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APOLLO 17

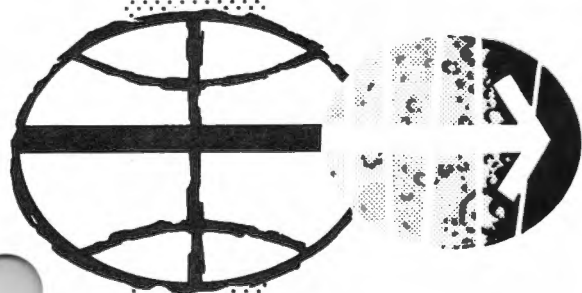
ALL LAUNCH DATES

REVISION A

LM SYSTEMS DATA

PREPARED BY

FLIGHT PLANNING BRANCH
CREW PROCEDURES DIVISION



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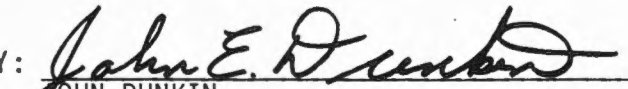
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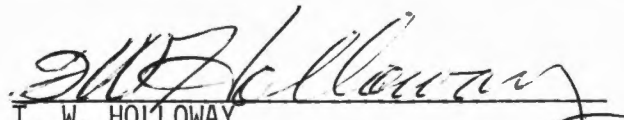
LM SYSTEMS DATA

NOVEMBER 3, 1972

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LM SYSTEMS DATA BOOK

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**Schematic dates shown are the sign-off dates.

***Date shown is the publication date of the CSM Systems Handbook from which these drawings were taken.

11
A

FUNCTIONS
POWERED
THRU CB

EFFECT OF
CB OPENING
(LOSS OF/OR
REMAINING
FUNCTION)

AC BUS B										AC BUS A									
SE WIND HTR	He/PQGS PROPUL DISP	S-BD ANT	ORDEAL	AGS	AOT LAMP	SE FDAI	NUM LTG	BUS TIE		BUS TIE		AC BUS VOLT	CDR WIND HTR	TAPE RCDR	AOT LAMP	RNDZ RDR	DECA GMBL	INTGL LTG	
INV 2	INV 1	INV 2	INV 1																
A-C pwr to LMP window htr	A-C pwr to helium, fuel, & oxid digital ind	A-C pwr to S-BD steerable ant mech drive Assy	A-C pwr to ORDEAL resolvers A-C pwr to ORDEAL pnl lgt	A-C pwr to AEA outputs for FDAI & ORDEAL drive signals	A-C pwr to AOT recticle lamps	A-C pwr to LMP FDAI sphere drive	A-C pwr to all num displays	Connects inv 2 output to AC BUS B thru INVERTER sw	Connects inv 1 output to AC BUS B thru INVERTER sw	Connects inv 2 output to AC BUS A thru INVERTER sw	Connects inv 1 output to AC BUS A thru INVERTER sw	AC BUS A signal characteristics to IS for TM	A-C pwr to CDR window htr	A-C pwr to DSEA tape transport motors	A-C pwr to AOT recticle lamps	A-C pwr to RR pwr supply for genera- tion of 400 cps 2 Ø used for slewing RR ant	A-C pwr to DECA for GDA drive pwr Aux DC to man throttle CKTS & DECA "ATCA pwr monitor" CKTS	A-C pwr to integral lgt (e.g. tb ind, & panels)	
Loss of LMP window defogging	Loss of onboard DPS fuel & oxid qty monitoring Loss of onboard APS helium press monitoring and DPS helium press monitoring (displays blank out)	Loss of S-BD steerable ant S-BD in-flight ant avail thru S-BAND sel	Loss of ORDEAL	Loss of monitoring of AEA outputs with FDAI & ORDEAL	AC BUS A pwr avail	Loss of LMP FDAI att display Error & rate needles still avail CDR FDAI att display avail	Loss of all num displays (including DEDA readout) Loss of RCS PRESS & RNG, RNG RATE ALT, ALT RATE IND, & X- PNTR scales	AC BUS A bus tie inv 2 pwr avail	AC BUS A bus tie inv 1 pwr avail	AC BUS B bus tie inv 2 pwr avail	AC BUS B bus tie inv 1 pwr avail	Loss of onboard monitoring of a-c characteristics Loss of a-c characteristics TM	Loss of CDR window defogging	Loss of recording capability	AC BUS B pwr avail	Loss of RR ant slew & track capability	GDA freezes at last position Man throttle range limited to ~83% (if DES ENG CMD OVRD-ON open DECA PWR cb for max throttle) ATCA pwr fail monit ct in DECA disabled (fail safe to 100% unavailable)	Loss of tb & ind lgt	

Legend

————— Designates DUAL POWER to function

----- Designates SIMILAR functions

————— Designates DIFFERENT functions

11
B

FUNCTIONS
POWERED
THRU CB

EFFECT OF
CB OPENING
(LOSS OF/OR
REMAINING
FUNCTION)

