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

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

DATE 7/7/72

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 Y (+109) (+18)
P Y (+63) (-32)
P Y (-2) (+41)

AOS (94 : 22 : 00)
AOS (96 : 16 : 17)
AOS (98 : 08 : 36)

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

PAGE 1

PIPA BIAS UPDATE

										PBIASX	
										PBIASY	
										PBIASZ	

V21N01E
1452E
PBIASX XXXXXE E
1454E
PBIASY XXXXXE E
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

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

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 _____

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

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		

LM SHADOW LENGTH

GET	LENGTH (ft)

PIPA BIAS UPDATE*

	PBIASX
	PBIASY
	PBIASZ

GYRO DRIFT UPDATE*

	NBDX
	NBDY
	NBDZ

*PROCEDURES ON PAGE 2

PAGE 6

DATE 7/7/72

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 Ṙ 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 Ṙ 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
+ 37

GET TPI 2 = [ ]

N55 (ω_t) = (ΔV TPF) / 2 = [ ]

V93

AGS

410 + 4

LOG TIG TPI (373)
+ 37.0

GET TPI 2 = [ ]

307 = (ΔV 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	
		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

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