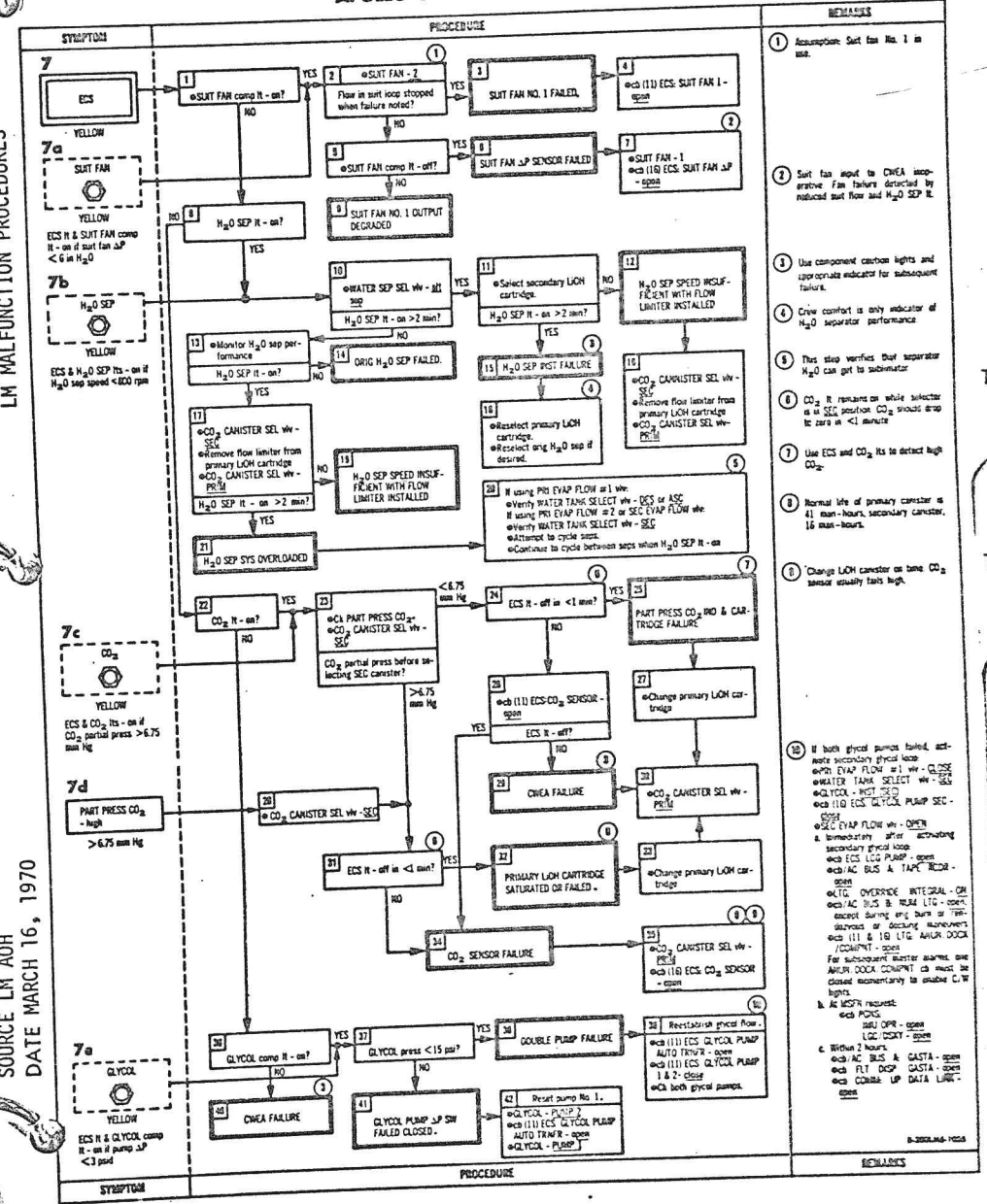


LM MALFUNCTION PROCEDURES

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LMA790-3-LM
APOLLO OPERATIONS HANDBOOK



7
THRU
8a

9
THRU
10

EMU, CAMERA, HTRS, ED

LMA790-3-LM
APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
8 GLYCOL YELLOW Light on if: Prim glycol temp > 50 F Prim glycol accum < 10% Sec glycol accum < 10%	1 GLYCOL temp > 50 F? NO CAUTION Sublimator freeze - up occurs if glycol pumps are off > 20 min YES 2 Ck for leak in prim loop •cb (11) ECS GLYCOL PUMP AUTO TRNFR - open •cb (11) ECS GLYCOL PUMP 1 - open Is difference between glycol press discharge > 2 psi from value recorded before pump start-up? NO 3 Ck for leak in sec loop •GLYCOL - INST (SEC) •GLYCOL - INST (SEC) Is difference between glycol press discharge > 2 psi from value recorded before pump start-up? NO 4 CWEA OR ACCUMULATOR LOW - LEVEL SENSOR FAILURE YES 5 Restart prim glycol loop •GLYCOL - PUMP 1 •cb (11) ECS GLYCOL PUMP 1 - close •cb (11) ECS GLYCOL PUMP AUTO TRNFR - close 6 Restart prim glycol loop •cb (11) ECS GLYCOL PUMP 1 - close •cb (11) ECS GLYCOL PUMP AUTO TRNFR - close •When GLYCOL temp > 50 F or pump press fluctuates, proceed to next step. 7 LEAK IN PRIMARY GLYCOL LOOP 8 Restart prim glycol loop •cb (11) ECS GLYCOL PUMP 1 - close •cb (11) ECS GLYCOL PUMP AUTO TRNFR - close •When GLYCOL temp > 50 F or pump press fluctuates, proceed to next step. 9 Activate sec glycol loop •Verify PRI EVAP FLOW = 1 & = 2 vlv - CLOSE •WATER TANK SELECT vlv - SEC •GLYCOL - INST (SEC) •cb (16) ECS GLYCOL PUMP SEC - close •SEC EVAP FLOW vlv - OPEN •Reconfigure electrical loads for secondary loop operation. 10 GLYCOL temp - high or inc > 45 F 11 SUIT temp = 10 F > GLYCOL temp? NO 12 GLYCOL temp - inc? YES 13 PRI EVAP FLOW = 1 vlv - CLOSE PRI EVAP FLOW = 2 vlv - OPEN 14 GLYCOL temp steady or decr within 5 min? YES 15 THERMAL OVERLOAD 16 Isolate sec H₂O reg •PRI EVAP FLOW = 2 vlv - CLOSE •PRI EVAP FLOW = 1 vlv - OPEN GLYCOL temp - inc again? YES 17 PRIMARY H₂O REG FAILED CLOSED 18 Reconfigure for ASC H₂O feed •WATER TANK SELECT vlv - SEC •PRI EVAP FLOW = 2 vlv - OPEN •PRI EVAP FLOW = 1 vlv - CLOSE 19 TRANSCIENT CONDITION	1 Assumption: Primary glycol loop was operating with cb ECS GLYCOL PUMP AUTO TRNFR closed. 2 Glycol loop redundancy lost. 3 Monitor system performance with GLYCOL caution inoperative. 4 For loss of primary glycol loop: a. Immediately after activating secondary glycol loop: •cb ECS LCC PUMP - open •cb AC BUS A: TAPE RCOR - open •LTC OVERRIDE INTEGRAL - ON •cb AC BUS B: NUM LTC - open, except during eng burn or rendezvous or docking maneuvers •cb (11) & (16) LTC: ANUN/DOCK /COMPNT - open For subsequent master alarms, one ANUN/DOCK COMPNT cb must be closed momentarily to enable C/W lights. b. At MSFN request: •cb PCHS •IMU DPR - open •LCC/DSKY - open c. Within 2 hours: •cb AC BUS A: CASTA - open •cb FLT DISP: CASTA - open •cb COMME: UP DATA LINK - open 5 Descent H₂O for cooling is lost.

8-300445-1036

LMA790-3-LM
APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
9 GLYCOL YELLOW Light on if pump ΔP < 3 psi	1 GLYCOL - PUMP 2 GLYCOL comp IT - on? YES 2 GLYCOL COMP LT RELAY FAILED CLOSED 3 Reselect pump No. 1 •cb (11) ECS GLYCOL PUMP AUTO TRNFR - open •GLYCOL - PUMP 1 •cb (11) ECS GLYCOL PUMP AUTO TRNFR - close NO 4 GLYCOL PUMP NO. 1 FAILED	1 Glycol pump automatic transfer is operable. Monitor GLYCOL ind. for pump failures. 2 A temporary ΔP switch failure will result in automatic transfer. Confirm pump No. 1 failure by re-setting automatic transfer circuit and reselecting pump No. 1 while monitoring glycol pressure. Do not stop glycol flow for > 2 minutes if sublimator is operating.
10 GLYCOL press - low or decr < 17 psi	1 Compare glycol pumps •cb (11) ECS GLYCOL PUMP AUTO TRNFR - open •GLYCOL - PUMP 2 GLYCOL press - normal? YES 2 GLYCOL PUMP NO. 1 DEGRADED OR BYPASS VLV FAILED OPEN 3 •cb (11) ECS GLYCOL PUMP 1 - open NO 4 GLYCOL PRESS TRANSDUCER CALIBRATION SHIFTED 5 Reconfigure •GLYCOL - PUMP 1 •cb (11) ECS GLYCOL PUMP AUTO TRNFR - close	

SOURCE LM AOH
DATE MARCH 16, 1970

SOURCE LM AOH
DATE MARCH 16, 1970

9
THRU
10

EMU, CAMERA, HTRS, ED

RCS APS DPS CES ECS COMM EPS

PAGE 62B

APOLLO 13 FLIGHT DATA FILE

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SOURCE MOCATA
DATE MARCH 16, 1970

LM MALFUNCTION PROCEDURES

SOURCE MOCATA
DATE MARCH 16, 1970

LM MALFUNCTION PROCEDURES

APOLLO 13 FLIGHT DATA FILE

PAGE 63

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EMU , CAMERA, HTRS

ED

ED MALFUNCTION INDEX

- 1 ED RELAYS
- 2 STAGE SEQ RLY SYS A & B
LTS - OFF WHEN MASTER ARM - ON

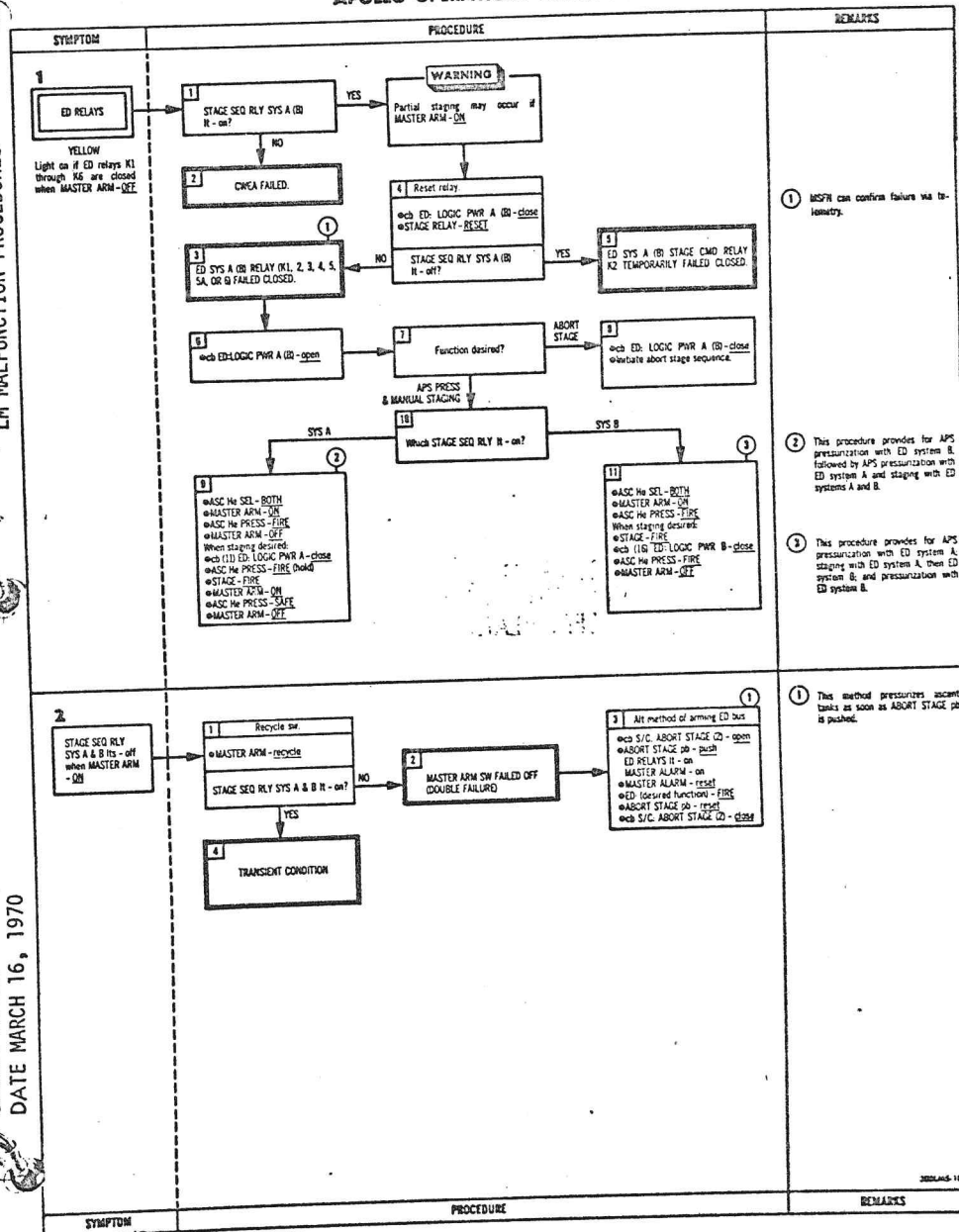
LM MALFUNCTION PROCEDURES

LM MALFUNCTION PROCEDURES

SOURCE MOCATA
DATE MARCH 16, 1970

SOURCE LM AOH
DATE MARCH 16, 1970

LMA790-3-LM
APOLLO OPERATIONS HANDBOOK



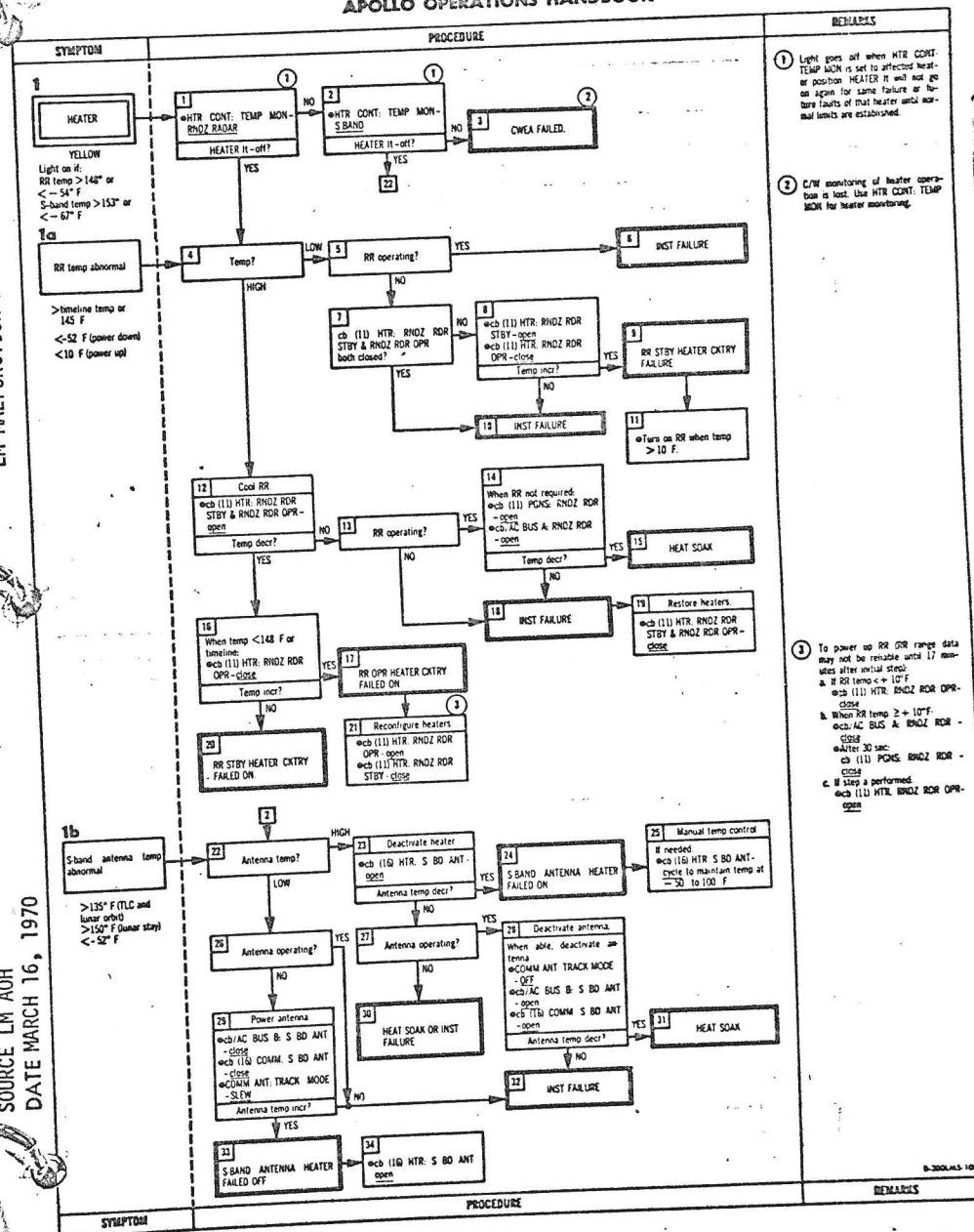
EMU , CAMERA , HTRS

HTRS MALFUNCTION INDEX

1 HEATER

- 1a RR TEMP ABNORMAL
- 1b S-BAND ANTENNA TEMP ABNORMAL
- 2 LR TEMP ABNORMAL
- 3 RCS QUAD 1 (2, 3, 4) TEMP ABNORMAL

LMA790-3-LM
APOLLO OPERATIONS HANDBOOK



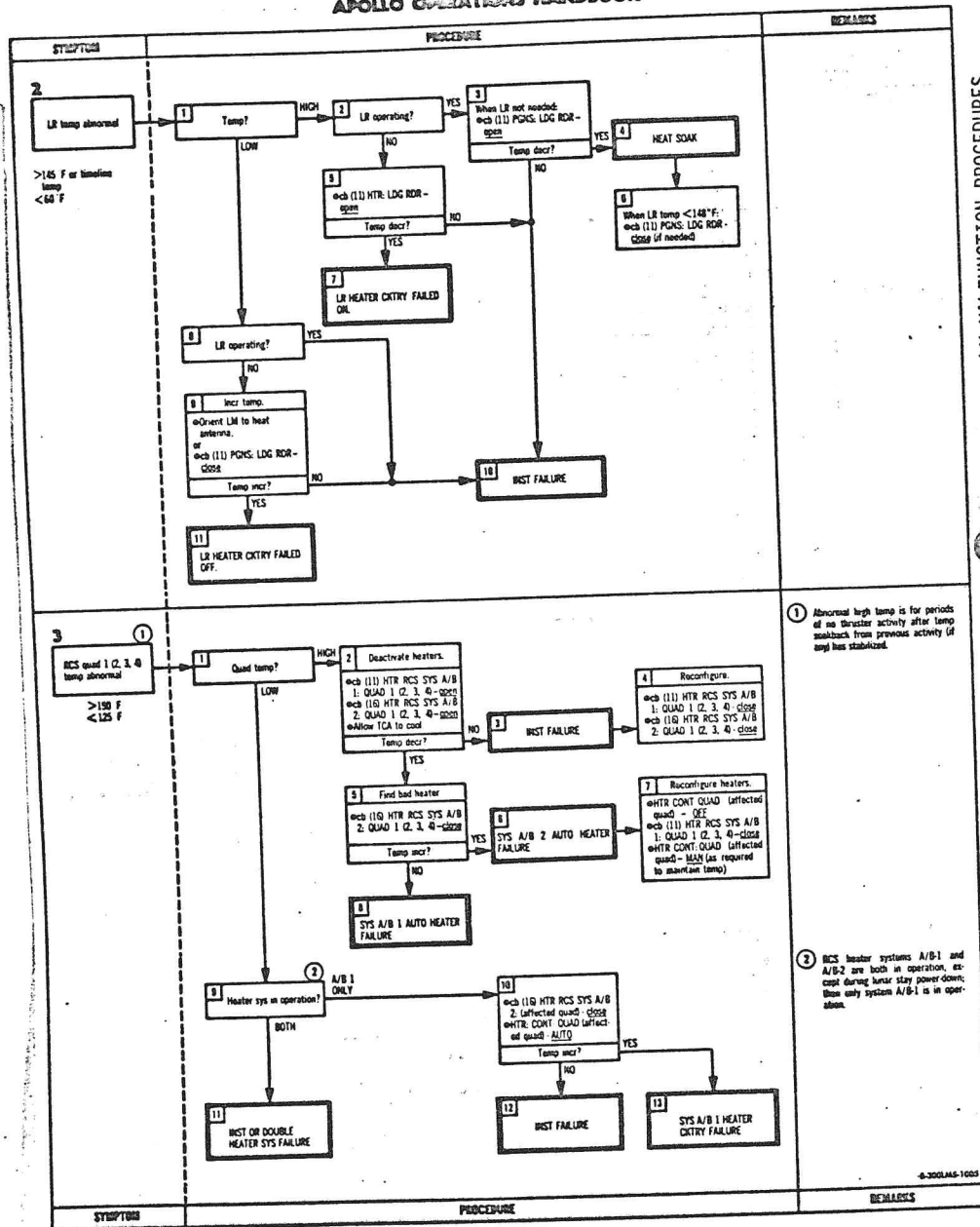
SOURCE MOCATA
DATE MARCH 16, 1970

SOURCE LM AOH
DATE MARCH 16, 1970

1
THRU
3

EMU, CAMERA

LM790-3-LM
APOLLO OPERATIONS HANDBOOK



LM MALFUNCTION PROCEDURES

LM MALFUNCTION PROCEDURES

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SOURCE LM AOH
DATE MARCH 16, 1970

SOURCE MOCATA
DATE MARCH 16, 1970

EMU CAMERA

RCS

CAMERA

HTRS

ED

ECS

COMM

EPS

PAGE 72

APOLLO 13 FLIGHT DATA FILE.

CAMERA MALFUNCTION INDEX

16mm

- A CANNOT START CAMERA
- B CANNOT STOP CAMERA
- C CAMERA STOPS IMMEDIATELY AFTER START
- D CAMERA RUNS 24 FPS IN ALL MODES SELECTED
- E CAMERA RUNS BUT FILM NOT TRANSPORTING

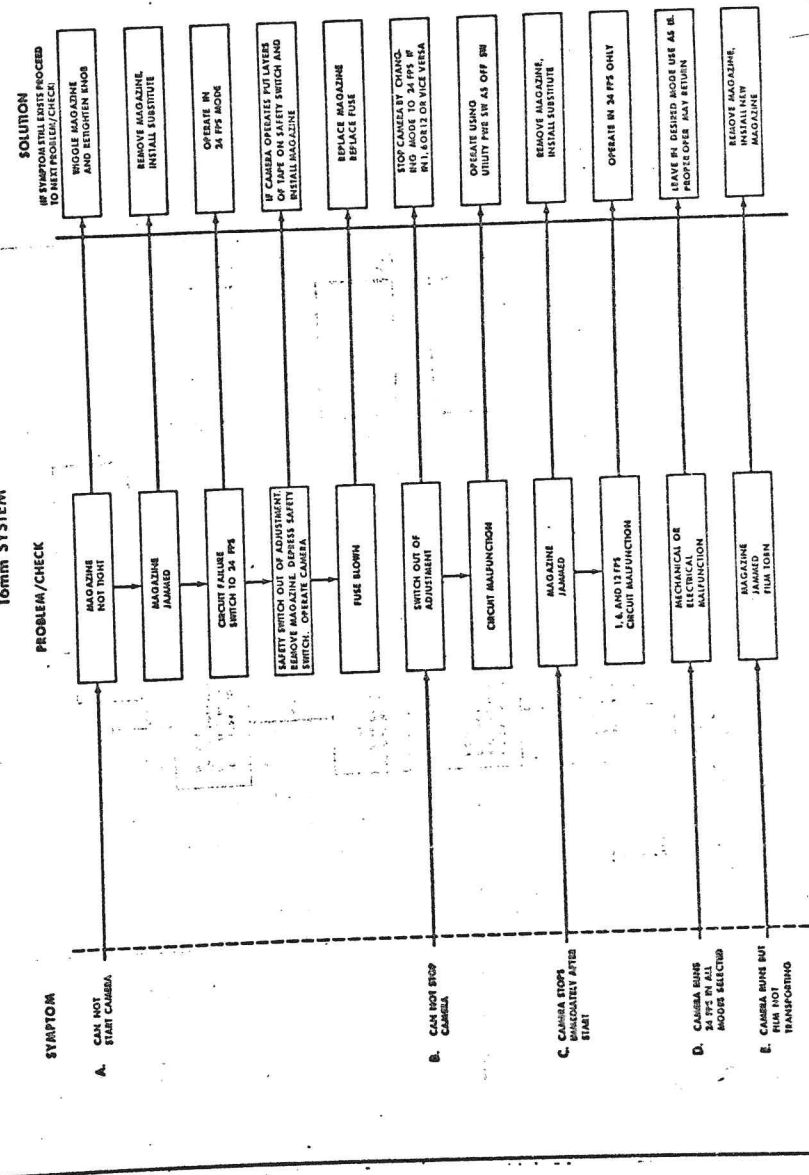
70mm

- I CAMERA WITH MAGAZINE
 - A SHUTTER FIRES/NO FILM ADVANCE
 - B NO CAMERA ACTION/BUTTON CYCLED
 - C SHUTTER FIRES/PARTIAL FILM ADVANCE
 - D CANNOT ATTACH LENS
- II CAMERA ONLY
 - A NO CAMERA ACTION/BUTTON CYCLED
- III CAMERA WITH MAGAZINE (EVA)
 - A NO CAMERA ACTION
 - B CAMERA BECOMES SLUGGISH

SOURCE MOCATA
DATE MARCH 16, 1970SOURCE TEAGUE
DATE MARCH 16, 1970

LM MALFUNCTION PROCEDURES

LM MALFUNCTION PROCEDURES

MALFUNCTIONS
16mm SYSTEM

PAGE 73

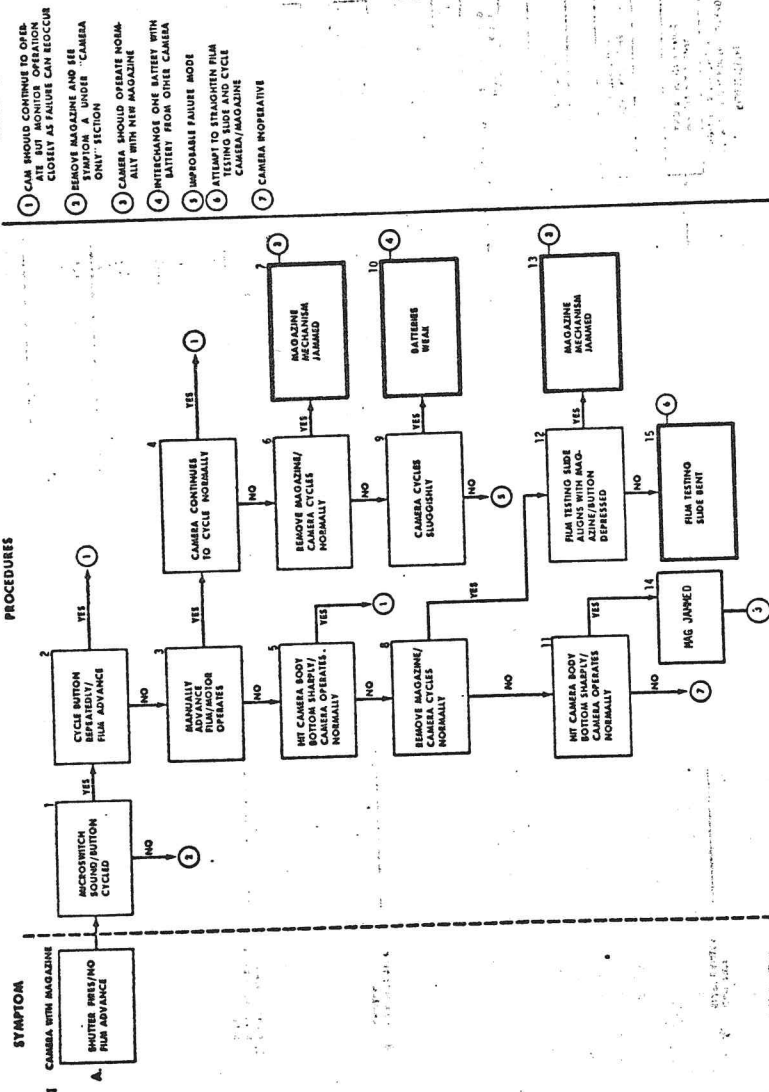
APOLLO 13 FLIGHT DATA FILE

16 A
THRU
70 IA70 mm
IB
THRU
IIA16mm
II

EMU

70mm CAMERA MALFUNCTIONS

PROCEDURES

SOURCE TEAGUE
DATE MARCH 16, 1970

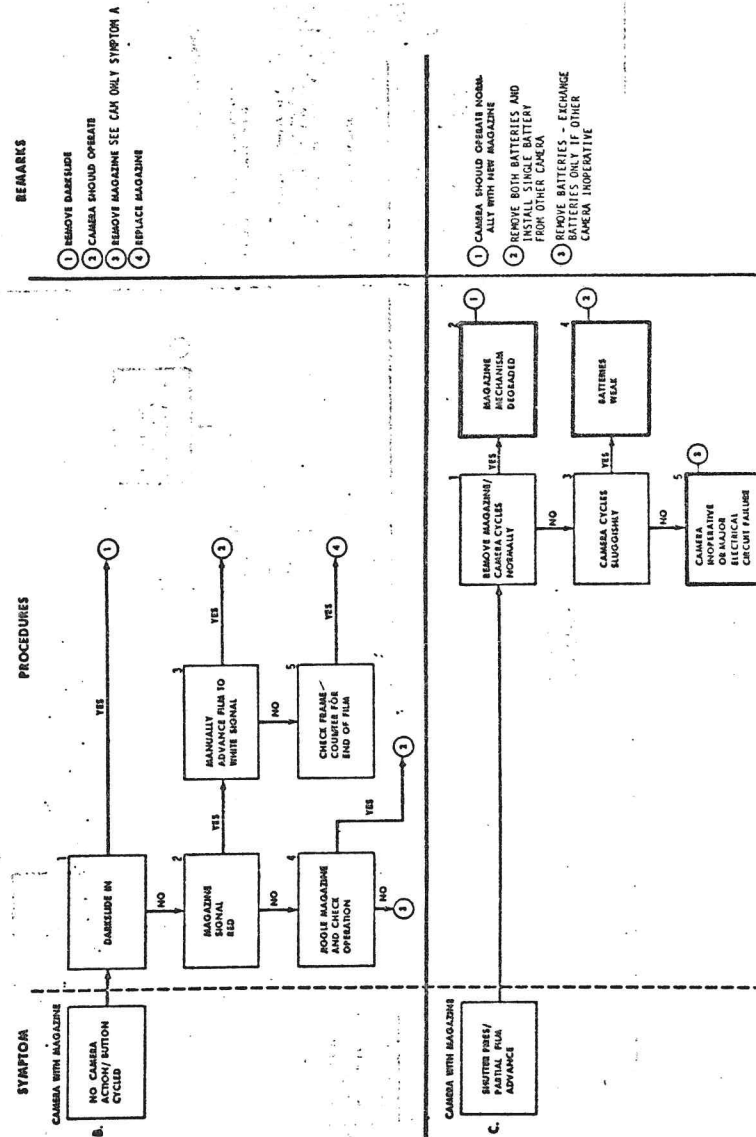
LM MALFUNCTION PROCEDURES

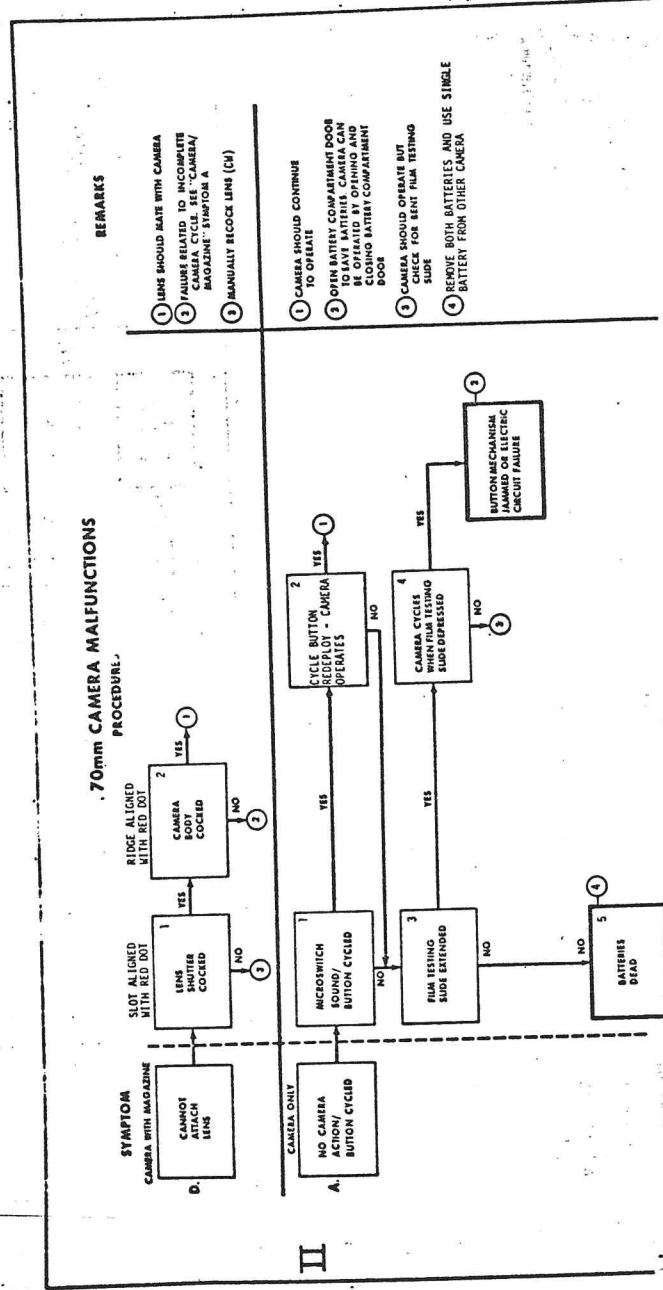
SOURCE TEAGUE
DATE MARCH 16, 1970

LM MALFUNCTION PROCEDURES

70mm CAMERA MALFUNCTIONS

PROCEDURES

70 mm
IB
THRU
IIA
II



SOURCE TEAGUE
DATE MARCH 16, 1970

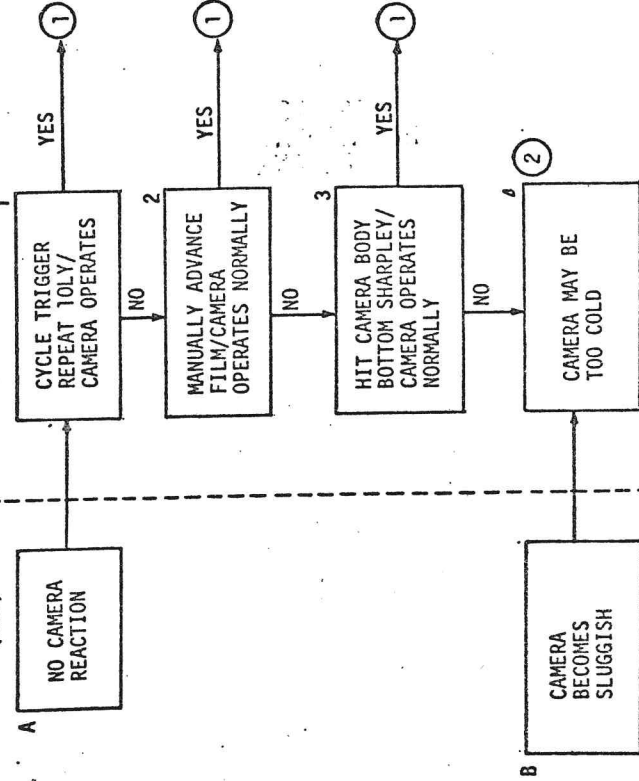
SOURCE TEAGUE
DATE MARCH 16, 1970

LM MALFUNCTION PROCEDURES

LM MALFUNCTION PROCEDURES

70 MM CAMERA MALFUNCTIONS PROCEDURES

III CAMERA WITH MAGAZINE (EVA)



1. CAMERA SHOULD CONTINUE TO OPERATE BUT MONITOR OPERATION CLOSELY AS FAILURE CAN RECUR.

2. PLACE CAMERA IN SUN WITH BOTTOM AND MAGAZINE ILLUMINATED. USE SECOND CAMERA AND CHECK FIRST AS REQUIRED

70mm
III

EMU MALFUNCTION INDEX

- 1 TONE AND LOW VENT FLOW FLAG [P]
- 2 TONE AND LOW PGA PRESSURE FLAG [O]
- 3 TONE AND HI O₂ FLOW FLAG [O]
- 4 TONE AND LOW FEEDWATER PRESSURE FLAG [A]
- 5 TONE ON, ALL FLAGS CLEAR
- 6 PGA PRESS GAGE LO (<3.7) - NO FLAG
- 7 PLSS O₂ QUANTITY ABNORMAL
- 8 PGA PRESSURE GAGE HI (>4.0)
- 9 LOSS OF PUMP NOISE
- 10 COOLING INADEQUATE
- 11 LOSS OF VOICE COMM

SOURCE MOCATA
DATE MARCH 16, 1970SOURCE SMITH
DATE MARCH 16, 1970

LM MALFUNCTION PROCEDURES

- | | | |
|-------|---|--|
| EMU 1 | 1 | TONE AND LOW VENT FLOW FLAG [P]
FAN OFF/ON |
| | 2 | IF FLAG STILL ON AFTER 10 SEC ACTUATE OPS AND PURGE VLV |
| EMU 2 | 1 | TONE AND LOW PGA PRESSURE FLAG [O]
ACTUATE OPS |
| | 2 | IF FLAG STILL ON, CHECK CUFF GAGE, VERIFY TM, OPS OFF (SENSOR FAIL) |
| EMU 3 | 1 | TONE AND HI O ₂ FLOW FLAG [O]
CHECK FOR LOW/HIGH PGA PRESS OR PLSS O ₂ DECREASING |
| | 2 | IF LEAK CONFIRMED, ACTUATE OPS |
| | 3 | IF HIGH PGA PRESS, ACTUATE OPS, PLSS O ₂ OFF (PLSS REG FAIL) |
| | 4 | IF NO APPARENT FAIL, VERIFY TM (SENSOR FAIL) |
| EMU 4 | 1 | TONE AND LOW FEEDWATER PRESSURE FLAG [A]
VERIFY FEEDWATER OPEN |
| | 2 | IF CLOSED: DIV VLV MIN COOL, FEEDWATER OPEN, WAIT 4 MIN. |
| | 3 | IF ADD'L COOL REQ'D, ACTUATE OPS AND PURGE VLV |
| EMU 5 | 1 | TONE ON, ALL FLAGS CLEAR
CHECK CUFF GAGE: IF <3.4, ACTUATE OPS |
| | 2 | IF PGA PRESS >3.4 AND TONE OFF: CHANGE MODE SW
MOMENTARILY - NO TONE, NO FAILURE. IF TONE ON AGAIN: |
| | 3 | CHECK LOW VENT FLOW FLAG: FAN OFF 5 SEC, VENT FLAG [P] SHOULD
COME ON; FAN ON. IF NO FLAG, ACTUATE OPS AND PURGE VLV
(FLAG FAIL) |
| | 4 | CHECK HI O ₂ FLOW FLAG: OBSERVE PLSS O ₂ , IF DECREASING,
ACTUATE OPS. |
| | 5 | CHECK FEEDWATER OPEN: IF CLOSED: DIV VLV MIN COOL,
FEEDWATER OPEN. AFTER 4 MIN IF COOL INADEQUATE, ACTUATE
OPS AND PURGE VLV. |
| EMU 6 | 1 | PGA PRESS GAGE LO (<3.7) - NO FLAG
ACTUATE OPS - CUFF GAGE SHOULD RISE (EMU LEAK OR REG SHIFT) |
| | 2 | IF NO GAGE RESPONSE, VERIFY TM - OPS OFF (GAGE FAIL) |
| EMU 7 | 1 | PLSS O ₂ QUANTITY ABNORMAL
CHECK PGA PRESS GAGE OR HIGH O ₂ FLOW FLAG [O] |
| | 2 | IF LEAK CONFIRMED, ACT. OPS |
| | 3 | IF HIGH PGA PRESS, ACT. OPS, PLSS O ₂ OFF (PLSS REG FAIL) |
| | 4 | IF NO APPARENT FAIL, VERIFY TM (GAGE FAIL) |

1
THRU
11

EPS

COMM

ECS

ED

HTRS

CAMERA

EMU

EMU 8

PGA PRESSURE GAGE HI (>4.0)

1 IF HI O₂ FLOW FLAG [0] OR PLSS O₂ DECREASING, ACT. OPS AND PLSS O₂ OFF (PLSS REG FAIL)

2 IF NOT, VERIFY TM (POSS GAGE FAIL)

EMU 9

LOSS OF PUMP NOISE

1 CHECK SIDETONE - IF NONE, ACTUATE OPS AND PURGE VLV (POWER FAIL). IF SIDETONE OK:

2 CHECK PUMP ON.

3 VERIFY TM FOR PUMP CONDITION

4 IF ADD'L COOL REQ'D, ACTUATE OPS AND PURGE VLV

EMU 10

COOLING INADEQUATE

1 VERIFY DIV VLV MAX

2 IF FEASIBLE, ACTUATE GAS TRAP 5 SEC

3 AFTER 3 MIN, IF ADD'L COOL REQ'D, ACTUATE OPS AND PURGE VLV

EMU 11

LOSS OF VOICE COMM

1 CHECK VOL CONTROLS [WHEEL-A (MSFN): BLADE-B (EVA)]

2 CYCLE PTT SW - MAIN AND MOM

3 CDR (EVA 1) MODE SW TO B, LMP (EVA 2) TO A (HAND SIGNALS)

4 IF NO COMM, CDR (EVA 1) TO A, LMP (EVA 2) TO B

LM MALFUNCTION PROCEDURES

SOURCE SMITH
DATE MARCH 16, 1970

APOLLO 13

LM SYSTEMS
ACTIVATION CHECKLIST

PART NO.

S/N

SKB32100082 - 360

1001

LM 7

Basic Date 2/6/70
Changed 3/16/70 4-3-70

CSM TO LM TRANSFER LIST (TLC)

Tissue Dispenser - RHSSC



70MM Magazines in Bag (3) - RHSSC

70MM Magazines HCEX (2) - ISA

SUIT HOSE INTERCONNECT

VACUUM HOSE (3 ft)

VACUUM BRUSH

CMG CONNECTOR

Flight Data In Bag:

LM ACTIVATION CHECKLISTS (2)

TV in LM

EASE OF MOVEMENT

ASCENT ENGINE

PLSS/OPS'S - SCALE & DRAW BAG

NEW LEVA MOD

DRINK BAGS

HANMOCK

5He - 740 psi
660-770 psi dr

Pg TLC-1A

6. Show to LM power (Flood light blank, c/w Power Lt. on)
GET: 54:46:15

☒ CB EPS - X Leman Des Tie (PML 11 & 16) CLOSE

☒ CB L2 - UTIL (PML 11) - CLOSE, THEN ON UTILITY LIT

7. CB - PML 11 AC BUS B - He PAGES DISP - CLOSE

" " " " AC BUS B - Num LIT - CLOSE

" " " " B BUS Tie INV 1 - CLOSE

CB EPS - INV. 1 PML 11 - CLOSE

CB PML 16 - INV. 1 SIG SW - CLOSE

INV. 1 - SELECT

He Now - SUPERGRIT PRESS, REPORT PRESS TO MCC

8. ON MCC REQUEST, DO STEP 9

9. He Now - OFF, INV - OFF

10. CONFIGURE CB'S PER ACT 3 & 4

11. DEREGULATE UTIL LIT

12. TRANS TO CSM PWR, USUAL OPERATIONS, & REPORT GET 54:58:50

LM 7

Basic Date 2/6/70

Changed TLC-1

58:00

IVT TO LM

1. Activate CABIN DUMP VALVE & Open Hatch
Take CSM 02 Hose When Transferring

2. Record Docking Tunnel Index Angle -2.0°

-2.0 Rc

3. FLOOD LIGHT - ALL
EXTERIOR LTG - OFF
Window Shades - Down

4. DES H20 - OPEN
DES 02 - OPEN
CABIN REPRESS - AUTO
CB(16) CABIN REPRESS - CLOSE

5. Check AOT Visibility

5a. TAPE BY FPAI'S - TTCA INPUTS FOR DOCKED DES

IVT TO LM

LOI DAY

PGNS T/O

IVT TO LM

TLC-2

59:45

IVT TO CSM

- 1 DES H2O - CLOSE
DES O2 - CLOSE
CABIN REPRESS - CLOSE
CB(16) CABIN REPRESS - Open
FLOOD LIGHT - OFF
Window Shades - Up
- 2 CABIN DUMP VALVE - OPEN
IVT TO CSM
CLOSE LM HATCH

TLC-3

LM 7

Basic Date 2/6/70
Changed

LM 7

Basic Date 2/6/70
Changed

LMP IVT TO LM

LOI DAY

PGNS T/O

LMP IVT TO LM

LOI DAY

ACT-10

SEC EVAP FLOW - CLOSE
PRIM EVAP FLOW (2)-CLOSE
DES H2O-OPEN
WATER TANK SELECT -DES
SUIT TEMP - COLD
LIQUID COOLING GARMENT - COLD

- 17 Verify (192 PKG) Lanyard
Not Seated
- 18 FWD CABIN RELIEF AND DUMP - AUTO

83:19

HOUSEKEEPING

- 1 Unsnap LMP's HSB And Stow Next To
CDR's HSB On Floor Velcro. Unsnap
CDR's HSB
- 2 Unstow 70mm Film Bag (Top Left
of RHSSC)
Put Up Bungee Straps
- 3 Install Pnl 16 Qd 1 HTR CB
Guard (FDF Acc. Kit)

5. TAPE CLIPS TO AOT & CRASHBAR

6. TAPE PWR DWN/EVA CARDS ABOVE PNL 11 & 12

7. TAPE LMP UTILITY LT.

8. INSTALL PORSE

(FIT DATA FILE)

Basic Date 2/6/70
Changed 3/16/70

LM 7

Basic Date 2/6/70
Changed 3/25/70

LM 7

ACT-11

- 4 Install 16mm CAMR Wedge (LS CAMR Bag)

***** SR 83:37 *****

***** AOS 84:01 *****

84:17

COMM ACTIVATION

- 1 Transfer To LM POWER (FLOOD Lts. Blink,
C/W PWR Caution Lt - On)
GET : (Report To MCC)
CB(11) EPS: XLUNAR BUS TIE - Close
CB(16) EPS: XLUNAR BUS TIE - Close
CB(11) LTG: UTIL - Close
Activate Utility Lights
- 2 CB(11) COMM: VHF B XMTR - Close
: VHF A RCVR - Close
: CDR AUDIO - Close
INST: SIG CONDR 1- Close
ECS: GLYCOL PUMP 2- Close

IVT TO LM
EPS ACT

COMM ACT & C/O

IVT TO CSM

PGNS 170

PDI DAY

LM 7

LM 7

Basic Date 2/6/70
Changed 2/6/70

Basic Date 2/6/70
Changed 4-3-70

CSM TO LM TRANSFER LIST (PDI)

Suits And Ancillary Eqpt:

Liners

IV Gloves

Helmet

Bio belt & Instrumentation

Comm Cap

Wristwatch (2)

Sunglasses in pouch

Pens & Pencils

Penlight

Scissors

Personal Radiation Dosimeter

Flight Data In Bag:

LM TIMELINE BOOK

LM DATA CARD BOOK

LM LUNAR SURFACE CHECKLIST

LM ORBIT MONITOR CHART

LUNAR PHOTO CHARTS

STAR CHARTS

LM LUNAR SURFACE MAPS

16 mm LS CAMERA/W PWR PACK

16 mm MAGAZINES (8)

EC FLAG

IVT TO LM
EPS ACT

C/W CHECKOUT

TB VERIFICATION

PGNS T/O

PDI DAY

LM IVT TO LM

LM 7

Basic Date 2/6/70
Changed 3/16/70
ACT-17

96:39

LMP IVT TO LM

- 1 Activate CABIN DUMP VALVE & Open Hatch
Carry Comm Carrier & CSM 02 Hose
Mount Purse
- 2 Verify Docking Tunnel Index
Angle (See TLC-1)
Window Shades - Down
Deploy LMP Crash Bar
- 3 Transfer To LM PWR
GET : Blink, C/W PWR Caution Lt-On
(FLOOD Lts. Blink, C/W PWR Caution Lt-On
CB(11) EPS: XLUNAR BUS TIE - Close
CB(16) EPS: XLUNAR BUS TIE - Close
- 4 FLOOD LIGHT - All
CB(11) LTG: UTIL - Close
Activate Utility Lts
- 5 DES H20 - OPEN
DES 02 - OPEN
CABIN REPRESS - AUTO
CB(16) ECS: CABIN REPRESS - Close

IVT TO LM
FPS ACT

C/W CHECKOUT

TB VERIFICATION

PGNS T/O

IVT TO LM
EPS ACT

PDI DAY

ACT-18

***** UD - 2:30 (96:46) *****

***** SR 96:54 *****

96:56

CDR IVT TO LM

CDR IVT To LM With CDR &
LMP Helmet & Gloves

CHECK!

1 LTG: ANUN/NUM - BRIGHT (1 Caution, 9
Power Failure, 1 COMP Lt - On)

Connect To LM Comm Umbilical
CB(11) COMM: CDR AUDIO - Close
AUDIO (CDR): S-BAND-T/R
: ICS - T/R

2 CB(11) INST: SIG CONDR 1 - Close
EPS: DES ECA CONT- Close
CB(16) INST: SIG SENSOR - Close
: PCM/TE - Close
: SIG CONDR 2 - Close
EPS: DISP - Close
: DES ECA CONT - Close

3 Connect To LM Comm Umbilical

EPS ACTIVATION

96:56

LM 7

Basic Date 2/6/70
Changed 3/16/70

LM 7

Basic Date 2/6/70
Changed 3/16/70

ACT-19

AUDIO (LMP): S-BAND T/R - T/R

: ICS - T/R

CB(11) COMM: SEC S-BD(2) - Close

CB(16) COMM: DISP - Close

: S.E. AUDIO - Close

: S-BD ANT - Close

: PMP - Close

S-BAND - PM, SEC, SEC, VOICE, PCM, RANGE,
OFF, LO

S-BAND ANT - AFT

4 Verify BAT 1,2,3,4 - tb-LO

DES BATS tb-gray

BATS 5&6 NORMAL & BACKUP (4)-tb-bp

Check BAT and BUS Voltages

When BUS Volts $\leq$ 27V, Select High Voltage
Taps
CB(16) EPS: CROSS TIE BAL LOADS - Open
BAT 1 HI VOLTAGE-OFF/RESET
BAT 1 HI VOLTAGE-ON
Repeat for BATS 2,3,4

5 CB(11) AC BUS B&A: BUS TIE INV 2&1(4)-
Close

AC BUS A : AC BUS VOLT - Close

EPS: INV 1 - Close

CB(16) EPS: INV 2 - Close

ECS ACT

C/W CHECKOUT

TB VERIFICATION

PGNS T/O

IVT TO LM
EPS ACT

PDI DAY

ACT-20

- 6 POWER/TEMP MON - AC BUS
INV -1 Then 2
Verify Voltage in GREEN Band
CB(11) EPS: INV 1 - Open

97:00

MISSION TIMER ACTIVATION

- 1 CB(11) AC BUS B: NUM LTG - Close
FLIGHT Displays: MISSION TIMER-Close
Set MSN TMR On CSM Mark

97:02

PRIMARY GLYCOL LOOP ACTIVATION

- 1 CB(16) ECS: DISP - Close
GLYCOL - PUMP 1 9 psia
- INST(SEC) 9 psia
- PUMP 2
CB(11) ECS: GLYCOL PUMP AUTO TRNFR - Close
: GLYCOL PUMP 1 - Close
: GLYCOL PUMP AUTO TRNFR-Open
GLYCOL - PUMP 1 21 psia
Verify Press
CB(11) ECS: GLYCOL PUMP 2 - Close

LM 7

Basic Date 2/6/70
Changed

LM 7

Basic Date 2/6/70
Changed

ACT-21

97:04

CAUTION/WARNING CHECKOUT

- 1 CB(16) LTG: MASTER ALARM - Close
INST: CWEA - Close

WARN	CAUT	COMP
ASC PRESS(ON THRU DES)	PREAMP	H2O SEP
CES AC	HEATER	
CES DC	ECS	
LGC	GLYCOL(ON IF TEMP	
RCS A REG	>50°)	
RCS B REG		

CB(16) LTG: ANUN/DOCK/COMPT - Close
STAB/CONT: ATCA - Close
HEATER: DISP - Close
CB(11) STAB/CONT: ENG CONT - Close

- 2 RCS SYS A/B-2: QUADS(4) - AUTO
HTR TEMP MONITOR - Cycle Then LDG
(HEATER Lt - Off)
LAMP/TONE TEST - Check All Positions

- 3 PRIM EVAP FLOW No 1 - OPEN

GET 56 :

- 4 Close CB's Per ACTIVATION PWR UP Chart

ECS ACT
S-BD ANT ACT

C/W CHECKOUT

TB VERIFICATION

PGNS T/O

IVT 10 LM
EPS ACT

C/W CHECKOUT

ACT-22

ACTIVATION PWR UP

AC BUS B										AC BUS A									
IN-100A	IN-100B	IN-100C	IN-100D	IN-100E	IN-100F	IN-100G	IN-100H	IN-100I	IN-100J	IN-100K	IN-100L	IN-100M	IN-100N	IN-100O	IN-100P	IN-100Q	IN-100R	IN-100S	IN-100T
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

ECS SYS A										FLIGHT DISPLAYS										AC BUS A									
IN-100A	IN-100B	IN-100C	IN-100D	IN-100E	IN-100F	IN-100G	IN-100H	IN-100I	IN-100J	IN-100K	IN-100L	IN-100M	IN-100N	IN-100O	IN-100P	IN-100Q	IN-100R	IN-100S	IN-100T										
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HEATERS										STAN/CONT										ID										I/O									
IN-100A	IN-100B	IN-100C	IN-100D	IN-100E	IN-100F	IN-100G	IN-100H	IN-100I	IN-100J	IN-100K	IN-100L	IN-100M	IN-100N	IN-100O	IN-100P	IN-100Q	IN-100R	IN-100S	IN-100T																				
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HEATERS ECS SYS A										ECS										CONV										FORMS									
IN-100A	IN-100B	IN-100C	IN-100D	IN-100E	IN-100F	IN-100G	IN-100H	IN-100I	IN-100J	IN-100K	IN-100L	IN-100M	IN-100N	IN-100O	IN-100P	IN-100Q	IN-100R	IN-100S	IN-100T																				
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ECS SYS B										ECS										CONV										FORMS									
IN-100A	IN-100B	IN-100C	IN-100D	IN-100E	IN-100F	IN-100G	IN-100H	IN-100I	IN-100J	IN-100K	IN-100L	IN-100M	IN-100N	IN-100O	IN-100P	IN-100Q	IN-100R	IN-100S	IN-100T																				
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LM 7

Basic Date 2/6/70
Changed 3/16/70

LM 7

Basic Date 2/6/70
Changed 4-3-70
4-8-70

ACT-23

ACTIVATION PWR UP

ECS SYS B										ECS										CONV										FORMS									
IN-100A	IN-100B	IN-100C	IN-100D	IN-100E	IN-100F	IN-100G	IN-100H	IN-100I	IN-100J	IN-100K	IN-100L	IN-100M	IN-100N	IN-100O	IN-100P	IN-100Q	IN-100R	IN-100S	IN-100T																				
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ECS SYS A										ECS										CONV										FORMS									
IN-100A	IN-100B	IN-100C	IN-100D	IN-100E	IN-100F	IN-100G	IN-100H	IN-100I	IN-100J	IN-100K	IN-100L	IN-100M	IN-100N	IN-100O	IN-100P	IN-100Q	IN-100R	IN-100S	IN-100T																				
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ECS SYS B										ECS										CONV										FORMS									
IN-100A	IN-100B	IN-100C	IN-100D	IN-100E	IN-100F	IN-100G	IN-100H	IN-100I	IN-100J	IN-100K	IN-100L	IN-100M	IN-100N	IN-100O	IN-100P	IN-100Q	IN-100R	IN-100S	IN-100T																				
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HEATERS										STAN/CONT										ID										I/O									
IN-100A	IN-100B	IN-100C	IN-100D	IN-100E	IN-100F	IN-100G	IN-100H	IN-100I	IN-100J	IN-100K	IN-100L	IN-100M	IN-100N	IN-100O	IN-100P	IN-100Q	IN-100R	IN-100S	IN-100T																				
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ECS ACT
S-BD ANT ACT

IMU C/A
SUIT FAN/H2O CK

TB VERIFICATION

PGNS T/O

IVT TO LM
EPS ACT

C/W CHECKOUT

TB VERIFICATION

ACT-24

97:10

TB VERIFICATION

- 1 CB(16) INST: CWEA - Open Then Close
Cycle TEMP MON

WARN	CAUT	COMP
ASC PRESS	ECS	SUIT FAN
RCS A REG		H20 SEP
RCS B REG		

- 2 FUEL & OXID VENT (2) -tb-gray
LDG GEAR DEPLOY - tb-bp

- 3 ASCENT He REG 1&2 -tb-gray
DESCENT He REG 1-tb-gray
DESCENT He REG 2 -tb-bp

- 4 SYS A&B ASC FUEL & OXID (4)-tb-bp
SYS A&B QUADS (8) - tb-gray
CRSFD tb-bp
SYS A&B MAIN SOV -tb-gray

- 5 RECORDER - OFF - tb-bp

LM 7

Basic Date 2/6/70

Changed

LM 7

Basic Date 2/6/70

Changed

ACT-25 -25

97:12

PGNS TURN-ON & SELF TEST

- 1 Check Bus Voltages

- 2 V35E
F 88 88

(Master Alarm, LGC & ISS Warning,
And All DSKY Lts - On,
8's In All Registers; Lts
Reset In 5 sec)

- 3 CB(11) PGNS: IMU OPR - Close
NO ATT Lt - On (Off In 90 sec)
Wait 20 sec After NO ATT Lt - Off,
then
V37E00E

- 4 V25 N01E 1365E
E,E,E

- 5 V15 N01E 1365E
R1,R2,R3 A11 Zero

ECS ACT
S-BD ANT ACT

IMU C/A
SUIT FAN/H20 CK

VHF C/O
LGC/CMC CLOCK SYNC

PGNS T/O

IVT TO LM
EPS ACT

C/W CHECKOUT

TB VERIFICATION

PGNS T/O

ACT-26

- 6 V21 N27E 10E (Test
Fixed And Erasable Memory)
- R1 Number Of Errors
R2 Number Of Tests Started
R3 Number Of Tests Successful
(Test Successful If R2 $\geq$ 3 Within
78 sec)

```
*
* *PR0G Lt-On
* * V05 N09E 01102 SELF-
* * TEST ERROR
* * N08E Record For MSFN
* *
* * R1
* * R2
* * R3
* *
```

- 7 V21 N27E 0E TERMINATE SELF TEST

LM 7

Basic Date 2/6/70
Changed

LM 7

Basic Date 2/6/70
Changed 3/16/70
ACT-27

***** UD - 2:00 (97:16) *****

***** A05 97:16 *****

Report LM Pwr Transfer Time (ACT-17)

97:16

* SEC S-BAND VOICE CHECK

Notify MSFN of SEC S-BD CK
Perform SEC S-BD VOICE CK With MSFN
(Up To 60 sec To Lock)

97:18

* PRIM S-BAND T/R AND PWR AMPL CHECK

- 1 Notify MSFN of PRIM S-BD CK
S-BAND XMTR/RCVR - PRIM
S-BAND PWR AMPL - PRIM
(Up To 60 sec To Relock)

- 2 Perform Comm Check With MSFN

ECS ACT
S-BD ANT ACT

IMU C/A
SUIT FAN/H2O CK

VHF C/O
LGC/CMC CLOCK SYNC

ASC BAT CK

ECS ACT
S-BD ANT ACT

C/W CHECKOUT

TB VERIFICATION

PGNS T/O

ACT-28.

97:21

ECS ACTIVATION & CHECKOUT

- 1 02/H2O QTY MON - ASC 2, ASC 1, DES
- 2 SUIT ISOL (2) - SUIT FLOW
SUIT ISOL (2) - ACTUATE OVRD (Suit Disc)
SUIT GAS DIVERTER - PUSH/CABIN
- 3 SUIT FAN - 2 (Master Alarm (Twice),
SUIT/FAN Warning Lt-On &
SUIT FAN Comp Lt-On
Momentarily, ECS Caution,
H2O SEP Comp Lts - ON
Then Off In 2 Min)

* S-BAND STEERABLE ANTENNA ACTIVATION

- 1 HTR CONT TEMP MONITOR - S-BAND
(-52° to +135°)
S-BAND -PM, PRIM, VOICE, PCM,
RANGE, OFF, HI
CSM Mnvr To Proper Attitude
- 2 HI GAIN: PITCH - -75°
YAW - -12°
TRACK MODE - SLEW (Wait 30 sec) (+112)CCW
PITCH (From MSFN) _____ (+ 34)CCW
YAW (From MSFN) _____
ANTENNA S-BAND - SLEW
- 3 Verify Signal Strength > 3.0
TRACK MODE - AUTO (>4.0)
- 4 S-BAND CHECK WITH MSFN

LM 7

LM 7

Basic Date 2/6/70
Changed 3/16/70

Basic Date 2/6/70
Changed ACT 25-29

97:23

CDR CONNECT TO LM ECS

- 1 Connect To CDR Hoses
(Stow Gas Connector Plugs In Purse)
SUIT ISOL - SUIT FLOW
Verify (192 PKG) Lanyard Stopper Not
Seated
CB(16) ECS: LCG PUMP - Close
PRESS REG A - EGRESS (Suit Gas Diverter
Automatically Extends)

97:23

LMP CONNECT TO LM ECS

Disconnect CSM 02 Hose & Return Hose to CSM
Connect To LMP Hoses
SUIT ISOL - SUIT FLOW

LDG GEAR DEPLOY
RCS PRESS

IMU C/A
SUIT FAN/H2O CK

VHF C/O
LGC/CMC CLOCK SYNC

DAY SET
ASC BAT CK

ECS AC1
S-BD ANT ACT

IMU C/A
SUIT FAN/H2O CK

TB VERIFICATION

PGNS T/O

ACT 30

97:26

97:26

DOCKED IMU COARSE ALIGN

SUIT FAN/H2O SEP CHECK

- 1 Verify CSM In Min DEADBAND ATT HOLD 1 CB(16) ECS: SUIT FAN 2 - Open
(Master Alarm, SUIT/FAN Warning
SUIT FAN Comp Lts - On)

- 2 Calculate LM Gimbal Angles

OG IG MG 2 CB(11) ECS: SUIT FAN 1 - Close
H2O SEP SEL - PUSH SEP 1

300.00 180.00 360.00

+Rc (See TLC-1)

SUIT FAN - 1 (SUIT/FAN Warning,
FAN Comp Lts-Off,ECS Caution,
H2O SEP Comp Lts -Off In 2 min)

-CM +CM -CM CB(16) ECS: SUIT FAN 2 - Close

LM LM LM LM

97:28

GLYCOL PUMP CHECK

- 3 V41 N20E COARSE ALIGN IMU
F 21 22 LOAD ICDU ANGLES OG,IG,MG (.01°)
(NO ATT Lt - On, FDAI Torques) 1

CB(11) ECS: GLYCOL PUMP 1 - Open
(Master Alarm, ECS Caution
Lt - On Momentarily)

CB(11) ECS: GLYCOL PUMP 1 - Close
(GLYCOL Comp Lt-On)

LM 7

Basic Date 2/6/70

Changed

LM 7

Basic Date 2/6/70

Changed

ACT 30-31

- 4 V40 N20E ZERO CDU (NO ATT Lt-Off)
Notify CSM ATT HOLD No Longer Required

2 GLYCOL - INST (SEC) (8 psia)
CB(16) ECS: GLYCOL PUMP SEC - Close
(10-20 psi Rise)
: GLYCOL PUMP SEC - Open

- 5 V25 N07E
F 21 07 SET REFSMFLG
77E,10000E,1E, V01 N01E,77E Confirm
Bit 13 Is Set (Set If 1st Digit Is
1,3,5, or 7)

3 GLYCOL - PUMP 2 (21-37 psi)
(GLYCOL Comp Lt - On Then Off)
CB(11) ECS: GLYCOL PUMP AUTO
TRNFR-Open
GLYCOL - PUMP 1 (21-37 psi)

- 6 V37E 51E
PRO
V37E 00E

- 4 Biomed Sw - Right

- 7 V06 N20 On LM MARK - ENTR
Note Time: Copy CSM & LM OG, IG, MG
GET 58:08:00

VHF B CHECKOUT

97:30

OG CM IG CM MG CM 1
LM LM LM LM LM LM

CSM Configure for VHF Simplex B
VHF B XMTR - VOICE
VHF B RCVR - ON
VHF ANT - FWD
AUDIO (Both): VHF B - T/R

- 8 Voice Gimbal Angles And Time To MSFN

- 2 Both CDR & LMP Perform Voice Check
On VHF Simplex B

LDG GEAR DEPLOY
RCS PRESS

RCS C/O

VHF C/O
LGC/CMC CLOCK SYNC

DAP SET

ASC BAT CK

CSW

PUL CB LM PWR 1 & 2 - OPEN
LMPWR SW - RESET, RELEASE

LM.

PUL 11 & 16 - XLUMIN BUSTIE - CLOSE

PUL 16 - ASC ECA CONT CLOSE
DESC ECA CONT CLOSE

PUL 14 BATS NORM FEED ON

BAT 1, 2, 3, 4 LO VOLTAGE TAP ON

BATS 5 NORM FEED-OFF

PUL 16 CB ASC ECA CONT - OPEN

Go ACT 1 - DO ~~STEP~~ 3

Do ACT 11 - omit step 1

Do ACT 12

Do ACT 13 - STEP 1

PGA CK
REC CK

PREP FOR UNDOCK

RR SELF TEST
AGS CAL

DRIFT CK
RATE GYRO CK

APOLLO 13

LM SYSTEMS
ACTIVATION CHECKLIST

PART NO.	S / N
SKB32100082 - 360	1002

LM 7

Basic Date 2/6/70
Changed ~~3/16/70~~ 4-3-70

CSM TO LM TRANSFER LIST (TLC)

Tissue Dispenser - RHSSC

~~70MM ES Camera~~

~~70MM Magazines (8)~~

70MM Magazines in Bag (3) - RHSSC

70MM Magazines HCEX (2) - ISA

SUIT HOSE INTERCONNECT

VACUUM HOSE (3 ft)

VACUUM BRUSH

CWG CONNECTOR

Flight Data In Bag:

LM ACTIVATION CHECKLISTS (2)

LM 7

Basic Date 2/6/70

Changed 2
TLC-1

58:00

IVT TO LM

1 Activate CABIN DUMP VALVE & Open Hatch
Take CSM 02 Hose When Transferring

2 Record Docking Tunnel Index Angle

Rc

3 FLOOD LIGHT - A11
EXTERIOR LTG - OFF
Window Shades - Down

4 DES H20 - OPEN
DES 02 - OPEN
CABIN REPRESS - AUTO
CB(16) CABIN REPRESS - CLOSE

5 Check AOT Visibility

6. TAPE BY FDAI'S - TTRC IMPVIS FOR DOCKED DES

IVT TO LM

LOI DAY

PGNS T/O

1 MD TWT TO 1M

PDI DAY

LM 7

Basic Date 2/6/70
Changed

LM 7

Basic Date 2/6/70
Changed 4-3-70

CSM TO LM TRANSFER LIST (PDI)

Suits And Ancillary Eqpt:

Liners

IV Gloves

Helmet

Bio belt & Instrumentation

Comm Cap

Wristwatch (2)

Sunglasses in pouch

Pens & Pencils

Penlight

Scissors

Personal Radiation Dosimeter

Flight Data In Bag:

LM TIMELINE BOOK

LM DATA CARD BOOK

LM LUNAR SURFACE CHECKLIST

LM ORBIT MONITOR CHART

LUNAR PHOTO CHARTS

STAR CHARTS

LM LUNAR SURFACE MAPS

16 mm LS CAMERA /w PWR PACK

16 mm MAGAZINES (8)

EC FLAG

IVT TO LM
EPS ACT

C/W CHECKOUT

TB VERIFICATION

PGNS T/O

IVT TO LM
EPS ACT

PDI DAY

ACT-18

***** UD - 2:30 (96:46) *****

***** SR 96:54 *****

96:56

CDR IVT TO LM

CDR IVT To LM With CDR &
LMP Helmet & Gloves

CHECK!

