



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
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TO CLARK —
WITH OUR APPRECIATION
FOR YOUR YEARS OF REPORT
TOWARD MAKING THE RIGHT
SUCCESS —

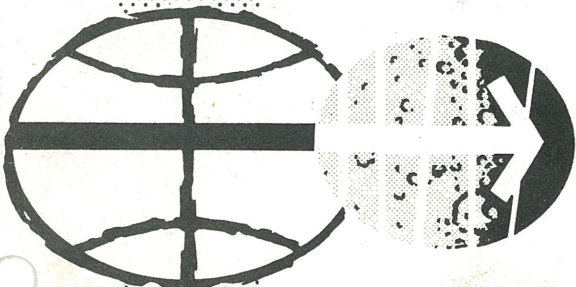
LM RENDEZVOUS
PROCEDURES

G MISSION

FINAL
REVISION A

JUNE 20, 1969

MANNED SPACECRAFT CENTER
HOUSTON, TEXAS





LM RENDEZVOUS PROCEDURES

G MISSION

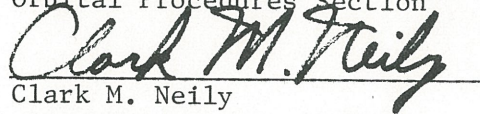
AS-506/CSM-107/LM-5

JUNE 20, 1969

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LIST OF ACRONYMS AND ABBREVIATIONS

ACQ	Acquisition
ADJ	Adjust
AGS	Abort Guidance System
AOH	Apollo Operations Handbook
AOS	Acquisition of Signal
AOT	Alignment Optical Telescope
APS	Ascent Propulsion System
ATT	Attitude
BU	Backup
CALIB	Calibration
CB	Circuit Breaker
CDH	Constant Delta Height
CDR	Commander
CM	Command Module
CMC	Command Module Computer
CMD	Command Module Commander's Position
CMP	Command Module Pilot
COAS	Crew Optical Alignment Sight
CSI	Concentric Sequence Initiation
CSM	Command and Service Module
CT	Cease Tracking
DAP	Digital Autopilot
DH	Delta Height
DOI	Descent Orbit Insertion
DPS	Descent Propulsion System
DSKY	Display and Keyboard
DV	Delta Velocity
DWN	Down
EMS	Entry Monitor System
ET	Event Timer
FDAI	Flight Director Attitude Indicator
FPS	Feet Per Second
FWD	Forward
GDC	Gyro Display Coupler
GET	Ground Elapsed Time
GETI	Ground Elapsed Time of Ignition
GMBL	Gimbal
GND	Ground (Mission Control)
HA	Apogee Altitude
HGA	High-Gain Antenna
HOR	Horizon
HORIZ	Horizontal
HP	Perigee Altitude
IMU	Inertial Measurement Unit
INS	Insertion
IT	Initiate Tracking
LGC	LM Guidance Computer
LM	Lunar Module
LMP	Lunar Module Pilot

LOI	Lunar Orbit Injection
LOS	Line of Sight
LV	Launch Vehicle
MNVR	Maneuver
MCC	Midcourse Correction
MCC1	First Midcourse Correction
MCC2	Second Midcourse Correction
MCC-H	Mission Control Center - Houston
MGA	Middle Gimbal Angle
MSFN	Manned Space Flight Network
NAV	Navigation
ORDEAL	Orbital Rate Drive Earth and Lunar
PAD	Data Voiced to Crew From Ground
PB	Pushbutton
PC	Plane Change
PDI	Powered Descent Initiation
PGNS	Primary Guidance, Navigation, and Control System
PHS	Phasing
PIPA	Pulse Integrating Pendulous Accelerometers
PLM	LM Pitch Angle
PRO	Proceed
PROG	Program
PROP	Propellant
R	Range
RCS	Reaction Control System
RDOT	Range Rate
REFSMMAT	Reference Stable Member Matrix
RHC	Rotation Hand Controller
RR	Rendezvous Radar
SHFT	Shaft
SC	Spacecraft
SEP	Separation
SM	Service Module
SXT	Sextant
SYNC	Synchronize
TFI	Time From Ignition
THC	Translation Hand Controller
THETA	Angle Between SC +X Axis and Local Horizontal
TIGN	Time of Ignition
TLM	Telemetry
TPF	Terminal Phase Finalization
TPI	Terminal Phase Initiation
TRUN	Trunnion
TTCA	Translation Thrust Control Assembly
VG	Velocity to be Gained
VHF	Very High Frequency
(XX:XX)	Indicates GET From Liftoff in Hours:Minutes
(XXX:XX:XX)	Indicates GET From Liftoff in Hours:Minutes:Seconds
(XXX,XXX/XXX,XXX)	(Ordeal/Inertial) Angles (Roll, Pitch, Yaw)
(XX,XX,XX)	Local Vertical DV's

Tracking Stations

ANG	Antigua Near Space Support Station
BDA	Bermuda Near Space Support Station
CRO	Carnarvon Near Space Support Station
CYI	Canary Near Space Support Station
GYM	Guaymas Near Space Support Station
HSK	Honeysuckle Deep Space Support Station
HTV	Huntsville Near Space Support Station
MAD	Madrid Deep Space Support Station
MER	Mercury Near Space Support Ship
MIL	MILA Near Space Support Station
RED	Redstone Near Space Support Ship
TEX	Corpus Christi Near Space Support Station
VAN	Vanguard Near Space Support Ship

1.0 PURPOSE

This document contains the primary procedures for the LM-5 active rendezvous with CSM-107 spacecraft, in accordance with Detailed Test Objective Section 4.0 defined in Reference 7.1.

The purpose of the LM Rendezvous Procedures document is to provide a single source of procedures information for use in flight planning, in crew training, and in preparing onboard data.

This is a control document, subject to review by all elements of the Apollo Program and to approval by the Procedures Configuration Control Board. Comments should be directed to Mr. Stephen P. Grega, Flight Procedures Branch, Flight Crew Support Division, Extension 5348.

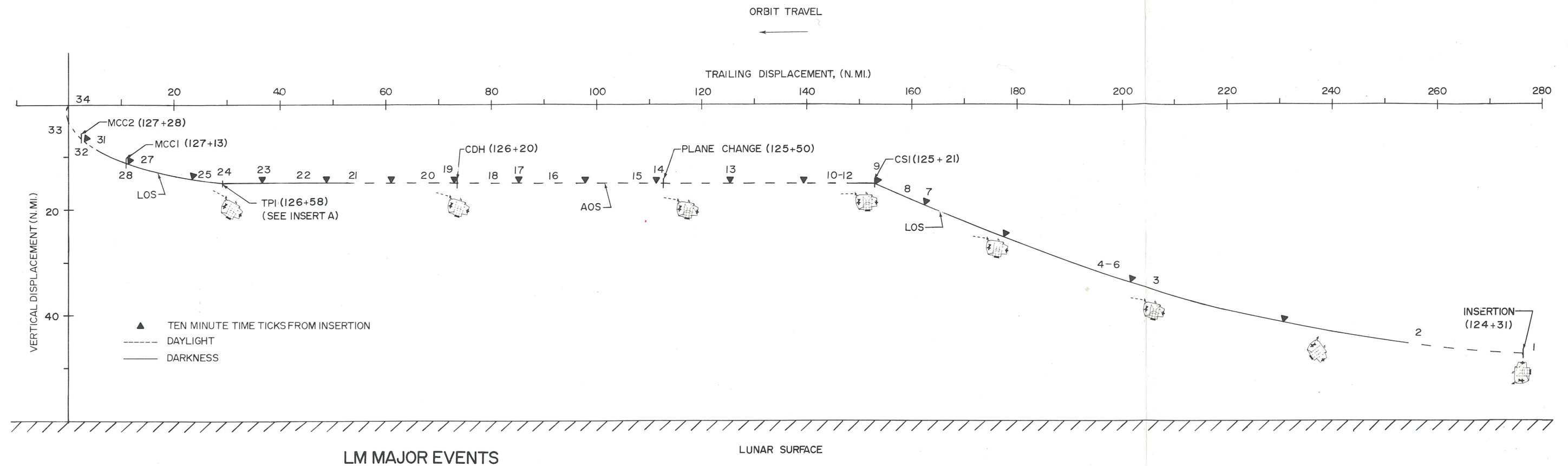
Beyond G mission planning, no additional techniques and trajectory information specific to Mission H have been made available as of this date. Therefore, since Missions G and H are expected to be similar in the area of rendezvous guidance and navigation procedures, the G mission final revision A "LM Rendezvous Procedures Document" will serve as an H mission preliminary "LM Rendezvous and Procedures Document." After reviewed by all elements of the Apollo Program and approval by the Procedures Configuration Control Board, this document will then evolve into the control document for the Mission H crew procedures.

2.0 INTRODUCTION

The LM-5/CSM-107 lunar orbit rendezvous exercise will begin during the twenty-fifth CSM revolution with insertion at 124:30:44.2 and end at approximately 127:43:35.7 with post rendezvous station keeping. The LM procedures during this period are divided into segments of major activities which are discussed in detail in Section 3.0.

A nominal LM-5/CSM-107 mission profile is contained in Figure (2-1). This figure shows the locations in time and local horizontal position of the most significant nominal mission events. Trajectory data used to generate the mission profile and timeline for procedures development was obtained from Reference 7.2. The rendezvous navigation update schedule assumed in the procedures is defined in Reference 7.3.

A history of the LM body attitudes during the rendezvous accompanies the major events discussion and is also presented in Figures (2-2) and (2-3). Each figure illustrates the body attitudes with respect to the moon, sun, and earth and indicates FDAI roll, pitch, and yaw gimbal angles and the ordeal pitch angle for significant events during each lunar orbit.



1	124+31	INSERTION	18	126+13	AGS UPDATE AND ALIGN (R47)
2	124+35	IMU REFSMMAT ALIGN (P52)	19	126+20	CDH THRUSTING (P41)
3	124+49	SET W MATRIX (10000,10,15)	20	126+22	TPI TARGETING (P34 & AGS)
4	124+50	CSI TARGETING (P32&AGS)	21	126+22-126+46	RR NAVIGATION P20,18 MARKS)
5	124+50-125+09	RR NAVIGATION (P20,18 MARKS)	22	126+48	AGS UPDATE AND ALIGN (R47)
6	124+52	AGS UPDATE AND ALIGN (R47)	23	126+53	COMPUTE TPI BACKUP
7	125+11	COMPUTE CSI BACKUP	24	126+58	TPI THRUSTING (P41)
8	125+14	AGS UPDATE AND ALIGN (R47)	25	127+00	MCC1 TARGETING (P35)
9	125+21	CSI THRUSTING (P41)	26	127+00-127+10	RR NAVIGATION (P20,9 MARKS)
10	125+24	CDH TARGETING (P33 & AGS)	27	127+11	COMPUTE MCC1 BACKUP
11	125+24-125+40	RR NAVIGATION (P20,14 MARKS)	28	127+13	MCC1 THRUSTING (P41)
12	125+28	SET W MATRIX (2000,2,5)	29	127+14	MCC2 TARGETING (P35)
13	125+40	EXT ΔV FOR PLANE CHANGE (P30)	30	127+14-127+25	RR NAVIGATION (P20,9 MARKS)
14	125+50	RCS PLANE CHANGE THRUSTING (P41)	31	127+26	COMPUTE MCC2 BACKUP
15	125+52	CDH TARGETING (P33 & AGS)	32	127+28	MCC2 THRUSTING (P41)
16	125+52-126+08	RR NAVIGATION (P20,13 MARKS)	33	127+30	BRAKING (P47)
17	126+08	COMPUTE CDH BACKUP	34	127+44	STATION KEEPING

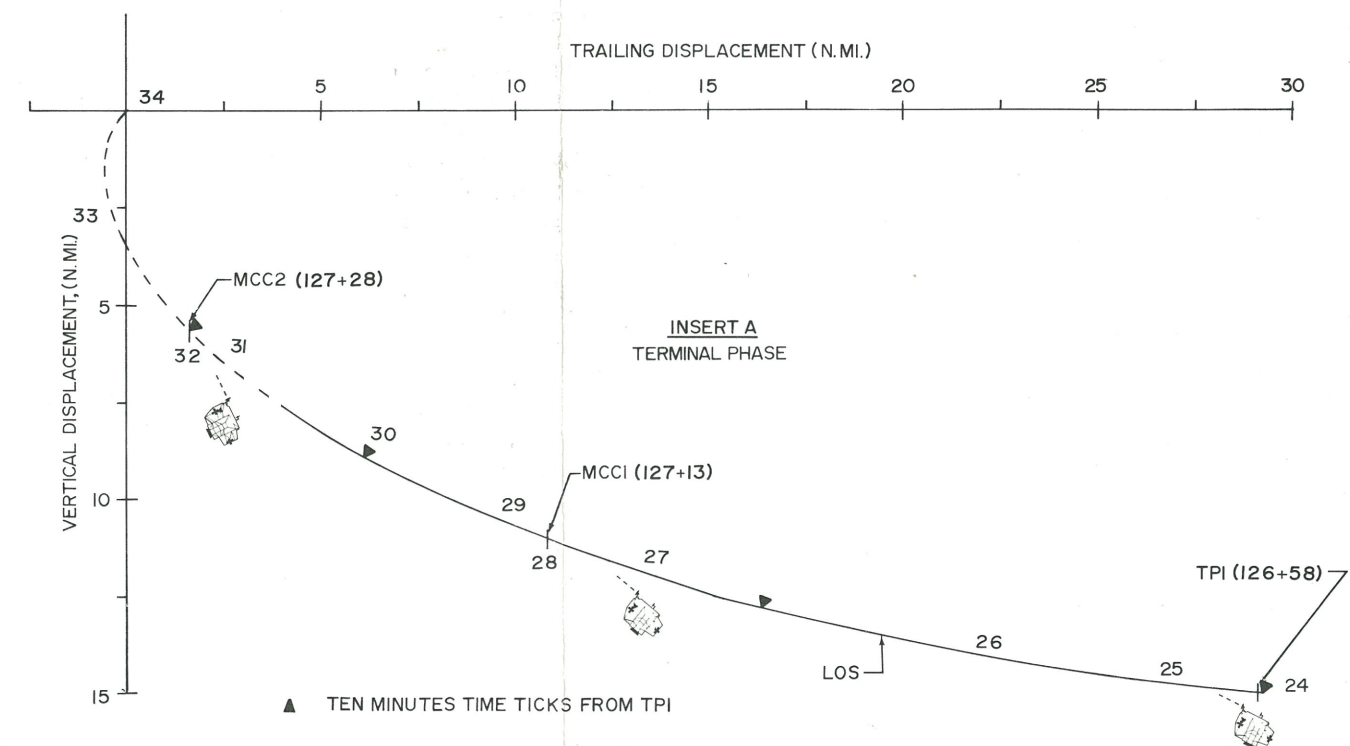


FIGURE 2-1
G MISSION RENDEZVOUS
(CSM-CENTERED RELATIVE MOTION)

MISSION G
LUNAR ORBIT RENDEZVOUS
ATTITUDE TIME HISTORY FOR THE LM

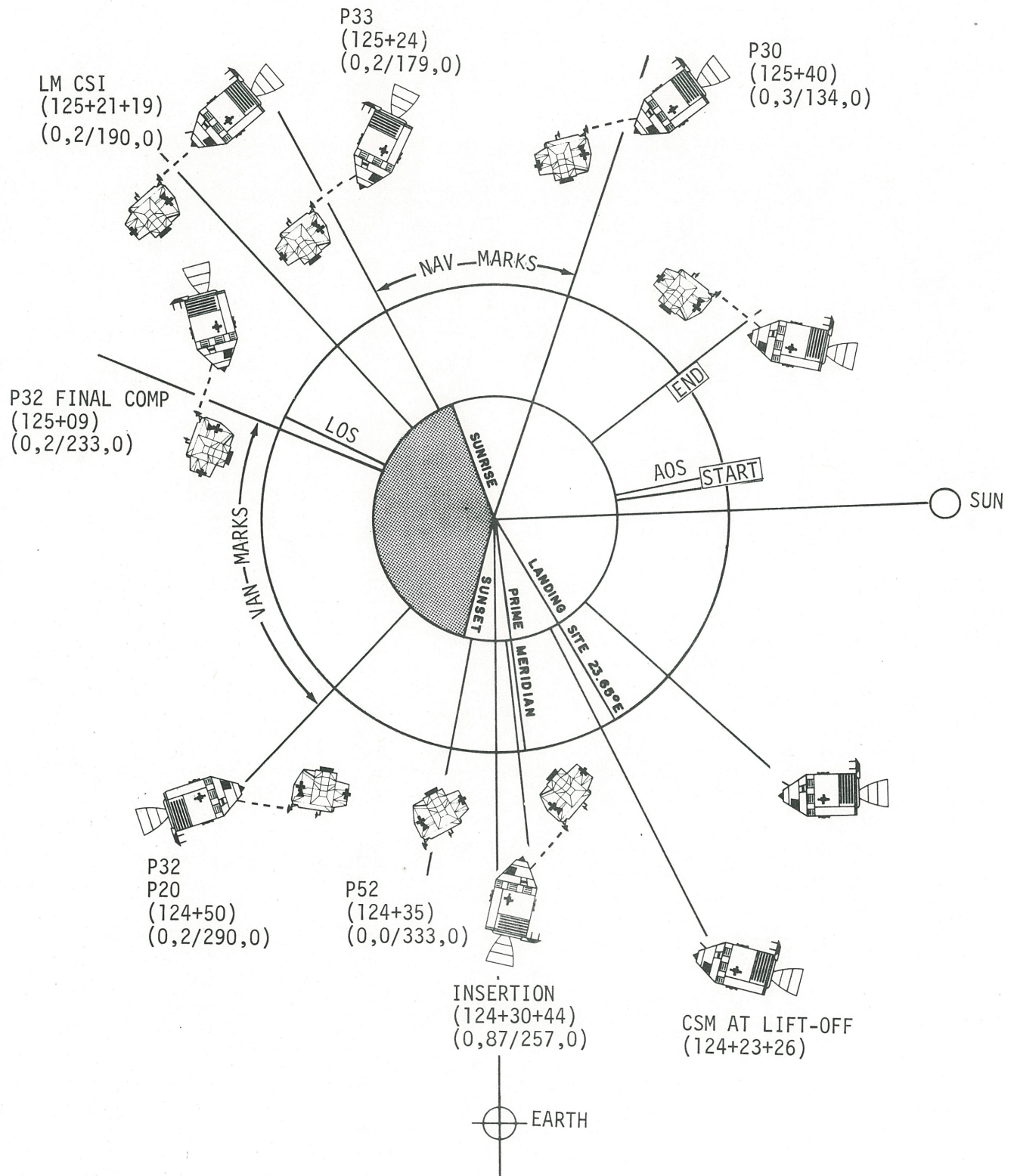


FIGURE 2-2

2-4

MISSION G
LUNAR ORBIT RENDEZVOUS
ATTITUDE TIME HISTORY FOR THE LM

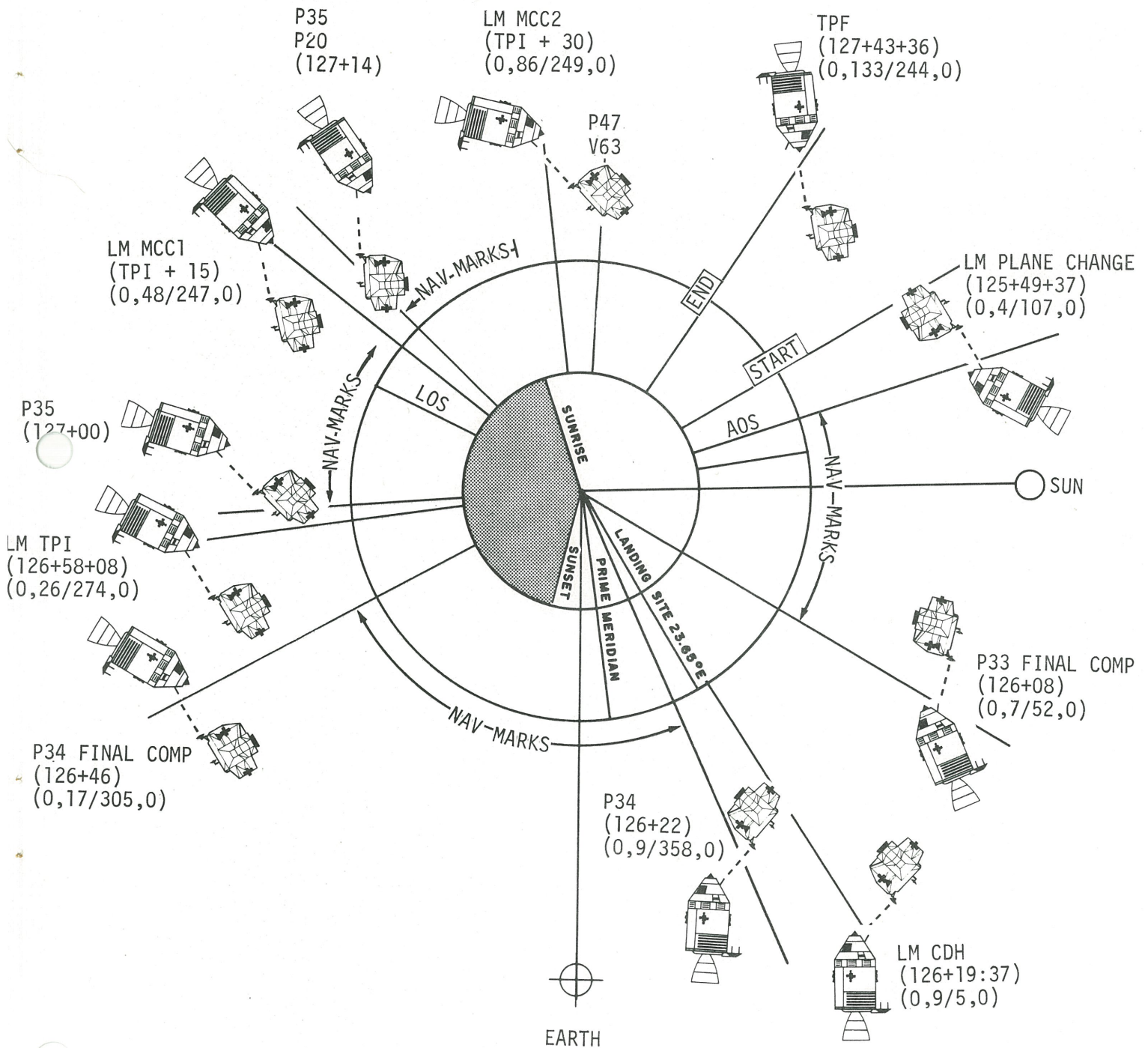


FIGURE 2-3

3.0 DISCUSSION OF MAJOR EVENTS

3.1 Concentric Sequence Initiation

Immediately following Insertion the LM navigated vector will be downlinked to Mission Control Center-Houston, this state vector is then uplinked to the CSM. The LM commander will perform a Program 52 fine alignment to REFSMMAT at approximately 124:35.

The digital autopilot is configured to wide deadband, Program P20 is called, and an automatic pitch maneuver is initiated to the preferred track attitude. At 124:50, CSI targeting parameters are loaded in the PGNS and AGS. A period of rendezvous radar marking will then take place from 124:50 to 125:09. Upon completion of tracking, the LM will obtain an out-of-plane velocity from the CSM to be vectored with the in-plane component of the CSI delta V. The CSM's estimate of out-of-plane velocity is alleged to be better than the LM's estimate. (Reference 7.4.)

At approximately 125:13 the LM will voice its CSI solution to the CSM; the AGS is updated, aligned, and targeted in external delta-V with the CDH solution to be executed. Program P41 will then be called and the automatic pitch maneuver bypassed since the burn is to be executed with Z-axis thrusting. The CSI burn occurs nominally at 125:21:19. After verification of the LM CSI burn, the CSM will incorporate the LM burn parameters in its CMC LM state vector.

