APOLLO 16	
LM TIMELINE BOOK	
PART NO.	S/N
SKB32100122-388	1002

APOLLO 16

LM TIMELINE BOOK

MARCH 30, 1972

PREPARED BY: *C. O. Lewis*
C. O. LEWIS
BOOK MANAGER

APPROVED BY: *Paul C. Kramer*
PAUL C. KRAMER, CHIEF
FLIGHT PROCEDURES BRANCH
CREW PROCEDURES DIVISION

It is requested that any organization having comments, questions, or suggestions concerning this document contact C. O. Lewis, Flight Procedures Branch, CG42, Building 4, room 224, telephone 483-3291.

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.

ACKNOWLEDGEMENT

AREA	NAME/BRANCH	LOCATION
Rendezvous (Pg. 11,12,19-44)	S. Grega Flight Procedures CG4	Ext 5348 Bldg 4, Rm 222
Post Docking (Pg. 13-18)	G. Doerre Spacecraft Systems CG2	Ext 4371 Bldg 4, Rm 252

It is requested that any organization having comments in the above areas contact the responsible individuals.

LM TIMELINE BOOK

LIST OF EFFECTIVE PAGES

BASIC 3/10/72
CHANGE A 3/30/72
CHANGE B 4/5 / 72 (P&I)
CHANGE C 4/11/72 (P&I)

PAGE	DATE	PAGE	DATE
*i	3/30/72	23	3/10/72
1	3/10/72	24	3/10/72
2	3/10/72	25	3/10/72
3	3/10/72	26	3/10/72
4	3/10/72	27	3/10/72
*5	3/30/72	28	3/10/72
6	3/10/72	29	3/10/72
7	3/10/72	30	3/10/72
*8	3/30/72	31	3/10/72
9	3/10/72	32	3/10/72
10	3/10/72	33	3/10/72
*11	3/30/72	34	3/10/72
12	3/10/72	35	3/10/72
*13	3/30/72 4/5/72 4/11/72	36	3/10/72
14	3/10/72	37	3/10/72
15	3/10/72	38	3/10/72
16	3/10/72	39	3/10/72
17	3/10/72	40	3/10/72
*18	3/30/72	41	3/10/72
19	3/10/72	42	3/10/72
20	3/10/72	43	3/10/72
21	3/10/72	44	3/10/72
22	3/10/72		

*Current Change

96:00

PREP FOR UNDOCKING
USE ACTIVATION & C.O.
   C/L TO 10 MIN BEFORE UNDOCK
CHECK ATT (0, 284, 060)
V48 22012
  LM WT _____ (36,685)
PRO, V34
V06N20 COPY LM AND CSM ANGLES AND TIME
P47

UNDOCK & SEPARATION ____:____:____ (96:14)
V77E
POO, V60   TRIM TO .1 FPS
YAW LT 60°
PITCH UP 90°
    *SEQUENCE CAMERA - ON (1 MIN)   *
FDAI (0, 013, 0)
    *VHF ANT - FWD   *
    *SEQUENCE CAMERA - OFF   *
HELMETS & GLOVES - OFF (OPT)

    *SUIT GAS DIVERTER - EGRESS   *
    *CABIN GAS RETURN - EGRESS   *

AOS
96
+16

    *S-BD ANT - AFT, VERIFY COMM   *
    *√S-BD P_____ (+63)   *
    *   Y_____ (-32)   *
    *S-BD ANT - SLEW (>3.0)   *
    *TRACK MODE - AUTO   *
    *VHF B XMTR - OFF   *
    *BIOMED - LEFT, PCM - HI   *
       *
    *UPLINK SQUELCH - OFF   *
VOICE N20 ANGLES AND TIME TO MSFN
    CAMERA SETTINGS FOR CABIN PHOTOS
    LM/DAC/10/CEX (T/1.8, 1/60, 2ft)
    * 6 FPS, .125 MAG N, (2 MIN)   *
    *LM/DC/60/HCEX (f5.6, 1/2 - 1/8, *
    * FOCUS) 5 FR, MAG A   *

96:20

UNDOCK TO DPS PRESS

96:20

DPS THROTTLE CHECK
    *CB(16) STAB/CONT: ENG ARM - CLOSE   *
THROT CONT - MAN/CDR
TTCA (BOTH) - THROTTLE (MIN)
    *VERIFY MSFN CONTACT   *
ENG STOP - PUSH
ENG ARM - DES (DES REG LT - ON)
TTCA MIN (6.6% - 13.4%)
   THEN SOFT STOP (46.2% - 59.2%)
   THEN MAX (93.6% - 100+%)
   THEN MIN
ADJUST FRICTION
MAN THROT - LMP
    *REPEAT TEST FOR LMP TTCA   *
ENG ARM - OFF
    *CYCLE CWEA (DES REG LT - OFF)   *
ENG STOP - RESET
THROT CONT - AUTO/CDR
TTCA (BOTH) - JETS

DPS PRESS & C.O.

PRPLNT TEMP/PRESS MON - DES 1 & 2
   FUEL 50°-75°F 50-130 PSI
   OXID 50°-75°F 30-80 PSI
HELIUM MON: SUPCRIT PRESS 1070-1570
     : AMB PRESS 1495-1750
DES He REG 1 tb - GRAY, REG 2 tb - bp
MASTER ARM - ON
DES PRPLNT ISOL VLV - FIRE
He PRESS/DES START - FIRE
MASTER ARM - OFF
PRPLNT TEMP/PRESS MON: DES 1 & 2
FUEL & OXID 50°-90°F 200-250 PSI
HELIUM MON: AMB PRESS 200-1110
     : SUPCRIT PRESS 1070-1570

96:25

96:25

AGS ACTIVATION
```
        *AGS STATUS - STBY (MASTER ALARM,      *
        *   & AGS WARNING LT - ON)             *
        *CB(16) STAB/CONT: AEA - CLOSE         *
        *    (AGS WARNING LT - OFF)            *
  CB(11) AC BUS B: AGS - CLOSE
        *RECORD TIME ____:____:____            *
        *AGS STATUS - OPERATE (MASTER ALARM,   *
        *   & AGS WARNING LT - ON)             *
        *02/H2O QTY MON - C/W RESET            *
        *ATT MON (LMP) - AGS                   *
        *V16 N65E                              *
        *SET AGS TIME USING 90 HR BIAS         *
        *   377 _____ (+03850)                *
        *616+0                                 *
        *224 _____ (+60514)                 *
        *225 _____ (+29419)                 *
        *226 _____ (+60384)                 *
        *305 _____ (+00563)                 *
        *662 _____ (-33024)                 *
        *673 _____ (-54517)                 *
        *412R+1 SELF TEST SATISFACTORY         *
        *    +3 LOGIC TEST FAILURE             *
        *    +4 MEMORY TEST FAILURE            *
        *    +7 LOGIC & MEMORY TEST FAILURE    *
        *574R DESCENT STAGE (+ NOT STAGED)     *
        *604R LUNAR SURFACE FLAG               *
        *    (+ NOT ON LUNAR SURFACE)          *
        *612R STAGING COUNTER (+0 NOM)         *
        *373 _____ (+05147)                 *
```

96:30

96:30
```
        *232R +00600                  *
        *233R +00250                  *
        *464R +00500                  *
        *465R +00195                  *
        *623R +00000                  *
        *514R +00000                  *
        *515R +40000                  *
        *516R +00000                  *
        *000 +888888 (OPR ERR LT - ON) *
        *123 -45679 (DO NOT ENTR)     *
```
MSFN UPDATE
```
        *COPY AGS K FACTOR ____:____:____   *
        *V47E                               *
        *V25E LOAD AGS K FACTOR UPDATE      *
        *414+1                              *
        *400+3 (AFTER 50 16)                *
        *V83, 317R, 440R, SET ORDEAL        *
```
LANDING RADAR CHECKOUT
```
  CB(11) PGNS: LDG RDR - CLOSE
  CK TEMP (60° - 95°)
  X-PNTRS - HI MULT

  MODE SEL - LR
  TM SW - H/Ḣ
  LDG ANT - AUTO

  RDR TEST - LDG
  POWER SIGNAL LIGHT OUT
  TEST MON - ALT/VEL XMTR (2.1 - 5.0), AGC
  X-PNTRS PEGGED UP, LT
  TM - H (8000 ± 100), Ḣ (-480 ± 2)
  V63 N12 OPT 2, PRO
  N66 8286 ± 10, ANT POS 1 (00001), PRO
  N67 Vx (-00495 ± 2), Vy (+01862 ± 2),
      Vz (+01331 ± 2)
  V34, RDR TEST OFF (ALT - 0, POWER SIGNAL
      LIGHT ON, X-PNTRS - CENTERED)
  CB(11) PGNS: LDG RDR - OPEN
```
96:35

96:35

AGS CONT CHECK
MODE CONT (AGS) - ATT HOLD
GUID CONT - AGS
MNVR TO FDAI (0, 330, 0)

    *CAMERA SETTINGS FOR REV 12 TCA   *
    *LM3/DAC/10/CEX (T/2.8, 1/250, ·) *
    * 1 FPS, .05 MAG N, (5 MIN)   *
    *LM/DC/60/HCEX (f5.6, 1/125, ·) *
    * 5 FR, MAG A   *

    *SEQUENCE CAMERA - ON (96:41)   *

REV 12 LS TCA ___:___:___ (96:46)

    *SEQUENCE CAMERA - OFF   *

RENDEZVOUS RADAR CHECKOUT

GUID CONT - PGNS
CB(11) AC BUS A: RNDZ RDR - CLOSE

CB(11) PGNS: RNDZ RDR - CLOSE
    *VHF A XMTR - VOICE/RNG   *
✓ TEMP (10° - 75°)
RT/ERR MON - RR
RR SLEW, MANUAL LOCK-ON, RR LGC
TM - RNG/RNG RT
V63, PRO, NO TRACK LIGHT OUT, PRO, N78

COMPARE N78, VHF, TM
V34
        VHF A XMTR - VOICE   *
V41N72E (+00000 TRUN, +28300 SHFT)
CB(11) PGNS: RNDZ RDR - OPEN
CB(11) AC BUS A: RNDZ RDR - OPEN
V44, RR - SLEW
RT/ERR MON - LDG RDR/CMPTR
TM - H/H

	R	R
MAX	.27 NM	7 FPS
N78		
VHF		
TM		

96:50

96:50

SS / 96
+52

MSFN UPDATE
    *COPY CSM CIRC P76   *
    *SET DET TO COUNT DN TO CSM CIRC *
    *COPY PADS FOR
    * NO PDI + 12 ABORT   *
    * PDI   *
    * PDI EARLY ABORT   *
    * PDI LATE ABORT   *
    * T2 ABORT   *
    * T3 TIG   *

IMU FINE ALIGN
V76
P52 OPT 3
CB(11) AC BUS B: AOT LAMP - CLOSE
AOT - DETENT F/0.0°
PGNS MODE CONT - AUTO
1ST STAR SPICA (226)
PRO
2ND STAR ANTARES (233)
N05 ANGLE DIFF _____
PRO
N93 TORQUING ANG
    X _____
    Y _____
    Z _____
PRO, RCD GET ___:___:___
N25, ENTR
P00
DETENT CL
CB AOT LAMP - OPEN

MSFN UPLINK
    *UPDATA LINK - DATA   *
    *UPLINK CSM/LM S.V., E-MEMORY, *
    *   DESCENT TARGETING   *
    *UPDATA LINK - OFF   *
    *V47, 414+1, 400+3   *
    *V83, 317R, 440R, SET ORDEAL   *

97:05

COAS CAL TO CSM CIRC

97:05

97:25
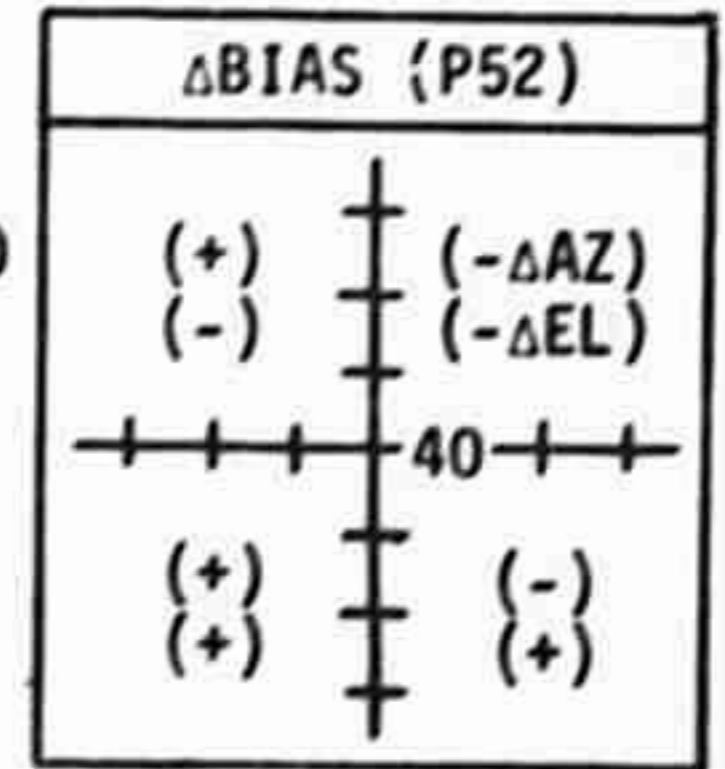
97:25

97:45

COAS CALIBRATION
P52
PGNS MODE CONT - AUTO
N70, ENTR 026 (SPICA), PRO   BIAS AZ _____
N87, (+00000, +00000) PRO, PRO   EL _____

LPD CALIBRATION
ENTR
N70, ENTR 026 (SPICA), PRO
N87, (+00000, +32046) PRO, PRO
P00

```
┌─────────────────────────┐
│       ΔBIAS (P52)       │
│                         │
│           │             │
│  (+)      │   (-ΔAZ)    │
│  (-)      │   (-ΔEL)    │
│      ──┼──┼──40──┼┼──   │
│           │             │
│  (+)      │    (-)      │
│  (+)      │    (+)      │
│           │             │
└─────────────────────────┘
```

MSFN UPDATE
    COPY AND LOAD GYRO DRIFT COMP, PIPA BIAS
    (REF. P2 DATA CARD BOOK)

CONFIGURE COMM FOR LOS

    *MATCH INDICATED ANGLES   *
    *TRACK MODE - SLEW   *
    *S-BD ANT - FWD   *
    *SET P ____ (- 2)   *
    * Y ____ (+41)   *
    *VHF B XMTR - DATA, PCM - LO   *
    *UPLINK SQUELCH - ENABLE   *

LOS 97 +22

SR 97 +41

MNVR TO AGS CAL ATT
V49, +02250 OGA   ROLL 24 ⎤
    +11250 IGA   PITCH 122 ⎬ FDAI
    +02250 MGA   YAW   339 ⎦

AGS CALIBRATION
    *READ AND RECORD INITIAL CAL.NOS.   *
PGNS MODE CONT - ATT HOLD
    *VERIFY 25 MIN SINCE TURN-ON   *
V60, V76, V16N20E
RATES < 0.075°/SEC
    *400+6, START WATCH   *
    *400R   *
    MONITOR ICDU LIMITS
    ⎡ OGA +00000 / +04500 ⎤
    ⎨ IGA +09000 / +13500 ⎬ LIMITS
    ⎣ MGA +00000 / +04500 ⎦

```
┌──────────────────────────────────┐
│ BEFORE LIMITS ARE EXCEEDED, 400+0.│
│ IF TIME IS LESS THAN 5 MINUTES    │
│ REPEAT AGS CALIBRATION.           │
└──────────────────────────────────┘
```

    *CHECK ECS, RCS, EPS, APS   *
    *CYCLE CWEA CB   *
    *400R+0   *
    *READ AND RECORD CAL VALUES   *

	INIT	CAL	Δ LIM
540			± .039
541			± .039
542			± .039
544			±2.00
545			±2.00
546			±2.00

CSM CIRCULARIZATION ____:____:____ (97:42)
P76 (UPDATE CSM S.V.), PRO
V82, N12-00002, PRO
√CSM HA/HP
    *PCM - HI   *
    *V47, 414+1   *
    *V83, 317R, 440R   *
    *PCM - LO   *

97:45

P63 IGNITION ALGORITHM TEST
```
P63
        *RESET DET TO CONT DN TO PDI          *
PGNS MODE CONT - AUTO
N18 R, P, Y (0, 111, XXX) PRO
YAW TO 340°
P00
V48, 22112, 00011, PRO, V34

        *CAMERA SETTING (PDI)                 *
        *LM3/DAC/10/CEX-WDG (T/2.8, 1/500, ∞)*
        * 12 FPS, .75 MAG N, (6 MIN)          *
        *CAMERA SETTING (EARTH RISE)          *
        *LM/DC/60/HCEX (f16, 1/250, ∞)        *
        * 5 FR, MAG A                         *


COAS TO OVERHEAD WINDOW
VERIFY LOOSE GEAR STOWED
RESTRAINTS ATTACHED
VERIFY FDAI'S INERTIAL
```

PRE-PDI ECS CHECKOUT
```
HELMETS AND GLOVES ON
        *CABIN REPRESS - CLOSE         *
        *SUIT GAS DIVERTER - EGRESS    *
        *CABIN GAS RETURN - EGRESS     *
        *PRESS REGS A&B - EGRESS       *
```

PRE-PDI SWITCH SETTING CHECK
```
        *VHF ANT - FWD                 *
CB(11)EPS: INV 1 - CLOSE               *
        *SELECT INV 1                  *
```

98:00

98:00

```
CB(11) STAB/CONT: AELD - CLOSE
CB(11) STAB/CONT: ABORT STAGE - CLOSE
RESET ENG STOP PB
SET WINDOW BARS


        *CB(16) STAB/CONT: AELD - CLOSE         *
        *CB(16) STAB/CONT: ABORT STAGE - CLOSE*

        *CYCLE CWEA CB                          *
        *BATS 5 & 6 NORM FEED - ON              *
        *RECORD GET ____:____:____              *
THROT CONT - AUTO
CDR TTCA - THROTTLE - MIN
        *LMP TTCA - THROTTLE - SOFT STOP
RATE SCALE - 25°/SEC
ATT/TRANSL - 4 JET
CHECK DPS, APS, RCS, ECS, EPS
CHECK SWITCH GUARDS
PRPLNT QTY MON - DES 1
        *S-BD ANT - FWD, VERIFY COMM            *
        *√S-BD P ____( -2)                      *
        *        Y ____(+41)                    *
        *S-BD ANT - SLEW (>3.0)                 *
        *TRACK MODE - AUTO                      *
        *VHF B XMTR - OFF                       *
        *BIOMED - LEFT, PCM - HI                *
        *UPLINK SQUELCH - OFF                   *
        *VOICE AGS CAL. NOS. TO MSFN            *
        *CHECK ED BATTS AND REPORT              *
        *VOICE ASC BATT ON TIME TO MSFN         *
```

-35

AOS -25
98
+10

MSFN UPLINK, UPDATE
```
        *UPDATA LINK - DATA                     *
        UPLINK LM S.V., RLS
        *UPDATA LINK - VOICE BU                 *
        *COPY, LOAD AGS RLS (231)_____   *
        *COPY, LOAD LPD BIAS                    *
```

√BURN ABORT RULES

98:20

AGS INITIALIZE TO PDI

98:20

AGS INITIALIZE
-15
　　　　*V47, 414+1
　　　　*V83, 317R, 440R
　　　　*240 + (231 RLS PAD)
　　　　*254+05390
　　　　*262-00150

　　MODE SEL - AGS

POWERED DESCENT INITIATION
-10　V25 N69E (IF NO UPLINK)
　　PGNS MODE CONT - AUTO
　　AGS MODE CONT - AUTO
　　P63
　　AUDIO MODE (BOTH) - VOX

　　√DPS CONFIG CARD
-8　　　　*RESET DET
　　N18, R, P, Y (0, 111, 340)
　　VERIFY FDAI
　　　　*V40N20E, 400+3, 410+0
　　　　*400+1, 433R VI
-5　CB(11) PGNS: LDG RDR - CLOSE
　　√ALT XMTR
-4　PRO - FINAL TRIM
　　ENTR, √DET
　　GO/NO-GO FOR PDI
　　COMM CHECK WITH CSM
　　RESET WATCH
-2:00　MASTER ARM - ON
　　MODE SEL - PGNS
　　　　*367R
-0:30　ENG ARM - DES
-0:07.5　ULLAGE
-0:05　PRO
0:00 PDI　　:　　:　　(98:34:41)
+0:02　(NO IGN) - START PB - PUSH
+0:05　DES ENG CMD OVRD - ON
　　MASTER ARM - OFF

*
*
*
*
*

*

*
*

*

GO-AROUND

SECURE SYSTEMS
　　ENG ARM - OFF
　　MASTER ARM - OFF
　　P00
　　LR - OFF
　　ASC BATTS - OFF
　　PRLPNT QTY MON - OFF
　　AUDIO - PTT
　　ECS - CABIN MODE
　　HELMETS & GLOVES - OFF (OPTIONAL)
　　AGS - ATT HOLD
ALIGN IMU
　　P52 (SAME STARS)

MSFN UPDATE
　　COPY PADS FOR:
　　　NO PDI + 12
　　　PDI
　　　PDI EARLY ABORT
　　　PDI LATE ABORT
　　　T2 ABORT
　　　T3 TIG
　　　AGS ABORT CONSTANTS
　　　　224,225,226,305,662,673
　　　AGS T2 UPDATE - 254

MSFN UPLINK
　　DESCENT TARGETING, ABORT CONSTANTS,
　　　　　　　　　　　　　　LM & CSM S.V.