Connect To LM Comm Umbilical
CB(11) COMM: CDR AUDIO - Close
AUDIO (CDR): S-BAND-T/R
: ICS - T/R

EPS ACTIVATION

1 LTG: ANUN/NUM - BRIGHT (1 Caution, 9
Power Failure, 1 COMP Lt - On)

2 CB(11) INST: SIG CONDR 1 - Close
EPS: DES ECA CONT - Close
CB(16) INST: SIG SENSOR - Close
: PCM/TE - Close
: SIG CONDR 2 - Close
EPS: DISP - Close
: DES ECA CONT - Close

3 Connect To LM Comm Umbilical

LM 7

LM 7

Basic Date 2/6/70
Changed 3/16/70

Basic Date 2/6/70
Changed 2/6/70

ACT-19

AUDIO (LMP): S-BAND T/R - T/R
: ICS - T/R
CB(11) COMM: SEC S-BD(2) - Close
CB(16) COMM: DISP - Close
: S.E. AUDIO - Close
: S-BD ANT - Close
: PMP - Close
S-BAND - PM, SEC, SEC, VOICE, PCM, RANGE,
OFF, LO
S-BAND ANT - AFT

4 Verify BAT 1,2,3,4 - tb-L0
DES BATS tb-gray
BATS 5&6 NORMAL & BACKUP (4)-tb-bp
Check BAT and BUS Voltages

When BUS Volts $\leq$ 27V, Select High Voltage
Taps
CB(16) EPS: CROSS TIE BAL LOADS - Open
BAT 1 HI VOLTAGE-OFF/RESET
BAT 1 HI VOLTAGE-ON
Repeat for BATS 2,3,4

5 CB(11) AC BUS B&A: BUS TIE INV 2&1(4)-
Close
AC BUS A : AC BUS VOLT - Close
EPS: INV 1 - Close
CB(16) EPS: INV 2 - Close

ECS ACT
S-BD ANT ACT

C/W CHECKOUT

TB VERIFICATION

PGNS T/O

LM 7
EPS ACT

U/W CHECKOUT

AY

ACT-22

ACTIVATION PWR UP

AC BUS B										AC BUS A																			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
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ECS SYS A										ECS SYS B										AC BUS A									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
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HEATERS										INST										STAT/CONT										ED										LIG									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30																				
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HEATERS ECS SYS A/B										ECS										CONNA										PONES									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30										
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M.A., LGC, RESTART

ECS										CONNA										PONES									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
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LM 7

Basic Date 2/6/70
Changed 3/16/70

Basic Date 2/6/70
Changed 4-3-70
4-8-70

LM 7

ACT-23

ACTIVATION PWR UP

ECS SYS A										ECS SYS B										AC BUS A									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
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ECS SYS A										ECS SYS B										AC BUS A									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
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M.A., ECS, CO2

ECS SYS A										ECS SYS B										AC BUS A									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
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ECS SYS A										ECS SYS B										AC BUS A									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
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ECS ACT
S-BD ANT ACT

IMU C/A
SUIT FAN/H2O CK

TB VERIFICATION

PGNS T/O

ECS ACT
S-BD ANT ACT

IMU C/A
SUIT FAN/H2O CK

TB VERIFICATION

FGMS T/O

ACT 30

97:26

288
360
648

97:26

DOCKED IMU COARSE ALIGN

SUIT FAN/H2O SEP CHECK

1 Verify CSM In Min DEADBAND ATT HOLD

1 CB(16) ECS: SUIT FAN 2 - Open
(Master Alarm, SUIT/FAN Warning
SUIT FAN Comp Lts - On)

2 Calculate LM Gimbal Angles

2 CB(11) ECS: SUIT FAN 1 - Close
H2O SEP SEL - PUSH SEP 1

OG 300.00 IG 180.00 MG 360.00

- 2.00 +Rc (See TLC-1)

3 SUIT FAN - 1 (SUIT/FAN Warning,
FAN Comp Lts-Off,ECS Caution,
H2O SEP Comp Lts -Off In 2 min)

358.57 -CM 167.78 +CM 351.87 -CM
(7.5) (112.5) (22.5)

302.43 LM 349.78 LM 08.13 LM
(292.5) (292.5) (337.5)

360.00
302.43
57.57

3 V41 N20E COARSE ALIGN IMU

F 21 22 LOAD ICPU ANGLES OG,IG,MG (.01°)
(NO ATT Lt - On, FDAI Torques)

654.00 *PROG Lt-On *
353.57 *V05 N09E 00211 COARSE *
302.43 * ALIGN ERROR,Go* *
302.43 * To 3 *

CB(11) ECS: GLYCOL PUMP 1 - Open
(Master Alarm, ECS Caution
Lt - On Momentarily)

CB(11) ECS: GLYCOL PUMP 1 - Close
(GLYCOL Comp Lt-On)

GLYCOL PUMP CHECK

LM 7

Basic Date 2/6/70
Changed

Basic Date 2/6/70
Changed

ACT 30-31

4 V40 N20E ZERO CDU (NO ATT Lt-Off)
Notify CSM ATT HOLD No Longer Required

2 GLYCOL - INST (SEC) (8 psia)
CB(16) ECS: GLYCOL PUMP SEC - Close
(10-20 psi Rise)
: GLYCOL PUMP SEC - Open

5 V25 N07E
F 21 07 SET REFSMFLG

77E,10000E,1E, V01 N01E,77E Confirm
Bit 13 Is Set (Set If 1st Digit Is
1,3,5, or 7)

3 GLYCOL - PUMP 2 (21-37 psi)
(GLYCOL Comp Lt - On Then Off)
CB(11) ECS: GLYCOL PUMP AUTO
TRNFR-Open

6 V37E 51E
PRO
V37E 00E

GLYCOL - PUMP 1 (21-37 psi)

4 Biomed Sw - Right

7 V06 N20 On LM MARK - ENTR

Note Time: Copy CSM & LM OG, IG, MG
GET 58:08:06

97:30

VHF B CHECKOUT

OG 356.69 CM 16.342 CM 345.67 CM

1 CSM Configure for VHF Simplex B
VHF B XMTR - VOICE
VHF B RCVR - ON
VHF ANT - FWD
AUDIO (Both): VHF B - T/R

302.26 LM 345.92 LM 01.19 LM

8 Voice Gimbal Angles And Time To MSFN

2 Both CDR & LMP Perform Voice Check
On VHF Simplex B

LDG GEAR DEPLOY
RCS PRESS

RCS C/O

VHF C/O
LGC/CMC CLOCK SYNC

DAP SET
ASC BAT CK

ACT 40

SS 97:59

- 97:59

*IMU FINE ALIGN

1 Copy Ground Calculated Gyro Torquing Angles
X100330, Y100000, Z-01510
+02480

2 V76E (Verify)
V42E Fine Align IMU
F 21 93 Load Gyro Torquing Angles X,Y,Z (.001°)

3 V16 N93E Monitor Torquing (A11 Zero)
- 97:59

*MSFN UPLINK/UPDATE

1 UPDATA LINK - DATA
MSFN P-27 Updates LS REFSMMAT,
LM STATE VECTOR And LGC Abort Constants
UPDATA LINK - OFF

2 Copy Updates
Gyro Torquing Angles
AGS Abort Constants
DAP Data
- LM +X South

LGC PWR UP

L08E TTC A SLC DIRECT MODE

UD - 1:15 (98:01)

133

LM 7

Basic Date 2/6/70

Changed

Basic Date 2/6/70

Changed 3/16/70

ACT-41

- 98:04

DROGUE AND PROBE INSTALLATION

1 Verify:
Both Electrical Umbilicals Removed
Drogue Lock Lever Engaged & Flush
Three Capture Latches Engaged & Locked
LM Hatch Exterior Insulation O.K.
Flaps Secured Around Handles

2 Close & Secure Hatch
CABIN DUMP (OVHD) - AUTO
PRESS REG A&B - CABIN
SUIT GAS DIVERter - PUSH/CABIN
- 98:01

AGS ACTIVATION AND SELF TEST

1 AGS STATUS - STBY (Master Alarm,
AGS Warning Lt-On)
CB(16) STAB/CONT: AEA-Close
(AGS Warning Lt-Off)
CB(11) AC BUS B: AGS - Close
AGS STATUS - OPERATE
(Master Alarm & AGS Warning Lt-On)
02/H20 QTY MON-C/W RESET

2 000+888888 (OPR ERR Lt-On)

3 123-45679

4 412+0 REINITIATE TEST
412R +1 SELF TEST SATISFACTORY
+3 LOGIC TEST FAILURE
+4 MEMORY TEST FAILURE
+7 LOGIC AND MEMORY TEST FAILURE

5 574R DESCENT STAGE FLAG (+ Not Staged)

6 604R LUNAR SURFACE FLAG (+ NOT On
Lunar Surface)

7 612R STAGING SEQ COUNTER (+0 Nom)

APOLLO 13

LM CONTINGENCY
CHECKLIST

PART NO.

S/N

SKB32100076 - 362

1001

EMERGENCY SECTION

FIRE/SMOKE IN CABIN	EMER-1
ABNORMAL VEHICLE DYNAMICS	EMER-2
NO AUTO ENGINE SHUTDOWN	EMER-2
ELECTRICAL	EMER-3
PROPULSION	EMER-7
G&N	EMER-9
ECS	EMER-11
HTRS, TEMP	EMER-13
<u>CONTINGENCY EVT, IVT SECTION</u>	
CONTINGENCY EVT (2 OPS)	EVT-1
CONTINGENCY EVT (CDR/OPS-LMP/PLSS)	EVT-7
CONTINGENCY EVT (2 PLSS/OPS)	EVT-15
VACUUM IVT	IVT-1

2 HOUR ACTIVATION

IVT TO LM

- 1 ✓ Activate CABIN DUMP VALVE & Open Hatch
Carry Comm Carrier, CWG Connector And CSM 02 Hose
- 2 ✓ Record Docking Tunnel Index Angle _____
Window Shades - Down
- 3 ✓ Transfer To LM PWR
GET : :
(FLOOD Lts. Blink, C/W PWR Caution Lt-On)
CB(11) EPS: XLUNAR BUS TIE - Close
CB(16) EPS: XLUNAR BUS TIE - Close
- 4 ✓ FLOOD LIGHT - All
CB(11) LTG: UTIL - Close
Activate Utility Lts
- 5 ✓ DES H2O - OPEN
DES 02 - OPEN
CABIN REPRESS - AUTO
CB(16) ECS: CABIN REPRESS - Close

EPS ACTIVATION

- 1 ✓ LTG: ANUN/NUM - BRIGHT (1 Caution, 9
Power Failure, 1 COMP Lt - On)
- 2 ✓ CB(11) INST: SIG CONDR 1 - Close
EPS: DES ECA CONT - Close
CB(16) INST: SIG SENSOR - Close
: PCM/TE - Close
: SIG CONDR 2 - Close
EPS: DISP - Close
: DES ECA CONT - Close

- 3 ✓ Connect To LM Comm Umbilical
AUDIO (BOTH): S-BAND T/R - T/R
: ICS - T/R

Basic Date Changed
Basic Date Changed
1/6/70

LM-

2 HOUR ACTIVATION

DOCKED DPS BURN
(PGNS)

DOCKED APS BURN

30-MIN ACTIVATION

2 HR ACTIVATION

2

- 4 ✓ Verify BAT 1,2,3,4 - tb-L0
DES BATS tb-gray
BATS 5&6 NORMAL & BACKUP (4)=tb-bp
Check BAT and BUS Voltages

When BUS Volts $\leq$ 27V, Select High Voltage
Taps
CB(16) EPS: CROSS TIE BAL LOADS - Open
BAT 1 HI VOLTAGE-OFF/RESET
BAT 1 HI VOLTAGE-ON
Repeat for BATS 2,3,4

- 5 ✓ CB(11) AC BUS B&A: BUS TIE INV 2&1(4)-Close
: AC BUS VOLT(1) - Close
EPS: INV 1 - Close
CB(16) EPS: INV 2 - Close

- 16 ✓ POWER/TEMP MON - AC BUS
INV -2 Then 1
Verify Voltage in GREEN Band
CB(16) EPS: INV 2 - Open

MISSION TIMER ACTIVATION

- 1 ✓ CB(11) AC BUS B: NUM LTG - Close
FLIGHT DISPLAYS: MISSION TIMER-Close
Set MSN TMR On CSM Mark V16N65

PRIMARY GLYCOL LOOP ACTIVATION

- 1 ✓ CB(16) ECS: DISP - Close
GLYCOL - PUMP 1 _____ psia
- INST (SEC) _____ psia
- PUMP 2
CB(11) ECS: GLYCOL PUMP AUTO TRNFR - Close
: GLYCOL PUMP 1 - Close
: GLYCOL PUMP AUTO TRNFR - Open
GLYCOL - PUMP 1
Verify Press _____ psia
CB(11) ECS: GLYCOL PUMP 2 - Close

3

CAUTION/WARNING CHECKOUT

- 1 ✓ CB(16) LTG: MASTER ALARM - Close
INST: CWEA - Close

WARN
ASC PRESS
CES AC
CES DC
~~EGC~~
~~RCS-A-REG~~
~~RCS-B-REG~~

CAUT
~~PREAMP~~
HEATER
~~ECS~~
~~GLYCOL (ON IF TEMP~~
~~>50°)~~

COMP
~~H2O-SEP~~

- CB(16) LTG: ANUN/DOCK/COMPT - Close
STAB/CONT: ATCA - Close
~~HEATER: DISP - Close~~
INST: CWEA - Cycle
CB(11) STAB/CONT: ENG CONT - Close

- 2 ✓ RCS SYS A/B-2: QUADS(4) - AUTO
HTR TEMP MONITOR - Cycle Then LDG
(HEATER Lt - Off)
LAMP/TONE TEST - Check All Positions

3 ✓ PRIM EVAP FLOW No 1 - OPEN GET _____:_____:_____

- 4 ✓ Close CB's Per ACTIVATION PWR UP Chart

Basic Data 1/6/70
Changed 2/9/70

Basic Data 1/6/70
Changed 2/13/70

LM-7

LM-7

DOCKED UPS BURN
(MANUAL)

DOCKED UPS BURN
(PGNS)

DOCKED APS BURN

30-MIN ACTIVATION

2 HR ACTIVATION

ACTIVATION PWR UP (MODE I, IIA, II, III)

AC BUS B										AC BUS A									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

EC3 SYS A										FLIGHT DISPLAYS										AC BUS A									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

HEATERS										INST										STAT/CONT										ED										LTO									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40										
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐										

HEATERS EC3 SYS A										EC3										COMM										POWERS									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

EC3 SYS B										EC3										COMM										POWERS									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

LM-7
Basic Date Changed 1/6/70
 3/10/70
Basic Date Changed 1/6/70
 2/9/70

ACTIVATION PWR UP

EC3 SYS B										EC3										COMM										POWERS									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

EC3 SYS A										FLIGHT DISPLAYS										AC BUS A																			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

HEATERS										INST										STAT/CONT										ED										LTO									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40										
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐										

EC3 SYS B										EC3										COMM										POWERS									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

2 HR ACTIVATION

6

PGNS TURN-ON & SELF TEST

Nothing

- 1 Check Bus Voltages
- 2 V35E
F 88 88
(Master Alarm, LGC & ISS Warning, And
All DSKY Lts - On, 8's In All
Registers; Lts Reset In 5 sec)
- 3 CB(11) PGNS: IMU OPR - Close
NO ATT Lt - On (Off In 90 sec)
Wait 20 Sec after NO ATT Lt-Off,
Then V37E00E
- 4 V25 N01E 1365E
E,E,E
- 5 V15 N01E 1365E
R1,R2,R3 All Zero
- 6 V21 N27E 10E (Test
Fixed And Erasable Memory)

R1 Number Of Errors
R2 Number Of Tests Started
R3 Number Of Tests Successful
(Test Successful If R2 > 3 Within
78 sec)

*PROG Lt-On *
* V05 N09E 01102 SELF-*
* TEST ERROR *
*N08E Record For MSFN *
* *
* R1 *
* *
* R2 *
* *
* R3 *

7 V21 N27E OE TERMINATE SELF TEST

Basic Date 1/6/70
Changed 2/13/70

Basic Date 1/6/70
Changed 2/13/70

LM

LM

7

Nothing

S-BAND ACTIVATION

- 1 HTR CONT TEMP MONITOR - S-BAND
(-52° to +135°)
S-BD -PM, PRIM, PRIM, VOICE, PCM, OFF/RESET, OFF, LO
ANT: S-BD - FWD or AFT

ECS ACTIVATION & CHECKOUT

- 1 02/H2O QTY MON - ASC 2, ASC 1, DES
- 2 SUIT GAS DIVERTER - PUSH/CABIN
- 3 SUIT FAN - 2 (Master Alarm (Twice),
SUIT/FAN Warning Lt-On &
SUIT/FAN Comp Lt-On
Momentarily, ECS Caution,
H2O SEP Comp Lts-On
Then Off In 2 Min)

DOCKED IMU COARSE ALIGN

- 1 Verify CSM In Min DEADBAND ATT HOLD
- 2 Calculate LM Gimbal Angles

OG	IG	MG
300.00	180.00	360.00
+Rc (See Page 1)		
-CM	+CM	-CM
LM	LM	LM

DOCKED DPS BURN
(MANUAL)

DOCKED DPS BURN
(PGNS)

DOCKED APS BURN

30-MIN ACTIVATION

2 HR ACTIVATION

8

- 3 ✓ V41 N20E COARSE ALIGN IMU
F 21 22 LOAD ICDU ANGLES OG, IG, MG (.01°)
(NO ATT Lt - On, FDAI Torques)

*PROG Lt-On *
*V05 N09E 00211 COARSE *
* ALIGN ERROR, Go*
* To 3 *

- 4 ✓ V40 N20E ZERO CDU (NO ATT Lt-Off)
Notify CSM ATT HOLD no Longer Required

- 5 ✓ V25 N07E
F 21 07 SET REFSMFLG
77E, 10000E, 1E, V01 N01E, 77E Confirm
Bit 13 Is Set (Set If 1st Digit Is
1, 3, 5, or 7)

- 6 ✓ V37E 51E
PRO
V37E 00E

- 7 ✓ V06 N20 On LM MARK - ENTR
Note Time; Copy CSM & LM OG, IG, MG
GET ____:____:____

	<u>OG</u>		<u>IG</u>		<u>MG</u>	
_____	CM	_____	CM	_____	CM	
_____	LM	_____	LM	_____	LM	

- 8 Voice Gimbal Angles And Time To MSFN

VHF B CHECKOUT

- 1 CSM Configure for VHF Simplex B
VHF B XMTR - VOICE
VHF B RCVR - ON
VHF ANT - FWD
AUDIO (Both): VHF B - T/R
- 2 Perform Voice Check On VHF Simplex B

VHF A CHECKOUT

- 1 ✓ CSM Configure For VHF Simplex A
VHF A XMTR - VOICE
VHF A RCVR - ON
VHF B XMTR - OFF
TLM - HI
AUDIO (Both): VHF B - RCV
: VHF A - T/R

LGC/CMC CLOCK SYNC/TEPHEM UPDATE

- 1 ✓ V25 N36E
- 2 Load CSM Time ____:____:____
- 3 On CSM Mark - ENTER
- 4 V06 N65E - Compare With CSM N65
- CSM Time ____:____:____
- LM Time ____:____:____

V55E - Load ΔT
Check Mission Timer

1/6/70
Basic Date
Changed

1/6/70
Basic Date
Changed

LM-7

LM-7

DOCKED DPS BURN
(MANUAL)

DOCKED DPS BURN
(PGNS)

DOCKED APS BURN

30-MIN ACTIVATION

2 HR ACTIVATION

5 ✓ CSM Read TEPHEM

R1 _____

R2 _____

R3 _____

6 V25 N01E, 1706E Load TEPHEM (Octal)

7 V05 N01E, 1706E Verify TEPHEM

S-BD STEERABLE ANTENNA ACTIVATION

1 ✓ TLM - HI
HI GAIN: PITCH- -75°
YAW - -12°

TRACK MODE - SLEW (Wait 30 Sec)

PITCH _____ (CCW)
YAW _____ (CCW)
ANTENNA: S-BD - SLEW

2 ✓ VERIFY SIGNAL STRENGTH >3.0
TRACK MODE - AUTO (>4.0)
S-BD CHECK WITH MSFN

E-MEMORY DUMP

1 ✓ Verify TLM - HI
V74E (42 Sec)

LANDING GEAR DEPLOY

1 ✓ CB 11) ED: LDG GEAR FLAG-Close
: LOGIC POWER A-Open
MASTER ARM-ON
LDG GEAR DEPLOY-FIRE, tb-gray
CB(11) ED: LOGIC POWER A-Close
LDG GEAR DEPLOY-FIRE
MASTER ARM-OFF
CB(11) ED: LDG GEAR FLAG-Open

10

Nothing

RCS PRESSURIZATION

1 ✓ RECYCLE: SYS A&B ASC FEED 2(2) - CLOSE
: SYS A&B ASC FEED 1(2) - OPEN

2 RCS QUANTITY A&B - 100%
SYS A&B ASC FUEL & ASC OXID - tb(4) Remain-bp
SYS A&B THRUSTER PAIR QUADS - tb(8) gray
(Possible tb-Red, Cycle CWEA If Necessary)
RECYCLE: CRSFD-CLOSE
: MAIN SOV SYS A&B - OPEN
HTR CONT TEMP MON - Check RCS QUADS (>120°)

3 TEMP/PRESS MON - He (2820-3280 psi)
PRPLNT (40°-100°/10-50 psi)
FUEL MANF (25-90 psi)
OXID MANF (25-90 psi)

4 CB(16) LOGIC PWR B-Open
MASTER ARM - ON
HE PRESS RCS - FIRE
(RCS A&B REG Warning Lts-Off)
RECYCLE: SYS A&B ASC FEED 2(2) - CLOSE
CB 16) LOGIC PWR B-Close
MASTER ARM-OFF

5 RECYCLE: SYS A&B ASC FEED 1(2) - OPEN
: SYS A&B THR PAIR QUADS(8)-OPEN
: CRSFD - CLOSE
: SYS A&B MAIN SOV-OPEN

6 TEMP/PRESS MON - OXID MANF (175-188 psi)
- FUEL MANF (175-188 psi)
- PRPLNT (40°-100°/178-188 psi)
- He (2750-3200 psi)
Read He Pressure To MSFN

1/6/70
2/13/70
Basic Date
Changed

1/6/70
3/10/70
Basic Date
Changed

LM-7

11

Nothing

(MANUAL)

(PGNS)

DOCKED APS BURN

30-MIN ACTIVATION

12

2 HR ACTIVATION

MSFN - UPDATE

- 1 UPDATA LINK - DATA
MSFN P-27 Updates REFSMMAT/
STATE VECTOR
UPDATE LINK - OFF

AGS ACTIVATION AND SELF TEST

- 1 AGS STATUS - STBY (Master Alarm,
AGS Warning Lt-On)
CB(16) STAB/CONT: AEA-Close
(AGS Warning Lt-Off)
CB(11) AC BUS B: AGS - Close
AGS STATUS - OPERATE
(Master Alarm & AGS Warning Lt-On)
02/H2O QTY MON-C/W RESET, Then DES
- 2 000+888888 (OPR ERR Lt-On)
- 3 123-45679
- 4 412+0 REINITIATE TEST
412R +1 SELF TEST SATISFACTORY
+3 LOGIC TEST FAILURE
+4 MEMORY TEST FAILURE
+7 LOGIC AND MEMORY TEST FAILURE
- 5 574R DESCENT STAGE FLAG (+ Not Staged)
- 6 604R LUNAR SURFACE FLAG (+ Not On
Lunar Surface)
- 7 612R STAGING SEQ COUNTER (+0 Nom)

1/6/70
2/13/70
Basic Date
Changed1/6/70
2/13/70
Basic Date
ChangedIMU FINE ALIGN

- 1 Copy Ground Calculated Gyro Torquing Angles
X _____, Y _____, Z _____
- 2 V76E (Verify)
V42E Fine Align IMU
F 21 93 Load Gyro Torquing
Angles X,Y,Z (.001°)
- 3 V16 N93E Monitor Torquing
(All Zero)

AGS ALIGN

- 1 400 + 5 Body Axis Align

DAP SET, GIMBAL/THROTTLE TEST

- 1 CB(11) STAB/CONT: DECA PWR - CLOSE
MODE CONT: PGNS - AUTO (Poss RCS TCA Lt, And QUAD
Verify GUID CONT - PGNS Flags-Red)
THR CONT - ~~MAN~~ *AUTO*
MAN THROT - CDR
TTCA(Both)-THROTTLE (MIN)

LM-

LM-

15

2 HR ACTIVATION

SET Low DB: V21 N01E 14
3011E, 200E

- 2 V48E
N46 ~~32021~~ 31021
PRO
N47 + (33731)
+ (From MSFN or CSM)
V34E
PRO
N48 + 5.86 (From MSFN or Chart)
+ 6.75 (From MSFN or Chart)
- ENG STOP - PUSH
ENG ARM - DES (DES REG Lt-ON)
PRO (ENG GMBL Lt-ON in Approx 30 sec)

- 3 TTCA (CDR) - MIN, THEN SOFT STOP,
CHECK CMD THRUST METER (50%),
THEN MAX (98%), THEN MIN

- 4 MAN THROT - SE
TTCA (LMP) - Repeat Test

- 5 F 50 48
PRO
ENG ARM - OFF (ENG GMBL Lt-OFF)
ENG STOP - Reset
MSFN Verifies Final GDA Position

- 6 THR CONT - AUTO
MAN THROT - CDR
TTCA (Both) - JETS
MODE CONT: PGNS - OFF

DPS PRESSURIZATION AND CHECKOUT

- 1 PRPLNT TEMP/PRESS MON - DES 1&2
(50°-90° FUEL, 50°-90° OXID/
58-144 psi FUEL, 33-255 psi OXID)
- 2 HELIUM MON: AMB PRESS (1490-1780 psi) 1610
: SUPCRIT PRESS 610-1070 760
- 3 DES HE REG 1 tb gray
DES HE REG 2 tb-bp

- 4 MASTER ARM - ON
DES PRPLNT ISOL VLV - FIRE
HE PRESS/DES START - FIRE
MASTER ARM-OFF

- 5 PRPLNT TEMP/PRESS MON: DES 2&1
(50°-90° FUEL, 50°-90° OXID/242-253 psi)
HELIUM MON: AMB PRESS (200-1110 psi)
: SURCRIT PRESS (610-1070 psi)

RCS CHECKOUT VERIFY FOLLOW-UP'S

CB(11) ATT DIR CONT - Close

GUID CONT - PGNS

ATT CONT (3) - PULSE MODE CONT

MODE CONTROL (Both) - ATT HOLD AUTO

ATT/TRANSL - 4 JETS

ACA PROP (LMP) - ENABLE

ACA/4 JET (LMP) - ENABLE

TTCA/TRANSL (LMP) - ENABLE

V76E

CB(11 & 16) QUAD TCA 1,2,3,4; (8) - Close

Cycle CWEA (DES REG Lt - OFF)

Cycle TEMP MON

VERIFY (LMP) TTCA/TRANS, ACA/4 JET, ACA PROP - ENABLE

Verify HBR With MSFN

Verify CSM In Wide Deadband & Attitude Hold

V11N10E, 5E

TTCA (LMP)

Up (+X) - R1 00252

Dn (-X) - 00125

E, 6E

Rt (+Y) 00220

Lt (-Y) 00140

Fwd(+Z) 00011

Aft(-Z) 00006

Notify CSM Check Complete

V48E, N46 31021

PRO, PRO, V34E

1/6/70
3/10/70
Basic Date
Changed1/6/70
3/23/70
Basic Date
Changed

LM

LM-7

DOCKED DPS BURN (PGNS)

Copy P30 Pad

If APS Follow-up Required:
Copy P30 Pad For APS Burn
BAT 5,6 - ON, tb(2) - gray
Verify BAT Current
BAT 1,3 - OFF/RESET, tb(2) -bp

V62E
V37E 30E
N33, TIG
PRO
N81 ΔV X, Y, Z
PRO
N42 Ha, Hp, ΔV
PRO
N45 M, TFI, MGA

SET EVNT TMR
PRO

-6:00 P40E

F 50 18

~~OSM Mnvr to Burn Attitude Then CMC - FREE~~

MODE CONT: (BOTH) - AUTO
ATT CONT (3) - MODE CONT
PRO (TRIM ATT)

ENTR
06 40 TFI, VG, ΔVM

2 HR ACTIVATION

Basic Data 1/6/70
Changed

LM-7

18

-1:00 ~~MASTER ARM - ON (ENGINE DOWN)~~
~~CB(16) ABORT STAGE - CLOSE~~

CB(16) ABORT STAGE - CLOSED
- :30 ENG ARM - DES

- :10 ~~MANUAL~~ ULLAGE (LMP) 10 SEC
MANUAL

- :07 AUTO ULLAGE

- :05 F 99 40, PRO

:00 IGNITION
IF NO IGNITION START - PB - PUSH, STILL NO IGNITION -
DESCEND CMD OVRD - ON
+ :05 TTCA (CDR) Throttle To 40%

+ :15 ~~MASTER ARM - OFF~~

When ~~PAUSE QTY~~ TIME TO GO = 10 SEC
DES He REG 1 - CLOSE

At Engine Cutoff: IF MANUAL START - THROTTLE
ENG STOP - PUSH TO 40% @ 30FPS V_{60} . STOP
MODE CONT: PGNS - ATT HOLD PB @ $V_{60} = 0$
V76E
Damp Excessive Rates Via LM Y, Z Translation
V76E

~~RESUME ALTITUDE CONTROL~~

PRO			
N85	+1.0	VGX	470 +0859.4
	+0.3	VGY	
	+0.0	VGZ	

PRO
POOE
V75E

17

400 + 0
404 + 0
405 + 0
406 + 0
470R

-4:00 CB(16) INV 2 - CLOSE

CB(16) CMEA - Cycle
Cycle TEMP MON

TTCA (CDR) - THROT (Min)
TTCA (LMP) - JETS

RATE/ERR MON (Both) - LDG RDR/CMPTR
ATTITUDE MON (CDR) - PGNS
(LMP) - AGS

RATE SCALE - 25°/SEC
ENG GMBL - ENABLE
THR CONT - AUTO
MAN THROT - CDR
ATT/TRANSL - 4 JET
BAL CPL - OFF
DES ENG CMD OVRD - OFF
DEADBAND - MIN
ENG STOP (2) - Reset
ABORT/ABORT STAGE - Reset
PRPLNT QTY MON - DES 1

V65E

Basic Date 1/6/70
Changed 2/9/70

Basic Date 1/6/70
Changed 3/23/70

LM-7

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DOCKED DPS BURN
(PGNS)

ENG ARM - OFF
PRPLNT QTY MON - OFF
ENG STOP - RESET
TTCA (CDR) - JETS

MODE I, III: TO UNSTAGED POWER DOWN

MODE IA : To UNSTAGED POWER DOWN
If Desired, then Reactivate
LM For Docked APS Burn
At Ground Calculated TIG.

MODE II : TO PAGE 16. Repeat
DPS Burn At Ground Cal-
culated TIG (up to 40 Hr),
Then to UNSTAGED POWER DOWN.

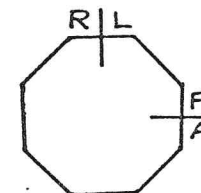
*Descent H₂O valve closed
Asc H₂O valve closed
H₂O subat tank to asun*

DOCKED APS BURN

If DPS Contains Insufficient ΔV To
Complete A MODE II Abort, This
Procedure May Be Entered Immediately
Upon Termination of DPS Burn.

APS BURN TECH

- * * * * *
- * If PITCH Error Needle Goes Down,
- * LMP Thrust AFT (Pull Out On TTCA).
- * If ROLL Needle Left, CDR Thrust
- * Right (Push Right ON TTCA).
- * See FDAI Picture Below.
- * * * * *



- * * * * *
- * When APS Ignition Occurs, LMP
- * Should Immediately Thrust Aft To
- * Maintain Control. Use Of PITCH
- * ATTITUDE CONTROL Switch To MODE
- * CONT Will Provide An Assist, IF
- * * * * *

*RATE & ERR NEEDLES MOVING IN SAME
DIRECTION IN SAME QUADRANT*

Basic Date 1/6/70
Changed

Basic Date 1/6/70
Changed

LM-7

LM-7

22

-6:00 P42E
1706 ALARM, PRO

F 50 18

CSM Mnvr To Burn Attitude

ENTR
06 40 TFI, VG, ΔVM

400 + 0
404 + 0
405 + 0
406 + 0
470R

-4:00 GUID CONT - AGS
ATTITUDE MON (BOTH) - PGNS
RATE SCALE - 5°/SEC
ATT/TRANSL - 4 JET
BAL CPL - ON
ATT CONT: ROLL - PULSE
: PITCH - PULSE
: YAW - MODE CONT
MODE CONT (BOTH) - ATT HOLD
ENG STOP (2) - RESET
ABORT/ABORT STAGE - RESET

-1:00 MASTER ARM - ON

21

If Required:

BAT 5,6 - ON, tb (2) - gray
Verify BAT Current
BAT 1,3 - OFF/RESET,
tb (2) - bp

CB(11&16) STAB/CONT:AELD (2)-CLOSE
EPS:ASC ECA CONT (2) - CLOSE

HELIUM MON - ASC PRESS 1&2
PRPLNT TEMP/PRESS MON - ASC
ASC He REG 1&2, tb(2) - gray

MASTER ARM - ON
ASC He SEL - BOTH
He PRESS:ASC - FIRE
MASTER ARM - OFF

DES H2O - CLOSE
WATER TANK SEL - ASC
ASC H2O - OPEN
DES O2 - CLOSE
CABIN REPRESS - CLOSE
#1 ASC O2 - OPEN

Verify ASC BATS Have Been On For 20 Min
BAT 2,4 - OFF/RESET, tb-bp
DES BATS - DEADFACE, tb-bp

400+5

V37E 30E
N33 TIG
PRO
N81 ΔV X, Y, Z
PRO
N42 Ha, Hp, ΔV
PRO
N45 M, TFI, MGA

SET EVNT TMR
PRO

9 LD ACTIVATION

DOCKED DPS BURN
(PGNS)

DOCKED APS BURN

Basic Date 1/6/70
Changed 2/9/70

Basic Date 1/6/70
Changed 4/1/70

LM-7

Midcourse 105.00
ACS

30-MIN ACTIVATION

IVT TO LM

1 *omit* CSM Mnvr To Burn Attitude
Activate CABIN DUMP VALVE & Open Hatch
Carry COMM Carrier & CWG Connector to LM

2 *omit* FLOOD LIGHT - ALL
DES O2 - OPEN
DES H2O - OPEN
CABIN REPRESS - AUTO
CB(16) ECS: CABIN REPRESS - CLOSE
SUIT GAS DIVERter - CABIN

3 *omit* CSM Transfer To LM PWR
(Flood Lts Blink, C/W PWR Caution Lt-On)
CB(11) EPS: XLUNAR BUS TIE - CLOSE
HEATERS: RCS SYS A/B-1 QUAD 4,3,2,1 (4)-CLOSE
CB(16) EPS: XLUNAR BUS TIE - CLOSE
HEATERS: RCS SYS A/B-2 QUAD 1,2,3,4 (4)-CLOSE

RCS SYS A/B-2: QUADS (4) - AUTO *time 15 min*
VERIFY AGS STATUS SW - OFF

EPS ACTIVATION

1 *omit* 8° LTG: ANUN/NUM - BRIGHT

2 *omit* CB(11) INST: SIG CONDR 1 - CLOSE
EPS: DES ECA CONT - CLOSE
CB(16) INST: SIG SENSOR - CLOSE
: PCM/TE - CLOSE
: SIG CONDR 2 - CLOSE
EPS: DISP - CLOSE
: DES ECA CONT - CLOSE

2 LD ACTIVATION

-:30 ENG ARM - ASC

-:10 MANUAL ULLAGE

-:07 STAGE - FIRE

-:05 F 99 40, PRO

-:02 CMC MODE - FREE

ACA - Out of Detent (Yaw) (Zero Error Needles)

:00 ENG START - PUSH
IgnitionSYS A&B ASC FEED 2(2) - OPEN, tb(4) - gray
SYS A&B MAIN SOV (2) - CLOSE

V16 N85E, VG X, Y, Z

(.1fps)

When VGX = 200 fps:
SYS A&B MAIN SOV (2) - OPEN
SYS A&B ASC FEED 2(2) - CLOSEWhen VGX = 0:
ENG STOP - PUSH

ATT CONT: YAW - PULSE

Damp Excessive Rates Via LM Y, Z Translation

CSM Resume Attitude ControlENG ARM - OFF
MASTER ARM - OFF
ENG STOP - RESETCopy Residuals: _____ VGX
_____ VGY
_____ VGZ

KEY REL, PRO, PRO

TO STAGED POWER DOWNDOCKED DPS BURN
(PGNS)

DOCKED APS BURN

1/6/70

Basic Date
Changed

1/6/70

Basic Date
Changed

LM-7

LM-7

DOCKED DPS BURN
(MANUAL)

UNSTAGED POWER DOWN

STAGED BURN

30-MIN ACTIVATION

30-MIN ACTIVATION

DOCKED APS BURN

DOCKED DPS BURN
(PGNS)

30-MIN ACTIVATION

25

3

omit

Verify BAT 1,2,3,4 - tb-L0
DES BATS - tb-gray
BATS 5&6 NORMAL & BACKUP(4)-tb-bp
Check BAT and BUS Voltages

When BUS Volts <27V, Select High Voltage Taps
CB(16) EPS: CROSS TIE BAL LOADS - OPEN
BAT 1 HI VOLTAGE-OFF/RESET Then ON
Repeat for BATS 2,3,4

4

CB(11) AC BUS B&A: BUS TIE INV 2&1(4) - CLOSE
: AC BUS VOLT - CLOSE
EPS: INV 1 - CLOSE
~~CB(16) EPS: INV-2 - CLOSE~~

5

INV-1, Verify Voltage In Green Band

PRIMARY GLYCOL LOOP ACT

1

CB(16) ECS: DISP - CLOSE *-crew option*
CB(11) ECS: GLYCOL PUMP AUTO TRNFR - CLOSE
: GLYCOL PUMP 1 - CLOSE
: GLYCOL PUMP AUTO TRNFR - OPEN
GLYCOL - PUMP 1
CB(11) ECS: GLYCOL PUMP 2 - CLOSE

2

PRIM EVAP FLOW No. 1 - OPEN

3

do

Close CB's Per 30-MIN ACTIVATION Chart

Basic Date 1/6/70
Changed 2/13/70

Basic Date 1/6/70
Changed 3/10/70

LM-7

LM-7

30-MIN ACTIVATION

AC BUS A	AC BUS B	AC BUS C	AC BUS D	AC BUS E	AC BUS F	AC BUS G	AC BUS H	AC BUS I	AC BUS J	AC BUS K	AC BUS L	AC BUS M	AC BUS N	AC BUS O	AC BUS P	AC BUS Q	AC BUS R	AC BUS S	AC BUS T	AC BUS U	AC BUS V	AC BUS W	AC BUS X	AC BUS Y	AC BUS Z
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AC BUS A	AC BUS B	AC BUS C	AC BUS D	AC BUS E	AC BUS F	AC BUS G	AC BUS H	AC BUS I	AC BUS J	AC BUS K	AC BUS L	AC BUS M	AC BUS N	AC BUS O	AC BUS P	AC BUS Q	AC BUS R	AC BUS S	AC BUS T	AC BUS U	AC BUS V	AC BUS W	AC BUS X	AC BUS Y	AC BUS Z
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AC BUS A	AC BUS B	AC BUS C	AC BUS D	AC BUS E	AC BUS F	AC BUS G	AC BUS H	AC BUS I	AC BUS J	AC BUS K	AC BUS L	AC BUS M	AC BUS N	AC BUS O	AC BUS P	AC BUS Q	AC BUS R	AC BUS S	AC BUS T	AC BUS U	AC BUS V	AC BUS W	AC BUS X	AC BUS Y	AC BUS Z
----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------

AC BUS A	AC BUS B	AC BUS C	AC BUS D	AC BUS E	AC BUS F	AC BUS G	AC BUS H	AC BUS I	AC BUS J	AC BUS K	AC BUS L	AC BUS M	AC BUS N	AC BUS O	AC BUS P	AC BUS Q	AC BUS R	AC BUS S	AC BUS T	AC BUS U	AC BUS V	AC BUS W	AC BUS X	AC BUS Y	AC BUS Z
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AC BUS A	AC BUS B	AC BUS C	AC BUS D	AC BUS E	AC BUS F	AC BUS G	AC BUS H	AC BUS I	AC BUS J	AC BUS K	AC BUS L	AC BUS M	AC BUS N	AC BUS O	AC BUS P	AC BUS Q	AC BUS R	AC BUS S	AC BUS T	AC BUS U	AC BUS V	AC BUS W	AC BUS X	AC BUS Y	AC BUS Z
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DOCKED DPS BURN
(MANUAL)

INSTAGEN POLLED MAIN

GMBL TRIM CHART

DOCKED DPS BURN
(PGNS)

С ИД АСТУВАН

mc 10302

30-MIN ACTIVATION

[illegible]

Basic Date 1/6/70
Changed .3/10/70

Basic Date 1/6/70
Changed 3/10/70

4

CB(16) INST: CWEA - Open Then Close

WARN
ASC PRESS
~~RCS-A-REG~~
~~RCS-B-REG~~

VHF/S-BD ACTIVATION AND CHECKOUT

- 1 CSM Configure For VHF Simplex A
VHF - A: XMTR - VOICE
RCVR - ON
AUDIO (BOTH): S-BAND T/R - T/R
ICS T/R - T/R
VHF A - T/R

- 2 COMM: S-BD-PM, PRIM; PRIM; DN-VOICE-BU,
PCM, ~~C~~, OFF, HI
S-BD ANT-As Required

- 3 ~~LMP-Perform Comm Check With CSM~~

PGNS TURN - ON

- 1 NO ATT Lt - Off
V96E
- 2 Set EVENT TIMER
V25N07E 1257E 252E E (ACTIVATES ALL VERT JETS)
DAP SET/GIMBAL DRIVE

- 1 MODE CONT: PGNS - AUTO
 GUID CONT - PGNS
 TTCA (CDR) - THROTTLE (MIN)

- 2
- V48E
N46 ~~REDACTED~~ 32021
PRO
V34 N47 + ~~(S2731)~~
~~+~~ ~~(From MSFN or GSM)~~
PRO
N48 + ~~(From MSFN or Chart)~~
~~+~~ ~~(From MSFN or Chart)~~

SEE NOTE ON NEXT Pg 29

ENG STOP - PUSH
ENG ARM - DES (DES REG Lt-ON)
PRO (ENG GMBL Lt-ON)
MSFN Verify GDA Position

- 3 F 50 48
PRO
ENG ARM - OFF (ENG GMBL Lt-OFF)
ENG STOP - Reset

AGS ACTIVATION

- Verify ASA on 16 in for 10 min
- 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 - C/W RESET, Then DES
- 2 412R + 1 SELF TEST SATISFACTORY

RCS PRESS

- 1 Recycle: SYS A&B ASC FEED 2(2) - CLOSE, tb(4)-bp
: SYS A&B ASC FEED 1(2) - OPEN, tb(4)-bp
: SYS A&B THRUSTER PAIR QUADS-OPEN,
tb(8)-gray
: CRSFD - CLOSE
: MAIN SOV SYS A&B - OPEN

- 2 Cycle TEMP/PRESS MON

- 3 MASTER ARM - ON
HE PRESS RCS - FIRE
(RCS A&B REG. Warning Lts - Off)
RECYCLE: SYS A&B ASC FEED 2(2) - CLOSE, tb(4)-bp
: SYS A&B ASC FEED 1(2) - OPEN, tb(4)-bp
: SYS A&B THRUSTER PAIR QUADS-OPEN,
tb(8)-gray
: CRSFD - CLOSE
: MAIN SOV SYS A&B - OPEN

- 4 TEMP/PRESS MON - He (2750-3200 psi)
- PRPLNT (40°-100°/178-188 psi)
- FUEL MANF (175-188)
- OXID MANF (175-188)

DPS PRESS

- 1 PRPLNT QTY MON - DES 1
PROP TEMP/PRESS MON - DES 2
HELIUM MON - ~~AMB PRESS~~ *SUPERCRT PRESS*
DES HE REG 1 - tb-gray bp
DES HE REG 2 - tb-bp

- 2 DES PRPLNT ISOL VLV - FIRE
HE PRESS/DES START - FIRE
- 3 PRPLNT TEMP/PRESS MON: DES 2&1
(50°-90° FUEL, 50°-90° OXID/242-253 psi)
HELIUM MON: AMB PRESS (200-1110 psi)
SUPRCRT PRESS (610-1070 psi)

LANDING GEAR DEPLOY

- 1 CB(11) LOGIC PWR A - Open
LDG GEAR DEPLOY - FIRE, tb-gray
- 2 CB(11) LOGIC PWR A - Close
LDG GEAR DEPLOY - FIRE
MASTER ARM - OFF

ENABLE LIMT CONTROLS

- Top of page 29
- 1 Verify HTRs (RES) ON for 15 min
2. Balance couple off - Dead band min
act control - pitch and roll & pulse
yaw - direct. Mode control - PG-5 att
Held, Guid control - ACS. Damp roll
Pitch and roll with TTCA, Yaw
with ACA - ref with earth.

Basic Date 1/6/70
Changed 3/10/70

Basic Date 1/6/70
Changed 3/10/70

LM-7

LM-7

DOCKED DPS BURN
(PGMS)

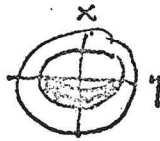
DOCKED DPS BURN
(PGMS)

DOCKED APS BURN

DOCKED APS BURN

DOCKED DPS BURN (MANUAL)Procedure To Burn ATT.

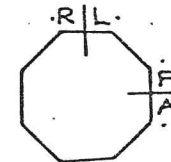
- 1 verify AGS is operable for 5 min
400+5, 400+0
ATT control pitch and roll-pulse, yaw
mode control
man using TTCA for pitch and roll, comp
controlling yaw can over ride with AGS
- 2 when on att AGS out of detent to null
needles.
3. SET DET



Basic Data 1/6/70
Changed

M-7

- * DPS BURN TECHNIQUE *
- * If PITCH Error Needle Goes Down, *
- * LMP Thrust AFT (Pull Out On TTCA). *
- * If ROLL Needle Left, CDR Thrust *
- * Right (Push Right On TTCA). *
- * See FDAI Picture Below. *



- * Only Set The PITCH or ROLL ATTITUDE *
- * CONTROL Switches To MODE CONT When *
- * The Rates & Errors Are Zero And *
- * Not Thrusting With TTCA's. Throt- *
- * tle Initially At 10%, Then Throt- *
- * tle Up When Stabilized, 10% Before *
- * Cutoff. *

~~MODES IN THE SAME DIRECTION IN THE~~
~~SAME QUADRANT.~~

DOCKED DPS BURN
(MANUAL)DOCKED DPS BURN
(PCNS)

DOCKED APS BURN

30-MIN ACTIVATION

32

N76E V76E

GUID CONT - AGS

MODE CONT (BOTH) - OFF

ENG STOP (2) - RESET

ABORT/ABORT STAGE - RESET

-6:00 ~~MODE CONT. PCNS~~ ~~ATT HOLD~~

V41 N20E, E, E, E

V41 N20E, E, E, E

At burn attitude:

V40 N20E V40 N20E

V25 N07E, 77E, 10000E, 1E

V01 N01E, 77E (Verify A = 1,3,5,7)

V37E 51E, PRO, V37EQ0E

400 + 5

~~At burn attitudes~~

400 + 0

V37E 47E

When CMPTR ACTY Lt - ON

V06 N65 E

hrs
min
sec

Load N65 Into N38:

V25 N38E

hrs
min
(.01 sec)

404 + 0

405 + 0

406 + 0

470R

CAUTION

after 400+0 do not go out of
detent with ACABasic Date 1/6/70
Changed

LM-7

Basic Date 1/6/70
Changed 3/23/70

LM-7

33

-4:00 RATE/ERR MON (BOTH) - LDG RDR/CMPTR

ATT MON (BOTH) - AGS

RATE SCALE - 5°/SEC

THR CONT - MAN AUTO

MAN THROT - CDR

ATT/TRANSL - 4 JET

BAL CPL - OFF

ENG GMBL - ENABLE OFF

DES ENG CMD OVRD - OFF

DEADBAND - MIN

ATT CONT: ROLL - PULSE

PITCH - PULSE

YAW - MODE CONT

MODE CONT (BOTH) - ATT HOLD (BOTH) ATT Hold

PRPLNT QTY MON - DES 1

TTCA (CDR) - THROT (MIN) FOR DPS, JETS FOR ACS

TTCA (LMP) - JETS

-1:00 MASTER ARM - ON

- :35 V32E

F-16-83 AVX, Y, Z (All Zero)

(.1fps)

ENG ARM - DES

10/10 MANUAL ULLAGE (LMP)

- :02 CMC MODE - FREE

ACA - Out of Detent (Yaw) (Zero Error Needles)

:00 ENG START (CDR) - PUSH +X ULLAGE
Ignition

10/10 MANUAL ULLAGE

+ :05 TTCA (CDR) - Throttle Up As Req'd
ATT CONT: PITCH, ROLL - As Req'd

+:15 MASTER ARM - OFF

LOSS OF COMM

UNSTAGED POWER DOWN

STAGCN POWER DOWN

GMBL TRIM CHART

~~When PRPLNT QTY = 37%:~~
~~DES He REG 1 - CLOSE~~

TTCA (CDR) ~~Reduce to 10% when Vgo = 10.0 f/s~~
~~SHUT DOWN ON BURN TIME (minus) 1m~~
 When $\Delta V_X = \text{Final } \Delta V_X$
 ENG STOP ~~PUSH~~
 ATT CONT: ~~YAW PULSE~~

~~Damp Excessive Rates Via LM-Y-Z Translation~~

~~Inventor Enroll Your Invention Address 470-9~~

GSM-Resume-Attitude-Control-

Oz 11/6

PROG VOGE
ENG ARM OFF
PRPLNT QTY MON OFF
ENG STOP RESET
TTCA (CDR) JETS
RETURN TO ENTRY LYN / LIST @ EI-5 hrs

1. Roll control (123) to pitch
2. Roll with +100 until attitude roll of ± 90
pitch 0 and yaw
3. When attitude is 0, ACS out of control
4. You are control your to make control
5. When rates are less than $0.05^\circ/\text{sec}$ att
control your to pitch.
6. SPIN up to $0.3^\circ/\text{sec}$ in yaw (12 f/s)
7. Mode control AGS - off.
8. Power DOWN per contingency chart
power 5.

INITIAL POWER DOWN (UNSTAGED)

F 50 25 V37E 06E
00062
CB(11) IMU OPR - Open
PRO (STBY Lt-On)

CB(16) AEA - Open (AGS Warn Lt-ON)
AGS STATUS - OFF (AGS Warn Lt-OFF)

SUIT GAS DIVERTER - EGRESS
PRIM EVAP FLOW No. 1 - CLOSE
(Dryout Complete In 90 min)
Start Watch

MASTER ARM - OFF
AUDIO (CDR) - All Switches-OFF

HELIUM MON - OFF
02/H2O QTY MON - DES

MODE CONTROL (Both) - OFF
RCS SYS A/B-2 QUAD 1,2,3,4(4) - OFF

Window Shades - Up
CDR Transfer To CSM
INV - OFF

Configure CB's Per UNSTAGED INITIAL DEACTIVATION Charts

DOCKED DPS BURN (MANUAL)

DOCKED DPS BURN
(PGNS)

DOCKED. APS BURN

30-MIN ACTIVATION

Basic Date - 1/6/70
Changed - 3/23/70

Basic Date 1/6/70
Changed 2/13/70

LM-2

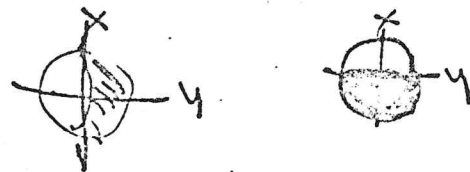
7

UNSTAGED POWER DOWN

STAFF POWER NOW

GMBL IKIM-CHARI

SS OF COMM



PWR-1

CONTINGENCY POWER DOWN LIST

*Required For LM Active Rendezvous

***** PGNS *****

*IMU: CB(11) PGNS: IMU OPR - Open 7.15 Amps
(15 Min Warm-up)

*LGC: V37E 06E
F 50 25 00062
PRO Until STBY Lt - On 1.76 Amps
CB(11) PGNS: LGC/DSKY - Open .85 Amps

***** AGS *****

AEA(STBY): CB(11&16) STAB/CONT: AEA - Open
AGS STATUS - STBY
CB(16) STAB/CONT: AEA- Close 2.96 Amps

AEA(OFF): CB(11&16) STAB/CONT: AEA - Open
AGS STATUS - OFF .40 Amps
(25 Min Warm-up)

AGS DISP: CB(11) AC BUS B: AGS - Open .16 Amps

***** CES *****

*ATCA: CB(16) STAB/CONT: ATCA - Open 1.93 Amps

GDA: CB(11) AC BUS A: DECA GMBL - Open .25 Amps

***** RADAR *****

*RR: CB(11) PGNS: RNDZ RDR - Open 5.35 Amps
CB(11) AC BUS A: RNDZ RDR - Open .62 Amps

LR: CB(11) PGNS: LDG RDR - Open 4.21 Amps

Basic Date 1/6/70
Changed

LM7

IR DOWN LIST

EMER PWR DOWN

SURFACE
SUBLIMATOR DRYOUT

SEC GLYCOL CONFIG
(LUNAR SURFACE)

PWR-4

***** EPS ******INV 1: CB(11) EPS: INV 1 - Open 1.40 Amps
(NO LOAD)*INV 2: CB(16) EPS: INV 2 - Open 1.40 Amps
(NO LOAD)***** ED *****LOGIC: CB(11) ED: LOGIC PWR A - Open .1 Amps
CB(16) ED: LOGIC PWR B - Open .1 Amps***** HEATERS *****LR: CB(11) HEATERS: LDG RDR - Open .41 Amps*RR: CB(11) HEATERS: RNDZ RDR OPR - Open .45 Amps
(2.5 Hr Warm-up)*AOT: CB(16) HEATERS: AOT - Open .20 AmpsCDR WIND: CB(11) AC BUS A: CDR WIND HTR - 2.86 Amps
Open
(Up to 90 min to Clear Window)LMP WIND: CB(11) AC BUS B: SE WIND HTR - 2.86 Amps
Open
(Up to 90 min to Clear Window)DOCK WIND: CB(11) HEATERS: DOCK WINDOW - .86 Amps
OPEN

PWR-5

* CAUTION: Damage Will Occur To The *
* Following Systems If Heater Power *
* Is Removed **RR ANT: CB(11) HEATERS: RNDZ RDR STBY - .17 Amps
Open*IMU: CB(11) PGNS: IMU STBY - Open .56 Amps*ASA: CB(16) STAB/CONT: ASA - Open .30 AmpsS-BD ANT: CB(11) HEATERS - S-BD ANT - .17 Amps
OpenEMERGENCY POWER DOWN

- 1 Configure COMM For Down Voice BU And ~~VHF~~ ~~A~~
~~Simplex Operation~~
S-BD-PM, PRIM, ~~PRM~~, DN VOICE BU, ~~DSM~~
OFF/RESET, OFF, LO
~~VHF VOICE, ON, OFF, OFF~~
LIGHTING: FLOOD - OFF
EXTERIOR LTG - OFF
- 2 ~~AFTITUDE CONTROL (3) - DIRECT~~
- 3 Configure C.B.'s per Chart

Basic Date 1/6/70
Changed 10/70Basic Date 1/6/70
Changed 3/10/70

LM7

LM7

EMER PWR DN

EMER PWR DN

AC BUS B										AC BUS A									
CS	TH	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100

close out out close out

[illegible]

over
close

[illegible]

*

[illegible]

25013

BPA		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100		

30

- * Opening these CB's may cause system damage.

LM-7

Basic Date 1/6/70
Changed

LM-7

Basic Date - 1/6/70
Changed - 3/10/70

EMER PWR DN

ITEM NO.	QTY	UNIT	PIT DISP		BGS FTS		PROF		ASC No	REV
			IN	OUT	IN	OUT	IN	OUT		
16	1	PCB	1	0	1	0	1	0	1	0
17	1	PCB	1	0	1	0	1	0	1	0
18	1	PCB	1	0	1	0	1	0	1	0
19	1	PCB	1	0	1	0	1	0	1	0
20	1	PCB	1	0	1	0	1	0	1	0
21	1	PCB	1	0	1	0	1	0	1	0
22	1	PCB	1	0	1	0	1	0	1	0
23	1	PCB	1	0	1	0	1	0	1	0
24	1	PCB	1	0	1	0	1	0	1	0
25	1	PCB	1	0	1	0	1	0	1	0
26	1	PCB	1	0	1	0	1	0	1	0
27	1	PCB	1	0	1	0	1	0	1	0
28	1	PCB	1	0	1	0	1	0	1	0
29	1	PCB	1	0	1	0	1	0	1	0
30	1	PCB	1	0	1	0	1	0	1	0
31	1	PCB	1	0	1	0	1	0	1	0
32	1	PCB	1	0	1	0	1	0	1	0
33	1	PCB	1	0	1	0	1	0	1	0
34	1	PCB	1	0	1	0	1	0	1	0
35	1	PCB	1	0	1	0	1	0	1	0
36	1	PCB	1	0	1	0	1	0	1	0
37	1	PCB	1	0	1	0	1	0	1	0
38	1	PCB	1	0	1	0	1	0	1	0
39	1	PCB	1	0	1	0	1	0	1	0
40	1	PCB	1	0	1	0	1	0	1	0
41	1	PCB	1	0	1	0	1	0	1	0
42	1	PCB	1	0	1	0	1	0	1	0
43	1	PCB	1	0	1	0	1	0	1	0
44	1	PCB	1	0	1	0	1	0	1	0
45	1	PCB	1	0	1	0	1	0	1	0
46	1	PCB	1	0	1	0	1	0	1	0
47	1	PCB	1	0	1	0	1	0	1	0
48	1	PCB	1	0	1	0	1	0	1	0
49	1	PCB	1	0	1	0	1	0	1	0
50	1	PCB	1	0	1	0	1	0	1	0
51	1	PCB	1	0	1	0	1	0	1	0
52	1	PCB	1	0	1	0	1	0	1	0
53	1	PCB	1	0	1	0	1	0	1	0
54	1	PCB	1	0	1	0	1	0	1	0
55	1	PCB	1	0	1	0	1	0	1	0
56	1	PCB	1	0	1	0	1	0	1	0
57	1	PCB	1	0	1	0	1	0	1	0
58	1	PCB	1	0	1	0	1	0	1	0
59	1	PCB	1	0	1	0	1	0	1	0
60	1	PCB	1	0	1	0	1	0	1	0
61	1	PCB	1	0	1	0	1	0</		

CLOSE

[illegible][illegible][illegible]

205545 0/0-2-
4 am 07-1

* Opening these CB's may cause system damage.

SEC GLYCOL CONFIG
(LINAR SURFACF)

SURFACE
SUBLIMATOR DRYOUT

FIRE/SMOKE

PWR DOWN LIST

EMER PWR DN

PWR-8

4 Spacecraft Functions Remaining:

- ✓ LBR TM
- ✓ VHF And S-BAND VOICE
- ✓ CWEA
- ✓ GLYCOL PUMPS
- ✓ SUIT FANS (2)
- ✓ CABIN REPRESS
- RCS MANUAL ATTITUDE CONTROL -
- ONBOARD RCS PQGS READOUT
- ONBOARD EPS And ECS READOUTS

*Normal use
requires 15 min
to get back to m.*

5 CWEA STATUS:

WARNING Lts - ON

- CES AC
- CES DC
- AGS (Unless AGS STATUS - OFF)
- LGC (When GUID CONT - PGNS)
- RCS TCA (Possible)
- APS PRESS (Unless APS Pressurized)

CAUTION Lts - ON

- INVERTER (Unless INV - OFF)
- PREAMPS (UNLESS STAGED)

Basic Date 1/6/70
Changed 3/16/70

Basic Date 1/6/70
Changed 3/10/70

LM-7

LM-

PWR-9

SURFACE SUBLIMATOR DRYOUT

ACTIVATE SEC LOOP

- 1 CB(11) ECS: GLYCOL PUMP AUTO TRNSFR - Close
: GLYCOL PUMP 1 - Open
GLYCOL-INST (SEC)
CB(16) ECS: GLYCOL PUMP SEC-Close
WATER TANK SEL-SEC
SEC EVAP FLOW-OPEN

DRYOUT INITIATION

- 1 PRIM EVAP FLOW - CLOSE
(Dryout Complete In Approx. 90 Min -
GLYCOL TEMP Should Not Go Above 95°)
- 2 EVENT TIMER: RESET/CONT - RESET
: TIMER CONT - START

SURFACE INITIAL POWER DOWN

- 1 F 50 25 V37E 06E
R1 00062
PRO (Until STBY Lt-On)
- 2 O2/H2O QTY MON - ASC
EXTERIOR LTG - OFF
- 3 SUIT TEMP - COLD
LIQUID COOLING GARMENT - MAX COLD
- 4 CB(11) AC BUS A: TAPE RCDR - Open
PGNS: LGC/DSKY - Open
CB(16) ANUN/DOCK/COMPNT - Open

FIRE/SMOKE
ARM DYNAMICS

ACNE

SUBIMATOR DRYOUT

SEC GLYCOL CONF 16
(LUNAR SURFACE)

EVT(20PS)

EVT(CDR/OPS-LMP/PLSS)

EVT(2 PLSS/OPS)

VACUUM IVT

0
4)
0

Roll 298.95
Pitch 271.30
Yaw +000 20

PHOTO LOG 6700-136410 2/

TIME GET	TARGET NO. WINDOW, N/S	ID, FRAME NOS. CAMERA SETTINGS	REMARKS
ENTRY	LM PREP	EI - 6 hours	(136+10)
1.	BAT5 NORM FEED - ON		
2.	USE MODIFIED LM DPS/ACS 30 min. ACT 1	LIST	
	FEI - 5 hr - MCC-7 IF REQUIRED	(137:40)	
	LM PRE-ENTRY PROCEDURE		
	MWVR TO SM SEP ATT		{ R - P - Y -
	2. CONFIGURE FOR CSM HOT FIRE		
	a. DB MAX		
	b. ATT CONT (3) PULSE		
	3. PERFORM CSM HOT FIRE		
	4. MWVR BACK TO SM SEP ATT		
	ATT CONT (PITCH & ROLL) - PULSE		
	ATT CONT (YAW) - MODE CONT		
	EI - 4 1/2 hrs CONFIGURE FOR SM SEP		(138+10)
	1. BAL COMPLE - ON		
	2. AGS - 409+0, 405+0, 406+0, 470		
	3. TRANS +X TO 0.5 fps		
	4. CM/SM SEP		

Basic Date January 5, 1970

Changed -

2/

PHOTO LOG

TIME GET	TARGET NO. WINDOW, N/S	ID, FRAME NOS. CAMERA SETTINGS	REMARKS
5. AFTER SEP NULL 470	TO ZERO		
6. ATT CONT	PULSE		
7. PITCH TO ACQUIRE STM FOR PHOTOS			
NOTE: USE ACA FOR CONTROL			
<u>EI - 3 hours (139+40)</u>			
1. MNA & ATT HOLD FOR MOON VIEW	UNTIL CM PLATFORM		
RELEASED -			
2. MNA TO SUN ATT.			
<u>EI - 2 1/2 hours 140+10</u>			
POWER REMOVAL FROM CM/LM IMBILICAL			
NOTE: This assumes all descent bolts on line and asc bolts 5 & 6 on Noava feed			
1. CSM CB Lm Pwr 1, RWB	- OPEN		
2. " " " 2, " "	- OPEN		
3. EPS SWG 1, RWB - OPEN			
4. LM " EPS (11 & 16)	X-TIE BAL LOADS	- CLOSE	
5. " " " (16)	BAT FEED TIE (2)	- OPEN	
6. " " " (16)	ASC ECA CONT	- CLOSE	
7. BAT 1 Hi VOLTS	- OFF/RESET		
8. BAT 5 Hi VOLTS	- OFF/RESET		

9. BAT 2 Lo VOLTS - OFF/RESET, THEN ON.
WAIT FOR MSFN GO BEFORE PROCEEDING.

EVT(20PS)

EVT(CDR/OPS-LMP/PLSS)

EVT(2 PLSS/OPS)

VACUUM IVT

PAGE 16

Basic Date - January 5, 1970

Changed -

Basic Date - January 5, 1970

Changed -

PHOTO LOG

142 40 3/10

3/

TIME GET	TARGET NO. WINDOW, N/S	ID, FRAME NOS. CAMERA SETTINGS	REMARKS
10. BAT 2	Hi VOLTS	- OFF, RESET THEN ON	
11. BAT 1	Hi VOLTS	- ON	
12. BAT 5	NORM FEED	- ON	
13. CB	EPS (16)	BAT FEED TIE (2) - CLOSE	
14. CB	EPS (16)	ASC ECA CONT - OPEN	
<u>LMP TRANSFER TO CM & DISCONNECT TIE LINES</u>			
<u>EI - 1+45 140+55</u>			
1. MNA TO CM / M Jett ATT (PM)			
<u>EI - 1+30 141+10</u>			
CONFIGURE FOR JETT			
A. VERIFY CM FREE			
B. ATT CONT (2) - MODE CONT, DB-MAX			
C. Comm CONFIG:			
1. S-Bd PM, PRIM	PRIM, OFF, PCM, RANGE, OFF, HIGH		
2. SELECT BEST OMNI			
D. EPS			
1. FLD DUMP VALVE	- CLOSE		
2. HPS OR REV -			
3. DUMP VALVE	- CLOSE		
4. FLD DUMP VALVE	- CLOSE		
5. FLD DUMP VALVE	- CLOSE		
6. FLD DUMP VALVE	- CLOSE		
7. FLD DUMP VALVE	- CLOSE		

2. REPAIR VALVE CLOSE

EVT(20PS)

4/

PHOTO LOG

[illegible]

91.

115 Vega alted Nazalhang Deneb.

Sept 27/22

PHOTO LOG

[illegible]

Basic Date - January 5, 1970

Changed

Basic Date: January 5, 1970

Changed -

VACUUM IVT

Basic Date January 5, 1970

Turn on RGB light bar off
Turn ECS Logic Power 2/3 off

572
~~143~~
414
29

1. Bond off
2. LBE
3. In Voice SV
4. Pur camp - Prime
5. Pnl 16 - Pur Camp el - ops
6. Large Household car - off.

APOLLO 13

LM G&N
DICTIONARY

PART NO.

S/N

SKB32100076 — 361

1001

PGNS-34

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
(RECYCLE) V32E To 1
PRO (.01°)
- 5 F 37 CB(11) AC BUS B: AOT LAMP-Open

DAP LOAD 31120

(1)

P52 IMU REALIGN

- F 04 06 CB(11) AC BUS B: AOT LAMP-Close
V37E 52E
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 REFSMMAT PRO To 6
4 LANDING SITE PRO To 2

PGNS-35

(hrs,min,.01sec)

- 2 F 06 34 GET ALIGN
(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
PRO (.001°, .01nm)
- 4 F 06 22 NEW ICDU ANGLES OG, IG, MG
(IF MGA NEAR GIMBAL LOCK, MNVR, Then V32E To 4)
PRO (.01°)
- 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
When Torquing Complete To 14 (.01°)
- 6 F 50 25 R1 00015 SELECT STAR ACQUISITION MODE
MNVR If Necessary
ENTER (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/LPD 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)
- ENTR 200
PRO
FL 06 88
LOAD R + 45498
R + 19024
R + 08250
PRO

P63-P68

P70-P71

P72-P76

VAN VAN

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/LPD CALIB, Go to 7)

9 06 18 AUTO MNVR TO FDAI RPY ANGLES (.01°)
Mon Auto Mnvr To 8

10 F 01 71 R1 00CDE (C) DETENT (DE) STAR CODE
PRO
(For C=7
F 06 87 AZ, EL
PRO) (.01°)

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 -112 (.01°)
(REJECT) V32E To 14
(ACCEPT) PRO

13 F 06 93 GYRO ANGLES X,Y,Z
(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

PGNS-37

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 REFSMMAT 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 1/5/70
Changed
Basic Date 1/5/70
Changed

LM-7

LM-7

P63-P68

P70-P71

P72-P76

V40-V49

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 Mnvr To 3

PGNS-58

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,
(REINITIAL) V25E, Load Values .lfps,mr)
PRO

V74 LGC DOWNLINK

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 (.1nm,min-sec)
(UPDATE) V32E (Not Required If AVE G-On)
(If TFF = -59:59) N32E Time From Perigee
PRO (hr,min,.01sec)

V83 RENDEZVOUS PARAMETER DISPLAY

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

P63-P68

P70 - P71

P72-P76

V40-V49

LM-7

LM-7

V55-V90

PGNS T/O, ORDEAL,
PIPA BIASLGC CLOCK INIT.,
LR, RR SELF TESTTHRUSTER INHIBIT,
RR BIAS, LPD BIAS

P27 UPDATE

AGS ACT AND SELF
TEST CALIBRATION

AGS MAN ACO
CANNON DIVISION

AGS MAN S.V.
BACK UP ALIGN

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	MIN				
X	X			X	X		NAV CHECK SEC				
	0				0		N43 LAT				
							LONG				
							ALT				
+	0			+	0						

Basic Date 5/70
Changed

Basic Date 12/70
Changed

LM-5

LM-7

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	MIN
X	X			X	X		NAV CHECK SEC
	0				0		N43 LAT
							LONG
							ALT
+	0			+	0		

LM SEP PHD

Prin @ 141:40:00 (ET - 1:00)

move to following altitude

R 130

P 125

Y 012.4

compd by CANNON DIVISION

R 291 31021

P 196 + 245 248

Y 015 09050

2 Fake current

30.2 Bat A Volt

UNIT VECTORS

P30 UPDATE (LM)

AGS STATE VECTOR

P27 UPDATE

AGS ACI AND SELF
TEST. CAI IRRATION

AGS MAN AGO,
ORDEAI INITIAI

AGS MAN S.V.,
BACK-UP ALIGN

P27 UPDATE (LM)											
V		V		V		PURP					
:	:	:	:	:	:	GET					
INDEX	DSM	INDEX	DSM	INDEX	DSM	1173	01				
Following acc-7 man							02				
R000°							03				
P071.3							04				
Y 000							05				
@ GET 138-10:00							06				
EC - 4 1/2 hrs							07				
EXECUTE PUSH of 0.5 fgs 4.5 fgs							10				
THEN EXECUTE SM SEP FOLLOWED							11				
BY PULL of 0.5 fgs							12				
							13				
							14				
							15				
							16				
							17				
							20				
						1213	21				
							22				
							23				
						1216	24				
X	X	X				N34	HR				
X	X	X	X				MIN				
X	X						NAV CHECK SEC				
	0					N43	LAT				
							LONG				
+	0						ALT				

Basic Date 1/5/70
Changed

Basic Date 1/5/70
Changed

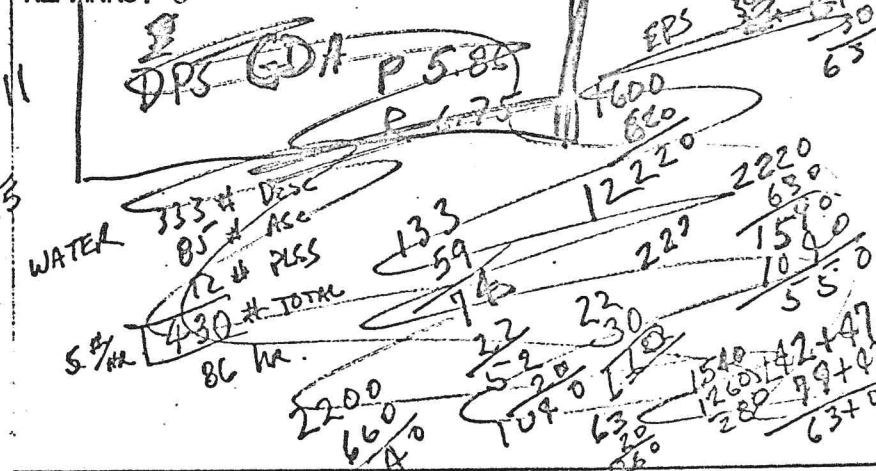
LM-7

P30 LM MANEUVER

N85 +0.1
+0.1
P70 +2.6 +0.1

PURPOSE		DPS/PE/eyocin+2	MCC-7	
HR	N33	+ 0 0 0 7 9	+ 0 0 1 3 7	
MIN	TIG	+ 0 0 0 2 5	+ 0 0 0 3 9	
SEC		+ 0 2 6 4 8	+ 0 4 8 3 9	
ΔVX	N81	+ 1 6 3 3 0	- 0 0 0 3 1	
ΔVY	LOCAL	- 0 0 1 4 5	+ 0 0 0 0 0	
ΔVZ	VERT	- 0 7 5 1 5	+ 0 0 0 0 1	
HA	N42	+ N/A	+ N/A	
HP		+ 0 0 2 0 5	+ 0 0 2 0 5	
AVR		+ 1 7 9 7 7	+ 0 0 0 3 1	
BT		X X X 8 3 5	X X X 0 2 3	
R	FDAI	X X X 2 6 8	X X X 0 0 8	
P	INER	X X X 2 6 4	X X X 3 5 9	
ΔVX	AGS	+ 1 6 4 1 0		
ΔVY	AGS	- 0 0 1 4 5		
ΔVZ	AGS	- 0 7 3 3 8		
BSS		X X X N/A	X X X	
SPA		X X	X X	
SXP		X X X	X X X	

REMARKS:



SECTION UNIT VECTORS

P30 UPDATE (LM)

AGS STATE VECTOR

P30 UPDATE

P30 UPDATE (LM)

AGS MAN ACQ, APPROX. 1000000

AGS MAN S.V. 2
RACV IN ALTON

P30 LM MANEUVER													
PURPOSE		Midcourse phase						10070 hr in Alt					
HR	N33	+	0	0	0	6	1	+	0	0	1	3	4
MIN	TIG	+	0	0	0	2	9	+	0	0	0	5	9
SEC		+	0	4	2	8	4	+	0	4	2	9	8
ΔVX	N81	-	0	0	2	1	3						
ΔVY	LOCAL	+	0	0	0	4	1						
ΔVZ	VERT	-	0	0	3	1	2						
HA	N42	+		N/A				+					
HP				N/A				+	0	0	2	0	5
ΔVR		+	0	0	3	8	0	+	0	0	1	9	3
BT		X	X	X	0	3	1	X	X	X	0	3	9
R	FDAI	X	X	X	1	2	0	X	X	X	0	0	8
P	INER	X	X	X	2	9	8	X	X	X	0	0	0
ΔVX	AGS N86	-	0	0	2	1	3						
ΔVY	AGS	+	0	0	0	4	1						
ΔVZ	AGS	-	0	0	3	1	2						
BSS		X	X	X	N/A			X	X	X			
SPA		X	X					X	X				
SXP		X	X	X				X	X	X			

REMARKS: GDA P 5.86
R 6.75
DPS THROT - 5 sec @ 10%
Burn REST @ 40%
2 Jet, 10 sec ULLAGE
Horizontal in plane burn towards sun
+ thrust 10% No Mcc at 105+00+00

Basic Date 10/3/70
Changed

LM-7

P30 LM MANEUVER													
PURPOSE		DPS Pct 2						DPS 1000 5					
HR	N33	+	0	0	0	7	9	+	0	0	1	0	5
MIN	TIG	+	0	0	0	2	7	+	0	0	0	3	0
SEC		+	0	4	0	1	3	+	0	0	0	0	0
ΔVX	N81	+	0	8	1	4	4						
ΔVY	LOCAL	-	0	0	4	4	3						
ΔVZ	VERT	-	0	0	2	2	6						
HA	N42	+						+					
HP		+	0	0	2	0	5	+	0	0	1	9	8
ΔVR		+	0	0	4	5	5	+	0	0	0	7	8
RT		X	X	X	4	2	0	X	X	X	0	1	5
R	FDAI	X	X	X	2	6	8	X	X	X			
P	INER	X	X	X	2	6	1	X	X	X			
ΔVX	AGS N86	+	0	8	1	5	5						
ΔVY	AGS	-	0	0	4	4	3						
ΔVZ	AGS	-	0	2	1	8	7						
BSS		X	X	X				X	X	X			
SPA		X	X					X	X				
SXP		X	X	X				X	X	X			

REMARKS: *604-0000 IS WHICH SHOULD BE?*
SHUTDOWN @ 14 sec ULLAGE 4 Jet, 10 Sec 10% THROTTLE
2 Jet 10 sec
DPS THROTTLE 10% FOR SS
100% FOR REST
142+07

Basic Date 10/3/70
Changed

LM-7

UNIT VECTORS

STAR HALF UNIT VECTORS

AGS STATE VECTOR

P27 UPDATE
 P30 UPDATE (LM)
 AGS MAN ACQ,
 AGS MAN S.V.

