



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

(JULY 26 LAUNCH)

\* APOLLO 15

LM 10  
REVISION A

# LM DATA CARD BOOK

INDEXING DATA

DATE	OPR	#	T	PGM	SUBJECT	SIGNATOR	LOC
6/10/71	MSC	00	R	AP0	*	Mitchell	080-13A

PREPARED BY

FLIGHT DATA SECTION

FLIGHT PLANNING BRANCH

CREW PROCEDURES DIVISION



MANNED SPACECRAFT CENTER

HOUSTON, TEXAS

JUNE 10, 1971

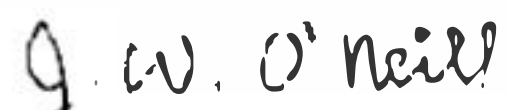
APOLLO 15  
LM DATA CARD BOOK

JUNE 10, 1971

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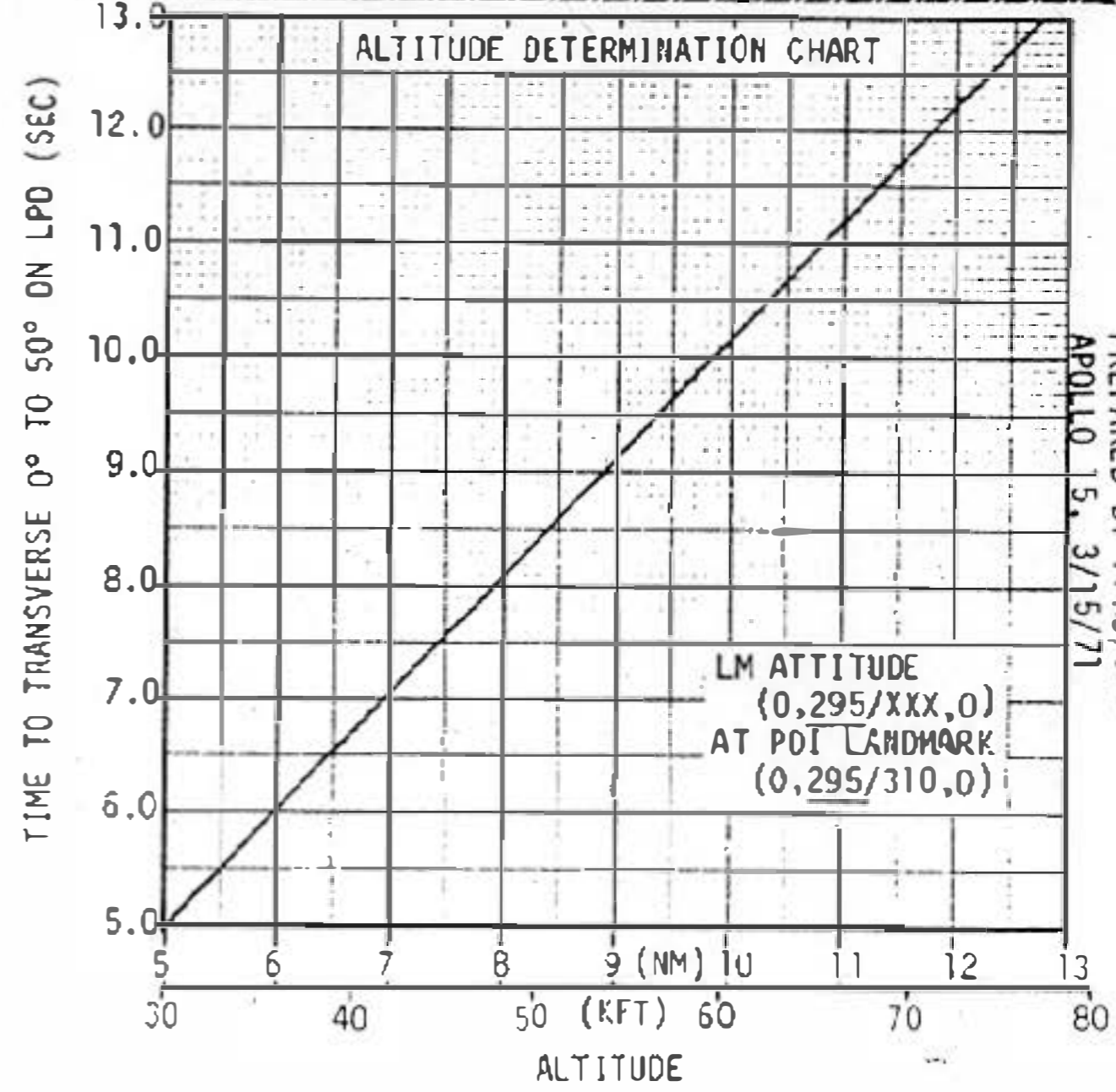
### LPD CAL/CSM CIRC