CONFIGURE COMM FOR LOS

PICK UP WITH P63 IGNITION ALGORITHM TEST, P.5

DATE 3/10/72

-2:00 MASTER ARM-ON
       MODE SEL-PGNS
       367R
- :30 ENG ARM-DES
- :07.5 ULLAGE
- :05 PRO

+ :00 **PDI**

+ :02 (NO IGN) ---
       START PB-PUSH
+ :05 DES ENG OVRD-ON
       MASTER ARM-OFF
+ :26 THROTTLE UP
       √T/W > 1.6

+2 V21 N69E (DN RNG)
+3 YAW FACE UP
+4 √ ED BATTS
    V57E TO PERMIT
        LR DATA
+5 V24 N69E (DN RNG,
        X-RNG)

N68

EVAL MAN CONT

+8 V23 N69E (ALT)

223+00140 (E @ 14K)
360-0XXX0E
SEQ CAMERA - ON

TFI	θ	ΔHMAX	(-ḢMAX) -HDOT	H	DPS	SBD
0:00	111		5.0	52700	95	-2/41
0:30	111		7.0	52600	95	
1:00	103		25.0	52100	95	5/36
1:30	97		36.0	51100	92	
2:00	93		45.0	49900	87	13/29
2:30	89		51.0	48500	82	
3:00	85		57.0	46800	77	19/23
3:30	82		62.0	45100	71	
4:00	79		67.0	43100	66	8/5
4:30	77		73.0	40400	61	
5:00	75	+17000	78.0	39000	56	11/2
5:30	74	+17000	89.0	36600	50	
6:00	72	+16000	99.0	32800	45	13/0
6:30	71	+14000	(511.0) 107.0	30000	40	
7:00	67	+12400	(481.0) 104.0	26900	35	17/-3
7:30	62	+10000	(447.0) 103.0	23500	30	
8:00	59	+ 8200	(410.0) 130.0	20000	27	23/-8
8:30	59	+ 6900	(368.0) 155.0	16400	24	
9:00	55	+ 4500	(298.0) 172.0	11300	21	26/-11

P64

┌─────────────────┐
│ P64 + 15 SEC: │
│ NO THROTTLE DN │
│   - ABORT   │
└─────────────────┘

MODE CONT (PGNS)-ATT HOLD

P66

X-PNTR - LO MULT

┌─────────────────┐
│   BINGO FUEL   │
│ DES QTY LT+1+31 │
└─────────────────┘

TOUCHDOWN

ENG STOP - PUSH
ENG ARM - OFF
PRO
DES ENG CMD OVRD - OFF
MODE CONT (PGNS)-ATT HLD
MODE CONT (AGS)-AUTO
413+1
RECYCLE PARKER VALVES

H	(-ḢMAX) -HDOT	DPS	VH (362)
7000	(226.0) 176.0	18	254
6000	(207.0) 159.0	18	234
5000	(185.0) 137.0	17	219
4000	(162.0) 115.0	16	200
3000	(135.0) 92.0	15	176
2000	(104.0) 66.0	14	144
1000	(63.0) 36.0	13	96
500	(35.0) 17.0	11	53
400	(28.0) 12.0	11	39
300	(21.0) 8.0	10	19
200	(12.0) 5.0	9	-6

┌──────────────────────────┐
│ ABORT STAGE - PUSH   │
│ ENG ARM - ASC   │
│ ENG STOP - RESET   │
│ ENG START - PUSH   │
│ V22 N46 E,E   │
│ MODE CONT (BOTH) - AUTO │
└──────────────────────────┘

PAGE 7

N76 <u>5510.6</u> V HORZ
<u>19.5</u> V VERT
CROSS RNG (<8.1)
N74 <u>TFI, YAW, PITCH</u>

```
┌─────────────────────────────┐
│ *IF AGS ALIGNMENT NO GO      │  *
│ *V47E, 414+1                 │  *
│ *V40N20E, 400+3              │  *
└─────────────────────────────┘
```

*410+0   *

22:16   T2   STAY/NO STAY AND GO/NO-GO FOR
[NO STAY]   DPS VENT

```
┌ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┐
│ -2:00   ASC He SEL - BOTH            │
│         MASTER ARM - ON              │
│         ASC He PRESS - FIRE          │
│         ASC He REGS 1, 2 - OPEN      │
│           *A ASC FEED 2-OPENI IUNLESS CDRI* │
│           *A MAIN SOV -CLOSEI I BUSS LOSSI* │
│           *B ASC FEED 2-OPENI IUNLESS LMPI* │
│           *B MAIN SOV -CLOSEI I BUSS LOSSI* │
│           *CRSFD - CLOSED          * │
│           *BAT 1,3 - OFF           * │
│           *BAT 2,4 - OFF           * │
│           *CB(16) EPS:ASC ECA CONT-CLOSE * │
│           *DES BAT - DEADFACE      * │
│           *SELECT ASC H2O TANK     * │
│           *DES O2 - CLOSE          * │
│           *ASC 1 O2 - OPEN         * │
│           *DES H2O - CLOSE         * │
│           *ASC H2O - OPEN          * │
│           *400+1, 367R             * │
│ - :10   ABORT STAGE - PUSH(AT T=0 FOR AGS) │
│         ENG ARM - ASC                │
│ - :05   PRO                          │
│   :00     *DET - RESET, RELEASE    * │
│         T2   :   :     (98:58:57)    │
│ + :01   ENG START - PUSH (IF AUTO IGN) │
└ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┘
```

[STAY]   *TAPE RECORDER - OFF   *
        AUDIO MODE - ICS/PTT
        P00

---

*RECYCLE PARKER VALVES   *
PRPLNT TEMP PRESS MON - ASC, THEN DES
ASC He MON - CYCLE
    *O2/H2O QTY MON - ASC 1, 2, THEN DES 2, 1 *
    *SEQUENCE CAMERA - OFF   *
CB(11) PGNS: LDG RDR - OPEN

17:30 T1 STAY/NO STAY

```
┌ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┐
[NO STAY] │ V22 N46 E,E              │
│ MODE CONT (BOTH) - AUTO  │
│ ABORT STAGE - PUSH       │
│ ENG ARM - ASC            │
│ ENG STOP - RESET         │
│ ENG START - PUSH         │
└ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┘
```

[STAY]
        *414+2   *
        *400+4   *

P68
ENG STOP-RESET

PRO
P12
MODE CONT (PGNS) - AUTO
N33 T-2 (98:58:57)

FDAI AND OVERHEAD WINDOW ANGLES FOR MANUAL DESCENT ABORT

DPS/APS

1:00	250/0
2:26	SD(FDAI)
2:36	SD(OHW)

1:30	0/0
1:44	300/0
2:30	250/0
3:20	SD

2:00	0/LV
2:14	300/36
3:00	300/0
3:18	250/0
4:16	SD

2:30	0/LV
2:44	300/36
3:46	300/0
4:02	250/0
5:12	SD

3:00	0/LV
3:14	300/36
4:34	270/0
5:10	250/0
5:57	SD(FDAI)
6:06	SD(OHW)

3:30	0/LV
3:44	300/36
5:24	270/0
5:54	250/0
6:50	SD(FDAI)
7:02	SD(OHW)

4:00	0/LV
4:14	300/36
5:56	270/0
6:38	250/0
7:34	SD(FDAI)
7:40	SD(OHW)

4:30	0/LV
4:44	300/36
6:26	270/5
7:32	250/0
8:19	SD

5:00	0/LV
5:14	300/36
6:58	270/5
8:20	250/0
9:03	SD

5:30	0/LV
5:44	300/36
7:34	270/10
9:04	250/0
9:46	SD

6:00	0/LV
6:14	300/36
8:04	270/11
9:50	250/0
10:39	SD

6:30	0/LV
6:44	300/36
8:34	270/11
11:04	250/0
11:47	SD

7:00	0/LV
7:14	300/36
9:06	270/14
12:26	250/0
12:53	SD

7:30	0/LV
7:44	300/36
9:38	270/14
13:38	250/0
13:53	SD

8:00	0/LV
8:14	300/36
10:16	270/15
14:30	250/0
14:43	SD

8:30	0/LV
8:44	300/36
11:12	270/15
15:18	250/0
15:31	SD

9:00	0/LV
9:14	300/36
12:10	270/16
16:04	250/0
16:18	SD

9:30	0/LV
9:44	300/36
12:56	270/16
16:44	250/0
16:58	SD

10:00	0/LV
10:14	300/36
13:16	270/16
17:32	SD

10:30	0/LV
10:44	300/36
13:48	270/16
18:05	SD

11:00	*
	USE MANUAL ASCENT ANGLES

ALL PITCH RATES 5°/SEC

* ESTABLISH POSITIVE HDOT, THEN ABORT STAGE TO USE MANUAL ASCENT ANGLES

APS

1:00	250/0
2:24	SD/(FDAI)
2:36	SD(OHW)

1:30	0/LV
2:10	250/0
3:32	SD(FDAI)
3:52	SD(OHW)

2:00	0/LV
2:40	300/0
3:10	250/0
4:24	SD(FDAI)
4:34	SD(OHW)

2:30	0/LV
3:10	300/0
4:00	250/0
5:18	SD

3:00	0/LV
3:40	300/36
4:22	270/0
5:28	250/0
6:09	SD

3:30	0/LV
4:10	300/36
5:00	270/5
6:30	250/0
7:02	SD

4:00	0/LV
4:40	300/36
5:40	270/5
7:28	250/0
7:56	SD

4:30	0/LV
5:10	300/36
6:22	270/10
8:26	250/0
8:51	SD

5:00	0/LV
5:40	300/36
7:08	270/10
9:20	250/0
9:46	SD

5:30	0/LV
6:10	300/36
7:54	270/12
10:14	250/0
10:42	SD

6:00	0/LV
6:40	300/36
8:44	270/14
11:08	250/0
11:37	SD

6:30	0/LV
7:10	300/36
9:34	270/14
12:02	250/0
12:33	SD

7:00	0/LV
7:40	300/36
10:24	270/14
12:56	250/0
13:28	SD

7:30	0/LV
8:10	300/36
11:12	270/14
13:48	250/0
14:19	SD

8:00	0/LV
8:40	300/36
12:06	270/14
14:26	250/0
15:05	SD

8:30	0/LV
9:10	300/36
13:00	270/14
15:02	250/0
15:50	SD

9:00	0/LV
9:40	300/36
13:54	270/14
15:34	250/0
16:31	SD

9:30	0/LV
10:10	300/36
14:30	270/14
16:12	250/0
17:07	SD

10:00	0/LV
10:40	300/36
14:30	270/14
17:00	250/0
17:37	SD

10:30	0/LV
11:10	300/36
14:48	270/14
17:50	250/0
18:09	SD

11:00	*
	USE MANUAL ASCENT ANGLES

MANUAL ABORT

ASCENT

TIG-2 MASTER ARM - ON
AUDIO MODE (BOTH) - VOX
400+1E GUID STEERING
RESET WATCH

367R   (604+0
START CAMERA   FOR AGS)
- :10 ABORT STAGE - PUSH (AT T=0
ENG ARM - ASC   FOR AGS)
- :05 PRO

+ :00 [ASC]   (171:45:09)

+ :01 ENG START-PUSH (IF AUTO IGN)
CHECK S-BD ANT

N76E (VH, Vv, ΔR)
V16 N77E (Tgo, VY, VI)
KEY RLSE

+4:00 STOP CAMERA
500R
500 FPS MAIN SOV (2) - OPEN·
ASC FEED 2 (2) - CLOSE·
200 FPS ENG ARM-OFF(IF IGN WAS AUTO)
0 FPS ABORT STAGE-RESET
ENG STOP - PUSH

PRO, NULL X < 2 FPS
PRO
STOP DET, RESET WATCH
COPY GET
ENG STOP - RESET
P00
·MCC FOR TWEAK

FOR NO VOICE (TRIM <2 FPS)
PGNS, AGS DIFFER <10 FPS,
TRIM ACTIVE SYSTEM
PGNS, AGS DIFFER >10 FPS,
TRIM SYSTEM THAT AGREES
WITH RR
(10° IN OHW) (0° YAW)
V82

NO AUTO IGNITION
WITHIN 10 SEC:
1. GUID CONT-AGS
STILL NO IGNITION
1. GUID CONT-PGNS
2. ENG START-PUSH

TFI	θ	OHW (0°YAW)	VGX	H DOT	H	SBD
0:00			1080.0	0.0	0	79/-30
0:10			880.0	53.0	300	
0:30	308	39	4810.0	91.0	1800	
1:00	305	38	4640.0	124.0	5100	137/-18
1:30	302	36	4460.0	151.0	9200	
2:00	299	34	4240.0	170.0	14000	142/-15
2:30	296	31	3980.0	183.0	19400	
3:00	293	29	3700.0	190.0	25000	147/-11
3:30	289	27	3380.0	190.0	30700	
4:00	285	24	3020.0	184.0	36300	152/-6
4:30	282	22	2640.0	173.0	41700	
5:00	278	19	2230.0	157.0	46600	158/-1
5:30	274	17	1790.0	135.0	51000	
6:00	269	14	1320.0	109.0	54700	164/4
6:30	265	11	810.0	80.0	57500	
7:00	260	8	270.0	49.0	59500	170/11
7:14	257	6	0.0	32.0	60100	172/13

MANUAL ASCENT (WILL NOMINALLY
BE TARGETED 11.5 MIN LATE)
CONFIGURATION NOMINAL EXCEPT:
MODE CONT - ATT HOLD
PROFILE NOMINAL EXCEPT:
7-STEP FOR DIRECT MODE

TFI	FDAI	OHW
0:00	0	
0:15	305	38
2:00	295	31
3:00	290	28
4:00	285	24
5:00	275	18
6:00	265	11
7:00	260	8

PITCH RATES
5°/SEC

MSFN WILL CALL PITCH AND
ROLL BIAS COMMANDS FROM
GROUND TRACKING.

6+30 - MAIN SOV(2) - OPEN+
ASC FEED 2 (2) - CLOSE·

SHUTDOWN
ENGINE ARM OFF
STANDBY TO RESET ABORT STAGE
Pb AND DEPRESS ENGINE STOP
Pb ON CALL FROM MSFN

TIME	RANGE	RDOT
LO+5	142	1652
LO+6	154	802
LO+7	157	-191
INS	156	-447
1+00	152	-444
2+00	148	-440
3+00	143	-436
4+00	139	-432
5+00	135	-426
6+00	130	-421
7+00	126	-415
8+00	122	-408
9+00	118	-401
10+00	114	-394

INSERTION 171:52:23

V82
V76
AGS MODE CONT-ATT HOLD
RR MODE-LGC
RATE/ERR MON(2)-RNDZ RDR ★
SHFT/TRUN +5
RATE SCALE 5°/SEC
RNG/ALT MON-RNG/RNG RT
   *VHF ANT-FWD ★
   *400+2 Z-AXIS STEER ★
   *410+4 TPI EXEC ★
   *373+0159.3 TIG TPI ★
   *616+00005 ULLAGE ★
   *623+0 ★
   *COPY AGS DATA ★
AUDIO MODE(2)-ICS/PTT ★
✓INV 2, CB INV 1-OPEN ★
CB(11) & (16) ED: LOGIC PWR-OPEN
CB(11) ECS CABIN FAN1-CLOSE

ATT CONT-
PULSE
MODE CONT-
AUTO

+1 GO/NO-GO FOR TWEAK
P47 FDAI (0,257,0)
   *404+0, 405+0, 406+0 ★
   *MONITOR 470, 471, 472 ★
+3 TWEAK 171:55:23

△V'S

INSERTION THRU TPI

P47 FDAI (0,242,0) OR 10° OHW
   *404+0, 405+0, 406+0 ★
   *MONITOR 470, 471, 472 ★

40 LM BAILOUT @ L.O.+12:10

TIG	171:57:23	
△VX	41.0	

   *EXT LTG-TRACK ★
P20, AUTO MNVR
V80, MAX N49(2.00,12.0)
P34 TGT TPI

RR-AUTO
TRACK

   *VERIFY PGNS WITH MSFN ★
   *V47, 414+1, 400+3 ★
   *400+2 Z-AXIS STEER ★
   *417+1 (✓417+0) ★
   *411+1 START AUTO(19,18) ★
   *310R SET DET ★
   *303R θ TPI ★
V82
V83 SET ORDEAL (35NM)
   *317R, 440R, 277R ★
V48, 12012
LM WT _____

35 CSM BAILOUT GET P76 PAD

30 CHART R/RDOT [ ] [ ] ⟨R

SS

27 RDOT ⟨R

M=15, V32

24 RDOT ⟨R

   *COMPARE CMC,AGS,VHF/RR ★
   *POLAR PLOT @ 90 NM ★

21 RDOT ⟨R

18 RDOT ⟨R

   *CHECK RCS, EPS, ECS ★

---

15 RDOT ⟨R
   *514+0 ★
   *515+4 YAW STEER VEC ★
   *516+0 ★

   *MATCH INDICATED ANGLES ★
   *TRACK MODE-SLEW ★
   *S-BD ANT-AFT ★
     SET P _____ (+125) ★
        Y _____ (-55) ★
   *BIOMED-OFF, PCM-HI ★
   *UPLINK SQUELCH-ENABLE ★

12 RDOT ⟨R

10 CHART R/RDOT/≡ [ ] [ ]
9 RDOT ⟨R
8 PRO-FINAL COMP

   *411+0 STOP AUTO ★
6 *COMPARE CMC, AGS ★
CHECK TIG OF CSM
   *✓DET & APS BURN CARD ★
P42 N86
PERFORM YAW/ROLL MANEUVER
   *404+0, 405+0, 406+0 ★
   *623+1 ★
   *400+1 GUID STEER
5 *410+5 ★
   *500R _____

ATT CONT-
MODE CONT

1:00 AGS MODE CONT-AUTO
:30 ABORT STAGE PB-PUSH
:10 MANUAL ULLAGE
:05 PRO
:00 TPI 172:39:23
ABORT STAGE PB-RESET
NO IGNITION
ENG ARM-ASC
MANUAL START
MANUAL STOP 3 SEC
ENG ARM-OFF
NULL RESIDUALS