P30 LM MANEUVER									
PURPOSE									
HR	N33								
MIN	TIG								
SEC									
ΔVX	N81								
ΔVY	LOCAL								
ΔVZ	VERT								
HA	N42								
HP									
ΔVR									
BT									
R	FDAI								
P	INER								
ΔVX	AGS N86								
ΔVY	AGS								
ΔVZ	AGS								
BSS									
SPA									
SXP									

REMARKS: ULRSE 2ht 10sec
 CSM WT 62480
 Lm " 33482
 Dps THROT. PROFILE
 5sec @ IDE
 21sec @ 40%
 REMINDER @ MAX
 LOS 77 08 35
 AOS 77 33 10
 ACT START

LUNAR LOS
 " AOS
 V49 R +27210
 R2 +35570
 R3 +33010
 V21 NOIE, 3011E, 200E
 SS 763245
 SR 77 1648

Basic Date 1/3/70
 Changed
 Basic Date 1/5/70
 Changed
 LM-7
 LM-7

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

REMARKS:

PLANET HALF
 UNIT VECTORS
 STAR HALF
 UNIT VECTORS
 AGS STATE VECTOR

APOLLO 13

CSM LAUNCH CHECKLIST

PART NO.

S/N

SKB32100082 - 309

1001

LIFTOFF CONFIG

HI GAIN ANT YAW POS - 180°
HI GAIN ANT PWR - OFF
HI GAIN ANT SERVO ELECT - PRIM

PANEL 3

VHF ANT - SM LEFT
SPS ENG INJ VLV ind (4) - CLOSE
FC RAD (3) - center (NORMAL*)
FC RAD (3) tb - N/A
FC HTRS (3) - on (up)
FC IND sel - 2
SPS QTY TEST - off (center)
OXID FLOW VLV INCR - NORM INCR
OXID FLOW VLV PRIM - PRIM
PUG MODE - NORM
FC PURG (3) - OFF
FC REAC (3) - center (on,up*)
FC REAC tb (3) - gray
FC 1 MN BUS A - center (on,up*)
FC 1 MN BUS A tb - gray
FC 2 MN BUS A - center (on,up*)
FC 2 MN BUS A tb - gray
FC 3 MN BUS A - OFF
FC 3 MN BUS A tb - bp
MN BUS A RSET - center (RESET*)
FC 1 MN BUS B - OFF
FC 1 MN BUS B tb - bp
FC 2 MN BUS B - OFF
FC 2 MN BUS B tb - bp
FC 3 MN BUS B - center (on,up*)
FC 3 MN BUS B tb - gray
MN BUS B RSET - center (RESET*)
DC IND sel - MNA
BAT CHARGE - OFF
SPS He vlv (2) - AUTO
SPS He vlv tb (2) - bp
SPS LINE HTRS - off (center)
SPS PRESS IND sw - He
S BD XPNDR - PRIM
S BD PWR AMPL PRIM - PRIM
S BD PWR AMPL HI - HIGH
PWR AMPL tb - gray

S BD MODE VOICE - VOICE
S BD MODE PCM - PCM
S BD MODE RNG - RNG
S BD AUX TAPE - off (center)
S BD AUX TV - off (center)
UP TLM DATA - DATA
UP TLM CMD - NORM
S BD ANT OMNI - B
S BD ANT - OMNI
VHF AM A - (center)
VHF AM B - DUPLEX
VHF AM RCV - off (center)
VHF AM SQLCH tw (2) - noise threshold + 1 div
VHF BCN - OFF
VHF RNG - OFF
S BD SQUELCH - ENABLE
FC REACS vlv - LATCH
H2 PURG LINE HTR - OFF
TAPE RCDR PCM - PCM/ANLG
TAPE RCDR RCD - RCD
TAPE RCDR FWD - FWD
TAPE MOTION tb - gray
SCE PWR - NORM
PMP PWR - NORM
PCM BIT RATE - HI
AC INV 1 - MNA
AC INV 2 - MNB
AC INV 3 - OFF
INV 1 AC 1 - on (up)
INV 2 AC 1 - OFF
INV 3 AC 1 - OFF
AC 1 RSET - center (RSET*)
INV 1 AC 2 - OFF
INV 2 AC 2 - on (up)
INV 3 AC 2 - OFF
AC BUS 2 RSET - center (RSET*)
AC IND sel - BUS 20C

PANEL 4

SPS GAUGING - AC1
TELCOM GRP 1 - AC1
TELCOM GRP 2 - AC2
GLY PUMPS - 1 - AC1

L
2-1

BOOST-INSERTION

BOOST PREPARATION

SM RCS PRPLNT (4) - on (up)
SM RCS PRPLNT tb (8) - gray

CTE UPDATE VERIFICATION

Change X STABLE MEMBER AZIMUTH, if necessary

*V78E *
F 06 29 X SM AZ (.01°)
*V21E *
*Load new Azimuth *
*PRO *
*ALIGN GDC *

FDAI-1 total att R=90+AZ, P=90, Y=0

BMAG MODE(3) - RATE 1

FDAI SCALE - 5/5

RATE - HIGH

RHC #1&#2 - ARMED

RHC PWR DIRECT(2)-MNA/MNB

CMC MODE - FREE

TRANS CONTR PWR -on(up) (verify)

ASTRO LAUNCH OPERATIONS VOICE CHECK
VOICE CHECK WITH MCCH

ADJUST MASTER VOL CONTROLS

SPS THRUST - NORMAL (locked)

ΔV THRUST (2) - OFF

α/PC IND sw - α

~~LV IND/GPI~~ ~~SII/SIVB~~

EDS AUTO - on (up)

LV RATES - AUTO

2 ENG OUT - AUTO

CM RCS PROP tb(2)-gray (verify)

RCS CMD - OFF

TVC SERVO PWR #1 - AC 1/MNA

TVC SERVO PWR #2 - AC 2/MNB

FC REAC vlv - LATCH

SEC COOL LOOP PUMP - off (ctr) (verify)

SIDE HATCH

CAB PRESS DUMP vlv - close (CW)
GEAR BOX sel - LATCH
ACTR HANDLE sel - UNLATCH
LOCK PIN REL KNOB - LOCK
LOCK PIN ind - flush
GN2 VLV HANDLE - outboard
BPC JETT KNOB - toward BPC JETT

* - last momentary position before liftoff.

LIFTOFF CONFIG

L
1-14Basic Date 3/9/70
ChangedBasic Date 3/9/70
Changed 3-27-70

LMP SBD SW - OFF
CDR VHF AM SW - OFF

LMP SBD SW - T/R
CDR VHF AM SW - T/R

-25:00

-20:00

-15:00

- 20:00

-10:00

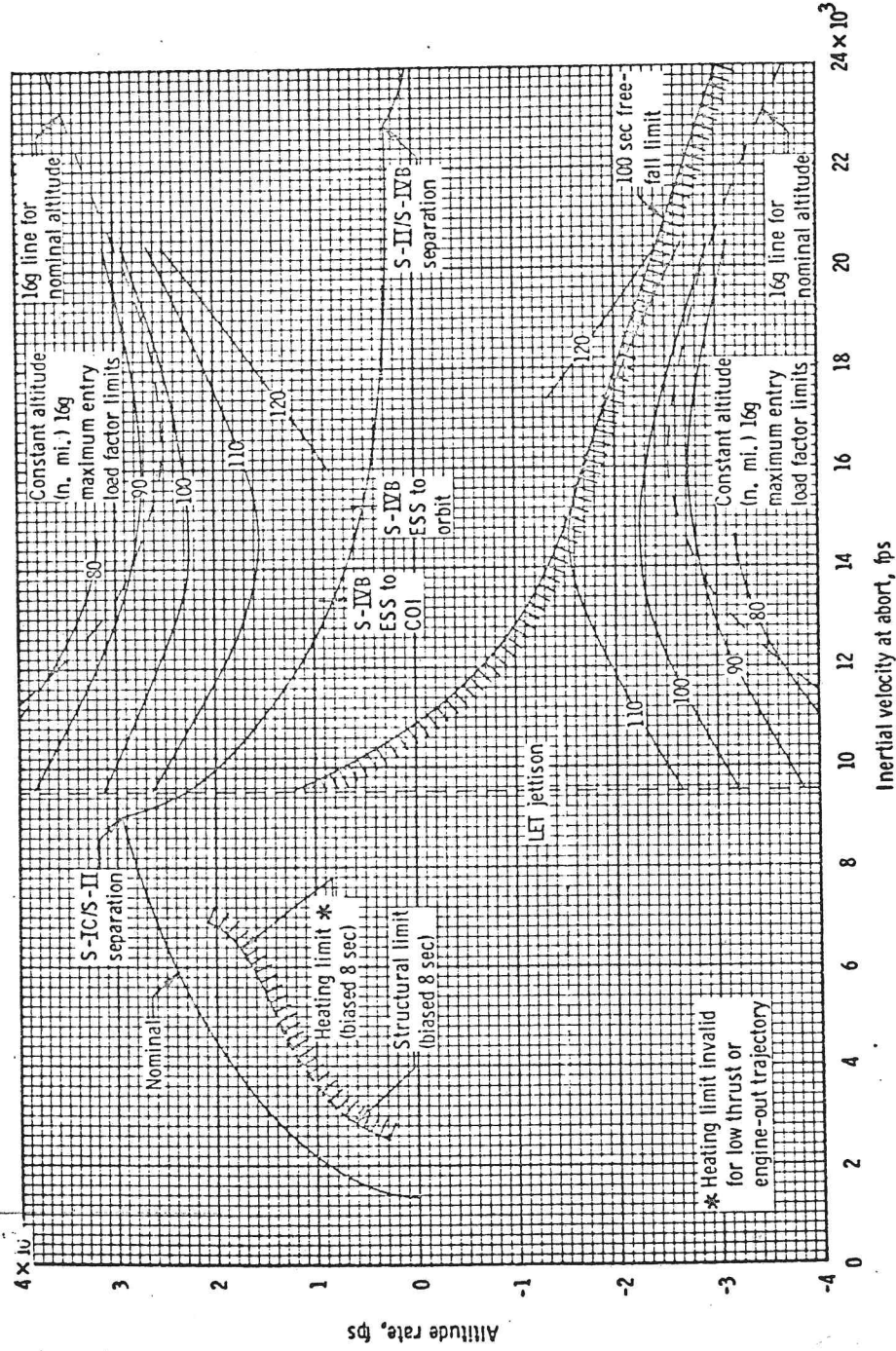
-08:30

CSM 109

LAUNCH ABORT

BOOST-INSERTION-TLI

LIFTOFF CONFIG



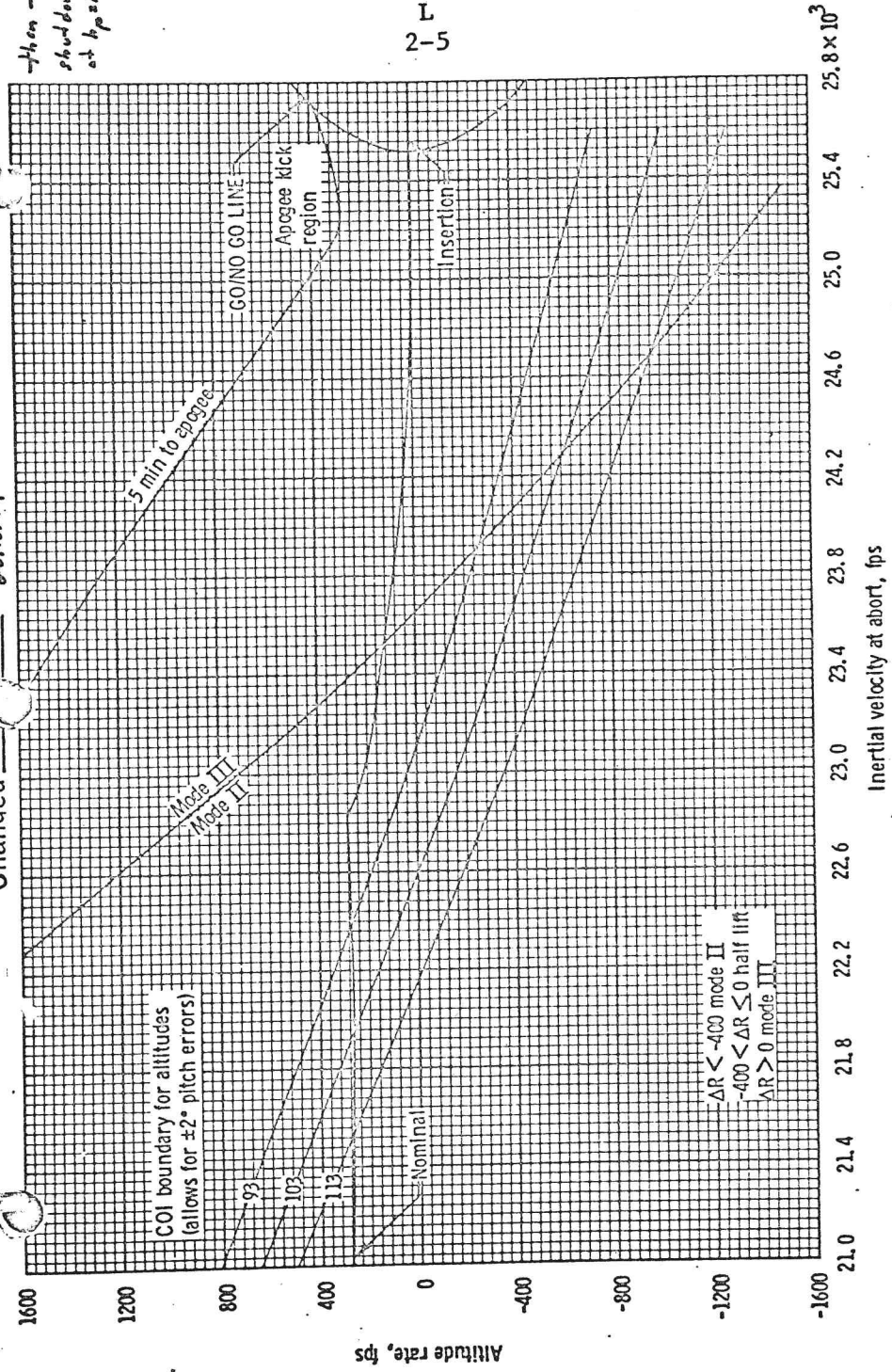
L
2-4

Launch abort and usability limits.
Basic Date 3/9/70
Changed 3/9/70

Basic Date 3/9/70
Changed For MSN confirmed IU error

CSV 109

if $h > 100$ above nominal
-then -
should down at $h_p \approx 100$



L
2-5

NEAR INSERTION
ABORT

MODE 1

NORM SC ROOSTER SEP

NOM & MAN

TLI TRAJECTORY OPP 1

LIFT OFF CONFIG

BOOST-INSERTION-TLI

LAUNCH ABORT

ALTITUDE vs V1

L
2-6CSM 1-4 RECOMMENDED MANUAL S-IVB SHUTDOWN VELOCITIES
FOR EARTH ORBIT INSERTION AT NON-NOMINAL
ALTITUDES

SHUTDOWN ALTITUDE, h (N. MI.)	INERTIAL VELOCITY, Vi (fps)	ha/hp (N. MI.)
150	25309	150/100
145	25336	145/100
140	25362	140/100
135	25389	135/100
130	25416	130/100
125	25442	125/100
120	25469	120/100
115	25496	115/100
110	25523	110/100
105	25550	105/100
100	25577	100/100
95	25604	100/95
90	25631	100/90
85	25659	100/85
80	25686	100/80
75	25713	100/75

NOTE: h = 0 AT SHUTDOWN

BOOST

-00:09 Ignition CMD
-00:01 L/V ENGINES lts (5) - out
00:00 LIFTOFF lt - on

*LIFTOFF VERIFIED:
* If LIFTOFF lt off - push
* If NO AUTO ABORT lt on - push*

Clock Running (auto) - report
MET Resets & starts counting up auto
P11 auto

*NO P11 - Key ENTR *
START DET & RESET MET

06 62 VI, H DOT, H PAD (fps, fps, .1nm)
If LV GUID & LV RATE lts-on
* LV GUID - CMC *

+00:02 Yaw Mnvr - report
+00:11 Roll & Pitch Program - report
+00:30 Roll complete - report

+00:42 MODE IB - report
PRPLNT DUMP - RCS CMD
+00:50 Monitor qa to T +02:00
(100%, 5° Att error)

CABIN PRESSURE DECREASING ~14K(2.3 nm)

NO PRESSURE DECREASE ~25K(4.1 nm)
* CAB PRESS RELIEF vlv(RH)-DUMP *

+01:21 MAX Q
+01:56 MODE IC - report

L
2-7

00:00

+4°/sec P, Y
+20°/sec R

MODE IA

00:42

+4°/sec P, Y
+20°/sec R

MODE IB

H=16.5 nm

TLI TRAJECTORY OP 1
NOM & MAN

NORM SC BOOSTER SEP

MODE 1

MODE IT. MON. ITT

L
2-9L
2-8

LIFTOFF CONFIG

BOOST-INSERTION-TLI

LAUNCH ABORT

ALTITUDE vs V1

+02:00 EDS AUTO - OFF
2 ENG OUT - OFF
LV RATES - OFF
 α /Pc sw - Pc
LV RATE 1t disabled as IU failure cue
GO/NO GO FOR STAGING - report
+02:16 INBOARD CUTOFF - (1t 5 on)
LIFTOFF 1t - out
+02:41 CMC BOOST Polynomial ends
+02:43 OUTBOARD CUTOFF - report (1ts 1,2,3,4 on)
+02:44 SIC/SII STAGING (1ts off)
+02:45 SII Ign Command (1ts on)
SII SEP 1t - on
+02:46 SII 65% - 1ts out
+03:14 SII SEP 1t - out report
+03:19 TWR JETT (2) - on(up) (TFF>1+20)
*NO TWR JETT, pg L/4-2 *
For MAN BOOSTER CONTROL
* LV GUID - CMC *
* Key V46E *
MAN ATT PITCH - RATE CMD
Twr Jett & MODE II - Report
GLY EVAP STEAM PRESS - AUTO
GLY EVAP H2O FLOW - AUTO
+03:24 Guidance Initiate - report (OECO +41sec)
+03:53 Guidance Good
+04:00 Report status
+05:00 Report Status
+05:45 SIVB to COI
+06:00 Report Status
GMBL MOT (4) - START - ON (LMP Confirm)
Check GPI
SII/SIVB/GPI - GPI (Momentarily)
PITCH = -1.52
YAW = +1.32

+9°/sec P,Y
+20°/sec R

MODE IC

TWR JETT

MODE II

+06:15 OMNI ANT - D (AZ < 96°)
- C (AZ > 96°)
+06:35 SIVB to orbit - Level sense arm 08:39
+07:00 Report Status
+07:42 IECO (1t 5 - on)
+08:00 Report Status
+08:01 PU SHIFT
+08:30 GO/NO GO FOR STAGING - report
+09:00 Mode IV - Report
(VI~22,000, HDOT~+265,
H~+100)
Report Status
+09:17 OECO (1ts 1,2,3, & 4 - on)
+09:18 SII Staging - 1ts out
+09:20 SIVB Ign Cmd - 1t on
+09:22 SIVB 65% - 1t out

+10:00 GO/NO GO FOR ORBIT - report

+11:00 Report Status
+11:45 SECO (1t on) - report
(Begin TB5)

*If LV GUID - CMC *
*LV STAGE sw - SII/SIVB *
*SECO *
*LV ENG 1 1t - on *
*Begin TB5 *

*If no SECO, (VI +100 fps) *
*LV STAGE sw SII/SIVB *
*If still no SECO, THC *
* CCW & neutral in 1 sec *

+11:55 INSERTION - 1t out (TB5 + 10 sec)

Record VI _____ (fps)
H DOT _____ (fps)
H PAD _____ (.1nm)

~09:00

~10:08

MODE III

MODE IV

INSERTION

N44 ha
hp
TFFN50 DR
hp
TFF

N32 TFR

L
2-11

INSERTION AND SYSTEMS CHECKS

- 1 GMBL MTRS (4) - OFF (LMP confirm)
EDS PWR - OFF
TVC SERVO PWR (2) - OFF
MN BUS TIE (2) - OFF (LMP)
SECS PYRO ARM (2) - SAFE
SECS LOGIC (2) - OFF
cb SECS ARM (2) - open
BMAG MODE (3) - RATE 2
ELS - MAN
CM RCS LOGIC - OFF
CAB PRESS REL vlv (2) - NORMAL/LATCHED
REPRESS PKG vlv - OFF
cb DIRECT ULLAGE (2) - open
cb FLT/PL VENT - open
cb ELS BAT (2) - open
DIRECT 02 vlv - CLOSE
TRANS CONT PWR - OFF
ROT CONTR PWR DIRECT (2) - OFF
RHC #1 & #2 - LOCKED
EMS FUNC - OFF
LV STAGE SW - OFF (verify)
INSTALL COAS
MONITOR LV TANK PRESS
*If AP >36 psid (OXID > FUEL) *
*If AP >26 psid (FUEL > OXID) *
*If LOX TK PRESS >50 psia *
* EMERGENCY CSM/LV SEP pg EMER/1-1 *
- Note: Steps 2 thru 31 are not sequential
- 2 SM RCS HTRS (4) - PRIM
- Ken 1 C/W - NORMAL
BPC JETT KNOB - 180° from BPC JETT
GN2 VLV HNDL - pull
HATCH GEAR BOX - LATCH (verify)
ACTR HNDL SELECTOR - neutral
- Fred 3 cb WASTE H2O/URINE DUMP HTRS (2) - close
FC REACS vlv - NORM
H2 PURGE LINE HTR - ON

L
2-1028 568
-05
102.2

KEY V82E

Record HA 102.6
HP 102.1
TFF -57 59(.1nm)
(.1nm)
(min-sec)105.9 at 5653
96.8

PRO

V37E 00E

When CMC ACTY 1t out:

V66E

V45E

Verify DAP load, V48: R1 = 31102, R2 = 01111

V46E

CSM WT 10678

V83E (check 0)

P TRIM -182

PRO

Y TRIM +180

BDA LOS
(00:12:46)

LIFTOFF CONFIG

BOOST-INSERTION-TLI

LAUNCH ABORT

ALTITUDE vs V1

Basic Date
Changed
3/9/70Basic Date
Changed
3/9/70

CSM 109

CSM 109

CYI AOS
(00:16:34)

LIFTOFF CONFIG

BOOST-INSERTION TLT

LAUNCH ABORT

ALTITUDE vs V1

L
2-12

Jim/Fred

- 4 MCCH - G/N Status
Z Torquing angle + .26

Jim
SUNSET
(00:22:59)

- 5 SM RCS MONITORING CHECK
SM RCS PRPLNT tb (8) - gray
SM RCS He 1 & 2 tb (8) - gray
RCS IND sel - SM A, B, C, D
PKG TEMP - 115°-175° F (C/W 75°-205°)
He PRESS - record
MANF PRESS - 192-207 psia (C/W 145-215 psia)
He TK TEMP - record
PRPLNT QTY - record

Jim

- 6 CM RCS MONITORING CHECK
CM RCS PRPLNT tb (2) - ~~gray~~
RCS IND sw - CM 1,2
He TEMP - 60-90°F
He PRESS - 4100-4200 psia
MANIF PRESS - 80-105 psia

Fred

- 7 C/W OPERATIONAL CHECK
C/W LAMP TEST - 1 (LH MA & 15 lts)
C/W LAMP TEST - 2 (RH MA & 20 lts)
C/W CSM - CM (CM RCS 1t (2) - on)
C/W CSM - CSM (CM RCS 1t (2) - out)

Ken 2

- 8 CMP to LEB for MN REG CHECK
STRUT UNLOCK LANYARD (2) - STOW
DRINKING WATER SUPPLY vlv - ON
cb COAS/TUNL LTG MNB - close
Unstow:

Helmet bags (R6)
Accessory bags (R6)
Tool E (L2)

Ken 3

- 9 Confirm normal suit pressure, cabin pressure, & O2 flow
EMERG CABIN PRESS vlv - BOTH
SUIT CKT RET vlv - open (pull)
Remove helmet & gloves & stow in PGA bag
Stow water wings
Unstow & mount TSB's (A1)

night adaptation

L
2-13

10 MAIN REG CHECK

Ken 4

MAIN REG B vlv - close
EMER CABIN PRESS sel - 1
PUSH TO TEST PB - PUSH (O2 FLOW INC)
MAIN REG B vlv - open
MAIN REG A vlv - close
EMER CABIN PRESS sel - 2
PUSH TO TEST PB - PUSH (O2 FLOW INC)
MAIN REG A vlv - open
EMER CABIN PRESS sel - BOTH
to 24 pg L2-16

11 SEC RAD LEAK CHECK

Fred & Ken 7 Monitor SEC ACCUM QUANTITY
SEC GLY To RAD vlv - NORM for 30 sec, then
BYPASS
to 19 (ORDINAL) pg L2-15

+20:00 12

Fred & Jim

ECS Post Insertion Config

GLY RSVR BYPASS vlv - OPEN
GLY RSVR OUT vlv - CLOSE
GLY RSVR IN vlv - CLOSE
PRIM GLY ACCUM QTY 25-50%
PRIM ACCUM FILL vlv - ON until 50-55%
ECS RAD FLOW CONT - PWR
PRIM GLY TO RAD vlv - NORMAL (push)
ECS RAD HTR - PRIM 1 (LMP)
ECS RAD TEMP PRIM OUT below PRIM IN
If outlet temp after 5 min
* above INLET TEMP *
*PRIM GLY TO RAD vlv - *
* BYPASS (pull) *
*Recheck in 10 min *
ECS RAD tb - gray
GLY EVAP TEMP IN - AUTO

Fred 13

CYI LOS
(00:23:40)

Ken 8 19

Jim 20 MOU

3/9/70
Basic Date
Changed
3/31/70
3/9/70
Basic Date
Changed

CSM 109

CSM 109

TLI TRAJECTORY OP 1
NOM & MAN

NORM SC ROOSTER SEP

MON 1 1

*meet may
advise a time*

L
2-1516 ECS MONITORING CHECK

SUIT COMP ΔP - .3-.4 psid
02 FLOW - 0.2-0.45 lb/hr (after changeover)
02 SURGE TANK PRESS - 865-935 psia
REPRESS 02 >865 psia
PRIM RAD tb - gray
*If PRIM RAD tb - 2 *
* ECS RAD FLOW AUTO CONT - 1 until*
* tb gray, then AUTO *
ECS RAD TEMP PRIM IN - 67-97° F
ECS RAD TEMP PRIM OUT - -20° to +63° F
PRIM GLY EVAP TEMP OUT - 38-50.5° F

PRIM GLY DISCH PRESS - 40-52 psig
SUIT TEMP - 45-55° F
SUIT PRESS/CABIN PRESS - 4.7-5.3 psia
PART PRESS CO2 < 7.6 mm Hg
POT H2O QTY - 10-100%
WASTE H2O QTY - 25-85%

17 SPS MONITORING CHECK

SPS PRPLNT TK TEMP ind - +45 to +75° F
*IF < 45° F, SPS LINE HTRS - A *
IF > 75° F, SPS LINE HTRS - off (ctr)
SPS PRESS IND sw - He, N2A, & N2B
SPS PRPLNT TK PRESS ind
He 3900 psia max
N2A 2900 psia max
N2B 2900 psia max
SPS PRESS IND sw - He
FUEL & OXID PRESS ind - 170 to 195 psia
SPS ENG INJ VLVS (4) - CLOSE
SPS OXID, FUEL & UNBAL QTY - record
OXID FLOW VLV PRIM - PRIM
SPS He VLV (1&2) - AUTO, tb - bp

Jim 18 GDC ALIGNKen 8 19 UNSTOW SEQ CAMERA BRACKET & ORDEAL to 22Jim 20 MOUNT ORDEAL BOX & INITIALIZEL
2-14Fred
14FC PURGE CHECK

H2/O2 PURGE (6) - on, then OFF (sequentially)
Observe Flow rate inc
Reset MA (as req'd)
H2 PURGE LINE HTR - OFF

Fred
15EPS MONITORING CHECK

Cryogenic Pressure - Quantity Check
H2 PRESS (2) - 225-260 psia
O2 PRESS (2) - 865-935 psia
SURGE TK PRESS - 865-935 psia
H2 QTY (2) - record
O2 QTY (2) - record
CRYO FANS - OFF; ON as req'd

FC Power Plant Check

FC HTRS(3) - on(up)
FC REACT tb (3) - gray
FC IND sel - 1, 2, 3
H2 FLOW - 0.03-0.15 lb/hr
O2 FLOW - 0.25-1.2 lb/hr
MOD SKIN TEMP - 390-450° F
MOD COND EXH TEMP - 150-175° F
FC pH HI tb - gray
FC RAD TEMP LO tb - gray
FC REACS & RAD cb (6) - out, all others
in(verify)

D-C Voltage-Amperage Check

MN BUS TIE (2) - OFF (verify)
FC MNA tb - 1 & 2 gray, 3 bp
FC MNB tb - 1 & 2 bp, 3 gray
FC 1, 2, & 3 (RECORD AMPS)
MAIN BUS A, B, (26.5-31 vdc - Record)
BAT BUS A, B, & BAT C (31.5-38 vdc < 3 amp)
PYRO BAT A, B (36.5 - 37.5 vdc)
DC IND sel - MNB
SYS TEST 4B (BAT RLY BUS - 3.4-4.1 vdc)

A-C VOLTS - 113 to 117 all phases
in PGA bag

3/9/70

Basic Date
Changed

CSM 109

3/9/70

Basic Date
Changed

CSM 109

1. IFTOFF CONFIG

BOOST-INSERTION-TLI

LAUNCH ABORT

ALTITUDE via VI

L
2-16

- 21 SECONDARY GLYCOL LOOP CHECK
Fred ECS IND sw - SEC
 SEC COOL LOOP PUMP - AC1
 GLY DISCH SEC PRESS - 39-51 psig
 ACCUM SEC QTY IND - 30-55%
 SEC COOL LOOP - EVAP
- After 5 min:
 SEC EVAP TEMP OUT - 38-50.5°F
 SEC COOL LOOP EVAP - RSET 1 min,
 off (ctr)
 SEC COOL LOOP PUMP - off (ctr)
 ECS IND sw - PRIM
- 22 UNSTOW CAMERAS
Ken 9 DAC (f8,250,7) 12 fps, MAG A (B3)
 Power cable (B3)
 18mm lens (B3)
 Rt. angle mirror (B3)
 (Assemble & mount in L.H. rendezvous window)
- 10 EL (f8,250,30) *mag L* (B3)
 (Stow in LMP TSB)
- 23 UNSTOW TV CAMERA
Ken 11 TV (ALC - PEAK, f44) (A7)
 Power cable (A6)
 Bracket (A6)
 Monitor & cable (A6)
 (Assemble, connect cables & hand to LMP)
- 24 OPTICS DUST COVER JETT
Ken 5 Install Optics eyepieces *G+N handholds*
 OPT ZERO - OFF *R1*
 G/N PWR OPTICS - on (up)
 OPT MODE - MAN
 OPT COUPLING CONT - DIRECT
 OPT SPEED CONT - HI
 OHC - MAX RIGHT (Obs eject thru eyepiece)
 (SXT 40°, SCT 80° shaft ang)

L
2-17

- 25 IMU REFSMMAT Realign Check (P52),
Ken 6 P52 - (PAD REFSMMAT)
- N71: 26.33 *CR 30*
 N05: 00.00
 N93:
 X 0.067
 Y 0.000
 Z 0.162
- GET: 0:45:35
to 11 pg 2/2-13
 If IMU is realigned,
 Realign GDC (CDR) *1.00*
 OOE
 RETICLE BRIGHTNESS - DIM
 Stow Optics Eyepieces
 Increase S BD volume
- CRO AOS *Jim*
 (00:52:17)
 SUNRISE *Ken 12*
 (01:00:07)
- CRO LOS
 (00:58:07)
- HSK AOS(s) 26 *Fred* Two way S BD VOICE Check
 (00:59:35) Report GYRO torquing angles
Fred - adjust TV & configure to emit
- HSK LOS
 (01:05:37)
- US AOS 27 *Jim* SCS ATT Ref Comp Check
 (01:28:19) V16 N20E
 FDAI SELECT - 1
 FDAI SOURCE - ATT SET
 ATT SET - GDC
 ATT SET dials - null FDAI 1 err needles
 Key VERB when nulled (freeze display)
 Record from DSKY:
85 R179.65, P138.48, Y359.17
 Record from ATT SET dials:
 R180.50, P140.20, Y359.46
 FDAI SEL - 1/2 *1.72*

Basic Date
Changed
3/9/70

Basic Date
Changed
3/9/70

CSM 109

CSM 109

TLI TRAJECTORY OPP 1
NOM & MAN

NORM SC BOOSTER SEP

MODE 1

MODE II. MODE III

L
2-18

- 28 EXTEND DOCKING PROBE
Jim cb DOCK PROBE (2) - close (verify)
DOCK PROBE EXTD/REL - EXTD/REL until
full probe extension
(DOCK PROBE tb - grey at full extension)

	EXT	RET
FULL EXT	Grey	Grey
FULL RET	BP	BP
PART EXT	BP	Grey

DOCK PROBE EXTD/REL - RETRACT (tb-gray)

- Fred* 29 COPY TLI, TLI ABORT, & P37 PADS
Jim 30 SV UPDATES (MCCH)
31 cb SECS ARM (2) - close
SECS LOGIC (2) - on (up)
MSFN confirm GO for PYRO ARM

US LOS (01:45:40) *Ken 13 - mount storage cards in LBB*
CYI AOS (01:50:07) *TV of Gulf Coast*

1.1FTOFF CONFIG

BOOST-INSERTION-TLI

LAUNCH ABORT

Basic Date 3/9/70
Changed

Basic Date 3/9/70
Changed

CSM 19

CSM 09

TLI

X	2	2	6	0	5	X					TB6p
X	X	X	1	7	9	X	X	X			R
X	X	X	1	0	8	X	X	X			P
X	X	X	0	0	0	X	X	X			Y
X	X	X	5	4	7	X	X	X			BT
1	0	4	1	6	9						ΔVC'
+	3	5	5	8	7	+					VI
X	X	X	3	5	8	X	X	X			R
X	X	X	1	3	9	X	X	X			P
X	X	X	3	2	0	X	X	X			Y
X	X	X	3	0	2	X	X	X			R
X	X	X	3	1	9	X	X	X			P
X	X	X	0	4	0	X	X	X			Y

*1m
4m
-04:01:00*

BOOST-INSERTION-TLI

LAUNCH ABORT

ATTITUDE TO V4

L 2-20		P27 UPDATE											
PURP		V			V			V					
GET		:	:		:	:		:	:				
304 01	INDEX				INDEX			INDEX					
02													
03													
04													
05													
06													
07													
10													
11													
12													
13													
14													
15													
16													
17													
20													
21													
22													
23													
24													
N34	HRS	X	X	X				X	X	X			
	MIN	X	X	X	X			X	X	X	X		
NAV CHECK	SEC	X	X					X	X				
N43	LAT		0					0					
	LONG												
	ALT	+	0					+	0				

Basic Date Changed 3/9/70

Basic Date Changed 3/9/70

CSM 19

CSM 1

L/2-21		P30 MANEUVER											
SET STARS												PURPOSE	
												PROP/GUID	
												WT	N47
												P _{TRIM}	N48
												Y _{TRIM}	
												HRS	GETI
												MIN	N33
												SEC	
												ΔV _X	N81
												ΔV _Y	
												ΔV _Z	
												R	
												P	
												Y	
												H _A	N44
												H _P	
												ΔVT	
												BT	
												ΔVC	
												SXTS	
												SFT	
												TRN	
												BSS	
												SPA	
												SXP	
												LAT	N61
												LONG	
												RTGO	EMS
												VI0	
												GET	0.05G

P37 FOR L/0+8

X													
X													

GETI
 ΔVT
 LONG
 GET_{400K}

L
 2-23

TLI PREPARATION

- (01:50:00) XLUNAR - INJECT (verify)
 EDS PWR - on (up)
 SUNSET (01:51:06) Perform EMS AV TEST & NULL
 BIAS CHECK, pg G/2-5
 Set AVC
 EMS FUNC - AV
 GDC ALIGN
 V48E, 31102, 01111
 CYI LOS Key V83E
 (01:55:25) Set ORDEAL - 100/EARTH
 SECS PYRO ARM (2) - on (up)
 TRANS CONTROL PWR - ON
 ROT CONTR PWR NORMAL (2)-AC/DC (verify)
 ROT CONTR PWR DIRECT (2)-MNA/MNB
 LV IND/GPI - SII/SIVB (verify)
 cb DIRECT ULLAGE (2) - closed
 Cycle CRYO FANS
 Set DET - 51:00
 *If P17,P20,P22,P23,P3X,P4X,P6X or P7X is inadvertently
 * called prior to TB6, do not attempt CMC TB6 LOAD
 * MANUAL TB6 must be used, pg L/2-31
 CMC TB6 LOAD
 V96E do only in P00
 V25 N33E
 Load GET of TB6
 V25 N26E
 26000E do not attempt if TB6
 01513E has passed
 10067E
 V30E
 06 34 Time from TB6
 If V37E XXE or RESTART occurs, key V21 N1E,
 * 3573EE & repeat CMC TB6 LOAD *

For MANUAL TLI, go to pg L/2-29

22550

P30 MANEUVER L/2-22

PURPOSE				
PROP/GUID				
WT N47				
P TRIM N48				
Y TRIM				
HRS GETI				
MIN N33				
SEC				
ΔV _X N81				
ΔV _Y				
ΔV _Z				
R				
P				
Y				
H _A N44				
H _P				
ΔVT				
BT				
ΔVC				
SXTS				
SFT				
TRN				
BSS				
SPA				
SXP				
LAT N61				
LONG				
RTGO EMS				
VIO				
GET 0.05G				

P37 FOR L/0+8				
GETI				
ΔVT				
LONG				
GET 400K				

Basic Date 3/9/70
 Changed
 Basic Date 3/9/70
 Changed
 CSM 109
 CSM 109

PROST-INSERTION-TLI
 LAUNCH ABORT

ATTENDING 300 114

L
2-25

SIVB ULLAGE Begins
Insure FDAI #1 PITCH = 10°
SII SEP 1t - out (TIG - 18 sec)
SIVB FUEL LEAD
SIVB ULLAGE discontinues
Insure FDAI #1 PITCH = 6°
LV ENG 1 lt - on
ORDEAL MODE - OPERATE/SLOW

SIVB IGNITION (__:__:__GETI)
LV ENG 1 lt - out
MONITOR THRUST & ATTITUDE
MONITOR LV TANK PRESS
SIVB ECO (1t on) (BEGIN TB7)

+45°/P,Y
+10°/sec P,Y
+20°/sec R

*EMER SIVB CUTOFF
If no ECO at +6 sec and VI attained
* LV STAGE sw - SII/SIVB
*If still no ECO,
* THC CCW & NEUTRAL in 1 sec
*If LV GUID - CMC,
* LV STAGE sw-SII/SIVB on VI

KEY VERB (freeze display)

LV ENG 1 lt - out (TB 7 + 10 sec)

SIVB MNVR TO ORB RT (HDS DN) (.3°/sec)
VI 35560 & AVC -3.0 report
HDOT +01945
HPAD +01769

KEY RLSE

KEY RLSE

AVX,Y,Z (.1fps)

SCS TVC SERVO PWR #1 - OFF
PCM BIT RATE - LOW
EMS MODE - STBY
EMS FUNC - OFF
SECS PYRO ARM (2) - SAFE
FDAI #1 - INRTL
RHC #2 - LOCKED

PRO

OOE

L
2-24

NOMINAL TLI

LV GUID - IU (verify)

TB 6 - SII SEP 1t on (TIG-9 min, 38 sec)
SII SEP 1t out (38 sec later)
Start DET counting up
SC CONT - SCS (verify)
MONITOR LV TANK PRESS

CRO AOS

(02:25:25) 56

*If AP > 36 psid (OXID > FUEL) *
*If AP > 26 psid (FUEL > OXID) *
*If LOX TK PRESS > 50 psia *
* EMERGENCY CSM/LV SEP pg EMER/1-1 *

SUNRISE

(02:28:24)

UP TLM CM - BLOCK (verify)
UP TLM IU - BLOCK (verify)
RHC #2 - ARMED

CRO LOS

(02:31:41)

ORDEAL - 300/LUNAR
ORDEAL FDAI #1 - ORB RATE
FDAI #2 - INERTIAL

57:00

Slew FDAI to PITCH = 18°
ORDEAL MODE - HOLD/FAST

V37E 47E (bias limit = 9.8 fps/min)

F 16 83

AVX,Y,Z (.1fps)

58:00

F 16 62

N62E
VI, HDOT, HPAD (fps, fps, .1nm)
SCS TVC SERVO PWR #1 - AC1/MNA
SCS TVC SERVO PWR #2 - OFF (verify)
TAPE RCDR - HBR/RCD/FWD/CMD RESET

58:20

EMS MODE - NORMAL

58:36

SII SEP 1t - on

*TLI Inhibit will not be honored *
* after 59:42, except LV STAGE sw *
* (Permanent Inhibit) *

58:38
59:00
59:42
59:52
59:55

59:59

00:00
00:02

05:55

06:05

08:26

F 16 62

F 16 83

MSFN AOS
(02:44:40)

F 37

3/9/70

Basic Date
Changed

3/9/70

Basic Date
Changed

CSM

CSM

L
2-26

When CMC ACTY 1t out,
Key V66E

CMP to LH couch
CDR to CTR couch

Ken

WASTE STOWAGE VENT vlv - CLOSED
HI GAIN ANT PWR - OFF (Verify)
cb HI GAIN ANT FLT BUS - close
cb HI GAIN ANT GRP 2 - close
T, D, & E, pg L/3-1

L
2-27

Basic Date 3/9/70
Changed

Basic Date 3/9/70
Changed

CSM 109

CSM 109

SIVB TLI - NOMINAL						SIVB TLI - MANUAL					
APR 11, 1970 AZ 72° FIRST OPPORTUNITY						APR 11, 1970 AZ 72° FIRST OPPORTUNITY					
θ	ψ	DET	V _I	H	θ	ψ	DET	V _I	H	θ	H
108	0.0	00:00	25566	19	102	4.0	00:00	25566	19	106	106
102	0.5	00:30	26100	15	101	4.0	00:30	26100	15	106	106
100	1.2	01:00	26684	40	100	4.0	01:00	26684	40	106	106
99	1.7	01:30	27295	117	98	4.0	01:30	27295	117	106	106
98	2.2	02:00	27996	251	97	4.0	02:00	27996	251	107	107
97	2.6	02:30	28781	459	96	4.0	02:30	28781	459	108	108
96	3.0	03:00	29606	750	95	4.0	03:00	29606	750	111	111
95	3.4	03:30	30475	1134	94	4.0	03:30	30475	1134	116	116
94	3.8	04:00	31395	1617	93	4.0	04:00	31395	1617	122	122
92	4.2	04:30	32371	2207	92	4.0	04:30	32371	2207	132	132
90	4.6	05:00	33412	2907	91	4.0	05:00	33412	2907	144	144
86	5.0	05:30	34529	3716	90	4.0	05:30	34529	3716	160	160
86	5.0	05:55	35553	4470	88	4.0	05:55	35553	4470	177	177

L
2-28

SIVB TLI - NOMINAL					SIVB TLI - MANUAL				
APR 11, 1970 AZ 72° SECOND OPPORTUNITY					APR 11, 1970 AZ 72° SECOND OPPORTUNITY				
θ	ψ	DET	V_I	H	θ	ψ	DET	V_I	H
107	0.0	00:00	25559	19	107	0.5	00:00	25559	19
101	1.0	00:30	26175	9	99	0.5	00:30	26175	9
99	1.0	01:00	26870	34	98	0.5	01:00	26870	34
98	1.0	01:30	27600	120	97	0.5	01:30	27600	120
97	1.0	02:00	28369	277	96	0.5	02:00	28369	277
96	1.0	02:30	29179	512	95	0.5	02:30	29179	512
95	0.5	03:00	30031	834	94	0.5	03:00	30031	834
94	0.5	03:30	30932	1251	93	0.5	03:30	30932	1251
92	0.0	04:00	31823	1772	92	0.5	04:00	31823	1772
91	0.0	04:30	32907	2402	91	0.5	04:30	32907	2402
88	0.0	05:00	33998	3147	89	0.5	05:00	33998	3147
85	0.0	05:30	35177	3986	88	0.5	05:30	35177	3986
85	0.0	05:39	35587	4292	88	0.5	05:39	35587	4292

Basic Date 3/9/70
Changed

Basic Date 3/9/70
Changed

L FDAI 1st err ~ 170 fps
2-29 6 sec err ~ 10 fps

TLI BACKUP GUIDANCE PROCEDURES

LV GUID - CMC
SC CONT - SCS (verify)
MONITOR LV TANK PRESS
*If ΔP > 36 psid (OXID > FUEL) *
*If ΔP > 26 psid (FUEL > OXID) *
*If LOX TK PRESS > 50 psia *
* EMERGENCY CSM/LV SEP pg EMER/1-1 *

ORDEAL - 300/LUNAR
V16 N20E
Mnvr SIVB to MANUAL TLI Att: R2 = 107.9°
Null SIVB rates
ORDEAL FDAI #1 = ORB RATE
ORDEAL MODE - HOLD/FAST
Slew FDAI #1 TO PITCH = 0°
KEY REL

06 34 Time from TB6

TB6 UPLK ACTY 1t - on
S-II SEP 1t - on
TB6+10sec UPLK ACTY 1t - out
F37 00E
51:00 S-II SEP 1t - out
Start DET
57:00 V37E 47E (bias limit: 9.8 fps/min)
F 16 83 AVX,Y,Z (.1fps)

N20E
Hold MANUAL TLI Att
Insure FDAI #1 PITCH = 0°
57:20 ORDEAL MODE - OPERATE/SLOW
Fly FDAI #1 PITCH = 0°
SCS TVC SERVO PWR #1 - AC1/MNA
SCS TVC SERVO PWR #2 - OFF (verify)
TAPE RECR - HBR/RCD/FWD/CMD RESET
58:20 EMS MODE - NORMAL
58:36 SII SEP 1t - on

*TLI Inhibit will not be honored *
* after 59:42, except LV STAGE sw *
* (Permanent Inhibit) *

R2
ORDEAL Start
Time (:)
YAW

TLI TRAJECTORY OPP 2
NOM & MAN

BOOST-INSERTION-TLI

L
2-30

58:38 SIVB ULLAGE Begins
59:42 S-II SEP 1t - out (TIG - 18 sec)
59:52 SIVB FUEL LEAD
59:55 SIVB ULLAGE discontinues
59:59 LV ENG 1 1t - on
00:00 SIVB IGNITION (: :) GETI
00:02 LV ENG 1 1t - out
FLY P = 0°, Y = +4°
MONITOR THRUST & ATTITUDE
MONITOR LV TANK PRESS

+45°/P,Y
+10°/sec P,Y
+20°sec R

N62E
F 16 62 VI,HDOT,HPAD (fps,fps,.lnm)
05:55 (1st) CUTOFF ON PAD VI (lead by 100 fps)
05:39 (2nd) LV STAGE sw -SII/SIVB

*If still no ECO *
* THC -CCW & NEUTRAL in 1 sec*

Key VERB (freeze display)
VI & ΔVC report

HDOT
HPAD

KEY RLSE

F 16 62

KEY RLSE

F 16 83

ΔVX,Y,Z (.1fps)

SCS TVC SERVO PWR #1 - OFF
PCM BIT RATE - LOW
EMS MODE - STBY
EMS FUNC - OFF
SECS PYRO ARM (2) - SAFE
FDAI #1 - INRTL

PRO

F 37

00E

When CMC ACTY 1t out,
Key V66E

CMP to LH couch
CDR to CTR couch
WASTE STOWAGE VENT vlv - CLOSED
HI GAIN ANT PWR - OFF (verify)
cb HI GAIN ANT FLT BUS - close
cb HI GAIN ANT GRP 2 - close
T, D, & E, pg L/3-1

L
2-31

*MANUAL TB6 *
* V25 N7E *
* 12E *
* 10000E *
* 1 Do not enter *
* ENTR to start TB6 *
* After S-II SEP *
* 1t - on *
* V37E 00E *

(: :) (TB6)

SATURN RATE CHANGE

V24 N1 E
3322E, XXXE, YYYYYE

SIVB RATE	SAT RATE +1 address 3322	SAT RATE +2 address 3323
	XXX	YYYYY
.05°/sec RPY	161	77616
.1 RPY	210	77567
.2 RPY	266	77511
*.3 RPY	344	77433
.3P,Y .5 R	476	77301

*USE FOR TLI

3/9/70

Basic Date
Changed

3/9/70

Basic Date
Changed

CSM 10

CSM

MODE III, MODE IV

NORM SC BOOSTER SEP

MODE I

MODE II, MODE III

NORMAL SC/BOOSTER SEPARATIONS

1 PRE CSM SEPARATION

DIRECT O2 vlv - OPEN until
CAB PRESS = 5.7, then close
cb DOCK PROBE (2) - close (verify)
COAS PWR - on

ALIGN GDC SIVB MNVR (: :)
*If LV GUID - CMC * SEP (: :)
* mnvr to SEP ATT *
* Do not reload DAP*

Load RCS DAP
R1=1110Z, R2=01111
V46E 2 OMNI ANT-#C
Load N17 (SEP) & N22 (EXTRACTION)
V63E (Monitor SIVB Mnvr) (TB7 + 15 min)

*If error needles not nulled: *
* V60E (SIVB +1.8°db) *
* V16 N20E *
* R22 = 300° - R20 *
* P22 = P20° + 180° *
* Y22 = 360° - Y20 *
* R P Y *
*N20 _____ *
* _____ *
*N22 _____ *
* _____ *
*Load new Docking Attitude *

2 CSM SEPARATION PREP

DOCK PROBE EXTID/REL - RETRACT (verify)
SM RCS PRPLNT tb (8) - gray (verify)
AUTO RCS SELECT (16) - MNA/MNB
Perform EMS NULL BIAS CHECK, pg G/2-5
Set AVC to -100.0
EMS FUNC - AV
FDAI SCALE - 5/1
MAN ATT (3) - RATE CMD
LIMIT CYCLE - OFF (verify)
ATT DB - MIN
RATE - LOW

Basic Date 3/9/70
Changed 3-27-70
4-10-70

CSM 09

TLI TRAJECTORY OFF 2
NOM & MAN

BOOST-INSERTION-TLI

1.1 INCH ABORT

ATMOSPHERIC DATA 114

NODE III, NODE IV

NORM SC BOOSTER SEP

NODE 1

NODE II, NODE III

LI TRAJECTORY APP 2
NOM & MAN
NORM SC/BOOSTER SEP

TAUNCH ABORT

L
3-2

TRANS CONT PWR - on (up) (verify)
ROT CONT PWR NORMAL (2) - AC/DC (verify)
ROT CONT PWR DIRECT (2) - MNA/MNB (verify)
ATT SET tw - R=0°, P=180°, Y=0°

Set up TV

Mount TV in R.H. rendezvous window
S BD AUX TV - TV (90 sec delay)
TV monitor power sw - ON
Adjust monitor for proper picture
Adjust lens aperture(f22), zoom and focus controls
S BD AUX TV - off (center)

Utility pwr for DAC-on

CMC MODE - FREE (verify)
SC CONT - CMC
BMAG MODE (3) - RATE 2 (verify)
cb RCS LOGIC (2) - close (verify)
TVC SERVO PWR #1 - AC1/MNA
Set DET - 59:30
FC REAC vlv - LATCH

3 CSM SEPARATION

V49E F 06 22 (EXTRACT ATT)
THC - ARMED
RHC #2 - ARMED
cb SECS LOGIC (2) - closed (verify)
cb SECS ARM (2) - closed (verify)
SECS LOGIC (2) - on (up) (verify)
RCS CMD - ON
TAPE RCDR - HBR/RCD/FWD/CMD RESET
SECS PYRO ARM (2) - ARM
*If LV GUID - CMC *
* Insure rates nulled and *
* yaw drifting towards 0° *
* Load DAP 11103, 01111 *
* V46E, V60E, V63E *

GDC ALIGN

EMS FUNC - ΔV (verify)

EMS MODE - NORMAL

59:30 Start DET

L
3-3

59:50 CMC MODE - AUTO
59:58 Thrust +X and hold
00:00 CSM/LV SEP pb - push, hold, and release
LV TANK PRESS - full scale Low

*No Separation: *

* THC - CCW (leave in detent) *

* DET reset and counting up (auto) *

* LV TK PRESS - full scale low (SEP ind) *

*00:03 THC - neutral *

00:03 THC - release (ΔV ~ .5 fps)
SM RCS PRPLNT tb (8)-gray (verify)
SM RCS He tb (8)-gray (verify)
SM RCS SEC PRPLNT FUEL PRESS (4) - CLOSE
FC REAC vlv - NORM

V62E ← SC CONT - SCs After 180° Pitch Mnvr
MAN ATT (PITCH) - ACCEL CMD MAN ATT (P) - RT CMD
SC CONT - CMC

00:15 Pitch up at .8°/sec

~~When Pitch error needle positive,~~

PRO F 50 18

OMNI ANT - CB

PRO 06 18

MAN ATT (PITCH) - RATE CMD

F 50 18 (completion of mnvr)

ENTR

Thrust +X(4 sec)(ΔV ~ .7 fps)

Load RCS DAP 11102, 01111

S BD AUX TV - TV (90 sec delay)

HI GAIN ANT TRACK - MAN

HI GAIN ANT PWR - POWER

Slew ANT to verify operation

HGA angles: P = -20, Y = 290 297

S BD ANT OMNI - HI GAIN

HI GAIN ANT TRACK - REACQ

TV TRANSMIT/STBY sw - TRANSMIT

Start DAC

Basic Date
Changed
3/9/70

Basic Date
Changed
3/9/70
3-27-70
4-10-70

CS 109

CSM 9

MODE III, MODE IV

LANDING PHASE

MODE 1

MODE II, MODE III

L
3-6

8 DOCKING LATCH VERIFICATION (Decal)

LATCH HANDLE - Pull to verify hook engaged (12 latches)

Not Engaged - Attempt to engage
* before recocking *

LATCH IND BUTTON (Red) - Flush (12 latches)

Power BUNGEE FAIRING - Parallel to +X

* Not parallel - Push +X end of *
* bungee before recocking*

*UNLOCKED LATCHES:

* Recock Latches

* Hook does not release:

* AUX REL (yellow)-push

* Cock latch

Release Latch - push man-release

Verify EXTEND LATCH ENGAGED INDICATOR (RED)
not visible

GN2 BLEED button (red) - press (10 sec)

9 LM UMBILICAL CONNECTION (Decal)

LM connector fairings (2) (orange)-open

LM umbilical connectors (2)-install & lock

LM connector fairings (2)(orange) - close

SYS Test - 4D

LM PWR - CSM

SYS Test ind - 0.5-3.2 volts

10 HATCH INSTALLATION (Decal)

Align Hatch in Tunnel

ACTR HNDL sel - unstow, set to L
- push to stop

Verify gearbox disconnect socket - L

*If latches cannot be closed: *

GEARBOX DISCONNECT - 180° CCW (Tool B)

*AUX LATCH DRIVE - LATCH (113° CW) *

*Verify hatch latches, remove tool B *

ACTR HNDL sel - stow

ACTR HNDL - push to stow

HATCH PRESS EQUAL vlv - close (CW) (C,pg S/2-8)

LM TUNL VENT vlv - LM/CM AP

LM TUNNEL LIGHTS - OFF

9 req'd for
SPShelmet &
gloves

3/9/70

Basic Date
Changed

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3/9/70

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Changed

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3-27-70

11 PRE LM SEP & EJECTION

cb SIVB/LM SEP (2) - close (verify)

AV CG - LM/CSM (verify)

EMS FUNCT - AV SET/VHF RNG

Slew AV ind to +100.0

CYCLE CRYO FANS

EMS FUNC - AV

TAPE RCDR - HBR/RCD/FWD/CMD RESET

Load RCS DAP 21101, X1111

V60E, V63E - 1000 N22

(DAC - 6 fps)

GDC ALIGN 0/180/0

DET - RESET

cb SECS ARM (2) - close (verify)

SECS LOGIC (2) - on (up)

Obtain GO from MSFN

SECS PYRO ARM (2) - ARM

TVC SERVO PWR #1 - AC1/MNA

RHC & THC - ARMED

V37E 47E F 16 83 AVX, Y, Z

(.1fps)

EMS MODE - NORMAL

Start DAC

12 LM SEP & EJECTION

SIVB/LM SEP - on (up)

(: :)

00:00 Start DET

CMC MODE - AUTO

00:05 Thrust -X (3 sec)

13 POST LM EJECTION

PRO

F37 00E

When CMC Acty lt out,

Key V66E

SECS PYRO ARM (2) - SAFE

SECS LOGIC (2) - OFF

cb SECS ARM (2) - open

cb SIVB/LM SEP (2) - open

LV/SPS IND sw - GPI

TVC SERVO PWR (2) - OFF

EMS MODE - STBY

EMS FUNC - OFF

TAPE RCDR - off (ctr)

PCM BIT RATE - LOW

AUTO RCS SEL AC ROLL or BD ROLL (4) - OFF

Stop DAC

L
3-8

V49E
F 06 22
Load N22 att (monitor APS mnvr, hatch window)
94.1°, 323.4°, 355.5°
PRO F 50 18 ~ 13 min
PRO 06.18
F 50 18 (completion of mnvr)
ENTR
cb DIRECT ULLAGE (2) - open
TRANS CONT PWR - OFF
ROT CONTR PWR DIR (2) - OFF
RHC & THC - LOCKED
REPRESS PKG vlv - OFF

*NO APS EVASIVE at 13:00 *
*Thrust +X (6 sec) *
*Monitor SIVB thru Hatch Window *

Time from Ejection (min:sec)	Att for viewing SIVB after RCS EVASIVE mnvr		
	Roll	Pitch	Yaw
15:00	36.9°	267.5°	26.3°
20:00	43.1°	263.7°	30.1°

assumes RCS at 13 min.

