SL-4

THIRD SKYLAB MISSION

(NOVEMBER 15, 1973 LAUNCH)

FINAL
REVISION C

SKYLAB CSM RENDEZVOUS BOOK

PREPARED BY
FLIGHT PROCEDURES BRANCH
CREW PROCEDURES DIVISION

National Aeronautics and Space Administration
LYNDON B. JOHNSON SPACE CENTER
Houston, Texas

NOVEMBER 8, 1973

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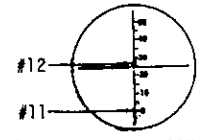
PSM ACTIVATION SWITCH LIST

SM RCS PSM 1 He-OPEN, tb-gray
SM RCS QUAD PRPLNT B-CLOSE, tb(2)-bp
SM RCS PSM PRPLNT B-OPEN , tb-gray
SM RCS QUAD PRPLNT C-CLOSE, tb(2)-bp
SM RCS PSM PRPLNT C-OPEN , tb-gray
SM RCS QUAD PRPLNT A-CLOSE, tb(2)-bp
SM RCS PSM PRPLNT A-OPEN , tb-gray
SM RCS QUAD PRPLNT D-CLOSE, tb(2)-bp
SM RCS PSM PRPLNT D-OPEN , tb-gray
SM RCS QUAD He(4)-CLOSE, tb(4)-bp

STAR AVAILABILITY

1.) BACKUP GDC ALIGN STARS ARE VISIBLE FROM SS TO SR



SHAFT = 0°
TRUN = 352.5°

2.) STAR ACQUISITION STARS ARE VISIBLE FROM SS+4 MIN TO SR+24 MIN

DEFINITIONS

$\overline{H}$ = AVERAGE ALTITUDE
θ_p = ORDEAL FDAI PITCH
TA = TRUNNION ANGLE

NC1 TARGETING PAD

		NOMINAL	NOMINAL UPDATE	PRELAUNCH UPDATE
N95	HR	+ 0 0 2	+	+
TIG NC1	MIN	+ 2 4	+	+
	SEC	+ 0 5 3 0	+	+
N57 HALF REVS		0 3		
N37	HR	+ 0 0 6	+	+
TIG TPI	MIN	+ 5 4	+	+
	SEC	+ 1 5 7 0	+	+

TALIGN PAD

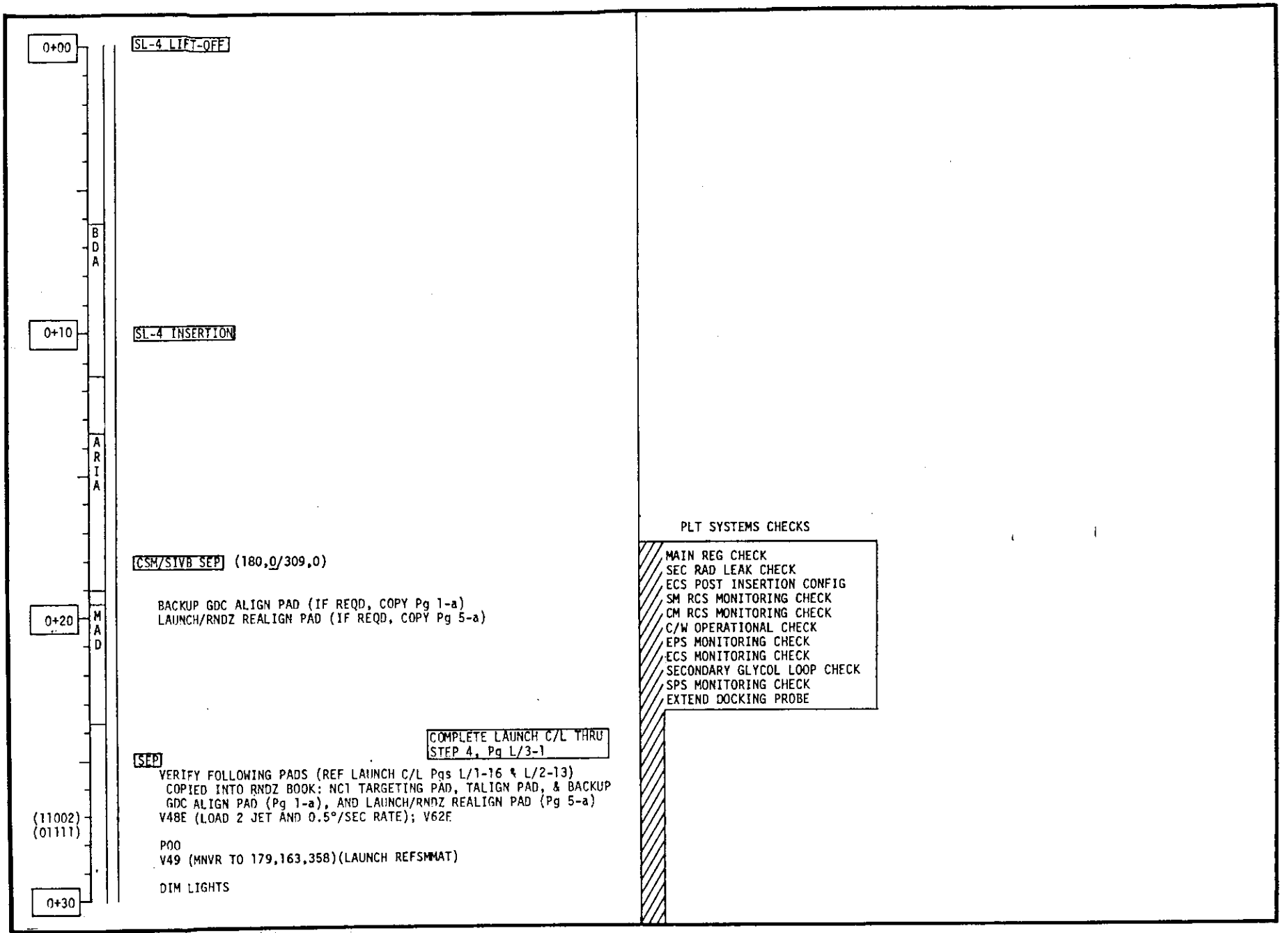
		NOMINAL	NOMINAL UPDATE	PRELAUNCH UPDATE
N34	HR	+ 0 0 6	+	+
GET	MIN	+ 4 7	+	+
ALIGN	SEC	+ 0 1 1 0	+	+

BACKUP GDC ALIGN PAD

		NOMINAL	NOMINAL UPDATE	UPDATE
0°/R STARS		1 1 / 1 2	/	/
ASCP tw	R	1 0 4 4		
	P	0 1 0 0		
(RNDZ REFSMMAT)	Y	0 1 9 7		

STAR ACQUISITION PAD

		NOMINAL	NOMINAL UPDATE	UPDATE
N22 (NC1)	R	+ 1 8 0 0 0	+ 0 0	+ 0 0
	P	+ 3 3 5 0 0	+ 0 0	+ 0 0
(RNDZ REFSMMAT)	Y	+ 0 0 2 0 0	+ 0 0	+ 0 0
N71 1ST STAR		0 4		
TPAC	SA	2 1 5 2 0	0	0
ANGLES	TA	0 2 8 8 0	0	0
N71 2ND STAR		1 4		
TPAC	SA	3 4 8 0 0	0	0
ANGLES	TA	0 1 3 9 0	0	0
N71 3RD STAR		1 7		