LPD ΔBIAS		NEW BIAS = ORIG BIAS(P64)+ΔBIAS(P52)							
LPD RDG (P52)		$\Delta\text{BIAS(AZ)} = (\text{LPD RDG}) \times 1.3$ $\Delta\text{BIAS(EL)} = (\text{LPD RDG}) \times 1.0$							
(+)	(-ΔAZ)	+	3	5	9	5	4	ORIG BIAS	<b>AZ</b>
(-)	(-ΔEL)							+ΔBIAS(AZ)	
+ 40								AZ BIAS 3373	
(+)	(-)	+	0	0	0	1	B	ORIG BIAS	<b>EL</b>
(+)	(+)							+ΔBIAS(EL)	
								EL BIAS 1353	
LOAD NEW BIAS (P64)					VERIFY BIAS				
V21 NO3E, 3373E LOAD AZ BIA (.01°) E, 1353E LOAD EL BIAS (.01°)					V06 NO3E, 3373E VERIFY AZ BIAS E, 1353E VERIFY EL BIAS				

CSM CIRC BURN											
P76											
+	0	0				+	0	0		HRS (101)	N33
+	0	0	0			+	0	0	0	MIN (34)	TIG
+	0					+	0			SEC (55.10)	
						+				ΔVX (+70.8)	NB4
						+				ΔVY (+0.0)	
						+				ΔVZ (+0.6)	
CSM HA/HP											
CMC			LGC			V82					
/			/			OPT 2					

### PDI RULES/ALTITUDE CHECK

- PDI RULES**
- NO AUTO ULLAGE - BACKUP VIA +X OVERRIDE (+NO AUTO IGNITION - PDI NO-GO)
  - NO IGN (WITH AUTO ULL) DELAY 2 SEC, THEN START PB-PUSH; THEN DES OVRD - ON AT 5 SEC
  - T/W >1.6 AND DSKY CHANGES >18 fps/2 SEC
  - ATT/RATE <5°/SEC
  - ΔH IN LIMITS >10 SEC, NOT OUT OF LIMITS >60 SEC
  - DATA GOOD AT > 6,000 ft
  - IF NO THROTTLE DOWN BY P64 + 15 SEC - ABORT
  - 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



PDI O/NO PDI + 12 CARD

PDI O ABORT PAD												
+	0	0				+	0	0			HRS (102)	N33
+	0	0	0			+	0	0	0		MIN (34)	TIG
+	0					+	0				SEC (59.20)	<b>A</b>
											$\Delta V X (+102.8)$	N81
											$\Delta V Y (+0.0)$	LV
											$\Delta V Z (+2.8)$	<b>B</b>
+						+					HA (+138.9)	N42
											HP (+8.2)	
+						+					$\Delta VR (+102.8)$	
X	X	X				X	X	X			BT (0:38)	
X	X	X				X	X	X			R (000)	FOAI
X	X	X				X	X	X			P (285)	INER
+						+					TIG (155.0)	373
											$\Delta V X (\pm 102.8)$	N86
											$\Delta V Y (\pm 0.0)$	AGS
											$\Delta V Z (\pm 3.6)$	
+	0	0				+	0	0			HRS (103)	N11
+	0	0	0			+	0	0	0		MIN (35)	CSI
+	0					+	0				SEC (37.90)	<b>C</b>
+	0	0				+	0	0			HRS (105)	N37
+	0	0	0			+	0	0	0		MIN (21)	TPI
+	0					+	0				SEC (46.50)	<b>D</b>

