

Rendezvous

STS-114

**Mission Operations Directorate
Flight Design and Dynamics Division**

**Final, Rev A
September 3, 2004**

National Aeronautics and
Space Administration

Lyndon B. Johnson Space Center
Houston, Texas




MISSION OPERATIONS DIRECTORATE

**RENDEZVOUS
STS-114**

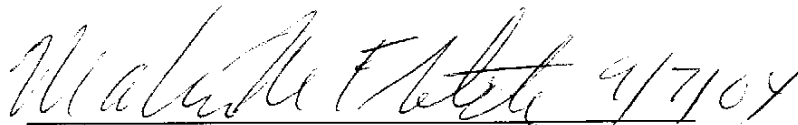
FINAL, REV A
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PREPARED BY:

 9/7/2004

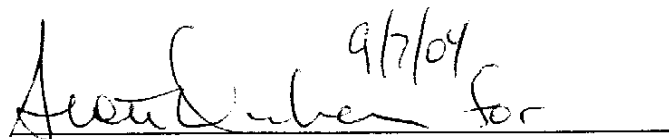
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	RNDZ-1098A	RNDZ-1113A	
	RNDZ-1101	RNDZ-1114	
	RNDZ-1102A	RNDZ-1115B	
	RNDZ-1105	RNDZ-1116A	
	RNDZ-1106	RNDZ-1117A	
	RNDZ-1107	RNDZ-1118A	
	RNDZ-1108	RNDZ-1119	
	RNDZ-1109	RNDZ-1120	
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AREAS OF TECHNICAL RESPONSIBILITY

Book Manager	DM34/S. O'Rourke	281-244-5522
Rendezvous Guidance and Procedures	DM34/N. O'Dosey	281-483-6178
Flight Dynamics	DM32/W. Tracy	281-483-0516
Rendezvous Design	USA/S. Snyder	281-282-4351
PROX OPS Design	USA/D. Brownfield	281-282-6785
Flight Design	USA/S. Staas	282-483-4696
Rendezvous Training	DT35/J. Tuxhorn	281-244-7446
APDS	DF52/J. Dake	281-483-6538

NOTE

This checklist is the controlling crew document for the ISS-LF1 rendezvous and separation. The Rendezvous Timeline begins at Ti -3:00 hr and continues through docking. This is a complete stand-alone document. The Separation Timeline begins 45 min prior to undock and continues through 1:15 after undock.

Timeline pages assume an FD3 rendezvous and undocking on FD10. Lighting is based on planned rendezvous altitude of 205 nm. Targeting I-Loads are based on 210 nm.

ACRONYMS

AZ, AZM	Azimuth
D/N	Day/Night
EL, ELEV	Elevation
IAH	Inertial
LOS	Line of Sight
LVLH	Local Vertical, Local Horizontal
R	Range
\dot{R} , RDOT	Range Rate
\bar{R} , RBAR	Radius Vector (toward Earth)
RNDZ	Rendezvous
RR	Rendezvous Radar
SK	Stationkeeping
ST, STRK	Star Tracker
\bar{V} , VBAR	Velocity Vector (direction of orbital travel)
$\pm X, Y, ZLV$	$\pm X, Y,$ or Z Local Vertical ($\pm X, Y,$ or Z toward Earth)
$X, Y, ZPOP$	$X, Y,$ or Z orbiter body axis Perpendicular to Orbit Plane (aligned with the angular momentum vector)
$\pm X, Y, ZVV$	$\pm X, Y,$ or Z orbiter body axis along the LVLH Velocity Vector

RENDEZVOUS
STS-114

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REV A 09/03/04

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RENDEZVOUS CUE CARDS

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**FLT RULES &
FLT PROFILE**

FLIGHT RULES SUMMARY

RNDZ/PROX OPS BREAKOUT PROCEDURES OVERVIEW

RANGE BREAKOUT REQD	BREAKOUT PROCEDURE AND SUMMARY
LONG RANGE SHUTTLE BREAKOUTS (Prior to RBAR Arrival)	
Prior to Ti	Discontinue RNDZ burns; specific breakout only on MCC call
Between Ti and TORVA init (+X burns to start TORVA are complete)	RNDZ BREAKOUT (<u>CONTINGENCY OPS</u>), 5-18 3 fps retrograde
Between TORVA init (+X burns to start TORVA are complete) and Vbar arrival	SHUTTLE NOSE IN-PLANE BREAKOUT (<u>CONTINGENCY OPS</u>), 5-16 1.5 fps $\pm X$ burn, followed in 30 min by 3.5/3.0 fps retrograde/out-of-plane burn (posigrade if second approach is desired)
Between Vbar arrival and contact OR Between undock and flyaround start	VBAR BREAKOUT (<u>CONTINGENCY OPS</u>), 5-14 If RNG < 75 ft, back out to 75 ft. When RNG > 75 ft, perform 1.5 fps radial up burn in LO Z, followed in 28 min by 3.0 fps posigrade/retrograde burn
During flyaround	SHUTTLE NOSE IN-PLANE BREAKOUT (<u>CONTINGENCY OPS</u>), 5-16 1.5 fps $\pm X$ burn, followed in 30 min by 3.5/3.0 fps retrograde/out-of-plane burn (posigrade if second approach is desired)
Otherwise:	<u>SEP MANEUVER</u> (ORB OPS), Perform 1 fps away from target, followed in 2 min by 2 fps out of plane, followed in 15 min by 3 fps posigrade
SHUTTLE BACKOUT	
Prior to docking	See VBAR CORRIDOR BACKOUT (<u>CONTINGENCY OPS</u>), 5-12

FLT RULES & FLT PROFILE

RNDZ BURN SOLUTION SELECTION GUIDELINES

BURN	SOLUTION PRIORITY
All burns prior to, but not including, NCC	1) Ground solution
NCC & Ti	1) Onboard FLTR solution if STRK or RR NAV converged* (for COAS, use step 2 below) 2) Onboard FLTR solution if it agrees with ground solution** 3) Onboard PROP solution if it agrees with ground solution 4) Ground solution
Post-Ti midcourse corrections	1) Onboard solution

*For the purpose of burn solution selection, NAV is converged if for the present sensor in acquisition (RR or STRK), at least 40 marks have been accepted with state vector position update of less than 0.5 Kft for at least the last 4 marks; or if state vector updates are small and stable. These criteria do not apply to COAS NAV

**Burn solutions are considered to be in agreement if delta Vs differ by no more than the 'final-ground' limits for each axis

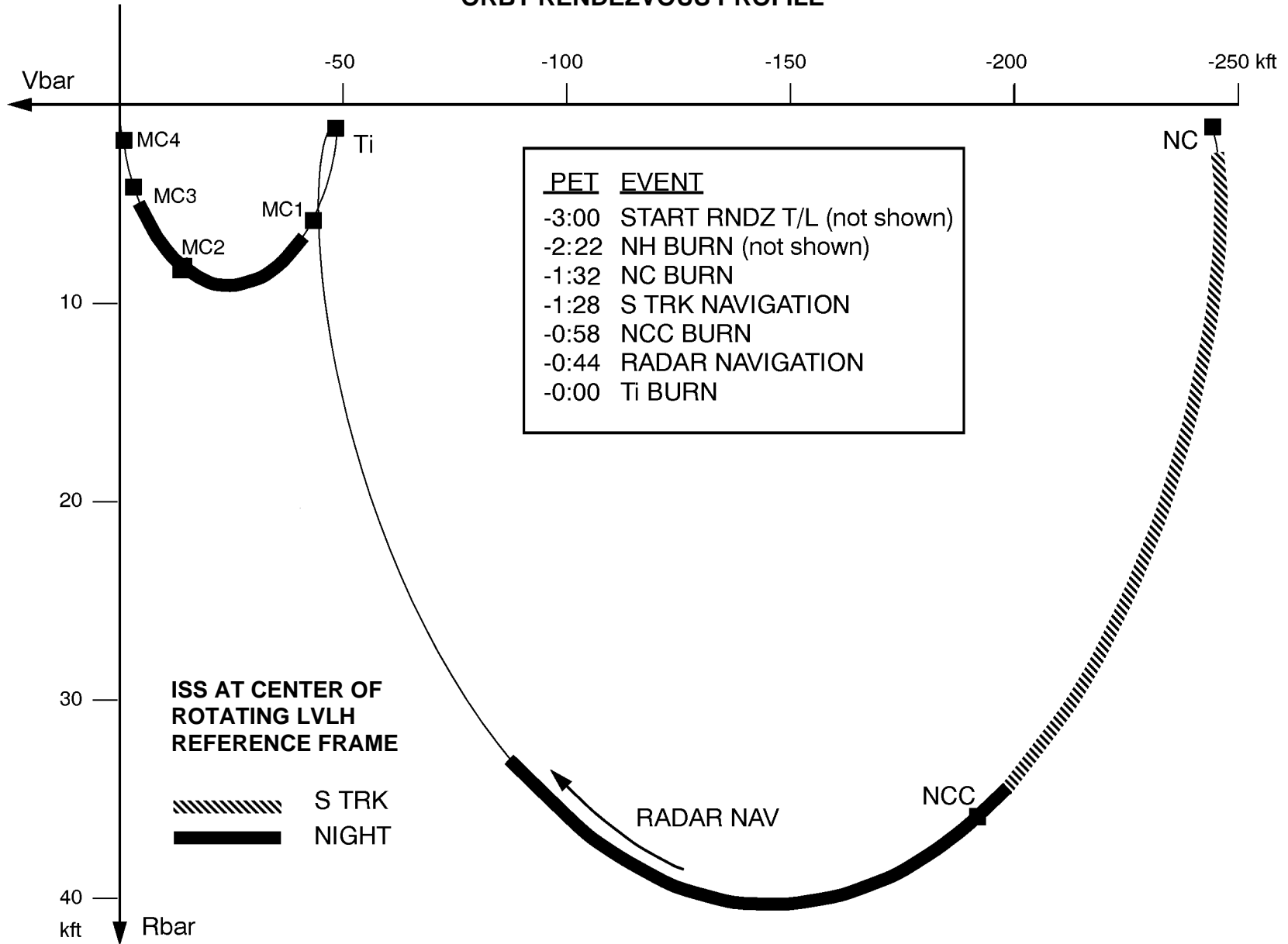
RNDZ BURN ENGINE SELECTION GUIDELINES

DELTA V	ENGINE
< 4 fps	RCS – Primary technique is multi-axis
4 to 6 fps	RCS – Primary technique is +X
> 6 fps	OMS – Single engine

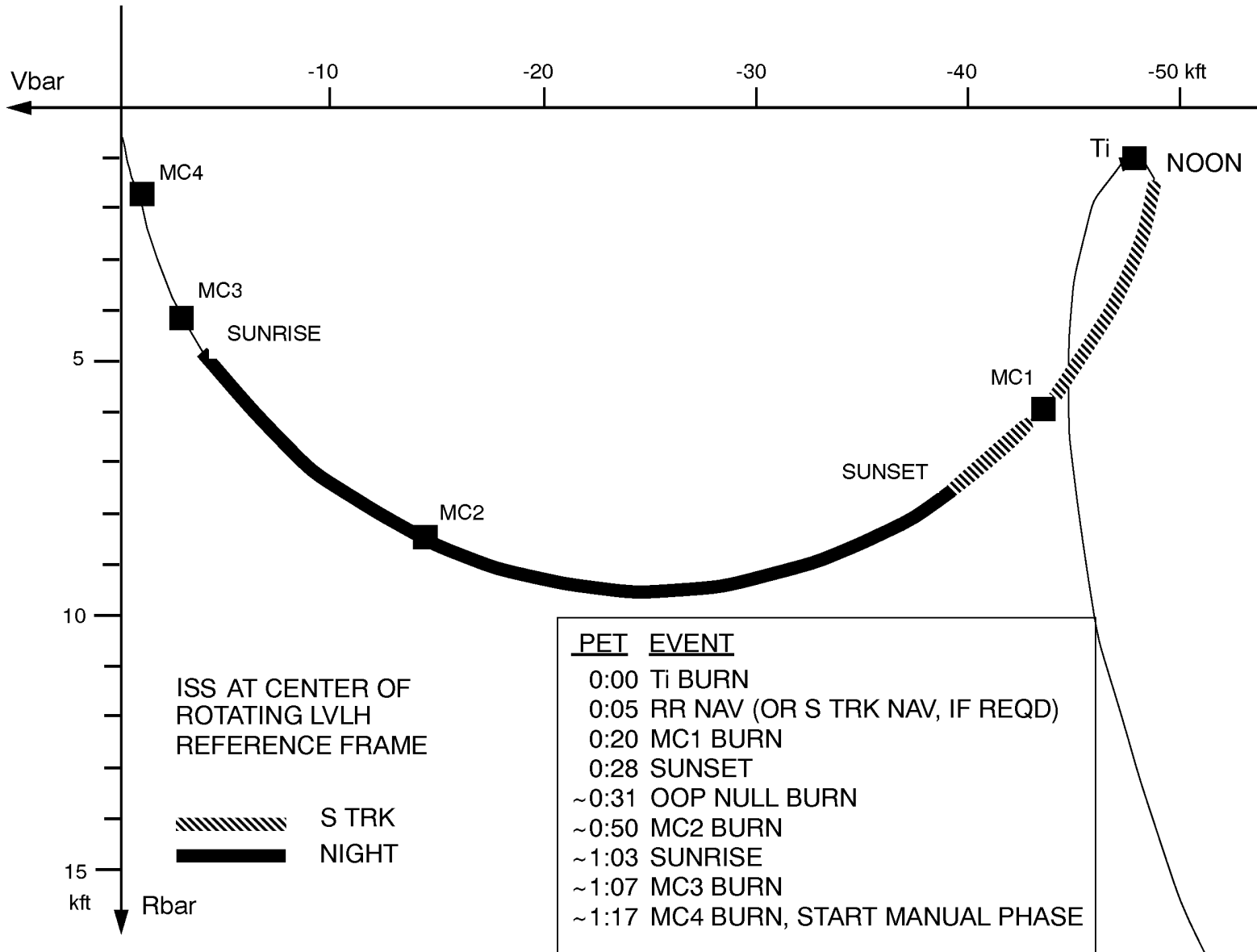
RNDZ FAILURE/RESPONSE SUMMARY

FAILURE	RESPONSE
No sensor data (RR, STRK, or COAS) during RNDZ and no visual acquisition	Breakout Burn by MC2 + 20 min
Good sensor data (RR, STRK, or COAS) during RNDZ, but no visual or RR acquisition	Breakout Burn by MC2 + 24 min
Target > 30 deg from COAS horizontal at start of radar fail correction	Breakout ASAP; use RNDZ BREAKOUT (<u>CONTINGENCY OPS</u>), 5-18, until RBAR arrival
Prop quantities violate bingo numbers on <u>RNDZ PRPLT PAD</u> (Cue Card) or Orbiter systems malfunctions require breakout	Breakout per overview on 1-2
SYSTEMS: DPS: < 2 GNC GPCs	2 GNC GPCs reqd for Ti and PROX OPS within 250 ft. Loss of GNC GPC redundancy inside 250 ft requires backout to 250 ft and stationkeep until reconfiguration to a 2 GNC redundant set is complete
GNC: Loss of redundant +Z Trans or PRCS TRANS, any axis ↓ or PRCS ROT, any axis ↓ or AFT THC (-Z sense), > 1 TX contact ↓, all TY contacts ↓, all TZ contacts ↓ or AFT RHC, all channels, any axis ↓ or < 2 IMUs	PROX OPS within 250 ft not permitted
Loss of VRCS	Use ALT in place of VERN during RNDZ, approach <u>outside</u> 2000 ft, and sep Use PRI in place of VERN during approach <u>inside</u> 2000 ft, and flyaround
Loss of LO Z Braking	During Approach: Continue approach; if braking reqd, then If prior to +VBAR: Wait for natural RDOT bleed down If on +VBAR: Limited NORM Z braking allowed During Separation: NORM Z with ISS solar arrays positioned to minimize plume loads See LOSS OF LO Z BRAKING (<u>CONTINGENCY OPS</u>), 5-29
MECH: 1 KU ANTENNA STOW MOTOR ↓	Normal ops