0+00
SL-4 LIFT-OFF
B
D
A
0+10
SL-4 INSERTION
A
R
I
A
CSM/SIVB SEP (180,0/309,0)
BACKUP GDC ALIGN PAD (IF REQD, COPY Pg 1-a)
LAUNCH/RNDZ REALIGN PAD (IF REQD, COPY Pg 5-a)
0+20
M
A
D
COMPLETE LAUNCH C/L THRU STEP 4, Pg L/3-1
SEP
VERIFY FOLLOWING PADS (REF LAUNCH C/L Pgs L/1-16 & L/2-13)
COPIED INTO RNDZ BOOK: NC1 TARGETING PAD, TALIGN PAD, & BACKUP
GDC ALIGN PAD (Pg 1-a), AND LAUNCH/RNDZ REALIGN PAD (Pg 5-a)
V48E (LOAD 2 JET AND 0.5°/SEC RATE); V62E
(11002)
(01111)
P00
V49 (MNVR TO 179,163,358)(LAUNCH REFSMMAT)
DIM LIGHTS
0+30
PLT SYSTEMS CHECKS
MAIN REG CHECK
SEC RAD LEAK CHECK
ECS POST INSERTION CONFIG
SM RCS MONITORING CHECK
CM RCS MONITORING CHECK
C/W OPERATIONAL CHECK
EPS MONITORING CHECK
ECS MONITORING CHECK
SECONDARY GLYCOL LOOP CHECK
SPS MONITORING CHECK
EXTEND DOCKING PROBE

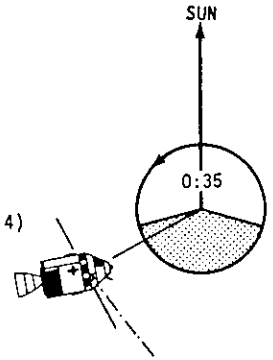
NOMINAL M-5

NOMINAL M-5

0+30

(11002)
(01111)

PERFORM EMS ΔV TEST & NULL BIAS CHECK CHECKLIST (Pg 1-2)



P52 (OPT 3) (RECORD)
REF STAR ACQ PAD STARS (Pg 1-a) (4,14)

0+40

P52 (OPT 2: COARSE ALIGN) (RECORD)
REF TALIGN PAD (Pg 1-a)
(NOMINAL N22=180,335,2) (4,14)

0:00

START SCS DRIFT CHECK (BMAG 2)
ALIGN GDC
RESET AND START DET COUNTING UP

0+50

PERFORM COAS LOS DETERMINATION CHECKLIST (Pg 1-2)

BORESIGHT STAR
14 - CANOPUS
(180,19,4)

ADVISE STDN ON SEPARATION EXECUTION

ARIA CRO

P31; BYPASS MINKEY OPT & AUTO MNVR
LOAD NC1 TARGETING PAD (Pg 1-a)

P31 (FINAL COMP: RECORD)
V56E

1+00

EMS ΔV TEST & NULL BIAS CHECK CHECKLIST

EMS MODE-STBY
EMS FUNC-ΔV SET/VHF RNG
SET ΔV ind to 1586.8 fps
EMS MODE-NORMAL
EMS FUNC-ΔV TEST
SPS THRUST Lt-on/off (10 sec)
ΔV ind stops at -0.1 to -41.5

EMS MODE-STBY
EMS FUNC-ΔV SET/VHF RNG
SET ΔV ind to (-100.0) fps
CMC MODE-FREE
EMS FUNC-ΔV (wait 5 sec)
EMS MODE-NORMAL (for 1 min 40 sec)
EMS MODE-STBY
If ΔV≤1 fps, do not bias
If ΔV>1 fps but ≤10 fps, bias if desired
If ΔV>10 fps, EMS is NO-GO
CMC MODE-AUTO

COAS LOS DETERMINATION CHECKLIST

1.		COAS PWR-ON(up)
		MNVR TO BORESIGHT ATTITUDE
		CMC MODE-FREE
		V37E52E
	F 04 06	R1 00001
		R2 00003
		PRO
	F 50 25	00015
		ENTER
	F 01 70	0OODE STAR CODE
		LOAD BORESIGHT STAR CODE
		OPT MODE-CMC(verify)
		OPT ZERO-OFF
		PRO
	06 92	SHAFT,TRUN
2.		BORESIGHT ON STAR AND MARK with VERB key
		RECORD SHAFT,TRUN (NOMINAL = 0°,+57.470°)
		TO VERIFY: KEY RLSE AND REPEAT STEP 2
3.		V37E00E
		CMC MODE-AUTO
		OPT MODE-MAN
		OHC-Drive trun<10°
		OPTI ZERO-ZERO

P52 (OPTION 3)

N71 1ST STAR			0	0	0		
N71 2ND STAR			0	0	0		
N05(R1) & ERR							
N93	X						
GYRO TORQUING ANGLES	Y						
	Z						
TIME OF GYRO TORQUE	HR	+	0	0	0		
	MIN	+	0	0	0		
	SEC	+	0				

P52 (OPTION 2)

N71 1ST STAR			0	0	0		
N71 2ND STAR			0	0	0		
N05(R1) & ERR							
N93	X						
GYRO TORQUING ANGLES	Y						
	Z						
TIME OF GYRO TORQUE	HR	+	0	0	0		
	MIN	+	0	0	0		
	SEC	+	0				

COAS LOS DETERMINATION

N92	SA	+					
	TA	+					

P31 FINAL COMP

N84	ΔV_{NC2}	+	0				
	ΔH_{NC2}	+	0				
	ΔV_{NCC}	+	0				
N81	ΔV_X	+	0				
ΔV_{NC1}	ΔV_Y	+	0	0	0	0	0
	ΔV_Z	+	0	0	0	0	0

1+00
(11002)
(01111)

P20 (OPT 5)
(N78 = +0,+9000,+18000)
(TRK EARTH N70 = 47)

PERFORM PGA DOFFING & STOWAGE CHECKLIST (Pg 1-3)

UNSTOW CUE CARDS (DATA CARD KIT-R3)

UNSTOW AND MOUNT ORDEAL BOX (U3)

1+10

+30:00

END SCS DRIFT CHECK (BMAG 2); PERFORM
GDC/IMU COMPARISON CHECKLIST (Pg 1-3)

0:00
1+20

```
****IF BMAG 2>10°/HR/AXIS************
* START SCS DRIFT CHECK (BMAG 1)     *
*  ALIGN GDC                         *
*  BMAG MODE(3)-RATE 1               *
*  RESET AND START DET COUNTING UP   *
************************************
```

