

NO	ALIGNMENT			N93 ANGLES			ΔT HRS	IBDM			GYRO DRIFT %HR.			NB DL		
	OPTION	TYPE	GET	X	Y	Z		X	Y	Z	X	Y	Z	X	Y	Z
1	3	REF	00+50+00	-0.019	+0.021	+0.039	0.833	+1.52	-1.68	3.12	+0.023	-0.025	+0.047	+2.0	-2.8	-7.6
2	3	TLC REF	05+30+00	-0.102	-0.013	+0.166	4.7	+1.46	+0.9	2.27	1.222	+0.014	0.036	—	—	—
	1	PTC	05+32+00													
3	3	TLC PTC	11+15+15	-0.096	-0.088	+0.191	5.72	+1.119	+1.026	2.109	+0.018	+0.015	+0.036			
4	3	TLC REF	27+23+30	-0.329	-0.256	+0.574	16.14	+1.359	+1.057	+2.371	+0.020	+0.016	0.036			
4	—	—	27+55+00	—	—	—								3.24	-1.84	-2.39
5	3	TLC REF	55+21+19	-0.021	-0.034	+0.016	27.96	+0.050	+0.081	+0.038	+0.0008	+0.001	+0.006			
6	3	TLC PTC	72+52+23	+0.012	-0.051	+0.015	17.52	+0.046	-0.194	+0.057	-0.0007	+0.0029	+0.0009			
7	3	PTC	73+11+15	+0.025	-0.011	+0.001	2.37	+1.5	+2	+1.8	+0.027	-0.030	+0.003	GET should be 75+14+00		
	1	LOI	75+19+00	—	—	—										
8	3	LO	80+04+00	-0.018	-0.006	+0.004	4.75	+0.025	+0.005	-0.006	+0.004	+0.001	-0.0008			
	1	LS	80+10+00	—	—	—										
7	3	PTC	75+14+09	+0.025	-0.011	+0.001	2.36	+0.005	-0.310	+0.028	-0.011	-0.005	+0.0004			

NO	ALIGNMENT			N/93 ANGLES			ΔT	BDM			GYRO DRIFT %HR.			NBDL		
	OPTION	TYPE	GET	X	Y	Z		X	Y	Z	X	Y	Z	X	Y	Z
1	1	LO	80+10											3.24	-1.84	-2.39
9 2	3	LO REF	82+02	+0.009	-0.007	+0.000	1.86	-0.321	+0.250	+0.000	+0.005	-0.004	—	—	—	—
10	3	LS REF	83+55+25	+0.005	+0.004	-0.002	1.89	+0.176	+0.141	-0.070	-0.003	-0.002	-0.001	—	—	—
11	3	LS REF	95+13+00	+0.022	-0.032	+0.038	11.29	-0.13	+0.19	+0.22	-0.002	+0.003	+0.003	—	—	—
12	3	LS REF	97+55+00	-0.010	-0.009	-0.025	2.37	+0.281	+0.254	-0.004	-0.001	-0.011	—	—	—	—
13	3	LS	123+00	+0.022	-0.005	+0.009	5.41	-0.283	+0.062	+0.110	+0.004	-0.001	-0.002	—	—	—
14	3	LS	105+12	+0.012	-0.011	+0.023	2.2	-0.364	+0.533	+0.697	+0.005	-0.005	+0.010	—	—	—
15	3	LS	109+07	+0.015	-0.004	-0.014	3.92	-0.26	+0.07	-0.24	-0.004	+0.001	-0.004	—	—	—
16	3	REF LS	119+05+00	-0.028	-0.053	+0.017	9.97	+0.187	+0.388	+0.114	-0.003	-0.006	+0.002	—	—	—
17	3	REF LS	126+48+00	-0.050	-0.007	+0.011	7.63	-0.427	+0.061	+0.16	+0.006	-0.0009	+0.001+	—	—	—
18	3	REF LS	130+38+00	-0.016	-0.005	-0.017	3.97	-0.269	+0.084	-0.286	+0.004	-0.001	-0.004	—	—	—
19	3	REF LS	140+49+00	-0.004	-0.050	+0.041	10.18	+0.026	+0.327	+0.268	-0.0004	-0.0049	+0.004	—	—	—
20	3	REF LS	152+46+00	+0.023	-0.031	+0.000	11.95	-0.156	+0.173	+0.000	+0.002	-0.000	+0.000	—	—	—
21	3	REF LS	162+19+00	-0.014	-0.044	+0.016	9.55	+0.1	+0.3	+0.1	+0.0015	+0.0040	+0.0017	—	—	—
22	3	REF LS	164+18+00	+0.050	-0.017	+0.005	1.98	-0.68	+0.57	-0.17	-0.0252	+0.0088	+0.0015	—	—	—
23	1	PREF LOPC	164+22+00											—	—	—
24	1	PREF LOPC	166+09											—	—	—
25	3	REF LS	170+06	-0.006	-0.017	-0.017	3.95	+0.101	+0.287	-0.287	-0.0015	-0.0015	-0.0015	—	—	—

69.2

6141.3²⁵

3.0
~~4.2~~ ACS

One Mass

37679

-

2.1432

32.174

6141 + 4.62

APR 30 13
ET DECAY
.64 SEC

N85(X)
ACCEL

BURN CONSTANTS (SEE SCP CSM-A26)

BURN	N85 X-AXIS	A-ACCEL AT SHUTDOWN	t CALC ms	ETDECAY LOADED ms	ETDECAY CALC ms	ETDECAY ① Δ ms	SODB THRUST ③	CALC THRUST	EFIMP16 ② Δ (CALC-LOADED) THRUST	LOADED THRUST EFIMP16
MCC-24	—	—	<1 SEC	640	—	—	—	—	—	19,989
LOI	0- —	—	7 640	640	640	— 0 —	*20607 20722	—	—	—
DOI	+6	8.596	—	640	570.3	+69.7	20597	NOT AVAIL	—	11
CIRC	X=0 Y=0 Z=.4	—	—	—	—	—	20289	20635	378	20,257
LOPC	X=.2 Y=.2 Z=.3	18.127	11.0	640	629	11.0	20575	20391	134	20,257
SHAPING	1.1	—	—	—	—	—	20595	19,950	-462	20,412
TEI	0.2	24.077	8ms	640	644	4.0ms	20673	—	—	—

* LATEST FROM SPAN SHIT 4 C-95 BEFORE + AFTER X-OVER

016148

- 1 - ETDECAY will be updated when calculated varies from loaded by 0.05 seconds.
- 2 - ETIMP16 will be updated when calculated or SODB varies from loaded by ±400 lbs-F.
- 3 - SODB thrust takes into account PU valve setting and single and dual bore operation.

N85
A

BURN CONSTANTS (SEE SCP CSM-A26)

BURN	N85 X-AXIS	A-ACCEL AT SHUTDOWN	ET CALC 115	ETDECAY LOADED	ETDECAY CALC	ETDECAY ① Δ	SODB THRUST ③	CALC THRUST	EFIMP16 ② Δ	LOADED THRUST EFIMP16
MCC-X										
LOI										
DOI										
CIRC	----	----	----	----	----					
LOPC										
SHAPING	----	----	----	----	----					
TEI										

- 1 - ETDECAY will be updated when calculated varies from loaded by 0.05 seconds.
- 2 - ETIMP16 will be updated when calculated or SODB varies from loaded by ±400 lbs-F.
- 3 - SODB thrust takes into account PU valve setting and single and dual bore operation.

1.3

2.1

- .7 - .3
1.7 2.1

8 - 0.52-
7 + 1.90

5-15
2-1-1

FLIGHT DIR MISSION LOG	DAY	REV	PG
A15			1
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING		
-07+20	"C" SHIFT ON CONSOLE		
	GNC INFORMED ME THAT NBDX		
	IS CHANGED TO +2.0 MERU PER		
	CHARLIE PARKER.		
-07+26	MED DISPLAY PIPA BIAS'S LOADED.		
	X +.0283		
	Y -.0030		
	Z -.0079		
	AND VERIFIED "G" CONSTANTS.		
-07+17	CHECKED FLWD'S, CHANNEL'S AND		
	IMOVES AGAINST DRY CDDT RUN.		
	GXN AND SCS LIMITS IN DATA		
	PACK DO NOT COMPARE TO THE LOADED.		
-06+29	✓ VERIFIED FORMAT OIA LOADED ON		
	✓ 32L.		
-05+49	PIPA PLOT REQUEST TO RTCC.		
-05+38	UPDATE "CSM CUE CARDS" TO		
	CHANGE "C".		
-03+26	FROM RETRO - TRIMS ARE		
	P = -0.32 Y = +1.90		

TM SYSTEM PLOT CHANGES

FROM: 64N (Console Pos.)
 DATE: 7/21/71
 TIME: 06+32 (GMT)

TO: COMPUTER TM
 P-TUBE STA: 31
 COMM LOOP: RTCC TLM

MSK: 670

V15:	VEH	SCALE (L,R)	PARAMETER RTCC EXTERNAL NUMBER	V17:	LABEL
Y1 (x):	<u>AGC</u>	<u>R</u>	<u>AGC 8101 C</u>	<u>AGC 8101 C</u>	<u>AGC 8101 C</u>
Y2 (o):	<u>AGC</u>	<u>R</u>	<u>AGC 1102 C</u>	<u>AGC 1102 C</u>	<u>AGC 1102 C</u>
Y3 (+):	<u>AGC</u>	<u>R</u>	<u>AGC 8103 C</u>	<u>AGC 8103 C</u>	<u>AGC 8103 C</u>
Y4 (Δ):	<u>CSM</u>	<u>L</u>	<u>CF 0018</u>	<u>CF 0018</u>	<u>CF 0018</u>
X <u>T</u> :	<u>CSM</u>		<u>CT 0145</u>		

("T" after X if time plot).

V16: UPDATE RATE(UR): 180 SEC. (Length in Min = 3 • UR)

SCALE VALUES

	EU MIN	EU MAX	
YR :	<u>- 0.02</u>	<u>+ 0.05</u>	
YL :	<u>35</u>	<u>75</u>	("D" if single scale plot)
X :			(Blank if time plot)

NOTES:

- Underlined spaces left blank will assume the previously defined values except as noted above.
- To delete a parameter, scale, or label use "D."
- Decimal placement of the intermediate scale values will be determined by the format of the upper (or rightmost) bound (e.g., a scale of 0 to 3.333 will result in intermediate values of X.XXX).

FLIGHT DIR MISSION LOG		DAY	REV	PG	
A 15				3	
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING				
GAT					
10+49+00	F. DIGENOVA ON CONSOLE T-2+45				
11+00	DATA PROBLEM				
	CH 3503 = .1	CH 3582 = -8.62			
	CH 3504 = 2.9	CH 3583 = 8.29			
	CH 3505 = 2.0	CH 3585 = -11.17			
	CG1201 = 30.7	CH 3586 = 43.56			
	CG1331 = 46.7	CH 3587 = 46.48			
	CG1040 = 119.6				
	CG2300 = 102				
11+12	DATA POINT TAKEN TO RECORD BAD DATA				
	RTCC CAL CURVE PROBLEM				
11+22	CHECKED DATA				
11+30	CALLED NEW LIMIT CHANGES TO COMPUTER TAI				
	(SAME AS T-3+19 & T-3+12)				
11+37	CHANGED UPDT RATE P14 PLAT TO 60 SEC				
T-1+12	GABC TVC CHK				
T-1+06	TRIM CHK OK				
	P = - .697	Y = 1.71	CHART RECORD		
12+57	CHANGED P14 TRIM LIMITS TO				
	LOW	H1			
	P -1.0	00	CH 3517		
	Y 1.4	2.4	CH 3518		
13+00	BURN COPIES OF FLT PLAN UP DATE				
	CARD (NOT APPLICABLE LAUNCH PHASE,				
	STARTS AT PG 8-85)				
13+04	RCS PRESSURIZATION SEQ 20-598				
13+08	AUTO RCS SELECT OK SEQ 20-600				

FLIGHT DIR MISSION LOG	DAY	REV	PG 4
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING		
13+23	TVC SERVO PWR ON P = -.65 Y = .44		
	L.O.		
06+02+19	NOISY DATA		
02+38	OX INT P CRIT ALARM - NOISY DATA		
03+17	NOISY DATA - DROP OUT		
06+18	TRIMS P = -.56 } DISPLAY		
	Y = 1.80 }		
07+33	NOISY DATA CAL STATIC		
11+45	SHUT DOWN GMPL MOTORS OFF		
13+40	BOOSTER CONFIG FOR ORBIT		
14+32	- .1° Z TORQUE &		
23+48	CHANGED P/Y TRIM LIMITS TO		
	LOW HI		
	P = -1.0 (.1) CH3517		
	Y = (-.1) 2.4 CH3518		
00+53+10	UNABLE TO CONFIRM H2 EC PURGE		
00+56+00	RCS PRG B ISO VALVE CLOSED - RE-OPENED		
	SECONDARY TB.		
	P52 (1ST) N71 37 & 41		
	N05 ÷ 00001		
	N93 X - 0.019		
	Y + 0.021		
	Z - 0.061		
	GET TORQUE AT 00+50+00		
01+29+18	AOS GDS		
01+30+00	PA1 & SEC QDD ISO VLW BP		
	CTCLED ON AND OK (GREY)		

FLIGHT DIR MISSION LOG		DAY	REV	PG
A13				3
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING			
01+32	MAIN ATT (3) MIN 1MP			
01+42	PIP COMP RE-INITIALIZE			
	TLI PAD			
	TB 6 2+90+23			
	R 180			
	P 45			
	Y 1			
	BT 5+55			
	ΔVc 1040.1			
	VI 35599			
	SEP ATT { R 359			
	P 77			
	Y 320			
	R 301			
	EXT ATT P 257			
	Y 40			
	EJECT TIME 2+16+00			
2+31+56	N 95 P 15 R 2 = +09991 V G			
	R 3 = +25608 INER V MAG			
	NO VMAG1 OR VGTLI DISPLAY			
2+50	SA IGNITION			
2+50	VMAG1 AND VGTLI DISPLAY OK WITH			
	AVC RUN			
2+55+10	MCRW OK GAN			
2+55+52	SHUT DOWN			
2+59	GOOD TLI BURN ΔVc -14.9			

FLIGHT DIR MISSION LOG	DAY	REV	PG 6
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING		
3+03	START PIF PLOT		
	START MANEUVER TO SEP ATT		
	ON TIME WITH DRP LOAD 11102		
	01111		
	FLT PLAN CALLS FOR 11103		
	01111		
3+16+47	GO FOR TPAE AT SEP ATT		
3+21+21	RCS RCS ARMABLE		
3+23+00	QD D PROP ISO WENT BP ESTD RESET		
	AT CSA/SA SEP GOOD SEP		
3+26+00	DOCKING ATT HOLDING GRN AUTO		
3+33	DOCKED		
3+34	HARD DOCK		
3+35	SPS 01, 02 LIGHTS ON		
	CH3602		
	CH3605		
3+37	CREW REPORTED EMS THRUST LIGHT		
	ON		
	SPS PILOT VALVE CB 69 & 68		
	OPENED		
4+16	P 47		
4+18	SEP TIME - GOOD SEP		
	SPS 01 & 02 STILL ON		
	CHANGE UPPER LIMIT TO +.5		
	FOR PITCH TRIM CH 3517		

CSM
GEN

MISSION NOTES

SPS Solid Driver assembly Events:

03+32+46 Docking (Soft)

03+33+50 Docking (Hard) + NO
SPS SOLID DR. events

03+4+56 DATA LOSS

03+35+19 DATA BACK & may have
SPS SOLID DR. events.

FLIGHT DIR MISSION LOG		DAY	REV	PG
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING			
	AV Thrust DIR - Normal			
	G 2-5 EMS AV Test first			
	five steps			
	Shuts off at -21.4			
	SPS Thrust light became			
	significantly brighter			
	during the 10 sec			
	thrust period			
	We recommend that the			
	SPS Circuitry be tested with			
	the AV thrust switches to			
	identify the failure			
06+54	Plumbach for 03+34 to 03+40			
	Data drops out from 3+34+40			
	to 3+35+19			
	Recorder Data loss 03+34+56.2			
	Docking 03+33+50			
	CTE static, 1 Sec pulses @ 03+34+40			
	Data Back			
07+41+30	AV Rins 0.9 test - No update			

FLIGHT DIR MISSION LOG A15	DAY	REV	PG 7
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING		
4+35+18	OFF RSTBY CREW VERIFY		
	OF EPS FUNCTION & MODE SW		
4+42	NOTE! PASS TO EPS ANY		
	PAO RELEASES		
05+00+39	P52 ATTITUDE		
05+17	PROCEDURE BEING CONSIDERED FOR		
	SPS D1, D2 PROBLEM		
	1. MAL PROCEDURE SPS 4		
	2. SPS THRWT SWITCH CYCLED		
	DIRECT ON AIN NORMAL		
	3. EMS DV TEST G/2-5		
05+24	SCS		
05+25	B Shift on console Mussato/Fitts		
05+26	P52		
	N05 -00001		
05+30	Torque -0.102		
	1 -0.063		
	+0.166		
05+32	PTC Retstat		
05+55			
05+55	Verify DV thrust & Pilot valve		
	CR's open - Verified		
	1. THC-CW / No Change		
	THC Neutral		
	2. SPS Thrust Dir. -ON - No Change		

FLIGHT DIR MISSION LOG A13	DAY	REV	PG 9
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING		
09410	Procedure for AV Test Test Flicker procedure - isolate failed bank by Pulling the 5. CR's under AV thrust switch to find intermediate position of SPS ON Lite Flicker now have found the problem SPS bank. If no flicker proceed with MCC ± single bank "individual" test to find problem.		
09429	Flicker Test data AV Thrust "A" on Both D1 & D2 went off Rec. turning the panel in the vicinity of the Thrust A & B switches the lights went on indicating that the problem is a contact in AV thrust A switch		
10409	Went to UV Photo RCS Config		
10430	Went to Normal Configuration		

FLIGHT DIR MISSION LOG		DAY	REV	PG
				10
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING			
11+15+15	N93 - 0096 N5 —			
	- 0088			
	+ 0181			
	Torque Time 11+15+15			
12+00	PTC Att & Rates damped			
	stayed uncoupled for about an			
	hour or so			
13+09+29	Start DTC			
	Plot initialized at 13+17			
	Blew first PTC Recommended			
	min - 0.375 %			
	Estimate			
	Set up for 2nd PTC Attempt			
	- X jets no + Roll jets			
	enabled			
	Configured for B & C and on			
	Wrong Jets on at start			
	up			
14+16+43	Start PTC Rate - 0.28 %			

5482-00

FLIGHT DIR MISSION LOG	DAY	REV	PG
A15			11
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING		
14+24	PLICE/FREUND ON SHIFT (C) —		
	PTC IN PROCESS.		
	CREW ASLEEP.		
17+03	RESTART PTC PLOT		
19+52	RESTART PTC PLOT		
21+40	F. DIGENOVA/LERDAL A TEAM SSR		
	PTC IN PROGRESS		
23+30	Computed preliminary NBD update		
	depending on next P-52 scheduled		
	for ≈ 28 HRS GET.		
26+55	EXIT PTC		
	$P = 90.2$ $Y = 8.3$ $R = 16.2$		
27+06	PROBLEM WITH		
27+20	P52		
27+24	SPS D1 & D2 LIGHTS ON FOR		
	ABOUT 10 SECONDS DUE TO		
	EMS ΔV CHECK		
27+24+30	P52 #9 NOS 00000		
	N93 $X = -.329$		
	$Y = -.256$		
	TORQUE 27+24+00 $Z = .574$		
	NBD UPDATE TIME 27+53+33		
27+54	SPS D1 & D2 ON DURING CREW TEST		
27+55+15	ATVC ON FOR 15 SEC		
27+56+17	SPS D1 ON		
	D2 OFF		

FLIGHT DIR MISSION LOG		DAY	REV	PG
				12
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING			
28715	V49 TO BURN AT			
	P 18.0 Y 20.0 R 61.0			
28740	MCC 2 BURN			
	5.3 ΔV ON DSKY			
	4.7 EMS ΔV			
	EMS MH A & B CB'S PULLED			
	MCC 2 BURN WAS DONE WITH			
	MODIFIED CREW CHECK LIST L/8-14			
	PER VERSION 0915 7/27/71 (29780			
	D2 WENT OUT FOR 7 SEC			
	D1 WENT OUT FOR 8 SEC			
	AT 28740 ± 23			
28759	V49 TO P 17.0 Y 50.0 R 55.0			
29741	P 52 AT 20 hrs NOT REQUIRED			
29741	.7 IS RESULT OF EMS ΔV			
	TEST RUN AT 28 hrs GET			
29743	3 SSR on Console			
	Changed the LL & UL of MSK 670			
32751	Uncoupled for SXT Photos			
	2nd time around			
33707	Disable jets for UV Photo			
33710	LIV Photo			
33740.10	AC Bus A also			
	No Orion S report			

FLIGHT DIR MISSION LOG	DAY	REV	PG 14
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING		
37+33	PRICE / FREUND (C) ON CONSOLE		
	PTC IN PROCESS		
39+34	RESTARTED UP27 PPA PLOT		
	RECEIVED SPAN REQUEST C-48 "S/S		
	BULW PLAN".		
40+14	RESTART UP 26 PTC PLOT		
40+40	RECEIVED SPAN REQUEST C-52.		
41+33	Changed MED format on 32L recorder to OSA.		
43+08	RESTART UP26 PTC PLOT		
45+40	DIGENOVA/LERDAL "A" TEAM SSR		
	PTC IN PROGRESS, EMS CB'S		
	WERE OPENED SOME TIME BEFORE		
47+00	LOGGED WRITE-UP ON OPTICS BIAS		
	DURING P23 (see WRITE-UP BY PHIL		
	SHEAFER)		
49+10	CREW AWAKENED BY CALCOA		
49+12	CMC WARNING CH33 B14		

FLIGHT DIR MISSION LOG		DAY	REV	PG
A15		3451	Sollar	15
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING			
53+20	Muscato & Fitts on console			
	Received TEL from Providence			
	G 5-1 stored in GEC			
	checklist.			
53+57	EMS Null Bias 0.8"/100mc			
56+10	N05 00001			
	- 000 21			
	- 000 34			
	+ 000 16			
	Torque Time Force 55 +21+19			
55+39	Stopped PTC			
57+24	FIDO called - says he is			
	using 12850 Tail off			
	impose bank A only			
57+56	Begin Damping for PTC			
58+14	Start PTC =25°/s			
59+39	Rheostat Position			
	Numerics 2:00			
	Integral			
	LEBDSKY Key Release			
	Is not visible.			
61+25	During the flood about 1.5 lb of water			
	was collected and dumped by the			
	crew - The PTC shrank and we changed the			
	pl. +			

FLIGHT DIR MISSION LOG		DAY	REV	PG 16
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING			
62+38	PRICE / FREUND ON CONSOLE			
	PTC IN PROCESS			
	NOTE: PIPA PLOT UP27 INDICATES			
	THAT THE X PIPA SHIFTED			
	FROM $\sim +.03$ TO $\sim -.02$			
	AT $\sim 58+30$ AND THEN			
	BACK TO $\sim +.03$ AT $\sim 60+10$.			
	AN ANALYSIS OF CMC COMP			
	TAB C 909 INDICATES THAT			
	THE PIPA X PVI MAXED OUT			
	(16383) AT $\sim 58+30$ AND			
	RECYCLED TO "0". THE PIPA			
	COMP WAS STARTED AT			
	57+59+08 AND 60+06+00.			
	APPARENTLY THE PIPA COMP			
	PROGRAM CANNOT TOLERATE			
	THESE CONDITIONS WHEN THE			
	PIPA MAX'S OUT BETWEEN			
	PIPA COMP PERIODS.			
	N.E.P.			
65+40	RECEIVED SMEAR C-80			
66+15	WITH PREV SMEAR C-79 PER SPAN			
	AND GNC			
68+00	RECEIVED SMEAR C-80 REVISION			
69+41	DIGENOVA/LERDAW ON CONSOLE			

FLIGHT DIR MISSION LOG A15	DAY	REV	PG 17
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING		
70+02	PTC IN PROGRESS, LOOK LIKE A VERY GOOD		
70+38	CREW ADVISED TO AVOID HIGH TURN RATE FOR ALL OPTICS USES; NOT ONLY FOR P 23 PLACE ZERO OPTICS TO OFF, BEFORE TURNING OPTICS PWR TO ON, THEN MAN ZERO OPTICS BEFORE GOING TO OPTICS ZERO.		
71+30	MADE CORRECTION TO LIST OF GNC "LIGHTING LOST AS RESULT OF POOLED CB33 (LEG 226)" DELETED OPTICS ANNUNCIATOR PNL 122		
	EMS DV BIAS TEST RESULTS 1.0		
72+58	P-52 #6, THEN EXIT PTC AND MANEUVER TO MCC-4 BURN ATT. (SEE MCC-4 BURN PAD) TIG = 73:31+14		
73+10	AT BURN ATT		
73+20	MAD 07H & MAD 08H HOFAT 30		
74+09	ACS B PROF ISO WENT TO BP RESET OK		
74+34+17	MCC-4 BURN WENT WELL BUT EPS REPORTED A 20 AMP GLITCHING AT ABOUT GET 73:28+10 WHICH WAS BEFORE CAL GEAR DRIVE TEST		
75+15+00	P52 75+15+00 TORQUE N 93 X=+0.025 NOJ=00000 Y=-0.011 Z=+0.001		

MSC FORM 1441 (APR 66)

NASA—MSC

75+19+

P52 TORQUE 2d

FLIGHT DIRECTOR'S MISSION LOG

[illegible]

FLIGHT DIR MISSION LOG		DAY	REV	PG
A15				19
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING			
	Munro & Fitts at work			
78+56	BT 6+38			
	Ign on Time			
	Res 0-0-0			
	AVC -4.8			
	2993.9			
	2998.7 DVT EMS			
	T On 78+31+45.9			
	T off 78+38+25.7			
	46+39.8 BT 32.2 CTE			
	F PTF 1.792 (YTF -0.695) PFS 1.076			
	YFS 7.063			
80+05	P52 N 05			
	- .018			
	- .006			
	- .004			
	Torque Time 80:04			
	73+14+45			
81+30	20644 MPAD Single Bank Thrust			
	we need to update F16			
	but cannot use this number			
	until it is verified			
82+01	Torque Time + 00009			
	82+02 - 00007			
	00000			

FLIGHT DIR MISSION LOG	DAY	REV	PG
A15			21
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING		
86+00	PRICE / FREUND ON CONSOLE		
	IN L.O. - P20		
86+16	LOS - CHANGED PIPA PLOT REPLACING		
	"GLY TEMP OUT" WITH "PIPA TEMP"		
	PER GNC REQUEST		
88+56	PLOTING PITCH PHASE PLANE ON		
AOS	669.		
}	CHANGED HI LIMIT ON PIPA TEMP		
	TO 130.5		
	CHANGED PIPA PLOT REPLACING "PIPA		
	TEMP" WITH "PRI RAD OUTLET"		
↓	CF 0020. HEADER STILL READS "PIPA TEMP"		
88+54	RECEIVED SMEAR C-109 - NOTES TO		
	MUSSATO.		
89+08	RECEIVED SMEAR C-10P		
89+10	CHANGED X SCALE ON 669 AND		
	RESTAINTED. (+6 TO -6)		
89+30	STOPPED THE SO CALLED PHASE PLANE PLOT		
	BECAUSE WERE IN P20. DOES NOT WORK		

FLIGHT DIR MISSION LOG		DAY	REV	PG
				22
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING			
91+25	PLOTING ERROR X,Y,Z VS TIME			
	ON 668			
93+50	DIGENOVA/LEPDA GH CONSOLE SSR TEAM A			
	LOS, RCS JET CONFIG FOR SIM BAY			
	OPERATION			
	P20 OPT 5 (-X FWD SIM ATT)			
	N78 +000.00 YAW/PITCH			
	N79 +005.00 DB			
94+37	AOS			
94+43	LUNAR SURF TV ATT			
	1328 MSK			
95+23	MNVR TO DOI TRIM BURN			
	(SEE BURN PAD)			
95+28	TERM AUTO MNVR TO DO P52			
	AT THIS ROLL			
95+30	ALL RCS JETS ON EXCEPT A/C			
	ROLL			
	DID NOT GET TO P-52 ATT			
	ON FRONT SIDE. WILL GET NPS			
	FROM CREW			
95:42	LOS			
96+25	SET UP FOR RT DUMP			
96+30	AOS			
	BT 18-19 SEC ^{AVE} X+.1 Y+.2 Z+.2 DOI/TRIM			
	AVC+. 59.4 X10.3			
	CREW READOUT OF BURN STATUS			

FLIGHT DIR MISSION LOG A15	DAY	REV	PG 23
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING		
96+50	P-52 CREW READ DOWN		
	N05 00001 N93 X = +.022		
	Y = -.032		
	Z = +.038		
	TORQUE TIME 95+13+00		
96+52	P 2A		
97+30	ALARM 00404 - TARGET OUT OF VIEW -		
	TURN A > 90 DEG		
97+06	DAP RI 2111		
	0111		
97+25	GOT PLAYBACK OF DOI/TRIM BURN		
	BECAUSE RT DUMP DID NOT OCCUR		
	AT TIME 96+55 AS INDICATED BY		
	INCO SPS D1, D2		
98+23+55	AOS REPORTED TO FLIGHT		
98+28	B team on console N05 00001		
	P52	X-00.010	
	OPT 3	N93	Y-00.009
	Tor Time 97+ ³⁵ 54+55		Z-00.025
98+46+53	Start Down IMU Align		
	During SCS Att Ctrl		
	Lim Cycle Off		
	DB Minimum		
	Rate Low		
98+56	Thrust in error for 1.5%		
	using 20280 actual vs 19999 mode		

FLIGHT DIR MISSION LOG		DAY	REV	PG
A 15				24
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING			
99+13	CMC CMTL AUTO			
	Hot Fire CMC Free			
	4 1/2 Roll			
	Hot Fire Complete			
	No Dep at AOS			
	sim Day selected			
	left it alone even though			
	I used more propellant			
100+40	Dep Complete 2.5 sec - X			
100+53	P52 may be deleted due			
	to late Dep.			
102+10	CMAOS No Voice ^{No data} ✓ then LOS			
102+3	AVC - 11.5			
102+27	DR1 = 11102 should be 11111			
102+59	P52 NOS 00000			
	+ 023			
	- 005			
	+ 009			
	Torque Time 103+00			

498-6166

Back

Color _____

P30 MANEUVER

SET STARS		0	0	1			PURPOSE
		5	P	S	G	N	PROP/GUID
		+	3	9	8	0 0	WT N47
R	ALIGN		0	0	1.6	8	P TRIM N48
P	ALIGN	-	0	0	0.5	5	Y TRIM
Y	ALIGN	+	0	0	0	8 2	HRS GETI
		+	0	0	0	3 9	MIN N33
		+	0	0	1	8.2 9	SEC
ULLAGE	4 quad	-	0	2	0	8.4	ΔV _X N81
	15 sec	-	0	0	4	7.0	ΔV _Y
			0	0	0	2.0	ΔV _Z
		X	X	X	0	0 0	R
		X	X	X	2	8 3	P
		X	X	X	3	4 7	Y
		+	0	0	5	8.4	H _A N44
			0	0	0	9.2	H _P
		+		2	1	3.9	ΔVT
HORIZON/WINDOW		X	X	X		2 4.8	BT
		X		2	0	8.4	ΔVC
		X	X	X	X		SXTS
		+				0	SFT
		+				0 0	TRN
		X	X	X			BSS
		X	X				SPA
		X	X	X			SXP
OTHER			0				LAT N61
							LONG
		+					RTGO EMS
		+					V10
							GET 0.05G

Changed _____

Basic Date 6/24/70

TM SYSTEM PLOT CHANGES

FROM: G4N (Console Pos.)
 DATE: 7/30
 TIME: 08437 (GMT)

TO: COMPUTER TM
 P-TUBE STA: 31
 COMM LOOP: RTCC TLM

MSK: 660

V15:	VEH	SCALE (L,R)	PARAMETER RTCC EXTERNAL NUMBER	V17:	LABEL
Y1 (X):	<u>AGC</u>	<u>R</u>	<u>ERROR X</u>		
Y2 (O):	<u>AGC</u>	<u>R</u>	<u>ERROR Y</u>		
Y3 (+):	<u>AGC</u>	<u>R</u>	<u>ERROR Z</u>		
Y4 (Δ):					
X <u>T</u> :	<u>CSM</u>		<u>CT 0145</u>		("T" after X if time plot)

V16: UPDATE RATE(UR): 30 SEC. (Length in Min = 3 • UR)

	SCALE VALUES	
	EU MIN	EU MAX
YR :	<u>-6</u>	<u>+6</u>
YL :		
X :		

("D" if single scale plot)

(Blank if time plot)

NOTES:

- Underlined spaces left blank will assume the previously defined values except as noted above.
- To delete a parameter, scale, or label use "D."
- Decimal placement of the intermediate scale values will be determined by the format of the upper (or rightmost) bound (e.g., a scale of 0 to 3.333 will result in intermediate values of X.XXX).

TM SYSTEM PLOT CHANGES

FROM: GYN (Console Pos.)
 DATE: 7/30
 TIME: 0445R (GMT)

TO: COMPUTER TM
 P-TUBE STA: 31
 COMM LOOP: RTCC TIM

MSK: 669

A15

V15:	VEH	SCALE (L,R)	PARAMETER RTCC EXTERNAL NUMBER	V17: LABEL
Y1 (x):	<u>AGC</u>	<u>R</u>	<u>BODY RATE Y</u>	<u>BODY RATE Y</u>
Y2 (o):	_____	_____	_____	_____
Y3 (+):	_____	_____	_____	_____
<u>Y4</u> (Δ):	_____	_____	_____	_____
X :	<u>AGC</u>	ERROR ("T" after X if time plot)		

V16: UPDATE RATE(UR): 60 SEC. (Length in Min = 3 • UR)

SCALE VALUES

	EU MIN	EU MAX
YR :	<u>.1</u>	<u>100</u>
YL :	_____	_____
X :	<u>+6</u>	<u>-6</u>

("D" if single scale plot)

(Blank if time plot)

NOTES:

- Underlined spaces left blank will assume the previously defined values except as noted above. 345)
- To delete a parameter, scale, or label use "D."
- Decimal placement of the intermediate scale values will be determined by the format of the upper (or rightmost) bound (e.g., a scale of 0 to 3.333 will result in intermediate values of X.XXX).

TM SYSTEM PLOT CHANGES

FROM: 04N (Console Pos.)

TO: COMPUTER TM

DATE: 2-5-71

P-TUBE STA: 31

TIME: 23+49+00 (GMT)

COMM LOOP: RTCC TLM

MSK: 0669

A 14

V15:	VEH	SCALE (L,R)	PARAMETER RTCC EXTERNAL NUMBER	V17:	LABEL
Y1 (x):	<u>AGC</u>	<u>R</u>	<u>BODY RATE Y</u>	<u>BODY RATE Y</u>	<u>Y</u>
Y2 (o):	_____	_____	_____	_____	_____
Y3 (+):	_____	_____	_____	_____	_____
Y4 (Δ):	_____	_____	_____	_____	_____
X _____:	<u>AGC</u>	_____	<u>TRANSFER R</u>	("T" after X if time plot) _____	

V16: UPDATE RATE(UR): 60 SEC. (Length in Min = 3 • UR)

SCALE VALUES

	EU MIN	EU MAX	
YR :	<u>-10</u>	<u>+10</u>	
YL :	_____	_____	("D" if single scale plot)
X :	<u>-10</u>	<u>+10</u>	(Blank if time plot)

NOTES:

- Underlined spaces left blank will assume the previously defined values except as noted above.
- To delete a parameter, scale, or label use "D."
- Decimal placement of the intermediate scale values will be determined by the format of the upper (or rightmost) bound (e.g., a scale of 0 to 3.333 will result in intermediate values of X.XXX).