RCS SYS A					FLIGHT DISPLAYS										AC BUS A		
MAIN SOV	QUAD 4 TCA	QUAD 3 TCA	QUAD 2 TCA	QUAD 1 TCA	ASC FEED 2	ASC FEED 1	THRUST	MISSION TIMER	CDR X-PNTR	RNG/RNG RT ALT/ALT RT	GASTA	CDR FDAI	COAS	ORDEAL	RNG/RNG RT ALT/ALT RT	GASTA	CDR FDAI
Pwr to sys A main fuel & oxid sov thru SYS A MAIN SOV sw	Pwr to prplnt vlvs prim coils of sys A quad 4 TCA (A4D & A4R)	Pwr to prplnt vlvs prim coils of sys A quad 3 TCA (A3R & A3U)	Pwr to prplnt vlvs prim coils of sys A quad 2 TCA (A2D & A2A)	Pwr to prplnt vlvs prim coils of sys A quad 1 TCA (A1U & A1F)	Pwr to sys A sec APS prplnt interconnect vlvs thru SYS A ASC FEED 2 sw	Pwr to sys A prim APS prplnt interconnect vlvs thru SYS A ASC FEED 1 sw	Pwr to eng THRUST ind Pwr to aux switching relay box thru ENG THRUST CONT THR CONT sw	Pwr to MISSION TIMER ind	Pwr to CDR X-pointer ind Pwr to aux switching relay box thru MODE SEL & RATE/ERR MON sw	Pwr to RNG, RNG RATE, ALT, ALT RATE ind drive motor	Pwr to GASTA	Pwr to CDR FDAI Pwr to aux switching relay box thru RATE/ ERR MON & ATTITUDE MON sw	Pwr to fwd or ovhd COAS mount thru COAS sw	Pwr to ORDEAL stepper motor thru EARTH/ LUNAR sw	Pwr to RNG, RNG RATE ALT, ALT RATE ind logic	Pwr to GASTA resolvers	Pwr to CDR FDAI sphere drive
Cannot change sys A main sov status (Normally Open) Note RCS sys A will not use APS prplnts if sov are open	Loss of prim auto & man cont of sys A quad 4 TCA's (hardover, AGS direct, & +X-transl cont avail thru sec coils) LMP BUS Critical	Loss of prim auto & man cont of sys A quad 3 TCA's (hardover, AGS direct, & +X-transl cont avail thru sec coils)	Loss of prim auto & man cont of sys A quad 2 TCA's (hardover, AGS direct, & +X-transl cont avail thru sec coils)	Loss of prim auto & man cont of sys A quad 1 TCA's (hardover, AGS direct, & +X-transl cont avail thru sec coils) LMP BUS Critical	Cannot change status of sec pair of sys A APS interconnect vlvs (ASC feed 2 vlv Normally Closed)	Cannot change status of prim pair of sys A APS interconnect vlvs (ASC feed 1 vlv Normally Open)	Loss of eng THRUST ind Loss of switching relays	Loss of MISSION TIMER ind	Loss of CDR X-pointer ind Loss of switching relays Loss of AEA & LDG RDR lat vel & LDG RDR fwd vel on LMP X-pntr also LDG RDR & AGS alt data on RNG/ALT ind	Loss of RNG, RNG RATE, ALT, ALT RATE ind	Loss of GASTA Computer servo Loss of IMU att data to FDAI's	Loss of CDR FDAI Loss of switching relays	Loss of COAS reticle lt	Loss of ORDEAL stepper motor Loss of local horiz reference	Loss of RNG, RNG RATE ALT & ALT RATE ind	Loss of PGNS gimbal angle display Loss of PGNS att display	Loss of CDR FDAI att display Error & rate needles still avail LMP FDAI att display avail