*If no TLI:
* ~~CSM~~
* SIVB - CSM/LM SEP (Earth orbit)
*
* Inertial Att.
* min-sec Event R P Y *
* 00:00 Ejection 302.1° 319.6° 40.4° *
* 00:05 3 sec -X *
* 00:22 Mnvr 94.1° 323.4° 355.5° *
* 03:00 6 sec -X *

ABORT PROCEDURES

L
4-1

MODE IA ABORT
(00:00 to 00:42) (10K)

00:00 TRANS CONTR - CCW then NEUTRAL
CM/SM SEP (2) - on (up)
00:14 ELS LOGIC - on
TWR JETT (2) - on (up)
APEX COVER JETT PB - PUSH
00:16 DROGUE DEPLOY PB - PUSH
00:18 CM RCS He DUMP PB - PUSH
Monitor altimeter
If <alidade - DEPLOY MAINS
>alidade - NO ACTION
00:28 If <10,000 ft - DEPLOY MAINS

Note: Alidade set for 3800 ft true altitude prior to Launch

GO TO LANDING PHASE pg L/4-8

MODE IB ABORT
(00:42 to 16.5 nm) (1:56)

00:00 TRANS CONTR - CCW then NEUTRAL
CM/SM SEP (2)-on (up)
00:11 CANARD DEPLOY - PUSH
00:14 ELS LOGIC - on (up)
RCS CMD - ON

GO TO LANDING PHASE pg L/4-8

Basic Date 3/9/70
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Changed

CSM 109

CSM 109

L
 4-4

MODE III SPS ABORT
 (ΔR = -400 NM to INSERTION)

00:00 TRANS CONTR - CCW (4 Sec Min)
 *NO BECO - RESET THC, *
 * LV STAGE sw - SII/SIVB*
 *Reset & start DET *

00:03 *CSM/LV SEP - PUSH*
 *RCS CMD - ON *
 THC - ARMED

00:05 TRANS CONTR - NEUTRAL THEN +X
 LV IND/GPI sw - GPI

00:24 TRANS CONTR +X OFF
 KEY V82E N50E ΔR,HP,TFF (.1nm,min-sec)
 If ΔR>0:
 MNVR to retro att (R=180°,P=194°,Y=0°)
 (Scribe on horiz, BEF, Hds up)
 BMAG MODE (3) - ATT1/RATE2
 SCS TVC P&Y - AUTO(verify)
 EMS MODE - NORMAL GETI _____
 ΔV THRUST A - NORMAL 6999.9
 DIRECT ULLAGE PB - PUSH ΔV _____
 02:05 THRUST ON PB - PUSH VC _____
 Burn to VC (ΔR=0) Δtb _____
 ΔV THRUST (2) - OFF GET 300K _____
 0 (.05G) _____
 If TFF>2min,Yaw 45°(LEFT) GET Drogue _____
 out-of-plane
 cb MNA&B BAT C(2) - closed
 CM/SM SEP - on (up)

CM RCS PRESS - on (up)
 RCS TRANSFER - CM
 C&W MODE - CM
 Mnvr to entry att (R=0°,P=105°,Y=0°)
 (BEF, Hds Dn, Full Lift)
 CSM/LM FNL SEP (2) - on (up)
 Note TFF

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L
 4-5

EMS MODE - STBY
 EMS FUNC - ENTRY
 EMS MODE - NORMAL
 Set up single ring RCS
 .05G Lt., Sw - on (up)
 EMS Roll - on (up)
 CORRIDOR → .2G Lt., Roll left 55° (305° inertial)
 Fly Half Lift

GO TO LANDING PHASE pg L/4-8

MODE III, MODE IV

LANDING PHASE

MODE I

MODE II, MODE III

L
4-8LANDING PHASE (30K, DESCENDING)30K' cb ELS (2) - close
ELS - AUTO

ELS LOGIC - on (up)

24K' Twr jett (auto)

*TWR JETT (2) - on (up) *

*CSM/LM FNL SEP(2)-on(up) *

Apex cover jett (auto)

*APEX COVER JETT PB-PUSH) *

(WAIT 2 SECS)

Drogues deployed (auto)

DROGUE DPLY PB-PUSH

If Both drogues Fail:

*ELS - Man *

*STABILIZE CM *

5K' MAIN DPLY PB - PUSH

*ELS - AUTO *

49 sec

23.5K' Cabin Pressure increasing

*If not increasing by 17K': *

*CABIN PRESS REL vlv (RH)-DUMP *

10K' Main parachutes deployed

MAIN DEPLOY PB - PUSH (within 1 sec)

VHF ANT - RECY

VHF AM A - SIMPLEX

VHF BCN - ON

CABIN PRESS REL vlv (2) - CLOSE

DIRECT O2 vlv - OPEN (verify)

RCS DUMP (Auto for Mode IA)

CM RCS LOGIC - on (up)

X IF MAIN OR PYRO BUS * CM PRPLNT - DUMP (burn audible)

X LOST, USE RHC'S FOR * MONITOR CM RCS 1&2 for He press decrease

X BURN, NOT DUMP SW *

NO BURN or PRESS DECREASE

* USE BOTH RHC's *

*DO NOT FIRE PITCH JETS *

CM PRPLNT - PURGE

CM RCS He DUMP PB-PUSH

*RHC (both) - 30 secs *

* NO PITCH *

CABIN PRESS REL vlv - BQOST/ENTRY

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L
4-9

STRUT LOCKS (4) - UNLOCK

cb FLT & PL BAT BUS A,B,&BAT C (3) - close

cb FLT & PL MNA & B (2) - open

cb ECS RAD HTR OVLD (2) - open

cb SPS P&Y (4) - open

cb BAT RLY BUS (2) - open

3K' CM RCS PRPLNT (2) - OFF (terminates purge)

CABIN PRESS REL vlv (RH) - DUMP

FLOOD Lts - POST LDG

ELS - AUTO (verify)

ELS LOGIC - ON (verify)

800' CAB PRESS REL vlv - CLOSE (latch off)

MN BUS TIE (2) - OFF

POSTLANDINGSTABILIZATION, VENTILATION, COMMUNICATIONS

Stabilization after landing

cb MAIN REL PYRO (2) - close

MAIN RELEASE - on (up)

SECS PYRO ARM (2) - SAFE

SECS LOGIC (2) - OFF

No contact with recovery forces

*VHF AM A&B - off (ctr) *

*VHF AM RCV ONLY - A *

cb PL VENT - close

cb FLOAT BAG (3) - close

cb UPRIGHT SYS COMPRESS (2) - close

If Stable II:

FLOAT BAG(3)-FILL till 2 min after
upright, then - OFF

VHF AM A/B & BCN - OFF while inverted

If Stable I:

After 10 Min Cooling Period,

FLOAT BAG (3) - FILL 7 min, then OFF

SM RCS/HYBRID DEORB

EARTH ORBIT ENTRY

TLI-90 MIN ABORT

MODE III, MODE IV

LANDING PHASE

TIME-90 MIN ABORT

EARTH ORBIT VEHICLE PREPARATION

If still on SEB:
L LV GUID - CMC
5-1 Fly pitch to BEF with
horizon on 31.7° hds up
LV GUID - IU
(SEB org rate)

- 1 INITIAL STOWAGE COMPLETED
- 2 CMC POWER UP pg G/2-2
- 3 IMU POWER UP pg G/2-1
- 4 SCS POWER UP pg G/2-4
- 5 P51 - IMU ORIENTATION pg G/6-1
- 6 LOAD DAP
V48E 11102, 01111, PRO, PRO, PRO
- 7 DON MAE WESTS & FOOT RESTRAINTS
- 8 (: :) P27 (SV, REFSMMAT), MNVR $T_{IGSPS} 180/180/0$
& ENTRY PAD UPDATES $T_{IGRCS} + \frac{1}{2} 64 0/180/0$
- 9 ECS CKS
02 SUPPLY REFILL pg S/1-7
PGA verification, (if suited) S/1-11
ECS Monitor Ck pg S/1-5
(382) EVAP H2O CONT PRI vlv - AUTO
EVAP H2O CONT SEC vlv - AUTO
SUIT HEAT EXCH SEC GLY - FLOW
- 10 EPS CKS #1, 3, 4 (5 if req'd) pg S/1-2
- 11 SPS CK (If req'd) pg S/1-1
- 12 RCS CKS
SM RCS Monit Ck pg S/1-1
CM RCS Monit Ck pg S/1-1
- 13 C&W SYS CK pg S/1-17
- 14 CMC SELF CK pg G/2-3
- 15 DSKY COND LT TEST pg G/1-23

19/70

Basic Date
Changed

CSM 10

SM RCS/HYBRID DEORB

EARTH ORBIT ENTRY
VEHICLE PREP

E.O. ENTRY UPDATE

E.O. BLOCK DATA

L
5-2

LOGIC SEQUENCE CK

- (8) cb SECS LOGIC (2) - close (verify)
 cb SECS ARM (2) - close
 cb ELS (2) - close
 ELS LOGIC - on (up)
 ELS - AUTO
 Coordinate next 3 steps with MSFN
 SECS LOGIC (2) - on (up)
 MSFN confirm GO for PYRO ARM as req'd
 SECS LOGIC (2) - OFF
 cb SECS ARM (2) - open
 ELS LOGIC - OFF
 ELS - MAN
 cb ELS (2) - open

16
17 (: :) P52-IMU REALIGN pg G/6-2 (OPTION 3)

Record gyro torquing angles

R _____
P _____
Y _____

If >1°, recycle P52

If confirmed, use SCS for EMS entry

*If still on SIVB:

- * LV GUID - CMC *
 * Pitch SIVB to Hds up, BEF, 31.7° *
 * window mk on horiz (SEP Att) *
 * Then, LV GUID - IU for orb rate *

GDC ALIGN

If drift >10°/hr, change rate source

EMS ENTRY CHECK

- EMS FUNC - OFF
 (8) cb EMS (2) - close
 EMS MODE - STBY
 EMS FUNC - EMS TEST 1 (wait 5 sec)
 EMS MODE - NORMAL (wait 10 sec)
 Check ind lts - off
 RANGE ind - 0.0
 Slew hairline over notch
 in self-test pattern
 EMS FUNC - EMS TEST 2 (wait 10 sec)
 .05G lt - on (all others out)

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20

21

21A

L
5-3

EMS FUNC - EMS TEST 3

.05G lt - on

RSI lower lt - on (10 sec later)

Set RANGE counter to 58 nm±0.0

EMS FUNC - EMS TEST 4

.05G lt - on (all others out)

G-V trace within pattern to lwr rt corner @9G

RANGE ind counts down to 0±0.2

EMS FUNC - EMS TEST 5

.05G lt - on

RSI upper lt - on (10 sec later)

RANGE ind - 0.0

Scribe traces vertical line 9g to 0.28±0.1

ALIGN SCROLL TO ENTRY PATTERN (on 37K ft sec line)

EMS FUNC - RNG SET

G-V scroll assy traces vert. line 0.28g to 0±0.1

EMS MODE - STBY

Perform EMS AV TEST & NULL
BIAS CHECK, pg G/2-5

PRIMARY WATER EVAP ACTIVATION

GLY EVAP H2O FLOW - AUTO

GLY EVAP STM PRESS - AUTO

PRI ECS GLY PUMP - AC1 (verify)

SET UP CAMERA

CM4/DAC/18/CIN - BRKT, MIR

(f16,250,7) 6fps, 8 min, MAG K B 2

EARTH ORBIT ENTRY
VEHICLE PREP

MODE III, MODE IV
MODE II, MODE III, MODE IV

P30 MANEUVER				L/5-6	
SET STARS				PURPOSE	
				PROP/GUID	
				WT	N47
R ALIGN				P TRIM	N48
P ALIGN				Y TRIM	
Y ALIGN				HRS	GETI
				MIN	N33
				SEC	
ULLAGE				ΔV_X	N81
				ΔV_Y	
				ΔV_Z	
				R	
				P	
				Y	
GET SEP				H _A	N44
ΔV SEP				H _P	
				ΔVT	
				BT	
				ΔVC	
				SXTS	
				SFT	
				TRN	
				BSS	
				SPA	
				SXP	
				LAT	N61
				LONG	
				RTGO	EMS
				VIO	
				GET	0.05G

Basic Date 9/70
Changed

CSM 109

Basic Date 9/70
Changed

CSM 109

E.O. ENTRY UPDATE (RET ref. to PAD GETI)												L/5-7	
X						X						AREA	
X	X	-				X	X	-				ΔV TAILOFF	
X	X	X				X	X	X				R	0.05G EMS
X	X	X				X	X	X				P	0.05G
X	X	X				X	X	X				Y	0.05G
+						+						RTGO EMS	
+						+						VIO	
X	X					X	X					RET 0.05G TIG	
	0						0					LAT N61	
												LONG	
X	X					X	X					RET 0.2G TIG	
												DRE (55°) N66	
R	R					R	R					BANK AN	
X	X					X	X					RET RB	
X	X					X	X					RETBBO	
X	X					X	X					RETEBO	
X	X					X	X					RETDROG	
X	X	X				X	X	X				(90°/fps) CHART	
X	X					X	X					DRE (90°) UPDATE	
POST BURN													
X	X	X				X	X	X				P	0.05G
+						+						RTGO	EMS
+						+						VIO	
X	X					X	X					RET 0.05G	
X	X					X	X					RET 0.2G	
												DRE ± 100 nm N66	
R	R					R	R					BANK AN	
X	X					X	X					RETRB	
X	X					X	X					RETBBO	
X	X					X	X					RETEBO	
X	X					X	X					RETDROG TO MAIN	

SM RCS/HYBRID DEORB
SPS DEORBIT
E.O. ENTRY UPDATE
E.O. BLOCK DATA

E.O. ENTRY UPDATE (RETTET, TO PAD GETI) L/5-8									
MODE III, MODE IV									
X					X				AREA
X	X	-			X	X	-		ΔV TAILOFF
X	X	X			X	X	X		R 0.05G EMS
X	X	X			X	X	X		P 0.05G
X	X	X			X	X	X		Y 0.05G
+					+				RTGO EMS
+					+				VIO
X	X				X	X			RET 0.05G
	0					0			LAT N61
									LONG
X	X				X	X			RET 0.2G
									DRE (55°) N66
R	R				R	R			BANK AN
X	X				X	X			RET RB
X	X				X	X			RETBBO
X	X				X	X			RETEBO
X	X				X	X			RETDROG
X	X	X			X	X	X		(90°/fps) CHART
X	X				X	X			DRE (90°) UPDATE
POST BURN									
X	X	X			X	X	X		P 0.05G
+					+				RTGO EMS
+					+				VIO
X	X				X	X			RET 0.05G
X	X				X	X			RET 0.2G
									DRE ± 100 nm N66
R	R				R	R			BANK AN
X	X				X	X			RETRB
X	X				X	X			RETBBO
X	X				X	X			RETEBO
X	X				X	X			RETDROG TO MAIN

Basic Date 3/9/70
Changed

Basic Date 3/9/70
Changed 4/8/70

CSM 10

PM 109

EARTH ORBIT BLOCK DATA L/5-9

X	X				1-4	X	X			AREA
X	X	X	+	2	1.6	X	X	X		LAT
X	X	-	1	4	8.0	X	X			LONG
0	0	1	0	4	4	7				GETI
X	X	X	3	1	7.3	X	X	X		ΔV_C
X	X			2-1		X	X			AREA
X	X	X	+	3	3.4	X	X	X		LAT
X	X	-	0	6	7.0	X	X			LONG
0	0	1	2	2	5	4				GETI
X	X	X	3	1	7.3	X	X	X		ΔV_C
X	X			2-4		X	X			AREA
X	X	X	+	2	1.0	X	X	X		LAT
X	X	-	1	4	8.0	X	X			LONG
0	0	2	3	7	1	8				GETI
X	X	X	3	1	7.3	X	X	X		ΔV_C
X	X			3-4		X	X			AREA
X	X	X	+	2	9.7	X	X	X		LAT
X	X	-	1	4	8.0	X	X			LONG
0	0	4	1	0	3	5				GETI
X	X	X	3	1	7.3	X	X	X		ΔV_C
X	X			4-4		X	X			AREA
X	X	X	+	3	3.4	X	X	X		LAT
X	X	-	1	4	8.0	X	X			LONG
0	0	5	4	3	4	5				GETI
X	X	X	3	1	7.3	X	X	X		ΔV_C

REMARKS:

1. Roll Right 90°
2. Do not use 2-1 for launch azimuth > 86°
3. Do not use 1-4 for launch azimuth < 86°

8

CM RCS CHECK

AUTO RCS A/C ROLL (4) - OFF (verify)
 cb RCS LOGIC (2) - closed (verify)
 SC CONT - SCS
 MAN ATT (3) - MIN IMP
 RCS TRANSFER - CM
 AUTO RCS SEL (RING 1) - MNA
 AUTO RCS SEL (RING 2) - MNB
 cb SCS B/D ROLL,P&Y MNA(3)-open
 TEST RING 2 THRUSTERS
 cb SCS B/D ROLL,P&Y MNA(3)-close
 cb SCS B/D ROLL,P&Y MNB(3)-open
 TEST RING 1 THRUSTERS
 cb SCS B/D ROLL,P&Y MNB(2)-close
 RCS TRANSFER - SM
 MAN ATT (3) - RATE CMD

9

MNVR TO PAD BURN ATT (BEF, HDS DN)
 LOAD DAP *0/180/0*
 BMAG MODE (3) - RATE 2
 SC CONT - CMC/AUTO
 ATT DB - MIN

10

V62E

11

V49E

12 F 06 22

DESIRED FINAL GMBL ANGLES (.01°)
 LOAD MNVR PAD GMBL ANGLES (0°,180°,0°)
 PRO

13 F 50 18

REQ MNVR TO FDAI RPY ANGLES (.01°)
 (AUTO) PRO
 (MAN) SC CONT - SCS
 BMAG MODE (3) - RATE 2
 MNVR To 15

14 06 18

AUTO MNVR TO FDAI RPY ANGLES (.01°)

15 F 50 18

REQ TRIM TO FDAI RPY ANGLES (.01°)
 (TRIM) Go to 13
 (BYPASS) ENTR

L
6-3

16

CHECK BORESIGHT & SXT STARS
 OPT MODE - CMC
 OPT ZERO - OFF

17

V41 N91E

18 F 21 92

SHAFT,TRUN (.01°, .001°)
 Load SXTS angles

19 41

OPTICS DRIVE
 Check SXT STAR
 Stow Optics eyepieces
 Check BORESIGHT STAR (if avail)

20

V25 N17E (.01°)
 Load Pad Data GMBL Angles
 for CM BURN ATT
 ATT SET tw - SET
 to PAD DATA GMBL ANGLES
 for CM BURN ATT

21

PWR REDUCTION (Hybrid only)
 MN BUS TIE (2) - ON
 HGA PWR - OFF
 FC PUMPS (3) - OFF
 FC 2 MNA - OFF
 Verify loads balanced
 VHF AM (A&B)-off (ctr)
 S BD PWR AMP - LOW
 cb ECS RAD CONT/HTR (2) - open
 cb WASTE H20/URINE DUMP HTRS(2)-open
 cb RAD HTRS OVLD (2) - open
 POT H2O HTR - OFF
 GLY EVAP TEMP IN - MAN

22

P41 - RCS THRUSTING
 V37E 41E

23 F 50 18

REQ MNVR TO BURN ATT (HDS DN) (.01°)
 (AUTO) BMAG MODE (3) - RATE 2
 SC CONT - CMC/AUTO
 PRO To 24

EARTH/POST LANDING

SPS DEORBIT

EARTH ORBIT ENTRY

SPS

SM RCS/HYBRID DEORB

EARTH ORBIT ENTRY
VEHICLE PREP

E.O. ENTRY UPDATE

E.O. BLOCK DATA

Basic Date 3/9/70
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CSM 109

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SM RCS/HYBRID DEORB

EARTH ORBIT ENTRY
VEHICLE PREP

E.O. ENTRY UPDATE

E.O. BLOCK DATA

L
6-4

(MAN/DAP) BMAG MODE (3) - RATE 2
SC CONT - CMC/HOLD

V62E

MNVR To 25

24 06 18 AUTO MNVR TO FDAI RPY (.01°)

25 F 50 18 REQ TRIM (.01°)

ALIGN SC ROLL
(AUTO TRIM) PRO To 24
(BYPASS) ATT DB - MIN
RATE - LOW
MAN ATT (3) - RATE CMD
BMAG MODE (3) - ATT1/RATE 2
If long Lambert (P37) burn
BMAG MODE (3) - RATE 2

ENTR

26 55:00m 06 85 VGX,Y,Z (.1fps)

RECHECK BORESIGHT STAR
TRANS CONTR PWR - on (up)
EMS MODE - STBY (verify)
EMS FUNC - Δ V SET/VHF RNG
SET Δ V for SM BURN = Δ V pad +100.0
EMS FUNC - Δ V
S BD ANT - OMNI C
SECS LOGIC (2) - ON
MSFN confirm Go for PYRO ARM
SECS PYRO ARM (2) - ARM
CM RCS LOGIC - ON

27 59:25 DSKY BLANKS

28 59:30 16 85 VG X,Y,Z (AVE G ON) (.1fps)

RHC's & THC - ARMED
LIMIT CYCLE - OFF
TAPE RCDR - HBR/RCD/FWD/CMD RESET
EMS MODE - NORMAL

L
6-5

00:00
29 F 16 85 REQ NULL VG X,Y,Z (.1fps)
BURN EMS Δ V CTR TO 100
RESET DET & COUNT UP

If SM ONLY burn go to step 32

THC - LOCKED
SC CONT - SCS/FREE
RATE - HIGH
PRIM GLY To RAD - BYPASS (verify)
MN BUS TIE (2) - ON (verify)

CM/SM SEP (2) - on (up)
MAN ATT(3)-MIN IMP
BMAG MODE(3)-RATE 2

C&W MODE - CM
RCS TRNFR - CM
CM RCS LOGIC - OFF
SECS PYRO ARM (2) - SAFE

Monitor VM A/B:

If <25 vdc, go to EMERG POWER DOWN

V63E (N17, CM BURN ATT)

* If CMC NO GO: *
* FDAI SOURCE - ATT SET *
* FDAI SEL - 1 or 2 *
* ATT SET - GDC *

MAN ATT PITCH - ACCEL CMD

FDAI SCALE - 5/5

MNVR TO CM BURN ATT(NULL ERR NEEDLES)

R 0°
(Θ ~290°) P 0° (~ 110° from SM BURN ATT)
Y 0°

CM RCS BURN

RATE - HI
B/D ROLL & YAW - single ring
RHC #1-Continuous Pitch Down
RHC #2-Modulate Pitch to null needles
BURN VGZ TO ZERO
* If only 1 RHC *
* Pulse $\pm$ P=5° from retro att*
* Maintain rates <3°/sec *

Hybrid
1 min

3/9/70

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CM RCS/HYBRID DEORB

SPS DEORBIT

EARTH ORBIT ENTRY

E.O. BLOCK DATA

L
8-2

6 F 16 63 RTOGO (.1nm) _____ PAD _____
VIO (fps) _____ PAD _____
TFE (min-sec) _____
NO COMM, SET RTOGO & VIO IN EMS &
INITIALIZE
(ACCEPT) PRO
(RECYCLE) V32E to 5 (TFE sensitive to oblateness)

P62 - CM/SM SEP & PRE-ENTRY MNVR

7 F 50 25 00041 REQUEST CM/SM SEP
For HYBRID DEORBIT, PRO to 8

SC CONT - SCS/FREE
YAW - 45° out-of-plane (left for RCS,
right for SPS)
RATE - HIGH
ATT DB - MIN
MAN ATT (3) - RATE CMD
BMAG MODE (3) - ATT1/RATE2
PRIM GLY to RAD - BYPASS (verify)
EMS MODE-STBY (verify)
CM RCS LOGIC - on (up)
SECS LOGIC (2) - on (up)
MSFN confirm GO for PYRO ARM
SECS PYRO ARM (2) - ARM
MN BUS TIE (2) - ON (verify)

CM/SM SEP (2) - ON
If docking ring still on:
CSM/LM FNL SEP (2) - on(up)(verify)
MAN ATT(3)-MIN IMP
BMAG MODE(3)-RATE 2
C&W MODE - CM
RCS TRNFR - CM
CM RCS MANF PRESS - 287-302 psia
CM RCS LOGIC - OFF
SECS PYRO ARM (2) - SAFE
Monitor VMA/B:
If <25vdc go to EMERG POWER DOWN
AUTO RCS SEL A/C ROLL (4) - OFF
AUTO RCS SEL CM 2(6) - OFF
AUTO RCS SEL CM 1(6) - MNA or MNB

Basic Date 3/9/70
Changed

Basic Date 3/9/70
Changed

CM 109

CM 109

L
8-3

MNVR TO ENTRY ATT

SPS RCS
R 0° (Lift up) R 180° (Lift dn)
P Horiz on 29° mark(400K) P
Y 0° Y 0°

ATT DB - MAX
MAINTAIN HORIZ TRK
MAN ATT (3)-RATE CMD
PRO (Act ENTRY DAP Att Hold)

8 F 06 61 IMPACT LAT, LONG, HDS/DN
(.01°, .01°, -00001)

EMS INITIALIZATION (except RCS DEORBIT)

If scroll not on 37K
* EMS FUNC-TEST 5 *
* Slew scroll to 37K*

EMS FUNC - RNG SET
Set RNG TO PAD DATA RNG
EMS FUNC - Vo SET
Slew scroll to PAD DATA VIO
Do not go thru TEST 3 or 5
EMS MODE - STBY (verify)
EMS FUNC - ENTRY

RSI ALIGNMENT (except RCS DEORBIT)

FDAI SOURCE - ATT SET
ATT SET - GDC
EMS ROLL - on(up)
GDC ALIGN PB - PUSH & HOLD
YAW tw - Position RSI thru 45° &
back to LIFT UP
GDC ALIGN PB - RELEASE
EMS ROLL - OFF
Align GDC to IMU

EMS FUNC - ENTRY (verify)

PRO (CMC Guidance)

9 POSS 06 22 FINAL ATT DISP, RPY (.01°)
(Only if X-axis beyond 45° of Vel vector)

EARTH/POST LANDING

LV

ECS

RDC

P63 - ENTRY INIT

10 06 64 G,VI,RTOGO (.01G,fps,.1nm)
 FDAI SCALE - 5/5
 ROT CONTR PWR DIR (2)-MNA/MNB (verify)
 TAPE RCDR - HBR/RCD/FWD
 HORIZ CK
 Pitch error needle goes toward
 zero approaching .05G time
 If CMC is GO:
 SC CONT - CMC/AUTO
 *If DAP NO GO: *
 * SC CONT - SCS*
 * FLY BETA *
 *If CMC NO GO: *
 * SC CONT - SCS*
 * FLY EMS *
 SPS DEORBIT: Track horiz with 29° window mk
 Maintain Lift up until .2G
 RCS DEORBIT: Track horiz with 9° window mk
 Maintain SCS control, Lift dn
 until 1G then CMC, lift up
 *After 1G, if both RCS ring *
 * He press <1550 psia, *
 * roll 20°/sec & disable RCS*
 *After peak G, enable RCS & *
 * fly BETA = 90° *

P64 - ENTRY POST .05G

Start DAC
 RTOGO AT .05G AGREES WITH EMS-verify
 HORIZ CK

EMS MODE - BACKUP/VHF RNG ON TIME
 .05 G Lt - on
 .05 G sw - on (up)
 EMS ROLL - on (up)

.05G time
 (+0:)
 (: :)

L
 8-5

06 74 BETA, VI, G (.01°,fps,.01G)
 NOTE: To monitor N68, Key V16 N68E
 Compare RSI & FDAI
 If CMC or PAD cmds Lift DN,
 MNVR Lift DN
 EMS GO/NO GO
 G-V Plot within limits
 Go to 12 (P67) or continue

P67 - ENTRY - FINAL PHASE (0.2G)

12 06 66 ^{+ = N & long}
 BETA,CRSRNG ERR,DNRNG ERR (.01°, .1nm, .1nm)
 KEY VERB
 Record DNRNG ERR _____
 KEY RLSE
 Limit: +100nm from PAD DRE
 Monitor lift vector on RSI & FDAI
 CM RCS: change rings when He PRESS
 <1150 psia
 F 16 67 RTOGO,LAT,LONG (Vrel=1000fps)
^{sign invalid} (.1nm,.01°, .01°)
 SC CONT - SCS
 RTOGO NEG - LIFT UP
 RTOGO POS - LIFT DOWN
 Monitor altimeter
 Record LAT, LONG, & voice to RECY at 10K'
 Record EMS RTGO
 EMS MODE - STBY
 EMS FUNC - OFF
 DAC - f11

Go To EARTH/POST LANDING pg L/9-1

SM RCS/HYBRID DEORB

SPS DEORBIT

EARTH ORBIT ENTRY

F C RTOGO DATA

Basic Date 3/9/70
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CSM 109

Basic Date 3/1/70
 Changed

CSM 109

EARTH/POST LANDING

LV

ECS

EPS

SM RCS/HYBRID DEORB

SPS DEORBIT

EARTH ORBIT ENTRY

E C BLOCK DATA

L
9-1

EARTH/POST LANDING

Start Watch

3RT (:) STEAM PRESS - pegged at 90K (00:00)
 50K' (:) CABIN PRESS REL vlv (2) - BOOST/ENTRY (00:54)
 SECS PYRO ARM (2) - ARM
 Check Altimeter

40K' (:) * CM UNSTABLE *(01:08)
 *RCS CMD - OFF *
 * 40K' APEX COVER JETT PB-PUSH *
 DROGUE DEPLOY PB - PUSH (2 sec
 *after apex cover jett) *

30K' ELS LOGIC - on (up) (01:26)
 ELS - AUTO

24K' (:) RCS disable (auto) (01:40)
 RCS CMD - OFF

Apex cover jett (auto)
 APEX COVER JETT PB - PUSH
 (WAIT 2 SECS)
 Drogue parachutes deployed (auto)
 DROGUE DEPLOY PB - PUSH

If Both Drogues Fail:
 *ELS - MAN *
 *Stabilize CM *
 5K' MAIN DPLY PB - PUSH
 *ELS - AUTO *

23.5K' Cabin Pressure increasing
 *If not increasing by 17K': *
 CABIN PRESS REL vlv (RH) - DUMP

10K' (:) Main parachutes deployed (Drogues +49s) (02:31)
 MAIN DEPLOY PB - PUSH (within 1 sec)
 VHF ANT - RECY
 VHF AM A - SIMPLEX
 VHF BCN - ON
 DIRECT 02 vlv - OPEN (if suited)

37770

Basic Date

Changed

CSM 109

EARTH/POST LANDING

LV

ECS

EPS

EARTH/POST LANDING

SPS DEORBIT

EARTH ORBIT ENTRY

E.O. BLOCK DATA

L
9-2

CABIN PRESS REL vlv (2) - CLOSE
 CM RCS LOGIC - on (up)
 * IF MAIN OR PYRO BUS *
 * LOST, USE RHC'S FOR *
 * BURN, NOT DUMP SW *
 CM PRPLNT - DUMP (burn audible)
 Monitor CM RCS 1&2 for He press decrease
 *NO BURN or PRESS DECREASE *
 * USE BOTH RHC's *
 *DO NOT FIRE PITCH JETS *
 CM PRPLNT-PURGE
 *CM RCS He DUMP PB - PUSH *
 RHC (2) - 30 secs, No PITCH

Stow DAC
 STRUT LOCKS (4) - UNLOCK
 If night landing:
 cb FLOAT BAG #3, FLT/PL (1 cb)-close
 PL BCN LT - LOW
 cb FLT & PL BAT BUS A,B,&BAT C (3)-close
 cb FLT & PL MNA & B (2) - open
 cb RAD HTR OVLD (2) - open (verify)
 cb SPS P&Y (4) - open (verify)
 cb BAT RELAY BUS (2) - open

3K'
 CM RCS PRPLNT (2) - OFF (terminates purge)
 CABIN PRESS REL vlv (RH) - DUMP
 ELS AUTO (verify)
 ELS LOGIC - ON (verify)
 FLOOD Lts - POST LDG

800'
 CAB PRESS RELF vlv - CLOSE (latch off)
 MN BUS TIE (2) - OFF

POSTLANDINGSTABILIZATION, VENTILATION, COMMUNICATIONS

1 Stabilization after landing
 cb MAIN REL PYRO (2) - close
 MAIN RELEASE - on (up)
 SECS PYRO ARM (2) - SAFE
 SECS LOGIC (2) - OFF
 No contact with recovery forces
 *VHF AM A&B - off (ctr) *
 *VHF AM RCV ONLY - A *
 cb PL VENT - close
 cb FLOAT BAG (3) - close
 cb UPRIGHT SYS COMPRESS (2) - close

L
9-3

If Stable II:
 FLOAT BAG(3)-FILL till 2 min after
 upright, then - OFF
 VHF AM A/B & BCN - OFF while inverted
 If Stable I:
 After 10 Min Cooling Period,
 FLOAT BAG (3) - FILL 7 min, then OFF

2 Post Stabilization And Ventilation

PL BCN LT - BCN LT LOW
 PL VENT vlv - UNLOCK (Pull)
 Remove PL VENT Exh Cover
 PL VENT - HIGH or LOW
 If req'd
 PL DYE MARKER - ON
 *Deploy auxiliary dye marker *
 Release restraints
 cb MNA BAT BUS A & BAT C (2) - open
 cb MNB BAT BUS B & BAT C (2) - open
 cb FLT & PL BAT C - open
 cb PYRO A SEQ A - open
 cb PYRO B SEQ B - open
 *EACH HR - CHECK DC VOLTS $\geq$ 27.5 V *
 *If Not: *
 * cb FLT & PL-BAT BUS A&B (2) -open*
 * cb FLT & PL BAT C (1) - close *
 * GO TO LOW POWER CHECKLIST *
 Unstow and install PLV DISTRIB DUCT
 Deploy grappling hook and line if req'd

UNAIDED EGRESS PROCEDURESPREPARATION

Disconnect umbilicals
 Neck dams on (if suited)
 Configure couch(s) - 270°
 Armrests stowed
 Unstow survival kits
 Connect lanyards, (green to S/C, white to crew)

STABLE I

PL VENT - OFF
 cb Pnl 250. (all) - open

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Changed

SM 109

GEC

LV

ECS

FPS

EARTH/POST LANDING

LV

ECS

EPS

EMER
1-8

AC BUS 2 LOST - LAUNCH, SPS BURNS OR ENTRY

SPS BURNS ONLY TVC SERVO PWR 2 - AC 1/MNA
SCS TVC (P&Y) - AUTO
AVCG - LM/CSM
MTVC WITH TRIM THUMBWHEELS (SCS)
BMAG MODE (3) - RATE 1
AC INV 2 MNB - OFF
ALL FDAI SEL - 1
✓ FDAI SOURCE - CMC
✓ SUIT COMPR - AC 1
✓ ECS GLY PUMP - AC 1

BAT BUS A LOST - LAUNCH, SPS BURNS OR ENTRY

LAUNCH ONLY EDS AUTO/OFF - OFF
AUTO RCS SEL (RING 1) - OFF
TVC GMBL DR (P,Y) - 2
(IF BUS LOST BEFORE GMBL MTRS ON)
SPS BURNS ONLY cb SPS P2 & Y2 (Pnl 8) - OPEN
(CRIT BURNS - AFTER GMBL MTRS ON)
cb B/D ROLL, P&Y (MNB)(3)(Pnl 8)
- CLOSED
ENTRY ONLY * cb SCS CONTR/AUTO (2)(Pnl 8) - OPEN
(AFTER APEX COVER JET)
ALL cb MNA BAT C (Pnl 275) - CLOSED
cb SCS B/D Roll, P&Y MNA (3) (Pnl 8)
*Before cmism sep - open
After RCS transfer to cm - close*
manual
BAT BUS B LOST - LAUNCH, SPS BURNS OR ENTRY

LAUNCH ONLY EDS AUTO/OFF - OFF
AUTO RCS SEL (RING 2) - OFF
TVC GMBL DR (P,Y) - 1
(IF BUS LOST BEFORE GMBL MTRS ON)
SPS BURNS ONLY cb SPS P1 & Y1 (Pnl 8) - OPEN
(CRIT BURNS - AFTER GMBL MTRS ON)
cb SCS B/D ROLL, P&Y (MNA)(3)(Pnl 8)
- CLOSED
ENTRY ONLY * cb SCS CONTR/AUTO (2)(Pnl 8) - OPEN
(AFTER APEX COVER JET)
ALL cb MNB BAT C (Pnl 275) - CLOSED
cb SCS B/D Roll, P&Y MNB (3) (Pnl 8)
*Before cmism sep - open
After RCS transfer to cm - close*
manual

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Changed 4/3/70

CSM 1

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CSM 1

EMER
1-9

CMC LITE

SC CONT - SCS
SEE G&N 5

ISS LITE + PROG ALARM LITE

SC CONT - SCS
SEE G&N 6

ABNORMAL DYNAMICS - CRITICAL SPS BURN

THC - CW
DAMP RATES USING RATE NEEDLES
AFTER SHUTDOWN, AUTO RCS SEL (16) - OFF
SEE G&C 1

* BAT BUS A (B) lost:
prior to cmism sep pull cb(3)
CONTR/AUTO ROLL, PITCH, YAW MNA (MNB)
AUTO RCS TRANSFER AT cmism sep
RCS TRANS - CM
cb(3) CONTR/AUTO MNA (MNB) - close
if desired

see 1-8

G&C

RCS

ALARM CODES

CREW LOG

MASTER

APOLLO 13

CSM LAUNCH CHECKLIST

PART NO.	S/N
SKB32100082-309	1002

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Procedure for charging Bat A

1. Pnl 250 Ch Bat A PurExt/PostLand - close (open)
2. 275 Ch Invt Pur 2 MNB - close (open)
3. 5 Ch Bat Rly Bus Bat A - close (open)
- Ch EPS Sess Unit AC Bus 2 - close (open)
- Ch EPS Sess Seg AC2 - close (open)
- Ch Bat Charger Main B - close (open)
- Ch Bat Charger AC Pur - close (open)
- Ch Bat Charger Bat A charge - close (open)
- Ch Invt Cont 2 - close (open)
- Ch Invt Cont 3 - close (open)
- Main Bus Tie Bat A/C - Off
- Bat Charge - AC2 (AC1)

- 3 AC INV 2 - MNB
- INV 2 AC BUS 2 - ON (off)
- AC BUS 2 REPT - RESET (center (off))
- BAT CHARGE - A (off)
- DC INV a/c BAT charger (MNB)
- Report Amps & volts to MSFN
- Every 10 min for 1st 30 min
- and then every 30 min on MSFN call

PROCEDURE

To Reverse

- 3 Bat Charge - OFF
- AC INV 2 - OFF
- Pnl 5 Main Bus Tie A/C - ON
- 250 Ch Bat A Pur Ext & P/C - open
- 275 Invt Pur 2 MNB - open
- reverse steps above

Basic Date
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CSM 1

LIFTOFF CONFIG

BOOST-INSERTION-TLI

LAUNCH TRAJECTORY

NEAR INSERTION

LIFTOFF CONFIGURATIONPANEL 1 ✓

EMS FUNC - ~~AV~~ OFF
 EMS MODE - STBY
 GTA - off (down)
 EMS GTA COVER - Secure
 CMC ATT - IMU
 FDAI SCALE - 5/5
 FDAI SEL - 1 1/2 1
 FDAI SOURCE - EMC GDC
 ATT SET - GDC
 MAN ATT ROLL - RATE CMD
 MAN ATT PITCH - ACCEL-CMD RATE CMD
 MAN ATT YAW - RATE CMD
 LIM CYCLE - OFF
 ATT DBD - MIN
 RATE - HIGH
 TRANS CONTR PWR - on-(up) OFF
 RHC PWR NORM (2) - AC/DC OFF
 RHC PWR DIR (2) - MNA/MNB OFF
 SC CONT - SCS
 CMC MODE - FREE
 BMAG MODE ROLL - RATE-1 RATE 2
 BMAG MODE PITCH - RATE-1 RATE 2
 BMAG MODE YAW - RATE-1 RATE 2
 SPS THRUST - NORMAL (lock)
 AV THRUST (2) - OFF (guarded)
 SCS TVC PITCH - AUTO
 SCS TVC YAW - AUTO
 SPS GMBL MOT PITCH (2) - OFF
 SPS GMBL MOT YAW (2) - OFF
 AV CG - LM/CSM
 ELS LOGIC - OFF (guarded)
 ELS AUTO - AUTO MANUAL
 CM RCS LOGIC - on (up) OFF DN
 CM PRPLNT DUMP - OFF (guarded)
 CM PRPLNT PURG - off (down) (guarded)
 IMU CAGE - off (down) (guarded)
 EMS ROLL - OFF
 .05G sw - OFF

3/9/70

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Changed

CSM 109

 1.
 2.
 3.

D.

Proceto Per

LIFTOFF CONFIG

α/Pc IND sw - α PC
LV/SPS IND SII/SIVB - SII/SIVB- CFI
TVC GMBL DR PITCH - AUTO
TVC GMBL DR YAW - AUTO
EVNT TMR RSET - up (center)
EVNT TMR STRT - center STOP
EVNT TMR MIN - center
EVNT TMR SEC - center

PANEL 2 ✓

PL VENT vlv - push (lock)
PROBE EXTD/REL - OFF (guarded)
PROBE EXTD/RETR (2) tb - gray
DOCK PROBE RETR PRIM - OFF
DOCK PROBE RETR SEC - OFF
EXT RUN/EVA LT - OFF
EXT RNDZ LT - off (center)
TUNL LT - OFF
LM PWR - OFF
SM RCS He 1 (4) - center (on, up*)
SM RCS He 1 tb (4) - gray
UP TLM CM - BLOCK
UP TLM IU - BLOCK
CM RCS PRESS - off (down) (guarded)
SM RCS IND sw - PRPLNT QTY
SM RCS He 2 (4) - center (on, up*)
SM RCS He 2 (4) tb - gray
SM RCS HTRS (4) - OFF
SM RCS PRPLNT (4) - center (on, up*)
SM RCS PRPLNT tb (8) - gray bP
RCS CMD - center (OFF*)
RCS TRNFR - center (SM*)
CM RCS PRPLNT (2) - center (on, up*)
CM RCS PRPLNT tb (2) - gray
SM RCS SEC FUEL PRESS (4) - Center (CLOSE*)
EDS AUTO - on (up) OFF
CSM/LM FINAL SEP (2) - off (down) (guarded)
CM/SM SEP (2) - off (down) (guarded)
SIVB/LM SEP - off (down) (guarded)
PRPLNT DUMP - AUTO
2 ENG OUT - AUTO
LV RATES - AUTO

Procs
to Rev

L
1-2

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CSM 109

TWR JETT (2) - ~~AUTO~~ (down) (guarded) OFF
LV GUID - IU
LV STAGE - off (down) (guarded)
XLUNAR - INJECT
MN REL - off (down) (guarded)
MSN TMR HR - off (center)
MSN TMR MIN - off (center)
MSN TMR SEC - off (center)
C/W NORM - BOOST ACK
C/W CSM - CSM CH
C/W PWR - 1 OFF
C/W LAMP TEST - off (center)
MSN TMR - START
RCS IND sel - SM D
CAB FAN (2) - OFF
H2 HTRS (2) - AUTO OFF
O2 HTRS (2) - AUTO OFF
O2 PRES IND sw - SURGE TK
H2 FANS (2) - OFF
O2 FANS (2) - OFF
ECS IND sel - PRIM
ECS RAD FLOW AUTO CONT - AUTO
ECS RAD tb - gray
ECS RAD FLOW PWR CONT - off (center)
ECS RAD MAN SEL - RAD 1
ECS RAD PRIM HTR - off (center)
ECS RAD SEC HTR - OFF
POT H2O HTR - OFF
SUIT CKT H2O ACCUM AUTO - 1
SUIT CKT H2O ACCUM - off (center)
SUIT CKT HT EXCH - off (center)
SEC COOL LOOP EVAP - off (center)
SEC COOL LOOP PUMP - off (center)
H2O QTY IND sw - POT
GLY EVAP IN TEMP - MAN
GLY EVAP STM PRESS AUTO - MAN
GLY EVAP STM PRESS INCR - center
GLY EVAP H2O FLOW - off (center)
CAB TEMP - MAN
CAB AUTO TEMP tw - max decr
HI GAIN ANT TRACK - AUTO
HI GAIN ANT BEAM - WIDE
HI GAIN ANT PITCH POS - 0°

TLI TRAJECTORY OPF 1
NOM & MAN

BOOST-INSERTION-TLI

LAUNCH TRAJECTORY

NEAR INSERTION

LIFTOFF CONFIG

L
1-4

HI GAIN ANT YAW POS - 180°
HI GAIN ANT PWR - OFF
HI GAIN ANT SERVO ELECT - PRIM

PANEL 3 ✓

VHF ANT - SM LEFT
SPS ENG INJ VLV ind (4) - CLOSE
FC RAD (3) - center (NORMAL*)
FC RAD (3) tb - N/A
FC HTRS (3) - ~~on (up)~~ OFF
FC IND sel - 2
SPS QTY TEST - off (center)
OXID FLOW VLV INCR - ~~NORM~~ INCR
OXID FLOW VLV PRIM - PRIM
PUG MODE - NORM
FC PURG (3) - OFF
FC REAC (3) - center (on, up*)
FC REAC tb (3) - gray
FC 1 MN BUS A - ~~center (on, up*)~~ OFF
FC 1 MN BUS A tb - gray
FC 2 MN BUS A - ~~center (on, up*)~~ OFF
FC 2 MN BUS A tb - gray
FC 3 MN BUS A - OFF
FC 3 MN BUS A tb - ~~bp~~ gray
MN BUS A RSET - ~~center (RESET*)~~ OFF
FC 1 MN BUS B - OFF
FC 1 MN BUS B tb - ~~bp~~ gray
FC 2 MN BUS B - OFF
FC 2 MN BUS B tb - ~~bp~~ gray
FC 3 MN BUS B - ~~center (on, up*)~~ OFF
FC 3 MN BUS B tb - gray
MN BUS B RSET - ~~center (RESET*)~~ OFF
DC IND sel - MNA
BAT CHARGE - OFF
SPS He vlv (2) - AUTO
SPS He vlv tb (2) - bp
SPS LINE HTRS - off (center)
SPS PRESS IND sw - He
S BD XPNDR - ~~PRIM~~ OFF
S BD PWR AMPL PRIM - PRIM
S BD PWR AMPL HI - ~~HIGH~~ OFF
PWR AMPL tb - gray bp

4.

Proc
to E

Basic Date
Changed 3-2-70

Basic Date
Changed 3/9/70

CSM 09

S BD MODE VOICE - VOICE
S BD MODE PCM - PCM
S BD MODE RNG - RNG
S BD AUX TAPE - off (center)
S BD AUX TV - off (center)
UP TLM DATA - DATA
UP TLM CMD - NORM OFF
S BD ANT OMNI - B
S BD ANT - OMNI
VHF AM A - (center)
VHF AM B - DUPLEX center
VHF AM RCV - off (center)
VHF AM SQLCH tw (2) - noise threshold + 1 div
VHF BCN - OFF
VHF RNG - OFF
S BD SQUELCH - ~~ENABLE~~ OFF
FC REACS vlv - ~~LATCH~~ NORM
H2 PURG LINE HTR - OFF
TAPE RCDR PCM - PCM/ANLG
TAPE RCDR RCD - RCD
TAPE RCDR FWD - ~~FWD~~ center
TAPE MOTION tb - gray bp.
SCE PWR - NORM center
PMP PWR - NORM center
PCM BIT RATE - HI
AC INV 1 - ~~MNA~~ OFF
AC INV 2 - ~~MNB~~ OFF
AC INV 3 - OFF
INV 1 AC 1 - ~~on (up)~~ OFF
INV 2 AC 1 - OFF
INV 3 AC 1 - OFF
AC 1 RSET - ~~center (RESET*)~~ OFF
INV 1 AC 2 - OFF
INV 2 AC 2 - ~~on (up)~~ OFF
INV 3 AC 2 - OFF
AC BUS 2 RSET - ~~center (RESET*)~~ OFF
AC IND sel - BUS 20C

PANEL 4 ✓

SPS GAUGING - AC1 OFF
TELCOM GRP 1 - AC1 OFF
TELCOM GRP 2 - AC2 OFF
GLY PUMPS - 1 - AC1 OFF

SUIT COMPR 1 - AC1 OFF
SUIT COMPR 2 - OFF OFF
CB Panel 4 - all closed - ?

PANEL 5

FC1 PUMPS - AC1 OFF
FC2 PUMPS - AC2 OFF
FC3 PUMPS - AC2 OFF
G/N PWR - AC1 OFF
MN BUS TIE BAT A/C - on (up) off
MN BUS TIE BAT B/C - on (up) off
BAT CHGR - AC1
NONESS BUS - OFF
INT INTGL LT - as desired OF
INT FLOOD LT - OFF, full dim or full bright
INT FLOOD LT DIM - 1
INT FLOOD LT FIXED - OFF
cb Panel 5 all closed except: all open

cb INST NONESS - open
cb INST SCI EQUIP SEB 1 - open
cb INST SCI EQUIP SEB 2 - open
cb INST SCI EQUIP HATCH - open
cb WASTE H2O/UR DUMP HTRS (2) - open

PANEL 6

MODE - INTERCOM/PTT
PWR - AUDIO/TONE OFF
INTERCOM - T/R
PAD COMM - OFF
S BD - T/R
VHF AM - T/R
AUDIO CONT - NORM
SUIT PWR - on (up) OFF
tw settings - as desired

PANEL 7

EDS PWR - on (up) OFF
SCS TVC SERVO PWR #1 - AC1/MNA OFF
SCS TVC SERVO PWR #2 - AC2/MNB OFF
FDAI/GPI PWR - BOTH OFF
LOGIC 2/3 PWR - on (up) OFF

SCS ELEC PWR - GDC/ECA OFF
SCS SIG CONDR/DR BIAS 1 - AC1 OFF
SCS SIG CONDR/DR BIAS 2 - AC2 OFF
BMAG PWR (2) - ON OFF
DIRECT O2 vlv - open (CCW) (>2 in H2O on SUIT/CAB AP ind)

PANEL 8

cb Panel 8 - all closed except:

cb CM RCS HTRS (2) - open
cb FLOAT BAG (3) - open
AUTO RCS SEL A/C ROLL A1 - OFF
AUTO RCS SEL A/C ROLL C1 - OFF
AUTO RCS SEL A/C ROLL A2 - OFF
AUTO RCS SEL A/C ROLL C2 - OFF
AUTO RCS SEL B/D ROLL B1 - MNA
AUTO RCS SEL B/D ROLL D1 - MNB
AUTO RCS SEL B/D ROLL B2 - MNA
AUTO RCS SEL B/D ROLL D2 - MNB
AUTO RCS SEL PITCH A3 - MNB
AUTO RCS SEL PITCH C3 - MNA
AUTO RCS SEL PITCH A4 - MNA
AUTO RCS SEL PITCH C4 - MNB
AUTO RCS SEL YAW B3 - MNA
AUTO RCS SEL YAW D3 - MNB
AUTO RCS SEL YAW B4 - MNB
AUTO RCS SEL YAW D4 - MNA

INT NUM LT - as desired
INT INTGL LT - as desired
INT FLOOD LT - OFF, full dim, or full brt
FLOOD LTS DIM - 1
FLOOD LTS FIXED - OFF
FLOAT BAG (3) - VENT (locked)
SECS LOGIC (2) - on (up) (locked) OFF
SECS PYRO ARM (2) - on (up) (locked) OFF

PANEL 9

MODE - INTERCOM/PTT
PWR - AUDIO/TONE OFF
INTERCOM - T/R
PAD COMM - OFF
S BD - T/R
VHF AM - T/R

Sec Logic bld (4) - open
Sps PLY (4) - open
Sec Guying (3) - open
SEC ACH (2) - open
EDS (3) - open
GCS BATT DATA (2) - open
FLK PL/AVENT - open
GCS DE VU (2) - open
SM RCS HTRA MNB - open
SM RCS HTRC MNB - open
SM RCS HTR B MNB - open
SM RCS HTR D MNB - open

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Changed

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L
1-8

AUDIO CONT - NORM
SUIT PWR - on (up) *off*
VHF RNG - NORM
tw settings - as desired

PANEL 10 ✓

MODE - INTERCOM/PTT
PWR - AUDIO/TONE *OFF*
PAD COMM - OFF
INTERCOM - T/R
S BD - T/R
VHF AM - T/R
AUDIO CONT - NORM
SUIT PWR - on (up) *OFF*
tw settings - as desired

PANEL 12 ✓

LM TUNL VENT vlv - LM/CM ΔP

PANEL 13

FDAI sw (2) - INRTL
EARTH/LUNAR - PWR OFF
ALT SET - 100
LTG - OFF
MODE - HOLD/FAST
SLEW - off (center)

PANEL 15 ✓

COAS PWR - OFF
UTIL PWR - OFF
PL BCN LT - off (center)
PL DYE MARKER - off (down) (guarded)
PL VENT - OFF

PANEL 16 ✓

DOCK TRGT - OFF
UTIL PWR - OFF
COAS PWR - OFF

PANEL 100 ✓

UTIL PWR - OFF
FLOOD LTS DIM - 1
FLOOD LTS FIXED - OFF
OPT PWR - OFF
IMU PWR - on (up) (guarded) *OFF*
RNDZ XPNDR - OFF
NUMERICS LT - as desired *off*
FLOOD LTS - off, full dim, or full bright *off*
INTGL LT - as desired *off*

PANEL 101 ✓

SYS TEST (LH) - 4
SYS TEST (RH) - B
CM RCS HTRS - OFF
UR DUMP - HTR A *off*
WASTE H2O DUMP - HTR A *off*
RNDZ XPNDR - OPR

PANEL 122 ✓

OPT ZERO - ZERO
OPT TELTRUN - SLAVE TO SXT
OPT COUPLING - DIRECT
OPT MODE - MAN
OPT SPEED - LO
COND LAMPS - ON *off*
UP TLM - ACCEPT

PANEL 162

SCI PWR - OFF (verified at panel closeout)

PANEL 163

SCI/UTIL PWR - OFF (verified at panel closeout)
PWR 201 ✓ Fuel warning - off
PANEL 225 ✓

cb Panel 225 - all closed except:
cb HI GAIN ANT FLT BUS - open
cb HI GAIN ANT GRP 2 - open

SBD XMTR DSE GPI - *on*
FLT BUS MAN - *open*
PLT BUS MAN - *open*
CRE (2) - *open*

Basic Date
Changed

Basic Date
Changed

CSM 109

TLI TRAJECTORY OPP 1
NOM & MAN

BOOST-INSERTION-TLI

LAUNCH TRAJECTORY

NEAR INSERTION
ABORT

PANEL 226 ✓

cb Panel 226 - all closed except:
cb ~~FC~~ REACS (3) - open
cb ~~FC~~ RAD (3) - open
cb COAS/TUNE LTC MNB - open

PANEL 227 ✓

SCI PWR - OFF

PANEL 229 ✓

cb Panel 229 all closed except:
cb MAIN REL PYRO (2) - open
cb 02 VAC ION PUMPS (2) - open
cb ~~Timing~~ 3 - open

PANEL 250 ✓

cb Panel 250 - all closed except:
cb ~~PYRO A TIE TO BAT BUS A~~ - open
cb ~~PYRO B TIE TO BAT BUS B~~ - open
cb ~~BAT C TO BAT BUS A~~ - open
cb ~~BAT C TO BAT BUS B~~ - open

PANEL 251 ✓

WASTE MGMT OVBD DRAIN vlv - OFF

PANEL 252 ✓

BAT VENT vlv - CLOSED
WASTE STOWAGE VENT vlv - VENT closed

PANEL 275 ✓

cb Panel 275 - all closed except:
cb ~~MNA BAT C~~ - open
cb ~~MNB BAT C~~ - open
cb ~~FLT/PL BAT BUS A~~ - open
cb ~~FLT/PL BAT BUS B~~ - open
cb ~~FLT/PL BAT C~~ - open

1-10

PANEL 276 ✓

cb Panel 276 - all closed

PANEL 278 ✓

cb Panel 278 - all closed except:
cb ~~UPRT SYS COMPR (2)~~ - open

PANEL 300 ✓

LH SUIT FLOW vlv - FULL FLOW

PANEL 301 ✓

RH SUIT FLOW vlv - FULL FLOW

PANEL 302 ✓

CTR SUIT FLOW vlv - FULL FLOW

PANEL 303 ✓

PRIM CAB TEMP vlv - COLD (CW)
SEC CAB TEMP vlv - COOL-MAX (CW)

PANEL 304 ✓

DRNK H2O SUPPLY vlv - OFF (CW)

PANEL 305 ✓

FOOD PREP COLD H2O vlv - rel
FOOD PREP HOT H2O vlv - rel

PANEL 306 ✓

MSN TMR - START STOP
EVNT TMR RSET - UP (center) STOP
EVNT TMR STRT - center
EVNT TMR MIN - center
EVNT TMR SEC - center
MSN TMR HR - center
MSN TMR MIN - center
MSN TMR SEC - center

1-11

TLI TRAJECTORY OP 1
NOM & MAN

BOOST-INSERTION-TLI

LAUNCH TRAJECTORY

NEAR INSERTION
ABORT

L
1-12

PANEL 325 ✓

CAB PRESS RELF vlv (RH) - BOOST/ENTRY *NORMAL*
CAB PRESS RELF vlv (LH) - BOOST/ENTRY *NORMAL*
PRIM GLY TO RAD vlv - BYPASS (pull)

PANEL 326 ✓

REPRESS PKG vlv - ON OFF
SM 02 SUPPLY vlv - ON OFF
SURGE TK 02 vlv - ON OFF
GLY RSVR IN vlv - OPEN *CLOSE*
GLY RSVR BYPASS vlv - CLOSE *OPEN*
GLY RSVR OUT vlv - OPEN *CLOSE*

PANEL 350 ✓

CO2 CSTR DIVERT vlv - both (center)

PANEL 351 ✓

MAIN REG vlv (2) - open *CLOSE*
H2O/GLY TK PRESS REG vlv - BOTH OFF
H2O/GLY TK PRESS RELF vlv - BOTH OFF
EMER CAB PRESS vlv - OFF
CAB REPRESS vlv - OFF (CCW)

PANEL 352 ✓

WASTE TK SERVICING vlv - CLOSE
PRESS RELF vlv - 2
POT TK IN vlv - OPEN
WASTE TK IN vlv - AUTO

PANEL 375 ✓

SURGE TK PRESS RELF vlv - open (CW)

PANEL 376 ✓

PLVC - NORMAL (up)

PANEL 377 ✓

GLY TO RAD SEC vlv - BYPASS (CCW)

PANEL 378 ✓

PRIM GLY ACCUM vlv - open (CCW)

PANEL 379 ✓

PRIM ACCUM FILL vlv - OFF (CW)

PANEL 380 ✓

02 DEMAND REG vlv - BOTH OFF
SUIT TEST vlv - OFF
SUIT CKT RET vlv - close (push) *pull trigger*

PANEL 382 ✓

SUIT HT EXCH PRIM GLY vlv - FLOW (CCW)
SUIT FLOW RELF vlv - OFF
PRIM GLY EVAP IN TEMP vlv - MIN (CCW)
SUIT HT EXCH SEC GLY vlv - FLOW (CCW)
SEC EVAP H2O CONT vlv - AUTO (CW) *off*
PRIM EVAP H2O CONT vlv - AUTO (CW) *off*
H2O ACCUM vlv (2) - RMTE (CCW) *out of range?*

PANEL 600 ✓

EMER 02 vlv - close

PANEL 601 ✓

REPRESS 02 vlv - close

PANEL 602 ✓

REPRESS 02 RELF vlv - OPEN (CW)

FWD HATCH

PRESS EQUAL vlv - CLOSE
ACTR HNDL sel - stow/check locked

Basic Date
Changed

Basic Date
Changed

1/9/70

Basic Date
Changed

Basic Date
Changed

CSM 09

CSM 10

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TLI TRAJECTORY O/P 1
NOM & MAN

BOOST-INSERTION-TLI

LAUNCH TRAJECTORY

NEAR INSERTION
ARORT

L
1-14

SIDE HATCH

CAB PRESS DUMP vlv - close (CW)
GEAR BOX sel - LATCH
ACTR HANDLE sel - UNLATCH- LATCH
LOCK PIN REL KNOB - LOCK
LOCK PIN ind - flush
GN2 VLV HANDLE - outboard
BPC JETT KNOB - toward BPC JETT 180°

* - last momentary position before liftoff.

BOOST-INSERTION

BOOST PREPARATION

SM RCS PRPLNT (4) - on (up)
SM RCS PRPLNT tb (8) - gray

CTE UPDATE VERIFICATION

Change X STABLE MEMBER AZIMUTH, if necessary:

*V78E *
F 06 29 X SM AZ (.01°)
*V21E *
*Load new Azimuth *
*PRO *
*ALIGN GDC *

FDAI-1 total att R=90+AZ, P=90, Y=0

BMAG MODE(3) - RATE 1

FDAI SCALE - 5/5

RATE - HIGH

RHC #1 - ARMED

RHC PWR DIRECT(2)-MNA/MNB

CMC MODE - FREE

TRANS CONTR PWR -on(up) (verify)

ASTRO LAUNCH OPERATIONS VOICE CHECK

VOICE CHECK WITH MCCH

ADJUST MASTER VOL CONTROLS

SPS THRUST - NORMAL (locked)

AV THRUST (2) - OFF

α/PC IND sw - α

LV IND/CPI - SII/SIVE

EDS AUTO - on (up)

LV RATES - AUTO

2 ENG OUT - AUTO

CM RCS PROP tb(2)-gray (verify)

RCS CMD - OFF

TVC SERVO PWR #1 - AC1/MNA

TVC SERVO PWR #2 - AC2/MNB

FC REAC vlv - LATCH

SEC COOL LOOP PUMP - off (ctr) (verify)

-25:00
-20:00

-15:00

-20:00

3/9/70
3-27-70

Basic Date
Changed

LMP SBD SW-OFF
CDR VHF AM SW-OFF

LMP SBD SW-T/R
CDR VHF AM SW-T/R

CS 109

-10:00

-08:30

TLI TRAJECTORY OPP 1
NON & MAN

BOOST-INSERTION-TLI

LAUNCH TRAJECTORY

NEAR INSERTION
ABORT

L
2-3

CSM 1-3 Launch Trajectory Parameters - Saturn V Boost
(April 11 Launch) MPAD

SATURN V BOOST				
θ	DET	V_1	$\dot{H}$	H
90	00:00	1341	0	0.0
85	00:30	1390	271	0.6
69	01:00	1834	765	3.0
51	01:30	2938	1437	8.4
33	02:00	4916	2131	17.2
a 28	02:15	6298	2504	23.0
24	02:30	7570	2726	29.4
b 21	02:44	8990	2964	35.8
21	03:00	9173	2641	43.3
24	03:30	9734	2141	55.1
27	04:00	10366	1794	64.8
24	04:30	11090	1478	72.8
21	05:00	11912	1192	79.4
18	05:30	12839	937	84.7
14	06:00	13879	716	88.7
11	06:30	15047	533	91.8
7	07:00	16362	394	94.1
4	07:30	17851	308	95.8
4	08:00	19335	267	97.2
358	08:30	20773	284	98.5
354	09:00	22026	266	99.9
c 352	09:18	22831	279	100.7
350	09:30	22949	224	101.2
346	10:00	23478	129	102.0
343	10:30	24036	56	102.5
340	11:00	24621	9	102.6
337	11:30	25235	-11	102.6
d 337	11:46	25562	0	102.6
APOLLO 13 MARCH 9, 1970				

- ^aTimebase 2 (S-IC Center-engine cutoff + .01 sec)
- ^bTimebase 3 (S-IC outboard-engine cutoff + .01 sec)
- ^cTimebase 4 (S-II outboard-engine cutoff + .01 sec)
- ^dTimebase 5 (S-IVB guidance cutoff signal + .21 sec)

L
2-2

- ~~-06:00~~ TVC SERVO PWR #1 AC1/MNA
- ~~-06:00~~ TVC SERVO PWR #2 AC2/MNB
- 04:10 L/V ENGINE lts (5) - on
- 04:00 ASTRO LAUNCH OPERATIONS COMM CHECK
- ~~-03:00~~ DSKY - Verify P02
- V75 (NO ENTR)
- TAPE RCD FWD - FWD (tb-gray)
- 2:15 PRIM GLY TO RAD - pull (bypass)
- 1:15 MN BUS TIE (2)-on (up)
- 1:00 PAD COMM (2) - OFF
- 00:45 GDC ALIGN pb - PUSH & HOLD
- R=90+AZ, P=90, Y=0
- FDAI 2 Total att - no motion
- GDC ALIGN pb - release

BOOST-INSERTION-TLI

Proc
to be

Basic Date 3/9/70
Changed 27-70

Basic Date 1/9/70
Changed

109

CSM 09

POST-INSERTION-TLI

LAUNCH ABORT

ALTITUDE vs V1

BDA LOS
(00:12:46)

KEY V82E

Record HA _____ (.1nm)
HP _____ (.1nm)
TFF _____ (min-sec)
PRO

V37E 00E
When CMC ACTY 1t out:
V66E
V45E
Verify DAP load, V48: R1 = 31102, R2 = 01111
V46E CSM WT _____
V83E (check 0) P TRIM _____
PRO Y TRIM _____

L
2-10

Basic Date 3/9/70
Changed

Basic Date 3/9/70
Changed

CSM 109

CSM 109

INSERTION AND SYSTEMS CHECKS

L
2-11

- 1 ✓ CMBL MTRS (4) - OFF (LMP confirm)
- ✓ EDS PWR - OFF
- ✓ TVC SERVO PWR (2) - OFF
- ✓ MN BUS TIE (2) - OFF (LMP)
- ✓ SECS PYRO ARM (2) - SAFE
- ✓ SECS LOGIC (2) - OFF
- ✓ cb SECS ARM (2) - open
- ✓ BMAG MODE (3) - RATE 2
- ✓ ELS - MAN
- ✓ CM RCS LOGIC - OFF
- ✓ CAB PRESS REL vlv (2) - NORMAL/LATCHED
- ✓ REPRESS PKG vlv - OFF
- ✓ cb DIRECT ULLAGE (2) - open
- ✓ cb FLT/PL VENT - open
- ✓ cb ELS BAT (2) - open
- ✓ DIRECT 02 vlv - CLOSE
- ✓ TRANS CONT PWR - OFF
- ✓ ROT CONTR PWR DIRECT (2) - OFF
- ✓ RHC #1 & #2 - LOCKED
- ✓ EMS FUNC - OFF
- ✓ LV STAGE SW - OFF (verify)
- ✓ INSTALL COAS
- MONITOR LV TANK PRESS
- * If AP > 36 psid (OXID > FUEL) *
- * If AP > 26 psid (FUEL > OXID) *
- * If LOX TK PRESS > 50 psia *
- * EMERGENCY CSM/LV SEP pg EMER/1-1 *

CYI AOS
(00:16:34)

Note: Steps 2 thru 31 are not sequential

- 2 ✓ SM RCS HTRS (4) - PRIM
- C/W - NORMAL
- BPC JETT KNOB - 180° from BPC JETT
- GN2 VLV HNDL - pull
- HATCH GEAR BOX - LATCH (verify)
- ACTR HNDL SELECTOR - neutral
- 3 ✓ cb WASTE H2O/URINE DUMP HTRS (2) - close
- FC REACS vlv - NORM
- H2 PURGE LINE HTR - ON

TLI TRAJECTORY OFF 1
NOM & MAN
NORM SC BOOSTER SEP

POST-INSERTION-TLI

LAUNCH ABORT

ALTITUDE vs V1

L
2-12

✓ 4 MCCH - G/N Status
Z Torquing angle

SUNSET (00:22:59) ✓ 5 SM RCS MONITORING CHECK

SM RCS PRPLNT tb (8) - gray
SM RCS He 1 & 2 tb (8) - gray
RCS IND sel - SM A, B, C, D
PKG TEMP - 115°-175° F (C/W 75°-205°)
He PRESS - record 4100
MANF PRESS - 192-207 psia (C/W 145-215 psia)
He TK TEMP - record 75/72/80/75
PRPLNT QTY - record FULL SCALE HIGH

✓ 6 CM RCS MONITORING CHECK

CM RCS PRPLNT tb (2) - bp gray
RCS IND sw - CM 1,2
He TEMP - 60-90°F
He PRESS - 4100-4200 psia
MANIF PRESS - 80-105 psia

✓ 7 C/W OPERATIONAL CHECK

C/W LAMP TEST - 1 (LH MA & 15 lts)
C/W LAMP TEST - 2 (RH MA & 20 lts)
C/W CSM - CM (CM RCS 1t (2) - on)
C/W CSM - CSM (CM RCS 1t (2) - out)

✓ 8 CMP to LEB for MN REG CHECK
STRUT UNLOCK LANYARD (2) - STOW
DRINKING WATER SUPPLY vlv - ON
cb COAS/TUNL LTG MNB - close
Unstow:

Helmet bags (R6)
Accessory bags (R6)
Tool E (L2)

✓ 9 Confirm normal suit pressure, cabin pressure, & O2 flow
EMERG CABIN PRESS vlv - BOTH
SUIT CKT RET vlv - open (pull)
Remove helmet & gloves & stow in PGA bag
Stow water wings
Unstow & mount TSB's (A1)

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2-13

✓ 10 MAIN REG CHECK

MAIN REG B vlv - close
EMER CABIN PRESS sel - 1
PUSH TO TEST PB - PUSH (O2 FLOW INC)
MAIN REG B vlv - open
MAIN REG A vlv - close
EMER CABIN PRESS sel - 2
PUSH TO TEST PB - PUSH (O2 FLOW INC)
MAIN REG A vlv - open
EMER CABIN PRESS sel - BOTH

✓ 11 SEC RAD LEAK CHECK

Monitor SEC ACCUM QUANTITY
SEC GLY To RAD vlv - NORM for 30 sec, then BYPASS

+20:00 ✓ 12 ECS Post Insertion Config

GLY RSVR BYPASS vlv - OPEN
GLY RSVR OUT vlv - CLOSE
GLY RSVR IN vlv - CLOSE
PRIM GLY ACCUM QTY 25-50%
PRIM ACCUM FILL vlv - ON until 50-55%
ECS RAD FLOW CONT - PWR
PRIM GLY TO RAD vlv - NORMAL (push)
ECS RAD HTR - PRIM 1 (LMP)

ECS RAD TEMP PRIM OUT below PRIM IN
If outlet temp after 5 min
* above INLET TEMP *
*PRIM GLY TO RAD vlv - *
* BYPASS (pull) *
*Recheck in 10 min *

ECS RAD tb - gray
GLY EVAP TEMP IN - AUTO

✓ 13

POT H2O HTR - MNA
PCM BIT RATE - LOW
UP TLM - CMD RSET, then NORM
VHF AM A - SIMPLEX
VHF AM B - off (ctr)

CYI LOS
(00:23:40)

TLI TRAJECTORY OPP 1
NOM & MAN

NORM SC BOOSTER SEP

None

POST-INSERTION-TLI

LAUNCH ABORT

ALTITUDE VS V.I.