LOS

Column 1:

```
0  TPI  172:39:23
   V76, AGS MODE CONT-ATT HOLD
   P35 TGT MCC 1      ATT CONT-PULSE
   MAX N49(0.80,5.0)  MODE CONT-AUTO
   V67 (+02000,+00020,+00005)
      *400+0                  *
      *623+0                  *
      *417+1 (√621+0)         *          SR
      *411+1 START AUTO(13,12) *
2                                     ЗR
      *410+4 TPI EXEC         *
      *373+TPI TIME +15 MIN   *
      *307+028.00             *

4                          RDOT  ЗR

6                          RDOT  ЗR

8                          RDOT  ЗR

9  CHART                          *

10                         RDOT  ЗR

12 PRO FINAL COMP          RDOT  ЗR

13 CHART R/RDOT/
      *411+0 STOP AUTO      *
                 370R TOTAL VEL MCC1
                 371R ΔV TPF

      *404+0, 405+0, 406+0   *
   P41, V77

14    *410+5           ATT CONT-
      *502R            MODE CONT

:05   *472R/502R        *A/H
15 MCC1
   NULL RESIDUALS
```

Column 2:

```
V76
P35 TGT MCC 2      ATT CONT-PULSE
V93                MODE CONT-AUTO
   *VERIFY PGNS (PCM-HI)    *
   *V47, 414+1, 400+3       *
   *411+1 START AUTO        *     AOS
   *EXT LTG-OFF             *

17                                    ЗR
      *410+4 TPI EXEC        *
      *373+TPI TIME +30 MIN  *
      *307+013.00            *

19                         RDOT  ЗR

21                         RDOT  ЗR

23                         RDOT  ЗR

24 CHART                          *

25                         RDOT  ЗR

27 PRO-FINAL COMP          RDOT  ЗR

28 CHART R/RDOT/
      *411+0 STOP AUTO      *
                 370R TOTAL VEL MCC2
                 371R ΔV TPF

      *404+0, 405+0, 406+0   *
   P41, V77

29    *410+5           ATT CONT-
      *502R            MODE CONT

:05   *472R/502R        *A/H
30 MCC2
   NULL RESIDUALS
```

Column 3:

```
P00
V48, 11002
P47, V63
   *404+0, 405+0, 406+0      *

   *S-BD ANT-AFT,VERIFY COMM*
   */S-BD P ____  (+125)     *
         Y ____  (-55)       *
   *S-BD ANT-SLEW (>3.0)     *
   *TRACK MODE-AUTO          *
   *BIOMED-LEFT, PCM-HI      *
   *UPLINK SQUELCH-OFF       *
TPI BURN REPORT

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

   *SETUP CAMERA FOR         *
   *  DOCKING:               *
   *LM3/DAC/10/CEX-ULC       *
   *  (T8,1/250,6) 1FPS      *
   *  .25 MAG(0), (4MIN)     *

V34, P00
V76                      ATT CONT-PULSE
MANEUVER/PICTURES OF SIMBAY,RCS
55 INITIATE DOCKING
COAS TO OVHD WINDOW
   *EXT LTG-DOCK             *
SHFT/TRUN ±50                *
V41N72 (+000,+320)
CB RR(2)-OPEN, V44
FDAI (180,282,300)
V77                      ATT CONT-
65 CONTACT               MODE CONT

CONFIRM CAPTURE FROM CSM
MODE CONT (BOTH)-OFF
```

__173:55__

CONFIGURE S-BAND

1 Verify FWD Dump VLV - AUTO
   CB(11): ECS CABIN FAN 1 - OPEN
   TAPE RECORDER - OFF
   CSM Maneuvers To JETT ATT, Proceed With
   "PREP FOR TRANSFER"Until Maneuver Completed

2 Verify: Jettison Attitude (330,XXX/~~303~~ 236,046)
            CSM in Narrow Deadband, Attitude Hold

3 S-BAND: PM,SEC,PRIM,VOICE,PCM,RANGE,RIGHT,HI
   S-BD ANT - ~~FWD~~, Verify COMM
   TRACK MODE - SLEW _AFT_
   S-BD P _____ (+205)
       Y _____ (+ 62)
   S-BD ANT - SLEW "(Peak Until >3.9)"
      (DO NOT PLACE TRACK MODE - AUTO)

__174:00__

PREP FOR TRANSFER

1 Window Shades (3) - Close
   Install Crash Bars
   Verify Tunnel Pressurized From CSM
   OVHD Dump VLV - OPEN

2 Doff Helmets and Gloves

3 Install Purse (ISA Bottom Pkt)
   Remove & Stow In Purse:
      CWG Adapter W/Cap (2, Fwd LHSSC)
      Purge Vlv   (1, Aft LHSSC)
      Padded Sample Bags (2, LHSSC)
      Waist Tethers (2, Fwd RHSSC)
      Neck Ring Dust Covers (2, AFT RHSSC)
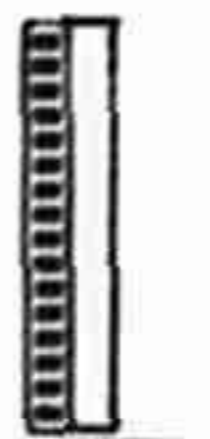
SS
174
+08

LOS
174
+27

SR
174
+54

4 Remove RH Window SEQ Camr, place Mag 0 In
      ISA Top Pkt(Bag) & Stow 16mm Camr In Purse
   Disconnect Lower ISA Hooks
   Stow LHSSC Collection Bag Aft of Engine
      Cover

5 When Tunnel/LM Pressures Equal,
      OVHD DUMP VLV - AUTO
   Verify PRESS REGS A&B - EGRESS
   Place LEVA Bags On Floor, Right Side-Fwd

6 Open Hatch
   Receive Probe From CMP, And Stow On Left
      Hand Side Using Outboard (Double)
      Restraint Cable
   Receive Drogue From CMP and Stow Over
      Probe Using Inboard (Single) Restraint
      Cables Through Drogue Handles

7 Receive Vacuum Cleaner Assembly From CMP
   Transfer LEVA Bags, Helmets, & IV Gloves
      w/Liner to CMP

8 Vacuum PGA's

9 CB(11) AC BUS A: TAPE RCDR - Open
                 COMM: CDR AUDIO - Open
   CB(16) COMM: DISP - Open
              : S.E. AUDIO - Open
   Disconnect DSEA & Place In Purse
   CB(11) COMM: CDR AUDIO - Close
   CB(16) COMM: DISP - Close
              : S.E. AUDIO - Close

AOS
175
+10

10 Receive Decontamination Bags & Jett Bag
      From CSM
   Transfer Purse To CSM

11 Unstow, Vacuum/Wet Wipe as required and
      Transfer to CSM:
      (*Decontamination Bag Provided)
      70MM Magazines (4 and 3 in Bags, RHSSC)
                     (3 and 3 in Bags, Bot
                         Boot Compt)
      16MM Magazines (6 in Bag, RHSSC)
      PPK's (3, LHMS - AFT SRC's)
      Flag Kit (LHMS - AFT SRC's)
      OPS (W/Highest Source Pressure), Perform
        Checkout per Decal
      *UV Cassette (Upper Boot Cmpt)
      *Penetrometer Drum (Upper Boot Cmpt)
      *Cosmic Ray Detector (Recharge Station)
      Core Stems (+Z27)
      Flight Data File (Place In Jett Bag➔ **UL LGTS**
        and Transfer to CMP) **ACA's, NETTING, SCALES,**
      AOT GUARD, CLIPS, 16MM CORD, PLIERS, LCG
      ADPT, COAS

      *Collection Bags (1, LHSSC) (1, RHSSC) - A1
      *Collection Bag (1, Recharge Station) - PGA Bag
      *BSLSS Rock Bag (+Z27) - A7
      *ISA - A2
      Collection Bag (Box AFT Eng Cover) - A9

12 Unstow SRC's (2), Vacuum and Transfer to CSM
   Receive B5 & B6 from CSM and Stow in SRC Rack

13 Receive Purse (empty) from CSM

14 Stow Unused Food, used Fecal & Urine Bags
      in Purse

15 Transfer Vacuum Cleaner (Leave Bag in LM)
      & Purse to CSM

175:50

MSFN UPLINK/UPDATE

1 UPDATA LINK - DATA
   MSFN Uplinks LM State Vector, P30
     EXT ΔV Load & P99 Erasable Loads (3)

2 Copy LM DAP Wt & DEORBIT Burn Pad

3 V48, 12021, PRO
   N47 _____ LM WT (From MSFN)
   PRO

4 V47E, 414+1

5 400+3

176:00

TARGET PGNS

1 P30 Target Impact Burn
   N45
   PRO, P00

CONFIGURE AGS

SS
176
+07

1 404+0
   405+0
   406+0
   470R

2 MCC-H GO/NO-GO For LM Closeout

LOS
176
+25

3 Verify All Items in LM TO CM TRANSFER
   LIST (Pg 18) Have been Transferred or
   Will Be Transferred "ON CREW."

<u>176:40</u>

<u>CONFIGURE LM FOR JETTISON</u>

1   VERIFY CSM MIN DB/ATT HOLD
     GUID CONT - PGNS
     PGNS MODE CONT - AUTO (NO DAP Lt - OFF)
     AGS MODE CONT - ATT HOLD
     ATT CONT (3) - MODE CONT
     Verify INV-2

2   VHF A: XMTR - VOICE/RANGE
         : RCVR - OFF
     VHF B: XMTR - OFF
         : RCVR - ON
     BIOMED - OFF

3   ASC FEED (4) - tb-bp
     SYS A&B QUADS (8) - ENABLE; tb-gray
     CRSFD - tb-bp
     SYS A&B MAIN SOV (2) - tb-gray

4   SUIT CIRCUIT RELIEF - AUTO
     SUIT ISOL VLV (Both) - SUIT DISC
     CB(11) COMM: CDR AUDIO - Open
     CB(16) COMM: S.E. AUDIO - Open
           ECS: LCG PUMP - Open
     Both Disconnect LM Hoses & Stow

5   S-BAND VOICE - OFF
     Verify UPDATA LINK - DATA

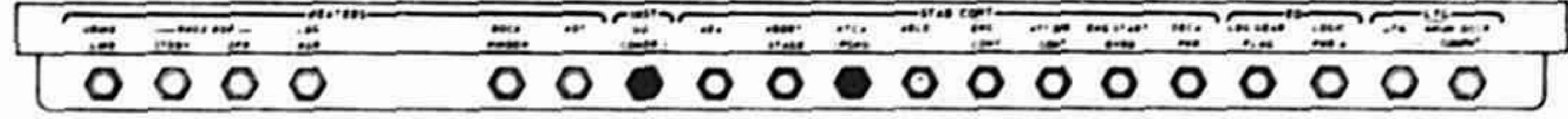6   Configure CB's Per Chart

POST DOCKING
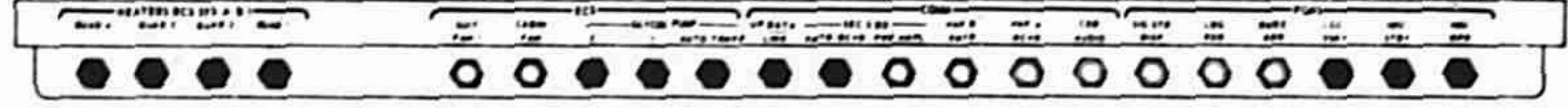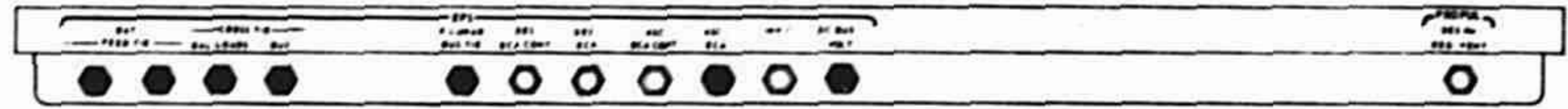
7 - CLOSED

4 - CLOSED
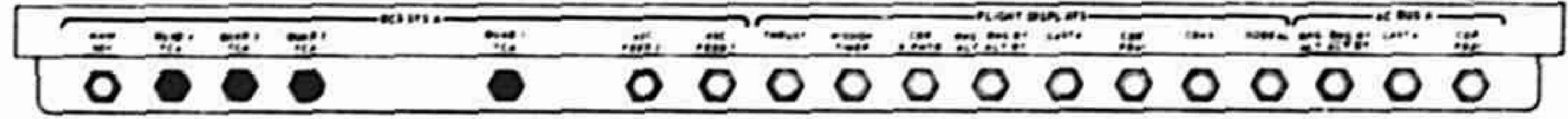
2 - CLOSED

12 - CLOSED

7 - CLOSED

176:50

IVT TO CSM

1   Stow CSM Jet Bag Behind LMP Restraint Cables

2   EXTERIOR LTG - TRACK
     BAT 5&6 BACK UP FEED-ON; tb(2) - Gray
     FLOOD LT - OFF
     Verify OVHD Dump VLV-AUTO
     Transfer To CSM

SR
176
+52

LM TO CM TRANSFER LIST

LM	ITEM	CSM
Floor	LEVA Bag (2) & Contents:	Temp Stwg
	LEVA	
	EV Gloves	
	Helmets (2)	HSB
	IV Gloves w/Liner (2 Pr)	HSB
	Purse & Contents (1st XFR):	
	CWG Adptr w/cap (2)	A8
	EMU Maint Kit (1)	A8
	Purge vlv (1)	L/H TSB
	Waist Tethers (2)	L/H TSB
	LCG Plugs (2)	L/H TSB
	PGA Pocket Contents	L/H TSB
	PGA Elect Conn Covers	PGA Bag
	Neck Ring Dust Covers	PGA Bag
	16mm RH Window SEQ Camr	F1
	DSEA	Temp A7
	Padded Sample Bags (2)	A6
RHSSC	70mm Mag (4) in Bag	R13
RHSSC	70mm Mag (3) in Bag	R13
Boot Compt	70mm Mag (3) in Bag	R13
Boot Compt	70mm Mag (3) in Bag	A8
RHSSC	16mm Mag (6) in Bag	R13
LHMS	PPK's (3)	Temp A7
LHMS	Flag Kit	Temp A7
Floor	OPS	A7
Boot Compt	UV Cassette	A7

LM	ITEM	CSM
Boot Compt	Penetrometer Drum	A7
Rechrg Stat	Cosmic Ray Detector	A7
+Z27	Core Stems	Wire Tray
Data File	Flt Data File in Jett Bag	L/H Couch
LHSSC/RHSSC	Collection Bag (2)	A1
Rechrg Stat	Collection Bag (1)	PGA Bag
+Z27	BSLSS/ROCK Bag	A7
	ISA & Contents:	A2
	Lens Brush (1)	
	16mm Mag (2) in Bag	
	Solar Wind Exp in Bag	
	Collection Bags (2)	
AFT Eng	Collection Bag	A9
SRC Rack	SRC (2)	B5/B6
Temp Stwg	Vacuum Cleaner	RH TSB
	Purse & Contents (2nd XFR):	
	Unused Food	B1
	Used Urine Bags	Fecal Bag
	Used Fecal Bags	Fecal Bag
	Suit (2) & Ancillary Eqpt:	
	Bio Instrumentation (2)	
	UCTA (2)	
	FCS (2)	
	LCG (2)	
	Sunglasses in Pouch (2)	
	Watch/Wrist Mirror/Watchband (2)	
	Pen (2)	
	Pen-Felt Tip (2)	
	Pencil (2)	
	Pocket, C/L & Scissor (2)	
	Pocket, Data (2)	
	Penlight (2)	
	Earplug (2 pr)	
	Dosimeter - Personal (2)	
	Passive (6)	
	Comm Carrier (2)	
	Scissor	

RENDEZVOUS TIMELINES

RELATIVE MOTION TRAJECTORIES

INERTIAL PLOTS

AND

ABORT CHARTS

ABORT
SECTION

PDI DATA
SUMMARY

PDI SUMMARY DATA

3/6/72 Final

PAGE	ABORT TIME PDI+	INS			BOOST TIME INS+	HAM TIME INS+	CSI		CDH			TPI TIME PDI+	AIM		
		TIME PDI+	N76	HA/HINS			TIME INS+	ΔVX	TIME INS+	ΔVX	ΔVZ		TIME PDI+	ΔVX	ΔVZ
A-1	NO 1+12	NA	NA	NA	NA	NA	1+00+00*	46.4	2+02+17*	-121.0	-62.7	2+48+42	12+00	102.3	-50.0
A-2	1+00	2+05	5655.2	137.3/55316.	NA	NA	0+55+00	50.2	1+57+17	-120.3	-42.9	2+47+19	NA	NA	NA
	2+00	3+59	5650.3	136.1/60016.				48.2	1+57+12	-117.9	-39.6				
	3+00	5+41	5646.3	132.8/60018.				47.7	1+57+02	-113.5	-33.7				
	4+00	7+18	5639.3	127.2/60023.				47.5	1+56+46	-106.2	-24.9				
	5+00	8+49	5629.8	119.6/60030.				47.3	1+56+25	-96.8	-14.2				
	6+00	10+13	5617.2	109.6/60038.				47.5	1+55+59	-84.3	-1.1				
	7+00	12+27	5597.2	97.0/65209.				46.0	1+55+24	-67.8	13.6				
A-3	8+00	14+29	5570.9	80.0/70999.				44.5	1+54+38	-45.6	30.2				
	9+00	16+06	5546.2	63.2/74096.				43.7	1+53+52	-23.0	43.4				
	10+00	17+15	5529.7	49.9/71992.				44.0	1+53+16	-4.7	51.0				
A-4	11+00	18+20	5554.2	65.7/67668.	50+00	1+50+00	2+40+00	35.3	3+38+59	-26.1	-37.3	4+46+08	NA	NA	NA
	12+00	19+23	5550.5	59.9/62010.				38.0	3+38+46	-19.8	-23.2				
	13+00	20+26	5541.9	52.7/60244.				39.9	3+38+29	-11.5	-6.1				
	14+00	21+26	5534.3	47.2/60242.				40.7	3+38+16	-4.8	6.2				
	15+00	22+25	5526.7	41.7/60241.				41.2	3+38+02	2.2	17.4				
	16+00	23+25	5519.1	36.2/60239.				41.6	3+37+48	9.4	27.7				
	17+00	24+24	5511.5	30.8/60238.				41.8	3+37+34	16.9	36.9				
A-5	T2-1	7+22Ω	5510.4	29.8/60154.	50+00	3+50+00	4+40+00	36.5	5+37+20	23.0	54.4	6+44+52	NA	NA	NA
A-6	NO 2+12	NA	NA	NA	1+07+00*	2+07+00*	3+07+00*	39.3	4+09+42*	-129.6	2.0	4+50+48	12+00	112.0	-50.0
A-7	1+00	2+07	5666.7	146.3/54651.	1+00+00	2+00+00	3+00+00	40.9	4+02+43	-132.1	-9.3	4+50+55	NA	NA	NA
	2+00	4+00	5661.5	145.2/60017.				38.7	4+02+38	-129.9	-6.8				
	3+00	5+43	5659.5	143.6/60019.				38.1	4+02+32	-127.2	-1.4				
	4+00	7+19	5656.2	140.9/60024.				37.5	4+02+24	-123.4	6.7				
	5+00	8+50	5651.5	137.1/60031.				37.2	4+02+13	-118.2	17.3				
	6+00	10+15	5645.6	132.3/60039.				36.7	4+01+59	-112.0	29.4				
A-8	7+00	12+32	5657.3	145.0/65451.	NA	NA	0+55+00	43.7	1+57+30	-125.5	-52.6	2+52+06	NA	NA	NA
	8+00	14+33	5632.3	128.0/71163.				43.3	1+56+46	-105.7	-26.5				
	9+00	16+10	5609.0	111.2/74179.				43.3	1+56+01	-85.4	-4.0				
	10+00	17+19	5593.7	98.0/72050.				44.2	1+55+26	-68.9	11.5				
A-9	11+00	18+22	5581.0	85.9/67701.				45.4	1+54+54	-53.4	23.9				
	12+00	19+24	5569.4	74.0/62035.				46.8	1+54+22	-37.8	34.3				
	13+00	20+26	5551.4	59.7/60246.				47.2	1+53+43	-18.6	44.5				
A-10	14+00	21+26	5536.6	48.8/60243.				47.1	1+53+14	-3.6	50.7				
	15+00	22+25	5521.5	37.9/60240.				46.8	1+52+44	11.7	55.1				
A-4	T2-2	7+22Ω	5510.4	29.8/60154.	50+00	1+50+00	2+40+00	42.0	3+37+31	17.9	38.9	4+50+52	NA	NA	NA

Ω INDICATES TIME IS REFERENCED TO LIFT-OFF.   * INDICATES TIME IS REFERENCED TO PDI.

