APOLLO 15	
LM DATA CARD BOOK	
PART NO.	S/N
SKB32100115-387	1001

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~~#7~~ 25/42

LM ACTIVATION CARD

97 : 54 : 55 PRIM EVAP FLOW TIME

DAP PAD

+	+ 36630	LM WT (+36636) N47
+	+ 37679	CSM WT (+37371)
+	+	GMBL (+00629) N48
+	+	(+00648)

DOCKED P52 ALIGN

+	+ 00171	R_1 N93
	− 00236	R_2
	− 00663	R_3
	99:11:30	GET

37.0 BATT A
37.0 BATT B
98:45:00 GET
ED BATT VOLTAGE

V06 N20

GET ___:___:___ (100: 03 : 56)

LM	R_1						
	R_2						
	R_3						
CSM	R_1						
	R_2						
	R_3						

S-BD

P	(+134)	AOS	(98 : 24 : 04)
Y	(+6)		
P	(+41)	AOS	(100 : 17 : 35)
Y	(−55)		
P	( )	AOS	( )
Y	( )		

UNDOCK/SEP GET 100 : 13 : 5600 (100 : 13 : 56)
P 108

AGS

K FACTOR 100 : 00 : 00006 (100 : 00 : 00)

+	+ 60442	(+60410)	224
+	+ 29365	(+29365)	225
+	+ 60449	(+60423)	226
−	− 01659	(−01751)	305
−	− 55021	(−54776)	662
−	− 32306	(−32014)	673
		(+00002 ~~−00005~~)	540
		(−00004 ~~−00005~~)	541
		(+00003 ~~+00000~~)	542
		(+00002 ~~−00048~~)	544
		(+00090 ~~−00076~~)	545
		(−00007 ~~−00036~~)	546

DATE ~~6/10/71~~ 7/28/71

PAGE 1

AGS SV/IMPACT P30 | TPF REL TRAJ NOM COEL RNDZ | CSI CDH/PLANE CHANGE | ABORT/ASCENT DIRECT TPI | PD12/PD12 ABORT LUNAR SURFACE | PDIO/NO PDI +12 PDI1/PDI1 ABORT | ACTIVATION LPD/CIRC/PDI

LPD CAL/CSM CIRC

LPD ΔBIAS	NEW BIAS = ORIG BIAS(P64)+ΔBIAS(P52) ΔBIAS(AZ) = (LPD RDG) x1.3 ΔBIAS(EL) = (LPD RDG) X1.0
LPD RDG (P52)	

(+) (-)	(-ΔAZ) (-ΔEL)	+	3	5	9	5	4	ORIG BIAS	AZ
								+ΔBIAS(AZ)	
								AZ BIAS 3373	
+ + +	+ 40 + +								
(+) (+)	(-) (+)	+	0	0	0	1	8	ORIG BIAS	EL
								+ΔBIAS(EL)	
								EL BIAS 1353	

LOAD NEW BIAS (P64)	VERIFY BIAS
V21 N03E, 3373E LOAD AZ BIAS (.01°) E, 1353E LOAD EL BIAS (.01°)	V06 N03E, 3373E VERIFY AZ BIAS E, 1353E VERIFY EL BIAS

65.2 x 54.8 CSM

65.2 x 54.6 LM

CSM CIRC BURN													
P76													
+	0	0				+	0	0	1	0	1	HRS (101)	N33
+	0	0	0			+	0	0	0	3	8	MIN (34)	TIG
+	0					+	0	5	8	1	9	SEC (55.10)	
						+	0	0	6	8	3	ΔVX (+70.8)	N84
						+	0	0	0	0	1	ΔVY (+0.0)	
						+	0	0	0	0	7	ΔVZ (+0.6)	

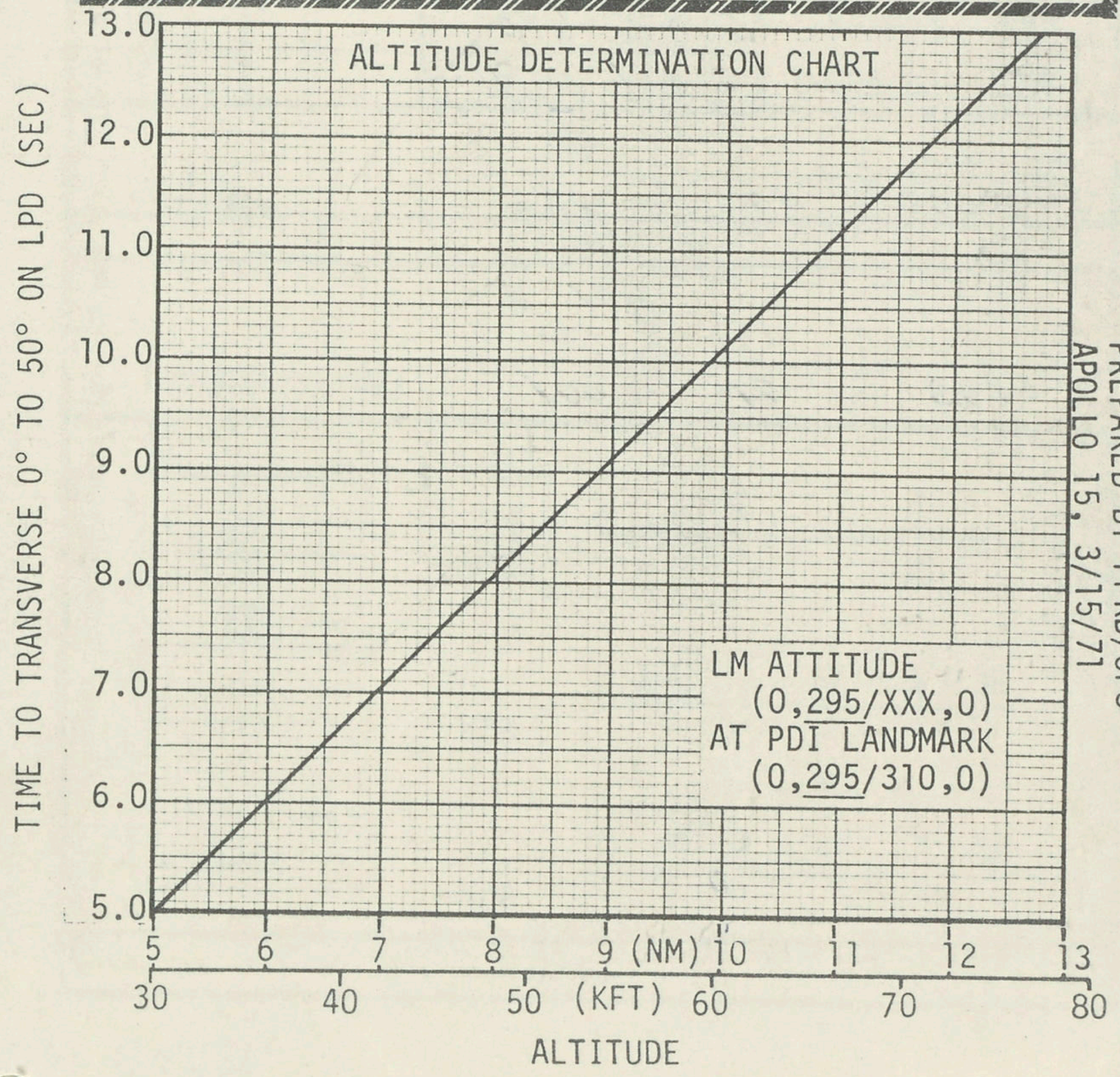
CSM HA/HP		
CMC	LGC	V82
/	/	OPT 2

PDI RULES/ALTITUDE CHECK

PDI RULES

1. NO AUTO ULLAGE - BACKUP VIA +X OVERRIDE (+NO AUTO IGNITION - PDI NO-GO)
2. NO IGN (WITH AUTO ULL) DELAY 2 SEC, THEN START PB-PUSH; THEN DES OVRD - ON AT 5 SEC
3. T/W >1.6 AND DSKY CHANGES >18 fps/2 SEC
4. ATT/RATE <5°/SEC
5. ΔH IN LIMITS >10 SEC, NOT OUT OF LIMITS >60 SEC
6. DATA GOOD AT > 6,000 ft
7. IF NO THROTTLE DOWN BY P64 + 15 SEC - ABORT
8. BINGO FUEL 1 MIN 31 SEC AFTER LOW LEVEL OR WHEN FUEL QTY <2% UNLESS LANDING IMMINENT

