

SM2A-03-BLOCK II-J-(2)
APOLLO OPERATIONS HANDBOOK

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FOREWORD

This handbook contains the flight crew operational procedures for all active J-series spacecraft.

Volume II constitutes the crew Normal/Backup, Abort, Malfunction and Emergency procedures. Normal procedures are defined as those used if all systems are operating normally. Backup procedures are those used to accomplish the objective of the normal procedures when system failure or some other anomaly prevents use of the normal procedures. Malfunction and Emergency procedures encompass the recognition, diagnosis, and corrective action for system malfunctions or failure.

Spacecraft Page Identification

Pages of this handbook which are usable only on a single J-series vehicle are identified by including the spacecraft number parenthetically as a part of the page number.

Pages applicable to a specific series of vehicles are identified by including the spacecraft number and the letter S parenthetically as a part of the page number. The "S" indicates the page is applicable to the spacecraft number shown and to subsequent vehicles as well.

Common pages (pages with no spacecraft identification in the page number) are used for all J-series spacecraft.

Some pages have been repeated in order to satisfy page requirements for all spacecraft covered by the current handbook.

Utilization and Updates

This handbook concept requires the use of specific pages to provide specific vehicle coverage. It is suggested that the list of effective pages in the front of the handbook be used when changes to the book are made or to verify a specific vehicle configuration of the manual.

To prepare the manual for use on a particular vehicle, select the complete set of common pages and those pages indicated for a particular vehicle as indicated on the list of effective pages.

When pages identified as applicable only to other vehicles have been removed in preparation of a manual for a specific vehicle, redundant pages will have been eliminated. Do not discard the removed pages. These pages are current for other vehicles until superseded by subsequent change.

Volume 1 - Spacecraft Description, SM2A-03-BLOCK II-(1), is bound separately and contains the description portion of the spacecraft systems and equipment. User of Volume 2 procedures should be thoroughly familiar with spacecraft and system descriptions in Volume 1.

Comments or suggested change to this handbook should be addressed to the Spacecraft Systems Branch, FCSD, MSC, Office Code CF22, Telephone HU3-5558.

INTRODUCTION

PROCEDURE COLUMNS

Procedural steps in this section are presented in tabular form and in numerical sequence. Steps are further organized by subgroups into related functions. Column headings of the Normal/Backup procedures consist of STATION/TIME (STA/T), STEP, PROCEDURE, PANEL and REMARKS. An explanation of each of these column headings is provided as follows:

<u>STA/T</u>	The station is equivalent to the crewmember assigned to the spacecraft location where a procedure or step is performed. Station CDR (commander), CMP (command module pilot) and LMP (lunar module pilot) correspond to the left, middle, and right crew couch positions, respectively. The CMP also pertains to the lower equipment bays inaccessible to the other crewmembers. The time column (T) will contain mission time, event time or altitudes.
<u>STEP</u>	The step is the numerical indication of the elements to be followed and their sequence in performing a complete procedure.
<u>PROCEDURE</u>	The procedure is a group of steps or overall task involved in performing a complete function or operation. If a perimeter of Xs are around a procedure, it constitutes a backup procedure relative to the preceding step.
<u>PANEL</u>	The panel location is the location of a particular control or display by panel number. The main display console (MDC) panels are numbered 1 through 12; the lower equipment bay (LEB), 100 through 181; the right-hand equipment bay (RHEB), 225 through 278; the left-hand equipment bay (LHEB), 325 through 382; the left-hand forward equipment bay (LHFEB), 300 through 306; and the upper equipment bay (UEB), 600 through 604 and 13 - ORDEAL BOX. (See figure B-1 for panel locations.)

REMARKS

This column provides the rationale supporting the adjacent step and the operational procedure. Rationale will grow in scope as the operational procedures are refined through continued application by the Flight Crew as applied during mission simulation using Apollo evaluators and simulators. As the Flight Crew becomes more familiar with the spacecraft and increases its proficiency, the Abbreviated Checklist is expected to diminish in overall coverage. Volume 2, however, with its supporting rationale will become a repository of comprehensive data providing a reference base-line to the Abbreviated Checklist and for use by support personnel more recently assigned to the program.

SHORT-FORM NOMENCLATURE AND ABBREVIATIONS

Spacecraft controls and displays and their relative positions and indications are called out by their respective placard titles. Exceptions have been taken, where titles are lengthy by adoption of short-form nomenclature.

Whenever a designated callout refers to a control or display, it is identified by one of the following:

Light	lt
Switch	sw
Rotary type switch	sel
Circuit breaker	cb
Talkback indicator	tb
Valve	vlv
Indicator	ind
Pushbutton	pb
Potentiometer or rheostat	cont
Thumbwheel	tw

For Symbols and Definitions, refer to Appendix A in the Apollo Operations Handbook, Block II Spacecraft, Volume 1 - Spacecraft Description (SM2A-03-BLOCK II-(1) (H&J).

APOLLO OPERATIONS HANDBOOK

SECTION 4

NORMAL/BACKUP PROCEDURES

Normal/backup procedures consist of detail control actions and anticipated displays for accomplishing CSM systems management, flight control, navigation, and experimental procedures under nominal mission operating conditions. Approved alternate operating methods and backup systems procedures are included, and options indicated where applicable to provide maximum vehicle capability and operational flexibility. As an aid to the user, supporting rationale, system operating limitations, and remarks clarifying unique or obscure operating methods are provided adjacent to or keyed to affected locations in the procedures.

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STA/T STEP	PROCEDURE	PANEL	REMARKS
4.1	BACKUP CREW PRELAUNCH CHECKS		Prelaunch procedures consist of operational and configuration checks performed by backup flight crew prior to ingress of prime crew. Procedures have been sequenced so they can be more easily compared with other prelaunch documents. In order to keep them closely aligned, redundant switch settings may appear in more than one area and GDC align procedures have been repeated wherever necessary. It is assumed that a complete prelaunch checkout, including loose gear stowage, has been performed by ground support personnel, prior to backup crew ingress into command module, and that all systems are in an active configuration as required at time of ingress. Spacecraft suit circuit shall have been purged and oxygen content verified to be 95% minimum. Backup crew will utilize facility headsets until service structure is clear of vehicle, as there will be no VHF AM or S BAND transmission until that time. Refer to Appendix B for cabin switch/control position prior to backup crew cabin ingress.
4.1.1	C&WS STATUS CHECK		
CMP	C/W NORM - NORM	2	
	C/W CSM - CSM		
	C/W PWR - 2 [pause at off (ctr) at least 1 sec]		Excessive switching speed will cause temporary loss of both power supplies, and alarm reset capability.
ALL	MASTER ALARM pb/lt (3) - on, push	1,3,122	
CMP	C/W PWR - 1 [pause at off (ctr) at least 1 sec]	2	Excessive switching speed will cause temporary loss of both power supplies, and alarm reset capability.
ALL	MASTER ALARM pb/lt (3) - on, push	1,3,122	
CMP	C/W LAMP TEST - 1 (hold)	2	1 position is momentary.
CDR	MASTER ALARM pb/lt - on	1	
CMP	1h C/W lt (15) - on	2	
	C/W NORM - BOOST		
CDR	MASTER ALARM pb/lt - out	1	
CMP	C/W NORM - NORM	2	
CDR	MASTER ALARM pb/lt - on	1	

4.1.1.1

C&WS STATUS CHECK

NORMAL BACKUP

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STA/T STEP	PROCEDURE	PANEL	REMARKS
CMF	C/W LAMP TEST - 2 (hold)	2	2 position is momentary.
CDR	MASTER ALARM pb/lt - out	1	
CMF	lh C/W lt (15) - out	2	SUIT COMPR C/W light will remain on until compressor is activated.
LMP	MASTER ALARM pb/lt - on	3	
CMF	rh C/W lt (20) - on	2	
	C/W LAMP TEST - rel	3	
LMP	MASTER ALARM pb/lt - out	2	A 5/32-inch hex driver is required.
CMF	rh C/W lt (19) - out	1	
	C/W NORM - ACK		GTA switch is used during ground operations only. Setting switch on (up) allows FMG calibration for zero G condition. Switch must be set off (down) and door closed before flight.
	4.1.2 EMS PRELAUNCH TESTS		
1	Initial EMS Prep		
CDR	EMS FUNC - OFF	1	
	<u>CAUTION</u>		
	If SPS THRUST lt on, a grd exists on one or both AV THRUST sws.		
	cb EMS (2) - close	8	
	Open EMS GTA cover	1	
	GTA sw - on (up)		
	EMS MODE - STBY		

EMS PRELAUNCH TESTS

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STA/T STEP	PROCEDURE	PANEL	REMARKS									
CDR 2	EMS FUNC - AV Adj alphanumeric brightness (option) Wait 5 sec	1										
3	GTA Null Adj EMS MODE - NORM Adj GTA null adj until ΔV/RNG least significant digit changes <1 per 10 sec											
4	EMS FUNC - AV SET Slew AV ind to +1586.8		AV/EMS SET switch used both for slewing G-V scroll and for setting AV/RNG indicator. Slew speeds executed by AV/EMS SET switch are as follows:									
			<table><tr><td></td><td>G-V Display Ft/Sec 1827 Ft/Sec = 1 In. of Scroll</td><td>AV RNG Indicator Ft/Sec or Nautical Miles</td></tr><tr><td>Slow (soft stop) INCR or DECR</td><td>30 ft/sec/sec = 0.0164 in./sec</td><td>0.25/sec</td></tr><tr><td>Fast (hard stop) INCR or DECR</td><td>480 ft/sec/sec = 0.263 in./sec</td><td>127.5/sec</td></tr></table>		G-V Display Ft/Sec 1827 Ft/Sec = 1 In. of Scroll	AV RNG Indicator Ft/Sec or Nautical Miles	Slow (soft stop) INCR or DECR	30 ft/sec/sec = 0.0164 in./sec	0.25/sec	Fast (hard stop) INCR or DECR	480 ft/sec/sec = 0.263 in./sec	127.5/sec
	G-V Display Ft/Sec 1827 Ft/Sec = 1 In. of Scroll	AV RNG Indicator Ft/Sec or Nautical Miles										
Slow (soft stop) INCR or DECR	30 ft/sec/sec = 0.0164 in./sec	0.25/sec										
Fast (hard stop) INCR or DECR	480 ft/sec/sec = 0.263 in./sec	127.5/sec										
5	EMS FUNC - AV TEST SPS THRUST lt - on AV ind - decr (10 sec)		For negative numbers ΔV/RNG indicator will display a minus sign. No sign will appear for positive numbers.									

4.1.2

EMS PRELAUNCH TESTS

NORMAL/BACKUP

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STA/T STEP	PROCEDURE	PANEL	REMARKS
CDR	SPS THRUST lt - out (at ΔV -0.1 fps) ΔV ind - stops at -20.8+20.7 fps EMS MODE - STBY 6 EMS FUNC - EMS TEST 1 (CCW) (wait 5 sec) EMS MODE - NORM (wait 10 sec) .05 G lt - out SPS THRUST lt - out Lift vctr dn lt - out Lift vctr up lt - out RNG ind - 0.0 NM Slew scroll until disp index superimposed upon notch at start of <u>next</u> self-test pattern 7 EMS FUNC - EMS TEST 2 Wait 10 sec .05 G lt - on (all others out) 8 EMS FUNC - EMS TEST 3 .05 G lt - on Lift vctr dn lt - on (10 sec after .05 G lt) Set RNG ind to 58.0+0.0 NM	1	Test 1 checks lower trip point of .05 G comparator. Ten seconds should be allowed to verify no malfunctions. No other light should come on before or after 10 seconds. EMS scroll reverse slew capability is limited to one inch. Test 2 checks upper trip point of .05 G comparator. No other light should come on before or after 10 seconds. Test 3 checks corridor verification circuitry associated with lift vector down light (G < .2). For negative numbers RNG indicator will display minus sign in most significant digit. No sign will appear for positive numbers.