11 C	HEATERS																		INST		STAB/CONT				ED		LTG	
	URINE LINE	RNDZ RDR		LDG RDR	DOCK WINDOW	AOT	SIG CONDR 1	AEA	ABORT STAGE	ATCA (PGNS)	AELD	ENG CONT	ATT DIR CONT	ENG START OVRD	DECA PWR	LDG GEAR FLAG	LOGIC PWR A	UTIL	ANUN/DOCK/ COMPNT									
FUNCTIONS POWERED THRU CB	Pwr to urine line htr to prevent freeze- up of vent tube valve	Pwr to RR ant htr cont ckt to maintain ant above min survival temp	Pwr to RR htr cont ckt for ant & electronics assy	Pwr to LR htr cont ckt to maintain ant above min survival temp	Pwr to docking window htr	Pwr to AOT htrs	Pwr to ERA 1 in SCEA	Pwr to AEA pwr supply for internal use & DEDA pwr	Rdnt to LMP ABORT STAGE cb: 1) Batt switch over. 2) LGC/AEA abort stage in-bit Not rdnt to LMP ABORT STAGE CB: 1) AUTO ENG ON bypass of STOP pbs & ENG ARM sw. 2) Inhibit of ED RELAYS caut.	Loss of PGNS RCS firing. Cannot switch from AGS to PGNS. RCS firings not affected in AGS.	Pwr for: APS on cmd (rdnt to LMP AELD). Staging cmd to ED SYS A when APS on Auto select of AGS min db & 4 Jet att cont (rdnt to switches & LMP AELD)	Pwr to various CES ckts.	Pwr to ACA for hardover & direct modes (powers RCS secondary coils) Enabling pwr for AGS pulse mode Pwr to +X TRANSL pb (powers RCS secondary coils)	Pwr to eng START pb Pwr to DES ENG CMD OVRD sw & ENG ARM sw for man APS ign (Rdnt to LMP DISP/ENG OVRD LOGIC cb)	Pwr to des eng & cont logic of DECA	Pwr to LDG GEAR DEPLOY tb	Pwr to EDS sys A	Pwr to portable util lts thru CDR & LMP UTILITY LIGHTS sw	Pwr to caut & warn anun, eng START & STOP, comp caut, pwr fail, & DSKY status lts Pwr to docking lts thru EXTERIOR LTG & LM/ SLA press sw Pwr to DEDA OPR ERR lt									
EFFECT OF CB OPEN- ING (LOSS OF/OR RE- MAINING FUNCTION)	Loss of htrs causes gradual degradation of urine collection capability	If RR temp below min survival temp, permanent degradation results CB not essential when RR OPR cb is closed	Loss of RR, or degradation of response	If LR temp below min survival temp, permanent degradation results CB not required when cb PGNS; LDG RDR is closed	Loss of window defrosting & defogging	Loss of AOT defrosting	Loss of ERA 1 (approx half oper data)	LMP AEA cb avail	Abort staging avail with ABORT STAGE pb and ENG ARM sw. If ABORT STAGE pb is pushed, the DPS will shut-down with an ED RELAYS caut lt. APS ign/staging will not occur until ENG ARM sw-ASC. At APS ign ED RELAYS caut lt goes out. Do not dearm APS prior to shut-down. Use man shut-down procedure.	Loss of PGNS cont Prim pwr provided with LMP ATCA cb Cannot switch from AGS to PGNS RCS firings not affected in AGS LMP BUS Critical	LMP AELD cb avail. Loss of APS on sig to ED SYS A (APS on sig from LMP AELD cb to ED SYS B avail). LMP BUS Critical	Loss of eng STOP pb. Loss of START pb for DES ENG Loss of AGS GOA drive (fails to PGNS GOA drive) Loss of pwr to the ABORT pb to arm the DPS (ENG ARM sw using LMP ENG ARM cb pwr avail). Loss of rdnt power to ENG ARM sw. (LMP ENG ARM cb avail) Loss of LUNAR CONTACT lt on panel 2 Loss of eng gimbal disable Loss of auto throttle disable Loss of auto select of AGS min db & 4 Jet att cont for DPS burns (rdnt to switches) LMP BUS Critical (PDI only)	Loss of ACA hardover Loss of AGS direct & pulse modes (fails ATTITUDE CONTROL sws to MODE CONTROL). Loss of +X TRANSL pb (TTCA's avail) (Man att cont avail via att hold/rate cmd & PGNS min impulse modes)	Loss of eng START pb for DPS and APS (DES ENG CMD OVRD sw & auto eng start avail) LMP BUS Critical	Loss of auto & man DPS start & DPS throt (DES ENG CMD OVRD sw avail-goes to 100% thrust) Loss of She SQUIB vlv firing capab Loss of GDA fail Ckt (GDA fail sig to C&W, LGC, & TLM not avail) Loss of auto sel of AGS min db & 4 Jet att cont (switches avail)	Loss of LDG GEAR DEPLOY tb LMP BUS Critical For man stage vent H1 PLSS fill with PLSS O ₂ vent cap (RHSSC)	Loss of EDS sys A EDS sys B avail LMP BUS Critical	Loss of portable util lts	Loss of docking lts (During TD & E, no backup) Loss of Anun lighting LMP's ANUN/DOCK/ COMPNT cb avail after TD & E Loss of DEDA OPR ERR lt									

LEGEND

- Designates DUAL POWER to function
 - - - - - Designates SIMILAR functions
 ===== Designates DIFFERENT functions