3.12 MICROBIAL RESPONSE TO SPACE ENVIRONMENT (M191) (NASA DATA SOURCE)

3.12.1 OBJECTIVES

The objectives are to determine the type and degree of alteration produced in selected biological systems when exposed to spaceflight environments.

3.12.2 PHYSICAL CHARACTERISTICS

3.12.2.1 Functional and Physical Description

The microbial ecology evaluation device (MEED) is designed to contain representative microbial test systems and to expose these test systems to various components of (1) solar irradiation in space for a specific time interval, (2) reduced gravity, (3) change in total pressure (0-14.7 psi) and alterations in oxygen partial pressure.

The self-contained experiment package (Figure 3.12-1) is deployed at the distal end of the TV camera/DAC pole (campole) which is attached to the open CM hatch sleeve mount (Figure 3.12-2). The MEED flight assembly consists of three MEED units, each containing approximately 280 cuvettes (Figure 3.12-3). Two MEED units will be exposed to irradiation when the flight assembly is deployed. The third unit is contained in the flight assembly but will not be exposed to sunlight. A ground control MEED unit will be maintained at MSC for data comparison and evaluation.

3.12.2.2 Envelope Dimensions and Weight (Approximate Value)

The MEED flight assembly has a volume of 200 in³ (approximately 4 1/2 X 9 3/4 X 4 1/2) and weighs 10 pounds.

3.12.2.3 Installation

The MEED flight assembly is installed on the TV mount plate of the campole. The campole with MEED in place is installed in the sleeve mount already attached to the CM hatch handle. The orientation of the MEED flight assembly provides a CSM look angle of θ =(TBD) and a ϕ =(TBD) degrees (Figure 3.12-4).

3.12.2.4 Deployment Characteristics

The test systems are manually exposed to solar irradiation by the crew upon completion of the EVA and after maneuvering the CSM to the required attitude.

3.12.3 PERFORMANCE AND OPERATIONAL DATA

3.12.3.1 Electrical Power

None required.

7/16/71

3.12.3.2 Attitude and Orbital Geometry

3.12.3.2.1 Attitude Constraints

The MEED flight assembly must be oriented such that the sun's rays are perpendicular to the open face of the MEED within ± 5.5 degrees. The CSM shall be in attitude hold with a $1/2$ degree deadband during exposure of the MEED.

3.12.3.2.2 Orbital Geometry Constraints

The microbial response experiment shall be accomplished during transearth coast.

3.12.3.3 Environment

3.12.3.3.1 Temperature Limitations

The microbial test systems must be kept at a temperature of 68 ± 9 F at all times.

3.12.3.3.2 Temperature Control

In addition to the superinsulation which is an integral part of the flight assembly, thermal control of the MEED flight assembly is achieved by keeping it in the flourel sponge-lined, teflon-coated, beta fabric stowage bag and by placing it in a convenient stowage compartment in the command module when not deployed.

3.12.3.3.3 Humidity Limitations

No requirements.

3.12.3.3.5 Nuclear Radiation Limitations

No requirements.

3.12.3.3.6 External Contaminations

The crewman must not allow the face of the MEED to become contaminated by touching it with his glove or other foreign material.

3.12.3.3.7 Ultraviolet Light Limitation

After loading the MEED flight assembly it must not be opened until it is deployed. After deploying the MEED flight assembly it must not be reopened until it has been returned to MSC. It will be opened by the principal coordinating scientist (PCS) under special laboratory lighting conditions.

3.12.3.4 Crew Support Requirements

3.12.3.4.1 Pre-Experiment Operations

The experiment package is to be placed in the CM as close to launch time as possible, and no earlier than twenty-four clock hours prior to nominal scheduled lift-off.

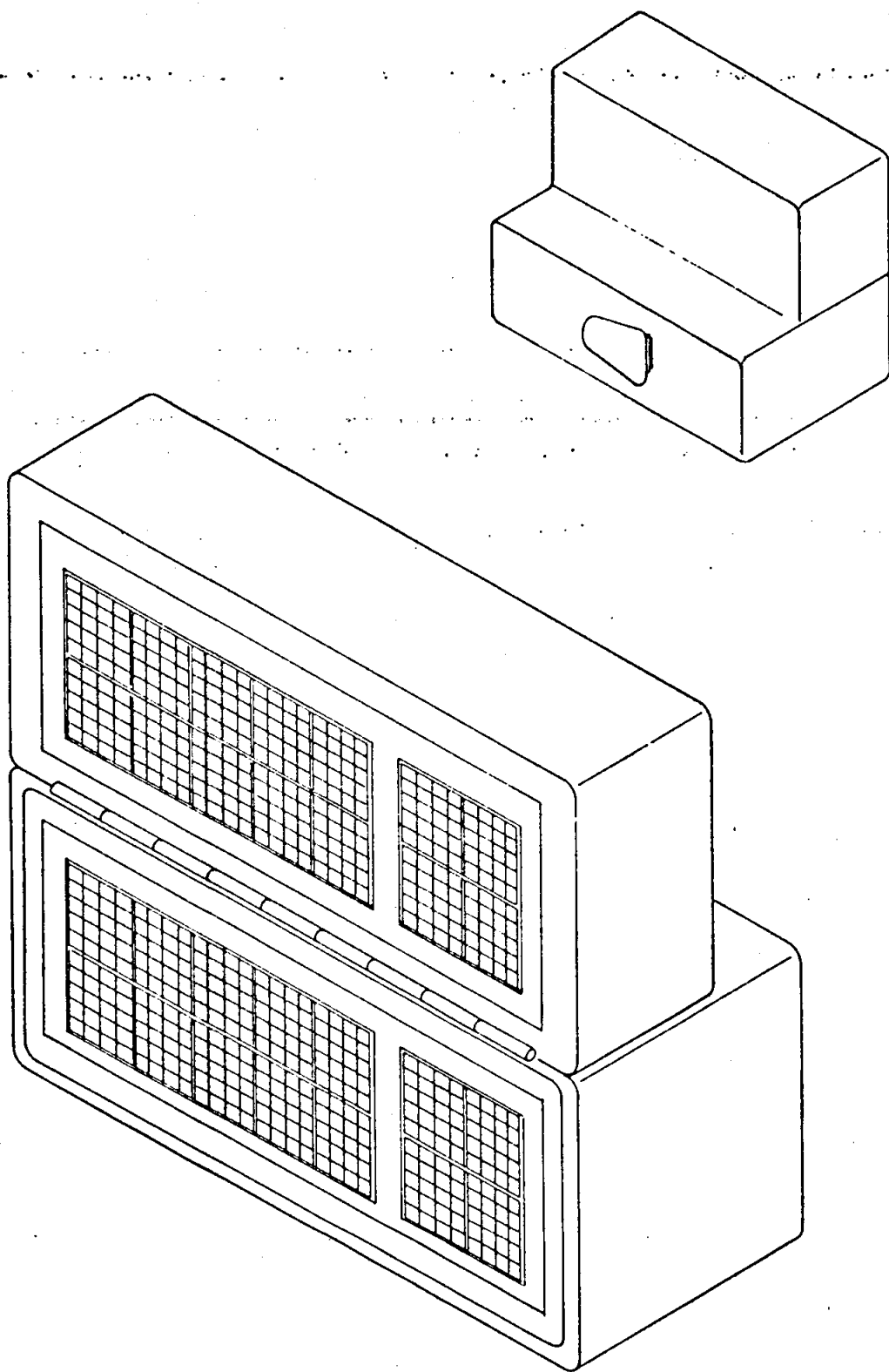


Figure 3.12-1 MEED Flight Assembly
(See Paragraph 3.12.2.1)

The MEED flight assembly is to be removed from the stowage compartment within the command module and attached to the TV mount plate on the distal end of the TV camera/DAC pole (campole). The spacecraft is maneuvered to the specified attitude before deploying the MEED flight assembly.

3.12.3.4.2 Experiment Operations.

The campole with MEED flight assembly attached shall be installed in the sleeve mount on the command module hatch. The MEED flight assembly shall be opened for an exposure of 10 minutes ± 30 seconds, with the exact time being recorded to the nearest second.

3.12.3.4.3 Post-Experiment Operations

The exact exposure time shall be recorded to the nearest second. The MEED flight assembly shall be placed in its stowage bag and in its designated compartment until CM recovery. Upon CM recovery the MEED flight assembly shall be placed into its shipping container and will be sent via air ASAP to MSC for experiment data reduction. Thermal control of 68 ± 9 F is mandatory.

3.12.3.5 Interface Constraints

This experiment does not require concurrent operation with any other experiment. An uplink command capability may be required to verify deployment of the experiment package.

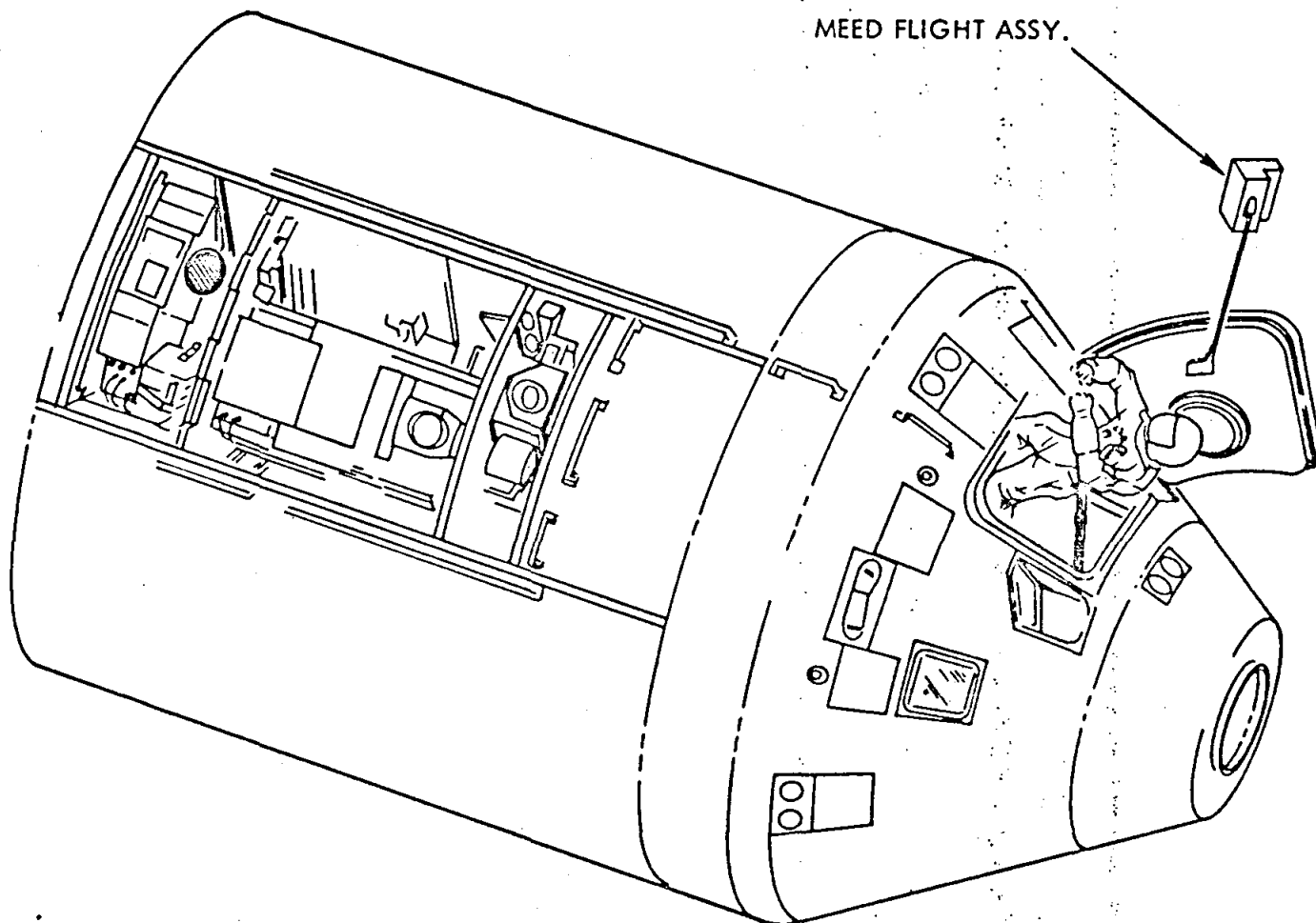
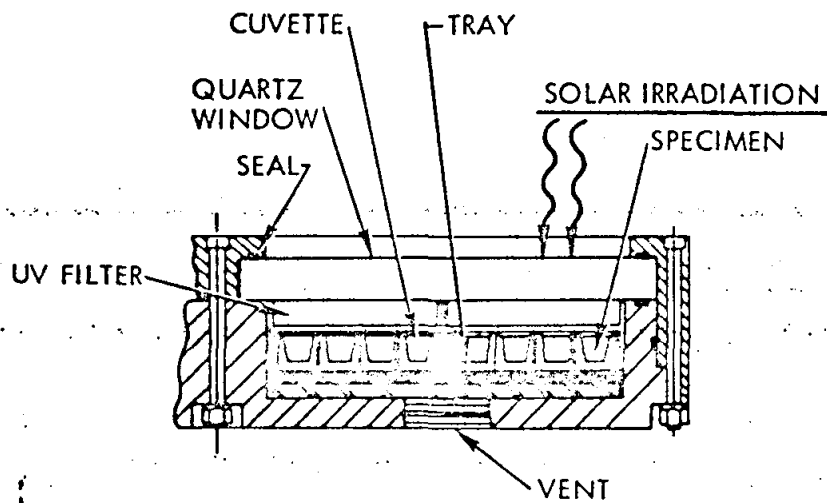


Figure 3.12-2 Flight Assembly - Deployed
(See paragraph 3.12.2.1)

3.12-5

SNA-8-D-027 (VI)



SECTION THROUGH MEED UNIT

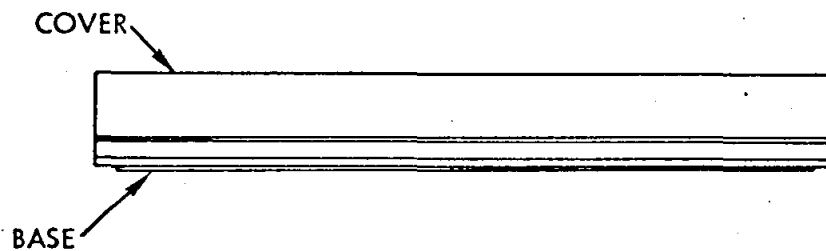
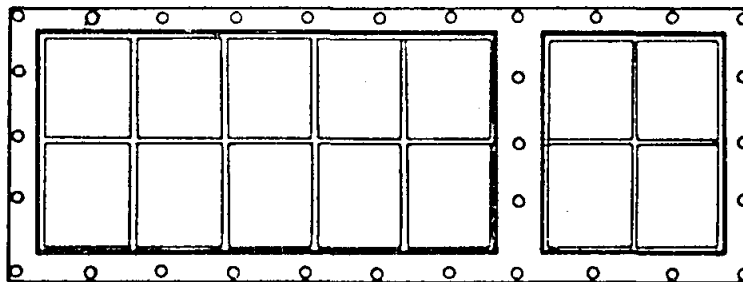


Figure 3.12-3 MEED Unit
(See paragraph 3.12.2.1)

3.12-6

SNA-8-D-027(V1)

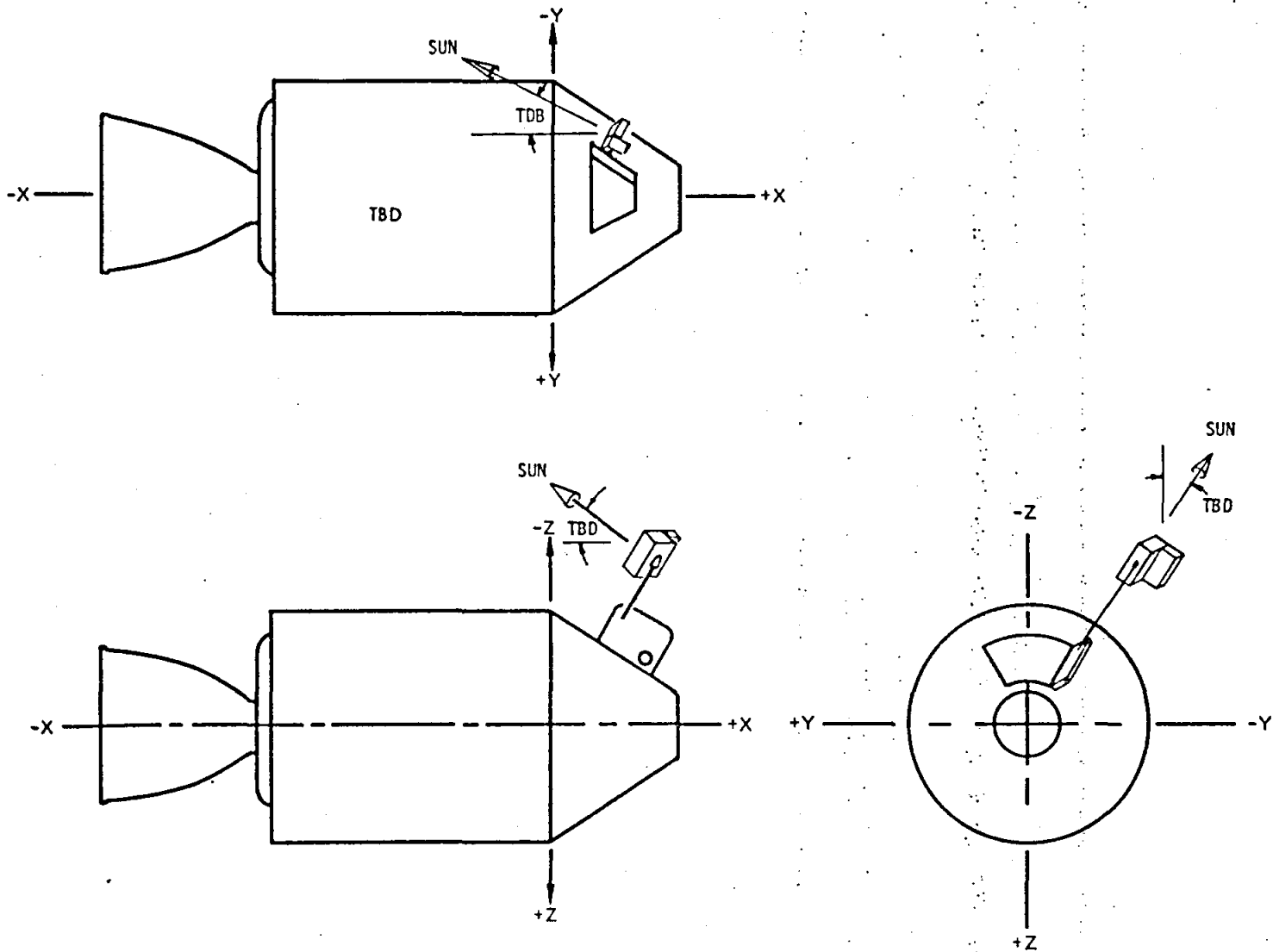


Figure 3.12-4 MEED/Spacecraft Orientation
(See paragraph 3.12.2.3)

3.12-7

TM SYSTEM PLOT CHANGES

FROM: 32L (Console Pos.)
 DATE: 8/7/71
 TIME: 1414 (GMT)

TO: COMPUTER TM
 P-TUBE STA: 31
 COMM LOOP: RTCC TLM

MSK: 66B

V15:	VEH	SCALE (L,R)	PARAMETER RTCC EXTERNAL NUMBER	V17: LABEL
Y1 (x):	<u>AEC</u>	<u>L</u>	<u>AEC8300C</u>	<u>R A K E R R O R </u>
Y2 (o):	<u>AEC</u>	<u>R</u>	<u>BAX SATERRK1</u>	<u>P A K E R R O R </u>
Y3 (+):	<u>AEC</u>	<u>R</u>	<u>OG ANGLEERRK2</u>	<u>Y A K E R R O R </u>
Y4 (Δ):	<u> </u>	<u> </u>	<u> </u>	<u> </u>
X <u>T</u> :	<u> </u>	<u> </u>	<u> </u>	("T" after X if time plot)

V16: UPDATE RATE(UR): 30 SEC. (Length in Min = 3 • UR)

	SCALE VALUES		
	EU MIN	EU MAX	
YR :	<u>-15.0</u>	<u>+5.0</u>	
YL :	<u>-5.0</u>	<u>+15.0</u>	("D" if single scale plot)
X :	<u> </u>	<u> </u>	(Blank if time plot)

NOTES:

1. Underlined spaces left blank will assume the previously defined values except as noted above.
2. To delete a parameter, scale, or label use "D."
3. Decimal placement of the intermediate scale values will be determined by the format of the upper (or rightmost) bound (e.g., a scale of 0 to 3.333 will result in intermediate values of X.XXX).

TM SYSTEM PLOT CHANGES

FROM: 32 L (Console Pos.)
 DATE: 8/5/71
 TIME: 18:03 (GMT)

TO: COMPUTER TM
 P-TUBE STA: 31
 COMM LOOP: RTCC TLM

MSK: 668

V15:	VEH	SCALE (L,R)	PARAMETER RTCC EXTERNAL NUMBER	V17: LABEL
Y1 (x):	<u>AGC</u>	<u>L</u>	<u>AGC8300C</u> <u>AKX</u>	<u>AGC8300C</u>
Y2 (o):	<u>AGC</u>	<u>L</u>	<u>BAXSATERRK1</u> <u>AKY</u>	<u>BAXSATERRK1</u>
Y3 (+):	<u>AGC</u>	<u>R</u>	<u>OGANGLERAK2</u> <u>AKZ</u>	<u>OGANGLERAK2</u>
Y4 (Δ):	_____	_____	_____	_____
X <u>T</u> :	_____	_____	_____	_____

("T" after X if time plot)

V16: UPDATE RATE(UR): 30 SEC. (Length in Min = 3 • UR)

SCALE VALUES

	EU MIN	EU MAX	
YR :	<u>-6</u>	<u>2</u>	
YL :	<u>-2</u>	<u>+6</u>	("D" if single scale plot)
X :	_____	_____	(Blank if time plot)

NOTES:

- Underlined spaces left blank will assume the previously defined values except as noted above.
- To delete a parameter, scale, or label use "D."
- Decimal placement of the intermediate scale values will be determined by the format of the upper (or rightmost) bound (e.g., a scale of 0 to 3.333 will result in intermediate values of X.XXX).

TM SYSTEM PLOT CHANGES

FROM: GAN (Console Pos.)
 DATE: 7/31
 TIME: 18:02 (GMT)

TO: COMPUTER TM
 P-TUBE STA: 31
 COMM LOOP: RTCC TLM

MSK: 668

V15:	VEH	SCALE (L,R)	PARAMETER RTCC EXTERNAL NUMBER	V17: LABEL
Y1 (x):	<u>AGC</u>	<u>L</u>	<u>ERROR X</u>	<u> </u>
Y2 (o):	<u>AGC</u>	<u>L</u>	<u>ERROR Y</u>	<u> </u>
Y3 (+):	<u>AGC</u>	<u>R</u>	<u>ERROR Z</u>	<u> </u>
Y4 (Δ):	<u> </u>	<u> </u>	<u> </u>	<u> </u>

X : ("T" after X if time plot)

V16: UPDATE RATE(UR): SEC. (Length in Min = 3 • UR)

SCALE VALUES

	EU MIN	EU MAX	
YR :	<u>- .6</u>	<u>+ 1.8</u>	
YL :	<u>- 1.8</u>	<u>+ .6</u>	("D" if single scale plot)

X : (Blank if time plot)

NOTES:

- Underlined spaces left blank will assume the previously defined values except as noted above.
- To delete a parameter, scale, or label use "D."
- Decimal placement of the intermediate scale values will be determined by the format of the upper (or rightmost) bound (e.g., a scale of 0 to 3.333 will result in intermediate values of X.XXX).

TM SYSTEM PLOT CHANGES

FROM: GEN (Console Pos.)

TO: COMPUTER TM

DATE: 31 JUL 71

P-TUBE STA: 31

TIME: 1631 (GMT)

COMM LOOP: RTCC TLM

MSK: 668

V15:	VEH	SCALE (L,R)	PARAMETER RTCC EXTERNAL NUMBER	V17:	LABEL
Y1 (X):	<u>AGC</u>	<u>L</u>	<u>ERROR X</u>		
Y2 (O):	<u>AGC</u>	<u>L</u>	<u>ERROR Y</u>		
Y3 (+):	<u>AGC</u>	<u>R</u>	<u>ERROR =</u>		
Y4 (Δ):	<u> </u>	<u> </u>	<u> </u>		
X <u> </u> :	<u> </u>	<u> </u>	<u> </u>		

("T" after X if time plot)

V16: UPDATE RATE(UR): _____ SEC. (Length in Min = 3 • UR)

SCALE VALUES

	EU MIN	EU MAX	
YR :	<u>- 6.0</u>	<u>+ 13.0</u>	
YL :	<u>- 13.0</u>	<u>+ 6.0</u>	("D" if single scale plot)
X :	<u></u>	<u></u>	(Blank if time plot)

NOTES:

1. Underlined spaces left blank will assume the previously defined values except as noted above.
2. To delete a parameter, scale, or label use "D."
3. Decimal placement of the intermediate scale values will be determined by the format of the upper (or rightmost) bound (e.g., a scale of 0 to 3.333 will result in intermediate values of X.XXX).

MCC DATA R — ST FORM

E-8N

① — A TYPE (CIRCLE)	② VEHICLE (CIRCLE ONE)	③ FORMAT (S) HSD OR THRIFT	④ TART/STOP TIME OF DATA CIRCLE ONE: CTE, MET, GMT, GET				⑤ CONFIGU + N (CIRCLE AS APPROPRIATE)
A. PCM PLAYBACK SPECIFY: <u>DSE</u> , MSFN, MCC	<u>CSM</u> LM IU SDS LCRU S-IV S-II S-IC PLSS	<u>HS 8</u> <u>HS 30</u> <u>Subf 21</u>	OTHER (SPECIFY) _____				⑥ A. <u>EVENTS DRIVEN:</u> <u>RTCC</u> <u>CCATS (PCMGS)</u> B. VOICE LOOP SPECIFY _____ (VOICE P/B ONLY) e.g. MSTC, CVTS C. COLOR EIDOPHOR (TV P/B ONLY) D. PLAYBACK BIT <u>SET</u> /NOT SET E. <u>MEDABLE CHART RECORDERS</u> F. DEDICATED CHART RECORDER G. <u>LBO CHART RECORDERS</u> H. PCMGS CHART RECORDERS I. OTHER (SPECIFY) _____
B. VOICE PLAYBACK SPECIFY: DSE, MSFN, MCC			DAYS	HOURS	MIN	SEC	
C. VOICE DUB SPECIFY: KEYSET/LOOP				95	55	00	
D. TELEVISION PLAYBACK				95	58	00	
E. EMOD							
F. <u>THRIFT DELOG</u> SPECIFY: NORM CYCLE, <u>ASAP</u>							
G. D/TV DELOG (SPECIFY MSK)							
H. OTHER (SPECIFY) _____							
			⑤ A. MISSION PHASE <u>LO</u> B. SITE/REVOLUTION <u>10</u> C. PCM BIT RATE <u>H</u> D. SAMPLE RATE <u>1/sec</u> E. PLAYBACK BIT RATE _____				

⑦ ORIGINATOR J. DeHenne MCC POSITION GNC PHONE/LOOP MOCP-1 CODE _____

GET OF REQUEST 96401

DATA REQUESTED BY 98100 GET

SHORT STATEMENT OF TIME CRITICALITY _____
 (e.g. NEEDED BEFORE DOI FOR MORE SPS ANALYSIS)
 or NEEDED BEFORE TLI FOR A FMR GO/NO-GO _____

NUMBER OF COPIES REQUIRED 2 DATA DELIVERED TO GNC

FLIGHT DIR MISSION LOG	DAY	REV	PG
A15			25
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING		
10442	Touchdown.		
105+09	P52		
	00001		
	+ 012		
	- 011		
	+ 023		
	Torque Time 105+12		
108+05	PILIE ON CONSOLE		
	P20 (0.5 DB) IN PROCESS		
108+10	ER ON FOIL THRUSTER COUNT.		
108+15	PAN CAMERA OPERATE.		
109+07	P52 +.015 N03 = 0		
	-.004 $\Delta t = 3.9$		
	-.014		
111+40	Sleep Period		
112+10	V99 ??? FOIL $\checkmark$ 1 MIN		
	IN P20 OPT 5 5° DB		
115+18	DIGENOVA - SPAN/FID0 (SHAFER) WOULD LIKE		
	TO LOAD THE DAP WITH A WEIGHT		
	OF 40000 LBS TO FAKE IT OUT.		
	THE REASON IS THAT IN THE PRO OPTS		
	CONFIGURATION WE HAVE WATCHED THE DAP		
	HANG ON THE DB IN ALL THREE AXES.		

FLIGHT DIR MISSION LOG	DAY	REV	PG 26
A15			
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING		
	IT IS BELIEVED (AND I TOO) THAT		
	IF YOU CAN GET ACROSS TO THE OTHER		
	SIDE OF THE DB AND THEN DRIFT BACK		
	WE WILL HAVE LESS FINDINGS - AND		
	RESULT IS PROP SAVINGS - OK.		
117+21	DIGENOVA/LERDAL ON CONSOLE		
117+52	CSM FLIGHT ON MSTC 212		
	COMM LOOP, A/G CSM ON		
	GOSS 2. LM FLIGHT ON FD		
	AND LM A/G ON GOSS CONF		
117+57	RE-INITIALIZED PIRP PLOT & PHASE		
	PLANE PLOTS.		
	AT AOS S/C IN SINGLE JET SIM BAY		
	CONFIGURATION USING B/D ROLL		
119+05	P-52 OPT 3 LDG SITE		
	N 93 X = - .028		
	Y = - .058		
	Z = + .012		
	TORQUE AT 119+05		
	CREW READ DOWN TANGLES BECAUSE OF		
	LOS ON DATA		
119+54	AOS REV 22		
	MIGHT HAVE PROB WITH MASS SPECT		
	P20 OPT 5 (+X FWD) 1.5°/DB		
	- .0533 - .0582		
120+33	RECEIVED NOTE FROM MIT TO SPAN		
	ON POSSIBLE METHODS OF REDUCING RCS		

FLIGHT DIRECTOR'S MISSION LOG	AV	PC	
MIT			
SITE ACQ LOS	FLIGHT EVENTS HISTORY BRIEFING		
119:50	To : SPAN FROM: MIT SUBJECT: POSSIBLE METHODS OF REDUCANT RCS USAGE IN THE GSM. We can suggest three methods of reducing RCS fuel usage: 1. Change the deadband from 5° to 3° - This might possibly change drive the spacecraft at a different rate and one that would be less coupled in the three axis. There is no data to suggest ^{whether} what this would have any effect. 2. Modify Mass on Inertia - This is not recommended at this time because the effect would probably be to fire on both sides of the db as opposed to only one which it is now doing. 3. Disable 2 adjacent guesds in RO3 (with corresponding jst config changes) - This would require a modification to the RCS and is probably not desirable.		

FLIGHT DIR MISSION LOG		DAY	REV	PG
A45				27
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING			
120+35	WE ARE THINKING OF IMPLEMENTING			
	SUGGESTION 1 FOR REV 24 WHEN			
	CSM IS SCHEDULED FOR 5° DB. 10 ;			
	PUT IN 3° DB INSTEAD OF 5°			
121+06	LOS REV 22			
121+08	MADE CHANGE TO UP-25			
	CHANGE SCALES YR - .6 to +1.8			
	YL -1.8 to .6			
121+55	AOS RCD 23 (NO DATA YET)			
122+04	DATA			
122+04	WRONG ATT WHEN LOADED			
	N78 AT 121+35 PER FLT PLAN			
122+40	V49 TO DEEP SPACE NEAR ATT			
	R332 P181.0 YAW 0			
122+40	MORE ON WRONG ATT AT 122+04			
	P=2.3 Y=343 ROLL 129.2			
	WITH N78 AT YAW +126.30, PITCH			
	+45.77 ONICRON 180 THE ROLL			
	ANGLE CANNOT BE ZERO DEGREES			
	AS CALLED OUT IN FLIGHT PLAN.			
	YAW WOULD HAVE TO BE 000 DEG			
	IN ORDER TO GET ROLL OF 000 DEG			
123+04	LOS REV 23			
123+52	AOS REV 24			
124+22	P20 OPT 5 5° DB N78 } 000			
	(+90			
	000			
	ROLL = 0 N79 5			

FLIGHT DIR MISSION LOG		DAY	REV	PG 28
A 15				
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING			
124+24	CHANGED RCS JET CONFIGURATION			
	D4, B3 DISABLED, D3, B4 ENABLED			
	DUE TO SUNSET SOLAR CORONA			
	PHOTOGRAPHY.			
124+51	V49 STARTED TO L4 PHOTO			
	ATT			
125+02	LOS REV 24			
125+14	REFERENCE DISCUSSION ON CHANGING			
	THE DB FROM 5° TO 3°;			
	I DONT RECOMMEND DOING IT			
	AT 125+30, HOWEVER THE			
	DB ACTIVITY SHOULD BE			
	OBSERVED FOR THE P20 OPT			
	AT 125+30 TO DETERMINE			
	IF IT IS WORTH TRYING THE			
	3° DB AT 133 GET			
125+20	FAO REPORTED THAT ORACON			
	WAS WRONG FOR THE P20			
	OPT 5 AT 121+30 GET.			
	SHOULD HAVE BEEN 197 VICE			
	180. THE			

FLIGHT DIR MISSION LOG		DAY	REV	PG
A 15				29
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING			
	B Team on console			
	Conversation with Joe Turnbull			
	MIT. There is probably an optimum			
	D.B. but Joe really doesn't			
	know what it is			
	- att 138/359 Pith Orkato			
	Reduce (XXX) 5 coll machine?			
	20, 25 mo Pulses instead of			
	25, 14 mo pulses			
126+40	P52	N 05 00001		
		N 93 +.050 .437		
	AT 7.63	-.007 -.061		
		+.011 .096		
		Torque Time 126+413+00		
130+30	P52	N 05 00001		
		N 93 + .016		
		- .005		
		- .017		
		Torque Time 130+38		
		T Start 126+40		

FLIGHT DIR MISSION LOG		DAY	REV	PG 30
A15				
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING			
133+41	PRICE/FILBUND ON CON.			
	P20-OPT 5 - 5°DB (REV 29)			
141+13	DIGENOVA/LEMM ON CONSOLE			
141+20	ORSO LOOKING AT +X ON SCRP			
141+35	AOS			
141+39	P52 TORQUE & READ BY CREW			
	N05 + 00001			
	N93 X = -.004 TORQUE AT			
	Y = -.050 140:49:00			
	Z = .041			
141+42	P20 OPT 5 +X FWD 142 ROLL			
141+46	MADE RECOMMENDATION TO GNC			
	THAT CONSIDERATION BE GIVEN			
	TO ELIMINATING SOME OF THE			
	P-52'S SCHEDULED PER FLIGHT			
	PLAN IN VIEW OF THE EXCELLENT			
	NBD'S LOADED. THIS EXCELLENCE			
	IS VERIFIED BY THE LAST 18			
	DATA POINTS OF WHICH THE FIRST			
	4 WERE BEFORE THE NBD UPDATE.			
	I THINK THIS WILL BE WELCOMED			
	BY THE CREW. SPECIFICALLY I			
	SUGGEST FLIGHT BE ADVISED OF			
	OUR PLATFORM STATUS AND THEN A			
	TASK FORCE OF FAO, GNC, GUIDO, ETC.			
	TAKE A LOOK AT ALL FUTURE P52.			
	SURELY THERE ARE SOME OR LOTS			

P 20 OPT J-

5° DB

- X FWD

ROLL $\approx 332.25^\circ$

ORB RATE
REQUIRES

- Y

- P JET FIRE
FOR ORB/RATE

PLOT SHOWS - R
+ R + F + Y FIRINGS NO = 4 FIRES

P 20 OPT J-

5° DB

+ X FWD

ROLL $\approx 142.25^\circ$

+ Y

+ P

JET FIRE

PLOT SHOWS

GNC HAS COPY OF THIS

P 52's

RECOMMENDED
DELETIONS IF
DESIRED

GET

148	OPT 3 ←	✓ DELETED
152+30	OPT 3	
162	OPT 3 ←	✓
164	OPT 3	
	OPT 1 LOPC	
166	OPT 1 LIFT OFF	
170	OPT 3	
174+30	OPT 3 ←	← DOLKING ✓
190	OPT 3	← LM JETT
198	OPT 3 ←	✓ Deleted
202	OPT 3	
212	OPT 3 ←	✓
219	OPT 3	
	OPT 1 TEI	
221+30	OPT 3	
226	OPT 3	
	OPT 1 PTC	
236	OPT 3	
251	OPT 3	
263	OPT 3	
267+30	OPT 3 ←	✓
272	OPT 3	
291	OPT 3	
	OPT 1 ENTRY	
293	OPT 3	

219

Informal input from George Chen
reference P 52 candidate for
deletion
Rules is in

Making run

G+C

///

save fuel

→ 148
152:50 then rest period in P20

→ 162
164:10
164:20 Option 1 prior P30

170 then COAS CAL then Rendering

→ 174
then JETT

rest

190:15

→ 197:50

201:50

rest

→ 211:45

219:20

219:25

221:30

TEI

226.