EMS PRELAUNCH TESTS

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STA/T STEP	PROCEDURE	PANEL	REMARKS
CDR 9	EMS FUNC - EMS TEST 4 .05 G lt - on (all others out) G-V trace (during 10-sec period) within test pattern After 10 sec, G-V trace stops at lower right corner of test pattern RNG ind (during 10-sec period) counts toward zero After 10 sec, stops at 0.0+0.2	1	Test 4 checks range-to-go integrator circuits, range-to-go indicator, G-servo circuits, and G-V plotter.
10	EMS FUNC - EMS TEST 5 .05 G lt - on Lift vctr up lt - on (10 sec after .05 G lt) RNG ind - resets to 0.0 NM Scribe traces vert line $\approx$ 9 G to 0.28+0.1 G & stops (trace within test pattern)		Test 5 checks corridor verification circuitry associated with lift vector up light (G > .2). Enables slewing scroll to start of entry pattern. After scroll is set to $\approx$ 37K fps, it is not permissible to return EMS FUNC switch to EMS TEST 5 position (range integrator and scroll sync would be lost).
11	Slew scroll until stylus is at 0.28 G tol step of grd test pattern 1 & verify AV instructions are visible		

SM2A-03-BLOCK II-J-(2)
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STA/T STEP	PROCEDURE	PANEL	REMARKS
CDR 12	EMS FUNC - RING SET EMS MODE - STBY Scribe traces vert line from 0.28 G to 0.0+0.1 G & stops All lt - out	1	
13	EMS FUNC - OFF		
	<u>WARNING</u> GTA sw is for grd tests only & must be set off (down) & door closed for proper fit oper of EMS.		
	GTA sw - off (down) Close GTA cover		
	4.1.1.3 GLYCOL LOOP CHECKS		
	Sec Gly Loop Check		
	GLY TO RAD SEC vlv - NORM	377	
	ECS IND sel - SEC	2	
	SEC COOL PUMP - ACL		
	RAD SEC IN TEMP ind - 60°-97°F		
	RAD SEC OUT TEMP ind - 60°-70°F (pegged)		
	SEC GLY EVAP OUT TEMP ind - 60°-75°F (pegged)		
	SEC GLY EVAP STM PRESS ind - 0.25 psia (pegged)		
	SEC GLY DISCH PRESS ind - 39-51 psig		
	SEC ACCUM QTY ind - 30-50%		
CMP			A 5/32-inch hex driver is required.

GLYCOL LOOP CHECKS

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STA/T STEP	PROCEDURE	PANEL	REMARKS
CMP	SEC COOL PUMP - AC2 SEC GLY DISCH PRESS ind - 39-51 psig SEC COOL PUMP - off (ctr) ECS IND sel - PRIM GLY TO RAD SEC vlv - RYP	2 377	
LMP	Prim Gly Loop Activation GLY PUMPS - 2 AC1	4	
CMP	PRIM GLY DISCH PRESS ind - 37-50 psig PRIM ACCUM (CY ind - 25-50%) GLY PUMPS - 1 AC1	2 4	(SEE flow must be temporarily interrupted (3 minutes maximum) for this check.
LMP	PRIM GLY DISCH PRESS ind - 37-50 psig	4	
CMP	RAD FLOW CONT PWR - PWR RAD FLOW CONT AUTO - ? ECS RAD tb - ?	2	2 indicates No. 2 flow proportioning valve controlling flow.
	RAD FLOW CONT AUTO - AUTO ECS RAD tb - Gray		Gray indicates No. 1 flow proportioning valve controlling flow.
CDR	RAD FLOW CONT PWR - off (ctr)	7	
CMP	DIRECT O2 vlv - OPEN (CCW), adj for O2 FLOW ind - 0.4+0.1 lb/hr	2	
	4.1.1.4 STANDBY INVERTER (NO. 3) CHECK		
LMP	AC2 RSET - OFF INV 3 - MNB INV 2 AC2 - OFF INV 3 AC2 - on (up)	3	Rapid performance of inverter switching sequence may initiate MASTER ALARM pb/lt when alternate inverter is connected to bus.

4.1.1.4

STANDBY INVERTER (NO. 3) CHECK

NORMAL/BACKUP

APOLLO OPERATIONS HANDBOOK

STA/T STEP	PROCEDURE	PANEL	REMARKS
LMP	AC2 RSET - RSET	3	RSET position is momentary. Positioning AC1 or 2 RSET switches to RSET and releasing ensures a MASTER ALARM light and tone. Positioning AC1 or 2 RSET switches to center will cause random activation of MASTER ALARM lights and tone.
CMP, LMP	MASTER ALARM pb/lt (2) - on (push)	3, 122	
CMP	C/W lts (34) - out	2	
LMP	AC IND sel - BUS 2, ØA, B, C	3	
	AC VOLTS ind - 113-117 vac		
	AC2 RSET - OFF		
	INV 3 AC2 - OFF		
	INV 2 AC2 - on (up)		
	AC2 RSET - RSET		Rapid performance of inverter switching sequence may initiate MASTER ALARM pb/lt when alternate inverter connected to bus.
LMP, CMP	MASTER ALARM pb/lt (2) - on (push)	3, 122	
CMP	C/W lts (34) - out	2	
LMP	INV 3 - OFF	3	
	AC IND sel - BUS 1 & 2, ØA, B, C		
	AC VOLTS ind - 113-117 vac		
	4.1.5 FC RADIATOR & FLOAT BAG CHECKS		
	FC Rad Check		
CMP	cb FC RAD (all) - close	226	
LMP	FC RAD tb (all) - gray	3	
CMP	cb FC RAD (all) - open	226	Gray indicates fuel cell radiator panels not bypassing flow.

FC RADIATOR & FLOAT BAG CHECKS

LHEB ECS VALVE STATUS

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STA/T STEP	PROCEDURE	PANEL	REMARKS
CMP	Open CO2 cstr atten pnl CO2 CSTR DIVERT vlv - ctr Close CO2 cstr atten pnl MN REG (2) - open H2O/GLY TK sel (2) - BOTH EMER CAB PRESS sel - OFF CAB REPRESS vlv - OFF (CCW) WASTE TK SERV vlv - CLOSE PRESS RELF sel - ? POT TK IN vlv - CLOSE WASTE TK IN vlv - AUTO PRESS EQUAL vlv - CLOSE AC UTIL PWR - OFF TUNL VENT vlv - LM/CM AP LM/CM AP ind - 0.0 psid SUIT FLOW vlv (3) - FULL FLOW PRIM CAB TEMP vlv - COLD (CW) SEC CAB TEMP vlv - MAX COOL (CW) DRINK H2O SUP vlv - OFF 4.1.1.7 LEB & TIMER PANEL 306 UTIL PWR - OFF FLOOD DIM - 1 FLOOD FIXED - OFF G/N OPT PWR - OFF G/N IMU PWR - on (up) RNDZ XPNDR PWR - HTR NUMERICS LTS - as desired INTGL LTS - as desired FLOOD LTS - OFF (CCW)	350 351 352 Fwd Hatch 201 12 300,301,302 303 304 100	Covers CO2 canisters. Servicing fitting is plugged. Potable water chlorination port capped. Drinking water unavailable during launch hold periods. Connector covered. Guarded.

LEB & TIMER PANEL 306

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STA/T STEP	PROCEDURE	PANEL	REMARKS
CMP	MSN TMR - RSET MSN TMR ind - zero MSN TMR - START	306	RSET position is momentary. Mission timer will reset to zero and count up at launch.
	MSN TMR ind - counting up (verify) EVNT TMR START - STOP, then ctr EVNT TMR RSET - RSET SYS TEST (2) - 5A SYS TEST ind - 1.1-1.9 vdc	101	RSET position is momentary. Equivalent to +45° to +75°F nominal SPS oxidizer engine feedline temperature.
	SYS TEST (2) - 5B RNDZ XPNDR TEST - OPR CM RCS HTRS - OFF WASTE H2O DUMP - HTR A URINE DUMP - HTR A		Monitors battery relay bus voltage during launch.
	CAUTION OPT ZERO sw must not be moved during prelaunch or inadvertent jett of opt covers could occur. OPT ZERO - ZERO OPT TELTRUN - SLAVE TO SXT OPT MODE - MAN OPT COUPLING - DIR OPT SPEED - LO COND LAMPS - ON UP TLM - ACPT RETCL BRT tw - as req	122	

4.1.1.7

LEB & TIMER PANEL 306

NORMAL/BACKUP

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STA/T STEP	PROCEDURE	PANEL	REMARKS
CMP	SCI/UTIL PWR - OFF SCI PWR - OFF	163 162	Switches are located behind closeout panel and will be set at panel closeout.
	S1 - OFF CRYO AC PWR - on (up) H2 FAN - AUTO O2 FAN - AUTO SM/AC PWR - on (up)	164 181	Connector covered. Supplies ac/dc power to cameras and EM sounder and heater power to pan camera.
	DOOR JETT - off (down) LOGIC PWR - OFF cb pnl 181 - all closed		Guarded.
	4.1.1.8 RHEB & PANEL 601		
	cb pnl 225 - all closed except cb HI GAIN ANT (2) - open	225	
	cb pnl 226 - all closed except cb FC RAD (all) - open	226	Prevents inadvertent fuel cell radiator effective area reduction.
	cb FC REACS (all) - open		Fuel cell reactant valve circuit breakers are opened after fuel cell start-up to preclude inadvertent valve closure.
	cb COAS/TUNL LTG MNB - open cb pnl 229 - all closed except cb MN REL (2) - open cb O2 VAC ION PUMPS (2) - open	229	
	MAP CAMR ON tb - gray MAP CAMR TRACK tb - gray	230	Gray indicates TBD. Gray indicates TBD.

RHEB & PANEL 601

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STA/T STEP	PROCEDURE	PANEL	REMARKS
CMP	MAP CAMR ON - STBY MAP CAMR TRACK - off (ctr) MAP CAMR IMAGE MTN - OFF GAMMA RAY BOOM DPLY tb - gray GAMMA RAY BOOM JETT tb - gray GAMMA RAY BOOM DPLY - off (ctr) GAMMA RAY BOOM JETT - off (down) GAMMA RAY EXP - OFF GAMMA RAY GAIN - SHLD OFF MASS SPECT BOOM DPLY tb - gray MASS SPECT BOOM JETT tb - gray MASS SPECT BOOM DPLY - off (ctr) MASS SPECT BOOM JETT - off (down) MASS SPECT EXP - off (ctr) MASS SPECT ION SOURCE - OFF MASS SPECT MULT - LO MASS SPECT DSCRM - LO DATA SYS CAL - off (down) DATA SYS ON - OFF SUB SAT tb - gray SUB SAT - off (ctr) PAN CAMR OPR tb - gray PAN CAMR SELF TEST - off (ctr) PAN CAMR MODE - STBY PAN CAMR PWR - BOOST X RAY DR DPLY - off (ctr) X RAY EXP - off (ctr) ALPHA RAY - OFF LASER ALTM - OFF	230	Map camera must be in standby during boost, TLI, and SPS thrusting periods. Gray indicates boom retracted. Gray indicates boom retracted and tie-down engaged. Gray indicates boom retracted. Gray indicates boom retracted and tie-down engaged. Gray indicates TBD. Gray indicates TBD. Pan camera must be in standby during boost, TLI, and SPS thrusting periods.