3.2 Constant Delta Height and Plane Change

At 125:24 approximately three minutes after the LM CSI burn, the LM targeting parameters are loaded in both the PGNS and AGS for the CDH maneuver then when marks equal four the W matrix will be set to (2000,2,5). Out-of-plane velocity will then be computed and voiced to the LM from the CSM. Program P30 is loaded with the targeting parameters for the LM Plane Change maneuver which will be accomplished in Program P41 30 minutes prior to the CDH maneuver. Following the burn, the target delta V parameters are voice to the CSM and incorporated into the CMC LM state vector. At 125:52 the CDH targeting parameters are loaded in both the PGNS and AGS for 126:19:37. A CDH chart solution is calculated 7 minutes prior to TIG. The AGS is updated, aligned, and targeted in external delta V with the CDH solution to be executed. The RCS Thrust Program, P41, is called at 126:14 and the burn attitude is bypassed since the LM executes CDH by thrusting out individual components of delta V while maintaining radar lock-on.

3.3 Terminal Phase Initiation

Radar tracking is initiated after the CDH maneuver and updating of the LGC continued. At 126:22, approximately two minutes after the LM CDH burn, targeting parameters are loaded in both the PGNS and AGS for the TPI maneuver which will be targeted for a node at intercept. Backup measurements are made at the appropriate times. The AGS is updated, aligned, and targeted in external delta V with the TPI solution to be executed. The RCS Thrust Program, P41, is called at 126:52 and the burn attitude is bypassed since the LM is burning along the plus Z-axis with the thrust direction established by resolving all delta V components into the third register.

3.4 Midcourse Corrections

Immediately after TPI the Midcourse Prethrust Program, P35, will be called and radar tracking reinitiated. Backup measurements are made and midcourse corrections chart solutions obtained. The MCC1 burn will nominally be performed at TPI plus 15 minutes (127:13:08). If MCC1 is to be executed, Program P41 will be called and the burn attitude maneuver is bypassed since the plus Z-axis will remain boresighted at the CSM until docking.

Following MCC1, Program P35 will be called and targeted for MCC2 at TPI plus 30 minutes (127:28:08) and executed identically to MCC1.

3.5 Braking

In preparation for braking, the DAP is configured in narrow deadband. Program P20 is terminated at 18,000 feet but the radar is kept in auto track to provide radar range and range rate displayed on the tapemeter. Average "G" is called by Program P47 prior to braking, and attitude hold is selected. The braking schedule is followed as contained in Section 4.

4.0 NOMINAL MISSION PROCEDURES

The procedures included in this section do not specify which crewmember, Commander or LM Pilot, performs each task. These need not be specified since the following basic rules define which crewmember performs each task.

4.1 Commander Tasks

1. All attitude changes, whether manual or automatic, will be accomplished by the CDR.
2. The operation of the DSKY during thrust programs (P40, P41, P42, P47) will be done by the CDR. Actual manipulation of the TTCA need not be always done by the CDR, but in most cases will be.
3. Operation of the rendezvous and landing radar will be done by the CDR.
4. The CDR will operate all other systems accessible to only his crew station.

4.2 LM Pilot Tasks

1. AGS operation.
2. DSKY operation will be done by the LMP except when keyboard entries affect the control of spacecraft attitude or thrusting.
3. Backup data logging and chart calculations.
4. All logging of maneuver solutions and systems performance.
5. The LMP will operate all other systems accessible to only his crew station.

These general rules are guidelines only, and may be deviated from by the LM crew if they develop more efficient Task assignments.

4.3 Abbreviations

The abbreviations used herein are consistent with those in the AOH. However, in order to condense and simplify the procedures so that they are representative of onboard data, a number of additional shorthand conventions have been used. To allow the unfamiliar reader to understand the procedures contained in this section, the following explanations are included:

1. AGS - A single asterisk is employed to denote those procedures involving operations to be performed on the DEDA. The three number group following an asterisk specifies DEDA address. An "R" following the address group indicates the address is to be read out. A five digit group behind the "R" indicates a

nominal or expected display. If the three number address group is followed by a plus or minus sign, a data load is indicated. When a single digit follows the plus, addition of four zeros behind this digit is assumed. Once used, these conventions are easily handled and save considerable space.

2. PGNS - The verb-noun addresses in the PGNS are indicated to the left of the procedures column. An "F" is used to indicate a flashing display, or absence of an "F" a static display. To the right of the verb-noun, on the same line, are the contents of the three data registers. If numeric quantities appear, the DSKY should be correspondingly made to agree by executing a V21, V22, or V23 and performing a data load. The procedure of blanking and loading registers is not included since it is repeated often and is highly familiar to the crews.

EXAMPLE: F 06 33 126:58:08 TIG OF TPI

Expanded, this means; Load flashing verb 06 noun 33 with the quantity 126 hours, 58 minutes and 8 seconds; the time of ignition of the RCS engine TPI maneuver. Procedurally, this is done by keying verb 25 enter, loading +00126 in register 1, +00058 in register 2, and +00800 in register 3.

If numeric quantities do not follow the verb-noun, it is indicated that a computed or information quantity is being displayed via the DSKY. If nominal values are listed for possible comparison, they appear in parentheses.

EXAMPLE: F 06 42 HA HP DELTA V

Expanded, this means: Flashing verb 06 noun 42 has computed height of apogee in register 1, height of perigee in register 2, and velocity to be gained in register 3.

3. TIME - The numbers in the left hand column preceded by a plus or minus indicate "event timer" time referenced to an event. Minus indicates event timer counting down to a future event. Periodically, this same column contains the nominal mission ground elapsed times in parentheses. Asterisks following the event time indicate a time critical event which should be accomplished to the nearest second.

4.4 Nominal PGNS Procedures

ASSUMPTIONS

 * AFTER INSERTION *

- 1 INSERTION COMPLETE (RESIDUALS NULLED)
- 2 VERIFY V82E (ORBIT)
- 3 RNDZ RDR LOCKED ON IN MODE II
- 4 LGC AT FLASHING VERB 37
- 5 PROPER INITIAL W MATRIX LOADED IN LGC

GUID CONT-PGNS
 ATTITUDE MON-PGNS(CDR)
 RATE ERR MON-CMPTR(LMP)
 ATTITUDE MON-AGS(LMP)
 SHFT/TRUN-+5 DEG
 RADAR TEST SW-OFF
 ENG ARM-OFF
 DEADBAND-MIN
 THROT/JET-JET
 CB/PGNS IMU OPR-CLOSE
 ATT CONT-MODE CONT(3)
 TTCA/TRANSL-ENABLE(CDR)

 * X POINTER-LO MULT *
 * R/R MODE-AUTO TRACK *
 * MODE SEL-AGS *
 * RNG/ALT MON-RGN/RNGRT *
 * ABORT STAGE-RESET *
 * STOP-RESET *
 * PGNS MODE CONT-ATT HOLD *
 * AGS MODE CONT-ATT HOLD *
 * ATT/TRANSL-2 JETS *
 * BAL CPL-ON *
 * RATE ERR MON-RNDZ RDR(CDR) *
 * ACA/4 JET-DISABLE(CDR) *
 * TTCA/TRANSL-DISABLE(LMP) *
 * ACA/4 JET-DISABLE(LMP) *

KEY 00E (P00)

(DOWNLINK LM STATE VECTOR)

KEY V63E (RR SELF TEST)

RR MODE-LGC

F 04 12 00004 00001

PRO

F 16 72 TRUN SHFT

PRO

F 16 78 R RDOT

VERIFY TAPE METER WITH DSKY

+2 * VERIFY INSERTION VELOCITY *
 * WITH RNDZ RDR, WHERE *
 * RANGE = 264.2 N.M. *
 * RANGE RATE = -425.1 FPS *

SUIT/CABIN PRESS - NOR

GLYCOL TEMP/PRESS - NOR

O2/H2O QUANTITY - NOMINAL

KEY V34E (TERMINATE AUTO TRACK ENABLE)

KEY V48E (LOAD DAP)

F 01 46 1(2) 2002

PRO

F 06 47 LMWT CMWT

PRO

+3 KEY V41N72E (COARSE ALIGN R/R)

F 24 73 +000.00TRUN +283.00SHFT

F 04 12 00006 00002 (CONTINUOUS DESIGNATE)

PRO

41 (COARSE ALIGN VERB)

KEY V16N72E

16 72 MONITOR TRUN/SHFT ANGLES

CB PGNS RNDZ RDR-OPEN

CB AC BUS A RNDZ RDR-OPEN

KEY V44E (TERMINATE RR DESIGNATE)

EXT LGT-TRACK

CB HEATER AOT-CLOSE

CB AOT LAMP-CLOSE

+4 KEY V37E52E (IMU REALIGN)

*410+1 CSI ROUTINE

*373+0321.3 CSI TIME
 *275+0418.1 TPI TIME
 *605+00777 COTANGENT OF LOS TO CSM
 *416+1 (ONE-HALF ORBITAL PERIOD)
 *623+0 Z-AXIS PARALLEL TO CSM ORBIT
 *451+0 OUT-OF-PLANE VELOCITY

F 04 06 00001 00003 (REFSMAT)
 PRO

F 50 25 00015 SELECT 1ST STAR
 ENTR

F 01 70 002DE LOAD 1ST STAR
 PRO

PGNS MODE CONT-AUTO
 F 50 18 FDAI ANGLES (REQUEST MNVR)
 PRO (AUTO MNVR)

06 18 FDAI ANGLES (AUTO MNVR)
 F 50 18 FDAI ANGLES (REQUEST MNVR)
 ENTR (BYPASS MNVR)

F 01 71 002DE

+6 SUNSET

KEY V76E (PGNS PULSE)
 PGNS MODE CONT-ATT HOLD
 PRO

+9 F 54 71 MARK 1ST STAR
 PRO

F 01 70 002DE LOAD 2ND STAR
 PRO

PGNS MODE CONT-AUTO
 F 50 18 FDAI ANGLES (REQUEST MNVR)
 PRO (AUTO MNVR)

06 18 FDAI ANGLES (AUTO MNVR)
 F 50 18 FDAI ANGLES (REQUEST MNVR)
 ENTR (BYPASS MNVR)

F 01 71 002DE

PGNS MODE CONT-ATT HOLD
 PRO

+13 F 54 71 MARK 2ND STAR
 PRO

F 06 05 STAR ANGLE DIFFERENCE
 PRO

F 06 93 GYRO TORQUE ANGLES
 PRO

F 50 25 00014

PRO (CHECK ALIGNMENT IF TIME WILL PERMIT)

F 50 25 00015 SELECT 3RD STAR

ENTR
F 01 70 002DE LOAD 3RD STAR
PRO

PGNS MODE CONT-AUTO
F 50 18 FDAI ANGLES (REQUEST MNVR)
PRO (AUTO MNVR)

06 18 FDAI ANGLES (AUTO MNVR)
F 50 18 FDAI ANGLES (REQUEST MNVR)
ENTR (BYPASS MNVR)

F 01 71 002DE

VERIFY ALIGNMENT VIA AOT

KEY V34E (TERMINATE)

F 37 8B

KEY V48E (LOAD DAP)

F 01 46 1(2) 1012

PRO

F 06 47 LMWT CMWT

+17

PRO

F 37 8B

CB AOT LAMP-OPEN
*310R TIME TO CSI

-35

RESET ET

(124:48)

CB AC BUS A RNDZ RDR-CLOSE
(WAIT 30 SEC)
CB PGNS RNDZ RDR-CLOSE

KEY V95E (NO SV UPDATE)

KEY V67E (RESET W MATRIX)

F 06 99 +10000 +00100 +00015

PRO

F 37 8B

KEY 20E (ACQUIRE RADAR)

PGNS MODE CONT-AUTO

F 50 18 FDAI ANGLES (REQUEST MNVR)
PRO (AUTO MNVR)

06 18 FDAI ANGLES (AUTO MNVR)

AGS MODE CONT-AUTO

RATE/ERR MON-CMPTR (LMP)

F 50 18 FDAI ANGLES (REQUEST MNVR)
ENTR (BYPASS MNVR)

NO TRK LT-OFF

F 50 72 RR TRUN/SHFT
 VERIFY R/R LOCK ON
 PRO
 DSKY BLANKS

(WAIT 20 SEC TO READ R/R DATA AT LEAST ONCE)
 KEY V80E (UPDATE LM SV)

KEY V67E (WHEN MARK=1)
 F 06 99 MONITOR CONVERGENCE
 PRO

 * CSI TARGETING *

(124:50) KEY V37E32E (CSI)

F 06 11 ____:____:____ LOAD TIG CSI FROM DATA PAD
 (NOM 125:21:19)
 PRO

F 06 55 +00001N +026.60E +130.00 OMEGAT
 (CDH 180 DEG AFTER CSI)
 PRO

F 06 37 ____:____:____ LOAD TIG TPI FROM DATA PAD
 (NOM 126:58:08)
 PRO

F 16 45 MKS TFI -00001

-30* COPY 1ST RDOT FOR CSI BU

KEY V47E (INITIALIZE AGS)
 F 06 16 GET OF AGS 0 TIME (120:00:00)
 TELEMETRY PCM SW-HI
 *414+1 UPDATE AGS
 PRO

06 16 UPDATE IN PROGRESS
 *414R (+00000 COMPLETE)
 F 50 16 UPDATE COMPLETE
 PRO

F 16 45 MKS TFI -00001

KEY V83E (RENDEZVOUS PARAMETERS)
 F 16 54 R RDOT THETA
 SET ORDEAL
 PRO

F 16 45 MKS TFI -00001

*400+3 AGS ALIGN
 *400R (00000 COMPLETE)
 *400+2 Z-AXIS STEERING
 *507+0 Z-AXIS BORESIGHT

*310R TIME TO CSI

*267R _____ VELOCITY TO BE GAINED CSI

*402R _____ DELTA H

*371R _____ PREDICTED VEL TO BE GAINED CDH

*372R _____ TIME CSI/CDH

-22

KEY V32E (MARKS=10)

F 06 75 DELTA H DELTA T CSI/CDH DELTA T CDH/TPI
 PRO

F 06 81 DELTA V'S-LV (CSI)

CSI(N81)

DELTA VX(LV) _____ (NOM 49.5)

DELTA VY(LV) _____ (NOM 0.0)

DELTA VZ(LV) _____ (NOM 0.0)

PRO

F 06 82 DELTA V'S-LV (CDH)

CDH(82)

DELTA VX(LV) _____ (NOM -1.1)

DELTA VY(LV) _____ (NOM 0.0)

DELTA VZ(LV) _____ (NOM 4.1)

-20*

COPY 2ND RDOT FOR CSI BU

PRO

F 16 45 MKS TFI -00001

TEMP/PRESS MON SEL - FUEL MAN

A AND B PRESS 181 +-3 PSIG

TEMP/PRESS MON SEL - PRPLNT

A AND B TEMP IND 40 TO 100 DEG F

A AND B PRESS IND 181 +-3 PSIA

TEMP/PRESS MON SEL - HEL

A AND B PRESS IND _____ PSIA

A QUANTITY IND _____ PERCENT REMAINING

B QUANTITY IND _____ PERCENT REMAINING

TEMP MON SEL RCS QUAD 1, 4, 2, 3 (120 - 190 DEG F)

KEY V90E (OUT-OF-PLANE)

F 06 16 ____:____:____ LOAD TIG CSI FROM DATA PAD
(NOM 125821819)

PRO

F 06 90 Y YDOT PSI
N90 CSM

YDOT _____

PRO

F 16 45 MKS TFI -00001

-12

PRO (FINAL COMP)

(LOS OF MSFN)

S-BAND - SLEW TO P = +90, Y = 0

S-BAND - FWD (OR AFT)

S-BAND - DN VOICE BU

BIOMED OFF

F 06 75 DELTA H DELTA TCSI/CDH DELTA TCDH/TPI

PRO

F 06 81 DELTA V'S-LV (CSI)

COPY YDOT FROM CSM AND LOAD NEGATIVE IN R2
CSI(N81)

DELTA VX(LV) _____ (NOM 49.5)

DELTA VY(LV) _____ (NOM 0.0)

DELTA VZ(LV) _____ (NOM 0.0)

PRO

F 06 82 DELTA V'S-LV (CDH)

CDH(82)

DELTA VX(LV) _____ (NOM -1.1)

DELTA VY(LV) _____ (NOM 0.0)

DELTA VZ(LV) _____ (NOM 4.1)

PRO

4-10

F 16 45 MKS TFI MGA

-10* COPY RANGE AND 3RD RDOT FOR CSI BU
COMPUTE CSI BU

-7 KEY V47E (INITIALIZE AGS)
F 06 16 GET OF AGS 0 TIME (120.00.00)
TELEMETRY PCM SW-HI
*414+1 UPDATE AGS
PRO
06 16 UPDATE IN PROGRESS
*414R (+00000 COMPLETE)
F 50 16 UPDATE COMPLETE
PRO

F 16 45 MKS TFI MGA

KEY V83E (RENDEZVOUS PARAMETERS)
F 16 54 R RDOT THETA
SET ORDEAL
PRO

F 16 45 MKS TFI MGA

*317R _____ RANGE

*440R _____ RANGE RATE

*400+3 AGS ALIGN

*400R (00000 COMPLETE)

*277R _____ LOS ANGLE

PRO

F 37 BB

-6 KEY 41E (RCS THRUSTING)
F 50 18 FDAI ANGLES (REQUEST MNVR)
ENTR (BYPASS MNVR)

16 85 DELTA V'S-BODY

KEY V06N86E DELTA V'S-LV
06 86 DELTA V'S-LV

AGS(N86) CHART

DELTA VX(LV)

DELTA VY(LV)

DELTA VZ(LV)

4-11

KEY RELEASE

16 85 DELTA V'S-BODY

PGNS MODE CONT-ATT HOLD
PULSE TO DRIVE R1 AND R2 TO ZERO
PGNS MODE CONT-AUTO

*400+0 ATT HOLD
*410+5 EXTERNAL DELTA V
*450 451 452 LOAD
*407+0 ROTATE EXTERNAL DELTA V RF

TRANSMIT TGT DELTA V'S TO CSM AND SYNC COUNTDOWN

*502R _____ DELTA VZ (NOM 49.5)

-835

DSKY BLANKS FOR 5 SEC

KEY V77E (RATE COMMAND)
PGNS MODE CONT-ATT HOLD
AGS MODE CONT-ATT HOLD
*407+1 FREEZE EXTERNAL DELTA V
*502R DELTA VZ

-0 F 16 85 DELTA V'S-BODY

(125:21:19) BURN +Z

NULL DELTA V'S

VERIFY AGS RESIDUALS

*500R 501R 502R
DELTA VX _____ DELTA VY _____ DELTA VZ _____

VERIFY PGNS RESIDUALS

CSI(N85)

DELTA VX(LM) _____

DELTA VY(LM) _____

DELTA VZ(LM) _____

PRO

F 37 BB

4-12

* CDH TARGETING *

KEY V76E (PGNS PULSE)
PGNS MODE CONT-AUTO
*400+2 Z-AXIS STEERING

(125:24) KEY 33E (CDH PRE-THRUST)

+4 SUNRISE

*410+2 CDH ROUTINE

F 06 13 : : TIG CDH (NOM 126:19:37)
-120 :00 :00 (AGS 0 TIME)

(CONVERT TO MINUTES)

ENTER IF YOU DON'T TARGET CSI

*373R (NOM 379.6)

*310R TIME TO CDH

*477R PREDICTED ALT RATE AT CDH

*402R DELTA H

*450R DELTA VX

*452R DELTA VZ

PRO

F 16 45 MKS TFI -00001

-52

RESET ET

KEY V67E (RESET W MATRIX WHEN MARKS = 4)

F 06 99 +02000 +00020 +00005
PRO

F 16 45 MKS TFI -00001

KEY V32E (MARKS = 3)

F 06 75 DELTA HCDH DELTA TCDH/TPI DELTA TTPI/TPI
PRO

F 06 81 DELTA VCDH-LV

4-13

CDH(N81)

DELTA VX(LV) _____ (NOM -1.1)

DELTA VY(LV) _____ (NOM 0.0)

DELTA VZ(LV) _____ (NOM 4.1)

PRO

F 16 45 MKS TFI -00001

-47

KEY V90E (OUT-OF-PLANE)

— : — : TIG CDH (NOM 126:19:37)
-30:00 TIME FROM CDH

F 06 16 — : — : LOAD TIG PLANE CHANGE
(NOM 125:49:37)

PRO

F 06 90 Y YDOT PSI
N90 CSM

YDOT
PRO

F 16 45 MKS TFI - 00001

-42

KEY V32E (MARKS=10)

F 06 75 DELTA HCDH DELTA TCDH/TPI DELTA TTPI/TPI
PRO

F 06 81 DELTA VCDH-LV

CDH(N81)

DELTA VX(LV) _____

DELTA VY(LV) _____

DELTA VZ(LV) _____

PRO

F 16 45 MKS TFI -00001

KEY V34E (TERMINATE)

F 37 BB

 * PLANE CHANGE TARGETING *

KEY 30E (EXTERNAL DELTA V)

___:___:___ TIG CDH (NOM 126:19:37)
 -30:00 TIME FROM CDH

F 06 33 ___:___:___ LOAD TIG PLANE CHANGE
 (NOM 125:49:37)
 PRO

F 06 81 DELTA V'S-LV (CDH)

-36* COPY 1ST RDOT FOR CDH BU

KEY V90E (OUT-OF-PLANE)

F 06 16 ___:___:___ LOAD TIG PLANE CHANGE
 (NOM 125:49:37)
 PRO

F 06 90 Y YDOT PSI
 N90 CSM

YDOT _____

PRO

F 06 81 DELTA V'S-LV

COPY YDOT FROM CSM AND LOAD NEGATIVE IN R2
 FOR PLANE CHANGE
 CDH(81)

DELTA VX(LV) _____ (NOM 0.0)

DELTA VY(LV) _____ (NOM 0.0)

DELTA VZ(LV) _____ (NOM 0.0)

PRO

F 06 42 HA HP DELTA V

PRO

F 16 45 MKS TFI MGA

PRO

F 37 BB

KEY 41E (RCS THRUSTING)

F 50 18 FDAI ANGLES (REQUEST MNVR)
 ENTR (BYPASS MNVR)

4-15

*400+0 ATT HOLD
*410+5 EXTERNAL DELTA V
*450+0 451-YDOT 452+0
(LOAD CSM -YDOT)
*407+0 ROTATE EXTERNAL DELTA V RF

16 85 DELTA V'S-BODY

-30:35 DSKY BLANKS FOR 5 SEC

KEY V77E (RATE COMMAND)
PGNS MODE CONT-ATT HOLD
AGS MODE CONT-ATT HOLD
*407+1 FREEZE EXTERNAL DELTA V
*501R DELTA VY

-30 F 16 85 NULL DELTA V'S

PRO

F 37 BB

KEY V76E (PGNS PULSE)
PGNS MODE CONT-AUTO
*400+2 Z-AXIS STEERING

(125:52) KEY 33E (CDH PRE-THRUST)

*410+2 CDH ROUTINE

F 06 13 ____:____:____ TIG CDH (NOM 126:19:37)
-120 :00 :00 (AGS 0 TIME)

____ (CONVERT TO MINUTES)

*373R ____ (NOM 379.6)
*310R TIME TO CDH

*477R ____ PREDICTED ALT RATE AT CDH

*402R ____ DELTA H

*450R ____ DELTA VX

*452R ____ DELTA VZ

PRO

F 16 45 MKS TFI -00001

-25

KEY V93E (REINIT W MATRIX WHEN MARKS = 4)