11 D	HEATER RCS SYS A/B-1				ECS				COMM				PGNS								
	QUAD 4	QUAD 3	QUAD 2	QUAD 1	SUIT FAN 1	CABIN FAN	2	1	AUTO TRNFR	UP DATA LINK	XMTR/RCVR	PWR AMPL	VHF B XMTR	VHF A RCVR	CDR AUDIO	SIG STR DISP	LDG RDR	RNDZ RDR	LGC/DSKY	IMU STBY	IMU OPR
FUNCTIONS POWERED THRU CB	Pwr to sys A/B-1 htr for each TCA of cluster 4	Pwr to sys A/B-1 htr for each TCA of cluster 3	Pwr to sys A/B-1 htr for each TCA of cluster 2	Pwr to sys A/B-1 htr for each TCA of cluster 1	Pwr to suit fan No. 1 (suit ckt assy) thru SUIT FAN sel	Pwr to cabin fan thru ECS relay box	Pwr to glycol pump No. 2 thru GLYCOL sel	Pwr to glycol pump No. 1 thru GLYCOL sel	Energizes transfer relay to auto switch to pump No. 2 when pump No. 1 ΔP drops below preset value	Pwr to DUA pwr supply	Pwr to sec pwr supply in S-BD xcvr thru XMTR/RCVR sw Pwr to PMP for emer key and VOICE BU functions	Pwr to sec pwr supply in S-BD pwr ampl thru PWR AMPL sw	Pwr to VHF B xmtr voice & data ckts thru VHF B XMTR sw	Pwr to VHF A rcvr thru VHF A RCVR sw	Pwr to CDR audio center	Pwr to SIGNAL STRENGTH ind	Pwr to LR pwr supply Interrupts pwr to htr cont ckt	Pwr to RR electronics assy	Pwr to LGC & PSA pwr supplies	Pwr to IMU temp cont ckt	Pwr to IMU, PSA, CDU, & PTA
EFFECT OF CB OPENING (LOSS OF/OR REMAINING FUNCTION)	Loss of set of htrs in cluster 4 (sys A/B-2 htrs avail, longer warmup required)	Loss of set of htrs in cluster 3 (sys A/B-2 htrs avail, longer warmup required)	Loss of set of htrs in cluster 2 (sys A/B-2 htrs avail, longer warmup required)	Loss of set of htrs in cluster 1 (sys A/B-2 htrs avail, longer warmup required)	Life support system degraded Backup is SUIT FAN sel - 2	Loss of cabin fan	Loss of prim loop redundancy To activate sec loop, WATER TANK SELECTOR vlv - SEC, GLYCOL sel - INST (SEC), SEC EVAP FLOW vlv - OPEN, GLYCOL PUMP SEC cb - close, PRIM EVAP FLOW #1 - closed	Loss of glycol pump No. 1 (if AUTO TRNFR cb closed, glycol pump No. 2 auto activated) Auto transfer relay switch to pump No. 2 (To disable GLYCOL comp caut lt, manually switch GLYCOL sel - PUMP 2)	Loss of auto transfer Manually select pump: GLYCOL sel - PUMP 1 or PUMP 2	Loss of digital uplink capability Loss of received S-bd backup voice Prime voice avail	Prim S-BD xcvr avail Loss of sec S-BD xcvr Loss of Emer key	Loss of sec S-BD pwr ampl Prim pwr ampl avail	VHF A xmtr voice ckts avail Loss of data & voice transmission via VHF B	VHF B rcvr avail Loss of voice reception on VHF A	Loss of relay capability CDR must use LMP audio center Loss of all VHF B xmtr voice	Loss of onboard LR & RR monitoring	Loss of LR	Loss of RR	Loss of PGNS Loss of 1.024-mc clock AGS avail LMP BUS Critical	Loss of PIPA & IRIG htrs, temp alarm thermostat IMU accuracy degraded	Loss of IMU, PSA, CDU, & PTA Loss of ISS & att data to LGC & ind LGC avail, but cannot perform all functions Loss of manual throttle in PGNS mode LMP BUS Critical

11 E	E1'S												PROPUL
	BAT FEED TIE	CROSS TIE		BAL LOADS	BUS	LUNAR BUS TIE	DES ECA CONT	DES ECA	ASC ECA CONT	ASC ECA	INV 1	DC BUS VOLT	DES HE REG/VENT
FUNCTIONS POWERED THRU CB	Connects bat No. 3 or lunar bat, & bat No. 4 & 6 to CDR d-c bus During bat No. 5 backup, also connects bat No. 5 to CDR d-c bus	Redundant cb	Supplies redundant pwr to CWEA, EPS disp, sig sensor, sig cond #2, & PCM/TE Connects CDR bus to LMP bus thru LMP CROSS TIE cb	Backup cb	Connects CDR neg bus to neg lunar bus for LM ground	Pwr from CDR bus to low- and high-voltage coils in ECA No. 1 & 2 thru HI VOLTAGE & LOW VOLTAGE sw Pwr to des bats lv/hv off & deadface relay reset for abort stage	Pwr from CDR bus to pwr supplies of both des ECA's for current & reverse current ind & O/C protection Pwr to relays for abort stage	Pwr from CDR bus to norm & backup main feed contactor coils in ECA No. 3 & 4 thru NORMAL FEED & BACK UP FEED sw to switch off asc bats Pwr to DES BATS sw	Pwr from CDR bus to pwr supplies of both asc ECA's for current & reverse current ind & O/C protection	Pwr from CDR bus to inv No. 1 for generation of 115V, 400-cps, a-c pwr, thru INVERTER sw	Pwr from CDR bus to IS, & to monitor bus voltage for telemetry & warn lt Pwr to PCM/TE, sig sensors & sig condrs via relay 4K6 for prelaunch telemetry	Pwr to DPS helium solenoid vlvs thru DES He REG 1 & 2 sw Pwr to DPS prplnt vent solenoid vlvs thru DES FUEL & OXID VENT sw	
EFFECT OF CB OPENING (LOSS OF/OR REMAINING FUNCTION)	Adjacent cb avail	Adjacent cb avail	Loss of LMP bus when CSM powers LM results in loss of AGS & possible loss of S-bd steerable ant	Only elosed in event of feeder short when powering LMP bus thru CDR bus, or vice versa	No loss of function; relay contacts in parallel with cb	Redundant cb on LMP panel supplies pwr from LMP bus	Redundant cb on LMP panel supplies pwr from LMP bus	Redundant cb on LMP panel supplies pwr from LMP bus	Redundant cb on LM panel supplies pwr from LMP bus	Inv No. 2 avail thru INVERTER sw (pwr from LMP bus to inv No. 2)	Loss of monitoring of CDR bus Loss of prelaunch telemetry	Cannot change status of helium solenoid vlv (Prim: Normally Open, Sec: Normally Closed dur- ing normal mission operation) Cannot change status of solenoid vent vlvs	