4.1.8

RHEB & PANEL 601

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STA/T STEP	PROCEDURE	PANEL	REMARKS
CMP	cb pnl 250 - all closed except <u>CAUTION</u> cbs BAT BUS A&B TO PYRO BUS (2) should never be closed when cb PYRO A&B/SEQ A&B (2) are closed. Loss of pyro bat pwr could result. cb BAT BUS A&B TO PYRO BUS (2) - open cb BAT C TO BAT BUS A&B (2) - open OVBD DRAIN vlv - OFF BAT VENT vlv - CLOSE WASTE STOW vlv - VENT REPRESS O2 - CLOSE 4.1.9 ORDEAL SWITCH POSITION CHECK <u>CAUTION</u> Before ORDEAL is stowed, or when not being used (whether EARTH/ LUNAR sw is in PWR OFF or not), FDAI 1 & 2 sw must be at INRTL. Otherwise, pitch inertial att cannot be displayed by FDAI ball.	250 251 252 601	Assumes that ORDEAL box has been interconnected between FDAIs and EDA during installation, and that prime or backup crews will not be required to connect or disconnect ORDEAL cables to stow or unstow ORDEAL.
CDR	FDAI sw (both) - INRTL EARTH/LUNAR - PWR OFF ALT SET cont - as desired	13	This value to be determined from planned nominal insertion altitudes for each particular mission.

ORDEAL SWITCH POSITION CHECK

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STA/T STEP	PROCEDURE	PANEL	REMARKS
CDR	LTG - OFF MODE - HOLD/FAST SLEW - ctr	13	
	4.1.1.10 LH COUCH CHECKS		
	THC & RHC - LOCKED		It is possible to actuate THC clockwise or counter-clockwise while locked.
	LH ECS Vlv Stat		
	SRG TK RELF vlv - open (CW)	375	
	PLVC sw - NORM	376	
	DEMAND REG sel - BOTH	380	
	SUIT TEST vlv - OFF		
	SUIT RETURN vlv - close (push)		
	PRIM GLY TO RAD - NORM		
	CAB PRESS RELF vlv (2) - BOOST/ENTR (safety latch off)	325	
	GLY RSVR IN vlv - OPEN		
	GLY RSVR OUT vlv - OPEN	326	
	GLY RSVR BYP vlv - CLOSE		
	SM 02 SUP vlv - ON		
	SRG TK 02 vlv - ON		
	REPRESS PKG vlv - ON		
	LH Side Pnls		
	COAS PWR - OFF	15	
	UTIL PWR - OFF		
	PL BCN LT - off (ctr)		
	DYE MARKER - off (down)		
	PL VENT - OFF		
CDR			Connector covered. Guarded. Verify safety removed.

4.1.1.10

LH COUCH CHECKS

NORMAL/BACKUP

STA/T STEP	PROCEDURE	PANEL	REMARKS
CDR	AUTO RCS (16) - OFF FLOOD DIM - 1 FLOOD FIXED - OFF NUMERICS LTS - as desired FLOOD LTS - as desired INTGL LTS - as desired SECS LOGIC (both) - OFF SECS PYRO ARM (2) - SAFE cb pnl 8 - all closed except cb CM RCS HTRS (both) - open cb FLOAT BAG (all) - open cb SECS LOGIC (2) - open cb SECS ARM (2) - open EDS PWR - OFF <u>CAUTION</u> More than 1 hr of contin on-time for TVC SERVO PWR 1 or 2 sw may be detrimental to SPS gmb1 actuators. TVC SERVO PWR (both) - OFF FDAI/CPI PWR - BOTH LOGIC 2/3 PWR - on (up) ELEC PWR - GDC/ECA SIG CONDR/DR BIAS PWR (both) - AC1 or AC2 BMAG PWR (both) - WARMUP LH MDC & Pnls 600, 602, 603, & 604 Set ALT index - 3300	8	Lever lock. Lever lock with key lock guard.
		7	
		1	Powers RJEC -4 vdc bias power supplies. To provide increased reliability, switches should not be set on same bus. Value obtained from LCC.

TLH COUGH CHECKS

SM2A-03-BLOCK II-J-(2)
APOLLO OPERATIONS HANDBOOK

STA/T STEP	PROCEDURE	PANEL	REMARKS
CDR	CMC ATT - IMU ACCEL - check (+1 G) FDAI SCALE - 5/1 FDAI SEL - 1/2 FDAI SOURCE - CMC ATT SET - GDC MAN ATT ROLL - RATE CMD MAN ATT PITCH - ACCEL CMD MAN ATT YAW - RATE CMD LIM CYCLE - OFF ATT DBD - MIN RATE - HI THC PWR - on (up) RHC PWR NORM (both) - AC/DC RHC PWR DIR (both) - OFF SC CONT - SCS CMC MODE - FREE BMAG MODE (3) - RATE 2 SPS THRUST - NORM ΔV THRUST (2) - OFF SPS GMBL τ (2) - 0 ATT SET τ (3) - R 162°, P 90°, Y 0° SCS TVC (2) - RATE CMD GMBL MOT (4) - OFF ΔV CG - LM/CSM	1	Normally left at IMU position throughout mission. Selection of GDC position causes total attitude display to be lost on both balls. GDC damage will result if GDC position selected and pitch or yaw rate is $>5^\circ/\text{sec}$, or if GDC yaw Euler angle is $>80^\circ$ and $<280^\circ$. For ground checks, TRANS CONTR PWR, ROT CONTR PWR NORM, and ROT CONTR PWR DIR are the equivalent of flight terms THC PWR, RHC PWR NORM, and RHC PWR DIR respectively. Lever lock. Guarded. Provides reduced gain for SPS thumbwheel control of SCS auto mode IV abort.

4.1.1.10

LH COUCH CHECKS

NORMAL BACKUP

APOLLO OPERATIONS HANDBOOK

STA/T STEP	PROCEDURE	PANEL	REMARKS
CDR	ELS LOGIC - OFF ELS AUTO - AUTO CM RCS LOGIC - OFF CM PRPLNT DUMP - OFF CM PRPLNT PURG - off (down) IMU CAGE - off (down) LMS ROLL - OFF .05 G sw - OFF α/Pc IND sw - α α/Pc ind - zero LV IND/GPI sw - GPI TVC GMBL DR (2) - AUTO EVNT TMR START - ctr	1	Guarded. Guarded. Guarded. Guarded. Required at OFF position until .05 G during entry. OFF position powered by LOGIC 2/3 PWR switch.
CMP	EVNT TMR RSET - up (ctr) SUIT CAB ΔP ind - >+2.0 in. H ₂ O O2 FLOW ind - 0.4+0.1 lb/hr (not pegged) PROBE EXTND/REL tb (2) - gray PROBE (3) - OFF EXT RUN/EVA LTS - OFF EXT RNDZ LTS - off (ctr) TUNL LTS - OFF LM PWR - OFF UP TLM CM - ACPT UP TLM IU - BLOCK	2	Event Timer not counting. Timer resets and starts counting automatically when lift-off occurs. Resets and starts counting up in event of abort initiation. DIRECT O2 valve partially open. Gray indicates probe fully extended or fully retracted. PROBE EXTND/REL switch guarded. UP TLM CM and UP TLM IU switches should be placed to ACPT only as required during updates.

LH COUCH CHECKS

APOLLO OPERATIONS HANDBOOK

STA/T STEP	PROCEDURE	PANEL	REMARKS
CMP	CM RCS PRESS - off (down) SM RCS IND sw - PRPLNT QTY RCS Status Check SM RCS He 1 tb (4) - bp SM RCS He 2 tb (4) - bp SM RCS PRIM PRPLNT tb (4) - bp SM RCS SEC PRPLNT tb (4) - bp SM RCS SEC FUEL PRESS (4) - OPEN RCS IND sel - SM A, B, C, D SM RCS PKG TEMP ind - amb SM RCS He PRESS ind - 4000-4350 psia SM RCS SEC FUEL PRESS ind - 192-207 psia	2	Guarded. Barber pole indicates helium isolation valves for system 1 are closed. Barber pole indicates helium isolation valves for system 2 are closed. Barber pole indicates at least one primary propellant isolation valve (fuel or oxidizer) in each quad is closed. Barber pole indicates at least one secondary propellant isolation valve (fuel or oxidizer) in each quad is closed. OPEN position is momentary. There is no position indicator talkback. Valve opening can be confirmed by ACE. SM RCS heaters are not operated on pad and during ascent to reduce effects of boost heating on package temperature. Ambient temperature <75° or >205°F will illuminate SM RCS status lights. Nominal He load is 4150 psig at 70°F. Pressure and temperature excursions are due to ambient conditions.

4.1.10

LH COUCH CHECKS

NORMAL/BACKUP

APOLLO OPERATIONS HANDBOOK

STA/T STEP	PROCEDURE	PANEL	REMARKS
CM1	SM RCS IND sw - He TK TEMP SM RCS He TK TEMP ind - 60°-80°F SM RCS IND sw - PRPLNT QTY SM RCS PRPLNT QTY ind - 100% SM RCS HTRS (1) - OFF CM RCS PRPLNT (both) - on (up) CM RCS PRPLNT tb (both) - gray RCS IND sel - CM 1, CM 2 CM RCS He TEMP ind - 60°-90°F CM RCS He PRESS ind - 4000-4450 psia CM RCS MANF PRESS ind - 80-105 psia RCS CMD - ctr RCS TRNFR - SM EDS AUTO - OFF CSM/LM FNL SEP (both) - off (down) CM/SM SEP (2) - off (down) SIVB/LM SEP - off (down) PRPLNT DUMP - AUTO 2 ENG OUT sw - AUTO LV RATES sw - AUTO TWR JETT (both) - AUTO	2	On position is momentary. Gray indicates propellant isolation valves are open. GSE servicing pressure monitored until system activated. Pressure varies with temperature and ullage. If manifold pressure drops suddenly (indicates a ruptured burst diaphragm), close CM RCS propellant isolation valves and then preheat jets, 4.15.4, for 15 minutes after orbit insertion. Preheating open vents to vent any propellant trapped between propellant isolation valves and jets by energizing jet valve direct coils. Switch last set to OFF (momentary position) prior to backup crew ingress. SM position is momentary. Guarded. Guarded. Guarded. Guarded.

LH COUCH CHECKS

SM2A-03-BLOCK II-J-(2)
APOLLO OPERATIONS HANDBOOK

STA/T STEP	PROCEDURE	PANEL	REMARKS
CMP	LV GUID sw - IU LV STAGE - OFF XLUNAR INJECT - INJECT MN REL - off (down) EMER O2 - CLOSE REPRESS O2 RELF - open (CW) REPRESS O2 PRESS ind - >865 psig EVA STA O2 SUP - OFF SUIT PRESS ALARM - OFF	2 600 602 603 604	Guarded. Guarded. Guarded.
	4.1.1.11 RH COUCH CHECKS		
LMP	RHEB & Pnl 16 SCI PWR - OFF DOCK TRGT - OFF UTIL PWR - OFF COAS PWR - OFF cb pnl 275 - all closed except cb MNA & B BAT C (2) - open cb FLT/PL BAT BUS A, B, & BAT C (3) - open cb pnl 276 - all closed cb pnl 278 - all closed except cb UPR SYS COMPR (both) - open	227 16 275 276 278	Connector covered. Connector covered. Connector covered.
	RH Side Pnls FC 1 PUMPS - AC1 FC 2 & 3 PUMPS - AC2 G/N PWR - AC1 MN BUS TIE (2) - OFF BAT CHGR - AC1	5	

4.1.1.11

RH COUCH CHECKS

SM2A-03-BLOCK II-J-(2)
APOLLO OPERATIONS HANDBOOK

STA/T STEP	PROCEDURE	PANEL	REMARKS
LMP	NONESS BUS - OFF INTGL LTS - OFF FLOOD LTS - OFF FLOOD DIM - 1 FLOOD FIXED - OFF cb pnl 5 - all closed except cb NONESS INST - open cb WASTE DUMP HTRS (2) - open SPS GAUGING - AC1 TELCOM GRP 1 - AC1 TELCOM GRP 2 - AC2 GLY PUMPS - 1 AC1 (verify) SUIT COMPR (both) - OFF cb pnl 4 - all closed RH MDC Pnls FC RAD (all) - off (ctr) FC RAD tb (all) - gray FC HTRS (all) - on (up) FC PURG (all) - OFF FC REACS (all) - ctr FC REACS tb (all) - gray FC MNA 1 & 3 - OFF, 2 - ctr	5 4 3	If circuit breaker RAD HTRS OVLD BAT A and/or BAT B trip, or are opened in flight, they should not be closed unless batteries are tied to main bus [MN BUS TIE (2) - on (up)]. This prevents possible disconnect of ECS radiator heaters by false overload signal. Gray does not indicate status of fuel cell radiator bypass valves as talkback circuits are not powered at this time. Gray indicates fuel cell reactants valves open. Fuel cell management will be monitored by ground crew until the gimbal drive and trim check at which time they will be verified on the main buses by the crew.