RANGE AND RANGE RATE AT INS AND 10 MINUTES PRIOR TO SUBSEQUENT BURNS

3/1/72

PAGE	ABORT TIME PDI+	INS RANGE	INS RANGE RATE	BOOST RANGE	BOOST RANGE RATE	HAM RANGE	HAM RANGE RAGE	CSI RANGE	CSI RANGE RATE	CDH RANGE	CDH RANGE RATE
A-1	NO 1+12	NA	NA	NA	NA	NA	NA	193.3	-526.5	104.3	-109.6
A-2	01+00	160.9	559.5	NA	NA	NA	NA	178.2	-526.3	105.3	-123.0
	02+00	157.5	545.2					173.2	-514.9	101.2	-123.1
	03+00	143.7	526.8					159.1	-491.3	100.4	-129.1
	04+00	119.0	493.6					135.5	-447.3	101.5	-112.0
	05+00	84.1	414.6					101.6	-373.1	98.5	-136.3
	06+00	49.9	85.5					58.4	-224.1	96.7	-149.7
	07+00	74.4	-428.8					33.2	243.6	96.4	-157.6
A-3	08+00	149.9	-468.5					86.2	196.7	96.1	-168.7
	09+00	224.5	-446.9					145.0	60.2	94.1	-176.6
	10+00	283.6	-424.8					190.7	-46.0	94.4	-182.2
A-4	11+00	335.5	-443.0	263.0	75.6	212.3	-378.0	81.5	24.3	99.3	-88.2
	12+00	387.7	-429.2	311.8	32.1	236.2	-385.3	106.5	-6.0	98.7	-101.2
	13+00	437.3	-415.9	357.9	-9.7	258.9	-390.0	131.1	-57.9	97.5	-111.8
	14+00	487.5	-402.0	404.2	-52.8	282.0	-392.2	153.0	-68.3	96.0	-121.2
	15+00	537.5	-388.0	450.1	-96.4	305.0	-392.3	175.9	-102.6	95.4	-130.6
	16+00	587.1	-374.0	495.3	-140.6	328.1	-390.4	198.2	-139.0	93.4	-138.2
	17+00	636.3	-359.8	540.0	-185.3	351.2	-386.7	220.1	-177.4	92.3	-149.4
A-5	T2-1	983.5	-305.9	895.9	-197.7	362.6	-350.9	245.2	-206.3	84.5	-154.7
A-6	NO 2+12	NA	NA	381.6	-726.1	158.0	468.2	195.2	-618.9	95.9	-160.2
A-7	01+00	381.1	618.1	373.0	-718.7	143.8	479.3	193.2	-611.4	103.9	-165.2
	02+00	378.2	604.0	368.1	-707.7	144.6	468.7	190.2	-603.0	99.1	-163.7
	03+00	364.3	594.8	352.8	-695.9	137.3	465.8	180.2	-588.6	101.1	-158.2
	04+00	338.8	583.8	327.3	-674.3	126.0	464.8	166.2	-565.8	99.2	-165.6
	05+00	300.2	570.2	289.8	-642.7	108.7	463.4	146.2	-530.3	97.3	-175.8
	06+00	247.0	551.9	238.9	-597.2	85.8	455.0	120.4	-475.0	96.4	-178.8
A-8	07+00	178.7	544.3	NA	NA	NA	NA	188.6	-540.8	102.7	-123.9
	08+00	99.5	455.1					115.8	-406.9	101.2	-135.0
	09+00	48.7	40.3					55.2	-203.7	98.1	-152.8
	10+00	69.8	-414.7					32.1	211.8	97.1	-156.9
A-9	11+00	114.4	-470.5					58.2	260.1	94.6	-164.5
	12+00	164.5	-466.4					97.0	166.5	92.1	-168.9
	13+00	213.5	-451.3					135.3	74.9	91.6	-171.7
A-10	14+00	264.0	-432.4					174.2	-18.6	90.7	-175.7
	15+00	314.6	-412.2					212.5	-112.5	88.3	-175.1
A-4	T2-2	654.0	-356.5	556.8	-194.8	363.0	-386.3	231.6	-185.9	93.2	-141.3

RANGE
RANGE RATE

INSERTION THRU BOOST

60 INSERTION

```
        V82
        AGS MODE CONT-ATT HOLD
        SHFT/TRUN ±5                    ATT CONT-
        RATE SCALE 5°/SEC                PULSE
        RNG/ALT MON-RNG/RNG RT         MODE CONT-
           *VHF ANT-FWD                  AUTO
           *EXT LTG-TRACK        *
           *SEQUENCE CAMERA-OFF  *
           *400+2                *
           *616+00005 ULLAGE     *
           *623+0                *
           *RATE/ERR MON-RNDZ RDR *
        AUDIO MODE(2)-ICS/PTT    *
        /INV 2, CB INV 1-OPEN    *
        CB(11) & (16) ED: LOGIC PWR-OPEN
        CB PGNS LDG RDR-OPEN
        CB RR(2)-CLOSE


        V48, 1 (2) 1002

        V41N72 (+000, +283)
        CB RR(2)-OPEN, V44
        RATE/ERR MON-LDG RDR/CMPTR
        P52 OPT 3
        CB AOT LAMP-CLOSE
        AOT DETENT F/0°
        V76
        1st STAR _____
        2nd STAR _____
        N05 ANG DIFF _____
        PRO
        N93 TORQUING ANG
            X _____
            Y _____
            Z _____
        PRO N25(R1=14) GET
        PRO N25(R1=15)
        PRO TO PICAPAIR
        DETENT CL
        CB AOT LAMP-OPEN
```

40 V34
```
    P00
        *VERIFY PGNS WITH MSFN  *
        *V47, 414+1, 400+3      *
        *400+2                  *


    V48, 1 (2) 2022

        *MATCH INDICATED ANGLES *
        *TRACK MODE-SLEW        *
        *S-BD ANT-AFT           *
         SET P _____        *
             Y _____        *
        *BIOMED-OFF, PCM-HI     *
        *UPLINK SQUELCH-ENABLE  *
```

SS
LOS
LOS
30
20

20

18
```
        *CHECK RCS, EPS, ECS    *
```

10
```
        *VERIFY PGNS (PCM-HI)   *
        *V47, 414+1, 400+3      *
        *400+2                  *
```
SR
```
        *EXT LTG-OFF            *

        ΔVX = +10.0 (HORZ)
    P30
    N33 TIG BOOST (INS + ΔT)
        *373 +      TIG BOOST   *
    IF STAGING @ BOOST
    V48, 12022, PRO, V34
    P41, V77
        *404+0, 405+0, 406+0    *
        *400+1 GUID STEER   ATT CONT-
    5   *410+5 LOAD ΔV      MODE CONT
        *500R _____         *

    :05   *500R _____        A/H
    STAGE AT BOOST IGNITION
    0 BOOST
```

60 BOOST

```
P00
V82
V76
   *400+2 Z-AXIS STEER      ATT CONT-
   *416+1 1/2 PERIOD         PULSE
   *410+1 TGT CSI        MODE CONT-
   *373+_____ TIG CSI        AUTO
   *275+_____ TIG TPI    *
   *605+00777 COT        *
   *310R SET DET (-60 MIN) *
   *402R_____ ΔH         *
```

```
50
```

AOS

```
*S-BD ANT-FWD,VERIFY COMM*
*/S-BD P _____          *
      Y _____           *
*S-BD ANT-SLEW (>3.0)    *
*TRACK MODE-AUTO         *
*BIOMED-LEFT, PCM-HI     *
*UPLINK SQUELCH-OFF      *
```

```
40
```

```
40
V48, 12012
(IF R <400)
CB RR(2)-CLOSE              *
RATE/ERR MON-RNDZ RDR
RR MODE-LGC
P20, AUTO MNVR          RR-AUTO
V80, MAX N49(2.00,12.0)  TRACK

P32, TGT CSI
N11 TIG CSI (INS + ΔT)
N37 TIG TPI (PDI + ΔT)
  *VERIFY PGNS WITH MSFN  *
  *V47, 414+1, 400+3      *
  *400+2 Z-AXIS STEER     *
   *417+1 (/417+0)        *
   *411+1 START AUTO(19,19)*

V83 SET ORDEAL
   *317R, 440R, 277R      *
   *COMPARE VHF/RR        *
36                      ]R

33                    RDOT ]R

30                    RDOT ]R

27                    RDOT ]R

24                    RDOT ]R
M=10,V32
```

```
21                      RDOT ]R

18
     *CHECK RCS, EPS, ECS    RDOT ]R
                             *

15
   V90                   RDOT ]R

12                       RDOT ]R

     *402R _____            *
```

10 PRO-FINAL COMP
```
     *411+0 STOP AUTO        [*]
     *USE HAM CHART          *
     *COMPARE CMC HAM        *

   V83, SET ORDEAL
     *317R, 440R, 277R      *

   P30
   N33 TIG HAM (INS + ΔT)
     *373+_____ TIG HAM      *

   P41, V77, N86
     *400+1 GUID STEER  ATT CONT-
5    *410+5 LOAD ΔV    MODE CONT
     *370R _____ TOT ΔV      *
     *500R _____            *

:05  *500R                 A/H
```
0 HAM
```
P00
V82
```

MISSION APOLLO 16, FEBRUARY 29, 1972

TIME	RANGE	RDOT
INS	282	-453
1+00	278	-449
2+00	273	-444
3+00	269	-439
4+00	264	-433
5+00	260	-427
6+00	256	-420
7+00	252	-413
8+00	248	-405
9+00	244	-397
10+00	240	-389

NOM COELLIPTIC/ONE REV ABORTS

INSERTION

V82
AGS MODE CONT-ATT HOLD | ATT CONT-
RR MODE-LGC | PULSE
SHFT/TRUN ±5 | MODE CONT-
RATE SCALE 5°/SEC | AUTO
RNG/ALT MON-RNG/RNG RT
  *VHF ANT-FWD   *
  *SEQUENCE CAMERA-OFF   *
  *616+00005 ULLAGE   *
  *605+00777 COT   *
  *RATE/ERR MON-RNDZ RDR   *
AUDIO MODE(2)-ICS/PTT   *
√INV 2, CB INV 1-OPEN   *
CB(11) & (16) ED: LOGIC PWR-OPEN
CB(11) ECS CABIN FAN1-CLOSE
CB RR(2)-CLOSE

  *400+2 Z-AXIS STEER   *
  *507+0 Z-AXIS TRACT   *
  *623+0   *
  *410+1 TGT CSI   *
  *373+____ TIG CSI   *
  *275+____ TIG TPI   *
  *416+1 1/2 PERIOD   *
  *310R SET DET   *
  *COPY AGS DATA(450R)   *

V48, 11002
V41N72 (+000, +283)
CB RR(2)-OPEN, V44   RR-AUTO
RATE/ERR MON-LDG RDR/CMPTR   TRACK
P52 OPT 3
CB AOT LAMP-CLOSE
AOT DETENT F/0°
V76
1st STAR NUNKI (37)
2nd STAR SPICA (26)   417+1 LOS
45   ≩R
42   RDOT ≩R
39   RDOT ≩R
N05 ANG DIFF
PRO
N93 TORQUING ANG
  X _____
  Y _____
  Z _____
PRO N25(R1=14) GET
PRO N25(R1=15)
PRO TO PICAPAIR
DETENT CL
CB AOT LAMP-OPEN
  *EXT LTG-TRACK   *
36 V34   RDOT ≩R
V48, 12012
CB RR(2)-CLOSE
RATE/ERR MON-RNDZ RDR
P20, AUTO MNVR
V80, MAX N49(2.00,12.0)
P32, TGT CSI
  *VERIFY PGNS WITH MSFN   *
  *V47, 414+1, 400+3   *
  *400+2   *
  *417+1 (√417+0,621+0)   *
45 *411+1 START AUTO(19,19)   *
V83 SET ORDEAL (35NM)
  *317R, 440R, 277R   *
33   RDOT ≩R

30 CHART RDOT   RDOT ≩R
27   RDOT ≩R
24   RDOT ≩R
   M=10, V32
21   RDOT ≩R
20 CHART RDOT
     *COMPARE CMC,AGS,VHF/RR *
     *MATCH INDICATED ANGLES *
     *TRACK MODE-SLEW   *
     *S-BD ANT-AFT   *
       SET P ____ (-7)   *
            Y ____ (+22)   *
     *BIOMED-OFF, PCM-HI   *
     *UPLINK SQUELCH-ENABLE *
18   RDOT ≩R
     *CHECK RCS, EPS, ECS   *
15   RDOT ≩R
   V90 OBTAIN CMC LM YDOT
12   RDOT ≩R
10 CHART R/RDOT   *
PRO-FINAL COMP
N81 LOAD CMC LM YDOT(IF>5fps)
9   RDOT ≩R
   N13 CDH TIG TO CSM
     *411+0 STOP AUTO   [*]
     *COPY AGS DATA   [*]
   CB(11) ECS CABIN FAN1-OPEN
   V83 SET ORDEAL
     *317R, 440R, 277R   *
   P41, V77, N86
5   *410+5   ATT CONT-
     *370R ____ TOT ΔV   MODE CONT
     *ΔV's TO CSM   *
:05 *500R/502R   *A/H
:00 CSI
   NULL RESIDUALS

58 CSI
V76
P33 TGT CDH
MAX N49(0.80,5.0)
V67 (+02000,+00020,+00005)
```
ATT CONT-PULSE
MODE CONT-AUTO
```

*417+1 (√621+0)   *
*410+2 TGT CDH   *
*373R TM CDH   *
*310R SET DET   *
*COPY AGS DATA   *
55 *411+1 START AUTO(19,19)*

V82

V83 SET ORDEAL (45NM)
*317R, 440R, 277R   *

54   }R

51 M=7, V32   RDOT }R

48 V90, LOAD CDH-30 RDOT }R
*COMPARE CMC,AGS,VHF/RR *

SR

45   RDOT }R

M=15, V32

42   RDOT }R

---

39 V34, P30 (PC ONLY)   RDOT }R
38 *411+0 STOP AUTO   *

V90 LOAD CDH-30
OBTAIN CMC LM YDOT

36 CHART RDOT   RDOT }R

P41, V77

*373+ ___   TIG PC
35 *410+5 LOAD ΔV   ```ATT CONT-
MODE CONT```
*263R
*501R

:05 *270R/501R   *A/H
30 PLANE CHANGE

S-BD ANT-FWD,VERIFY COMM
*√S-BD P ___ (-7)   *
Y ___ (+22)   *
*S-BD ANT-SLEW (>3.0)   *
*TRACK MODE-AUTO   *
*BIOMED-LEFT, PCM-HI   *
*UPLINK SQUELCH-OFF   *

CSI BURN REPORT
TIG,ΔV'S, RESIDUALS

V76
P33 TGT CDH   ```ATT CONT-PULSE
V93   MODE CONT-AUTO```
*VERIFY PGNS WITH MSFN   *
*V47, 414+1, 400+3   *
*400+2 Z-AXIS STEER   *
*410+2 TGT CDH   *
373+ ___   TIG CDH IF PC
*451+0 YDOT   *
*COPY AGS DATA   *
28 *411+1 START AUTO   *

27   }R

AOS

---

24   RDOT }R
23 CHART RDOT
21   RDOT }R
M=7, V32
*COMPARE CMC,AGS,VHF/RR *
18   RDOT }R
*CHECK RCS, EPS, ECS   *
15   RDOT }R
V90 OBTAIN CMC LM YDOT
12   RDOT }R
10 CHART RDOT   *
PRO-FINAL COMP
N81 LOAD CMC LM YDOT
9   RDOT }R
*411+0 STOP AUTO   *
*VERIFY PGNS (PCM-HI)   *
*V47, 414+1, 400+3   *
*400+2 Z-AXIS STEER   *
*COPY AGS DATA   *
V83, SET ORDEAL
*317R, 440R, 277R   *

P41, V77, N86
(LARGE ΔV USE APS OR DPS)
5 *410+5   ```ATT CONT-
*370R ___ TOT ΔV   MODE CONT```
*500R   *
*502R   *

:05 *500R/502R   *A/H
:00 CDH
NULL RESIDUALS

```
53 CDH
   V76
   P34 TGT TPI        ATT CONT-PULSE LOS
   MAX N49(0.80,5.0)  MODE CONT-AUTO
   V93
      *417+1 (√621+0)          *
      *SET DET                 *
   V82
      *410+3 TPI SRCH          *
      *310+TIME TO TPI         *
      *303R θ TPI              *
      *410+4 (When 303=26.6)   *
43    *411+1 START AUTO(19,19)*
      *POLAR PLOT @ 75 NM      *
                              310R

42                             }R

39 M=7, V32             RDOT  }R
      *COMPARE TPI TIME        *
36                      RDOT  }R

33                      RDOT  }R

30                      RDOT  }R

27                      RDOT  }R
   *MONITOR 303R θ TPI AND *
   *RETARGET IF REQ          *
   *COPY AGS DATA            *
24                      RDOT  }R
   M=15, V32
      *COMPARE CMC,AGS,VHF/RR *
      *VOICE LM TPI TIME       *
      * TO CSM                 *
21                      RDOT  }R

18                      RDOT  }R
   *CHECK RCS, EPS, ECS      *
```

```
15                            RDOT  }R
      *MATCH INDICATED ANGLES *
      *TRACK MODE-SLEW         *
      *S-BD ANT-AFT            *
         SET P ____ (+236)     *
             Y ____ (+51)      *
      *BIOMED-OFF, PCM-HI      *
      *UPLINK SQUELCH-ENABLE   *

12                            RDOT  }R

   ┌─────────────────────────────┐
   │*VERIFY PGNS (PCM-HI)      * │
   │*411+0 STOP AUTO           * │
   │*V47, 414+1, 400+3         * │
   │*400+2 Z-AXIS STEER        * │
   └─────────────────────────────┘

10 PRO-FINAL COMP
   TIG TO CSM
      *SET DET                 *
9  CHART θ                    RDOT  }R

      *411+0 STOP AUTO        [*]
      *410+3                   *
      *310+TIME TO TPI         *
      *303R θ TPI              *
      *410+4 (WHEN 303=26.6)   *
      *310R √ WITH DET         *
      *COPY AGS DATA           *

5  CHART R/RDOT/θ

   P41, V77, N86
      *404+0, 405+0, 406+0     *
4     *410+5 LOAD ΔV & TIG     *
      *507+1 THR Z-AXIS   ATT CONT-
      *502R ____          MODE CONT
:05   *472R/502R              *A/H
:00 TPI
   NULL RESIDUALS
```

SS

Column 1

```
0  TPI
   V76
      *507+0 Z-AXIS TRACT        *
   P35 TGT MCC 1        ATT CONT-PULSE
   MAX N49(0.80,5.0)    MODE CONT-AUTO
   V93
      *417+1 (√621+0)            *
      *411+1 START AUTO(13,12) *

2
      *410+4 TPI EXEC            *        }R
      *373+TPI TIME +15 MIN      *
      *307+028.00                *

4                            RDOT  }R

6                            RDOT  }R

8                            RDOT  }R

9  CHART                          *

10                           RDOT  }R

12 PRO FINAL COMP           RDOT  }R

13 CHART R/RDOT/
      *411+0 STOP AUTO         *
                     370R TOTAL VEL MCC1
                     371R ΔV TPF

      *404+0, 405+0, 406+0       *
   P41, V77

14    *410+5                ATT CONT-
      *502R _____            MODE CONT

:05   *472R/502R                *A/H
15 MCC1
   NULL RESIDUALS
```