NOTE: FOR FLASHING LR ALT OR VEL LIGHTS PRECEDED BY STEADY LR LT, CYCLE RADAR TEST SWITCH



PREPARED BY FPRB/OPS
APOLLO 15, 3/15/71

DATE 6/10/71

PDI O/NO PDI + 12 CARD

PDI O ABORT PAD

+ 00	+ 001 02	HRS (102)	N33
+ 000	+ 0003 9	MIN (34)	TIG
+ 0	+ 035.35	SEC (59.20)	A
	+ 01000	ΔVX (+102.8)	N81
	+ 0 —	ΔVY (+0.0)	LV
	+ 00018	ΔVZ (+2.8)	B
+	+ 0138.3	HA (+138.9)	N42
	+ 00090	HP (+8.2)	
+	+ 0100.1	ΔVR (+102.8)	
XXX	XXX 0:34	BT (0:38)	
XXX	XXX 000	R (000)	FDAI
XXX	XXX 273	P (285)	INER
+	+ 015.96	TIG (155.0)	373
	+ 01000	ΔVX (+102.8)	N86
	+ 0 —	ΔVY (+0.0)	AGS
	+ 00024	ΔVZ (+3.6)	
+ 00	+ 001 03	HRS (103)	N11
+ 000	+ 0004 0	MIN (35)	CSI
+ 0	+ 024.00	SEC (37.90)	C
+ 00	+ 001 05	HRS (105)	N37
+ 000	+ 0002 2	MIN (21)	TPI
+ 0	+ 030.00	SEC (46.50)	D

RESIDUALS

PGNS		AGS	
ΔVX	N85	ΔVX	500
ΔVY		ΔVY	501
ΔVZ		ΔVZ	502

NO PDI + 12 ABORT PAD

+ 00	+ 001 04	HRS (104)	N33
+ 000	+ 0000 2	MIN (40)	TIG
+ 0	+ 030.00	SEC (24.70)	E
	+ 01082	ΔVX (+113.9)	N81
	+ 0 —	ΔVY (+0.0)	LV
	− 00500	ΔVZ (-46.8)	F
+	+ 0144.9	HA (+146.6)	N42
	+ 00086	HP (+8.8)	
+	+ 0119.2	ΔVR (+123.1)	
XXX	XXX 0:36	BT (0:40)	
XXX	XXX 000	R (000)	FDAI
XXX	XXX 270	P (271)	INER
+	+ 028.25	TIG (280.4)	373
	+ 01085	ΔVX (+114.3)	N86
	+ 0 —	ΔVY (+0.0)	AGS
	− 00493	ΔVZ (-45.9)	
+ 00	+ 001 07	HRS (107)	N11
+ 000	+ 0003 7	MIN (35)	CSI
+ 0	+ 030.00	SEC (38.90)	G
+ 00	+ 001 09	HRS (109)	N37
+ 000	+ 0001 8	MIN (18)	TPI
+ 0	+ 045.00	SEC (38.30)	H

RESIDUALS

PGNS		AGS	
ΔVX	N85	ΔVX	500
ΔVY		ΔVY	501
ΔVZ		ΔVZ	502

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PDI 1 ABORT CARD

PDI 1 PAD

+	0	0	1	0	4	+	0	0	~~0~~	~~0~~	~~4~~	HRS(104)	N33
+	0	0	0	3	0	+	0	0	0	~~3~~	~~0~~	MIN(28)	PDI
+	0	0	8	5	4	+	0	1	~~0~~	~~9~~	~~4~~	SEC(54.82)	I
X	X					X	X	1	1	0	3	TGO(11:04)	N61
~~+~~	~~0~~	~~0~~	~~0~~	~~3~~	~~3~~	~~+~~	~~0~~	~~0~~	~~0~~	~~2~~	~~9~~	X RANGE(+0.0)	
X	X	X				X	X	X	0	0	2	R (000)	FDAI
X	X	X				X	X	X	1	1	0	P (111)	AT TIG
X	X	X				X	X	X	3	1	0	Y (310)	
~~+~~	~~5~~	~~6~~	~~9~~	~~4~~	~~3~~	~~+~~	~~5~~	~~6~~	~~9~~	~~2~~	~~2~~	DEDA 231 IF ROD	

#04

-01600

(0<PDI 1< 6:10) ABORT PAD EARLY

LOG INSERTION GET= ___ ___ ___:___ ___:___ ___
+ 1 0 0 0 0

BOOST GET= ___ ___ ___:___ ___:___ ___
+ 1 0 0 0 0

HAM GET= ___ ___ ___:___ ___:___ ___
+ 1 0 0 0 0

CSI GET= ___ ___ ___:___ ___:___ ___

+	0	0				+	0	0	1	0	9	HRS(109)	N37
+	0	0	0			+	0	0	0	1	8	MIN(18)	TPI
+	0					+	0	4	5	0	0	SEC(38.30)	J

T1-1(6:10 ≤ PDI 1 ≤ 15) ABORT PAD LATE

LOG INSERTION GET= ___ ___ ___:___ ___:___ ___
+ 5 5 0 0

CSI GET= ___ ___ ___:___ ___:___ ___

+	0	0				+	0	0	1	0	7	HRS(107)	N37
+	0	0	0			+	0	0	0	2	0	MIN(20)	TPI
+	0					+	0	3	0	0	0	SEC(12.50)	K

T2-1(PDI 1 + 21 : 26___:___) ABORT PAD

LOG INSERTION GET= ___ ___ ___:___ ___:___ ___
+ 5 0 0 0

BOOST GET= ___ ___ ___:___ ___:___ ___
+ 1 0 0 0 0

HAM GET= ___ ___ ___:___ ___:___ ___
+ 5 0 0 0

CSI GET= ___ ___ ___:___ ___:___ ___

+	0	0				+	0	0	1	0	4	HRS(104)	N33
+	0	0	0			+	0	0	0	5	0	MIN(50)	TIG
+	0					+	0	4	9	6	7	SEC(20.80)	L
+	0	0				+	0	0	1	0	9	HRS(109)	N37
+	0	0	0			+	0	0	0	1	8	MIN(18)	TPI
+	0					+	0	4	5	0	0	SEC(38.30)	M