1+30

NOMINAL M=5

PGA DOFFING AND STOWAGE CHECKLIST

STOW LIFE VESTS (Disp Bag A)
STOW WRIST DAMS & NECK DAMS (Disp Bag A)
STOW C/L POCKETS WITH SCISSORS (Disp Bag A)
(CDR SCISSORS IN Disp Bag B)
STOW IN Disp Bag B: SUNGLASSES, PEN,
PENCIL, MARKER, WATCH W/BAND & PRD.
LEAVE PENLIGHT IN PGA
STOW OTHER CREW OPTIONAL EQPT AS REQD

AUDIO CONT(3)-NORM (verify) (PNLS 6,9,10)
PWR(3)-OFF (PNLS 6,9,10)
SUIT PWR(3)-OFF (PNLS 6,9,10)
DISCONN COMM CARRIER & STOW (Disp Bag B)
SUIT FLOW VLV-OFF
DISCONN O2 HOSES & ELECTRICAL, SNAP TO BKH
UNSTOW 3 O2 UMBILICAL SCREEN CAPS AND
3 PGA ELECT CONNECTOR COVERS (B2)
INSTALL PGA ELECT CONNECTOR COVERS ON PGAs
INSTALL HOSE SCREENS ON RETURN HOSES (RED)
SUIT FLOW VLV-FULL FLOW

DOFF PGAs
CAUTION
DO NOT PULL RED LANYARD

INSTALL HELMETS & IV GLOVES (ACCESSORY
BAGS) ON PGAs
SECURE HELMET BAGS TO HELMETS
DOFF OBS/BIOBELTS
CLEAN ELECTRODES WITH TISSUES (ON A8)
STOW OBS/BIOBELTS (ACCESSORY BAGS)
SECURE ACCESSORY BAGS TO HELMET BAGS
STOW PGAs IN PGA BAGS (U2) (CREW OPTION)
STOW PGAs (UNDER COUCH)

DON TROUSERS, JACKETS & BOOTS (U2)
DON CWG HARNESSES (U2) &
COMM CARRIERS (Disp Bag B)
CONN COMM CARRIER TO CWG HARNESS
PWR(3)-AUDIO/TONE (PNLS 6,9,10)
SUIT PWR(3)-ON(up) (PNLS 6,9,10)
DON PRD & WATCH (Disp Bag B) (SHORT
WATCH BANDS AVAILABLE LATER E625)
PLACE LOOSE POCKET ITEMS (Disp Bag B) IN
TROUSER PKTS
DOFF UCTAs (WHEN FULL)
PLACE UCTA CLAMPS (ON A9) ON UCTAs
STOW UCTAs AND CLAMPS IN PORTABLE WASTE
STOWAGE CONTAINER (ON A9) & TEMP STOW
DON UCTAs (ON A9)

GDC/IMU COMPARISON CHECKLIST

V16N20E
FDAI SELECT-1
FDAI SOURCE-ATT SET
ATT SET-GDC
ZERO FDAI 1 err needles with ASCP tw
Key VERB when ZERO
RECORD N20 values
RECORD ASCP tw values
RECORD DET
FDAI SELECT-1/2

```
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
X TOTAL ATTITUDE DIFFERENCE GREATER X
X THAN 10 DEG/HR PER AXIS IS        X
X UNACCEPTABLE.                     X
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
```

BMAG 2 GDC/IMU COMPARISON RESULTS

N20	IMU	R	+						
		P	+						
		Y	+						
ASCP tw	GDC	R	X						X
		P	X						X
		Y	X						X
DET (30:00)	ΔT		X	X					

BMAG 1 GDC/IMU COMPARISON RESULTS

N20	IMU	R	+						
		P	+						
		Y	+						
ASCP tw	GDC	R	X						X
		P	X						X
		Y	X						X
DET (30:00)	ΔT		X	X					

NOMINAL M-5

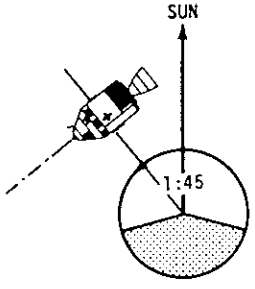
1+30

(11002)
(01111)

TEX

TO ENABLE REFSMMAT DOWNLINK
CMC MODE-FREE
V37E52E (HOLD FOR 30 SECONDS)
V37E20E
CMC MODE-AUTO
NC1 PRELIMINARY PAD (COPY Pg 1-5)
NPC ADVISORY
TRANSMIT GYRO TORQUE ANGLES AND TIME OF GYRO TORQUE
(OPT 3 & OPT 2; Pg 1-2)
TRANSMIT EMS ΔV TEST RESULTS
TRANSMIT GDC/IMU COMPARISON RESULTS (Pg 1-3)

1+40



+30:00
1+50

*****IF BMAG 2>10°/HR/AXIS*****
* END SCS DRIFT CHECK (BMAG 1); PERFORM *
* GDC/IMU COMPARISON CHECKLIST (Pg 1-3) *
*****

STDN UPLINK (P27) [CSM & SWS STATE VECTORS, PIPA BIAS UPDATE]

MAD

NC1 FINAL PAD (COPY Pg 1-5)
STAR ACQ PAD (COPY Pg 1-a)

V48E (LOAD WT, PT & YT IF REQD)

P31; BYPASS MINKEY OPT & AUTO MNVR
LOAD N95 NC1 TIG PAD VALUE (Pg 1-5)
SET DET

P31 (FINAL COMP: RECORD Pg 1-5)

2+00

2+00
(11002)
(01111)

P00
V49E (MNVR TO STAR ACQ PAD ATT (Pg 1-a))
(NOMINAL ATT=(180,335,2)

P52 (OPT 3) (RECORD Pg 1-6) (4,14)

```
*****IF P52 N93 RSS>1°*************************************
* TIG > 15 MIN:  PERFORM BACKUP GDC ALIGN (G/3-18)      *
*                REF PAD (Pg 1-a)                       *
*                AND                                    *
* TIG < 15 MIN:  PERFORM GDC CHECK AT STAR ACQ PAD ATT  *
*                (OHC TO FIRST PAD STAR SA/TA)          *
*****IF STAR > 5° FROM CENTER OF SCT*********************
* APPLY ΔVX USING 16° WINDOW MARK FOR BURN ATT          *
* IF DESIRED, PERFORM BURN ATT CHECK AT THE BURN ATT    *
************************************************************
```

2+10
-12:00

GO TO SPS BURN CUE CARD
(BANK A & B)

P40

2+20

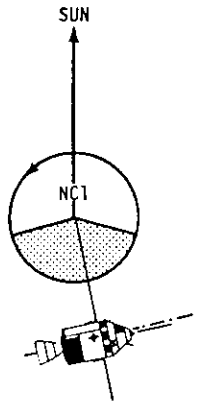
NC1 (180,359/335,2) (TRIM VGX ±0.2)
RECORD BURN STATUS