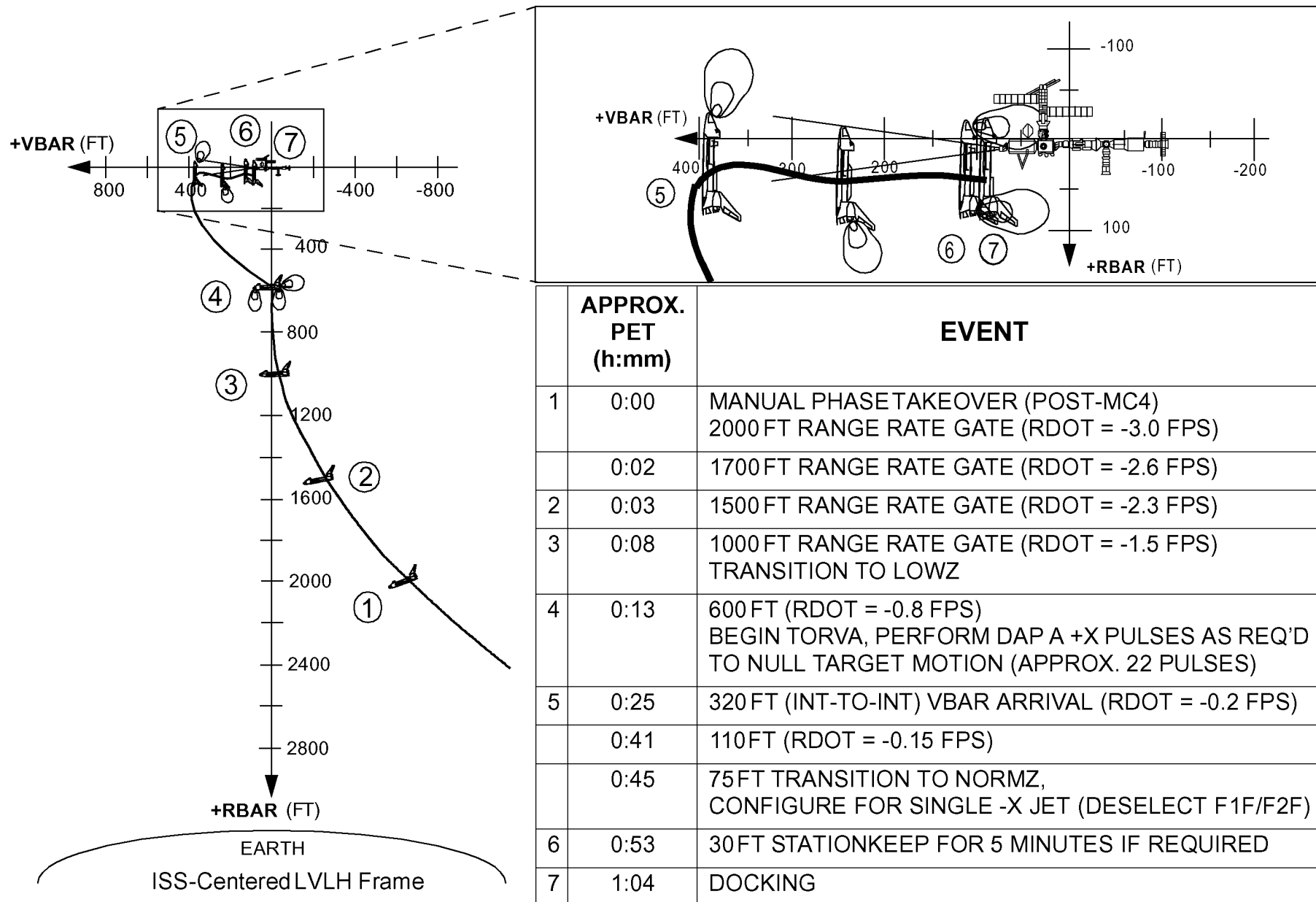
ORBT RENDEZVOUS PROFILE



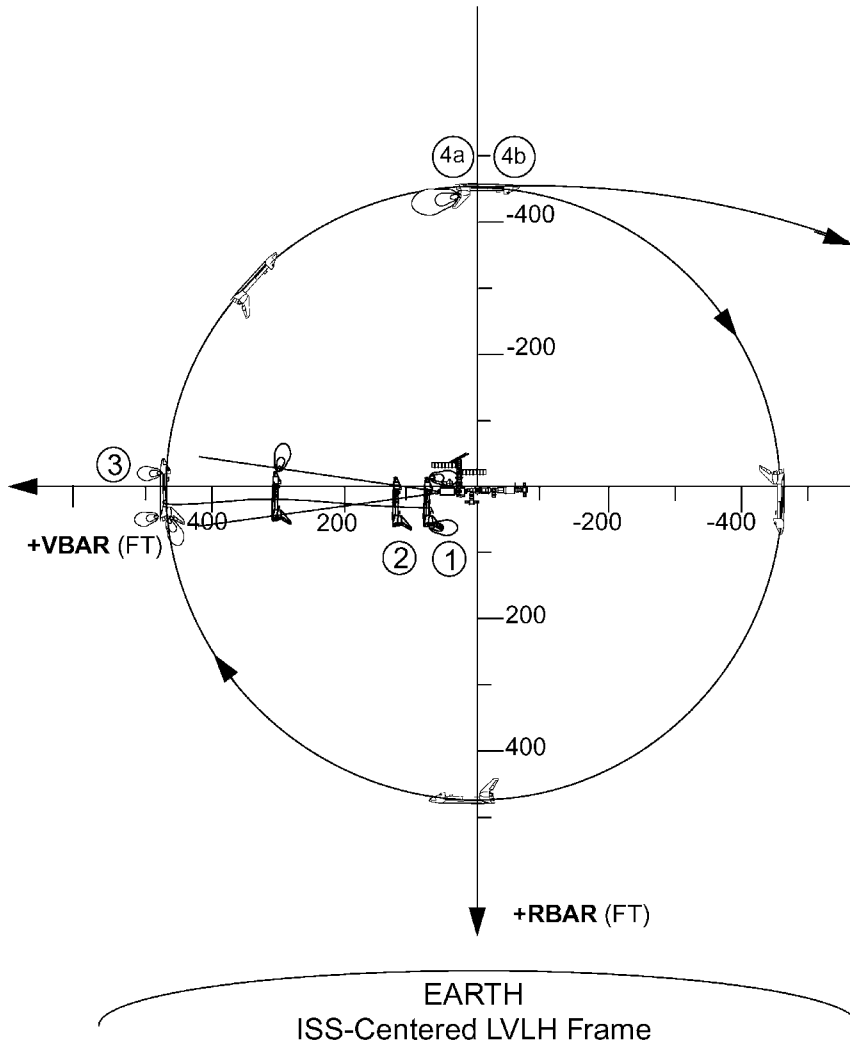
ORBT POST Ti PROFILE



TERMINAL PHASE, TORVA, AND VBAR APPROACH



UNDOCKING, CORRIDOR SEP TO 450 FT, AND FINAL SEPARATION



	APPROX. PET (h:mm)	EVENT	
	-0:03	ORBITER AND ISS IN FREE DRIFT TO BEGIN UNHOOKING PROCESS (ISS LVLH 0,0,0 ATTITUDE)	
1	0:00	UNDOCKING AT SUNSET-10 MIN ; AT 2 FT MODE TO LVLH HOLD AND PERFORM 4 DAP B +Z NORMZ BURNS SEPARATED BY 10 SEC; 3 MIN LATER PERFORM +Z NORMZ BURNS OUTSIDE 30 FT TO BUILD OPENING RATE TO 0.2 FPS; MAINTAIN CORRIDOR	
	0:04	OUTSIDE 50 FT, RESELECT -X JETS (F1F, F2F)	
2	0:05	AT 75 FT, MODE TO LOWZ; MAINTAIN CORRIDOR AND OPENING RATE GREATER THAN OR EQUAL TO 0.2 FPS	
	0:11	AT 150 FT, MANEUVER BACK TO UNDOCKING ATTITUDE IN AUTO	
3	0:31	AT 450 FT NULL RDOT, MAINTAIN 400 FT < R < 500 FT (CG-TO-CG)	
		PROP AVAILABLE	PROP NOT AVAILABLE
		STATIONKEEP UNTIL SUNRISE	INITIATE TORF
4a	0:43		FINAL SEP BURN*
3	0:46	INITIATE TORF (SUNRISE)	
4b	1:44	FINAL SEP BURN*	

*FINAL SEP BURN 3 FPS RETROGRADE +X LOWZ AT -R BAR CROSSING

UNDOCKING/SEPARATION TIMELINE

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UNDOCKING/SEPARATION PAD [4A]

Undocking Time:

Nominal:

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Backup:

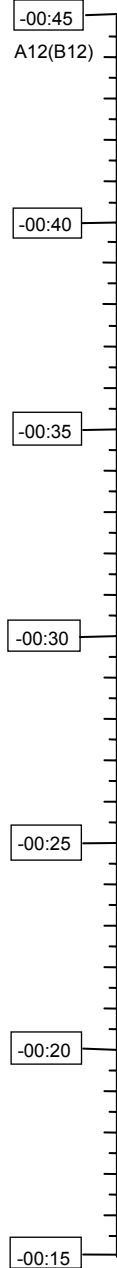
	/			:			:		
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Flyaround Terminate Criteria Post-Undocking:

When FRCS QTY < % or L or R RCS QTY < % :

Go to SHUTTLE NOSE IN-PLANE BREAKOUT (CONTINGENCY OPS), 5-16>>

PET



√DPS config for Undocking Ops - STRING 1233

CONFIGURE FOR SEPARATION [5A]

ENABLE RENDEZVOUS NAV [5B]

On RPOP PGSCs:

Perform RPOP INITIALIZATION (RNDZ TOOLS), 7-8, then:
 Perform RPOP OPS, steps 1 thru 5 (RNDZ TOOLS), 7-9, then:
 Perform TCS ACTIVATION, steps 1 thru 3 (RNDZ TOOLS), 7-18, then:
 Perform TCS MANUAL ACQUISITION, step 1 (RNDZ TOOLS), 7-19
 (Set RANGE = 4 ft, AZIMUTH = 0, ELEVATION = 0)
 NOTE: TCS will not track until after undock

Perform HHL CHECKOUT (RNDZ TOOLS), 7-6

Perform DOCKING MECHANISM PWRUP (APDS), 8-5
 UNDOCKING PREP (APDS), 8-7

Perform CCTV CONFIG FOR DOCKING/UNDOCKING (RNDZ TOOLS), 7-2

MCC UPDATE
 ORB SV
 TGT SV
 Covar Matrix

MCC UPDATE
 Undocking Time [4A]

CONFIGURE FOR SEPARATION [5A]

GNC 20 DAP CONFIG

CRT √DAP config: A12, B12

GNC 2 TIME

Set GNC TIMER counting down to Undocking Time per [4A]

√DAP: LO Z

√DAP: A(B)/AUTO/VERN(ALT)

O14:E √cb MNA, C DDU AFT (two) - cl
 O16:E

R1 O2 TK3 HTR A - AUTO

A6U ADI ATT - LVLH
 ERR - MED
 RATE - LO
 SENSE - -Z
 √FLT CNTLR PWR - OFF

CRT GNC 23 RCS

RCS F - ITEM 1 EXEC (*)
 JET DES F1U - ITEM 17 EXEC (no *)
 F3U - ITEM 19 EXEC (no *)
 F2U - ITEM 21 EXEC (no *)

GNC UNIV PTG

CRT TGT ID √+2
 BODY VECT √+5
 P √+180
 Y √+0
 OM √+0
 √TRK - ITEM 19 EXEC (CUR - *)
 √ERR TOT - ITEM 23 EXEC (*)

Install -Z COAS
KU OPS Cue Card
CORRIDOR Overlay
RANGE RULER Overlay

ENABLE RENDEZVOUS NAV [5B]

GNC 33 REL NAV

CRT RNDZ NAV ENA - ITEM 1 EXEC (*)
 SV SEL, ITEM 4 - FLTR
 √INH RNG, ITEM 18 - (*)
 √RDOT, ITEM 21 - (*)
 √Angles, ITEM 24 - (*)

UNDOCKING OPERATIONS [6A]

1. **PREP FOR UNDOCKING**

When MCC-H and ISS issue GO for Undocking:

GNC 33 REL NAV

CRT ORB TO TGT - ITEM 10 EXEC
A6U FLT CNTLR PWR - ON

2. **RECONFIGURE DAP**

GNC UNIV PTG

When ATT and RATES in limits:

ATT ERR (Each Axis)	≤ 3.0 (VERN) ≤ 5.0 (ALT)
ROLL, YAW RATE	≤ 0.05 (VERN) ≤ 0.07 (ALT)
PITCH RATE	-0.115 ≤ RATE ≤ -0.015 (VERN) -0.135 ≤ RATE ≤ +0.005 (ALT)

-03:00 > DAP: FREE

GNC 23 RCS

√RCS F – ITEM 1 EXEC (*)
JET DES F3F – ITEM 33 EXEC (no *)

GNC 20 DAP CONFIG

Config DAP A,B to A9,B9
X Jets ROT ENA – ITEM 7 EXEC (no *)
DAP: B/FREE/ALT
DAP TRANS: NO LO Z
√DAP TRANS: PULSE/PULSE/PULSE
√SENSE: -Z