N69 TARGET UPDATE

						ΔDN RNG	
						ΔX RNG	V25
						ΔRLS	
						ΔDN RNG	V21
						ΔDN RNG	V24
						ΔX RNG	
						ΔRLS	V23

THROTTLE DOWN _____:_____

F2 2039
~~2299~~

T3-1 (1 REV) ABORT TIME

+	0	0				+	0	0	1	0	6	HRS(106)	N33
+	0	0	0			+	0	0	0	4	1	MIN(40)	TIG
+	0					+	0	2	0	0	5	SEC(58.40)	N

PDI 2 ABORT CARD

PDI 2 PAD

+ 0 0 / + 0 0	HRS (106)	N33
+ 0 0 0 / + 0 0 0	MIN (22)	PDI
+ 0 . / + 0 .	SEC (34.00)	I
X X : / X X :	TGO (11:04)	N61
.	X RANGE (+0.0)	
X X X / X X X	R (000)	FDAI
X X X / X X X	P (111)	AT TIG
X X X / X X X	Y (310)	
	DEDA 231 IF RQD	

(0<PDI 2 < 9:16) ABORT PAD EARLY

LOG INSERTION GET= ___ ___ ___:___ ___:___ ___
+ 1 0 0 0 0
BOOST GET= ___ ___ ___:___ ___:___ ___
+ 1 0 0 0 0
HAM GET= ___ ___ ___:___ ___:___ ___
+ 1 0 0 0 0
CSI GET= ___ ___ ___:___ ___:___ ___

+ 0 0 / + 0 0	HRS (111)	N37
+ 0 0 0 / + 0 0 0	MIN (17)	TPI
+ 0 . / + 0 0 .	SEC (04.20)	J

T1-2(9:16 ≤ PDI 2 ≤ 15) ABORT PAD LATE

LOG INSERTION GET= ___ ___ ___:___ ___:___ ___
+ 5 5 0 0
CSI TIG ___ ___ ___:___ ___:___ ___

+ 0 0 / + 0 0	HRS (109)	N37
+ 0 0 0 / + 0 0 0	MIN (18)	TPI
+ 0 . / + 0 .	SEC (38.30)	K

T2-2(PDI 2 +19:40 ___ : ___) ABORT PAD

LOG INSERTION GET= ___ ___ ___:___ ___:___ ___
+ 5 0 0 0
CSI GET= ___ ___ ___:___ ___:___ ___

+ 0 0 / + 0 0	HRS (106)	N33
+ 0 0 0 / + 0 0 0	MIN (42)	TIG
+ 0 . / + 0 .	SEC (14.10)	L
+ 0 0 / + 0 0	HRS (109)	N37
+ 0 0 0 / + 0 0 0	MIN (18)	TPI
+ 0 . / + 0 .	SEC (38.30)	M

N69 TARGET UPDATE

	ΔDN RNG ΔX RNG ΔRLS	V25
	ΔDN RNG	V21
	ΔDN RNG ΔX RNG	V24
	ΔRLS	V23

THROTTLE DOWN ___:___

T3-2 (1 REV) ABORT TIME

+ 0 0 / + 0 0	HRS (108)	N33
+ 0 0 0 / + 0 0 0	MIN (39)	TIG
+ 0 . / + 0 .	SEC (10.00)	N

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AGS SV/IMPACT P30 | TPF REL TRAJ NOM COEL RNDZ | CSI CDH/PLANE CHANGE | ABORT/ASCENT DIRECT TPI | PD12/PD12 ABORT LUNAR SURFACE | EXTRA P27 PAD | ASCENT/CSI NOTES

PDI2/PDI2 ABORT
LUNAR SURFACE

PDI0/NO PDI +12
PDI1/PDI1 ABORT

ACTIVATION
LPD/CIRC/PDI

FIRST REV ACTIVITY

LUNAR SURFACE CARD

LAUNCH PREP

N20
34267 OG 00702 IG 35143 MG

P57, A/T 1, REFSMMAT
N04 + 04, +01 NAV ERR
N05 -03
N93 -011 X -041 Y -002 Z

P57, A/T 2, REFSMMAT 40 170
STAR1 303 (N71)
STAR2 612 (N71)

N05 +01 ANGLE DIFF
N93 -075 X
+058 Y
-060 Z
N89 +26167 LAT
+01799 LONG/2
+0— ALT

P57, A/T 2, REFSMMAT
STAR1 6 61 (N71)
STAR2 3 122 (N71)
N05 -00 ANGLE DIFF
N93 -08 X
-21 Y
-33 Z
N89 +26191 LAT
+01812 LONG/2
+0000 ALT

N88 +10975
61 +99373
-02127

181
23

122 +54566
+09353
+83277

N43
LAT(+N) +2612
LONG(+E) +.370
ALT ___.__

047 +36416 053 +11461

544 +00021 +5:02 +00014
545 +00081 +00081
546 -00015 -00006

047 +36451 053 +11331

P57, A/T 3, LANDING SITE
N04 ____, ____ GRAV ERR
STAR ____ (N71)
N05 ____ ANGLE DIFF
N93 ____ X
____ Y
____ Z

5MR 5 D 3
182.2 284.0

P57, A/T 3, LANDING SITE
N04 ____, ____ GRAV ERR
STAR ____ (N71)
N05 ____ ANGLE DIFF
N93 ____ X
____ Y
____ Z

P22 ACQ ____:____:____

REV 48 TIG ____:____:____
(171: 37 : 24)

544 ____ +5:02 ____
545 ____ ____
546 ____ ____
377 ____

K FACTOR ____:____:____
(170 : 00 : 00)

047 ____
053 ____

LIFT-OFF TABLE

NOMINAL = (M=2)			(M=1) ~ (M=2) -2:30		
REV	NEW TIG	NOM TIG	REV	NEW TIG	NOM TIG
16	108 39 45	108:39:10	32	140 10 24	140:09:26
17	110 38 00	110:37:19	33	142 08 33	142:07:34
18	112 36 13	112:35:28	34	144 06 46	144:05:43
19	114 34 26	114:33:36	35	146 05 03	146:03:51
20	116 32 39	116:31:45	36	148 02 57	148:01:59
21	118 30 48	118:29:53	37	150 01 04	150:00:07
22	120 29 06	120:28:02	38	151 58 58	151:58:15
23	122 27 10	122:26:10	39	153 57 03	153:56:23
24	124 25 21	124:24:19	40	155 55 07	155:54:31
25	126 23 32	126:22:27	41	157 53 14	157:52:39
26	128 21 44	128:20:36	42		159:50:46
27	130 19 54	130:18:44	43	161 49 31	161:48:54
28	132 17 54	132:16:53	44	163 47 36	163:47:02
29	134 16 02	134:15:01	45	165 45 40	165:45:23
30	136 14 10	136:13:09	46	167 43 49	167:43:32
31	138 12 19	138:11:18	47	169 41 53	169:41:40

+180
H.G. +270
+71
-58

105 20
1800 - FRIDAY

LOCATION
BR 3 75.5

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V21 N01
1459 E
04366

X P
V21 N01
1452 E
04672

41.3
X
9.1

171 37 2236

ABORT/ASCENT CARD

DATE ~~6/10/71~~ 7/16/71

ASCENT RULES

UNDERBURN

ΔV(FPS)	TIME(SEC)	PGNS	AGS
<400	<20	NULL RESIDUALS	AUTO,A/H 15fps
>400	>20	A/H BURN HA,HP Ḣ CONTROL	AUTO,A/H 15fps

INSERTION

WITH VOICE-GROUND RECOMMENDS TRIM SOURCE AT T_{GO}=1 MIN

- DIRECT ASCENT RNDZ
  TRIM TO <2 FPS AND STANDBY FOR TWEAK AT INSERTION ATTITUDE
- COELLIPTIC RNDZ
  TRIM TO <2 FPS (AGS X-AXIS ONLY) AND STANDBY FOR TWEAK (10° OHW OR 250° FDAI)
- TWEAK AT INSERTION PLUS 2 MINUTES