-23*

COPY 2ND RDOT FOR CDH BU

(AOS OF MSFN)

S-BAND - SLEW TO P = _____, Y = _____

ACQUIRE HGA LOCK ON

VOICE - BU/VOICE -- VOICE

VERIFY VOICE, TLM

BIOMED - LEFT (OR RIGHT)

KEY V32E (MARKS = 5)

TEMP/PRESS MON SEL - FUEL MAN

A AND B PRESS 181 $\pm$ 3 PSIG

TEMP/PRESS MON SEL - PRPLNT

A AND B TEMP IND 40 TO 100 DEG F

A AND B PRESS IND 181 $\pm$ 3 PSIA

TEMP/PRESS MON SEL - HEL

A AND B PRESS IND _____ PSIA

A QUANTITY IND _____ PERCENT REMAINING

B QUANTITY IND _____ PERCENT REMAINING

TEMP MON SEL RCS QUAD 1, 4, 2, 3 (120 - 190 DEG F)

SUIT/CABIN PRESS - NOR

GLYCOL TEMP/PRESS - NOR

O2/H2O QUANTITY - NOMINAL

F 06 75 DELTA HCDH DELTA TCDH/TPI DELTA TTPI/TPI
PRO

F 06 81 DELTA VCDH-LV

CDH(N81)

DELTA VX(LV) _____

DELTA VY(LV) _____

DELTA VZ(LV) _____

PRO

F 16 45 MKS TFI -00001

KEY V90E (OUT-OF-PLANE)

F 06 16 _____:_____:_____ LOAD TIG CDH FROM DATA PAD
(NOM 126:19:37)

PRO

4-17

F 06 90 Y YDOT PSI
N90 CSM

YDOT

PRO

F 16 45 MKS TFI -00001

-12

PRO (FINAL COMP)

F 06 75 DELTA HCDH DELTA TCDH/TPI DELTA TTPI/TPI
PRO

F 06 81 DELTA VCDH-LV

COPY YDOT FROM CSM AND LOAD NEGATIVE IN R2
CDH(N81)

DELTA VX(LV) (NOM -1.1)

DELTA VY(LV) (NOM 0.0)

DELTA VZ(LV) (NOM 4.1)

PRO

F 16 45 MKS TFI MGA

-10*

COPY 3RD RDOT FOR CDH BU

COMPUTE CDH BU

TRANSMIT TGT DELTA V'S TO CSM AND SYNC COUNTDOWN

-7

KEY V47E (INITIALIZE AGS)

F 06 16 GET OF AGS 0 TIME (120:00:00)

TELEMETRY PCM SW-HI

*414+1 UPDATE AGS

PRO

06 16 UPDATE IN PROGRESS

*414R (+00000 COMPLETE)

F 50 16 UPDATE COMPLETE

PRO

F 16 45 MKS TFI MGA

KEY V83E

F 16 54 R RDOT THETA

SET ORDEAL

PRO

F 16 45 MKS TFI MGA

*317R RANGE

4-18

*440R _____ RANGE RATE
*400+3 AGS ALIGN
*400R (00000 COMPLETE)

*277R _____ LOS ANGLE

PRO

F 37 BB

-6

F 50 18 KEY 41E (RCS THRUSTING)
FDAI ANGLES (REQUEST MNVR)
ENTR (BYPASS MNVR)

16 85 DELTA V'S-BODY

KEY V06N86E

06 86 DELTA V'S-LV

AGS(N86)

CHART

DELTA VX(LV) _____

DELTA VY(LV) _____

DELTA VZ(LV) _____

KEY RELEASE

16 85 DELTA V'S-BODY

*400+0 ATT HOLD

*410+5 EXTERNAL DELTA V

*450 451 452 LOAD

*407+0 ROTATE EXTERNAL DELTA V RF

*500R _____ DELTA VX

-835

DSKY BLANKS FOR 5 SEC

KEY V77E (RATE COMMAND)

PGNS MODE CONT-ATT HOLD

AGS MODE CONT-ATT HOLD

*407+1 FREEZE EXTERNAL DELTA V

*500R DELTA VX

-0 F 16 85 DELTA V'S-BODY

(126:19:37) NULL DELTA V'S

VERIFY AGS RESIDUALS

*500R

501R

502R

DELTA VX _____

DELTA VY _____

DELTA VZ _____

VERIFY PGNS RESIDUALS

CDH(N85)

DELTA VX(LM) _____

DELTA VY(LM) _____

DELTA VZ(LM) _____

PRO

F 37 BB

 * TPI TARGETING *

KEY V76E (PGNS PULSE)
 PGNS MODE CONT-AUTO
 *400+2 Z-AXIS STEERING

(126:22) KEY 34E (TPI)

-36 RESET ET

F 06 37 ____:____:____ LOAD TIG TPI FROM DATA PAD
 (NOM 126:58:08)

PRO

F 06 55 +00000 +026.60E +130.00 OMEGAT

PRO

F 16 45 MARKS TFI -00001

-32 KEY V93E (REINIT W MATRIX WHEN MARKS = 4)

-29 KEY V32E (MARKS = 3)

F 06 37 ____:____:____ TIG TPI

PRO

F 06 58 HP DELTA VTPI DELTA VTPF

PRO

F 06 59 DELTA V'S-LDS

TPI(N59)

DELTA V F/A _____ (NOM 24.8)

DELTA V R/L _____ (NOM 0.0)

DELTA V D/U _____ (NOM 0.0)

4-20

PRO
F 16 45 MKS TFI -00001

RESET ET

-26 *410+3 TPI SEARCH ROUTINE
*307+043.00 DELTA T TRANSFER
*310+026.00 TFI TPI

*303R _____ THETA AT TPI

*267R _____ DELTA VTPI

*371R _____ DELTA VTPI + DELTA VTPF

-23 ***** SUNSET *****
***** KEY V32E (MARKS = 10) *****

F 06 37 ____:____:____ TIG TPI

PRO

F 06 58 HP DELTA VTPI DELTA VTPF

PRO

F 06 59 DELTA V'S-LOS

TPI(N59)

DELTA V F/A _____

DELTA V R/L _____

DELTA V D/U _____

PRO

F 16 45 MKS TFI -00001

TEMP/PRESS MON SEL - FUEL MAN

A AND B PRESS 181 +-3 PSIG

TEMP/PRESS MON SEL - PRPLNT

A AND B TEMP IND 40 TO 100 DEG F

A AND B PRESS IND 181 +-3 PSIA

TEMP/PRESS MON SEL - HEL

A AND B PRESS IND _____ PSIA

A QUANTITY IND _____ PERCENT REMAINING

B QUANTITY IND _____ PERCENT REMAINING

TEMP MON SEL RCS QUAD 1, 4, 2, 3 (120 - 190 DEG F)

SUIT/CABIN PRESS - NOR

GLYCOL TEMP/PRESS - NOR

O2/H2O QUANTITY - NOMINAL

KEY V90E (OUT-OF-PLANE)

F 06 16 ____:____:____ LOAD TIG TPI FROM DATA PAD
(NOM 126:58:08)

PRO

F 06 90 Y YDOT PSI
N90 CSM

YDOT _____

PRO

F 16 45 MKS TFI -00001

RESET ET

-13 *310+013.00 TFI TPI

*303R _____ THETA AT TPI

-12 PRO (FINAL COMP)

F 06 37 ____:____:____ TIG TPI

TRANSMIT TIG OF TPI TO CSM

PRO

F 06 58 HP DELTA VTPI DELTA VTPF

PRO

F 06 81 DELTA V'S-LV

COPY CSM YDOT AND LOAD NEGATIVE IN R2
TPI(N81)

DELTA VX(LV) _____ (NOM 22.0)

DELTA VY(LV) _____ (NOM 0.0)

DELTA VZ(LV) _____ (NOM -11.1)

PRO

F 06 59 DELTA V'S LOS

TPI(N59)

DELTA V F/A _____ (NOM 24.8)

DELTA V R/L _____ (NOM 0.0)

DELTA V D/U _____ (NOM 0.0)

PRO

F 16 45 MKS TFI MGA

4-22

RESET ET

PRO

F 37 BB

-10

KEY V47E (INITIALIZE AGS)

F 06 16 GET OF AGS 0 TIME (120:00:00)

TELEMETRY PCM SW-HI

*414+1 UPDATE AGS

PRO

06 16 UPDATE IN PROGRESS

*414R (+00000 COMPLETE)

F 50 16 UPDATE COMPLETE

PRO

F 37 BB

*400+3 AGS ALIGN

*400R (00000 COMPLETE)

-9*

*277R COPY TGT LOS ANGLE

*310+008.00

*303R _____ THETA AT TPI

*410+4 DIRECT TRANSFER AT ET=-8

*404+0 405+0 406+0

(MONITOR 470 471 472)

*373R _____ TIG TPI

*267R _____ DELTA V TPI

*371R _____ DELTA V TPI + DELTA V TPF

-6

KEY 41E (RCS THRUSTING)

F 50 18 FDAI ANGLES (REQUEST MNVR)

ENTR (BYPASS MNVR)

16 85 DELTA V'S-BODY

KEY V06N86E DELTA V'S-LV

06 86 DELTA V'S-LV

AGS(N86)

CHART

DELTA VX(LV)

DELTA VY(LV)

DELTA VZ(LV)

KEY RELEASE

4-23

16 85 DELTA V'S-BODY

-5*

*277R COPY TGT LOS ANGLE

COPY R, RDOT FROM TAPE METER FOR BU'S

*400+0 ATT HOLD

*410+5 EXTERNAL DELTA V

*450 451 452 LOAD

*407+0 ROTATE EXTERNAL DELTA V RF

COMPUTE TPI BU

COPY CSM TPI SOLUTION AND SYNC COUNTDOWN WITH CSM

*502R _____ DELTA VZ (NOM 24.8)

-835

DSKY BLANKS FOR 5 SEC

KEY V77E (RATE COMMAND)

PGNS MODE CONT-ATT HOLD

AGS MODE CONT-ATT HOLD

*407+1 FREEZE EXTERNAL DELTA V

*502R DELTA VZ

-0 F 16 85 DELTA V'S-BODY

(126858:08) BURN +Z

VERIFY AGS RESIDUALS

*500R 501R 502R
DELTA VX _____ DELTA VY _____ DELTA VZ _____

VERIFY PGNS RESIDUALS

TPI(N85)

DELTA VX(LM) _____

DELTA VY(LM) _____

DELTA VZ(LM) _____

PRO

F 37 BB

4-24

* MCC1 TARGETING *

KEY V76E (PGNS PULSE)
PGNS MODE CONT-AUTO
*400+2 Z-AXIS STEERING

KEY V93E (BEFORE 1ST MARK REINIT W MATRIX)

+2 KEY 35E (TPM PRE-THRUST)
F 16 45 MKS TFI -00001

(LOS OF MSFN)
S-BAND - SLEW TO P = +90, Y = 0
S-BAND - FWD (OR AFT)
S-BAND - DN VOICE BU
BIOMED OFF
TELEMETRY PCM SW-LO

*404+0 405+0 406+0
(MONITOR 470 471 472)

+9* *277R COPY TGT LOS ANGLE

+12 PRO (COMPUTE MCC FOR TPI+15)

F 06 81 DELTA V'S-LV

MCC1(81)

DELTA VX(LV) _____ (NOM 0.0)

DELTA VY(LV) _____ (NOM 0.0)

DELTA VZ(LV) _____ (NOM 0.0)

PRO

F 06 59 DELTA V'S-LOS

MCC1(59)

DELTA V F/A _____

DELTA V R/L _____

DELTA V D/U _____

PRO

F 16 45 MKS TFI MGA

+13* *277R COPY TGT LOS ANGLE

4-25

COPY R, RDOT FROM TAPE METER FOR BU'S

COMPUTE MCC1 BU

PRO

F 37 BB

+14

KEY 41E (RCS THRUSTING)
F 50 18 FDAI ANGLES (REQUEST MNVR)
ENTR (BYPASS MNVR)
16 85 DELTA V'S-BODY

+14:25

DSKY BLANKS FOR 5 SEC

KEY V77E (RATE COMMAND)

PGNS MODE CONT-ATT HOLD

AGS MODE CONT-ATT HOLD

*407+1 FREEZE EXTERNAL DELTA V

*472R DELTA VZ

+15 F 16 85 NULL DELTA V'S

PRO

F 37 BB

* MCC2 TARGETING *

KEY V76E (PGNS PULSE)

PGNS MODE CONT-AUTO

KEY V93E (BEFORE 1ST MARK REINIT W MATRIX)

+16

KEY 35E (TPM PRE-THRUST)
F 16 45 MKS TFI -00001

*404+0 405+0 406+0
(MONITOR 470 471 472)

+23

SUNRISE

+24*

*277R COPY TGT LOS ANGLE

+27

PRO (COMPUTE MCC FOR TPI+30)

F 06 81 DELTA V'S-LV

4-26

MCC2(81)

DELTA VX(LV) _____ (NOM 0.0)

DELTA VY(LV) _____ (NOM 0.0)

DELTA VZ(LV) _____ (NOM 0.0)

PRO

F 06 59 DELTA V'S-LOS

MCC2(59)

DELTA V F/A _____ (NOM 0.0)

DELTA V R/L _____ (NOM 0.0)

DELTA V D/U _____ (NOM 0.0)

PRO

F 16 45 MKS TFI MGA

+28*

*277R COPY TGT LOS ANGLE

COPY R, RDOT FROM TAPE METER FOR BU'S

COMPUTE MCC2 BU

PRO

*F 37 BB

KEY 41E (RCS THRUSTING)

F 50 18 FDAI ANGLES (REQUEST MNVR)

ENTR (BYPASS MNVR)

16 85 DELTA V'S-BODY

+29:25

DSKY BLANKS FOR 5 SEC

KEY V77E (RATE COMMAND)

PGNS MODE CONT-ATT HOLD

AGS MODE CONT-ATT HOLD

*407+1 FREEZE EXTERNAL DELTA V

*472R DELTA VZ

+30 F 16 85 NULL DELTA V'S

PRO

F 37 BB

KEY 00E (P00)

4-27

KEY V48E (LOAD DAP)
F 01 46 11002
PRO
F 06 47 LMWT CMWT
PRO

KEY V37E47E (AVE G)
F 16 83 DELTA V'S

V63E (RR SELF TEST)
F 04 12 00004 00001
PRO
F 16 72 TRUN SHFT
PRO
F 16 78 R RDOT
VERIFY TAPE METER WITH DSKY

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

RENDEZVOUS

STATION KEEPING

5.0 ABORT PROCEDURE

This is a specific AGS nominal abort procedure due to a PGNS failure between insertion and station keeping.

5.1 Nominal AGS Procedures

ASSUMPTIONS

 * AFTER INSERTION *

- 1 INSERTION COMPLETE (RESIDUALS NULLED)
- 2 PGNS FAILURE BEFORE INSERTION
- 3 RADAR NOT LOCKED ON

GUID CONT-AGS
 ATTITUDE MON-AGS(CDR)
 RATE ERR MON-CMPTR(LMP)
 ATTITUDE MON-AGS(LMP)
 SHFT/TRUN-+5 DEG
 RADAR TEST SW-OFF
 ENG GMBL-OFF
 ENG ARM-OFF
 DEADBAND-MAX
 THROT/JET-JET
 CB/PGNS IMU OPR-CLOSE
 R/R MODE-AUTO TRACK
 ATT CONT-MODE CONT(3)
 TTCA/TRANSL-ENABLE(CDR)

 * X POINTER-LO MULT *
 * MODE SEL-AGS *
 * RNG/ALT MON-RNG/RNGRT *
 * ABORT STAGE-RESET *
 * STOP-RESET *
 * PGNS MODE CONT-OFF *
 * AGS MODE CONT-AUTO *
 * ATT/TRANSL-2 JETS *
 * BAL CPL-ON *
 * RATE ERR MON-RNDZ RDR(CDR) *
 * ACA/4JET-DISABLE(CDR) *
 * TTCA/TRANSL-DISABLE(LMP) *
 * ACA/4JET-DISABLE(LMP) *

*507+0 Z-AXIS BORESIGHT
 *400+2 Z-AXIS STEERING
 PULSE TO NULL AGS ERRORS
 POINT Z-AXIS IN DIRECTION OF CSM
 AGS MODE CONT-ATT HOLD
 R/R MODE - SLEW
 SLEW RATE - LO
 SLEW R/R ANT TO 0.0 ON FDAI
 VERIFY MAX SIGNAL STRENGTH
 R/R MODE-AUTO TRACK
 NO TRACK LIGHT OFF
 ATT CONT(3)-PULSE

 * CHECK INSERTION VELOCITY WITH TAPEMETER *
 * COMPARE TAPEMETER WITH AGS STATE VECTOR DATA *
 *
 * *317R _____ RANGE(NOM 264.2) *
 *
 * *440R _____ RANGE RATE(NOM -425.1) *

SUIT/CABIN PRESS - NOR
 GLYCOL TEMP/PRESS - NOR
 O2/H2O QUANTITY - NOMINAL

 * CSI TARGETING *

+3 *417+1 (RADAR FILTER INITIALIZED)
 *415+1 (NO BORESIGHT)
 *503-XXXX.X RANGE RATE

EXT LGT-TRACK

+5 *415+1 (NO BORESIGHT)
 *503-XXXX.X RANGE RATE
 BORESIGHT ON CSM
 *415+1
 *316+XXXX.X RANGE

+6 SUNSET

*410+1 CSI ROUTINE
 *373+0321.3 CSI TIME
 *275+0418.1 TPI TIME
 *605+00777 COTANGENT OF LOS TO CSM

*416+1 (ONE-HALF ORBITAL PERIOD)
 *623+0 Z-AXIS PARALLEL TO CSM ORBIT
 *451+0 OUT-OF-PLANE VELOCITY
 *310R TIME TO CSI

-43

RESET ET

*267R _____ VELOCITY TO BE GAINED CSI

*402R _____ DELTA H

*371R _____ PREDICTED VEL TO BE GAINED CDH

*372R _____ TIME CSI/CDH

-42

*415+1 (NO BORESIGHT)

*503-XXXX.X RANGE RATE

-40

*415+1 (NO BORESIGHT)

*503-XXXX.X RANGE RATE

BORESIGHT ON CSM

*415+1

*316+XXXX.X RANGE

-37

*415+1 (NO BORESIGHT)

*503-XXXX.X RANGE RATE

-35

*415+1 (NO BORESIGHT)

*503-XXXX.X RANGE RATE

BORESIGHT ON CSM

*415+1

*316+XXXX.X RANGE

-32

*415+1 (NO BORESIGHT)

*503-XXXX.X RANGE RATE

*310R TIME TO CSI

RESET ET

*415+1 (NO BORESIGHT)

*503-XXXX.X RANGE RATE

-30*

COPY 1ST RDOT FOR CSI BU

BORESIGHT ON CSM

*415+1

*316+XXXX.X RANGE

-27

*415+1 (NO BORESIGHT)

*503-XXXX.X RANGE RATE

*267R _____ VELOCITY TO BE GAINED CSI
 *402R _____ DELTA H
 *371R _____ PREDICTED VEL TO BE GAINED CDH
 *372R _____ TIME CSI/CDH

-25 *415+1 (NO BORESIGHT)
 *503-XXXX.X RANGE RATE
 BORESIGHT ON CSM
 *415+1
 *316+XXXX.X RANGE

-22 *415+1 (NO BORESIGHT)
 *503-XXXX.X RANGE RATE
 *415+1 (NO BORESIGHT)
 *503-XXXX.X RANGE RATE

-20* COPY 2ND RDOT FOR CSI BU
 BORESIGHT ON CSM
 *415+1
 *316+XXXX.X RANGE

 TEMP/PRESS MON SEL - FUEL MAN
 A AND B PRESS 181 +-3 PSIG
 TEMP/PRESS MON SEL - PRPLNT
 A AND B TEMP IND 40 TO 100 DEG F
 A AND B PRESS IND 181 +-3 PSIA
 TEMP/PRESS MON SEL - HEL
 A AND B PRESS IND _____ PSIA
 A QUANTITY IND _____ PERCENT REMAINING
 B QUANTITY IND _____ PERCENT REMAINING
 TEMP MON SEL RCS QUAD 1, 4, 2, 3 (120 - 190 DEG F)

-17 *415+1 (NO BORESIGHT)
 *503-XXXX.X RANGE RATE

-15 *415+1 (NO BORESIGHT)
 *503-XXXX.X RANGE RATE
 BORESIGHT ON CSM
 *415+1
 *316+XXXX.X RANGE

-12 *415+1 (NO BORESIGHT)
 *503-XXXX.X RANGE RATE

(LOS OF MSFN)

S-BAND - SLEW TO P = +90, Y = 0

S-BAND - FWD (OR AFT)

S-BAND - DN VOICE BU

BIOMED OFF

*267R _____ VELOCITY TO BE GAINED CSI

*402R _____ DELTA H

*371R _____ PREDICTED VEL TO BE GAINED CDH

*372R _____ TIME CSI/CDH

*263R _____ OUT OF PLANE VELOCITY

*415+1 (NO BORESIGHT)

*503-XXXX.X RANGE RATE

-10*

COPY RANGE AND 3RD RDOT FOR CSI BURN

BORESIGHT ON CSM

*415+1

*316+XXXX.X RANGE

COMPUTE CSI BU

-7

*415+1 (NO BORESIGHT)

*503-XXXX.X RANGE RATE

-5

*415+1 (NO BORESIGHT)

*503-XXXX.X RANGE RATE

BORESIGHT ON CSM

*415+1

*316+XXXX.X RANGE

*277R _____ LOS ANGLE

SET ORDEAL

*317R _____ RANGE

*440R _____ RANGE RATE

*400+0 ATT HOLD

*410+5 EXTERNAL DELTA V

(LOAD SOLUTION TO BE EXECUTED)

*450 451 452

*407+0 ROTATE EXTERNAL DELTA V RF

NULL ERROR SIGNALS WITH AGS PULSE

TRANSMIT TGT DELTA V'S TO CSM AND SYNC COUNTDOWN

-020

*502R _____ DELTA VZ (NOM 49.5)

DEADBAND-MIN
 (DEFLECT RHC OUT OF DETENT)
 AGS MODE CONT-ATT HOLD
 ATT CONT(3)-MODE CONT
 *407+1 FREEZE EXTERNAL DELTA V
 *502R DELTA VZ

SET ET COUNTING UP AT ZERO

(125:21:19) BURN +Z

NULL DELTA V'S

VERIFY AGS RESIDUALS
 *500R 501R 502R
 DELTA VX _____ DELTA VY _____ DELTA VZ _____

 * CDH TARGETING *

DEADBAND-MAX
 ATT CONT(3)-PULSE
 AGS MODE CONT-AUTO
 *400+2 Z-AXIS STEERING

+3

*410+2 CDH ROUTINE

+4

SUNRISE

*373R _____ (NOM 379.6)
 *310R TIME TO CDH

-52

RESET ET

*477R _____ PREDICTED ALT RATE AT CDH

*402R _____ DELTA H

*450R _____ DELTA VX

*452R _____ DELTA VZ

*417+1 (RADAR FILTER INITIALIZED)

-50 *415+1 (NO BORESIGHT)
 *503-XXXX.X RANGE RATE
 BORESIGHT ON CSM
 *415+1
 *316+XXXX.X RANGE

-47 *415+1 (NO BORESIGHT)
 *503-XXXX.X RANGE RATE

-45 *415+1 (NO BORESIGHT)
 *503-XXXX.X RANGE RATE
 BORESIGHT ON CSM
 *415+1
 *316+XXXX.X RANGE

-42 *415+1 (NO BORESIGHT)
 *503-XXXX.X RANGE RATE

-40 *415+1 (NO BORESIGHT)
 *503-XXXX.X RANGE RATE
 BORESIGHT ON CSM
 *415+1
 *316+XXXX.X RANGE

 * PLANE CHANGE TARGETING *

-36* *415+1 (NO BORESIGHT)
 *503-XXXX.X RANGE RATE
 COPY 1ST RDOT FOR CDH BU

-35 BORESIGHT ON CSM
 *415+1
 *316+XXXX.X RANGE
 +400+0 ATT HOLD
 *410+5 EXTERNAL DELTA V
 (COPY YDOT FROM CSM AND LOAD NEGATIVE IN 451)
 *450+0 451 452+0
 *407+0 ROTATE EXTERNAL DELTA V RFT
 NULL ERROR SIGNALS WITH AGS PULSE