RESIDUALS					
PGNS			AGS		
		$\Delta V X$	N85		$\Delta V X$ 500
		$\Delta V Y$			$\Delta V Y$ 501
		$\Delta V Z$			$\Delta V Z$ 502

NO PDI + 12 ABORT PAD												
+	0	0				+	0	0			HRS (104)	N33
+	0	0	0			+	0	0	0		MIN (40)	TIG
+	0					+	0				SEC (24.70)	<b>E</b>
											$\Delta V X (+113.9)$	N81
											$\Delta V Y (+0.0)$	LV
											$\Delta V Z (-46.8)$	<b>F</b>
+						+					HA (+146.6)	N42
											HP (+8.8)	
+						+					$\Delta VR (+123.1)$	
X	X	X				X	X	X			BT (0:40)	
X	X	X				X	X	X			R (000)	FOAI
X	X	X				X	X	X			P (271)	INER
+						+					TIG (280.4)	373
											$\Delta V X (+114.3)$	N86
											$\Delta V Y (+0.0)$	AGS
											$\Delta V Z (-45.9)$	
+	0	0				+	0	0			HRS (107)	N11
+	0	0	0			+	0	0	0		MIN (35)	CSI
+	0					+	0				SEC (38.90)	<b>G</b>
+	0	0				+	0	0			HRS (109)	N37
+	0	0	0			+	0	0	0		MIN (18)	TPI
+	0					+	0				SEC (38.30)	<b>H</b>

RESIDUALS					
PGNS			AGS		
		$\Delta V X$	N85		$\Delta V X$ 500
		$\Delta V Y$			$\Delta V Y$ 501
		$\Delta V Z$			$\Delta V Z$ 502

PDI0/NO PDI +12  
PDI1/PDI1 ABORT

### PDI 1 ABORT CARD

PDI 1 PAD													
+	0	0				+	0	0				HRS(104)	N33
+	0	0	0			+	0	0	0			MIN( 28)	PDI
+	0					+	0					SEC(54.62)	
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)	
												DECA 231 IF ROD	

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

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

LOG INSERTION GET=	_____	_____	_____	_____	_____
+			5	5	0 0
CSI GET=	_____	_____	_____	_____	_____

+	0	0				+	0	0				HRS( 107 )	N37
+	0	0	0			+	0	0	0			MIN( 20 )	TPI
+	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				HRS( 104 )	N33
+	0	0	0			+	0	0	0			MIN( 50 )	TIG
+	0					+	0					SEC( 20.80 )	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	V25
												ΔRLS	
												ΔDN RNG	V21
												ΔDN RNG	V24
												ΔX RNG	
												ΔRLS	V23

THROTTLE DOWN \_\_\_\_\_

T3-1 (1 REV) ABORT TIME

+	0	0				+	0	0				HRS( 106 )	N33
+	0	0	0			+	0	0	0			MIN( 40 )	TIG
+	0					+	0					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					TGD (11:04)	N61
												X RANGE (+C.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 ROD	

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

LOG INSERTION GET=											
			1	0	0	0	0	0	0	0	0
+											
BOOST GET=											
				1	0	0	0	0	0	0	0
+											
HAM GET=											
				1	0	0	0	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	0	0	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= _____ : _____ : _____													
+ _____ : _____ : _____													
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	V25
												ΔRLS	
												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 (34)	TIG
+	0					+	0					SEC (37.58)	N

PDI 2/PDI 2 ABORT  
LUNAR SURFACE



FIRST REV ACTIVITY

LUNAR SURFACE CARD

LAUNCH PREP

120 \_\_\_\_\_ OG \_\_\_\_\_ IG \_\_\_\_\_ MG \_\_\_\_\_

P57, A/T 1, REFSMMAT  
NO4 \_\_\_\_\_, \_\_\_\_\_ NAV ERR  
NO5 \_\_\_\_\_  
N93 \_\_\_\_\_ X \_\_\_\_\_ Y \_\_\_\_\_ Z \_\_\_\_\_