FOR NO VOICE

PGNS, AGS DIFFER <10FPS, TRIM ACTIVE SYSTEM
PGNS, AGS DIFFER >10FPS, TRIM SYSTEM WHICH AGREES WITH RR

ATT/RATE ERROR >10°/SEC

LM ASCENT PAD

+	0	0				+	0	0	1	7	1	+	0	0	1	7	1	HRS (171) N33
+	0	0	0			+	0	0	0	4	0	+	0	0	0	3	7	MIN (37) TIG
+	0			.		+	0	1	3	.	4	1	+	0	2	2	.	3 6	SEC (23.87)
+					.	+	5	5	3	2	.	0	+	5	5	3	0	. 4	V(~~X~~ H)(5536.4)
+					.	+	0	0	2	0	.	0	+	0	0	3	2	. 0	V(~~H~~ V)(32.0)N76
	0				.	−	0	0	0	0	5	−	0	0	0	0	.	4	X RANGE(+0.0)
						+	3	7	7	4	2	+	3	7	7	4	2	047 (+40000)
						+	0	1	7	2	2	+	0	1	7	2	2	053 (+00000)
						+	5	8	5	5	0	+	5	8	5	1	6	224/226(+58566)
						+	5	6	9	4	3	+	5	6	9	4	3	231 (+56907)
					.	+	0	0	2	0	.	0	+	0	0	3	2	. 0	465 (+32.0)
					.	NA					.		+	0	1	4	9	. 6	373 (+149.7)
+	0	0				+	0	0					+	0	0	1	7	2	HRS (172) N37
+	0	0	0			+	0	0	0				+	0	0	0	2	9	MIN (29) TPI
+	0			.		+	0			.			+	0	3	9	.	0 0	SEC (39.10)
+						+							+	1	0	9	3	6	LM WT (10873)

*NOTE: LOAD 8 NM CROSSRANGE IF GREATER THAN 8 NM

173 35 34

+												HA V82	+											HA 315
+												HP	+											HP 403

T3 (1 REV) ABORT PAD

LOG INSERTION GET= ___ ___ ___:___ ___:___ ___
+ 5 0 0 0

CSI TIG= ___ ___ ___:___ ___:___ ___
+ 1 3 3 0 0

TPI TIG= ___ ___ ___:___ ___:___ ___

+	0	0				+	0	0										HRS (106) N33
+	0	0	0			+	0	0	0									MIN (40) TIG
+	0			.		+	0			.								SEC (58.40) N

ONE REV LATE ___:___:___
(173 : 38 : 06)

RESIDUALS

PGNS				AGS			
		.	ΔVX N85			.	ΔVX 500
		.	ΔVY			.	ΔVY 501
		.	ΔVZ			.	ΔVZ 502

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AGS SV/IMPACT P30 | TPF REL TRAJ NOM COEL RNDZ | CSI CDH/PLANE CHANGE | ABORT/ASCENT DIRECT TPI | SHADOW DATA | EXTRA P27 PAD | ASCENT/CSI NOTES

DIRECT TPI CARD

BURN RULES

IF TWO OF THREE SOLUTIONS AGREE, BURN PRIORITY SOLUTION.

PRIORITY OF SOLUTION: PGNS, AGS, CMC, CHARTS.
GUIDE VALUES: $\dot{X}$=3 fps, $\dot{Y}$=7 fps, $\dot{Z}$=9 fps

RR AGREES WITH VHF.WHERE
$\Delta R = 0.01R + 0.5$ NM, ΔR IS ALWAYS $\geq$ 1 NM
RR DOES NOT AGREE WITH VHF,
MSFN ISOLATES FAILED SYSTEM.

APS ENGINE FOR ΔV>40fps

TPI SOLUTIONS

		PGNS	AGS	CMC	CHARTS
TIG	N37		373	N37	149.6
θ LOS (+26.6)	N55	31.1	303 37.67	N55	15.
HP (+43.9)	N58	+38.5	402 +35.1	N58	164.6
ΔV TPI (+73.6)		+72.9	370 74.6		15
ΔV TPF (+31.7)		+25.6	371 25.6		179.6
ΔVX	N81	+70.6	450 +67.5	N81* -69.4 ΔVX	
ΔVY		+5.9	451 -6.4	* -6.2	
ΔVZ		-16.9	452 -30.4	* +12.0 ΔVZ	

** IF ΔV TPF >55 fps, SEE TPI 2 BELOW:

*CHANGE SIGN
BIAS; ΔVX = -1.0
ΔVZ = +2.0

TIG	V21 N01 1452	N37	373	N37	
θ LOS		N55 32°	303	N55	
HP	05210	N58 38.3	402	N58	
ΔV TPI		72.8	370 73.1		
ΔV TPF	1456	25.4	371 25.4		
ΔVX	63170	N81 +70.3	450 +70.4	N81* -69.1 ΔVX	
ΔVY		+5.9	451 +5.9	* -6.1	
ΔVZ		-17.7	452 -19.1	* +16.1 ΔVZ	

TPI PAD

+	0	0				+	0	0				HRS(172) N37
+	0	0	0			+	0	0	0			MIN(29) TPI
+	0			.		+	0			.		SEC(39.10)
R1(+00000),R2(+000.00),R3(+130.00)												N55
	0				.		0		6	6	.3	ΔVX(+70.6) N81
	0				.	+	0			7	.8	ΔVY(-0.5) LV
-	0		1	9	.0	-	0		3	1	.2	ΔVZ(+21.0)
+	0			.		+	0			.		R(+37.35) N54
-	0				.	-	0				.	Ṙ(-113.0) TPI TIG-5
X	X			:		X	X			:		BT(00:03)

RESIDUALS

PGNS					AGS				
+		.2	ΔVX	N85			.	ΔVX	500
+		.2	ΔVY				.	ΔVY	501
-		.4	ΔVZ				.	ΔVZ	502

TPI 2

PGNS

73.7 26.0 TPF

P34
TPI 2 = TPI + 37 min
N55 (Wt) = ΔVTPF/2
V67 (+02000, +00020, +00005)