RH COUCH CHECKS

SM2A-03-BLOCK II-J-(2)
APOLLO OPERATIONS HANDBOOK

STA/T STEP	PROCEDURE	PANEL	REMARKS
IMP	FC MNA 1 & 3 tb - bp, 2 tb - gray MNA RSET - ctr FC MNB (all) - OFF FC MNB tb (all) - bp MNB RSET - ctr FC IND sel - 1, 2, 3 FC H2 FLOW ind - 0.01-0.05 lb/hr FC O2 FLOW ind - 0.1-0.4 lb/hr FC SKIN TEMP ind - 390°-450°F FC COND EXH TEMP ind - 150°-175°F FC tb (2) - gray FC IND sel - 2 BAT CHG - OFF DC IND sel - FC 1, 2, 3 DC AMPS ind - 5-20 amps DC IND sel - MNA, B DC VOLTS ind - 26.5-31 vdc DC IND sel - BAT BUS A, B, BAT C DC VOLTS ind - 35-37.5 vdc DC AMPS ind - <3.0 amps	3	Barber pole indicates fuel cells 1 and 3 disconnected from main bus A, gray indicates fuel cell 2 connected to main bus A. Barber pole indicates all fuel cells disconnected from main bus B. Flow limits are proportional to individual fuel cell currents and can be approximated by fuel cell H2 flow $\approx$(amps x 2.5)/1000, and fuel cell O2 flow $\approx$(amps x 2.0)/100. GSE is supplying most of the SC power. Gray indicates normal pH factor and normal fuel cell radiator temperature.

4.1.11

RH COUCH CHECKS

NORMAL/BACKUP

SM2A-03-BLOCK II-J-(2)
APOLLO OPERATIONS HANDBOOK

STA/T STEP	PROCEDURE	PANEL	REMARKS
LMP	<u>CAUTION</u> Do not leave DC IND sel at PYRO BAT A (B) position any longer than req to read DC VOLTS, or PYRO bat chg will be depleted. DC IND sel - PYRO BAT A, B DC VOLTS ind - 36.0-37.5 vdc DC IND sel - MNA Dual Inv Stat Check INV 1 - MNA INV 2 - MNB INV 3 - OFF INV 1 AC1 - on (up) INV 2 AC1 - OFF INV 3 AC1 - OFF INV 1 AC2 - OFF INV 2 AC2 - on (up) INV 3 AC2 - OFF AC IND sel - BUS 1 & 2, ØA, B, C AC VOLTS ind - 113-117 vac SPS Stat Checks SPS PRPLNT TEMP ind - 100°F max SPS FUEL PRESS ind - 170-195 psia SPS OXID PRESS ind - 170-195 psia	3	Switch position verification only. If switch positions must be changed, refer to 4.5.3.9, step a. Normal operating temperature is +45° to +75°F. Redline is +27 and +100°F. Normal operating pressure after fuel and oxidizer tank is pressurized with He (after He valve is actuated) is 170-195 psia. GSE servicing pressure is 110 psia.

PHI COUCH CHECKS

SM2A-03-BLOCK II-J-(2)
APOLLO OPERATIONS HANDBOOK

STA/T STEP	PROCEDURE	PANEL	REMARKS
LMP	SPS PRESS IND sw - He, N2A, N2B SPS He PRESS ind - 3300-3900 psia SPS N2 PRESS ind - 2200-2800 psia SPS INJ VLV ind (4) - CLOSE SPS OXID VLV upper tb - MAX (verify) SPS OXID VLV lower tb - gray (verify) OXID FLOW VLV INCR - INCR (verify) OXID FLOW VLV PRIM - PRIM PUG MODE - NORM SPS He VLV tb (both) - bp SPS He VLV (both) - AUTO SPS LINE HTRS - off (ctr) SPS PRESS IND sw - He VHF ANT - SM LEFT S BD XPNDR - OFF S BD PWR AMPL PRIM - PRIM S BD PWR AMPL HI - off (ctr) S BD MODE VOICE - VOICE S BD MODE PCM - PCM S BD MODE RNG - RNG S BD AUX TAPE - ctr S BD AUX TV - ctr UP TLM DATA - DATA UP TLM CMD - RSET, then OFF PWR AMPL tb - bp TAPE MOTION tb - bp	3	GSE servicing pressure is 3600+50 psia. Upper talkback MAX and lower talkback gray indicates propellant utilization valve positioned for maximum oxidizer flow. Valve positioned to INCR by GSE during hypergolic landing. Barber pole indicates both helium isolation valves closed. Barber pole indicates power is not applied to S-band power amplifier. Barber pole indicates no tape motion.

4.1.1.11

RH COUCH CHECKS

NORMAL BACKUP

SM2A-03-BLOCK II-J-(2)
APOLLO OPERATIONS HANDBOOK

STA/T STEP	PROCEDURE	PANEL	REMARKS
LMP	S BD ANT OMNI A - B S BD ANT OMNI - OMNI VHF AM SQLCH tw (2) - noise +1 VHF AM (2) - off (ctr) VHF AM RCV - off (ctr) VHF BCN - OFF VHF RNG - OFF S BD SQLCH - ENBL FC REAC VLV - NORM H2 PURG LINE HTR - OFF TAPE RCDR PCM - PCM/ANLG TAPE RCDR RCD - RCD TAPE RCDR FWD - REWIND TAPE RCDR FWD - off (ctr) SCE PWR - NORM PMP PWR - NORM PCM BIT RATE - HI MSN TMR - RSET MSN TMR ind - zero MSN TMR - START MSN TMR ind - counting up C/W NORM - ACK C/W CSM - CSM C/W PWR - 1 (verify) C/W LAMP TEST sw - ctr PL VENT VLV - push (lock) CRYO H2 PRESS ind (both) - 225-260 psia	3	Power to switch is provided by the up-data link or the TAPE RCDR FWD switch in FWD position. Allow tape to completely rewind before proceeding. TAPE MOTION talkback is gray when tape is in motion.
CMP		2	RSET position is momentary. Will reset to zero and count up at lift-off, but not abort initiation.

RH COUCH CHECKS

SM2A-03-BLOCK II-J-(2)
APOLLO OPERATIONS HANDBOOK

STA/T STEP	PROCEDURE	PANEL	REMARKS
CMP	O2 PRESS IND SW - SURGE TK CRYO O2 PRESS 1 ind - 65-95 psia O2 PRESS IND SW - TK 1 CRYO O2 PRESS ind (both) - 65-95 psia CRYO H2 QTY ind (both) - 100% CRYO O2 QTY ind (both) - 100% CAB FAN (both) - OFF H2 HTRS (both) - AUTO O2 HTRS (both) - AUTO O2 PRESS IND SW - SURGE TK H2 FANS (both) - AUTO O2 FANS (both) - AUTO ECS IND sel - PRIM RAD PRIM IN TEMP ind - 60-97°F RAD PRIM OUT TEMP ind - 35-50°F PRIM GLY EVAP OUT TEMP ind - 35-50°F PRIM GLY EVAP INM PRESS ind - 0.25 psia (pegged) PRIM GLY DISCH PRESS ind - 60 psia max SUIT TEMP ind - 45-55°F CAB TEMP ind - 70-80°F SUIT PRESS ind - ≈14.9 psia CAB PRESS ind - ≈14.7 psia CO2 PP ind - 0.0 mm Hg RAD FLOW CONT AUTO - AUTO ECS RAD tb - Gray RAD FLOW CONT PWR - off (ctr) RAD MAN SEL - RAD 1	2	Gray indicates No. 1 flow proportioning valve controlling flow. When switch is powered, by placing RAD FLOW CONT PWR switch to MAN SEL, center position will close all isolation valves.

4.1.1.11

RH COUCH CHECKS

NORMAL/BACKUP

APOLLO OPERATIONS HANDBOOK

STA/T STEP	PROCEDURE	PANEL	REMARKS
CMF	RAD PRIM HTR - off (ctr) RAD SEC HTR - OFF SUIT COMPR ΔP ind - 0.0 psid PRIM ACCUM QTY ind - 25-50% min H2O QTY IND sw - WASTE WASTE H2O QTY ind - <80% H2O QTY IND sw - POT POT H2O QTY ind - 80% POT H2O HTR - OFF SUIT H2O ACCUM AUTO - ctr SUIT H2O ACCUM OH - ctr SUIT HT EXCH - OH for 20 sec then off (ctr) SEC COOL EVAP - RCCT for 58 sec min, then off (ctr) SEC COOL PUMP - off (ctr) GLY EVAP IN TEMP - MAN Position prim loop stm press vlv GLY EVAP STM AUTO - MAN GLY EVAP STM INCR - INCR for 58 sec min, then DECR for 8.5+0.5 sec GLY EVAP H2O FLOW - off (ctr) CAB TEMP - MAN CAB TEMP tw - max decr HI GAIN ANT PWR - OFF HI GAIN ANT TRACK - AUTO HI GAIN ANT BEAM - WIDE	2	SUIT COMPR C/W light remains on as long as compressors are not operating. Unless SUIT HT EXCH control switch is positioned to off (center), continuous power will be applied to motor valve. Ensures secondary loop steam pressure valve closed. INCR and DECR positions are momentary. Steam pressure valve requires 58 seconds from full close to full open.

RH COUCH CHECKS

SM2A-03-BLOCK II-J-(2)
APOLLO OPERATIONS HANDBOOK

STA/T STEP	PROCEDURE	PANEL	REMARKS
CMP	HI GAIN ANT PITCH ind - +90° HI GAIN ANT YAW ind - 0° HI GAIN ANT PITCH cont - 0° HI GAIN ANT YAW cont - 180° HI GAIN ANT SERVO - PRIM CAB PRESS DUMP vlv - close (CW) Side hatch	2	Power off indicator reading. Power off indicator reading. Stow position. Stow position.
4.1.1.2 COMMUNICATIONS CHECK			
IMP	1 Comm Activation S BD XPNDR - PRIM S BD PWR AMPL HI - HI PWR AMPL tb - Gray (after 90 sec)	3	Gray indicates power applied to S-band power amplifier.
CMP ALL	VHF AM B - DUPLEX S BD ANT ind - >1/3 scale MODE (3) - INTERCOM/PTT PAD COMM (3) - T/R PAD COMM VOL tw (3) - 5 PWR (3) - AUDIO/TONE MASTER VOL tw (3) - 5 SUIT PWR (3) - on (up) INTERCOM (3) - T/R INTERCOM VOL tw (3) - 5 VHF AM (3) - T/R VHF AM VOL tw (3) - 5 S BD (3) - T/R S BD VOL tw (3) - 5 AUDIO CONT (3) - NORM VHF RNG - NORM	2 9,10,6	
CDR		9	