L
2-14

- ✓ 14 FC PURGE CHECK
H2/O2 PURGE (6) - on, then OFF (sequentially)
Observe Flow rate inc
Reset MA (as req'd)
H2 PURGE LINE HTR - OFF

- ✓ 15 EPS MONITORING CHECK
Cryogenic Pressure - Quantity Check
H2 PRESS (2) - 225-260 psia
O2 PRESS (2) - 865-935 psia
SURGE TK PRESS - 865-935 psia
H2 QTY (2) - record 91/93
O2 QTY (2) - record 97/95
CRYO FANS - OFF; ON as req'd

- FC Power Plant Check
FC HTRS(3) -on(up)
FC REACT tb (3) - gray
FC IND sel - 1, 2, 3
H2 FLOW - 0.03-0.15 lb/hr
O2 FLOW - 0.25-1.2 lb/hr
MOD SKIN TEMP - 390-450° F
MOD COND EXH TEMP - 150-175° F
FC pH HI tb - gray
FC RAD TEMP LO tb - gray
FC REACS & RAD cb (6) - out, all others in(verify)

- D-C Voltage-Amperage Check
MN BUS TIE (2) - OFF (verify)
FC MNA tb - 1 & 2 gray, 3 bp
FC MNB tb - 1 & 2 bp, 3 gray
FC 1, 2, & 3 (RECORD AMPS) 21/23/27
MAIN BUS A, B, (26.5-31 vdc - Record) 28.5/28
BAT BUS A, B, & BAT C (31.5-38 vdc < 3 amp)
PYRO BAT A, B (36.5 - 37.5 vdc)
DC IND sel - MNB
SYS TEST 4B (BAT RLY BUS - 3.4-4.1 vdc)

A-C VOLTS - 113 to 117 all phases

3/9/70

Basic Date
Changed

CSM 109

3/9/70

Basic Date
Changed

CSM 109

L
2-15

- ✓ 16 ECS MONITORING CHECK
SUIT COMP AP - .3-.4 psid
O2 FLOW - 0.2-0.45 lb/hr (after changeover)
O2 SURGE TANK PRESS - 865-935 psia
REPRESS O2 >865 psia
PRIM RAD tb - gray

*If PRIM RAD tb - 2
* ECS RAD FLOW AUTO CONT - 1 until*
* tb gray, then AUTO *

ECS RAD TEMP PRIM IN - 67-97° F
ECS RAD TEMP PRIM OUT - -20° to +63° F
PRIM GLY EVAP TEMP OUT - 38-50.5° F

PRIM GLY DISCH PRESS - 40-52 psig
SUIT TEMP - 45-55° F
SUIT PRESS/CABIN PRESS - 4.7-5.3 psia
PART PRESS CO2 < 7.6 mm Hg
POT H2O QTY - 10-100%
WASTE H2O QTY - 25-85%

- ✓ 17 SPS MONITORING CHECK
SPS PRPLNT TK TEMP ind - +45 to +75° F
*IF<45° F, SPS LINE HTRS - A *
IF>75° F, SPS LINE HTRS - off (ctr)
SPS PRESS IND sw - He, N2A, & N2B
SPS PRPLNT TK PRESS ind
He 3900 psia max 3600
N2A 2900 psia max 2400
N2B 2900 psia max 2550
SPS PRESS IND sw - He
FUEL & OXID PRESS ind - 170 to 195 psia
SPS ENG INJ VLVs (4) - CLOSE
SPS OXID, FUEL & UNBAL QTY - record 0.5/0.6
OXID FLOW VLV PRIM - PRIM
SPS He VLV (1&2) - AUTO, tb - bp

- ✓ 18 GDC ALIGN

- ✓ 19 UNSTOW SEQ CAMERA BRACKET & ORDEAL

- ✓ 20 MOUNT ORDEAL BOX & INITIALIZE

TLI TRAJECTORY OPP 1
NOM & MAN

NORM SC BOOSTER SEP

MODE 1

MODE 11 MON-111

2-17

L
2-16

- 21 SECONDARY GLYCOL LOOP CHECK
 ✓ ECS IND sw - SEC
 ✓ SEC COOL LOOP PUMP - AC1
 ✓ GLY DISCH SEC PRESS - 39-51 psig
 ✓ ACCUM SEC QTY IND - 30-55%
 ✓ SEC COOL LOOP - EVAP

After 5 min:
 SEC EVAP TEMP OUT - 38-50.5°F
 SEC COOL LOOP EVAP - RSET 1 min,
 off (ctr)
 SEC COOL LOOP PUMP - off (ctr)
 ECS IND sw - PRIM

- 22 UNSTOW CAMERAS
 DAC (f8,250,7) 12 fps,MAG A (B3)
 Power cable (B3)
 18mm lens (B3)
 Rt. angle mirror (B3)
 (Assemble & mount in L.H. rendezvous
 window)

EL (f8,250,30) (B3)
 (Stow in LMP TSB)

- 23 UNSTOW TV CAMERA
 TV (ALC - PEAK, f44) (A7)
 Power cable (A6)
 Bracket (A6)
 Monitor & cable (A6)
 (Assemble, connect cables & hand to LMP)

- 24 OPTICS DUST COVER JETT
 Install Optics eyepieces
 OPT ZERO - OFF
 G/N PWR OPTICS - on (up)
 OPT MODE - MAN
 OPT COUPLING CONT - DIRECT
 OPT SPEED CONT - HI
 OHC - MAX RIGHT (Obs eject thru eyepiece)
 (SXT 40°, SCT 80° shaft ang)

- 25 IMU REFSMMAT Realign Check (P52),
 P52 - (PAD REFSMMAT)

N71: _____
 N05: 4000.00
 N93: _____
 X _____
 Y _____
 Z _____
 GET: _____:_____:_____

If IMU is realigned,
 Realign GDC (CDR)
 OOE
 RETICLE BRIGHTNESS - DIM
 Stow Optics Eyepieces
 Increase S BD volume

52.36
 CRO AOS
 (00:52:17)
 SUNRISE
 (01:00:07)

CRO LOS
 (00:58:07)

HSK AOS(s)26 Two way S BD VOICE Check
 (00:59:35) Report GYRO torquing angles

HSK LOS
 (01:05:37)

- US AOS (01:28:19) 27 SCS ATT Ref Comp Check
 V16 N20E

FDAI SELECT - 1
 FDAI SOURCE - ATT SET
 ATT SET - GDC
 ATT SET dials - null FDAI 1 err needles
 Key VERB when nulled (freeze display)
 Record from DSKY:
 R _____, P _____, Y _____
 Record from ATT SET dials:
 R _____, P _____, Y _____
 FDAI SEL - 1/2

3/9/70
 Basic Date
 Changed
 3/9/70
 Basic Date
 Changed

CSM 109
 CSM 109

COAST-INSERTION-TLI

LAUNCH ABORT

ALTITUDE vs V1

2-18

28

FULL EXT	Grey	Grey
FULL RET	BP	BP
PART EXT	BP	Grey

PART EXT	BP	- Gray
DOCK PROBE EXTID/REL - RETRACT (tb-gray)		

29

30

31

US LOS
(01:45:40)

CYI AOS
(01:50:07)

POST-INSERTION-TLI

LAUNCH ABOUT

ALTITUDE vs VI

Basic Date _____ 3/9/70
Changed _____

Basic Date 9/70
Changed 9/70

CSM T

CSM 10

111

[illegible]

Elect Time 4+01+00

$$\begin{array}{r} 2605 \\ \cdot 938 \\ \hline 213543 \end{array}$$

TRAJECTORY OPP 1
NOM & MAN

NORM SC BOOSTER SEP

L
2-20

P27 UPDATE

PURP		V		V		V	
GET		:	:	:	:	:	:
304 01	INDEX			INDEX		INDEX	
02							
03							
04							
05							
06							
07							
10							
11							
12							
13							
14							
15							
16							
17							
20							
21							
22							
23							
24							
N34	HRS	X	X	X		X	X
	MIN	X	X	X	X	X	X
NAV CHECK	SEC	X	X			X	X
N43	LAT		0			0	
	LONG						
	ALT	+	0			+	0

COAST INSERTION-TY 1

LAUNCH ABORT

ALTITUDE VS V1

Basic Date 3/9/70
ChangedBasic Date 3/9/70
Changed

CSM 109

L/2-21

P30 MANEUVER

SET STARS
21

R ALIGN 0 4 4
P ALIGN 0 1 2
Y ALIGN 0 2 5

ULLAGE Not

HORIZON/WINDOW

P37 FOR L/0+8

0 0 8 0 0 GETI
X 7 8 3 5 ΔVT
X - 1 6 5 LONG
0 2 2 3 6 GET 400K

PURPOSE	PROP/GUID
WT N47	
P TRIM N48	
Y TRIM	
HRS GETI	
MIN N33	
SEC	
ΔV _X N81	
ΔV _Y	
ΔV _Z	
R	
P	
Y	
H _A N44	
H _P	
ΔVT	
BT	
ΔVC	
SXTS	
SFT	
TRN	
BSS	
SPA	
SXP	
LAT N61	
LONG	
RTGO EMS	
VIO	
GET 0.05G	

FLI TRAJECTORY OPP 1
NON & MAN

NORM SC BOOSTER SEP

MODE 1

MODE TT - MODE TT

P30 MANEUVER L/2-22

SET STARS					PURPOSE				
					PROP/GUID				
					WT	N47			
R ALIGN					P TRIM	N48			
P ALIGN					Y TRIM				
Y ALIGN					HRS	GETI			
					MIN	N33			
					SEC				
ULLAGE					ΔV _X	N81			
					ΔV _Y				
					ΔV _Z				
	X	X	X		R				
	X	X	X		P				
	X	X	X		Y				
	+				H _A	N44			
					H _P				
	+				ΔVT				
HORIZON/WINDOW	X	X	X		BT				
	X				ΔVC				
	X	X	X	X	SXTS				
	+				SFT	0			
	+				TRN	0 0			
	X	X	X		BSS				
	X	X			SPA				
	X	X	X		SXP				
P37 FOR L/0+8					LAT	N61			
X					LONG				
X					RTGO	EMS			
					VI0				
					GET	0.05G			

GETI

ΔVT

LONG

GET 400K

(01:50:00)

SUNSET
(01:51:06)

CYI LOS
(01:55:25)

TLI PREPARATION

- ☒ XLRAR - INJECT (verify)
- ☒ EDS PWR - on (up)
- ☒ Perform EMS ΔV TEST & NULL
- ☒ BIAS CHECK, pg G/2-5
- ☒ Set ΔVC
- ☒ EMS FUNC - ΔV **+8**
- ☒ CDC ALIGN
- ☒ V48E, 31102, 01111
- ☒ Key V83E
- ☒ Set ORDEAL - 100/EARTH
- ☒ SECS PYRO ARM (2) - on (up)
- ☒ TRANS CONTROL PWR - ON
- ☒ ROT CONTR PWR NORMAL (2)-AC/DC (verify)
- ☒ ROT CONTR PWR DIRECT (2)-MNA/MNB
- ☒ LV IND/GPI - SII/SIVB (verify)
- ☒ DIRECT ULLAGE (2) - closed
- ☒ Cycle CRYO FANS
- ☒ Set DET - 51:00

- *If P17,P20,P22,P23,P3X,P4X,P6X or P7X is inadvertently
- * called prior to TB6, do not attempt CMC TB6 LOAD
- * MANUAL TB6 must be used, pg L/2-31

CMC TB6 LOAD

- ☒ V96E
- ☒ V25 N33E
- ☒ Load GET of TB6
- ☒ V25 N26E
- ☒ 26000E
- ☒ 01513E
- ☒ 10067E
- ☒ V30E
- ☒ 06 34 Time from TB6

- *If V37E XXE or RESTART occurs, key V21 N1E,*
- * 3573EE & repeat CMC TB6 LOAD

For MANUAL TLI, go to pg L/2-29

2+25+50

Basic Date 3/70
Changed

Basic Date 3/9/70
Changed

CSM 109

CSM 109

COAST-INSERTION-TLI

LAUNCH ABORT

ALTITUDE vs V1

POST-INSERTION-TLI

LAUNCH ABORT

ALTITUDE vs V1

CRO AOS
(02:25:25)
2+25+50

SUNRISE
(02:28:24)

CRO LOS
(02:31:41)

57:00

F 16 83

58:00

F 16 62

58:20

58:36

NOMINAL TLI

✓ LV GUID - IU (verify)

TB 6 - SII SEP 1t on (TIG-9 min, 38 sec)
SII SEP 1t out (38 sec later)
Start DET counting up

✓ SC CONT - SCS (verify)
MONITOR LV TANK PRESS

*If AP > 36 psid (OXID > FUEL) *
*If AP > 26 psid (FUEL > OXID) *
*If LOX TK PRESS > 50 psia *
* EMERGENCY CSM/LV SEP pg EMER/1-1 *

UP TLM CM - BLOCK (verify)
UP TLM IU - BLOCK (verify)
RHC #2 - ARMED

ORDEAL - 300/LUNAR

ORDEAL FDAI #1 - ORB RATE
FDAI #2 - INERTIAL

Slew FDAI to PITCH = ~~18~~ 20°
ORDEAL MODE - HOLD/FAST

V37E 47E (bias limit = 9.8 fps/min)

AVX,Y,Z (.1fps)

N62E (fps,fps,.1nm)
VI,HDOT,HPAD

SCS TVC SERVO PWR #1 - AC1/MNA
SCS TVC SERVO PWR #2 - OFF (verify)
TAPE RCD - HBR/RCD/FWD/CMD RESET

EMS MODE - NORMAL
SII SEP 1t - on

*TLI Inhibit will not be honored *
* after 59:42, except LV STAGE sw *
* (Permanent Inhibit) *

3/9/70

Basic Date

Changed

3/9/70

Basic Date

Changed

CSM 19

MSFN AOS
(02:44:40)

F 37

58:38
59:00
59:42
59:52
59:55

59:59

00:00

00:02

05:55

06:05

08:26

F 16 62

F 16 83

2-25

SIVB ULLAGE Begins
Insure FDAI #1 PITCH = 10°
SII SEP 1t - out (TIG - 18 sec)
SIVB FUEL LEAD
SIVB ULLAGE discontinues
Insure FDAI #1 PITCH = 6°
LV ENG 1-1t - on
ORDEAL MODE - OPERATE/SLOW

SIVB IGNITION (_ : _ : _ GETI)
LV ENG 1 1t - out
MONITOR THRUST & ATTITUDE
MONITOR LV TANK PRESS
SIVB ECO (1t on) (BEGIN TB7)

+45°/P,Y
+10°/sec P,Y
+20°/sec R

*EMER SIVB CUTOFF *
If no ECO at +6 sec and VI attained *
* LV STAGE sw - SII/SIVB *
*If still no ECO, *
* THC CCW & NEUTRAL in 1 sec *
*If LV GUID - CMC, *
* LV STAGE sw-SII/SIVB on VI *

KEY VERB (freeze display)

LV ENG 1 1t - out (TB 7 + 10 sec)

SIVB MNVR TO ORB RT (HDS DN) (.3°/sec)
VI _____ & AVC _____ report

HDOT _____

HPAD _____

KEY RLSE

KEY RLSE

AVX,Y,Z

(.1fps)

SCS TVC SERVO PWR #1 - OFF
PCM BIT RATE - LOW
EMS MODE - STBY
EMS FUNC - OFF
SECS PYRO ARM (2) - SAFE
FDAI #1 - INRTL
RHC #2 - LOCKED

PRO

OOE

1 TRAJECTORY OPP 1
NOM & MAN

NORM SC BOOSTER SEP

MODE 1

MODE 1

ALTITUDE vs VI

LAUNCH ABOVE

BOOST-INSERTION-TLI

L
2-26

When CMC ACTY 1t out,

Key V66E

CMP to LH couch

CDR to CTR couch

WASTE STOWAGE VENT vlv - CLOSED

HI GAIN ANT PWR - OFF (Verify)

cb HI GAIN ANT FLT BUS - close

cb HI GAIN ANT GRP 2 - close

T, D, & E, pg L/3-1

L
2-27

Basic Date 3/9/70
Changed

Basic Date 9/70
Changed

CSM 109

SIVB TLI - NOMINAL

APR 11, 1970 AZ 72°
FIRST OPPORTUNITY

θ	ψ	DET	V _I	H	H
108	0.0	00:00	25566	19	106
102	0.5	00:30	26100	15	106
100	1.2	01:00	26684	40	106
99	1.7	01:30	27295	117	106
98	2.2	02:00	27996	251	107
97	2.6	02:30	28781	459	108
96	3.0	03:00	29606	750	111
95	3.4	03:30	30475	1134	116
94	3.8	04:00	31395	1617	122
92	4.2	04:30	32371	2207	132
90	4.6	05:00	33412	2907	144
86	5.0	05:30	34529	3716	160
86	5.0	05:55	35553	4470	177

SIVB TLI - MANUAL

APR 11, 1970 AZ 72°
FIRST OPPORTUNITY

θ	ψ	DET	V _I	H	H
102	4.0	00:00	25566	.19	106
101	4.0	00:30	26100	15	106
100	4.0	01:00	26684	40	106
98	4.0	01:30	27295	117	106
97	4.0	02:00	27996	251	107
96	4.0	02:30	28781	459	108
95	4.0	03:00	29606	750	111
94	4.0	03:30	30475	1134	116
93	4.0	04:00	31395	1617	122
92	4.0	04:30	32371	2207	132
91	4.0	05:00	33412	2907	144
90	4.0	05:30	34529	3716	160
88	4.0	05:55	35553	4470	177

MODE 1

NORM SC BOOSTER SEP

TLI TRAJECTORY OPP 1
NOM & MAN

NORMAL SC/BOOSTER SEPARATIONS

1 PRE CSM SEPARATION

- ✓ DIRECT O2 vlv - OPEN until
CAB PRESS = 5.7, then close
- ✓ cb DOCK PROBE (2) - close (verify)
- ✓ COAS PWR - on
- ✓ ALIGN GDC
 - * If LV GUID - CMC
 - * mnvr to SEP ATT
 - * Do not reload DAP*
- Load RCS DAP
 - R1=1110Z, R2=01111
 - V46E
- Load N17 (SEP) & N22 (EXTRACTION)
- V63E (Monitor SIVB Mnvr) (TB7 + 15 min)
 - * If error needles not nulled: *
 - * V60E (SIVB $\pm 1.8^\circ$ db) *
 - * V16 N20E *
 - * R22 = 300° - R20 *
 - * P22 = $P20^\circ + 180^\circ$ *
 - * Y22 = 360° - Y20 *
 - * R P Y *
 - * N20 _____ *
 - * N22 _____ *
 - * _____ *
 - * _____ *
 - * Load new Docking Attitude *

SIVB MNVR (256:37)
SEP (343:37)

OMNI ANT-B C

Basic Date 11/9/70
Changed 3/27/70
4/10/70

2 CSM SEPARATION PREP

- ✓ DOCK PROBE EXTD/REL - RETRACT (verify)
- ✓ SM RCS PRPLNT tb (8) - gray (verify)
- ✓ AUTO RCS SELECT (16) - MNA/MNB
- Perform EMS NULL BIAS CHECK, pg G/2-5
- Set AVC to -100.0
- EMS FUNC - AV
- ✓ FDAI SCALE - 5/1
- ✓ MAN ATT (3) - RATE CMD
- ✓ LIMIT CYCLE - OFF (verify)
- ✓ ATT DB - MIN
- ✓ RATE - LOW

2450

AC roll H

60

CSM 10

TLI TRAJECTORY OPP 2
NOM & MAN

BOOST-INSERTION-TLI

LAUNCH ABORT

ALTITUDE vs V1

MODE III, MODE IV

NORM SC BOOSTER SEP

MODE 1

MODE II, MODE III

ELI TRAJECTORY OPP 2
NOM & MAN
NORM SC/BOOSTER SEP

LAUNCH ABORT
ALTITUDE vs V1

L
3-2

- TRANS CONT PWR - on (up) (verify)
- ROT CONT PWR NORMAL (2) - AC/DC (verify)
- ROT CONT PWR DIRECT (2) - MNA/MNB (verify)
- ATT SET tw - R=0°, P=180°, Y=0°

Set up TV

- Mount TV in R.H. rendezvous window
- S BD AUX TV - TV (90 sec delay)
- TV monitor power sw - ON
- Adjust monitor for proper picture
- Adjust lens aperture(f22), zoom and focus controls
- S BD AUX TV - off (center)

CMC MODE - FREE (verify)

SC CONT - CMC

BMAG MODE (3) - RATE 2 (verify)

cb RCS LOGIC (2) - close (verify)

TVC SERVO PWR #1 - AC1/MNA

Set DET - 59:30

FC REAC vlv - LATCH

3 CSM SEPARATION

V49E F 06 22 (EXTRACT ATT)

THC - ARMED

RHC #2 - ARMED

cb SECS LOGIC (2) - closed (verify)

cb SECS ARM (2) - closed (verify)

SECS LOGIC (2) - on (up) (verify)

RCS CMD - ON

TAPE RCDR - HBR/RCD/FWD/CMD RESET

SECS PYRO ARM (2) - ARM

*If LV GUID - CMC

* Insure rates nulled and

* yaw drifting towards 0°

* Load DAP 11103, 01111

* V46E, V60E, V63E

GDC ALIGN

EMS FUNC - ΔV (verify)

EMS MODE - NORMAL

59:30 Start DET

3-3

59:50 CMC MODE - AUTO

59:58 Thrust +X and hold

00:00 CSM/LV SEP pb - push, hold, and release

LV TANK PRESS - full scale Low

*No Separation:

* THC - CCW (leave in detent)

* DET reset and counting up (auto)

* LV TK PRESS - full scale low (SEP ind)

*00:03 THC - neutral

00:03 THC - release (ΔV ~ .5 fps)

SM RCS PRPLNT tb (8)-gray (verify)

SM RCS He tb (8)-gray (verify)

SM RCS SEC PRPLNT FUEL PRESS (4) - CLOSE

FC REAC vlv - NORM

V62E SC CONT - SCs

MAN ATT (PITCH) - ACCEL CMD

00:15 Pitch up at 1.0°/sec

When Pitch error needle positive,

PRO F 50 18

PRO 06 18

MAN ATT (PITCH) - RATE CMD

F 50 18 (completion of mnvr)

ENTR

Thrust +X(4 sec)(ΔV ~ .7 fps)

Load RCS DAP 11102, 01111

S BD AUX TV - TV (90 sec delay)

HI GAIN ANT TRACK - MAN

HI GAIN ANT PWR - POWER

Slew ANT to verify operation

HGA angles: P = -20, Y = 290 297

S BD ANT OMNI - HI GAIN

HI GAIN ANT TRACK - REACQ

TV TRANSMIT/STBY sw - TRANSMIT

Start DAC

Basic Date 3/9/70
Changed

Basic Date 3/9/70
Changed 3/27/70 4/10/70

CSN 109

CSN 109

MODE III, MODE IV

LANDING PHASE

MODE 1

MODE II, MODE III

L
3-4

4

DOCKING

- ✓ Stabilize & align CSM
- ✓ BMAG MODE (3) - ATT 1/RATE 2
- At capture:
 - PROBE EXTD/RETR tb-bp (A, pg S/2-7)
 - CMC MODE - FREE
 - ✓ Allow probe to damp S/C motions (approx 10 sec)
 - ✓ Align Pitch and Yaw with THC (<3°) (minimum possible)
 - ✓ DOCK PROBE RETRACT PRIM-1
 - *If no RETRACT in 30 sec: PRIM-2 *
 - *If still no RETRACT: SEC-1 *

After dock latches have engaged:

- ✓ PROBE EXTD/RETR tb - grey (A-1,5,9,;B-3,7,11)
- ✓ SECS PYRO ARM (2) - SAFE
- ✓ SECS LOGIC (2) - OFF
- ✓ EDS PWR - OFF
- ✓ cb EDS (3) - open
- ✓ DOCK PROBE EXTD/REL - OFF
- ✓ DOCK PROBE RETRACT (2) - OFF
- ✓ cb DOCK PROBE (2) - open
- ✓ TAPE RCDR - off (ctr)
- ✓ PCM BIT RATE - LOW
- ✓ DAC/TV-off
- ✓ S BD AUX TV - off (center)

5

POST DOCKING

- ✓ RATE - HIGH
- ✓ ATT DB - MAX
- ✓ COAS PWR - OFF
- ✓ cb RCS LOGIC (2) - open
- ✓ TVC SERVO PWR #1 - OFF
- ✓ THC,RHC - locked
- ✓ EMS MODE - STBY
- ✓ EMS FUNC - OFF
- ✓ BMAG MODE (3) - RATE 2 (verify)
- ✓ COUCHES - CDR-90°,CMP-0°,LMP-180°
- ✓ LM PWR - OFF (verify)
- ✓ TUNNEL LIGHTS - ON

malf. DOCK

2

Basic Date 3/9/70
ChangedBasic Date 3/9/70
Changed

CSM 09

CSM 09

L
3-5

6

CM/LM PRESSURE EQUALIZATION (Decal)

- 02 PRESS IND sw - SURGE TANK
- Verify CRYO 02 PRESS 1 ind - 865-935 psia
- EMER CAB PRESS sel - OFF
- REPRESS PKG vlv - OFF
- DIRECT 02 vlv - CLOSE (verify)
- TUNL VENT vlv - LM/CM AP
 - LM/CM AP ind - +4 psid (pegged)
 - PRESS EQUAL vlv - OPEN (D, pg S/2-8)
- CAB PRESS ind - 4.5 psia
- PRESS EQUAL vlv - CLOSE
- LM/CM AP ind - ~2.4 psid
- Monitor LM/CM AP ind for 3 min and verify AP stable
- PRESS EQUAL vlv - OPEN
- CAB PRESS ind - 4.0 psia
- REPRESS 02 vlv - OPEN
- CAB PRESS ind 5.7 psia
- Cycle REPRESS 02 as required between 4.0 and 5.7 psia limits until REPRESS 02 PRESS ind ~0.0 psia
- REPRESS 02 - CLOSE
- CAB PRESS ind > 4.0 psia
 - *If CAB PRESS ind <4.0 psia *
 - * PRESS EQUAL vlv - CLOSE *
- LM/CM AP ind - ~0.0 psid
- CRYO 02 PRESS 1 ind (SURGE TK) > 400 psia
- REPRESS PKG vlv - FILL to 865-935
- EMER CAB PRESS sel - BOTH
- TUNL VENT vlv - OFF
- WASTE STOW vlv - VENT (until cabin purge complete at 8 hrs)

7

TUNNEL HATCH REMOVAL (Decal)

- HATCH PRESS EQUAL vlv - open (CCW) (verify) malf. HATCH 1
- ACTR HNDL sel - unstow, pull to stop,
 - set to U
 - Push to stop
- Verify gearbox disconnect socket - U
- ACTR HNDL sel - stow
- ACTR HNDL - push to stow
- Remove hatch, stow

L
3-68 DOCKING LATCH VERIFICATION (Decal)

LATCH HANDLE - Pull to verify hook engaged (12 latches)

Not Engaged - Attempt to engage
* before recocking *

LATCH IND BUTTON (Red) - Flush (12 latches)

Power BUNGEE FAIRING - Parallel to +X

* Not parallel - Push +X end of *
* bungee before recocking*

*UNLOCKED LATCHES: *

* Recock Latches *

* Hook does not release: *

* AUX REL (yellow)-push *

* Cock latch *

Release Latch - push man-release

Verify EXTEND LATCH ENGAGED INDICATOR (RED)
not visible

GN2 BLEED button (red) - press (10 sec)

9 LM UMBILICAL CONNECTION (Decal)

LM connector fairings (2) (orange)-open

LM umbilical connectors (2)-install & lock

LM connector fairings (2)(orange) - close

SYS Test - 4D

LM PWR - CSM

SYS Test ind - 0.5-3.2 volts

10 HATCH INSTALLATION (Decal)

Align Hatch in Tunnel

ACTR HNDL sel - unstow, set to L

- push to stop

Verify gearbox disconnect socket - L

*If latches cannot be closed: *

GEARBOX DISCONNECT - 180° CCW (Tool B)

*AUX LATCH DRIVE - LATCH (113° CW) *

*Verify hatch latches, remove tool B *

ACTR HNDL sel - stow

ACTR HNDL - push to stow

HATCH PRESS EQUAL vlv - close (CW) (C,pg S/2-8)

LM TUNL VENT vlv - LM/CM AP

LM TUNNEL LIGHTS - OFF

L
3-711 PRE LM SEP & EJECTION

cb SIVB/LM SEP (2) - close (verify)

AV CG - LM/CSM (verify)

EMS FUNCT - AV SET/VHF RNG

Slew AV ind to +100.0 *CYCLE CYRO FANS*

EMS FUNC - AV

TAPE RCDR - HBR/RCD/FWD/CMD RESET

Load RCS DAP 21101, X1111

V60E, V63E

(DAC - 6 fps)

GDC ALIGN

DET - RESET

cb SECS ARM (2) - close (verify)

SECS LOGIC (2) - on (up)

Obtain GO from MSFN

SECS PYRO ARM (2) - ARM

TVC SERVO PWR #1 - AC1/MNA

RHC & THC - ARMED

V37E 47E F 16 83 AVX, Y, Z

(.1fps)

EMS MODE - NORMAL

Start DAC

12 LM SEP & EJECTION

SIVB/LM SEP - on (up)

(4:01:00)

00:00 Start DET

CMC MODE - AUTO

00:05 Thrust -X (3 sec)

13 POST LM EJECTION

PRO

F37 OOE

When CMC Acty lt out,

Key V66E

SECS PYRO ARM (2) - SAFE

SECS LOGIC (2) - OFF

cb SECS ARM (2) - open

cb SIVB/LM SEP (2) - open

LV/SPS IND sw - GPI

TVC SERVO PWR (2) - OFF

EMS MODE - STBY

EMS FUNC - OFF

TAPE RCDR - off (ctr)

PCM BIT RATE - LOW

AUTO RCS SEL AC ROLL or BD ROLL (4) - OFF

Stop DAC

Basic Date 3/9/70
ChangedBasic Date 3/27/70
Changed

SM 109

CSM 109

L
3-8

V49E

F 06 22

Load N22 att (monitor APS mnvr, hatch window)
94.1°, 323.4°, 355.5°

PRO F 50 18

PRO 06 18

F 50 18 (completion of mnvr)

ENTR

cb DIRECT ULLAGE (2) - open

TRANS CONTR PWR - OFF

ROT CONTR PWR DIR (2) - OFF

RHC & THC - LOCKED

REPRESS PKG vlv - OFF

*NO APS EVASIVE at 13:00 *

*Thrust +X (6 sec) *

*Monitor SIVB thru Hatch Window *

Time from Ejection (min:sec)	Att for viewing SIVB after RCS EVASIVE mnvr		
	Roll	Pitch	Yaw
15:00	36.9°	267.5°	26.3°
20:00	43.1°	263.7°	30.1°

*If no TLI:

* SIVB - CSM/LM SEP (Earth orbit) *

*min-sec	Event	R	P	Y
* 00:00	Ejection	302.1°	319.6°	40.4°
* 00:05	3 sec -X			
* 00:22	Mnvr	94.1°	323.4°	355.5°
* 03:00	6 sec -X			

ABORT PROCEDURES

L
4-1

MODE IA ABORT

(00:00 to 00:42) (10K)

00:00 TRANS CONTR - CCW then NEUTRAL

CM/SM SEP (2) - on (up)

00:14 ELS LOGIC - on

TWR JETT (2) - on (up)

APEX COVER JETT PB - PUSH

00:16 DROGUE DEPLOY PB - PUSH

00:18 CM RCS He DUMP PB - PUSH

Monitor altimeter

If <alidade - DEPLOY MAINS

>alidade - NO ACTION

00:28 If <10,000 ft - DEPLOY MAINS

Note: Alidade set for 3800 ft true altitude prior to
Launch

GO TO LANDING PHASE pg L/4-8

MODE IB ABORT

(00:42 to 16.5 nm) (1:56)

00:00 TRANS CONTR - CCW then NEUTRAL

CM/SM SEP (2)-on (up)

00:11 CANARD DEPLOY - PUSH

00:14 ELS LOGIC - on (up)

RCS CMD - ON

GO TO LANDING PHASE pg L/4-8

Basic Date 3/9/70
Changed 7/27/70Basic Date 3/9/70
Changed

CSM 09

CSM 09

MODE II, MODE III

E.O. ENTRY UPDATE (RET ref. to PAD GELL) L/D-8

X			-		X			-		AREA
X	X	-			X	X	-			ΔV TAILOFF
X	X	X			X	X	X			R 0.05G EMS
X	X	X			X	X	X			P 0.05G
X	X	X			X	X	X			Y 0.05G
+					+					RTGO EMS
+					+					VIO
X	X				X	X				RET 0.05G
	0					0				LAT N61
										LONG
X	X				X	X				RET 0.2G
										DRE (55°) N66
R	R		/		R	R		/		BANK AN
X	X				X	X				RET RB
X	X				X	X				RETBBO
X	X				X	X				RETEBO
X	X				X	X				RETDROG
X	X	X			X	X	X			(90°/fps) CHART
X	X				X	X				DRE (90°) UPDATE
POST BURN										
X	X	X			X	X	X			P 0.05G
+					+					RTGO EMS
+					+					VIO
X	X				X	X				RET 0.05G
X	X				X	X				RET 0.2G
										DRE ± 100 nm N66
R	R		/		R	R		/		BANK AN
X	X				X	X				RETRB
X	X				X	X				RETBBO
X	X				X	X				RETEBO
X	X				X	X				RETDROG TO MAIN

CSM 100 3/9/70
Basic Date
Changed . . .

CS 109 Basic Date 1/9/70
Changed 4-8-70

EARTH ORBIT BLOCK DATA L/5-9

X	X			1	4		X	X						AREA
X	X	X	+	2	1	6	X	X	X					LAT
X	X	-	1	4	8	0	X	X						LONG
0	0	1	0	4	4	7								GETI
X	X	X	3	1	7	3	X	X	X					ΔV_C
X	X			2	1		X	X						AREA
X	X	X	+	3	3	4	X	X	X					LAT
X	X	-	0	6	7	0	X	X						LONG
0	0	1	2	2	5	4								GETI
X	X	X	3	1	7	3	X	X	X					ΔV_C
X	X			2	4		X	X						AREA
X	X	X	+	2	1	0	X	X	X					LAT
X	X	-	1	4	8	0	X	X						LONG
0	0	2	3	7	1	8								GETI
X	X	X	3	1	7	3	X	X	X					ΔV_C
X	X			3	4		X	X						AREA
X	X	X	+	2	9	7	X	X	X					LAT
X	X	-	1	4	8	0	X	X						LONG
0	0	4	1	0	3	5								GETI
X	X	X	3	1	7	3	X	X	X					ΔV_C
X	X			4	4		X	X						AREA
X	X	X	+	3	3	4	X	X	X					LAT
X	X	-	1	4	8	0	X	X						LONG
0	0	5	4	3	4	5								GETI
X	X	X	3	1	7	3	X	X	X					ΔV_C

REMARKS:

- REMARKS:
1. Roll Right 90°
2. Do not use 2-1 for launch azimuth $> 86^\circ$
3. Do not use 1-4 for launch azimuth $< 86^\circ$

SM RCS/HYBRID DEORB

SPS DEORBIT

EARTH ORBIT ENTRY

E.O. BLOCK DATA

EARTH/POST LANDING

SPS DEORBIT

EARTH ORBIT ENTRY

P C DATA

L
9-2

CABIN PRESS REL vlv (2) - CLOSE
 CM RCS LOGIC - on (up)
 CM PRPLNT - DUMP (burn audible)
 Monitor CM RCS 1&2 for He press decrease
 *NO BURN or PRESS DECREASE *
 * USE BOTH RHC's. *
 *DO NOT FIRE PITCH JETS *
 CM PRPLNT-PURGE
 *CM RCS He DUMP PB - PUSH *
 RHC (2) - 30 secs, No PITCH

Stow DAC
 STRUT LOCKS (4) - UNLOCK

If night landing:

cb FLOAT BAG #3, FLT/PL (1 cb)-close
 PL BCN LT - LOW

cb FLT & PL BAT BUS A,B,&BAT C (3)-close
 cb FLT & PL MNA & B (2) - open
 cb RAD HTR OVLD (2) - open (verify)
 cb SPS P&Y (4) - open (verify)
 cb BAT RELAY BUS (2) - open

3K'

CM RCS PRPLNT (2) - OFF (terminates purge)
 CABIN PRESS REL vlv (RH) - DUMP
 ELS AUTO (verify)
 ELS LOGIC - ON (verify)
 FLOOD Lts - POST LDG

800'

CAB PRESS RELF vlv - CLOSE (latch off)
 MN BUS TIE (2) - OFF

POSTLANDINGSTABILIZATION, VENTILATION, COMMUNICATIONS

1

Stabilization after landing

cb MAIN REL PYRO (2) - close
 MAIN RELEASE - on (up)
 SECS PYRO ARM (2) - SAFE
 SECS LOGIC (2) - OFF
 No contact with recovery forces
 *VHF AM A&B - off (ctr)- *
 *VHF AM RCV ONLY - A *

cb PL VENT - close
 cb FLOAT BAG (3) - close
 cb UPRIGHT SYS COMPRESS (2) - close

L
9-3

If Stable II:

FLOAT BAG(3)-FILL till 2 min after
 upright, then - OFF

VHF AM A/B & BCN - OFF while inverted

If Stable I:

After 10 Min Cooling Period,
 FLOAT BAG (3) - FILL 7 min, then OFF

2

Post Stabilization And Ventilation

PL BCN LT - BCN LT LOW
 PL VENT vlv - UNLOCK (Pull)
 Remove PL VENT Exh Cover
 PL VENT - HIGH or LOW
 If req'd

PL DYE MARKER - ON

*Deploy auxiliary dye marker *

Release restraints

cb MNA BAT BUS A & BAT C (2) - open
 cb MNB BAT BUS B & BAT C (2) - open
 cb FLT & PL BAT C - open
 cb PYRO A SEQ A - open
 cb PYRO B SEQ B - open

*EACH HR - CHECK DC VOLTS $\geq$ 27.5 V *

*If Not:

* cb FLT & PL-BAT BUS A&B (2) -open*
 * cb FLT & PL BAT C (1) - close *
 * GO TO LOW POWER CHECKLIST *

Unstow and install PLV DISTRIB DUCT
 Deploy grappling hook and line if req'd

UNAIDED EGRESS PROCEDURESPREPARATION

Disconnect umbilicals
 Neck dams on (if suited)
 Configure couch(s) - 270°
 Armrests stowed
 Unstow survival kits
 Connect lanyards, (green to S/C, white to crew)

STABLE I

PL VENT - OFF
 cb Pnl 250 (all) - open

Basic Date 3/9/70
 Changed 3-27-70

Basic Date 3/9/70
 Changed

109

109

G&C

STORAGE

ECS

Crew LOG

EARTH/POST LANDING

SPS DEORBIT

EARTH ORBIT ENTRY

RUCY DATA

C
PL
9-4

Charge hatch counterbalance
 Open side hatch
 ACTR HNDL SEL - N
 Remove raft from kit No. 2
 Put raft overboard & pull inflation lanyard
 Pass kits to raft
 Egress, inflate life vest, board raft
 If no ventilation - CM O2 supply ~1 hr

STABLE II

cb CREW STA AUDIO (3) open
 PWR (3) - OFF
 SUIT PWR (3) - OFF
 PRESS EQUAL vlv - OPEN
 Remove & stow hatch
 Put survival rucksacks down tunnel
 Exit feet first; when clear of S/C inflate
 water wings
 Remove life raft from kit No. 2 and inflate
 If no ventilation - CM O2 supply ~1 hr

POST LANDING COMMUNICATIONS

VHF ANT-RECY (verify)

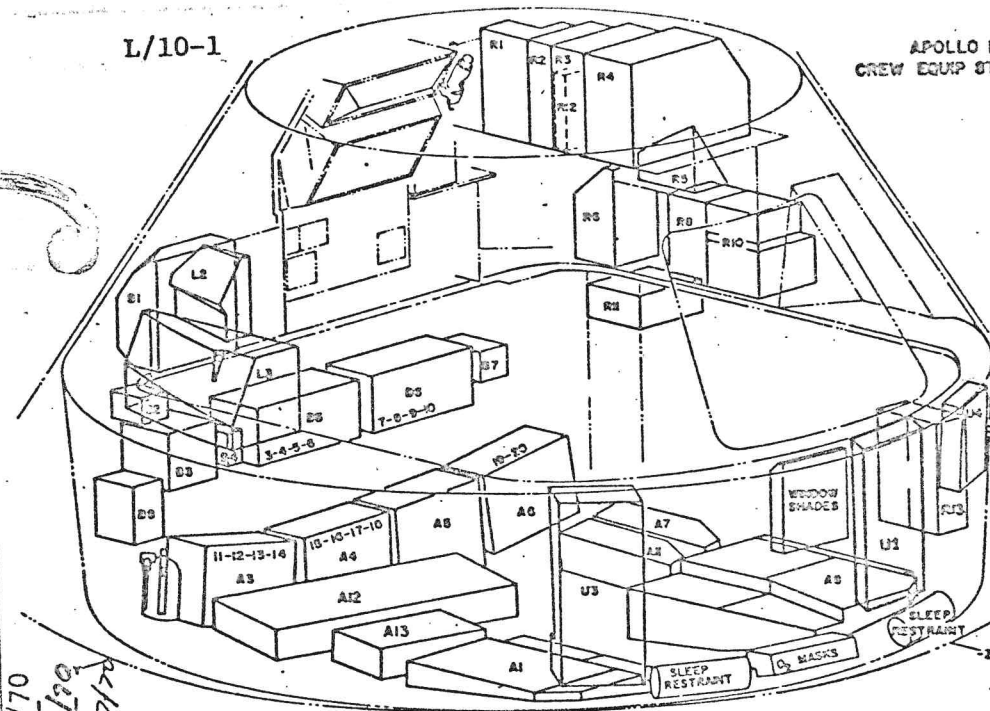
VHF BCN - ON (verify)

If no contact with recovery forces
 perform VHF BEACON Check
 MONITOR VHF BEACON transmission with
 VHF AM B Rcvr and/or Survival Transceiver
 *VHF Beacon not operating *
 *connect Survival Transceiver to ant *
 cable conn P112 behind VHF ant access pnl
 *and place radio in BCN mode *

LOW POWER CHECKLIST

VHF BCN - OFF
 VHF AM (3) - RCV
 FLOOD LTS - OFF
 VHF AM A&B - off (ctr)
 VHF AM RCV ONLY - A (verify)
 COUCH LIGHTS - OFF
 POSTLANDING VENT SYS: minimize use
 SURV RADIO - plug into VHF BCN ANT cable
 conn P112 behind VHF ant access pnl & turn
 radio on in BCN mode

L/10-1

APOLLO 13
CREW EQUIP STOWAGEBasic Date 3/9/70
Changed

CSM 09

Basic Date 3/11/70
Changed

CSM 109

Cabin Fan Filter Bag
 Cabin Vent QD
 1 CCU Cable, Spare
 1 CCU Control Head, Spare
 1 Chlorination Equipment
 1 COAS
 2 Bulbs
 1 Filter
 20 CO2 Absorbers
 1 CO2 Absorber Ground Cable
 4 CWG
 4 CWG Elect. Adapters
 1 Camera, 16mm L.S. W/Mag, Lens, Handle,
 Battery Pack, RCU Bracket & Spare Mag
 1 Camera, 16mm W/Mag
 10 Mag
 78 Mag
 1 Power Cable
 1 ea Lens, 5mm, 18mm, 75mm
 1 Mirror
 1 Bracket
 1 Sextant Adapter
 1 Fuse, Spare
 1 Camera, 70mm Reaseau, Mag & Spare Mag
 1 Camera, 70mm W/Mag
 6 Mag
 5 Mag
 1 Bracket, 80/250
 1 Bracket, 500
 1 Lens, 250
 1 Lens, 500
 1 Remote Cable
 1 Intervalometer
 1 PCM Cable
 1 Camera Ryon (CTC) W/Mag
 1 Mag
 1 Control Box
 2 Cables

PGC BAG

R6
 L2
 L2
 B4, B8, A1, B7
 Above LH Window
 U3
 U3 A3
 4-B5, 4-A4, 2-A6, 4-B5, 4-B6, 2-ECU
 L2
 3-A8, 1-A1
 A8
 A8 (IM Xfr)
 B3
 5-B2, 5-B8
 5-R-13 (IM Xfr), 2-AB (LM XFR)
 B3
 B3
 B3
 U3
 A5
 R3 (Data Kit)
 A13
 B3
 1-A8, 5-A13
 R-13, (IM Xfr)
 A1
 A11
 U4
 A11
 A11
 U4
 L2
 A12
 A13
 A13
 A12

GSC

STORAGE

ECS

GOT LOG

EARTH/POST LANDING

STOWAGE

EARTH ORBIT ENTRY

P C RICK DATA

- 1 Camera, TV & Ringsight
 - 1 Monitor
 - 2 Cables
 - 1 Bracket
- 2 Data Card Kit
 - 1 Eyepatch
 - 6 Data Clips
 - 2 Water Covers *Food Light shield*
- 11 Decontamination Bags
- 3 Dispers (FCS)
- 1 Docking Target
- 1 Exerciser
- 30 Food Bags
- 1 Flight Data File
- 1 Fire Extinguisher
- 2 Food
- 1 Gas Separator
- 1 Glare Shades
- 3 Helmet & Accessory Bags
- 2 Handhold, G&N
- 3 Headrest Pads
- 3 Heel Restraints
- 1 Helmet Shield
- 3 Inflight Coveralls
- 1 Jettison Bag
- 2 Liquid Cooled Garments
- 3 Lightweight Headsets
- 1 Maintenance Kit
- 1 Medical Kit
- 1 Monocular
- 3 O₂ Screen Caps
- 3 O₂ Mask
- 3 O₂ Interconnect
- 2 Penlight
- 3 PGA Elect Covers
- 3 PLV Ducts
- 10 FPK
- 1 Radiation Meter
- 3 Roll-on-cuff
- 3 Rope
- 1 Side Hatch Dump Equipment
- 3 Sleep Restraint
- 1 Snag Line
- 1 Spotmeter
- 2 Sun Filters, G&N
- 1 S-178 Shade
- 1 Sea Dye Marker
- 2 Springs, Snaps, Clips
- 2 Survival Kits
- 2 Strap, Couch
- 2 Strap, Utility
- 2 Strap, Probe
- 1 Tone Booster
- 1 Tape
- 2 Tape Recorder
- 4 Tape Cassettes & Batteries
- 11 Tape Cassettes & Batteries (pre-recorded)
- 3 Temporary Stowage Bags
- 1 Timer
- 1 Tissue Dispenser
- 1 Tool "E"
- 1 Tool Kit
- 3 Towels
- 3 UCTA Clamps
- 1 Urine Hose & Suit Adapter
- 3 Urine Transfer System
- 3 Urine Filters
- 1 UTS Receiver, Spare
- 1 Urine Receptacle
- 1 Vacuum Hose, 2 Brushes, & Interconnect
- 5 Window Shades

A7
A6
A6
R3 (1-Xfr to LM)
Data Kit
Data Kit
Data Kit
A8, U1
A8 U1
U3
A8
R10
B1, R2, R3, R12
A3
B1, L3
A1
R1
R6
R1
A5
A5
PGA Bag
PGA Bag
R13
U1
A8
A8
R8
U4
PGA Bag
Under Repress Rack
2-A1, 1-side A8
A1
PGA Bag
A1
2-A8, 1-R1, 1-R2
G&N Panel
R11
A5
R10
UEB
A1
A5
R1
Window Shade Bag
A1
Curtain in front B5, B6
R4
PGA Bag
R5
A1
Under A3
R5 RC
1-B3, 1-A1
U4
R1
A1
A5
5-A1, 2-A8
L2
A1
A1
PGA Bag
Under A6
R11
R5
R11
A8
Side A8
On Repress Rack

L/10-2

EMER
1-1

EMERGENCY CSM/LV SEPARATION

IF POWERED FLT

TRANS CONTR - CCW (4 SEC)

MN BUS TIES - ON

TVC SERVO PWR 1 - AC1/MNA

TVC SERVO PWR 2 - AC2/MNB

BMAG MODE (3) - ATT 1/RATE 2

GMBL MTRS (4) - ON

AV THRUST A - NORMAL

DIR ULLAGE & THRUST ON PB - PUSH

SPS BURN (5 SEC) - THEN AV THRUST (2) - OFF

Basic Date 3/9/70
Changed 4/9/70Basic Date 3/9/70
Changed 4/9/70

CSM 109

CSM 109

C&G

LV

FCS

CREW LOG

AC BUS 2 LOST - LAUNCH, SPS BURNS OR ENTRY

SPS BURNS ONLY

TVC SERVO PWR 2 - AC 1/MNA
SCS TVC (P&Y) - AUTO
ΔVCG - LM/CSM
MTVC WITH TRIM THUMBWHEELS (SCS)
BMAG MODE (3) - RATE 1
AC INV 2 MNB - OFF
FDAL SEL - 1
✓ FDAL SOURCE - CMC
✓ SUIT COMPR - AC 1
✓ ECS GLY PUMP - AC 1

ALL

CMC LITE

SC CONT - SCS
SEE G&N 5

ISS LITE + PROG ALARM LITE

SC CONT - SCS
SEE G&N 6

BAT BUS A LOST - LAUNCH, SPS BURNS OR ENTRY

LAUNCH ONLY

EDS AUTO/OFF - OFF
AUTO RCS SEL (RING 1) - OFF
TVC GMBL DR (P,Y) - 2
(IF BUS LOST BEFORE GMBL MTRS ON)

SPS BURNS ONLY

cb SPS P2 & Y2 (Pnl 8) - OPEN
(CRIT BURNS - AFTER GMBL MTRS ON)

ENTRY ONLY

cb B/D ROLL, P&Y (MNB) (3) (Pnl 8)
- CLOSED
cb SCS CONTR/AUTO (2) (Pnl 8) - OPEN
(AFTER APEX COVER JET)

ALL

cb MNA BAT C (Pnl 275) - CLOSED
cb SCS B/D ROLL, P&Y MNA (3) (Pnl 8)
Before cm/sm SEP - open
After RCS transfer to cm - close

BAT BUS B LOST - LAUNCH, SPS BURNS OR ENTRY

LAUNCH ONLY

EDS AUTO/OFF - OFF
AUTO RCS SEL (RING 2) - OFF
TVC GMBL DR (P,Y) - 1
(IF BUS LOST BEFORE GMBL MTRS ON)

SPS BURNS ONLY

cb SPS P1 & Y1 (Pnl 8) - OPEN
(CRIT BURNS - AFTER GMBL MTRS ON)

ENTRY ONLY

✓ cb SCS B/D ROLL, P&Y (MNA) (3) (Pnl 8)
- CLOSED
cb SCS CONTR/AUTO (2) (Pnl 8) - OPEN
(AFTER APEX COVER JET)

ALL

cb MNB BAT C (Pnl 275) - CLOSED
cb SCS B/D ROLL, P&Y MNB (3) (Pnl 8)
Before cm/sm SEP - open
After RCS transfer to cm - close

ABNORMAL DYNAMICS - CRITICAL SPS BURN

THC - CW
DAMP RATES USING RATE NEEDLES
AFTER SHUTDOWN, AUTO RCS SEL (16) - OFF
SEE G&C 1

Basic Date 3/9/70
Changed 7/3/70

Basic Date 1/9/70
Changed

CSM 10

CSM 10

EARTH/POST LANDING

LV

ECS

LFS

G&C

ALARM CODES

CREW LOG

*31207 No vac area for marks
Rset

Reselect program

If alarm recurs, consult MSFN.

*31211 Illegal interrupt of extended verb
Reselect extended verb after optics
marking is completed.

(m) - Malf procedure indicated

**(2xxxx) - Generates restart, F37 (no lt)

*(3xxxx) - Restart (no lt) and program
continues (i.e. attempted
recovery)

NOTE - All **alarms act as *type if
they occur when Ave-g is on

BAT B PWRENT P/L-opn

Procedure for charging BAT B

3 - BAT CHG - OFF
5 - MAIN BUSTIE BAT A/C - MC
CB BAT CHARGER BAT A CHG - open
CB BAT CHARGER BAT B CHG - closed
250 - CB BAT B PWRENT P/L - closed
5 - MAIN BUS TIE BAT D/C - OFF
3 - BAT CHG - B

Δ to 1st Bat charge proc.

3. BAT CHG - OFF
AC INV 2 - OFF
5. MAIN BUSTIE - BAT B/C (UP)
250 CB BAT A PWRENT P/L-opn
CB BAT B PWRENT P/L-opn
5. CB BAT CHARGER BAT A CHG - open

ALARM CODES

LF5

3/9/70

Basic Date
Changed

OCTOBER 20, 1969

Basic Date
Changed

CSM 109

NASA - MS

Basic Date 3/9/70
Changed

CSM 109

Basic Date OCTOBER 20, 1969
Changed

APOLLO

TIME	REMARKS
IN 235	delete CH MNC BAT BUS B - close (open) CH INU AIR 2 MNB - close (open)
SEQUENCE	
27	CO BAT 6 RURENT P/L - close (-)
MDC 3	AC INU 2-MNB (-) AC INU 2 AC1 - ON (OFF)
WDC 3	AC INU AIR BUS 1 - Reset (Reset) (center) (OFF)
3	OP TM - CAT Reset (Reset) off. (OFF) Select host mini
	Read out.
	3 - Bat B volts 37.0 37.0 (A 716, 116, 116) Pyro A volts 37.0 37.0 Pyro B volts 37.0 37.0 SPS He Pres 3450 2300, 2400 3400 2200, 2400
	101 CH PCS INJ TEMP 5C 4.5 5D 3.53 6A 4.0 3.6 6B 4.0 6C 4.0 6D 3.8 3.7 BAT MANIFOLD PRES 4A 1.4 1.7
To EXIT	
03	PINP AMP - OFF XPDN DEP - OFF AC 2 INU 2 - OFF

CREW LOG

TIME	REMARKS
	Procedure to get TLM to check CSM Systems
	Pwr & Telecom (p. 1 - AC1 (OFF)
	S ch - ECS Pwr Gp1 MNB
	ECS Pwr Gp2 MNB
	ECS Temp MNB
	(open) ECS Svc Temp MNB
	ECS RAD CONT MNB
	BAT CORD BUS BAT B
	BAT CHARGER BAT B
	INV CONT 2
	INV CONT 1
	EPS SENS SG AC1
	EPS SENS SG MNB
	EPS SENS UNIT 101 1
	WASTE POT H ₂ O MNB
	WST ESS MNB
PUL 3	XPRINTER - PRIM
	PWRAMP - PRIM
	PWRAMP - H ₂ LO
	*NOTE VOICE OFF (VOICE)
	PWLSCE - NORM (OFF)
	PMP - NORM (OFF)
	S BAND - ANT - OMNI D (B.)
PUL 2750	ch - ELT BUS MNB - close (open)
ch	ch - MNB - close (open)
PUL 330	ch - Bat B Bat Charger / EPS2 - close (open)
	ch - Bat B Pwr Ent P/L - close (open)

NASA - MSC

Basic Date: OCTOBER 20, 1969

Changed

APOLLO 12

PWR CSM FROM LM

LM

1. Pul 11 & 16 ch ASC ECA2 close
2. Pul 11 & 16 ch ASC ECA CONT (2) close
3. ~~BAT 5 & 6 NORM FEED - ON~~
- 3*. BAT 12 & 3A - OFF/RESET
5. Wait 30 min for preconditioning
6. BAT 2 & 4 to OFF/RESET

CSM

1. Connect LM/CSM umbilicals
2. Pul 5 ch LM PWR 1 MNB and 2 MNB - closed (2 cbs)
3. Pul 5 ch EPS SENS Signal MNB - closed
4. Pul 250 ch Bat B Pwr Ent and P/L closed
- 4*. ch MNB & BAT BUS B closed
5. Verify Main Bus Voltage, then LM PWR to CSM
6. ch MNB & BAT BUS B - open
7. (250) BAT B Pwr Ent & P/L open
verify main Bus voltage.

LM

1. BAT 1, 2, 3, 4 - Hi Volt - ON
2. BAT 5 & 6 TO OFF
3. CB 11 & 16 ABC ECA CONT Both open

note 1 ch protection limits current to 15 amp

note 2 Umbilical between CSM and LM is hot
Monitor Main B for Bus voltage

BUS PWR UP 100

1. PNL 225 ch-RR XNUTEL FLT BUS - open
ch SBD XNTE/DSE FLT BUS - open
2. PNL 215 BRT CHARGER BATA CTG - close
BAT CHARGER BAT B CHS - close
3. d? EPS SENS SIG MNA - close
EPS SENS SIG MVB - close
3. PNL 250 ch- BAT A PWR ENTRY R - close
BAT B PWR ENTRY R - close
4. Read Bat Bus Volls on A $\frac{32.8}{37.0}$
B
5. PNL 275 ch-MAIN A BAT BUS A - close
ch-MAIN B BAT BUS B - close
6. 5. MAIN BUS tie - AC
Read MAIN A volts $\frac{32.0}{0}$
amps
7. MAIN BUS tie AC - ON
Read MAIN B volts $\frac{37.0}{0}$
amps
8. Platform steps 5, 3, 2 unsecured

Proc to take LM power away from CSM

1. Assumes all Bat Bats on and Bat Con Norm feed

CS1 ch-5d-LM PWR 2 MNB - open
ch-LM PWR 1 MNB open
ch-EPS SENS SIG MNB - open

LM (16) ch-EPS Bat Feed Tie (2) - open
Bat 1 HV - off/Reset
Bat 2 LV - off/Reset then ON
Bat 2 HV - off/Reset then ON
Bat 1 HV - ON

(16) ch Bat Feed tie (2) - close

APOLLO 13

CSM SYSTEMS CHECKLIST

PART NO.

S / N

SKB32100082 - 311

1002

S
TC-2

TELECOMM PROCEDURES

- 1 HI-GAIN ANT OPN
HGA SCAN LIMIT GRAPH
ANTENNA LOCATION CHART
 - 2 TV CAMERA OPN (COLOR)
 - 3 VHF RANGING OPN
 - 4 RNDZ XPNDR ACT & SELF TEST
 - 5 COMM MODES
- GENERAL
- PRESLEEP C/L
 - POSTSLEEP C/L
 - RCS ENGINE, VENT, & RAD LOC
 - SYSTEM TEST CHART
 - PRPLNT GAUGING METER NOMOGRAPH
 - SPS PRPLNT NOMOGRAPH

1-18
1-18
1-19
1-20
1-21
1-22
1-22
1-23
1-26
1-26
1-26
1-27
1-28
1-29
1-30

2. LM INTERFACE

- 1 IVT to LM (CHECKOUT, TLC)
- 2 IVT to LM (UNDocking, ~~DET~~) PD/
- 3 Tunnel Hatch Removal
- 4 Probe Removal (CM side)
- 5 Droque Removal
- 6 Crew Transfer to LM
- 6A Crew Transfer to CSM
- 7 Remove LM Umbilicals (FINAL)
- 8 Install Droque
- 9 Install Probe
- 10 Preload Probe
- 11 Hatch Installation
- 12 Hatch Integrity Check
- 13 Docking Latch Release
- 14 Soft Undocking
- 15 Malfunction List
- 16 LM JETTISON

2-1
2-1
2-2
2-3
2-3
2-4
2-4
2-4
2-5
2-5
2-5
2-6
2-6
2-6
2-7
2-7
2-7
2-10

3. CONTINGENCY EVA

4. SAFE OF APEX COVER JETT

3-1
4-1

5. STOWAGE

5-1

6. EMERGENCY PROCEDURES

EMER/1-1-2

- Launch Vehicle 1-1
- ECS 1-3
- EPS 1-5
- G&C 1-9
- SPS 1-10
- RCS 1-11
- Alarm Codes 1-13

7. CREW LOG

Basic Date 3/23/70
Changed
Basic Date 3/23/70
Changed

CSM 100

S
1-26

GENERAL

SIV B impact
8.595
33. W
77-51

PRESLEEP CHECKLIST

CREW STATUS REPORT (MEDICATION)
ONBOARD READOUTS
CYCLE O2 & H2 FANS
CHLORINATE POTABLE WATER
VERIFY:

WASTE MNGMT OVBD DRAIN - OFF
WASTE STOW VENT vlv - CLOSED
EMERGENCY CABIN PRESS - BOTH
SURGE TANK O2 vlv - ON
REPRESS PKG O2 vlv - OFF
LM TUNNEL VENT vlv - LM/CM ΔP
"E" MEMORY DUMP
CONFIGURE COMMUNICATIONS (S/1-24)

POST SLEEP CHECKLIST

CREW STATUS REPORT (SLEEP & RADIATION)
CONSUMABLES UPDATE
CYCLE O2 & H2 FANS
CONFIGURE COMMUNICATIONS (S/1-24)

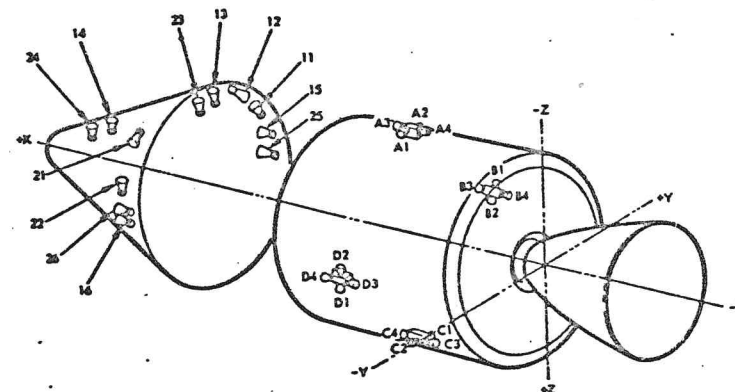
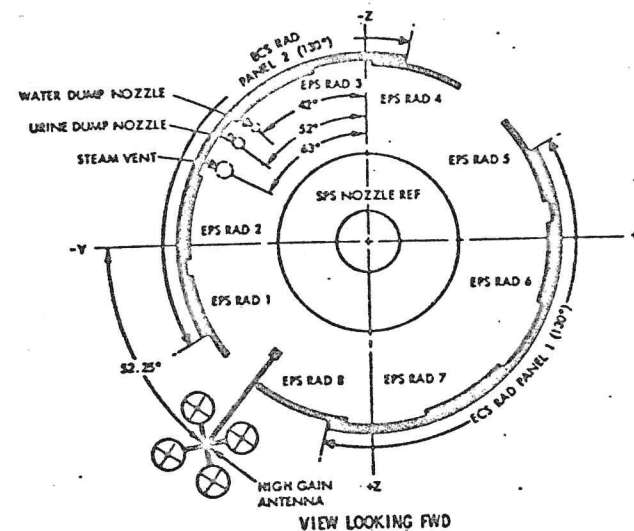
Basic Date 9/70
Changed

Basic Date 3/70
Changed

CSM 109

CSM 109

S
1-27



CM RCS CODE

FIRST DIGIT: SYSTEM (1 OR 2)
SECOND DIGIT: 1, 2 (+, -ROLL) 3, 4 (+, -PITCH) 5, 6 (+, -YAW)

SM RCS CODE

1 AND 2 ARE ROLL ENGINES
3 AND 4 ARE A/C PITCH OR S/D YAW ENGINES
1 AND 3 = + ROTATION, 2 AND 4 = - ROTATION

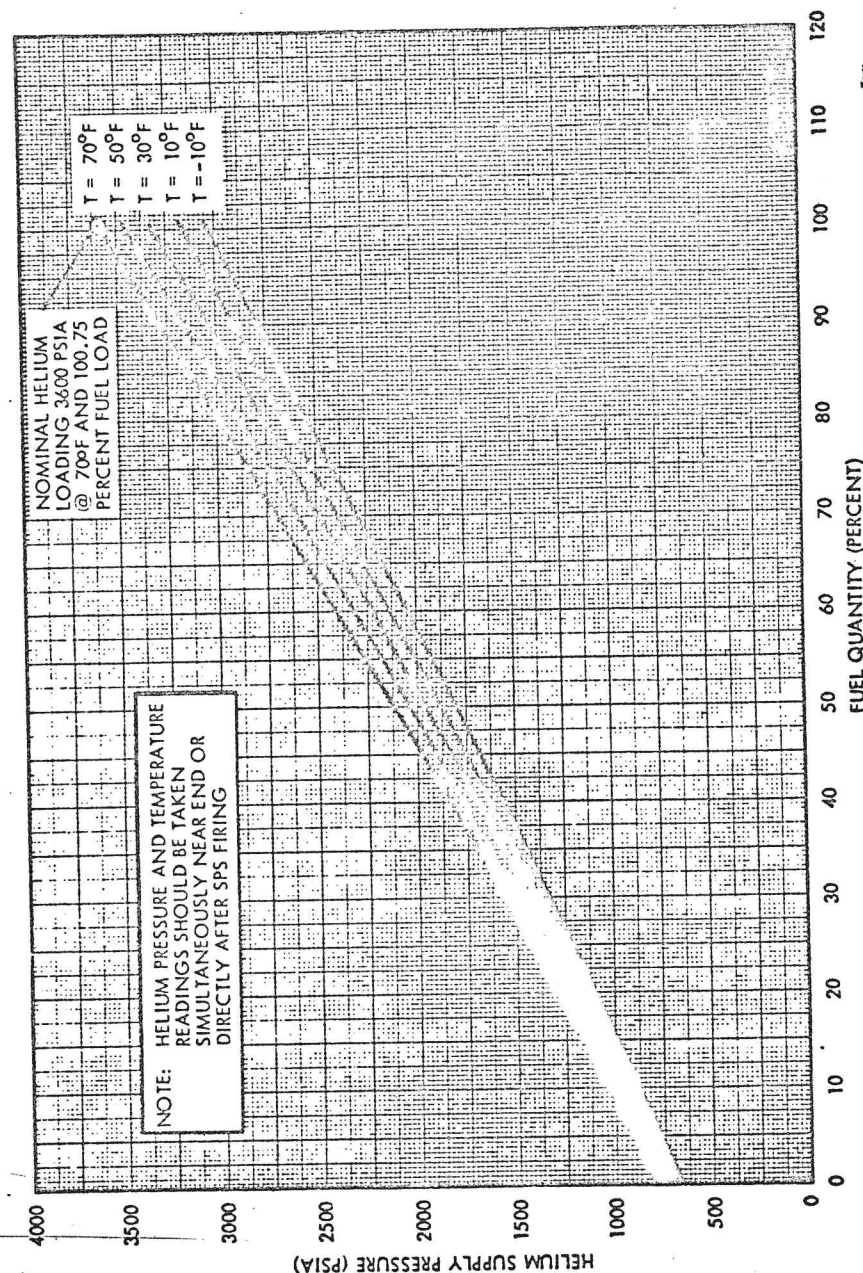
RCS Engines, Vent, and Radiator Location

LM INTERFACE

CONNECTIONS TO TWA

SAFE OF APEX

SPS PROPELLANT NOMOGRAPH



S
1-30

Basic Date 3/9/70
Changed

Basic Date 3/1/70
Changed 23-70

CSM 10

CSM 10

S
2-1

LM INTERFACE

1 IVT TO LM (CHECKOUT, TLC)

At 2 hours prior to IVT to LM:

TUNL VENT vlv - LM/CM ΔP

Verify LM/CM ΔP > 1.7 psid

*LM/CM ΔP < 1.7 psid *

*TUNL VENT vlv - VENT *

* till LM/CM ΔP > 1.7 psid *

Couches: CDR - 0°, CMP - 0°, LMP - 180°

TUNL LTS - ON

Equalize CM/TUNL pressure (Decal)

Verify LM/CM ΔP < 2

Remove hatch & stow (Decal) (3)

Remove probe & stow (Decal) (4)

Remove drogue & stow (Decal) (5)

Read docking tunnel index angle

Open LM hatch

Transfer the following to LM:

Box of tissues A1

Vacuum brush, hose and A8

suit hose interconnect 16mm L.S. CAMERA SYSTEM A8

16mm magazines (8) R13/A8

70mm magazines HBW (3) R13

70mm magazines HCEX (2) R13

LMP Transfer to LM (6)

At LM request

LM PWR - RESET, then OFF

SYS TEST - 4D

SYS TEST ind - 0 volts

Perform comm checks with LM

At LM request

LM PWR - CSM

SYS TEST - 4D

SYS TEST ind - 0.5 - 3.2 volts

LMP Transfer to CSM (6A)

Close LM hatch

Install drogue (Decal) (8)

Install probe (Decal) (9)

Install CM hatch (Decal) (11)

TUNL VENT vlv - LM/CM ΔP

TUNL LTS - OFF

STORAGE

LM INTERFACE

CONTINUATION OF 1-1

SAFE OF APRX

- S
2-2
PD/
- 2 IVT TO LM (UNDOCKING, DOI)
 Couches: CDR - 0°, CMP - 0°, LMP - 180°
 CDR don LCG & PGA
 Don helmet protective shield (if req'd)
 Suit Integrity Ck (if req'd)
 TUNL LTS - ON
 TUNL VENT vlv - LM/CM ΔP
 Verify LM/CM ΔP <0.2
 *LM/CM ΔP >0.2 *
 * Equalize CM/TUNL Pressure*
 *(DECAL) *
- Remove tunnel hatch (Decal) (3)
 Remove & stow probe (Decal) (4)
 Remove & stow drogue (Decal) (5)
 Verify docking tunnel index angle
 Open LM hatch
- LMP transfer to LM (6)
 At LM request,
 LM PWR - RESET, then OFF
 SYS TEST - 4D
 SYS TEST ind - 0 volts
- CDR transfer to LM (6)
 LMP transfer to CSM (6A)
 LMP don LCG & PGA
 LMP transfer to LM (6)
 Remove LM umbilicals (7)
 Install drogue (Decal) (8)
 Install probe (Decal) (9)
 Preload probe (Decal) (10)
 LM hatch closed
 Verify CSM roll cmds inhibited
 until LM/CM ΔP >3.5 psid (>3.5, 2 jet; >4, 4 jet)
 Cock docking latches (Decal) (13)
- Install tunnel hatch (Decal) (11)
 Perform hatch integrity check (Decal) (12)
 Remove center couch and stow

CSM 109

Basic Date 9/70
Changed 3-3-70

Basic Date 9/70
Changed

S
2-3

Install docking target
 DOCKING TARGET - BRIGHT
 Receive target alignment verification from LM
 Configure side hatch for EVT
 ACTR HANDLE SEL - N (neutral)
 GN2 VLV HANDLE - pull (inboard)
 GN2 PRESS ind - minimum

- HATCH
1
(D)
- 3 TUNNEL HATCH REMOVAL (Decal)
 PRESS EQUAL vlv - open (CCW)
 ACTR HNDL - unstow, pull to stop, set to U
 - push to stop
 Verify gearbox disconnect socket - U
 ACTR HNDL SEL - stow
 - push to stow
 Remove hatch, stow
- 4 PROBE REMOVAL (CM Side) (Decal)
 NOTE: Probe may be hot from stay in Lunar orbit
- A Translunar Docking:
 Verify EXTEND LATCH engaged indicator
 (red) not visible
- *EXTEND LATCH not engaged: *
 * PRELOAD SEL LEVER - rotate CW (away from *
 * orange stripe) *
 * PRELOAD HANDLE - Torque CCW to engage *
 * extend latch (red ind. not visible) *
- GN2 BLEED button (RED) - press (10 sec)
 PRELOAD SEL LEVER - rotate CCW (parallel
 to orange stripe)
 PRELOAD HNDL - Torque (CW) unload support beams
- B Lunar Orbit Docking:
 PRELOAD SEL LEVER - rotate CW (away from orange
 stripe)
 PRELOAD HNDL - torque CCW to engage EXTEND LATCH
 (red indicator not visible)
 GN2 BLEED button (red) - press (10 sec)
- C Both TLD & LOD:
 PROBE UMBILICALS (2) (yellow) - disconnect and stow
 Elec connector covers (2) (yellow) - close
 PRELOAD HNDL - position against umbilical connector
 PRELOAD SEL LEVER - mid position

S
2-12

- 4 CSM/LM FINAL SEP (2) - ON (.4 fps sep)
SECS PYRO ARM (2) - SAFE
SECS LOGIC (2) - OFF
cb SECS ARM (2) - open
SC CONT - CMC
BMAG MODE (3) - RATE 2
MNVR (180°, 90° ORDEAL, 0°)
- 5 SEP (2 jet +Z 1.0 fps)
PRO (POO)
- 6 EMS MODE - STBY
EMS FUNCT - OFF
SC CONT - SCS
MAN ATT (3) - MIN IMP
~~Track-LM~~ *GO ORB RATE (P≈93° ORDEAL)*
~~P20, V77 at 1 mile~~
- 7 Empty PGA (2) pockets
Move watch (2) from PGA to arm
Stow PGA (2)
All wash hands thoroughly

LM INTERFACE

Basic Date 3/9/70
Changed 3/3/70

Basic Date 3/9/70
Changed 3/3/70

CSM 105

CSM 105

S
3-1

CONTINGENCY EVA

CM PREP FOR CONTINGENCY EVA

- 1 C & R SUIT FLOW - OFF
- 2 C & R O2 hoses interconnected with A-1 interconnects
- 3 Center hoses stowed in tunnel, right hoses secured to tunnel MDC hand straps
- 4 EVA Stabilizer Strut installed
- 5 TSB's installed on R&L Girth Ring and LEB
- 6 Jackscrews (A-1) Fully opened/ Tool Kit
- 7 Tool Kit (A-1) Snapped to RH Girth Ring
- 8 Hatch Counterbalance (Engage/Disengaged) (Pull Pip Pin, stow in TSB)
- 9 MDC Ingress Bar (Stowed/Unstowed)

FINAL CABIN PREP

- 1 Depress tunnel, if req'd
- 2 Stow optics
- 3 Stow COAS
- 4 Stow cameras and bkt in TSB
- 5 Set up comm panels
- 6 PGA Bag - Remove/Secure (tie side straps to fwd straps)
- 7 Unstow couch straps - (2) PGA Bag
- 8 Center couch - Remove/Stow under LH couch
- 9 Marmon Clamps - Closed and locked
- 10 Stow Hand Controllers (Translation to Y-Y Strut, Rotation to Translation Strut, Rotation to RH TSB)
- 11 L and R Couch - Stow foot, leg, and seat pans
- 12 LH X-X Strut - Connected/Disconnect and tie off

CONTINGENCY EVA

SAFE OF APEX

LM INTERFACE

CONTINGENCY PLAN

SAFE OF APEX
COVER JETTS
4-2

Perform CM RCS pressurization & CM/SM
Separation together at which time ARM
PYRO's in the following manner:
SECS PYRO ARM (B) - SAFE (verify)
SECS PYRO ARM (A) - ARM

To Jettison Apex Cover At 24K':
SECS PYRO ARM (B) - ARM

STEP A

cb ELS/CM-SM SEP BAT A - close
cb ELS/CM-SM SEP BAT B - open (verify)
If MSFN GO, Go to STEP B

If Still Apex Cover Jettison,
cb ELS/CM-SM SEP BAT B - close
cb ELS/CM-SM SEP BAT A - open
SECS LOGIC (2) - OFF, then ON

MSFN confirm GO,

cb ELS/CM-SM SEP BAT A - open (verify), close
at or after apex cover jettison at 24K'
Continue normal entry

STEP B

cb ELS/CM-SM SEP BAT B - open (verify), close
at or after apex cover jettison at 24K'
Continue normal entry

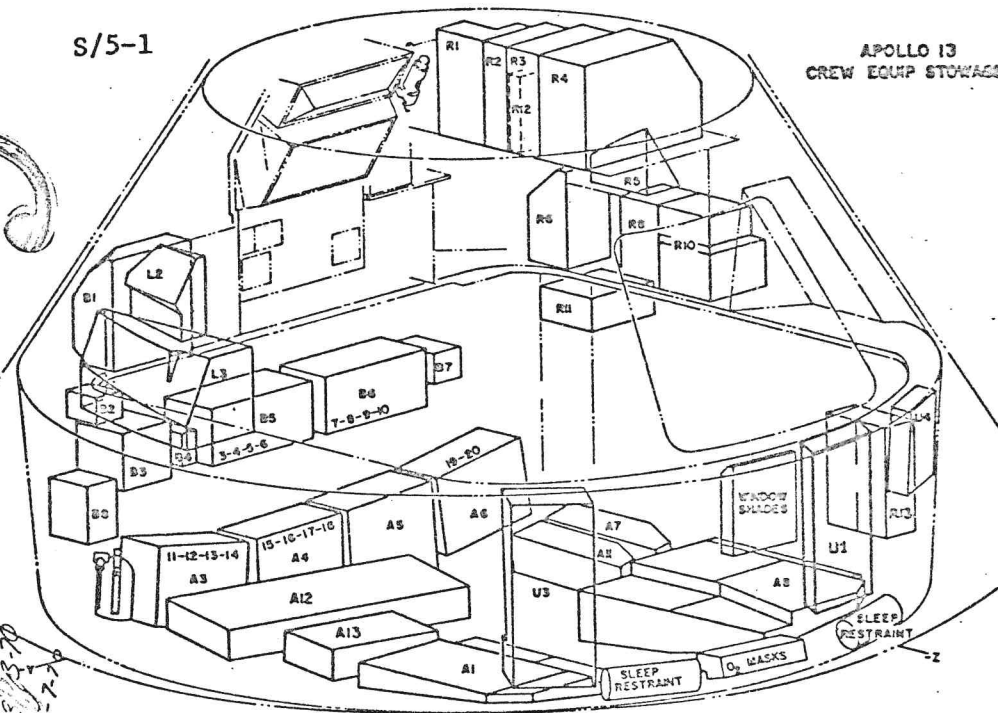
STEP C

cb SECS LOGIC A - open (verify), close
at or after apex cover jettison at 24K'
Continue normal entry

STEP D

cb SECS LOGIC B - open (verify), close
at or after apex cover jettison at 24K'
Continue normal entry

S/5-1

APOLLO 13
CREW EQUIP STORAGEBasic Date 3/9/70
ChangedBasic Date 3/9/70
Changed

CSM 109

CSM 109

- 1/2 Cabin Fan Filter Bag
1 Cabin Vent QD
1 CCU Cable, Spare
1 CCU Control Head, Spare
1 Chlorination Equipment
1 COAS
2 Bulbs
1 Filer
20 CO₂ Absorbers
1 CO₂ Absorber Ground Cable
4 CWG
4 CWG Elect. Adapters
1 Camera, 16mm L.S. W/Mag, Lens, Handle,
Battery Pack, RCU Bracket & Spare Mag
1 Camera, 16mm W/Mag
10 Mag
78 Mag
1 Power Cable
1 ea Lens, 5mm, 18mm, 75mm
1 Mirror
1 Bracket
1 Sextant Adapter
1 Fuse, Spare
1 Camera, 70mm Reaseau, Mag & Spare Mag
1 Camera, 70mm W/Mag
6 Mag
5 Mag
1 Bracket, 80/250
1 Bracket, 500
1 Lens, 250
1 Lens, 500
1 Remote Cable
1 Intervalometer
1 PCM Cable
1 Camera Hycon (CTC) W/Mag
1 Mag
1 Control Box
2 Cables

- A6 PGA BAG
R6
L2
L2
B4, B5, A1, B7
Above LH Window
U3
U3 A3
4-U3, 4-A4, 2-A6, 4-B5, 4-B6, 2-ECU
L2
3-A8, 1-A1
A8
A8 (LM Xfr)
B3
5-B2, 5-B8
5-R-13 (LM Xfr), 2-A8 (LM XFR)
B3
B3
B3
U3
A5
R3 (Data Kit)
A13
B3
1-A8, 5-A13
R-13, (LM Xfr)
A1
A11
U4
A11
A11
U4
U2
A12
A13
A13
A12

STORAGE

S/5-2

S
5-3

ENTRY STOWAGE CHANGES FROM EARTH LAUNCH

STOWAGE

LM INTERFACE

CONTINGENCY EVA

SAFE OF APEX

1	Camera, TV & Ringsight	A7
	1 Monitor	A6
	2 Cables	A6
	1 Bracket	A6
2	Data Card Kit	R3 (1-Xfr to LM)
	1 Eyepatch	Data Kit
	6 Data Clips	Data Kit
	2 Meter Covers	Data Kit
	<i>Flood Light shield</i>	A8, U1
11	Decontamination Bags	A8 U1
3	Dispers (FCS)	U3
1	Docking Target	A8
1	Exerciser	R10
30	Fecbl Bags	R2, R3, R12
1	Flight Data File	A3
1	Fire Extinguisher	B1, L3
2	Food	A1
1	Gas Separator	R1
4	Glare Shades	R6
3	Helmet & Accessory Bags	R1
2	Handhold, G&N	A5
3	Headrest Pads	A5
3	Heel Restraints	PGA Bag
1	Helmet Shield	PGA Bag
3	Inflight Coveralls	R13
1	Jettison Bag	U1
2	Liquid Cooled Garments	A8
3	Lightweight Headsets	A8
1	Maintenance Kit	R8
1	Medical Kit	U4
1	Monocular	PGA Bag
3	O ₂ Screen Caps	Under Repress Rack
3	O ₂ Mask	2-A1, 1-side A8
3	O ₂ Interconnect	A1
2	Penlight	PGA Bag
3	PGA Elect Covers	A1
3	PLV Ducts	3-A8, 1-R1, 1-R2
10	PPK	G&N Panel
1	Radiation Meter	R11
1	Roll-on-cuff	A5
5	Rope	R10
1	Side Hatch Dump Equipment	UEB
3	Sleep Restraint	A1
1	Snag Line	A5
1	Spotmeter	R1
2	Sun Filters, G&N	Window Shade Bag
1	S-178 Shade	A1
1	Sea Dye Marker	Curtain in front B5, B6
32	Springs, Snaps, Clips	R4
2	Survival Kits	PGA Bag
3	Strap, Couch	R5
6	Strap, Utility	A1
2	Strap, Probe	Under A3
1	Tone Booster	B5 R6
1	Tape	B3
2	Tape Recorder	U4
4	Tape Cassettes & Batteries	1-A1
11	Tape Cassettes & Batteries (pre-recorded)	R1
3	Temporary Stowage Bags	A1
1	Timer	A5
7	Tissue Dispenser	5-A1, 2-A8
1	Tool "E"	L2
1	Tool Kit	A1
3	Towels	A1
3	UCTA Clamps	PGA Bag
1	Urine Hose & Suit Adapter	Under A6
3	Urine Transfer System	R11
3	Urine Filters	R5
1	UTS Receiver, Spare	R11
1	Urine Receptacle	A8
1	Vacuum Hose, 2 Brushes, & Interconnect	Side A8
5	Window Shades	On Repress Rack

A. (LM to CM XFER) ADDITIONS

QTY	NOMENCLATURE	CM STOWAGE LOCATION/VOLUME
1	PPK, 1 FLAG KIT	A13 (IN CABIN FAN FILTER BAG)
2	PPK's	R13
1	DSEA	R13
1	SRC #1	B6 (In Decontam. Bag From A8)
1	SRC #2	B5 (In Decontam. Bag From A8)

NOTE: Solar Wind 1 Ea. and Weigh Bag 1 Ea.
IN SRC

1	Contingency	
	Sample	B1 (In Decontam. Bag From A8)
1	CSC Cassette	B1 (In Decontam. Bag From A8)

B. (CM to LM XFER) - Final Docking - Off Load

QTY	NOMENCLATURE	CM STOWAGE LOCATION/VOLUME
1	B5 Container W/4 CO ₂ Absorbers	From B5
1	B6 Container W/4 CO ₂ Absorbers	From B6
1	Docking Probe	From Tunnel
1	Jettison Stowage Bag	From R13

C. Relocations - For Re-Entry

QTY	NOMENCLATURE	LAUNCH STOW	RE-ENTRY STOW
3	Helmet Stowage Bags	3 Ea. R6	1 Ea. R6/B1/L3
3	Accessory Bags	3 Ea. R6	1 Ea. R6/B1/L3
3	ICG	PGA Container	3 Ea. On Crew
3	Headrest Pad	3 Ea. A5	3 Ea. On Couch
3	Heel Restraint	3 Ea. A5	3 Ea. On Crew
4	CWG Elect. Adapter	4 Ea. A8	3 Ea. On Crew 1 Ea. A8
3	CWG Elect. Adapter	3 Ea. PGA Cont.	3 Ea. On PGA Cover
1	Panel Indicator/ Noun List	1 Ea. Installed	1 Ea. Data Card Kit
2	PGA-EV	2 Ea. On Crew	2 Ea. PGA Container

Basic Date 3/9/70
Changed 4/9/70Basic Date 3/1/70
Changed 4-23-70

CSM 109

CSM 109

SAFE OF APEX

LM INTERFACE

STOWAGE

QTY	NOMENCLATURE	LAUNCH STOW	RE-ENTRY STOW
2	Helmet	2 Ea. On Crew	2 Ea. in Helmet Bags 1-B1/1-L3
1	PGA-IV	1 Ea. On Crew	1 Ea. RH Sleep Restraint
1	Helmet	1 Ea. On Crew	1 Ea. RH Sleep Restraint
1	Gloves, IV-Pr.	1 Ea. On Crew	1 Ea. RH Sleep Restraint
11	Decontamination Bags	10 Ea. A8 1 Ea. U1	1 Ea. W/70MM Mag. R13 1 Ea. W/70MM Mag. R13 1 Ea. Conting. Sample B1 1 Ea. CSC Cassette B1 1 Ea. SRC #1-B6 1 Ea. SRC #2-B5 1 Ea. ISA On top A1 1 Ea. Tote On top A7/ A11 1 Ea. 16mm R13 1 Ea. 70mm A8 1 Ea. Rtn. Equip. B1

S.
5-4

CSM 109

Basic Date 3/9/70
Changed

MASTER

APOLLO 13

CSM G & C CHECKLIST

PART NO.