Column 2

```
                 TPI THRU DOCKING

   V76
   P35 TGT MCC 2      ATT CONT-PULSE
   V93                MODE CONT-AUTO

      *VERIFY PGNS (PCM-HI)      *
      *V47,414+1,400+3           *
      *400+2 Z-AXIS STEER        *
      *411+1 START AUTO          *

17
      *410+4 TPI EXEC            *        }R
      *373+TPI TIME +30 MIN      *
      *307+013.00                *
      *EXT LTG-OFF               *

19                           RDOT  }R

21                           RDOT  }R

23                           RDOT  }R

24 CHART                          *

25                           RDOT  }R

27 PRO-FINAL COMP           RDOT  }R

28 CHART R/RDOT/
      *411+0 STOP AUTO         *
                     370R TOTAL VEL MCC2
                     371R ΔV TPF

      *404+0, 405+0, 406+0       *
   P41, V77

29    *410+5                ATT CONT-
      *502R _____            MODE CONT

:05   *472R/502R                *A/H
30 MCC2
   NULL RESIDUALS
```

Column 3
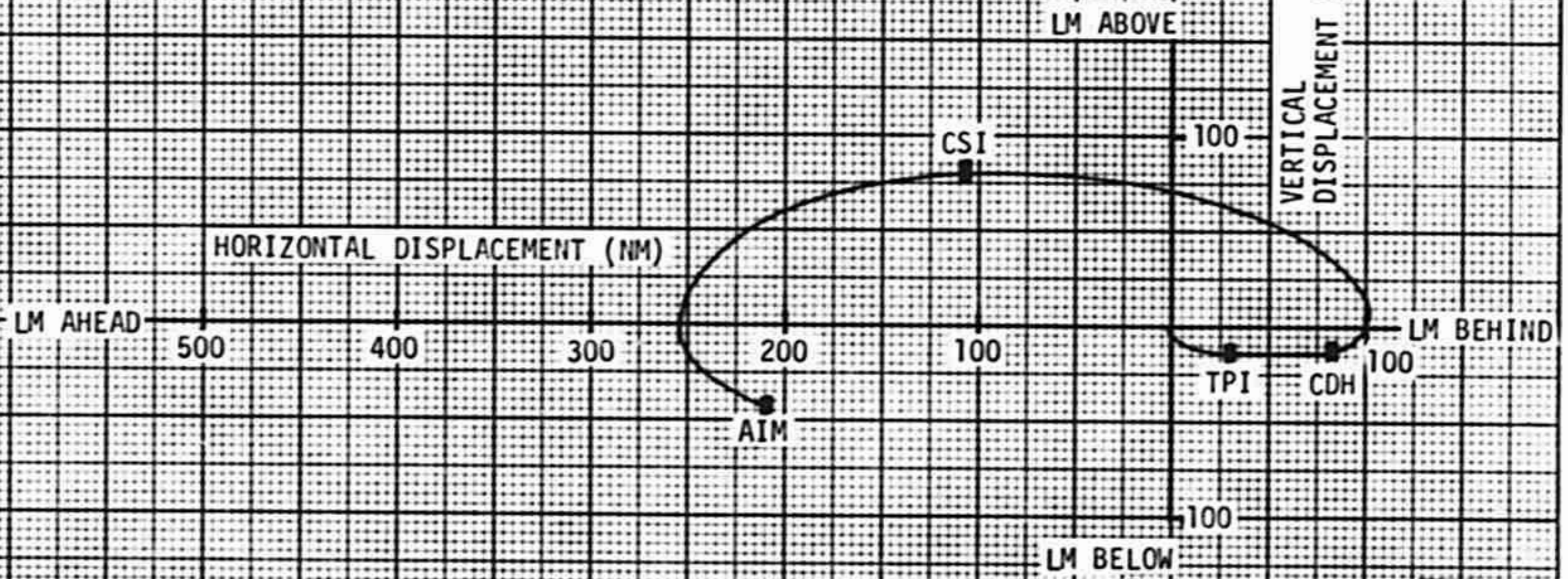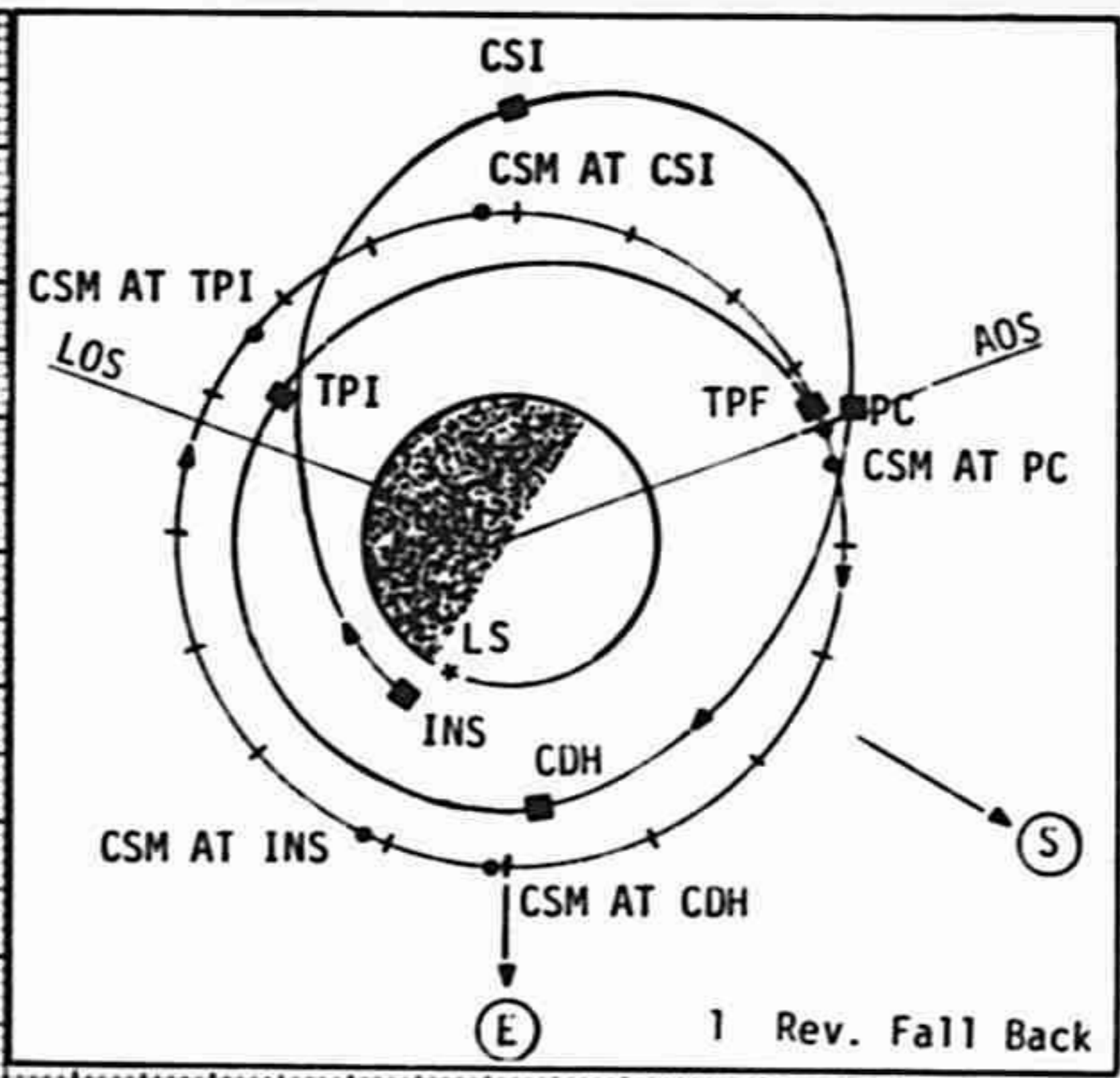
```
   CB(11) ECS CABIN FAN1-CLOSE
   P00
   V48, 11002
   P47, V63
      *404+0, 405+0, 406+0       *
AOS TPI BURN REPORT
40 INITIATE BRAKING
      30 FPS - 6000 FT
      20 FPS - 3000 FT
      10 FPS - 1500 FT
       5 FPS -  600 FT

      *SETUP CAMERA FOR          *
      *  DOCKING:                *
      *LM3/DAC/10/CEX-ULC        *
      *  (T3,1/250,6) 1FPS       *
      *  .25 MAG(0), (4MIN)      *

   V34, P00
   V76                     ATT CONT-PULSE
   MANEUVER/PICTURES OF SIMBAY,RCS
55 INITIATE DOCKING
   COAS TO OVHD WINDOW
      *EXT LTG-DOCK              *
   SHFT/TRUN ±50                 *
   V41N72 (+000,+320)
   CB RR(2)-OPEN, V44
      *S-BD ANT-FWD,VERIFY COMM*
      *√S-BD P      (+236)       *
      *  Y _____    (+51)        *
      *S-BD ANT-SLEW (>3.0)      *
      *TRACK MODE-AUTO           *
      *BIOMED-LEFT, PCM-HI       *
      *UPLINK SQUELCH-OFF        *
   FDAI (180,290,300)
   V77                      ATT CONT-
65 CONTACT                  MODE CONT

   CONFIRM CAPTURE FROM CSM
   MODE CONT (BOTH)-OFF
   POST DOCKING PROCEDURES
```

EVENT	GET TIG
INS	
CSI	
PC	
CDH	
TPI	

APOLLO 16/17 MISSIONS
INERTIAL AND RELATIVE PLOTS

1. $1 \leq PDI\ 1 \leq 7$

CSI

CSM AT CSI

CSM AT TPI

LOS   TPI   TPF   PC   AOS

CSM AT PC

LS

INS   CDH

CSM AT INS

CSM AT CDH

(S)

(E)   1 Rev. Fall Back

LM ABOVE
100
CSI

HORIZONTAL DISPLACEMENT (NM)

VERTICAL DISPLACEMENT (NM)

LM AHEAD
300   200   100   CSI   100   LM BEHIND
TPI   CDH
INS
+1,+2,+3,+4   (1+5) (1+6)   (1+7)
100
LM BELOW

PREPARED BY FPRB/OPS
DECEMBER 25, 1971

PAGE A-2

EVENT	GET TIG
INS	
CSI	
PC	
CDH	
TPI	

APOLLO 16/17 MISSIONS
INERTIAL AND RELATIVE PLOTS

$8 \leq PDI \ 1 \leq 10$

CSM AT TPI

CSM AT CSI

LOS

TPI

CSI

AOS

TPF

LS

INS

PC

CSM AT INS

CDH

S

CSM AT CDH

E

1 Rev. Catch Up

LM ABOVE

HORIZONTAL DISPLACEMENT (NM)

CSI

LM BEHIND

TPI

CDH

CSI

VERTICAL DISPLACEMENT (NM)

(1+8)

(1+9)

INS (1+10)

LM BELOW

EVENT	GET TIG
INS	
BOOST	
HAM	
CSI	
PC	
CDH	
TPI	

APOLLO 16/17 MISSIONS
INERTIAL AND RELATIVE PLOTS
1. 11 < PDI 1 ≤ 17
2. T2-2

CSM AT CSI
CSM AT BOOST
CSM AT TPI
CSI
BOOST
LOS
TPI
AOS
TPF
PC
INS
LS
HAM
CSM AT PC
CSM AT INS
CDH
S
CSM AT HAM
CSM AT CDH
E
2 Rev. Catch Up

VERTICAL DISPLACEMENT (NM)
HORIZONTAL DISPLACEMENT (NM)
LM ABOVE
LM AHEAD
100   200   300   400   500   600   700
LM BEHIND
TPI   CDH
CSI
HAM
BOOST
INS
(1+11) (1+12) (1+13) (1+14) (1+15)(1+16)(1+17)(T2-2)
100
LM BELOW
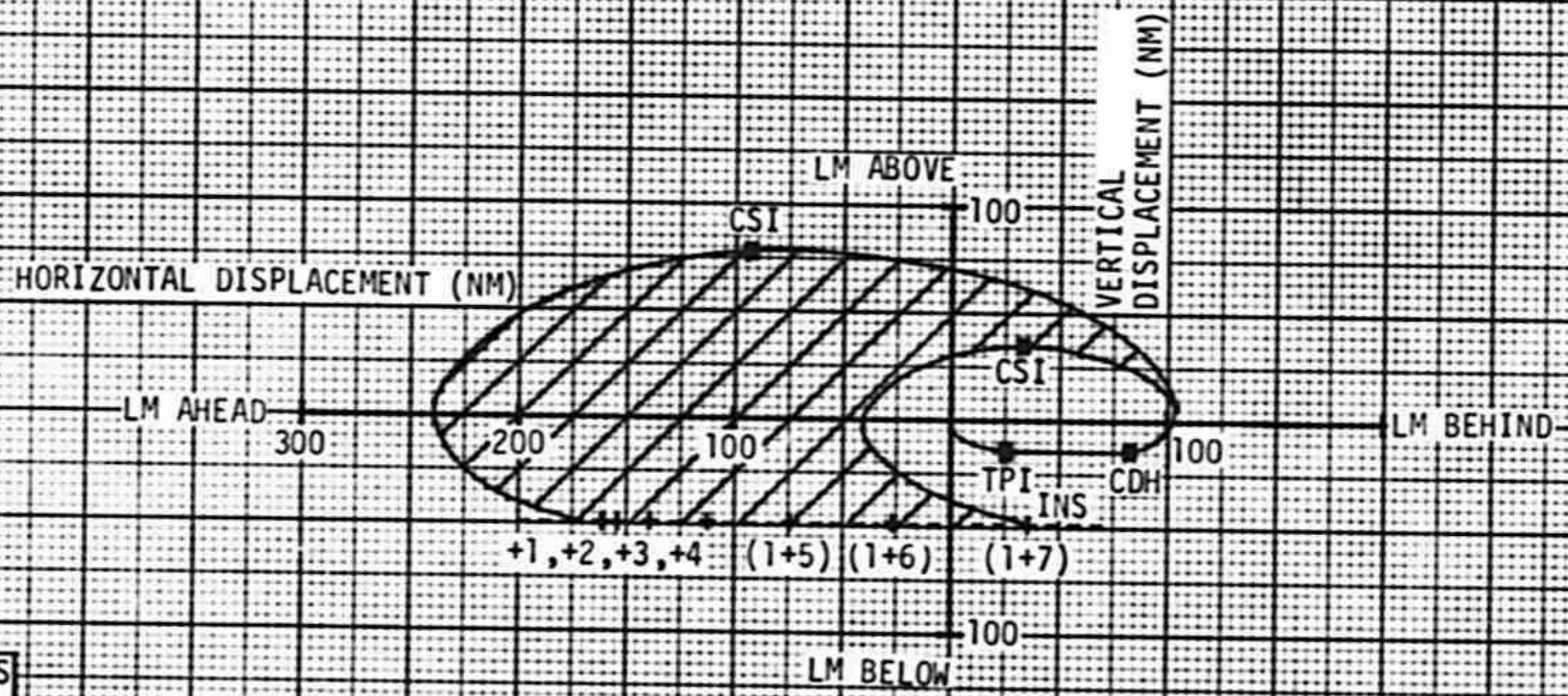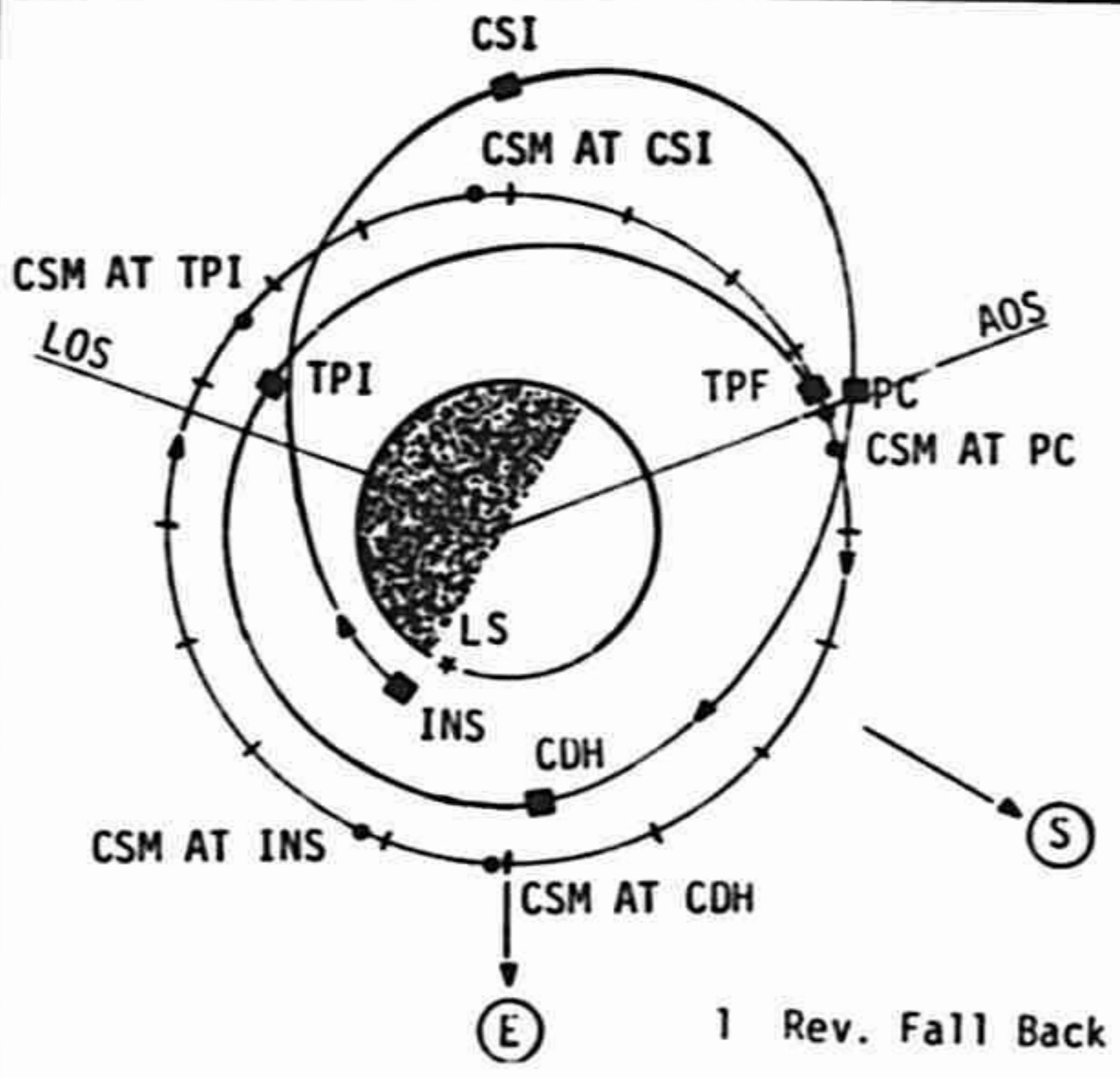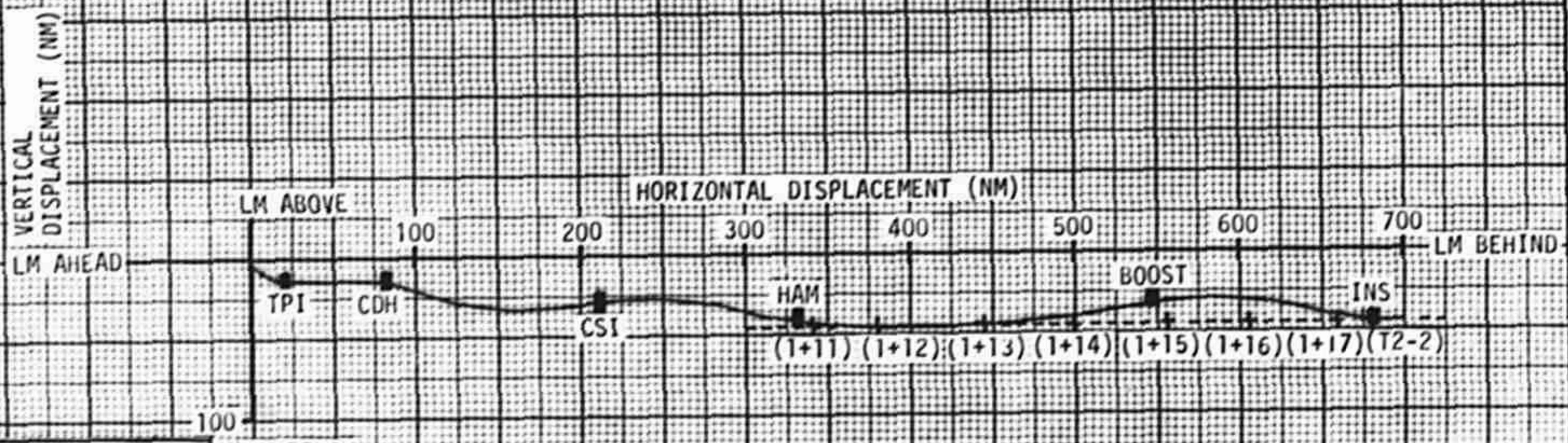
PREPARED BY FPRB/OPS
FEBRUARY 29, 1972