3. **COMMAND UNDOCKING**

SM 167 DOCKING STATUS

- * If HOOKS 1(2) OPEN It failed ON: *
- * APDS PWR A_{DS} - OFF (√A_{DS} and failed It off) *

A7L APDS CIRC PROT OFF pb - push (It on)

-02:20 > UNDOCKING pb - push
√HOOKS 1, HOOKS 2 CL Its (two) - off [HOOKS 1,2 POS (two) < 92% + decr]

- CRT * If Hooks 1(2) fail to drive (Hooks 1(2) DRV CMD - OFF): *
- A7L * OPEN HOOKS pb - push *
- * If Hooks 1(2) appear to stop before reaching end of travel *
- * [Hooks 1(2) Pos > 4% + not decr]: *
- * Allow for single motor drive time (~4:40) before performing *
- * PWR OFF pb - push *
- * PWR ON pb - push *

- 00:30 > √INTERF SEALED It - off
√RDY TO HOOK It - off [HOOKS 1,2 POS approx 30%]
- 00:00 √HOOKS 1, HOOKS 2 OP Its (two) - on [HOOKS 1,2 POS ≈ 4%]
√UNDOCK COMPLETE It - on
- * (+02:20) If HOOKS 1(2) fail to open *
- * (confirmed by no physical separation): *
- * Inform MCC: "Hooks failed to open" *
- * PWR OFF pb - push *
- * PWR ON pb - push *
- * CLOSE HOOKS pb - push *
- * √HOOKS 1,2 POS (two) incr *
- * √HOOKS 1(2) CL It - on *
- * (HOOKS 1(2) POS=92±3%) *
- * PWR OFF pb - push *
- * Perform DOCKING MECHANISM PWRDN (APDS), 8-6 *
- * √MCC for IFM capability *
- * Prepare for 96 BOLT EVA TIMELINE (EVA FS, ORB CONT EVA), *
- * then, *
- * Perform ODS HOOKS OPEN-CONTINGENCY (APDS),8-25 >> *
- 00:00 > 4. **POST UNDOCKING**
Inform MCC-H and ISS:
"Physical Separation"
- When petals clear:
DAP: B/LVLH/ALT
√DAP TRANS: PULSE/PULSE/PULSE, NO LO Z
THC: +Z (out) as reqd to maintain C/L target within 8 deg corridor on C/L camera
Note: DAP A allowed for ±X and -Z (in) THC
- At physical sep + 1:00
DAP: VERN(ALT)
THC: +Z(out) pulses at 10 sec intervals to build to 0.15 fps
Record time of VERN select or last pulse: _____ : _____
Perform TCS MANUAL ACQUISITION, step 3 (RNDZ TOOLS), 7-19
- At last pulse TIG+2:00 and when RNG > 30 ft (DP-DP):
THC: +Z(out) as reqd at 10 sec intervals to establish and maintain RDOT > 0.2 fps
- When RNG = 50 ft (DP-DP):
GNC 23 RCS
√RCS FWD – ITEM 1 EXEC (*)
JET DES F1F – ITEM 31 EXEC (no *)
F2F – ITEM 35 EXEC (no *)
- 5. **POWER OFF**
A7L PWR OFF pb - push
√STATUS Its (eighteen) - off
GO TO SEP/FLYAROUND [8A]

PET



-00:15
A12(B12)

Confirm ISS arrays feathered per SEPARATION SOLAR ARRAY CONFIG (6-11).
Report config to MCC.

√MCC: GO FOR UNDOCKING

MCC UPDATE
GO for
Undocking

-00:10

-00:05

← UNDOCKING OPERATIONS [6A]

A9(B9)

00:00

← **UNDOCK COMPLETE**

00:05

00:10

00:15

SEP/FLYAROUND [8A]

√Flyaround terminate criteria per [4A]

- * If Breakout required during flyaround *
- * Go to SHUTTLE NOSE IN-PLANE BREAKOUT *
- * (CONTINGENCY OPS), 5-16 >> *

1. When RNG > 75 ft (DP-DP):
 DAP: LO Z
 THC: Maintain RDOT > 0.2 fps
 Maintain C/L tgt within 8 deg corridor on C/L camera
 NOTE: DAP A allowed for ± X and ± Z THC

If TCS not tracking during corridor sep or flyaround, provide periodic HHL range updates to MCC

2. When RNG > 150 ft (DP-DP): If radar desired, INIT RADAR ACQ [9A]
 NOTE: DAP A allowed for all THC Inputs

3. When RNG > 250 ft: Set RPOP POR: ORB CG - TGT CG
 Set RPOP Overlay: Flyaround Zone [Shift]/[F7]
 Perform DOCKING MECHANISM POWERDOWN (APDS), 8-6

4. When RNG = 450 ± 50 FT (CG-CG)

If no flyaround, Go to SEP BURN [8B]

GNC UNIV PTG

TGT ID √+2
 BODY VECT √+5
 P +90 (-RBAR)
 Y √+0
 OM √+0

√ERR TOT – ITEM 23 (*)

TRK – ITEM 19 EXEC (CUR - *)
 DAP: A/AUTO/VERN(PRI)
 THC: Maintain flyaround range of 450 ± 50 ft (CG-CG)
 Maintain ISS cg inside ±8 degree vertical and
 ± 20 degrees horizontal on C/L camera

5. Prior to -Rbar crossing (Aft ADI P = 270):

GNC UNIV PTG

P +0 (-VBAR)
 TRK - ITEM 19 EXEC (CUR - *)

6. Prior to -Vbar crossing (Aft ADI P = 0):

GNC UNIV PTG

P +270 (+RBAR)
 TRK - ITEM 19 EXEC (CUR - *)

7. Prior to +Rbar crossing (Aft ADI P = 90):

GNC UNIV PTG

P +180 (+VBAR)
 TRK - ITEM 19 EXEC (CUR - *)

8. Prior to +Vbar crossing (Aft ADI P = 180):

GNC UNIV PTG

P +90 (-RBAR)
 TRK - ITEM 19 EXEC (CUR - *)

9. Repeat steps 5 thru 8 as reqd to continue flyaround

10. At flyaround completion -10 minutes:

If radar not tracking target:

INITIAL RADAR ACQ [9A]

11. When flyaround cmlpt (on +/-Vbar per Undock/Flyaround message),

DAP: A/INRTL/VERN(PRI)
 DAP TRANS: NORM/PULSE/PULSE
 THC: +X(up) for 2 sec (0.5 fps)
 DAP TRANS: PULSE/PULSE/PULSE
 Record Radial Burn TIG ___/___:___:___

Go to SEP BURN [8B], Step 2

TERMINATE SEP OPS [8C]

If KU MODE – RDR PASSIVE,
 Perform KU OPS, step 4 (Cue Card)

GNC UNIV PTG

CRT CNCL – ITEM 21 EXEC

GNC 33 REL NAV

RNDZ NAV ENA - ITEM 1 EXEC (no *)
 A6L LIGHTS TRUSS FWD, AFT (two) - OFF
 VESTIBULE PORT, STBD (two) - OFF
 Exit RPOP - [Shift]/[F10]
 Perform TCS DEACTIVATION (RNDZ TOOLS), 7-20
 Perform HHL STOW (RNDZ TOOLS), 7-6

R1 O2 TK3 HTR A – OFF

Go to FLIGHT PLAN

ISS NIGHT VISIBILITY [8D]

Which ISS lights can be seen?

solar array tip lights? _____
 tracking light? _____
 SSRMS lights? _____
 CETA light? _____
 other lights? _____
 other ISS structure? _____

Can ISS CG location be determined sufficiently to perform flyaround?

Can HHL aimpoints be determined sufficiently for HHL operations?

Other observations on ISS visibility at far range:

SEP BURN [8B]

1. RADIAL BURN

DAP TRANS: NORM/PULSE/PULSE
 THC: +X (up) 6 sec (1.5 fps)

DAP: INRTL
 DAP TRANS: PULSE/PULSE/PULSE
 FLT CNTRL PWR-OFF

Inform MCC when SEP complete
 Record Radial Burn TIG ___/___:___:___

When 600 < RNG < 700 ft:

ISS NIGHT VISIBILITY [8D] :

2. CONFIG FOR POSIGRADE/RETROGRADE BURN

√MCC for breakout direction
 GNC OPS 202 PRO

GNC ORBIT MNVR EXEC

√RCS SEL - ITEM 4 EXEC (*)

If Radial burn from +Vbar:
 TVROLL - ITEM 5+180 EXEC
 If Radial burn from -Vbar:
 TVROLL - ITEM 5+0 EXEC

Set TIG to Radial Burn TIG + 28 minutes

TGT PEG 7 VX - ITEM 19-3 EXEC
 VY - ITEM 20+0 EXEC
 VZ - ITEM 21+0 EXEC

- * If posigrade burn *
- * VX - ITEM 19+3 EXEC *
- * NOTE: Same day deorbit or re-rendezvous *
- * would require posigrade burn *

LOAD - ITEM 22 EXEC
 TIMER - ITEM 23 EXEC

At TIG - 8:00

3. MNVR TO POSIGRADE/RETROGRADE BURN ATTITUDE

Config DAP A,B to A7,B7

GNC ORBIT MNVR EXEC

MNVR - ITEM 27 EXEC
 DAP: B/AUTO/ALT, NO LO Z

At TIG - 0:30

4. EXECUTE POSIGRADE/RETROGRADE BURN

DAP: A/INRTL/PRI
 FLT CNTRL PWR - ON
 At TIG, deflect THC to null VGOs

FLT CNTRL PWR - OFF
 DAP: A/INRTL/VERN(ALT)
 GNC, OPS 201 PRO

Go to TERMINATE SEP OPS [8C]

INITIAL RADAR ACQ [9A]

GNC 33 REL NAV

CRT \sqrt{INH} RNG, ITEM 18 - (*)
 \sqrt{RDOT} , ITEM 21 - (*)
 \sqrt{Angles} , ITEM 24 - (*)
 KU ANT ENA - ITEM 2 EXEC (*)
 GNC I/O RESET
 \sqrt{SV} SEL, ITEM 4 - (FLTR)
 RADAR - ITEM 13 EXEC (*)

SM ANTENNA

CRT RDR RNG MIN - ITEM 17 EXEC (*)
 A2 DIGI-DIS sel - R/RDOT
 A1U KU MODE - RR PASSIVE
 RADAR OUTPUT - LO
 \sqrt{sel} - GPC
 CNTL - PNL
 \sqrt{PWR} - ON

IF NO RADAR LOCK-ON WITHIN 2 MIN

KU sel - AUTO TRK
 SLEW EL,AZ to 0,0 deg
 KU SEARCH - SEARCH (tb-gray)

When lock on occurs:

GNC 33 REL NAV

CRT AUT RNG - ITEM 17 EXEC (*)
 RDOT - ITEM 20 EXEC (*)
 Angles - ITEM 23 EXEC (*)
 If RATIO > 1.0,
 Force aff mark until RATIO < 1.0

When RESIDs small and stable,

SM ANTENNA

RDR RNG AUTO - ITEM 16 EXEC (*)

FLYAROUND RANGE REFERENCE

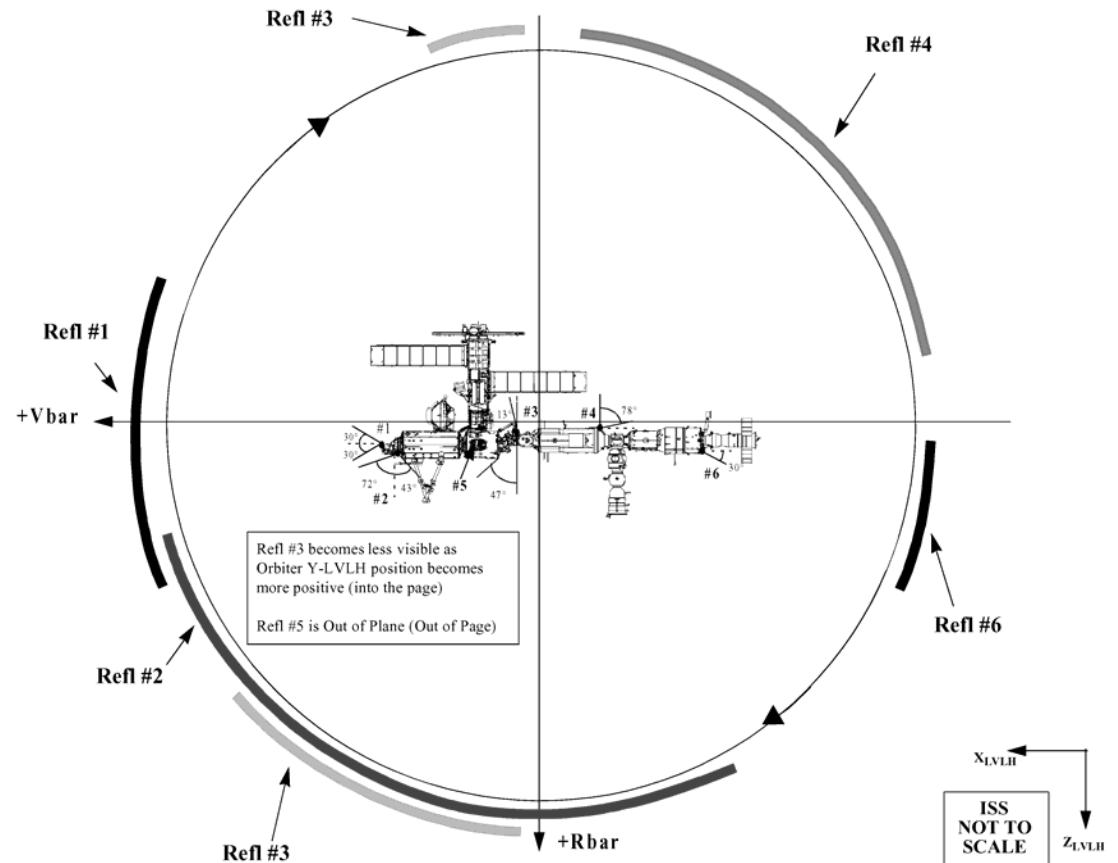
NOTE

Range conversion assumes ISS cg in center of centerline camera at a cg-cg range of 450 ft, with HHL aim point directly between HHL and ISS cg

450 FT cg to cg
 HHL RANGE CONVERSION

HHL Aim Point	Raw HHL Range (ft)
US Lab - Fwd	385
Centerline Target	378
ISS Airlock	426
P6 Truss - End	392
Progress - Aft	353

TCS Reflector Visibility During Flyaround



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MANEUVER PADS

MNVR PADS

MNVR PADS

PRELIMINARY ORBIT MANEUVER PAD FOR NC

OMS BOTH	1	<input type="text"/>
L	2	<input type="text"/>
R	3	<input type="text"/>
RCS SEL	4	<input type="text"/>
TV ROLL	5	<input type="text"/>
TRIM LOAD	P 6	() .
	LY 7	() .
	RY 8	() .
WT	9	<input type="text"/>
TIG	10	<input type="text"/>
TGT PEG 7	ΔV_X 19	() .
	ΔV_Y 20	() .
	ΔV_Z 21	() .