236 to PTC

P-23

MCC-S

250:30

P-23

263

P-23

→ 267: 30.

272

MCC - 6

P-23.

289

P-23

291

P-23

to Entry

293

This is an informal input for
P-52 deletion candidate if desired
since we have such a good
compensation in NBD from
George Silver.

F.D.

(With CG $\begin{matrix} 944'' & X \\ 3.89'' & Y \\ 2.93'' & Z \end{matrix}$)

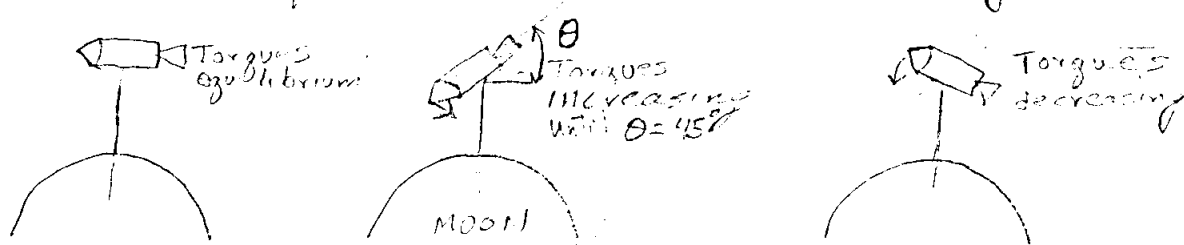
1. Quad A has an $\approx 8\%$ greater Torque advantage in single jet pitch control than quad C.
2. Quad D has an $\approx 11\%$ Torque advantage over quad B in single jet yaw control.
3. (+) Pitch and (-) Yaw firings have greater authority than (-) pitch and (+) yaw.
4. Plots of attitude error show only (+) Pitch and (+) yaw firings with 5.0° DB while orbiting in a retrograde attitude.

ADJ

5. No conclusion
Maybe the CG is not
where we think it is 740.

740

1. When orbiting the CSM is in an unstable equilibrium. with attitude errors close to zero the gravity gradient torques are in equilibrium and vary as a function of the $\sin 2\theta$ of the S/C until local vertical attitude where the torques are minimum again.



2. As the torque trying to twist the S/C out of attitude increases the force of jet firings to keep it at attitude must increase.
3. If an attempt is made to keep the S/C in an attitude that minimizes torque imbalance less torque would be required to null those effects.
4. Therefore decreasing the deadband would keep the S/C at an attitude where gravity gradient torques are less and jet firing would be less.

FLIGHT DIR MISSION LOG	DAY	REV	PG
A15			31
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING		
142+10	CAPCOM ADVISED CREW TO LOAD		
	NEW WEIGHT IN DAP		
	30000 VK 37,276		
142+12	NEW DAP WEIGHT LOADED		
	P20 OPT 5 .5° DB ROLL		
	(71 POINTS ON THE UP25 ERROR X,Y,Z PLOT)		
	REV 33		
142+36	CREW TOLD TO GO BACK TO OLD		
142+37	RCS DAP WEIGHT 37276		
143+32	AOS REV 34		
	P20 OPT 5 (25° BACKWARD OBLIQUE PHOTO		
	ATT) N78 +052.70		
	+45.77 ROLL 145°		
144+25	P20 OPT 5 +X FWD SIA ATT ROLL 141		
144+29	MNVR TO P20 OPT 5 +X FWD SIA ATT		
	ROLL 141		
144+43	LOS REV 34		
144+30	AOS RE 35		
	P20 OPT 5 (40° N. OBLIQUE PHOTO ATT)		
	N78 +090.00 ATT 102, 86, 61		
	+012.25		
→	V49 MNVR TO KEEP SPACE MEAS.		
146+18	299, 213, 065 SCHED 146+17		
145+48	CREW WAS TOLD TO DELETE P52		
	AT 148 GET		
146+05	CHANGED ISS ATT G1, G2 CONSTANTS		
	G1 = 2.79		

FLIGHT DIR MISSION LOG		DAY	REV	PG
A15				32
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING			
146+29	CRITICAL ALARM MG 1X COS			
	CG 2143 NORMAL DUE TO			
	NORMAL YAW ATT 61 55°			
146+2753	CHANGED G1 ISS ATT CONSTANT			
	BACK TO 3.184442			
146+41	LOS REV 35			
	SPDN RECOMMENDS 1.8 X MAX			
	FOR DAF WEIGHT TO REDUCE			
	RCJ			
147+30	AOS REV 36 P20 CPT 5			
	+X FW 5° 10			
148+34	LOS			
149	B team on shift			
151+27	- X forward			
153+30	+0.028 Torque time			
	-0.021 152+46+00			
	+0.000			
153+35	MIB Single Jet Burn Rate .015 sec.			
	roll 0.0282; pitch 0.0097; yaw 0.0091			

USE BLACK
BALLPOINT
PEN

SPAN / MISSION EVALUATION ACTION REQUEST

USE BLACK
BALLPOINT
PEN

TIME
(T-MINUS/GET)

132:25

REQUEST
ORGANIZATION

FOD/OSO

RESPONSE
ORGANIZATION

B A5

CONTROL
NUMBER

CX-193

ACTION REQD BY (TIME): 148:00

REQUESTER H. DRAGHAN

SUBJECT:

Attitude for sleep cycle

APPROVAL

Is there any constraint
on flying in the +X attitude
for the sleep cycle beginning
at 153:30?

FOD REP

Koach

TIME 132:25

SPAN MGR

Kull

TIME 133:22

WE MAY FLY IN THIS ATTITUDE TO
HELP QUAD C RCS USAGE RATES.

RESPONSE:

CONCUR

This attitude will cold bias
Quad D. However the minimum
temperature will occur on
the RCS line and is expected
to be approximately 41.2°F at the
start of the sleep cycle
following 171:00. Some look
angles are needed to
evaluate during LM
docking and period
following.

TEAM LDR

J. J. J.

TIME 147:00

CON SR REP

R. J. J.

TIME 147:41

ME MGR

J. J. J.

TIME 147:50

SPAN MGR

J. J. J.

TIME 148:05

RESPONDER

FOD REP

M. F. Brooks

SPAN MANAGER

J. J. J.

TIME

148:11

TIME

148:12

USE BLACK BALLPOINT PEN		SPAN / MISSION EVALUATION ACTION REQUEST		USE BLACK BALLPOINT PEN	
TIME (T-MINUS /GET)	REQUEST ORGANIZATION	RESPONSE ORGANIZATION	CONTROL NUMBER		
148:45	8/dg.45	FOD	CX-193R1		
ACTION REQD BY (TIME):			REQUESTER		
ASAP			J.T. Taylor		
SUBJECT:		ATTITUDE FOR SLEEP CYCLE		APPROVAL	
It is recommended that the attitude be maintained for the sleep period beginning at 153:50. RCS GUA'D will not receive solar heating during the LM rendezvous period. It is estimated that the RCS oxidizer line will decrease at a rate of approximately 2 1/2 degrees per hour resulting in reaching the 20°F limit. In addition, a small error in predicting this cool down rate		TEAM LDR		TIME	
		J.T. Taylor		148:46	
		CON SR REP		TIME	
		P.H. Babin		148:51	
		ME MANAGER		TIME	
J.M.		148:57			
SPAN MGR		TIME			
Low		149:17			
RESPONSE:		CONCURRENCE			
over such a long period of time can result in large deviations in the RCS line temperature. Therefore, due to the sensitivity of the problem, it is recommended staying with the planned attitude. Reference CX-193		FOD REP			
		TIME			
		SPAN MGR			
		TIME			
		TEAM LDR			
TIME					
CON SR REP					
TIME					
RESPONDER					
ME MANAGER				SPAN MANAGER	
TIME				TIME	

USE BLACK
BALLPOINT
PEN

SPAN / MISSION EVALUATION ACTION REQUEST

USE BLACK
BALLPOINT
PENTIME
(T-MINUS /GET)

149:05

REQUEST
ORGANIZATION

45

RESPONSE
ORGANIZATION

FOD

CONTROL
NUMBER

C-223

ACTION REQD BY (TIME):

REQUESTER

SUBJECT:

It has been noted that the CSM has been hanging up on the edge of the 5.0° db in pitch and yaw (-pitch, -yaw) due to gravity gradient. This has caused an increase in RCS propellant usage, above that predicted but not exceeding the RCS redlines. To reduce RCS propellant usage, a method that should be considered is to decrease the db from 5° to 2° . The savings realized from this would be as follows:

For a 37493 lb CSM at 60 nm

 5° db 0.124 #/hr 2° db 0.084 #/hr

This would result in approximately a 30 percent saving in RCS propellant.

The above data was obtained from an Apollo 15 digital simulation that was performed at NR using Apollo 15 weights and inertias (reference TL 192-401-71-123) dated July 14, 1971.

APPROVAL

TEAM LDR

C. J. Smith

TIME 149:02

CON SR REP

R. J. Smith

TIME 149:05

ME MANAGER

J. J. Smith

TIME 149:05

SPAN MGR

J. J. Smith

TIME 149:53

RESPONSE:

CONCURRENCE

P20 USAGE RATES ARE ACCEPTABLE AT THIS TIME. IN THE 5° DB QUAD C SHOWS LITTLE IF NO USAGE. WE WILL PROBABLY ADJUST DAP WT TO TRY TO REDUCE THE TOTAL NUMBER OF RCS FIRING FOR DOPPLER REASONS.

FOD REP

J. J. Smith

TIME 149:04

SPAN MGR

R. J. Smith

TIME 150:31

TEAM LDR

J. J. Smith

TIME :

CON SR REP

J. J. Smith

TIME :

QUESTION: DOES GOING TO 2° DB SHOW USAGE FROM QUAD C (C4, -P) IN P20? IF YES, RECOMMEND STAYING IN 5° DB.

RSD/GNC

RESPONDER

ME MANAGER

SPAN MANAGER

TIME :

TIME :

New Guidelines for P20 Operation

Option 5 of the CMC Universal Pointing Program (P20) is being used on Apollo 15 for local vertical tracking of the moon for the SIM Bay experiments. The program controls vehicle attitude by passing rate information to the RCS DAP once each 4-to-5 seconds. Attitude error is corrected by computing a rate that will null 20% of the error over one cycle (assuming 4 seconds per cycle) in addition to the rate required to maintain the desired control (e.g., local vertical). However, if the attitude error is over 10° , the 4 second cycles cease and an R60 maneuver is requested to bring the vehicle back in line. Deadband for the DAP is supplied from N79. The noun's deadband value is written into the DAP deadband at the beginning of each cycle. This deadband control and the peculiarities of P20 rate computations lead to several operational constraints for maintaining tight pointing accuracies and avoiding unnecessary jet firings.

The rate computations require use of the orbital integration routine which allows only one user at a time on a first-come-first-served basis with others forced to wait. If P20 (the rate computation) is forced to wait, it does not take into account the waiting time when it does finally execute. That is, it computes rates for where the vehicle was when it first tried to integrate, rather than for where it is now. During the wait, the vehicle CDU's continue to be driven at the last computed rate which is probably essentially correct. However, the delayed P20 cycle comes up with a false error (it wants the CSM to be back where it was at the start of the delay) and therefore derives an erroneous error correction rate (to remove 20% of the error over the next 4 seconds).

Users of integration that can delay P20 include periodic integration (integrates both vectors - unless SURFFLAG set - if they are more than about 25 minutes old in lunar 60 n.m. orbit), V83 (range, range rate, theta - integrates both, theta used often), V85 (like V83), V82 (integrates one vector), P21 and P29 (callable over P20), and V90 (out-of-plane display - integrates both vectors to input time). Periodic integration keeps the vectors from getting more than about 25 minutes old. However, the ground can, and does uplink vectors with timetags in the future. Hence the ΔT over which (e.g.) V83 must integrate can vary - and thus can the delay to P20. Likewise, time to integrate to is an input to P21 and thus the ΔT is variable by crew input.

The results of delaying P20 assuming 1 second per minute integration time, and a 4-second cycle and a 60 n.m. orbit are:

- a. Single vector over ΔT minutes: 4 seconds of incorrect rate drive following the integration leading up to a pointing error of about $\Delta T/100$ degrees which is brought back to near zero over the next 40 seconds.

b. Two vectors over ΔT minutes each: " ΔT seconds" of incorrect rate drive (during the seconds vector integration) leading up to an error of about $(\Delta T/20)^2$ degrees which is brought back to near zero over the next 40 seconds (unless that error is over 10° in which case R60 is requested following the second vector integration).

Note that two vector periodic integration of 20 minutes ΔT gives 1 degree error. Using exact computations, this is the $.9^\circ$ quoted by MIT in their study on this subject. Note that a simple V83 (which integrates both vectors to current time) on vectors only half a rev (60 min.) in the future can cause a peak 9 degrees error $((60/20)^2 = 3^2)$.

Out of this discussion many sets of operational constraints (guidelines) can be derived. The set I propose is as follows during P20 operation:

a. Do not execute extended verbs and programs which use integration with other than current time inputs.

b. Do not uplink state vectors timetagged more than 30 minutes away from current time.

c. During camera operation (tight control required):

(1) Set SURFFLAG (V44E) to prevent two vector integration by Periodic Integration.

(2) Do not uplink vectors (additionally, this prevents the mild transient resulting from a new ephemeris).

(3) Do not execute verbs or programs that integrate both vectors (e.g. V83, V85).

(4) Do not perform P52 alignments (not related, requires going to FREE mode and the subsequent return to AUTO causes a mild transient).

Note that these constraints can be broken under given circumstances and hence should be used as guidelines for normal activity where further analysis is not done or technical advice is not available.

Deadband related operational constraints are as follows (during P20):

a. PRO on N46 in R03 (V48) causes N46 deadband to be used by the DAP for up to 4 seconds (i.e. until next P20 cycle) and hence may cause unnecessary firings.

b. V46 (to RCS DAP load) causes the same as above plus zero commanded rate and attitude error - corrected at the next P20 cycle but may have caused unnecessary firings.

c. Some savings of fuel can be realized if deadband collapsing by loading N79 "on-the-fly" is done in the FREE mode, since the resultant switch to AUTO will center the deadband around current attitude and cause P20 to initiate the 20% in 4 seconds type correction.

Although not expected, it should also be pointed out that simply selecting P31 through 36 will terminate options 1, 2, and 5 of P20; and V96 kills all options. To round out this note (being redundant Mr. Shaffer's memo), the following were also discussed at the June 1 Data Priority meeting:

a. The P20 N78 load will most likely not be the 90° and 52.25° that is being used during simulations (pad measurements are refining Sim Bay reference position).

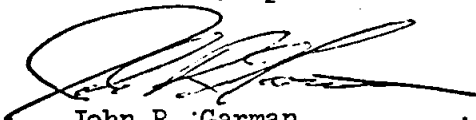
b. Pointing analyses have assumed a P52 each three revs. An attempt is being made to conform to this during wake hours in the Flight Plan.

c. The ground will uplink a new vector if known downtrack error exceeds a maximum of 30,000 feet.

d. An attempt is being made to add performance of a P52 simultaneously with stellar camera observation for post-flight calibration.

e. REFSMMAT is not on the P20 downlist. The agreed upon procedure for ground observance of REFSMMAT when required is: FREE mode, select P52 for 20 seconds, return to P20, then return to AUTO.

f. If gravity gradients are as expected, then a 3° deadband may actually use less fuel than 5° during P20. Following rendezvous this theory may be investigated during what would be 5° operation.



John R. Garman



JCS, Jr.

FLIGHT DIR MISSION LOG		DAY	REV	PG
A 15				33
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING			
157+00	PRICE ON CONSOLE			
157+17	AOS REV 41 P20 OPT 5 -X FWD			
	5° DB - GAMMA IS EXTENDED			
159+00	RECEIVED C-223			
159+15	AOS REV 42			
160+?	PIPA X MAX PULSES AGAIN.			
161+13	AOS REV 43			
162+16	CMC - FREE			
162+19+00	P52 - .014 (# 21)			
	- .044			
	+ .016			
	CMC - AUTO			
163+15	AOS-44, All Booms RETRACK P20, OPT 5, +X FWD, 0.5 DB			
164+08	ENABLED RCS JETS EXCEPT AC Roll.			
164+18+00	P52 OPT 3 - LDB +.030, -.017, +.005			
164+22+00	P52 OPT 1 - RC.			
164+41	REQUESTED 01 A ON 32L			
165+11+32	P.C. RESIDUALS +.2 ΔVc -10.6			
	+.2			
	+.3			
165+14	GIMB MOTORS OFF			

FLIGHT DIR MISSION LOG		DAY	REV	PG
A15				34
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING			
165+58	DIGENONA/LERDAL ON CONSOLE			
	RESULT OF LOOK AT DOI BURN DATA			
	REVEALED ONLY ONE NEW DATA POINT.			
	IT LOOKED LIKE TAC ^{TX} WAS RELEASED			
	BY CREW AT ABOUT 675 SEC			
	AFTER IGNITION. THIS INFO PASSED			
	ON TO C TEAM BEFORE PC			
	BURN. ^{SHOULD NOT HAVE AFFECTED RESULTS.} PC BURN AT 165+11			
	LOOKED GOOD			
166+09	P52 OPT 1 To LDG REFORMAT			
	NOJ. 00000			
	N193 X = .125			
	Y = -.810			
	Z = -.730			
	TORQUE TIME 166+09			
	DID COARSE ALIGN AND IMU			
	FAIL WAS OBSERVED (CH 30 B13) WITH			
	NO AT LIGHT THIS IS NORMAL			
166+22	LOS REV 45			
167+13	NO AOS YET FOR REV 46			
167+14	AOS HSK REV 46			
167+16	P 20 OPT 5, TX FWD, SIM ATT RE142			
167+24	LOS REV 46			
169	AOS REV FT			
	V49 TO MOUNTAIN PT 180, 261, 021			
	ALL RCS JETS ENABLED			

FLIGHT DIR MISSION LOG		DAY	REV	PG
A 15				35
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING			
169+27+00	SIS D1, D2 FLICKERED FROM S/C LOGIC			
	0 TO LOGIC 1 THEN BACK TO ZERO.			
1	WHEN H1 TO LBIT RATE SWITCHED			
169+42	BELIEVE THERE IS A SMALL ERROR			
	IN THE % EMS ERROR EQUATION			
	IN SCP NO CSM-A24			
	EMS ΔV _c COMPUTATION AND ΔV			
	MONITORING ACCURACY.			
	SHOULD BE			
	$\% \text{ EMS ERR} = \frac{PAVE - NBSR1 - \Delta V_c + V_{ch}}{PAVE + NBSR1} \times 100$			
	I DID NOT GET A CHANCE TO CORRECT THE SUMMARY AT PERFORMANCE WORTH			
170+00	B Team on console			
170+06	P52	706	170+06	
		-017		
		-017		
	Poodoo 21502 Just			
	before docking. Will get a			
	replay			
	No P52			

FLIGHT DIR MISSION LOG		DAY	REV	PG
A15				37
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING			
180+12	PLICE ON CONSOLE RE: 169+42 I AGREE.			
181+11	AOS-53, P20, OPT 5, -X FWD, 5° DB			
182+53	AOS-54			
182+59	GAMMA RAY Boom EXTENDED (MARS SPEC Boom ALREADY EXTENDED)			
	ZERO OPTICS SPEC VALUES SHFT 0.00 ± 0.02 ± 0.03 TRUN 0.000 ± 0.006 ± 0.007			
184+50	AOS-55			
	20410 1613p			
186+48	AOS-56			
	THRUST CONVERSION TO OCTAL FOR SHAPING BURN.			
	20410 = 1613p			
	(20257 NOW LOADED)?			
188+46	AOS 57			
189+32	A TEAM SSR ON CONSOLE DIGENOUA/CERIAL PED OPT 5 -X FWD 5° DB			
	SIM BAY RCS			

FLIGHT DIR. MISSION LOG		DAY	REV	PG
A15				38
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING			
190+45	AOS REV 58			
190+46	WE LOOKED AT MORE BURN DATA (LOPC)			
	AND FOUND THAT ONCE AGAIN THE			
	CREW WAS RELEASING THE THC			
	TOO SOON AFTER IGNITION. I			
	SUSPECT HE THINKS THE TRANSLATION			
	LOCKS UP AFTER IGNITION, THINK			
	HE SHOULD BE ADVISED OF THIS,			
	IN BOTH DOI AND LOPC IT			
	LOOKS LIKE HE IS RELEASING THC			
	ABOUT 3/4 SECONDS AFTER D2 SOL			
	IS POWERED, NO GREAT IMPACT ON			
	LONG BURNS BUT COULD IMPACT			
	SHORT BURNS. THINK THIS ITEM			
	NEEDS TO BE PICKED UP IN CREW			
	CHECK LIST FOR P40 BURNS			
191+52	LOS REV 58			
192+46	AOS REV 59			
	CREW AWAKE P20 OPTJ -X FWD 5° DB 322 FWD			
192+51	CAPCOM ADVISED CREW TO			
	DO P20 OPTJ +X FWD SIM BAY			
	ATT 142 ROLL, RETRACT			
	MASS SPEC BOOM			
193+15	MINVR COMPLETED +X FWD SIM BAY			
	5° DB			
	194+35 15° DB			

PROBLEM MAY BE IN OUR DATA
CMC SHOULD CMD 2 SEC RCS AFTER 1G!!

FLIGHT DIR MISSION LOG		DAY	REV	PG
A-15				39
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING			
	DELAY P52 to 194			
193+46	HOLDING ATT IN EMC FREE			
193+53	P52 OPT 3 NOJ + 00002			
	N93 X = +.018			
	Y = -.081			
	Z = -.003			
	TORQUE AT 193+52			
193+56	LOS REV 59			
194+45	AOS P20 OPT 5 15° 8B			
	142° ROLL +X FWD SIM ATT			
195+54	LOS Rev 60			
196+40	AOS Rev 61 +X FWD 142° Roll 5.0° DB			
197+00	B team on shift			
198+30	Camera crew (.5° deadband)			
	to 201+30			
199+40	Format 30 Subformat 17			
	196+42 → 196+52			
	To verify EECOM AC glitch			
202+40	P52 N93			
	+.007			
	-.047			
	-.005			
	Termination 202+00+30			
	We've been asked to send copies of			
	MSK 669 & 668 to SPAIN MIT-STA43			

FLIGHT DIR MISSION LOG		DAY	REV	PG
A15				40
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING			
	199:23:57			
	199:31:53			
	ECOOM Power Glitch			
205+08	PRICE/FREUND ON CONSOLE			
	P20, OPT 5, -X FWD, 5° DB, AC Roll			
	REV 65			
208+28	REV 67			
209+23	GNC passed 01614g to Guido for EFIMP16 update. ~ 20912#			
210+27	REV 68			
210+46	MORE THAN NORMAL RATES IN Roll AFTER HITTING (-) DB EIRRoll.			
	REQUESTED THRIFT DELOG OF 3640 From 210+45 To 210+50			
	AND EVENT PLAYBACK AND SNAP SHOT			
	PLOT OF CDWIR AND BR VSTIME.			
212+	REV 69 - OPT 3, 0.5° DB, +X FWD			
	AC Roll			
311+52	P52	+0.29	311+52+00	
		-0.25		
		+0.18		

SITE/ACQ/LOS

FLIGHT EVENTS/HISTORY/BRIEFING

MAIN BUS B CURRENT GLITCH TIMES
($\approx$ 13 AMP LOAD FOR $\approx$ 6 SECONDS)

195+33+30

196:43:15

196:49:18

196:51:04

196:52:49

199:17

199:24

199:32

199:46

201:41:30

FLIGHT DIR. MISSION LOG		DAY	REV	PG
A 15				41
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING			
214,00	DIGENOVA/LEPDA ON CONSOLE A TEAM			
	LOS NEXT REV AOS REV 78			
	P 20 OPT 5, 5° DB 11101, 11111			
	+X FWD			
214+54	CHANGED G1 ISS ATT COMPUTATION			
	MEADABLE TO 3.09 TO CORRECT			
	THE SINE PITCH CAL CURVE,			
215+13	FOR THE SHAPE BURN; IF			
	CREW RELEASES THE THC AS IN			
	THE LEPDA REV DOI AND LOPC			
	BURNS (2 3/4 SECONDS AFTER IGN)			
	THIS SHOULD GIVE US +.4 RESIDUAL			
215+23	V49 MNVR TO 281,130,001			
215+25	THIS V49 MNVR GAVE US AN			
	OPPORTUNITY TO EVALUATE THE			
	G1 CONSTANT CHANGE FOR THE			
	FULL SINE CURVE RANGE AND IT			
	IS PERFECT - (WITHIN 1 PCM COUNT).			
	THE COSINE CURVE IS ALSO GOOD			
	FOR PITCH AXIS.			
215+35	LOS REV 70			
215+44	CHANGED PITCH/YAW SPN TRIM			
	LIMITS TO	LO	HI	
	PITCH	+1.2	+1.0	
	YAW	+1.2	+1.5	
	SHOULD BE GOOD FOR BOTH SHAPE			
	& TEI BURN			

FLIGHT DIR MISSION LOG	DAY	REV	PG 42
A15			
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING		
	AOS REV 71 SHOULD BE		
	OPT 5 (40°S OBLIQUE SIMPHOTO)		
	182 ROLL		
216+25	4 MIN LATE IN AOS DATA		
216+36	CREW ADVISED TO ZERO MODE OPTICS		
216+38	OPTICS ZEROED		
	F-K1 CHE CARD MARKED UP		
	G/5-1 CHECKLIST		
217+25-50	-Y THRUSTER ACT & CREW ADVERT		
	LIGHT (GLITCH?). ROOM EXT		
	LOS REV 71 +X FWD PRG		
	OPT 5 ROLL 141.5° 15° DB		
218+18	COMPUTER TM ADVISED THAT THERE WAS SOME		
	PROBLEMS IN GETTING SNAPSHOT PLOTS FOR BACK SIDE PASSES		
	AND THAT IT WILL REQUIRE RE-RUN TO GET THEM		
218+19	AOS REV 72		
218+24	GOT LATEST CHECKLISTS FOR		
	SHAPE BURN AND TEI BURN		
	SHAPE BURN CHECKLIST VERSION 217H		
	TEI BURN VERSION 204+00		
219+18	CAPCOM CHECKING WITH CREW TO		
	VERIFY SPS BURN CHECKLISTS		
	CHANGES		
219+28	P52 NOS 00001		
	N43 X = +0.018		
	Y = -0.027		
	Z = -0.009		
	TORQUE 219+26		

[illegible]

FLIGHT DIR MISSION LOG		DAY	REV	PG
A15				43
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING			
219+31	P52 OPT 1 TO TEI			
	N05 00000			
	N93 -978			
	,308			
	,432			
	TORQUE AT 219+31			
219+32	LOS REV 72			
220+17	AOS REV 73			
22054	BT.com on command			
	Shops Burn on time			
	Reschedule N95			
	+1.0 -1.1 -1.2			
	1.0			
	P52	Trim to .1		
	.021	-.2		
	.04	-.2		
	.024	N/C -11.4		
		54.8		
		66.2		
	P52 Torque Time 221+28			
	AT 1.95			
	Sub Pit Vol			
	Rates Interval R P Y			
		.0044 / -.0022 / .0349		
		at Error .165 / .121 / -.022		

FLIGHT DIR MISSION LOG		DAY	REV	PG
A15				49
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING			
223+25	223 P40 TEL			6
	Barr Status			
	2+21			
	No Trim			
	-.2			
	+.6			
	+.2			
	AVE -16.7			
	3628.5			
	<u>3045.2</u>			
225+02	No Events on 32L for TEL because CCATS did not set his playback bit.			
226+10	- 00015	226+10+45	opt. 3	
	- 00027			
	+ 00004			
	+ 440	226+14	opt 1	
	- 522			
	- 180			
227+49	Set up for PTC no hd enable on R2 - then 1A, BD enable no roll until jets were enable - have EPCSD Log			

USE BLACK BALLPOINT PEN		SPAN / MISSION EVALUATION ACTION REQUEST		USE BLACK BALLPOINT PEN	
TIME (T-M NUS/GET)	REQUEST ORGANIZATION	RESPONSE ORGANIZATION	CONTROL NUMBER		
220:00	45	FOD	C-316		
ACTION REQD BY (TIME):			REQUESTER		
SUBJECT: EVA FLT PLAN & CK list changes			APPROVAL		
ATTACHED ARE RECOMMENDED			TEAM LDR <i>[Signature]</i>		
FLIGHT PLAN AND CK LIST CHANGES.			TIME 219:33		
as marked items:— In document the exit check is out of sync Recommendations are attached and not needed on check list (see item (1)) item (2) explains reason for accumulation			CON SR REP <i>[Signature]</i>		
			TIME 220:30		
			ME MANAGER <i>[Signature]</i>		
			TIME 220:34		
			SPAN MGR <i>[Signature]</i>		
			TIME 221:49		
RESPONSE:			CONCURRENCE		
PROCEDURES WILL BE			FOD REP <i>[Signature]</i>		
USED AS MODIFIED.			TIME 231:25		
WE CONCUR EXCEPT AS NOTED:			SPAN MGR <i>[Signature]</i>		
(1) O. TK 2 SW W HTRS MHA			TIME 231:32		
(2) PRIM ACCUM FILL MAY HAVE TO BE REPEATED			TEAM LDR <i>[Signature]</i>		
(3) CREW SYSTEMS CHECKING C2F ² DATA IN			TIME 232:27		
MAPPING CAMERA CASSETTE FIT IN B1			CON SR REP <i>[Signature]</i>		
WILL REPORT IF WE DO NOT CONCUR WITH PLAN			TIME 232:42		
RESPONDER <i>PAD/GNC/INCO/TECOM</i>					
ME MANAGER <i>[Signature]</i>			SPAN MGR <i>[Signature]</i>		
TIME 232:51			TIME 233:17		

MCC-H

0934 CDT

FLIGHT PLAN

NOTES

241:00
(11101)
(X1111)

:10

:20

(11101)
(10011)

241:30

:40

:50

242:00

M
S
F
N

V49 MNVR TO EVA ATT

S-BAND AUX TV - TV
COMM CHECK
SYSTEM PREP FOR DEPRESS~~V48 MNVR TO EVA ATT (241:35)~~

(352,063,050) P 4, Y 225

DISABLE ALL JETS EXCEPT:

; QUADS C & D AT CONCLUSION OF MNVR

O₂ HEATERS 1, 2, & 3 (3) - AUTO (50 W HTRS "OFF")ESTABLISH SCS ATT CONT, ~~ATT DB - MIN. RATE LOCK~~ LIMIT CYCLE-ON

V48 (11101) (00011)

CONCLUDE DOWNING PGA'S

CMP DON EVA EQUIPMENT

CDR/LMP INTEGRITY CHECK

CMP INTEGRITY CHECK

GO/NO-GO FOR CABIN DEPRESS

CABIN DEPRESS

HATCH OPENING

PANEL 226

~~O₂ (TK1) 50 W HTRS - MN B~~
~~O₂ (TK2) 50 W HTRS - MN B~~
~~O₂ (TK3) 50 W HTRS - MN A~~

FOV 5°

GET = 241

PANEL 226

O₂ (TK1) 50 W HTRS - MN B
O₂ (TK2) 50 W HTRS - MN B
O₂ (TK3) 50 W HTRS - MN A

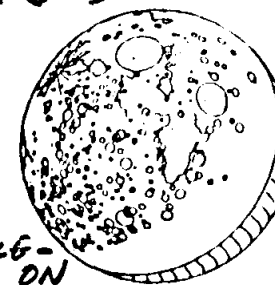
OPEN

OPEN

OPEN

ECCOM

A11A



FOV 3°

GET = 241

GO/NO-GO FOR
CABIN DEPRESS

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 15	FINAL (7/26)	7/12/71	241:00 - 242:00	11/TEC	3-355

CHANGE B

FLIGHT PLANNING BRANCH

DELETE
OPS NORMAL

done
@ 225+4
filled to 51%

3-1

CM EVA

gxc

EECom

1 CM EVA PREP

CABIN PREP FOR EVA

- Stow Optics ~~in bays~~
- Temp stow A9 rock bag
- Stow A-9 between Z-Z couch struts, secure with 2 short bungees, snap to side of A9
- Install EVA stabilizer strut
- Unstow CM EVA cue card (R-2) attach to MDC
- Stow MDC ingress bar
- Verify ORDEAL stowed
- Stow COAS
- Stow LEVA bags (2) in tunnel using short bungees
- Unstow EVA umbilical bag from side of A-7, attach 4 snaps to top of A4, A5 & A6
- Discon inboard hooks on A2 Decon bag, attach to handhold on L3
- Discon inboard hooks on A7 Decon bag, attach to R9 handle
- Retrieve garbage bag, secure draw string
- Position garbage bag for jettison between LMP hoses
- Unstow from A-8
 - Tool kit with jack screws fully opened inside, snap 2 snaps to LH girth ring
 - DAC Mags F & G, stow in CDR TSB, top pkt
 - 1-interconnect - stow in CDR TSB (Top Pkt)
 - EMU maint kit, stow in CDR TSB (Top Pkt)
 - CWG's (3), stow in LMP TSB
 - Biomed harness (3), verify unstowed and/or donned, stow in LMP TSB
 - Comm carriers (3), stow in LMP TSB
- Close A8
- Unstow MDC guards (3) and TV pole from side of A-8
- Stow TV pole on RH LEB with bungees
- Install MDC guards

Prim Accoun Fill Vlv : on
until 50 to 55%
then : off

MAY HAVE 1 PILOT
DUE TO CM COOLING
DOWN IN
PTC.