-30:20 DEADBAND-MIN
 (DEFLECT RHC OUT OF DETENT)
 AGS MODE CONT-ATT HOLD
 ATT CONT(3)-MODE CONT
 *407+1 FREEZE EXTERNAL DELTA V

*501R DELTA VY

-30

NULL DELTA V'S

DEADBAND-MAX
ATT CONT(3)-PULSE
AGS MODE CONT-AUTO
*400+2 Z-AXIS STEERING

*410+2 CDH ROUTINE

*373R _____ (NOM 379.6)
*310R TIME TO CDH

*477R _____ PREDICTED ALT RATE AT CDH

*402R _____ DELTA H

*450R _____ DELTA VX

*452R _____ DELTA VZ

-27

*417+1 (RADAR FILTER INITIALIZED)
*415+1 (NO BORESIGHT)
*503-XXXX.X RANGE RATE

-25

*415+1 (NO BORESIGHT)
*503-XXXX.X RANGE RATE
BORESIGHT ON CSM
*415+1
*316+XXXX.X RANGE

*415+1 (NO BORESIGHT)
*503-XXXX.X RANGE RATE

-23*

COPY 2ND RDOT FOR CDH BU

(AOS OF MSFN)
S-BAND - SLEW TO P = _____, Y = _____
ACQUIRE HGA LOCK ON
VOICE - BU/VOICE -- VOICE
VERIFY VOICE, TLM
BIOMED - LEFT (OR RIGHT)

TEMP/PRESS MON SEL - FUEL MAN
A AND B PRESS 181 +-3 PSIG
TEMP/PRESS MON SEL - PRPLNT
A AND B TEMP IND 40 TO 100 DEG F
A AND B PRESS IND 181 +-3 PSIA
TEMP/PRESS MON SEL - HEL

A AND B PRESS IND _____ PSIA

A QUANTITY IND _____ PERCENT REMAINING

B QUANTITY IND _____ PERCENT REMAINING
TEMP MON SEL RCS QUAD 1, 4, 2, 3 (120 - 190 DEG F)SUIT/CABIN PRESS - NOR
GLYCOL TEMP/PRESS - NOR
O2/H2O QUANTITY - NOMINAL

-20

*415+1 (NO BORESIGHT)
*503-XXXX.X RANGE RATE
BORESIGHT ON CSM
*415+1
*316+XXXX.X RANGE

-17

*415+1 (NO BORESIGHT)
*503-XXXX.X RANGE RATE

-15

*415+1 (NO BORESIGHT)
*503-XXXX.X RANGE RATE
BORESIGHT ON CSM
*415+1
*316+XXXX.X RANGE

-12

*415+1 (NO BORESIGHT)
*503-XXXX.X RANGE RATE

*415+1 (NO BORESIGHT)
*503-XXXX.X RANGE RATE

-10*

COPY 3RD RDOT FOR CDH BU

BORESIGHT ON CSM
*415+1
*316+XXXX.X RANGE

COMPUTE CDH BU

-7

*415+1 (NO BORESIGHT)
*503-XXXX.X RANGE RATE

-5

*415+1 (NO BORESIGHT)
*503-XXXX.X RANGE RATE
BORESIGHT ON CSM
*415+1
*316+XXXX.X RANGE*277R _____ LOS ANGLE
SET ORDEAL

*317R _____ RANGE

*440R _____ RANGE RATE

*400+0 ATT HOLD

*410+5 EXTERNAL DELTA V
(LOAD SOLUTION TO BE EXECUTED)

*450 451 452

*407+0 ROTATE EXTERNAL DELTA V RF

NULL ERROR SIGNALS WITH AGS PULSE

TRANSMIT TGT DELTA V'S TO CSM AND SYNC COUNTDOWN

*500R _____ DELTA VX

-:20

DEADBAND-MIN

(DEFLECT RHC OUT OF DETENT)

AGS MODE CONT-ATT HOLD

ATT CONT(3)-MODE CONT

*407+1 FREEZE EXTERNAL DELTA V

*500R DELTA VX

SET ET COUNTING UP AT ZERO

(126:19:37) NULL DELTA V'S

VERIFY AGS RESIDUALS

*500R 501R 502R
DELTA VX _____ DELTA VY _____ DELTA VZ _____

* TPI TARGETING *

DEADBAND-MAX

ATT CONT(3)-PULSE

AGS MODE CONT-AUTO

*400+2 Z-AXIS STEERING

*417+1 (RADAR FILTER INITIALIZED)

*415+1 (NO BORESIGHT)

*503-XXXX.X RANGE RATE

BORESIGHT ON CSM

*415+1

*316+XXXX.X RANGE

+3

*410+3 TPI SEARCH ROUTINE
 *307+043.00 DELTA T TRANSFER
 *310+034.00 TFI TPI

*303R _____ THETA AT TPI
 *410+4 (WHEN 303 = 26.6 DEG)

*310R _____ TFI TPI

RESET ET

*267R _____ DELTA V TPI

*371R _____ DELTA V TPI + DELTA V TPF

-32

*415+1 (NO BORESIGHT)
 *503-XXXX.X RANGE RATE

-30

*415+1 (NO BORESIGHT)
 *503-XXXX.X RANGE RATE
 BORESIGHT ON CSM
 *415+1
 *316+XXXX.X RANGE

-27

*415+1 (NO BORESIGHT)
 *503-XXXX.X RANGE RATE

-25

*415+1 (NO BORESIGHT)
 *503-XXXX.X RANGE RATE
 BORESIGHT ON CSM
 *415+1
 *316+XXXX.X RANGE

-23

SUNSET

-22

*415+1 (NO BORESIGHT)
 *503-XXXX.X RANGE RATE

-21

*410+3 TPI SEARCH ROUTINE
 *307+043.00 DELTA T TRANSFER
 *310+021.00 TFI TPI

*303R _____ THETA AT TPI
 *410+4 (WHEN 303 = 26.60 DEG)

*310R _____ TFI TPI

RESET ET

*267R _____ DELTA V TPI

*371R _____ DELTA V TPI + DELTA V TPF

-20 *415+1 (NO BORESIGHT)
 *503-XXXX.X RANGE RATE
 BORESIGHT ON CSM
 *415+1
 *316+XXXX.X RANGE

-17 *415+1 (NO BORESIGHT)
 *503-XXXX.X RANGE RATE

TEMP/PRESS MON SEL - FUEL MAN
 A AND B PRESS 181 +/-3 PSIG
 TEMP/PRESS MON SEL - PRPLNT
 A AND B TEMP IND 40 TO 100 DEG F
 A AND B PRESS IND 181 +/-3 PSIA
 TEMP/PRESS MON SEL - HEL

A AND B PRESS IND _____ PSIA

A QUANTITY IND _____ PERCENT REMAINING

B QUANTITY IND _____ PERCENT REMAINING
 TEMP MON SEL RCS QUAD 1, 4, 2, 3 (120 - 190 DEG F)

SUIT/CABIN PRESS - NOR
 GLYCOL TEMP/PRESS - NOR
 O2/H2O QUANTITY - NOMINAL

-15 *415+1 (NO BORESIGHT)
 *503-XXXX.X RANGE RATE
 BORESIGHT ON CSM
 *415+1
 *316+XXXX.X RANGE

-12 *415+1 (NO BORESIGHT)
 *503-XXXX.X RANGE RATE

*410+3 TPI SEARCH ROUTINE
 *307+043.00 DELTA T TRANSFER

-11 *310+011.00 TFI TPI

*303R _____ THETA AT TPI
 *410+4 (WHEN 303 = 26.60 DEG)

*277R _____ LOS ANGLE
 SET ORDEAL

*310R _____ TFI TPI

RESET ET

*267R _____ DELTA V TPI

*371R _____ DELTA V TPI + DELTA V TPF

TRANSMIT TIG OF TPI TO CSM

-9* *277R COPY TGT LOS ANGLE

-7 *415+1 (NO BORESIGHT)

*503-XXXX.X RANGE RATE

*404+0 405+0 406+0

(MONITOR 470 471 472)

*415+1 (NO BORESIGHT)

*503-XXXX.XX RANGE RATE

-5* *277R COPY TGT LOS ANGLE

COPY R, RDOT FROM TAPE METER FOR BU'S

BORESIGHT ON CSM

*415+1

*316+XXXX.X RANGE

COMPUTE TPI BU

*373R _____ TIG TPI

*267R _____ DELTA V TPI

*371R _____ DELTA V TPI + DELTA V TPF

*400+0 ATT HOLD

*410+5 EXTERNAL DELTA V

(LOAD SOLUTION TO BE EXECUTED)

*450 451 452

*407+0 ROTATE EXTERNAL DELTA V RF

NULL ERROR SIGNALS WITH AGS PULSE

COPY CSM TPI SOLUTION AND SYNC COUNTDOWN WITH CSM

*502R _____ DELTA VZ (NOM 24.8)

-:20 DEADBAND-MIN

(DEFLECT RHC OUT OF DETENT)

AGS MODE CONT-ATT HOLD

ATT CONT(3)-MODE CONT

*407+1 FREEZE EXTERNAL DELTA V

*502R DELTA VZ

5-15

SET ET COUNTING UP AT ZERO

(126:58:08) BURN +Z

VERIFY AGS RESIDUALS

*500R 501R 502R
DELTA VX _____ DELTA VY _____ DELTA VZ _____

* MCC1 *

DEADBAND-MAX
ATT CONT(3)-PULSE
AGS MODE CONT-AUTO
*400+2 Z-AXIS STEERING

(LOS OF MSFN)
S-BAND - SLEW TO P = +90, Y = 0
S-BAND - FWD (OR AFT)
S-BAND - DN VOICE BU
BIOMED OFF

*404+0 405+0 406+0
(MONITOR 470 471 472)

+9* *277R COPY TGT LOS ANGLE

+13* *277R COPY TGT LOS ANGLE

COPY R, RDOT FROM TAPE METER FOR BU'S

COMPUTE MCC1 BU

+14:40 DEADBAND-MIN
 (DEFLECT RHC OUT OF DETENT)
*400+0 ATT HOLD
AGS MODE CONT-ATT HOLD
ATT CONT(3)-MODE CONT
*470R 471R 472R

+15 NULL DELTA V'S

 * MCC2 *

DEADBAND-MAX
 ATT CONT(3)-PULSE
 AGS MODE CONT-AUTO
 *404+0 405+0 406+0
 (MONITOR 470 471 472)

+23 SUNRISE

+24* *277R COPY TGT LOS ANGLE

+28* *277R COPY TGT LOS ANGLE

COPY R, RDOT FROM TAPE METER FOR BU'S

COMPUTE MCC2 BU

+29:40 DEADBAND-MIN
 (DEFLECT RHC OUT OF DETENT)
 AGS MODE CONT-ATT HOLD
 ATT CONT(3)-MODE CONT
 *470R 471R 472R

+30 NULL DELTA V'S

ATT CONT(3)-PULSE
 *404+0 405+0 406+0
 (MONITOR 470 471 472)

VERIFY TAPE METER WITH AGS

LOS CONTROL

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

RENDEZVOUS

5-17

STATION KEEPING

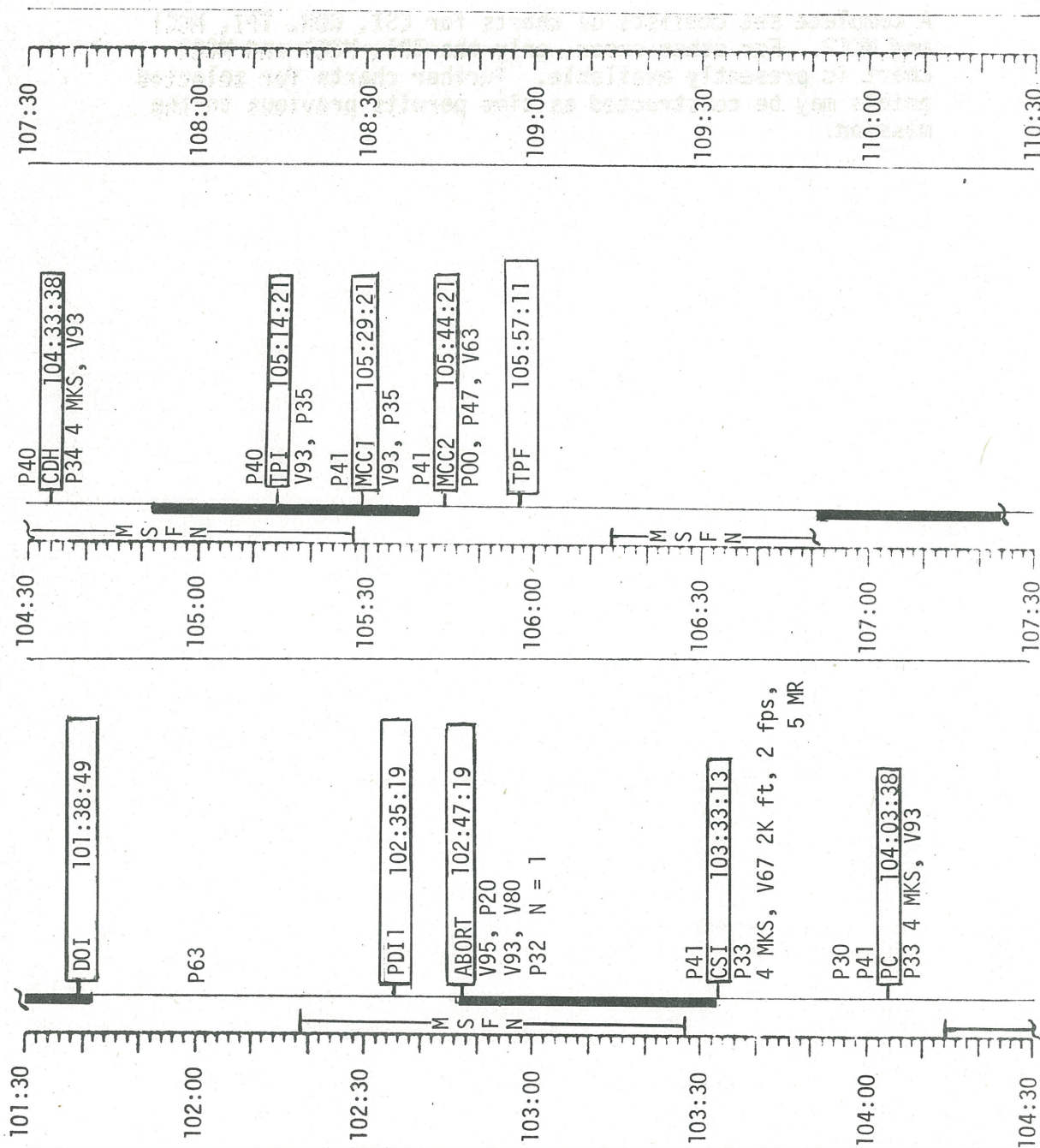
6.0 ONBOARD RENDEZVOUS CHARTS AND TIMELINES

Complete Rendezvous charts have been constructed for the following cases:

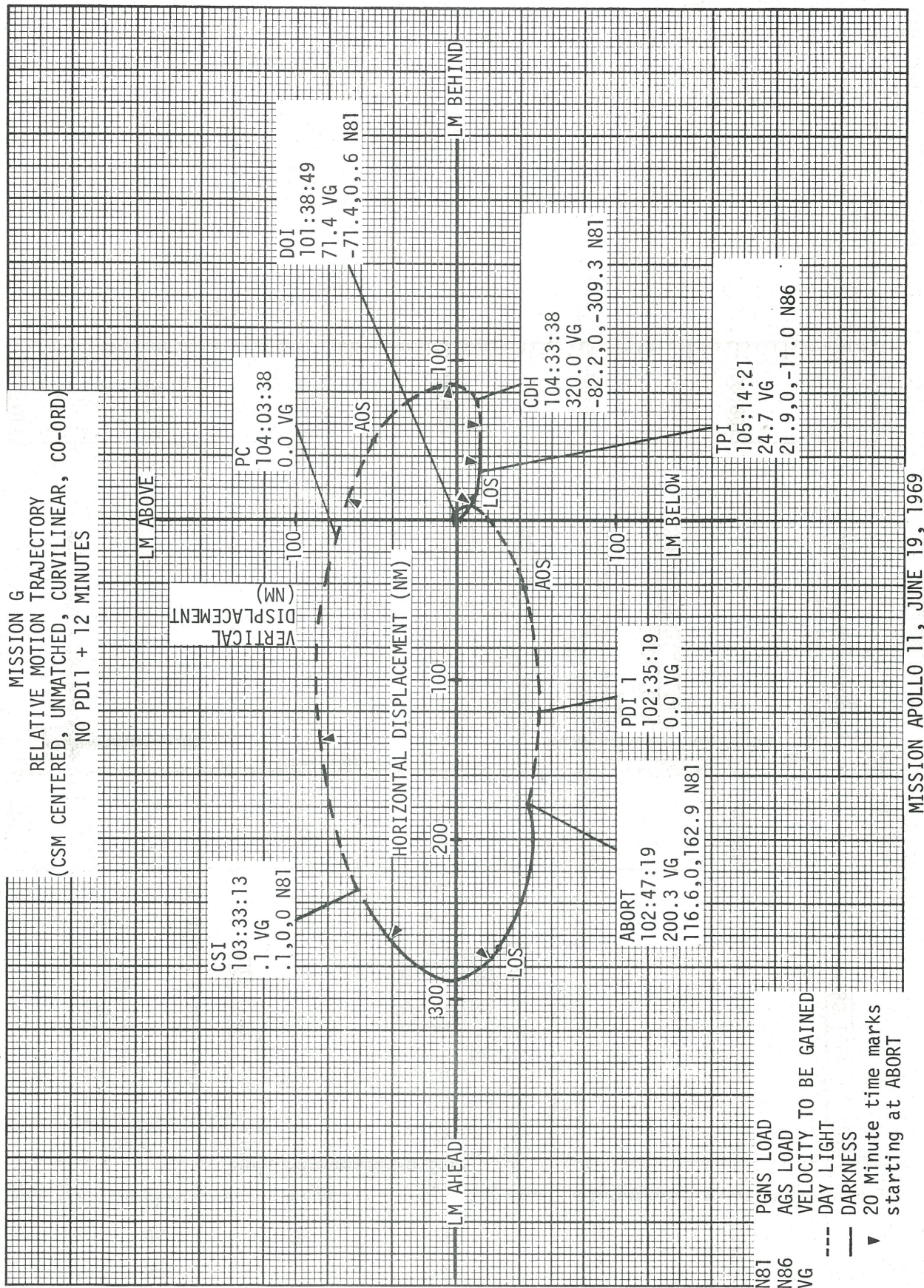
- 1) PDI1 + 10 MINUTES (CHART 6.2 through CHART 6.4)
- 2) NOMINAL ASCENT (CHART 6.10 through CHART 6.15)

A complete set consists of charts for CSI, CDH, TPI, MCC1 and MCC2. For other cases, only the TPI, MCC1 and MCC2 chart is presently available. Further charts for selected points may be constructed as time permits previous to the mission.

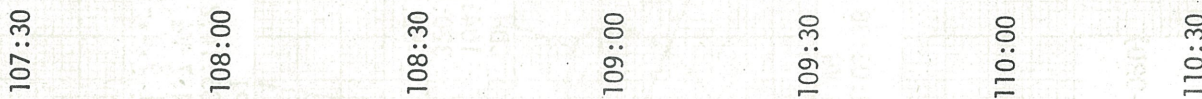
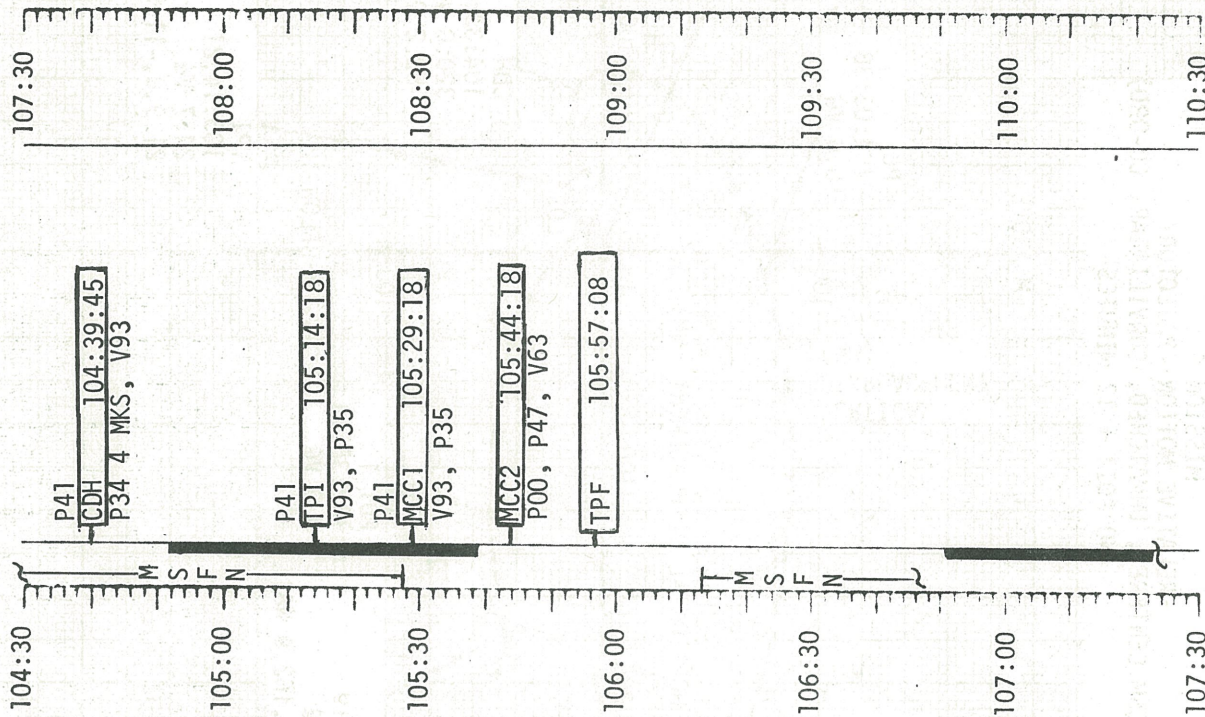
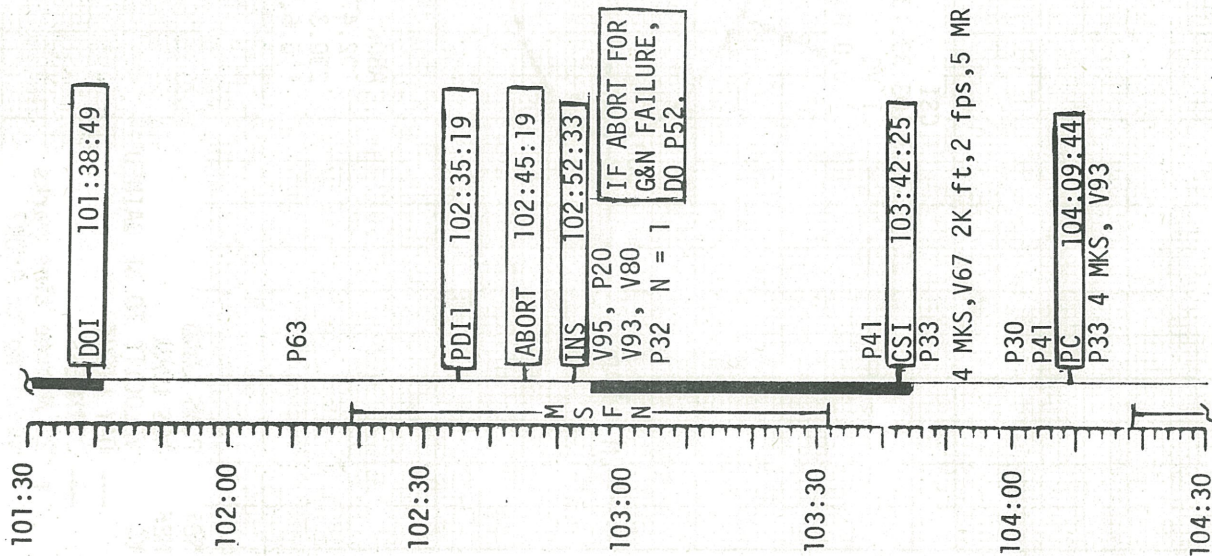
NO PDI1 + 12 MINUTES