4.1.1.2

COMMUNICATIONS CHECK

NORMAL BACKUP

SM2A-03-BLOCK II-J-(2)
APOLLO OPERATIONS HANDBOOK

STA/T STEP	PROCEDURE	PANEL	REMARKS
2 CDR, LMP	Comm Checks Replace facility headsets with CM headsets		CM headsets and CMG adapters have been connected to communication control head prior to backup crew ingress at which time PWR and SUIT PWR switches were OFF (panels 6, 10, and 9).
CDR LMP	Perform comm checks (pad comm, S-band, & VHF AM) Return to facility headset Don CMP headset & perform S-band & VHF AM comm checks UP TLM DATA - UP VOICE PU Establish 2-way comm on S-band UP TLM DATA - DATA S BD AUX TAPE - DN VOICE BU Establish 2-way comm on S-band S BD AUX TAPE - ctr Return to facility headset	3	Ground will switch communication channel such that S-band modes and VHF AM may be verified.
3 ALL	At Completion of Comm Checks SUIT PWR (3) - OFF PWR (3) - OFF	9,10,6	
CMP	MASTER VOL tw - 6 INTERCOM VOL tw - 6 S BD VOL tw - 6 VHF AM VOL tw - 7	10	
ALL	Disconnect CM headset & CMG adapter from comm cont head		
CMP LMP	C/W PWR - off (ctr) cb C/W (2) - open CDR & LMP egress CM	2 5	

COMMUNICATIONS CHECK

SM2A-03-BLOCK II-J-(2)
APOLLO OPERATIONS HANDBOOK

STA/T STEP	PROCEDURE	PANEL	REMARKS
4.1.1.13 BCMP	4.1.1.13 VERIFY COUCH CONFIGURATION NDC assist bar - extd & locked Headrests - soft suit position THC armrest in launch position & locked Inbd arm rests - stowed & contr locked Couches - launch/entry position (Y-Y struts extd & locked) Seat pans - 85° position & locked O2/comm umb - stowed Harnesses & restraints - extd & laid aside Couch stab brace - stowed Egress CM		Backup CMP (BCMP) accomplishes all tasks in 4.1.1.13 and 4.1.1.14. To eliminate confusion, station callouts for CDR and LMP locations have not been included.
4.1.1.14	PRIME CREW PRE-INGRESS PROCEDURE Ingress CM S BD PWR AMPL HI - OFF 3 S BD XPNDR - OFF 5 cb C/W (2) - close 2 C/W PWR - 1 1,3,122 MASTER ALARM pb/lt - on, push 352 Perform Pot Water Chlor POT TK IN vlv - OPEN Attach needle assy to inj port Insert chlor ampoule into casing Conn knob assy & rot (CW) until piston contacts ampoule Install ampoule assy on needle assy (push & turn CW)		Backup CMP re-enters CM. The S-band is powered down to allow GMIL station S-band antenna alignment. Performed following launch vehicle propellant loading. Use carry-on sterilization kit for chlorination.

4.1.1.14

PRIME CREW PRE-INGRESS PROCEDURE

NORMAL/BACKUP

SM2A-03-BLOCK II-J-(2)
APOLLO OPERATIONS HANDBOOK

STA/T STEP	PROCEDURE	PANEL	REMARKS
B CMP	Rot knob (CW) until ampoule is empty (piston bottoms out) Disconnect ampoule assy from needle assy (push & turn CCW) Rot knob (CCW), remove used ampoule Repeat chlor inj steps using buffer ampoule (do not remove empty ampoule after inj) Wait 10 min. Then rot inj barrel (CCW) four turns while holding bayonet section in locked position (CW) Rot knob (CCW), remove filled ampoule Remove needle assy from inj port Wait 30-45 min. Then withdraw water as follows Attach H2O sampling container to food prep unit H2O probe FOOD PREP HOT H2O vlv - push, rel until 40 oz water withdrawn FOOD PREP COLD H2O vlv - push, rel until 20 oz water withdrawn Remove H2O sampling container from food prep unit & attach to drink gun nozzle DRINK H2O SUP vlv - ON Actuate drink gun cont until 2-4 oz water withdrawn DRINK H2O SUP vlv - OFF Remove H2O sampling container from drink gun nozzle Remove sterilization kit from CM	352 305 304	Requires $\approx 5-1/2$ turns. Needle assembly to remain on inject port. Withdraws one ampoule of water.

PRIME CREW PRE-INGRESS PROCEDURE

41.1.4

APOLLO OPERATIONS HANDBOOK

STA/T STEP	PROCEDURE	PANEL	REMARKS
4.2	PRIME CREW PRELAUNCH CHECKS		
4.2.1	INGRESS & STATUS CHECKS		
BCMP	SEC COOL PUMP - may be cycled from AC1 to off (ctr) during crew ingress & checkout to maintain crew comfort	2	Activation of secondary loop will warm suit circuit $\approx 10-15^{\circ}\text{F}$. Secondary pump may be selected on or off at option of flight crew for their comfort. Crew may be cold as vehicle is being prechilled by GSE coolant at this time.
	4.2.1.1 CDR Ingress LH Couch		
CDR	Ingress LH couch CDR comm umb - conn to PGA SUIT PWR - on (up) PWR - AUDIO/TONE	9	
BCMP	1h SUIT FLOW vlv - OFF CDR 02 umb - conn to PGA 1h SUIT FLOW vlv - FULL FLOW CDR 02 vent - shut off & disconnect	301	Connect red to red and blue to blue. Suit hose interconnect removed from CM. PGA gas connector plugs installed. Ventilator removed from CM.
	Assist CDR in position; connections & adjustments completed		Restraints connected and tightened, and arm rests, torso and life vest adjusted. Helmet protector removed from CM.
	Verify sw positions as follows: CAB FAN (both) - on (up) FLOAT BAG (3) - VENT THC - neutral (locked) MAN ATT ROLL - RATE CMD MAN ATT PITCH - ACCEL CMD	2 8 1	Lever lock.
CDR			

4.2.1.1

INGRESS & STATUS CHECKS

NORMAL BACKUP

SM2A-03-BLOCK II-J-(2)
APOLLO OPERATIONS HANDBOOK

STA/T STEP	PROCEDURE	PANEL	REMARKS
CDR	MAN ATT YAW - RATE CMD SCS TVC (2) - RATE CMD ΔV CG - LM/CSM ELS AUTO - AUTO	1	
	4.2.1.1.2 LMP <u>Ingress RH Couch</u>		
LMP	Ingress RH couch LMP comm umb - conn to PGA SUIT PWR - on (up) PWR - AUDIO/TONE	6	
BCMP	rh SUIT FLOW vlv - OFF LMP 02 umb - conn to PGA rh SUIT FLOW vlv - FULL FLOW LMP 02 vent - shut off & disconnect	300	Connect red to red and blue to blue. Suit nose interconnect removed from CM. PGA gas connector plugs installed. Ventilator removed from CM.
LMP	Assist LMP in position; connections & adjustments completed Verify the following SPS GAUGING - AC1 GLY PUMPS - 1 AC1 VHF ANT - SM LEFT OXID FLOW VLV INCR - NORM MNA RSET - ctr MNB RSET - ctr SPS He VLV (both) - AUTO S BD ANT OMNI A - B S BD ANT OMNI - OMNI VHF BCN - OFF SCE PWR - NORM AC 1 RSET - ctr AC 2 RSET - ctr	4 3	Restraints connected and tightened, and arm rests, torso and life vest adjusted.

INGRESS & STATUS CHECKS

SM2A-03-BLOCK II-J-(2)
APOLLO OPERATIONS HANDBOOK

STA/T STEP	PROCEDURE	PANEL	REMARKS
4.2.1.1.3	CMP Ingress Center Couch		
CMP	Ingress ctr couch		
BCMP	CMP comm umb - conn to PGA	10	
	SUIT PWR - on (up)		
	PWR - AUDIO/TONE		
	ctr SUIT FLOW vlv - OFF	302	
	CMP 02 umb - conn to PGA		Connect red to red and blue to blue. Suit hose interconnect removed from CM.
	ctr SUIT FLOW vlv - FULL FLOW		
	CMP 02 vent - shut off & disconnect		PGA gas connector plugs installed. Ventilator removed from CM.
	Assist CMP in position; connections & adjustments completed		Restraints connected and tightened, and arm rests, torso and life vest adjusted. Helmet protector removed from CM.
	Perform fnl crew verification		Helmets, umbilicals, PGA diverter valves and wrist disconnects, foot restraints, and life vests rechecked.
CMP	Verify the following	2	
	PRPLNT DUMP - AUTO		
	C/W NORM - BOOST		
	MSN TMR - START		
	SUIT H2O ACCUM AUTO - 1		
	SUIT COMPR ΔP ind - 0.7-0.9 psid		
All	VHF AM VOL tw (3) - as desired	6,10,9	
	S BD VOL tw (3) - as desired		
LMP	UP TLM CMD - NORM	3	
CMP	UP TLM CM - BLOCK	2	
BCMP	PAD COMM - OFF	10	
	Egress CM		PAD COMM can be used after launch for intercom backup with PAD COMM VOL thumbwheel decreased.

4.2.1.1.3

INGRESS & STATUS CHECKS

NORMAL/BACKUP

INGRESS & STATUS CHECKS

SM2A-03-BLOCK II-J-(2)
APOLLO OPERATIONS HANDBOOK

STA/T STEP	PROCEDURE	PANEL	REMARKS
CMP	Hatch open lock - rel (tech) Side hatch Push hatch to near closed position (tech) Lock pin rel knob - UNLOCK (verify) Hold hatch closed Insert tool B (handle in 9 o'clock position) into external hatch actuation socket, rot CW to stops & hold (tech) Press & hold LOCK PIN reset button Relax torque & remove tool B (tech) LOCK PIN reset button - rel LOCK PIN ind - not extd (rh couch) &/or white ind is opposite white mrk (ctr & lh couch) xxx x If lock pin is not engaged Insert tool B into external hatch actuation socket & slowly rot CCW until LMP verifies lock pin engagement (tech) xxx x xxx x <u>NOTE</u> If RED lock pin is extd ≈ 0.5 inch, lock pin has been sheared. GN2 press ind - green (verify)		Obtains lock pin engagement. Mechanism should rotate ≈ 14 inches CCW due to spring pressure.

SM2A-03-BLOCK II-J-(2)
APOLLO OPERATIONS HANDBOOK

STA/T STEP	PROCEDURE	PANEL	REMARKS
CMF	Configure hatch for rapid egress Gear box sel - UNLATCH Actr handle sel - U (unlatch) BPC JETT knob - arrow on knob pointing to BPC JETT decal -01:35:00 If rapid hatch opening req, refer to 5.3.1.1 Strut unlock lanyard (2) - unstow & attach handle ends to MDC Grd performs cab purge & hatch leak test Cab purge to 60% O₂/40% N₂ (launch atmosphere) Grd performs hatch leak test <u>CAUTION</u> During this check, established SUIT/CAB ΔP should be maintained by DIRECT O₂ vlv. 4.2.1.6 <u>Change Launch Azimuth (if necessary)</u> Key V78E FL V06 N29 X SM launch azimuth XXX.XX DEG Key V21E, load new azimuth PRO CAB FAN (both) - OFF	Side hatch	GSE verifies 60/40 ratio. Requires ≈ 20 minutes.

INGRESS & STATUS CHECKS

SM2A-03-BLOCK II-J-(2)
APOLLO OPERATIONS HANDBOOK

STA/T STEP	PROCEDURE	PANEL	REMARKS
4.2.1.1.7	EDS Test Complete		
-01:21:00	Set cont after test		
CDR	INTERCOM - T/R	9	
	VHF AM - T/R		
	S BD - T/R		
LMP	PAD COMM - T/R	6	
CDR	EDS PWR - OFF	7	
CMP	EDS AUTO - OFF (verify)	2	
	2 ENG OUT sw - AUTO (verify)		
	LV RATES sw - AUTO (verify)		
CDR	α /Pc ind - _____%	1	
-01:13:00			
CMP	UP TLM IU - BLOCK	2	
4.2.2	FINAL VERIFICATION & SYSTEMS CHECKS		
4.2.2.1	G&C Verification		
1	Gyro Pwr Up		
	C/W NORM - NORM		
	BMAG TEMP lt (both) - out		
CDR	FDAI/GPI PWR - OFF	7	
	ELEC PWR - GDC/ECA		
	BMAG PWR (both) - ON		
	FDAI/GPI PWR - BOTH		
CMP	C/W NORM - ACK	2	
2	GDC Align		
CDR	FDAI SEL - 1	1	
	FDAI SOURCE - ATT SET		
4.2.2.1			If FDAIs are powered when BMAGs come up to speed, rate needles will oscillate full scale.