S/N

SKB32100082-310

1001

G
1-2

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 } *only in P00*
- 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 (N20)
- 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)

Basic Date
Changed

CSM 10

3/9/70

Basic Date
Changed

CSM 09

- 55 Increment CMC Time (Decimal)
 - *56 Terminate Tracking (P20)
 - 57 Start REND sighting mark (R21)
 - *58 Reset Stick Flag and set V50N18 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
 - *68 CSM Stroke Test on (LM on only)
 - *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
 - *76 Set preferred att flag (pref track axis)
 - *77 Reset preferred att flag (X axis)
 - *78 Update prelaunch azimuth
 - 79 Start DAP PTC/ORB RATE Routine
 - *80 Update LM State Vector
 - *81 Update CSM State Vector
 - 82 Start Orbit Param Disp (R30)
 - 83 Start REND Param Display (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
 - *92 Start IMU performance test (P07)
 - *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

CMC GENERAL

- not manually callable^G with valid data
1-4

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 (can be R1,R2,R3)	.01°
-05	Angular Error/Diff	.01°
-06	Option Code (R1 & R2)	OCTAL
-07	BIT operator: Address,BIT ID, Action	OCTAL
08	Add +1 of error	OCTAL
	B BANK + SUPERBANK	OCTAL
	No of SELF TEST errors	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
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)	
-26	Prio/Delay, ADRES, BBCON(R1,R2 & R3)	OCTAL
27	Self-Test on/off sw	
-29	X SM LAUNCH Azimuth	.01°
-30	Target Code(Gyrocomp verif)	
32	Time from Perigee hrs,min,	.01sec
33	Time of Ignition (GETI) 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	GETI-TPI hrs,min,	.01sec
38	State Vector Time hrs,min,	.01sec
39	Δ Time of Transfer hrs,min,	.01sec

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CSM 1

CSM 10

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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)	.1 NM
	Perigee Alt (HP) <i>RLS</i>	.1 NM
	ΔV (Required)	.1 FPS
43	Lat	.01°
		(+ North)
	Long	.01°
		(+ East)
	Alt <i>RLS</i>	.1 NM
44	Apogee Alt (HA) <i>RLS</i>	.1 NM
	Perigee Alt (HP)(N50)	.1 NM
	TFF	min-sec
45	Marks	XXBXX
	TF GETI of next burn	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	.1 NM
	ΔV	.1 FPS
	SOURCE CODE (1 optics,2 VHF)	0000X.
50	ΔR (miss distance)	.1 NM
	PERIGEE (HP)	.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°

ALARM CODES

EXT VERBS

G & C SYSTEM MANAGEMENT

G
1-6

57	ΔR offset (SOR)	.1 NM
	(+ indicates behind target)	
58	HP alt (post TPI) (SOR for P38) <i>PLS</i>	.1 NM
	ΔV (TPI) (SOR for P38)	.1 FPS
	ΔV (TPF) (SOR FINAL for P38)	.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	.1 NM
63	RTGO from 0.05 G	.1 NM
	To Splash	
	VIO, Predicted Iner Vel	FPS
	TFE, time from .05G	min-sec
64	Drag Acceleration	.01 G
	VI, Inertial Velocity	FPS
	RTGO to Target	.1 NM
65	Sampled CMC Time	hrs,min,.01 sec
	(fetched in interrupt)	
66	Beta, CMD Bank Angle	.01°
	CRSRNG Error	.1 NM
	DNRNG Error	.1 NM
67	RTGO 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

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CSM

CSM 1

G
1-7

70	Star Code(before mark)	OCTAL
	LMK Data	OCTAL
	Horiz data	OCTAL
71	Star code (after mark)	OCTAL
	LMK Data	OCTAL
	Horiz data	OCTAL
72	Δ ang	.01°
	Δ alt	.1 NM
	Search option	
73	ALT (P21)	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
79	PTC/Orb Rate	.0001°/sec
	PTC/Orb deadband	.01°
	PTC/Orb Code	XXXXX
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
87	Opt Calib Data - Shaft (R1)	.01°
	Trunnion(R2)	.001°
88	Planet	X
		Y
		Z
89	Landmark - Lat	.001°
	(+ North)	
	Long/2	.001°
	(+ East)	
	Alt	.01 NM
90	REND out of	Y
	Plane para	Y DOT
		PSI
91	OCDU Angles Shaft (R1)	.01°
	Trunnion (R2)	.001°

CMC GENERAL

ALARM CODES

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92 New OCDU Angles Shaft (R1) .01°
Trunnion (R2) .001°
93 Delta Gyro Angles X,Y,Z .001°
94 OCDU ANGLES (R56 & R23)
R1 SHAFT .01°
R2 TRUNNION .001°
95 Pref att ICDU angles .01°
96 +X axis att ICDU angles .01°
97 System Test Inputs XXXXX.
XXXXX.
XXXXX.
XXXXX.
XXXXX.
98 System Test Results .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
00112 Mark reject with no marks being accepted
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.
00122 Marking not called for
Continue.
00124 P17 (77) TPI search unsuccessful (G/3-1)
(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 V40 N20E.
(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/1-25 (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
Reinitiate current program.
If alarm recurs, terminate use of ISS (G&N 12).
00220 IMU orientation unknown
Align or if aligned set REFSMMAT flag.

NAVIGATION

PRETRUST (P30's & 70's)

EXT VERBS

G & C SYSTEM MANAGEMENT

G
1-10

- 00401 Desired middle gimbal angle is excessive
Call N22 - maneuver if MGA < 85° or
realign IMU.
- 00404 Target out of view (90 deg test)
(G/3-6,6-3)
- 00405 Acceptable star pair is not available
(G/6-3,6-6)
- 00406 Rnd navigation not operating
Select P20 or continue.
- 00421 W-matrix overflow
Notify MSFN but continue.
W-matrix automatically reinitialized at
next mark.
- 00600 No solution on first iteration in
P32/72
(G/4-2)
- 00601 Post CSI Perigee/lune alt <85nm/ 5.8nm
(G/4-2)
- 00602 Post CDH Perigee/lune alt <85nm/ 5.8nm
(G/4-2)
- 00603 Time from TIG (CSI) to TIG (CDH)
<10 min
(G/4-2)
- 00604 Time from TIG (CDH) to TIG (TPI)
<10 min
(G/4-2)
- 00605 Number of iterations exceeds loop
maximum
(G/4-2,4-7,4-8)
- 00606 ΔV (CSI) has been >1000 fps for last
two iterations
(G/4-2)
- 00611 No TIG for given ELEV angle
(G/4-4,4-5)
- 00612 State vector in wrong sphere of influence
at TIG
(G/4-7)
- 00613 Reentry angle out of limits
(G/4-8)
- (m)00777 ISS warning caused by PIPA fail
(G&N 6).

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- 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
Copy N08, notify MSFN, continue.
- (m)01407 VG increasing
(G/5-6,L/7-6) (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
- 01602 Bad optics during verification
See 01600
- 01703 Insufficient time for integration.
TIG slipped
(G/5-4,5-14,L/7-5).
- (m)03777 ISS warning caused by ICDU fail
(G&N 6)

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1-12

- (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&N6)
- (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.
- **21103 Unused CCS branch executed
Copy N08, notify MSFN, initiate V36 recovery
- **21204 Negative or zero time waitlist call.
If ave-g 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 device 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

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CSM 09

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- **21521 V92 keyed (P07) during P00 or P01 selected and P11 has already been performed
See 21204
 - *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
 - *31203 Waitlist overflow - too many tasks
See 31201
 - *31207 No vac area for marks
Rset
Reselect program
If alarm recurs, consult MSFN.
 - *31211 Illegal interrupt of extended verb
Reselect extended verb after optics marking is completed.
(m) - Malf procedure indicated
**(2xxxx) - Generates restart, F37 (no lt) P00D00
*(3xxxx) - Restart (no lt) and program continues (i.e. attempted recovery) BAIL OUT
- NOTE - All **alarms act as *type if they occur when Ave-g is on

EXT VERBS

G & C SYSTEM MANAGEMENT

G
1-14

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
00041	Switch	CM/SM SEP to UP
00062	Key	CMC to STBY
00202	Perform	PGNS AUTO 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
00003	Specify tracking Attitude	1=Preferred, 2=+X-axis
00005	Specify SOR Phase	1=First, 2=Second
00007	Specify Propulsion System	1=SPS, 2=RCS

CSM 109
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FLAG WORD LISTING

TITLE	ADDRESS	BIT	WHEN SET	WHEN RESET
<u>DRIFT</u> RNDZ	00076 00074	15 7	by P52/51 opt 1,2,4 P20 initiated	V36, coarse align P20 terminated
UPDATE	00075	7	State vector up- date by marks allowed	State vector up- dating by marks not allowed
Track	00075	5	RNDZ Tracking allowed	Rendezvous tracking not allowed
Pref Att	00076	4	Pref Att computed	Preferred S/C attitude not computed
Steer.	00076	11	Steering to be done	Steering omitted
REFSMAT	00077	13	REFSMAT good	REFSMAT not good
IMU	00074	8	IMU in use	IMU not in use
State Vector	00075	8	CSM State vector updated	LM state vector updated
Terminate	00103	15	Terminate <u>auto optics</u> R52,R53 <u>mark</u>	Do not terminate

G
1-15

CMC CENDDAT

Trunnion drive 00074 4 Trunnion driven to
calculated value 50°

Target 1 00075 10 LM sighting Not sighting LM

Target 2 00075 9 LMK Sighting Sighting star

W-matrix (RNDV) 00101 1 W-matrix for rendezvous navigation is valid W-matrix for rendezvous navigation is invalid

W-Matrix (ORB) 00077 6 P22,P23 W-matrix valid P22,P23, W-matrix invalid

3 axis 00101 6 MNVR Specified by 3 axes Maneuver specified by 1 axis

External AV 00076 8 Ext AV VG comp Lambert VG computations

Active vehicle 00076 5 LM active CSM active

Final comp. 00076 6 Final RNDZ comp Interim pass through rendezvous program computations

Sighting mark 00074 6 V51 initiated V51 not initiated

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CSM 109
Stick flag 00075 14 RHC out of detent RHC in detent (auto maneuver enabled)

CMOON flag 00104 12 Permanent CSM SV in Lunar Sphere of Influence Permanent CSM SV in Earth Sphere of Influence

LMOON flag 00104 11 Permanent LM SV in Lunar Sphere of Influence Permanent LM SV in Earth Sphere of Influence

NON-FLAGS

IMODES 30 1320 9 IMU not operating IMU operating
GPTMOOES 1351 OCTAL-TO-BINARY CONVERSION

ABCDE = OCTAL WORD

BINARY BIT SET = 1
RESET = 0

OCTAL DIGIT	A			B			C			D			E		
BINARY BIT	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
OCTAL DIGIT =	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0
	2	0	1	0	0	1	0	0	1	0	0	1	0	0	1
	3	0	1	1	0	1	0	1	0	0	1	0	0	1	0
	4	1	0	0	1	0	1	0	0	1	0	0	1	0	1
	5	1	0	1	1	0	1	0	1	1	0	0	1	0	0
	6	1	1	0	1	0	1	1	0	1	0	1	1	0	1
	7	1	1	1	1	1	1	1	1	1	1	1	1	1	1

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 V37E*
- or b. V37E 00E
2. V25 N7E, 76E, 40000E, 1E (set DRIFT flag)
3. V25 N7E, 77E, 10000E, 1E (set REFSMMAT flag)

if V30 or 31 inadvertently keyed in:
RECORD N26, NOTIFY MSFN, V74E
Perform General System Checkout

if V36 inadvertently keyed in:
1. V25 N7E, 76E, 40000E, 1E (set DRIFT flag)
2. V48
3. V46
4. Perform General System Checkout as necessary

if GO JAM performed:
V74 when convenient, see V36

if All 8's appear spontaneously on DSKY

1. V99 N99
2. V25 N1E
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 V96E
4. Simultaneously press RSET 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

To change programs with engine on bit set:

V21 N01E

775E

XXE (program code in octal)

V25 N26E

30000E

2025E

10063E

V30 N26E

Basic Date Changed 10/9/70

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CSM 09

CSM 09

V35 - DSKY CONDITION LIGHT TEST
CMC - on

- 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
 - e. ISS lt - off
CMC lt - off
V, N quits flashing
 - f. P00 will be displayed.
 - g. Key RSET
don't use PIPs for 10 sec

V41 N91 COARSE ALIGN OCDU's
CMC - on
ISS - on
G/N PWR OPTICS - on
OPT MODE - CMC
OPT ZERO - OFF

1 V41N 91E

Basic Date
Changed 1/9/70

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CSM 109

- 2 F 21 92 SHAFT, TRUN NEW OCDU (.01°, .001°)
Load desired shaft and trun
 - 3 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 V40 N20E
NO ATT lt - off
Wait 20 sec
 - 5 V37E XXE
- V42 GYRO TORQUING
CMC MODE - FREE
- 1 F 21 93 V42E
LOAD DELTA GYRO ANGLES (XYZ) (.001°)
(In flight - 90° max)
 - 2 42 NO ATT lt - off
Monitor Gyro Torquing on FDAI

V67 - W-MATRIX ERROR DISPLAY

1
-F 06 99 V67E
POS ERR,VEL ERR,OPT CODE (ft,.lfps)
R3 00001=Rend
00002=Orbital
00003=Cislunar
00000=No Reinitialization

Load desired data
PRO

V74 CMC DOWNLINK

1
V74E (Places erasable memory on downlink)
~ 0.5 sec. MIFN can firm

V79 - DAP PTC/Orb rate

PTC - pg G/8-2
ORB RATE-pg G/8-4

Basic Date
Changed 19/70

Basic Date
Changed 19/70

CSM 11

CSM 11

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
F 04 12 V82E (If AVE G On, Go To 3)
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 RW (.1nm,.1nm,min-sec)
(RECYCLE) V32E To 2 (Not Nec If AVE G On)
(AR-miss dist DISP-P11 & P00) N50E To 4
(TF PER) N32E To 5
(EXIT) PRO

4
F 16 50 AR (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

* when using time quits away in future -
v96 to stop int. then v37E00E on
completion

*
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 P00)
V83E (or 85E) - perform routine
V37E OOE to resume int.

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

*
V85 - RNDZ PARAMETER DISPLAY #2

Note: See V83 restrictions

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

V87 - SET VHF RNG FLAG

VHF AM B - DUPLEX

VHF RNG - on (up)

P20 - running

1 V87E (starts VHF range sampling)

2 V88E (TERMINATE)
or V37E XXE

* during P22 R & R are invalid

V89 - RENDEZVOUS FINAL ATTITUDE

Note: This routine will change N17 cells

CMC - on

ISS - on

SCS - operating

1 V37E OOE
V62E

2 F 04 06 V89E
R1 00003 SPECIFY TRACKING ATTITUDE
R2 00001 (PREF)
00002 (+X AXIS)
PRO

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

4 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 6

5 06 18 AUTO MNVR TO FDAI RPY ANGLES (.01°)

6 F 50 18 REQ MNVR TO FDAI RPY ANGLES (.01°)
(TRIM) ALIGN SC In ROLL
PRO To 5
(BYPASS) ENTR

Basic Date 9/70
Changed

Basic Date 9/70
Changed

CSM 109

CSM

NAVIGATION

PRETHRUST (P30's & 70's)

AV₀ vs ΔLONG

G & C SYSTEM MANAGEMENT

V90 - OUT-OF-PLANE DISPLAY

- 1
F 04 12 V90E
R1 00002 Specify Vehicle
R2 00001 CSM
00002 LM
PRO
- 2 F 06 16 GET EVENT (hrs,min,.01sec)
Load desired time
PRO
- 3 F 06 90 Y,YDOT,PSI (.01nm,.1fps,.01°)
(RECYCLE) V32E to 2
(EXIT) PRO

V91 - COMPUTE BANKSUM
CMC - on (req)

- 1 V37E 00E
- 2 F 05 01 V91E
R1 - Sum of all cells in bank
R2 - Bank number
R3 - Bugger word
Verify R1=R2 or R1+R2=77777(If not, red R2)
(NEXT BANK) PRO
(TERM) V34E

V93 - ENABLE W-MATRIX INITIALIZATION

- 1 V93E

IMU POWER UP PROCEDURE

- ✓ LOGIC POWER 2/3-on
✓ FDAI POWER - BOTH
✓ FDAI SELECT - 1/2
✓ CMC MODE - FREE

G/N IMU PWR - on (up)
NO ATT lt - on (90 sec)
NO ATT lt - out
Wait 15 sec *to allow pipe inhibit*
reset

V37E XXE

- *If CMC not available: *
* G/N IMU PWR - on(up) *
* Wait 90 sec *
* IMU CAGE - on(up) 5 sec,*
* then release *

IMU POWER DOWN PROCEDURE

CMC MODE - FREE

G/N IMU PWR - OFF
ISS warning
*RSET *

Basic Date 3/9/70
Changed

Basic Date 3/9/70
Changed

CSM 103

CSM 103

MEASUREMENT & LOADING OF PIPA BIAS

1 DET - RESET
SC RATES <0.1°/sec
CMC MODE - FREE

2 V25N 21E, E,E,E/Start Event Timer

3 06 21 V06 N21 (do not ENTR)
XYZ PIPA COUNTS

4 At T + 1:04 - ENTR
T1:04
Record (X) R1 ____ (Y) R2 ____ (Z) R3 ____ (+XXXAB)

5 F 21 01 V21N 01E (use same sign as above)
1452 E (CALCULATED X BIAS) E,E, (+ABXXX)
1454 E (CALCULATED Y BIAS) E,E
1456 E (CALCULATED Z BIAS) E

CMC POWER UP PROCEDURE

1 PRO, push until STBY lt - out
(repeat, if necessary)
CMC warning, RESTART, PROG ALARM
*RSET and continue *

2 ~~F 37~~ ^{V96E} 00E*

P06 - CMC POWER DOWN PROGRAM

V34 will not inhibit

1 F04 46 V48E
Load 0 (NO DAP) in left digit of R1
PRO
PRO
PRO
V46E

V37E 06E
F 50 25 00062 CMC PWR DN

PRO, push until STBY lt - on

CMC SELF CHECK

F21 01 V25 N01E, 1365E
E,E,E

15 01 V15 N01E, 1365E
R1 NUMBER OF ERRORS
R2 NUMBER OF TESTS STARTED
R3 NUMBER OF TESTS SUCCESSFUL

3 V21 N27E 10E SELF TEST FIXED & ERASABLE
(4E SELF CHECKS ERASABLE
5E SELF CHECKS FIXED)

4 15 01 TEST SUCCESSFUL WHEN R2>3 (78 sec)
* IF PROG lt - On *
* V05 N09E 01102 SELF *
* TEST ERROR *
*N8E-Rec for MSFN *

(TERM) V21N27E OE

OPTICS POWER UP PROCEDURE

Verify optics manual drive disengaged

✓ G/N PWR OPTICS - on (up)

✓ OPT ZERO - OFF

✓ OPT ZERO - ZERO (15 sec)

OPTICS POWER DOWN

G/N PWR OPTICS - OFF

OPTICS MANUAL DRIVE PROCEDURE

Verify G&N PWR OPTICS - OFF

Insert tool E and rotate ~1 rev CCW
to engage drive (socket backs out)

Drive optics either direction
(~ 1 rev/degree)

To disengage, push and rotate
~1 rev CW (button will remain
flush)

Basic Date 3/9/70
Changed

Basic Date 3/9/70
Changed

CSM 109

CSM 109

SCS POWER UP

~~AUTO RCS SELECT (16) - OFF~~
~~BMAG MODE (3) - RATE 2~~
~~CMC MODE - FREE~~
~~SC CONT - CMC~~
~~SCS LOGIC PWR (4) - close~~
~~AV CG as required~~
~~LOGIC PWR 2/3 - on (up)~~
~~SIG COND/DRIVER BIAS PWR (2) - AC1~~
~~SCS ELEC PWR - GDC/ECA (88 watts)~~
~~FDAI PWR - OFF (verify)~~
~~BMAG PWR (2) - ON (145 watts)~~
~~FDAI PWR - BOTH (58 watts)~~
~~AUTO RCS SELECT (16) - enable~~
~~BMAG MODE (3) - RATE 2~~

warm up (40 min)

41 BMAG

SCS POWER DOWN

EMS FUNCTION - OFF
 EMS MODE - STBY
 FDAI SCALE - 5/1
 FDAI SELECT-1/2 1 or 2 x
 FDAI SOURCE - ATT SET CMC x
 ATT SET - GDC
 MAN ATT (3) - MIN IMP
 ATT DB - MAX
 RATE - LOW
 *AUTO RCS SELECT (16) - OFF
 TRANS CONTR PWR - OFF
 *RHC PWR NORMAL (2) - OFF
 RHC PWR DIRECT (2) - OFF
 *CMC MODE - FREE
 BMAG MODE (3) - RATE 2
 SCS TVC (2) - RATE CMD
 .05G sw - OFF
 a/Pc sw - Pc
 TVC GMBL DRIVE (P&Y) - AUTO 1 to conserve pwr
 BMAG PWR (2) - WARMUP (105 watts)
 TVC SERVO PWR (2) - OFF
 FDAI PWR - OFF
 *LOGIC PWR 2/3 - OFF
 SCS ELEC PWR - OFF
 *SIG COND/DRIVER BIAS PWR (2) - OFF
 For total pwr dn - BMAG (2) - off
 OR DERIV & like - OFF
 COMS - OFF
 limit cycle - ON

* for CMC control

SCS ATTITUDE REFERENCE COMPARISON

CMC - on
 IMU - on
 SCS - operating
 If SIVB SEPARATED: Damp vehicle rates

Key V16 N20E (present IMU angs)

FDAI SELECT - 1
 FDAI SOURCE - ATT SET
 ATT SET - GDC
 ATT SET dials - null FDAI 1 error needles
 Key VERB when nulled (freeze display)
 Record from DSKY:

R _____°, P _____°, Y _____°
 Record ATT SET dials: _____°
 R _____°, P _____°, Y _____°
 GDC > 10%
 NO GO

AV TEST & NULL BIAS CHECK

EMS MODE - STBY
 EMS FUNC - AV SET/VHF RNG
 SET AV ind to 1586.8 fps
 EMS MODE - NORMAL
 EMS FUNC - AV TEST
 SPS THRUST Lt - on/off (10 sec)
 AV ind. stops at -0.1 to -41.5

EMS MODE - STBY
 EMS FUNC - AV SET/VHF RNG
 SET AV ind to - 100.0 fps
 EMS FUNC - AV (wait 5 sec)
 START DET

00:00
 01:40

EMS MODE - NORM
 EMS MODE - STBY
 If AV < 1 fps, do not bias
 If AV > 1 fps but < 10 fps, bias
 if desired
 If AV > 10 fps, EMS is NO-GO
 *Bias check is invalidated by EMS
 FUNC-OFF*

Basic Date 3/9/70
 Changed

Basic Date 3/9/70
 Changed

CSM 1 9

P17 - TPI SEARCH (P77 LM)
CMC - on (req)

- 1 F 06 37 V37E (17E or 77E) (hrs,min,.01sec)
GETI (TPI)
Load desired GETI
PRO
- 2 F 06 72 *cent. angle of active*
 $\Delta\text{ANG}(\text{TPI}), \Delta\text{ALT}(\text{TPI}), \text{SEARCH OPT}$
(.01°, .1nm, 0000X)
R3=SEARCH OPT 00001<180°
00002>180°
(change GETI TPI) V32E to 1
(change Search opt) V23E
PRO
*F 05 09 00124 alarm code *
V32E, RSET to 1 to adjust
*GETI or SEARCH OPTION *
- 3 F 06 58 HP, $\Delta\text{V}(\text{TPI}), \Delta\text{V}(\text{TPF})$ (.1nm, .1fps, .1fps)
(RECYCLE) V32E to 1 to adjust
GETI or Search option
PRO
- 4 F 06 55 R1=Perigee Code, R3=CENTANG(0000X, .01°)
00001, perigee between TPI and TPF
00002, perigee after TPF
(RECYCLE) V32E to 1 to adjust
GETI or Search option
PRO
- 5 F 37 XXE

Basic Date 19/70
Changed

CS 109

G
3-2P20 - RENDEZVOUS NAVIGATION

CMC - on (req)
 ISS - on and aligned (req)
 SCS - on (des)
 BMAG MODE (3) - RATE 2
 G/N OPT PWR - on (verify)
 OPT ZERO - ZERO (verify)
 OPT MODE - CMC

Note: For VHF RNG display see p G/1-21

1

V37E 20E
 F 50 18 Request MNVR to FDAI RPY angles (.01°)

(AUTO) SC CONT - CMC
 CMC MODE - AUTO

PRO
 06 18 RPY (.01) to 1 when MNVR complete
 (MAN) SC CONT - SCS

PRO To 1
 or V62E
 RHC - MNVR To 1

When attitude OK:

CMC MODE - AUTO

ENTR

OPTIC ZERO - OFF
 *POSS UPLINK ACTY 1t *
 *(Mnvr >10° req'd) *
 *To reestablish F 50 18 *
 * Key V58E *

Basic Date 9/70
 Changed

CM 109

Basic Date 9/70
 Changed

CM 109

2

F 51

V57E (SXT)

OPT MODE - MAN

OHC - Cntr Target in SXT

MARK (repeat as necessary)

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

OPT ZERO - ZERO

PRO (return to program in process)
 (To terminate P20 - V56E)

3

F 06 94

V54E (COAS)

SHAFT, TRUNNION

(.01°, .001°)

PRO

4

F 53

Request Alt LOS MARK

RHC - ALIGN Target in COAS

ENTR (V86E To reject)

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

PRO (return to Program in process)
 (To Terminate P20 - V56E)

To display N49 for every measurement:

V1 N1E

2002E

Rcrd: R1

V21 N1E

2002E

77776E

To return:

V21N1E

2002E

Load previously recorded value

G
3-4

P21. GROUND TRACK DETERMINATION
CMC - on (req)

- 1 F 04 06 V37E 21E
R1 00002, Specify Vehicle
R2 00001, CSM
or 00002, LM
PRO
- 2 F 06 34 GET LAT, LONG (hrs, min, .01sec)
Load desired GET (for present time, use
all zeroes)
PRO
- 3 F 06 43 LAT, LONG, ALT (LS) (.01°, .01°, .1nm)
(RECYCLE) V32E to 2 (Increment GET 10 min)
(EXIT) PRO
- 4 F 37 XXE

NOTE: Additional Information is available
by V6 N73E
N73 Alt, VEL, GAMMA(10nm, fps, .01°)

Basic Date 3/9/70
Changed

Basic Date 1/9/70
Changed

M 109

CSM 109

G
3-5

P22 - ORBITAL NAVIGATION

CMC - on (req)
ISS - on and aligned (req)
SCS - on (req)
BMAG MODE (3) - RATE 2
G&N PWR OPTICS - on (verify)
COUPLING - RESOLVED
SPEED - MED
OPT ZERO - ZERO (verify)
OPT MODE - CMC
To remove rate limit: V21N1E, 1341E, E

- 1 F 06 45 V37E 22E
R3=MAX MGA (.01°)
(REJECT) R3>60° to P52
R3<60° IMU ALIGNED
MNVR To SIGHTING ATTITUDE
Roll to keep shaft axis >10° from
plane defined by X axis & LOS to
LMK (For 60nm alt, LMK >10nm from
gnd track requires no roll)
(MAN) OPT MODE - MAN
OPT ZERO - OFF
PRO (To 3 for earth orbit)
(AUTO) OPT ZERO - OFF
PRO (To 3 for earth orbit)
- 2 F 05 70 (lunar orbit only)
R2 ABCDE lmk code
Load lmk code: SITE = 10001
KNOWN = 10000
UNKN = 20000
A=1(known), 2(unknown)
B=INDEX OF OFFSET designator
C=not used
DE=LMK ID (0,1, 5X are legal)
IF A=2
OPT MODE - MAN
PRO to 5
or IF A=1 & DE≠00
PRO to 4 (To 5 if OPTICS - MAN)
or IF A=1 & DE=00
PRO to 3

THRUSTING (P40's)

PRETHRUST (P30's & 70's)

AV₀ vs ΔELONG

P37 BLOCK DATA

C & C SYSTEM MANAGEMENT

G
3-6*mean lunar radius*

3 F 06 89 LAT, LONG/2, ALT *(.001°, .001°, .01nm)*
Load lmk coords
PRO (To 5 if OPTICS - MAN)

4 06 92 SHAFT, TRUN NEW OCDU *(.01°, .001°)*
*F 05 09 00404 *(TRUN > 90°)**
* MNVR to acquire *
* PRO *
* or V34E, F 37 *
Establish proper pitch rate
OPTICS MODE - MAN

5 F 51 MARK REQUEST (Avoid lmk near horiz)
MARK
After sufficient MARKS:
*After 5 MARKS: *
F 50 25 00016 TERM MARKS
PRO

6 F 05 71 R2 ABCDE LMK DATA
Load lmk code (if nec)
A=1 if KNOWN LMK
A=2 if UNKNOWN LMK
B=INDEX OF OFFSET DESIGNATOR
(If only 1 mark made, insure B=0)
C=Not used in P22
DE=LMK ID NO. (0,1 are valid)
PRO - if A=2 (or A is 1 & DE = 01) to 8

7 F 06 89 LAT, LONG/2, ALT *(.001°, .001°, .01nm)*
PRO

8 F 06 49 ΔR, ΔV (ORB PARA) *(.1nm, .1fps)*
(RECYCLE) V32E to 2
(ACCEPT) Hold for 30 sec *for downlink*
PRO

Basic Date 3/9/70
Changed

109

Basic Date 3/9/70
Changed

CS 109

G
3-7

9 F 06 89 LAT, LONG/2, ALT LMK ID *(.001°, .001°, .01nm)*
(DON'T STORE) V32E to 2
(STORE-CODE 01) PRO to 2
(terminate Prog) V34E

10 F 37 XXE
OPT ZERO - ZERO
To restore rate limit (CDU transient
detection): V21N1E, 1341E, 5E

P23 OPTICS CALIBRATION
CMC - on
OPT ZERO - ZERO (verify)
OPT MODE - MAN
OPT PWR - ON

1 F 05 70 V37E 23E (IMU NOT ALIGNED - to 3)
STAR ID(ABCDE)/LMK ID/HOR ID
Insure R1 DE≠00, R2=00000, R3=00XX0
(X=1 or 2)
PRO

2 F 50 25 00202 MNVR/CALIB REQUEST
ENTR

3 F 59 PERFORM OPTICS CALIB
OPT MODE - MAN (verify)
OPTICS COUPLING - DIRECT
SPEED - LOW
OPT ZERO - OFF
SUPERIMPOSE LLOS TO SLOS
MARK

4 F 06 87 R2 TRUNNION ANGLE BIAS *(.001°)*
(repeat until 2 measurements
agree within .003°) *100000*
For manual load: *189147*
V22 N94E
XXXXXE
(ACCEPT) PRO
(REJECT) MARK to 4

5 F 51 V37E XXE
OPT ZERO - ZERO

G
3-8P23 - CISLUNAR MIDCOURSE NAV MEASUREMENT

CMC - on
SCS - on
ISS - on & aligned
G/N PWR OPTICS - on (30 min prior)
OPT ZERO - ZERO (verify)
OPT MODE - CMC

1 V37E 23E

2 F 05 70 R1 000DE STAR ID
R2 00C00 LMK ID
R3 00CDO HOR ID

STAR/ENH	STAR/LNH	STAR/EL
000DE	000DE	000DE
00000	00000	00100
00110	00210	00000

STAR/EFH	STAR/LFH	STAR/LL
000DE	000DE	000DE
00000	00000	00200
00120	00220	00000

STAR/HOR PRO TO 5 (DE=00 to 4)
STAR/LMK PRO

3 F 06 89 LAT, LONG/2, ALT (LMK) (.001°+N/E, .01nm) |
PRO (DE=00 to 5)

4 F 06 88 CELESTIAL BODY VECTOR
LOAD DESIRED VECTOR
PRO

5 F 50 25 00202 MNVR/CALIB REQUEST
(MNVR) PRO
(CALIB) ENTR to 8

Basic Date 9/70
Changed

109

Basic Date 9/70
Changed

CSM 119

G
3-9

6 F 50 18 REQUEST MNVR TO FDAI R,P,Y (.01°)
(AUTO) SC CONT - CMC
CMC MODE - AUTO
BMAG MODE (3) -RATE 2
PRO to 7
(MAN) V62E
MNVR to 6
(BYPASS) ENTR to 8 (CALIB COMPLETED to 10)

7 06 18 AUTO MNVR FDAI R, P, Y (.01°)
AUTO MNVR COMPLETE RETURN TO 6

8 F 59 REQUEST OPTICS CALIB
(BYPASS) OPT MODE - CMC (verify)
OPT ZERO - OFF
ENTR to 10
(CALIB) OPT MODE - MAN
OPT COUPLING - DIR
SPEED - LOW
OPT ZERO - OFF
SUPERIMPOSE LLOS ON SLOS
MARK

9 F 06 87 R2 TRUN BIAS (.001°)
For manual load:
V22 N94E
XXXXXE
(RECALIB) MARK to 9
(INCRP OPT MODE-CMC
CALIB) PRO

10 06 92 AUTO OPT SHF/TRUN (.01°, .001°)
(MNVR) V94E to 6
(MARK) MNVR SC TO POSITION LMK/HOR
IN FOV
OPT MODE - MAN

G
3-10

- 11 F 51 MARK REQUEST
(MNVR)* V94E to 6
(MARK)
SUPERIMPOSE STAR ON LMK/HOR
MARK
- 12 F 50 25 00016 TERM MARKS
(REJECT) MARK REJECT to 11
(TERM) PRO
- 13 F 05 71 R1 000DE STAR ID
R2 00C00 LMK ID
R3 00CDO HOR ID

(STAR/HOR) PRO to 16 (DE=00 to 15)
(STAR/LMK)PRO to 14
- 14 F 06 89 LAT, LONG/2 ALT(LMK) (.001°+N/E,.01nm)
PRO (DE#00 to 16)
- 15 F 06 88 CELESTIAL BODY VECTOR
Verify vector
PRO
- 16 F 06 49 ΔR ΔV (SV PARA) (.1nm,.1 fps)
(REJECT) V37E 23E
(UPDATE) PRO
- 17 F 37

* If this is first P23 MARK since last:
CSM S.V. Uplink
or P20
or Reinitialization of P23 W-matrix
by V93 or V67
or Alarm code 421

Then key V93E prior to mark

G
3-11

P27 CMC UPDATE

CMC - on (req)

Auto Update:

V37E 00E *no ext verbs*

UP TLM (2) - ACCEPT

UPLINK ACTY 1t - on

POSS LOS before completion

*If V33 N02 showing: *

* Key ENTR *

* UPLINK ACTY 1t - out *

* P00 displayed *

*If V21 N01 *

*or V21 N02 *

* Key V34E *

* UPLINK ACTY 1t - out *

* P00 displayed *

*UP TLM (2) - BLOCK *

Update complete:

UPLINK ACTY 1t - out

V37E 00E

UP TLM (2) - BLOCK

Basic Date 9/70
Changed

Basic Date 9/70
Changed

M 109

M 109

Voice Transmission Update:

V37E 00E

V70E LIFT-OFF TIME UPDATE
or V71E LOAD DATA CONSEC ADD
or V72E LOAD DATA IN NON CONSEC
or V73E CMC TIME UPDATE

P27 Displayed

F 21 01 R3 UPDATE BUFFER ADD (initially 304)
R1 Data E (R3 Increments)
(If change - To 6)
Repeat Step 4 for all data

F 21 02 R3. 330
(Verify Data) V1 N1E
R3 304E
R1 Verify Data
N15E (R3 305)
R1 Verify Data
Consecutive ENTR's display
remaining comps. Note
octal ident (01-24) of
comps which need change
KEY REL To 6

F 21 02 R3 330
(CHANGE) Load octal ident, XXE to 4
(ACCEPT UPDATE) Key Verb, then PRO

P00 Displayed

P30 EXTERNAL AV

If uplinked REFSMMAT, do P52 (OPT 1) before P30

1 F 06 33 V37E 30E
GETI (hrs,min,.01sec)
Load desired GETI
PRO

2 F 06 81 AVXYZ(LV) (.1fps)
Load desired AV's do not use all zeros
PRO ~ 0.2 in y

3 F 06 42 HA,HP,AV(REQ) (.1nm,.1nm,.1fps)
Set AV Counter
PRO

4 F 16 45 M,TFI,MGA (MKS,min-sec,.01°)
Set DET
PRO (MGA Set to -00002 IF
REFSMMAT FLAG NOT SET)

5 F 37

P31 GENERAL LAMBERT PRETHRUST

TARG PARAMS - LOADED FROM GND (P27)

1 F 06 33 V37E 31E
GETI (hrs,min,.01sec)
Load desired GETI
PRO

2 F 06 81 AVXYZ(LV) (.1fps)
PRO

3 F 06 42 HA,HP,AV(REQ) (.1nm,.1nm,.1fps)
Set AV Counter
PRO

Basic Date 3/9/70
Changed

Basic Date 3/9/70
Changed

CSM 109

CSM 109

THRUSTING(P40's)

PRETHRUST(P30's & 70's)

AV₀ vs ΔLONG

P37 BLOCK DATA

NAVIGATION

G & C SYSTEM MANAGEMENT

G
4-2

G
4-3

THRUSTING(P40's)

SPS vs RCS CRITERIA

AV₀ vs ΔBLONG

P37 BLOCK DATA

NAUTICMANS

PRETHRUST(350's & 70's)

G & C SYSTEM MANAGEMENT

4 F 16 45 M,TFI,MGA (MKS,min-sec,.01°)
Set DET
PRO (MGA Set to -00002 IF
REFSMAT FLAG NOT SET)

5 F 37

P32 CSI PRETHRUST (P72 LM)

1 F 06 11 V37E (32E or 72E)
TIG (CSI) (hrs,min,.01sec)
PRO

2 F 06 55 APSIS CDH,TPI ELEVATION ANGLE,(+0000N,.01°)
CENTRAL ANGLE,Passive Vehicle (ω t)
(For CDH N π from CSI, load non-zero
in R3) if zero, nth apsidal crossing
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
(FINAL PASS) TERM MARKS
PRO

*F 05 09 *
* 00600 No Intersection on *
* First Iteration *
* 00601 hp+CSI <85nm/5.8nm *
* 00602 hp+CDH <85nm/5.8nm *
* 00603 TIG(CDH)-TIG(CSI) *
* <10 min *
* 00604 TIG(TPI)-TIG(CDH) *
* <10 min *
* 00605 NO SOL IN 15 Tries *
* 00606 ΔV(CSI)>1000fps in 2 *
* Iterations *
* V32E to 1 Adjust *
* Inputs *

Basic Date 3/9/70
Changed

CSM 10

Basic Date 3/9/70
Changed

CSM 19

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

6 F 06 81 ΔV XYZ(LV)CSI (.1fps)
(For Out-of-Plane Corr in Final Comp ONLY)
V90E

F 04 12 R1 00002 Specify Vehicle
R2 00001 CSM
00002 LM

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

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

Insert -Y DOT 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 (marks,min-sec,.01°)
SET EVENT TIMER TO TFI
PRO (MGA Set to -00002 If No
REFSMAT Set or If P72)

9 F 37

P72 - Transmit mnvr Parameters to LM

P33 CDH PRETHRUST (P73 LM)

1 F 06 13 V37E (33E or 73E)
TIG(CDH) (hrs,min,.01sec)
PRO

2 F 16 45 MARKS,TFI,-00001 (marks,min-sec)
(RECYCLE) V32E to 3
(FINAL PASS) TERM MARKS
PRO

G
4-4

F 05 09 00611 NO TIG FOR
* SPECIFIED ANGLE *
* (REDO)V32E to 1 *
* PRO to 3 *
*CMC will use last *
* calculated value of *
* TIG (TPI) *

G
4-5

2 F 06 55 PRECISION OFFSETS, ELEV ANGLE, wt
(0000X,.01°, .01°)
Load desired values
(+00000 in R2 to CALC ELEV
ANGLE AT TIG TIME)
PRO

3. F 16 45 MARKS,TFI,-00001 (min-sec)
(RECYCLE) V32E
(FINAL PASS) TERM MARKS
PRO

F 05 09 (00611 NO SOL)
*PRO To 1 *

4 F 06 37 TIG (TPI) (hrs,min,.01sec)
(IF ELEV ANGLE COMPUTED BY CMC
THIS DISPLAY WILL BE REPLACED
BY F 06 55 AS IN 2 ABOVE)
PRO

5 F 06 58 HP,AV(TPI),AV(TPF) (.1nm,.1fps,.1fps)
PRO (If Recycle - To 7)
(If Final - To 6)

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

NAVIGATION

PRETHRUST(P30's & 70's)

3 F 06 75 AH(CDH),AT(TPI-CDH),AT(TPI-NOMTPI)
PRO (.1nm,min-sec)

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

V90E
F 04 12 R1 00002 Specify Vehicle
R2 00001 CSM
00002 LM

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

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

Insert -Y DOT in R2 of AV (CDH)
PRO (If Recycling to 2)

5 F 16 45 MARK,TFI,MGA (marks,min-sec,.01°)
SET EVENT TIMER TO TFI
PRO (MGA Set to -00002 If No
REFSMMAT Set or If P73)

6 F 37

P73 - Transmit mnvr Parameters to LM

P34 TPI PRETHRUST (P74 LM)

1 F 06 37 V37E (34E or 74E)
TIG (TPI) (hrs,min,.01sec)
Load desired TIG
PRO

Basic Date 3/9/70
Changed

Basic Date 3/9/70
Changed

SM 109

CSM 10

G & C SYSTEM MANAGEMENT

THRUSTING(P40's)

SPS vs RCS CRITERIA

AV₀ vs ΔLONG

P37 BLOCK DATA

PRETHRUST Q30's & 70's

G & C SYSTEM MANAGEMENT

G
4-6

7 F 06 59 AVXYZ(LOS)TPI (.lfps)
PRO (If Recycle - To 3)

8 F 16 45 MARKS,TFI,MGA (marks,min-sec,.01°)
PRO (MGA SET To -00002 IF NO
REFSMAT SET or If P74)

9 F 37
P74 - Transmit Mnvr Parameters To LM

P35 TPM PRETHRUST (P75 LM)
must have valid P34 solution

1 F 16 45 MARK,TFI,-00001 (marks,min-sec)
(RECYCLE) V32E To 3
(FINAL PASS) TERM MARKS
PRO TIG in 3

2 F 06 81 AVXYZ(LV)TPM (.lfps)
PRO

3 F 06 59 AVXYZ(LOS)TPM (.lfps)
PRO (If Recycle - To 1)

4 F 16 45 MARKS,TFI,MGA (marks,min-sec,.01°)
PRO (MGA SET TO -00002 IF NO
REFSMAT SET or If P75)

5 F 37
P75 - Transmit Mnvr Parameters To LM

ATIGINC

V24 N01E
2021E

6min - 00002E, 06240E
10min - 00003E, 25140E
3min - 00001E, 03120E

3/9/70
Basic Date
Changed

CSM 109

3/9/70
Basic Date
Changed

CSM 109

G
4-7

P37 RETURN TO EARTH PGM
(LONG CONTROL CANNOT BE DONE WHEN TIME
TO ENTRY IS <4 HRS) *lunar return only*

Perform the following once:

VINIE

3376E

Verify R1= 01603(1185.6nm)

1 F 06 33 V37E 37E
TIG (hrs,min,.01sec)
Load desired TIG
PRO

2 F 06 60 BLANK,AV DESIRED, GAMMA EI DESIRED
Load desired AV: (fps,.01°)
PAD AV IF ON TLC
0. IF ON TEC
Load R3=0 if V *< 35,000 & must be loaded*
R2 XXXXX
PRO

*F 05 09 00612 State vector in *
* Lunar Influence *
* 00605 Solution not *
* Convergent *
*V32E, RSET TO 1 *
* 20607 Conic Routine *
* Failed *
* 20610 State vector is *
* below 400K ft *
* altitude *
*F 37 37E to 1 *

3 F 06 61 IMPACT LAT, IMPACT LONG (.01°)
If Impact LONG <12° from desired:
Record Impact LONG as 0cl _____.
PRO
If Impact LONG >12° from desired:
TEC:N40E Record R2 as ΔVmin fps TLC: V32E to 1
V32E to 1 & use |ΔV| >ΔV min Decrease ΔV to
ΔV neg to move LONG WEST move LONG WEST
ΔV pos to move LONG EAST Increase ΔV to
move LONG EAST

THRUSTING(P40's)

SPS vs RCS CRITERIA

ΔV₀ vs ΔV LONG

P37 BLOCK DATA

PRETHRUST (P30's & 70's)

G & C SYSTEM MANAGEMENT

G
4-8

- 4 F 06 39 AT TRANSFER (hrs,min,.01sec)
PRO
(RECYCLE) V32E To 1
- 5 F 06 60 BLANK,V PRED,GAMMA EI (fps,.01°)
PRO
(RECYCLE) V32E To 1
- 6 F 06 81 AVXYZ(LV) at TIG
Record R3 as $\Delta V_{zcl} = \underline{\hspace{1cm}}$ fps
N40E
Record R2 as $\Delta V_{cl} = \underline{\hspace{1cm}}$ fps
KEY RLSE
PRO
*F 05 09 00605 Solution not *
* Convergent *
* 00613 Flt Path Ang *
* not reached *
*RSET V32E to 1 *
* 20607 Conic Routine *
* Failed *
*F 37 37E to 1 *
- 7 F 06 61 IMPACT LAT,IMPACT LONG (.01°)
Record LONG as $\theta_{pl} = \underline{\hspace{1cm}}$
If θ_{pl} , acceptable, PRO to step 15
PRO
- 8 F 06 39 AT TRANSFER
PRO
- 9 F 06 60 BLANK,VPRED,GAMMA EI (fps,.01°)
PRO

Basic Date 3/9/70
Changed

CSM 109

Basic Date 3/9/70
Changed

CSM 10

G
4-9

- 10 F 06 81 AVXYZ(LV) at TIG
Record R1 as $\Delta V_{xpl} = \underline{\hspace{1cm}}$ fps
Record R3 as $\Delta V_{zpl} = \underline{\hspace{1cm}}$ fps
N40E
R2 XXXX,X Record as $\Delta V_{pl} = \underline{\hspace{1cm}}$ fps
V32E to 11
- 11 F 06 33 TIG (hrs,min,.01sec)
Load same value used initially
PRO
- 12 F 06 60 BLANK,AV DESIRED, GAMMA EI DESIRED
To move West from θ_{pl}
TEC: Load $\Delta V_{c2} = -\Delta V_{cl} - 10$
TLC: Load $\Delta V_{c2} = \Delta V_{cl} - 10$
To move EAST from θ_{pl}
TLC or TEC: Load $\Delta V_{c2} = \Delta V_{cl} + 10$
Record $\Delta V_{c2} \underline{\hspace{1cm}}$ fps
R2 XXXXX.
PRO
F 05 09 SAME AS IN 2
*V32E. RSET to 11 *

THRUSTING(P40's)

SPS vs RCS CRITERIA

AV vs ALONG

P37 BLOCK DATA

G
4-10

13 F 06 61 IMPACT LAT, IMPACT LONG (.01°)
Record LONG as $\theta c2 =$ _____

Compute K:

N81E Record R3 as

$\Delta Vcz2 =$ _____ fps

$$K = \left| \frac{\theta c2 - \theta c1}{\Delta Vzc2 - \Delta Vzc1} \right|$$

K = +. _____

Compute $\Delta \theta LONG = \theta d - \theta pl = +$ _____ °

Obtain from chart $\Delta Vo = +$ _____ fps

Make sign of ΔVo same as $\Delta \theta LONG$

Compute ΔVd :

$\Delta Vz d = \Delta Vz pl + \Delta Vo$

$$\Delta Vd = (\Delta Vz d^2 + \Delta Vx pl^2)^{1/2}$$

Make sign of ΔVd same
as $\Delta Vz d$

$\Delta Vd =$ _____

14 V32E to step 1 & use ΔVd in R2 of N60
(Step 2)

15 F 06 39 AT TRANSFER (hrs,min,.01sec)
(RECYCLE) V32E To 1
PRO

G
4-11

16 F 06 60 BLANK, V PRED, GAMMA EI (fps,.01°)
(RECYCLE) V32E To 1
PRO

17 F 06 81 $\Delta VXYZ(LV)$ TIG (.1fps)
(OPTION) N40E - VG MAG avail
in N40 and N80
KEY REL
PRO

18 F 04 06 THRUST OPTION
R1 00007
R2 0000X
X=1 (SPS)
2 (RCS) *DA?*
Perform R03 if not performed just
prior to P37 call
PRO

19 F 06 ³³ ~~13~~ TIG (hrs,min,.01sec)
PRO

20 F 16 45 MARK, TFI, MGA (mark,min-sec,.01°)
PRO (MGA SET TO -00002 If No
REFSMAT SET)

21 F 37 (40E or 41E)

Basic Date 3/9/70
Changed

Basic Date 3/9/70
Changed 3-27-70

CSM 109

CSM 10

PRETHRUST (P30's & 70's)

G & C SYSTEM MANAGEMENT

THRUSTING (P40's)

SPS vs RCS CRITERIA

ΔV_0 vs $\Delta \theta LONG$

P37 BLOCK DATA

G
4-12

OBTAIN ENTRY REFSMMAT (No Comm)

1. Record 400K time from final P37 solution (Step 1 TIG + FNL N39)
2. Use 400K time for T-align P52 (Option 2).

NOTE: P37 MCC used to compute T-align must be performed prior to step 2.

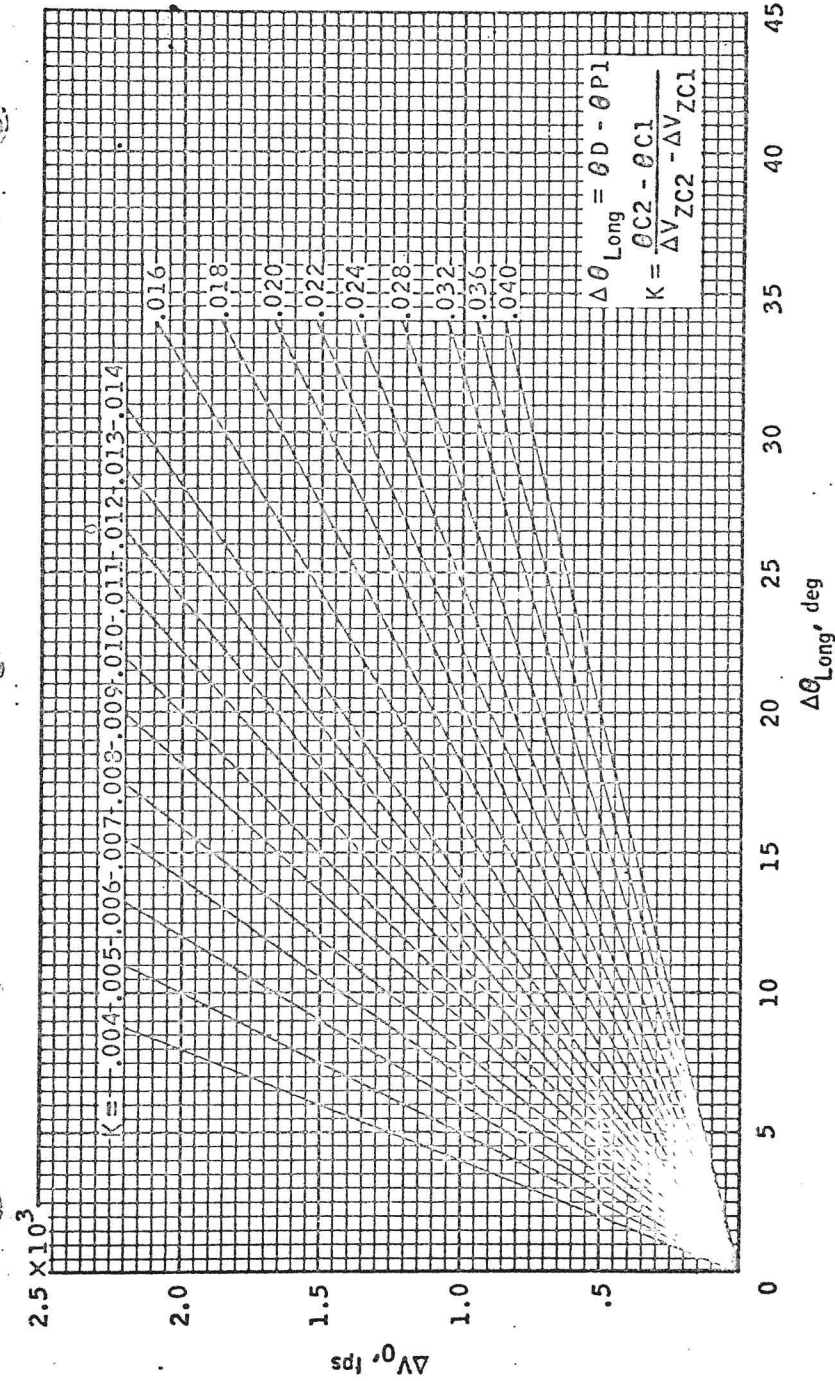
Earth orbit -

- ① Tig must have positive δ
- ② Tig is primary for long control

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Changed

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ΔV_0 versus $\Delta \theta_{Long}$, $K = .04$ to $.004$.

P37 BLOCK DATA

AV₀ vs ΔLONG

PRETHRUST (P40's) & TIG

P37 BLOCK DATA										G 4-16
										GETI
X								X		ΔVT
X								X		LONG
										GET _{400K}
										GETI
X								X		ΔVT
X								X		LONG
										GET _{400K}
										GETI
X								X		ΔVT
X								X		LONG
										GET _{400K}
										GETI
X								X		ΔVT
X								X		LONG
										GET _{400K}
										GETI
X								X		ΔVT
X								X		LONG
										GET _{400K}

Basic Date 3/9/70
Changed

CSM 19

Basic Date 3/9/70
Changed

CSM 09

P38 SOR TARGETING (P78 LM)

- 1 F 06 33 V37E (38E or 78E)
TIG (SOR) (hrs,min,.01sec)
Load desired TIG *use time from step 5*
PRO *phase I when on phase II*
- 2 F 06 55 R3 wt
Load desired wt
PRO (.01°)
- 3 F 04 06 R1 00005 Specify Phase Option
R2 0000X X=1 or 2
PRO (To 6 If R2=2)
- 4 F 06 57 ΔR SOR
Load desired ΔR *+ is behind* *passive veh*
PRO (.1nm)
- 5 F 06 34 SOR TIME *record* (hrs,min,.01sec)
PRO *not recump on recycle*
- 6 F 16 45 MARK,TFI,-00001 (mark,min-sec,.01°)
(RECYCLE) V32E
(FINAL PASS) PRO (Terminate Marks)
- 7 F 06 58 HP(SOR),ΔV(SOR),ΔV(SOR-FINAL)
PRO *ELS* (.1nm,.1fps,.1fps)
- 8 F 06 81 ΔVXYZ(LV)
PRO (If Recycle - To 6) (.1fps)
- 9 F 16 45 MARKS,TFI,MGA (marks,min-sec,.01°)
PRO (MGA SET TO -00002 IF NO
REFSMAT SET OR P78)
- 10 F 37

P78 - Transmit Mnvr Parameters To LM

THRUSTING(P40's)

SPS vs RCS CRITERIA

GIMB ANGCS vs WT

ALIGNMENTS(P50's)

PRETHRUST (P30's & 70's) THRUSTING (P40's)

AV₀ vs ΔLONG

P37 BLOCK DATA

5-4

Verify GPI returns to 0,0(CMC) or trim (SCS)

ROT CONT PWR NORM (2) - AC/DC
ROT CONT PWR DIRECT (2) - MNA/MNB

(TRIM) BMAG MODE (3)-RATE 2
PRO

(BYPASS) BMAG MODE (3) - ATT1/RATE 2 (verify)
ENTR

15 F 50 25 00204 GMBL TEST OPTION
(ACCEPT) SC CONT - CMC (verify)
PRO

Monitor GPI Response:
00,02,-02,00,02,-02,00, Trim

*TEST FAIL: *
*SC CONT - SCS *
SCS TVC(2) - AUTO

(REJECT) ENTR

16 06 40 TFI, VG, ΔVM (min-sec,.lfps)

PROG ALARM - TIG Slipped
*V5N9E 01703 *
*KEY RLSE TO 16 *

FDAI SCALE - 5/5
LIMIT CYCLE - OFF
RATE - HIGH
UPDATE DET
SPS He vlvs (2) - AUTO (verify)

chk M₂A - M₂B

58:00
(-02:00)

ΔV THRUST A(B) - NORMAL
THC - ARMED
RHC (2) - ARMED
TAPE RCDR - HBR/RCD/FWD/CMD RESET

59:25
(-00:35)

DSKY BLANKS

59:30
(-00:30)

(AVE G ON)
EMS MODE - NORMAL

G
5-5

06 40 TFI, VG, ΔVM (min-sec,.lfps)
CHECK PIPA BIAS <2fps for 5 sec

59:XX
(-00:XX)

ULLAGE AS REQ

*If no ULLAGE: * *
* DIR ULLAGE PB - PUSH*
* Control Att with RHC*

MONITOR ΔVM (R3) COUNTING UP

59:55
(-00:05)

F 99 40 ENG ON ENABLE REQUEST
(AUTO IGN) PRO AT TFI >0 Sec
(BYPASS IGN) ENTR to 19
EXIT - V37E 00E

17 00:00 IGN *IF SCS: THRUST PB - PUSH*

06 40 TFC, VG, ΔVM (min-sec,.lfps,.lfps)

*F 97 40 SPS Thrust fail *
*ΔV THRUST B(A)-NORMAL *
*(RESTART) PRO to IGN *
(RECYCLE) ENTR to TIG-05sec

*restarts TVC DAP continue
for at least 2 hrs*

00:03

SPS THRUST Lt - ON
ΔV THRUST B(A) - NORMAL
IF SCS: +X & THRUST PB - PUSH

MONITOR THRUSTING

Pc 95-105 psia
EMS COUNTING DOWN

SPS INJ VLVS (4) - OPEN
SPS He vlvs tb-gray
SPS FUEL/OXID PRESS - 170-195 psia
PUGS - BALANCED

3/9/70

Basic Date
Changed

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Basic Date
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CSM 109

CSM 109

STAR CHARTS

SPS vs RCS CRITERIA

GIMB ANGCS vs WT

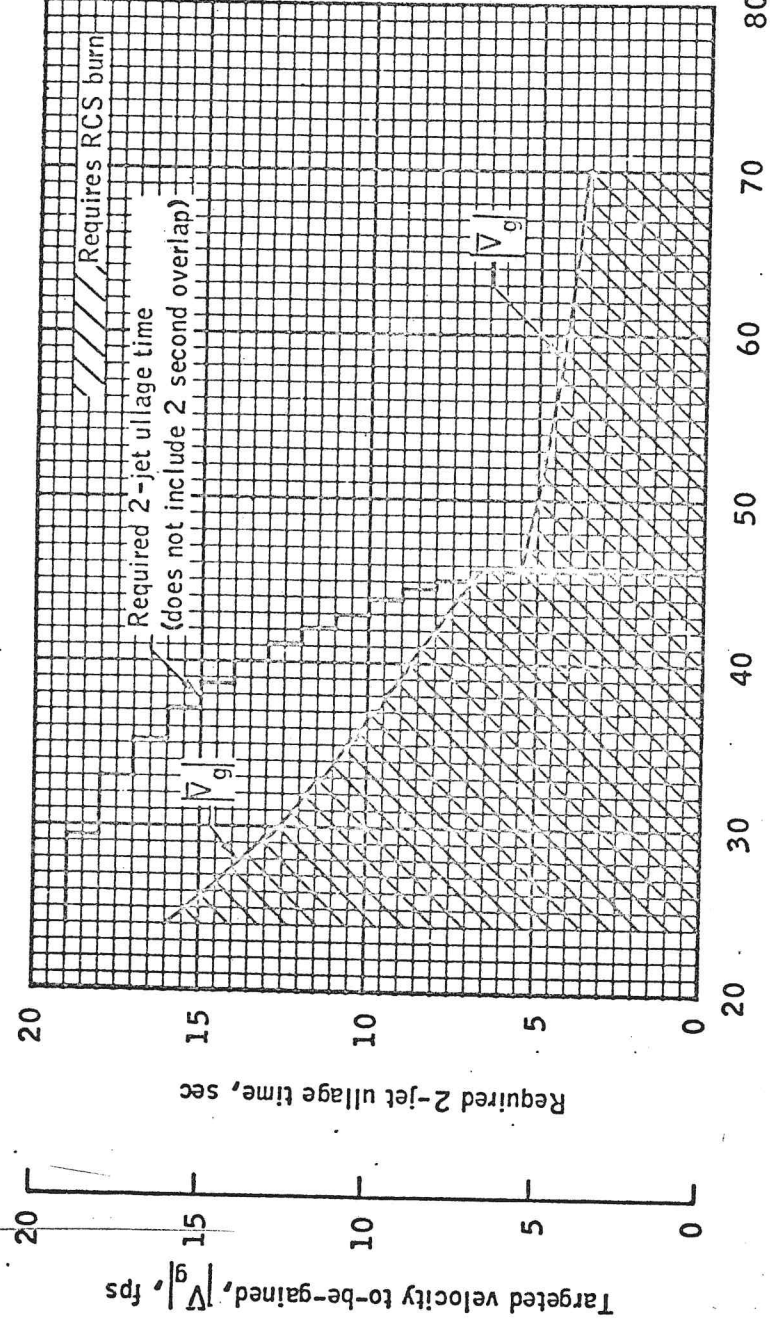
AT THRUSTING (P40's)

DATA REVIEW

ΔV_0 vs ΔLONG

SPS vs RCS CRITERIA

THRUSTING (P40's)

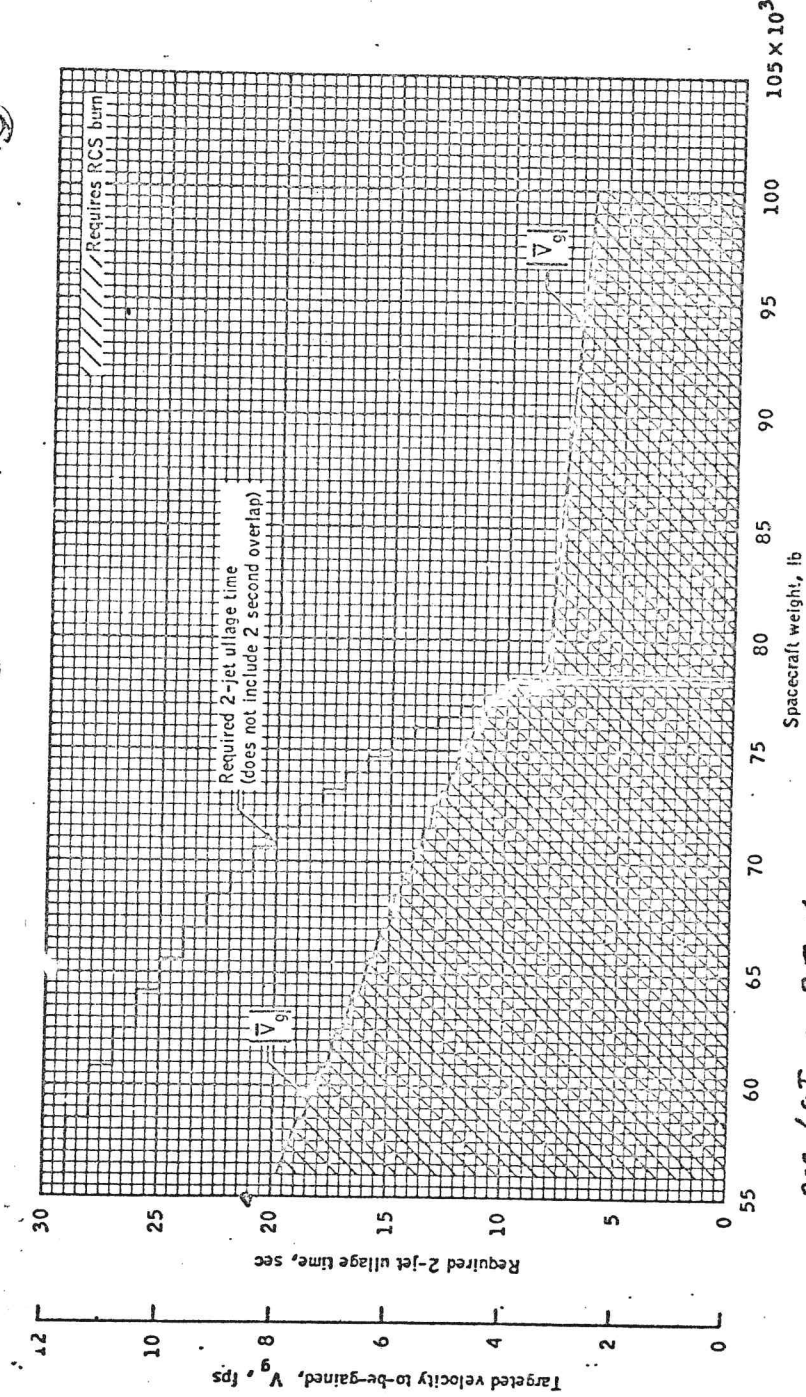


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Changed _____

CSM 109

Basic Date 3/9/70
Changed _____



SPS versus RCS criteria (CSM/LM docked)

ALIGNMENTS (P50's)

GIMB ANGS vs WT

INITIALIZATION

STAR CHARTS

G
6-2

P52 IMU REALIGN

CMC - on
ISS - on
SCS - operating
BMAG MODE (3) - RATE 2
G/N PWR OPTICS - on (verify)
OPT ZERO - ZERO (verify)
OPT MODE - CMC

- 1 F 04 06 V37E 52E
R1 00001 IMU ALIGN OPTION
R2 00001 PREF PRO to 4
2 NOM PRO to 2
3 REFSMMAT PRO to 7
4 LDG SITE PRO to 2
- 2 F 06 34 GET ALIGN (0,0, 0 initially)
(hr,min,.01sec)
Load desired GET
TO SPECIFY PRESENT TIME - PRO on (0,0,0)
PRO (NOM go to 4)
- 3 F 06 89 LAT, LONG/2, ALT (.001°, .001°, .01nm)
Load ldg site coords
PRO
- 4 F 06 22 NEW ICDU ANGLES OG, IG, MG (.01°)
(IF MG > +70°, MNVR) V32E - to 4
PRO
- 5 F 50 25 00013 GYRO TORQUE
(COARSE) PRO - NO ATT 1t - on then off - to 7
(TORQUE) CMC MODE - FREE
ENTR
- 6 16 20 ICDU ANGLES (.01°)
When torque complete - go to 17
- 7 F 50 25 00015 STAR SELECT
(MNVR If Necessary)
(PICAPAR) PRO

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CSM 109

G
6-3

*F 05 09 00405 NO PAIR *
(CREW SPECIFY) PRO - to 8
*(PICAPAR) MNVR-V32E to 7 *

(MAN ACQ) ENTR

JUN-46
REC-50

- 8 F 01 70 000DE STAR CODE
Load desired code
OPT MODE - CMC (verify)
OPT ZERO - OFF
PRO to 10 (to 9 if DE=00)
F 05 09 00404 (TA>90°)
*MNVR - PRO to 10 *
- 9 F 06 88 CELESTIAL BODY VECTOR
Load desired vector
PRO
F 05 09 00404 (TA>90°)
*MNVR - PRO to 10 *
- 10 06 92 SHAFT, TRUN (.01°, .001°)
(MARK ROUTINE) OPTICS MODE - MAN
- 11 F 51 PLEASE MARK
MARK
- 12 F 50 25 00016 TERMINATE MARKS
PRO
- 13 F 01 71 000DE STAR CODE
Load code (if necessary)
PRO to 8 after 1st MARK (to 14 if DE=00)
to 15 after 2nd MARK (to 14 if DE=00)
- 14 F 06 88 CELESTIAL BODY VECTOR
Load vector
PRO to 8 after 1st MARK
to 15 after 2nd MARK

G
7-6

LUNAR		EARTH	
Alt(nm)	Angle*	Alt(nm)	Angle*
8	7°	100	14°
60	20°	200	19°
170	32°	500	29°

*Angle from +X S/C axis to horiz

COAS LOS DETERMINATION

CMC - on
ISS - on
SCS - operating
SC CONT - SCS
MAN ATT (3) - MIN IMP
G/N PWR OPTICS - on
OPT MODE - CMC
OPT ZERO - ZERO (verify)

- 1 V37E 52E
- 2 F 04 06 00003
PRO
- 3 F 50 25 00015
ENTR
- 4 F 01 70 000DE STAR CODE
LOAD BORESIGHT STAR CODE
OPT ZERO - OFF
PRO
- 5 06 92 SHAFT, TRUN (.01°, .001°)
Center target
MARK with VERB key
Record SHAFT, TRUN _____
(REPEAT) KEY RLSE
(EXIT) V37E XXE
OPT ZERO - ZERO

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CSM 10

CSM

G
7-7CMC/LGC CLOCK SYNC/TEPHEM UPDATEV16 N65E (On LM request)
(hr,min,.01sec)

Voice CMC time to LM

V05 N01E 1706E (On LM request)

Voice TEPHEM to LM

V55 CMC TIME UPDATE

(See EXT VERBS pg. G/1-27)

DOCKED IMU ALIGN

ATT DB - MIN rate-to, dinit cycle on
SC CONT - SCS
MAN ATT (3) - RATE CMD
BMAG MODE (3) - ATT1/RATE2
V06 N20E
Voice ICDU angles to LM
Terminate attitude hold on LM cmd
V06 N20 (On LM request)
On LM MARK, Key ENTR
Copy ICDU angles and transmit to
MSFN

LM STEERABLE ANT POINTING

1. Select V64 (pg G/1-27)
2. Mnvr to N51 angles:

R1 = +03000, R2 = 09000 (+Z orien)
R1 = -03000, R2 = 27000 (-Z orien)

$$LM (IGA)_P = P_{20} + 180$$

$$(OGA)_Y = 300^\circ - R_{20} + \Delta\phi$$

$$(MGA)_R = 360^\circ - \gamma_{20}$$

G
8-2

PASSIVE THERMAL CONTROL (G&N)

RHC - Locked
FDAI SCALE - 5/1
RCS DAP - Activated

- 1 V48E (Select 0.5° DB)
V37E 00E
V49E
- 2 F 06 22 Load PTC Attitude R - Present
P - 90° (TLC) or 270°
Y - 0° (TEC)

PRO

- 3 F 50 18 BMAG MODE (3) - RATE 2
SC CONT - CMC
CMC MODE - AUTO
PRO

- 03750 R1

- 4 06 18 AUTO MANEUVER
F 50 18

- 5 Damp vehicle rates:
ENTR
Disable all jets on two adjacent quads
Wait 20 minutes for rates to damp
MAN ATT (PITCH & YAW) - ACCEL CMD
MAN ATT (ROLL) - RATE CMD

- 6 V79E

- 7 F 06 79 Rate, Deadband, Code (.0001°/sec, .01°, +XXXXX)

Load desired values in R1 and R2
and +00000 in R3
Enable all jets *coupler in all axis*

PRO

- 8 MAN ATT (ROLL) - ACCEL CMD
MAN ATT (PITCH & YAW) - RATE CMD

G
8-3

To disable RCS:
AUTO RCS SEL (16) - OFF
ROT CONTR PWR DIR (2) - OFF

To exit G&N PTC

1. AUTO RCS SEL (12) - MNA/B
MAN ATT (3) - ACCEL CMD
2. Verify DAP load
3. Select new desired att:
V49E
F 06 22 New ICDU angles
SC CONT - SCS, then CMC
PRO
F 50 18
4. Start auto maneuver:
PRO within 180° (in direction of roll)
of new att
MAN ATT (3) - RATE CMD

For simple termination: See "GENERAL V79 PROPERTIES"

PASSIVE THERMAL CONTROL (SCS)

SCS - operating
S/C CONT - SCS
ROT CONTR PWR NORMAL #2 - AC/DC

- 1 DEADBAND - MIN
RATE - LOW
LIMIT CYCLE - ON(up)
MAN ATT (3) - RATE CMD
BMAG MODE (3) - ATT 1/RATE 2

- 2 AUTO RCS SEL -
Configure for single jet operation
(Wait 20 min to allow rates to damp)

- 3 DEADBAND - MAX
MAN ATT (ROLL) - ACCEL CMD or MIN IMP
FDAI SCALE - 5/1

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Changed

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Changed 3-27-70

CS 109

CS 109

TLC ABORT

LUNAR ORBIT ABORTS

TFC ABORTS

ERASABLE LOAD UPDATE

G
8-4

Initiate Desired Roll Rate

AUTO RCS SEL (16) - OFF
ROT CONTR PWR DIR (2) - OFF
BMAG MODE (3) - RATE 2

TERMINATE PTC

AUTO RCS SEL (12) - MNA/B
Null Rates

PITCH ORBIT RATE MANEUVER (G&N)

Note: V79 orb rate is designed to operate most efficiently at 7.25° roll. A roll angle of 180° will yield the proper rate for low values ($\sim 0.05^\circ/\text{sec}$) but will use ~ 6 times as much fuel as roll=0°.