LEGEND

- Designates DUAL POWER to function
- Designates SIMILAR functions
- Designates DIFFERENT functions

16
A

FUNCTIONS
POWERED
THRU CB

EFFECT OF
CB OPENING
(LOSS OF/OR
REMAINING
FUNCTION)

FLT DISP				RCS SYS B								PROPUL		
EVENT TIMER/ SE FDAI	SE X-PNTR	ASC FEED 1	ASC FEED 2	QUAD 1 TCA	QUAD 2 TCA	QUAD 3 TCA	QUAD 4 TCA	CRSFD	TEMP/PRESS DISP - FLAGS	PQGS/ DISP	MAIN SOV	DISP/ENG OVRD LOGIC	PQGS	ASC He REG
Pwr to EVENT TMR ind Pwr to LMP FDAI Pwr to aux switching relay box thru RATE/ ERR MON & ATTITUDE MON sw	Pwr to LMP X pointer ind PWR to aux switching relay box thru RATE/ ERR MON sw	Pwr to sys B prim APS prplnt interconnect vlvs thru SYS B ASC FEED 1 sw	Pwr to sys B sec APS prplnt interconnect vlvs thru SYS B ASC FEED 2 sw	Pwr to prplnt vlvs prim coils of sys B quad 1 TCA (B1L & B1D)	Pwr to prplnt vlvs prim coils of sys B quad 2 TCA (B2L & B2U)	Pwr to prplnt vlvs prim coils of sys B quad 3 TCA (B3A & B3D)	Pwr to prplnt vlvs prim coils of sys B quad 4 TCA (B4F & B4U)	Pwr to prplnt crossfeed vlvs thru CRSFD sw	Pwr to RCS TEMP & PRESS ind thru TEMP/PRESS MON sel & to all RCS tb	Pwr to RCS sys A & sys B prplnt qty computers & QUANTITY ind	Pwr to sys B main fuel & oxid sov thru SYS B MAIN SOV sw	Pwr to MPS: FUEL & OXID TEMP & PRESS ind thru PRPLNT TEMP/PRESS MON sw & to all MPS tb Redundant pwr to eng arm circuits for manual asc eng arm & des cmd ovrd	Pwr to DPS prplnt qty gaging sys cont unit thru PRPLNT QTY MON sw	Pwr to APS helium solenoid vlv thru ASC He REG 1 & 2 sw
Loss of EVENT TIMER ind Loss of LMP FDAI Loss of switching relays	Loss of LMP X pointer ind Loss of switching relays	Cannot change status of prim pair of APS interconnect vlvs (ASC FEED 1 vlv Normally Open)	Cannot change status of sec pair of APS interconnect vlvs (ASC FEED 2 vlv Normally Closed)	Loss of prim auto & man cont of sys B quad 1 TCA's (hardover, AGS direct, & +X- transl cont avail thru sec coils) CDR BUS Critical	Loss of prim auto & man cont of sys B quad 2 TCA's (hardover, AGS direct, & +X- transl cont avail thru sec coils) CDR BUS Critical	Loss of prim auto & man cont of sys B quad 3 TCA's (hardover, AGS direct, & +X- transl cont avail thru sec coils) CDR BUS Critical	Loss of prim auto & man cont of sys B quad 4 TCA's (hardover, AGS direct, & +X- transl cont avail thru sec coils) CDR BUS Critical	Cannot change status of crsfd vlvs (Normally Closed)	Loss of onboard monitoring of RCS prplnt temp & press, & helium press (Pwr fail light above PRESS ind goes on) Loss of monitoring of RCS vlv status (tb indicates pwr off)	Loss of onboard monitoring of RCS sys A & sys B prplnt qty (Pwr fail light above ind goes on)	Cannot change sys B main sov status (Normally Open) Note RCS sys B will not use APS prplnts if sov are open	Loss of onbd monit of DPS & APS prplnt temp & press. Loss of APS & DPS He reg tbs (4) & DPS vent vlv tbs (2). Loss of rdnt pwr to: man ASC ENG on logic & DES ENG CMD OVRD sw (Both rdnt to CDR ENG START OVRD cb).	Loss of onboard monitoring of DPS prplnt qty	Cannot change status of helium solenoid vlv (Normally Open)