FINAL VERIFICATION & SYSTEMS CHECKS

NORMAL/BACKUP

FINAL VERIFICATION & SYSTEMS CHECKS

SM2A-03-BLOCK II-J-(2)
APOLLO OPERATIONS HANDBOOK

STA/T STEP	PROCEDURE	PANEL	REMARKS										
4.2.2.2	<u>Gimbal Drive & Trim Check</u>		Verifies trim control and manual (MTVC) control capability of primary and secondary gimbal control system. SPS gimbal angle settings based on CSM c.g. and vary with propellant loading.										
			PITCH and YAW GMBL caution/warning lights (panel 2) indicate overcurrent to gimbal motors. Otherwise, no indication to crew, except for switch selection, that a gimbal motor not operating or auto switchover (THC-CW) has taken place.										
			GMBL POS indicator response opposite to RHC commands as follows:										
			<table><tr><td><u>RHC</u></td><td><u>IND</u></td></tr><tr><td>+ Pitch</td><td>- Pitch</td></tr><tr><td>- Pitch</td><td>+ Pitch</td></tr><tr><td>+ Yaw</td><td>- Yaw</td></tr><tr><td>- Yaw</td><td>+ Yaw</td></tr></table>	<u>RHC</u>	<u>IND</u>	+ Pitch	- Pitch	- Pitch	+ Pitch	+ Yaw	- Yaw	- Yaw	+ Yaw
<u>RHC</u>	<u>IND</u>												
+ Pitch	- Pitch												
- Pitch	+ Pitch												
+ Yaw	- Yaw												
- Yaw	+ Yaw												
			Fuel cells are placed on main buses by crew prior to primary TVC check per ground crew instructions.										
		3	Gray indicates fuel cells 1 and 2 connected to main bus A; barber pole indicates fuel cell 3 disconnected from main bus A.										
			Barber pole indicates fuel cells 1 and 2 disconnected from main bus B; gray indicates fuel cell 3 connected to main bus B.										
		5											
		1											
1	Initialization FC on mn buses (verify)												
LMP	FC MNA 1 & 2 - ctr, 3 - OFF FC MNA 1 & 2 tb - gray, 3 tb - bp												
	FC MNB 1 & 2 - OFF, 3 - ctr FC MNB 1 & 2 tb - bp, 3 tb - gray												
CDR	MN BUS TIE (2) - on (up) SCS TVC (2) - RATE CMD (verify)												

FINAL VERIFICATION & SYSTEMS CHECKS

4.2.2.2

SM2A-03-BLOCK II-J-(2)
APOLLO OPERATIONS HANDBOOK

STA/T STEP	PROCEDURE	PANEL	REMARKS
	<u>CAUTION</u> More than 1 hr of contin on-time for TVC SERVO PWR 1 or 2 sw may be detrimental to SPS gmb1 actuators.		
CDR	TVC SERVO PWR 1 - AC1/MNA TVC SERVO PWR 2 - AC2/MNB LV IND/GPI sw - GPI (verify) RHC 2 - ARMED	7 1	
2	Prim TVC Check GMBL MOT P1, Y1 - START Confirm trim cont on inds SPS GMBL tw (2) - + & - RHC 2 - perform MTVC check		START position is momentary. Start SPS gimbal motors sequentially at ≈1-second intervals to avoid power surge. For ground checks, GMBL MOT PITCH or YAW are the equivalent of flight terms GMBL MOT P or Y. Gimbals drive in response to SPS pitch and yaw thumb-wheel movement. Verifies primary gimbal trim control. Gimbals drive in response to RHC movement, and return to set-in values when RHC is neutral. Verifies primary MTVC loops.
3	Sec TVC Check SCS TVC (2) - AUTO GMBL MOT P2, Y2 - START THC - CW Confirm trim cont on inds SPS GMBL tw (2) - + & - RHC 2 - perform MTVC check		Verifies secondary gimbal trim control. Verifies secondary MTVC loops.

FINAL VERIFICATION & SYSTEMS CHECKS

SM2A-03-BLOCK II-J-(2)
APOLLO OPERATIONS HANDBOOK

STA/T STEP	PROCEDURE	PANEL	REMARKS
CDR	4 Auto Switchover Check GMBL MOT P2, Y2 - OFF Verify no MIVC THC - neut SPS GMBL tw (2) - P <u> </u>°, Y <u> </u>° GMBL MOT P1, Y1 - OFF RHC PWR NORM 2 - AC/DC RHC 2 - LOCKED MN BUS TIE (2) - OFF, then AUTO TVC SERVO PWR (both) - OFF LV IND/GPI sw - SII/SIVB 4.2.2.3 <u>FDAI Verification</u> FDAI SEL - 1/2 FDAI SOURCE - CMC FDAI 1 - total att R X°; P 90°; Y 0° 4.2.2.4 <u>RSI Test & Setup</u> EMS ROLL - on (up) GDC ALIGN pb - push & hold ATT SET YAW tw - adj thru 45° angle, observe RSI tracks ≈ 45°, then adj until RSI points up GDC ALIGN pb - rel EMS ROLL - OFF	1 5 7 1	Shut off gimbal motors sequentially to avoid a power surge. Gimbals are trimmed to thrusting values. These values are derived from Operational Trajectory, Table VIIIa, and include gimbal offset of <u> </u> in pitch and <u> </u> in yaw from spacecraft axis. FDAI 2 is drifting as a function of earth rate. For ground checks, EMS RAI is the equivalent of flight term RSI. Avoid FDAI gimbal lock region.

4.2.2.4

FINAL VERIFICATION & SYSTEMS CHECKS

NORMAL BACKUP

APOLLO OPERATIONS HANDBOOK

STA/T STEP	PROCEDURE	PANEL	REMARKS
CDR	Align GDC to IMU		Ensures that GDC is aligned to actual IMU angles, rather than calculated values. Attitude reference comparison (in orbit) will be more accurate.
	FDAI SEL - 1	1	
	FDAI SOURCE - ATT SET		Constraint: If CMC is on, an overload in IMU resolver circuitry may cause an ICDU oscillation and trigger ISS warning light. (Reference ICD MH01-01325-216.) FDAI must be used as a null meter in this mode of operation. If not, large errors will result because of impedance mismatch.
	ATT SET - IMU		
	ATT SET tw (3) - null FDAI 1 err		
	ATT SET - GDC		
	GDC ALIGN pb - push		
	FDAI SOURCE - CMC		
	FDAI SEL - 1/2		
	4.2.2.5 <u>EMS Prep</u>		
	Set EMS ΔV		
	EMS MODE - STBY (verify)		
	EMS FUNC - ΔV SET		
	Set ΔV ind - 6999.9 fps		
	EMS FUNC - ΔV		
-55:00	C/W NORM - BOOST	2	Inhibits master alarm light on panel 1.
CMP	Cont head sw - XMIT, hold until		
LMP	advised to rel		
	UP TLM CMD - NORM	3	

FINAL VERIFICATION & SYSTEMS CHECKS

SM2A-03-BLOCK II-J-(2)
APOLLO OPERATIONS HANDBOOK

STA/T STEP	PROCEDURE	PANEL	REMARKS
4.2.2.6	<u>Pad Abort Enable</u> <u>WARNING</u> After pad abort enbl, oper of THC - CCW will init an abort.		
-44:00 CDR CMP	EDS PWR - on (up) Gear box sel - LATCH Actr handle sel - U (unlatch) (verify)	7 Side hatch	
ALL CDR	Shoulder harness - locked CM RCS LOGIC - on (up) cb SECS ARM (2) - close cb SECS LOGIC (2) - close SECS LOGIC (both) - on (up) Report logic arm After GO from STC SECS PYRO ARM (2) - on (up)	1 8	Lever lock. Both lever lock pyro arm switches must be operated. LES pad abort capability enabled; SECS LOGIC and PYRO buses are armed.
-28:00 CMP	H2 FANS (both) - off (ctr) O2 FANS (both) - off (ctr)	2	
	<u>4.2.2.7 SM RCS Activation</u>		
-25:00	SM RCS He 1 (4) - OPEN SM RCS He 1 tb (4) - gray SM RCS He 2 (4) - OPEN SM RCS He 2 tb (4) - gray		OPEN position is momentary. Gray indicates primary He isolation valves open. OPEN position is momentary. Gray indicates secondary He isolation valves open.

4.2.2.7

FINAL VERIFICATION & SYSTEMS CHECKS

NORMAL BACKUP

APOLLO OPERATIONS HANDBOOK

STA/T STEP	PROCEDURE	PANEL	REMARKS
CMF	RCS IND sel - SM A, B, C, D SM RCS SEC FUEL PRESS ind - 192-207 psia	2	Check pressure with RCS IND selector positioned at SM A, B, C, and D (in turn).
	SM RCS SEC FUEL PRESS (4) - CLOSE		CLOSE position is momentary. No talkbacks. ACE can confirm valves closed.
	SM RCS PRPLNT (4) - OPEN		OPEN position is momentary. Opens 16 isolation valves.
	SM RCS PRIM PRPLNT tb (4) - gray		Gray indicates primary fuel and oxidizer isolation valves open.
	SM RCS SEC PRPLNT tb (4) - gray		Gray indicates secondary fuel and oxidizer isolation valves open.
4.2.2.8	SM RCS Status Check		
	RCS IND sel - SM A, B, C, D SM RCS PKG TEMP ind - amb		SM RCS heaters are not operated on pad or during ascent to reduce effects of boost heating on package temperature. Ambient temperature <75° or >205°F will cause SM RCS status lights to come on.
	SM RCS He PRESS ind - 4000-4350 psia		Nominal He load 4150 psig at 70°F. Pressure and temperature excursions are due to ambient conditions.
	SM RCS SEC FUEL PRESS ind - 192-207 psia		Primary fuel pressure initially shown for each quad until momentary OPEN position of SM RCS A (B, C, D) SEC FUEL PRESS switch selected.
	SM RCS IND sw - He TK TEMP SM RCS He TK TEMP ind - 60°-80°F SM RCS IND sw - PRPLNT QTY SM RCS PRPLNT QTY ind - 100%		
	RCS IND sel - CM 2		

FINAL VERIFICATION & SYSTEMS CHECKS

SM2A-03-BLOCK II-J-(2)
APOLLO OPERATIONS HANDBOOK

STA/T STEP	PROCEDURE	PANEL	REMARKS
4.2.3 LAUNCH PREPARATION			
-20:00 CMP	Change launch azimuth (if necessary) Key V78E FL V06 N29 X SM launch azimuth XXX.XX DEG Key V21E, load new azimuth PRO Align GDC to IMU, 4.7.3	2	Ensures that GDC is aligned to actual IMU angles, rather than calculated values. Attitude reference comparison (in orbit) will be more accurate.
CDR	FDAI SEL - 1 FDAI SOURCE - ATT SET	1	Constraint: If CMC is on, an overload in IMU resolver circuitry may cause an ICDU oscillation and trigger ISS warning light. (Reference ICD MH01-01325-216.) FDAI must be used as a null meter in this mode of operation. If not, large errors will result because of impedance mismatch.
	ATT SET - IMU ATT SET tw (3) - null FDAI 1 err ATT SET - GDC GDC ALIGN pb - push FDAI SOURCE - CMC FDAI SEL - 1/2 AUTO RCS A/C ROLL (4) - OFF (verify) AUTO RCS B/D ROLL B1 & B2 - MNA AUTO RCS B/D ROLL D1 & D2 - MNB AUTO RCS PITCH A3 & C4 - MNB AUTO RCS PITCH C3 & A4 - MNA AUTO RCS YAW B3 & D4 - MNA AUTO RCS YAW D3 & B4 - MNB	8	

