R. Parker

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

* APOLLO 16

APRIL 16 LAUNCH

NOTE: CHANGE E INCORPORATES APOLLO 17 PROCEDURE AND TECHNIQUE CHANGES INTO THE APOLLO 16 TIMELINE. THIS BOOK WILL BE USED FOR TRAINING AND SIMULATION UNTIL SIMULATORS ARE RE-CONFIGURED WITH APOLLO 17 TRAJECTORY DATA.

CHANGE E

LM DATA CARD BOOK

PREPARED BY

FLIGHT PLANNING BRANCH

CREW PROCEDURES DIVISION

MANNED SPACECRAFT CENTER

HOUSTON, TEXAS

JULY 7, 1972

INDEXING DATA

DATE	OPR	#	T	PGM	SUBJECT	SIGNATOR
7-7-72	MSC	00	R	APO	*	Mitchell

080-26A

APOLLO 16

LM DATA CARD BOOK

JULY 7, 1972

PREPARED BY: R. A. Mitchell

R. A. MITCHELL
BOOK MANAGER

APPROVED BY: J. W. O'Neill

J. W. O'NEILL, CHIEF
FLIGHT PLANNING BRANCH
CREW PROCEDURES DIVISION

It is requested that any organization having comments, questions, or suggestions concerning this document contact R. A. Mitchell, TRW Task 81, Building 4, room 265, telephone 483-3953.

This document is under the configuration control of the Crew Procedures Control Board (CPCB). All proposed changes should be submitted to the Apollo Flight Data File Manager, T. W. Holloway, CG5, Building 4, room 230, telephone 483-4271.

Distribution of this document is controlled by Flight Data File Manager, T. W. Holloway, Flight Planning Branch, Crew Procedures Division.

APOLLO 16

LM DATA CARD BOOK

LIST OF EFFECTIVE PAGES

BASIC 12/16/71
REV A 3/10/72
CHANGE A 3/28/72 (P&I)
CHANGE B 3/30/72 (P&I)
CHANGE C 4/7/72 (P&I)
CHANGE D 4/11/72 (P&I)
CHANGE E 7/7/72

PAGE	DATE
*i	7/7/72
ii	3/10/72
iii	3/10/72
iv	3/10/72
*1	7/7/72
*2	7/7/72
*3	7/7/72
*4	7/7/72
*5	7/7/72
*6	7/7/72
7	3/10/72
8	3/10/72
*9	7/7/72
*10	7/7/72
11	3/10/72
12	3/28/72
*13	7/7/72
*14	7/7/72
15	3/10/72
16	3/10/72
17	4/11/72
18	4/7/72
19	3/28/72
20	3/10/72
21	4/7/72
22	3/10/72
23	3/10/72
24	3/10/72
25	3/10/72
26	3/10/72
27	3/10/72
28	3/10/72
29	3/10/72
30	3/10/72
31	3/10/72
32	3/10/72
33	3/10/72
34	3/10/72
35	3/10/72
36	3/10/72

*Current Change

THIS PAGE INTENTIONALLY BLANK

LM ACTIVATION CARD

PRIM EVAP ACTIVATION TIME

: : GET

DAP PAD

+ +	LM WT (36685) N47
+ +	CSM WT (39354)
+ +	GMBL (00648) N48
+ +	(00646)

ED BATT VOLTAGE

	BATT A
	BATT B
	GET

DOCKED P52 ALIGN

	R_1 N93
	R_2
	R_3
	GET

V06 N20

LM	CSM	R	GET
		R1	___:___:___
		R2	(94 : 56 : 00)
		R3	
		R1	___:___:___
		R2	(95 : 08 : 00)
		R3	
		R1	___:___:___
		R2	(96 : 08 : 00)
		R3	

S-BD

P	(+109)	AOS	(94 : 22 : 00)
Y	(+18)		
P	(+63)	AOS	(96 : 16 : 17)
Y	(-32)		
P	(-2)	AOS	(98 : 08 : 36)
Y	(+41)		

UNDOCK/SEP GET (96 : 13 : 31)

AGS

K FACTOR (90 : 00 : 00)

+ +	(+60514)	224
+ +	(+29419)	225
+ +	(+60384)	226
+ +	(+00959)	305
- -	(-33024)	662
- -	(-54517)	673
	(-00010)	540
	(+00001)	541
	(+00002)	542
	(-00010)	544
	(+00027)	545
	(-00059)	546