MISSION APOLLO 11, JUNE 19, 1969
6-2

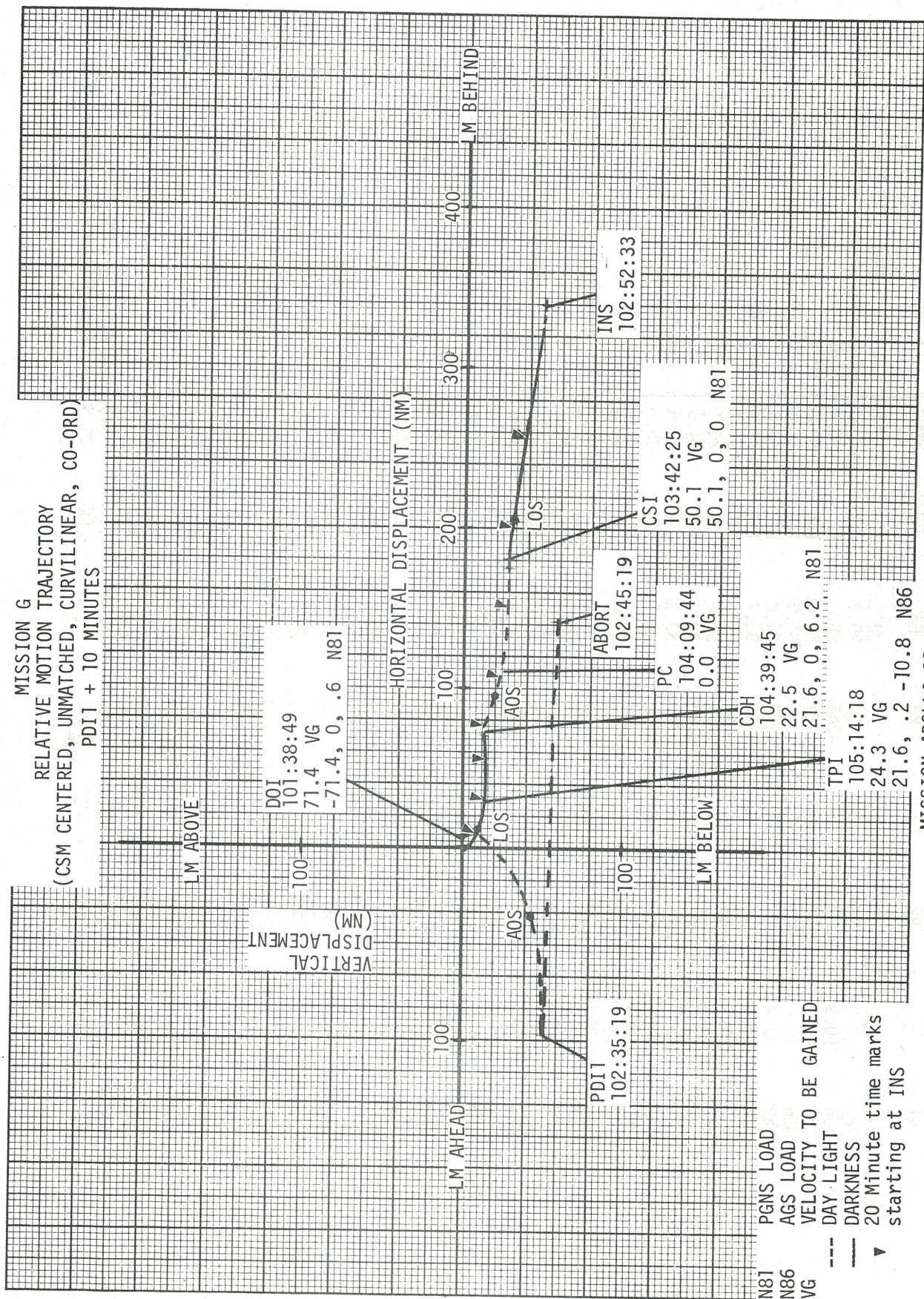


PDI1 + 10 MINUTES



MISSION APOLLO 11, JUNE 19, 1969
6-4

CHART 6.2



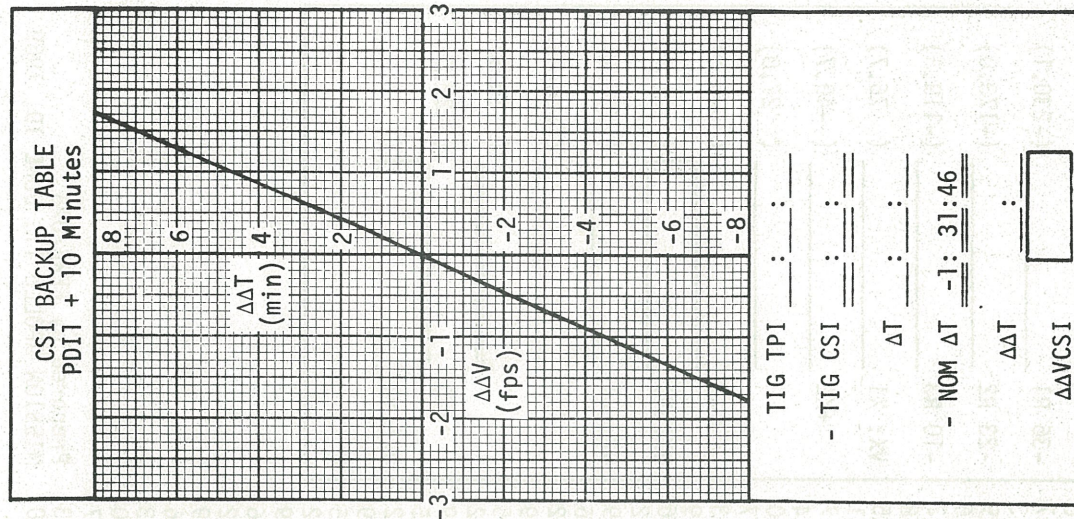
MISSION APOLLO 11, JUNE 19, 1969
6-5

CSI BACKUP TABLE	
PDI + 10 Minutes	
TIME (MIN)	NOMINAL
-30 R1	(-327.9)
-20 R2	(-269.3)
-10 R3	(-228.3)
-10 R3	(201.8)
F1	(55.2)
+ F2	(- 23.1)
+ F3	(32.1)
+ F3	(54.3)
+ F4	(86.4)
+ F4	(-36.3)
+ΔΔVCSI	(0.0)
ΔVCSI	(50.1)

R1	-370	F1	103.2	R2	-312	F2	-108.0	R3	-270	F3	100.3	R3	122	F4	-21.1
-369	102.0		100.9	-311	-106.0		-104.0	-269	99.2		98.1	124	-21.5		-21.9
-368	99.7		98.6	-309	-102.0		-100.0	-268	97.0		95.9	126	-22.2		-22.6
-366	97.4		96.3	-308	-98.0		-96.0	-267	94.8		93.7	130	-23.0		-23.4
-365	95.1		94.0	-307	-96.0		-94.1	-266	92.6		91.5	132	-23.7		-24.1
-364	94.0		92.9	-306	-94.1		-92.1	-265	90.4		89.3	134	-24.5		-24.8
-363	91.7		90.6	-305	-92.1		-90.1	-264	88.2		87.1	136	-25.2		-25.6
-362	89.4		88.3	-304	-90.1		-88.1	-263	86.0		84.9	138	-26.0		-26.3
-361	87.1		86.0	-303	-88.1		-86.1	-262	83.8		82.7	142	-26.7		-27.1
-359	84.9		83.7	-302	-86.1		-84.1	-259	81.6		80.5	144	-27.5		-27.8
-358	82.6		81.4	-301	-84.1		-82.1	-258	79.4		78.3	146	-28.2		-28.6
-357	80.3		79.1	-300	-82.1		-80.1	-257	77.2		76.1	148	-29.0		-29.4
-356	78.0		76.9	-299	-80.1		-78.1	-256	75.0		73.9	152	-29.7		-30.1
-355	75.7		74.6	-298	-78.1		-76.1	-255	73.9		72.8	154	-30.5		-30.9
-354	74.6		73.5	-297	-76.1		-74.2	-254	72.8		71.7	156	-31.3		-31.7
-353	73.5		72.3	-296	-74.2		-72.2	-253	71.7		70.6	158	-32.0		-32.4
-352	72.3		71.2	-295	-72.2		-70.2	-252	70.6		69.5	162	-32.8		-33.2
-351	71.2		70.0	-294	-70.2		-68.2	-251	69.5		68.4	164	-33.6		-34.0
-350	69.9		68.9	-293	-68.2		-66.2	-250	68.4		67.3	166	-34.4		-34.8
-349	67.8		66.8	-292	-66.2		-64.2	-249	67.3		66.1	168	-35.1		-35.5
-348	66.6		65.5	-291	-64.2		-62.2	-248	66.1		65.0	170	-35.9		-36.3
-347	65.5		64.4	-290	-62.2		-60.2	-247	65.0		63.9	172			
-346	64.4		63.2	-289	-60.2		-58.3	-246	63.9		62.8	174			
-345	63.2		62.1	-288	-58.3		-56.3	-245	62.8		61.7	176			
-344	62.1		60.9	-287	-56.3		-54.3	-244	61.7		60.6	178			
-343	60.9		59.8	-286	-54.3		-52.3	-243	60.6		59.5	180			
-342	59.8		58.7	-285	-52.3		-50.3	-242	59.5		58.4	182			
-341	58.7			-284	-50.3		-48.3	-241	58.4		57.3	184			
-340				-283	-48.3		-46.3	-240	57.3			186			
-339				-282	-46.3		-44.4	-239	56.1			188			
-338				-281	-44.4		-42.4	-238	55.0			190			
-337				-280	-42.4		-40.4	-237	53.9			192			
-336				-279	-40.4		-38.4	-236	52.8			194			
-335				-278	-38.4		-36.4	-235	51.7			196			
-334				-277	-36.4		-34.4	-234	50.6			198			
-333				-276	-34.4		-32.5	-233	49.5			200			
-332				-275	-32.5		-30.5	-232	48.4						
-331				-274	-30.5			-231	47.3						
-330				-273					46.2						

Prepared by FPRB/OPS
MISSION APOLLO 11, JUNE 19, 1969

CHART 6.3



R1	F1	R2	F2	R3	F3	R3	F4
-330	57.5	-272	-28.5	-230	56.2	202	-36.3
-329	56.4	-271	-26.5	-229	55.1	204	-36.7
-328	55.3	-270	-24.5	-228	54.0	206	-37.1
-327	54.1	-269	-22.5	-227	52.9	208	-37.5
-326	53.0	-268	-20.6	-226	51.8	210	-37.9
-325	51.9	-267	-18.6	-225	50.7	212	-38.3
-324	50.7	-266	-16.6	-224	49.6	214	-38.7
-323	49.6	-265	-14.6	-223	48.5	216	-39.1
-322	48.5	-264	-12.6	-222	47.4	218	-39.5
-321	47.3	-263	-10.7	-221	46.3	220	-39.9
-320	46.2	-262	-08.7	-220	45.2	222	-40.3
-319	45.1	-261	-06.7	-219	44.1	224	-40.7
-318	44.0	-260	-04.7	-218	43.0	226	-41.1
-317	42.8	-259	-02.7	-217	41.8	228	-41.5
-316	41.7	-258	1.8	-216	40.7	230	-41.9
-315	40.6	-257	1.2	-215	39.6	232	-42.3
-314	39.4	-256	3.2	-214	38.5	234	-42.7
-313	38.3	-255	5.2	-213	37.4	236	-43.1
-312	37.2	-254	7.1	-212	36.3	238	-43.5
-311	36.0	-253	9.1	-211	35.2	240	-43.9
-310	34.9	-252	11.1	-210	34.1	242	-44.3
-309	33.8	-251	13.1	-209	33.0	244	-44.7
-308	32.7	-250	15.0	-208	31.9	246	-45.1
-307	31.5	-249	17.0	-207	30.8	248	-45.5
-306	30.4	-248	19.0	-206	29.7	250	-45.9
-305	29.3	-247	21.0	-205	28.6	252	-46.3
-304	28.2	-246	22.9	-204	27.5	254	-46.8
-303	27.0	-245	24.9	-203	26.4	256	-47.2
-302	25.9	-244	26.9	-202	25.3	258	-47.6
-301	24.8	-243	28.9	-201	24.2	260	-48.0
-300	23.7	-242	30.8	-200	23.0	262	-48.4
-299	22.5	-241	32.8	-199	21.9	264	-48.8
-298	21.4	-240	34.8	-198	20.8	266	-49.2
-297	20.3	-239	36.8	-197	19.7	268	-49.6
-296	19.2	-238	38.7	-196	18.6	270	-50.1
-295	18.0	-237	40.7	-195	17.5	272	-50.5
-294	16.9	-236	42.7	-194	16.4	274	-50.9
-293	15.8	-235	44.7	-193	15.3	276	-51.3
-292	14.7	-234	46.6	-192	14.2	278	-51.7
-291	13.5	-233	48.6	-191	13.1	280	-52.1

Prepared by FRPB/OPS
MISSION APOLLO 11, JUNE 19, 1969

CDH BACKUP TABLE PDI1 + 10 Minutes									
		TIME (MIN)		NOMINAL					
		-36 R1		(-230.1)					
		-23 R2		(-173.0)					
		-10 R3		(-119.5)					
		VX: X1		(76.7)					
		+X2		(-49.7)					
				(27.0)					
		+X3		(-5.6)					
		VX(LV)		(21.4)					
		VZ: Z1		(65.9)					
		+Z2		(-36.6)					
				(29.3)					
		+Z3		(-22.0)					
		VZ(LV)		(7.3)					

RD0T1	Z1	Z2	RD0T2	X2	Z2	RD0T3	X3	Z3
-272	89.8	+56.1	-215	-59.6	+ 1.8	-161	-9.1	-36.6
-271	89.5	+56.4	-214	-59.3	+ .9	-160	-9.0	-36.2
-270	89.2	+56.6	-213	-59.1	- .1	-159	-8.9	-35.8
-269	88.8	+56.9	-212	-58.8	- 1.0	-158	-8.9	-35.4
-268	88.5	+57.1	-211	-58.6	- 1.9	-157	-8.7	-35.0
-267	88.2	+57.3	-210	-58.3	- 2.8	-156	-8.7	-34.7
-266	87.9	+57.6	-209	-58.1	- 3.7	-155	-8.6	-34.3
-265	87.6	+57.8	-208	-57.9	- 4.7	-154	-8.5	-33.9
-264	87.3	+58.1	-207	-57.6	- 5.6	-153	-8.5	-33.6
-263	86.9	+58.3	-206	-57.4	- 6.5	-152	-8.4	-33.2
-262	86.6	+58.6	-205	-57.1	- 7.4	-151	-8.3	-32.8
-261	86.3	+58.8	-204	-56.9	- 8.4	-150	-8.2	-32.5
-260	86.0	+59.1	-203	-56.7	- 9.3	-149	-8.1	-32.1
-259	85.7	+59.3	-202	-56.4	-10.2	-148	-8.0	-31.7
-258	85.4	+59.5	-201	-56.2	-11.1	-147	-8.0	-31.4
-257	85.1	+59.8	-200	-56.0	-12.1	-146	-7.9	-31.0
-256	84.7	+60.0	-199	-55.7	-13.0	-145	-7.8	-30.7
-255	84.4	+60.2	-198	-55.5	-13.9	-144	-7.7	-30.3
-254	84.1	+60.5	-197	-55.2	-14.8	-143	-7.6	-29.9
-253	83.8	+60.7	-196	-55.0	-15.7	-142	-7.5	-29.6
-252	83.5	+61.0	-195	-54.8	-16.7	-141	-7.4	-29.2
-251	83.2	+61.2	-194	-54.5	-17.6	-140	-7.4	-28.9
-250	82.9	+61.4	-193	-54.3	-18.5	-139	-7.3	-28.6
-249	82.6	+61.7	-192	-54.1	-19.4	-138	-7.2	-28.2
-248	82.2	+61.9	-191	-53.8	-20.3	-137	-7.1	-27.9
-247	81.9	+62.1	-190	-53.6	-21.3	-136	-7.0	-27.5
-246	81.6	+62.3	-189	-53.4	-22.2	-135	-6.9	-27.2
-245	81.3	+62.6	-188	-53.1	-23.1	-134	-6.9	-26.9
-244	81.0	+62.8	-187	-52.9	-24.0	-133	-6.8	-26.5
-243	80.7	+63.0	-186	-52.7	-24.9	-132	-6.7	-26.2
-242	80.4	+63.3	-185	-52.5	-25.8	-131	-6.6	-25.9
-241	80.1	+63.5	-184	-52.2	-26.7	-130	-6.5	-25.5
-240	79.8	+63.7	-183	-52.0	-27.6	-129	-6.4	-25.2
-239	79.5	+63.9	-182	-51.8	-28.5	-128	-6.3	-24.9
-238	79.1	+64.2	-181	-51.5	-29.4	-127	-6.3	-24.6
-237	78.8	+64.4	-180	-51.3	-30.4	-126	-6.2	-24.2
-236	78.5	+64.6	-179	-51.1	-31.3	-125	-6.1	-23.9
-235	78.2	+64.8	-178	-50.8	-32.2	-124	-6.0	-23.6
-234	77.9	+65.0	-177	-50.6	-33.1	-123	-5.9	-23.3
-233	77.6	+65.3	-176	-50.4	-34.0	-122	-5.8	-23.0
-232	77.3	+65.5	-175	-50.1	-34.8	-121	-5.7	-22.7
-231	77.0	+65.7	-174	-49.9	-35.7	-120	-5.7	-22.3
-230	76.7	+65.9	-173	-49.7	-36.6	-119	-5.6	-22.0

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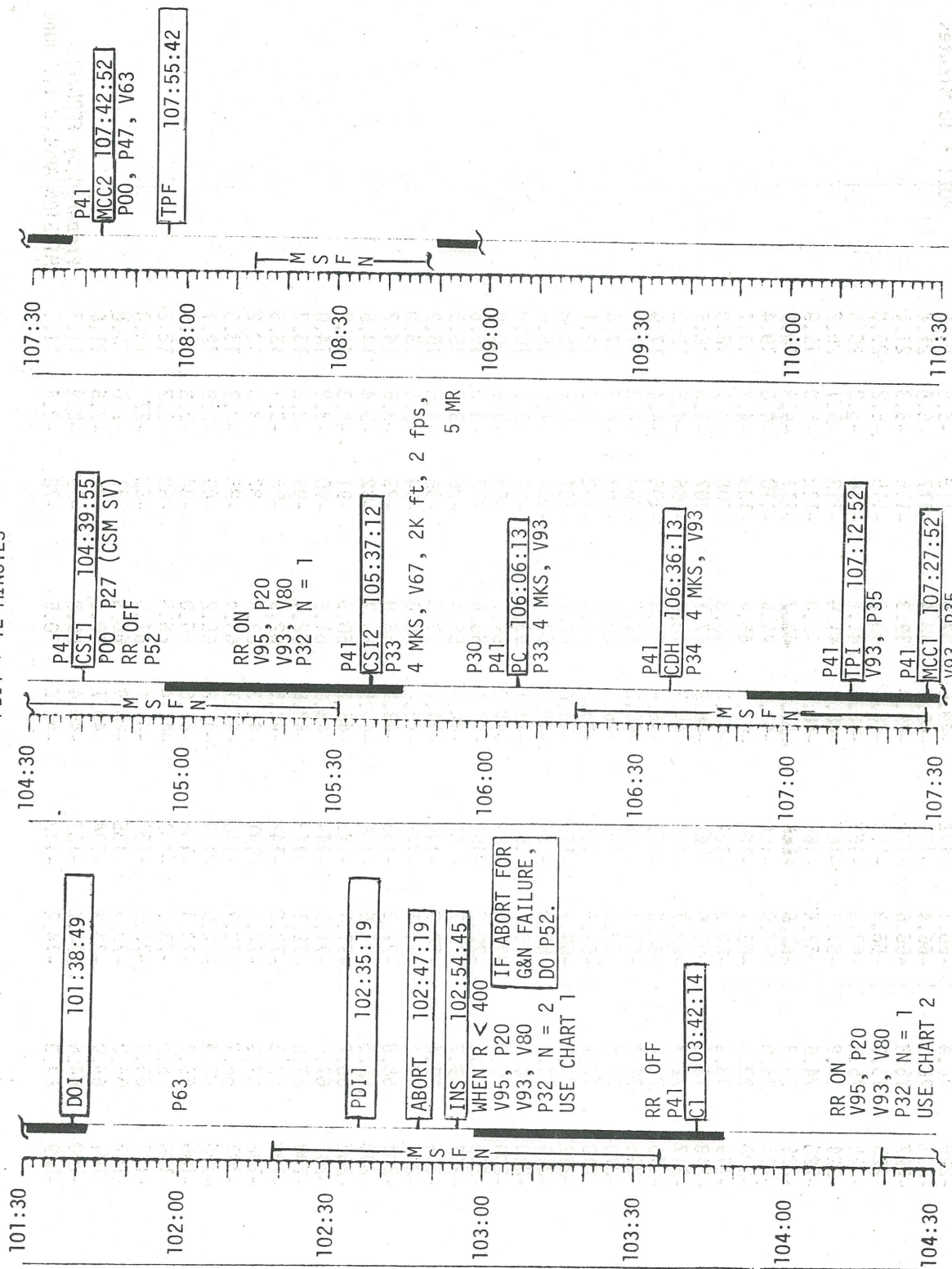
CHART 6.4