LAUNCH PREPARATION

4.2.3

NORMAL BACKUP

SM2A-03-BLOCK II-J-(2)
APOLLO OPERATIONS HANDBOOK

STA/T STEP	PROCEDURE	PANEL	REMARKS
LMP	BAT C voltage - _____ vdc	3	
	DC IND sel - MNA		
CDR	FDAI 1 - total att	1	FDAI 2 is drifting as function of earth rate.
	R _____, P _____, Y _____		This position provides most reliable configuration in event a rate gyro fails during boost.
	BMAG MODE (3) - RATE 1		
	FDAI SCALE - 5/5		Roll attitude error is scaled in P11 assuming FDAI is in 50/15/50/10 position. Until this position is selected at +01:50, roll full scale deflection will be 20°, not 5° as position indicates.
	RATE - HI		
	RHC (both) - ARMED		
	RHC PWR DIR (both) - MNA/MNB		
	CMC MODE - FREE		
	THC PWR - on (up)		
LMP	S BD - OFF	6	
CDR	VHF AM - OFF	9	
ALL	Perform air-to-grd voice check with MCCH		
LMP	S BD - T/R	6	
CDR	VHF AM - T/R	9	
	SPS THRUST - NORM	1	Lever lock.
	ΔV THRUST (2) - OFF		Guarded.
	α/Pc IND sw - α		
CMP	EDS AUTO - on (up)	2	
	LV RATES sw - AUTO		
	2 ENG OUT sw - AUTO		
	RCS CMD - OFF		OFF position is momentary.
CDR	TVC SERVO PWR 1 - AC1/MNA	7	
	TVC SERVO PWR 2 - AC2/MNB		
-10:00			
LMP	FC REAC VLVS - LATCH	3	

LAUNCH PREPARATION

SM2A-03-BLOCK II-J-(2)
APOLLO OPERATIONS HANDBOOK

STA/T STEP	PROCEDURE	PANEL	REMARKS
-08:30 CMP	SEC COOL PUMP - off (ctr)	2	Crew option may have been exercised to turn SEC COOL PUMP on for crew comfort.
-08:00 -06:00 -04:00	Sys stat report Sys GO/NO GO for launch		
CDR CMP	LV ENG lts (5) - on P02 (verify)	1 2	Launch vehicle engine lights on T -04:00 minutes.
	<u>CAUTION</u> Do not press ENTR after keying V75. If ENTR is pressed, G&C sys will receive incorrect liftoff time.		
	Key V75		
-03:00 LMP	TAPE RCDR FWD - FWD TAPE MOTION tb - gray	3	Gray display indicates tape is in motion.
-02:15 CDR	PRIM GLY TO RAD - BYP (pull)	325	Accomplished immediately after GSE water-glycol pump deactivated (T -02:15).
CMP	PRIM GLY DISCH PRESS ind - 37-50 psig PRIM ACCUM QTY ind - 25-50%	2	
-01:15 LMP	MN BUS TIE (2) - on (up)	5	
-01:00 CDR,LMP	PAD COMM (2) - OFF	9,6	PAD COMM can be used after launch for intercom backup with PAD COMM VOL thumbwheel decreased.

4.2.3

LAUNCH PREPARATION

NORMAL BACKUP

SM2A-03-BLOCK II-J-(2)
APOLLO OPERATIONS HANDBOOK

STA/T STEP	PROCEDURE	PANEL	REMARKS
-00:45 CDR	CHC ALIGN pb - push, hold	1	
CHP	PLAI 2 total att - no motion	2	
CDR	CHC ALIGN pb - rel	1	
	READY FOR LIFT OFF		
	Refer to Appendix B for cab sw/cont position at veh liftoff.		

LAUNCH PREPARATION

SM2A-03-BLOCK II-J-(2)
APOLLO OPERATIONS HANDBOOK

STA/T STEP	PROCEDURE	PANEL	REMARKS
4.3 BOOST AND INSERTION 4.3.1 BOOST			
-00:09 Ignition			LV engines lights (5) go on at T -4 min when S-IC indicating circuits are armed.
CDR			
-00:01 LV ENG lts (5) - out		1	Indicates all five engines have achieved over 90 percent of rated thrust.
00:00 LIFT OFF lt - on & NO AUTO ABORT lt - out			Additional lift-off cues: Event Timer start Voice communications from MSFN DSKY displays Program 11
	<u>WARNING</u> Do not press LIFT OFF/NO AUTO ABORT pb if LV RATE or any LV ENG lts on. xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx Liftoff verified If LIFTOFF lt off - push If NO AUTO ABORT lt on - push xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx		Manual abort initiation may be required. (Refer to mission rules.)
CDR, CMP	Verify EVNT TMR ind resets to zero & starts counting up		Guarded. Guarded.

4.3.1

BOOST

NORMAL BACKUP

SM2A-03-BLOCK II-J-(2)
APOLLO OPERATIONS HANDBOOK

STA/T STEP	PROCEDURE	PANEL	REMARKS
CDR	xxxxxxxxxxxxxxxxxxxxx x EVNT TMR START - START x xxxxxxxxxxxxxxxxxxxxx	1	START position is momentary.
CMP	Verify MSN TMR ind resets to zero & starts counting up xxxxxxxxxxxxxxxxxxxxx x MSN TMR - RSET/START x xxxxxxxxxxxxxxxxxxxxx Verify Pll (auto) xxxxxxxxxxxxxxxxxxxxx No Pll - Key ENTR x xxxxxxxxxxxxxxxxxxxxx V06 N62 VI XXXXX. FPS H dot XXXXX. FPS H pad XXXX.X NM	2	RSET position is momentary.
CDR	If LV RATE & LV GUID lts - on, from T +0 to T +2 min	1	V75 inserted in P02 prior to lift-off. These parameters will be displayed throughout ascent. VI = Inertial velocity. H dot = Altitude rate. H pad = Altitude above pad radius.

BOOST

APOLLO OPERATIONS HANDBOOK

STA/T STEP	PROCEDURE	PANEL	REMARKS
CMP	LV GUID sw - CMC If man cont req Key 46E	2	Allows CMC automatic steering, all stages.
CDR +00:12	Roll prog report		Disables CMC steering and activates Saturn DAP; REC provides steering commands to the IU for booster control. These stick commands are discrete rate commands. The attitude error needles are not designed to provide meaningful "fly to" information in the manual mode.
+00:30	Pitch prog - report		
+00:42	Roll prog - complete		
CMP +00:42	PRPLNT DUMP - RCS CMD MODE 1B - report	MODE 1A 00:42 MODE 1B	
CDR +00:50	Mon α /Pc ind > to T +02:00	RATES +4°/sec P,Y +20°/sec R	
CMP 13K' to 15K'	CAB PRESS ind - starts decr xxxxxxxxxxxxxxxxxxxxxx x If no decr by 25K' rh CAB PRESS RELF vlv - DUMP (safety latch off) until	2 ATT ERROR +5° P,Y 325	Relieves high CM-to-atmosphere ΔP . Assuming that cabin pressure at lift-off is 14.47 to 14.87 psia, the cabin pressure relief valve could begin modulating at 13K'.
CDR			

4.3.1

BOOST

NORMAL/BACKUP

SM2A-03-BLOCK II-J-(2)
APOLLO OPERATIONS HANDBOOK

STA/T STEP	PROCEDURE	PANEL	REMARKS
CDR	CAB PRESS ind - 8 psia, then NORM (safety latch on)	2	
CMP	If still no decr CAB PRESS DUMP vlv - open (CCW) until CAB PRESS ind - 8 psia, then close (CW) XXXXXXXXXXXXXXXXXXXXX MAX Q	Side hatch 2	
+01:21		MODE 1B	
CDR	MODE 1C - report (R3 = 16.5 NM)	01:56 MODE 1C	
CMP	EDS AUTO - OFF 2 ENG OUT sw - OFF LV RATES sw - OFF α /Pc IND sw - Pc LV RATE lt disabled as platform failure cue & limits changed to 9.2° in P&Y		
CDR	Report GO/NO GO for staging CECO (LV ENG 5 lt - on) LIFT OFF lt - out (CECO +0.6 sec)	1	Center engine cutoff.
+02:10			
+02:15			

BOOST

SM2A-03-BLOCK II-J-(2)
APOLLO OPERATIONS HANDBOOK

STA/T STEP	PROCEDURE	PANEL	REMARKS
CDR +02:42	OECO (LV ENG 1, 2, 3 & 4 lts - on)	1	Outboard engine cutoff.
+02:43	All eng lts - out SII/SIVB staging capability armed (OECO +1.4 sec)		S-IC/SII separation.
	xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx x If early SII/SIVB staging req, LV STAGE - on (up)		
CMP	xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx x xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	2	Guarded.
		MODE 1C	
CDR +02:44	LV ENG 1, 2, 3, 4 & 5 lts - on	1	SII engine ignition.
+02:45	SII SEP lt - on		
CMP	All eng lts - out GLY EVAP STM AUTO - AUTO GLY EVAP H2O FLOW - AUTO	2	SII 2nd plane separation circuitry armed. SII engines 65 percent rated thrust.
CDR +03:13	SII SEP lt - out	1	SII interstage jettisoned.
CMP +03:18	TWR JETT (both) - on (up) (TFF >1+20) TWR JETT & MODE II report	2	Guarded. On position is momentary.
	xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx x No tower jett Go to EMER PROCEDURES, 5.3.2.6		
	xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx x xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx		

BOOST

4.3.1

APOLLO OPERATIONS HANDBOOK

STA/T STEP	PROCEDURE	PANEL	REMARKS	
CMP	If LV GUID sw - CMC Key V46E for man cont	2	Activates Saturn DAP, provides steering commands to the IU for booster control. These stick commands are discrete rate commands. Attitude error needles are not designed to provide meaningful "fly to" information in manual mode.	
CDR	MAN ATT PITCH - RATE CMD	1		
+03:23	LV guidance init (OECO +41 sec)	MODE II		START position is momentary. Start SPS gimbal motors sequentially at ≈ 1 -second intervals to avoid power surge.
+03:53	Guidance good			
+04:00	Report status			
LMP				
+05:00	Report status			
CMP				
+05:40	Upstage capability to COI			
+05:50	SIVB to orb capability			
CDR				
+06:00	Report status			
CMP	LV IND/GPI sw - GPI Mon main bus voltages during gmb1 mot start	3		
CDR	GMBL MOT (4) - START	1		
LMP	LV IND/GPI sw - SII/SIVB	MODE II		
+06:15	If AZ <96° S BD ANT OMNI - D			
	If AZ >96° S BD ANT OMNI A - C			

BOOST

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STA/T STEP	PROCEDURE	PANEL	REMARKS
CMP +07:00 Report status +07:42 CECO (LV ENG 5 lt - on)		1	SII center engine cutoff.
LMP +08:00 Report status			
CDR +09:00 MODE IV report +09:11 OEEO (LV ENG 1, 2, 3 & 4 lts - on)	09:00 MODE IV		SII outboard engines cutoff. SII/SIVB separation.
+09:12 All eng lts - out			
CMP	xxxxxxxxxxxxxxxxxxxxxxxxxxxxx x If no SII/SIVB staging LV STAGE - on (up) x xxxxxxxxxxxxxxxxxxxxxxxxxxxxx x	2	Guarded.
CDR +09:13 LV ENG 1 lt - on +09:16 LV ENG 1 lt - out		1	SIVB ignition. SIVB thrust to 65 percent.
CMP +10:00 Report/confirm COI MODE IV			Coast orbital insertion.
+11:00 Report status If CMC takeover exercised during thrusting go to backup for SECO		10:08 MODE III	SIVB cutoff must be manually initiated at a TBD time calculated during the boost.
		MODE IV	