DATE 7/7/72

PAGE 1

PIPA BIAS UPDATE

										PBIASX	V21N01E 1452E PBIASX XXXXXE E
										PBIASY	1454E PBIASY XXXXXE E
										PBIASZ	1456E PBIASZ XXXXXE E

GYRO DRIFT COMPENSATION

																NBDX
																NBDY
																NBDZ

PROCEDURES	
V25N01E 1460E NBDX XXXXXE NBDY XXXXXE NBDZ XXXXXE	V21N01E 1460E NBDX XXXXXE E 1461E NBDY XXXXXE E 1462E NBDZ XXXXXE

CSM CIRC

P76													
+	0	0				+	0	0				HRS (97)	N33
+	0	0	0			+	0	0	0			MIN (41)	TIG
+	0			•		+	0			•		SEC (44.50)	
					•						•	ΔVX (+69.7)	N84
					•						•	ΔVY (+0.0)	
					•						•	ΔVZ (-71.2)	

CSM HA/HP		
CMC	LGC	V82
/	/	OPT 2

DOI-2

+	0	0				+	0	0				HRS	N33
+	0	0	0			+	0	0	0			MIN	TIG
+	0			•		+	0			•		SEC	
-					•						•	ΔVX	N81
					•						•	ΔVY	LOCAL
					•						•	ΔVZ	VERT
+					•	+	0	0			•	H_A	N42
					•	+	0	0			•	H_P	
+					•	+	0				•	ΔVR	
X	X	X		•		X	X	X	0	•		BT	
X	X	X				X	X	X				R	FDAI
X	X	X				X	X	X				P	INER
					•						•	ΔVX AGS	
					•						•	ΔVY AGS	
					•						•	ΔVZ AGS	

NO CSM CIRC

+	0	0				+	0	0				HRS TIME
+	0	0	0			+	0	0	0			MIN CLOSEST
+	0					+	0					SEC APPROACH
												RANGE
												RDOT
	0						0					θ

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: FLASHING LR ALT OR VEL LTS PRECEDED BY STEADY LR LT WITH ALT LOCK-ON (<40K ft), CYCLE LR CB

NO PDI + 12

+	0	0				+	0	0				HRS ( ) N33
+	0	0	0			+	0	0	0			MIN ( ) TIG
+	0					+	0					SEC ( ) E
												ΔVX ( ) N81
												ΔVY ( ) LV
												ΔVZ ( ) F
+						+						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 ( )
+	0	0				+	0	0				HRS ( ) N11
+	0	0	0			+	0	0	0			MIN ( ) CSI
+	0					+	0					SEC ( ) G
+	0	0				+	0	0				HRS ( ) N37
+	0	0	0			+	0	0	0			MIN ( ) TPI
+	0					+	0					SEC ( ) H

RESIDUALS

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

CIRC/NO PDI +12
PDI1/PDI2 ABORT

PDI 1 ABORT CARD

PDI 1 PAD

+	0	0				+	0	0				HRS( )	N33
+	0	0	0			+	0	0	0			MIN( )	PDI
+	0			•		+	0			•		SEC( )	1
X	X			•		X	X			•		TGO(:)	N61
					•						•	X RANGE(+0.0)	
X	X	X				X	X	X				R ( )	FDAI
X	X	X				X	X	X				P ( )	AT TIG
X	X	X				X	X	X				Y ( )	
												DEDA 231 IF ROD	

(0<PDI 1< :) ABORT PAD EARLY

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

+	0	0				+	0	0				HRS( )	N37
+	0	0	0			+	0	0	0			MIN( )	TPI
+	0			•		+	0			•		SEC( )	J

T1-1 (: ≤ PDI 1 ≤ :) ABORT PAD LATE

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( )	N37
+	0	0	0			+	0	0	0			MIN( )	TPI
+	0			•		+	0			•		SEC( )	K

T2-1(PDI 1 + : :) ABORT PAD

LOG INSERTION GET = ___ ___ ___:___ ___:___ ___
+ 5 0 0 0
BOOST GET = ___ ___ ___:___ ___:___ ___
+ 3 0 0 0 0
HAM GET = ___ ___ ___:___ ___:___ ___
+ 5 0 0 0
CSI GET = ___ ___ ___:___ ___:___ ___

+	0	0				+	0	0				HRS( )	N33
+	0	0	0			+	0	0	0			MIN( )	TIG
+	0			•		+	0			•		SEC(.)	L
+	0	0				+	0	0				HRS( )	N37
+	0	0	0			+	0	0	0			MIN( )	TPI
+	0			•		+	0			•		SEC(.)	M