<input type="text"/>	+X
<input type="text"/>	-X
<input type="text"/>	MULTI-AXIS

BURN ATT

R	24	<input type="text"/>	<input type="text"/>	<input type="text"/>
P	25	<input type="text"/>	<input type="text"/>	<input type="text"/>
Y	26	<input type="text"/>	<input type="text"/>	<input type="text"/>

ΔV_{TOT}	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
TGO	<input type="text"/>	:	<input type="text"/>	<input type="text"/>

VGO	X	()	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
VGO		()	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
VGO	Z	()	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

TGT	HA	<input type="text"/>	<input type="text"/>	<input type="text"/>	HP	()	<input type="text"/>	<input type="text"/>	<input type="text"/>
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<h3>OMSGMBL CK:</h3> <table border="1"> <tr> <td></td> <td>PRE</td> <td>POST-BURN</td> </tr> <tr> <td>L PRI</td> <td><input type="text"/></td> <td><input type="text"/></td> </tr> <tr> <td>L SEC</td> <td><input type="text"/></td> <td><input type="text"/></td> </tr> <tr> <td>R PRI</td> <td><input type="text"/></td> <td><input type="text"/></td> </tr> <tr> <td>R SEC</td> <td><input type="text"/></td> <td><input type="text"/></td> </tr> <tr> <td>NONE</td> <td><input type="text"/></td> <td><input type="text"/></td> </tr> </table>			PRE	POST-BURN	L PRI	<input type="text"/>	<input type="text"/>	L SEC	<input type="text"/>	<input type="text"/>	R PRI	<input type="text"/>	<input type="text"/>	R SEC	<input type="text"/>	<input type="text"/>	NONE	<input type="text"/>	<input type="text"/>	<h3>NOTES</h3> <table border="1"> <tr> <td>RCS I'CNCT:</td> <td></td> </tr> <tr> <td>L OMS → RCS</td> <td><input type="text"/></td> </tr> <tr> <td>R OMS → RCS</td> <td><input type="text"/></td> </tr> <tr> <td>NONE</td> <td><input type="text"/></td> </tr> </table>	RCS I'CNCT:		L OMS → RCS	<input type="text"/>	R OMS → RCS	<input type="text"/>	NONE	<input type="text"/>	<h3>DOWN MODE OPTIONS:</h3> <table border="1"> <tr> <td>2 OMS → 1 OMS</td> <td><input type="text"/></td> </tr> <tr> <td>1 OMS → RCS</td> <td><input type="text"/></td> </tr> <tr> <td>NONE</td> <td><input type="text"/></td> </tr> </table>	2 OMS → 1 OMS	<input type="text"/>	1 OMS → RCS	<input type="text"/>	NONE	<input type="text"/>
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DO NOT UPDATE TIG	<input type="text"/>																																		
UPDATE TIG AFTER __ MIN.	<input type="text"/>																																		

FINAL ORBIT MANEUVER PAD FOR NC

OMS BOTH	1	<input type="text"/>	<div style="display: flex; align-items: center; justify-content: center;"> <div style="border-left: 1px solid black; border-right: 1px solid black; height: 40px; margin: 0 5px;"></div> <div style="font-size: 2em; margin: 0 5px;">}</div> <div style="display: flex; flex-direction: column; align-items: center;"> <div style="margin-bottom: 5px;"><input type="text"/> +X</div> <div style="margin-bottom: 5px;"><input type="text"/> -X</div> <div>MULTI-AXIS</div> </div> </div>
L	2	<input type="text"/>	
R	3	<input type="text"/>	
RCS SEL	4	<input type="text"/>	
TV ROLL	5	<input type="text"/> <input type="text"/> <input type="text"/>	
TRIM LOAD	P	6	<input type="text"/> () <input type="text"/> . <input type="text"/>
	LY	7	<input type="text"/> () <input type="text"/> . <input type="text"/>
	RY	8	<input type="text"/> () <input type="text"/> . <input type="text"/>
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TGT PEG 7	ΔV_X	19	<input type="text"/> () <input type="text"/> <input type="text"/> . <input type="text"/>
	ΔV_Y	20	<input type="text"/> () <input type="text"/> <input type="text"/> . <input type="text"/>
	ΔV_Z	21	<input type="text"/> () <input type="text"/> <input type="text"/> . <input type="text"/>

BURN ATT

R	24	<input type="text"/> <input type="text"/> <input type="text"/>
P	25	<input type="text"/> <input type="text"/> <input type="text"/>
Y	26	<input type="text"/> <input type="text"/> <input type="text"/>

ΔV_{TOT}	<input type="text"/> <input type="text"/> <input type="text"/> . <input type="text"/>
TGO	<input type="text"/> : <input type="text"/> <input type="text"/>

VGO	X	<input type="text"/> () <input type="text"/> <input type="text"/> . <input type="text"/>
VGO		<input type="text"/> () <input type="text"/> <input type="text"/> . <input type="text"/>
VGO	Z	<input type="text"/> () <input type="text"/> <input type="text"/> . <input type="text"/>

	HA	HP
TGT	<input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> () <input type="text"/> <input type="text"/>

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	PRE	POST-BURN																		
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NONE	<input type="text"/>	<input type="text"/>																		
			DOWN MODE OPTIONS: <input type="text"/> 2 OMS → 1 OMS <input type="text"/> 1 OMS → RCS <input type="text"/> NONE																	
OMS HE REG TEST: L,R OMSHE P/VAP ISOL <table border="0" style="width: 100%;"> <tr> <td style="text-align: center;">GPC</td> <td style="text-align: center;">OP</td> <td style="text-align: center;">CL</td> </tr> <tr> <td>A <input type="text"/></td> <td><input type="text"/></td> <td><input type="text"/></td> </tr> <tr> <td>B <input type="text"/></td> <td><input type="text"/></td> <td><input type="text"/></td> </tr> </table>		GPC	OP	CL	A <input type="text"/>	<input type="text"/>	<input type="text"/>	B <input type="text"/>	<input type="text"/>	<input type="text"/>	-X RCS BURNS: <table border="0" style="width: 100%;"> <tr> <td style="text-align: center;">BURN ATT</td> <td style="text-align: center;">LVLH ATT</td> </tr> <tr> <td>P 15 <input type="text"/><input type="text"/><input type="text"/></td> <td>R <input type="text"/><input type="text"/><input type="text"/></td> </tr> <tr> <td>Y 16 <input type="text"/><input type="text"/><input type="text"/></td> <td>P <input type="text"/><input type="text"/><input type="text"/></td> </tr> <tr> <td>OM 17 <input type="text"/><input type="text"/><input type="text"/></td> <td>Y <input type="text"/><input type="text"/><input type="text"/></td> </tr> </table>		BURN ATT	LVLH ATT	P 15 <input type="text"/> <input type="text"/> <input type="text"/>	R <input type="text"/> <input type="text"/> <input type="text"/>	Y 16 <input type="text"/> <input type="text"/> <input type="text"/>	P <input type="text"/> <input type="text"/> <input type="text"/>	OM 17 <input type="text"/> <input type="text"/> <input type="text"/>	Y <input type="text"/> <input type="text"/> <input type="text"/>
GPC	OP	CL																		
A <input type="text"/>	<input type="text"/>	<input type="text"/>																		
B <input type="text"/>	<input type="text"/>	<input type="text"/>																		
BURN ATT	LVLH ATT																			
P 15 <input type="text"/> <input type="text"/> <input type="text"/>	R <input type="text"/> <input type="text"/> <input type="text"/>																			
Y 16 <input type="text"/> <input type="text"/> <input type="text"/>	P <input type="text"/> <input type="text"/> <input type="text"/>																			
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ORBIT BURN MONITOR GPC FILL-INS <input type="text"/> (<input type="text"/>) <input type="text"/> CRIT BURN <input type="text"/> NON-CRIT BURN																				
MAX TIG SLIP ___ MIN. } <div style="display: inline-block; vertical-align: middle; margin-left: 5px;"> <input type="text"/> DO NOT UPDATE TIG <input type="text"/> UPDATE TIG AFTER ___ MIN. </div>																				

PRELIMINARY ORBIT MANEUVER PAD FOR NH

OMS BOTH	1	<input type="text"/>	<div style="display: flex; align-items: center; justify-content: center;"> <div style="border-left: 1px solid black; border-right: 1px solid black; height: 40px; margin-right: 5px;"></div> <div style="font-size: 2em; margin-right: 5px;">}</div> <div style="display: flex; flex-direction: column; align-items: center;"> <div style="margin-bottom: 5px;">+X</div> <div style="margin-bottom: 5px;">-X</div> <div>MULTI-AXIS</div> </div> </div>
L	2	<input type="text"/>	
R	3	<input type="text"/>	
RCS SEL	4	<input type="text"/>	
TV ROLL	5	<input type="text"/> <input type="text"/> <input type="text"/>	
TRIM LOAD	P 6	<input type="text"/> () <input type="text"/> . <input type="text"/>	
	LY 7	<input type="text"/> () <input type="text"/> . <input type="text"/>	
	RY 8	<input type="text"/> () <input type="text"/> . <input type="text"/>	
WT	9	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	
TIG	10	<input type="text"/> <input type="text"/> / <input type="text"/> <input type="text"/> : <input type="text"/> <input type="text"/> : <input type="text"/> <input type="text"/> . <input type="text"/> <input type="text"/>	
TGT PEG 7	ΔV_X 19	<input type="text"/> () <input type="text"/> . <input type="text"/>	
	ΔV_Y 20	<input type="text"/> () <input type="text"/> . <input type="text"/>	
	ΔV_Z 21	<input type="text"/> () <input type="text"/> . <input type="text"/>	

BURN ATT

R	24	<input type="text"/> <input type="text"/> <input type="text"/>
P	25	<input type="text"/> <input type="text"/> <input type="text"/>
Y	26	<input type="text"/> <input type="text"/> <input type="text"/>

ΔV_{TOT}	<input type="text"/> <input type="text"/> <input type="text"/> . <input type="text"/>
TGO	<input type="text"/> : <input type="text"/> <input type="text"/>

VGO	X	<input type="text"/> () <input type="text"/> . <input type="text"/>
VGO		<input type="text"/> () <input type="text"/> . <input type="text"/>
VGO	Z	<input type="text"/> () <input type="text"/> . <input type="text"/>

	HA	<input type="text"/> <input type="text"/> <input type="text"/>	HP	<input type="text"/> () <input type="text"/> <input type="text"/>
TGT		<input type="text"/> <input type="text"/> <input type="text"/>		

<p>OMS GMBL CK:</p> <table border="0" style="width: 100%;"> <tr> <td></td> <td style="text-align: center;">PRE</td> <td style="text-align: center;">POST-BURN</td> </tr> <tr> <td>L PRI</td> <td><input type="text"/></td> <td><input type="text"/></td> </tr> <tr> <td>L SEC</td> <td><input type="text"/></td> <td><input type="text"/></td> </tr> <tr> <td>R PRI</td> <td><input type="text"/></td> <td><input type="text"/></td> </tr> <tr> <td>R SEC</td> <td><input type="text"/></td> <td><input type="text"/></td> </tr> <tr> <td>NONE</td> <td><input type="text"/></td> <td><input type="text"/></td> </tr> </table>		PRE	POST-BURN	L PRI	<input type="text"/>	<input type="text"/>	L SEC	<input type="text"/>	<input type="text"/>	R PRI	<input type="text"/>	<input type="text"/>	R SEC	<input type="text"/>	<input type="text"/>	NONE	<input type="text"/>	<input type="text"/>	<p style="text-align: center;">NOTES</p> <p>RCS I'CNCT:</p> <table border="0" style="width: 100%;"> <tr> <td><input type="text"/></td> <td>L OMS → RCS</td> </tr> <tr> <td><input type="text"/></td> <td>R OMS → RCS</td> </tr> <tr> <td><input type="text"/></td> <td>NONE</td> </tr> </table>	<input type="text"/>	L OMS → RCS	<input type="text"/>	R OMS → RCS	<input type="text"/>	NONE	<p>DOWN MODE OPTIONS:</p> <table border="0" style="width: 100%;"> <tr> <td><input type="text"/></td> <td>2 OMS → 1 OMS</td> </tr> <tr> <td><input type="text"/></td> <td>1 OMS → RCS</td> </tr> <tr> <td><input type="text"/></td> <td>NONE</td> </tr> </table>	<input type="text"/>	2 OMS → 1 OMS	<input type="text"/>	1 OMS → RCS	<input type="text"/>	NONE
	PRE	POST-BURN																														
L PRI	<input type="text"/>	<input type="text"/>																														
L SEC	<input type="text"/>	<input type="text"/>																														
R PRI	<input type="text"/>	<input type="text"/>																														
R SEC	<input type="text"/>	<input type="text"/>																														
NONE	<input type="text"/>	<input type="text"/>																														
<input type="text"/>	L OMS → RCS																															
<input type="text"/>	R OMS → RCS																															
<input type="text"/>	NONE																															
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<input type="text"/>	1 OMS → RCS																															
<input type="text"/>	NONE																															
<p>OMS HE REG TEST: L,R OMSHE P/VAP ISOL</p> <table border="0" style="width: 100%;"> <tr> <td></td> <td style="text-align: center;">GPC</td> <td style="text-align: center;">OP</td> <td style="text-align: center;">CL</td> </tr> <tr> <td>A</td> <td><input type="text"/></td> <td><input type="text"/></td> <td><input type="text"/></td> </tr> <tr> <td>B</td> <td><input type="text"/></td> <td><input type="text"/></td> <td><input type="text"/></td> </tr> </table>		GPC	OP	CL	A	<input type="text"/>	<input type="text"/>	<input type="text"/>	B	<input type="text"/>	<input type="text"/>	<input type="text"/>	<p>-X RCS BURNS:</p> <table border="0" style="width: 100%;"> <tr> <td></td> <td style="text-align: center;">BURN ATT</td> <td style="text-align: center;">LVLH ATT</td> </tr> <tr> <td>P 15</td> <td><input type="text"/><input type="text"/><input type="text"/></td> <td>R <input type="text"/><input type="text"/><input type="text"/></td> </tr> <tr> <td>Y 16</td> <td><input type="text"/><input type="text"/><input type="text"/></td> <td>P <input type="text"/><input type="text"/><input type="text"/></td> </tr> <tr> <td>OM 17</td> <td><input type="text"/><input type="text"/><input type="text"/></td> <td>Y <input type="text"/><input type="text"/><input type="text"/></td> </tr> </table>		BURN ATT	LVLH ATT	P 15	<input type="text"/> <input type="text"/> <input type="text"/>	R <input type="text"/> <input type="text"/> <input type="text"/>	Y 16	<input type="text"/> <input type="text"/> <input type="text"/>	P <input type="text"/> <input type="text"/> <input type="text"/>	OM 17	<input type="text"/> <input type="text"/> <input type="text"/>	Y <input type="text"/> <input type="text"/> <input type="text"/>	<p>ORBIT BURN MONITOR</p> <p>GPC FILL-INS __ (__)</p> <table border="0" style="width: 100%;"> <tr> <td><input type="text"/></td> <td>CRIT BURN</td> </tr> <tr> <td><input type="text"/></td> <td>NON-CRIT BURN</td> </tr> </table>	<input type="text"/>	CRIT BURN	<input type="text"/>	NON-CRIT BURN		
	GPC	OP	CL																													
A	<input type="text"/>	<input type="text"/>	<input type="text"/>																													
B	<input type="text"/>	<input type="text"/>	<input type="text"/>																													
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P 15	<input type="text"/> <input type="text"/> <input type="text"/>	R <input type="text"/> <input type="text"/> <input type="text"/>																														
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OM 17	<input type="text"/> <input type="text"/> <input type="text"/>	Y <input type="text"/> <input type="text"/> <input type="text"/>																														
<input type="text"/>	CRIT BURN																															
<input type="text"/>	NON-CRIT BURN																															
<p>MAX TIG SLIP ___ MIN. — <input type="text"/> <input type="text"/></p> <p style="margin-left: 150px;">DO NOT UPDATE TIG</p> <p style="margin-left: 150px;">UPDATE TIG AFTER ___ MIN.</p>																																