CM EVA

DATE 7/9/71

S
3-6

PGA DONNING

Remove PGA's from bag
Partially unzip Fecal Containment Bag (PGA Bag)
Disconnect bag and stow bag under RH couch using a
long hook bungee

MP PGA donning:

FCS - LMP TSB
CWG - LMP TSB
Biomed harness - on crewman/LMP TSB
UCTA - inside PGA
Comm carrier - LMP TSB (don later)
Conn 02 hoses to LH side R/R, B/B -
PGA Diverter vlvs - Horizontal
Suit Flow - full flow -
Move scissors to PGA EVA pocket

LMP PGA donning:

Remove IV gloves stow in LEB TSB
FCS - inside PGA
CWG - LMP TSB
Biomed harness - on crewman/LMP TSB
UCTA - inside PGA
LCG plug - installed (spare in EVA bag)
Gas connector plugs installed
Comm carrier - LMP TSB (don later)

Pnl 6 - POWER - OFF
SUIT POWER - OFF
AUDIO CONTROL - NORM

Conn 02 hoses to RH PGA connectors (R/R-B/B)
Conn comm
Suit Flow - full flow
Conn IV tether to RH side/Lock, install pin

PNL 6 - POWER - AUDIO/TONE
SUIT PWR - ON UP.

DATE 7/9/71

INCO OK JBT
OK FAD


S
3-8

1 CHECK

~~Pnl 6 - POWER - AUDIO/TONE
SUIT POWER - on (up)~~

OK
NCO PBA



Pnl 9 - POWER - AUDIO/TONE
SUIT POWER - on (up)

Pnl 10 - POWER - AUDIO
SUIT POWER - on (up)
MODE - VOX
VOX SENS TW (as reqd, ~7)
PAD COMM - OFF
S-BD - T/R
AUDIO CONT - NORM
INTERCOM - T/R
VHF AM - OFF

Pnl 3 - S-BD AUX TAPE - off (ctr) (verify)

Pnl 3 - S-BD AUX TV - TV

TV MONITOR PWR - ON

Perform comm check with crew & Hou

Pnl 604 - Suit Press Alarm SW - on/off, verify-tone

Pnl 3 - S-BD AUX TV - off (ctr)

SYSTEMS PREP FOR DEPRESS

Pnl 325 - CABIN PRESS RELIEF vlv (2) - NORMAL

Pnl 2 - CABIN FANS - OFF

Pnl 602 - Verify REPRESS 02 PRESS - 865-935 psi

Pnl 326 - REPRESS PKG vlv - ON

Pnl 326 - verify SURGE TK vlv - ON

Pnl 351 - CABIN REPRESS vlv - OFF (verify)

Pnl 600 - EMER 02 vlv - CLOSED

Pnl 601 - verify REPRESS 02 vlv - CLOSED

Pnl 2 - 02 PRESS 1/SRG - 865-935 psi

7/9/71
DATE

~~NO POWER TO EMB 2-1 (200, 200, 200)~~

OK

S
3-14

HATCH OPENING

GN2 vlv handle - pull
Gage reads - min < -
Lock pin release knob - unlock
Lock pin indicator released
Gear box sel - Unlatch
Actr handle sel-U
Stow ACTR handle
Unlock Hatch
ACTR handle SEL-L
Stow actr handle
Gear box SEL - latch
Lower Visors
Open hatch

2 EVA OPERATIONS

Jettison jett bag
Egress
Install TV/DAC pole (align)
Adjust TV settings if required
Pnl 15 - UTILITY PWR - ON
DAC - on

Transfer to sim bay and enter foot
restraints

LMP tend Umb (stop at mark)

CMP verify cuff gage 3.7-4.0 psig

Retrieve Pan Camera Cassette

Remove hard and soft covers -

Attach hook and lock

Pull pip pin, squeeze handle and
remove cassette

Transfer to hatch

LMP attach tether large hook to cassette and lock

Remove wrist tether hook, temp stow cassette

CMP - Return to work station

CMP verify cuff gage 3.7-4.0 psig

Rest - inspect SIM BAY -

INSPECT SIM BAY.

DATE 7/9/77

**BETTER
TIME TO
PERFORM**

VERIFY BAY CONTROLS FROM JETT.

- not necessary
performed in
insertion

**J.W.A.
B.M.**

S
3-17

POST EVA PROCEDURES

Pnl 351 - EMER CAB PRESS sel-BOTH
CMP purge vlv - HI, pull pin, activate purge vlv
(Place in CDR TSB, top pkt)
Pnl 603 - EVA Sta O2 - OFF
Pnl 604 - SUIT PRESS ALARM - OFF

When PGA press zero (psid) CMP pop glove, do
not remove gloves

Pnl 603 EVA sta O2 - ON
Doff helmet with LEVA
Pnl 603 EVA sta O2 - OFF

CDR/LMP doff gloves, then helmets
Pnl 380 - SUIT CKT RTN vlv - open (pull)
Verify surge tank press > 400 psia
Pnl 326 - REPRESS PKG vlv - FILL

CLEANUP PROCEDURES

Unstow 3 towels and accessory bag from CDR TSB,
top pkt

CMP place both gloves in accessory bag
Remove gloves handling wrist rings only
Remove OPS

Wet 1 towel with water gun
Wipe cassette handles with wet towel
Wipe other contaminated areas as required,
stow towel in accessory bag

Tape (EVA Bag) film openings on cassettes, do
not cover breather hole, mapping camera only
Stow Tape (R-6)

Stow Mapping camera cassette (Handle Up) in B1
Snap curtain, lock B1
Stow comfort gloves in accessory bag
Wipe hands with second wet towel, then dry,
stow in accessory bag

*With 1st. enough
2nd. enough.*

DATE 7/9/71

~~File Under GUM SOFT
MATERIAL~~

*Checked with EVA procedures
and he feels MAP Camera
Cassettes fits snug enough
in B1 so this is not
required.*

FAD

1. RECOMMENDED CSM EVA PROCEDURE CHANGES:

After: Cabin Prep for EVA *done @ 225449*
B Moon

Add: Prim Accum Fill Vlv: On Until 50 to 55%, Then = Off.

Reason: This procedure is required to preclude gas, dissolved in the coolant, from coming out of solution and possibly causing pump cavitation and loss of coolant flow. This adjustment is normal for depressurized cabin operations and is included in the AOH for EVA but is not included in the crew procedures.

2. CSM EVA:

No additional procedure changes are recommended for the nominal CSM EVA procedures. However, the following procedures are recommended if the CDR/LMP suit circuit integrity check is out of spec:

Perform the PGA CHECK, page S1-12, paragraph C. If this check fails, DISCONNECT, INSPECT, AND RECONNECT ALL O₂ CONNECTIONS AND REPERFORM THE PGA CHECK.

If the PGA's leak check is acceptable, the leak is probably the suit circuit. The crew should clean and lubricate both of the LiOH cannister door seals and cycle the suit circuit return valves.

If the CMP suit integrity check EXCEEDS the specification, all O₂ CONNECTIONS of his suit should be disconnected, inspected, reconnected, and the suit integrity check reperformed.

PTC Startup @ 227+45

Roll control problem occurred during auto maneuver
to PTC attitude

$R = 327$
 $P = 90$
 $Y = 0$

Roll drifted thru 327 @ 227+44+02

{ Configuration @ 227+49+30 roll error = -5°
DAP = AC Roll; jet select = BD roll; ADB = 5°

227+45+30 Crew performed V48 and changed DRI
to 11101 but did ^{not} Key PRO

227+45+43 V37E00E and DRI went to 11111
due to track flag = 0, and max DB Flag = 1

227+59+02 Crew redid V48 and set DRI = 11101
no change to DR2 DR2 = 11111

227+48+38 V16N20E to monitor gimbal angles
Roll still drifting

227+49+02 V22N46E 01111E to change DR2
to BD roll. This will not work since a ~~different~~
erasable is used to specify roll control in the DAP
V48E must be performed to change that erasable
DR2 was 01111 at this time with DAP AC roll.

227+55+45 P20 selected N79 = -0.3752, .51

Roll control still not established

227+59+04 P20 completed and -0.4°/s commanded
in roll, configuration still wrong

227+59+16 CMC mode Free; roll error zeroed

227+59+18 V37E20E P20 restarted, command rate
zeroed

227+59+38 CMC mode-Auto
227+59+42 P20 executed with commanded
rate = $-0.4^\circ/\text{s}$ (still no control)
227+59+57 CMC mode Free ; roll error zeroed
228+00+02 V48 performed which configured
DAP to BD roll - still in free mode
228+01+10 CMC mode-Auto with $-0.4^\circ/\text{s}$
commanded and roll spinup started
~~228+01+21~~ (13) - Roll jet firings occurred
228+01+36 V37E00E KILLED commanded
rate and returned to 0.5° ADB
(16) + Roll jet firings occurred
Crew then did V49 maneuver to PTC
attitude, damped rates and did a
proper PTC start.

Ref

USE BLACK BALLPOINT PEN		SPAN / MISSION EVALUATION ACTION REQUEST		USE BLACK BALLPOINT PEN	
TIME (T-MINUS/GET)	REQUEST ORGANIZATION	RESPONSE ORGANIZATION	CONTROL NUMBER		
230+09	FOD	45	OX - 327		
ACTION REQD BY (TIME): 232+00			REQUESTER SPAN/MOON		
SUBJECT: BOOM EXTENSION		APPROVAL			
1. WHAT IS MAXIMUM MANEUVER				FOD REP	
RATE WITH BOOMS				KACIK	
EXTENDED?				TIME 23:10	
2. IS IT "GO" TO EXTEND BOOMS				SPAN MGR	
WITH JETS ENABLED:				RUB	
				TIME 23:10	
RESPONSE:		CONCUR			
Accelerations other than g's are constant. Booms can withstand effective pilot roll plus minor acceleration recommended maneuver. 1. to 2.5 g's maximum. Sum of roll altitude control is effective. 3. to 4. jet controls. 5. jet control altitude control. 6. by used for pitch and yaw. These constraints are caused by theoretical stuck on thrusters, boom deflection and restoring accelerations.				TEAM LDR	
				R. Burt	
				TIME 23:31	
				CON SR REP	
				4M. Miller	
				TIME 23:29	
				ME MGR	
				J. Miller	
				TIME 23:30	
				SPAN MGR	
				HIS	
				TIME 23:40	
SEE ATTACHED					
R. Burt					
RESPONDER					
FOD REP		SPAN MANAGER			
W. Miller		Scott H. Humpherson			
TIME 237:48		TIME 237:49			

(PLEASE USE BLACK BALLPOINT PEN)

NSC Form 1214C (May 69) (OT)

518.2

REPLY TO
ATTN: CC

C652-71M-146

C652-71X-146

JUL 22 1971

MEMORANDUM

TO: PA/Manager, Apollo Spacecraft Program

FROM: CA/Director, of Flight Crew Operations

SUBJECT: Constraints on Extended Booms in TBC

Please refer to SDR, Vol 1, 3.3.2.6, subject: Transearth Const - SDI Experiments.

The referenced constraint requires a deactivated control system in TBC when the experiment booms are extended. It is our understanding that the intent of the constraint is to provide protection against a boom bending and striking the service module when a roll rate caused by a stuck-on thruster is damped with two jets using the direct control mode.

The intent of the constraint will be met by the following procedural steps which are similar to the CSM EVA thruster-failed on procedures:

- a. Direct will be disabled during TBC except for midcourse corrections. The booms will be retracted for all midcourse.
- b. If a jet fails on, the crew will isolate that jet to stop the thruster firing. The primary rate command system will be used to damp the resulting rotation. This provides only one jet control in roll.
- c. If the problem is not alleviated, the crew will isolate two adjacent quads, which gives a one-jet direct control in roll, and then damp the rates.

Although we are operating the experiments in TBC with the booms extended and the control system activated, the intent of the constraint is met by the above procedures.

Original Signed By:

Thomas P. Stallord

Donald H. Slayton

cc:

See attached page

(4)

A15

45

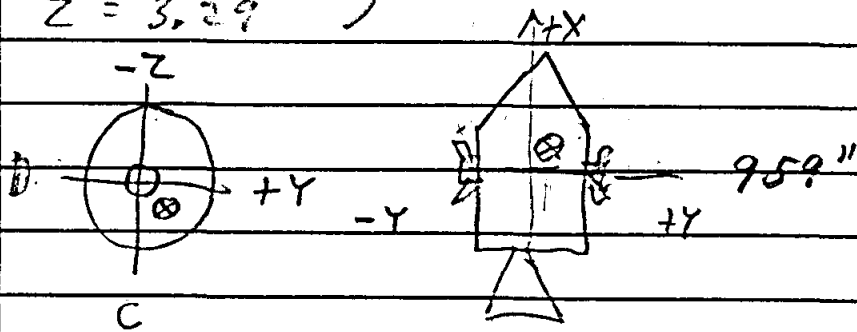
SITE/ACQ/LOS

FLIGHT EVENTS/HISTORY/BRIEFING

228.145

The auto mnors. stopped at 227° but were called to drift in roll to about 317°. we told him to turn BD on in the Dps which he did, but still no roll attitude control. At this time he proceeded with P2000. 2 and landed PTC rate of - .350 and the DSKY blanked. There was no Omega and still no roll db. At roll 2307. OMGA indicator .350 and A00T went to .350. At this time the DAP killed the auto and we began to hand land. We later gave a very ~~short~~ short this time rather more < .005 but just as soon as they started ~~conclusion~~ with went to .006%. The roll rate ~~only went to~~ only went to -.2386% went only

FLIGHT DIR MISSION LOG		DAY	REV	PG
A 15				46
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING			
227+20	PRICE/FREUND ON Console			
	PTC IN PROCESS			
234+15	RECEIVED C-316			
	RE: 228+45 - FREUND ANALYSIS			
	IN LOG.			
235+46	CREW Awake			
236+00	Flight plan updates read to crew			
	DAP config updated from 247+30 to			
	261+00 to PRI = (11101) to (11111)			
236+25+30	P52 OPT3 +.019 (PTC)			
	-.031			
	+.027			
236+36	OUT OF PTC - MANU FOIL P23			
	OPTICS CAL ATT. 66, 152, 350			
236+50	84, 120, 330 MANU TO SIGNING ATT			
236+57	XRAY - ON			
237+04	84, 114, 330 MANU P23			
237+07	84, 117, 330 MANU P23			
237+20	OUT OF P23 MANU TO XRAY Point ATT			
	355, 36, 0			

FLIGHT DIR MISSION LOG		DAY	REV	PG
A 15				47
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING			
237+24	DIGENOVA/LEAPAL TEAM A ON CONSOLE			
	X = 970		27349	
	Y = 1.37		} CG LOCATION	
	Z = 3.29			
				
	-Y (D4) MORE AUTH THAN +Y (D3)			
	-P (C4) MORE AUTH THAN +P (C3)			
	STUCK D3 NO RATE YAW			
	STUCK D4 - RATE YAW			
	STUCK C3 NO RATE PITCH			
	STUCK C4 - RATE PITCH			
241+02	U49 TO EVA ATTITUDE			
	P 63, Y 50, R 352.			
241+17	SCS MODE & QD A&B JETS			
	DISAB			
241+40+15	MCW LATCH (GLITCH)?			
242+27	ATT IS WITHIN 0° PITCH .2° YAW .2° R			
242+37	MCW CRIT ALARM			
242+47				
242+51	RE-CONFIG JETS & WENT TO GEN MODE			
	ALL JETS ENABLED			

FLIGHT DIR MISSION LOG		DAY	REV	PG
				48
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING			
242+55	P/Y DRIFT OF BMAGS WAS			
	A $\approx .13^\circ/\text{hr}$ and Roll $\approx .05^\circ/\text{hr}$			
243+06	SPAN WOULD LIKE AT 295+30 JETS			
	A2 & B1 disabled.			
	EVA WENT VERY WELL			
243+18	HOLDING AT THERMAL ATT			
244+32	REF CSM/EVA SPAN VERBAL INPUT			
	ON ROLL BMAG DRIFT RATE WAS			
	$\approx 1.9 \text{ DEG/hr}$			
244+48	LATEST HACK ON THE BMAG			
	DRIFT RATES ARE:			
	YAW = $.14 \text{ DEG/hr}$			
	PITCH = $.19 \text{ DEG/hr}$			
	ROLL = $.23 \text{ DEG/hr}$			
	NOTE: KEEP RCS JETS			
	A2 & B1 DISABLED DUE			
	TO GN2 LINE ASSOCIATED WITH MAP			
	CAMERA WHICH IS OUT.			
245+32	B team on shift -			
	Gamma Room out 15			
	Mass Spec out 20			
248+15	PTC Start 2			
	248+22	Ret. Boom		
	248+42	Boom Retract		
	249+02	Retract		
249+30	MASS SPEC Boom Deploy			

FLIGHT DIR MISSION LOG		DAY	REV	PG
				29
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING			
	P52 NOS ———			
	N 93 + 008			
	T Time - 007			
	251.00 + 034			
252+0530	PTC Spin up			
	- 2645°/5			
253+00	PRICE/FIREND ON CONSO/5			
	PTC IN PROCESS			
255+42	DID NOT CUT HAIRD COPY OF PTC FROM 254+10.			
	GPC HAS COPY,			
261+30	Lerdal & Digenova			
261+39	EXIT PTC V49 TO XRAY ATT.			
	(322, 226, 000)			
* 262+00	PTC Y medable was changed TO			
	226° must be changed back			
	to 90° For PTC			
262+50	P52 NOS +00000 T-Time 262+57+00			
	X -0.017			
	Y -0.074			
	Z +0.021			
263+18	V49 TO OPT. Cal. ATTITUDE (082, 166, 330)			
263+22	KKK Fail? glitch			
263+29	Begin P-23			
263+58	END P-23 (GOOD MARKS)			

FLIGHT DIR MISSION LOG		DAY	REV	PG
SITE/ACQ/LOS		FLIGHT EVENTS/HISTORY/BRIEFING		
2640500	CREW Reported			
	during U40 To U49 R3 showed 1°/sec P down			
	rate. May have loaded N20 instead			
	of N22. zeroed CDUs and			
	prob. appeared fixed. (TPB verified)			
264+13	AT PTC ATT. Jets Config per FLT			
264+33	.42°/sec Roll Rate To initiate PTC			
	.43°/sec actual Roll rate			
	Glossus Memo #319 Indicates init spinup			
	rate of $\approx 0.3^\circ/\text{sec}$ would result from			
	load of $0.42^\circ/\text{sec}$ (92%) Event Recorder			
	indicated 2 jet roll firing 400ms			
	long.			
	ROLL JETS FIRED AT GET			
	264+33+25 SEC PER EVENT RECORDER			
	Event Record indicates CMC Free			
	0.5 sec after roll jet firing.			
	Talked to MIT (Turnbull) he			
	had nothing to answer for the			
	anomaly. (Another candidate			
	for post mission Analysis)			
	Post mission Analysis may prove			
	There was one jet firing longer			
	than 200ms			
267+32	P-52	N05 00000	N93	X-0.005
	Time 267+36+00			Y-0.006
				Z+0.019

PTC Start 264 + 33

264 + 32 + 36 Crew reconfigured jet selects for -Roll only

264 + 32 + 46 Vehicle reached the -0.5° dead-band and attempted to fire the +Roll jets which were disabled. The rate filter anticipates new rates from the jet firings ~~and~~^{by} incorporating jet firings into ADOT estimation. Erroneous Roll ADOT occurred at this time.

264 + 33 + 24 P20 (2) was completed; Roll ADOT was $+0.2\%$ at this time due to the disabled +Roll jets. A rate command of $WBODY = -0.42\%$ was entered in the CMC for the desired PTC rate. The DAP commands jet firings based on rate error (EDOT). EDOT at this time was:

$$\begin{aligned} EDOT &= ADOT - WBODY \\ &= 0.2\% - (-0.42\%) = 0.62\% \end{aligned}$$

Since the jet firing will produce 72% of the rate commanded the resulting rate (produced by the -Roll jets to counteract the $+0.62\%$ rate error) was -0.45% . The Actual roll rate at this time was in the order of -0.01 to -0.02% before the spin up. The -0.4% PTC rate was due to the disabling of the +Roll jets before spin up *Ref*.

FLIGHT DIR MISSION LOG		DAY	REV	PG
				58
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING			
267+38	EXIT PTC TO V49 (230,180,024)			
	Thermal Attitude			
	AT about 267+18 Gamma Boom			
	was retracted and Roll rate			
	increased $\approx .02^\circ/\text{sec}$ & PTC plot			
	Tightened up slightly.			
268+15	Playing With Mass Spec Boom			
268+27	V49 TO (217,045,332) changed Dep TR1(11/02)			
268+38	I GOT (COMPUTED) AN ACCURATE			
	DRIFT RATE FOR THE BMAGS USED			
	IN YESTERDAY CSM/EVA FOR			
	ATTITUDE CONTROL OF SIC FOR			
	ABOUT 1.5-8 HRS.			
	ROLL DRIFT .27 DEG			
	PITCH DRIFT .18 DEG/HR			
	YAW DRIFT .11 DEG/HR			
269+30	B trans on console			
271+22	V49 (014,175,016)			
271+51	P52 N93			
	+ .029 Torque time 271+55			
	- .018			
	+ .001			
272+28	EMS Eddy Check OK.			
277+15	PRICE / FLEUND ON CONSOLE			
277+18	MANNA TO PTC ATT 87,90,0			

FLIGHT DIR MISSION LOG		DAY	REV	PG
				58
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING			
277+30	PTC SPIN UP N79 - 0.42, +.5			
	CDW BRP - .2635			
280+47	RE: 264+33 FREUND ANALYSIS			
	IN LOG.			
285+34	A TEAM SSR DIGENVA/LEAPL ON			
	CONSOLE.			
286+32	CREW AWAKENED WITH			
	HAWAIIAN MUSIC			
286+39	POST SLEEP CHECKLIST			
287+21	CALLED TO GNC & SPAN ATTENTION			
	THAT APOLLO 15 STATUS REPORT			
	AUGUST 7, 1971, GET 286:13			
	REPORTED ACCELEROMETER BIASES			
	THAT ARE IN ERROR, AS FOLLOWS			
	PIPA'S			
	X = .91 CM/SEC ² .030 FT/SEC ²			
	Y = .05 " " .002 FT/SEC ²			
	Z = .21 " " .007 FT/SEC ²			
	Z LOADED IS -.0079 FT/SEC ²			
	ERROR = MEAS - LOADED			
	= .007 - (-.0079)			
	= .0149 FT/SEC ²			

APOLLO 15 STATUS REPORT
August 7, 1971

GET: 286:13

THERMAL

All temperatures are within acceptable limits.

DISPLAYS AND CONTROLS

Performance is nominal.

INSTRUMENTATION

Performance is nominal.

POWER DISTRIBUTION AND SEQUENCING

Performance is nominal.

COMMUNICATIONS

System performance has been normal.

CREW SYSTEMS

No change in status.

GUIDANCE AND CONTROL

The primary guidance navigation and control system is continuing its superb flawless performance. The gyro drift rates and accelerometer biases are as follows:

IRIG's	PIRA's	
X = +.34 mrad (.015°/hr)	X = .91 cm/sec ²	.030 FT/SEC ²
Y = +.12 "	Y = .05 "	.002 FT/SEC ²
Z = -.05 "	Z = .21 "	.007 FT/SEC ²

PROPULSION AND POWER

SPS: All parameters are nominal.

OSM RCS: All parameters are nominal.

Fuel Cells and Cryogenics: Fuel cell system nominal in all respects.

Cryo quantities:	Oxygen	Hydrogen
	140.7	7.59
	146.2	6.93
	121.2	8.37
	408.1 lbs	22.89 lbs

IF YOU BELIEVE
THIS, IT SAYS THE
ERROR IS .014 FT/SEC
THIS IS WRONG.
PIRA'S ARE OK.

Batteries: CM Batteries - Batt A:	AH	0.79	AH Remaining	39.206
Batt B:	AH	2.11	AH Remaining	37.890
Batt C:	AH	2.11	AH Remaining	37.890
			Total AH Remaining	114.986

SIM BAY EXPERIMENTS

No change in status.

Lewis H. Kelly
255.31

J. R. Sevier

GN & Prop

USE BLACK BALLPOINT PEN		SPAN / MISSION EVALUATION ACTION REQUEST		USE BLACK BALLPOINT PEN	
TIME (T-MINUS/GET) 61 + 00	REQUEST ORGANIZATION FOD	RESPONSE ORGANIZATION 45	CONTROL NUMBER C-75		
ACTION REQD BY (TIME): INFO		REQUESTER GNC			
SUBJECT:	CB 33 Panel 226			APPROVAL	
Enclosed is a detail listing of functions lost with CB 33 on panel 226 opened. (Considered to be 95% correct)			FOD REP HJ Moon		
			TIME 61:00		
			SPAN MGR Ruk		
			TIME 61:03		
INFO					
RESPONSE:				CONCUR	
			TEAM LDR		
			TIME :		
			CON SR REP		
			TIME :		
			ME MGR		
			TIME :		
			SPAN MGR		
			TIME :		
RESPONDER					
FOD REP				SPAN MANAGER	
TIME :				TIME :	

SPAN

LIGHTING LOST AS RESULT
of popped cb 33 (LEB 226).
(LIGHTING-NUMERICS/INTEGRAL LEB AC2)

1. EMS scroll lite
2. EMS RST Lite
3. Electroluminescent Lites on:
 - a. LIGHTING CONTROL PNL 100 (LEB)
 - b. Comm. PNL 10 (RHEB)
 - c. cb PNL 225 (RHEB)
 - d. cb PNL 226 (RHEB)
 - e. Mission & Event Timer PNL 306 (LHFEB)
 - f. System Tacit Mator PNL 101 (LEB)
 - g. Optics PNL 122 (LEB)

4. NAV DSKY KEYBOARDS PNL 140 (LEB)
5. NAV DSKY ANNUNCIATOR PNL 140 (LEB)
6. Optics ANNUNCIATOR PNL 122 (LEB)
7. Mission Timer Counters PNL 306 (LHFEB)

ONC

FLIGHT DIR MISSION LOG		DAY	REV	PG
				53
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING			
287+45	V 16 H 20			
287+56	DISCUSSION ON PROBLEMS WHICH MAY AFFECT ENTRY.			
	1) AC 2 CB 33 LEB 226			
	INTEGRAL LIGHTING			
	a - EMS SCROLL LITE			
	b. EMS RSI LITE			
	SEE SPAN CHIT C-75			
	FOLLOWING THIS PAGE			
288+25	RCS JETS ENAB & EXIT PTC			
288+55	PROC 52			
	N05			
	N93 X - .020			
	Y - .057			
	Z + .055			
	288+58			
288+59	LOADED H 22 FOR V 49 TO			
	330, 73, 330 CALIB AFT OPTICS			
289+05	P23			
289+30	P23'S COMPLETED			
289+36	NO BACKGROUND LIGHTING ON EMS			
	SCROLL & NO LIGHTING ON RSI			
	READ UP TO CREW			
290+00	B Team on console			

FLIGHT DIR MISSION LOG		DAY	REV	PG
				54
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING			
289+58	CREW READ OUT OF CM INT VALVE			
	TEMP AT GET 288+87 IS			
	5C, 4.5			
	5D, 4.4			
	6A 4.4			
	6B 4.4			
	6C 4.6			
	6D 4.5			
290+00	B Term on Console			
290+01				
	- 016			
	- 019			
	+ 603			
	290+01+00 Torque Time -			
291+04	Align to entry Refsmt			
	N93 - .776			
	+ .165			
	+ .563			
	MCC 7 on time			
	Residuals			
	- 0000.1			
	0			
	- 0000.1			
	Burn time 22.35 sec			
	Crew Reported 21 sec.			

FLIGHT DIR MISSION LOG		DAY	REV	PG
				55
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING			
293+21	P52 N93 T 006 NOS 00001			
	- 010			
	+ 005			
	Torque time 293+21+00			
	. 175			
	- 292 Mon			
	. 146			
	DT 2.28			
	000	0029		
	153	N69/NA		
	000	400		
	294+41+54	0212		
	267	0018		
	- 2613	6337		
	- 1581.3	0744		
	062	LU up		
	360			
	96	1 use		
	651	can cut		
	108	SAMS		
	49	6.06		
	361	Main 8.32		
	78	Q 1929		
	294	RA GG		
	58	294-56 115		
	54	✓		

MANEUVER PAD

M	C	C	-	7		PURPOSE
R	C	S	G	E	N	PROP/GUID
+	2	6	3	6	3	WT N47
	0	0	NA			P _{TRIM} N48
	0	0	↓			Y _{TRIM}
+	0	0	2	9	1	HRS GET1
+	0	0	0	5	6	MIN N33
+	0	4	7	9	0	SEC
-	0	0	0	5	6	ΔV _X N81
-	0	0	0	0	0	ΔV _Y
+	0	0	0	0	2	ΔV _Z
X	X	X	1	8	0	R
X	X	X	3	1	1	P
X	X	X	0	0	0	Y
+		NA				H _A N44
+	0	0	2	2	3	H _P
+	0	0	0	5	6	ΔVT
X	X	X	0	2	4	BT
X	0	0	0	5	6	ΔVC
X	X	X	X	3	1	SXTS
+	3	4	7	9	0	SFT
+	3	5	3	0	0	TRN
X	X	X	NA			BSS
X	X					SPA
X	X	X				SXP
	0					LAT N61
						LONG
+						RTGO EMS
+						V10
						GET .05G

COMMENTS:

GDC ALIGN _____ SET STARS

R ALIGN _____

P ALIGN _____

Y ALIGN _____

ULLAGE 2J + X

HORIZON/WINDOW _____

OTHER _____

TELEMETRY DESCRIPTION SHEET FOR PLOTS (TDSF)

For The Telemetry History Report In Formatted Tabulations (THRIFT)

0										1										2										3										4										5										6																													
1 2 3 4 5 6 7 8 9 0										0 1 2 3 4 5 6 7 8 9 0										0 1 2 3 4 5 6 7 8 9 0										0 1 2 3 4 5 6 7 8 9 0										0 1 2 3 4 5 6 7 8 9 0										0 1 2 3 4 5 6 7 8 9 0																																							
PLOT										VEH										AGC										UR										20										FROM										140:50:00										TO										247:50:00									
FORMAT PCL																				SEC										H/M/S										H/M/S																																																	
ONLY FOR TREND PLOTS										UPDATE RATE										ONLY FOR SNAPSHOT PLOTS																																																																					
PLOT TITLE:																																																																																									
TITLE										GM ATTITUDE ERASES																																																																															
PARAMETERS:										TITLE										RTCC EXTERNAL NUMBER										TITLE										RTCC EXTERNAL NUMBER																																																	
Y1L										GN R ERR										: ERAS X										Y2R										GN Z ERR										: ERAS Z																																							
Y3L										GN P ERR										: ERAS Y										Y4																				:																																							
XT																				:																																																																					
GRID INDICATOR (L or R)																				GRID INDICATOR (L or R)																																																																					
SCALES:										LOWER										UPPER										LOWER										UPPER										LEFT										RIGHT																													
YR										-6										+2										YL										-2										+6										XS																													
ONLY IF TWO SCALES																				ONLY FOR A NON-TIME PLOT																																																																					

AK ENCKS

NOTES:

1. TREND TIME PLOTS WILL OUTPUT 5 HOURS ON ONE PAGE.
2. TREND NON-TIME PLOTS WILL OUTPUT ON ONE PAGE.
3. SNAPSHOT TIME PLOT X-AXIS LENGTH IN MINUTES IS TWICE THE UPDATE RATE (UR), PER PAGE.
4. SNAPSHOT NON-TIME PLOTS WILL OUTPUT ON ONE PAGE.

ALLOWABLE SYMBOLS * . \$ + - : ' () ; LETTER (OH) MUST HAVE A SLASH (Ø).

For The Telemetry History Report In Formatted Tabulations (THRIFT)

[illegible]

NOTES:

1. TREND TIME PLOTS WILL OUTPUT 5 HOURS ON ONE PAGE.
2. TREND NON-TIME PLOTS WILL OUTPUT ON ONE PAGE.
3. SNAPSHOT TIME PLOT X-AXIS LENGTH IN MINUTES IS TWICE THE UPDATE RATE (UR), PER PAGE.
4. SNAPSHOT NON-TIME PLOTS WILL OUTPUT ON ONE PAGE.

ALLOWABLE SYMBOLS * . \$ + - = ' () ! LETTER (OH) MUST HAVE A SLASH (/).

TELEMETRY DESCRIPTION SHEET FOR PLOTS (TDSB) For The Telemetry History Report In Formatted Tabulations (THRIFT)

0										1										2										3										4										5										6									
1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0
PLOT										VEH										UR										FROM										TO																													
FORMAT PCL										SEC										H/M/S										H/M/S																																							
ONLY FOR TREND PLOTS										UPDATE RATE										ONLY FOR SNAPSHOT PLOTS																																																	
PLOT TITLE:																																																																					
T-TITLE																																																																					

PARAMETERS:										TITLE										RTCC EXTERNAL NUMBER										TITLE										RTCC EXTERNAL NUMBER																			
Y1																				ERR	SRK									Y2																				ERR	SRK								
Y3																				ERR	SRK									Y4																				ERR	SRK								
X1																																																											

GRID INDICATOR (L or R)

GRID INDICATOR (L or R)
T IF A TIME PLOT

SCALES:										LOWER										UPPER										LOWER										UPPER										LEFT										RIGHT									
YR																																																																					

ONLY IF TWO SCALES

ONLY FOR A NON-TIME PLOT

7					8				
5	6	7	8	9	0				
					01				
					02				
					03				
					04				
					05				
					06				

PLOT
FORMAT
NUMBER

NOTES:

1. TREND TIME PLOTS WILL OUTPUT 5 HOURS ON ONE PAGE.
2. TREND NON-TIME PLOTS WILL OUTPUT ON ONE PAGE.
3. SNAPSHOT TIME PLOT X-AXIS LENGTH IN MINUTES IS TWICE THE UPDATE RATE (UR), PER PAGE.
4. SNAPSHOT NON-TIME PLOTS WILL OUTPUT ON ONE PAGE.

ALLOWABLE SYMBOLS * . \$ + - = ' () : LETTER (OH) MUST HAVE A SLASH (Ø).

160+30

**PLOT
FORMAT
NUMBER**

1. TREND TIME PLOTS WILL OUTPUT 5 HOURS ON ONE PAGE.
2. TREND NON-TIME PLOTS WILL OUTPUT ON ONE PAGE.
3. SNAPSHOT TIME PLOT X-AXIS LENGTH IN MINUTES IS TWICE THE UPDATE RATE (UR), PER PAGE.
4. SNAPSHOT NON-TIME PLOTS WILL OUTPUT ON ONE PAGE.

ALLOWABLE SYMBOLS * . \$ + - = ' () : LETTER (OH) MUST HAVE A SLASH (/).