P57, A/T 2, REFSMMAT  
STAR1 \_\_\_\_\_ (N71)  
STAR2 \_\_\_\_\_ (N71)

105 \_\_\_\_\_ ANGLE DIFF  
193 \_\_\_\_\_ X \_\_\_\_\_  
\_\_\_\_\_ Y \_\_\_\_\_  
\_\_\_\_\_ Z \_\_\_\_\_  
189 \_\_\_\_\_ LAT \_\_\_\_\_  
\_\_\_\_\_ LONG/2 \_\_\_\_\_  
\_\_\_\_\_ ALT \_\_\_\_\_

N43  
LAT(+N) \_\_\_\_\_  
LONG(+E) \_\_\_\_\_  
ALT \_\_\_\_\_

047 \_\_\_\_\_ 053 \_\_\_\_\_

544 \_\_\_\_\_ +5:02 \_\_\_\_\_  
545 \_\_\_\_\_  
546 \_\_\_\_\_

047 \_\_\_\_\_ 053 \_\_\_\_\_

P57, A/T 3, LANDING SITE  
NO4 \_\_\_\_\_, \_\_\_\_\_ GRAV ERR  
STAR \_\_\_\_\_ (N71)  
NO5 \_\_\_\_\_ ANGLE DIFF  
N93 \_\_\_\_\_ X \_\_\_\_\_  
\_\_\_\_\_ Y \_\_\_\_\_  
\_\_\_\_\_ Z \_\_\_\_\_

P57, A/T 3, LANDING SITE  
NO4 \_\_\_\_\_, \_\_\_\_\_ GRAV ERR  
STAR \_\_\_\_\_ (N71)  
NO5 \_\_\_\_\_ 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		108:39:10	32		140:09:26
17		110:37:19	33		142:07:34
18		112:35:28	34		144:05:43
19		114:33:36	35		146:03:51
20		116:31:45	36		148:01:59
21		118:29:53	37		150:00:07
22		120:28:02	38		151:58:15
23		122:26:10	39		153:56:23
24		124:24:19	40		155:54:31
25		126:22:27	41		157:52:39
26		128:20:36	42		159:50:46
27		130:18:44	43		161:48:54
28		132:16:53	44		163:47:02
29		134:15:01	45		165:45:23
30		136:13:09	46		167:43:32
31		138:11:18	47		169:41:40

P57, A/T 2, REFSMMAT  
STAR1 \_\_\_\_\_ (N71)  
STAR2 \_\_\_\_\_ (N71)

105 \_\_\_\_\_ ANGLE DIFF  
193 \_\_\_\_\_ X \_\_\_\_\_  
\_\_\_\_\_ Y \_\_\_\_\_  
\_\_\_\_\_ Z \_\_\_\_\_  
189 \_\_\_\_\_ LAT \_\_\_\_\_  
\_\_\_\_\_ LONG/2 \_\_\_\_\_  
\_\_\_\_\_ ALT \_\_\_\_\_

# ABORT/ASCENT CARD

DATE 0/10/71

**ASCENT RULES**

UNDERBURN		PGNS	AGS
$\Delta V$ (FPS)	TIME (SEC)		
<400	<20	NULL RESIDUALS	AUTO, A/H 15fps
>400	>20	A/H BURN HA, HP H 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° CHW OR 250° FOAI)
- 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				+	0	0				HRS (171) N33
+	0	0	0			+	0	0	0			+	0	0	0			MIN (37) TIG
+	0					+	0					+	0					SEC (23.87)
+						+						+						V(V) (5536.4)
+						+						+						V(H) (32.0) N76
0						0						0						X RANGE (+0.0)
																		047 (+40000)
																		053 (+00000)
																		224/226 (+58566)
																		231 (+56907)
																		465 (+32.0)
																		373 (+149.7)
+	0	0				+	0	0				+	0	0				HRS (172) N37
+	0	0	0			+	0	0	0			+	0	0	0			MIN (29) TPI
+	0					+	0					+	0					SEC (39.10)
+						+						+						LM WT (10873)