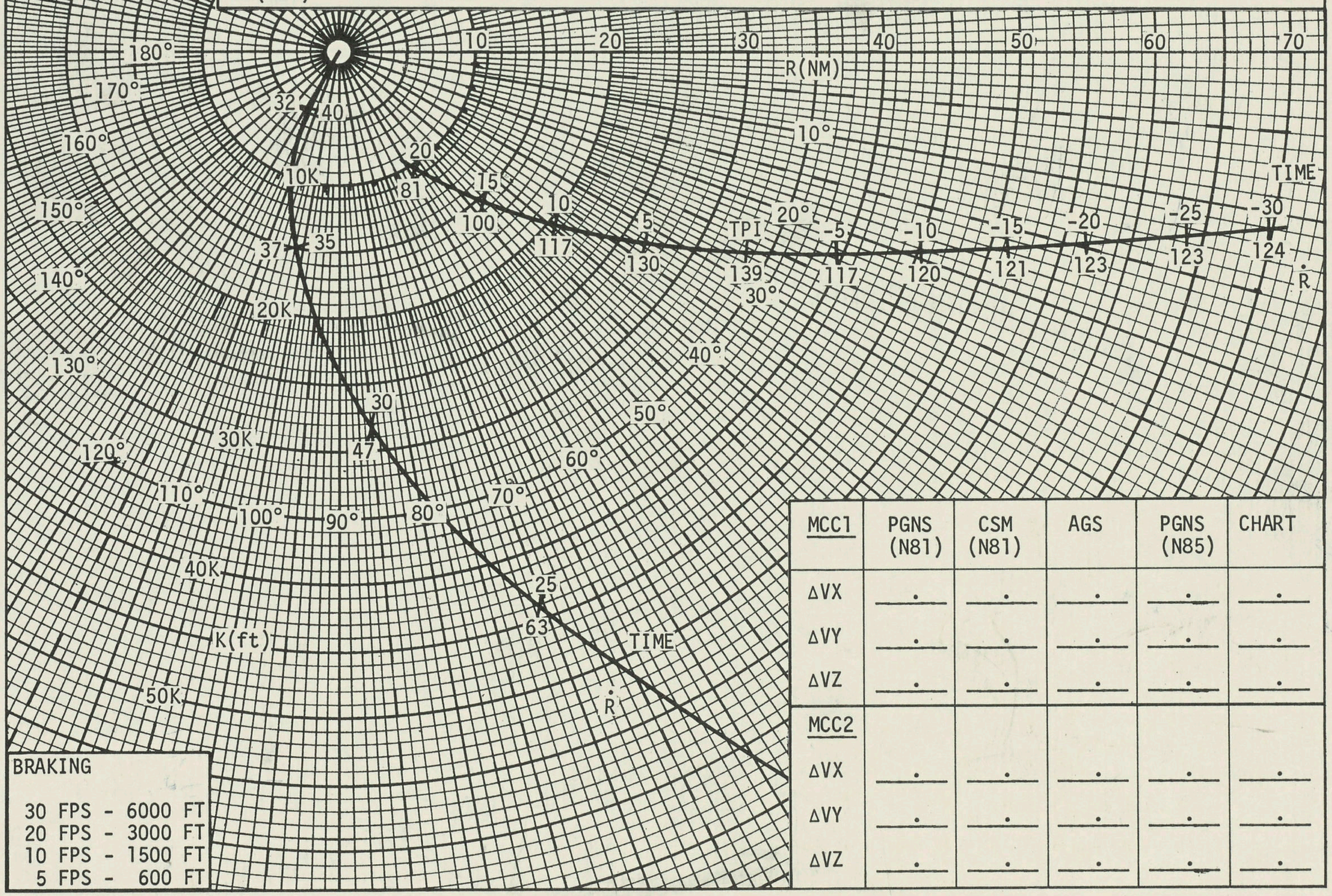
AGS

410 + 4
373 = TPI + 37 min
307 + (ΔVTPF/6)
DELAY 5 min:
417 +1
411 +1

DATE ~~6/10/71~~ 7/16/71

J-1 MISSION RELATIVE REFERENCE TRAJECTORY

Time (MIN)	18	20	22	24	26	28	30	32	34	36	38	40
R (NM)	12.9	11.2	9.6	8.2	6.9	5.8	4.8	3.9	3.1	2.3	1.6	0.95
$\dot{R}$ (fps)	91	83	75	68	60	54	48	43	39	36	35	33
θ (DEG)	52.6	56.9	61.5	67.0	72.1	77.5	84.2	90.8	97.5	104.3	111.3	118.3



MCC1	PGNS (N81)	CSM (N81)	AGS	PGNS (N85)	CHART
ΔVX	___.___	___.___	___.___	___.___	___.___
ΔVY	___.___	___.___	___.___	___.___	___.___
ΔVZ	___.___	___.___	___.___	___.___	___.___
MCC2					
ΔVX	___.___	___.___	___.___	___.___	___.___
ΔVY	___.___	___.___	___.___	___.___	___.___
ΔVZ	___.___	___.___	___.___	___.___	___.___

BRAKING

30 FPS - 6000 FT
20 FPS - 3000 FT
10 FPS - 1500 FT
5 FPS - 600 FT

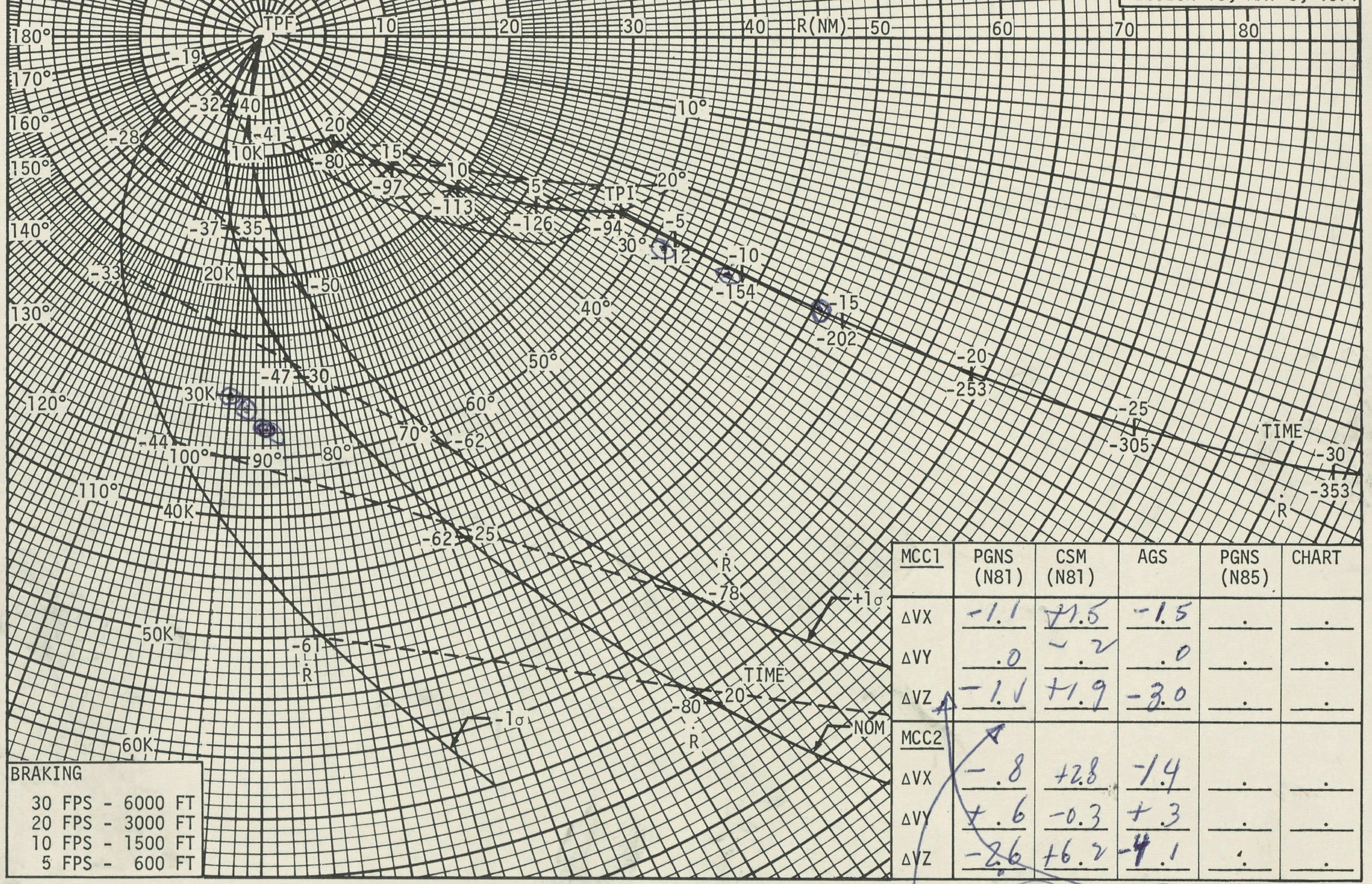
Prepared by FPRB/OPS
MISSION APOLLO 15, MAY 3, 1971