BOOST

4.3.1

SM2A-03-BLOCK II-J-(2)
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STA/T STEP	PROCEDURE	PANEL	REMARKS
CDR +11:29	SECO LV ENG 1 lt - on	1	SIVB engine cutoff (auto).
CMF	Begin TB5		Time base 5.
+TBD	xxxxxxxxxxxxxxxxxxxxxxxxxxxxx x If late SECO or LV GUID sw - CMC LV STAGE sw - on (up) SECO LV ENG 1 lt - on Begin TB5 If still no SECO <u>WARNING</u> THC must be returned from CCW position before 3.0 sec or CSM SLA sep will occur. THC - CCW, return within 1 sec SECO LV ENG 1 lt - on Begin TB5 xxxxxxxxxxxxxxxxxxxxxxxxxxxxx x	2	Guarded.
CDR		1	
+11:39	INSERTION	INSERTION	

BOOST

SM2A-03-BLOCK II-J-(2)
APOLLO OPERATIONS HANDBOOK

STA/T STEP	PROCEDURE	PANEL	REMARKS
CMP	LV ENG 1 lt - out (SECO +10 sec)	1	VI = Inertial velocity. H dot = Altitude rate.
	Red from DSKY	2	
	VI H dot	XXXXX. FPS XXXXX. FPS	
	H pad	XXXX.X NM	H pad = Altitude above pad radius. V82 should not be selected during P02 or P11 within 5 seconds of liftoff time (this applies to any extended verb which sets bit 1 of flagword 4).
	(R30, Orbital Parameters)		Displays orbital parameters (N44). A meaningful display of N32 and N50 is available only during R30.
	Key V82E		
	FL V16 N44		
	Ha	XXXX.X NM	Ha = Apogee altitude.
	Hp	XXXX.X NM	Hp = Perigee altitude.
	TFF	XXBXX MIN-SEC	TFF = Time of free fall to 49.4 NM (300,000 feet).
	Key N50E		
	Splash err		
	Hp	XXXX.X NM	
	TFF	XXBXX MIN-SEC	
	KEY REL		Negative for undershoot, positive for overshoot.
	FL V16 N44		
	Ha	XXXX.X NM	
	Hp	XXXX.X NM	
	TFF	XXBXX MIN-SEC	
	PRO		If TFF = -59B59, TF perigee is available by keying N32E.

BOOST

4.3.1

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STA/T STEP	PROCEDURE	PANEL	REMARKS
CMP V06 N62 VI H dot H pad SAFE ORBIT Key V37E OOE	XXXX. FPS XXXX. FPS XXXX.X NM	2	

BOOST

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STA/T STEP	PROCEDURE	PANEL	REMARKS
4.3.2	POSTORBITAL INSERTION CHECK		
4.3.2.1	Status Checklist		
CDR	GMBL MOT (4) - OFF	1	Shut off gimbal motors sequentially to avoid power surge. Setting No. 2 motors off first minimizes switching in servo logic.
LMP	MN BUS TIE (2) - OFF	5	
CDR	AV THRUST (2) - OFF (verify)	1	Guarded.
	RHC PWR DIR (both) - OFF		
	ELS AUTO - MAN		
	CM RCS LOGIC - OFF	8	
	cb ELS (2) - open		Lever lock.
	SECS PYRO ARM (2) - SAFE		Lever lock.
	SECS LOGIC (both) - OFF		
	cb SECS ARM (2) - open		
	AUTO RCS (16) - OFF	7	
	EDS PWR - OFF		
	TVC SERVO PWR (both) - OFF		
LMP	PAN CAMR PWR - off (ctr)	230	
	PCM BIT RATE - LO	3	
	FC REAC VLVS - NORM		Setting switch to NORM removes holding voltage from open side of FC reactant valves.
CMP	UP TLM IU - as req	2	
	SM RCS HTRS (4) - PRIM		
	C/W NORM - NORM		

POSTORBITAL INSERTION CHECK

4.3.2.1

NORMAL BACKUP

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STA/T STEP	PROCEDURE	PANEL	REMARKS
	<u>WARNING</u> If BPC JETT knob cannot be positioned 180° away from the BPC JETT position before opening side hatch, a pin in the plunger may be sheared possibly allowing press seal to be broken. Cabin repressurization may not be possible due to overboard venting around the BPC plunger.		
CMP	BPC JETT knob - turn arrow on knob 180° away from BPC JETT decal Actr handle sel - N (neut) Vent piston chamber GN2 handle - pull (inbd) GN2 press ind - min MODE (3) - as desired Crew couch strut unlock lanyards (2) - stow Couch to docking position Red 2-1 data from grd Lat _____ Long _____ GETI _____ AV _____	Side hatch	Disarms boost cover hatch release mechanism, preventing BPC JETT plunger from actuating during inflight operation of hatch.
ALL CMP		9,10,6	This data defines landing site and thrusting parameters for a first orbit, deorbit, and entry.
CDR	Mon LV TK PRESS ind (4) from orb insertion to CSM/SIVB sep for the following limits AP <36 psid (oxid > fuel) AP <26 psid (fuel > oxid) LV TK PRESS <50 psia	1	Refer to mission rules concerning SIVB fuel and oxidizer tank pressures.

POSTORBITAL INSERTION CHECK

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STA/T STEP	PROCEDURE	PANEL	REMARKS
4.3.2.2	<u>SCS Attitude Reference Comparison Check, 4.8.2.7</u>		Check must be performed as near to orbit injection as possible to prevent additional drift in attitude reference systems.
4.3.2.3	<u>SCT/SXT Dust Cover Jett Procedure</u>		
	<u>WARNING</u>		
	Until optics are to be used, the OPT ZERO (pnl 122), should be kept at ZERO to prevent inadvertent jett of optics covers.		
CMP	1 OPT PWR - on (up)	100	
	OPT ZERO - OFF	122	Optics zero switch to OFF enables function of OPT MODE and OPT SPEED switches.
	OPT MODE - MAN		
	OPT COUPLING - DIR		
	OPT SPEED - HI		
	2 OHC - max right		Shaft angles for dust cover jettison are SCT = 150° and SXT = 40°. The optics shaft should be driven and maintained at full rate through these angles until covers are jettisoned.
	Observe ejection thru optics		
4.3.2.4	<u>ECS Postinsertion Configuration</u>		
	Sec rad leak check		
	Mon SEC ACCUM QTY ind	2	
	GLY TO RAD SEC vlv - NORM	377	Provides rapid postinsertion pressure integrity check of secondary radiator circuit - verification system has not opened during boost phase. This does not verify coolant loop heat rejection capability as defined in 4.5.4.2, step 7.
	for 30 sec, then BYP		

4.3.2.4

POSTORBITAL INSERTION CHECK

NORMAL BACKUP

APOLLO OPERATIONS HANDBOOK

STA/T STEP	PROCEDURE	PANEL	REMARKS
CDR	cb PL VENT FLT/EL - open	8	Prevents inadvertent opening of postlanding vent valves.
LMP	CAB PRESS RELF vlv (?) - NORM (safety latch on) PRIM GLY EVAP STM PRESS ind - 0.09-0.14 psia PRIM GLY EVAP OUT TEMP ind - 38-43°F Init rad flow	325 2	Water-glycol flow through primary loop radiators to commence no sooner than T +30:00 or later than T +55:00. After 2-1/2 minutes of flow, radiator outlet temperature should be less than inlet temperature.
CDR	GLY RSVR BYP vlv - OPEN GLY RSVR OUT vlv - CLOSE GLY RSVR IN vlv - CLOSE	326	
LMP	PRIM ACCUM QTY ind - 25-50%	2	
CMP, LMP	PRIM ACCUM FILL vlv - ON, until 50% is reached	379, 2	Primary accumulator quantity reading must be increased by at least 5% to provide ullage in glycol reservoir for temperature excursion.
LMP	RAD FLOW CONT PWR - PWR	2	
CDR	PRIM GLY TO RAD - NORM	325	
LMP	RAD PRIM HTR - 1 RAD PRIM OUT TEMP ind - below RAD PRIM IN TEMP ind	2	
CDR	xxx x Outlet temp > than inlet after 5 min PRIM GLY TO RAD - BYP (pull), recheck in 10 min x xxx x	325	ECS primary loop radiators again isolated. In 10 minutes, flow through radiators is attempted once more by repeating procedure.

POSTORBITAL INSERTION CHECK

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STA/T STEP	PROCEDURE	PANEL	REMARKS
CMP	DRINK H2O SUP vlv - ON (CCW)	304	
LMP	ECS RAD tb - gray	2	Gray indicates No. 1 flow proportioning valve controlling flow.
	POT H2O HTR - MNA		
	GLY EVAP IN TEMP - AUTO		
	cb WASTE DUMP HTRS (2) - close	5	
CDR	REPRESS PKG vlv - FILL for 10 sec, then OFF	326	
CMP	REPRESS O2 PRESS ind - >865 psia	602	
	4.3.2.5 <u>Systems Verification and Monitoring</u>		
	1 Mount ORDEAL BOX	13	
	Perform ORDEAL Initialization, 4.8.4.8		
	2 Perform C&WS Oper Check, 4.5.5.1		
	3 Perform SM RCS Mon Check, 4.5.2.2		
	4 Perform CM RCS Mon Check, 4.5.2.3		
CMP,			
LMP	5 Perform EPS Checks, 4.5.3.1 thru 4.5.3.4		
	6 Perform ECS Mon Check, 4.5.4.1		
LMP	7 Perform SPS Mon Check, 4.5.2.1		
	8 cb FC REACS (3) - open (verify) cb COAS/TUNL LTG MNB - close	226	Provides power for right COAS six tunnel lights, and docking spotlight door indicator.

4.3.2.5 POSTORBITAL INSERTION CHECK

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STA/T STEP	PROCEDURE	PANEL	REMARKS
4.3.4.6 Cabin Atmosphere Verification			
LMP 1	CAB PRESS ind - 5.6-6.2 psia & decr	2	Cabin pressure will be 5.6-6.2 psia after launch and continuously decrease until cabin pressure regulator activates and controls pressure to 4.7-5.3 psia.
CDR 2	DIRECT O2 vlv - close (CW)	7	
LMP 3	O2 FLOW ind - 0.2 lb/hr	2	
CMP 4	EMER CAB PRESS sel - BOTH	351	
5	SUIT RETURN vlv - open (pull)	380	
ALL 6	Gloves & helmet removed		
CMP 7	When CAB PRESS ind < 5.3 psia O2 FLOW ind - 1.0 lb/hr O2 FLOW HI lt - on	?	
ALL	MASTER ALARM pb/lt - on, push	1, 3, 1??	After 16-second time delay.
CAUTION			
Opening cb ECS PRESS XDUCER 2 MNB to extinguish O2 FLOW HI lt is a crew option. If exercised, the following redundant functions will be lost.			
C02 PP ind & C/W circuit CAB PRESS ind O2 reg out press (PCM only) GLY EVAP STM PRESS ind O2 FLOW ind			

POSTORBITAL INSERTION CHECK

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STA/T STEP	PROCEDURE	PANEL	REMARKS
LMP 8	cb ECS PRESS XDUCER 2 MNB - open	5	
9	60/40 cab purge complete at 8 hrs after LM isolation following transposition & docking. For 24 hrs after LM isolation following T & D, LM press will be monitored at ≈8-hr intervals using tunnel vent vlv in the LM/CM AP position. At 24 hrs after LM isolation, it will be determined if a Δ cabin purge is required & the length of this purge.		
CMP	WASTE STOW vlv - CLOSE	252	
LMP	cb ECS PRESS XDUCER 2 MNB - close	5	
	O2 FLOW HI lt - out	2	

4.3.2.6

POSTORBITAL INSERTION CHECK

NORMAL BACKUP