LEGEND

- Designates DUAL POWER to function
- Designates SIMILAR functions
- Designates DIFFERENT functions

16
B

FUNCTIONS
POWERED
THRU CB

EFFECT OF
CB OPENING
(LOSS OF/OR
REMAINING
FUNCTION)

LTG				ED	STAB/CONT						INST				ECS		
FLOOD	TRACK	ANUN/DOCK/ COMPNT	MASTER ALARM	LOGIC PWR B	AEA	ENG ARM	ASA	AELD	ATCA	ABORT STAGE	ATCA (AGS)	DES ENG OVRD	CWEA	SIG SENSOR	PCM/TE	SIG COND 2	SUIT FLOW CONT
Pwr to cabin pnl, fwd & ovhd flood lts thru FLOOD sw Pwr to cabin fwd & ovhd lt thru docking hatch sw	Pwr to tracking lt thru EXTERIOR LTG sw & tracking lt electronics assy	Pwr to caut & warn anun, eng START & STOP, docking thru EXTERIOR LTG sw, comp caut, ind pwr fail, & DSKY status lts Pwr to DEDA OPR ERR lt	Pwr to MASTER ALARM lt & tone gen	Pwr to EDS SYS B Pwr to DES ENG CMD OVRD sw	Pwr to AEA pwr supply for internal use & DEDA pwr	(ENG ARM sw - DES) Pwr to des eng actuator isol vlvs thru DECA relays (ENG ARM sw - ASC) Pwr to AELD to enable asc eng ignition Pwr to relay drivers for auto APS & DPS cont logic	Pwr to ASA pwr supply & ASA heaters	Pwr for: APS on cmd (rdnt to CDR AELD cb) Staging cmd to ED SYS B when APS on APS auto start (rdnt to LMP ENG ARM CB)	Pwr to ATCA pwr sup for ATCA & DECA pwr. Pwr to LUNAR CONTACT lt on pnl 3 Rdnt noise supression bias to jet drivers under PGNS & ATCA control	Rdnt to CDR ABT STG cb: 1) Batt sw over 2) LGC/AEA abt stg in-bit Not rdnt to CDR ABT STG 1) Pwr to stop DPS via ABORT STAGE pb. 2) APS arm via ABORT STAGE pb.	Pwr to enable abort preamps Pwr to enable both AGS TTCAs Pwr to S&C cont assy for guid cont switching Provides gyro test pwr	Redundant pwr to actuator isol & pilot vlvs of DES ENG.	Pwr to CWEA	Pwr to all subsys sensors	Pwr to PCMTEA	Pwr to ERA 2 in SCEA	Pwr to suit isol vlv solenoid for auto closure
Loss of flood lts	Loss of tracking lt	Loss of caut & warn anun, eng START & STOP, docking, comp caut, ind pwr fail, & DSKY status lts Alternative is CDR CB LTG: ANUN/DOCK/ COMPNT Loss of DEDA OPR ERR lt	Loss of MASTER ALARM lt and audio tone	Loss of EDS SYS B (EDS SYS A avail) Loss of DES ENG CMD OVRD sw CDR BUS Critical (PCI only) For man stage vent H1 PLSS fill with PLSS O ₂ vent cap (RHSSC)	CDR AEA cb avail	Loss of auto eng start and stop capability for APS and DPS (START and STOP pbs avail). Loss of rdnt DPS/APS arm pwr for man starts: (DPS arm pwr avail from CDR ENG CONT cb) (APS arm pwr avail from CDR ENG START OVRD cb). CDR BUS Critical	Loss of AGS AUTO/ATT HOLD modes (Pulse, dir, CES rate cmd & PGNS modes avail with AEA cbs open) Loss of AEA	CDR AELD cb avail. Loss of APS on sig to ED SYS B (APS on sig from CDR AELD cb to ED SYS A avail) Loss of auto sel of AGS min db & 4 Jet att cont (rdnt to sws & CDR AELD) CDR BUS Critical	Loss of auto APS cont (man eng on/off cont avail) Loss of gmb1 & throt capability (DPS goes to max thrust) Loss of AGS att cont & transl modes (only "DIR" available) Loss of RR auto track & slew modes (LGC modes avail) Loss of FDAI RGA rate ind & AGS error ref. Loss of LUNAR CONTACT lt on pnl 3	Abort staging avail with ABORT STAGE pb and ENG ARM sw. If ABORT STAGE pb is pushed DPS shutdown/APS ign/staging will not occur until ENG ARM sw- ASC. Do not dearm APS prior to shutdown. Use man shutdown procedure. Loss of 400 ms time delay between DPS shut-down & staging/APS ign. CDR BUS Critical	Loss of AGS RCS firing Cannot sw from PGNS to AGS. PGNS RCS firing unaffected Loss of RGA test CDR BUS Critical	Loss of des eng override CDR BUS Critical (PDI only)	Loss of CWEA Most malfunctions are monitored by MSFN via telemetry: some are monitored on cabin ind	Loss of approx 40 subsys sensors MSFN & vehicle: DES & ASC oxygen, oxid manifold, suit, cabin, & all DPS, APS, RCS pressure	Loss of telemetry to MSFN Loss of voice & data S-bd sub- carriers, Rng/Alt ind, emer key, inv timing, DSEA ind, & ATCA	Loss of ERA 2: (approx- half oper data)	Loss of torn suit protection