PAGE A-4

EVENT	GET TIG
INS	
BOOST	
HAM	
CSI	
PC	
CDH	
TPI	

Plot labels: CSM AT CSI, CSM AT BOOST, CSM AT TPI, LOS, CSI, BOOST, AOS, TPI, TPF, LS, (1.5 REV), PC, INS, HAM, CSM AT PC (S), CSM AT INS, CDH, CSM AT HAM, CSM AT CDH, (E), 3 Rev. Catch Up
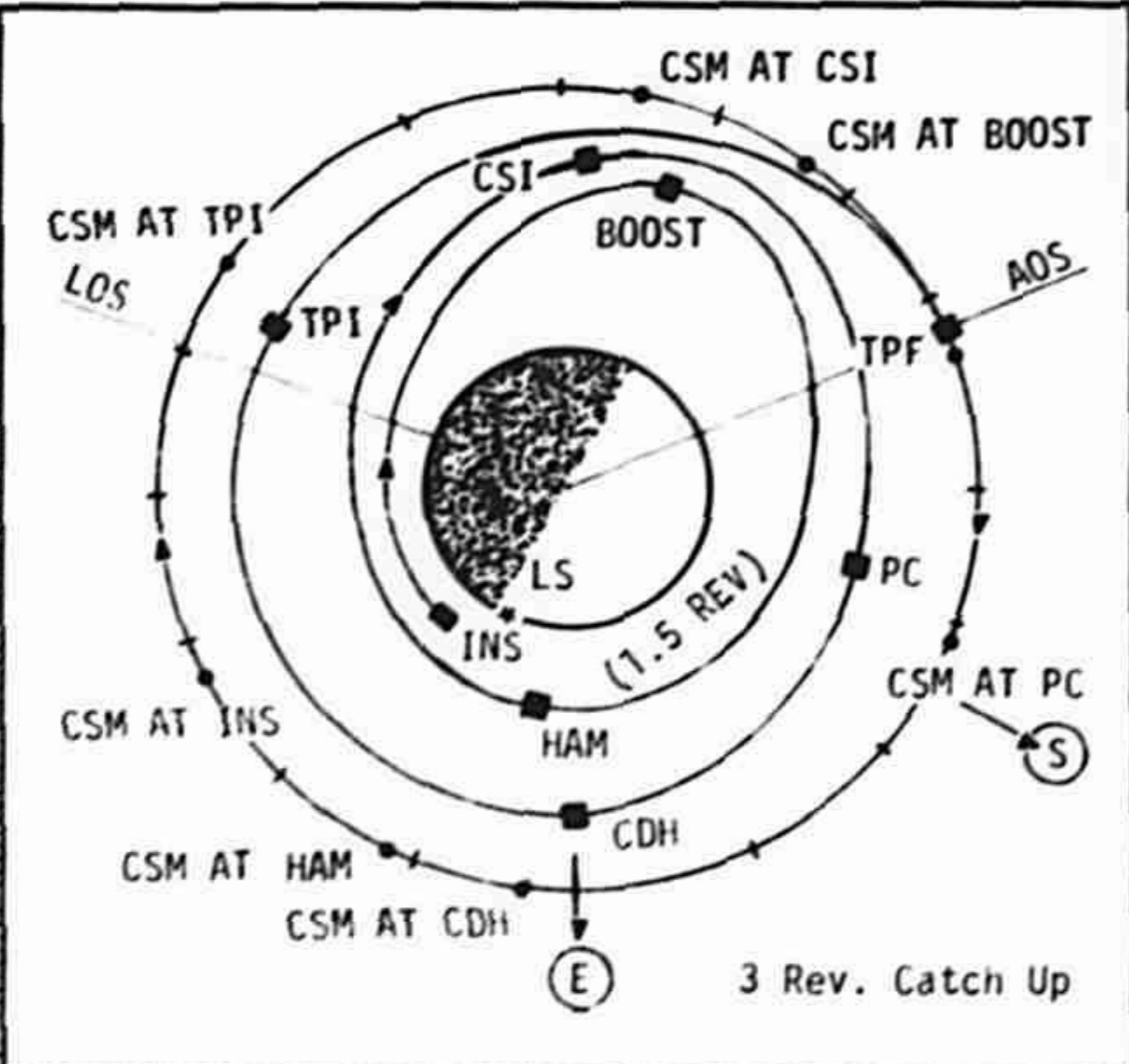
**APOLLO 16/17 MISSIONS
INERTIAL AND RELATIVE PLOTS**

T2-1

PROCEDURES:

BOOST BURN PERFORMED
P00
V82
V76
1 REV COASTING FLIGHT
60 MIN PRIOR TO HAM
  DO PROCEDURES FOR
  BOOST THRU HAM.
  ON PAGE 23

BURN GROUND HAM

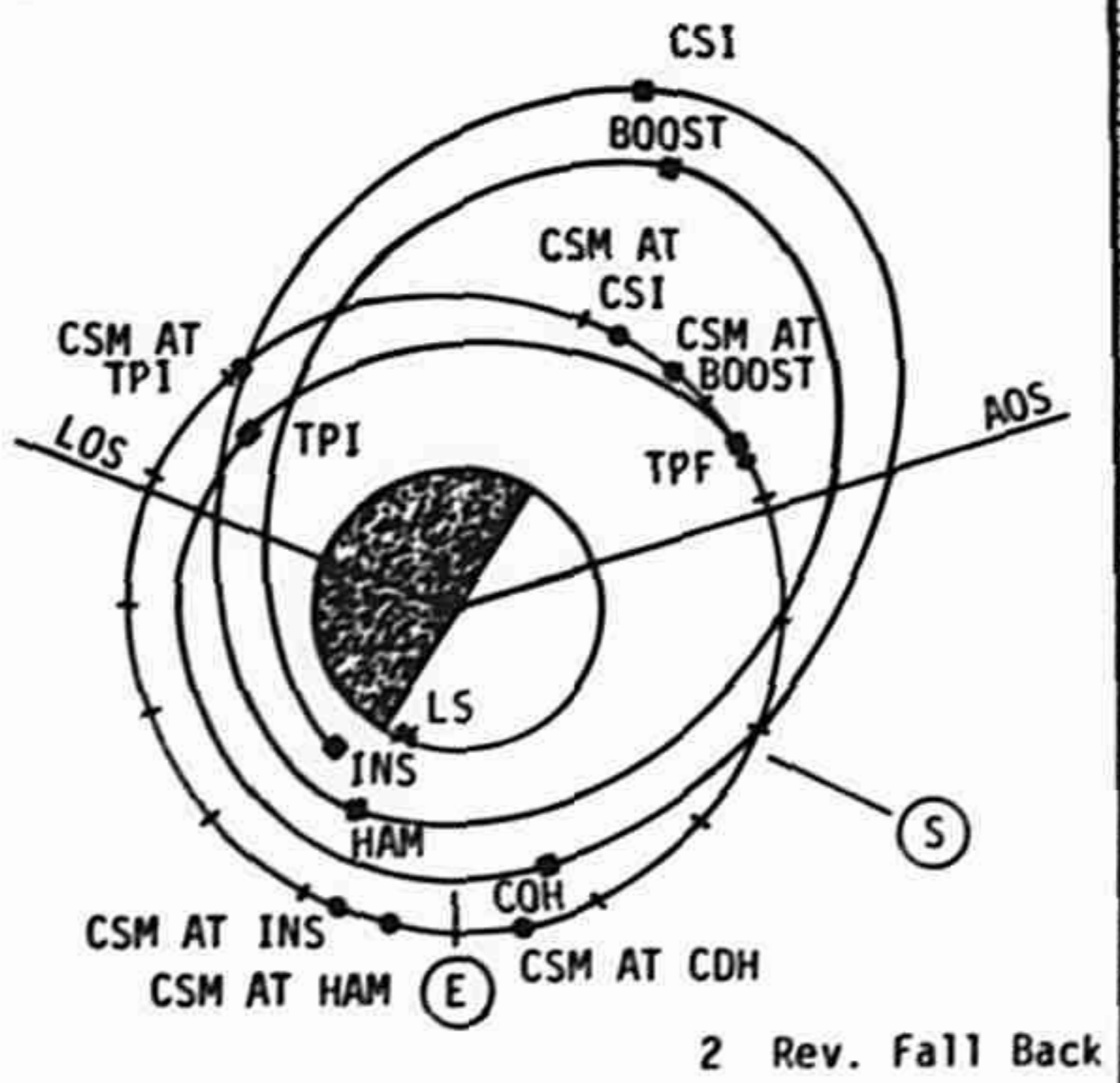VERTICAL DISPLACEMENT (NM)

LM ABOVE
LM AHEAD

HORIZONTAL DISPLACEMENT (NM)

200   400   600   800   1000   LM BEHIND   1200

TPI CDH   CSI   HAM   BOOST   INS

-100

-200

LM BELOW
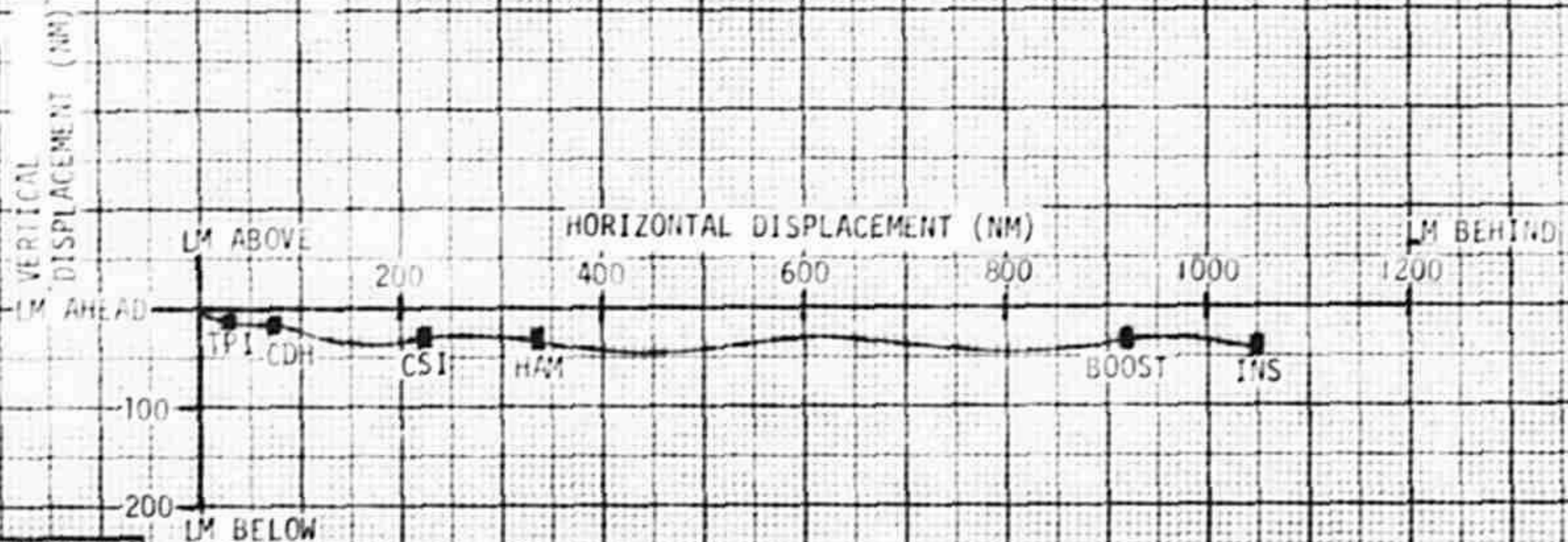
PREPARED BY FPRB/OPS
DECEMBER 25, 1971

EVENT	GET TIG
INS	
BOOST	
HAM	
CSI	
PC	
CDH	
TPI	

APOLLO 16/17 MISSIONS
INERTIAL AND RELATIVE PLOTS

NO PDI 2 + 12
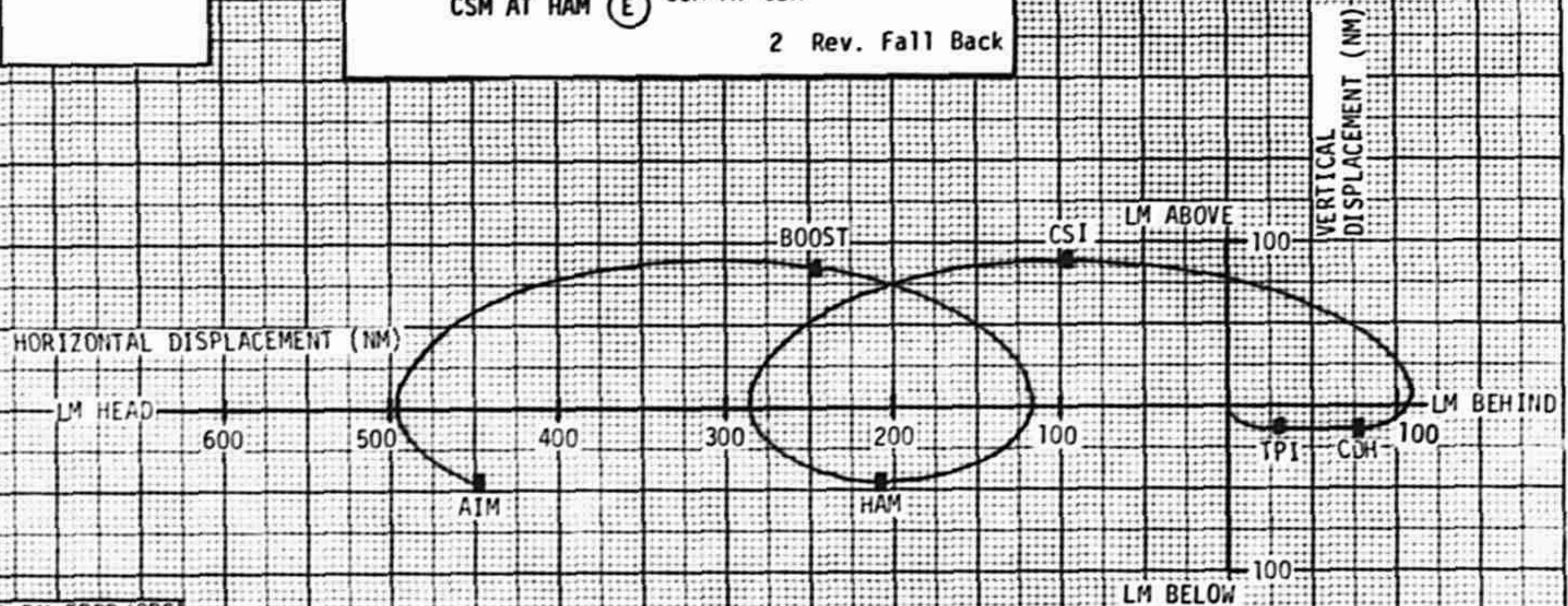
2 Rev. Fall Back

HORIZONTAL DISPLACEMENT (NM)

VERTICAL DISPLACEMENT (NM)

LM ABOVE

LM HEAD

LM BEHIND

LM BELOW

EVENT	GET TIG
INS	
BOOST	
HAM	
CSI	
PC	
CDH	
TPI	

APOLLO 16/17 MISSIONS
INERTIAL AND RELATIVE PLOTS

1. 1 ≤ PDI 2 ≤ 6

2 Rev. Fall Back

HORIZONTAL DISPLACEMENT (NM)