CDH BACKUP TABLE
PDI1 + 10 Minutes

RDOT1	X1	Z1	RDOT2	X2	Z2	RDOT3	X3	Z3
-229	76.4	-66.1	-172	-49.5	37.5	-118	-5.5	21.7
-228	76.1	-66.4	-171	-49.2	38.4	-117	-5.4	21.4
-227	75.8	-66.6	-170	-49.0	39.3	-116	-5.3	21.1
-226	75.5	-66.8	-169	-48.8	40.2	-115	-5.2	20.8
-225	75.2	-67.0	-168	-48.5	41.1	-114	-5.2	20.5
-224	74.9	-67.2	-167	-48.3	41.9	-113	-5.1	20.2
-223	74.6	-67.4	-166	-48.1	42.8	-112	-5.0	19.9
-222	74.3	-67.6	-165	-47.9	43.7	-111	-4.9	19.6
-221	74.0	-67.9	-164	-47.6	44.5	-110	-4.8	19.4
-220	73.7	-68.1	-163	-47.4	45.4	-109	-4.7	19.1
-219	73.3	-68.3	-162	-47.2	46.3	-108	-4.7	18.8
-218	73.0	-68.5	-161	-46.9	47.1	-107	-4.6	18.5
-217	72.7	-68.7	-160	-46.7	48.0	-106	-4.5	18.2
-216	72.4	-68.9	-159	-46.5	48.8	-105	-4.4	17.9
-215	72.1	-69.1	-158	-46.2	49.7	-104	-4.3	17.7
-213	71.8	-69.3	-157	-46.0	50.5	-103	-4.3	17.4
-213	71.5	-69.5	-156	-45.8	51.4	-102	-4.2	17.1
-212	71.2	-69.7	-155	-45.6	52.2	-101	-4.1	16.8
-211	70.9	-69.9	-154	-45.3	53.1	-100	-4.0	16.6
-210	70.6	-70.1	-153	-45.1	53.9	-99	-3.9	16.3
-209	70.3	-70.3	-152	-44.9	54.7	-98	-3.9	16.0
-208	70.0	-70.5	-151	-44.6	55.6	-97	-3.8	15.8
-207	69.7	-70.7	-150	-44.4	56.4	-96	-3.7	15.5
-206	69.4	-70.9	-149	-44.2	57.2	-95	-3.6	15.2
-205	69.1	-71.1	-148	-43.9	58.0	-94	-3.5	15.0
-204	68.8	-71.3	-147	-43.7	58.8	-93	-3.5	14.7
-203	68.5	-71.5	-146	-43.5	59.7	-92	-3.4	14.5
-202	68.2	-71.7	-145	-43.2	60.5	-91	-3.3	14.2
-201	67.9	-71.9	-144	-43.0	61.3	-90	-3.2	14.0
-200	67.6	-72.1	-143	-42.8	62.1	-89	-3.2	13.7
-199	67.3	-72.3	-142	-42.5	62.9	-88	-3.1	13.5
-198	67.0	-72.5	-141	-42.3	63.6	-87	-3.0	13.2
-197	66.7	-72.7	-140	-42.1	64.4	-86	-2.9	13.0
-196	66.4	-72.9	-139	-41.8	65.2	-85	-2.9	12.7
-195	66.1	-73.1	-138	-41.6	66.0	-84	-2.8	12.5
-194	65.8	-73.3	-137	-41.4	66.8	-83	-2.7	12.2
-193	65.5	-73.5	-136	-41.1	67.5	-82	-2.7	12.0
-192	65.2	-73.7	-135	-40.9	68.3	-81	-2.6	11.8
-191	64.9	-73.9	-134	-40.7	69.0	-80	-2.5	11.6
-190	64.6	-74.1	-133	-40.4	69.8	-79	-2.4	11.3
-189	64.3	-74.2	-132	-40.2	70.5	-78	-2.4	11.1

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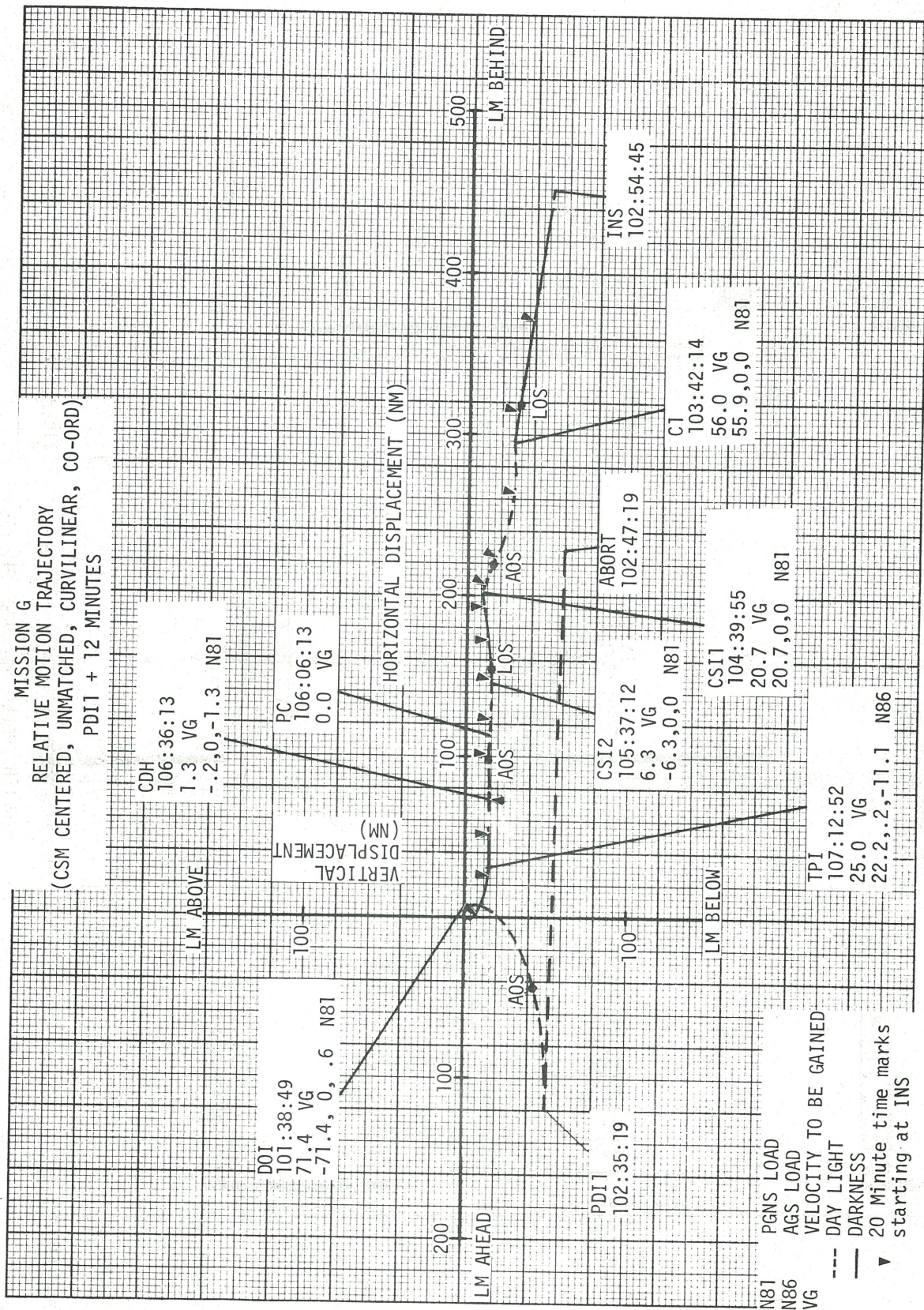
PDI1 + 12 MINUTES



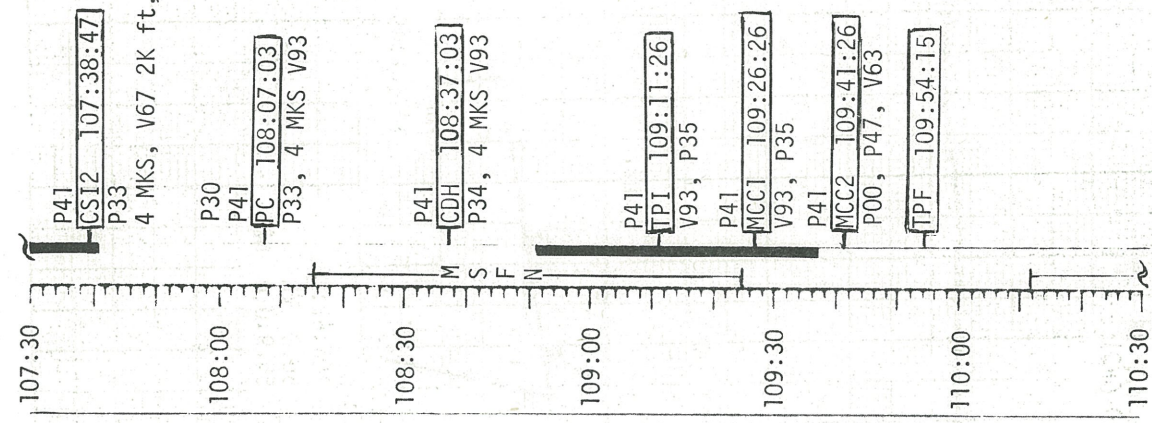
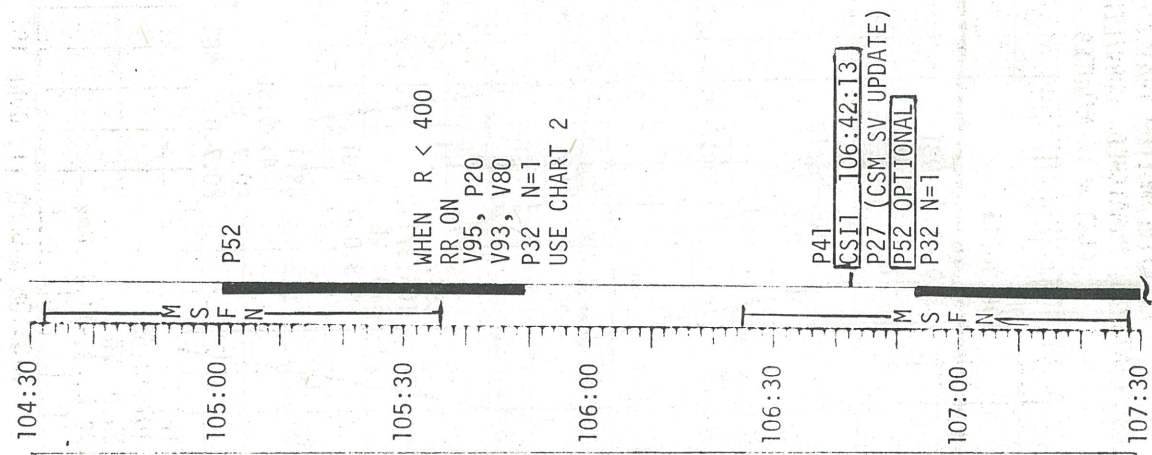
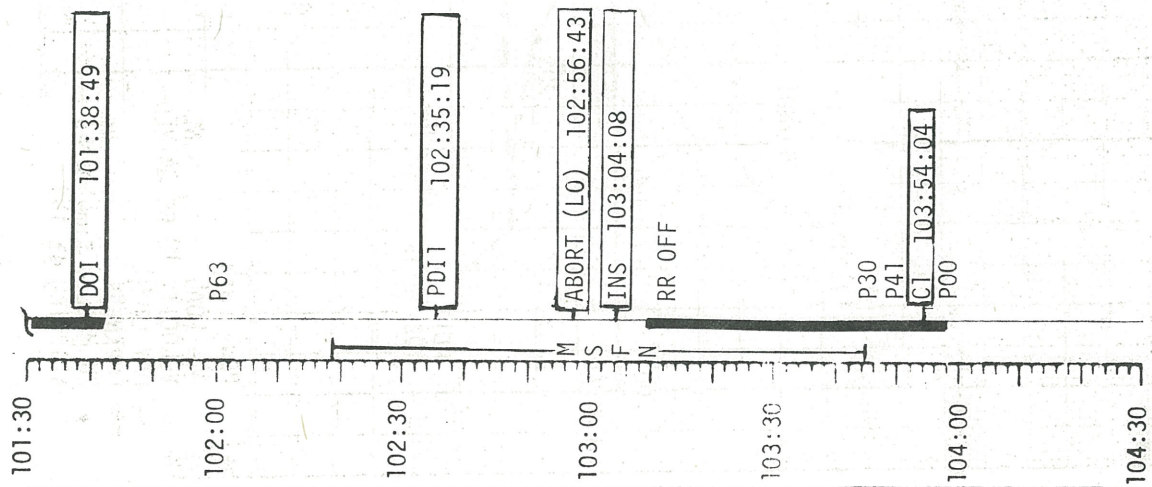
MISSION APOLLO 11, JUNE 19, 1969