N69 TARGET UPDATE

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

THROTTLE DOWN ___:___

T3-1 (1 REV) ABORT TIME

+	0	0				+	0	0				HRS( )	N33
+	0	0	0			+	0	0	0			MIN( )	TIG
+	0			•		+	0			•		SEC(.)	N

PDI 2 ABORT CARD

PDI 2 PAD

+	0	0				+	0	0				HRS( )	N33
+	0	0	0			+	0	0	0			MIN( )	PDI
+	0		•			+	0		•			SEC( )	I
X	X		•			X	X		•			TGO(:)	N61
				•						•		X RANGE(+0.0)	
X	X	X				X	X	X				R ( )	FDAI
X	X	X				X	X	X				P ( )	AT TIG
X	X	X				X	X	X				Y ( )	
												DEDA 231 IF RQD	

(0<PDI 2 < :) 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( )	N37
+	0	0	0			+	0	0	0			MIN( )	TPI
+	0		•			+	0		•			SEC(.)	J

T1-2(: ≤ PDI 2 ≤ :) ABORT PAD LATE

LOG INSERTION GET= ___ ___ ___:___ ___:___ ___

\+ 5 5 0 0

CSI TIG ___ ___ ___:___ ___:___ ___

+	0	0				+	0	0				HRS( )	N37
+	0	0	0			+	0	0	0			MIN( )	TPI
+	0		•			+	0		•			SEC(.)	K

T2-2(PDI 2 + : ___:___) 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( )	N33
+	0	0	0			+	0	0	0			MIN( )	TIG
+	0		•			+	0		•			SEC(.)	L
+	0	0				+	0	0				HRS( )	N37
+	0	0	0			+	0	0	0			MIN( )	TPI
+	0		•			+	0		•			SEC(.)	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 ( )	N33
+	0	0	0			+	0	0	0			MIN ( )	TIG
+	0		•			+	0		•			SEC (.)	N

PD12/PD12 ABORT
LUNAR SURFACE

DATE 7/7/72

PDI2/PDI2 ABORT
LUNAR SURFACE

LUNAR SURFACE CARD

FIRST REV ACTIVITY

LAUNCH PREP

N20 (EMERGENCY LIFTOFF)
_____OG_____IG_____MG

P57, A/T 3, REFSMMAT
NO4 _____, _____ GRAV ERR
STAR _____ (N71)
NO5 _____ ANGLE DIFF
N93 _____ X
_____ Y
_____ Z

N20 (PARKING)
_____OG 0.00 IG_____MG

NO VOICE LGC CLOCK SYNCH

CST ZERO = : :

+(i)·(24) = : : (1)

Latest CST = : : (2)

+CST(Watch)= : : (3)

GET = : :

NOTES:
(1) i=1, 2, 3, -----
(2) Latest CST not exceeding NOM TIG for this REV
(3) Must be in 24 hour day

LM SHADOW LENGTH

GET	LENGTH (ft)

N43
LAT(+N) ___•___
LONG(+E) ___•___
ALT ____•

047 _____ 053 _____

544 _____ +5:02 _____
545 _____ _____
546 _____ _____

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

DATA STAR 1 _____
DATA STAR 2 _____
DATA STAR 3 _____
DATA STAR 4 _____

P57, A/T 3, LANDING SITE
NO4 _____, _____ GRAV ERR
STAR _____ (N71)
NO5 _____ ANGLE DIFF
N 93 _____ X
_____ Y
_____ Z

P22 ACQ ___:___:___
(: :)

REV 50 TIG ___:___:___
(: :)

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

K FACTOR ___:___
(: 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
15			32		
16			33		
17			34		
18			35		
19			36		
20			37		
21			38		
22			39		
23			40		
24			41		
25			42		
26			43		
27			44		
28			45		
29			46		
30			47		
31			48		
			49		
			50		

PIPA BIAS UPDATE*

					PBIASX
					PBIASY
					PBIASZ

GYRO DRIFT UPDATE*

					NBDX
					NBDY
					NBDZ

*PROCEDURES ON PAGE 2

AGS RECOVERY FROM BAD RADAR MARKS

PRE TPI

ASSUMED STEADY STATE BEFORE N49
411+0
✓ ANGLE, RANGE AND RANGE RATE
606R -XXXXX RANGE AND ANGLES USED IN LAST UPDATE
+00000 RANGE RATE USED IN LAST UPDATE
DO AN IMMEDIATE V47 FOR THE FOLLOWING:
1) LESS THAN 10 MIN OF TRACKING LEFT (AND ANOTHER AT TIG -5 MIN)
2) FOR θ,R, OR $\dot{R}$ GREATER THAN 5°, 5NM, OR 15FPS: ALSO REINITIALIZE FILTER, AND CONTINUE MANUAL UPDATING.