CSM GEN

USE BLACK BALLPOINT PEN		SPAN / MISSION EVALUATION ACTION REQUEST		USE BLACK BALLPOINT PEN	
TIME (T-MINUS / GET)	REQUEST ORGANIZATION	RESPONSE ORGANIZATION	CONTROL NUMBER		
4:36	45	FOD	C-13		
ACTION READ BY (TIME): AS SPAN ME PLACIA REQUESTER DPA					
SUBJECT:		APPROVAL			
Trouble shooting procedure for SPS lite		TEAM LDR			
to verify SPS thrust switch on Panel I in normal position		TIME			
2. If yes - cycle SPS thrust switch from normal to direct on - observe lite indication for any change - then return switch to normal		CON SR REP			
		TIME 4:38			
		ME MGR			
Note: make sure CB SPS pilot valves A & B (Panel 8) OPEN and AV Thrust switches A & B are OFF on Panel I.		TIME			
Prior to starting item 2.		SPAN MGR			
		TIME 4:51			
RESPONSE:					
CONCUR					
TEAM LDR					
FOD PLANS FOLLOWING INITIAL TEST PROCEDURE:					
CON SR REP					
FOR ALL STEPS BELOW BE SURE SPS PILOT VALV CBS ARE OPEN AND AV THRUST SWIS ARE OFF.					
TIME					
ME MGR					
TIME 5:22					
SPAN MGR					
TIME 5:22					
A. PERFORM MMFUNCTION PROCEDURE 4B.					
B. CYCLE SPS THRUST DIRECT ON SW TO "DIRECT ON" AND BACK TO NORMAL.					
C. PERFORM EMS AV TEST (CHECKLIST G 2-5). (FIRST 7 STEPS)					
THROUGHOUT ABOVE TESTS MONITOR STATUS AND INTENSITY OF SPS THRUST LIGHT.					
RESPONDER					
FOD REP ME MGR		SPAN MANAGER			
TIME 6:08		TIME 6:25			

Flicker Test Back Room -

1. Cycle ΔV Thrust A Both lights (D1-D2) and EMS Thrust ON went off. - Short went away -
2. ΔV Thrust B switch was flicker tested and the lights staged out.
3. The panel was tapped in the vicinity of the Thrust switches and all lights D1-D2 and SPS Thrust ON came on. - Short came back -
4. ΔV Thrust B was cycled and nothing happened
5. ΔV Thrust A was Flickered. The SPS Thrust ON light went out, SPS D1 Stayed ON SPS D2 went off
- 5a. Later when ΔV Thrust A was turned on Both D1 & D2 went off.
6. ΔV Thrust A off both lights staged off

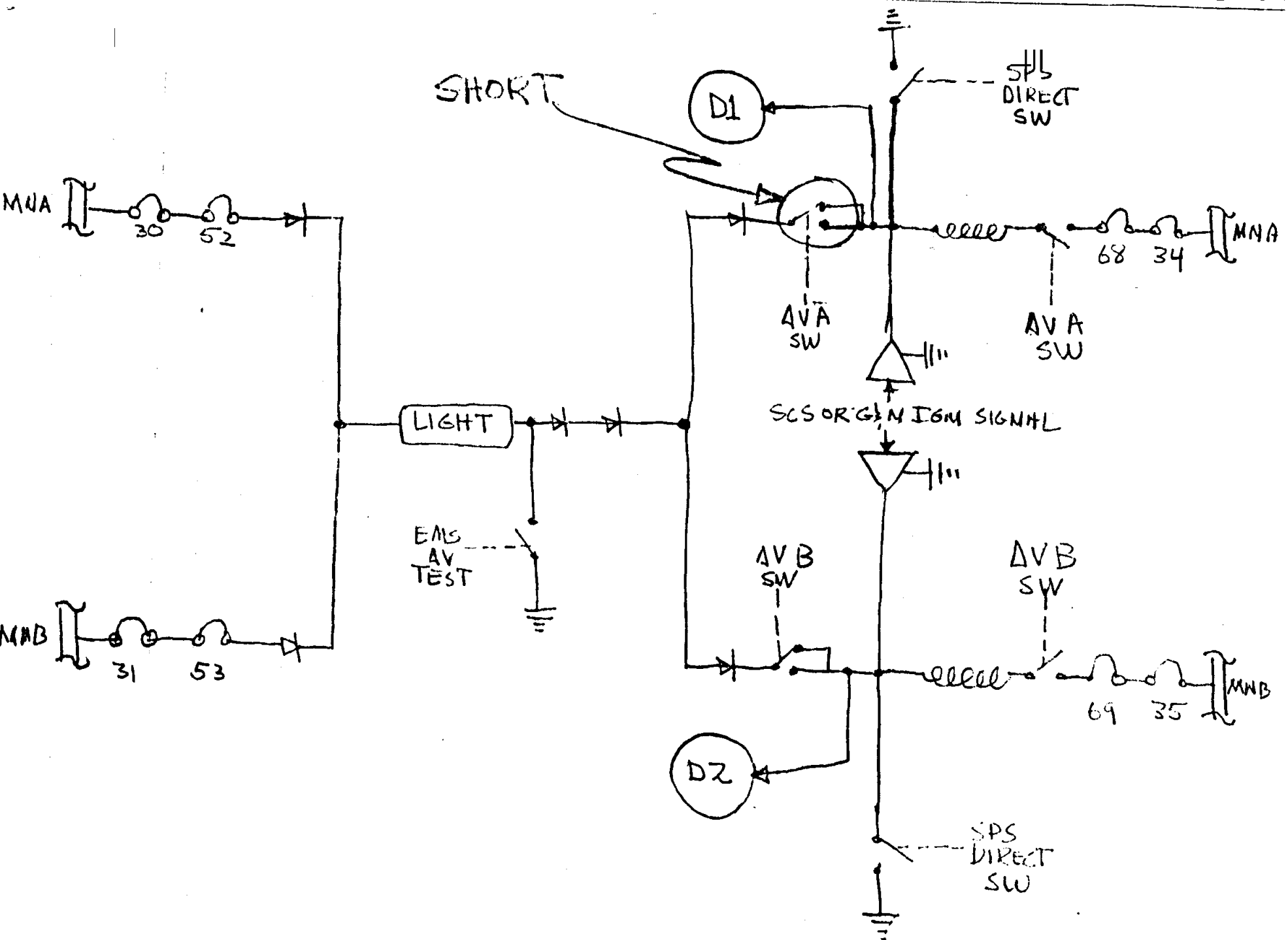
FLIGHT DIR MISSION LOG		DAY	REV	PG
SITE ACQ/LOS	FLIGHT EVENTS/HISTORY BRIEFING			
	SPS "FLICKER" TEST RESULTS!			
	Test performed at ~ 9:35 GET.			
	1. ΔV THRUST A - NORMAL			
	2. SPS THRUST LITE (EMS panel onboard)			
	and SPS Solenoid Driver 1 & 2 Lites			
	went off.			
	3. ΔV THRUST A - OFF			
	4. Tapped on panel and SPS			
	THRUST Lite and SPS D1 & D2			
	came back on.			
	5. ΔV THRUST B - NORMAL and had			
	no change.			
	6. Then placed ΔV THRUST A to			
	an intermediate position between			
	OFF and NORMAL. and SPS THRUST			
	Lite stayed on but had split			
	SPS D1 & D2 lites, ie SPS D1 - ON			
	D2 - OFF			
	7. Then placed ΔV THRUST A - NORMAL			
	and SPS THRUST, SPS D1 & D2 lites			
	again turned off.			
	GNC - J. Kamman			
	Get 12:00			

CREW ACTIONS (OBTAINED FROM ECS A/G TAPE RECOR)

- ① RAN EMS AV TEST - LIGHT GLOWED BRIGHTER
- ② OPERATE SPS DIRECT SWITCH - NO CHANGE
- ③ OPERATE AV THRUST A SWITCH - LIGHT OUT, D1 & D2 OUT
- ④ OPERATE AV THRUST B SWITCH - NO CHANGE
- ⑤ TAPPED ON PANEL - LIGHT ON, D1 & D2 ON
- ⑥ OPERATE AV THRUST B SWITCH - NO CHANGE
- ⑦ OPERATE AV THRUST A SWITCH - CENTER: LIGHT OUT, D2 OUT
UP (ON): LIGHT ON, D2 ON
DOWN (OFF): LIGHT OUT, D1 & D2 OUT

CONCLUSION:

TESTS ② & ⑦ ISOLATE THE FAILURE TO
DOWNSTREAM OF SOLENOID & UPSTREAM OF
EMS power contact of AV Thrust switch.



FLIGHT DIR MISSION LOG	DAY 6/10	REV	PG
SITE ACQ LOS	FLIGHT EVENTS/HISTORY BRIEFING		
	SPS "FLICKER" TEST RESULTS		
	Test performed at ~9:35 GET		
	1. AV THRUST A - NORMAL		
	2. SPS THRUST LITE (EMSPANEL) and		
	SPS Solenoid Driver 1 & 2 Lites went		
	OUT.		
	3. AV THRUST A - OFF		
	4. AV THRUST B - NORMAL and no change.		
	5. Tapped on panel and SPS THRUST		
	Lite and SPS D1 & D2 came back on.		
	6. AV THRUST B - NORMAL and no change.		
	7. AV THRUST A - placed to center		
	between off and NORMAL and		
	had following:		
	SPS THRUST Lite - OUT		
	SPS D1 - ON		
	SPS D2 - OUT		
	8. AV THRUST A - NORMAL and following:		
	SPS THRUST Lite - on		
	SPS D1 - ON		
	SPS D2 - ON		
	9. AV THRUST A - OFF and following:		
	SPS THRUST LITE - OUT		
	SPS D1 - OUT		
	SPS D2 - OUT		
	CALC		
	GET 13+00		

Analysis of Flicker Test

The problem has been isolated to the ΔV Thrust A Switch, however the switch performs 3 Functions:

Contact 1. Powers the SPS Propellant Prevalve Solenoids

Contact 2. Transfers EMS 28V from the EMS Thrust on light to the SPS Solenoid Driver and SPS Thrust Direct Switch.

Contact 3. Powers the high side of the SPS Propellant Control Pilot Valve Solenoids.

Failed Contact "

1.

This would be difficult since it requires two failures, i.e.; that contacts 1 & 2 or 1 & 3 be shorted together and grounded. - Rather unlikely

2.

This switch failed intermittently to ground would cause the problem that was indicated on telemetry and by the EMS Thrust on light.

If the short were on the contact side of the switch and by switch actuation (losing) the switch pole was not making contact in either position then D1, CH3604 would indicate "0" or ON while D2, CH3605 indicated a "1" or off.

3.

This switch failed intermittently to ground ~~would cause~~ on the pole side or on the normally off side would cause the indications we had on tm and on the EMS thrust on light.

If the short were on the normally open or contact side we

expect the problem to be corrected during the "tease test". However, D1 CH3604 and D2 CH3605 would not have disagreed i.e. they would indicate a "0" or a "1" simultaneously. Unless both contacts 2 & 3 can assume an open position simultaneously.

If the short were on the pole side (which is not likely to be intermittent) the failure indications would be the same as for switch contact 2 but again D1 and D2 would always be in agreement, same comment as for the contact side, i.e. simultaneous switch position.

If the failure is in the contact side of switch 3 there are no impacts to ΔV thrust procedure.

If the failure is in the pole side of switch 3 or the contact side of switch 2 we could have a loss of auto thrust on/off control for bank A - However we cannot identify the problem further without a burn or possibly with a burn due to the intermittent nature of the problem.

mcc 2
mcc 4
LCI
DEF

USE BLACK BALLPOINT PEN		SPAN / MISSION EVALUATION ACTION REQUEST		USE BLACK BALLPOINT PEN	
TIME (T- MINUS /GET)	REQUEST ORGANIZATION	RESPONSE ORGANIZATION	CONTROL NUMBER		
12:15	45	FOD	C19		
ACTION REQD BY (TIME): MCC 2		REQUESTER			
SUBJECT:		SHORT IN ENGINE CIRCUIT		APPROVAL	
Attached is the procedure to be used to isolate short in the SPS Engine control circuit.				TEAM LDR	
				TIME :	
				CON SR REP	
				TIME :	
				ME MANAGER	
				TIME 13:14	
				SPAN MGR	
				TIME 13:27	
RESPONSE :		CONCURRENCE			
				FOD REP	
				TIME :	
				SPAN MGR	
				TIME :	
				TEAM LDR	
				TIME :	
				CON SR REP	
				TIME :	
RESPONDER					
ME MANAGER				SPAN MANAGER	
TIME :				TIME :	

I. Procedure to determine location of short upstream or downstream of solenoid:

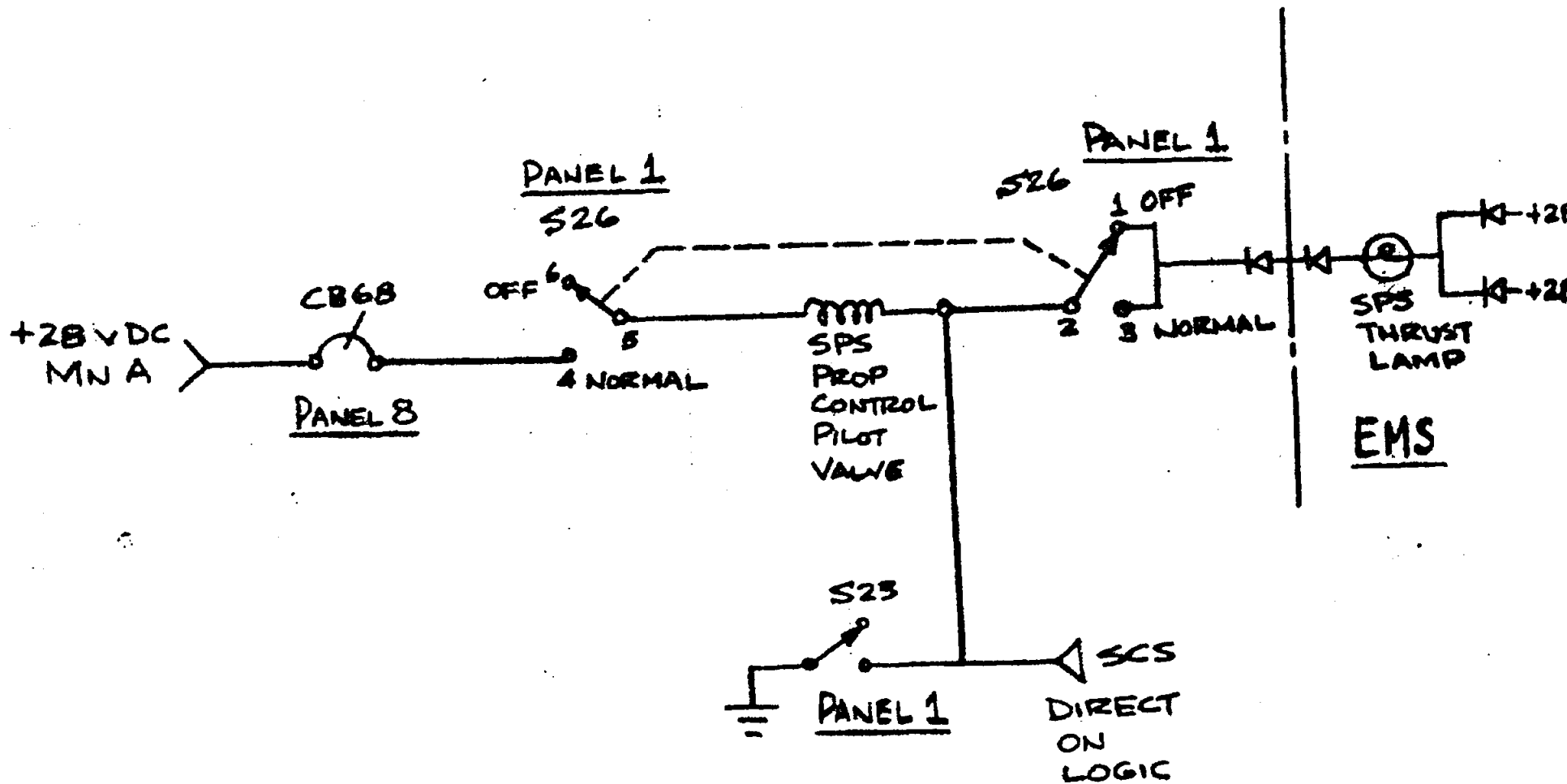
1. Open CB pilot valve A.
2. Close ΔV thrust A.
3. Get light to come on by rapping or cycling ΔV thrust A switch (but end up in ΔV thrust "on").
4. Close CB pilot valve A.
5. Immediately pull out CB pilot valve A when engine starts.
6. If engine does not start within about 3 seconds, pull out CB pilot valve A. The short is upstream of solenoid valve provided light still on.
7. Following step 5, i.e., engine starts and is stopped with breaker, if light still on the short is downstream of solenoid.

II. Procedure to show if short burned clear:

1. If light goes ou then try to get light to come on by tapping o cycling ΔV thrust switch. If light can't be made to return the short was burned clear.

HIGH INTERCOM SYSTEMS CORPORATION
To E. M. PATTERSON Dept NR Phone 4505
BH 48
Name Phone

SPS SCHEMATIC



DETAILS & CONTROLS INC.
A Corporate Division of
TEXAS INSTRUMENTS INCORPORATED
Attleboro, Mass.

Acceptance Test Procedure
Page 16 of 24

CPC Part No. 13154-1

NAA Serial No. 057738218262

Part Name: Toggle Switch

CPC Specification: QAS 750 Rev. 1

NAA Part No. 13452-0102-1301

NAA Purchase Order: HEHRY 147300A

Crumen Spec: 15P-350-802A

NAA Spec: 13-452-0102, Rev. A 13-452-0102 Rev. CPD1B 2-2

The following inspection must be performed in accordance with QAS 753 in the order shown below:

ORDER OF INSPEC	QAS PARA. #	CHARACTERISTIC	SPECIFICATION LIMIT(S)	ACTUAL VALUE	RESP. NO.	✓ = ACCEPT. REJ. NO. = REJ.	DATE
1	3.2	Visual Inspection	N/A	N/A			
2	3.3	Depth	1.450 Max	N/A	(CPC)	✓	8-8-68
3	3.3	Length	1.324 Max	N/A	(CPC)	✓	"
4	3.3	Center Line Coincident	0.020 TIR	N/A	(CPC)	✓	"
5	3.3	Width - "W" Dim.	1.345 Max	N/A	(CPC)	✓	"
6	3.3	All Switches	501 - 439 in	N/A	(CPC)	✓	"
7	3.3	Height of Toggle	1.150 - 1.070	N/A	(CPC)	✓	"
8	3.3	Height of Toggle Lock Cam	1.650 - max	N/A	(CPC)	✓	"
9	3.3	Thread 15/32 - 32UN-2A		N/A	(CPC)	✓	"
10	3.3	Thread 5/8-20 UNF-2A		N/A	(CPC)	✓	"
11	3.4	Weight	15 Pounds max	N/A	(CPC)	✓	"
12	3.5	Continuity	N/A	N/A	(CPC)	NOT IN SAMPLE	"
13	3.6.1	Operating Force	1-8 lbs	N/A	(CPC)	NOT IN SAMPLE	"
14	3.6.2	Angular Position	17° ± 4° (0° ± 4°)	N/A	(CPC)	NOT IN SAMPLE	"
15	3.6.3	Locking Lever Release Force	2.75 ± 0.500 lbs	N/A	(CPC)	✓	"
16	3.7	Dielectric	0.5 MA 500 VDC	N/A	(CPC)	✓	"
17	3.8	Insulation Resistance	100 VDC, 100 MΩ/min	N/A	(CPC)	✓	"
18	3.9	Vibration	See Ref. Para.	N/A	(CPC)	✓	"
19	3.10	Locks	1 x 10 ⁻⁴ cc/sec	N/A	(CPC)	✓	"
20	3.11	Contact Resistance	See below	See below	(CPC)	✓	"
21	3.12.1	Visual	N/A	N/A	(CPC)	✓	"
22	3.12.2	Cleanliness	N/A	N/A	(CPC)	✓	"
23	3.1	Operating Limit	N/A	N/A	(CPC)	✓	"

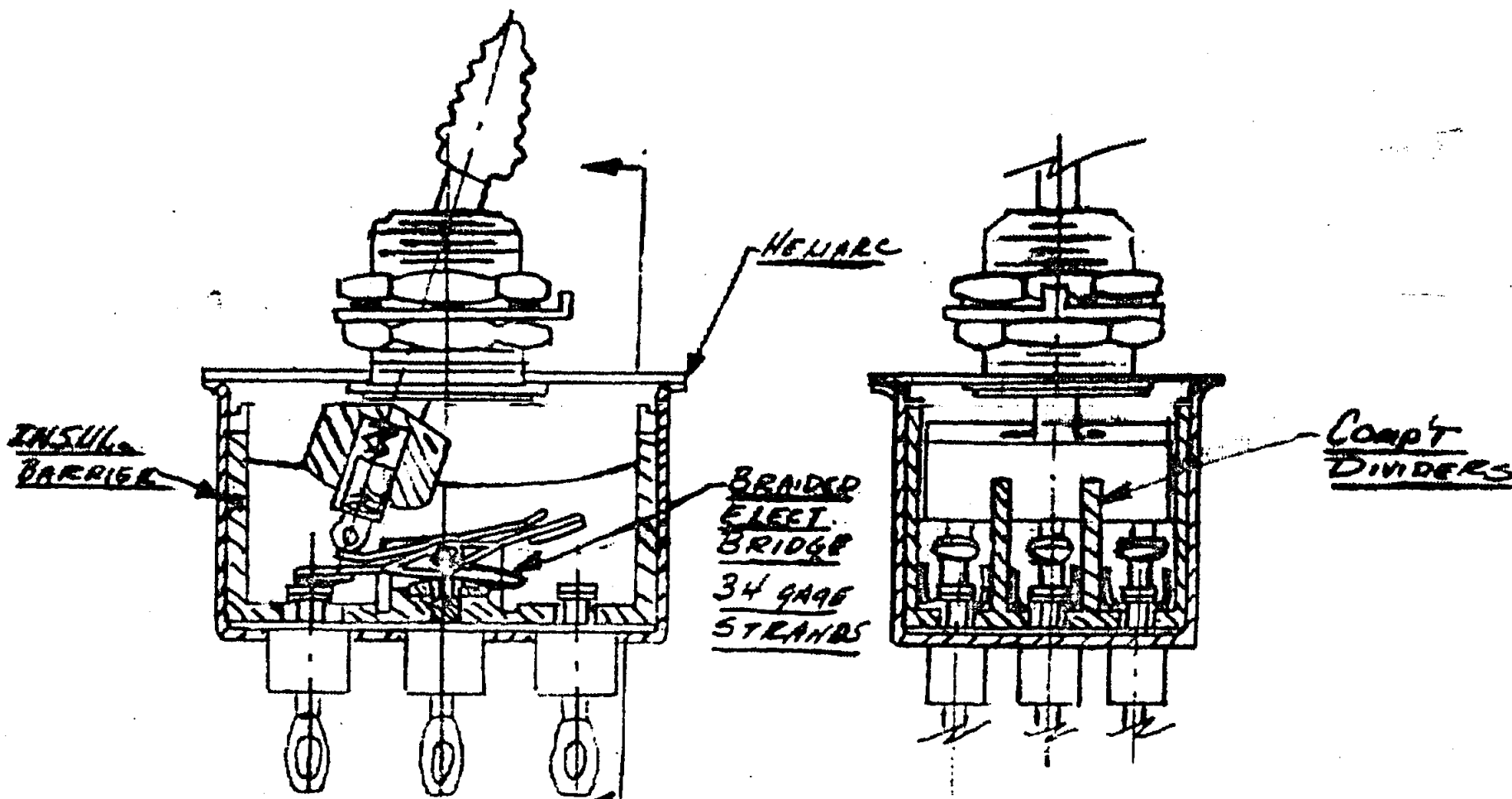
Contact Resistance 2 MV
* Contact Resistance 15 MV

Amp Type Switch
Amp Type Switch

	CONTACT IDENTITY									
1st Reading	5	4	5	5	5	6				VIA STD. MIL. STD 810
2nd Reading	5	6	5	5	5	6				SINE VIB. MONITOR
3rd Reading	6	6	5	5	5	5				CONTACT CHATTER

To E.M. PATTERSON Dept NR 45 Phone 4505

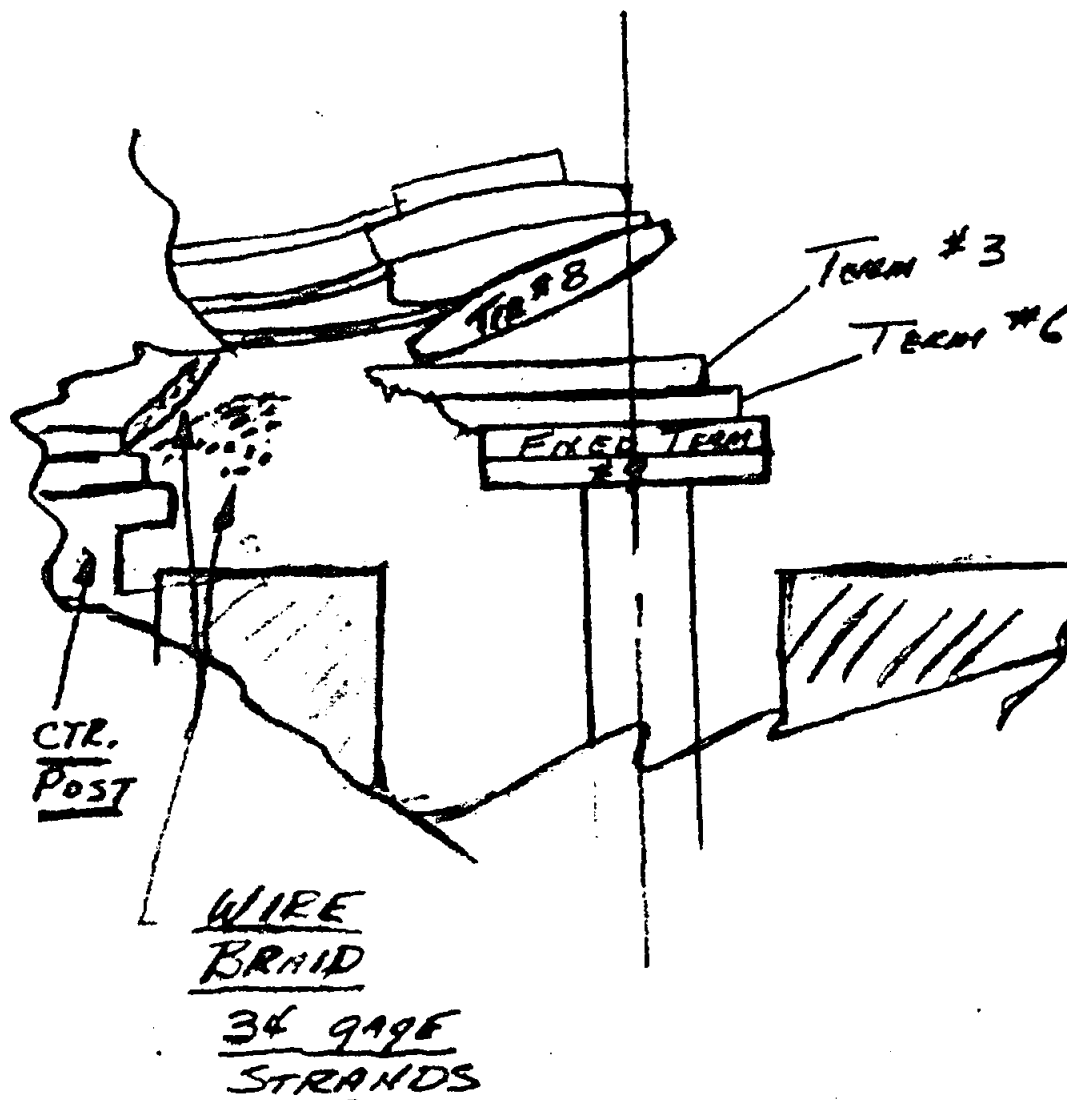
ME 452-0102-1301



To: F. W. PATERSON
Dept. NK
Bldg. 45
Phone 4202

NORTH AMERICAN TELEPHONE CO. || 10X
To F. M. PATTERSON

Dept NR Phone 45
Bldg 45
Room _____



THIS VIEW
WAS UNCLEAR
ON XRAY

ME 452-0102-1301

S-26

SN 057758218262

XRAY DATE 10/23/68

CONTROL No. CB 276

USE BLACK
BALLPOINT
PEN

SPAN / MISSION EVALUATION ACTION REQUEST

USE BLACK
BALLPOINT
PEN

TIME
(T- MINUS /GET)

12:15

REQUEST
ORGANIZATION

45

RESPONSE
ORGANIZATION

FOD

CONTROL
NUMBER

C19

ACTION REQD BY (TIME): MCC 2

REQUESTER

SUBJECT:

SHORT IN ENGINE CIRCUIT

APPROVAL

Attached is the procedure
to be used to isolate short
in the SPS engine control
circuit.

TEAM LDR

4/10/77
ERG

CON SR REP

4/10/77

TIME

ME MANAGER

A. C. Jones

TIME 13:14

SPAN MGR

Paul

TIME 13:27

RESPONSE:

CONCURRENCE

Have reviewed your procedure
and have included it in the most
recent report. The report is attached
and anomaly and dump reviewed.

Been previously scheduled 7 2-8-73 0607

FOD REP

4/10/77

TIME 22:29

SPAN MGR

4/10/77

TIME 22:33

TEAM LDR

4/10/77

TIME

CON SR REP

4/10/77

TIME

RESPONDER

W. H. Apple

ME MANAGER

SPAN MANAGER

TIME

TIME

I. Procedure to determine location of short upstream or downstream of solenoid:

1. Open CB pilot valve A.
2. Close ΔV thrust A.
3. Get light to come on by rapping or cycling ΔV thrust A switch (but end up in ΔV thrust "on").
4. Close CB pilot valve A.
5. Immediately pull out CB pilot valve A when engine starts.
6. If engine does not start within about 3 seconds, pull out CB pilot valve A. The short is upstream of solenoid valve provided light still on.
7. Following step 5, i.e., engine starts and is stopped with breaker, if light still on the short is downstream of solenoid.

II. Procedure to show if short burned clear:

1. If light goes out then try to get light to come on by tapping or cycling ΔV thrust switch. If light can't be made to return the short was burned clear.

7/27/71, 0500 CDT

SPS IGNITION CIRCUIT ANOMALY

35

1. GET 3 + (25) Crew reports SPS THRUST light is ON. Telemetry measurements CH3604X and CH3605X confirms a short-to-ground in either SPS solenoid driver #1 or #2 circuitry. Telemetry records show that the short occurred at GET (01+48+41) for 9 seconds. Problem is either in SPS bank A or B. Arming either bank with ΔV THRUST switches may result in SPS ignition.

TLI PREP CHECKLIST EMS ΔV TEST PER FLIGHT PLAN IS
POSSIBLE
EXPLANATION
FOR THIS

E.D

2. Crew was advised to pull both SPS pilot valve circuit breakers. They did so and system was safed, This occurred at 3+37

3. GET 4 + 34. Crew verified that the EMS MODE switch was in STBY and EMS FUNCTION switch was in OFF. This verified that an improper EMS switch configuration was not cause of problem.

4. GET 5 + 50. Crew performed following tests:

a. EMS ΔV test - The THRUST light got brighter. This would indicate that the short is not in the EMS ΔV test circuit. Also may indicate a high resistance short.

b. Crew cycled the SPS THRUST DIRECT ON switch. No change indicated on light or on telemetry. This results in no conclusive evidence of the location of the short circuit.

.06

5. GET 9 + 35. Crew performed following tests:

a. Operated ΔV THRUST A switch - light out, TM of D1 & D2 out.

When switch placed back to off, the light and TM remained off.

b. Operated ΔV THRUST B switch - No change in light or TM. Switch placed back to off.

c. Crew tapped panel in area of ΔV THRUST switches; light and TM came back on.

d. Operated ΔV THRUST B switch - no change in light or TM.

e. Operated ΔV THRUST A switch - held in center (between NORMAL and OFF). Light out, TM D1 - ON, TM D2 - OUT.

Placed to NORMAL. Light ON, TM D1 - ON, TM D2 - ON.

Placed to OFF. Light OUT, TM D1 - OUT, TM D2 - OUT.

CONCLUSION:

- (1) No problem in the bank B circuits.
- (2) Short is intermittent and mechanical shock can probably induce or remove the problem.
- (3) Short is probably in the bank A circuit.
- (4) Assume that the short can be on either side of the bank A propellant control pilot valve solenoids.

6. The flight article ΔV THRUST A switch went through a series of pre-flight acceptance tests, including vibration (see attachment 3). The switch was xrayed. Based on xray data, there are some suspect strands of wire (internal wiring is 30 strand, 34 gauge braided) which may be causing a short-to-ground on the wiper side of the switch.

7. CONCLUSIONS:

Based on the crew tests and switch data, it is believed that the anomaly is the result of a short in the ΔV THRUST A switch. This short may be on either side of the bank A pilot valve solenoids. Only an SPS burn test can determine which side.

8. IMPACT:

a. Hard short on upstream side of bank A pilot valve solenoids - Bank A will not operate.

b. Hard or soft short on downstream side of bank A pilot valve solenoids - Bank A will fire when the ΔV THRUST A switch is placed to the NORMAL position.

9. NR is presently conducting tests at Downey to duplicate the problem.

10. Testing indicates that if the short is caused by up to 3 strands of 34 gauge wire on the high side of the solenoid, they can burn out without popping circuit breakers and result in clearing the short.

11. It is proposed that a test to determine the location of the short be run on MCC-2. Attachment 2 details the test.

12. If the MCC-2 test proves that the short is downstream of the SPS pilot valve solenoids, subsequent dual bank burns should be performed starting on bank B and bringing on bank A after ignition and turning off prior to cutoff. Bank A should be controlled with both the ΔV THRUST A switch and the SPS PILOT VLVS A-MNA circuit breaker. Single bank burns should all be performed using Bank B. LQI should be performed using single bank for the last 40 seconds of the burn to get some solid single bank thrust data. DOI and LOPC should be done single rather than dual bank.

13. If the MCC-2 test proves that the short is upstream of the SPS pilot valve solenoids, bank A is failed. Recommend no lunar landing.

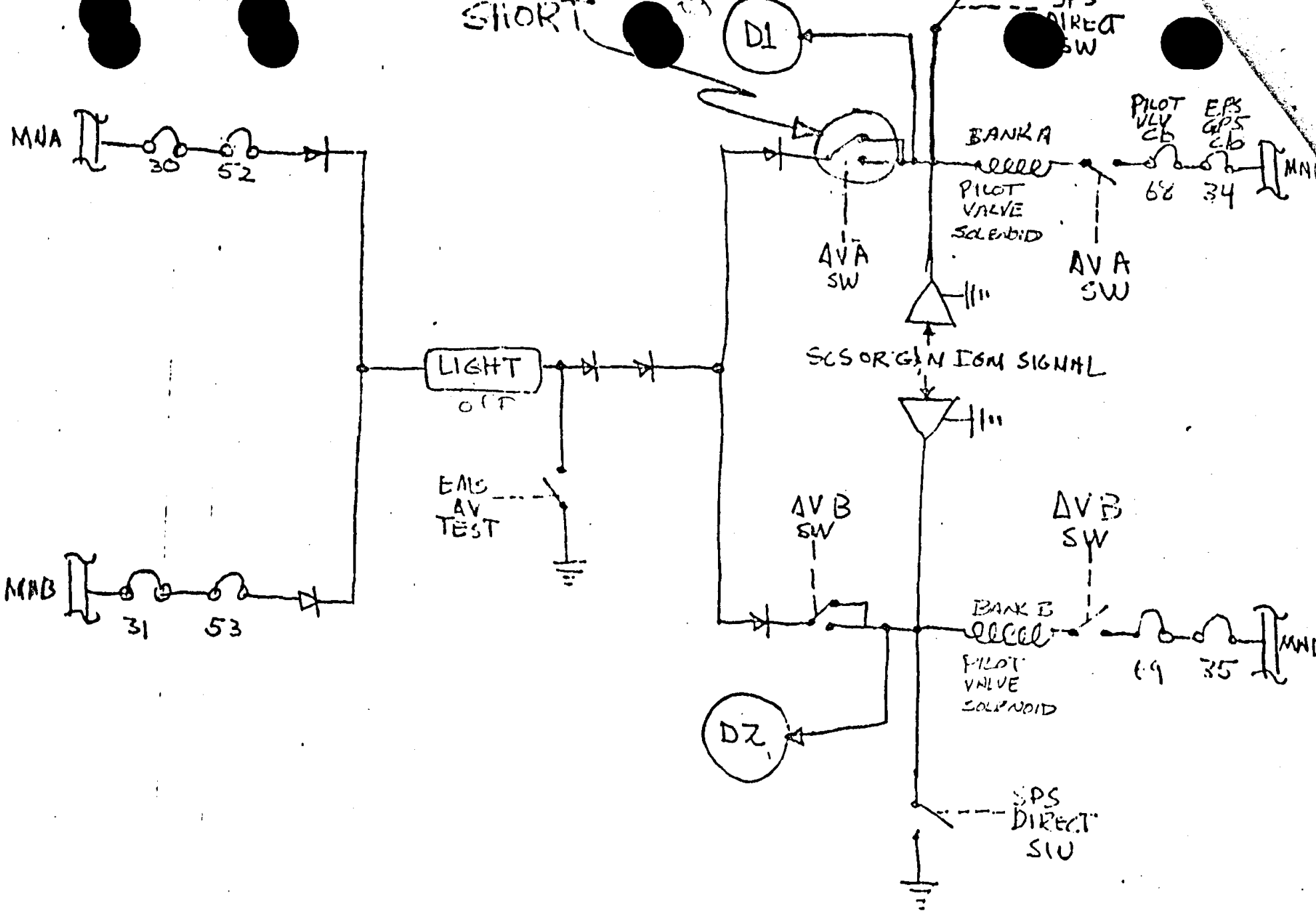
4
14. It should be pointed out that if the short is migratory (i.e., a floating solder ball), it may move from the downstream to upstream side of the pilot valve solenoid.