16 C	COMM																ECS	
	DISP	SE AUDIO	VHF A XMTR	VHF B RCVR	PWR AMPL	XMTR/RCVR	S-BD ANT	PMP	TV	DISP	GLYCOL PUMP SEC	LCG PUMP	CABIN FAN CONT	CABIN REPRESS	SUIT FAN 2	SUIT FAN ΔP	DIVERT VLV	CO ₂ SENSOR
FUNCTIONS POWERED THRU CB	Pwr to COMM ANT; PITCH, YAW, & SIGNAL STRENGTH ind	Pwr to LMP audio center	Pwr to VHF A xmtr pwr supply	Pwr to VHF B rcvr	Pwr to prim pwr supply in S-BD pwr ampl thru PWR AMPL sw	Pwr to prim pwr supply in S-BD xcvr thru XMTR/RCVR sw	Pwr to S-BD steerable ant	Pwr to PMP pwr supply Pwr to spacesuit biomed ckts thru BIOMED sw & umbilicals		Pwr to all ECS ind	Pwr to backup glycol pump in coolant recirculation assy (Not normally used in flight, except in emergency or checkout modes)	Pwr to LCG pump	Turns off cabin fans when PRESS REG A or B in EGRESS	Pwr to CABIN REPRESS vlv & CABIN warn lt	Pwr to suit fan No. 2 (suit ckt assy) thru SUIT FAN sel	Pwr to fan ΔP sensor (ind function only)	Pwr to SUIT GAS DIVERter vlv for auto closure caused by low cabin press or by PRESS REG A or B vlv - EGRESS	Pwr to CO ₂ sensor
EFFECT OF CB OPENING (LOSS OF/OR REMAINING FUNCTION)	Loss of S-BD ant pitch & yaw position indications & S-BD received signal strength indication	Loss of relay mode LMP must use CDR audio center Loss of DSEA and VHF-A XMTR	Loss of VHF A ranging & VHF A voice	Loss of VHF B ranging Loss of EVA data Loss of VHF B received voice	Loss of prim S-BD pwr ampl Sec pwr ampl avail	Loss of prim S-BD XCVR Sec S-BD xcvr avail	Loss of S-BD steerable ant S-BD comm thru omni ant avail	Loss of S-BD biomed, PCM, downlink voice, & EMU data, except emergency key & backup voice		Loss of all ECS cabin ind	Loss of sec coolant loop	Loss of circulation thru LCG from LM	Loss of cabin fan auto shutoff Turn off fan by opening fan cb	Loss of auto cabin repress mode; manual mode avail Loss of indication of low cabin press (CABIN warn lt), CABIN PRESS ind avail	Loss of suit fan No. 2 (suit ckt assy) - if not in cabin mode, remove helmet & breath cabin air. After period of time, flush cabin air In egress mode PRESS REG A & B vlv - DIRECT O ₂	Loss of indication for failure of suit fan No. 1 or 2	Loss of auto vlv closure; manual mode avail	Loss of CO ₂ ind. CO ₂ comp caut lt, & TM
LEGEND ————— Designates DUAL POWER to function - - - - - Designates SIMILAR functions ———— Designates DIFFERENT functions																		