AGS SV/IMPACT P30 | TPF REL TRAJ NOM COEL RNDZ | CSI CDH/PLANE CHANGE | SHADOW DATA | EXTRA P27 PAD | ASCENT/CSI NOTES

J-1 MISSION RELATIVE REFERENCE TRAJECTORY

Time (MIN)	18	20	22	24	26	28	30	32	34	36	38	40
R (NM)	12.56	10.91	9.40	8.03	6.80	5.70	4.72	3.84	3.05	2.53	1.64	.99
Ṙ (fps)	87.27	80.02	72.77	65.67	58.90	52.62	47.02	42.23	38.36	35.45	33.47	32.32
θ (DEG)	52.27	56.47	61.03	65.99	71.34	77.09	83.18	89.57	96.16	102.84	109.50	116.03

PREPARED BY FPRB/OPS
MISSION 15, MAY 3, 1971



MCC1	PGNS (N81)	CSM (N81)	AGS	PGNS (N85)	CHART
ΔVX	-1.1	+1.5	-1.5	.	.
ΔVY	.0	-.2	.0	.	.
ΔVZ	-1.1	+1.9	-3.0	.	.
MCC2					
ΔVX	-.8	+2.8	-1.4	.	.
ΔVY	+.6	-0.3	+.3	.	.
ΔVZ	-2.6	+6.2	-4.1	.	.

BRAKING
30 FPS - 6000 FT
20 FPS - 3000 FT
10 FPS - 1500 FT
5 FPS - 600 FT

Res. .0 .1 .2 | + 18 - 1 - 1 0 1 | 15 - 14 mcc 2

CSI CARD

DATE 6/10/71

BURN RULES

IF TWO OF THREE SOLUTIONS AGREE
BURN PRIORITY SOLUTION.

PRIORITY OF SOLUTIONS: PGNS, AGS, CMC, CHARTS.

GUIDE VALUE: $\dot{X}$ = 3 fps.

RR AGREES WITH VHF WHERE
$\Delta R = 0.01R + 0.5$ NM, ΔR IS ALWAYS $\geq$ 1 NM
RR DOES NOT AGREE WITH VHF,
MSFN ISOLATES FAILED SYSTEM.

V90 < 5 fps - NO BURN

APS ENGINE FOR ΔV>40fps

CSI SOLUTIONS

	PGNS	AGS	CMC	CHARTS
ΔH (+15.0)	N75 _____	402 _____		
CSI/CDH(58:18)	_____	372 _____		
CDH/TPI(53:54)	_____			
ΔVX (ΔVG)	N81 _____	370 _____	N81* _____	ΔV _____
ΔVY	_____	263 _____	* _____	
CDH ΔVX(0.0)	N82 _____			
CDH ΔVZ(0.0)	_____			

*CHANGE SIGN BIAS; ΔVX = -1.0

	PGNS	AGS	CMC	CHARTS
ΔH	N75 _____	402 _____		
CSI/CDH	_____	372 _____		
CDH/TPI	_____			
ΔVX (ΔVG)	N81 _____	370 _____	N81* _____	ΔV _____
ΔVY	_____	263 _____	* _____	
CDH ΔVX	N82 _____			
CDH ΔVZ	_____			

CSI PAD

+	0	0				+	0	0	1	7	2	HRS(172) N11
+	0	0	0			+	0	0	0	3	5	MIN(36) CSI
+	0					+	0	0	8	0	0	SEC(50.50)
R1(+00001),R2(+026.60),R3(+130.00)												N55
+	0	0				+	0	0	1	7	4	HRS(174) N37
+	0	0	0			+	0	0	0	2	7	MIN(29) TPI
+	0					+	0	0				SEC(02.88)
	0					+	0	0	4	9	0	ΔVX(+50.4)N81
	0					+	0					ΔVY(+0.0)LV
410+1, 605+00777, 416+1, 623+0												
+						+	0	1	5	5	1	373(156.9)
+						+	0	2	6	7	0	275(269.0)
	0					+	0	0	4	9	0	ΔVX(+50.4)N86
	0					+	0					ΔVY(+0.0)AGS
	0					+	0	0	0	1	0	ΔVZ(+1.1)

RESIDUALS

PGNS			AGS		
ΔVX	N85		ΔVX	500	
ΔVY			ΔVY	501	
ΔVZ			ΔVZ	502	

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IF TWO OF THREE SOLUTIONS AGREE, BURN PRIORITY SOLUTION.
PRIORITY OF SOLUTION: PGNS, AGS, CMC, CHARTS.
GUIDE VALUES: $\dot{X}$=3fps, $\dot{Z}$=9 fps
RR AGREES WITH VHF WHERE ΔR=0.01 + 0.5 NM,
ΔR IS ALWAYS $\geq$1 NM
RR DOES NOT AGREE WITH VHF, MSFN ISOLATES FAILED SYSTEM.
V90 < 5 fps - NO BURN

+	0	0				+	0	0				HRS(173) N13
+	0	0	0			+	0	0	0			MIN(35) CDH
+	0			.		+	0			.		SEC(08.50)
	0				.		0				.	ΔVX(+0.0) N81
	0				.		0				.	ΔVY(+0.0) LV
	0				.		0				.	ΔVZ(+0.0)
X	X	X				X	X	X				PLM FDAI
+					.	+					.	373(215.1)
	0				.		0				.	ΔVX(+0.0) N86
	0				.		0				.	ΔVY(+0.0) AGS
	0				.		0				.	ΔVZ(+0.0)

PLANE CHANGE P30

TIG CDH ___ ___ ___:___ ___:___ ___.___ ___
— 3 0 0 0 0 . 0 0

TIG PC ___ ___ ___:___ ___:___ ___.___ ___

YDOT AND Y

CSM(N90)		PGNS(N90)		AGS(270)	
YDOT	Y	YDOT	Y	YDOT	
(-) ___.___	___.___	(-) ___.___	___.___	( ) ___.___	___.___
(-) ___.___	___.___	(-) ___.___	___.___	( ) ___.___	___.___

CDH/PLANE CHANGE CARD

CDH SOLUTIONS

		PGNS	AGS	CMC	CHARTS
ΔH	(+14.9) N75	___	402 ___		
CDH/TPI	(53:54)	___			
ΔT SLIP	(00:00)	___			
ΔVX	N81	___	450 ___	N81* ___	ΔVX ___
ΔVY		___	263 ___	* ___	
ΔVZ		___	452 ___	* ___	ΔVY ___

*CHANGE SIGN NO BIAS

ΔH	N75	___	402 ___		
CDH/TPI		___			
ΔT SLIP		___			
ΔVX	N81	___	450 ___	N81* ___	ΔVX ___
ΔVY		___	263 ___	* ___	
ΔVZ		___	452 ___	* ___	ΔVY ___

RESIDUALS

PGNS			AGS		
		ΔVX N85			ΔVX 500
		ΔVY			ΔVY 501
		ΔVZ			ΔVZ 502

COELLIPTIC TPI CARD

DATE 6/10/71

BURN RULES

IF TWO OF THREE SOLUTIONS AGREE, BURN PRIORITY SOLUTION.