VERTICAL DISPLACEMENT (NM)
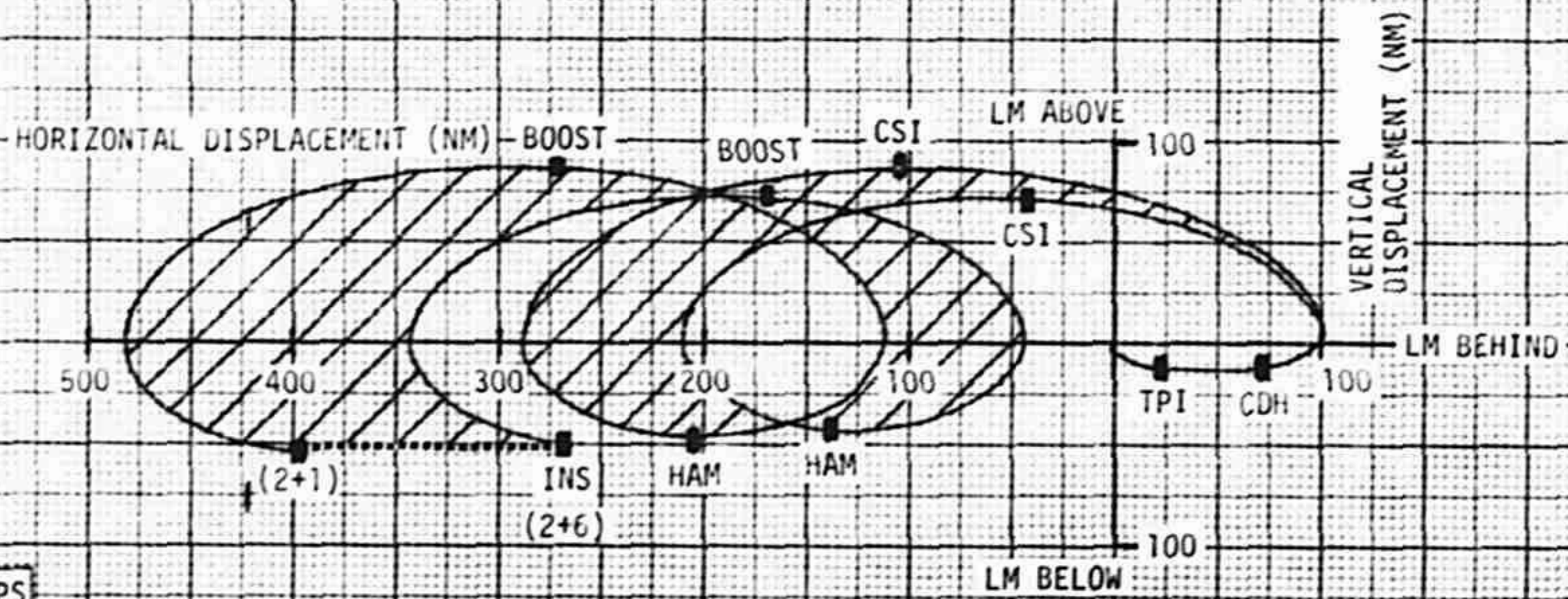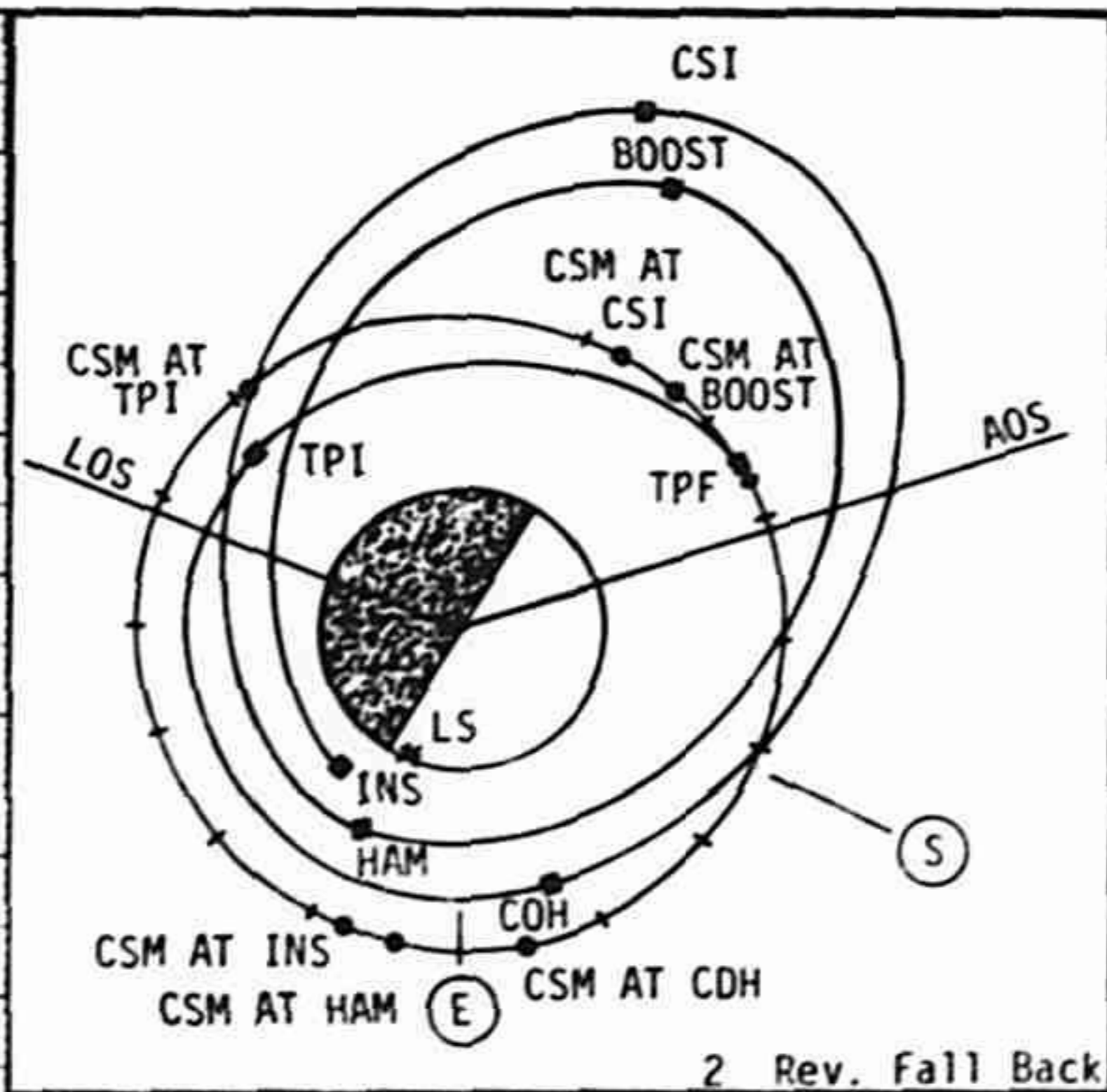
PREPARED BY FPRB/OPS
DECEMBER 25, 1971

EVENT	GET TIG
INS	
CSI	
PC	
CDH	
TPI	

APOLLO 16/17 MISSIONS
INERTIAL AND RELATIVE PLOTS

$7 \leq PDI\ 2 \leq 10$
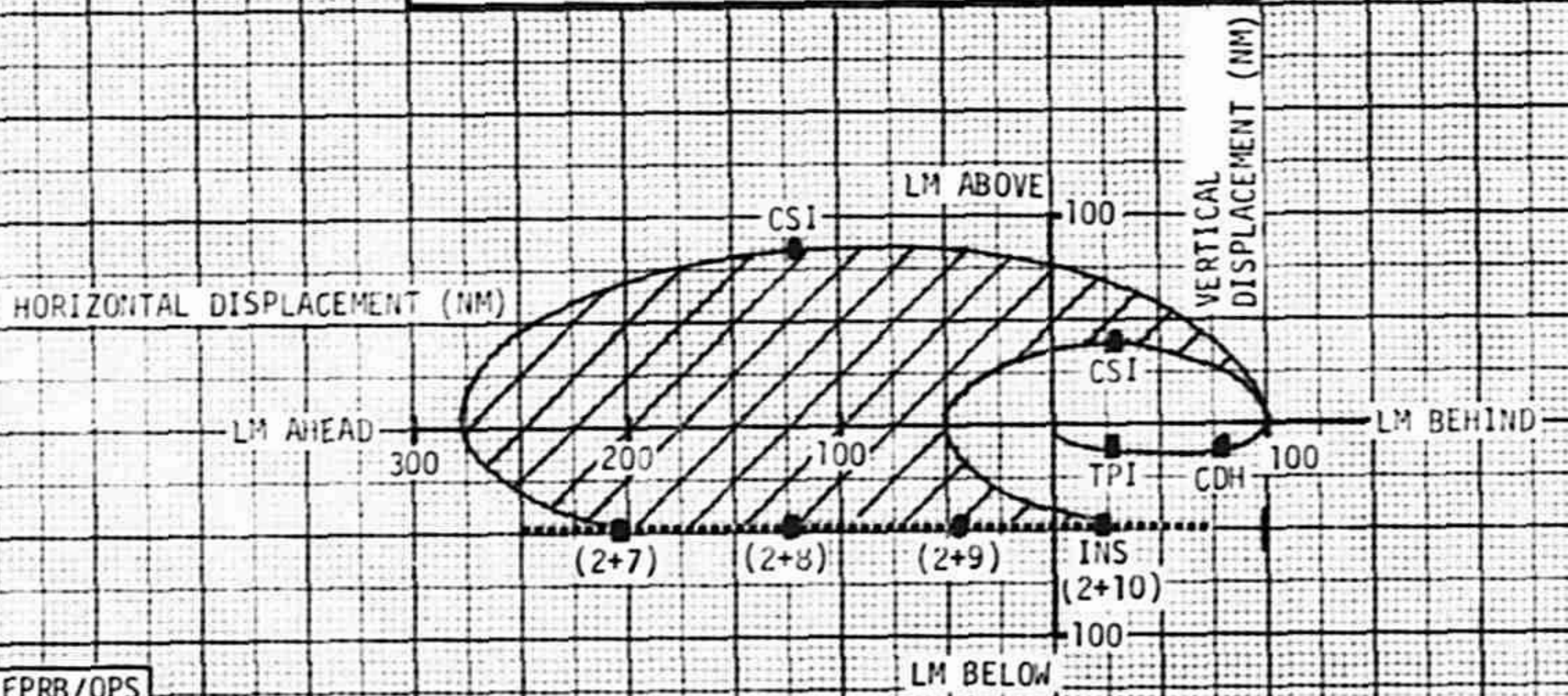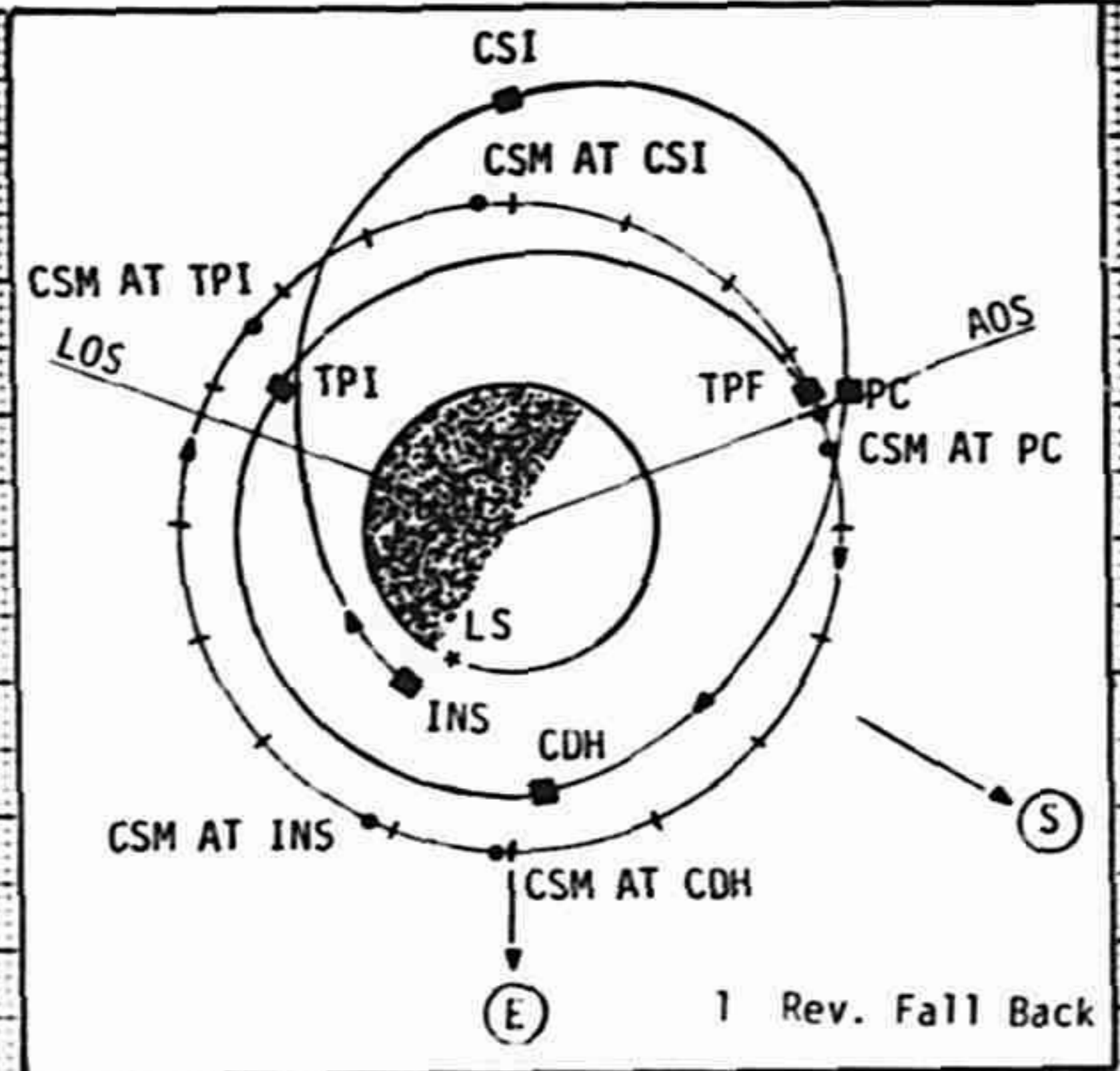
CSI

CSM AT CSI

CSM AT TPI

LOS

TPI

TPF

AOS

PC

CSM AT PC

LS

INS

CDH

CSM AT INS

CSM AT CDH

(S)

(E)   1 Rev. Fall Back

LM ABOVE   100

VERTICAL DISPLACEMENT (NM)

CSI

HORIZONTAL DISPLACEMENT (NM)

CSI

LM AHEAD

LM BEHIND

300   200   100   TPI   CDH   100

(2+7)   (2+8)   (2+9)   INS
(2+10)

100

LM BELOW

APOLLO 16/17 MISSIONS
INERTIAL AND RELATIVE PLOTS
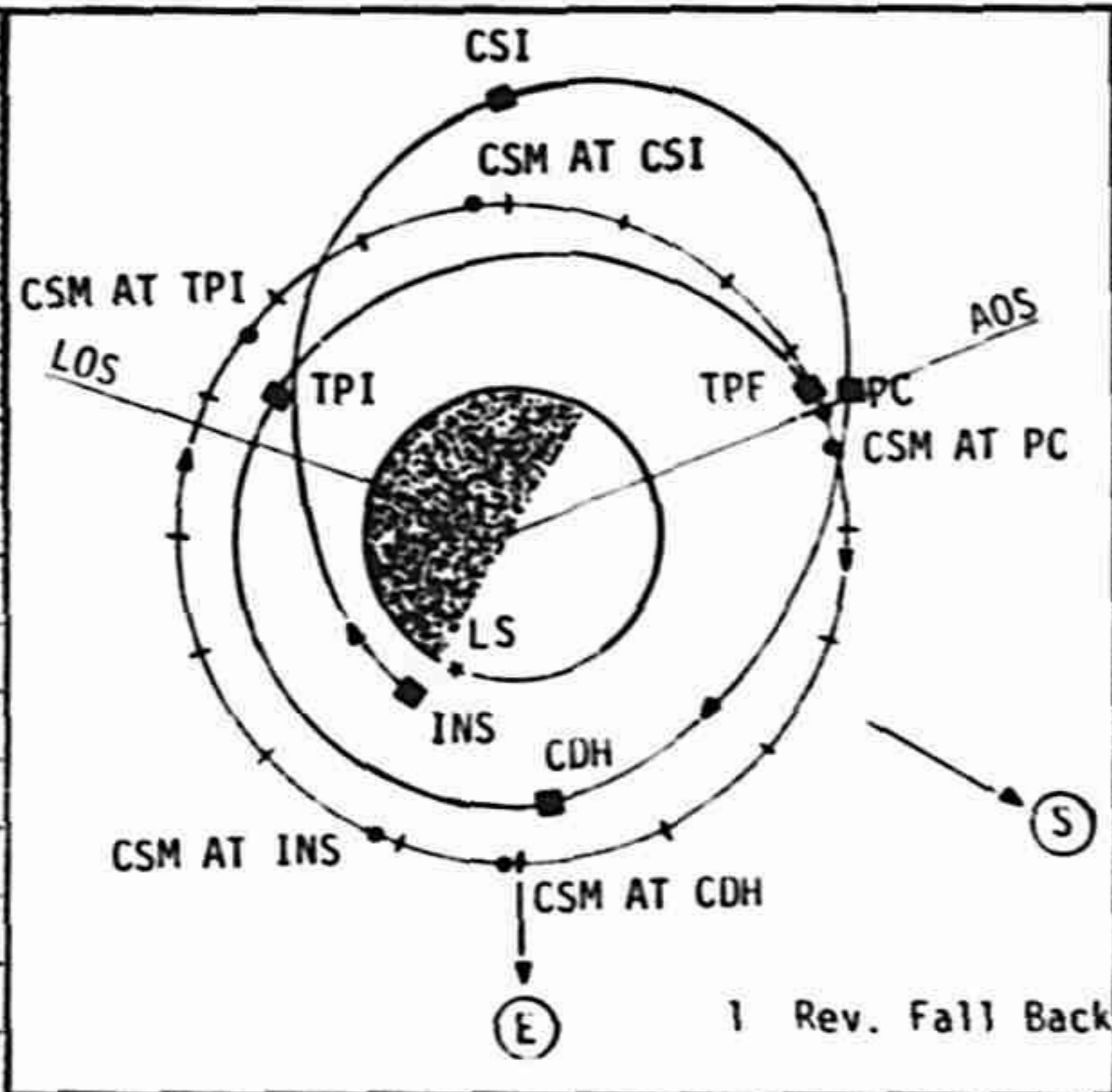
$11 \leq PDI\ 2 \leq 13$

EVENT	GET TIG
INS	
CSI	
PC	
CDH	
TPI	
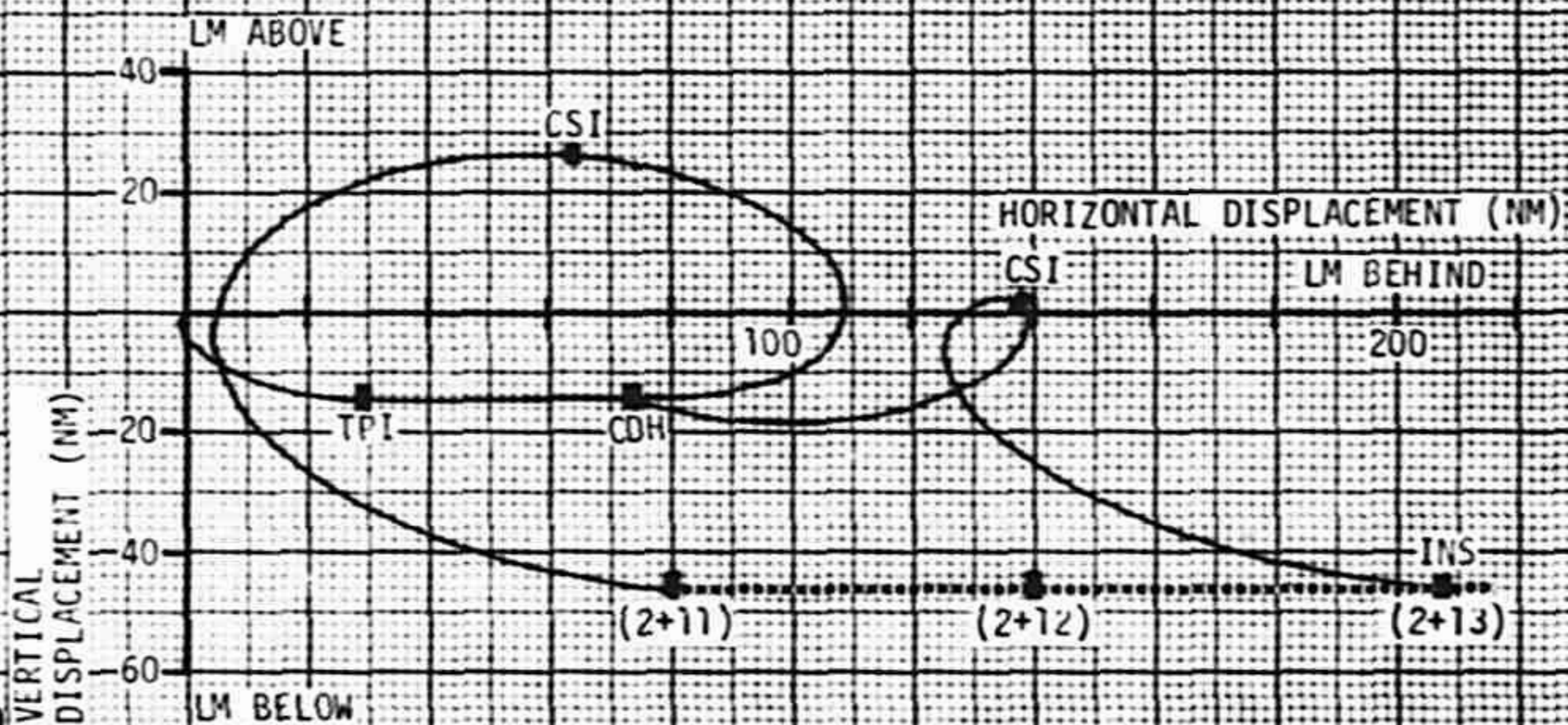
PREPARED BY FPRB/OPS
DECEMBER 25, 1971

PAGE A-9

EVENT	GET TIG
INS	
CSI	
PC	
CDH	
TPI	

APOLLO 16/17 MISSIONS
INERTIAL AND RELATIVE PLOTS

$14 \leq PDI \ 2 \leq 15$

CSM AT TPI

CSM AT CSI

LOS

CSI

TPI

TPF

AOS

LS

INS

PC

CSM AT INS

CDH

S

CSM AT CDH

E

1 Rev. Catch Up

VERTICAL DISPLACEMENT (NM)