FINAL ORBIT MANEUVER PAD FOR NH

OMS BOTH	1	<input style="width: 100%;" type="text"/>	<div style="display: flex; align-items: center; justify-content: center;"> <div style="border-left: 1px solid black; border-right: 1px solid black; height: 40px; margin-right: 5px;"></div> <div style="font-size: 2em; margin-right: 5px;">}</div> <div style="display: flex; flex-direction: column; align-items: center;"> <div style="margin-bottom: 5px;"><input style="width: 100%;" type="text"/> +X</div> <div style="margin-bottom: 5px;"><input style="width: 100%;" type="text"/> -X</div> <div>MULTI-AXIS</div> </div> </div>
L	2	<input style="width: 100%;" type="text"/>	
R	3	<input style="width: 100%;" type="text"/>	
RCS SEL	4	<input style="width: 100%;" type="text"/>	
TV ROLL	5	<input style="width: 100%;" type="text"/>	
TRIM LOAD	P 6	<input style="width: 100%;" type="text"/>	
	LY 7	<input style="width: 100%;" type="text"/>	
	RY 8	<input style="width: 100%;" type="text"/>	
	WT 9	<input style="width: 100%;" type="text"/>	
	TIG 10	<input style="width: 100%;" type="text"/>	
TGT PEG 7	ΔV_X 19	<input style="width: 100%;" type="text"/>	
	ΔV_Y 20	<input style="width: 100%;" type="text"/>	
	ΔV_Z 21	<input style="width: 100%;" type="text"/>	

BURN ATT

R	24	<input style="width: 30px; height: 20px;" type="text"/>	<input style="width: 30px; height: 20px;" type="text"/>	<input style="width: 30px; height: 20px;" type="text"/>
P	25	<input style="width: 30px; height: 20px;" type="text"/>	<input style="width: 30px; height: 20px;" type="text"/>	<input style="width: 30px; height: 20px;" type="text"/>
Y	26	<input style="width: 30px; height: 20px;" type="text"/>	<input style="width: 30px; height: 20px;" type="text"/>	<input style="width: 30px; height: 20px;" type="text"/>

ΔV_{TOT}	<input style="width: 30px; height: 20px;" type="text"/>	<input style="width: 30px; height: 20px;" type="text"/>	<input style="width: 30px; height: 20px;" type="text"/>	<input style="width: 30px; height: 20px;" type="text"/>	<input style="width: 30px; height: 20px;" type="text"/>
TGO	<input style="width: 30px; height: 20px;" type="text"/>	:	<input style="width: 30px; height: 20px;" type="text"/>	<input style="width: 30px; height: 20px;" type="text"/>	<input style="width: 30px; height: 20px;" type="text"/>

VGO	X	<input style="width: 30px; height: 20px;" type="text"/>	<input style="width: 30px; height: 20px;" type="text"/>	<input style="width: 30px; height: 20px;" type="text"/>	<input style="width: 30px; height: 20px;" type="text"/>	<input style="width: 30px; height: 20px;" type="text"/>
VGO		<input style="width: 30px; height: 20px;" type="text"/>	<input style="width: 30px; height: 20px;" type="text"/>	<input style="width: 30px; height: 20px;" type="text"/>	<input style="width: 30px; height: 20px;" type="text"/>	<input style="width: 30px; height: 20px;" type="text"/>
VGO	Z	<input style="width: 30px; height: 20px;" type="text"/>	<input style="width: 30px; height: 20px;" type="text"/>	<input style="width: 30px; height: 20px;" type="text"/>	<input style="width: 30px; height: 20px;" type="text"/>	<input style="width: 30px; height: 20px;" type="text"/>

	HA	<input style="width: 30px; height: 20px;" type="text"/>	HP	<input style="width: 30px; height: 20px;" type="text"/>	<input style="width: 30px; height: 20px;" type="text"/>	<input style="width: 30px; height: 20px;" type="text"/>
TGT		<input style="width: 30px; height: 20px;" type="text"/>	()	<input style="width: 30px; height: 20px;" type="text"/>	<input style="width: 30px; height: 20px;" type="text"/>	<input style="width: 30px; height: 20px;" type="text"/>

OMS GMBL CK:		NOTES									
	PRE	POST-BURN									
L PRI	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<table border="1" style="border-collapse: collapse; width: 100%;"> <tr> <td style="text-align: center;"><input style="width: 100%;" type="text"/></td> <td>L OMS → RCS</td> </tr> <tr> <td style="text-align: center;"><input style="width: 100%;" type="text"/></td> <td>R OMS → RCS</td> </tr> <tr> <td style="text-align: center;"><input style="width: 100%;" type="text"/></td> <td>NONE</td> </tr> </table>	<input style="width: 100%;" type="text"/>	L OMS → RCS	<input style="width: 100%;" type="text"/>	R OMS → RCS	<input style="width: 100%;" type="text"/>	NONE		
<input style="width: 100%;" type="text"/>	L OMS → RCS										
<input style="width: 100%;" type="text"/>	R OMS → RCS										
<input style="width: 100%;" type="text"/>	NONE										
L SEC	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>									
R PRI	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>									
R SEC	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>									
NONE	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<table border="1" style="border-collapse: collapse; width: 100%;"> <tr> <td style="text-align: center;"><input style="width: 100%;" type="text"/></td> <td>2 OMS → 1 OMS</td> </tr> <tr> <td style="text-align: center;"><input style="width: 100%;" type="text"/></td> <td>1 OMS → RCS</td> </tr> <tr> <td style="text-align: center;"><input style="width: 100%;" type="text"/></td> <td>NONE</td> </tr> </table>	<input style="width: 100%;" type="text"/>	2 OMS → 1 OMS	<input style="width: 100%;" type="text"/>	1 OMS → RCS	<input style="width: 100%;" type="text"/>	NONE		
<input style="width: 100%;" type="text"/>	2 OMS → 1 OMS										
<input style="width: 100%;" type="text"/>	1 OMS → RCS										
<input style="width: 100%;" type="text"/>	NONE										
OMS HE REG TEST: L,R OMSHE P/VAP ISOL		-X RCS BURNS:									
GPC	OP	CL									
A	<input style="width: 30px; height: 20px;" type="text"/>	<input style="width: 30px; height: 20px;" type="text"/>	P 15 <input style="width: 30px; height: 20px;" type="text"/>								
B	<input style="width: 30px; height: 20px;" type="text"/>	<input style="width: 30px; height: 20px;" type="text"/>	Y 16 <input style="width: 30px; height: 20px;" type="text"/>								
			OM 17 <input style="width: 30px; height: 20px;" type="text"/>								
			R <input style="width: 30px; height: 20px;" type="text"/>								
			P <input style="width: 30px; height: 20px;" type="text"/>								
			Y <input style="width: 30px; height: 20px;" type="text"/>								
			LVLH ATT								
			<input style="width: 30px; height: 20px;" type="text"/>								
			<input style="width: 30px; height: 20px;" type="text"/>								
			<input style="width: 30px; height: 20px;" type="text"/>								
ORBIT BURN MONITOR											
GPC FILL-INS __ (__)											
			<input style="width: 30px; height: 20px;" type="text"/> CRIT BURN								
			<input style="width: 30px; height: 20px;" type="text"/> NON-CRIT BURN								
<table border="0" style="width: 100%;"> <tr> <td style="width: 50%;">MAX TIG SLIP __ MIN.</td> <td style="width: 10%; text-align: center;">{</td> <td style="width: 10%; text-align: center;"><input style="width: 100%;" type="text"/></td> <td style="width: 20%;">DO NOT UPDATE TIG</td> </tr> <tr> <td></td> <td style="text-align: center;">}</td> <td style="text-align: center;"><input style="width: 100%;" type="text"/></td> <td>UPDATE TIG AFTER __ MIN.</td> </tr> </table>				MAX TIG SLIP __ MIN.	{	<input style="width: 100%;" type="text"/>	DO NOT UPDATE TIG		}	<input style="width: 100%;" type="text"/>	UPDATE TIG AFTER __ MIN.
MAX TIG SLIP __ MIN.	{	<input style="width: 100%;" type="text"/>	DO NOT UPDATE TIG								
	}	<input style="width: 100%;" type="text"/>	UPDATE TIG AFTER __ MIN.								

PRELIMINARY ORBIT MANEUVER PAD FOR Ti

OMS BOTH	1	<input style="width: 100%;" type="text"/>	<div style="display: flex; align-items: center; justify-content: center;"> <div style="border-left: 1px solid black; border-right: 1px solid black; height: 40px; margin: 0 5px;"></div> <div style="margin: 0 5px;">+</div> <div style="border-left: 1px solid black; border-right: 1px solid black; height: 40px; margin: 0 5px;"></div> <div style="margin: 0 5px;">-X</div> </div>
L	2	<input style="width: 100%;" type="text"/>	
R	3	<input style="width: 100%;" type="text"/>	
RCS SEL	4	<input style="width: 100%;" type="text"/>	
TV ROLL	5	<input style="width: 100%;" type="text"/>	<div style="display: flex; align-items: center; justify-content: center;"> <div style="border-left: 1px solid black; border-right: 1px solid black; height: 40px; margin: 0 5px;"></div> <div style="margin: 0 5px;">+</div> <div style="border-left: 1px solid black; border-right: 1px solid black; height: 40px; margin: 0 5px;"></div> <div style="margin: 0 5px;">-X</div> </div>
TRIM LOAD	P 6	<input style="width: 100%;" type="text"/>	<div style="display: flex; align-items: center; justify-content: center;"> <div style="border-left: 1px solid black; border-right: 1px solid black; height: 40px; margin: 0 5px;"></div> <div style="margin: 0 5px;">+</div> <div style="border-left: 1px solid black; border-right: 1px solid black; height: 40px; margin: 0 5px;"></div> <div style="margin: 0 5px;">-X</div> </div>
LY	7	<input style="width: 100%;" type="text"/>	
RY	8	<input style="width: 100%;" type="text"/>	
WT	9	<input style="width: 100%;" type="text"/>	<div style="display: flex; align-items: center; justify-content: center;"> <div style="border-left: 1px solid black; border-right: 1px solid black; height: 40px; margin: 0 5px;"></div> <div style="margin: 0 5px;">+</div> <div style="border-left: 1px solid black; border-right: 1px solid black; height: 40px; margin: 0 5px;"></div> <div style="margin: 0 5px;">-X</div> </div>
TIG	10	<input style="width: 100%;" type="text"/>	<div style="display: flex; align-items: center; justify-content: center;"> <div style="border-left: 1px solid black; border-right: 1px solid black; height: 40px; margin: 0 5px;"></div> <div style="margin: 0 5px;">+</div> <div style="border-left: 1px solid black; border-right: 1px solid black; height: 40px; margin: 0 5px;"></div> <div style="margin: 0 5px;">-X</div> </div>
TGT PEG 7	ΔV_X 19	<input style="width: 100%;" type="text"/>	<div style="display: flex; align-items: center; justify-content: center;"> <div style="border-left: 1px solid black; border-right: 1px solid black; height: 40px; margin: 0 5px;"></div> <div style="margin: 0 5px;">+</div> <div style="border-left: 1px solid black; border-right: 1px solid black; height: 40px; margin: 0 5px;"></div> <div style="margin: 0 5px;">-X</div> </div>
	ΔV_Y 20	<input style="width: 100%;" type="text"/>	
	ΔV_Z 21	<input style="width: 100%;" type="text"/>	

BURN ATT

R	24	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>
P	25	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>
Y	26	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>

	ΔV_{TOT}	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>
	TGO	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>
VGO	X	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>
VGO	Y	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>
VGO	Z	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>
	HA	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>
	HP	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>
TGT		<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>

OMS GMBL CK:		PRE		POST-BURN		RCS I'CNCT:		DOWN MODE OPTIONS:	
L PRI	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>
L SEC	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>
R PRI	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>
R SEC	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>
NONE	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>

OMS HE REG TEST: L,R OMSHE P/VAP ISOL			-X RCS BURNS: BURN ATT			LVLH ATT			ORBIT BURN MONITOR		
GPC	OP	CL	P 15	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	R	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	GPC FILL-INS __ (__)		
A	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	Y 16	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	P	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/> CRIT BURN <input style="width: 100%;" type="text"/> NON-CRIT BURN		
B	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	OM 17	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	Y	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>			

TIG SLIP:	If Ti not started by nominal TIG + ___ min. (G34 as req'd), reload original TIG and go to Ti DELAY, 5-25	
Max Ti DELAY TIG slip ___ min.	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>
	<input style="width: 100%;" type="text"/> DO NOT UPDATE TIG <input style="width: 100%;" type="text"/> UPDATE TIG AFTER ___ MIN.	