0:00

P20 (OPT 5)
(N78 = +0,+9000,+18000)
(TRK EARTH N70 = 47)

ARIA

2+30



NC1 PAD DATA

			NOMINAL	PRELIMINARY	FINAL
N95	HR	+	0 0 2		
TIG NC1	MIN	+	2 4		
	SEC	+	0 5 3 0		
N81	ΔV_X	+	2 1 3 3		
ΔV_{NC1}	ΔV_Y	+	0 0 0 0		
	ΔV_Z	+	0 0 0 0		
N22	R	+	1 8 0 0 0	0 0	0 0
NC1	P	+	3 3 5 0 0	0 0	0 0
	Y	+	0 0 2 0 0	0 0	0 0
	ΔV_C		2 0 0 7		
	BT		0 0 1 0		

WT + | PT | YT

BURN ATT CHECK

STAR		
SA	+	0
TA	+	0 0

BURN ATT CHECK UPDATE

STAR		
SA	+	0
TA	+	0 0

NC1 ONBOARD DATA

SPS BURN STATUS

ΔTIG			
AFTER TRIM			
ΔVC			
FDAI (IF ATTITUDE NOT NOMINAL)	R	+	
	P	+	
	Y	+	
N85 (IF VG >.2)	VGX		0 0
	VGY		0 0
	VGZ		0 0
TRANSMIT N81 APPLIED			

P31 FINAL COMP

N84	ΔV_{NC2}	+	0				
	ΔH_{NC2}	+	0				
	ΔV_{NCC}	+	0				
N81	ΔV_X	+	0				
ΔV_{NC1}	ΔV_Y	+	0	0	0	0	0
	ΔV_Z	+	0	0	0	0	0

```
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
X N81 COMP LIMITS ±0.5 FPS      X
X                               X
X CMC/STDN WITHIN LIMITS GO CMC X
X NO AGREEMENT GO STDN          X
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
```

NOMINAL M=5

2+30 (11002) (01111) ARIA

H_2 PURGE LINE HTR=ON(up)

UNSTOW NK CAMERA (U1) AND PLACE IN TSB

HSK

2+40

2+50

FUEL CELL PURGE (S/1-3) (20 MIN AFTER LINE HTR-ON)

3+00

H_2 PURGE LINE HTR-OFF (10 MIN AFTER PURGE)

P52 (OPTION 3)

N71 1ST STAR		X	0	0	0		
N71 2ND STAR		X	0	0	0		
N05(R1) § ERR		X			•		
N93	X			•			
GYRO TORQUING ANGLES	Y			•			
	Z			•			
TIME OF GYRO TORQUE	HR	+	0	0	0		
	MIN	+	0	0	0		
	SEC	+	0		•		

3+00
(11002)
(01111)

GDS

TRANSMIT NC1 SPS BURN STATUS (Pg 1-5)
TRANSMIT GYRO TORQUE ANGLES AND TIME OF GYRO TORQUE (Pg 1-6)

```
*****IF NPC REQUIRED**************
* POO                            *
* STDN UPLINK (P27) [CSM &       *
*  SWS STATE VECTORS]            *
* NPC PAD (COPY)                 *
* V48E (LOAD 2°/SEC) (11003)     *
*  (LOAD WT, PT & YT IF REQD)    *
**********************************
```

TEX

NC2 PRELIMINARY PAD (COPY Pg 1-10)

3+10

PLT PREPARE LUNCH

```
*****IF NPC REQUIRED**************
*   IF NO COMM (NO NPC PAD)-     *
*    DO NOT BURN NPC.            *
* ENTER P38 (G/5-14) 14 MIN      *
*  PRIOR TO TIG (STDN MAY ADVISE *
*  P30 INSTEAD OF P38)           *
*  BYPASS AUTO MNVR              *
* LOAD PAD VALUES IN N33 & N81   *
* SET DET                        *
* GDC ALIGN BEFORE P38 IMU TORQUE*
*                                *
*                                *
*                                *
* GO TO SPS BURN CUE CARD        *
*  (BANK A)                      *
*                                *
*                                *
***                            ***
```

BDA

3+20

PNL 7 DIRECT O_2 VLV-CLOSE(cw)

STDN UPLINK (P27) [CSM & SWS STATE VECTORS]

```
**********************
* GYRO COMP UPDATE   *
**********************
```

CYI MAD

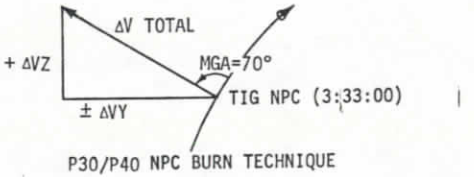
3+30

```
***                            ***
* P40                           *
*                               *
*                               *
*                               *
*                               *
*                               *
```

NPC PAD DATA

N33 TIG NPC	HR	+						
	MIN	+						
	SEC	+						
N81 ΔV_{NPC}	ΔV_X							
	ΔV_Y							
	ΔV_Z							
N22 NPC	R	+					0	0
	P	+					0	0
	Y	+					0	0
	ΔV_C							
	BT							
	ΔVC AT IGN	+						
	ΔVC TAILOFF	-						

WT + | PT | YT



NOMINAL M=5

NOMINAL M-5

3+30

(11002)
(01111)

MAD CYI

3+40

3+50

-49:00

SXT

4+00

* NPC (TRIM VGY & VGZ ± 0.2)
* RECORD BURN STATUS
* TRANSMIT NPC SPS BURN STATUS

* GDC ALIGN AFTER P38 IMU TORQUE
* V48E (LOAD 0.5°/SEC)(11002)

P52 (OPT 3) (RECORD) (IF STARS NOT AVAILABLE
REF STAR ACQ PAD (Pg 1-a)) (4,14)

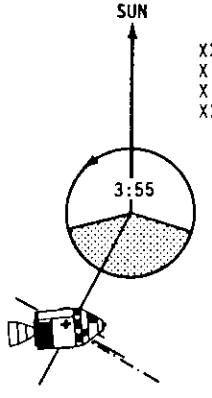
P32

PERFORM VHF RANGING SWITCH LIST (Pg 1-8)

ATTEMPT VHF ACQUISITION (R=411 NM) TO CHECK OUT VHF RANGING SYSTEM
(OPTIMUM LOCK-ON PERIOD IS ~3+52 TO 4+05 FOR SWS IN SI ATTITUDE)

SET DET

AT 3+58
R=370 NM



XXXXXXXXXXXXXXXXXXXXX
X UNREASONABLE UPDATE X
X 1.00 NM, 6.0 FPS X
XXXXXXXXXXXXXXXXXXXXX

SPS BURN STATUS

ΔTIG						
AFTER TRIM						
ΔVC						
FDAI (IF ATTITUDE NOT NOMINAL)	R	+				
	P	+				
	Y	+				
N85 (IF VG >.2)	VGX		0	0		
	VGY		0	0		
	VGZ		0	0		
TRANSMIT N81 APPLIED						

P52 (OPTION 3)