PRIORITY OF SOLUTIONS: PGNS, AGS, CMC, CHARTS.
GUIDE VALUES: $\dot{X}$=3 fps, $\dot{Y}$=7 fps, $\dot{Z}$=9 fps

RR AGREES WITH VHF WHERE
$\Delta R = 0.01R + 0.5$ NM, ΔR IS ALWAYS $\geq$ 1 NM
RR DOES NOT AGREE WITH VHF,
MSFN ISOLATES FAILED SYSTEM.

IF TIG TPI > 8 min EARLY - RECYCLE P34 WITH TIG EQUAL TO NOMINAL TIG-8 min

APS ENGINE FOR ΔV > 40 fps

TPI SOLUTIONS

		PGNS	AGS	CMC	CHARTS
TIG	N37		373	N37	
θ LOS	(+26.6) N55		303	N55	
HP	(+44.1) N58		402	N58	
ΔV TPI	(+24.7)		370		
ΔV TPF	(+31.6)		371		
ΔVX	N81		450	N81*	ΔVX
ΔVY			451	*	
ΔVZ			452	*	ΔVZ

*CHANGE SIGN
BIAS; ΔVX = -1.0
ΔVZ = +2.0

TIG	N37	373	N37	
θ LOS	N55	303	N55	
HP	N58	402	N58	
ΔV TPI		370		
ΔV TPF		371		
ΔVX	N81	450	N81*	ΔVX
ΔVY		451	*	
ΔVZ		452	*	ΔVZ

TPI PAD

+ 0 0	+ 0 0	HRS(174) N37
+ 0 0 0	+ 0 0 0	MIN(29) TPI
+ 0 .	+ 0 .	SEC(02.88)
R1(+00000),R2(+026.60),R3(+130.00)		N55
0 .	0 .	ΔVX(+21.9)N81
0 .	0 .	ΔVY(-1.0)LV
0 .	0 .	ΔVZ(-11.0)
+ 0 .	+ 0 .	R(+37.68) N54 TPI
- 0 .	- 0 .	Ṙ(-111.7)TIG-5
X X .	X X .	BT(00:23)

RESIDUALS

PGNS		AGS	
ΔVX	N85	ΔVX	500
ΔVY		ΔVY	501
ΔVZ		ΔVZ	502

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AGS SV/IMPACT P30 | COELLIPTIC TPI P76/77/P27 | SHADOW DATA | EXTRA P27 PAD | ASCENT/CSI NOTES

P76/77/P27 PADS

P76/77 PAD

													PURPOSE	
+	0	0				+	0	0					HRS	N33
+	0	0	0			+	0	0	0				MIN	TIG
+	0			.		+	0			.			SEC	
					.							.	ΔVX	N84/N81
					.							.	ΔVY	
					.							.	ΔVZ	
													PURPOSE	
+	0	0				+	0	0					HRS	N33
+	0	0	0			+	0	0	0				MIN	TIG
+	0			.		+	0			.			SEC	
					.							.	ΔVX	N84/N81
					.							.	ΔVY	
					.							.	ΔVZ	
													PURPOSE	
+	0	0				+	0	0					HRS	N33
+	0	0	0			+	0	0	0				MIN	TIG
+	0			.		+	0			.			SEC	
					.							.	ΔVX	N84/N81
					.							.	ΔVY	
					.							.	ΔVZ	
													PURPOSE	
+	0	0				+	0	0					HRS	N33
+	0	0	0			+	0	0	0				MIN	TIG
+	0			.		+	0			.			SEC	
					.							.	ΔVX	N84/N81
					.							.	ΔVY	
					.							.	ΔVZ	

P27 PAD

V			V			V			PURP	
:	:		:	:		:	:			
INDEX			INDEX			INDEX			01	1173
									02	
									03	
									04	
									05	
									06	
									07	
									10	
									11	
									12	
									13	
									14	
									15	
									16	
									17	
									20	
									21	1213
									22	
									23	
									24	1216

X	X	X				X	X	X				HRS	
X	X	X	X			X	X	X	X			MIN	
X	X			.		X	X			.		SEC	NAV CHECK
	0			.			0			.		LAT	N43
				.						.		LONG	
+	0				.	+	0				.	ALT	

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DATE 6/10/71

AGS SV/IMPACT PAD

AGS STATE VECTOR PAD	PURP	LOAD
	240	
	241	
	242	
	260	
	261	
	262	
	254	414+2
	244	
	245	
	246	
	264	
	265	
	266	
	272	414+3

AGS STATE VECTOR PAD/LM INSERT	PURP	LOAD
+56613	240	
+00010	241	
+10108	242	
-0941.4	260	
-00000.2	261	
+5455.8	262	
+0104.7	254	414+2
+57305	244	
+00010	245	
+19477	246	
-1721.6	264	
-00000.6	265	
+5064.1	266	
+0104.7	272	414+3

IMPACT CARD														
+	0	0				+	0	0				HRS	(179)	N33
+	0	0	0			+	0	0	0			MIN	(06)	TIG
+	0			.		+	0			.		SEC	(22.70)	
					.						.	ΔVX	(-161.1)	N81
					.						.	ΔVY	(+57.3)	LV
					.						.	ΔVZ	(+94.6)	
+					.	+					.	H_A	(+62.0)	N42
					.						.	H_p	(-52.8)	
+					.	+					.	ΔVR	(+195.4)	
X	X	X		:		X	X	X		:		BT	(1:22)	
X	X	X				X	X	X				R	(037)	FDAI
X	X	X				X	X	X				P	(016)	INER
+					.	+					.	TIG	(546.4)	373
					.						.	ΔVX	(-164.3)	N86
					.						.	ΔVY	(+57.3)	AGS
					.						.	ΔVZ	(+90.0)	

DATE ~~6/10/71~~ 7/8/71

P30 PAD

P30													
+	0	0				+	0	0				HRS	N33
+	0	0	0			+	0	0	0			MIN	TIG
+	0					+	0					SEC	
												ΔVX	N81
												ΔVY	LV
												ΔVZ	
+						+						HA	N42
												HP	
+						+						ΔVR	
X	X	X				X	X	X				BT	
X	X	X				X	X	X				R	FDAI
X	X	X				X	X	X				P	INER
+						+						TIG	373
												ΔVX	N86
												ΔVY	AGS
												ΔVZ	
X	X	X				X	X	X				BSS	
X	X					X	X					SPA	
X	X	X				X	X	X				SXP	

RESIDUALS

PGNS					AGS				
			ΔVX	N85				ΔVX	500
			ΔVY					ΔVY	501
			ΔVZ					ΔVZ	502

P30													
+	0	0				+	0	0	1	7	9	HRS	N33
+	0	0	0			+	0	0	0	0	6	MIN	TIG
+	0					+	0	2	2	5	0	SEC	
						−	0	1	2	1	9	ΔVX	N81
						+	0	0	5	6	0	ΔVY	LV
						+	0	1	4	8	8	ΔVZ	
+						+	0	0	7	1	1	HA	N42
						−	0	0	3	7	1	HP	
+						+	0	2	0	0	3	ΔVR	
X	X	X				X	X	X	1	2	7	BT	
X	X	X				X	X	X	0	4	7	R	FDAI
X	X	X				X	X	X	1	7	4	P	INER
+						+			NA			TIG	373
												ΔVX	N86
												ΔVY	AGS
												ΔVZ	
X	X	X				X	X	X				BSS	
X	X					X	X					SPA	5444
X	X	X				X	X	X				SXP	