Ti DELAY		
TGT PEG 7	ΔV_X 19	<input style="width: 100%;" type="text"/>
	ΔV_Y 20	<input style="width: 100%;" type="text"/>
	ΔV_Z 21	<input style="width: 100%;" type="text"/>
NEW Ti (BASETIME)		<input style="width: 100%;" type="text"/>

FINAL ORBIT MANEUVER PAD FOR Ti

OMS BOTH	1	<input type="text"/>	<div style="display: flex; align-items: center; justify-content: center;"> <div style="border-left: 1px solid black; border-right: 1px solid black; border-bottom: 1px solid black; width: 15px; height: 15px; margin-right: 5px;"></div> <div style="display: flex; flex-direction: column; align-items: center; justify-content: center; gap: 5px;"> <div style="border-left: 1px solid black; border-right: 1px solid black; border-bottom: 1px solid black; width: 15px; height: 15px;"></div> <div style="border-left: 1px solid black; border-right: 1px solid black; border-bottom: 1px solid black; width: 15px; height: 15px;"></div> <div style="border-left: 1px solid black; border-right: 1px solid black; border-bottom: 1px solid black; width: 15px; height: 15px;"></div> </div> <div style="margin-left: 5px;"> +X -X MULTI-AXIS </div> </div>
L	2	<input type="text"/>	
R	3	<input type="text"/>	
RCS SEL	4	<input type="text"/>	
TV ROLL	5	<input type="text"/> <input type="text"/> <input type="text"/>	
TRIM LOAD	P 6	<input type="text"/> () <input type="text"/> . <input type="text"/>	
	LY 7	<input type="text"/> () <input type="text"/> . <input type="text"/>	
	RY 8	<input type="text"/> () <input type="text"/> . <input type="text"/>	
	WT 9	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	
	TIG 10	<input type="text"/> <input type="text"/> / <input type="text"/> <input type="text"/> : <input type="text"/> <input type="text"/> : <input type="text"/> <input type="text"/> . <input type="text"/>	
TGT PEG 7	ΔV_X 19	<input type="text"/> () <input type="text"/> . <input type="text"/>	
	ΔV_Y 20	<input type="text"/> () <input type="text"/> . <input type="text"/>	
	ΔV_Z 21	<input type="text"/> () <input type="text"/> . <input type="text"/>	
Ti DELAY			
TGT PEG 7	ΔV_X 19	<input type="text"/> () <input type="text"/> . <input type="text"/>	
	ΔV_Y 20	<input type="text"/> () <input type="text"/> . <input type="text"/>	
	ΔV_Z 21	<input type="text"/> () <input type="text"/> . <input type="text"/>	
NEW Ti (BASETIME)		<input type="text"/> <input type="text"/> / <input type="text"/> <input type="text"/> : <input type="text"/> <input type="text"/> : <input type="text"/> <input type="text"/> . <input type="text"/>	

<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="2" style="text-align: center;">BURN ATT</td> </tr> <tr> <td>R 24</td> <td><input type="text"/><input type="text"/><input type="text"/></td> </tr> <tr> <td>P 25</td> <td><input type="text"/><input type="text"/><input type="text"/></td> </tr> <tr> <td>Y 26</td> <td><input type="text"/><input type="text"/><input type="text"/></td> </tr> </table>	BURN ATT		R 24	<input type="text"/> <input type="text"/> <input type="text"/>	P 25	<input type="text"/> <input type="text"/> <input type="text"/>	Y 26	<input type="text"/> <input type="text"/> <input type="text"/>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="2" style="text-align: center;">NOTES</td> </tr> <tr> <td style="width: 50%;"> OMS GMBL CK: PRE POST-BURN L PRI <input type="text"/> <input type="text"/> L SEC <input type="text"/> <input type="text"/> R PRI <input type="text"/> <input type="text"/> R SEC <input type="text"/> <input type="text"/> NONE <input type="text"/> <input type="text"/> </td> <td style="width: 50%;"> RCS I'CNCT: <input type="text"/> L OMS → RCS <input type="text"/> R OMS → RCS <input type="text"/> NONE </td> </tr> <tr> <td colspan="2"> DOWN MODE OPTIONS: <input type="text"/> 2 OMS → 1 OMS <input type="text"/> 1 OMS → RCS <input type="text"/> NONE </td> </tr> </table>	NOTES		OMS GMBL CK: PRE POST-BURN L PRI <input type="text"/> <input type="text"/> L SEC <input type="text"/> <input type="text"/> R PRI <input type="text"/> <input type="text"/> R SEC <input type="text"/> <input type="text"/> NONE <input type="text"/> <input type="text"/>	RCS I'CNCT: <input type="text"/> L OMS → RCS <input type="text"/> R OMS → RCS <input type="text"/> NONE	DOWN MODE OPTIONS: <input type="text"/> 2 OMS → 1 OMS <input type="text"/> 1 OMS → RCS <input type="text"/> NONE																			
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P 25	<input type="text"/> <input type="text"/> <input type="text"/>																																
Y 26	<input type="text"/> <input type="text"/> <input type="text"/>																																
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DOWN MODE OPTIONS: <input type="text"/> 2 OMS → 1 OMS <input type="text"/> 1 OMS → RCS <input type="text"/> NONE																																	
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="2" style="text-align: center;">OMS HE REG TEST: L,R OMSHE P/VAP ISOL</td> <td style="text-align: center;">-X RCS BURNS: BURN ATT</td> <td style="text-align: center;">LVLH ATT</td> <td style="text-align: center;">ORBIT BURN MONITOR</td> </tr> <tr> <td style="text-align: center;">GPC OP CL</td> <td style="text-align: center;">P 15</td> <td style="text-align: center;"><input type="text"/><input type="text"/><input type="text"/></td> <td style="text-align: center;">R <input type="text"/><input type="text"/><input type="text"/></td> <td style="text-align: center;">GPC FILL-INS __ (__)</td> </tr> <tr> <td style="text-align: center;">A <input type="text"/><input type="text"/><input type="text"/></td> <td style="text-align: center;">Y 16</td> <td style="text-align: center;"><input type="text"/><input type="text"/><input type="text"/></td> <td style="text-align: center;">P <input type="text"/><input type="text"/><input type="text"/></td> <td style="text-align: center;"><input type="text"/> CRIT BURN</td> </tr> <tr> <td style="text-align: center;">B <input type="text"/><input type="text"/><input type="text"/></td> <td style="text-align: center;">OM 17</td> <td style="text-align: center;"><input type="text"/><input type="text"/><input type="text"/></td> <td style="text-align: center;">Y <input type="text"/><input type="text"/><input type="text"/></td> <td style="text-align: center;"><input type="text"/> NON-CRIT BURN</td> </tr> </table>	OMS HE REG TEST: L,R OMSHE P/VAP ISOL		-X RCS BURNS: BURN ATT	LVLH ATT	ORBIT BURN MONITOR	GPC OP CL	P 15	<input type="text"/> <input type="text"/> <input type="text"/>	R <input type="text"/> <input type="text"/> <input type="text"/>	GPC FILL-INS __ (__)	A <input type="text"/> <input type="text"/> <input type="text"/>	Y 16	<input type="text"/> <input type="text"/> <input type="text"/>	P <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> CRIT BURN	B <input type="text"/> <input type="text"/> <input type="text"/>	OM 17	<input type="text"/> <input type="text"/> <input type="text"/>	Y <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> NON-CRIT BURN	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: right;">ΔV_{TOT}</td> <td><input type="text"/><input type="text"/><input type="text"/> . <input type="text"/></td> </tr> <tr> <td style="text-align: right;">TGO</td> <td><input type="text"/><input type="text"/> : <input type="text"/><input type="text"/></td> </tr> <tr> <td style="text-align: right;">VGO X</td> <td><input type="text"/> () <input type="text"/><input type="text"/><input type="text"/> . <input type="text"/></td> </tr> <tr> <td style="text-align: right;">VGO Y</td> <td><input type="text"/> () <input type="text"/><input type="text"/><input type="text"/> . <input type="text"/></td> </tr> <tr> <td style="text-align: right;">VGO Z</td> <td><input type="text"/> () <input type="text"/><input type="text"/><input type="text"/> . <input type="text"/></td> </tr> <tr> <td style="text-align: right;">TGT</td> <td>HA <input type="text"/><input type="text"/><input type="text"/> HP <input type="text"/> () <input type="text"/><input type="text"/><input type="text"/></td> </tr> </table>	ΔV_{TOT}	<input type="text"/> <input type="text"/> <input type="text"/> . <input type="text"/>	TGO	<input type="text"/> <input type="text"/> : <input type="text"/> <input type="text"/>	VGO X	<input type="text"/> () <input type="text"/> <input type="text"/> <input type="text"/> . <input type="text"/>	VGO Y	<input type="text"/> () <input type="text"/> <input type="text"/> <input type="text"/> . <input type="text"/>	VGO Z	<input type="text"/> () <input type="text"/> <input type="text"/> <input type="text"/> . <input type="text"/>	TGT	HA <input type="text"/> <input type="text"/> <input type="text"/> HP <input type="text"/> () <input type="text"/> <input type="text"/> <input type="text"/>
OMS HE REG TEST: L,R OMSHE P/VAP ISOL		-X RCS BURNS: BURN ATT	LVLH ATT	ORBIT BURN MONITOR																													
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A <input type="text"/> <input type="text"/> <input type="text"/>	Y 16	<input type="text"/> <input type="text"/> <input type="text"/>	P <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> CRIT BURN																													
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<p>TIG SLIP: If Ti not started by nominal TIG + ___ min. (G34 as req'd), reload original TIG and go to Ti DELAY, 5-25</p> <p>Max Ti DELAY TIG slip ___ min. <input type="text"/> <input type="text"/> DO NOT UPDATE TIG <input type="text"/> <input type="text"/> UPDATE TIG AFTER ___ MIN.</p>																																	

ORBIT MANEUVER PAD FOR _____

I

OMS BOTH	1	<input type="text"/>	<div style="display: flex; align-items: center; justify-content: center;"> <div style="border-left: 1px solid black; border-right: 1px solid black; height: 40px; margin-right: 5px;"></div> <div style="font-size: 2em; margin-right: 5px;">}</div> <div style="display: flex; flex-direction: column; align-items: center;"> <div style="margin-bottom: 5px;"><input type="text"/> +X</div> <div style="margin-bottom: 5px;"><input type="text"/> -X</div> <div>MULTI-AXIS</div> </div> </div>
L	2	<input type="text"/>	
R	3	<input type="text"/>	
RCS SEL	4	<input type="text"/>	
TV ROLL	5	<input type="text"/> <input type="text"/> <input type="text"/>	
TRIM LOAD	P 6	<input type="text"/> () <input type="text"/> . <input type="text"/>	
	LY 7	<input type="text"/> () <input type="text"/> . <input type="text"/>	
	RY 8	<input type="text"/> () <input type="text"/> . <input type="text"/>	
	WT 9	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	
	TIG 10	<input type="text"/> <input type="text"/> / <input type="text"/> <input type="text"/> : <input type="text"/> <input type="text"/> : <input type="text"/> <input type="text"/> . <input type="text"/> <input type="text"/>	
TGT PEG 7	ΔV_X 19	<input type="text"/> () <input type="text"/> . <input type="text"/>	
	ΔV_Y 20	<input type="text"/> () <input type="text"/> . <input type="text"/>	
	ΔV_Z 21	<input type="text"/> () <input type="text"/> . <input type="text"/>	

	BURN ATT R 24 <input type="text"/> <input type="text"/> <input type="text"/> P 25 <input type="text"/> <input type="text"/> <input type="text"/> Y 26 <input type="text"/> <input type="text"/> <input type="text"/>	ΔV_{TOT} <input type="text"/> <input type="text"/> <input type="text"/> . <input type="text"/> TGO <input type="text"/> <input type="text"/> : <input type="text"/> <input type="text"/>
		VGO X <input type="text"/> () <input type="text"/> . <input type="text"/> VGO <input type="text"/> () <input type="text"/> . <input type="text"/> VGO Z <input type="text"/> () <input type="text"/> . <input type="text"/>
		HA <input type="text"/> <input type="text"/> <input type="text"/> HP <input type="text"/> <input type="text"/> <input type="text"/> TGT <input type="text"/> <input type="text"/> <input type="text"/> () <input type="text"/> <input type="text"/> <input type="text"/>

OMS GMBL CK: <table border="0" style="width: 100%;"> <tr> <td></td> <td style="text-align: center;">PRE</td> <td style="text-align: center;">POST-BURN</td> </tr> <tr> <td>L PRI</td> <td style="text-align: center;"><input type="text"/></td> <td style="text-align: center;"><input type="text"/></td> </tr> <tr> <td>L SEC</td> <td style="text-align: center;"><input type="text"/></td> <td style="text-align: center;"><input type="text"/></td> </tr> <tr> <td>R PRI</td> <td style="text-align: center;"><input type="text"/></td> <td style="text-align: center;"><input type="text"/></td> </tr> <tr> <td>R SEC</td> <td style="text-align: center;"><input type="text"/></td> <td style="text-align: center;"><input type="text"/></td> </tr> <tr> <td>NONE</td> <td style="text-align: center;"><input type="text"/></td> <td style="text-align: center;"><input type="text"/></td> </tr> </table>		PRE	POST-BURN	L PRI	<input type="text"/>	<input type="text"/>	L SEC	<input type="text"/>	<input type="text"/>	R PRI	<input type="text"/>	<input type="text"/>	R SEC	<input type="text"/>	<input type="text"/>	NONE	<input type="text"/>	<input type="text"/>	NOTES RCS I'CNCT: <input type="text"/> L OMS → RCS <input type="text"/> R OMS → RCS <input type="text"/> NONE	DOWN MODE OPTIONS: <input type="text"/> 2 OMS → 1 OMS <input type="text"/> 1 OMS → RCS <input type="text"/> NONE
	PRE	POST-BURN																		
L PRI	<input type="text"/>	<input type="text"/>																		
L SEC	<input type="text"/>	<input type="text"/>																		
R PRI	<input type="text"/>	<input type="text"/>																		
R SEC	<input type="text"/>	<input type="text"/>																		
NONE	<input type="text"/>	<input type="text"/>																		