6-10

CHART 6.5

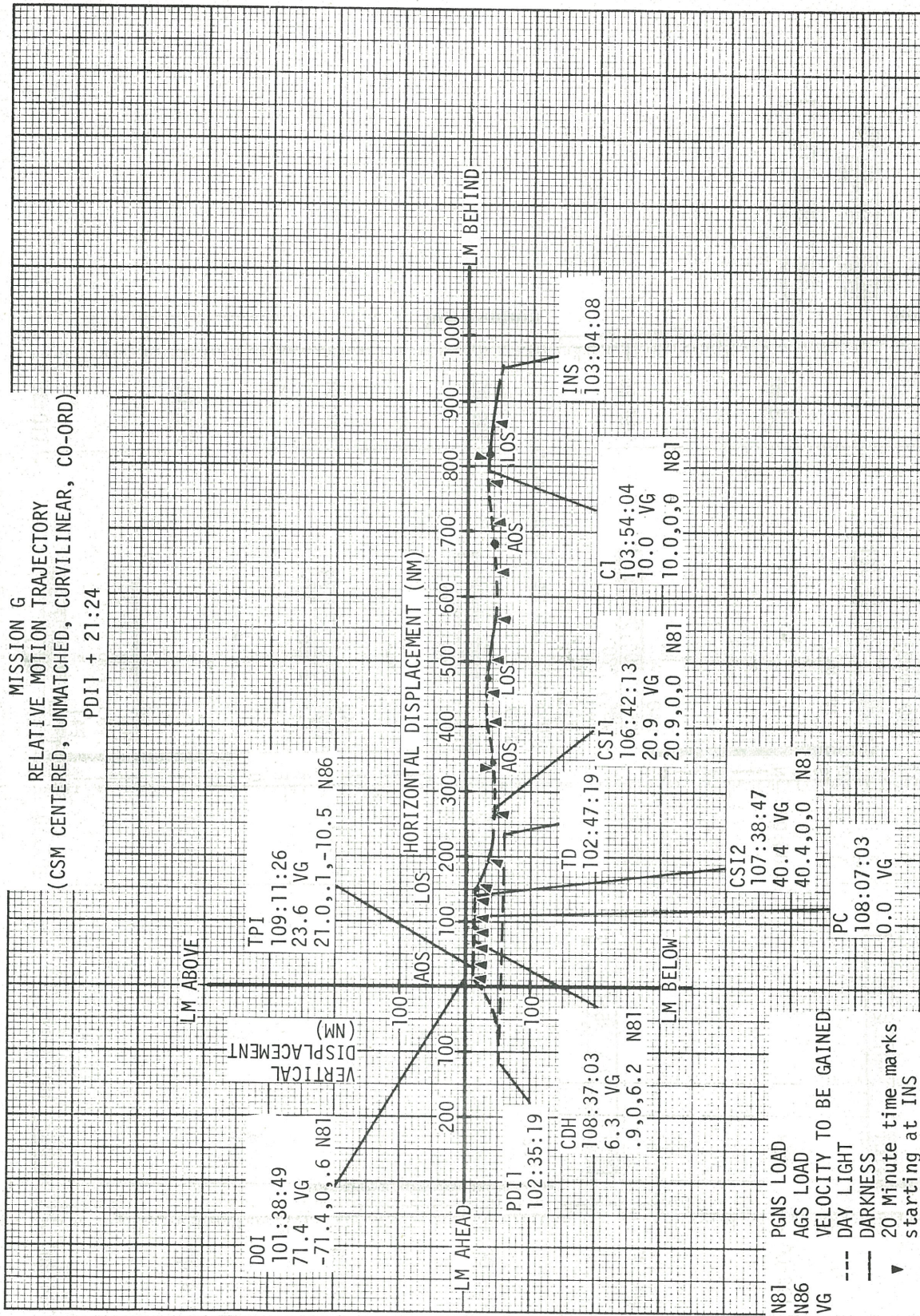


PD11 + 21:24

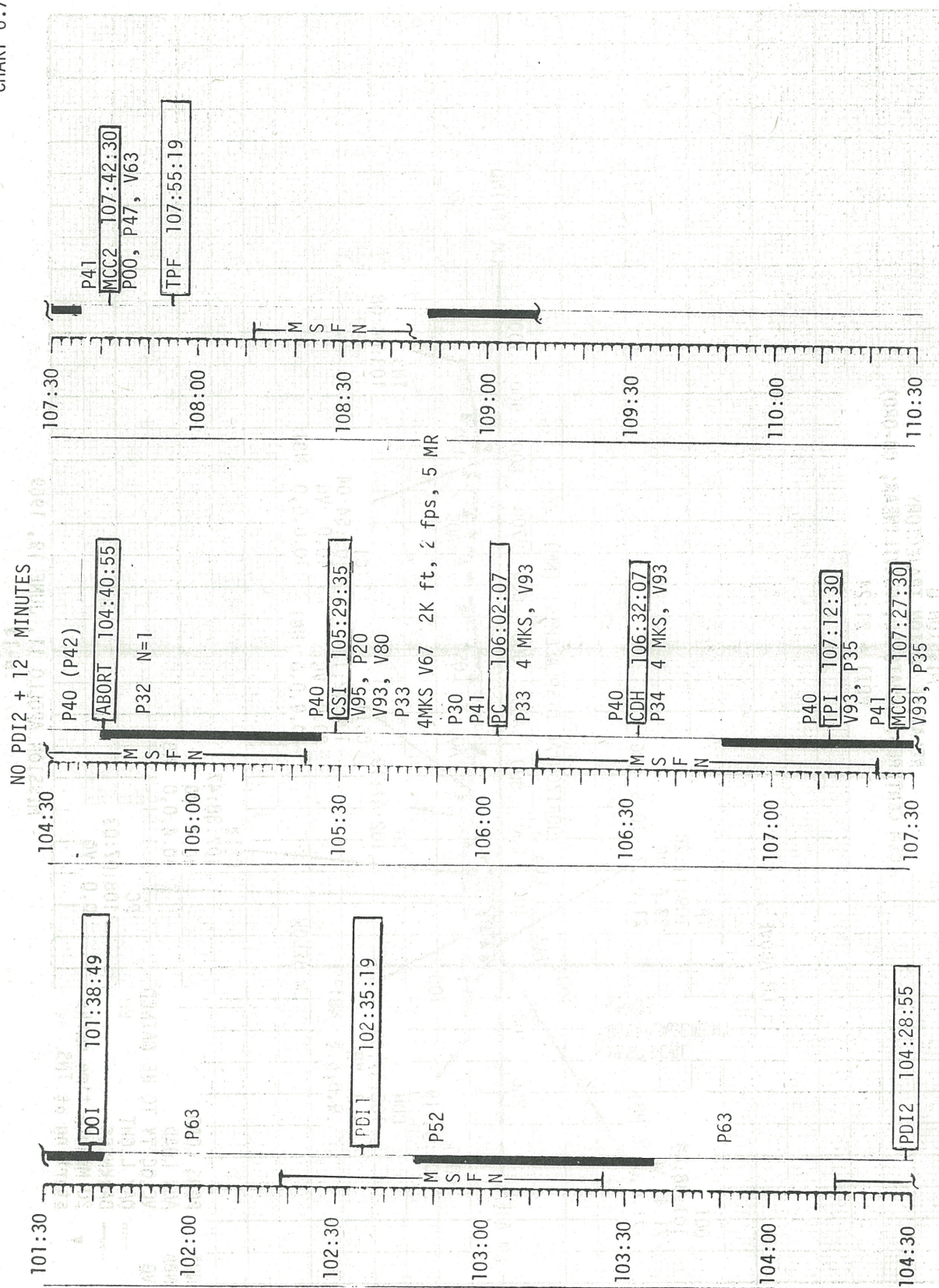


MISSION APOLLO 11, JUNE 19, 1969
6-12

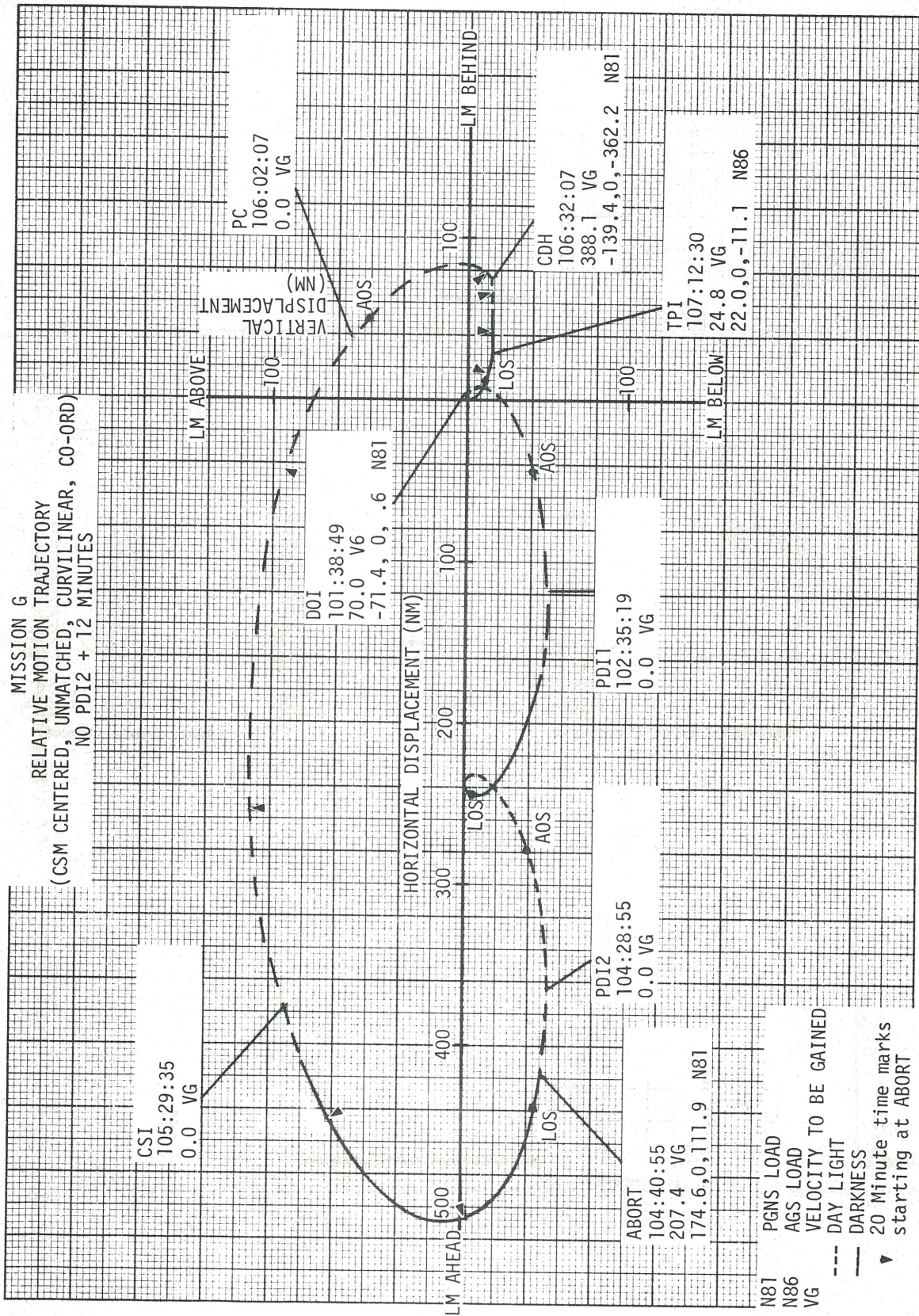
CHART 6.6



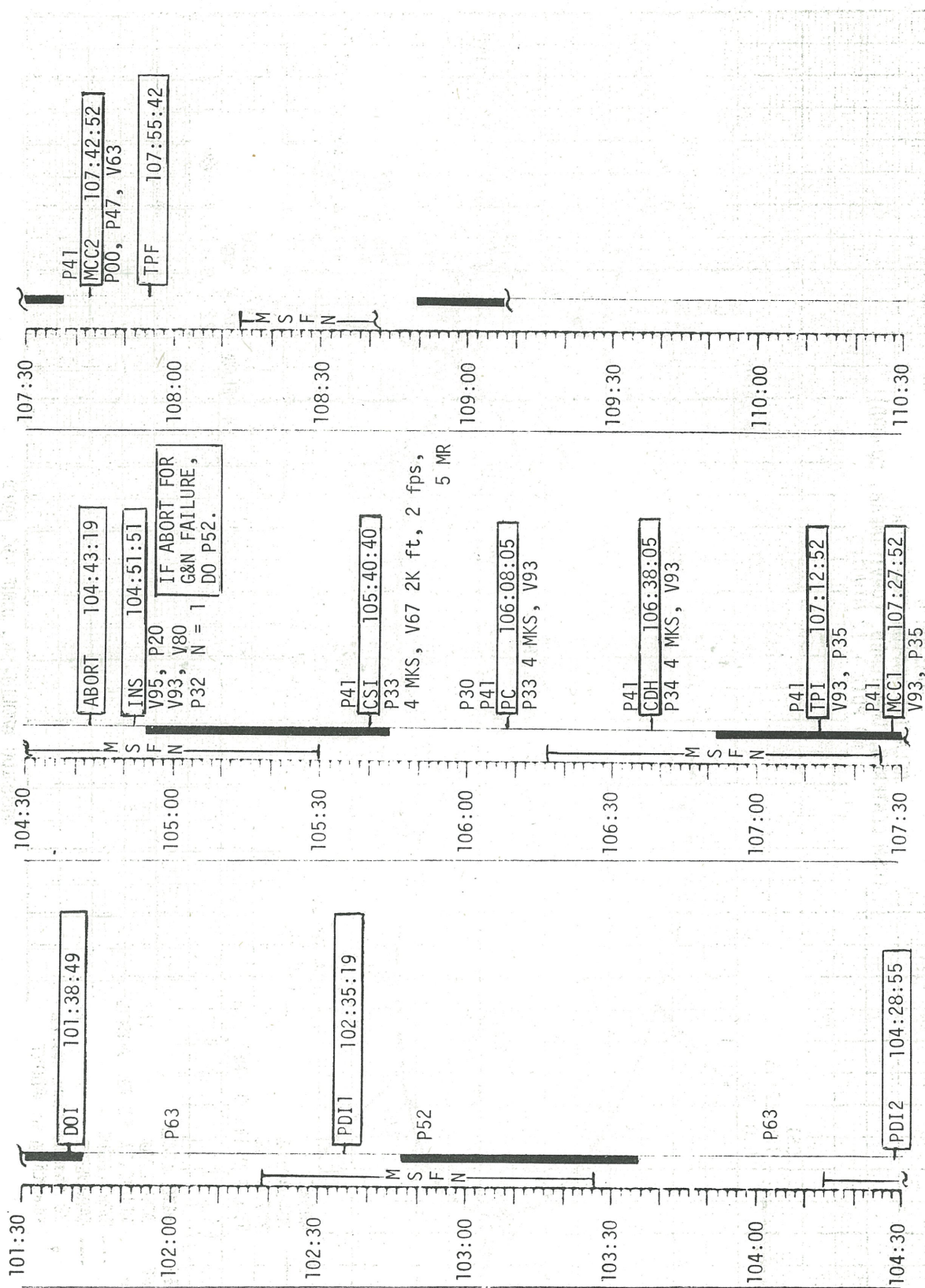
MISSION APOLLO 11, JUNE 19, 1969
6-13



MISSION APOLLO 11, JUNE 19, 1969
6-14

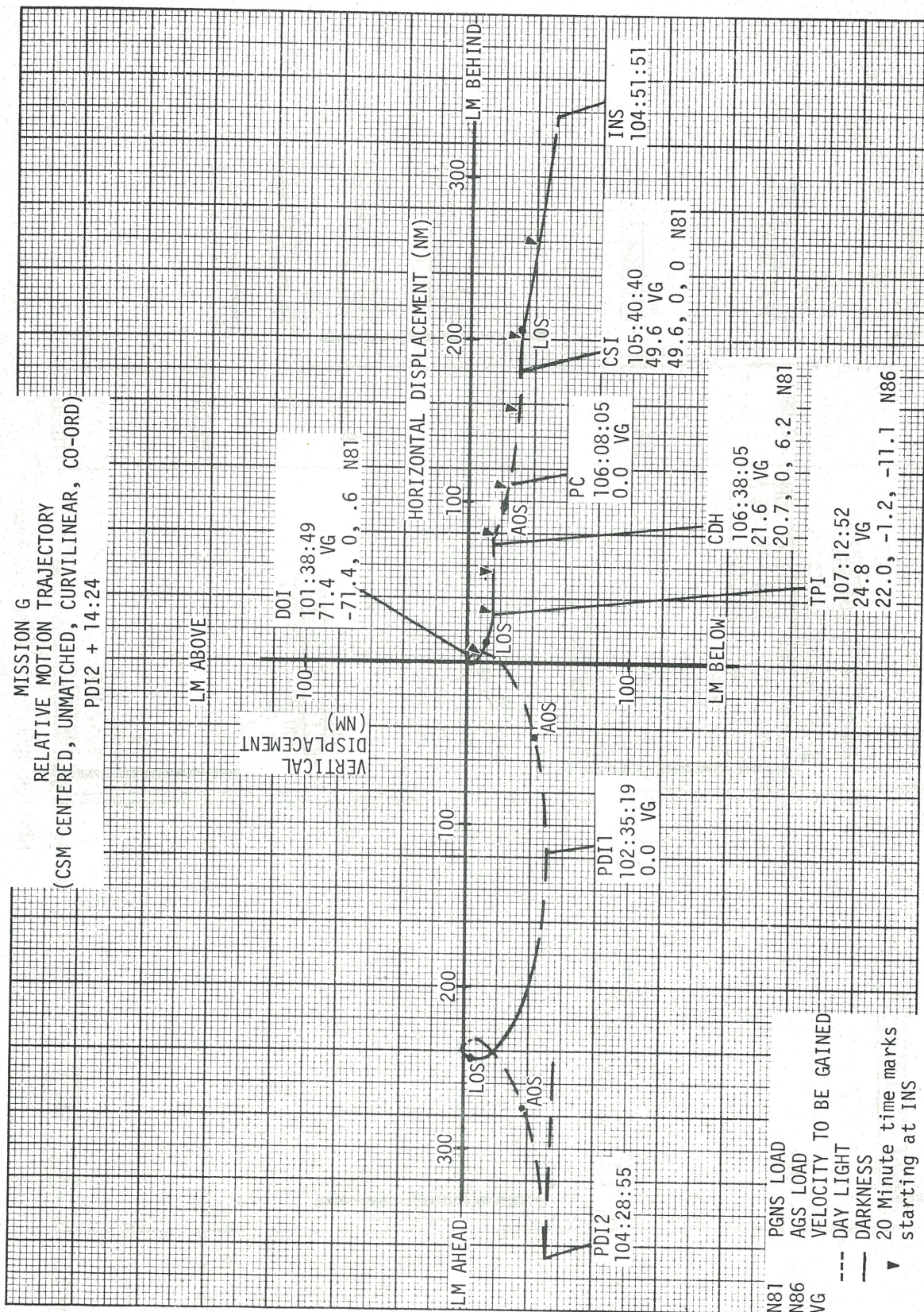


PDI2 + 14:24



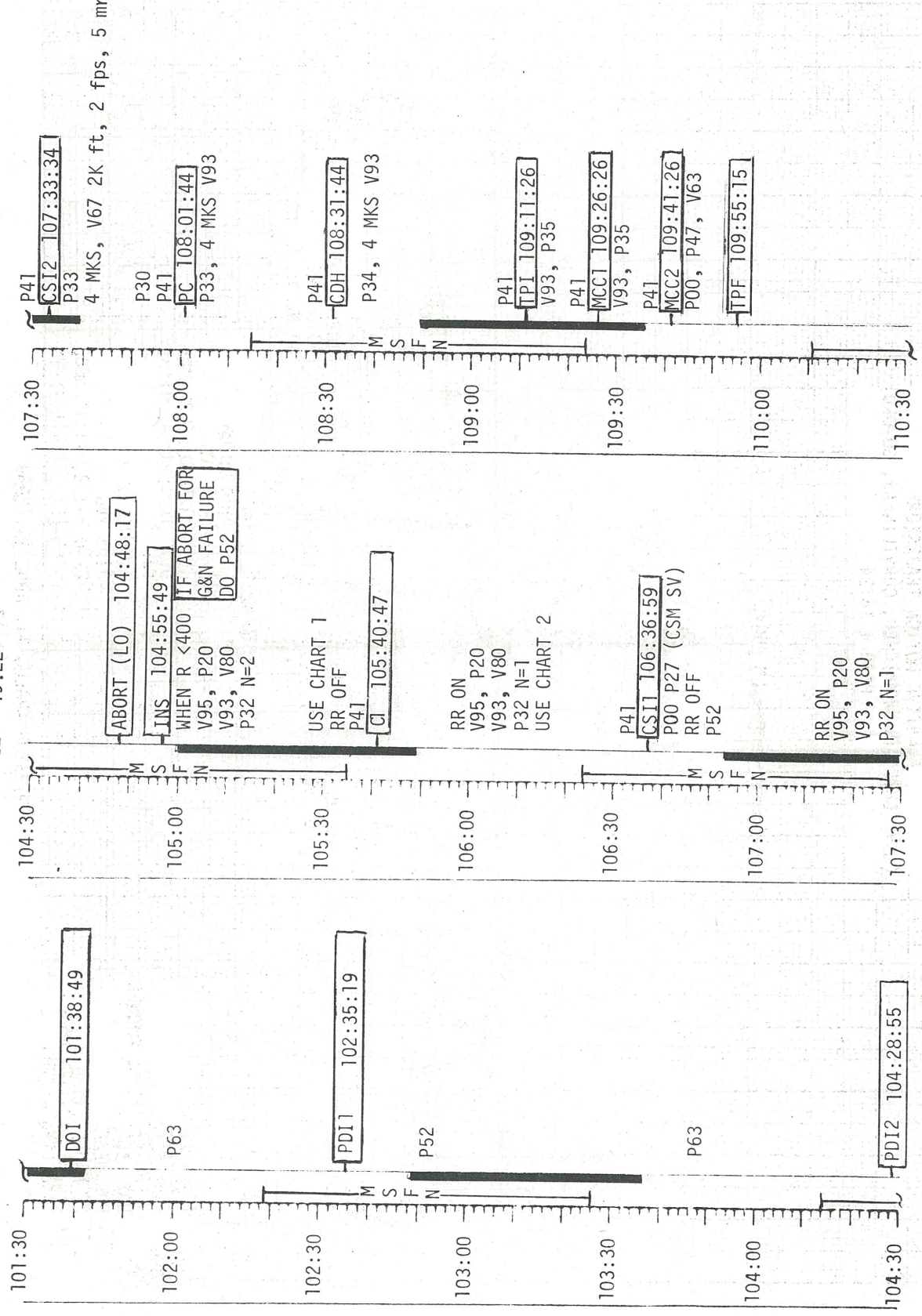
MISSION APOLLO 11, JUNE 19, 1969
6-16

CHART 6.8



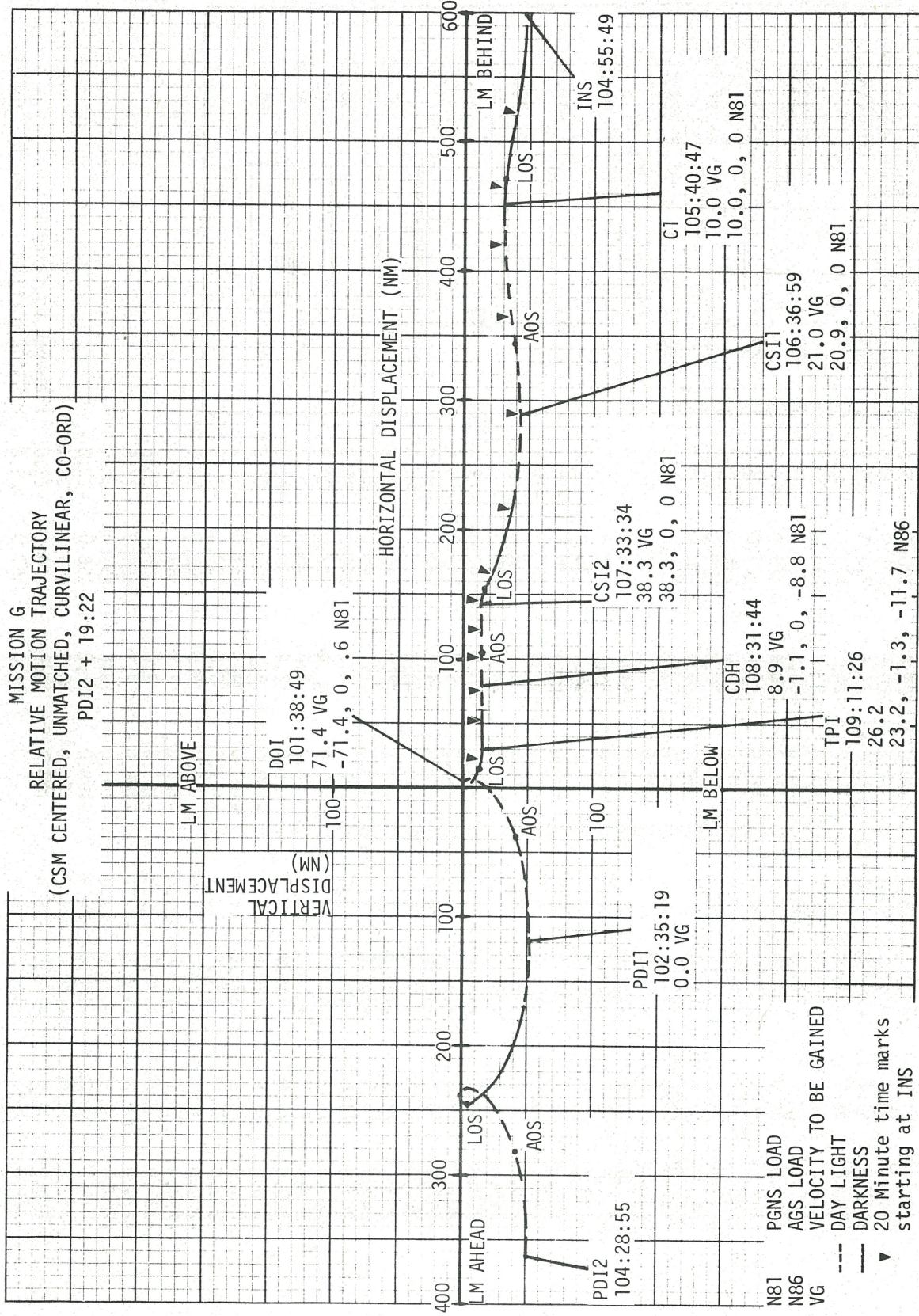
MISSION APOLLO 11, JUNE 19, 1969

PDI2 + 19:22



MISSION APOLLO 11, JUNE 19, 1969
6-18

CHART 6.9



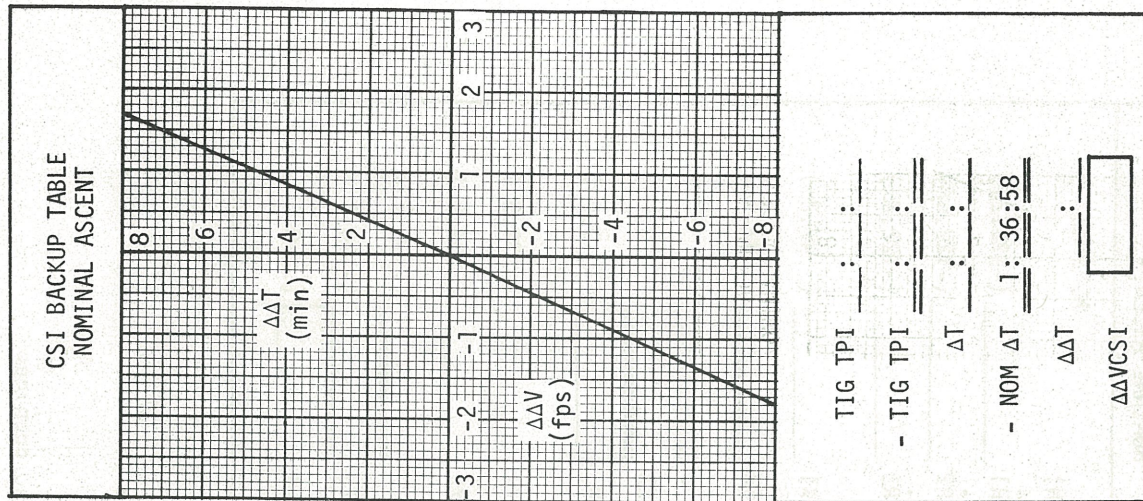
MISSION APOLLO 11, JUNE 19, 1969
6-19

CSI BACKUP TABLE	
NOMINAL ASCENT	
TIME (Min)	NOMINAL
-30 R1	(-283.3)
-20 R2	(-173.9)
-10 R3	(- 94.0)
-10 R3	(154.1)
F1	(93.0)
+F2	(-17.3)
+F3	(75.7)
+F4	(-22.4)
+ΔΔVCSI	(0.0)
ΔVCSI	(50.5)

R1	R2	R3	F3	R3	F4
-240.0	47.3	-140.0	45.2	-70.0	-15.2
-241.0	48.4	-141.0	43.4	-71.0	-15.5
-242.0	49.4	-142.0	41.6	-72.0	-15.7
-243.0	50.5	-143.0	39.8	-73.0	-15.9
-244.0	51.5	-144.0	37.9	-74.0	-16.1
-245.0	52.5	-145.0	36.1	-75.0	-16.3
-246.0	53.6	-146.0	34.3	-76.0	-16.5
-247.0	54.6	-147.0	32.4	-77.0	-16.7
-248.0	55.7	-148.0	30.6	-78.0	-16.9
-249.0	56.7	-149.0	28.7	-79.0	-17.1
-250.0	57.8	-150.0	26.9	-80.0	-17.3
-251.0	58.8	-151.0	25.1	-81.0	-17.5
-252.0	59.9	-152.0	23.2	-82.0	-17.7
-253.0	60.9	-153.0	21.4	-83.0	-17.9
-254.0	62.0	-154.0	18.6	-84.0	-18.1
-255.0	63.0	-155.0	17.7	-85.0	-18.4
-256.0	64.1	-156.0	15.9	-86.0	-18.6
-257.0	65.1	-157.0	14.0	-87.0	-18.8
-258.0	66.2	-158.0	12.2	-88.0	-19.0
-259.0	67.2	-159.0	10.3	-89.0	-19.2
-260.0	68.3	-160.0	8.5	-90.0	-19.4
-261.0	69.3	-161.0	6.6	-91.0	-19.6
-262.0	70.4	-162.0	4.8	-92.0	-19.8
-263.0	71.4	-163.0	3.0	-93.0	-20.0
-264.0	72.5	-164.0	1.1	-94.0	-20.2
-265.0	73.5	-165.0	-.7	-95.0	-20.5
-266.0	74.6	-166.0	-2.6	-96.0	-20.7
-267.0	75.7	-167.0	-4.4	-97.0	-20.9
-268.0	76.7	-168.0	-6.3	-98.0	-21.1
-269.0	77.8	-169.0	-8.1	-99.0	-21.3
-270.0	78.8	-170.0	-10.0	-100.0	-21.5
-271.0	79.9	-171.0	-11.9	-101.0	-21.7
-272.0	81.0	-172.0	-13.7	-102.0	-21.9
-273.0	82.0	-173.0	-15.6	-103.0	-22.1
-274.0	83.1	-174.0	-17.4	-104.0	-22.4
-275.0	84.2	-175.0	-19.3	-105.0	-22.6
-276.0	85.2	-176.0	-21.1	-106.0	-22.8
-277.0	86.3	-177.0	-23.0	-107.0	-23.0
-278.0	87.4	-178.0	-24.9	-108.0	-23.2
-279.0	88.4	-179.0	-26.7	-109.0	-23.4
-280.0	89.5	-180.0	-28.6	-110.0	-23.6
-281.0	90.6	-181.0	-30.4	-111.0	-23.8

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CHART 6.10



R1	F1	R2	F2	R3	F3	R3	F4
-282.0	91.6	-182.0	-32.3	-112.0	16.0	162.0	-24.0
-283.0	92.7	-183.0	-34.2	-113.0	17.0	163.0	-24.2
-284.0	93.8	-184.0	-36.0	-114.0	18.1	164.0	-24.5
-285.0	94.8	-185.0	-37.9	-115.0	19.1	165.0	-24.7
-286.0	95.9	-186.0	-39.8	-116.0	20.2	166.0	-24.9
-287.0	97.0	-187.0	-41.6	-117.0	21.2	167.0	-25.1
-288.0	98.1	-188.0	-43.5	-118.0	22.3	168.0	-25.3
-289.0	99.2	-189.0	-45.4	-119.0	23.3	169.0	-25.5
-290.0	100.2	-190.0	-47.2	-120.0	24.4	170.0	-25.7
-291.0	101.3	-191.0	-49.1	-121.0	25.4	171.0	-25.9
-292.0	102.4	-192.0	-51.0	-122.0	26.5	172.0	-26.1
-293.0	103.5	-193.0	-52.9	-123.0	27.5	173.0	-26.3
-294.0	104.6	-194.0	-54.7	-124.0	28.6	174.0	-26.5
-295.0	105.6	-195.0	-56.6	-125.0	29.6	175.0	-26.7
-296.0	106.7	-196.0	-58.5	-126.0	30.7	176.0	-26.9
-297.0	107.8	-197.0	-60.4	-127.0	31.7	177.0	-27.1
-298.0	108.9	-198.0	-62.2	-128.0	32.8	178.0	-27.3
-299.0	110.0	-199.0	-64.1	-129.0	33.8	179.0	-27.5
-300.0	111.1	-200.0	-66.0	-130.0	34.9	180.0	-27.7
-301.0	112.2	-201.0	-67.9	-131.0	35.9	181.0	-27.9
-302.0	113.2	-202.0	-69.8	-132.0	37.0	182.0	-28.1
-303.0	114.3	-203.0	-71.6	-133.0	38.0	183.0	-28.3
-304.0	115.4	-204.0	-73.5	-134.0	39.1	184.0	-28.5
-305.0	116.5	-205.0	-75.4	-135.0	40.1	185.0	-28.7
-306.0	117.6	-206.0	-77.3	-136.0	41.2	186.0	-28.9
-307.0	118.7	-207.0	-79.2	-137.0	42.2	187.0	-29.1
-308.0	119.8	-208.0	-81.1	-138.0	43.3	188.0	-29.3
-309.0	120.9	-209.0	-83.0	-139.0	44.3	189.0	-29.5
-310.0	122.0	-210.0	-84.9	-140.0	45.4	190.0	-29.7
-311.0	123.1	-211.0	-86.8	-141.0	46.4	191.0	-29.9
-312.0	124.2	-212.0	-88.7	-142.0	47.5	192.0	-30.1
-313.0	125.3	-213.0	-90.5	-143.0	48.5	193.0	-30.3
-314.0	126.4	-214.0	-92.4	-144.0	49.6	194.0	-30.5
-315.0	127.5	-215.0	-94.3	-145.0	50.7	195.0	-30.7
-316.0	128.6	-216.0	-96.2	-146.0	51.7	196.0	-30.9
-317.0	129.7	-217.0	-98.1	-147.0	52.8	197.0	-31.0
-318.0	130.8	-218.0	-100.0	-148.0	53.8	198.0	-31.2
-319.0	131.9	-219.0	-101.9	-149.0	54.9	199.0	-31.4
-320.0	133.0	-220.0	-103.8	-150.0	55.9	200.0	-31.6
-321.0	134.1	-221.0	-105.7	-151.0	57.0	201.0	-31.8
-322.0	135.3	-222.0	-107.7	-152.0	58.1	202.0	-32.0
-323.0	136.4	-223.0	-109.6	-153.0	59.1	203.0	-32.2