RESIDUALS

PGNS					AGS				
			ΔVX	N85				ΔVX	500
			ΔVY					ΔVY	501
			ΔVZ					ΔVZ	502

DATE 6/10/71

ASCENT/CSI PADS

LM ASCENT PAD																							
+	0	0				+	0	0				+	0	0				HRS	N33
+	0	0	0			+	0	0	0			+	0	0	0			MIN	TIG
+	0			.		+	0			.		+	0			.		SEC	
+					.	+					.	+					.	V (HOR)	
+					.	+					.	+					.	V (VERT)	N76
	0				.		0				.		0				.	*CROSSRANGE	
												+						047	
												+						053	
												+						224/226	
												+						231	
					.						.	+					.	465	
					.						.	+					.	373	
+	0	0				+	0	0				+	0	0				HRS	N37
+	0	0	0			+	0	0	0			+	0	0	0			MIN	TPI
+	0			.		+	0			.		+	0			.		SEC	
+						+						+						LM WT	

*NOTE: LOAD 8 NM CROSSRANGE IF GREATER THAN 8 NM

CSI PAD													
+	0	0				+	0	0				HRS	N11
+	0	0	0			+	0	0	0			MIN	CSI
+	0			.		+	0			.		SEC	
R_1(+00001), R_2(+026.60), R_3(+130.00)												N55	
+	0	0				+	0	0				HRS	N37
+	0	0	0			+	0	0	0			MIN	TPI
+	0			.		+	0			.		SEC	
	0				.		0				.	ΔVX	N81
	0				.		0				.	ΔVY	LV
410+1, 605+00777, 416+1, 623+0													
+					.	+					.	373	
+					.	+					.	275	
	0				.		0				.	ΔVX	
	0				.		0				.	ΔVY	AGS
	0				.		0				.	ΔVZ	

SHADOW DATA
EXTRA P27 PAD
ASCENT/CSI NOTES

	DOS O_2 CLOSE BOTH
(1)	IF LEAK STOPS ~~[illegible]~~ ~~[illegible]~~ VALVE CLOSE
	& URINE QD
(2)	THEN POSSIBLY CYCLE OPEN ON DUMP VALVES

EXTRA
P27 PAD

SHADOW
DATA

P76/77/P27 PADS

P76/77 PAD

												PURPOSE	
+	0	0				+	0	0				HRS	N33
+	0	0	0			+	0	0	0			MIN	TIG
+	0			•		+	0			•		SEC	
					•						•	ΔVX	N84/N81
					•						•	ΔVY	
					•						•	ΔVZ	
												PURPOSE	
+	0	0				+	0	0				HRS	N33
+	0	0	0			+	0	0	0			MIN	TIG
+	0			•		+	0			•		SEC	
					•						•	ΔVX	N84/N81
					•						•	ΔVY	
					•						•	ΔVZ	
												PURPOSE	
+	0	0				+	0	0				HRS	N33
+	0	0	0			+	0	0	0			MIN	TIG
+	0			•		+	0			•		SEC	
					•						•	ΔVX	N84/N81
					•						•	ΔVY	
					•						•	ΔVZ	
												PURPOSE	
+	0	0				+	0	0				HRS	N33
+	0	0	0			+	0	0	0			MIN	TIG
+	0			•		+	0			•		SEC	
					•						•	ΔVX	N84/N81
					•						•	ΔVY	
					•						•	ΔVZ	

P27 PAD

V			V			V			PURP	
: :			: :			: :				
INDEX			INDEX			INDEX			01	1173
									02	
									03	
									04	
									05	
									06	
									07	
									10	
									11	
									12	
									13	
									14	
									15	
									16	
									17	
									20	
									21	1213
									22	
									23	
									24	1216
X X X			X X X			HRS				
X X X X			X X X X			MIN				
X X	•		X X	•		SEC	NAV CHECK			
0	•		0	•		LAT	N43			
	•			•		LONG				
+ 0		•	+ 0		•	ALT				

DATE 6/28/71

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SHADOW DATA

EXTRA P27 PAD

AGS SV/IMPACT P30

COELLIPTIC TPI P76/77/P27

CSI CDH/PLANE CHANGE

ABORT/ASCENT DIRECT TPI

PDI2/PDI2 ABORT LUNAR SURFACE

PD P

ASCENT/CSI NOTES

	CDT	SUN ANGLE	SHADOW LENGTH (METERS)	SHADOW LENGTH (FEET)
July 30	1715	12.0°	28.6	94.0
	1800	12.4°	27.9	91.5
	1900	12.8°	26.8	88.0
	2000	13.3°	25.9	85.0
	2100	13.8°	25.0	82.0
	2200	14.2°	24.4	80.0
	2300	14.7°	23.3	76.5
July 31	0000	15.1°	22.5	74.0
	0100	15.5°	22.1	72.5
	0200	16.0°	21.3	70.0
	0300	16.5°	20.6	67.5
	0400	16.9°	20.1	66.0
	0500	17.4°	19.5	64.0
	0600	17.8°	19.0	62.5
	0700	18.3°	18.4	60.5
	0800	18.7°	18.0	59.0
	0900	19.2°	17.8	58.4
	1000	19.6°	17.1	56.0
	1100	20.0°	16.8	55.0
	1200	20.5°	16.3	53.5
	1300	21.0°	15.8	52.0
	1400	21.4°	15.5	51.0
	1500	21.9°	15.2	50.0
	1600	22.3°	14.9	49.0
	1700	22.8°	14.6	48.0
	1800	23.2°	14.3	47.0
	1900	23.6°	14.0	46.0
	2000	24.1°	13.7	45.0
	2100	24.5°	13.4	44.0
	2200	24.0°	13.1	43.0
	2300	25.4°	12.8	42.0
Aug 1	0000	25.9°	12.5	41.0
	0100	26.3°	12.3	40.5
	0200	26.8°	12.0	39.5
	0300	27.2°	11.9	39.0

	CDT	SUN ANGLE	SHADOW LENGTH (METERS)	SHADOW LENGTH (FEET)
	0400	27.6°	11.6	38.0
	0500	28.1°	11.4	37.5
	0600	28.5°	11.3	37.0
	0700	29.0°	11.0	36.0
	0800	29.4°	10.8	35.5
	0900	29.8°	10.7	35.0
	1000	30.3°	10.4	34.0
	1100	30.7°	10.4	34.0
	1200	31.2°	10.1	33.0
	1300	31.6°	9.9	32.5
	1400	32.0°	9.7	32.0
	1500	32.5°	9.6	31.5
	1600	32.9°	9.4	31.0
	1700	33.3°	9.3	30.5
	1800	33.8°	9.1	30.0
	1900	34.2°	9.0	29.5
	2000	34.6°	8.8	29.0
	2100	35.1°	8.7	28.5
	2200	35.5°	8.5	28.0
	2300	35.9°	8.4	27.5
Aug 2	0000	36.3°	8.2	27.0
	0100	36.8°	8.2	27.0
	0200	37.2°	8.1	26.5
	0300	37.6°	7.9	26.0
	0400	38.0°	7.8	25.5
	0500	38.5°	7.6	25.0
	0600	38.9°	7.6	25.0
	0700	39.3°	7.4	24.5
	0800	39.7°	7.3	24.0
	0900	40.1°	7.3	24.0
	1000	40.6°	7.0	23.0
	1100	41.0°	7.0	23.0
	1200	41.4°	7.0	23.0
	1300	41.8°	6.9	22.5

AGS SV/IMPACT
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CSI
CDH/PLANE CHANGE

ABORT/ASCENT
DIRECT TPI

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ASCENT/CSI
NOTES