16 D	HEATERS																			EPS										CROSS TIE		BAT FEED TIE	
	MESA	QUAD 1	QUAD 2	QUAD 3	QUAD 4	DISP	S-BD ANT	CAMR SEQ	DISP	DC BUS VOLT	INV 2	ASC ECA	ASC ECA CONT	DES ECA	DES ECA CONT	XLUNAR BUS TIE	BUS	BAL LOADS															
FUNCTIONS POWERED THRU CB	Pwr to six hrs on MESA	Pwr to sys A/B-2 htr for each TCA of cluster 1 thru HTR CONT: RCS SYS A/B 2 QUAD 1 sw	Pwr to sys A/B-2 htr for each TCA of cluster 2 thru HTR CONT: RCS SYS A/B 2 QUAD 2 sw	Pwr to sys A/B-2 htr for each TCA of cluster 3 thru HTR CONT: RCS SYS A/B 2 QUAD 3 sw	Pwr to sys A/B-2 htr for each TCA of cluster 4 thru HTR CONT: RCS SYS A/B 2 QUAD 4 sw	Pwr to HTR CONT: TEMP ind	Pwr to S-bd ant hrs	Pwr to sequence camera	Pwr from LMP bus to AMPs & VOLTS ind, & to th	Pwr from LMP bus to IS, to DC BUS FAULT comp caut lt, & to monitor bus voltage for TM & warn lt	Pwr from LMP to inv No. 2 for generation of 115V, 400-cps, a-c pwr, thru INVERTER sw	Pwr from LMP bus to pwr supplies of both asc ECA's for current & reverse current ind & O/C protection	PWR from LMP bus to norm & backup main feed contactor coils in ECA No. 3 & 4 thru NORMAL FEED & BACK UP FEED sw to switch off asc bats Pwr to DES BATS sw	Pwr from LMP bus to pwr supplies of both des ECA's for current & reverse current ind & O/C protection Pwr to relays for abort stage	Pwr from LMP bus to low & high voltage coils in ECA No. 1 & 2 thru HI VOLTAGE & LOW VOLTAGE sw Pwr to des bats lv/hv off & deadface relay reset for abort stage	Connects LMP neg bus to neg xlunar bus for LM ground	Backup cb	Connects LMP bus to CDR bus thru CDR CROSS TIE cb	Connects bat No. 2 or lunar bat, & bat No. 1 & 5 to LMP d-c bus During bat 6 backup also connects bat No. 6 to LMP d-c bus	Redundant cb													
EFFECT OF CB OPENING (LOSS OF/OR REMAINING FUNCTION)	Loss of hrs with possible degradation of items requiring temp stabilization	Loss of set of hrs in cluster 1 (sys A/B-1 hrs avail; longer warmup required)	Loss of set of hrs in cluster 2 (sys A/B-1 hrs avail; longer warmup required)	Loss of set of hrs in cluster 3 (sys A/B-1 hrs avail; longer warmup required)	Loss of set of hrs in cluster 4 (sys A/B-1 hrs avail; longer warmup required)	Loss of onboard monitoring of temp of RCS cluster, LR, RR temp, & S-BD ant	If S-bd ant temp below min survival temp, permanent degradation results	Loss of sequence camera	Loss of onboard bus & bat monitoring	Loss of monitoring of LMP bus	Inv No. 1 avail thru INVERTER sw (Pwr from CDR bus to inv No. 1)	Redundant cb on CDR panel supplies pwr from CDR bus	Redundant cb on CDR panel supplies pwr from CDR bus	Redundant cb on CDR panel supplies pwr from CDR bus	Redundant cb on CDR panel supplies pwr from CDR bus	No loss of function; relay contacts in parallel with cb	Only closed in event of feeder short when powering LMP bus thru CDR bus, or vice versa	BUS CROSS TIE cb avail	Adjacent cb avail	Adjacent cb avail													

SYSTEMS SCHEMATICS
THE CONTENTS WILL CONSIST OF REPRINTS OF THE FOLLOWING
DRAWINGS FROM THE LM AND LRV SYSTEMS HANDBOOKS

- 3.1 LIGHTING
- 4.1 PYROTECHNIC
- 5.2 DESCENT ELECT DC POWER
- 5.3 ASCENT ELECT DC POWER
- 5.4 ELECT AC POWER
- 6.1 ECS O2 SUPPLY/SUIT LOOP
- 6.2 ECS H2O SUPPLY/GLYCOL LOOP
- 7.1 EMU DETAIL
- 8.2 COMM
- 8.3 COMM RF
- 8.4 COMM SPA
- 9.4 C&W INSTR
- 9.5 INSTR C&W WARNING
- 9.6 INSTR C&W CAUTION
- 10.2 G&N OVERVIEW
- 10.3 SCS OVERVIEW
- 10.18 AGS SIGNAL FLOW
- 10.20 RCS SIGNAL FLOW
- 12.1 RCS MECHANICAL
- 10.21 DESCENT ENGINE SIGNAL FLOW
- 10.23 DPS THROTTLING SIGNAL FLOW
- 11.1 DPS MECHANICAL
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- 11.2 APS MECHANICAL
- 1.15 SIM BAY VIEWS
- 1.16 SIM BAY VIEWS
- 4.3 SUSPENSION
- 4.6 STEERING MECHANICAL
- 4.7 LRV STEERING ELECTRONICS
- 4.8 LRV DRIVE CONTROL ELECTRONICS
- 5.3 SENSORS, DISPLAYS, AND SWITCHING
- 6.2 ELECT POWER, CONTROL, and DISTR
- 13.2 LCRU