LM ABOVE

HORIZONTAL DISPLACEMENT (NM)

LM AHEAD

50

100

150

200

250

300

LM BEHIND

CSI

CSI

20

TPI

CDH

40

(2+14)

INS
(2+15)

60 LM BELOW
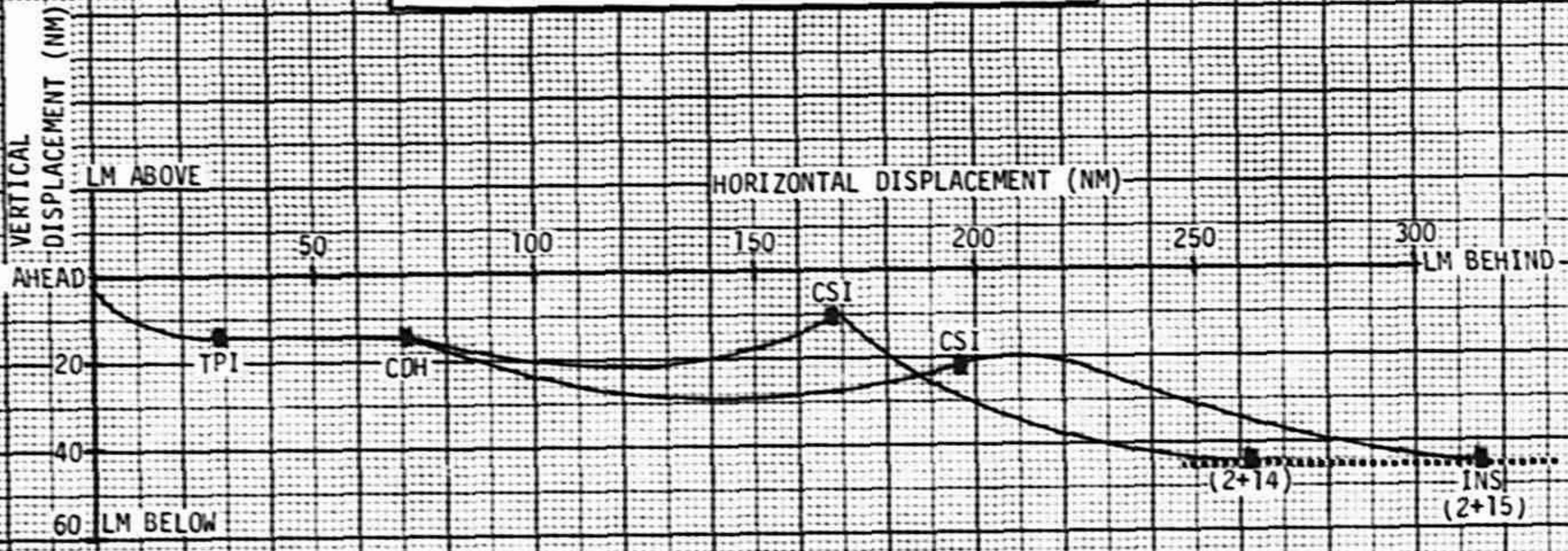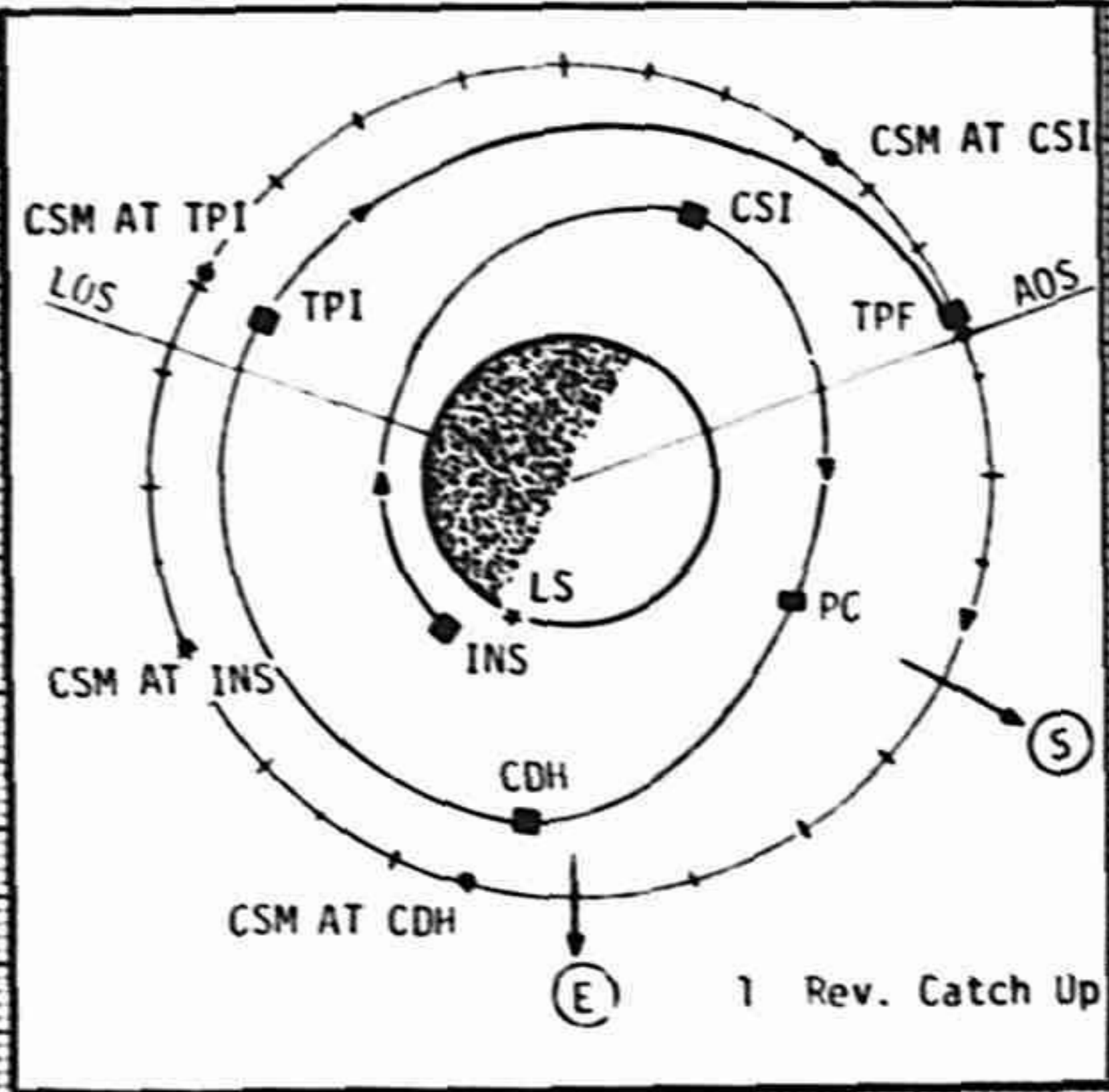
PREPARED BY FPRB/OPS
DECEMBER 25, 1971

PAGE A-10

A-10

APOLLO 16/17 MISSIONS
INERTIAL AND RELATIVE PLOTS

BAILOUT

EVENT	GET TIG
INS	
BAILOUT	
CSI	
PC	
CDH	
TPI	
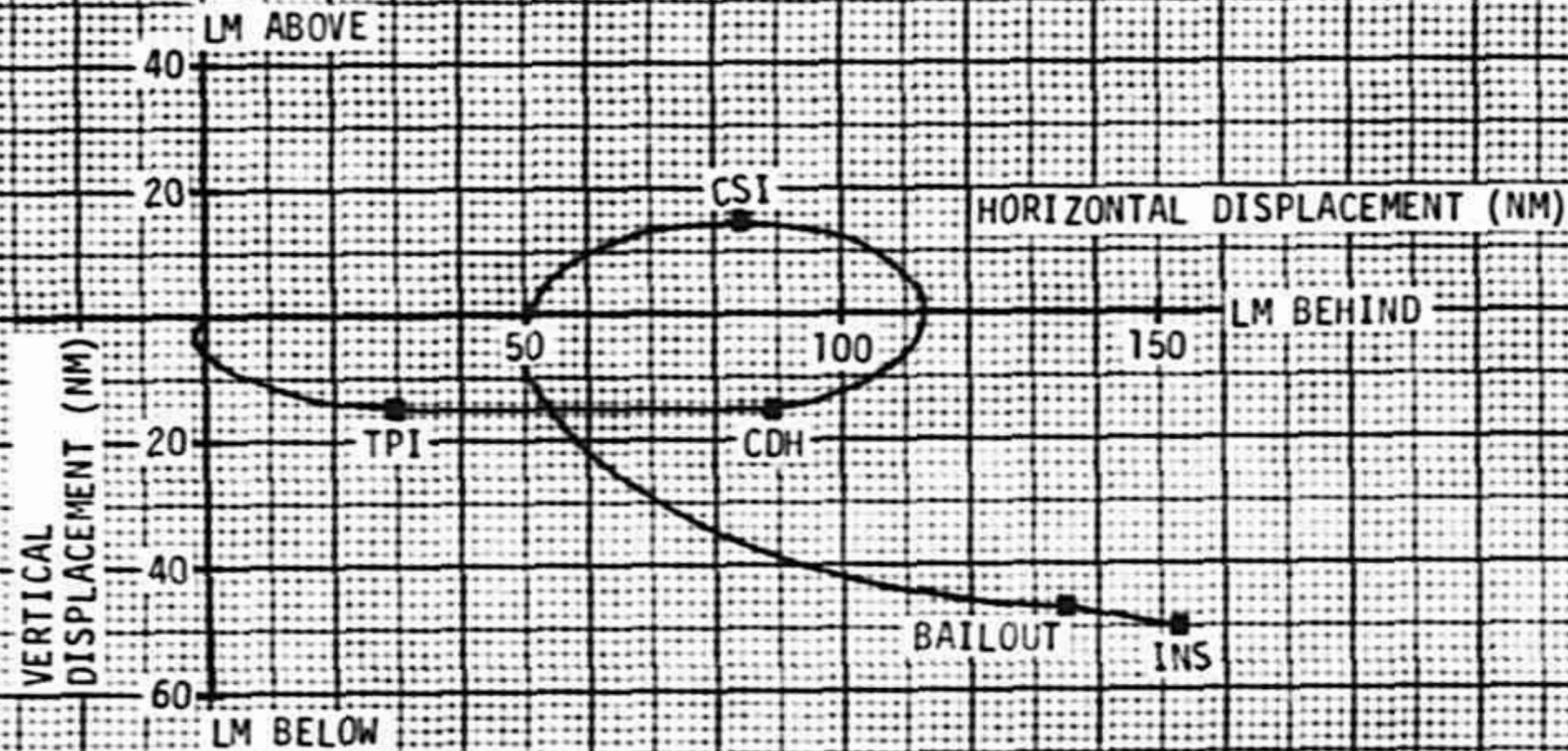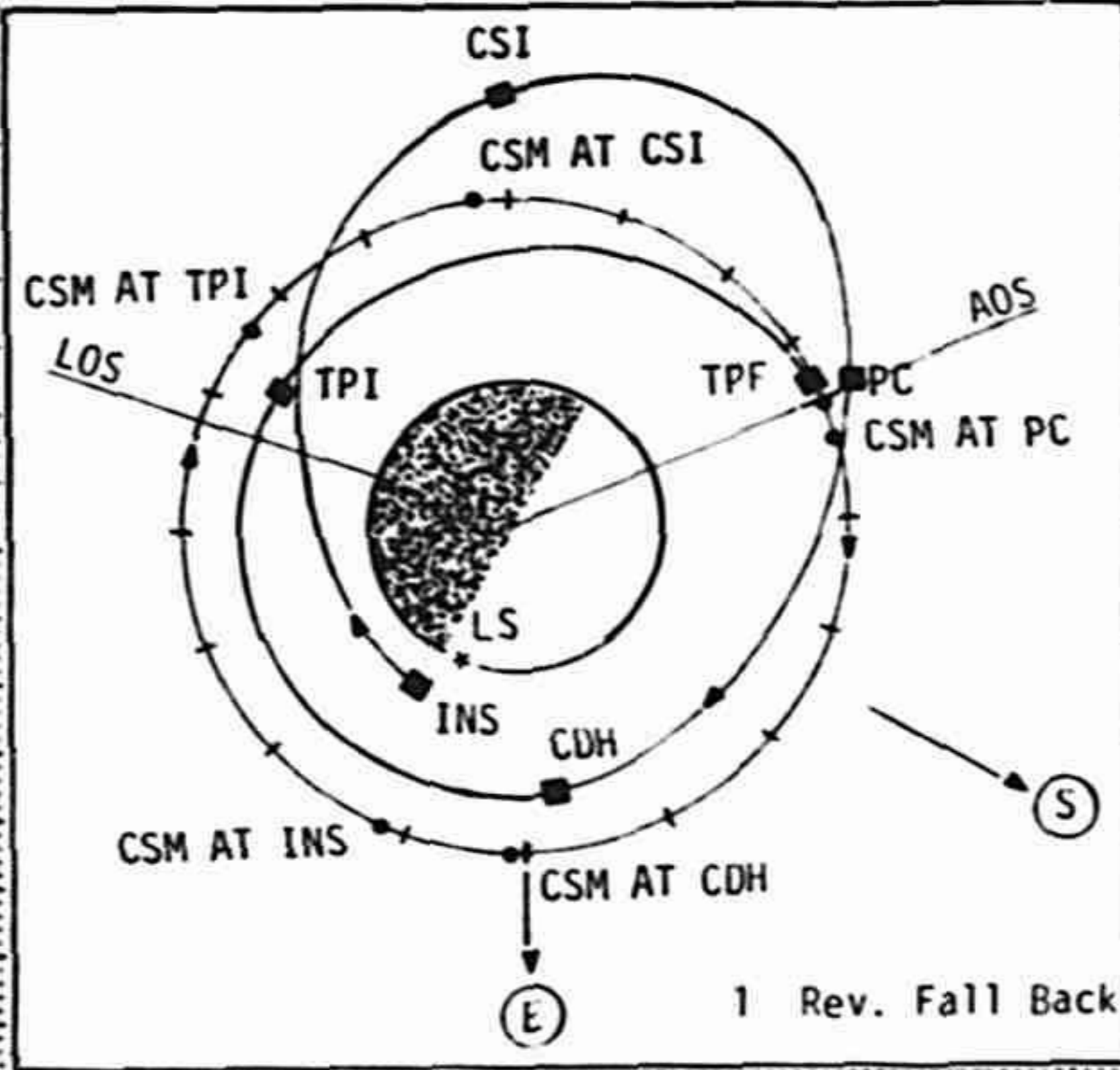
CSI

CSM AT CSI

CSM AT TPI

LOS

TPI

TPF

PC

AOS

CSM AT PC

LS

INS

CDH

CSM AT INS

CSM AT CDH

S

E

1 Rev. Fall Back

LM ABOVE

40

20

CSI

HORIZONTAL DISPLACEMENT (NM)

LM BEHIND

50

100

150

20

TPI

CDH

VERTICAL DISPLACEMENT (NM)

40

BAILOUT

INS

60

LM BELOW

PREPARED BY FPRB/OPS
DECEMBER 25, 1971

EVENT	GET TIG	
INS		
CSI		
PC		
CDH		
TPI		

APOLLO 16/17 MISSIONS
INERTIAL AND RELATIVE PLOTS

NOMINAL COELLIPTIC RNDZ

ΔT	RANGE	RDOT
INS	285.6	-456.6
-48	281.1	-452.3
-44	263.6	-429.7
-40	247.3	-399.1
-36	232.2	-362.0
-32	218.7	-320.2
-28	206.9	-275.8
-24	196.9	-230.9
-20	188.7	-188.0
-16	182.0	-149.3
-12	176.8	-116.8
-8	172.7	-92.0
-4	169.4	-76.0
CSI	166.6	-69.4
CDH	95.7	-122.2
TPI	33.5	-110.2
+4	27.8	-129.3
+8	22.9	-120.4
+12	18.4	-108.8
+16	14.3	-95.2
+20	10.9	-80.4
+24	8.0	-65.7
+28	5.6	-52.5
+32	3.8	-42.0
+36	2.3	-35.3
+40	.9	-32.4
+42	.3	-31.9
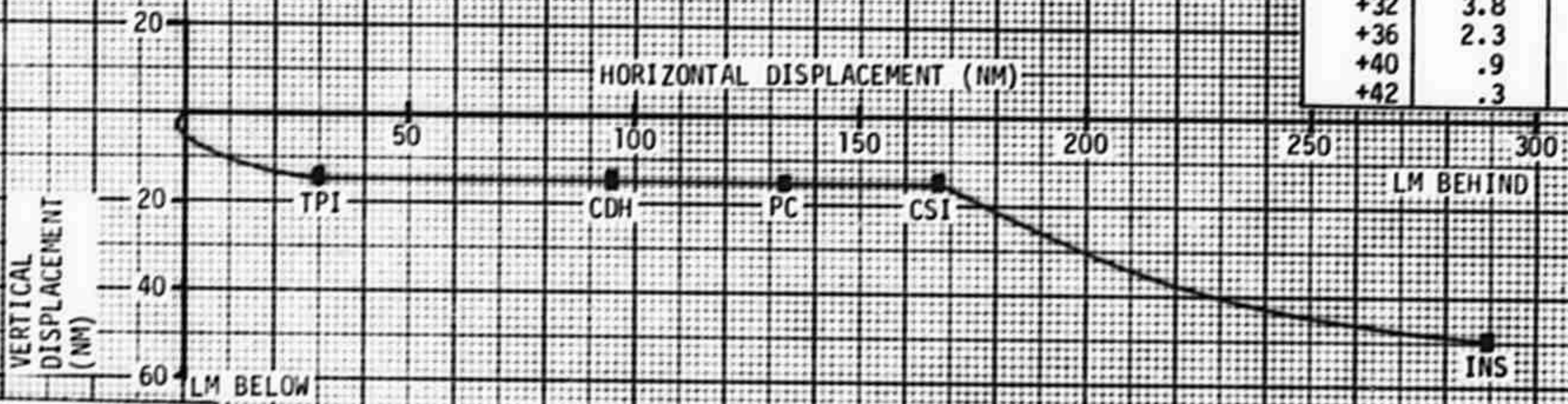
PREPARED BY FPRB/OPS
DECEMBER 25, 1971

RELATIVE TRAJ
NOM COEL RNDZ

LM 1-1.- LM height adjustment maneuver chart.

Mission profile dependent

11/29/71

P32
N11 LOAD TIG CSI
N55 +00001 +02660 +13000
N37 LOAD TIG TPI

N75 _____ . _____ ΔH

_____ . _____ ΔVX

P30
N33 LOAD TIG HAM

ΔVX (FPS)

ΔH (NM)

HAM CHART

PAGE 40

DATE 3/10/72

CSI BIAS CHART

CSM 10-1.– CSI bias chart for aborts from PDI. (April 16 launch date)

Mission profile dependent

2/28/72 Basic

$10:16 \leq$ PDI 1 $\leq 17:30$

$0 <$ PDI 2 $< 6:20$

$0 <$ PDI 1 $< 10:16$

$6:20 \leq$ PDI 2 $\leq 15:30$

No PDI 1 + 12 min abort
Bias = 0.9
No PDI 2 + 12 min abort
Bias = 0.3
CSM_____ΔV_X (always positive)
+_____Bias
LM [   ] ΔV_X

CSM solution greater

CSM solution smaller

CSI bias ΔV, fps

Time from PDI to abort, min:sec

CSI BIAS
DELTA V

THIS PAGE INTENTIONALLY BLANK

J-2/J-3 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
Ṙ (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

R(NM)

TIME

TPI

BRAKING

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

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

PREPARED BY FPRB/OPS
MISSION APOLLO 16, DECEMBER 25, 1971

TPF REL TRAJ
NOM COEL RNDZ

J-2/J-3 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 APOLLO 16, DECEMBER 25, 1971

BRAKING

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

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

NASA — MSC