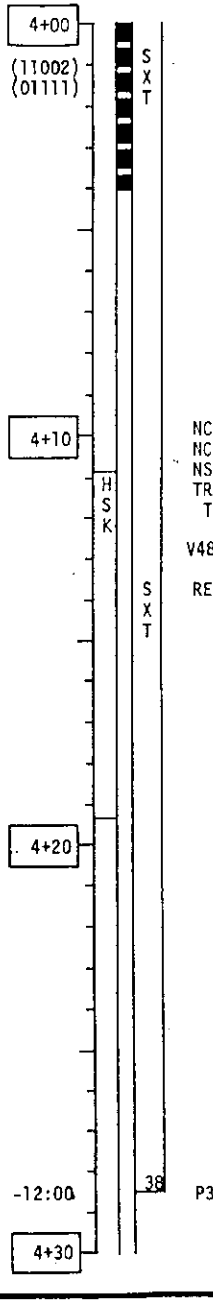
N71 1ST STAR			0	0	0	
N71 2ND STAR			0	0	0	
N05(R1) ϑ ERR						
N93	X					
GYRO TORQUING ANGLES	Y					
	Z					
	HR	+	0	0	0	
TIME OF GYRO TORQUE	MIN	+	0	0	0	
	SEC	+	0			

P52 (OPTION 3)
(FOR M>5)

N71 1ST STAR			0	0	0	
N71 2ND STAR			0	0	0	
N05(R1) ϑ ERR						
N93	X					
GYRO TORQUING ANGLES	Y					
	Z					
	HR	+	0	0	0	
TIME OF GYRO TORQUE	MIN	+	0	0	0	
	SEC	+	0			

VHF RANGING SWITCH LIST

VHF AM A-OFF(ctr)
VHF AM B-DUPLEX
VHF RANGING-ON(up)
VHF ANTENNA-RIGHT
EMS FUNC-ΔV SET/VHF RNG
EMS MODE-BACKUP/VHF RNG
PANEL 6,9,10:
VHF AM-RCV



XXXXXXXXXXXXXXXXXXXXX
X UNREASONABLE UPDATE X
X 1.00 NM, 6.0 FPS X
XXXXXXXXXXXXXXXXXXXXX

****
* IF STDN CSM STATE VECTOR *
* UPLINK REQUIRED-DELETE *
* REMAINING PRE-NC2 SXT MARKS *
****

NC2 FINAL PAD (COPY Pg 1-10)
NCC PRELIMINARY PAD (COPY Pg 1-11)
NSR PRELIMINARY PAD (COPY Pg 1-12)
TRANSMIT GYRO TORQUE ANGLES AND
TIME OF GYRO TORQUE (Pg 1-8)

V48E (LOAD WT, PT & YT IF REQD)

RECALL P32 (LOAD N28 NC2 TIG PAD VALUE (Pg 1-10))

P32 (FINAL COMP: RECORD Pg 1-10)

NOMINAL M-5

NOMINAL M-5

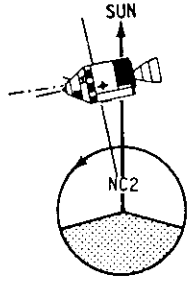
4+30

(11002)
(01111)

H A W

GO TO SPS BURN CUE CARD
(BANK A)

P40



4+40

0:00

G D S

NC2 (180,359/154,1) (TRIM VGX ± 0.2)
RECORD BURN STATUS
TRANSMIT NC2 SPS BURN STATUS

P33 (USE CMC TIG)

SET DET

-41:00

S X T

XXXXXXXXXXXXXXXXXXXXX
X UNREASONABLE UPDATE X
X 1.00 NM, 6.0 FPS X
XXXXXXXXXXXXXXXXXXXXX

RANGE DATA FOR NCC
CHART SOLN NOT PROBABLE
WITH SWS IN SI ATT

*****IF SWS IN R-ZLV**********
* OBTAIN NCC/NSR CHART SOLNS *
****

4+50

B D A

5+00

NC2 PAD DATA

		NOMINAL	PRELIMINARY	FINAL
N28	HR	+ 0 0 4	+	+
TIG NC2	MIN	+ 4 2	+	+
	SEC	+ 0 8 7 0	+	+
N81	ΔV_X	+ 0 2 0 6		
ΔV_{NC2}	ΔV_Y	+ 0 0 0 0		
	ΔV_Z	+ 0 0 0 0		
N22	R	+ 1 8 0 0 0	+ 0 0	+ 0 0
NC2	P	+ 1 5 4 0 0	+ 0 0	+ 0 0
	Y	+ 0 0 1 0 0	+ 0 0	+ 0 0
	ΔV_C	0 0 8 0		
	BT	0 0 0 1		
WT		+	PT	YT

NC2 ONBOARD DATA

SPS BURN STATUS

ΔTIG		
AFTER TRIM		
ΔVC		
FDAI (IF ATTITUDE NOT NOMINAL)	R	+
	P	+
	Y	+
N85 (IF VG >.2)	VGX	0 0
	VGY	0 0
	VGZ	0 0
TRANSMIT N81 APPLIED		

P32 FINAL COMP

N84	ΔV_{NCC}	+	0				
	ΔH_{NCC}	+	0	0			
	ΔV_{NSR}	+	0	0			
N81	ΔV_X	+	0				
ΔV_{NC2}	ΔV_Y	+	0	0	0	0	0
	ΔV_Z	+	0	0	0	0	0

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
X N81 COMP LIMITS ±0.5 FPS X
X X
X CMC/STDN WITHIN LIMITS GO CMC X
X NO AGREEMENT GO STDN X
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

5+00
(11002)
(01111)
SXT
CYI
ACN
5+10
-12:00
30
5+20
0:00
5+30

NCC FINAL PAD (COPY)
NSR FINAL PAD (COPY Pg 1-12)

V48E (LOAD WT, PT & YT IF REQD)

DO NOT OVERWRITE
NCC TIG (N11)
UNLESS ADVISED
BY STDN - RECALL
P33 TO OVERWRITE

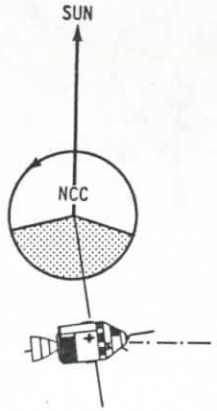
XXXXXXXXXXXXXXXXXXXXXX
X UNREASONABLE UPDATE X
X 1.00 NM, 6.0 FPS X
XXXXXXXXXXXXXXXXXXXXXX

ATTEMPT VHF ACQUISITION (R=170 NM) TO CHECK OUT VHF RANGING SYSTEM
(OPTIMUM LOCK-ON PERIOD IS ~5+16 TO 5+52 FOR SWS IN SI ATTITUDE)

P33 (FINAL COMP: RECORD)

GO TO SPS BURN CUE CARD
(BANK A)