OMS HE REG TEST: L,R OMSHE P/VAP ISOL <table border="0" style="width: 100%;"> <tr> <td></td> <td style="text-align: center;">GPC</td> <td style="text-align: center;">OP</td> <td style="text-align: center;">CL</td> </tr> <tr> <td>A</td> <td style="text-align: center;"><input type="text"/></td> <td style="text-align: center;"><input type="text"/></td> <td style="text-align: center;"><input type="text"/></td> </tr> <tr> <td>B</td> <td style="text-align: center;"><input type="text"/></td> <td style="text-align: center;"><input type="text"/></td> <td style="text-align: center;"><input type="text"/></td> </tr> </table>		GPC	OP	CL	A	<input type="text"/>	<input type="text"/>	<input type="text"/>	B	<input type="text"/>	<input type="text"/>	<input type="text"/>	-X RCS BURNS: <table border="0" style="width: 100%;"> <tr> <td></td> <td style="text-align: center;">BURN ATT</td> <td style="text-align: center;">LVLH ATT</td> </tr> <tr> <td>P 15</td> <td style="text-align: center;"><input type="text"/><input type="text"/><input type="text"/></td> <td style="text-align: center;">R <input type="text"/><input type="text"/><input type="text"/></td> </tr> <tr> <td>Y 16</td> <td style="text-align: center;"><input type="text"/><input type="text"/><input type="text"/></td> <td style="text-align: center;">P <input type="text"/><input type="text"/><input type="text"/></td> </tr> <tr> <td>OM 17</td> <td style="text-align: center;"><input type="text"/><input type="text"/><input type="text"/></td> <td style="text-align: center;">Y <input type="text"/><input type="text"/><input type="text"/></td> </tr> </table>		BURN ATT	LVLH ATT	P 15	<input type="text"/> <input type="text"/> <input type="text"/>	R <input type="text"/> <input type="text"/> <input type="text"/>	Y 16	<input type="text"/> <input type="text"/> <input type="text"/>	P <input type="text"/> <input type="text"/> <input type="text"/>	OM 17	<input type="text"/> <input type="text"/> <input type="text"/>	Y <input type="text"/> <input type="text"/> <input type="text"/>	ORBIT BURN MONITOR GPC FILL-INS <input type="text"/> (<input type="text"/>) <input type="text"/> CRIT BURN <input type="text"/> NON-CRIT BURN
	GPC	OP	CL																							
A	<input type="text"/>	<input type="text"/>	<input type="text"/>																							
B	<input type="text"/>	<input type="text"/>	<input type="text"/>																							
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P 15	<input type="text"/> <input type="text"/> <input type="text"/>	R <input type="text"/> <input type="text"/> <input type="text"/>																								
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OM 17	<input type="text"/> <input type="text"/> <input type="text"/>	Y <input type="text"/> <input type="text"/> <input type="text"/>																								

MAX TIG SLIP <input type="text"/> MIN. <input type="text"/>	<div style="display: flex; align-items: center; justify-content: center;"> <div style="border-left: 1px solid black; border-right: 1px solid black; height: 40px; margin-right: 5px;"></div> <div style="font-size: 2em; margin-right: 5px;">}</div> <div style="display: flex; flex-direction: column; align-items: center;"> <div style="margin-bottom: 5px;">DO NOT UPDATE TIG</div> <div>UPDATE TIG AFTER <input type="text"/> MIN.</div> </div> </div>
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ORBIT MANEUVER PAD FOR _____

OMS BOTH	1	<input style="width: 100%;" type="text"/>	<div style="display: flex; align-items: center; justify-content: center;"> <div style="border-left: 1px solid black; border-right: 1px solid black; height: 40px; margin-right: 5px;"></div> <div style="font-size: 2em; margin-right: 5px;">}</div> <div style="display: flex; flex-direction: column; align-items: center;"> <div style="margin-bottom: 5px;">+X</div> <div style="margin-bottom: 5px;">-X</div> <div>MULTI-AXIS</div> </div> </div>
L	2	<input style="width: 100%;" type="text"/>	
R	3	<input style="width: 100%;" type="text"/>	
RCS SEL	4	<input style="width: 100%;" type="text"/>	
TV ROLL	5	<input style="width: 100%;" type="text"/>	
TRIM LOAD	P	6	<input style="width: 100%;" type="text"/>
	LY	7	<input style="width: 100%;" type="text"/>
	RY	8	<input style="width: 100%;" type="text"/>
WT	9	<input style="width: 100%;" type="text"/>	
TIG	10	<input style="width: 100%;" type="text"/>	
TGT PEG 7	ΔV_X	19	<input style="width: 100%;" type="text"/>
	ΔV_Y	20	<input style="width: 100%;" type="text"/>
	ΔV_Z	21	<input style="width: 100%;" type="text"/>

<p style="text-align: center;">BURN ATT</p> <table border="0" style="width: 100%;"> <tr> <td>R</td> <td>24</td> <td><input style="width: 100%;" type="text"/></td> </tr> <tr> <td>P</td> <td>25</td> <td><input style="width: 100%;" type="text"/></td> </tr> <tr> <td>Y</td> <td>26</td> <td><input style="width: 100%;" type="text"/></td> </tr> </table>	R	24	<input style="width: 100%;" type="text"/>	P	25	<input style="width: 100%;" type="text"/>	Y	26	<input style="width: 100%;" type="text"/>	<table border="0" style="width: 100%;"> <tr> <td>ΔV_{TOT}</td> <td><input style="width: 100%;" type="text"/></td> </tr> <tr> <td>TGO</td> <td><input style="width: 100%;" type="text"/></td> </tr> <tr> <td>VGO X</td> <td><input style="width: 100%;" type="text"/></td> </tr> <tr> <td>VGO Y</td> <td><input style="width: 100%;" type="text"/></td> </tr> <tr> <td>VGO Z</td> <td><input style="width: 100%;" type="text"/></td> </tr> <tr> <td>TGT</td> <td> <table border="0" style="width: 100%;"> <tr> <td style="text-align: center;">HA</td> <td style="text-align: center;">HP</td> </tr> <tr> <td><input style="width: 100%;" type="text"/></td> <td><input style="width: 100%;" type="text"/></td> </tr> </table> </td> </tr> </table>	ΔV_{TOT}	<input style="width: 100%;" type="text"/>	TGO	<input style="width: 100%;" type="text"/>	VGO X	<input style="width: 100%;" type="text"/>	VGO Y	<input style="width: 100%;" type="text"/>	VGO Z	<input style="width: 100%;" type="text"/>	TGT	<table border="0" style="width: 100%;"> <tr> <td style="text-align: center;">HA</td> <td style="text-align: center;">HP</td> </tr> <tr> <td><input style="width: 100%;" type="text"/></td> <td><input style="width: 100%;" type="text"/></td> </tr> </table>	HA	HP	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>													
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ORBIT MANEUVER PAD FOR _____

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L	2	<input type="text"/>	
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RCS SEL	4	<input type="text"/>	
TV ROLL	5	<input type="text"/> <input type="text"/> <input type="text"/>	
TRIM LOAD	P 6	<input type="text"/> () <input type="text"/> . <input type="text"/>	
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	RY 8	<input type="text"/> () <input type="text"/> . <input type="text"/>	
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	ΔV_Y 20	<input type="text"/> () <input type="text"/> <input type="text"/> . <input type="text"/>	
	ΔV_Z 21	<input type="text"/> () <input type="text"/> <input type="text"/> . <input type="text"/>	

BURN ATT

R	24	<input type="text"/>	<input type="text"/>	<input type="text"/>
P	25	<input type="text"/>	<input type="text"/>	<input type="text"/>
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ΔV_{TOT}	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
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<p>MAX TIG SLIP __ MIN. } DO NOT UPDATE TIG</p> <p style="margin-left: 150px;">UPDATE TIG AFTER __ MIN.</p>																																											

ORBIT MANEUVER PAD FOR _____

OMS BOTH	1	<input type="text"/>		
L	2	<input type="text"/>		
R	3	<input type="text"/>		
RCS SEL	4	<input type="text"/>	<input type="text"/> +X <input type="text"/> -X <input type="text"/> MULTI-AXIS	
TV ROLL	5	<input type="text"/>		
TRIM LOAD	P 6	<input type="text"/>		
	LY 7	<input type="text"/>		
	RY 8	<input type="text"/>		
	WT 9	<input type="text"/>		
	TIG 10	<input type="text"/>		
TGT PEG 7	ΔV_X 19	<input type="text"/>	<input type="text"/>	<input type="text"/>
	ΔV_Y 20	<input type="text"/>	<input type="text"/>	<input type="text"/>
	ΔV_Z 21	<input type="text"/>	<input type="text"/>	<input type="text"/>

BURN ATT

R 24	<input type="text"/>	<input type="text"/>	<input type="text"/>
P 25	<input type="text"/>	<input type="text"/>	<input type="text"/>
Y 26	<input type="text"/>	<input type="text"/>	<input type="text"/>

ΔV_{TOT}	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
TGO	<input type="text"/>	:	<input type="text"/>	<input type="text"/>
VGO X	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
VGO	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
VGO Z	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
	HA	HP		
TGT	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

OMS GMBL CK:		NOTES	
		PRE	POST-BURN
L PRI	<input type="text"/>	<input type="text"/>	<input type="text"/>
L SEC	<input type="text"/>	<input type="text"/>	<input type="text"/>
R PRI	<input type="text"/>	<input type="text"/>	<input type="text"/>
R SEC	<input type="text"/>	<input type="text"/>	<input type="text"/>
NONE	<input type="text"/>	<input type="text"/>	<input type="text"/>
		RCS I'CNCT:	DOWN MODE OPTIONS:
		<input type="text"/> L OMS → RCS	<input type="text"/> 2 OMS → 1 OMS
		<input type="text"/> R OMS → RCS	<input type="text"/> 1 OMS → RCS
		<input type="text"/> NONE	<input type="text"/> NONE
OMS HE REG TEST: L,R OMSHE P/VAP ISOL	-X RCS BURNS:	ORBIT BURN MONITOR	
GPC OP CL	BURN ATT	LVLH ATT	GPC FILL-INS __ (__)
A <input type="text"/>	P 15 <input type="text"/>	R <input type="text"/>	<input type="text"/> CRIT BURN
B <input type="text"/>	Y 16 <input type="text"/>	P <input type="text"/>	<input type="text"/> NON-CRIT BURN
	OM 17 <input type="text"/>	Y <input type="text"/>	
MAX TIG SLIP __ MIN. } <div style="display: inline-block; vertical-align: middle; margin-left: 10px;"> <input type="text"/> DO NOT UPDATE TIG <input type="text"/> UPDATE TIG AFTER __ MIN. </div>			

ORBIT MANEUVER PAD FOR _____

I

OMS BOTH	1	<input type="text"/>	<div style="display: flex; align-items: center; justify-content: center;"> <div style="border-left: 1px solid black; border-right: 1px solid black; height: 40px; margin: 0 5px;"></div> <div style="font-size: 2em; margin: 0 5px;">}</div> <div style="display: flex; flex-direction: column; align-items: center;"> <div style="margin-bottom: 5px;"><input type="text"/> +X</div> <div style="margin-bottom: 5px;"><input type="text"/> -X</div> <div>MULTI-AXIS</div> </div> </div>
L	2	<input type="text"/>	
R	3	<input type="text"/>	
RCS SEL	4	<input type="text"/>	
TV ROLL	5	<input type="text"/> <input type="text"/> <input type="text"/>	
TRIM LOAD	P 6	<input type="text"/> () <input type="text"/> . <input type="text"/>	
	LY 7	<input type="text"/> () <input type="text"/> . <input type="text"/>	
	RY 8	<input type="text"/> () <input type="text"/> . <input type="text"/>	
	WT 9	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	
	TIG 10	<input type="text"/> <input type="text"/> / <input type="text"/> <input type="text"/> : <input type="text"/> <input type="text"/> : <input type="text"/> <input type="text"/> . <input type="text"/> <input type="text"/>	
TGT PEG 7	ΔV_X 19	<input type="text"/> () <input type="text"/> . <input type="text"/>	
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	BURN ATT	
R 24	<input type="text"/> <input type="text"/> <input type="text"/>	
P 25	<input type="text"/> <input type="text"/> <input type="text"/>	
Y 26	<input type="text"/> <input type="text"/> <input type="text"/>	
		ΔV_{TOT} <input type="text"/> <input type="text"/> <input type="text"/> . <input type="text"/> TGO <input type="text"/> : <input type="text"/> <input type="text"/>
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OMS GMBL CK:	NOTES																										
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MAX TIG SLIP ____ MIN.	<table border="0" style="width: 100%;"> <tr> <td style="border: 1px solid black; width: 30px; height: 20px; margin-right: 5px;"></td> <td>DO NOT UPDATE TIG</td> </tr> <tr> <td style="border: 1px solid black; width: 30px; height: 20px; margin-right: 5px;"></td> <td>UPDATE TIG AFTER ____ MIN.</td> </tr> </table>		DO NOT UPDATE TIG		UPDATE TIG AFTER ____ MIN.
	DO NOT UPDATE TIG				
	UPDATE TIG AFTER ____ MIN.				

RENDEZVOUS TIMELINE

RENDEZVOUS
TIMELINE

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AFT FLT STATION CONFIG FOR RNDZ 4A

O14,16:E √cb MNA,C DDU AFT (two) - cl

A6U ADI ATT - LVLH
ERR - MED
RATE - LO
SENSE - minus Z

R13 √KU ANT - GND
A1U √PWR - ON
sel - MAN SLEW
MODE - RDR PASSIVE
RADAR OUTPUT - HI
CNTL - PNL
SIG STRENGTH sel - KU
SLEW RATE - as reqd

A2 DIGI-DIS sel - R/RDOT
X-PNTR SCALE - X1

SM ANTENNA

CRT SELF TEST - ITEM 7 EXEC (*)

NOTE
SELF TEST runs about 3 min

A1U √KU SCAN WARN tb - gray
√TRACK tb - gray
√SEARCH tb - gray

A2 √RANGE - 888.8
DIGI-DIS sel - EL/AZ

CRT SELF TEST - ITEM 7 EXEC (no *)

A1U KU MODE - COMM
sel - GPC
CNTL - CMD

Install:

-Z COAS
RCS BURN Cue Card
KU OPS Cue Card
APPROACH Cue Card
TARGET ALIGNMENT Cue Card
DOCKING SEQUENCE Cue Card
Velcro over Aft DAP PCT pbi (SPARE pbi)

PET

-03:00

CDR AFT FLT STATION CONFIG FOR RNDZ 4A

A7(B7)

PLT RNDZ OPS INITIALIZATION 5A

MCC UPDATE
Final NH Burn Pad,
3-5 (if reqd)

MCC UPLINK
ORB SV
TGT SV
Drag K-factor

RNDZ OPS INITIALIZATION 5A

√DPS Config for Rndz Ops - String 1233

SM 2 TIME

Set SM TIMER counting to Ti TIG per burn Pad, 3-6

Config DAP A,B to A7,B7

Record nominal TIGs in burn solution blocks per Execute Package:

NCC TIG pg 4-11

MC1 TIG pg 4-17

MC2 TIG pg 4-18

GNC 55 GPS STATUS

DES RCVR, ITEM 27 - (*)

√INH GPS to G&C, ITEM 33 - (*)

NAV, ITEM 36 - (*)

-02:55

MS Perform SSOR ACTIVATION (SODF: JOINT OPS, COMM/DATA PROC), steps 1 and 2

-02:50

CDR If NH reqd:
If OMS BURN, Perform RNDZ OMS BURN, steps 1-4 (CONTINGENCY OPS), 5-4
If +X RCS burn, Perform RCS BURN, steps 1-5 (Cue Card)