Not Solenoid Damaging the switch

Prepared by:

J. DeAtkine

L. Canin/GNC



BH 12+00GET

Attachment

MCC-2 BURN PROCEDURE

1. Set up for SCS burn.
2. SPS PILOT VLVS A - MNA cb - OPEN.
3. SPS PILOT VLVS B - MNB cb - OPEN.
4. ΔV THRUST A - NORMAL.
5. Get THRUST light on by rapping panel or cycling ΔV THRUST A switch.
If light does not come on, terminate test. Place ΔV THRUST switch to OFF. Consider doing a bank A G & N burn.
6. SPS PILOT VLVS A - MNA cb - CLOSE.
7. After ignition, open SPS PILOT VLVS A - MNA cb.

NOTE: Burn should not exceed 1 second duration.

8. If engine does not start within about 3 seconds, open SPS PILOT VLVS A - MNA cb. The short is upstream of the SPS pilot solenoid valves.
9. If engine starts, short is downstream of the SPS pilot solenoids.

7/27/71, 0500 CDT

SPS IGNITION CIRCUIT ANOMALY

35

1. GET 3 + 25. Crew reports SPS THRUST light is ON. Telemetry measurements CH3604X and CH3605X confirms a short-to-ground in either SPS solenoid driver #1 or #2 circuitry. Telemetry records show that the short occurred at GET 01+48+41 for 9 seconds. *AV Test as per flight Plan and 10 sec not 9 sec.* ~~Problem is either in SPS bank A or B. Arming either bank with AV THRUST switches may result in SPS ignition.~~
2. Crew was advised to pull both SPS pilot valve circuit breakers. They did so and system was safed, *This occurred at 3+37*
3. GET 4 + 34. Crew verified that the EMS MODE switch was in STBY and EMS FUNCTION switch was in OFF. This verified that an improper EMS switch configuration was not cause of problem.
4. GET 5 + 50. Crew performed following tests:
 - a. EMS Δ V test - The THRUST light got brighter. This would indicate that the short is not in the EMS Δ V test circuit. Also may indicate a high resistance short.
 - b. Crew cycled the SPS THRUST DIRECT ON switch. No change indicated on light or on telemetry. This results in no conclusive evidence of the location of the short circuit.
5. GET 9 + 35. Crew performed following tests:
 - a. Operated Δ V THRUST A switch - light out, TM of D1 & D2 out. When switch placed back to off, the light and TM remained off.
 - b. Operated Δ V THRUST B switch - No change in light or TM. Switch placed back to off.

c. Crew tapped panel in area of ΔV THRUST switches; light and TM came back on.

d. Operated ΔV THRUST B switch - no change in light or TM.

e. Operated ΔV THRUST A switch - held in center (between NORMAL and OFF). Light out, TM D1 - ON, TM D2 - OUT.

Placed to NORMAL. Light ON, TM D1 - ON, TM D2 - ON.

Placed to OFF. Light OUT, TM D1 - OUT, TM D2 - OUT.

CONCLUSION:

(1) No problem in the bank B circuits.

(2) Short is intermittent and mechanical shock can probably induce or remove the problem.

(3) Short is probably in the bank A circuit.

(4) Assume that the short can be on either side of the bank A propellant control pilot valve solenoids.

6. The flight article ΔV THRUST A switch went through a series of pre-flight acceptance tests, including vibration (see attachment 3). The switch was xrayed. Based on xray data, there are some suspect strands of wire (internal wiring is 30 strand, 34 gauge braided) which may be causing a short-to-ground on the wiper side of the switch.

7. CONCLUSIONS:

Based on the crew tests and switch data, it is believed that the anomaly is the result of a short in the ΔV THRUST A switch. This short may be on either side of the bank A pilot valve solenoids. Only an SPS burn test can determine which side.

8. IMPACT:

a. Hard short on upstream side of bank A pilot valve solenoids - Bank A will not operate.

b. Hard or soft short on downstream side of bank A pilot valve solenoids - Bank A will fire when the ΔV THRUST A switch is placed to the NORMAL position.

9. NR is presently conducting tests at Downey to duplicate the problem.

10. Testing indicates that if the short is caused by up to 3 strands of 34 gauge wire on the high side of the solenoid, they can burn out without popping circuit breakers and result in clearing the short.

11. It is proposed that a test to determine the location of the short be run on MCC-2. Attachment 2 details the test.

12. If the MCC-2 test proves that the short is downstream of the SPS pilot valve solenoids, subsequent dual bank burns should be performed starting on bank B and bringing on bank A after ignition and turning off prior to cutoff. Bank A should be controlled with both the ΔV THRUST A switch and the SPS PILOT VLVS A-MNA circuit breaker. Single bank burns should all be performed using Bank B. LQI should be performed using single bank for the last 40 seconds of the burn to get some solid single bank thrust data. DOI and LOPC should be done single rather than dual bank.

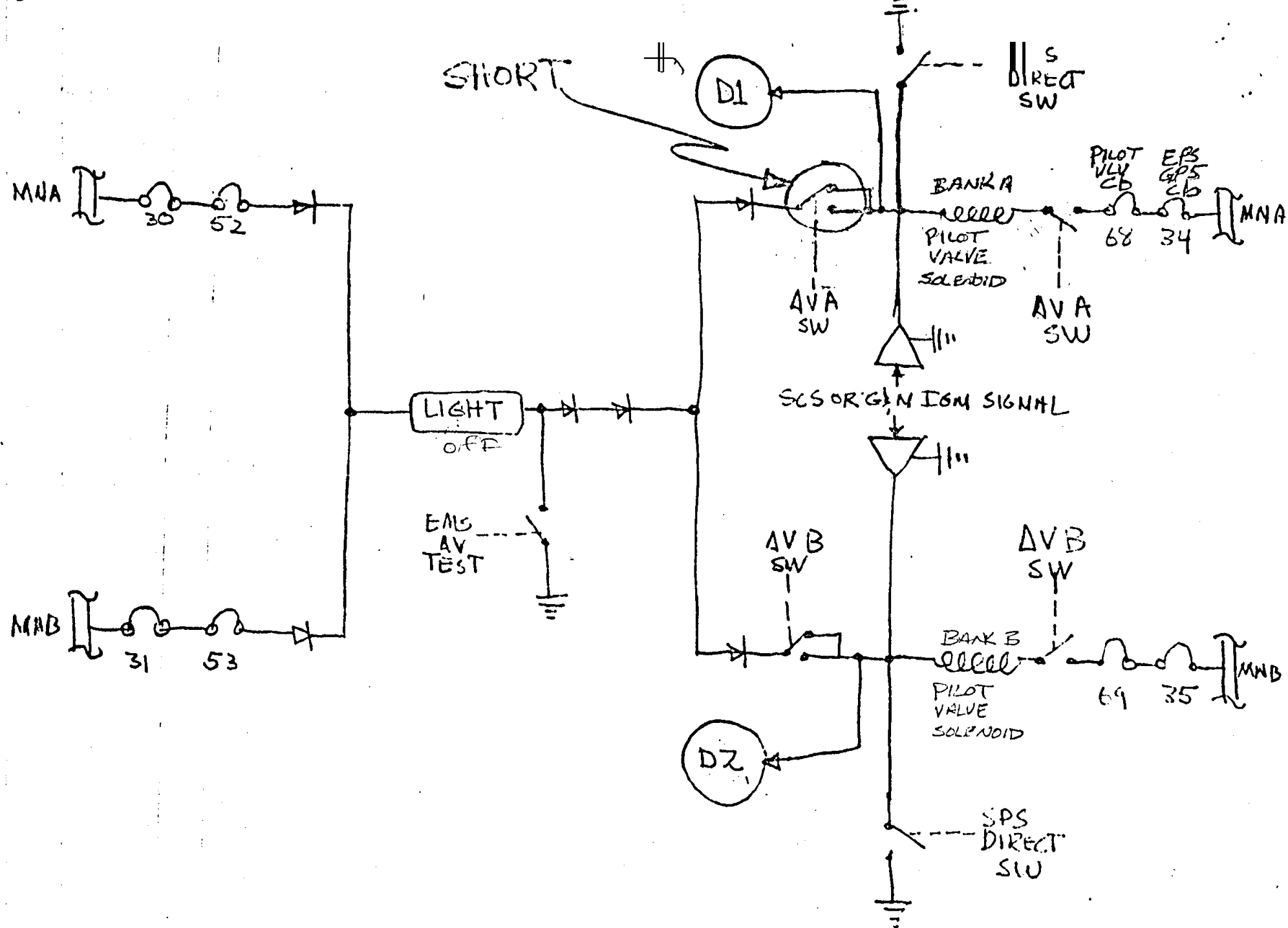
13. If the MCC-2 test proves that the short is upstream of the SPS pilot valve solenoids, bank A is failed. Recommend no lunar landing.

14. It should be pointed out that if the short is migratory (i.e., a floating solder ball), it may move from the downstream to upstream side of the pilot valve solenoid.

Prepared by:

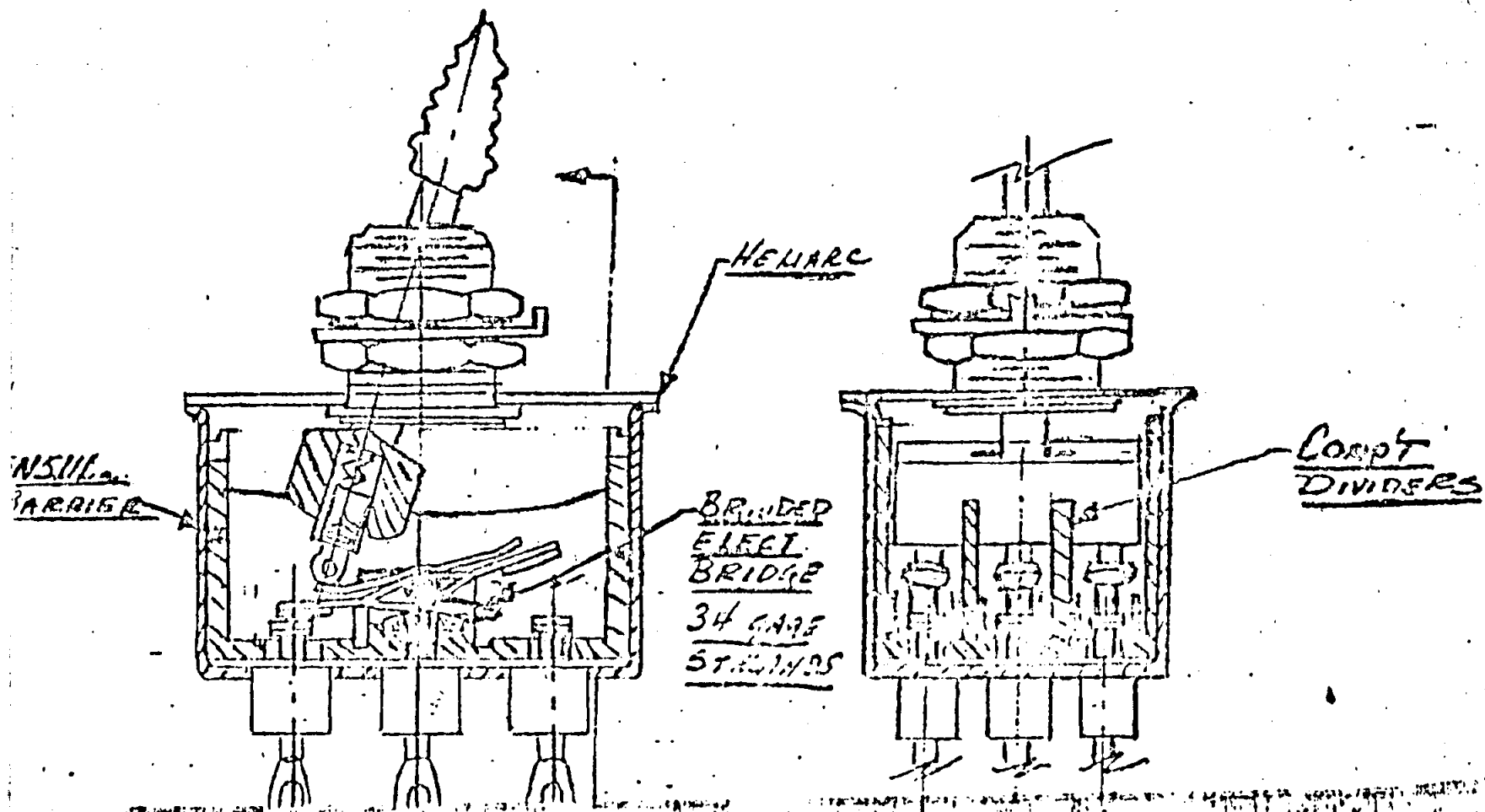
J. DeAtkine

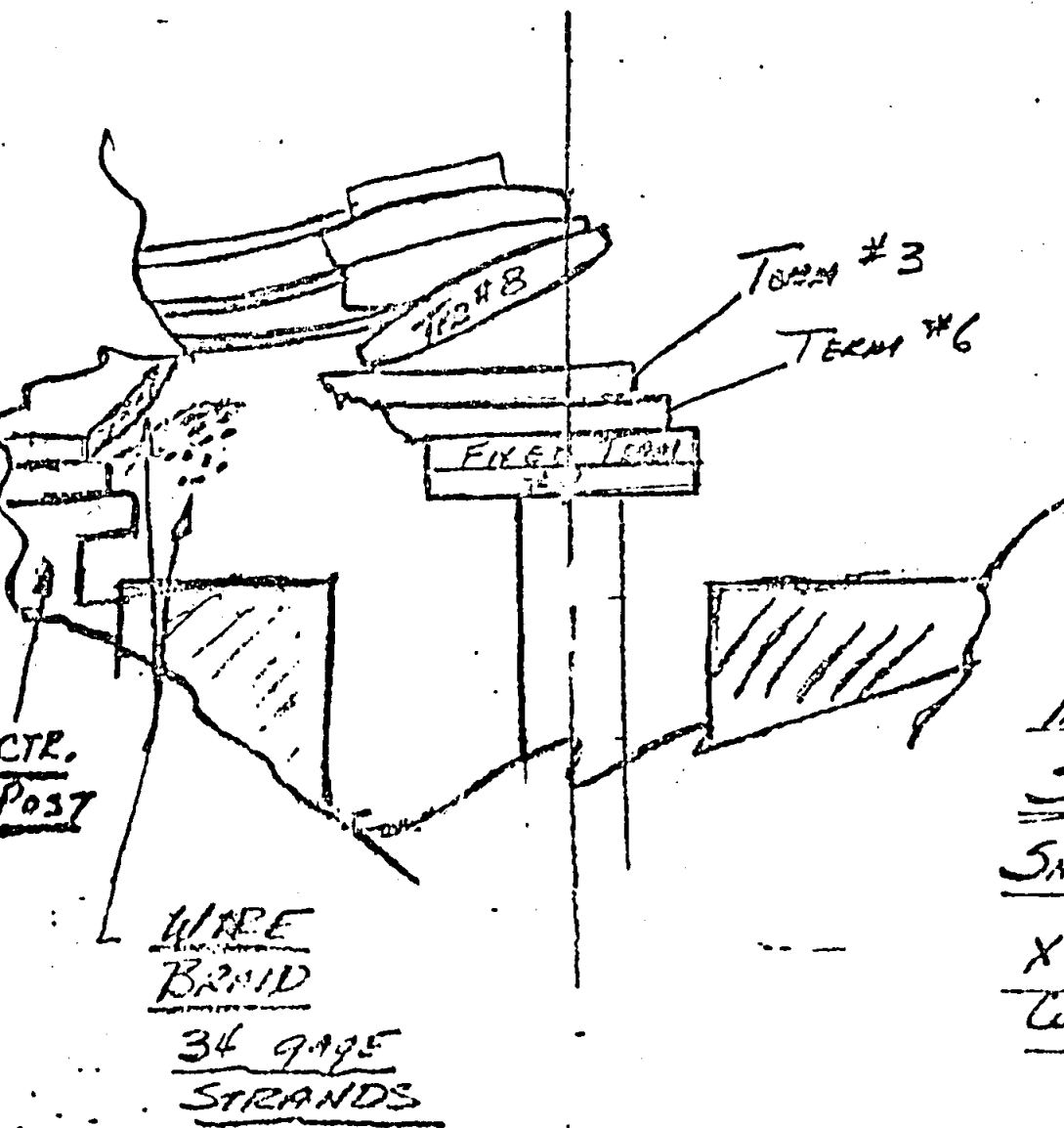
L. Canin/GNC



MCC-2 BURN PROCEDURE

1. Set up for SCS burn.
2. SPS PILOT VLVS A - MNA cb - OPEN.
3. SPS PILOT VLVS B - MNB cb - OPEN.
4. Δ V THRUST A - NORMAL.
5. Get THRUST light on by rapping panel or cycling Δ V THRUST A switch.
If light does not come on, terminate test. Place Δ V THRUST switch to OFF. Consider doing a bank A G & N burn.
6. SPS PILOT VLVS A - MNA cb - CLOSE.
7. After ignition, open SPS PILOT VLVS A - MNA cb.
NOTE: Burn should not exceed 1 second duration.
8. If engine does not start within about 3 seconds, open SPS PILOT VLVS A - MNA cb. The short is upstream of the SPS pilot solenoid valves.
9. If engine starts, short is downstream of the SPS pilot solenoids.

ME 352-0102-1301



THIS VIEW
WAS UNCLEAR
ON XRAY

ME 452-0102-1301

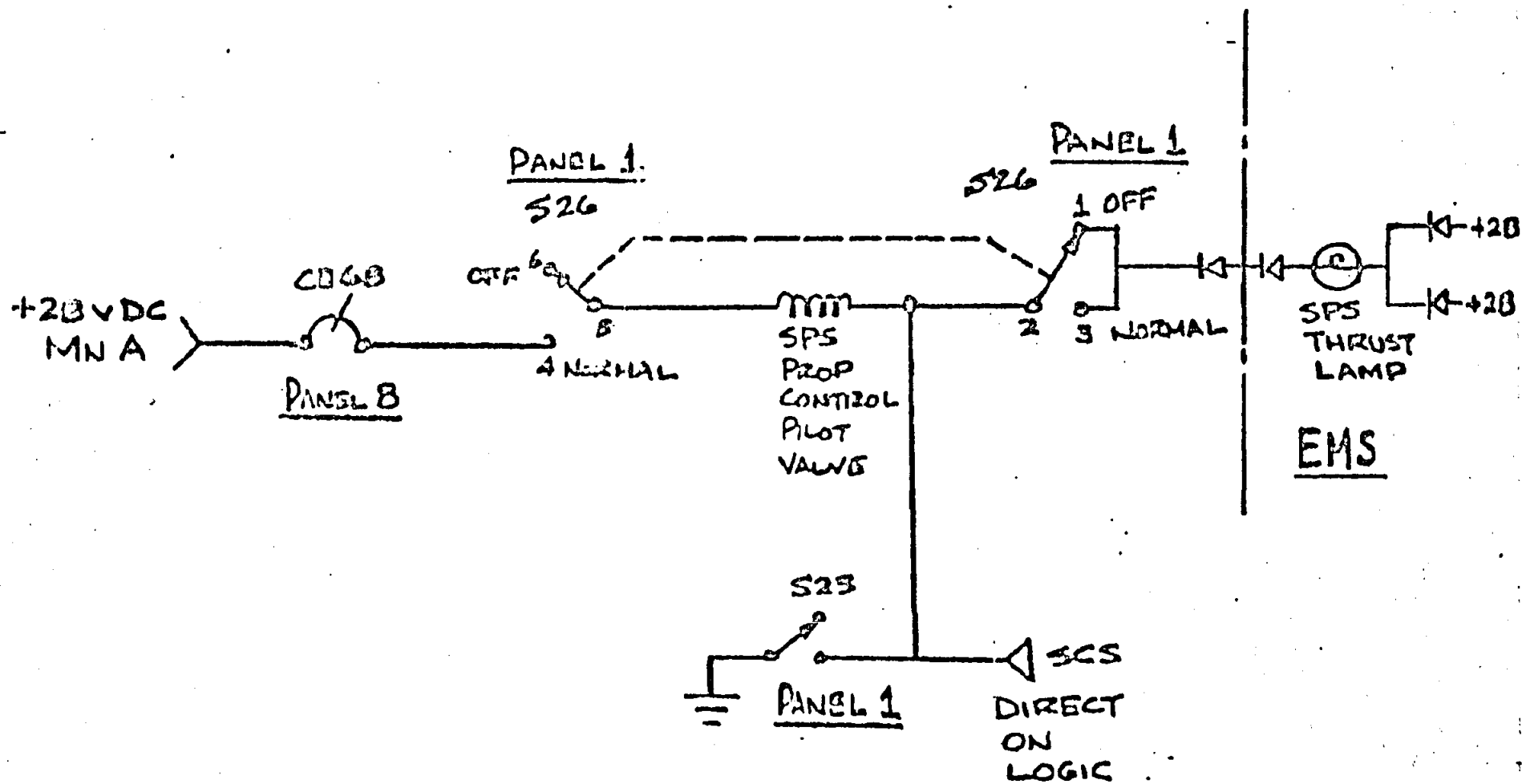
S-26

SN 057758218262

XRAY DATE 10/23/53

CONTROL No. CB 276

SPS SCHEMATIC



NMA Part No. 12452-0102-20
NMA Purchase Order: 12452-0102-20
Grammar Spec: LSP-250-802A

11A Spec: 1E-452-0102, Rev. 4 1E-452-0102 Rev. F PD1B 2+3

The following inspection must be performed in accordance with QAS 752 in the order shown below:

Contact Resistance	2	RV	15	Amp Type Switch
* Contact Resistance		RV		Amp Type Switch

	CORRECT IDENTITY											
	1	2	3	4	5	6	7	8	9	10	11	12
1st Reading	.5	.6	.5	.5	.5	.6					110	570
2nd Reading	.5	.6	.5	.5	.5	.6					110	570
3rd Reading	.6	.6	.5	.5	.5	.5					110	570

SPS THRUST LIGHT ANOMALY

CONDITION

CYCLING S26 SYS A SW CAUSES LIGHT
TO CHANGE STATE, CYCLING S59 SYS B
SW CAUSES NO CHANGE TO LIGHT STATE

LIGHT FLICKERS AS S26 CROSSES THROUGH
CENTER

X-RAY - NO PARTICULATE COULD BE OBSERVED,
PARTICLE SIZE TO SHORT. CENTER POST TO
CASE WOULD HAVE TO BE LARGE ENOUGH TO BE
OBVIOUS IN X-RAY

CONCLUSION

PROBLEM IN SYS A COULD BE HIGH OR LOW SIDE
SHORT.

MOST PROBABLE LOCATION OF SHORT IS CENTER
POLE (TERM. 2 OR 5) TO GROUND

MOST LIKELY CONDITION WOULD BE WIRE FROM
CENTER POST TO CASE AT OUTER TERMINAL SHELL

BASED UPON ABOVE AND POTENTIAL IMPACT ON MISSION, ISOLATION OF THE SHORT ON THE HIGH OR LOW
SIDE OF THE BANK "A" PILOT VALVE SHOULD BE ACCOMPLISHED. IF SHORT IS ON THE LOW SIDE, BANK "A"
CAN BE OPERATED MANUALLY. IF SHORT IS ON THE HIGH SIDE, TEST OFFERS POSSIBILITY OF FUSING
SHORT OPEN.

PROCEDURE FOR LOCATION OF SHORT

CB 68 OPEN

Δ V THURST A — NORMAL

TAP PANEL TO RECREATE LAMP ON

- CLOSE CB 68 —
1. IF ENGINE IGNITES OPEN CB 68 IMMEDIATELY
 2. IF NO IGNITION — OPEN CB 68 in 3 SECONDS

w/p47 on!

7

INDICATIONS

CASE	IGNITION	LIGHT RESPONSE		CURRENT RESPONSE	COMMENT
		CB 68 CLOSED	CB 68 OPENED		
I	YES	ON	ON	≈ Δ 2 AMPS	Low side hard short - have manual back-up
II	YES	ON	OFF or DIM	≈ Δ 2 AMPS - but decreases	Same as Case I, failure magnitude reduced
III	NO	ON	ON	High Current	Hard high side short — loss of Bank A
IV	NO	OFF	OFF	Little or No transient	High or Low side soft short — could have burned away. Try to recreate failure
V	NO	OFF	OFF	Transient	Momentary high side soft short could have burned away. Try to recreate failure

CASE	IGNITION	LIGHT RESPONSE		CURRENT RESPONSE	COMMENT
		CB 68 CLOSED	CB 68 OPENED		
VI	NO	OFF	ON	Continuous Current	Continuous, high side soft short. Could use Bank if assume no degradation of failure.

NOTE: OBSERVE CURRENT CHANGES ON
SC 2113C
SC 2114 C

THIS WILL PROBABLY HAVE TO BE DONE
AT MSFN STATION AT FULL SAMPLE RATE
WITH "O" APERTURE READOUT.

(9)

SPECIAL TEST 7-26-71

- SINGLE WIRE BRAID STRAND TO SWITCH CASE SHORT WAS SIMULATED ON A TEST SAMPLE (ME452-0102-1301).
- RESISTANCE OF SHORT VARIED FROM 0.5 TO 3.0 OHMS WITH TAPPING THE SWITCH.
- APPLICATION OF 28VDC THROUGH ONE OHM RESISTOR RESULTED IN BURNING THE SHORT OPEN IMMEDIATELY.

1 - strand 50-100 msec

3 - strand burn out before C.B. pops

1 single strand 50-100 msec

41

USE BLACK
BALLPOINT
PEN

SPAN / MISSION EVALUATION ACTION REQUEST

USE BLACK
BALLPOINT
PEN

TIME
(T-MINUS /GET)

REQUEST
ORGANIZATION

RESPONSE
ORGANIZATION

CONTROL
NUMBER

29:06

45

FOD

C-34

ACTION REQD BY (TIME):

REQUESTER

SUBJECT:

Results of Test - 3 days.

APPROVAL

see attachment.

TEAM LDR

R. Munford

TIME 29:01

CON SR REP

B. Seikin

TIME 29:03

ME MANAGER

ALL

TIME 29:01

SPAN MGR

R. Seikin

TIME 29:40

RESPONSE:

CONCURRENCE

FOD REP

TIME :

SPAN MGR

TIME :

TEAM LDR

TIME :

CON SR REP

TIME :

RESPONDER

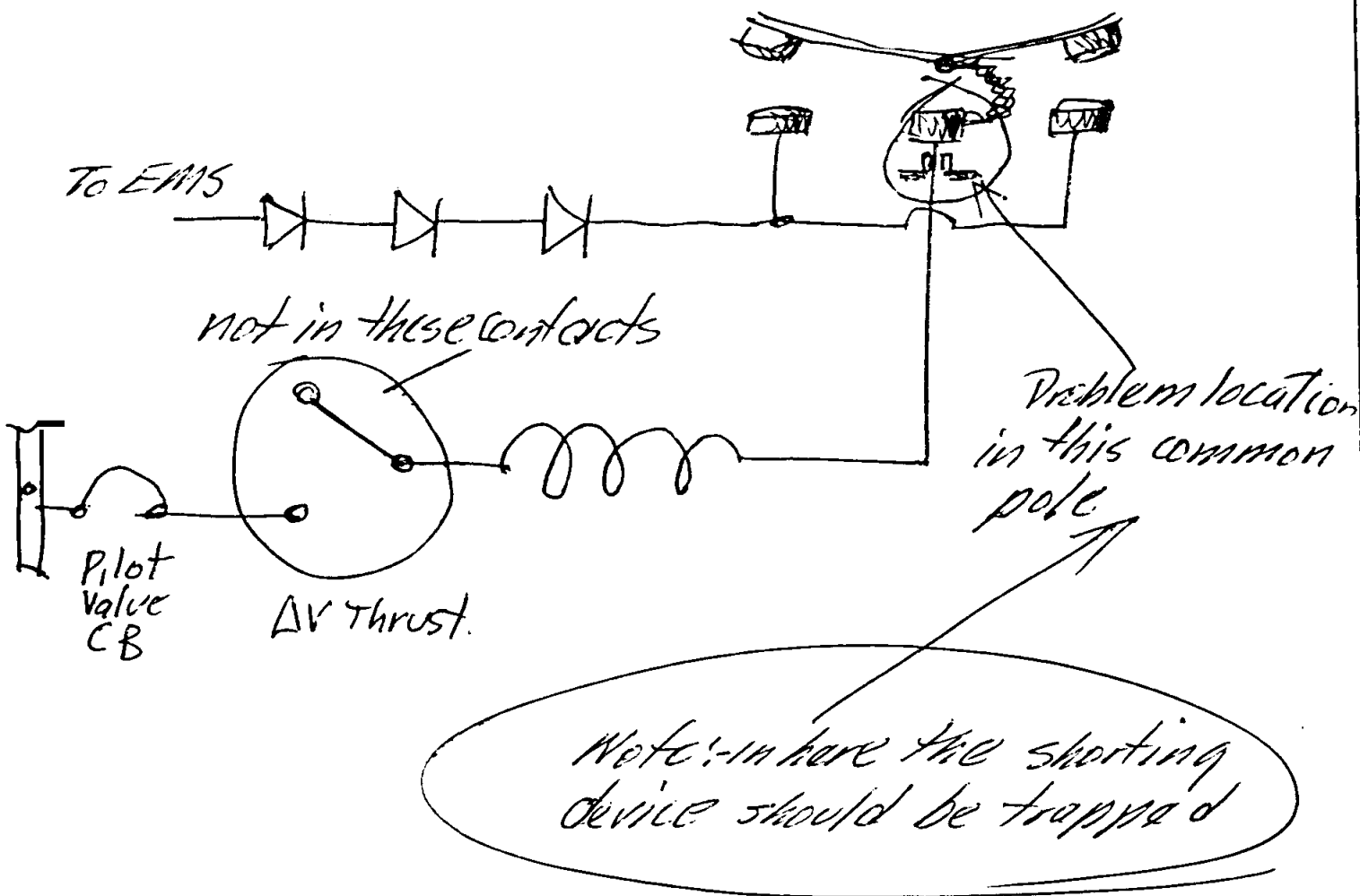
ME MANAGER

SPAN MANAGER

TIME :

TIME :

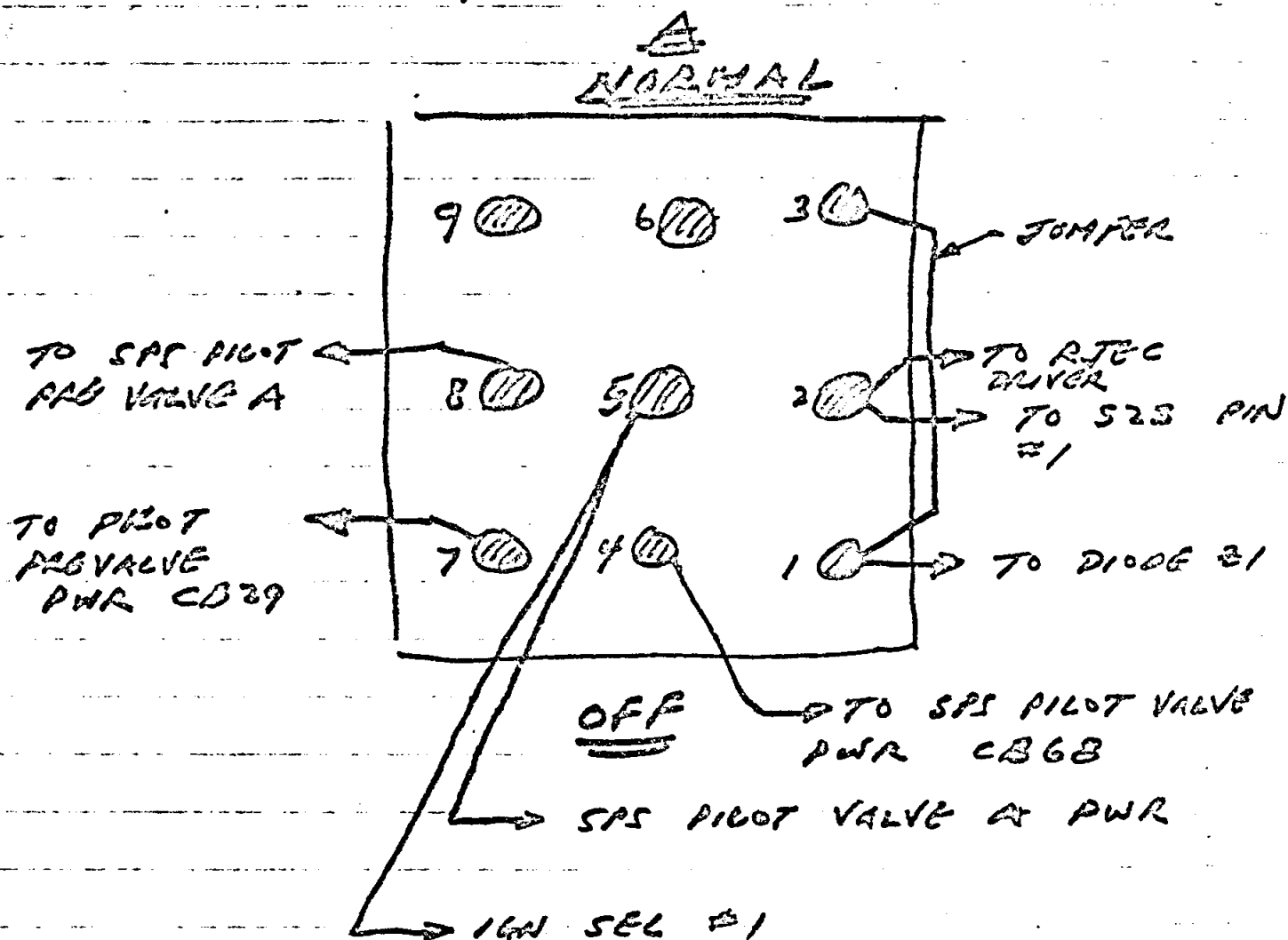
Result of the pre-firing & firing says short on the ΔV Thrust contacts associated with the EMS tie in to the Firing circuit. In fact the short on the common side of the switch see schematic



3FN

WIRE LAYOUT ON SPS AV THRUST SWITCH 526

(DATA TAKEN FROM PANEL 1 PRODUCTION WIRE LIST)



VIEW LOOKING AT BACK SIDE OF PANEL 1

A. Brown
4-28-53 10:09

FLIGHT DIR MISSION LOG		DAY	REV	PG
SITE/ACQ/LOS	FLIGHT EVENTS/HISTORY/BRIEFING			
	MCC SPECIAL SPS BURN			
	TEST PERFORMED AT			
	28+40+22 GET.			
	1. ΔV THRUST A - NORMAL			
	SPS PILOT CB - OPEN			
	THRUST LITE - ON.			
	2. CLOSED SPS PILOT CB			
	SPS BANK A BURN			
	$\approx$ 1 SEC.			
	3. PULLED SPS PILOT CB			
	ENGINE - OFF.			
	4. ΔV THRUST A - OFF			
	AFTER ENGINE SHUT DOWN THE			
	FOLLOWING OCCURRED:			
	1. DI & D2 - OFF			
	2. 7 SECONDS LATER			
	DI & D2 ON.			
	THIS COULD HAVE BEEN ASSOC. WITH			
	TURNING OFF THE ΔV THRUST SWITCH.			
	THE RESULTS OF THIS TEST PROVED			
	THAT THE SHORT IS ON THE GROUND			
	SIDE OF THE EMS LIGHT CIRCUITY.			
	POSSIBLE CONTAMINATION IN THE ΔV			
	THRUST A SWITCH CONTACTS ASSOCIATED			
	WITH THE EMS LIGHT.			