P40



NCC (180,359/334,0) (TRIM VG'S ±0.2)
RECORD BURN STATUS

IF NCC EXECUTION IS QUESTIONABLE
START RECORDING CHART DATA AT NSR-28

ATTEMPT VHF ACQUISITION (R=121NM) TO CHECK OUT VHF RANGING SYSTEM
(OPTIMUM LOCK-ON PERIOD IS ~5+16 TO 5+52 FOR SWS IN SI ATTITUDE)

NCC PAD DATA

		NOMINAL	PRELIMINARY	FINAL
N11 TIG NCC	HR	+ 00 05	+	+
	MIN	+ 28	+	+
	SEC	+ 16 70	÷	÷
N81 ΔV_{NCC}	ΔV_X	+ 029.7		
	ΔV_Y	+ 000.0		
	ΔV_Z	+ 000.1		
N22 NCC	R	+ 180.00	+ 00	+ 00
	P	÷ 334.00	+ 00	+ 00
	Y	+ 000.00	+ 00	+ 00
	ΔV_C	017.1		
	BT	00:01		
WT	+		PT	YT

NCC ONBOARD DATA

P33 FINAL COMP

N82 ΔV_{NSR}	ΔV_X	0
	ΔV_Y	0
	ΔV_Z	0
N81 ΔV_{NCC}	ΔV_X	0
	ΔV_Y	0
	ΔV_Z	0

NCC CHART SOLN

ΔV_X	
ΔV_Y	
ΔV_Z	

SPS BURN STATUS

ΔTIG		
AFTER TRIM		
ΔVC		
FDAI (IF ATTITUDE NOT NOMINAL)	R	+
	P	+
	Y	+
N85 (IF VG >.2)	VGX	00
	VGY	00
	VGZ	00
TRANSMIT N81 APPLIED		

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
X N81 COMP LIMITS ±1.5,±5.0,±10.0 FPS X
X X
X CMC/CHART WITHIN LIMITS GO CMC X
X IF NOT CMC/STDN WITHIN LIMITS GO CMC X
X IF NOT CHART/STDN WITHIN LIMITS GO STDN X
X NO AGREEMENT-NORMALLY GO STDN X
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

NOMINAL M=5

5+30

(11002)
(01111)

-30:00

5+40

5+50

-12:00

6+00

S
X
T

C
R
O

H
S
K

19

P34

V32E (P34 RECYCLE: RECORD CMC MATCHED PAIR)

SET DET

XXXXXXXXXXXXXXXXXXXXX
X UNREASONABLE UPDATE X
X 1.00 NM, 6.0 FPS X
XXXXXXXXXXXXXXXXXXXXX

AT 5+40
R=100 NM

TRANSMIT NCC SPS BURN STATUS (Pg 1-11)

V48E (LOAD WT, PT & YT IF REQD)

SET HDSUPFLG (V25N7E, 106E, 2000E, 1E)
P34 (FINAL COMP: RECORD)

IF NCC EXECUTION IS QUESTIONABLE
THEN CMC FINAL COMP IS PRIME

GO TO SPS BURN CUE CARD
(BANK A)

P40

NSR PAD DATA

TIG NSR(N13)=TIG NCC(N11) + 00:37:00= _____:____:____.____

			NOMINAL	PRELIMINARY	FINAL
N81 ΔV_{NSR}	ΔV_X	+	0187		
	ΔV_Y	+	0000		
	ΔV_Z	+	0005		
N22 NSR	R	+	18000	00	00
	P	+	18900	00	00
	Y	+	00000	00	00
	ΔV_C				
	BT		00:01		
ΔVC AT IGN		+			
ΔVC TAILOFF		-			
WT		+		PT	YT

NSR ONBOARD DATA

			P34 RECYCLE	P34 FINAL COMP
N75	ΔH_{NSR}	+	00	00
	ΔT(NSR/TPI)	+	B	B
	ΔT(TPI/TPI)		B	B
N81 ΔV_{NSR}	ΔV_X		0	0
	ΔV_Y		0	0
	ΔV_Z		0	0

SPS BURN STATUS

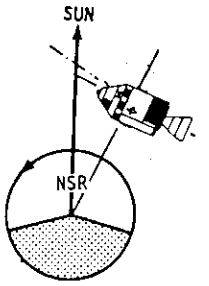
ΔTIG			
AFTER TRIM			
ΔVC			
FDAI (IF ATTITUDE NOT NOMINAL)	R	+	
	P	+	
	Y	+	
N85 (IF VG>.2)	VGX		00
	VGY		00
	VGZ		00
TRANSMIT N81 APPLIED			

NSR CHART SOLN

ΔV_X	
ΔV_Y	
ΔV_Z	

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
X N81 COMP LIMITS NA,NA,NA FPS X
X X
X USE P34 FINAL COMP ΔVY FOR CMC SOLN X
X X
X BURN P34 RECYCLE, STDN OR CHART SOLN X
X IF NCC WAS BURNED CMC, STDN X
X OR CHART, RESPECTIVELY X
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

6+00
(11002)
(01111)



0:00

(11103)
(01111)

NSR (180,357/189,0) (TRIM VG'S ± 0.2)
RECORD BURN STATUS (Pg 1-12)
POO
V48E (LOAD 4 JET, 2°/SEC)
RECALL P35 (ACCEPT AUTO MNVR TO HEADS UP TRACK ATT)

TRANSMIT NSR SPS BURN STATUS (Pg 1-12)
V32E (1ST P35 RECYCLE: RECORD) (RECORD N37 (Pg 1-13))
(REF TPI EARLY/LATE LOGIC (Pg 1-13))
REACQUIRE VHF RANGING (R=67 NM) FOR CHART DATA
**MOMENTARY LOSS OF VHF LOCK-ON CAN BE EXPECTED WHILE
TAKING TPI CHART DATA.
IF VHF DATA NOT AVAILABLE FOR 1ST TPI CHART DATA
POINT (TPI-32) DELAY ALL TPI CHART DATA POINTS 4 MINUTES
AND ATTEMPT REACQUISITION PRIOR TO TPI-28.
SET DET
V76E (LOAD N72 WITH CHART TPI TIG 1-32)

H A W

6+10

-40:00

S X T

6+20

G D S

TPI PRELIMINARY PAD (COPY Pg 1-14)
DOCKING ATT PAD (COPY Pg 1-16)

XXXXXXXXXXXXXXXXXXXXXX
X UNREASONABLE UPDATE X
X 0.50 NM, 3.0 FPS X
XXXXXXXXXXXXXXXXXXXXXX

-32:00

R CHART DATA FOR TPI-32 (GET)
SECS PYRO ARM(2)-SAFE(VERIFY)
SECS LOGIC(2)-OFF(VERIFY)
cb SECS ARM(2)-CLOSE
cb SECS LOGIC(2)-CLOSE(VERIFY)
**AFTER STDN GO-SECS LOGIC(2)-ON(up)
RECEIVE STDN GO/NO GO FOR PYRO ARM

-28:00

R CHART DATA FOR TPI-28 (GET)
V32E (2ND P35 RECYCLE: RECORD Pg 1-13)(RECORD N37 (Pg 1-13))