V79E

F 06 79 RATE, DB, CODE (.0001°/sec, .01°, +XXXXX)
Load desired values in R1&R2
& non-zero in R3
PRO

To Terminate: See "GENERAL V79 PROPERTIES"

*Do not use V37 with CMC in
orb rate or PTC control*

G
8-5

PITCH ORBIT RATE MANEUVER (SCS)

ORDEAL - initialized (p G/7-5)
SCS - Operating

FDAI SCALE - 5/1

Maneuver to desired LCL Vert
Att (Roll = 7.25° or 187.25°)

BMAG MODE (3) - ATT 1/ RATE 2
DEADBAND - MAX
RATE - LOW
MAN ATT (ROLL, YAW) - RATE CMD
MAN ATT (PITCH) - MIN IMP

Establish desired Pitch Rate
using MIN IMP & ORDEAL FDAI

To terminate:
MAN ATT (PITCH) - RATE CMD

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Basic Date
Changed

CSM 109

CSM 109

TLC ABORT

LUNAR ORBIT ABORTS

TEC ABORTS

ERASABLE LOAD UPDATE

ERASABLE LOAD UPDATE

IN THE EVENT OF PROG ALARM 1107 PERFORM THE FOLLOWING:

V74E (WAIT 3 MIN) (DUMP E MEMORY)
V36E
V48E (LOAD DAP AS DESIRED - USE
V46E LATEST KNOWN WEIGHTS)
V25N07E 77E 10000E 1E (SET REFSMMAT)
VIN1E 104E (VERIFY CMOON FLAG AND LMOON FLAG)
(BITS 11 and 12 should be 0 in
EARTH SPHERE AND 1 IN MOON SPHERE)
P52-OPTION 3-AUTO OPTICS *cycle zero optics*
AUTO OPTICS SUCCESSFUL, REFSMMAT
VALID
AUTO OPTICS UNSUCCESSFUL, DO P51
V16 N65 VERIFY CMC CLOCK (UPDATE)

VERIFY E MEMORY (MAY BE USED WHEN DESIRED) *should be done ASAP*
VIN1E *set DRIFT*
XXXXE (LOAD OID 2 OF UPDATE)
N15E, READ R1,E REPEAT FOR UPDATES A-L

FOR UPDATE M

- VIN1E
1. XXXXE (LOAD EVEN OID'S)
 2. READ R1,E (READ ODD OID'S IN R1)
 3. RETURN TO 1

IN CASE OF A DISCREPANCY
LOAD THAT UPDATE AS A NORMAL P27

TO CHECK STATE VECTOR CALL P21
AND LOAD PRESENT TIME. WHEN COMP CYCLE
IS COMPLETE

V06 N73E
READ R1 (R1 X 10=CURRENT ALT (NM))
COMPARE TO SOME KNOWN VALUE (E.G., FLIGHT PLAN)
IF ANSWER COMPARES - STATE VECTOR IS OK AND
P23 SHOULD BE USED TO IMPROVE IT.
IF GROSS ERRORS ARE OBSERVED, P23 IS UNLIKELY
TO CORRECT THEM. IN THIS CASE PERFORM
V71 LOAD OF LATEST PAD S.V. - SELECT
POO TO BRING S.V. TO PRESENT TIME.

Basic Date 9/70
Changed

CSM 109

INITIALIZATION
PROCEDURES

PTC/ORB RATE

AT TOWER/REAR

STAR CHARTS

TLC ABORT

LUNAR ORBIT ABORTS

TEC ABORTS

ERASABLE LOAD UPDATE

INITIALIZATION
PROCEDURES

PTC/ORB RATE

STAR CHARTS

OID	A V71	B V71	C V71	D V71	E V71	F V71	G V71
01	00021	00015	00010	00013	00023	00023	00024
02	01452	01706	01345	01767	02000	02021	02042
03	77316	00011	06510	00001	00137	00001	00003
04	74561	05300 05253	07025	24315	00763	03120	02526
05	77143	11000 33661	00620	00000	00023	00001	00015
06	74705	30623	00000	22274	00001	03120	00107
07	77667	37367	27340	00552	00000	00311	00022
10	71220	00000	37723	02210	00000	31177	35751
11	77646 00114	23066		25231	00471	77700	00012
12	77232 77545	00000		12160	00364	55774	24655
13	76617 77201	26474		03363	04400	77762	00077
14	00710	37777			77772	55732	25776

G
9-2

CSM 109

Basic Date 1/9/70
Changed

CSM 109

Basic Date 1/9/70
Changed

OID	A V71	B V71	C V71	D V71	E V71	F V71	G V71
15	00023	37777			46750	00011	77747
16	00665				77773	14374	50503
17	77731				57473	11272	77764
20	00000				00006	77767	75066
21	77615				06361	77461	00010
22					00002	00006	32477
23					26244	07520	77616
24							55641

G
9-3

GEN SIGINT SCHEDULES

TEC ABORTS

LUNAR ORBIT ABORTS

TLC ABORT

PLANET VECTORS

NO COMM IM TRFT

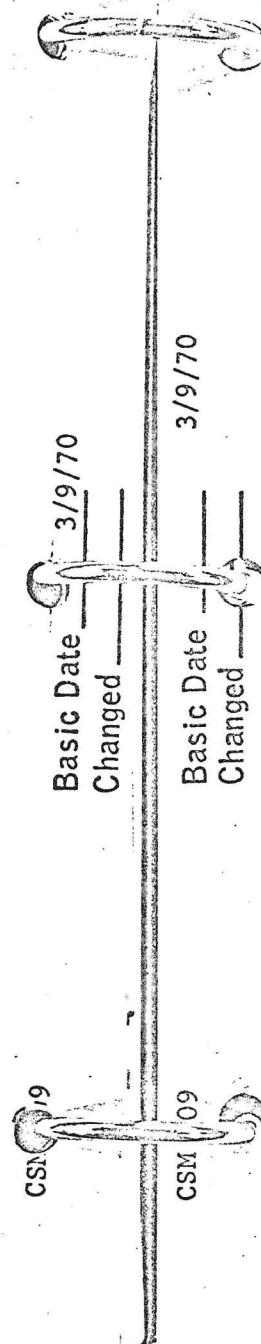
LOI ABORTS

CSM 09

LOI 30 MIN ABORT CHART
NOT APPLICABLE TO
APOLLO 13

G
13-2

G
13-3



- 1 MNVR TO PAD BURN ATTITUDE
V62E
- 2 F 06 22 V49E
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
EMS FUNC - OFF
Set ΔVC= +100.0
EMS FUNC - ΔV
28:00 V37E 47E
(-02:00) F 16 83 ΔV XYZ(CSM) (.1fps)
- *VI, HDOT, H available by N62E*
*KEY RLSE to return to N83 *
- 29:30
(-00:30) EMS MODE - NORMAL
- 29:58
(-00:02) CMC MODE - FREE (on LM request)
- 30:00
(00:00) DPS IGNITION

PLANET VECTORS

LOI ABORTS

PLANET VECTORS

13-4

RECORD ΔV COUNTER & RESIDUALS

ΔVC _____
VGX _____
VGY _____
VGZ _____

(RECYCLE) V32E
(TERM) PRO

F 37 XXE

EMS FUNC - OFF
EMS MODE - STBY

G
13-5

LOI 2 HR DPS ABORT

ΔV Thrust A/B - OFF
SPS INJ vlvs (4) - CLOSED
SPS He tb (2) - BP
GMBL MTRS (4) - OFF (LMP verify)
TVC SERVO PWR (2) - OFF
SC CONT - SCS
PCM BIT RATE - LOW
EMS MODE - STBY

RECORD DATA AND COMPUTE PAD

F 97 40

Record TFC _____
VG _____
ΔVM _____
EMS ΔVC _____

ENTR

F 99 40

ENTR

F 16 85

Record VGX _____ R _____
VGY _____ P _____
VGZ _____ Y _____

PRO

V 37 00E

When CSM ACTY 1t out, V66E
P52 OPTION 3

ASSIST IN LM ACTIVATION

LM Set MSN TMR to CSM MSN TMR on MARK
Configure for VHF Simplex B and respond
to LM comm check

Configure for VHF Simplex A
Verify CSM in min DB and ATT HOLD
V06 N20E; Read CSM ICDU ANGLES to LM
ENTR on LM MARK and note time. Compare
CSM & LM ICDU ANGLES

OG	IG	MG
CM	CM	CM
LM	LM	LM

V16 N65E, call CSM time to LM : : :

3/9/70

Basic Date

Changed

3/9/70

Basic Date

Changed

3-27-70

CS 109

CS 109

LM ENTR time on CSM MARK
V 06 N65E on LM MARK and compare with
LM N65
CSM Time ____:____:____
LM Time ____:____:____

V 05N01E 1706E, Call TEPHEM to LM

R1 _____
R2 _____
R3 _____

Maintain wide DB and ATT HOLD for LM RCS
check. Copy P-30 Pad

MNVR TO PAD BURN ATTITUDE AND MONITOR BURN
CYCLE CRYO FANS BURN ATT STAR CK

Set DET Counting Up to Burn

BMAG MODE (3) - RATE 2

SC CONT - CMC

CMC MODE - AUTO

MNVR to PAD BURN ATT, then maintain ATT
HOLD

-06:00 CMC - FREE (or) SC CONT - SCS with
MAN ATT (3) - ACCEL CMD

EMS FUNC - OFF ΔV SET / VHF RING

Set $\Delta VC +100.0$

EMS FUNC - ΔV TUC SERVO PWR #1 - AC1/MNA

-02:00 V37 E 47E, monitor F 16 83 (ΔV XYZ)

-00:30 EMS MODE - NORMAL

00:00 DPS IGNITION

After engine cutoff (and on LM callout)

CMC MODE - AUTO

Record ΔV COUNTER & RESIDUALS

ΔVC _____ R _____
VGX _____ P _____
VGY _____ Y _____
VGZ _____

PRO

F 37 XXE

EMS FUNC - OFF

EMS MODE - STBY

TUC SERVO PWR #1 - OFF

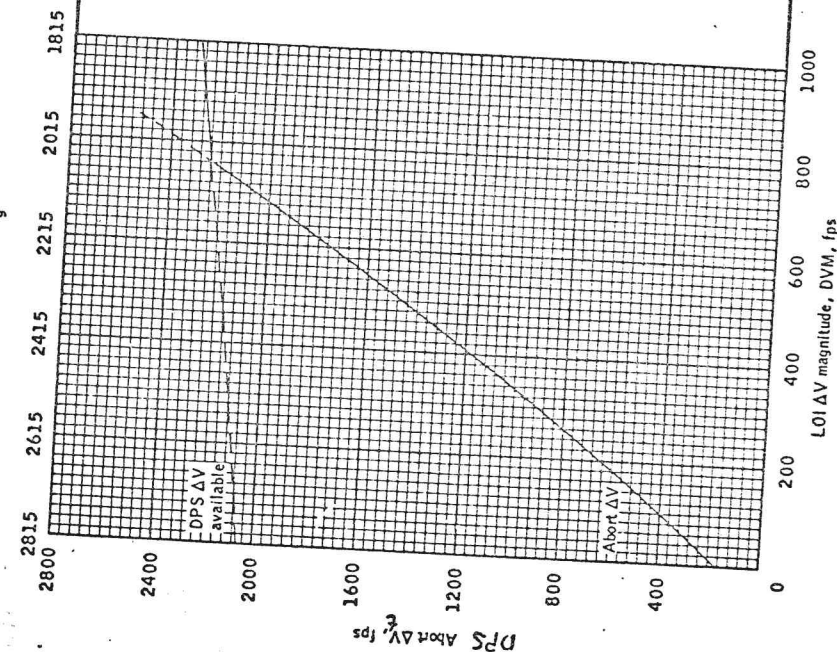
BMAG MODE (3) - RATE 2

Basic Date 3/9/70
Changed 3-27-70

Basic Date 3/9/70
Changed 3-27-70

CM 109

Velocity to be gained, V_g , fps



Burntime	ΔVM	Mode	SPS	Type
0 - 1:45	0 - 750	I	TIGHT	DPS at 2 hr (RTCC or Crew Chart)
1:45 - 2:50	750 - 1245	II	LOOSE	DPS at 2 hr + DPS at perilune (RTCC)
2:50 - 3:50	1245 - 1700	III	LOOSE	DPS at perilune (RTCC)
3:50 - Cutoff	1700 - Cutoff	III	TIGHT	DPS at perilune (RTCC)

DPS LOI + 2 HR ABORT
BACKUP CHART (DPS ΔV_t)

GETIG	79:24:53
CSM FDAI angles	
R	300
P	263
Y	359
LM FDAI angles	
R	1
P	83
Y	0

BY AIRMAN VINCENZO

LOI ABORTS

BY AIRMAN VINCENZO

G
13-7

LOI DOCKED APS ABORT
TIG(: :)

50:00
(-10:00)

START DET

1 MNVR TO PAD BURN ATTITUDE
V62E

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

54:00
(-06:00)

CMC MODE - FREE
SC CONT - SCS
BMAG MODE(3) - ATT 1/RATE 2
V48E, 61102, 01111
EMS FUNC - OFF
Set ΔVC= +100.0
EMS FUNC - ΔV

58:00
(-02:00)

V37E 47E
F 16 83 ΔV XYZ(CSM) (.1fps)

VI, HDOT, H available by N62
*KEY RLSE to return to N83 *

Basic Date 3/9/79
Changed

CSM 1

PLANET VECTORS

59:30
(-00:30)

EMS MODE - NORMAL

59:58
(-00:02)

SC CONT - CMC (on LM request)
BMAG MODE(3) - RATE 2

00:00

APS IGNITION

RECORD AV COUNTER & RESIDUALS

AVC _____
VGX _____
VGY _____
VGZ _____

(RECYCLE) V32E
(TERM) PRO

F 37 XXE

EMS FUNC - OFF
EMS MODE - STBY

TOT ARDTC

NASA - MSC

Basic Date 3/9/70
Changed _____

CSM 29

MASTER

APOLLO 13	
CSM ENTRY CHECKLIST	
PART NO.	S/N
SKB32100082 - 305	1002

ENTRY TABLE OF CONTENTS

1. VEHICLE PREPARATION	1-1
2. SUPERCIRCULAR ENTRY	2-1
3. EARTH/POST LANDING	3-1
4. EMERGENCY PROCEDURES	EMER/1-1

Basic Date
Changed

19/70
3/30/70

CSM 109

VEHICLE PREPARATION

LUNAR ENTRY PAD

SUPERCIRCULAR ENTRY

PRE-ENTRY ALTITUDE
TIMELINE

LUNAR RETURN VEHICLE PREPARATION

- 1 INITIAL STOWAGE COMPLETED
- 2 CMC & ISS START UP pg G/2-1 & 2
- 3 SCS POWER UP pg G/2-4
- 4 P51 - IMU ORIENTATION pg G/6-1
- 5 LOAD DAP
V48E 11102, 01111, PRO, PRO, PRO
- 6 -06:00h LAST MCC DECISION
- 7 -05:35h NO COMM - P52 & NAV SIGHTINGS
- 8 DON MAE WESTS & FOOT RESTRAINTS
- 9 ACTIVATE VHF FOR COMM CHECKS
- 10 VERIFY DSE POWERED
cb S BD FM XMTR/DSE (2) - close (verify)
- 11 -04:30h P27 (SV, REFSMMAT), MNVR
& ENTRY PAD UPDATES
- 12 -04:15h P52 - IMU REALIGN pg G/6-2
(: :) (OPTION 1)
- 13 P37 (NO COMM ONLY)
- 14 ECS CKS
02 SUPPLY REFILL pg S/1-7
PGA verification, (if suited) S/1-11
ECS Monitor Ck pg S/1-5
(382) EVAP H2O CONT PRI vlv - AUTO
EVAP H2O CONT SEC vlv - AUTO
SUIT HEAT EXCH SEC GLY - FLOW
- 15 EPS CKS #1, 3, 4 (5 if req'd) pg S/1-2

3/9/70

Basic Date
Changed

3M 109

VEHICLE PREPARATION

LUNAR ENTRY PAD

SUPERCIRCULAR ENTRY

PRE-ENTRY ATTITUDE
TIMELINE

E
1-2

16 SPS CK (If req'd) pg S/1-1

17 RCS CKS
SM RCS Monit Ck pg S/1-1
CM RCS Monit Ck pg S/1-1

18 C&W SYS CK pg S/1-17

19 CMC SELF CK pg G/2-3

20 DSKY COND LT TEST pg G/1-23

21 -03:45h MIDCOURSE MANEUVER
P30 - EXT ΔV
-03:15h P40/41 - SPS/RCS THRUSTING
-03:00h MIDCOURSE (#7) BURN
Key V66E

-02:00h LOGIC SEQUENCE CK
(8) cb SECS LOGIC (2) - close (verify)
cb SECS ARM (2) - close
cb ELS (2) - close
ELS LOGIC - on (up)
ELS - AUTO
Coordinate next 3 steps with MSFN
SECS LOGIC (2) - on (up)
MSFN confirm GO for PYRO ARM as req'd
SECS LOGIC (2) - OFF
cb SECS ARM (2) - open
ELS LOGIC - OFF
ELS - MAN
cb ELS (2) - open

22 NO COMM NAV SIGHTINGS

23 MNVR TO SUPERCIRCULAR ENTRY ATT ° PITCH
V62E

24 V49E

25 F 06 22 DESIRED FINAL GMBL ANGLES (.01°)
LOAD ENTRY ATT PAD ANGLES
PRO

3/9/70

Basic Date

Changed

3/9/70

Basic Date

Changed

CSM 109

CSM 109

E
1-3

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

PRO
(MAN) SC CONT - SCS
MNVR to 28

27 06 18 AUTO MNVR TO FDAI RPY ANGLES (.01°)

28 F 50 18 REQUEST TRIM (.01°)
(TRIM) Go to 26
(BYPASS) ENTR

29 ~~Select best S-BD Omni Ant~~
~~S-BAND OMNI - OMNI B~~
BORESIGHT & SXT STAR CHECK
OPT MODE - CMC
OPT ZERO - OFF

V41 N91E

F 21 92 SHAFT, TRUN (.01°, .001°)
Load SXTS angles

41 OPTICS DRIVE

CHECK SXT STAR
OPT ZERO - ZERO
CHECK BORESIGHT STAR (If avail)

30 -01:35h P52 - IMU REALIGN pg G/6-2 (OPTION 3)
Record gyro torquing angles
R _____
P _____
Y _____

*If > 1°, recycle P52
If confirmed, use SCS for EMS Entry
Drive Optics to 90° shaft angle
OPTICS PWR - OFF

31 (: :) GDC ALIGN
If drift > 10°/hr, change rate source

E
1-4

32 -01:15h

EMS ENTRY CHECK

- EMS FUNC - OFF
- (8) cb EMS (2) - close
- EMS MODE - STBY
- EMS FUNC - EMS TEST 1 (wait 5 sec)
- EMS MODE - NORMAL (wait 10 sec)
- Check ind lts - off
- RANGE ind - 0.0
- Slew hairline over notch
- in self-test pattern
- EMS FUNC - EMS TEST 2 (wait 10 sec)
- .05G lt - on (all others out)
- EMS FUNC - EMS TEST 3
- .05G lt - on
- RSI lower lt - on (10 sec later)
- Set RANGE counter to 58 nm+0.0
- EMS FUNC - EMS TEST 4
- .05G lt - on (all others out)
- G-V trace within pattern to lwr rt corner @9G
- RANGE ind counts down to 0+0.2
- EMS FUNC - EMS TEST 5
- .05G lt - on
- RSI upper lt - on (10 sec later)
- RANGE ind - 0.0
- Scribe traces vertical line 9g to 0.28+0.1
- ALIGN SCROLL TO ENTRY PATTERN (on 37K ft sec line)
- EMS FUNC - RNG SET
- G-V scroll assy traces vert. line 0.28g to 0+0.1
- EMS MODE - STBY

33

PRIMARY WATER EVAP ACTIVATION

- GLY EVAP H2O FLOW - AUTO
- GLY EVAP STM. PRESS - AUTO
- PRI ECS GLY PUMP - AC1 (verify)

33A

SET UP CAMERA

- CM4/DAC/18/CIN - BRKT, MIR
- (f16,250,7) 6 fps, 8 min, MAG K

34

SEC WATER EVAP ACTIVATION

- ECS IND sel - SEC
- SEC COOL LOOP PUMP - AC2
- GLY DISCH SEC PRESS - 39-51 psig
- SEC COOL LOOP EVAP - EVAP
- SEC GLY EVAP OUT TEMP - 38 - 50.5°F

- SUIT CKT HT EXCH - BYPASS 20 sec, OFF
- ECS IND sel - PRIM

35 (-01:10h)

CM RCS PREHEAT

Note: If sys test mtr 5c,d,6a,b,c,d all read 3.9 vdc (28°F) or more, omit preheat

- (8) cb RCS LOGIC (2) - close
- CM RCS LOGIC - on (up)
- (8) cb CM RCS HTRS (2) - close
- (101) CM RCS HTRS - ON (IMP Confirm)
- (20 min or til lowest rdg is 3.9 vdc) (Monitor Manf press for press drop)

36

FINAL STOWAGE

OPTICS

ORDEAL

- (377) GLY TO RAD SEC vlv - BYPASS (verify)
- Verify EVA COUCH STRUT disengaged
- (382) Cool pnl installed
- Y-Y struts (2) extended

WASTE MGMT DRAIN vlv-OFF Stow Data Box R-12

Remove + stow URA, urine transfer hose and urine filter.

Attach both strut unlock lanyards

Check for water in tunnel area

Stow gas separator & C1 injector (A1)

37 (-00:50m)

TERM. CM RCS PREHEAT

- (101) CM RCS HTRS - OFF
- CM RCS LOGIC - OFF
- (8) cb CM RCS HTR (2) - open

38

SYSTEMS TEST PANEL CONFIGURATION

SYS TEST METER - 4B (BAT RLY BUS 3.4-4.1 vdc)

- (101) CM RCS HTRS - OFF (verify)
- WASTE H2O DUMP HTR - OFF

Basic Date 3/9/70

Changed

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Changed 3/27/70

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- (101) URINE DUMP HTR - OFF
- (100) LEB FLOOD & INTGL LIGHTING - OFF
- PYRO BATT CK
- (250) cb PYRO A SEQ A - close (verify)
cb PYRO B SEQ B - close (verify)
DC IND - PYRO BAT A(B)
*If PYRO BAT A(B) < 35 vdc *
- (250) *cb PYRO A(B) seq A(B) - open *
cb PYRO A(B)BAT BUS A(B)TO PYRO
* BUS TIE - close *
- (275) cb MNA BAT C - close
cb MNB BAT C - close
DC IND - MNB
PNL 8 - All cb's closed except:
EDS BAT (3) - open (verify)
PL VENT - open (verify)
FLOAT BAG (3) - open (verify)
SPS P&Y (4) - open
CM RCS HTRS (2) - open (verify)
DOCKING PROBE (2) - open (verify)
DIRECT ULLAGE (2) - open

40 (: :) FINAL GDC DRIFT CK (if req'd)
If drift >10°/hr, Suspect GDC, Do not
use RSI & FDAI #2

41 CM RCS ACTIVATION
(8) cb SECS ARM (2) - close (verify)
SECS LOGIC (2) - on(up)
MSFN confirm GO for PYRO ARM
SECS PYRO ARM (2) - ARM
CM RCS PRPLNT 1&2 tb(2) - gray (verify)
CM RCS PRESS - ON
RCS IND sw - CM1, then 2
He PRESS stabilizes at 3300 - 3500
psia after 15 minutes
MANF PRESS 287-302 psia
SECS PYRO ARM (2) - SAFE

42 -00:45m

P27 & ENTRY PAD UPDATE

Basic Date 3/9/70

Changed 3/1/70

Basic Date 3/1/70

Changed

CSM 109

E/1-7										LUNAR ENTRY										
										AREA										
X X X										X X X										R 0.05 G
X X X										X X X										P 0.05 G
X X X										X X X										Y 0.05 G
																				GET HOR
X X X										X X X										P CK
O										O										LAT N61
																				LONG
X X X										X X X										MAX G
+										+										V _{400K} N60
- O O										- O O										Y _{400K}
+										+										RTGO EMS
+										+										VIO
																				RRT
X X										X X										RET 0.05 G
+ O O										+ O O										DL MAX
+ O O										+ O O										N69 DL MIN
+										+										VL MAX
+										+										VL MIN
X X X										X X X										DO
X X										X X										RET V _{CIRC}
X X										X X										RETBB0
X X										X X										RETEB0
X X										X X										RETDR0
X X X X										X X X X										SXTS
+ O										+ O										SFT
+ O O										+ O O										TRN
X X X										X X X										BSS
X X										X X										SPA
X X X										X X X										SXP
X X X X										X X X X										LIFT VECTOR

EARTH/POST LANDING

LUNAR ENTRY PAD

SUPERCIRCULAR ENTRY

PRE-ENTRY ATTITUDE
TIMELINE

VEHICLE PREPARATION

LUNAR ENTRY PAD

E/1-8

										AREA
X	X	X								R 0.05 G
X	X	X								P 0.05 G
X	X	X								Y 0.05 G
										GET HOR
X	X	X								P CK
	0									LAT N61
										LONG
X	X	X								MAX G
+										V _{400K} ^{N60}
-	0	0								Y _{400K}
+										RTGO EMS
+										VIO
										RRT
X	X									RET 0.05 G
+	0	0								DL MAX ^{N69}
+	0	0								DL MIN
+										VL MAX
+										VL MIN
X	X	X								DO
X	X									RET V _{CIRC}
X	X									RET _{BBO}
X	X									RETEBO
X	X									RETDRO
X	X	X	X							SXTS
+									0	SFT
+									0 0	TRN
X	X	X								BSS
X	X									SPA
X	X	X								SXP
X	X	X	X							LIFT VECTOR

SUPERCIRCULAR ENTRY

1

Set DET (up, to EI)

2

EMS INITIALIZATION

Scroll not on 37K:

EMS FUNCT - TEST 5

Slew scroll to 37K

EMS FUNCT - RNG SET (verify)

SET RNG TO PAD DATA RNG

EMS FUNC - Vo SET

Slew Scroll to Pad Data VIO

EMS MODE - STBY (verify)

EMS FUNC - ENTRY

3

RSI ALIGNMENT

FDAI SOURCE - ATT SET

ATT SET - GDC

EMS ROLL - on (up)

GDC ALIGN pb - push & hold

YAW THUMBWHEEL - Position RSI thru
45° & back to LIFT UP

GDC ALIGN pb - release

EMS ROLL - OFF

Align GDC to IMU

4

CM RCS CHECK

AUTO RCS A/C ROLL (4) - OFF (verify)

cb RCS LOGIC (2)-close (verify)

SC CONT - SCS

MAN ATT (3) - MIN IMP

RCS TRANSFER - CM

AUTO RCS SEL (RING 1) - MNA

AUTO RCS SEL (RING 2) - MNB

cb SCS B/D ROLL, P&Y MNA (3) - open

TEST RING 2 THRUSTERS

cb SCS B/D ROLL, P&Y MNA (3) - close

cb SCS B/D ROLL, P&Y MNB (3) - open

TEST RING 1 THRUSTERS

cb SCS B/D ROLL, P&Y MNB (3) - close

RCS TRANS - SM

MAN ATT (3) - RATE CMD

SC CONT - CMC/AUTO

Basic Date 3/9/70
ChangedBasic Date 3/1/70
Changed

CSM 109

CSM 110

EARTH/POST LANDING

G01 MEN

SUPERCIRCULAR ENTRY

PRE-ENTRY ATTITUDE
TIMELINE

VEHICLE PREPARATION

LUNAR ENTRY PAD

SUPERCIRCULAR ENTRY

E
2-2

5 30:00m
(-30:00)

MN BUS TIE (2) - ON
TAPE RCDR - REWIND

6 35:00m
(-25:00)

SEPARATION CK LIST

cb ELS BAT (2) - close (verify)
PRIM GLY TO RAD - BYPASS (pull)
REPRESS PKG vlv - FILL to 865-935,
then ON

02 SM SUPPLY vlv - OFF
SURGE TK - ON (verify)
CAB PRESS REL vlv (2) - NORM
ABORT SYS PRPLNT - RCS CMD (verify)
SM RCS SEC PRPLNT FUEL PRESS (4) - ON
VHF AM A&B - off (ctr)
HI GAIN ANT PWR - OFF
FC PUMPS (3) - OFF
FC 2 MNA - OFF
Verify Loads Balanced
S BD PWR AMP - LOW
~~S-BD ANT OMNI~~ best
cb ECS RAD CONT/HTR (2) - open
cb WASTE H2O/URINE DUMP HTR (2) - open
cb RAD HTRS OVLD (2) - open
POT H2O HTR - OFF
GLY EVAP TEMP IN - MAN

MNVR TO HORIZON CHECK ATT

MNVR TO PAD ATT
R _____ (0°)
P _____ (265°)
Y _____ (0°)

~~S-BAND OMNI~~ - OMNI C
P61 - ENTRY PREP

V37E 61E (AVE G ON)

05 09 01427 - ROLL REVERSED
*05 09 01426 - IMU UNSAT *

E
2-3

2 F 06 61
41:30m
(-18:30)

IMPACT LAT, LONG, HDS UP/DN (+/-)
(.01°, .01°, +00001)

PRO

3 F 06 60

GMAX, V400K, GAMMA EI (.01G, fps, .01°)
Record
GMAX _____
V400K _____
GAMMA EI _____
PRO

4 F 16 63

RTOGO (.1nm) _____ PAD _____
VIO (fps) _____ PAD _____
TFE(min-sec) _____
If NO COMM, Set RTOGO & VIO in EMS
& initialize
(ACCEPT) PRO
(RECYCLE) V32E to 3

P62 - CM/SM SEP & PRE-ENTRY MNVR

5 F 50 25
43:00m
(-17:00)

00041 REQUEST CM/SM SEP
COMPARE PITCH ATT WITH PAD DATA _____
If not +5°, G&N NO GO
YAW - 45° OUT-OF-PLANE (LEFT) (315°)
RATE - HIGH
ATT DB - MIN
MAN ATT(3) - RATE CMD
SC CONT - SCS/FREE
BMAG MODE (3) - ATT1/RATE 2
MN BUS TIE (2) - ON (verify)
PRIM GLY TO RAD - BYPASS (verify)
EMS MODE - STBY (verify)
CM RCS LOGIC - on (up)
SECS LOGIC (2) - on(up)(verify)
SECS PYRO ARM (2) - on (up)

CM/SM SEP (2) - ON
If docking ring still on:
CSM/LM FNL SEP (2) - on(up)(verify)

Basic Date 9/70
Changed 27-70

Basic Date 9/70
Changed

CSM

CSM 109

EARTH/POST LANDING

LOG MEMO

PRE-ENTRY ATTITUDE
TIMELINE

VEHICLE PREPARATION

LUNAR ENTRY PAD

SUPERCIRCULAR ENTRY

(258°P)

50:00m
(-10:00)
(236°P)

(: :)

Dark
Horiz

(240:46:50)

6

F 06 61

IMPACT LAT, LONG, HDS/DN (.01°, .01°, -00001)
PRO (CMC Guidance)
MAN ATT (3) - MIN IMP (if desired)

7

POSS 06 22

FINAL ATT DISP, RPY (.01°)
(Only if X-axis beyond 45° of Vel vector)

P63 - ENTRY INIT

8

06 64

G, VI, RTOGO (.01G, fps, .1nm)
FDAI SCALE - 5/5
ROT CONTR PWR DIR (2) - MNA/MNB
TAPE RCDR - HBR/RCD/FWD

E
2-4

MAN ATT (3) - MIN IMP
BMAG MODE (3) - RATE 2
C&W MODE - CM
RCS TRNFR - CM
CM RCS MANF PRESS - 287-302 psia
CM RCS LOGIC - OFF
SECS PYRO ARM (2)-SAFE
Monitor VMA/B:

If <25 vdc go to EMERG
POWERDOWN pg
AUTO RCS SEL A/C ROLL (4) - OFF (verify)
cb SCS B/D ROLL, P & Y MNB (3) - open
AUTO RCS SEL CM 1(6)-MNA (verify)
YAW back to 0°
PITCH TO HORIZ TRACK ATT
ROLL - 0° (LIFT UP)
PITCH - 400K Horiz Mark (31.7°)
YAW - 0°

ATT DB - MAX
EMS DATA - Verify
EMS FUNC - ENTRY (verify)
EMS MODE - NORMAL
MAINT HORIZ TRK
MAN ATT (3) - RATE CMD
PRO (Act ENTRY DAP Att Hold)

58:00m
(-02:00)
(177°P)

E
2-5

HORIZ CHECK
Pitch error needle goes toward
zero approaching .05G time
If CMC is GO:
MAN ATT (3) - RATE CMD (verify)
SC CONT - CMC/AUTO

*If DAP NO GO: *
* SC CONT - SCS*
* FLY BETA *
*If CMC NO GO: *
* SC CONT - SCS*
* FLY EMS *

P64 - ENTRY POST .05G
(If no P64 at .05G +5 sec & .05G Lt - on,
GNCS NO GO)

Start DAC

9 (158°P at 400K)
(RRT=0:00)

RTOGO AT .05G AGREES WITH EMS-verify
HORIZ CHECK
.05G lt - on (EMS START)

* No EMS START within 3 sec: *
* EMS MODE - BACKUP/VHF RNG *

.05G time
(+0 : :)
(: : :)
(152°P at .05G)

.05G sw - on (up)
EMS ROLL - on (up)
06 74 BETA, VI, G (.01°, fps, .01G)
NOTE: To monitor N68, (BETA, VI, HDOT)
Key V16 N68E

Compare RSI & FDAI
If CMC or PAD cmds Lift DN,
MNVR Lift DN (Lift UP at 1.5 G)
EMS GO/NO GO
G-V Plot within limits
Monitor G-meter for
convergence with pad data (Do)
CMC is NO GO if commanding
>+90° when G >6.52
Go to 13 (P67) or continue

EARTH/POST LANDING

CREW LOG

PRE-ENTRY ATTITUDE
TIMELINE

Basic Date 3/9/70
Changed 4/2/70
Basic Date 3/11/70
Changed

CSM 10
CSM 10

VEHICLE PREPARATION

E
2-6

P65 - ENTRY - UP CONT (VL>18K fps)

10 F 16 69 BETA (.01°) _____
 DL (.01G) _____ PAD _____
 VL (fps) _____ PAD _____

IF NO AGREEMENT:
 *SC CONT - SCS *
 *FLY EMS *

PRO

11 06 74 BETA,VI,G (.01°,fps,.01G)
 (V<VL+500 fps & RDOT Neg) Go to 13

P66 - ENTRY - BALLISTIC (D<DL)

12 06 22 DESIRED GMBL ANGLES RPY (.01°)
 Monitor horiz $\pm 12^\circ$ of 31.7° mark

P67 - ENTRY - FINAL PHASE (AUTO AT .2G)

13 06 66 BETA,CRSRNG ERR,DNRNG ERR (.01°, .1nm, .1nm)
 BETA will be $\pm 15^\circ$ until R3 > ~~9nm~~ -45 NM
 Monitor lift vector on RSI & FDAI
 CM RCS: change rings when HE PRESS <1150 psia

F 16 67 RTOGO,LAT,LONG (Vrel=1000fps)
 (.1nm,.01°, .01°)

SC CONT - SCS
 RTOGO NEG - LIFT UP
 RTOGO POS - LIFT DOWN
 Monitor altimeter
 Record LAT, LONG & VOICE TO RECY at 10K'
 Record EMS RTGO
 EMS MODE - STBY
 EMS FUNC - OFF
 DAC - f11

TUNAR ENTRY PAD

SUPERCIRCULAR ENTRY

E
2-7

3/17/70 Amendment 3

Basic Date 3/19/70

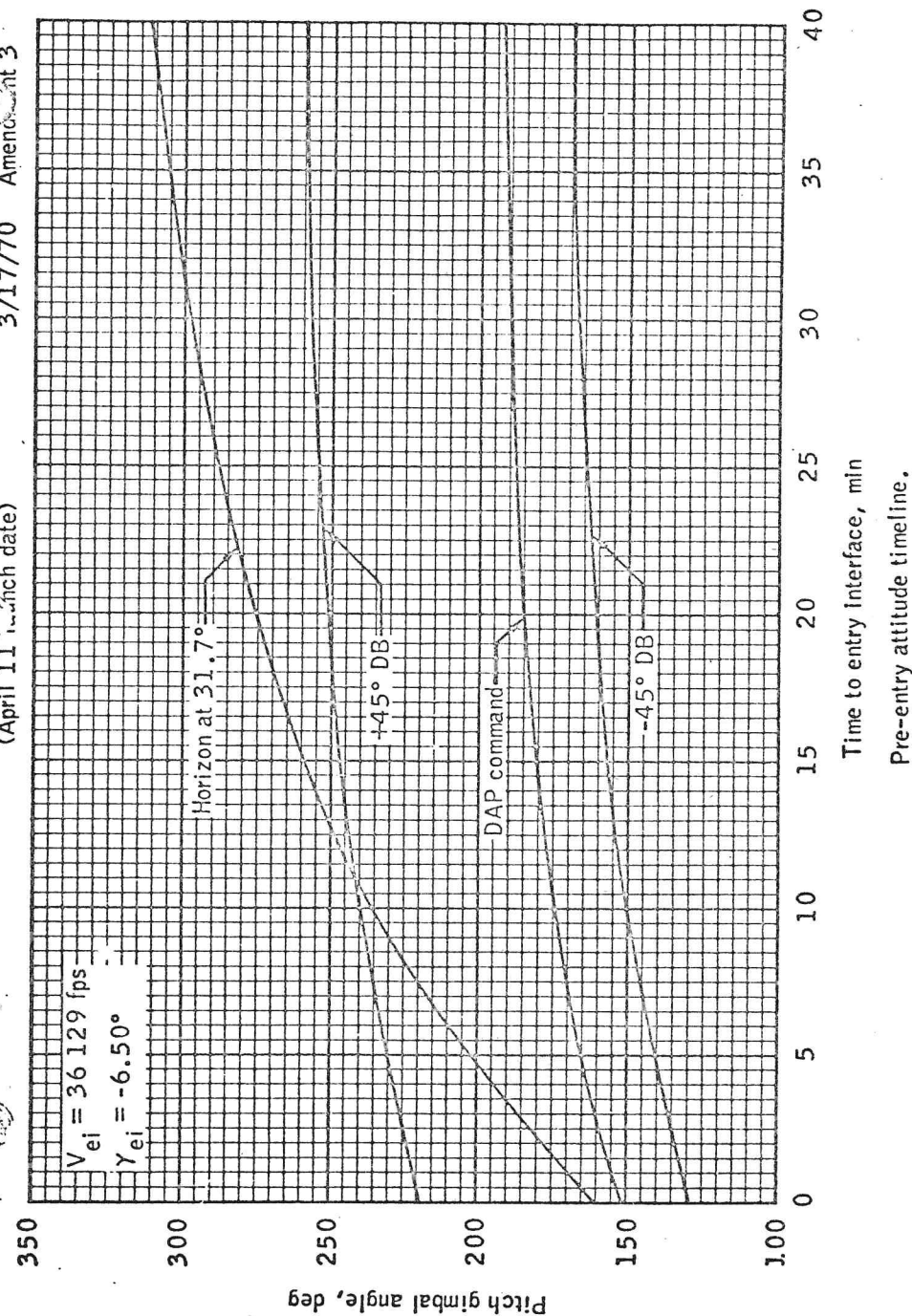
Changed 3-27-70

Basic Date 3/19/70

Changed 3/27/70
(April 11 launch date)

CSM 109

CSM 109



EARTH/POST LANDING

CREW LOG

PRE-ENTRY ATTITUDE
TIMELINE

VEHICLE PREPARATION

LUNAR ENTRY PAD

SUPERCIRCULAR ENTRY

TIME-ENTRY ALTITUDE
TIMELINEE
3-1

EARTH/POST LANDING

Start Watch

RRT (06:30) STEAM PRESS - pegged at 90K (00:00)
 50K' (07:24) CABIN PRESS REL vlv (2) - BOOST/ENTRY (00:54)
 SECS PYRO ARM (2) - ARM
 Check Altimeter

40K' (07:38) * CM UNSTABLE *(01:08)
 *RCS CMD - OFF *
 * 40K' APEX COVER JETT PB-PUSH *
 DROGUE DEPLOY PB - PUSH (2 sec
 *after apex cover jett) *

30K' ELS LOGIC - on (up) (01:26)
 ELS - AUTO

24K' (08:10) RCS disable (auto) (01:40)
 RCS CMD - OFF

Apex cover jett (auto)
 APEX COVER JETT PB - PUSH
 (WAIT 2 SECS)
 Drogue parachutes deployed (auto)
 DROGUE DEPLOY PB - PUSH

If Both Drogues Fail:
 *ELS - MAN *
 *Stabilize CM *
 5K' MAIN DPLY PB - PUSH
 *ELS - AUTO *

23.5K' Cabin Pressure increasing
 *If not increasing by 17K': *
 CABIN PRESS REL vlv (RH) - DUMP

10K' (09:01) Main parachutes deployed (Drogues +49s) (02:31)
 MAIN DEPLOY PB - PUSH (within 1 sec)
 SURGE TK 02 vlv -OFF (if unsuited)
 REPRESS PKG vlv -OFF (if unsuited)
 DIRECT 02 vlv -OPEN
 VHF ANT - RECY
 VHF AM A - SIMPLEX
 VHF BCN - ON

Basic Date
Changed

CSM 109

EARTH/POST LANDING

CREW LOG

PRE-ENTRY ATTITUDE
TIMELINE
SUPERCIRCULAR ENTRY
TUNAR ENTRY PAD
EARTH/POST LANDING

3-2

IF MAIN OR PYRO BUS
LOST USE RHC'S
FOR BURN, NOT
DUMP SW

CABIN PRESS REL vlv (2) - CLOSE
CM RCS LOGIC - on (up)
CM PRPLNT - DUMP (burn audible)
Monitor CM RCS 1&2 for He press decrease
*NO BURN or PRESS DECREASE *
* USE BOTH RHC's *
*DO NOT FIRE PITCH JETS *

CM PRPLNT-PURGE
*CM RCS He DUMP PB - PUSH *
RHC (2) - 30 secs, No PITCH

Stow DAC
STRUT LOCKS (4) - UNLOCK
If night landing:
cb FLOAT BAG #3, FLT/PL (1 cb)-close
PL BCN LT - LOW
cb FLT & PL BAT BUS A,B,&BAT C (3)-close
cb FLT & PL MNA & B (2) - open
cb RAD HTR OVLD (2) - open (verify)
cb SPS P&Y (4) - open (verify)
cb BAT RELAY BUS (2) - open

3K' CM RCS PRPLNT (2) - OFF (terminates purge)
CABIN PRESS REL vlv (RH) - DUMP
ELS AUTO (verify)
ELS LOGIC - ON (verify)
FLOOD Lts - POST LDG

800' CAB PRESS RELF vlv - CLOSE (latch off)
MN BUS TIE (2) - OFF

POSTLANDING

STABILIZATION, VENTILATION, COMMUNICATIONS

- 1 Stabilization after landing
cb MAIN REL PYRO (2) - close
MAIN RELEASE - on (up)
SECS PYRO ARM (2) - SAFE
SECS LOGIC (2) - OFF
No contact with recovery forces
*VHF AM A&B - off (ctr). *
*VHF AM RCV ONLY - A *
cb PL VENT - close
cb FLOAT BAG (3) - close
cb UPRIGHT SYS COMPRESS (2) - close

Basic Date 3/9/70

Changed 3-7-70

Basic Date

Changed

CSM 09

CSM 19

E
3-3

If Stable II:

FLOAT BAG(3)-FILL till 2 min after
upright, then - OFF

VHF AM A/B & BCN - OFF while inverted

If Stable I:

After 10 Min Cooling Period,
FLOAT BAG (3) - FILL 7 min, then OFF

Post Stabilization And Ventilation

PL BCN LT - BCN LT LOW
PL VENT vlv - UNLOCK (Pull)
Remove PL VENT Exh Cover
PL VENT - HIGH or LOW
If req'd:

PL DYE MARKER - ON

*Deploy auxiliary dye marker *

Release restraints

cb MNA BAT BUS A & BAT C (2) - open
cb MNB BAT BUS B & BAT C (2) - open
cb FLT & PL BAT C - open
cb PYRO A SEQ A - open
cb PYRO B SEQ B - open

*EACH HR - CHECK DC VOLTS $\geq$ 27.5 V *

*If Not:

* cb FLT & PL-BAT BUS A&B (2) -open*
* cb FLT & PL BAT C (1) - close *
* GO TO LOW POWER CHECKLIST *

Unstow and install PLV DISTRIB DUCT
Deploy grappling hook and line if req'd

UNAIDED EGRESS PROCEDURES

PREPARATION

Disconnect umbilicals
Neck dams on (if suited)
Configure couch(s) - 270°
Armrests stowed
Unstow survival kits
Connect lanyards, (green to S/C, white to crew)

STABLE I

PL VENT - OFF
cb Pnl 250 (all) - open

CREW LOG

APOLLO 13.

CMP SOLO BOOK

PART NO.

S/N

SKB32100082 - 353

1001

CH 16, 1970

96:00 (20101) (1111) (+0.000) (+10.00)		96:10		96:20		96:30 (20111) (1111)		96:40		96:50 REV 11		97:00																			
REST ATTITUDE (94,289.0) HGA (P=-4;Y=276) TV-OFF P52 (OPTION 3) REPORT TORO ANGLES TO MSFN FOR DRIFT CHECK P52 (OPTION 1) REFSMMAT TIME <table border="1"> <thead> <tr> <th></th> <th>HRS</th> <th>MIN</th> <th>SEC</th> </tr> </thead> <tbody> <tr> <td>+</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>+</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>+</td> <td>0</td> <td>0</td> <td>0</td> </tr> </tbody> </table> P00 CDR V49 MNVR TO AGS CALIB ATTITUDE (7.5,112.5,22.5) V48 (20111) V48 (1111)					HRS	MIN	SEC	+	0	0	0	+	0	0	0	+	0	0	0	P52(IMU REALIGN) N71: --- N05: --- N93: --- X --- Y --- Z --- GET ---				P52(IMU REALIGN) N71: --- N05: --- N93: --- X --- Y --- Z --- GET ---				MAP UPDATE REV 11 L05: --- 180°: --- A05: ---			
	HRS	MIN	SEC																												
+	0	0	0																												
+	0	0	0																												
+	0	0	0																												
DO NOT PGA W/O HELMET AND GLOVES				DO NOT PGA W/O HELMET AND GLOVES				DO NOT PGA W/O HELMET AND GLOVES																							
LMP VERIFY DSE (LBR/RCD/FWD/CMD RESET)				LMP VERIFY DSE (LBR/RCD/FWD/CMD RESET)				LMP VERIFY DSE (LBR/RCD/FWD/CMD RESET)																							
PRESSURIZE LM CH/LM PRESS EQUALIZATION VALVE-CLOSE OPEN AND STOW CH HATCH REMOVE AND STOW PROBE AND DROGUE; CHECK LATCHES --- LMP IN				MARK TO LM FOR LM MISSION TIMER SYNC AT LMP REQUEST				MARK TO LM FOR LM MISSION TIMER SYNC AT LMP REQUEST																							
OPEN HATCH				LMP TO LM				CDR TO LM																							

MARCH 16, 1970

97:00 (20111) (11111)	97:10	97:20	97:30 (20111) (11111)	97:40	97:50	98:00
THU COARSE ALIGN RCS PRESS RCS C/O						
CONFIGURE CAMERAS FOR UNDOCKING* CM2/EL/80/CEX (F8,250,FOCUS) 10 MAG(L) ,PR# CM2/DAC/18/CEX-BRKT,MR (F8,250,7)12 FPS(8 MIN) MAG(B) ,MAG# SWITCH TO CDR COMM UMB V64; ACQ MSFN (P=-76,V=127) REPORT DOCKING TUNNEL INDEX ANGLE TO MSFN P00; MSFN UPLINK: CSM S.V. AND V66 MSFN UPDATE: P22 PAD COPY AT (99:35) UNDOCK/SEP PAD COPY AT (99:05)* MAN ATT(3) RATE CMD ATT DB-MIN RATE-LOW SC CONT-SCS BWAG-ATT 1/RATE 2 LM COARSE ALIGN VOGN2OE VOICE ANGLES TO LM ON CDR MARK ENTER RECORD GIMBAL ANGLES VOICE ANGLES TO LM N20: R P Y						
VHF C/O AT LMP REQUEST VHF AM B-SIMPLEX FOR VHF B CHECK VHF AM A-SIMPLEX FOR VHF A CHECK SC CONT-CMC LM CLOCK SYNC: V16N65E DON HELMET AND GLOVES POSSIBLE T EPHM VOS NOI 1706E SUIT LOOP INTEGRITY CHECK (DECAL) AT CDR'S REQUEST DURING RCS CHECKOUT CMC-FREE FOR RCS HOT FIRE AFTER LM RCS CHECKOUT CMC-AUTO						

98:00 (20111) (11111)	98:10	98:20	98:30 (20111) (11111)	98:40	98:50	99:00
DOCKED ALIGN AGS ACTIVAT CLOSSE HATCH RRS / PPGA CHHECK						
ROLL (9)-OFF UNTIL LM/CH AP>3.5 PSID REMOVE AND STOW CSM/LM UMBILICAL * INSTALL DROGUE AND PROBE PRE-LOAD PROBE COCK LATCHES (12) INSTALL HATCH VENT TUNNEL (98:00) (7.5,214.5/112.5,22.5) HATCH INTEGRITY CHECK (DECAL) CYCLE CMC MODE-FREE/AUTO ROLL(4)-ON CB RH2Z XPNDR FLT BUS-CLOSE (VERIFY) RH2Z XPNDR-HTR (VERIFY) VHF ANT-LT (VERIFY) VHF RCV ONLY-B DATA VHF AM A-SIMPLEX VHF AM B -OFF PANEL 10 MODE-VOX VOX SENS tw-5 S BD-OFF INTERCOM-OFF VERIFY DSE (LBR/RCD/FWD/CHD RESET) DOFF HELMET AND GLOVES (98:21) (7.5,282.5/112.5,22.5) MAP UPDATE REV 12 LOS : 100°: AOS : LIQH CANISTER CHANGE: 10 INTO B, STOW B IN 06						
RR XPNDR ACTIVATION AND SELF TEST (DECAL) SET DET COUNTING UP TO UNDOCK/SEP UNDOCK CUE CARD CYCLE CMC MODE-FREE/AUTO V48 (20101) (11111) LM DRIFT CHECK VOGN2OE ON CDR MARK ENTER RECORD GIMBAL ANGLES VOICE ANGLES TO LM V49 TRIM TO AGS CAL ATT(7.5,112.5,22.5) N20: R P Y						

MARCH 16, 1970

P30: LOAD UNDOCK/SEP
WHEN LM RR SELF TEST COMPLETE
[AUTO RCS SEL B3-ON
RNDZ XPNDR-PWR
P00; V49 MNVR TO (0,102,0)
LOAD AV IN ENS TO -100.0
CHECK NULL BIAS
GDC ALIGN
VERIFY ORDEAL
ALT SET=40 N.M.



(99:07)
(0,59/102,0)

P41 (TRIM)(0,59/102,0)

V64: ACQ MSFN (P=87,Y=3)
GO/NO GO FOR UNDOCK/SEP
AUTO TRIM (PRO)

CONFIGURE SWITCHES

ATT DB-MIN CHC MODE-FREE
RATE-LOW RHC PWR DIR-MNA/MNB
SC CONT-SCS THC PWR-ON
BMAG-ATT 1/RATE 2 EMS MODE-NORMAL
UTIL PWR-ON(PNL 15)AUTO RCS (16)-MNA/MNB

V48 (11101)

START DAC CH2/18/CEX-BRKT-MIR(f8,250,7)12 FPS, 8 MIN
PERFORM SOFT UNDOCKING CHECKLIST

UNDOCK/SEPARATION (99:16:21)(+0,0,0,+1.0)
(0,90/102,0)

(THRUST AFT; BURN VGX TO +2.0)

SC CONT-CHC RHC PWR DIR-OFF VHF AM A-OFF
CHC MODE-AUTO ROLL (4)-OFF VHF AM B-DUPLEX
DV CG-CSM THC PWR-OFF VHF RANGING-RANGING
BMAG-RATE 2 VHF ANT-RT

VERIFY LM TRACKER LT-ON
DAC-OFF



GDC ALIGN at 0 yaw
VERIFY ORDEAL
ALT SET=40 N.M.

P00
V49 MNVR TO
(0,335,0)

MONITOR S-BAND

P30 MANEUVER

SET STARS	C	S	M	S	E	P	PURPOSE
	R	C	S	G	N		PROP/GUID
P ALIGN	+						WT N47
P ALIGN		+					P TRIM N48
P ALIGN			+				Y TRIM
ULLAGE	+	+	+	+	+		HRS GET1
	+	+	+	+	+		MIN N33
	+	+	+	+	+		SEC
	+	+	+	+	+		ΔV _X N81
	+	+	+	+	+		ΔV _Y
	-	+	+	+	+		ΔV _Z
	X	X	X	X	X		R
	X	X	X	X	X		P
	X	X	X	X	X		Y

SOFT UNDOCKING CHECKLIST

CB DOCKING PROBE-CLOSED
PROBE EXT/REL-EXT/REL (Momentary)
VERIFY PROBE EXTENDED, LM ATTACHED
ALLOW MOTION TO DAMP (5 SEC)
PROBE EXT/REL-EXT/REL(HOLD<20 SEC)
AFTER 2 SEC XLATE (4 JET) AFT
FOR ≈4 SEC
AFTER PROBE/DROGUE DISENGAGED-
PROBE EXT/REL-OFF

99:00
(20101)
(11111)

(P41)
(.508)

99:10

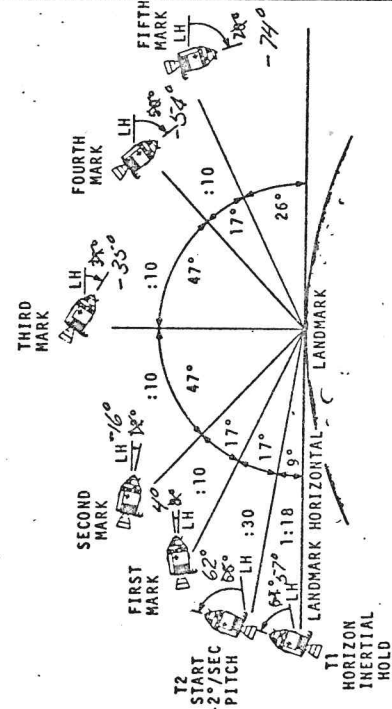
(11101)
(1111)

99:20

99:30

3-27-70
-15-1970

99:30
(11101)
(11111)



CSM P22 PROFILE (LOW ALTITUDE)

EVENT	ORDEAL/INERTIAL	TIME FROM TCA
T1	57 6X/335	-2:08
T2	62 6X/335	- :50
FIRST MARK	4 X/275	- :20
SECOND MARK	344 3X/255	- :10
THIRD MARK	325 3X/235	- :00
FOURTH MARK	306 3X/215	+ :10
FIFTH MARK	286 3X/195	+ :20

	13-2	13-3	13-4	13-5
LAT	-03.606	-03.189	-03.707	-03.226
LONG/12	-07.658	-07.739	-07.006	-07.057
ALT	+000.00	+000.76	+000.73	+000.85

CM/DAC/SEXT/CEX
(FIXED, 60, FIXED)1FPS

MAG (C) _____
MAG % _____

SET CREW RCDR FOR P22

OPTICS ZERO-OFF
OPTICS TEL TRUN-
SLAVE TO SXT
OPTICS COUPLING-RSLV
OPTICS MODE-CHC
OPTICS SPEED-HI

ACQ MSFN-OMNI D
V21N01E 1341E E
P22
V79 (-2.0000
+000.50)
(+11111)

P22 LDMK TRACKING
TGT: 13-1

T1

T2

TCA

R

N of S NH

LAT

LONG/2

ALT

LHK

LAT

LONG/2

ALT

LHK

LAT

LONG/2

ALT

LHK

LAT

LONG/2

ALT

V49 TRIM TO CIRC BURN ATT ON PAD (0,111,0)
 P30; VERIFY CIRC TIGN AND ΔV'S
 P40 (TRIM)(0,258/111,0)
 SXT STAR CHECK
 (100:03)
 (0,258/111,0)
 MAP UPDATE REV 13
 LOS :
 180°:
 AOS :
 GO/NO GO FOR CIRC
 VHF AM B-OFF
 VHF AM A-SIMPLEX
 VHF RCV ONLY-B DATA
 VERIFY DSE (LBR/RCD/FMD/CMD RESET)
 GDC ALIGN
 VERIFY ORDEAL
 ALT SET-50 N.M.
 SET DET COUNTING DOWN
 TO CIRC
 SPS CHECKLIST

100:30
P40
.508

(1011)
(1111)

REV
13
100:40

100:50

101:00

P00
V49 MHVR TO COMM ATY(60,281,0)

MARCH 10, 1970

V64: ACQ MSFN (P=30, Y=266)
BURN STATUS REPORT TO MSFN

BATTERY CHARGE:
BATTERY B

MSFN UPDATE:
TOPO PAD COPY AT 103:05
(LM LANDING)
P00
MSFN UPLINK:
CSM S.V. (PDI-10)
PIPA BIAS
CYCLE CMC MODE-FREE/AUTO
V48 (10101)
V49 MNVR TO
(0.281,0)
MSFN UPDATE TO LM
WITH CSM COPY:
PADS E-N

CONFIGURE CAMERA FOR P22
CM/DAC/SEXT/CEX
(FIXED, 60, FIXED) 1FPS
MAG (C) _____, MAG % _____

101:00
(10111)
101:10
(10101)
101:20
(10111)
101:30
(10111)

101:00
(10111)
101:10
(10101)
101:20
(10111)
101:30
(10111)

101:00
(10111)
101:10
(10101)
101:20
(10111)
101:30
(10111)

101:00
(10111)
101:10
(10101)
101:20
(10111)
101:30
(10111)

A

PURPOSE				PDI ₀ ABORT PAD			
GETI	HRS	MIN	SEC	AVX	AVY	AVZ	
N33							
N84							
LOCAL							
VERT							

B

PURPOSE				PDI ₀ ABORT PAD			
GETI	HRS	MIN	SEC	AVX	AVY	AVZ	
CS1							
N11							

C

PURPOSE				PDI ₀ ABORT PAD			
GETI	HRS	MIN	SEC	AVX	AVY	AVZ	
TPI							
N37							

D

PURPOSE				PDI ₀ ABORT PAD			
GETI	HRS	MIN	SEC	AVX	AVY	AVZ	
TPI							
N37							

E

PURPOSE				NO PDI ₀ ABORT			
GETI	HRS	MIN	SEC	AVX	AVY	AVZ	
N33							
N84							
LOCAL							
VERT							

F

PURPOSE				NO PDI ₀ ABORT			
GETI	HRS	MIN	SEC	AVX	AVY	AVZ	
CS1							
N11							

G

PURPOSE				NO PDI ₀ ABORT			
GETI	HRS	MIN	SEC	AVX	AVY	AVZ	
TPI							
N37							

H

PURPOSE				NO PDI ₀ ABORT			
GETI	HRS	MIN	SEC	AVX	AVY	AVZ	
TPI							
N37							

I

PURPOSE				PDI PAD			
GETI	HRS	MIN	SEC	PDI	HRS	MIN	SEC

J

PURPOSE				PDI ADORT EARLY < S42			
GETI	HRS	MIN	SEC	TPI	HRS	MIN	SEC

K

PURPOSE				PDI ADORT LATE > S42			
GETI	HRS	MIN	SEC	TPI	HRS	MIN	SEC

L

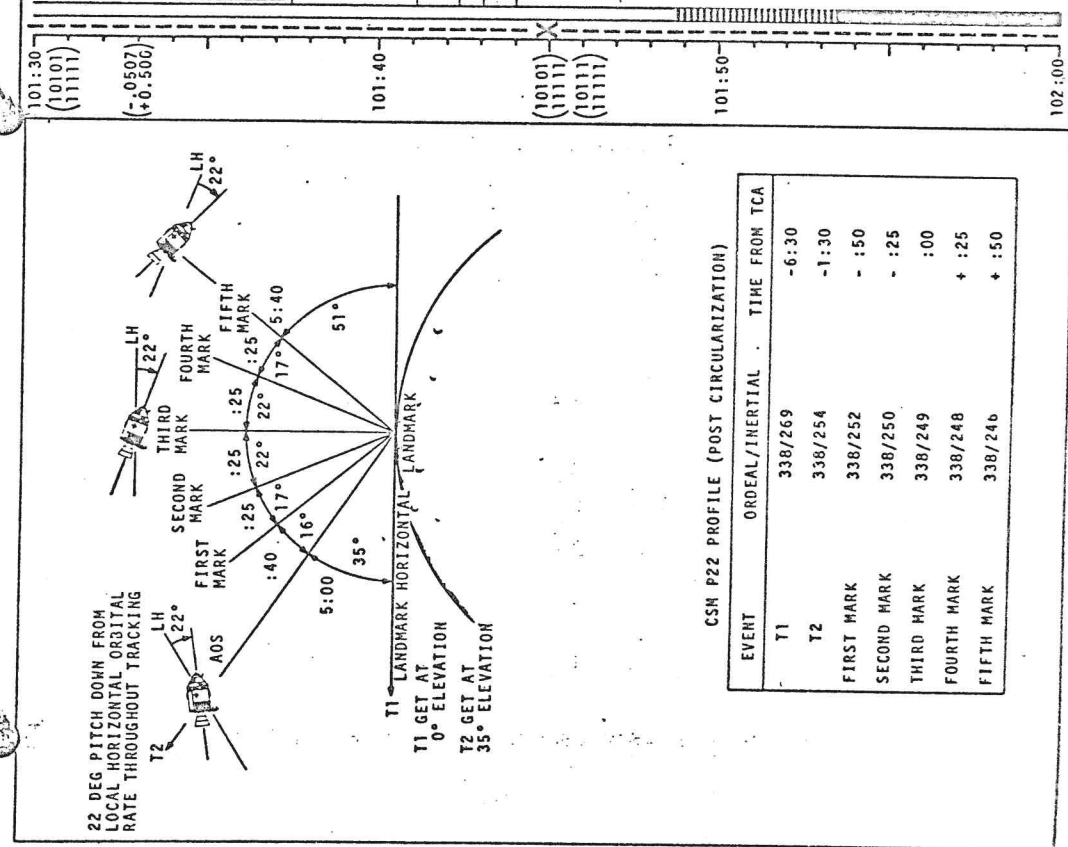
PURPOSE				T2-1 PAD			
GETI	HRS	MIN	SEC	T2	HRS	MIN	SEC

M

PURPOSE				T2-1 PAD			
GETI	HRS	MIN	SEC	TPI	HRS	MIN	SEC

N

PURPOSE				T2-1 PAD			
GETI	HRS	MIN	SEC	T3	HRS	MIN	SEC



ACQ MSFN-OMNI D
P22
V79 (-0.0507)
(+000.50)
(+11111)
PRO-TO START PITCH RATE AT 338° ORDEAL SET CREW RCDR FOR P22 HI

OPTICS ZERO-OFF
OPTICS TEL TRUN- SLAVE TO SXT
OPTICS COUPLING-RSLV
OPTICS MODE-CMC
OPTICS SPEED-MED
T1 (HORIZON) START
CREW RCDR

P22 LDMK TRACKING
TGT: T3-1

T1	T2	R	N of S NM	LAT	LONG/2	ALT

LDMK LAT LONG/2 ALT
T3-2 03-583° 07-650° +000-00
T3-3 03-183° 07-742° +000-00

START DAC(T2-1 MIN)
T2 (TCA-1 MIN 30 SEC, ACQ LANDING SITE); VERIFY DSE
T2 (TCA-50 SEC) TAKE 5 MARKS 25 SEC APART; DAC-OFF
HOLD ON N89 DISPLAY
TCA

STOP PITCH RATE; MNVR TO P52 AND CONS CALIB ATT (0.258,0)
V48 (10111)

LAT 13.2
LONG/2 -03.606
ALT -03.189

LAT -07.658
LONG/2 -07.739
ALT +000.00

AGCS INITIALIZE

27-70
H-16, 1970

MARCH 16, 1970

102:00 (10111) (11111)

102:10

102:20 (10101) (11111)

102:30 (10101) (11111)

P52 (OPTION 3)

PS2 (JMU REALIGN)

N71: _____

N05: _____

N93: _____

X _____

Y _____

Z _____

GET _____

COAS CALIB

N92: _____ SHIFT _____ TRUN _____

PS2 (COAS CALIB)

USE SPICA #26

VERIFY DSE (LBR/RCD/FWD/CMD RESET)

MSFN ENABLES MSFN S-BAND RELAY

GDC ALIGN

VERIFY ORDEAL

ALT SET=60 N.M.