G & N . copy

09:15 7/27/71 (24:40 GET)

L
4-14

RETRO UPDATE (NO COMM - use Block Data)

GETI _____ 0 .05G _____

ΔV _____

GET DROGUE _____

VC _____

ENTRY R _____

Δtb _____

P _____

GET 400K _____

Y _____

If time permits, go to G&N thrusting procedures;
if time critical, continue with SCS ΔV .

CB EPS GROUP 5 (2) - CLOSE

XX:XX

Set DET counting up to GETI

GDC ALIGN

EMS FUNC - ΔV SET/VHF RNG

SET ΔVc ~~ABORT~~ *100*

EMS FUNC - ΔV

TVC CHECK & PPEP *10*

(8) cb STAB CONT SYS (all) - close

cb SPS ~~(1)~~ - close

MAN ATT (3) - RATE CMD

LIMIT CYCLE - on (up)

ATT DB - MIN

RATE - LOW

TRANS CONT PWR - ON

SCS TVC (2) - RATE CMD

ΔV CG - ~~CSM~~ *LM/CSM*

TVC GMBL DRIVE P&Y - AUTO

*CB SPS PILOT VLVS (2) - OPEN
(VER)*

(54:00)
(-06:00)

MN BUS TIE (2) - ON

TVC SERVO PWR #1 - AC1/MNA

TVC SERVO PWR #2 - AC2/MNB

ROT CONTR PWR NORMAL (2) - AC

ROT CONT PWR DIRECT (2) - OFF

BMAG MODE (3) - ATT1/RATE2

SC CONT - SCS

RHC #2 - ARMED

3/29/71

LI 90 MIN

L
4-15

(55:00) PRIMARY TVC CHECK
(05:00)

GMBL MOT P1-Y1 - START/ON (LMP Confirm)
Verify TRIM CONTROL & SET
Verify MTVC
SCS TVC (2) - AUTO
THC - CW
Verify NO MTVC

SEC TVC CHECK

GMBL MOT P2-Y2 - START/ON (LMP Confirm)
SET GPI TRIM
Verify MTVC
THC NEUTRAL
Verify GPI returns to trim
Verify NO MTVC
ROT CONT PWR NORM (2) - AC/DC
ROT CONT PWR DIRECT (2) - MNA/MNB
FDAI SCALE - 5/5
LIMIT CYCLE - OFF
~~RATE - HIGH~~
UPDATE DET
SPS He vlvs (2) - AUTO (verify)

(58:00)
(-02:00)

AV THRUST ~~ACT~~ - NORMAL

V37E 47E

THC - ARMED

RHC (2) - ARMED

TAPE RCDR - HBR/RCD/FWD/CMD RESET

EMS MODE - NORMAL

(59:30)
(-00:30)

ON MSEN CUE C6 SPS PILOT VLV (A) CLOSE

~~00:00~~ ULLAGE & THRUST ON PB - PUSH

~~SPS THRUST LIT ON~~

~~00:03~~ AV THRUST B(A) - NORMAL

~~ULLAGE & THRUST ON PB - PUSH~~

~~MONITOR THRUSTING~~

~~PC 95-105 psia~~

~~EMS COUNTING DOWN 2~~

SPS INJ VLVS (4) - OPEN

SPS He vlvs tb-gray

SPS FUEL/OXID PRESS - 170-195 psia

~~RUCS - BALANCED~~

{ 1 SEC BURN
DESIRED
IF NO IGN
C6 SPS PILOT VLV
(A) - OPEN AFTER
3 SECONDS

AFTER IGNITION CONFIRMED: C6 SPS PILOT VLV A(MNA)
- OPEN

NOTE: BURN SHOULD NOT EXCEED
1 SEC DURATION

DATE 3/29/71

DATE

L
4-16

00:XX

ECO

ΔV THRUST ~~AVS~~ - OFF

VERIFY THRUST OFF

SPS INJ VLVS (4) - CLOSED

SPS He vlvs tb (2) - bp

GMBL MTRS (4) - OFF (LMP Confirm)

TVC SERVO PWR 1&2 - OFF

MN BUS TIE (2) - OFF

19 F 16 83

ΔV XYZ (CM)

(.1fps)

RECORD

ΔVC

EMS FUNC - OFF

ΔVX

EMS MODE - STBY

ΔVY

ΔVZ

ATT DB - MAX

TRANS CONT PWR - OFF

ROT CONTR PWR DIRECT (2) - OFF

BMAG MODE (3) - RATE 2

TAPE RCDR - off (ctr)

PCM BIT RATE - LOW

PRO

F37 00E

When CMC Acty lt out:

V66E

Go to ENTRY PREP & SUPERCIRC ENTRY PROCEDURE
pg E/1-1

AFTER TEST ~~IF~~ IF SPS LITE GOES
OUT ATTEMPT TO GET LITE ON
BY PUSHING ON PANEL.

DATE 3/29/71

USE BLACK
BALLPOINT
PEN

SPAN / MISSION EVALUATION ACTION REQUEST

USE BLACK
BALLPOINT
PEN

TIME
(T-MINUS/GET)

39+20

REQUEST
ORGANIZATION

FOD

RESPONSE
ORGANIZATION

45

CONTROL
NUMBER

C-48

ACTION REQD BY (TIME):

REQUESTER SPAN/GUC

SUBJECT:

SPS Burn Plan

APPROVAL

Attached is present plan for
BANK USGAGE FOR SPS BURN
STARTS. No Response Req'd

FOD REP

MS

TIME 39:20

SPAN MGR

R60

TIME 39:25

RESPONSE:

CONCUR

TEAM LDR

TIME :

CON SR REP

TIME :

ME MGR

Tracy

TIME 39:50

SPAN MGR

MS

TIME 40:00

RESPONDER

FOD REP

SPAN MANAGER

Robert K. Brown

~~SPAN~~
SPAN

SPS BURN PLAN

LOI - Bank B, then Bank A 5 sec
after Ign and Bank A off
at Ign + 6 min

DOI - Bank B only

CIRC - Bank B only

PCI - Bank B only

Shaping - Bank B only

TEI - Bank B, then Bank A 5 sec
after Ign and Bank A
off at cutoff (- 5 sec.

GNC / J. Kamman
Get 38+00

[illegible]

G&N OPTICS BIAS DURING P23

FLIGHT DIR MISSION LOG	DAY 7-28	REV 39:30.00	PS
SITE ACQ/LOS	FLIGHT EVENTS HISTORY BRIEFING		
	Phil Hunter (40:11)		
	During the first Translunar		
	P23 sequence the first optics		
	cal detected a trimmer bias of		
	-10 sec and the next optics cal		
30 sec delta	an additional bias of +20 sec.		
	These biases appear to be		
	associated with zeroing the		
	optics which is normally done		
	before calibration. We do not		
	know the effects of this in total		
	except it does introduce a nav		
	error during P23 and could be		
	large enough to miss the entry		
	corridor. We will know this		
	tomorrow (28th).		
	For now any situation where		
	significant error is jeopardized		
	to crew should know the		
	problem and take the following		
	measures.		
	Reduce trimmer to less than		
	10° before zeroing		
	Always do optics cal after		
	optics zero during P23		

36+40 report

DUE TO LOSS OF
S. LEB AC2 NUMERICS/INTEGRAL LIGHTING - CB33

EMS SC(4)201/ LTS (DS1 & DS2) INCANDESCENT

RSI LTS

EL LTS ON

LEB 100 (DS1)

RHEB 10 (DS1)

RHEB 225 (DS1)

RHEB 226 (DS1)

LHFEB 306 (DS1 & M1)

LEB 101 ~~CLOCK TIMER~~ TEST (DS1 & M4)

GYN PANEL (DS2, DS53, DS55 - DS17)

LEB 122

DSKY EL KEYS (S1 - S19)

DSKY C/S ANNUNCIATOR (DS2)

~~DSKY NUMERICS PWR SWITCH (DS1) - AL~~

LHFEB 306 MISSION TIMER (M2)

Integral Lighting Loss

DSKY CAUTION STATUS (NAV DSKY)

1. UPLK ACTY - Loss of indication for maneuver request during PLO rendezvous tracking. If track error becomes greater than 100° UPLK ACTY signals crew to ~~execute~~^{key} VSSE to execute auto maneuver to track attitude.
2. TEMP - Loss of temperature fail indication. Onboard. Ground can monitor PIPA temp. Crew will receive a PGNS~~is~~ Light on GNIC panel and can view the MAIN DSKY to determine the caution status. No problem
3. NO ATT - Lit in coarse align. If inadvertent coarse align ground can monitor. Will normally be off. No problem
4. Gimbal Lock - If the MGA becomes greater than $\pm 70^\circ$ the PGNS Light on the GNIC panel will be Lit and the crew can view the MAIN DSKY to determine the caution status. No Problem.
5. STANDBY - If standby mode is desired, view the main DSKY. Light is normally not Lit. No problem
6. PROG - If a program alarm occurs the PGNS Light on the GNIC panel will be Lit and the crew can view the main DSKY to determine the caution status. No problem

- 1
7. KEY REL - ILLUMINATED when a priority display is active and another display is requested or V/N Keyed. Should be no problem with close monitor by ground of crew activity. Nominal procedures ~~during critical phases~~ include Keying KEY REL when a new display is requested.
 8. RESTART - If a random restart occurs the PGNS light on the GNIC panel will be lit and the crew can view the MAIN DSKY to determine the caution status. No problem.
 9. OPR ERR - Keying errors will not be accepted by the CMC while erroneous program inputs in program will cause a recycle or exit to occur. If CMC response ^{looks} ~~is~~ questionable to crew they can view the MAIN DSKY to determine if the OPR ERR exists. No problem.
 10. TRACKER - If an OCDU Fail or Data Good Loss occurs the PGNS light will be lit and the crew can view the MAIN DSKY to determine status. No problem.

KEYBOARD BACKLIGHTS (NAV DSKY)

The keys are an ivory coloring with black numerals while the DSKY is grey. Enough contrast exists to allow keying with low cabin lighting intensity.

GNIC PANEL Backlighting for V/N List and star/
Landmark code List.

Probably not distinguishable with low intensity
cabin lighting. Flight data file also contains this
information.

FILED

LIGHTING LOST AS RESULT
of popped cb 33 (LEB 226).
(LIGHTING-NUMERICS/INTEGRAL LEB AC2)

1. EMS scroll lite
2. EMS RSI lite
3. Electroluminescent Lites on:
 - a. LIGHTING CONTROL PNL 100 (LEB)
 - b. Comm. PNL 10 (RHEB)
 - c. cb PNL 225 (RHEB)
 - d. cb PNL 226 (RHEB)
 - e. Mission & Event Timer PNL 306 (LHFEB)
 - f. System Test Meter PNL 101 (LEB)
 - g. Optics PNL 122 (LEB)

4. NAV DSKY KEYBOARD PNL 140 (LEB)
5. NAV DSKY ANNUNCIATOR PNL 140 (LEB)
6. ~~Optics ANNUNCIATOR PNL 122 (LEB)~~ 70
7. Mission Timer Counters PNL 306 (LHFEB)

GNC

Apollo 15/GET 57:00
AGC/JRGarman
7/28/71

More on the Optics

Based on the large optics calibration shift observed on Monday, and on our suspicion that performing "optics zero" from a high (greater than 10 degrees) trunnion angle may be the cause, the crew was advised this morning to always drive the optics to less than 10 degrees before performing optics zero during P23 activities. The whole subject of optics and the way the crew is using them still has me a little concerned and I'd like to explain why.

First, some background and facts from conversations I've been in and observations I've made during the past couple days. For as long as I can remember, it has been a standard required procedure at KSC for the optics trunnion to be manually driven to zero prior to zeroing the optics. This procedure, a long time ago, was in the crew checklist, but was removed at crew request since they said it was absolutely standard procedure with them (around the time of Apollo 9 I believe). On Apollo 10, it is believed that an optics calibration angle shift similar to what we've seen on 15 took place, but the evidence then was inconclusive because the mark data was not nearly as good as it's been on this mission. MIT suspects that zeroing the optics from a trunnion angle of greater than 10 or so degrees could be the cause of our angle shift. This is because the trunnion motor reaches its full drive rate of 10 deg/sec in one second, and if the trunnion is moving a full speed when it reaches zero degrees, it is virtually guaranteed that it will overshoot and hit the spring at around -11 degrees, or even the hard stop at around -13 degrees. In either case, the sextant (SXT) mirror (and perhaps other things) is jarred and could possibly shift or even in a very remote case, become inoperable. I understand that NAR once broke one in this way, but that some design changes were made subsequently. At any rate, if the above theory is correct, then one could be haunted (like me) by a vision of continued zeroings causing continuing shifts (which could well be cumulative) leading to a calibration angle of sufficient magnitude to affect such things as P24 tracking. This would be no problem to the most important program, P23, since it would know about the angle by dint of calibrations that always precede marking (and the crew has been told to be careful during P23). Other programs, however, assume the calibration angle to be zero! Charles Manry (G&CD x3566) performed some tests on a real (but well used) set of optics today. These tests conclusively showed that zeroing the optics from a high trunnion angle will cause the trunnion to overshoot at least into the spring. By doing this a number of times followed by an optics calibration each time, they were able to positively show an optics calibration angle shift. In addition, the shifts seemed to be in the same direction. However, because of 1 g environment, etc., shift magnitude data from these tests is very inconclusive.

Out of all this a couple of conclusions are beginning to form in at least my head. I believe that we should go ahead and tell the crew to always drive the optics to near zero trunnion angle before turning the optics zero switch on. All of the optics experts I've talked to today were

(over...)

quite surprised that we'd specified only P23, and we're quite sure that the crew took the comment literally since we've seen the optics zeroing from a high trunnion angle during non-P23 activity since the comment was read up to them. Once again, there is no problem for P23 since it will know the angle; and I doubt that we'd ever be worried about P52's. But, no one has yet been able to tell me for sure that we wouldn't have problems in other programs (P24, P20) if enough little shifts added up to a big enough offset. Anyway, it's such an easy thing to ask the crew to do, and it just doesn't seem right to be knocking any piece of precision gear around when we don't have to! (and we did observe a calibration shift). Just to keep it from being too easy, though, I guess I should point out that MIT informed me that the optics trunnion angle can drift out while the optics is off (and in zero which is how he does it). Hence, simply turning the optics on in that configuration is the same as zeroing from a high trunnion angle. Thus, we made need to add a postscript that says always turn the optics on in manual, drive to zero, then optics zero. This is little change since he's supposed to cycle the optics zero switch off and on anyway after powering up the optics.

Another conclusion I'm coming to is that we should have the crew perform a simple optics calibration. There must be some time tomorrow that he is in ATT HOLD anyway, and, we wouldn't specifically be trying to prove any theories, we'd simply be verifying that the optics are still good and would be good for those other programs. I'm sure that this is what we should have suggested in the first place, and I believe that Manry is going to initiate just such a request via building 45 and SPAN. What we'd be looking for is a calibration angle that is very small and close to that last one he measured. We'd at least be able to get an idea of what kind of shifts to expect if the above comment isn't read to the crew (always vice just P23 comment), and some proof that the mirror isn't loose or any other such nightmares.

For a couple of closing remarks, let me point out that we are unable, on the ground, to observe how much the optics drifts while off, since the optics CDU's themselves also go off. The fact that the optics can drift while off is what makes it virtually mandatory to cycle optics zero from off to on after power up. I'm quite sure that the crew does not always do this. The "postscript" mentioned above, however, takes care of it. And finally: no, I don't know how we've done so many missions without this bag of worms appearing before. I suspect it's because crews used to drive to zero before zeroing which gets rid of the whole problem; or we were just lucky (e.g. different optics, or didn't happen to zero from high angles much); or a combination.



John R. Garman

GNC

USE BLACK BALLPOINT PEN		SPAN / MISSION EVALUATION ACTION REQUEST		USE BLACK BALLPOINT PEN	
TIME (T-MINUS/GET) 55+09	REQUEST ORGANIZATION FOD	RESPONSE ORGANIZATION 45	CONTROL NUMBER C-66		
ACTION REQD BY (TIME): 60+00:00		REQUESTER GNC			
SUBJECT: OPTICS ZERO PROBLEM, Re. P23		APPROVAL			
With reference to the optics zero problem and the note per GET 47:50 Flight Plan UPDATE re; OPTICS zero when trunion angle $> 10^\circ$ 1. If the trunion angle is $< 10^\circ$ will the Trunion zero drive rate be low enough to prevent the prism from being jarred out of calibration by hitting the stops? 2. Should the optics be manually zeroed for all future OPTICS OPERATIONS before using the OPTICS zero switch? 3. When Turning OPTICS POWER ON & OFF should the optics zero/off switch be in the off position with the optics mode switch in Manual? * 4. What if trunion is jumping to manual?		FOD REP R. J. Moore		TIME 55:57	
		SPAN MGR R. J. Moore		TIME 56:02	
RESPONSE:		CONCUR			
1. DRIVE RATE MAY BE HIGH ENOUGH TO ALLOW HITTING THE SOFT STOP, HOWEVER, EVEN HITTING THE HARD STOP SHOULD NOT CAUSE THE MIRROR TO MOVE RELATIVE TO THE RESOLVER. 2. NO DESIGN CONSTRAINTS REQUIRE MANUAL ZEROING BEFORE SELECTING ZERO OPTICS. 3. SAME AS #2		TEAM LDR R. J. Moore		TIME 57:47	
		CON SR REP R. J. Moore		TIME 57:58	
		FOD MGR R. J. Moore		TIME 58:01	
		SPAN MGR R. J. Moore		TIME 58:47	
RECOMMEND PERFORMING ANOTHER OPTICS CALIBRATION BEFORE MCC-4					
FOD & FAO working up FLT Plan change to action - R. J. Moore					
RESPONDER		SPAN MANAGER			
FOD REP R. J. Moore		SPAN MANAGER R. J. Moore		TIME 63:15	
TIME 62:00					

$G \cong N$

USE BLACK BALLPOINT PEN		SPAN / MISSION EVALUATION ACTION REQUEST		USE BLACK BALLPOINT PEN	
TIME (T-MINUS/GET) 63+1.5		REQUEST ORGANIZATION FOD		RESPONSE ORGANIZATION 45	
				CONTROL NUMBER C-79	
ACTION REQD BY (TIME): 60 70+0.2			REQUESTER GNC		
SUBJECT:		TRunion Spring Ref C-66 What if trunion spring is broken?			
		APPROVAL			
		FOD REP JRM			
		TIME 63:15			
		SPAN MGR Pell			
		TIME 63:15			
NOT DRAWN					
RESPONSE:		CONCUR			
		TEAM LDR			
		TIME :			
		CON SR REP			
		TIME :			
		ME MGR			
		TIME :			
		SPAN MGR			
		TIME :			
RESPONDER					
FOD REP				SPAN MANAGER	
TIME :				TIME :	

USE BLACK
BALLPOINT
PEN

SPAN / MISSION EVALUATION ACTION REQUEST

USE BLACK
BALLPOINT
PEN

TIME
(T-MINUS/GET)

63+15

REQUEST
ORGANIZATION

FOD

RESPONSE
ORGANIZATION

45

CONTROL
NUMBER

C-79

ACTION REQD BY (TIME):

670+02

REQUESTER

GNC

SUBJECT:

Trunion ~~Spring~~ Spring

APPROVAL

Ref C-66

FOD REP

JKM

TIME 63:15

SPAN MGR

Pull

TIME 63:15

What if trunion spring is broken?

RESPONSE:

CONCUR

TEAM LDR

TIME :

CON SR REP

TIME :

ME MGR

TIME :

SPAN MGR

TIME :

RESPONDER

FOD REP

JKM

SPAN MANAGER

Scott Thompson

TIME 67:05

TIME 67:05

USE BLACK BALLPOINT PEN		SPAN / MISSION EVALUATION ACTION REQUEST		USE BLACK BALLPOINT PEN	
TIME TIME /GET)	REQUEST ORGANIZATION	RESPONSE ORGANIZATION	CONTROL NUMBER		
64:40	SPAN	B-45	C-80		
ACTION REQD BY (TIME): —			REQUESTER R. KUBICKI		
SUBJECT:	OPTICS CALIBR. RERUN			APPROVAL	
REF: C-66 CLOSEOUT				FOD REP [Signature]	
CONTRARY TO C-66 CLOSEOUT				TIME 44:58	
STATEMENT: FOD (GUC) AND FAD WITH				SPAN MGR [Signature]	
MIT/SPAN CONCURRENCE ARE NO LONGER				TIME 44:52	
PLANNING TO PERFORM ANOTHER OPTICS					
CALIBRATION TOMORROW. THE CALIB. IS					
NOT CONSIDERED NECESSARY BASED ON					
RESPONSE:				CONCUR	
THE PERFORMANCE OF F2B(S) TO.				TEAM LDR	
DAY WHICH REQUIRES OPTICS "O" &				TIME :	
CALIBRATION AS THE NORMAL PRO-				CON SR REP	
CEDURE.				TIME :	
				ME MGR	
				TIME :	
				SPAN MGR	
				TIME :	
SEE REVISION					
RESPONDER					
FOD REP [Signature]				SPAN MANAGER	
TIME :				TIME :	

REVISED AT 66:30

USE BLACK BALLPOINT PEN		SPAN / MISSION EVALUATION ACTION REQUEST		USE BLACK BALLPOINT PEN	
TIME 64:40		REQUEST ORGANIZATION SPAN		RESPONSE ORGANIZATION B-45	
				CONTROL NUMBER C-80	
ACTION REQD BY (TIME):			REQUESTER R. KUBICKI		
SUBJECT:		OPTICS CALIBR. RERUN			
REF: C-66 CLOSEOUT		APPROVAL			
CONTRARY TO C-66 CLOSEOUT		FOO REP			
STATEMENT: FOD (GUC) AND FAO WITH		TIME 64:58			
MIT/SPAN CONCURRENCE ARE NO LONGER		SPAN MGR			
PLANNING TO PERFORM ANOTHER OPTICS		TIME 64:52			
CALIBRATION TOMORROW. THE CALIB. IS					
NOT CONSIDERED NECESSARY BASED ON					
RESPONSE:		Run at CONCUR			
THE PERFORMANCE OF FL20(S) IS		TEAM LDR			
5 hrs 9.0.7.1. NOT LOCATION REQUIRED OPTICS "O" ;		TIME :			
CALIBRATION AS THE NORMAL PRO-		CON SR REP			
CEDURE.		TIME :			
		ME MGR			
		TIME :			
		SPAN MGR			
		TIME :			
RESPONDER					
FOO REP		SPAN MANAGER			
TIME		TIME			

GEN

Console 32

USE BLACK BALLPOINT PEN		SPAN / MISSION EVALUATION ACTION REQUEST		USE BLACK BALLPOINT PEN	
TIME (T-MINUS/GET) 53+21	REQUEST ORGANIZATION	RESPONSE ORGANIZATION FOD	CONTROL NUMBER C-63		
ACTION REQD BY (TIME):		REQUESTER			
SUBJECT: REFERENCE SMEAR C-35		APPROVAL			
FINAL UPDATE TO LOI THRUST		FOD REP MFD		TIME 53:24	
PROCEDURE IS ATTACHED NEW		SPAN MGR R. K. K.		TIME 53:25	
ENTRIES ARE IDENTIFIED AS					
50+51, B45 RECOMMENDATIONS					
IN C-35 WERE DISPOSITIONED AS FOLLOWS:					
A. - INCORPORATED					
B. - INTENT INCORPORATED. ACTUAL ENTRY IS AT T-5 SEC					
C. - NOT ADDED TO PROCEDURE. WILL BE FOLLOWED IN					
REAL TIME BASED MAN SITUATION AT TIME.					
RESPONSE:	D. DO NOT CONCUR. WILL NOT OPERATE		CONCUR		
	P.U. VALVE FOR LAST PART		TEAM LDR MFD		
	OF BURN IN ORDER TO GET		TIME 53:58		
	GOOD DATA ON ENGINE		CON SR REP J. J. Jones		
	PERFORMANCE ON SINGLE BANK		TIME 56:50		
	FOR LATER LUNAR ORBIT		ME MGR S. J. Jones		
	BURNS.		TIME 57:00		
			SPAN MGR R. K. K.		
			TIME 58:30		
RESPONDER		SPAN MANAGER			
FOD REP [Signature]		R. K. K.			
TIME		TIME 58:30			

RECOMMENDED LOI PROCEDURE

FROM GNC'S

G
5-1

cb SPS PILOT VLVS(2)-OPEN(VER)
cb EPS GP 5(2)-CLOSE(VER)

[P40 SPS THRUSTING

Pretest Program Complete
Verify SIM PWR DOWN (Nominal)
configuration, pg. S/1-39

CMC & ISS - on
Cycle CRYO FANS
SCS - OPERATING

TEST C/W LAMPS

Perform EMS ΔV TEST & NULL
BIAS CHECK, pg G/2-5

Set ΔVC

EMS FUNC - ΔV

SPS GAUGING - AC1

PUG MODE - NORMAL

OXID FLOW vlv - PRI

BMAG MODE (3) - RATE 2

CMC MODE - FREE

AUTO RCS SELECT(16)-as req'd

LOAD DAP (check roll jets)

ROT CONTR PWR NORM (2) - AC/DC

Set DET

V37E 00E

SC CONT - CMC/AUTO

MNVR TO PAD BURN ATT

V49E

PERFORM BORESIGHT & SXT STAR CHECK

V41 N91E

V37E 40E

(TFI available via N40, N45 or N35)

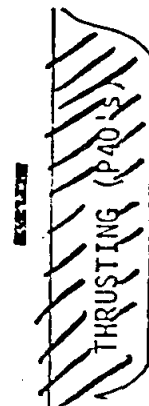
4 F 50 18 REQUEST MNVR TO FDAI RPY ANGLES (.01°)
(AUTO) BMAG MODE (3) - RATE 2

SC CONT - CMC/AUTO

PRO

5 06 18 AUTO MNVR TO FDAI RPY ANGLES (.01°)

7/14/71
5/24/71
DATE



G
5-2

6 F 50 18 REQUEST TRIM MIXR TO FDAI RPY ANGLES
ALIGN S/C ROLL (.01°)
GDC ALIGN

TVC CHECK & PREP

cb STAB CONT SYS (all) - close (Pnl 8)
cb SPS (X) - close 10
SET ΔVC (verify)
EMS FUNC - ΔV (verify)
MAN ATT (3) - RATE CMD

ATT DB - MIN
RATE - LOW
TRANS CONT PWR - ON
SCS TVC (2) - RATE CMD
LVCG - LM/CSM or CSM
TVC GMBL DRIVE P&Y - AUTO

+54:00m
(-06:00)

IN BUS TIE (2) - ON
TVC SERVO PWR #1 - AC1/MNA
TVC SERVO PWR #2 - AC2/MNB
ROT CONTR PWR NORMAL (2) - AC
ROT CONT PWR DIRECT (2) - OFF
BMAG MODE (3) - ATT1/RATE 2
SC CONT - SCS
RHC #2 - ARMED

55:00m
(-05:00)

PRIMARY TVC CHECK

GMBL ROT P1-Y1-START/ON (LMP Confirm)
Verify TRIM CONTROL & SET
Verify MTVC
IF SCS: SCS TVC (2) - AUTO
SC CONT - CMC (SCS)
THC - CW
Verify NO MTVC

SEC TVC CHECK

GMBL ROT P2-Y2-START/ON (LMP Confirm)
SET GPI TRIM
Verify MTVC
THC NEUTRAL
Verify NO MTVC

DATE 3/22/71

THRUSTING (P40's)

G
5-3

(TRIM) Verify GPI returns to 0,0(CMC) or trim (SCS)
ROT CONT PWR NORM (2) - AC/DC
ROT CONT PWR DIRECT (2) - MNA/MNB
BMAG MODE (3) - RATE 2
PRO
BMAG MODE (3) - ATT1/RATE 2
ENTR

7 F 50 25 00204 GMBL TEST OPTION
(ACCEPT) SC CONT - CMC (verify)
PRO

Monitor GPI Response:
00,02,-02,00,02,-02,00, Trim

*TEST FAIL: *
*SC CONT - SCS *
SCS TVC(2) - AUTO

(REJECT) *ENTR

8 06 40 TFI, VG, ΔVM (min-sec,.1fps)
PROG ALARM - TIG Slipped
*V5N9E 01703 *
*KEY RLSE TO 8 *

FDAI SCALE - 5/5

RATE - HIGH
UPDATE DET
SPS He vlvs (2) - AUTO (verify)
Check N2 A and N2 B

58:00
(-02:00)

CD SPS PILOT VLV MNB - CLOSE

LV THRUST A(B) - NORMAL

THC - ARMED

RHC (2) - ARMED

TAPE RCDR - HBR/RCD/FWD/CMD RESET

59:25
(-00:35)

DSKY BLANKS

DATE 5/24/71

REV
52+51

G
5-4

59:30 (AVE G ON)
(-00:30) EMS MODE - NORMAL

06 40 TFI, VG, ΔVM (min-sec, .1fps)
CHECK PIPA BIAS <2fps for 5 sec

59:XX ULLAGE
(-00:XX)

*If no ULLAGE:
* DIR ULLAGE PB - PUSH*
* Control Att with RHC*

MONITOR ΔVM (R3) COUNTING UP

59:55
(-00:05)

F 99 40 ENG ON ENABLE REQUEST
(AUTO IGN) PRO AT TFI >0 Sec
(BYPASS IGN) ENTR to 11 (Perform switching in 10)
EXIT - V37E 00E

REV 52+51

ΔV THRUST A & B (2) - NOZ

9 00:00 IGN *IF SCS: THRUST PB - PUSH*

REV 52+51

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

cb SPS PILOT
VLV MNA-CLCS

F 97 40 SPS Thrust fail
ΔV THRUST B (1) NORMAL
(RESTART) PRO to IGN
(RECYCLE) ENTR to TIG-05sec

cb SPS PILOT VLV MNA-CLCS

00:03

SPS THRUST Lt - ON
ΔV THRUST B (1) - NORMAL
IF SCS: +X & THRUST PB - PUSH

DATE 3/22/71

MONITOR THRUSTING

Pc 95-105 psia

EMS COUNTING DOWN

SPS INJ VLVS (4) - OPEN

SPS He vlvs tb-gray

SPS FUEL/OXID PRESS - 170-195 psia

PUGS - BALANCED

06:00 cb SPS PILOT VLV-MNA-OPEN

DISCONTINUE PU VALVE OPERATION

G
5-5

XX:XX ECO

10 F 16 40 TFC (STATIC), VG, ΔVM (min-sec,.1fps)

ΔV THRUST A&B - OFF

VERIFY THRUST OFF

SPS INJ VLVS (4) - CLOSED

SPS He vlvs tb (2) - bp

GMBL MTRS (4) - OFF (LMP Confirm)

TVC SERVO PWR 1&2 - OFF

MN BUS TIE (2) - OFF

PRO

11 F 16 85 VG XYZ (CM) (.1fps)

NULL RESIDUALS

RECORD ΔV COUNTER & RESIDUALS ΔVC

EMS FUNC - OFF

VGX

EMS MODE - STBY

VGY

RHC & THC - LOCKED

VGZ

ATT DB - MAX

TRANS CONT PWR - OFF

ROT CONTR PWR DIRECT (2) - OFF

BMAG MODE (3) - RATE 2

cb DIRECT ULLAGE (2) - open

cb SPS P1 & Y1 - open

PCM BIT RATE - LOW

MAP CAMR ON - OFF (except lunar orb.)

PAN CAMR PWR - OFF

SM/AC PWR - OFF (except lunar orb.)