TPI FINAL PAD (COPY Pg 1-14)

B D A

6+30

V48E (LOAD WT, PT & YT IF REQD)

NOMINAL M-5

```
********TPI EARLY/LATE LOGIC*********************************************
*                                                                        *
* 1ST RECYCLE                                                            *
*   IF 2 SOLUTIONS INDICATE TIG SLIP > ±8 MIN FROM PRELAUNCH N37:        *
*   •ADJUST LOCATION OF 2ND RECYCLE ±8 MIN                               *
*                                                                        *
* 2ND RECYCLE                                                            *
*   IF CMC SOLUTION INDICATES TIG SLIP > ±10 MIN FROM PRELAUNCH N37:     *
*   •USE CMC TIG OPTION:                                                 *
*      RECALL P35, PRO TO N37, LOAD PRELAUNCH N37±10 MIN                 *
*      PRO TO N55, SPECIFY TIG OPTION (V22E,+E)                          *
*   •CONTINUE CHART SOLUTION FOR FINAL ΔV COMPARISON                     *
*   •AT FINAL COMP-USE NOMINAL COMPARISON LOGIC                          *
*     IF ALL COMPARISONS DISAGREE-BURN THE SOLUTION                      *
*     WHOSE TIG (CMC 2ND RECYCLE, STDN PREL. PAD)                        *
*     COMPARES CLOSEST WITH CHART TPI TIG 2.                             *
************************************************************************
```

CHART TPI TIG 1							
-			3	2			
N72							

TPI TIG (N37)

PRELAUNCH (Pg 1-a)							
RECYCLES 1ST							
2ND							
STDN PREL							
CHART TPI TIG 2							

		1ST P35 RECYCLE						2ND P35 RECYCLE					
N37	HR	+	0	0	0			+	0	0	0		
TIG TPI	MIN	+	0	0	0			+	0	0	0		
	SEC	+	0					+	0				
N58	ΔV_{TPI}	+	0	0				+	0	0			
	ΔV_{TPF}	+	0	0				+	0	0			
	ΔT(TPI/TPI)				8						8		
N81	ΔV_X		0	0					0	0			
ΔV_{TPI}	ΔV_Y		0	0					0	0			
	ΔV_Z		0	0					0	0			
N59	ΔV_F		0	0					0	0			
$\Delta V_{(LOS)}$	ΔV_R		0	0					0	0			
	ΔV_D		0	0					0	0			

NOMINAL M=5

6+30
-24:00
(11103)
(01111)

R CHART DATA FOR TPI-24 (GET)

-16:00

R CHART DATA FOR TPI-16 (GET)

V77E
V83E; SET ORDEAL (FDAI 1)

H=229NM

6+40

-12:00

28

P35 (FINAL COMP: RECORD)
PNL 252 WASTE STOW VENT VLV-CLOSE(cw)

GO TO SPS BURN CUE CARD
ULLAGE AT -14 SEC
(BANK A)

P40

6+50

0:00

TPI (359,25/27,1) (TRIM VG'S ± 0.2)

P36

REACQUIRE VHF RANGING (R=20 NM)

+3:00

V87E; FDAI 1-ORB RATE

+4:30

θp & TA CHART DATA FOR TPI+4:30

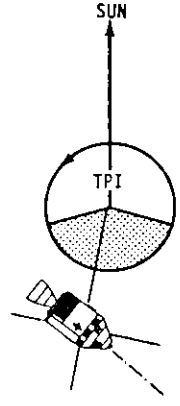
7+00

BDA MIL

SXT

ACN

SXT/VHF



CENTER SWS IN SXT WHEN READING CHART DATA θp & TA

XXXXXXXXXXXXXXXXXXXXX
X UNREASONABLE UPDATE X
X 0.50 NM, 3.0 FPS X
XXXXXXXXXXXXXXXXXXXXX

TPI PAD DATA

		NOMINAL	PRELIMINARY	FINAL
N37 TIG TPI	HR	+ 0 0 6		
	MIN	+ 0 5 4		
	SEC	+ 1 5 7 0		
N81 ΔV_{TPI}	ΔV_X	+ 1 8.8		
	ΔV_Y	+ 0 0.0		
	ΔV_Z	- 0 8.5		
N59 (RCS) ΔV_F/BT		+ 2 0 6.5 4		
(LOS) ΔV_R/BT		+ 0 0 0.0 0		
ΔV_D/BT		+ 0 1 0.0 5		
ΔV_C				
BT		0 0 : 0 1		
N22 (SPS USING N81)	R	+ 3 5 9.0 0	+ 0 0	+ 0 0
	P	+ 0 2 7.0 0	+ 0 0	+ 0 0
	Y	+ 0 0 1.0 0	+ 0 0	+ 0 0
ΔVC AT IGN		+		
ΔVC TAILOFF		-	-	-

WT + PT YT

TPI ONBOARD DATA

TPI CHART SOLN

ΔV_X	
ΔV_Y	
ΔV_Z	

P35 FINAL COMP

N37 TIG TPI	HR	+	0	0	0	
	MIN	+	0	0	0	
	SEC	+	0			
N58	ΔV_{TPI}	+	0	0		
	ΔV_{TPF}	+	0	0		
	ΔT(TPI/TPI)				B	
N81 ΔV_{TPI}	ΔV_X		0	0		
	ΔV_Y		0	0		
	ΔV_Z		0	0		
N59 $\Delta V_{(LOS)}$	ΔV_F		0	0		
	ΔV_R		0	0		
	ΔV_D		0	0		

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
X N81 COMP LIMITS ±1.0,±3.0,±3.0 FPS X
X X
X CMC/CHARTS WITHIN LIMITS GO CMC X
X IF NOT CMC/STDN WITHIN LIMITS GO CMC X
X IF NOT CHART/STDN WITHIN LIMITS GO CHART X
X NO AGREEMENT GO STDN X
X X
X FOR CHART/STDN-USE CMC TIG OPTION: X
X RECALL P35, PRO TO N37, LOAD CHART/STDN TIG; X
X PRO TO N55, SPECIFY TIG OPTION (V22E, +E). X
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

7+00
(11103)
(01111)
+7:30
+8:30
+9:00
+12:00
+15:00
7+10
+16:30
+19:30
+20:30
+21:00
+24:00
7+20
(11102)
(01111)
7+30

S/V
SXT/VHF
CRO
VHF

R CHART DATA FOR TPI+7:30

R, θp & TA CHART DATA FOR TPI+8:30
PRO (P36 FINAL COMP: RECORD)

P41

TPM1

P36
V25N33E (LOAD TPI TIG)

θp & TA CHART DATA FOR TPI+16:30

CENTER SWS IN SXT WHEN READING CHART DATA θp & TA

XXXXXXXXXXXXXXXXXXXXX
X UNREASONABLE UPDATE X
X 0.50 NM, 3.0 FPS X
XXXXXXXXXXXXXXXXXXXXX

R CHART DATA FOR TPI+19:30

R, θp & TA CHART DATA FOR TPI+20:30
PRO (P36 FINAL COMP: RECORD)