T3 (1 REV) ABORT PAD

LOG INSERTION GET= \_\_\_\_\_ : \_\_\_\_\_ : \_\_\_\_\_  
 + \_\_\_\_\_ : 5 0 0 0  
 CSI TIG= \_\_\_\_\_ : \_\_\_\_\_ : \_\_\_\_\_  
 + \_\_\_\_\_ : 1 3 3 0 0  
 TPI TIG= \_\_\_\_\_ : \_\_\_\_\_ : \_\_\_\_\_

\*NOTE: LOAD & HM CROSSRANGE IF GREATER THAN 8 HM

+					HA	V82	+					HA	315
+					HP		+					HP	403

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

RESIDUALS					
PGNS			AGS		
		$\Delta V_X$	N65		$\Delta V_X$ 500
		$\Delta V_Y$			$\Delta V_Y$ 501
		$\Delta V_Z$			$\Delta V_Z$ 502

ONE REV LATE \_\_\_\_\_ : \_\_\_\_\_ : \_\_\_\_\_  
 ( 173 : 38 : 06 )

TABLE

# 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,  $\Delta R$  IS ALWAYS  $\geq 1$  NM

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

APS ENGINE FOR  $\Delta V > 40$  fps

## TPI SOLUTIONS

	PGNS	AGS	CMC	CHARTS
TIG	N37	373	N37	
θ LOS (+26.6)	N55	303	N55	
HP (+43.9)	N58	402	N58	
ΔV TPI (+73.6)		370		
ΔV TPF (+31.7)		371		
ΔVX	N81	450	N81*	ΔVX
ΔVY		451	*	
ΔVZ		452	*	ΔVZ

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

## TPI PAD

+ 0 0	+ 0 0	HRS(172) N37
+ 0 0 0	+ 0 0 0	MIN( 29) TPI
+ 0	+ 0	SEC(39.10)
R1(+0000), R2(+000.00), R3(+130.00)		N55
0	0	ΔVX(+70.6) N81
0	0	ΔVY(-0.5) LV
0	0	ΔVZ(+21.0)
+ 0	+ 0	R(+37.35) N54
- 0	- 0	R(-113.0) TPI TIG-5
X X	X X	BT(00:03)

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

## RESIDUALS

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

IF TWO OF THREE SOLUTIONS AGREE, BURN PRIORITY SOLUTION.

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

GUIDE VALUES:  $\dot{X}=3$  fps,  $\dot{Z}=9$  fps

RR AGREES WITH VHF WHERE  $\Delta R=0.0\} + 0.5$  NM,

$\Delta R$  IS ALWAYS  $\geq 1$  NM

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

V90 < 5 fps - NO BURN

# CDH/PLANE CHANGE CARD

## CDR SOLUTIONS

+	0	0				+	0	0				HRS(173) N13
+	0	0	0			+	0	0	0			MIN( 35) CDH
+	0					+	0					SEC(08.50)
	0					0						$\Delta VX(+0.0)$ N31
	0					0						$\Delta VY(+0.0)$ LV
	0					0						$\Delta VZ(+0.0)$
X	X	X				X	X	X				PLM FOAI
+						+						373(215.1)
	0					0						$\Delta VX(+0.0)$ N85
	0					0						$\Delta VY(+0.0)$ AGS
	0					0						$\Delta VZ(+0.0)$

### PLANE CHANGE P30

TIG CDH \_\_\_\_\_ : \_\_\_\_\_ : \_\_\_\_\_ : \_\_\_\_\_  
 - : 3 0 : 0 0 . 0 0

TIG PC \_\_\_\_\_ : \_\_\_\_\_ : \_\_\_\_\_ : \_\_\_\_\_

### YDOT AND Y

CSM(N90)		PGNS(N90)		AGS(270)	
YDOT	Y	YDOT	Y	YDOT	Y
(-)	_____	(-)	_____	(-)	_____
(-)	_____	(-)	_____	(-)	_____

	PGNS	AGS	CMC	CHARTS
$\Delta H$	(+14.9) N75	402		
CDH/TPI	(53:54)			
$\Delta T$ SLIP	(00:00)			
$\Delta VX$	N81	450	N81*	$\Delta VX$
$\Delta VY$		263	*	
$\Delta VZ$		452	*	$\Delta VZ$