DON'T DO A V47 FOR THE FOLLOWING:
1) FOR θ,R, OR $\dot{R}$ LESS THAN 5°, 5NM, OR 15FPS: DO REINITIALIZE FILTER, AND CONTINUE MANUAL UPDATING.

POST TPI

N49 ON FIRST PGNCS UPDATE
1) DO NOT INCORPORATE INTO PGNCS, WAIT FOR SECOND UPDATE.
2) AT SECOND UPDATE:
IF N49 REPEATS: KEEP AGS AUTO UPDATING
IF N49 DOES NOT REPEAT: DO V47 AND NO UPDATES

N49 AFTER STEADY-STATE
DO V47 WITH NO FURTHER UPDATES

TPI 2 PROCEDURE

PERFORM MCC-1

PGNS

P34

LOG N37
+ 3 7

GET TPI 2 = [ ][ ][:][:][.][ ][ ]

N55 (ω_t) = $\frac{(\Delta V \text{ TPF})}{2}$ = [ ][ ][ ][.][ ]

V93

AGS

410 + 4

LOG TIG TPI (373)
+ 3 7 . 0

GET TPI 2 = [ ][ ][ ][ ][.]

307 = $\frac{(\Delta V \text{ TPF})}{6}$ = [ ][ ][ ][ ][.]

417 + 1

411 + 1

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, ΔR IS ALWAYS $\geq$ 1 NM
RR DOES NOT AGREE WITH VHF,
MSFN ISOLATES FAILED SYSTEM.

V90 < 5 fps - NO BURN

APS FOR ΔV>40fps, DPS FOR ΔV>6 fps (DPS FULL)

CSI SOLUTIONS

		PGNS		AGS		CMC		CHARTS
ΔH (.)	N75		402					
CSI/CDH(:)			372					
CDH/TPI(:)								
ΔVX (ΔVG)	N81		370		N81*		ΔV	
ΔVY			263		*			
CDH ΔVX(0.0)	N82							
CDH ΔVX(0.0)								

*CHANGE SIGN BIAS; ΔVX = -1.0

CSI PAD

+	0	0				+	0	0				HRS( )	N11
+	0	0	0			+	0	0	0			MIN( )	CSI
+	0			•		+	0			•		SEC(.)	
R1(+00001),R2(+026.60),R3(+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(+0.0)	LV
410+1, 605+00777, 416+1, 623+0													
+					•	+					•	373(.)	
+					•	+					•	275(.)	
	0				•		0				•	ΔVX(.)	N86
	0				•		0				•	ΔVY(+0.0)	AGS
	0				•		0				•	ΔVZ(.)	

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

RESIDUALS

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

P76/77 PADS

		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
. . . . .	. 0	ΔVX N84/N81
. . . . .	. . . . .	ΔVY
. . . . .	. . . . .	ΔVZ

AGS SV PADS

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

DATE 7/7/72

PAGE 13

P27 PADS

V	V	V	PURP
: :	: :	: :	GET
INDEX	INDEX	INDEX	01 1173
			02 1174
			03 1175
			04 1176
			05 1177
			06 1200
			07 1201
			10 1202
			11 1203
			12 1204
			13 1205
			14 1206
			15 1207
			16 1210
			17 1211
			20 1212
			21 1213
			22 1214
			23 1215
			24 1216
XXX	XXX		HRS
XXXX	XXXX		MIN
XX	XX		SEC NAV CHECK
0	0		LAT N43
			LONG
+0	+0		ALT

V	V	V	PURP
: :	: :	: :	GET
INDEX	INDEX	INDEX	01 1173
			02 1174
			03 1175
			04 1176
			05 1177
			06 1200
			07 1201
			10 1202
			11 1203
			12 1204
			13 1205
			14 1206
			15 1207
			16 1210
			17 1211
			20 1212
			21 1213
			22 1214
			23 1215
			24 1216
XXX	XXX		HRS
XXXX	XXXX		MIN
XX	XX		SEC NAV CHECK
0	0		LAT N43
			LONG
+0	+0		ALT