PRO (If MINKEY, To Sequencer 3X.2)

DATE 5/24/71

12 F 37 V82E

13 F 16 44 HA,HP,TFF (.1nm,min-sec)

PRO

14 F 37 00E

PROP CONS

[illegible]

RECOMMENDED LOI PROCEDURE

FROM GNC'S

G
5-1

cb SPS PILOT VLVS(2)-OPEN(VER)
cb EPS GP 5(2)-CLOSE(VER)

P40 SPS THRUSTING

Prethrust Program Complete
Verify SIM PWR DOWN (Nominal)
configuration, pg. S/1-40

CMC & ISS - on
Cycle CRYO FANS
SCS - OPERATING
TEST C/W LAMPS

cb EMS MNA,B(2)-CLOSE

Perform EMS ΔV TEST & NULL
BIAS CHECK, pg G/2-5

Set ΔVC
EMS FUNC - ΔV
SPS GAUGING - AC1
PUG MODE - NORMAL
OXID FLOW vlv - PRI
BMAG MODE (3) - RATE 2
CMC MODE - FREE
AUTO RCS SELECT(16)-as req'd
LOAD DAP (check roll jets)
ROT CONTR PWR NORM (2) - AC/DC
Set DET

V37E 00E

SC CONT - CMC/AUTO

7/14/71
DATE 5/24/71

1

MNVR TO PAD BURN ATT
V49E

2

PERFORM BORESIGHT & SXT STAR CHECK
V41 N91E

3

V37E 40E
(TFI available via N40, N45 or N35)

4

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

5

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

THRUSTING (P40-S)

G
5-2

6 F 50 18 REQUEST TRIM MINVR TO FDAI RPY ANGLES
ALIGN S/C ROLL (.01°)
GDC ALIGN

TVC CHECK & PREP

cb STAB CONT SYS (all) - close (Pnl 8)
cb SPS (~~X~~) - close 10
SET ΔVC (verify)
EMS FUNC - ΔV (verify)
MAN ATT (3) - RATE CMD

ATT DB - MIN
RATE - LOW
TRANS CONT PWR - ON
SCS TVC (2) - RATE CMD
LVCG - LM/CSM or CSM
TVC GMBL DRIVE P&Y - AUTO

+54:00m
(-06:00)

IN BUS TIE (2) - ON
TVC SERVO PWR #1 - AC1/MNA
TVC SERVO PWR #2 - AC2/MNB
ROT CONTR PWR NORMAL (2) - AC
ROT CONTR PWR DIRECT (2) - OFF
BMAG MODE (3) - ATT1/RATE 2
SC CONT - SCS
RHC #2 - ARMED

55:00m
(-05:00)

PRIMARY TVC CHECK

GMBL MOT P1-Y1-START/ON (LMP Confirm)
Verify TRIM CONTROL & SET
Verify MTVC
IF SCS: SCS TVC (2) - AUTO
SC CONT - CMC (SCS)
THC - CW
Verify NO MTVC

SEC TVC CHECK

GMBL MOT P2-Y2-START/ON (LMP Confirm)
SET GPI TRIM
Verify MTVC
THC NEUTRAL
Verify NO MTVC

DATE 3/22/71

THRUSTING (P40's)

G
5-3

(TRIM) Verify GPI returns to 0,0(CMC) or trim (SCS)
ROT CONT PWR NORM (2) - AC/DC
ROT CONT PWR DIRECT (2) - MNA/MNB
BMAG MODE (3) - RATE 2
PRO
BMAG MODE (3) - ATT1/RATE 2
ENTR

7 F 50 25 00204 GMBL TEST OPTION
(ACCEPT) SC CONT - CMC (verify)
PRO

Monitor GPI Response:
00,02,-02,00,02,-02,00, Trim

*TEST FAIL: *
*SC CONT - SCS *
SCS TVC(2) - AUTO

(REJECT) *ENTR

8 06 40 TFI, VG, ΔVM (min-sec,.1fps)
PROG ALARM - TIG Slipped
*V5N9E 01703 *
*KEY RLSE TO 8 *

FDAI SCALE - 5/5

RATE - HIGH
UPDATE DET
SPS He vlv (2) - AUTO (verify)
Check N2 A and N2 B

58:00
(-02:00)

CD SPS PILOT VLV MNB - CLOSE

ΔV THRUST A(B) - NORMAL
THC - ARMED
RHC (2) - ARMED
TAPE RCD - HBR/RCD/FWD/CMD RESET

59:25
(-00:35)

DSKY BLANKS

DATE 5/24/71



G
5-4

59:30 (AVE G ON)
(-00:30) EMS MODE - NORMAL

06 40 TFI, VG, ΔVM (min-sec, .1fps)
CHECK PIPA BIAS <2fps for 5 sec

59:XX
(-00:XX) ULLAGE

*If no ULLAGE: *
* DIR ULLAGE PB - PUSH*
* Control Att with RHC*

MONITOR ΔVM (R3) COUNTING UP

59:55
(-00:05)
F 99 40 ENG ON ENABLE REQUEST
(AUTO IGN) PRO AT TFI >0 Sec
(BYPASS IGN) ENTR to 11 (Perform switching in 10)
EXIT - V37E 00E

9 00:00 IGN *IF SCS: THRUST PB - PUSH*

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

*F 97 40 SPS Thrust fail *
*LV THRUST B(A)-NORMAL *
*(RESTART) PRO to IGN *
(RECYCLE) ENTR to TIG-05sec

cb SPS PILOT VLV MNA - ~~OPEN~~

00:03 → SPS THRUST Lt - ON
~~LV THRUST B(A) - NORMAL~~
IF SCS: +X & THRUST PB - PUSH
MONITOR THRUSTING
Pc 95-105 psia
EMS COUNTING DOWN
SPS INJ VLVS (4) - OPEN
SPS He vlvs tb-gray
SPS FUEL/OXID PRESS - 170-195 psia
PUGS - BALANCED

DATE 3/22/71

06:00 cb SPS PILOT VLV-MNA - OPEN
DISCONTINUE PU VALVE OPERATION

G
5-5

XX:XX ECO

10 F 16 40 TFC (STATIC), VG, Δ VM (min-sec,.1fps)
| Δ V THRUST A&B - OFF
| VERIFY THRUST OFF
| SPS INJ VLVS (4) - CLOSED
| SPS He vlvs tb (2) - bp
| GMBL MTRS (4) - OFF (LMP Confirm)
| TVC SERVO PWR 1&2 - OFF
| MN BUS TIE (2) - OFF

| PRO

11 F 16 85 | VG XYZ (CM) (.1fps)

| NULL RESIDUALS

| RECORD Δ V COUNTER & RESIDUALS Δ VC

| EMS FUNC - OFF

VGX

| EMS MODE - STBY

VGY

| RHC & THC - LOCKED

VGZ

| ATT DB - MAX

| TRANS CONT PWR - OFF

| ROT CONTR PWR DIRECT (2) - OFF

| BMAG MODE (3) - RATE 2

| cb DIRECT ULLAGE (2) - open

| cb SPS P1 & Y1 - open

| PCM BIT RATE - LOW

| MAP CAMR ON - OFF (except lunar orb.)

| PAN CAMR PWR - OFF

| SM/AC PWR - OFF (except lunar orb.)

PRO (If MINKEY, To Sequencer 3X.2)

DATE 5/24/71

12 F 37 V82E

13 F 16 44 HA,HP,TFF (.1nm,min-sec)

PRO

14 F 37 OOE

cb SPS PILOT VLV MNB - OPEN ->

PROP CONS

CSM 114 TESTS ON PANEL 100 NUMERICS/INTEGRAL TRANSFORMERS WITH
PANEL 226 CB33 OPEN

With CB33 on Panel 226 open, a current path exists to the primaries of the T2 and T3 transformers through a 1/8 amp. fuse and 1.27K resistor. This limited primary current provides sufficient secondary current to illuminate some lights. This capability was checked on CSM 114. The following are the results of these tests:

General Conditions: 1. Normal cabin ambient lighting.
2. CB33 open.

Test 1: Both integral and numerics full on.
Integral (T2) - Pnl EL's not readable.
Numerics (T3) - Pnl 306 MET readable, DSKY alarm indicator
lt (NO ATT), bright.

Test 2: Integral full dim with numerics full on.
Integral - EL's not readable.
Numerics - Pnl 306 EL's readable, MET readable, DSKY alarm lt
bright.

Test 3: Integral full on with numerics full dim.
Integral - Pnl EL's readable.
Numerics - Pnl 306, MET and DSKY lt not readable.

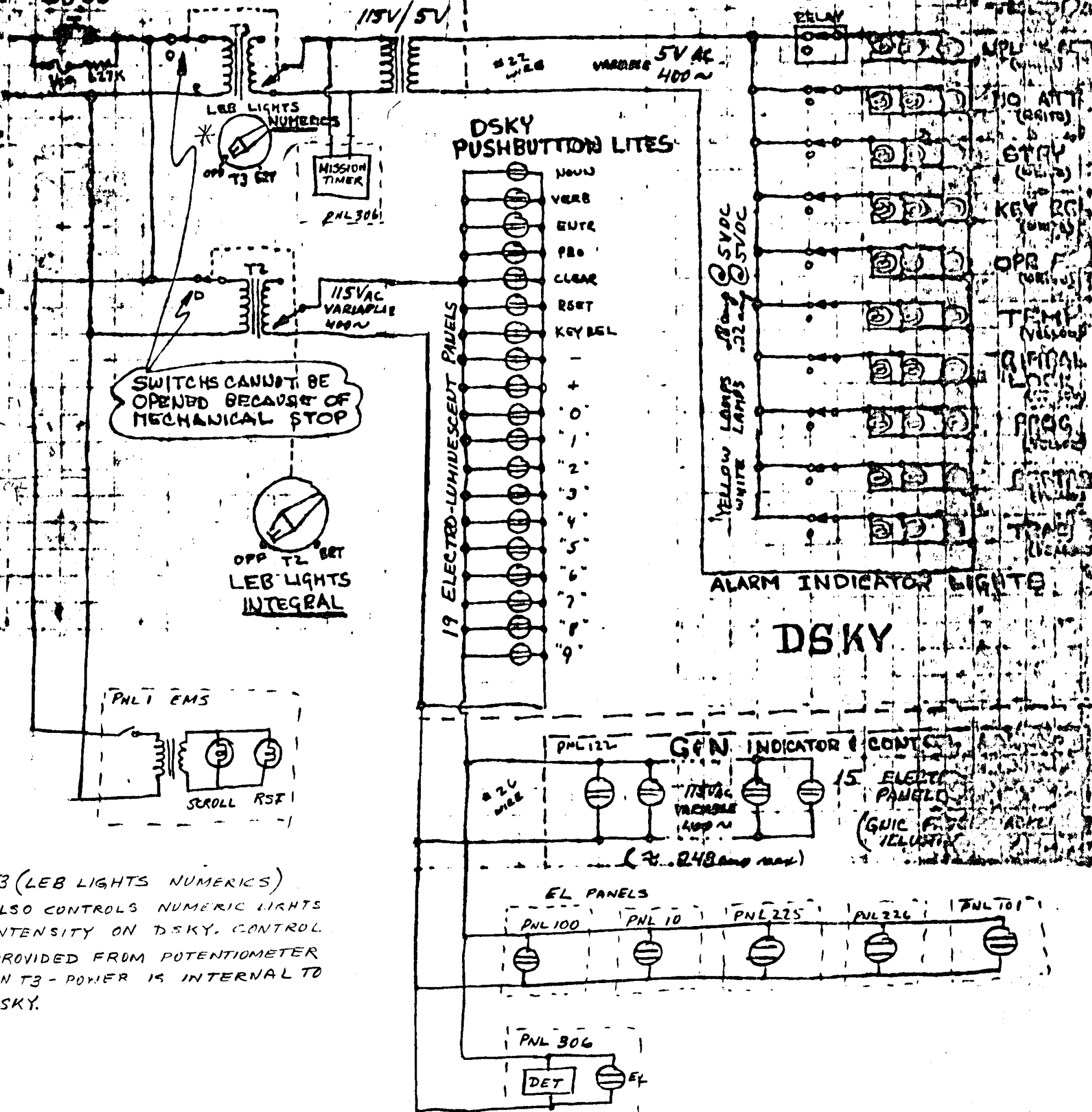
The above tests shows that the sufficient lighting could be available if the LEB DSKY alarm lts are desired by turning on the numerics control full on with the integral on full dim. This assumes that a short circuit does not exist on the primaries of either T2 or T3 or the secondary of T3; also, that the 1/8 amp. fuse had not blown when CB33 opened. With CB33 open, this procedure does not pose any safety hazard since the maximum primary and secondary current is limited by the 1/8 amp. fuse and 1.27K resistor.

As a simple check, the CSM 112 crew can be requested to view the Pnl 306 MET and the integral lights on panel 100. The crew should also be requested to report the positions of T2 and T3.

CB 33

115V/5V

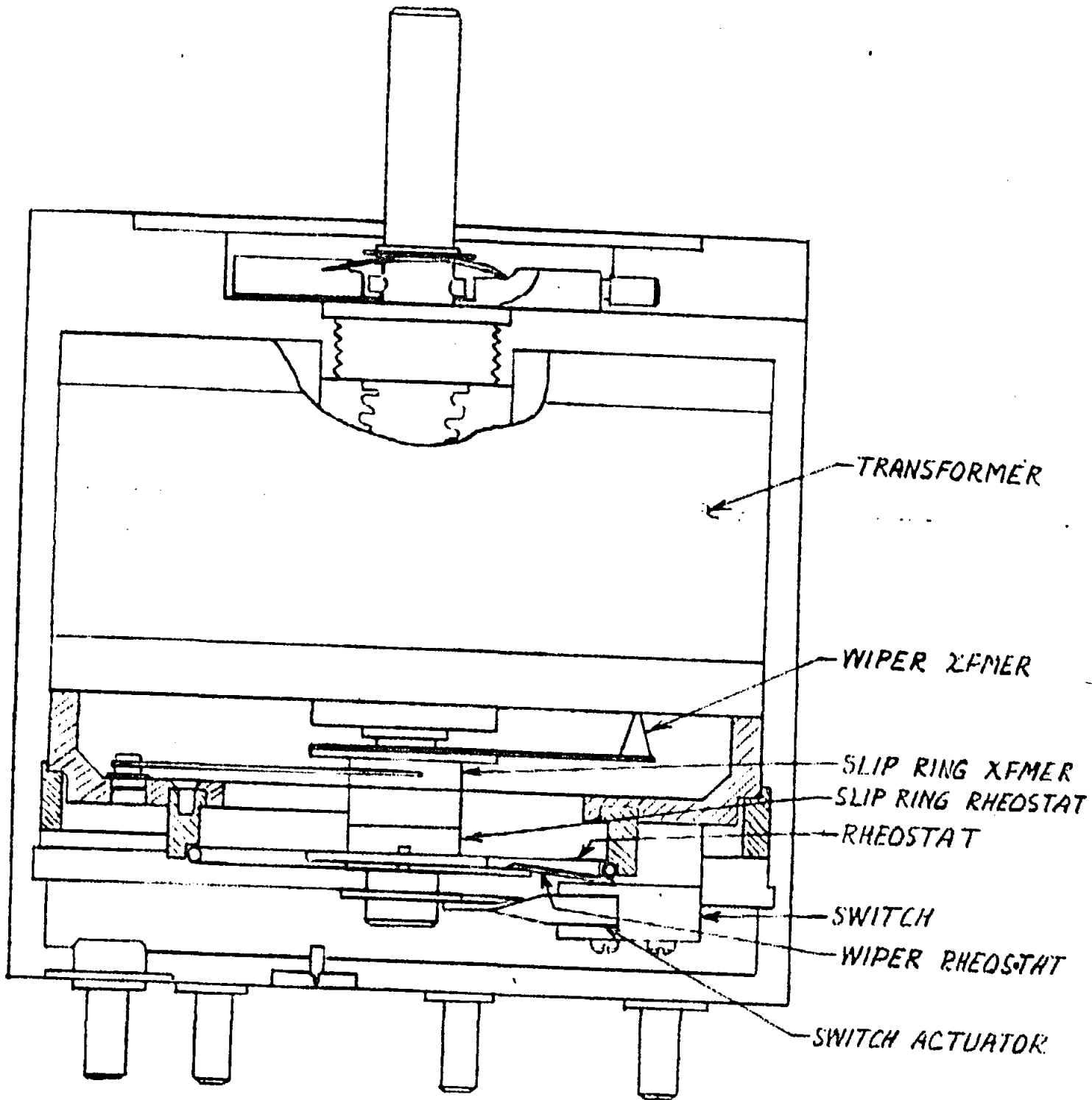
30 LITES



* T3 (LEB LIGHTS NUMERICS)
 ALSO CONTROLS NUMERIC LIGHTS
 INTENSITY ON DSKY. CONTROL
 PROVIDED FROM POTENTIOMETER
 ON T3 - POWER IS INTERNAL TO
 DSKY.

GE JEFFS

ME 446-0036
TRANSFORMER-RHEOSTAT



To - H. Herii (NR 711. 45)

G/N
(41)

USE BLACK BALLPOINT PEN		SPAN / MISSION EVALUATION ACTION REQUEST		USE BLACK BALLPOINT PEN	
TIME (T- MINUS /GET)	REQUEST ORGANIZATION	RESPONSE ORGANIZATION	CONTROL NUMBER		
87:11	45	G/N FOD	C-108		
ACTION REQD BY (TIME):		REQUESTER			
SUBJECT:		APPROVAL			
G/N Coolant Temperature limits		TEAM LDR:			
The G/N Coolant Temperature limits can be relaxed to allow a peak of 95° for 5 minutes. This is based on recent experiments conducted in building 16 laboratory and also because the heat load is cyclic. No numbers are available for steady state temperatures above the 33DB limits at this time. (75°) on steady state		TIME 86:53			
		CON SR REP			
		TIME :			
		ME MANAGER			
		TIME 87:12			
		SPAN MGR			
		TIME 87:25			
RESPONSE:		CONCURRENCE			
Thanks for info		FOD REP			
		TIME 88:30			
		SPAN MGR			
		TIME 88:53			
		TEAM LDR			
		TIME :			
		CON SR REP			
		TIME :			
RESPONDER		ME MANAGER			
J Deethrie (G/N)		SPAN MANAGER			
TIME :		TIME :			

USE BLACK BALLPOINT PEN		SPAN / MISSION EVALUATION ACTION REQUEST		USE BLACK BALLPOINT PEN	
TIME (T-MINUS/GET)	REQUEST ORGANIZATION	RESPONSE ORGANIZATION	CONTROL NUMBER		
88 GET	FOD	45	C-109		
ACTION REQD BY (TIME):		REQUESTER			
ASAP		GWC			
SUBJECT:		APPROVAL			
TET SHUTDOWN PROCEDURE					
DURING TET, CREW WILL SHUT		FOD REP		748	
DOWN BANK A (WITH PILOT VLVCH)		TIME		88:27	
When DSKY SHOWS TGO TO BE		SPAN MGR		848	
LESS THAN 4 SEC. ANY COMMENTS?		TIME		88:28	
IF NOT, GWC WILL PASS ABOVE					
RECOMMENDATION TO PCT					
RESPONSE:		CONCUR			
1. need at least 6 seconds in order		TEAM LDR		12.6	
to make computer sufficient time to		TIME		89:30	
calculate cutoff		CON SR REP			
		TIME			
See Continuation sheet.		ME MGR		Rumley	
FOR FOD RATIONALE		TIME		90:11	
		SPAN MGR		848	
		TIME		90:44	
RESPONDER					
FOD REP		SPAN MANAGER			
TIME		TIME			

(PLEASE USE BLACK BALLPOINT PEN)

UCC Form 1214C (Apr 89) (OT)

MCC - 4 D1/D2 STATUS
REVERSE LOGIC
EVENT RECORDER 1 = ENG ON/EMS PWR OFF
REV 1

D1 = 1 ALL THE TIME

D2 WENT FROM 1 TO 0 73+30+13 AV THRUST B-NORM

D2 WENT FROM 0 TO 1 73+31+17 AV THRUST B-OFF

STRAIGHT LOGIC
LBO RECORDER 0 = ENG ON/EMS PWR OFF

D1 = 0 ALL THE TIME

D2 WENT FROM 1 TO 0 73+31+15 ENG ON

0 TO 1 73+31+16 ENG OFF

1 TO 0 73+31+18 AV THRUST B-OFF

TIG WAS 73+31+14

F. DIGENOVA

P.S. WE SHOULD DO SOMETHING ABOUT
THE LOGIC ON THESE RECORDERS;
LIKE GET THEM TO AGREE.

FD.

41

USE BLACK BALLPOINT PEN		SPAN / MISSION EVALUATION ACTION REQUEST		USE BLACK BALLPOINT PEN	
TIME (T-MINUS/GET)	REQUEST ORGANIZATION	RESPONSE ORGANIZATION	CONTROL NUMBER		
72:35	PA	MPAD	C-87		
ACTION REQD BY (TIME): 73:00		REQUESTER McDIUITT			
SUBJECT: SPS End Of Mission Margin		APPROVAL			
Please provide expected			FOD REP		
SPS end of mission margins			TIME 72:38		
FOR NOMINOG AND LM			SPAN MGR		
Rescue.			TIME 72:37		
4/5 INFO					
RESPONSE:	CONCUR				
			TEAM LDR		
			TIME :		
			CON SR REP		
			TIME :		
			ME MGR		
			TIME :		
			SPAN MGR		
			TIME :		
RESPONDER					
FOD REP		SPAN MANAGER			
TIME :		TIME :			

PAD READ-UP GET 72 + 30

Back

Color _____

P30 MANEUVER

SET STARS		P	C	+	2		PURPOSE
		S	P	S	G	N	PROP/GUID
		+	6	6	3	1 3	WT N47
R ALIGN	_____	+	0	0	1.2	3	P TRIM N48
P ALIGN	_____	-	0	0	0.1	2	Y TRIM
Y ALIGN	_____	+	0	0	0	8 0	HRS GETI
		+	0	0	0	2 9	MIN N33
		+	0	1	3.4	7	SEC
ULLAGE	NO ULLAGE	+	3	1	8	9.4	ΔV_X N81
		-	2	4	3	7.0	ΔV_Y
		-	1	3	5	6.5	ΔV_Z
		X	X	X	1	7 5	R
		X	X	X	0	7 9	P
		X	X	X	3	3 2	Y
		+					H _A N44
							H _P
		+					ΔVT
HORIZON/WINDOW	_____	X	X	X			BT
		X					ΔVC
		X	X	X	X		SXTS
		+				0	SFT
		+				0 0	TRN
		X	X	X			BSS
		X	X				SPA
		X	X	X			SXP
OTHER	_____		0				LAT N61
							LONG
		+					RTGO EMS
		+					V10
							GET 0.05G

Changed _____

Basic Date 6/24/70

09:15 7/27/71 (24:40 GET.)

L
4-14

RETRO UPDATE (NO COMM - use Block Data)

GETI _____ 0 .05G _____

ΔV _____

VC _____

Δtb _____

GET 400K _____

GET DROGUE _____

ENTRY R _____

P _____

Y _____

If time permits, go to G&N thrusting procedures;
if time critical, continue with SCS ΔV .

CB EPS GROUP 5 (2) - CLOSE

XX:XX

Set DET counting up to GETI

GDC ALIGN

EMS FUNC - ΔV SET/VHF RNG

SET ΔVc ~~ABORT~~ **100**

EMS FUNC - ΔV

TVC CHECK & PPEP

(8) ~~cb STAB CONT SYS (all)~~ - close

~~cb SPS (all)~~ - close

MAN ATT (3) - RATE CMD

LIMIT CYCLE - on (up)

ATT DB - MIN

RATE - LOW

TRANS CONT PWR - ON

SCS TVC (2) - RATE CMD

ΔV CG - ~~CSM~~ **LM/CSM**

TVC GMBL DRIVE P&Y - AUTO

CB SPS PILOT VLVS (2) - OPEN (VER)

(54:00)

(-06:00)

MN BUS TIE (2) - ON

TVC SERVO PWR #1 - AC1/MNA

TVC SERVO PWR #2 - AC2/MNB

ROT CONTR PWR NORMAL (2) - AC

ROT CONT PWR DIRECT (2) - OFF

BMAG MODE (3) - ATT1/RATE2

SC CONT - SCS

RHC #2 - ARMED

3/29/71

TLI 90 MIN ABORT

L
4-15

(55:00) PRIMARY TVC CHECK

(05:00) GMBL MOT P1-Y1 - START/ON (LMP Confirm)
Verify TRIM CONTROL & SET
Verify MTVC
SCS TVC (2) - AUTO
THC - CW
Verify NO MTVC

SEC TVC CHECK

GMBL MOT P2-Y2 - START/ON (LMP Confirm)
SET GPI TRIM
Verify MTVC
THC NEUTRAL
Verify GPI returns to trim
Verify NO MTVC
ROT CONT PWR NORM (2) - AC/DC
ROT CONT PWR DIRECT (2) - MNA/MNB
FDAI SCALE - 5/5
LIMIT CYCLE - OFF
~~RATE - HIGH~~
UPDATE DET
SPS He vlvs (2) - AUTO (verify)

(58:00)
(-02:00)

ΔV THRUST ~~ADJ~~ - NORMAL

V37E 47E ~~GET THRUST LITE ON BY PUSHING~~
THC - ARMED ~~ON PANEL FIRST, IF THIS DOESN'T~~
RHC (2) - ARMED ~~WORK MAP ON PANEL OR CYCLING~~
TAPE RCDR - HBR/RCD/FWD/CMD RESET ~~SWITCH. IF NO LITE DELETE TEST~~

(59:30)
(-00:30)

EMS MODE - NORMAL

~~ON MSFN CUE C6 SPS PILOT VLV (A) CLOSE~~

~~00:00 ULLAGE & THRUST ON PD - PUSH~~

~~SPS THRUST L - ON~~

~~00:03 ΔV THRUST B(A) - NORMAL~~

~~ULLAGE & THRUST ON PD - PUSH~~

~~MONITOR THRUSTING~~

~~PC 95-105 psia~~

~~EMS COUNTING DOWN~~

SPS INJ VLVS (4) - OPEN

SPS He vlvs tb-gray

SPS FUEL/OXID PRESS - 170-195 psia

~~RUCS - BALANCED~~

AFTER IGNITION CONFIRMED: C6 SPS PILOT VLV A(MNA)
- OPEN

NOTE: BURN SHOULD NOT EXCEED
1 SEC DURATION

DATE 3/29/71

DATE

L
4-16

00:XX

ECO

ΔV THRUST ~~AX~~ - OFF
VERIFY THRUST OFF
SPS INJ VLVS (4) - CLOSED
SPS He vlvs tb (2) - bp
GMBL MTRS (4) - OFF (LMP Confirm)
TVC SERVO PWR 1&2 - OFF
MN BUS TIE (2) - OFF

19 F 16 83

ΔV XYZ (CM) (.1fps)

RECORD	ΔVC	_____
EMS FUNC - OFF	ΔVX	_____
EMS MODE - STBY	ΔVY	_____
	ΔVZ	_____

ATT DB - MAX
TRANS CONT PWR - OFF
ROT CONTR PWR DIRECT (2) - OFF
BMAG MODE (3) - RATE 2
TAPE RCDR - off (ctr)
PCM BIT RATE - LOW

PRO

F37 00E

When CMC Acty lt out:
V66E

Go to ENTRY PREP & SUPERCIRC ENTRY PROCEDURE
pg E/1-1

AFTER TEST ~~IF~~ IF SPS LITE GOES
OUT ATTEMPT TO GET LITE ON
BY PUSHING ON PANEL.

DATE 3/29/71

MIT		FLIGHT EVENTS HISTORY BRIEFING	
SITE ACQ LOS			
119:50		TO : SPAN	
		FROM: MIT	
		SUBJECT: POSSIBLE METHODS OF REDUCING RCS USAGE	
		IN THE CSM.	
		We can suggest three methods of	
		reducing RCS fuel usage:	
		1. Change the deadband from 5° to 3° -	
		This might possibly change	
		drive the spacecraft at a different	
		rate and one that would be less	
		coupled in the three axis. There	
		is no data to suggest ^{whether} what this	
		would have any effect.	
		2. Modify Mass on Inertias - This is	
		not recommended at this time because	
		the effect would probably be to fire	
		on both sides of the db as opposed	
		to only one which it is now doing.	
		3. Disable 2 adjacent guesds in	
		RO3 (with corresponding jth config	
		changes) - This would require	
		a modification to the RCS and is probably	
		not desirable.	

TEI PROCEDURE

USE BLACK
BALLPOINT
PEN

SPAN / MISSION EVALUATION ACTION REQUEST

USE BLACK
BALLPOINT
PEN

TIME
(T-MINUS/GET)

205+33

REQUEST
ORGANIZATION

FOD

RESPONSE
ORGANIZATION

45

CONTROL
NUMBER

C-305

ACTION REQD BY (TIME):

INFL ONLY

REQUESTER

GNC

SUBJECT:

TEI PROCEDURES

APPROVAL

FOD REP

W. J. Moore

TIME 205:33

SPAN MGR

W. J. Moore

TIME 205:41

RESPONSE:

CONCUR

1. T. J. Moore

2. ELC - GNC

3. PDHS, DDC, INST - Concur

4. COMAN OK

5. GNC OK

6. PPD OK

TEAM LDR

R. J. Moore

TIME 209:30

CON SR REP

W. J. Moore

TIME 209:34

ME MGR

W. J. Moore

TIME 209:38

SPAN MGR

W. J. Moore

TIME 209:51

All Systems OK

RESPONDER

FOD REP

W. J. Moore

TIME 210:09

SPAN MANAGER

W. J. Moore

TIME 210:09

USE BLACK
BALLPOINT
PEN

USE BLACK
BALLPOINT
PEN

CONTROL
NUMBER

C-305

GNC

TEI PROCEDURES

APPROVAL

FOO REP

H. J. Ince

TIME 205:33

SPAN MGR

KWR
TIME 2:54

RESPONSE :

CONCUR

TEAM LDR

TIME :

CON SR REP

TIME :

ME MGR

TIME :

SPAN MGR

TIME :

RESPONDER

FOD REP

SPAN MANAGER

TIME :

TIME :

MB
Ac

RECOMMENDED TEI PROCEDURE

* only change from the
LoI procedure.

G
5-1

GNC
204000

P40 SPS THRUSTING

cb SPS PILOT VLVS(2)
OPEN(VER)

cb EPS GPS(2)-
CLOSE(VER)

EMS FUNC - OFF(VER)

cb. EMS MN A, B(2) - CLOSE

Prethrust Program Complete
Verify SIM PWR DOWN (Nominal)
configuration, pg. S/1-35-40

CMC & ISS - on
Cycle CRYO FANS
SCS - OPERATING
TEST C/W LAMPS

Perform EMS LV TEST & NULL

BIAS CHECK, pg G/2-5

Set AVC
EMS FUNC - LV
SPS GAUGING - AC1
PUG MODE - NORMAL
OXID FLOW vlv - PRI
BMAG MODE (3) - RATE 2
CMC MODE - FREE
AUTO RCS SELECT(16)-as req'd
LOAD DAP (check roll jets)
ROT CONTR PWR NORM (2) - AC/DC
Set DET

V37E 00E

SC CONT - CMC/AUTO

MNVR TO PAD BURN ATT
V49E

PERFORM BORESIGHT & SXT STAR CHECK
V41 H91E

V37E 40E
(TFI available via H40, H45 or H35)

4 F 50 18 REQUEST MNVR TO FDAI RPY ANGLES (.01°)
(AUTO) BMAG MODE (3) - RATE 2
SC CONT - CMC/AUTO
PRO

5 06 18 AUTO MNVR TO FDAI RPY ANGLES (.01°)

THRUSTING (P40's)

DATE 5/24/77 7/14/77

THRUSTING (P40's)

G
5-2

6 F 50 18 REQUEST TRIM MNVR TO FDAI RPY ANGLES
ALIGN S/C ROLL (.01°)
GDC ALIGN

TVC CHECK & PREP

cb STAB CONT SYS (all) - close (Pnl 8)
cb SPS ~~(X)~~ - close 10
SET LVC (verify)
EMS FUNC - LV (verify)
MAN ATT (3) - RATE CMD

ATT DB - MIN
RATE - LOW
TRANS CONT PWR - ON
SCS TVC (2) - RATE CMD
ΔVCG - LMC SM or CSM
TVC GMBL DRIVE P&Y - AUTO

+54:00m
(-06:00)

ML BUS TIE (2) - ON
TVC SERVO PWR #1 - AC1/MNA
TVC SERVO PWR #2 - AC2/MNB
ROT CONTR PWR NORMAL (2) - AC
ROT CONT PWR DIRECT (2) - OFF
BMAG MODE (3) - ATT1/RATE 2
SC CONT - SCS
RHC #2 - ARMED

55:00m
(-05:00)

PRIMARY TVC CHECK

GMBL MOT P1-Y1-START/ON (LMP Confirm)
Verify TRIM CONTROL & SET
Verify MTVC
IF SCS: SCS TVC (2) - AUTO
SC CONT - CMC (SCS)
THC - CH
Verify NO MTVC

SEC TVC CHECK

GMBL MOT P2-Y2-START/ON (LMP Confirm)
SET GPI TRIM
Verify MTVC
THC NEUTRAL
Verify NO MTVC

DATE 3/22/71

G
5-3

Verify GPI returns to 0,0(CMC) or trim
(SCS)

ROT CONT PWR NORM (2) - AC/DC

ROT CONT PWR DIRECT (2) - MNA/MNB

(TRIM) BMAG MODE (3) - RATE 2

PRO

BMAG MODE (3) - ATT1/RATE 2

ENTR

7 F 50 25 00204 GMBL TEST OPTION
(ACCEPT) SC CONT - CMC (verify)
PRO

Monitor GPI Response:

00,02,-02,00,02,-02,00, Trim

*TEST FAIL: *

*SC CONT - SCS *

SCS TVC(2) - AUTO

(REJECT) ENTR

8 06 40 TFI, VG, ΔVM (min-sec,lfps)
PROG ALARM - TIG Slipped
*V5N9E 01703 *
*KEY RLSE TO 8 *

FDAI SCALE - 5/5

RATE - HIGH

UPDATE DET

SPS He vlvs (2) - AUTO (verify)

Check N2 A and N2 B

58:00 ← cb SPS PILOT VLV MNB - CLOSE
(-02:00) ← ~~AV THRUST X(2) NORMAL~~
THC - ARMED
RHC (2) - ARMED
TAPE RCDR - HBR/RCD/FWD/CMD RESET

59:25
(-00:35) DSKY BLANKS

DATE 5/24/71

G
5-4

59:30 (AVE G ON)
(-00:30) EMS MODE - NORMAL

06 40 TFI, VG, ΔVM (min-sec, .1fps)
CHECK PIPA BIAS <2fps for 5 sec

59:XX
(-00:XX) ULLAGE

*If no ULLAGE: *
* DIR ULLAGE PB - PUSH*
* Control Att with RHC*

MONITOR ΔVM (R3) COUNTING UP

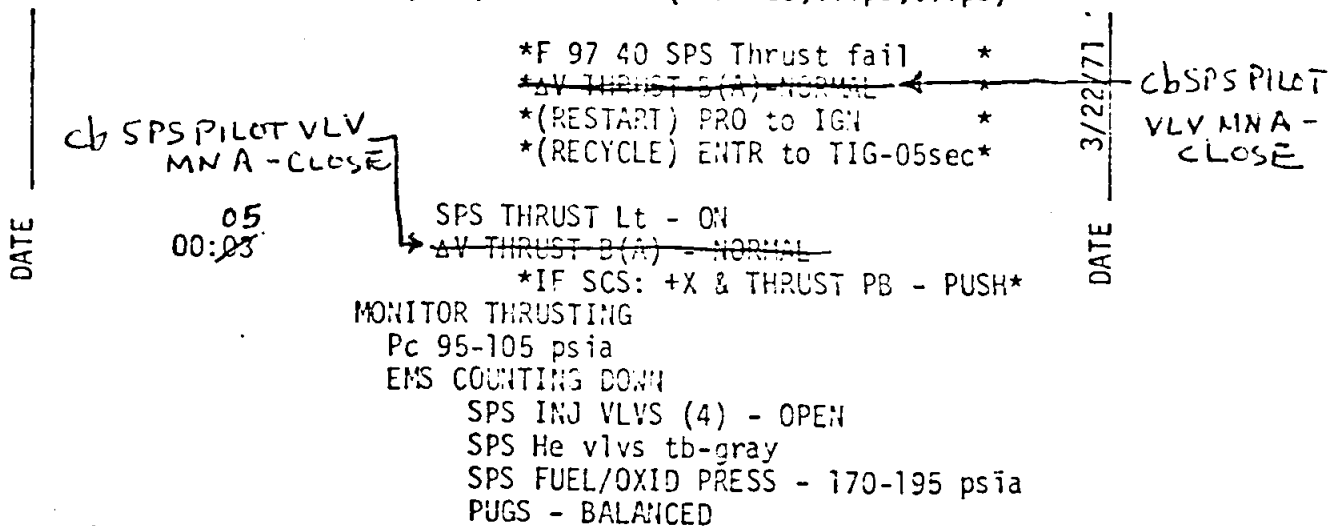
59:55
(-00:05)

F 99 40 ENG ON ENABLE REQUEST
(AUTO IGN) PRO AT TFI >0 Sec
(BYPASS IGN) ENTR to 11 (Perform switching in 10)
EXIT - V37E 00E

ΔV THRUST A & B (2) - NORMAL

9 00:00 IGN *IF SCS: THRUST PB - PUSH*

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



*

ECO-10sec cb SPS PILOT VLV MNA - OPEN :

G
5-5

XX:XX ECO

10 F 16 40 TFC (STATIC), VG, Δ VM (min-sec,.1fps)
 Δ V THRUST A&B - OFF
VERIFY THRUST OFF
SPS INJ VLVS (4) - CLOSED
SPS He vlvs tb (2) - bp
GMBL MTRS (4) - OFF (LMP Confirm)
TVC SERVO PWR 1&2 - OFF
MN BUS TIE (2) - OFF
PRO

11 F 16 85 VG XYZ (CM) (.1fps)
NULL RESIDUALS
RECORD Δ V COUNTER & RESIDUALS Δ VC _____
EMS FUNC - OFF VGX _____
EMS MODE - STBY VGY _____
RHC & THC - LOCKED VGZ _____
ATT DB - MAX
TRANS CONT PWR - OFF
ROT CONTR PWR DIRECT (2) - OFF
BMAG MODE (3) - RATE 2
cb DIRECT ULLAGE (2) - open
cb SPS P1 & Y1 - open
PCM BIT RATE - LOW
MAP CAMR ON - OFF (except lunar orb.)
PAN CAMR PWR - OFF
SM/AC PWR - OFF (except lunar orb.)
PRO (If MINKEY, To Sequencer 3X.2)

cb SPS PILOT VLV MNB-
OPEN

DATE 5/24/71

12 F 37 V82E

13 F 16 44 HA,HP,TFF (.1nm,min-sec)

PRO

14 F 37 00E

PROP CONS