\*CHANGE SIGN NO BIAS

$\Delta H$	N75	402		
CDH/TPI				
$\Delta T$ SLIP				
$\Delta VX$	N81	450	N81*	$\Delta VX$
$\Delta VY$		263	*	
$\Delta VZ$		452	*	$\Delta VZ$

## RESIDUALS

PGNS		AGS	
$\Delta VX$	N85	$\Delta VX$	500
$\Delta VY$		$\Delta VY$	501
$\Delta VZ$		$\Delta VZ$	502



# CSI CARD

## 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,  $\Delta R$  IS ALWAYS  $\geq 1$  NM

RR DOES NOT AGREE WITH VHF,

MSFN ISOLATES FAILED SYSTEM.

$V_{90} < 5$  fps - NO BURN

APS ENGINE FOR  $\Delta V > 40$  fps

## CSI SOLUTIONS

	PGNS	AGS	CMC	CHARTS
$\Delta H$ (+15.0) N75	402			
CSI/CDH(58:18)	372			
CDH/TPI(53:54)				
$\Delta VX$ ( $\Delta VG$ ) N81	370		N81*	$\Delta V$
$\Delta VY$	263		*	
CDH $\Delta VX$ (0.0) N82				*CHANGE SIGN BIAS; $\Delta VX = -1.0$
CDH $\Delta VZ$ (0.0)				

## CSI PAD

+ 0 0	+ 0 0	HRS(172) N11
+ 0 0 0	+ 0 0 0	MIN( 36) CSI
+ 0	+ 0	SEC( 50.50)
R1(+00001), R2(+026.60), R3(+130.00)		N55
+ 0 0	+ 0 0	HRS(174) N37
+ 0 0 0	+ 0 0 0	MIN( 29) TPI
+ 0	+ 0	SEC(02.88)
0	0	$\Delta VX$ (+50.4)N81
0	0	$\Delta VY$ ( +0.0)LV
410+1, 605+00777, 416+1, 623+0		
+	+	373( 156.9 )
+	+	275( 269.0 )
0	0	$\Delta VX$ (+50.4)N86
0	0	$\Delta VY$ ( +0.0)AGS
0	0	$\Delta VZ$ ( +1.1)

$\Delta H$	N75	402		
CSI/CDH		372		
CDH/TPI				
$\Delta VX$ ( $\Delta VG$ )	N81	370	N81*	$\Delta V$
$\Delta VY$		263	*	
CDH $\Delta VX$	N82			
CDH $\Delta VZ$				

## RESIDUALS

PGNS		AGS	
•	$\Delta VX$ N85	•	$\Delta VX$ 500
•	$\Delta VY$	•	$\Delta VY$ 501
•	$\Delta VZ$	•	$\Delta VZ$ 502

CSI  
CDH/PLANE CHANGE

# COELLIPTIC TPI CARD

## 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,  $\Delta R$  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  $\Delta V > 40$  fps

## 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(+025.60), R3(+130.00)											N55	
	0					0						$\Delta VX(+21.9)N81$
	0					0						$\Delta VY(-1.0)LV$
	0					0						$\Delta VZ(-11.0)$
+	0					+	0					R(+37.68) N54
-	0					-	0					TPI
											$\dot{R}(-111.7)TIG-5$	
X	X					X	X					BT(00:23)

## TPI SOLUTIONS

	PGNS	AGS	CMC	CHARTS
TIG	N37	373	N37	
$\theta$ LOS	(+26.6)N55	303	N55	
HP	(+44.1)N58	402	N58	
$\Delta V$ TPI	(+24.7)	370		
$\Delta V$ TPF	(+31.6)	371		
$\Delta VX$	N81	450	N81*	$\Delta VX$
$\Delta VY$		451	*	
$\Delta VZ$		452	*	$\Delta VZ$