P41

TPM2

P37 (N54-$\dot{R}$,R,θ FROM NAVIGATED STATE VECTORS)
CMC MODE-HOLD (MONITOR LOS RATES & RANGE RATE)
PERFORM PRE-BRAKING SWITCH LIST (Pg 1-15)
PERFORM EVAP DEACT SWITCH LIST (Pg 1-15)

PRO (P48)(N77=R,$\dot{R}$,θ)($\dot{R}$,R FROM VHF RANGING FILTER)
V48E (LOAD 0.5°/SEC)
NULL LOS RATES AND ADJUST RANGE RATE TO BRAKING GATES.
N83(ΔVX,ΔVY,ΔVZ CONT)(OPTIONAL)

NK-60 FRAMES (1000 FT)
CM4/(f8,1/250,∞)

TPM1 ONBOARD DATA

		P36 FINAL COMP	TPM1 CHART SOLN
N59 $\Delta V_{(LOS)}$	ΔV_F	0 0	
	ΔV_R	0 0	
	ΔV_D	0 0	

TPM2 ONBOARD DATA

		P36 FINAL COMP	TPM2 CHART SOLN
N59 $\Delta V_{(LOS)}$	ΔV_F	0 0	
	ΔV_R	0 0	
	ΔV_D	0 0	

PRE-BRAKING SWITCH LIST

FDAI SCALE-5/1
FDAI SELECT-1/2
FDAI SOURCE-ATT SET
ATT SET-GDC
MAN ATT(3)-RATE CMD
LIMIT CYCLE-OFF
DBD/RATE-MIN/LOW
THC PWR-ON(up)
RHC PWR NORMAL(2)-AC/DC
RHC PWR DIRECT(2)-MNA/MNB
SC CONT/MODE-CMC/HOLD
BMAG MODE(3)-ATT 1/RATE 2
AUTO RCS SELECT(16)-MNA/MNB
(FOR SINGLE QUAD FAILED CONFIGURATION-SEE Pg 7-2)
THC-ARMED, RHC#2-ARMED

GLYCOL EVAPORATOR DEACTIVATION SWITCH LIST

GLYCOL EVAP H2O FLOW-OFF
GLYCOL EVAP STEAM PRESS-MAN
GLYCOL EVAP STEAM PRESS-INCR (for 58 sec)

BRAKING GATES

R(NM)	$\dot{R}$(FPS)	RETICLE ANGLE(DEG) SWS DIA	SAS + DIA	ATM ARRAYS	R(FT)
1.00	30	.2	.5	.6	6000
.50	20	.4	1.1	1.2	3000
.25	10	.8	2.2	2.5	1500
.08	5	2.5	6.6	7.3	500
.05		4.2			300
.03		6.3			200
.02		10.0			130

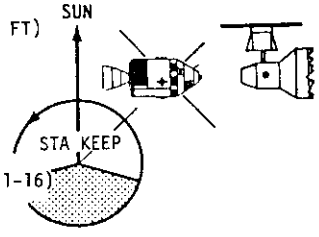
NOMINAL M-5

NOMINAL M-5

7+30
(11102)
(01111)

G
W
M

STATION KEEP ON SWS +X AXIS (R ~ 100 FT)
P00; V93E
CMC MODE-AUTO
BMAG MODE(3)-RATE 2
V49E (MNVR TO DOCKING ATT)(Pg 1-16)



STOW NK (U1)
PERFORM PRE-DOCKING SWITCH LIST (Pg 1-16)

PERFORM DOCKING CHECKLIST (Pg 1-16)

7+40

CSM/SWS DOCKING

GO TO SWS ACTIVATION C/L (R3)

7+50

G
D
S

SUNSET
AT 8+18

8+00

DOCKING ATTITUDE

		NOMINAL						UPDATE					
N22	R	+	1	5	4	0	0	+				0	0
	P	+	0	0	8	0	0	+				0	0
	Y	+	0	0	8	0	0	+				0	0

PRE-DOCKING SWITCH LIST

BMAG MODE(3)-ATT 1/RATE 2	DOCKING PROBE EXTD/REL tb(2)-gray
cb DOCK PROBE(2)-CLOSE	SPOT LIGHT-ON(down)
DOCKING PROBE RETRACT(2)-OFF(ctr)	SECS PYRO ARM(2)-ON(up)
DOCKING PROBE EXTD/REL-RETRACT	FC REACS VALVES-LATCH

DOCKING CHECKLIST

TO INITIATE CAPTURE

VERIFY STATION KEEPING ON SWS +X AXIS
(RANGE=40 TO 100 FT) (DOCK TGT=1.8 TO 0.8° IN COAS)
LOAD EMS WITH (-100.0) FPS
EMS FUNC/MODE-ΔV/NORMAL
THC-INITIATE 0.4 +0.1 FPS CLOSING RATE
RHC-MAINTAIN MINIMUM RELATIVE ALIGNMENT ANGLES

AT CAPTURE (IF NO CAPTURE-SEE BACKUP DOCKING PROCEDURES (S/2-1))

DOCKING PROBE EXTD/REL tb(either)-bp (IF GRAY-SEE DOCKING MALFUNCTION PROCEDURES #2, Pg 15-3 IN CSM MALFUNCTION PROCEDURES BOOK)
CMC MODE-FREE
RHC PWR DIRECT(2)-OFF(ctr)
REPORT CAPTURE TO STDN
ALLOW PROBE TO DAMP SC MOTION (10 SEC)
THC-NULL PITCH AND YAW MISALIGNMENT<3°
RHC-NULL ROLL MISALIGNMENT<5°
DOCKING PROBE RETRACT PRIM-1 (SEC-1 IF REQD)

AT DOCK LATCH

DOCKING PROBE EXTD/REL tb(2)-gray

AFTER HARD DOCK

V45E	EMS FUNC/MODE-OFF/STBY
SECS PYRO ARM(2)-SAFE	DBD/RATE-MIN/LOW
SECS LOGIC(2)-OFF	THC PWR-OFF
cb SECS ARM(2)-OPEN	RHC PWR NORMAL#1-OFF(ctr)
cb DOCK PROBE(2)-OPEN	RHC PWR DIRECT(2)-OFF(ctr)
DOCKING PROBE EXTD/REL-OFF	SC CONT/MODE-CMC/FREE
DOCKING PROBE RETRACT(2)-OFF(ctr)	BMAG MODE(3)-RATE 2
SPOT LIGHT-OFF(up)	AUTO RCS SELECT(A1,D2,A3,C4,B3,D4)-OFF
FC REACS VALVES-NORM	cb SCS A/C & B/D ROLL(4)-OPEN
VHF AM B-OFF(ctr)	cb SCS PITCH & YAW(4)-OPEN
VHF RANGING-OFF	THC-LOCKED
COAS PWR-OFF	RHC(2)-LOCKED