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RDOT	X1	Z1	X2	Z2	X3	Z3
-75.	29.7	147.4	-30.6	-68.0	-1.9	-79.2
-76.	30.1	146.6	-31.0	-66.1	-1.9	-80.3
-77.	30.5	145.7	-31.3	-64.1	-1.9	-81.5
-78.	30.8	144.9	-31.7	-62.1	-1.9	-82.6
-79.	31.2	144.1	-32.1	-60.1	-1.9	-83.8
-80.	31.6	143.2	-32.5	-58.2	-1.9	-84.9
-81.	32.0	142.3	-32.8	-56.2	-1.9	-86.1
-82.	32.4	141.6	-33.2	-54.2	-1.9	-87.2
-83.	32.7	140.7	-33.6	-52.2	-1.8	-88.4
-84.	33.1	139.9	-33.9	-50.2	-1.8	-89.6
-85.	33.5	139.0	-34.3	-48.2	-1.8	-90.7
-86.	33.9	138.2	-34.7	-46.2	-1.8	-91.9
-87.	34.2	137.3	-35.0	-44.1	-1.8	-93.1
-88.	34.6	136.5	-35.4	-42.1	-1.8	-94.2
-89.	35.0	135.6	-35.8	-40.1	-1.8	-95.4
-90.	35.4	134.7	-36.1	-38.1	-1.8	-96.6
-91.	35.7	133.9	-36.5	-36.0	-1.8	-97.8
-92.	36.1	133.0	-36.9	-34.0	-1.8	-98.9
-93.	36.5	132.1	-37.2	-31.9	-1.7	-100.1
-94.	36.9	131.2	-37.6	-29.8	-1.7	-101.3
-95.	37.2	130.4	-38.0	-27.8	-1.7	-102.5
-96.	37.6	129.5	-38.3	-25.8	-1.7	-103.7
-97.	38.0	128.6	-38.7	-23.7	-1.7	-104.9
-98.	38.3	127.7	-39.0	-21.6	-1.7	-106.1
-99.	38.7	126.8	-39.4	-19.5	-1.6	-107.3
-100.	39.1	125.9	-39.8	-17.3	-1.6	-108.5
-101.	39.5	125.0	-40.1	-15.2	-1.6	-109.7
-102.	39.8	124.1	-40.5	-13.3	-1.6	-110.9
-103.	40.2	123.2	-40.8	-11.1	-1.6	-112.1
-104.	40.6	122.3	-41.2	-9.0	-1.6	-113.3
-105.	40.9	121.4	-41.5	-6.9	-1.5	-114.5
-106.	41.3	120.5	-41.9	-4.8	-1.5	-115.7
-107.	41.7	119.6	-42.2	-2.7	-1.5	-116.9
-108.	42.0	118.6	-42.6	- .6	-1.5	-118.2
-109.	42.4	117.7	-42.9	-1.6	-1.5	-119.4
-110.	42.8	116.8	-43.3	-3.7	-1.4	-120.6
-111.	43.1	115.8	-43.6	-5.9	-1.4	-121.8
-112.	43.5	114.9	-44.0	-8.0	-1.4	-123.0
-113.	43.9	114.0	-44.3	-10.2	-1.4	-124.3
-114.	44.2	113.0	-44.7	-12.3	-1.4	-125.5
-115.	44.6	112.1	-45.0	-14.5	-1.3	-126.7
-116.	45.0	111.1	-45.4	-16.7	-1.3	-128.0
-117.	45.3	110.2	-45.7	-18.8	-1.3	-129.2

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CDH BACKUP TABLE	
TIME (MIN)	NOMINAL
-36 R1	(-122.21)
-23 R2	(-122.68)
-10 R3	(-122.87)
ΔVX: X1	(47.2)
+X2	(- 47.7)
	(- .5)
+X3	(0.1)
ΔVX(LV)	(- 0.4)
ΔVZ: Z1	(31.3)
+Z2	(105.2)
	(136.5)
+Z3	(-136.5)
ΔVZ(LV)	(0.0)

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CHART 6.11

CDH BACKUP TABLE
NOMINAL ASCENT

RDOT	X1	Z1	X2	Z2	X3	Z3
-118.	45.7	109.2	-46.1	21.0	.3	-130.5
-119.	46.1	108.3	-46.4	23.2	.2	-131.7
-120.	46.4	107.3	-46.7	25.4	.2	-132.9
-121.	46.8	106.4	-47.1	26.6	.2	-134.2
-122.	47.1	105.4	-47.4	29.8	.2	-135.4
-123.	47.5	104.4	-47.8	32.0	.1	-136.7
-124.	47.9	103.5	-48.1	34.2	.1	-137.9
-125.	48.2	102.5	-48.4	36.4	.1	-139.2
-126.	48.6	101.5	-48.8	38.6	.0	-140.5
-127.	48.9	100.5	-49.1	40.9	.0	-141.7
-128.	49.3	99.5	-49.5	43.1	-.0	-143.0
-129.	49.7	98.5	-49.8	45.3	-.0	-144.3
-130.	50.0	97.6	-50.1	47.6	-.1	-145.5
-131.	50.4	96.6	-50.5	49.8	-.1	-146.8
-132.	50.7	95.6	-50.8	52.1	-.1	-148.1
-133.	51.1	94.6	-51.1	54.4	-.2	-149.3
-134.	51.5	93.6	-51.4	56.6	-.2	-150.6
-135.	51.8	92.6	-51.8	58.9	-.2	-151.9
-136.	52.2	91.5	-52.1	61.2	-.3	-153.2
-137.	52.5	90.5	-52.4	63.4	-.3	-154.5
-138.	52.9	89.5	-52.8	65.7	-.3	-155.8
-139.	53.2	88.5	-53.1	68.0	-.4	-157.0
-140.	53.6	87.5	-53.4	70.3	-.4	-158.3
-141.	53.9	86.4	-53.7	72.6	-.4	-159.6
-142.	54.3	85.4	-54.1	74.9	-.5	-160.9
-143.	54.6	84.4	-54.4	77.2	-.5	-162.2
-144.	55.0	83.4	-54.7	79.6	-.5	-163.5
-145.	55.3	82.3	-55.0	81.9	-.6	-164.8
-146.	55.7	81.3	-55.3	84.2	-.6	-166.1
-147.	56.1	80.2	-55.7	86.5	-.7	-167.4
-148.	56.4	79.2	-56.0	88.9	-.7	-168.8
-149.	56.8	78.1	-56.3	91.2	-.7	-170.1
-150.	57.1	77.1	-56.6	93.6	-.8	-171.4
-151.	57.5	76.0	-56.9	95.9	-.8	-172.7
-152.	57.8	75.0	-57.3	98.3	-.9	-174.0
-153.	58.2	73.9	-57.6	100.7	-.9	-175.3
-154.	58.5	72.7	-57.9	103.0	-.9	-176.7
-155.	58.8	71.7	-58.2	105.4	-1.0	-178.0
-156.	59.2	70.7	-58.5	107.8	-1.0	-179.3
-157.	59.5	69.6	-58.8	110.2	-1.1	-180.7
-158.	59.9	68.5	-59.1	112.6	-1.1	-182.0
-159.	60.2	67.4	-59.4	115.0	-1.2	-183.3

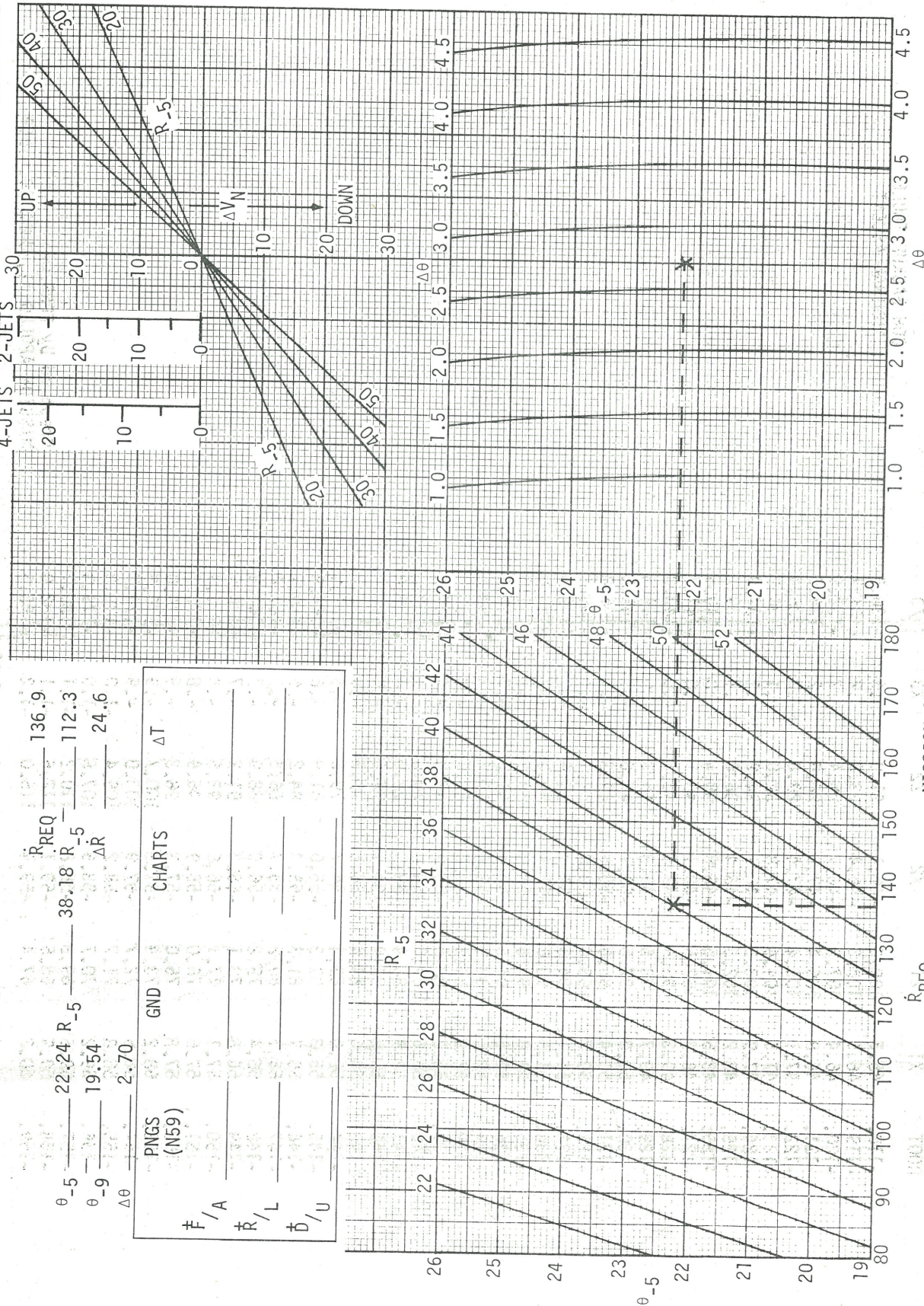
G MISSION TERMINAL PHASE INITIATION

PREPARED BY FPRB/OPS

CHART 6.12

θ_{-5} — 22.24 R_{-5} — 38.18 R_{-5} — 136.9
 θ_{-9} — 19.54 ΔR — 24.6
 $\Delta \theta$ — 2.70

CHARTS		GND		PINGS (N59)	
$\dot{r}/A$	_____	$\dot{r}/L$	_____	$\dot{r}/U$	_____
$\dot{r}/L$	_____	$\dot{r}/U$	_____	ΔT	_____



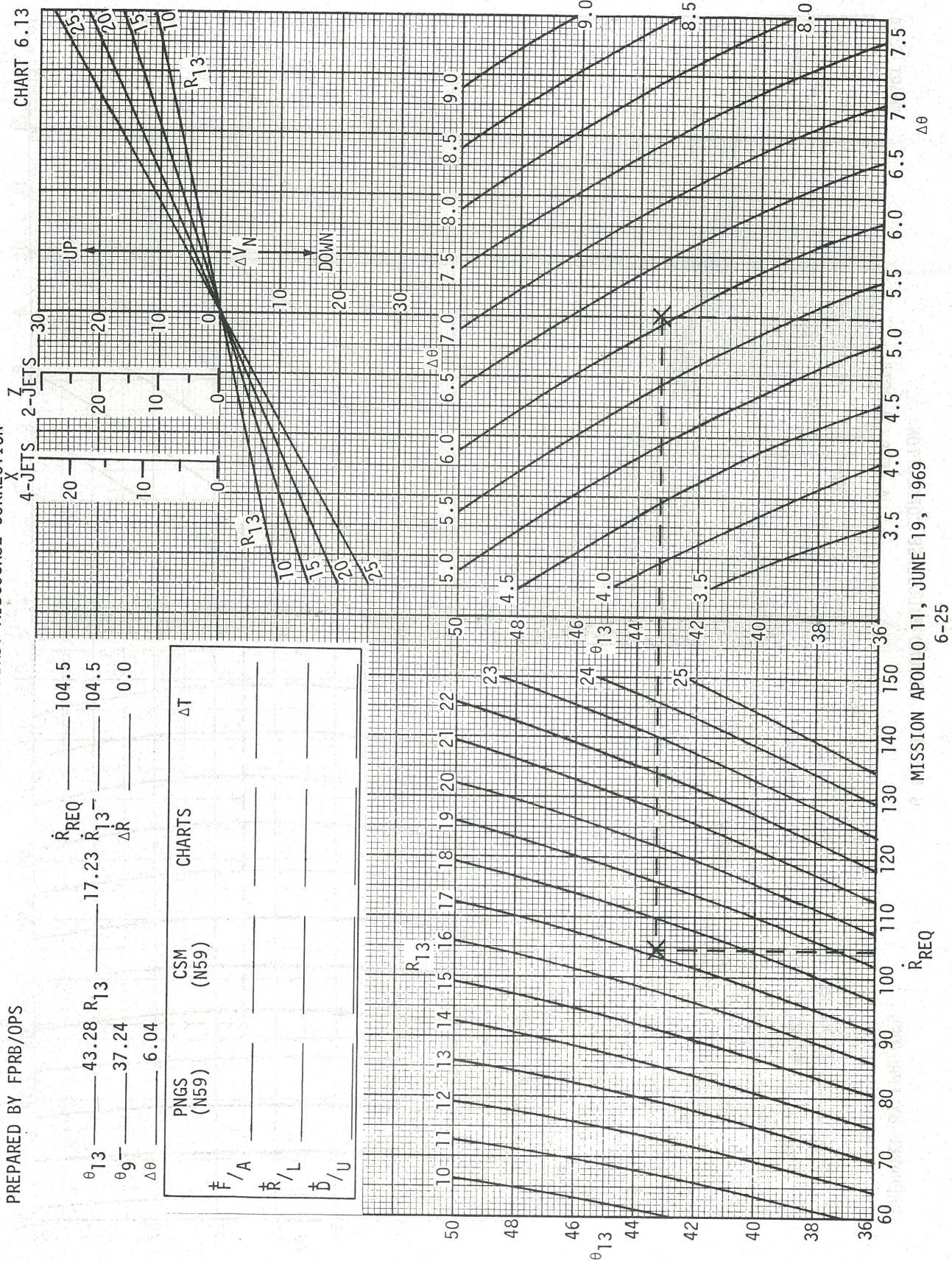
MISSION APOLLO 11, JUNE 19, 1969
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G MISSION FIRST MIDCOURSE CORRECTION

PREPARED BY FPRB/OPS

θ_{13} — 43.28 R_{13} — 17.23 $\dot{R}_{REQ}$ — 104.5
 θ_9 — 37.24 ΔR — 0.0
 $\Delta \theta$ — 6.04

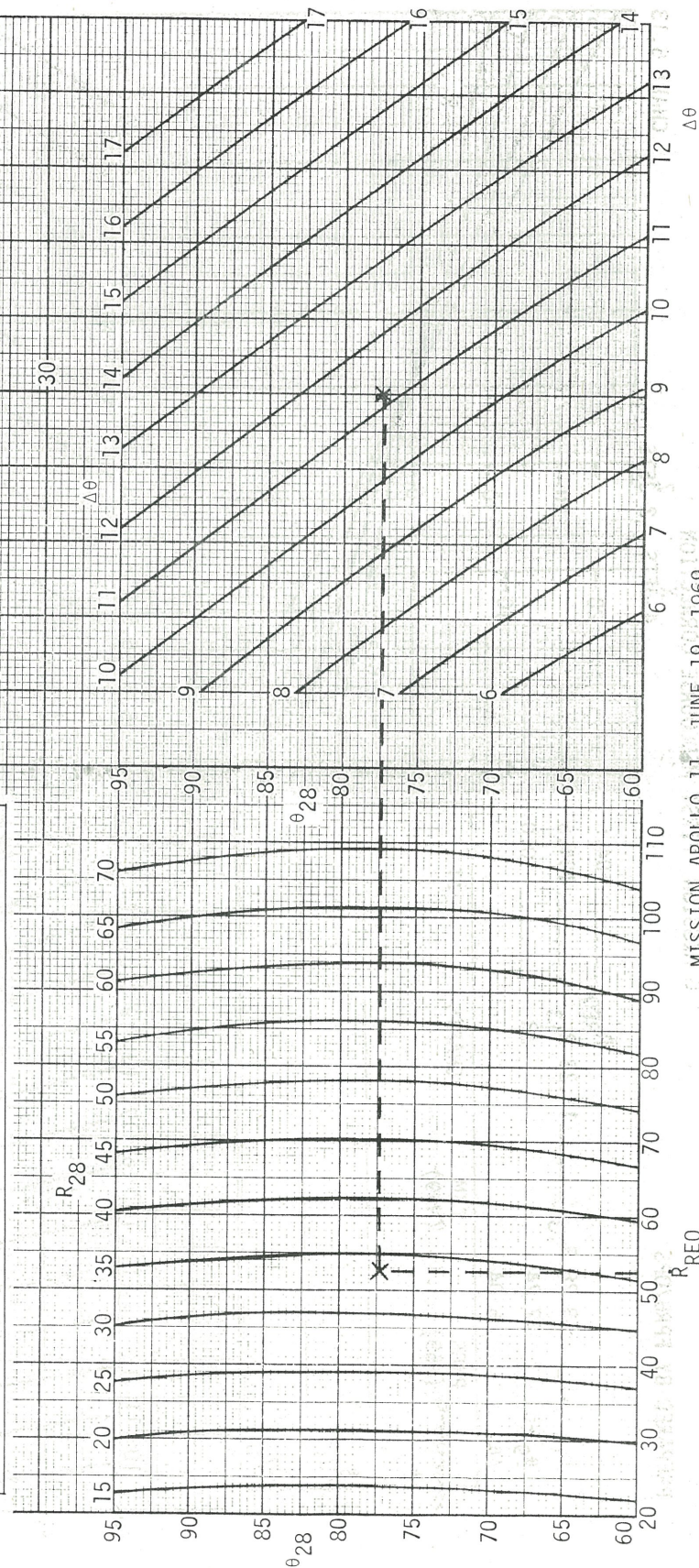
PNGS (N59)	CSM (N59)	CHARTS	ΔT
$\dot{F}/A$			
$\dot{R}/L$			
$\dot{D}/U$			



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θ_{28} — 77.41 R_{28} — 34.3 R_{REQ} — 52.4
 θ_{24} — 66.22 ΔR — 0.0
 $\Delta \theta$ — 11.19

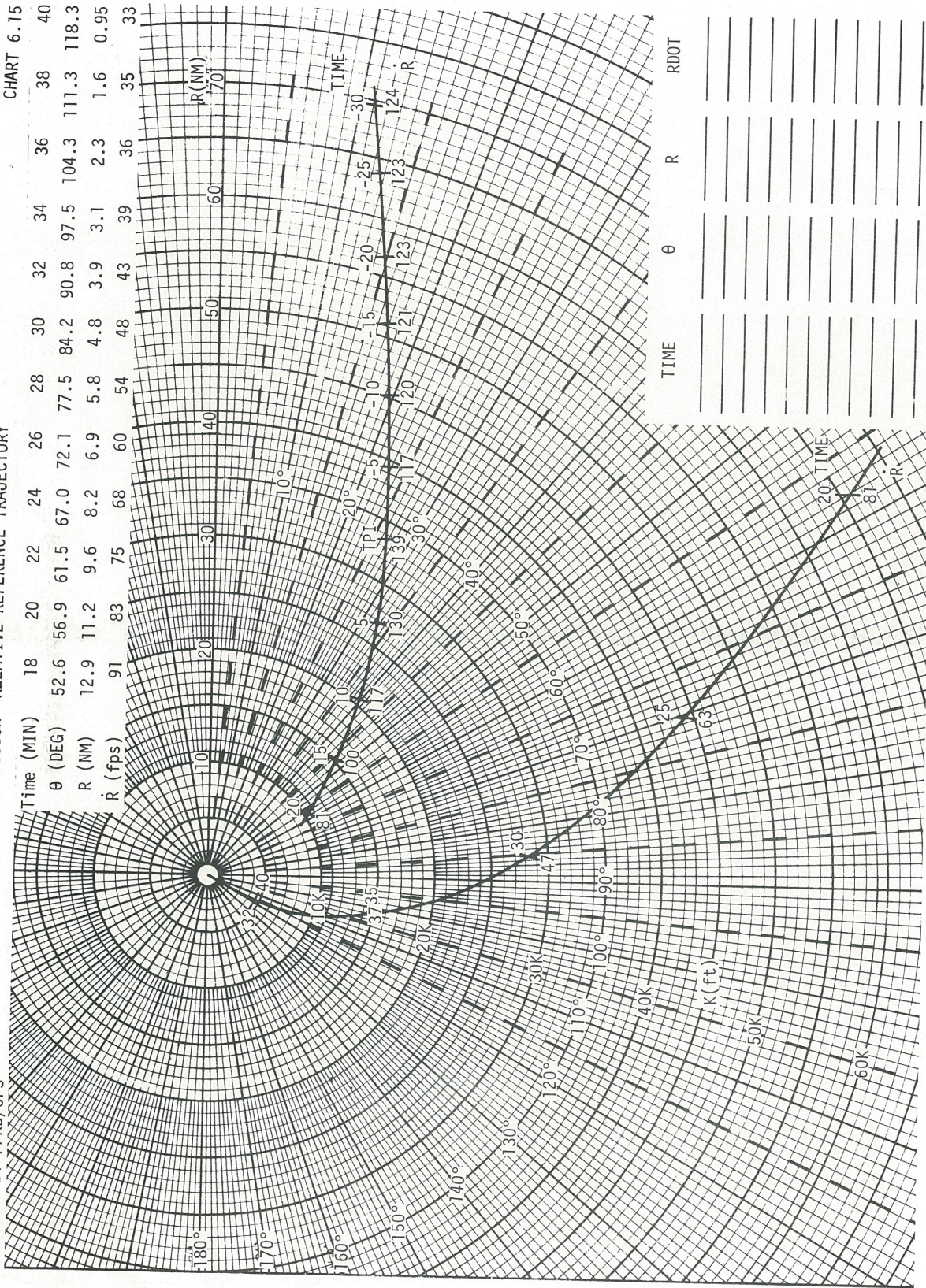
	PNGS (N59)	CSM (N59)	CHARTS	ΔT
$\dot{F}/A$	_____	_____	_____	_____
$\dot{R}/L$	_____	_____	_____	_____
$\dot{D}/U$	_____	_____	_____	_____



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CHART 6.75



MISSION APOLLO 11, JUNE 19, 1969
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7.0 REFERENCES

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