\*CHANGE SIGN  
BIAS;  $\Delta VX = -1.0$   
 $\Delta VZ = +2.0$

TIG	N37	373	N37
$\theta$ LOS	N55	303	N55
HP	N58	402	N58
$\Delta V$ TPI		370	
$\Delta V$ TPF		371	
$\Delta VX$	N81	450	N81* $\Delta VX$
$\Delta VY$		451	*
$\Delta VZ$		452	* $\Delta VZ$

## RESIDUALS

PGNS		AGS	
	$\Delta VX$	N85	$\Delta VX$ 500
	$\Delta VY$		$\Delta VY$ 501
	$\Delta VZ$		$\Delta VZ$ 502

DATE 07/10/71

INCL 11

### 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	

P30 PAD

P30													
+	0	0				+	0	0				HRS	N33
+	0	0	0			+	0	0	0			MIN	TIG
+	0					+	0					SEC	
												$\Delta$ VX	N81
												$\Delta$ VY	LV
												$\Delta$ VZ	
+						+						HA	N42
												HP	
+						+						$\Delta$ VR	
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
												$\Delta$ VX	N86
												$\Delta$ VY	AGS
												$\Delta$ VZ	
X	X	X				X	X	X				BSS	
X	X					X	X					SPA	
X	X	X				X	X	X				SXP	
RESIDUALS													
PGNS						AGS							
						$\Delta$ VX	N85					$\Delta$ VX	500
						$\Delta$ VY						$\Delta$ VY	501
						$\Delta$ VZ						$\Delta$ VZ	502

P30													
+	0	0				+	0	0				HRS	N33
+	0	0	0			+	0	0	0			MIN	TIG
+	0					+	0					SEC	
												$\Delta$ VX	N81
												$\Delta$ VY	LV
												$\Delta$ VZ	
+						+						HA	N42
												HP	
+						+						$\Delta$ VR	
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
												$\Delta$ VX	N86
												$\Delta$ VY	AGS
												$\Delta$ VZ	
X	X	X				X	X	X				BSS	
X	X					X	X					SPA	
X	X	X				X	X	X				SXP	
RESIDUALS													
PGNS						AGS							
						$\Delta$ VX	N85					$\Delta$ VX	500
						$\Delta$ VY						$\Delta$ VY	501
						$\Delta$ VZ						$\Delta$ VZ	502



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

### AGS SV/IMPACT PAD

IMPACT CARD																					
+	0	0								+	0	0								HRS (179)	N33
+	0	0	0							+	0	0	0							MIN (06)	TIG
+	0									+	0									SEC (22.70)	
																				$\Delta V_X$ (-161.1)	N81
																				$\Delta V_Y$ (+57.3)	LV
																				$\Delta V_Z$ (+94.6)	
+										+										$H_A$ (+62.0)	N42
																				$H_P$ (-52.8)	
+										+										$\Delta VR$ (+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
																				$\Delta V_X$ (-164.3)	N86
																				$\Delta V_Y$ (+57.3)	AGS
																				$\Delta V_Z$ (+90.0)	

## ASCENT/CSI PADS

LM ASCENT PAD										CSI PAD																															
+	0	0						+	0	0								+	0	0								+	0	0								HRS	N33		
+	0	0	0					+	0	0	0							+	0	0	0							+	0	0	0							MIN	TIG		
+	0							+	0									+	0									+	0									SEC			
+								+										+										$R_1(+00001), R_2(+026.60), R_3(+130.00)$					N55						V (HOR)		
+								+										+										+	0	0								V (VERT)N76	HRS	N37	
0								0									0											+	0	0	0							*CROSSRANGE	MIN	TPI	
																	+											+	0									047	SEC		
																	+											+	0									053	$\Delta$ VX	N81	
																	+											+	0									224/226	$\Delta$ VY	LV	
																	+												410+1, 605+00777, 416+1, 623+0												
																	+											+										465	373		
																	+											+										373	275		
+	0	0						+	0	0								+	0	0								0										HRS	N37	$\Delta$ VX	
+	0	0	0					+	0	0	0							+	0	0	0							0										MIN	TPI	$\Delta$ VY	AGS
+	0							+	0									+	0									0										SEC		$\Delta$ VZ	
+								+										+																					LM WT		

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