CYCLE CMC MODE-FREE/AUTO

V48 (10101) (11111)

P20 (70°)(0.27/188.0)

V48 (10111) (11111)

CONFIGURE CAMERA FOR TOPO PHOTOS

CH3/LTC/BW

(FIXED, 50, FIXED)

RANGE (91.7), INTERVAL (8.7)

MAG(U) _____, FR# _____

MAP UPDATE REV 14

LOS: _____

180°: _____

AOS: _____

102:30 (10111) (11111)

102:40

102:50

103:00

CHECK LM VISIBILITY

VHF AM A-OFF

VHF AM B-DUPLEX

VHF RANGING-RANGING

SUN/LM LOS ANGLE >30 DEG

V67(+10000,+00100,+00001)

V57: V87

(FOR NO UPDATE MODE SET NEGATIVE N49 THRESHOLD:

KEY V21 NOTE 200ZE 77776E

N15E 77776E

DO NOT INCORPORATE MARKS)

5-27-70
MARCH 16, 1970

103:00 (10111) (11111)

103:10

103:20 (10101) (11111)

103:30

ACQ MSFN OMNI B

when relay confirmed

pol 9 VHF T/R-off

TOPO PHOTO PAD

(0,153,0)

R _____ P _____ Y _____

T START: _____

T STOP: _____

RNG _____ NH _____

SET DET COUNTING UP TO PDI

V88

(TO END NO UPDATE MODE:

KEY V21 NOTE 200ZE 23E

N15E 1E

FOR 2000 FT, 2.5 FPS LIMITS)

V56 (TERMINATE P20)

P00

V48 (10101) (11111)

V49 MNVR TO TOPO PHOTO ATT

103:30 (10101) (11111)

103:40

103:50

104:00

LM PDI (103:31:00)

PCM BIT RATE-HIGH (VERIFY)

LTC PHR-ON (T START-1 MIN)

LTC-AUTO (T START)

TOPO PHOTOS OF LM LANDING

LM TOUCHDOWN (103:42:02)

LTC-OFF (T STOP)

P00: V49 MNVR TO (0,100,0)

V48 (10111) (11111)

V64: ACQ MSFN (P=83,Y=2)

CONFIRM STAY/NO STAY FOR T1

V44 (SET LUNAR SURFACE FLAG)

VHF RANGING-OFF

S BAND MODE-VOICE (VERIFY)

CONFIRM STAY/NO STAY FOR T2

PS2 (OPTION 3)

slow LTC

GDC ALIGN

VERIFY ORDEAL

ALT SET=60 N.M.

103:30 (10111) (11111)

103:40

103:50

104:00

PS2 (JMU REALIGN)

N71: _____

N05: _____

N93: _____

X _____

Y _____

Z _____

GET _____

POST TOUCHDOWN ACTIVITIES

D6

PHOTO TGT 14, SOUTH (f8, 250, ∞) 14 @ 20 SEC (250 mm)

ACQ WSEN OMNI 0 (180° ± 23)

QUALITY	SCIENCE

[illegible]

STOP ORB RATE AT CONTAM FIELD ATY (0.192,0)
VIA. ACCOMSEN (P-C VION)

3-27-70
MARCH 16, 1970

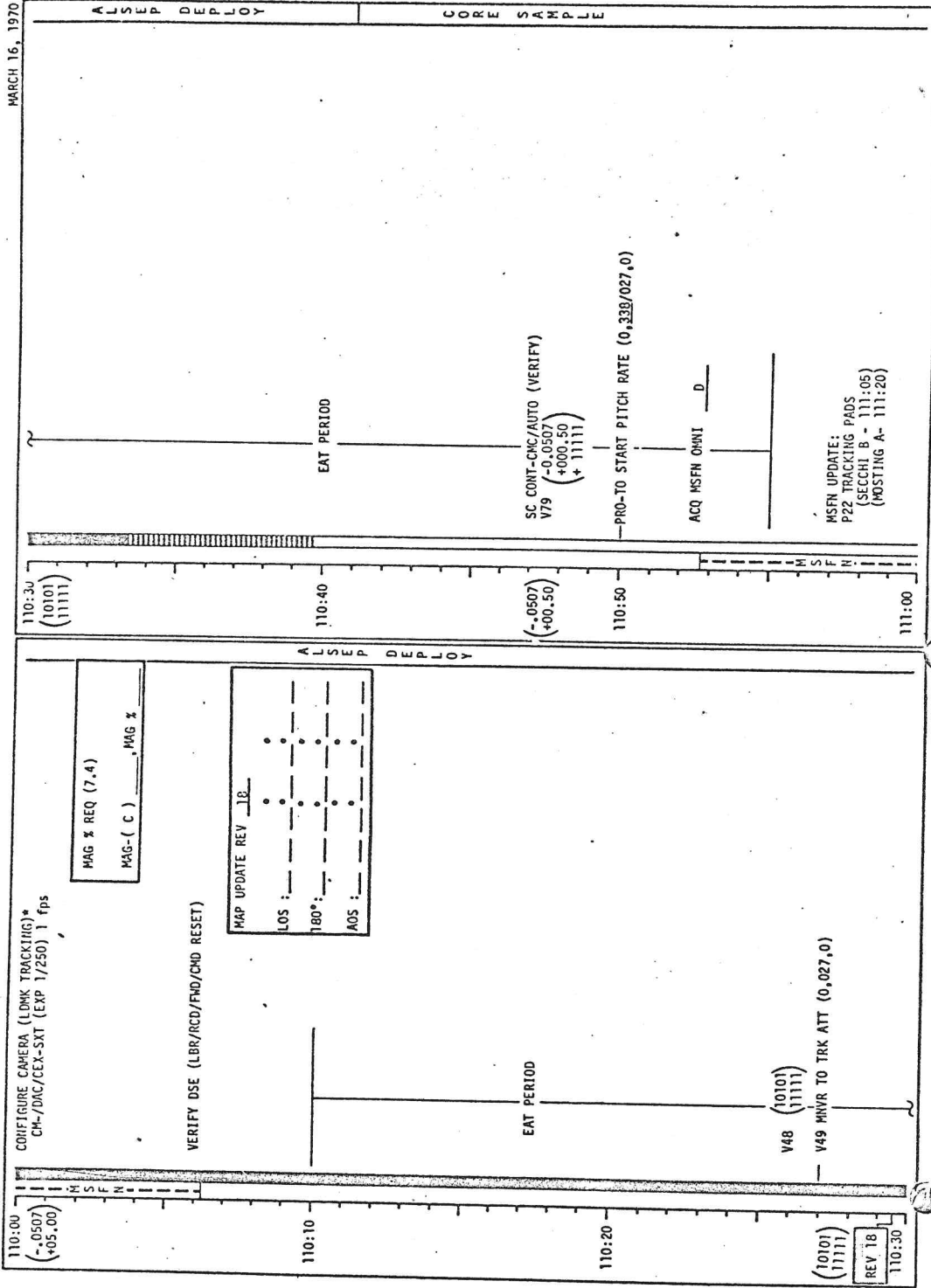
EQUIPMENT PREP		PLSS DOWNING	
106:00 (10101) (11111)	106:30 (10112) (11111)	106:40	106:50 (-0507) (+05.00)
VERIFY DSE (LBR/RCD/RND/CMD RESET) V48 (10112) (11111) MAP UPDATE REV 16 LOS: 180°: AOS: CONTAMINATION PHOTO PAD T-START: START RECORDER AT SUNRISE (-) 10 MIN S/C CONTAMINATION FIELD PHOTOS (REGULUS#) FLOOD LIGHTS-OFF INHIBIT-A3, C4, B3, D4 THRUSTERS 106:26:42 START RECORDER (SR-10 MIN) DIM INTERIOR LIGHTING		106:31:42 1 FRAME, EXP TIME 1/4 SEC (SR-5 MIN) CHANGE EXP TIME TO 1 SEC (2 clicks V) 1 FRAME, EXP TIME 1 SEC CHANGE EXP TIME TO BULB (1 click V) 1 FRAME, EXP TIME 4 SEC 106:39:42 1 FRAME, EXP TIME 4 SEC (SR-3 MIN) CHANGE EXP TIME TO 1 SEC (1 click) 1 FRAME, EXP TIME 1 SEC CHANGE EXP TIME TO 1/4 SEC (2 clicks) 1 FRAME, EXP TIME 1/4 SEC RECORDER-OFF, LIGHTS UP ENABLE-A3, C4, B3, D4 THRUSTERS REMOVE EL FROM WINDOW, COVER LENS, & CYCLE 5 FRAMES, REPLACE DARKSLIDE V49 MVR TO ORB SCIENCE ATT (0,286,0) REMOVE WINDOW SHADES CONFIGURE CAMERA (ORBITAL SCIENCE)* CH-EL/250/CEX (F8,250,-) INTVL SC CONT - CMC/AUTO (VERIFY) V79 (-0.0507) (+005.00) FR REQ (11) MAG- (M) , FR # PRO-TO START PITCH RATE (0,230/286,0) ORBITAL SCIENCE MAG- (M) , FR # VISUAL TGT 3, ON TRACK (180° + 19) ACQ MSFN OMNI D (106:51) (0,230/286,0)	

3-30-70

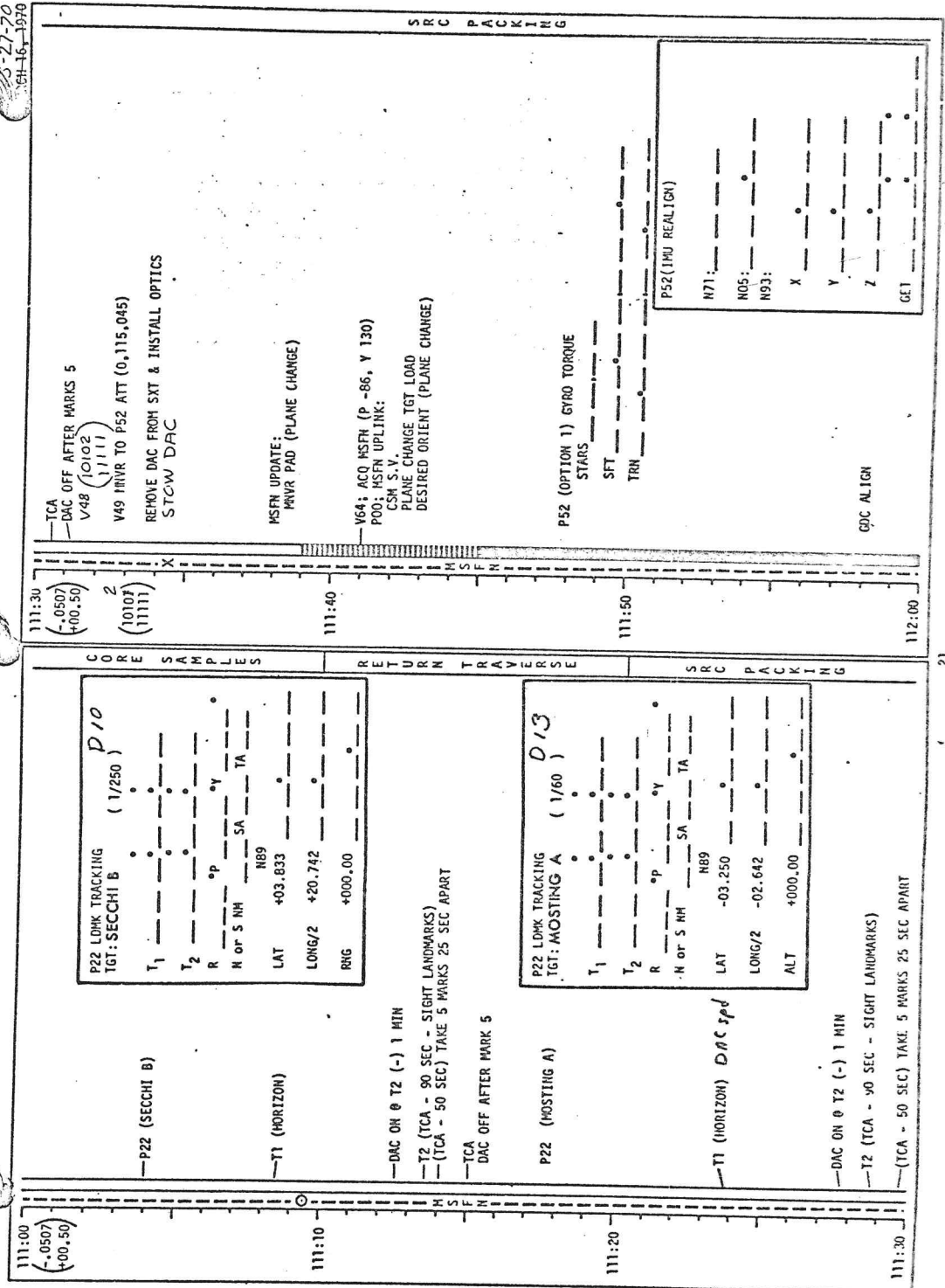
3-27-70
MARCH 16, 1970

PLSS DOWNING		PLSS COMM CHECK	
107:00 (-0507) (+05.00)	107:10	107:20 (10101) (11111)	107:30 (10102) (11111)
VISUAL TGT 5, ON TRACK (180° + 29) D7 PHOTO TGT 23, NORTH (F8,250,-) 1/4° @ 20 sec (250mm) (180° + 38) D8/9 MSFN UPDATE: TOPO PHOTO PAD (LH) SOLAR CORONA PHOTO PAD (107:45) FM-BRIGHTENING-PHOTO-PAD (106:05) V48 (10101) (11111) V49 MVR TO TOPO ATT & ACQ MSFN (P -75, V 188) INSTALL TOPO CAMERA IN WATCH WINDOW SET: SHUTTER 1/50 SEC RANGE 91.7 INTERVAL 8.7 FR REQ (6) MAG- (U) , FR # CONFIGURE CAMERAS & TAPE CH4/EL/80/VHWA (SOLAR CORONA)* BRT, CONT (F2.8,125,-) REMOVE DARKSLIDE, COVER LENS & CYCLE EL 5 FRAMES, REPLACE DARKSLIDE V48 (10102) (11111)		TOPO PHOTO PAD LM (082,123,081) 358 359 R P Y T START: T STOP: RNG NM	

MARCH 16, 1970



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CH-16-1970



3-27-70

FORM 100-10-70

112:00
(10105)
(11111)

112:10
(10111)
(11111)

112:20

REV 19

112:30

P30 V49 HVR TO BURN ATT (0,0,0)

VERIFY DSE (LBR/RCD/FWD/CMD RESET)

SEXTANT STAR CHECK

V48 (10111)
(11111)

SECURE EQUIPMENT FOR PC 1

MAP UPDATE REV 19

LOS : ---

180°: ---

AOS : ---

POST EVVA SYSTEMS CONFIG

PLSSS OZ REECH

PLSSS/OPS DOFF HEG

P30 MANEUVER

C	S	M	P	G	A	N	I	PURPOSE
SET STARS								
								MT N47
								P TRIM N48
								Y TRIM
								HRS GETI
								MIN N33
								SEC
								AVX N81
								AVY
								AVZ
								R
								P
								Y
								H _A N44
								H _P
								ΔVT
								BT
								ΔVC
								SXTS
								SFT
								TRN
								BSS
								SPA
								SXP
								LAT N61
								LONG
								RTGO EMS
								VTD
								GET 0.05G

HORIZON/WINDOOW

OTHER

APR 16, 1970

112:30
(10111)
(11111)

112:40

112:50

113:00

PLSSS/OPS DOFF HEG

POST EVVA C

L10H CARLISTER CHANGE
11 INTO A, STON 9 IN A3

V64: ACQ HSFN (P -44, Y 270)

3-27-70

3-27-70

114:30
(-.0507)
(+05.00)

(10111)
(11111)

114:40

114:50

(-.0000)
(+10.00)

115:00

RECORD - OFF, LIGHTS UP
REMOVE EL FROM WINDOW, COVER LENS, & CYCLE 5 FRAMES,
REPLACE DARKSLIDE

V48 (10111)
(11111)

V49 MVR TO REST ATT (098.272.0)
PERFORM PRESLEEP CHECKLIST

MAP %	FR #

MAP UPDATE REV 20
LOS: .
180°: .
AOS: .

ONBOARD READOUT

BAT C
PYRO BAT A
PYRO BAT B
RCS A
B
C
D

DC-IND SEL - MNA OR B

V64: ACQ MSFN (P -6, Y 268)

SC CONT - CHC/FREE (VERIFY)
V79 (-0.0000)
(+010.00)
+11111

REST PERIOD (10 HRS)
115:00 to 125:00

Accel end

EVA DEBRIEFING

REST PERIOD

3-27-70

125:30
(-.0000)
(+10.00)

125:40

125:50

(10111)
(11111)

126:00

WAKE UP
PERFORM POST SLEEP CHECKLIST

EAT PERIOD

MSFN UPDATE:
CONSUMPABLES
VERTICAL STEREO PAD (126:15)

MSFN UPLINK:
CSH S.V.

CSH CONSUMABLES PAD
GET: .
RCS TOTAL
QUAD A B C D
H ₂ TOTAL
O ₂ TOTAL
H ₂ -TOTAL

EVA PLANNING

CABIN PREP FOR EVA

MAP UPDATE REV 26
LOS: .
180°: .
AOS: .

VERIFY DSE (LBR/RCD/TWO/CMD RESET)

P52 (IMU REALIGN)

N71: .
N05: .
N93: .
X .
Y .
Z .
GET .

P52 (OPTION 3)

3-30-70 15-1079

Swigert-on

126:00
(10111)
(10101)
(11111)

126:10

REV 26

126:20
(-0507)
(+00.50)

126:30

CABIN PREP FOR EVA

DC-FR REQ (+00) / 72
MAG- (R) , FR #

V48 (10101)
(11111)

49 MVR TO VERTICAL STRIP ATT (0.348,0)

CONFIGURE CAMERAS
CH4/DC/80/8M (VERTICAL STRIP)*
BRKT.1VL (F2.8,250,-)*
CH-/EL/250/CEX (ORBITAL SCIENCE)*
(F5.6,250,-)*
CH-DAC/SXI/CEX (EXP 1/60) 1 fps (VERTICAL STRIP)

EL-FR REQ (24)
MAG- (M) , FR #

DAC-MAG % REQ (61.3)
MAG- (H) , MAG %

SC CONT - CHC/AUTO (VERIFY)
V79 (-0.0507)
(+000.50)
(+11111)

PRO - TO START PITCH RATE (0.279/348,0)

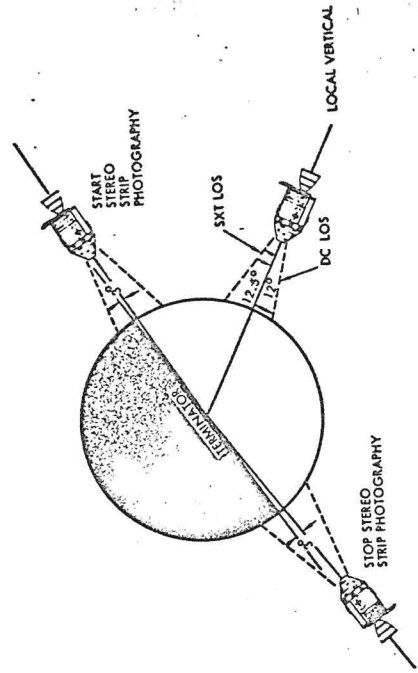
ORBITAL SCIENCE & VERTICAL STRIP
ZERO OPTICS & MANUALLY SET OPTICS:
TRN = 45°, SFT = 0°
VOGN65 (DO NOT ENTER)
PCH BIT RATE-HI

126:27:08 - ENTER, DAC - ON (TRN + 1 MIN)
DC-ON

PHOTO TGT 5, NORTH (F5.6,250,-) 4 @ 20 sec (250mm) (180° + :14)

VERTICAL STRIP

STEREO STRIP PHOTOGRAPHY (RESEAU & DAC)



VERTICAL STEREO PHOTO

T-START: --- : : : ---

T-STOP: --- : : : ---

126:30
(-0507)
(+00.50)

126:40

126:50

127:00

RECORD TIME FROM VOGN65
V76N91E, PCH BIT RATE-LU
SWITCH TO ONNI D
- DC (F4), DAC (1/125)

PHOTO TGT 13, NORTH (F5.6,250,-) 9 @ 20 sec (250mm) (180° + :27)
P 5/6
ACQ MSFN ONNI D

DC (F5.6), DAC (1/250)

MSFN UPDATE
FRA MAURO ZERO PHASE PAD (127:05)

VERTICAL STRIP

PHOTO TGT 25, NORTH (F5.6,250,-) 11 @ 20 sec (250mm) (180° + :40)
P 9/10

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CHARGE BATTERY A

RECORD OBSERVATIONS ON ZERO PHASE
CRATERS: CLUSTER, SHALLOW, DUMBELL, MEDIUM
VISIBILITY: ZERO, QUESTION, CRUTCH, OBVIOUS

MAP UPDATE REV 27

LOS: ---
180°: ---
AOS: ---

VERIFY DSE (LBR/RCD/FWD/CHD RESET)

FR REQ 109
MAG-(U) FR #

INSTALL TOPO CAMERA IN HATCH WINDOW
SET: SHUTTER 1/50 SEC
RANGE 92.0
INTERVAL 8.3

127:30 (-.0507) (+00.50) 127:40 127:50 128:00

PLSS COMM CHECK

FR REQ (10)
MAG-(Q) FR #

CONFIGURE CAMERA (FRA MAURO-ZERO PHASE)*
CH3/EL/80/BH-
(F 0, 250, -)
5:6

DAC (1/125)

DC (14)

FRA MAURO ZERO PHASE PAD (TGT 46A)
T-START: ---
START RECORDER @ FRA MAURO
SUN ELEV. (-) 3 1/2 MINUTES

VERTICAL STRIP
OMNI 2
FRA MAURO ZERO PHASE - 3 1/2 MIN

DC (F 2.8), DAC (1/60)

127:14:20 - START VISUAL OBSERVATIONS OF FRA MAURO
F 13/14

127:15:40 - PHOTO-TGT 46A (FRA MAURO - ZERO PHASE) - ON TRK
5:6 (F 250, -) 5 @ 5 SEC
CONTINUE VISUAL OBSERVATIONS
STOP OBSERVATIONS - RECORDER OFF
DC (F 2.8), DAC (1/60)

127:14:20 - PHOTO-TGT 56, ON TRK (F 250, -) 5 @ 20 SEC (80mm) (180° + 1:05)
F 15 5:6

VGN65 (DO NOT ENTER)

127:24:20 - ENTER, DAC - OFF (TS-1 MIN)
DC-OFF
RECORD TIME FROM VGN65

MSRN UPDATE:
TOPO PHOTO PADS (TGT: 6, 9, CENSORINUS, 29, 34, 42, 46/54)
(128:15 - 129:30)

TOPO TGT 9 (SHUT-1/100, RNG-92.5, INT-7.8) 12 FRAMES
F 5

V48 (10101) (11111)
V49 MNVR TO TOPO TGT CENSORINUS
VERIFY DSE (LBR/RCD/FWD)

ACQ MSFN OMNI B C

V64 ACQ MSFN
(P -21, Y 177)

TOPO PHOTO PAD TGT 9 (020,255,013)
F 5
R --- P --- Y ---
T START: ---
T STOP: ---
RNG --- NM

TOPO PHOTO PAD CENSORINUS (0,170,0)
F 11
R --- P --- Y ---
T START: ---
T STOP: ---
RNG --- NM

V48 (10102) (11111)
VERIFY PCM - HBR

TOPO STRIP, CENSORINUS (SHUT-1/200, RNG-92.2, INT-8.2) 26 FRAMES
F 11/12

128:30 (10102) (11111) 128:40 128:50 129:00

128:00 (10101) (11111) 128:10 128:20 128:30

REV 27

V48 (10102) (11111)

ORBITAL SCIENCE (TOPO TGT)
VERIFY DSE (HBR/RCD/FWD)
VERIFY LTC (MODE-STBY/PMR-ON) (T-START(-) 1 MIN)

TOPO TGT 6 (SHUT-1/50, RNG-92.0, INT-8.3) 14 FRAMES
F 4

V49 MNVR TO TOPO TGT 9

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129:00 (10102) (11111)

V49 MVR TO TOPO TGT 29
C-11
TOPO TGT 29 (SHUT-1/200,RNG-92.5,INT-7.8) 6 FRAMES

V49, MVR TO TOPO TGT 34
C-12
TOPO TGT 34 (SHUT-1/200,RNG-92.3,INT-8.1) 14 FRAMES

V49 MVR TO TOPO TGT 42
C-13
TOPO TGT 42 (SHUT-1/100,RNG-92.1,INT-8.2) 12 FRAMES

V49 MVR TO TOPO TGT 46/54
C-14
TOPO TGT 46/54 (SHUT-1/50,RNG-92.3,INT-8.1) 25 FRAMES

V48 (10111) (11111)

EAT PERIOD

FIELD GEOLOGY

MAP UPDATE REV 28

LOS: .
180°: .
AOS: .

TOPO PHOTO PAD TGT 42 (010,127,007)

R P Y
T START: .
T STOP: .
RNG NH

TOPO PHOTO PAD TGT 46/54 (002,117,001)

R P Y
T START: .
T STOP: .
RNG NH

VERIFY DSE (LBR/RCD/FWD/CHD RESET)

129:30 (10111) (11111)

129:40

129:50

130:00

130:00 (10111) (11111)

REV 28

130:10

V48 (10101) (11111)
V49 MVR TO OBLIQUE STEREO ATT (0,227,0)

EAT PERIOD

FIELD GEOLOGY

FR REQ (49) 25
MAG- (H) . FR

CONFIGURE CAMERA (ORBITAL SCIENCE)
CH-/EL/250/CEX- (f8,250,) 1-5 V L

SC CONT - CHC/AUTO (VERIFY)
V79 (-0.0507) (+000.50) (+11111)
PRO - TO START PITCH RATE (0,183/227,0)

ACQ M5FN OMNI D

ORBITAL SCIENCE & OBLIQUE STEREO

PHOTO TGT 18, NORTH (f8,250,) 8 @ 20 SEC (250mm) (180° + :29)
C-7

OMNI A
CONFIGURE CAMERA
SET TOPO:
SHUTTER 1/200 SEC
RANGE 94.4
INTERVAL 5.8
V64; ACQ M5FN (P-12, V178)

TOPO PHOTO PAD CENSORINUS (ORB RATE)

R P Y
T START: .
T STOP: .
RNG NH

VERIFY LTC (HOUSE-STBY/PMR-ON) (T-START (-) 1 MIN)
VERIFY PCH-HBR
OBLIQUE TOPO STRIP, CENSORINUS
(SHUT-1/200,RNG-94.4,INT-5.8) 26 FRAMES

130:30 (-0.0507) (+000.50)

130:40

130:50

131:00

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131:00
(-0507)
(+00.50)

V48 (10102)
(11111)

PHOTO TGT 33, NORTH (F5.6,250,-) 20 SEC (250MM) (180°+55)
5 12 113

V49 MNVR TO TOPO TGT 54A

TOPO TGT 54A (SHUT-1/50, RNG-92.1, INT-8.2) 23 FRAMES
5 14

V48 (10111)
(11111)

V49 MNVR TO ZODIACAL LT ATT (0.183,0)

CONFIGURE CAMERA & TAPE
CH4/DAC/18/VHBM (ZODIACAL LIGHT)*
BRKT *MIR (10.9,60,-) 24 FPS
CMW-EL/250/CEX (ORBITAL SCIENCE)
(F5.6,250,-) 1/50

DAC-MAG % REQ (3.1)
MAG- (G) , MAG %
EL-FR REQ (39)
MAG- (M) , FR #

MSFN UPDATE:
ZODIACAL PHOTO PAD
P22 TRK PADS
RELAUMUR X (132:35)
EUCLIDES F (133:10)

STOM TOPO CAMERA
ACQ MSFN OMNI 2 A

131:10
(10102)
(11111)

131:20
(10111)
(11111)

131:30

DOCUMENTED SAMPLE OF FLOWAD

TOPO PHOTO PAD TGT 54A (012,117,008)

R P V

T START:

T STOP:

RNG NM

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MARCH 16 1550-

DOCUMENTED SAMPLE OF FLOWAD

POST EVAL SYS CONFLICT

MAP UPDATE REV 29

LOS:

180°:

AOS:

SC CONT - CMC/AUTO (VERIFY)
W79 (-0.0507)
+005.00
+11111

PRO - TO START PITCH RATE (0.246/183,0)

ZODIACAL LIGHT PHOTO PAD(SR)

T-START:
START RECORDER at SUNRISE (-)30 MIN

ZODIACAL LIGHT PHOTOS

INHIBIT-A3,C4,B3,D4 THRUSTERS
RECORD - ON (SR-30 MIN)
VERIFY USE (LBR/RCD/FND/CHD RESET)
DIM INTERIOR LIGHTING
DAC-ON @ 24 fps FOR 2 SEC (~50 FR) (COVER LENS)
CHANGE FRAME RATE TO TIME

131:30
(12111)
(11111)

131:40
(-0507)
(+05.00)

131:44:45 - 3 FRAMES, 18 SEC EXP TIME (SR - 25 MIN)

131:49:45 - 3 FRAMES, 16 SEC EXP TIME (SR-21:40)

131:53:05 - 3 FRAMES, 12 SEC EXP TIME (SR-18:20)

131:59:45 - 3 FRAMES, 9 SEC EXP TIME (SR - 15 MIN)

131:50

132:00

ZODIACAL LIGHT PHOTOGRAPHY

optional

LOCAL HORIZONTAL

DAC LOS (II TO X-AXIS)

1°

(HU-SEF)

SUB SOLAR POINT

SPACECRAFT DARKNESS

SPACECRAFT MOTION

MARCH 16, 1970

132:00
(-.0507)
(+05.00)

REV 29

132:10

132:20
(10102)
(11111)

132:30
(-.0507)
(+05.00)

PLSS VOSS DOFFING

132:03:05 - 3 FRAMES, 7 SEC EXP TIME (SR-11:40)

132:06:25 - 3 FRAMES, 5 SEC EXP TIME (SR-8:20)

132:09:45 - 3 FRAMES, 2 SEC EXP TIME (SR - 5 MIN)
SET FRAME RATE TO 1 FRAME / SEC

132:13:45 - DAC ON FOR 4 SEC (SR-1 MIN)
DAC-ON @ 24 FPS FOR 2 SEC (~50 FR) (COVER LENS)
ENABLE-A3, C4, B3, D4 THRUSTERS
V48 (10102)
(11111)

V49 HWVR TO ORB SCIENCE ATT (0,287,0)

MAG %

SC CONT - CHC/AUTO (VERIFY)
V79 (-0.0507)
(+005.00)
(+11111)

PRO - TO START PITCH RATE (0,230/287,0)

ORBITAL SCIENCE

PHOTO TGT 10, ON TRK (F5,6,250,~) 12 @ 10 SEC (250MM) (180° + :18)
E5

PHOTO TGT 12, ON TRK (F5,6,250,~) 5 @ 10 SEC (250MM) (180° + :21)
E5

132:40

132:50
(10102)
(11111)

133:00
(-.0507)
(+00.50)

PREP FOR EQUIP

132:30
(-.0507)
(+05.00)

ACQ MSFN OMNI D

PHOTO TGT 15, NORTH (F8,250,~) 6 @ 20 SEC (250MM) (180° + :24)
E6

P22 LDMK TRACKING
TGT: REAMUR X (1/125)

T1
T2
R
N or S NH
LAT -02.917
LONG/2 -00.366
ALT +000.00

PHOTO TGT 21, NORTH (F8,250,~) 15 @ 20 (250MM) (180° + :35)
E6/9

V49 HWVR TO TRK ATT (0,291,0)

CONFIGURE CAMERA (LDMK TRACKING)*
CH-/DAC/SXT/CEX-(EXP 1/125) 1 fps

MAG % REQ (7.4)
MAG- (C) , MAG %

P22 (REAMUR X)
SC CONT-CHC/AUTO(VERIFY)
V79 (-0.0507)
(+000.50)
(+11111)

PRO - TO START PITCH RATE (0,338/291,0)

T1 (HORIZON)

133:00

133:00
(-.0507)
(+00.50)

POST EVAL CLEAN UP

DAC-ON @ T2 (-) 1 MIN

T2 (TCA-90 SEC - SIGHT LANDMARK)
(TCA -50 SEC) TAKE 5 MARKS 25 SEC APART

TCA
DAC-OFF AFTER MARK 5

P22 (EUCIDES F)

T1 (HORIZON) DAC Fpd

DAC-ON @ T2 (-) 1 MIN

T2 (TCA-90 SEC - SIGHT LANDMARK)
(TCA-50 SEC) TAKE 5 MARKS 25 SEC APART

TCA
DAC-OFF AFTER MARK 5

V48 (10101)
(11111)

V49 HWVR TO P22/ANTI-SOLAR PT ATT (180,238,000)

ACQ MSFN (P -43, Y 184)

CONFIGURE CAMERA (GEGENSCHEIN)*
CH-/DAC/18/HIGH
BRKT, MIR (TO 9,60,~) TIME 24 MAG

MAP UPDATE:
P22 TRK PAOS
MOLTKE (134:40)
L/S LDMK 13-1 (134:50)

133:10

133:20
(10101)
(11111)

133:30
(-.0507)
(+00.50)

P22 LDMK TRACKING
TGT: EUCIDES F (1/60)

T1
T2
R
N or S NH
LAT -06.377
LONG/2 -16.853
ALT +000.00

PHOTO TGT 12, ON TRK (F5,6,250,~) 5 @ 10 SEC (250MM) (180° + :21)
E5

MAG % REQ (2.7)
MAG- (C) , MAG %

133:40

133:50
(10101)
(11111)

134:00

DEBVR AT EFF

EAT PERIOD

133:30
(10101)
(11111)

P52 (OPTION 3)

P52 (IMU REALIGN)

N71: ---
N05: ---
N93: ---
X ---
Y ---
Z ---
GET ---

GOC ALIGN
VERIFY ORDEAL
ALT SET = 60 NM

133:42:00 RECORDER-ON
VERIFY DSE (LBR/PCD/FRD/CHD RESET)

GEGENSCHEIN PHOTOS

133:45:00 INHIBIT - A3, C4, B3, D4 THRUSTERS
DIM INTERIOR LIGHTING
DAC-ON @ 24 FPS FOR 2 SEC (~50 FR) (COVER LENS)
CHANGE 2 FRAMES, EXP TIME 20 SEC (MIDWAY PT)
FRAME TO 1 FRAME, EXP TIME 5 SEC
RATE TO 1 FPS
ENABLE - A3, C4, B3, D4 THRUSTERS
V49 HWVR TO MIDWAY PT ATT (180,247,000)

133:50:00 INHIBIT - A3, C4, B3, D4 THRUSTERS
DIM INTERIOR LIGHTING
2 FRAMES, EXP TIME 20 SEC (MIDWAY PT)
1 FRAME, EXP TIME 5 SEC
LIGHTS UP
ENABLE - A3, C4, B3, D4 THRUSTERS
V49 HWVR TO MOULTON PT ATT (179,259,001)

133:55:00 INHIBIT - A3, C4, B3, D4 THRUSTERS
DIM INTERIOR LIGHTING
2 FRAMES, EXP TIME 20 SEC (MOULTON PT)
1 FRAME, EXP TIME 5 SEC
DAC-ON @ 24 FPS FOR 2 SEC (~50 SEC) (COVER LENS)
LIGHTS UP
ENABLE - A3, C4, B3, D4 THRUSTERS

V49 HWVR TO ORB SCIENCE ATT (0,306,0)

MAG %

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3-27-70
MARCH 16 1970

CONFIGURE SWITCHES FOR RNDZ XPNDR ACTIVATION AND SELF TEST (DECAL)

134:00
(10101
11111)

REV 30

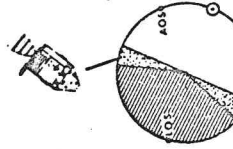
134:10

(-0.0507)
(+05.00)

134:20

134:30

EAT PERIOD



SC CONT - CMC/AUTO (VERIFY)
V79 (-0.0507)
+005.00
(+ 11111)
PRO - TO START PITCH RATE (

(134:15)
(0.230/306.0)

CONFIGURE CAMERAS
CH-/EL/250/CEX (ORBITAL SCIENCE)
(F5.6,250,-) 1VL
CH-/DAC/SXT/CEX-(EXP 1/250) 1 f

EL-FR REQ (15)

MAG-(M) _____, FR

DAC-MAG % REQ (3.7)

MAG-(C) , MAG %

ORBITAL SCIENCE

PHOTO TGT 11, NORTH (F5.6, 250, ∞) 6 @ 20 SEC (250MM) (180° + :21)

52

ACO HSFN OMNI D

THEORETICAL AREA

134:30
(-.0507)
+05.00

(111111)
(101010)

134:40

-0507
+00.50

134:50

135:00

P22 LDMK TRACKING
TGT: MOLTKE
E11 (1/250)

T ₁	-----	•	•	•
T ₂	-----	•	•	•
R	-----	•	•	•
N or S	-----	•	•	•
N	-----	•	•	•
S	-----	•	•	•
N89	-----	•	•	•
LAT	-----	•	•	•
LONG/2	-----	•	•	•
ALT	-----	•	•	•

P22 LDMK TRACKING
YGT: 13-1

T₁ • •

T₂ • •

R •P *V
N or S NH SA TA
N89
LAT -04.043
LONG/2 -07.799
ALT -26

	13-2	13-3
LAT	-03.606	-03.189
LONG/2	-07.658	-07.739
ALT	+000.00	+000.76

PHOTO TGT 16, NORTH (F5.6, 250^{mm}) 9 @ 20 SEC (250MM) (180° + :28)

乙

- V49 MNVR TO TRK ATT (0 ,314, 0)

RNOZ XPNDR - PWR

P22 (MOLTKE)
SC CONT - CMC/AUTO (VERIFY)
V79 -0.0507
+000.50
+ 11111

PRO - TO START PITCH RATE (0,338/314,0)

T1 (HORIZON)

DAC-ON @ T2 (-) 1 MIN

T2 (TCA - 90 SEC - SIGHT LANDMARK)

(TCA - 50 SEC) TAKE 5 MARKS 25 SEC APART

TCA

DAC - OFF AFTER MARK 5
REMOVE DAC FROM SXT & INSTALL OPTICS

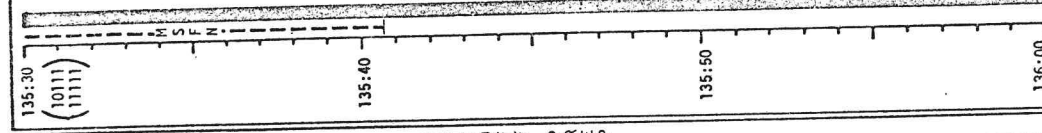
P22 (L/S LDMK 13-1)

THE FOLLO WING

Swigert - off

3-27-70
MARCH 16, 1970

P52 (OPTION 3)



T1 (HORIZON)

T2 (TCA - 90 SEC - 91GHT LANDMARK)
TCA - 50 SEC) TAKE 5 MARKS 25 SEC APART

TCA

V48 (10111)
11111

V49 HVR TO P52 ATT (180,240,358)
ACQ MSFN (P -45, Y 181)

MSFN UPDATE:
CSM CONSUMABLES PAD (IF REQ)

CSM CONSUMABLES PAD

GET:	---
RCS TOTAL	---
QUAD A	---
C	---
D	---
H ₂ TOTAL	---
O ₂ TOTAL	---
H ₂ TOTAL	---

MSFN UPLINK:
LM S.V. (INS + 18)
CSM S.V. (L/O)
RESET SURFACE FLAG

MSFN UPDATE
COPY LM ASCENT PAD DATA (136:30)

H₂ PURGE LINE HTRS - ON

135:00 (-.0507)
(+00.50)

135:10

(10111)
(11111)

135:20

135:30

P52 (INU REALIGN)

N71: ---
N05: ---
N93: ---
X ---
Y ---
Z ---
GET ---

P52 (COAS CALIB)
USE STAR SPICA

VERIFY DSE (LBR/RCD/FMD/CHD RESET)
MSFN ENABLES MSFN S-BD RELAY

V49 (0, 249,358)

COAS CALIB - N92

SHAFT: ---
TRUN: ---

CONFIGURE CAMERAS*
CH2/DAC/18/CEA-BRKT.MTR (F8,250,7) 6 fps,
CM-/EL/80/CEA- (F8,250,7) focus)
CH4/TV: IN BRKT (F22) 30 MIN

EAT PERIOD

WASTE WATER DUMP
O₂ & H₂ FUEL CELL PURGE

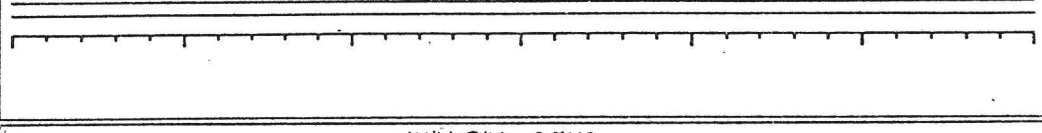
V49 (0, 79,0)

MAG % REQ - (1 MAG)
MAG- (E) --- MAG %
FR REQ - (10)
MAG- (O) --- FR #

MAP UPDATE REV 31

LOS: ---
180°: ---
AOS: ---

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H₂ PURGE HEATERS - OFF

EAT PERIOD

Set up TV & chit out
-62 7
V64, ACQ MSFN (P 345, Y 181)

DON PGA W/O HELMET & GLOVES
PACK JETTISON ITEMS
INSTALL CABIN FAN LUNAR DUST FILTER

136:00 (10111)
(11111)

136:10

136:20

136:30

H₂ PURGE HEATERS - OFF

EAT PERIOD

Set up TV & chit out
-62 7
V64, ACQ MSFN (P 345, Y 181)

DON PGA W/O HELMET & GLOVES
PACK JETTISON ITEMS
INSTALL CABIN FAN LUNAR DUST FILTER

3-27-70
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136:30
(10111)
(11111)

V49 MINVR TO LIFTOFF ATT (0.79,0)

136:40

136:50

V64; ACQ MSFN (P=62,Y=7)

VHF AM B-DUPLEX
VHF AM A-OFF
VHF RANGING-RANGING
VHF ANT-LT
VHF AM-A-OFF PML 9
RNDZ APNDR-PWR (VERIFY)
SC CONT-CHC/AUTO (VERIFY)

GDC ALIGN; VERIFY ORDEAL

SET DET COUNTDOWN TO LIFTOFF

137:00

PURPOSE		RENDEZVOUS PAD			
GETI LIFT-OFF	HRS	+	0	0	
	MIN	+	0	0	0
	SEC	+	0		
GETI INSERTION	HRS	+	0	0	
	MIN	+	0	0	0
	SEC	+	0		
GETI CSI N11	HRS	+	0	0	
	MIN	+	0	0	0
	SEC	+	0		
GETI TPI N37	HRS	+	0	0	
	MIN	+	0	0	0
	SEC	+	0		

137:00
(10111)
(11111)

LIFT-OFF (137:09:16)
: : :

LM INSERTION (137:16:23)
: : :

EXT RNDZ LT-ON VHF-ANT-RT
EXT RUN/EVA LT-ON
VHF RANGING-RESET

(COMPUTE VHF R DOT FOR LM IF REQUESTED)

P52 (OPT 3)
VHF VOICE CHECK

P00; V45 (RESET SURFLG)
MSFN UPLINK;
LM S.V.

GDC ALIGN; VERIFY ORDEAL

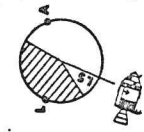
V67 (+10000,+00100,+00001); V48 (10102)
VERIFY;

LM TRACKER LT ON

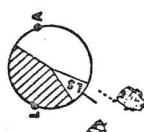
P20 (T01H)(0.232/79.0)

P32; OBTAIN AND LOAD LM

137:30
R=212.53
R=-353.0



LIFT-OFF



LM INSERTION

137:20
R=251.62
R=-431.8

BACKUP RR CHECK

FOR RR
XPANDR
COVERAGE
(0.118,0)
R₁ -
R₂ -
ΔR -
R_{100xAR}
MIN

P52(LMU REALIGN)
N71: -
N05: -
N93: -
X -
Y -
Z -
GET -

P32 INPUT

11
55
37
CSI TIGH
+00001
R(180°)
+208 30
ELEVATION
OPTION CODE
YPT TIGH

MARCH 16, 1970

137:30
R=212.53
R=-353.0

V57
V87
BEFORE STEADY STATE
PRE-CSI: N49>(+00020,+00120) REJECT/REPEAT
POST-CSI: N49>(+00008,+00050) REJECT/REPEAT
AFTER STEADY STATE
ANYTIME: N49>(+00003,+00020) REJECT/REPEAT

V48 (10112)
(11111)

VERIFY DSE MOTION AT LOS (LBR/RCO/FWD/CHD RESET)
MSFN DISABLE, MSFN S-BAND RELAY;
GO VHF COMM

137:45
R=171.96
R=-193.5

V90 (R2=2)
V90 (R2=1)
V32 RECYCLE
V57

VOICE CSI COMPARISON TO LM

P32 FINAL COMP
OVERWRITE VGY WITH (-) CSM VD0T

COPY LM CSI P76 PAD
[CHC-FREE/AUTO]

P40 (71°)(0.162/273.0)

[VHF ANT-LEFT]

138:00
R=152.74
R=-82.4

GROUND CSI SOLUTION
VGX

V90

LM Y Y DOT
CSM Y Y DOT

V32 RECYCLE

75 ΔH ΔT, CDH-CSI ΔT, TPI-CDH
81 ΔV, LV
82 ΔV AT CDH, LV

P32 FINAL COMP

75 ΔH ΔT, CDH-CSI ΔT, TPI-CDH
81 ΔV, LV
82 ΔV AT CDH, LV

138:00
R=152.74
R=-82.4

SPS CHECKLIST

CSI COMPARISON LIMIT=3FPS
L66 IF LCC=CMC
L66 IF LCC=AGS AND RR=VHF
CHG IN AGS IF AGS=CMC

LM CSI (+49.6,+0.0,+0.0)
CSM CSI (-50.2,+0.0,+0.0)

P76 (ADD 22 SEC); V58
P20 (39°)(0.229/307.0)

[VHF ANT-RT]

V67 (+02000,+00020,+00001)
V57
V87

P33: LOAD LM CDH TIGN
V32 RECYCLE
V57
V87

138:15
R=137.78
R=-118.1

ACQ MSFN OMNI D

V90 (R2=2)
V90 (R2=1)

VOICE V90
SOLUTION
TO LM

138:30
R=120.38
R=-117.2

PRIORITIES ARE LCC, AGS, CMC
RR/VHF COMPARISON LIMIT IS
AR = R100 + 0.5nm, ΔR IS ALWAYS ≥ 1nm
V90 ≤ 5 FPS - NO BURN
CSI P76 + 22.

33 TIME OF IGNITION
84 ΔV, LM

(CSM)13 CDH TIGN
(LM) 13 CDH TIGN

V32 RECYCLE

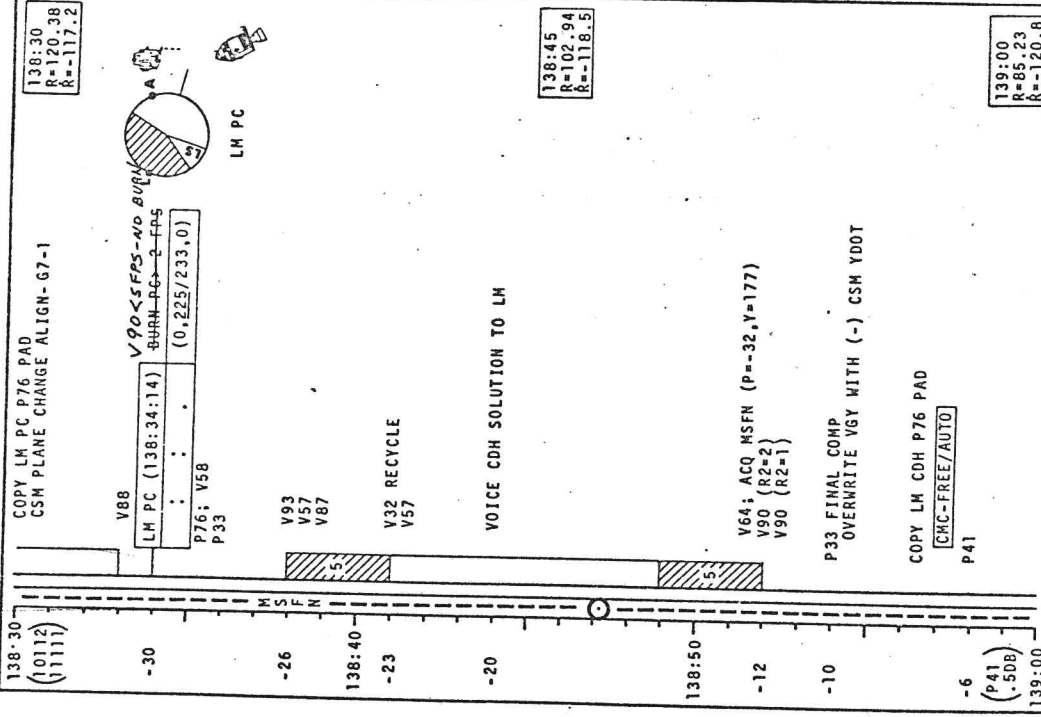
75 ΔH ΔT, TPI-CDH ΔT, TPI-TPI (P32)
81 ΔV, LV

LM PC TIGN

V90

LM Y Y DOT
CSM Y Y DOT

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LM PC P76

33 TIME OF IGNITION :
84 AV, LM : . . .

V32 RECYCLE

75
81

ΔH : . . . ΔT, TPI-CDH ΔT, TPI-TPI (P32)
ΔV, LV : . . .

V90

LM : . . . Y : . . . Y DOT : . . .
CSM : . . . Y : . . . Y DOT : . . .

P33 FINAL COMP

75
81

ΔH : . . . ΔT, TPI-CDH ΔT, TPI-TPI (P32)
ΔV, LV : . . .

RCS CHECKLIST

CDH COMPARISON LIMIT=VGX22 AND VGZ26
IF LGC=CMC
IF LGC=AGS AND-RR=WHF
CHC-IN-AGS IF AGS=CMC

139:00
R=85.23
R=-120.8

LM CDH (+0.0,+0.0,+0.0)
CSM CDH (+0.0,+0.0,+0.0)
P76; V58 : . . . (0.246/163.0)

P34 (27°) (0.232/136.0)

SUNSHAFING MAY
PRECLUDE SAT
MARKS UNTIL
SUNSET

P34 INPUT

37
55

TPI IGN : . . .
INTEG OPTION ELEVATION 4 +208.30 +13000
TRANSFER 4

V32 RECYCLE; V57
(OPTIONAL)

139:15
R=67.34
R=-120.2

37
58
59

TPI TIGN : . . .
PERILUNE ALT TPI ΔV : . . .
AV, LOS : . . .

V32 RECYCLE
COMPARE TPI ΔV SOLUTIONS
COPY LM TPI TIGN
V57

LM TPI TIGN

37

TPI TIGN : . . .

PRIORITIES ARE LGC, AGS, CMC
RR/VHF COMPARISON LIMIT IS
ΔR = R/100 + 0.5nm, ΔR IS ALWAYS ≥ 1nm
(V90 < 5 FPS - NO BURN)

CDH P76

33 TIME OF IGNITION :
84 AV, LM : . . .

V32 RECYCLE

37
58
59

TPI TIGN : . . .
PERILUNE ALT TPI ΔV : . . .
AV, LOS : . . .

4-1-70
22-30
MARCH 16, 1970

PRIORITIES ARE LGC, AGS, CMC
AR/VHF COMPARISON LIMIT IS
AR = 1/100 + 0.5nm, AR IS ALWAYS IN NM

P34 FINAL COMP

37	TPI TIGN	:	:
58	PERLUNE ALT	TPI ΔV	TPF ΔV
81	ΔV, LV	:	:
59	ΔV, LOS	:	:

P34 RECALL

37	TPI TIGN	:	:
55	+00000	TRANSFER	+130.00
58	INTEG OPTION	ELEVATION	Δ
81	PERLUNE ALT	TPI ΔV	TPF ΔV
59	ΔV, LV	:	:
	ΔV, LOS	:	:

TPI P76

33	TIME OF IGNITION	:	:
84	ΔV, LM	:	:

P35 FINAL COMP

81	ΔV, LV	:	:
59	ΔV, LOS	:	:

139:30
R=49.71
R=117.5

P34 FINAL COMP; TPI ΔV COMPARISON

P34 RECALL (TIGN OPTION AND LM TPI TIGN)

COPY LM TPI P76 PAD
VERIFY DSE MOTION AT LOS (LBR/RCD/FWD/CMD RESET)

CMC-FREE/AUTO

P40 (50°) (0.184/2.0)

SPS CHECKLIST

TPI COMPARISON LIMIT=VGX±2, VGY±5, VGZ±6
LGC IF LGC=CMC (ELEV-OPTION)
LGC IF LGC=AGS AND RR=VHF
CMC IN AGS IF AGS=CMC (ELEV-OPTION)

LM TPI (+21.9, +0.1, -11.0)
CSM TPI (-22.4, +0.0, +12.1)

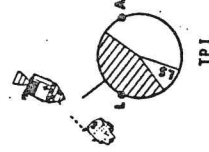
P76 (ADD 11 SEC): V58 (0.208/2.0)

V48 (11102)
(X1111)

P35 (28°) (0.249/30.0)

AUTO RCS SEL (16)-MNA/MNB

(IF SXT OR VHF ONLY, NO V93)
V93
V57
V87



140:00
R=15.07
R=98.1

P35 FINAL COMP

COPY LM MCC1 P76 PAD

P41

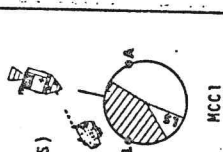
140:00
+15
(11102)
(X1111)

MCC1 (140:00:41)

P76; V58 (0.265/9.0)

P35 (TRIM)

(IF SXT OR VHF ONLY, V93 AFTER 3 MARKS)
V93
V57
V87



140:10
+27

P35 FINAL COMP

COPY LM MCC2 P76 PAD

P41

MCC2 (140:15:41)

P76; V58 (0.302/1.0)

V77; P20 (34°) (0.275/327.0)

V87

V83/VHF/LM RR COMPARISONS

PERFORM PREDOCK CHECKLIST

ROLL TO 180°

TV-ON

V56; ACQ MSFM (P=45, Y=35G)

IF CSM ACTIVE

IP47 AT R=1.25 NM

SEC PRPLNT FUEL PRESS(4)-OPEN

V83E

KEY REL

DAC-ON

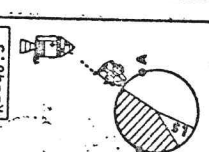
LM PHOTO WITH DAC/TV

TPF (140:27:56)

EXT RNDZ LT-OFF

LM STATION KEEP

140:15
R=4.54
R=46.3



MCC1 P76

33	TIME OF IGNITION	:	:
84	ΔV, LM	:	:

P35 FINAL COMP

81	ΔV, LV	:	:
59	ΔV, LOS	:	:

MCC2 P76

33	TIME OF IGNITION	:	:
84	ΔV, LM	:	:

PRE-DOCK CHECKLIST

MAN ATT(3)-RATE CMD
LIM CYCLE-OFF
ATT DB-MIN
RATE-LO
TRANS CONTR PHR-ON(UP)
ROT CONTR PHR DIR(BOTH)
-MNA/MNB
SC CONT-CMC
CMC MODE-AUTO
AUTO RCS SELECT(16)
-MNA OR MNB
CB DOCK PROBE(2)-CLOSE
PROBE RETR(2)-OFF (VERIFY)
PROBE EXTID/REL-RETR
PROBE EXTID/REL TB(2)-GRAY
(VERIFY) (F, PG S/2-8)
CB SECS LOGIC(2)-CLOSED (VERIFY)
CB SECS ARM(2)-CLOSE
SECS LOGIC(BOTH)-ON(UP)
EXT RUN/EVA LT-OR(UP) VERIFY
COAS PHR-ON(UP)

R (FPS)	R (FT)	R (NM)	RETICLE ANGLE (DEG)
45	9000	1.5	.08
30	6000	1.0	.13
20	3000	.5	.26
10	1500	.25	.54
5	500	.08	1.6
	300	.05	2.7
	200	.03	4.0
	100	.02	8.5

AT CAPTURE
PROBE EXT0/REL Y8-BP(A,PG S/2-7)
REPORT CAPTURE TO LM
SC CONT-CNC/FREE
ALLOW PROBE TO DAMP SC MOTION (10 SEC)
WHEN WITHIN +2° OF DOCKING ATTITUDE
PROBE RETRACT SEC-1 (PRIM-2 IF RECD)

AT DOCK LATCH

PROBE EXTD/RE
AFTER HARD DOCK

SECS PYRO ARM (2)-SAFE	EXT RNDZ LIGHT-OFF
SECS LOGIC (2)-OFF	CONS PUR-OFF
CB SECS ARM (2)-OPEN	RNDZ XPDR-OFF
CB DOCK PROBE (2)-OPEN	LIMIT CYCLE-ON
BMAG MODE (3)-RATE 2	ATT DB-MAX
PROBE RETURN (2)-OFF	SC CONT-SCS
EXT RUN/EVA 1 T-OFF	BMAG MODE (3)-ATT

338 9910 (U) - 0000

[illegible]

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 27, 1970	140:00 - 141:00	6/33	3-110

FLIGHT PLANNING BRANCH

REVISION A

MCC VERIFY DSE
MOTION BEFORE
LOS

REVISION

MCC-H

FLIGHT PLAN

NOTES

1213 CST

143:00
Sec 5 min
10102

DAC ON
P47-THRUST MONITOR
LM JETTISON 143:04
P41-RCS THRUSTING
MNVR TO SEP ATT, (143:08) R 180, P 341.6, Y 0
OMNI B

DUMP DSE
UPLINK TO LM
V48-LOAD DAP
R1-12011
P42-APS THRUSTING
UPDATE TO CSM
TOPO PHOTO PAD REV 35

[CSM SEPARATION 143:09
GO ORB RATE (143:10) P 093/342, V64-ACQ MSFN
PREPARE DAC FOR LM DEORBIT BURN PHOTOGRAPHY
CM/DAC/SXT/CEX (FIXED, 250, FIXED) 12 FPS, 0.5 MAG, 4 MIN
MAG F

S/C CLEANUP
CMP DOFF PGA
CONFIGURE FOR BI-STATIC RADAR TEST
VERIFY VHF AM B - DUPLEX
VHF RANGING-RANGING
VHF ANTENNA-LEFT
VHF AM SQUELCH A-MAX
VHF AM T/R OFF

VERIFY DSE MOTION @ LOS
(3 AUDIO PANELS)
THIS VHF CONFIGURATION WILL BE
MAINTAINED UNTIL 166:10

EAT PERIOD
TOPO PHOTO PAD REV 35
R P Y
T START: : : : :
T STOP: : : : :
RNG NM.

ONBOARD READOUT
BAT C
PYRO BAT A
PYRO BAT B
RCS A
B
C
D
DC IND SEL - MNA OR B
MAP UPDATE REV 35
LOS : : : :
180° : : : :
AOS : : : :
TIG: 143:09
BT: 6.12 SEC
AVR: 1.0 FT/SEC
ULLAGE: N/A
ORBIT: 57.7 x 55.3
LM IS TARGETED FOR
APS IMPULSE BURN.
THRUST IS RCS
ULLAGE ONLY.

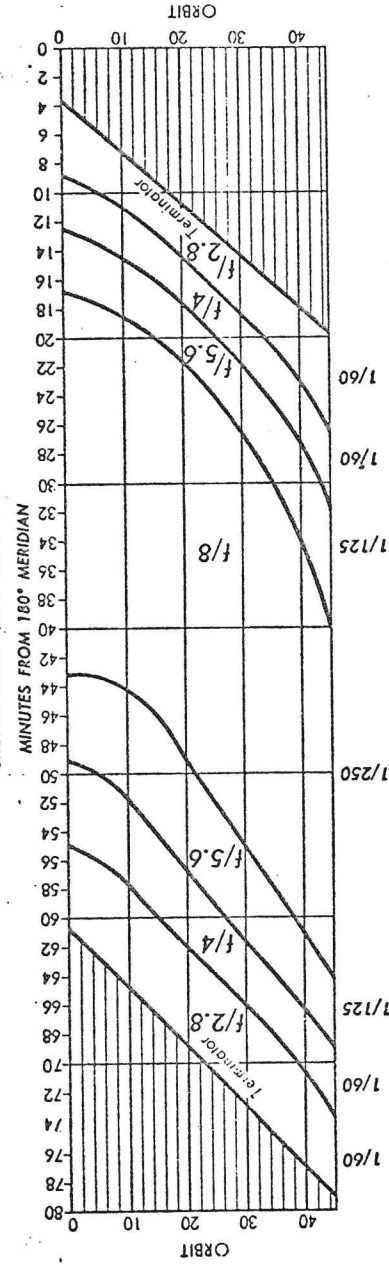
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 13	FINAL (APRIL)	MARCH 27, 1970	143:00 - 144:00	6/34-35	3-113

MSC Form 29 (May 68)

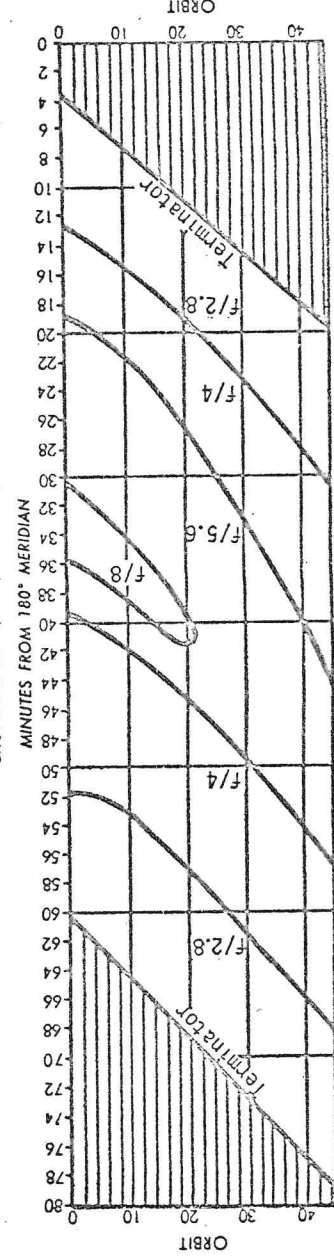
FLIGHT PLANNING BRANCH

REVISION A

CREW OPTION (CEX)
SHUTTER SPEED 1/250 (CONSTANT)



CREW OPTION (BW)
SHUTTER SPEED 1/250 (CONSTANT)



LM to CM Transfer List
3-25-70

1) Jettison Bag		Receive from CM & use to transfer the following	
ITEM	QTY	LM	CM LOC
16MM Mag	8	6 in bag & inside Decom Bag	6 R-13 2- B1
70MM Mag	5	3 in bag & inside Decom Bag	3 R-13
		2 in bag & inside Decom Bag	2 R-13
70MM Camera	1	Inside Decom Bag	A-8
Data Books & Card Kit	6	-	R-2, R-3
	1	-	R-3
PPK	3	-	2-R13, 1 Cabin Fan
Flag Kit	1	-	Filter Bag top A13
			Cabin Fan
			Filter Bag top A13
DSEA	1	-	R-13
CLSRC	1	in Decom Bag	B-1
ISA	1	in Decom Bag	Top A-1
including Tote Bag & Weigh Bag	1	in Decom Bag	Top A-1
	1	in Decom Bag	Top A-1
Tote Bag	1	in Decom Bag	Top A-7/A-11
including Lens Brush, Dust Cover, Tote Bag	1	in Decom Bag	Top A-7/A-11
	1	in Decom Bag	Top A-7/A-11
CSC	1	in Decom Bag	B-1
2) SRC 1&2	2	in Decom Bags	B-5, B-6
3) LCG	2	Crew	Return to LM
4) FCS	2	Crew	Return to LM
5) Helmet & Accessory Bag	2	-	Upper Equipment Bay
a) Install gloves in Accessory Bag & helmets in Helmet Bag w/accessory bag inside helmet.			

NOTE: Return Jettison Bag to CM

CM to LM Transfer List
3-25-70

ITEM	QTY	CM LGC	LM STG
1) Jettison Bag	1	R-13	Return to CM
a) 16MM Mag	8	5 R-13 in bag 2 A-8 in bag 1 A-8 in Camera	RHSSC 1 to L.S. Cam Bag, 1 LM Camera L.S. Camera Bag
b) 70MM Mag	5	3 R-13 in bag 2 R-13 in bag	RHSSC ISA
c) Data Books & Card Kit	6 1	R-2, R-3 R-3	FDF CTR FDF CTR
d) 16MM L.S. Camera System	1	A-8	L.S. Camera Bag
e) Vacuum Brush, Interconnect & hose	1 ea	Side A-8	LM Fwd Hatch
2) Below listed items transferred after Rendezvous			
a) Vol B-5 & B-6 w/8 CO2 Absorbers			Leave in LH LH Midsection
b) Decom, Tote	1	U-1	Top A-7/A-11
c) Decom, Return Eq (following are inside #C)	A-8	-	B-1
1) Decom, CSC	1		B-1
2) Decom, CLSRC	1		B-1
3) Decom, 70MM Mag	2		R-13
4) Decom, SRC	2		B-5, B-6
5) Decom, ISA	1		Top A-1
6) Decom, 16MM Mag	1		R-13
7) Decom, 70MM Reseau	1		A-8
d) CM Helmet Stowage Bag & Accessory Bags	2 ea	R-6	Upper Equipment Bay
e) Probe	1		Leave in LM
f) All other waster except Urine and Feces Food must be treated and in Beta Bag, not loose			

NOTE: Jettison Bag used for transferring equipment as required. Keep bag for use when leaving CM for carrier to carry PPK, & personal items you do not want to leave in CM.

TEST RESULTS 1-1-68

TEST NO	TEST NO	TEST NO	TEST NO
1-1	1-1	1-1	1-1
1-2	1-2	1-2	1-2
1-3	1-3	1-3	1-3
1-4	1-4	1-4	1-4
1-5	1-5	1-5	1-5
1-6	1-6	1-6	1-6
1-7	1-7	1-7	1-7
1-8	1-8	1-8	1-8
1-9	1-9	1-9	1-9
1-10	1-10	1-10	1-10
1-11	1-11	1-11	1-11
1-12	1-12	1-12	1-12
1-13	1-13	1-13	1-13
1-14	1-14	1-14	1-14
1-15	1-15	1-15	1-15
1-16	1-16	1-16	1-16
1-17	1-17	1-17	1-17
1-18	1-18	1-18	1-18
1-19	1-19	1-19	1-19
1-20	1-20	1-20	1-20
1-21	1-21	1-21	1-21
1-22	1-22	1-22	1-22
1-23	1-23	1-23	1-23
1-24	1-24	1-24	1-24
1-25	1-25	1-25	1-25
1-26	1-26	1-26	1-26
1-27	1-27	1-27	1-27
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1-29	1-29	1-29	1-29
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1-97	1-97	1-97	1-97
1-98	1-98	1-98	1-98
1-99	1-99	1-99	1-99
1-100	1-100	1-100	1-100

cb1 - logic (2) close

cb1 pyru arm (2) close

Probe - retract, Prim 2, Sec 1

Logic - on

Pyru - arm

Ext lights run/EVA - on/2v

Rdzv radar xprdr - on/pwr

cmc control - min d6 - att hold

att. 9,274,0 orb rate

Comm - comm B, comm, LBR, RNC, PCN, cmc reset/norm