Postburn DAP: A/LVLH/VERN(ALT)

-02:45

-02:40

-02:35

-02:30

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PET

-02:30

A7(B7)

← TIG-5 MIN

-02:25

← If reqd,
NH TIG
Postburn DAP: A/LVLH/VERN(ALT)

-02:20

-02:15

PLT ENABLE RENDEZVOUS NAV [7A]

MS √PGSCs setup per PGSC Usage Chart (if available) or UTILITY OUTLET PLUG-IN
PLAN ORBIT CONFIGURATION (REF DATA FS, UTIL PWR)

PLT, On RPOP PGSCs:
MS Perform RPOP INITIALIZATION (RNDZ TOOLS), 7-8, then
Perform RPOP OPS (RNDZ TOOLS), 7-9, then
Perform TCS ACTIVATION, step 1 (RNDZ TOOLS), 7-18

-02:10

MS Perform HHL CHECKOUT (RNDZ TOOLS), 7-6

-02:05

MCC UPDATE
Final NC Burn Pad,
3-3

-02:00

ENABLE RENDEZVOUS NAV [7A]

1. GNC 33 REL NAV
CRT RNDZ NAV ENA - ITEM 1 EXEC (*)
√SV SEL, ITEM 4 - PROP
√INH RNG, ITEM 18 - (*)
RDOT, ITEM 21 - (*)
Angles, ITEM 24 - (*)
√S TRK, ITEM 12 - (*)
2. GNC 34 ORBIT TGT
TGT NO - ITEM 1 +1 EXEC
Set BASE TIME to Ti TIG, (Ti Burn Pad, 3-6)
LOAD - ITEM 26 EXEC

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PET

-02:00

A7(B7)

CDR LOAD TARGET TRACK [9A]

NOTE
If NH performed, delay mnvr to NC burn attitude until NC TIG - 5 min to minimize

MCC UPDATE
STAR TRK NAV
IMU DES _____
[10A] , 4-10

CDR If OMS BURN, Perform RNDZ OMS BURN, steps 1-4 (CONTINGENCY OPS), 5-4
If +X RCS burn, Perform RCS BURN, steps 1-5 (Cue Card)

-01:55

-01:50

-01:45

-01:40

← TIG-5 MIN

-01:35

← [NC TIG]

CDR INITIATE TARGET TRACK [9B]

PLT TARGET NCC BURN [11A] (Preliminary), 4-11

-01:30

LOAD TARGET TRACK [9A]

√DAP: A/LVLH/VERN(ALT)

[GNC UNIV PTG]

CRT CNCL - ITEM 21 EXEC
TGT ID +1

	<u>-Z AXIS</u>	<u>-Y STRK</u>
BODY VECT	+3 (-Z)	+4
P	√+90	√+0
Y	√+0	√+280.57
OM	+0	+90

Do not INITIATE TARGET TRACK [9B] until post NC

INITIATE TARGET TRACK [9B]

[GNC UNIV PTG]

TRK - ITEM 19 EXEC (CUR - *)
DAP: B/AUTO/ALT

When MNVR cmplt,
DAP: A/AUTO/VERN(ALT)

STAR TRACKER NAV 10A

1. CONFIG FOR STRK NAV

√DAP: A/AUTO/VERN(ALT)

Turn down cabin lights to optimize target viewing through -Z COAS/overhead window

IMU for Deselect _____ (If no comm, use IMU 1 for deselect)

GNC 21 IMU ALIGN

CRT IMU DES - ITEM 7(8,9) EXEC (*)

√MCC for NAV selected IMU _____

GNC 33 REL NAV

If first NAV pass,

√SV SEL, ITEM 4 - PROP

If previous NAV,

√SV SEL, ITEM 4 - FLTR

√INH Angles, ITEM 24 - (*)

√S TRK, ITEM 12 - (*)

GNC 22 S TRK/COAS CNTL

-Y THOLD - ITEM 13 +3 EXEC

-Z THOLD - ITEM 14 +3 EXEC

-Z (-Y) TGT TRK - ITEM 6(5) EXEC (*)

√STATUS - blank

√SHUTTER - op

2. INITIAL MEASUREMENT EVALUATION

GNC 22 S TRK/COAS CNTL

When S PRES - (*), continue

GNC 33 REL NAV

Monitor RESID V and H each NAV cycle for at least four consecutive cycles (~30 sec)

Record init RESID V = _____

H = _____

If RESID V or H changes by > 0.05 each cycle:

GNC 22 S TRK/COAS CNTL

-Z(-Y) BREAK TRK - ITEM 8(7) EXEC

Repeat Step 2

If RESID V or H > 0.6:

GNC 22 S TRK/COAS CNTL

-Z(-Y) BREAK TRK - ITEM 8(7) EXEC

When S PRES - (*), if RESID V or H still > 0.6 and stable:

Perform S TRK NAV - HIGH INITIAL RESID (CONTINGENCY OPS), 5-8

3. INCORPORATE DATA INTO NAV

If SV SEL = PROP:

AUTO Angles - ITEM 23 EXEC (*)

Record 1st SV UPDATE POS = _____

When SV UPDATE POS < 1.0 and Angle ACPT > 9:

SV SEL - ITEM 4 EXEC (FLTR) >>

If SV = FLTR:

FLTR TO PROP - ITEM 8 EXEC

AUTO Angles - ITEM 23 EXEC (*)

Record 1st SV UPDATE POS = _____

* If FLTR MINUS PROP changes by more than 8 kft within a S TRK pass: *

* Perform S TRK NAV - HIGH FLTR MINUS PROP *

* (CONTINGENCY OPS), 5-9 *

END S TRK NAV 10B

GNC 33 REL NAV

CRT INH Angles - ITEM 24 EXEC (*)

GNC 21 IMU ALIGN

IMU DES - ITEM 7(8,9) EXEC (no *)

PET

-01:30

A7(B7)

PLT STAR TRACKER NAV 10A

MCC UPDATE
Nav Selected IMU

-01:25

MCC UPDATE
Ground NCC Burn
Solution

When NAV converged (SV UPDATES small and stable):

-01:20

CDR TARGET NCC BURN 11A (Intermediate)

-01:15

-01:10

← TIG-10 MIN √MCC for burn type

```

*****
* If no comm *
* If ΔVT > 6 fps: *
*   END S TRK NAV 10B *
*   TARGET NCC BURN 11A (Final) *
*   Perform RNDZ OMS BURN (CONTINGENCY OPS), 5-4*
* If ΔVT > 4 fps: *
*   END S TRK NAV 10B *
*   TARGET NCC BURN 11A (Final) *
*   Perform +X Burn, RCS BURN (Cue Card) *
*****

```

-01:05

PLT END S TRK NAV 10B

← TIG-5 MIN

PLT TARGET NCC BURN 11A (Final)

-01:00

CDR Perform RCS BURN (Cue Card)

TARGET NCC BURN 11A

FINAL SOLUTION

OPS 202 PRO
GNC ORBIT MNVR EXEC
√Eng Sel CORRECT

CRT √SV SEL correct

GNC 34 ORBIT TGT

TGT NO - ITEM 1 +9 EXEC

√TGT Set data:

T1 TIG = NCC BURN SOLUTION TIG

EL +0

ΔT +57.7

ΔX -48.6

ΔY +0.0

ΔZ +1.2

COMPUTE T1 - ITEM 28 EXEC

Record solution in PAD

FINAL SOLUTION

If > 40 marks in current sensor pass and
SV UPDATE POS < 0.5 for the last 4 marks:

| Burn FLTR soln

If FLTR within ground solution limits:

| Burn FLTR soln

If PROP within ground solution limits:

| Burn PROP soln

If none of the above:

| Burn ground soln EXT ΔVs

NCC BURN SOLUTION

TIG [] [] [] / [] [] : [] [] : [] []

PRELIMINARY

ΔVX	()			.	
ΔVY	()			.	
ΔVZ	()			.	
ΔVT				.	

INTERMEDIATE

()				.	
()				.	
()				.	
				.	

FINAL

ΔVX	()			.	
ΔVY	()			.	
ΔVZ	()			.	
ΔVT				.	

GROUND

()				.	
()				.	
()				.	
				.	

FINAL - GROUND LIMITS

(0.5)

(1.6)

(1.9)

-Z AXIS TARGET TRACK 12A

GNC UNIV PTG

CRT $\sqrt{\text{TGT ID}}$ +1
BODY VECT +3 (-Z)
OM +0
C3 DAP: B/AUTO/ALT
CRT TRK - ITEM 19 EXEC (CUR - *)

When MNVR cmplt,
DAP: A/AUTO/VERN(ALT)

PET

-01:00

A7(B7)

← NCC TIG

-00:55

PLT TARGET TI BURN 13A (Preliminary)

IF Y S TRK TRACK

CDR -Z AXIS TARGET TRACK 12A

-00:50

When:

GNC 33 REL NAV
 NAV RNG < 150 KFT:
 KU OPS, step 1 (Cue Card)

MS

-00:45

If no lock-on by
 10 minutes after initial search:
 KU OPS, step 2 (Cue Card)

MS

-00:40

When RR RNG < 135 KFT:
 Perform RR NAVIGATION 13B

PLT

-00:35

When NAV converged (SV UPDATES small and stable):

PLT TARGET TI BURN 13A (Intermediate)

-00:30

MCC UPDATE
 RNDZ PRPLT PAD

TARGET TI BURN 13A

CRT √SV SEL correct
 GNC 34 ORBIT TGT
 TGT NO - ITEM 1 +1.0 EXEC
 √TGT Set data:
 T1 TIG = BASE TIME
 EL +0
 ΔT +76.9
 ΔX -0.9
 ΔY +0
 ΔZ +1.8
 COMPUTE T1 - ITEM 28 EXEC
 Record solution in PAD

RR NAVIGATION 13B

GNC 33 REL NAV

CRT RR - ITEM 13 EXEC (*)
 √Elev, Az approx 0

Record Initial RESID RANGE = _____
 RDOT = _____

**IF RESID RANGE > 5.0 or
 RDOT > 3.0**

SV SEL - ITEM 4 EXEC (PROP)
 Proceed with taking data and contact MCC
 as soon as practical

FLTR TO PROP - ITEM 8 EXEC
 AUTO RNG - ITEM 17 EXEC (*)
 RDOT - ITEM 20 EXEC (*)
 Angles - ITEM 23 EXEC (*)

Record 1st SV UPDATE POS = _____

IF SV SEL = PROP

When SV UPDATE POS < 0.3 and MARK ACPT > 9:
 SV SEL - ITEM 4 EXEC (FLTR)

Ti_BURN SOLUTIONS

PREL FLTR

()			.	
()			.	
()			.	
			.	

INTER FLTR

()			.	
()			.	
()			.	
			.	

FINAL FLTR

()			.	
()			.	
()			.	
			.	

GND

()			.	
()			.	
()			.	
			.	

FINAL Ti Burn Pad, 3-7

PROP
(If Reqd)

()			.	
()			.	
()			.	
			.	

FINAL - GROUND
LIMITS

ΔV_X (0.6)
 ΔV_Y (1.1)
 ΔV_Z (0.9)

PET

-00:30

A7(B7)

-00:25

√MCC for burn type. If no comm:

If $\Delta VT > 6$, at TIG-17:

| Perform RNDZ OMS BURN (CONTINGENCY OPERATIONS), 5-4

If $4 \leq \Delta VT \leq 6$, at TIG-17:

| Perform +X RCS burn, RCS BURN (Cue Card)

If $\Delta VT < 4$, at TIG-5:

| Perform multi-axis RCS burn, RCS BURN (Cue Card)

MCC UPDATE

Ti Final Ground

Soln, 3-7

Ti DELAY Burn

PAD, 3-8

-00:20

IF RNDZ DELAY

CDR Perform Ti DELAY BURN (CONTINGENCY OPS), 5-25

-00:15

← TIG-17

If Ti is multi-axis burn, delay final targeting until TIG-5

PLT TARGET Ti BURN 15A (Final)

If Ti is +X RCS burn:

CDR | Perform RCS BURN (Cue Card)

If Ti is OMS BURN:

| Perform RNDZ OMS BURN (CONTINGENCY OPERATIONS), 5-4

MCC UPDATE

GO for Ti

-00:10

-00:05

← TIG-5

If Ti is multi-axis burn:

CDR | Perform RCS BURN (Cue Card)

00:00

← Ti TIG

TARGET Ti BURN 15A (Final)

CRT OPS 202 PRO

GNC ORBIT MNVR EXEC

Load Eng Sel, TVR, WT and Trims for Ti per Final Ti Burn Pad
LOAD - ITEM 22 EXEC

GNC 33 REL NAV

√SV SEL correct

GNC 34 ORBIT TGT

TGT NO - ITEM 1 +1 0 EXEC

√TGT Set data:

T1 TIG = BASE TIME

EL +0

ΔT +76.9

ΔX -0.9

ΔY +0

ΔZ +1.8

COMPUTE T1 - ITEM 28 EXEC

Record solution in PAD

FINAL SOLUTION

If > 40 marks in current sensor pass and
SV UPDATE POS < 0.5 for the last 4 marks:

| Burn FLTR soln

If FLTR within ground solution limits:

| Burn FLTR soln

If PROP within ground solution limits:

| Burn PROP soln

If none of the above:

| Burn ground soln EXT ΔV s

POST Ti NAV 16A

A6U √DAP: A/AUTO/VERN(ALT)
A1U √KU sel - GPC

GNC 33 REL NAV

IF SV SEL = FLTR:

FLTR TO PROP - ITEM 8 EXEC (*)

If RR Tracking TGT:

√AUTO Angles - ITEM 23 EXEC (*)

If RR NOT Tracking TGT:

√Inhibit Data

Perform KU OPS, steps 2 and 3 (Cue Card)

If still no RR ACQ, assume RR Fail

GNC 22 S TRK/COAS CNTL

CRT √Z TGT TRK - ITEM 6 EXEC (*)

IF RR FAIL

If -Z Star Tracker:

√-Z TGT TRK ATT, then:

Perform STAR TRACKER NAV 10A

If COAS NAV:

√-Z TGT TRK ATT, then:

Perform COAS NAVIGATION (CONTINGENCY OPS), 5-10

If -Y Star Tracker:

GNC UNIV PTG

TGT ID +1

BODY VECT +4

P √+0

Y √+280.57

OM +90

DAP: B/AUTO/ALT

TRK - ITEM 19 EXEC

When MNVR cmplt:

DAP: A/AUTO/VERN(ALT)

Perform STAR TRACKER NAV 10A

NIGHTTIME STRK OPS 16B

1. GNC 33 REL NAV

INH Angles - ITEM 24 EXEC (*)

At sunset,

2. GNC 22 S TRK/COAS CNTL

-Z(-Y) THOLD - ITEM 14(13) +0 EXEC

3. Perform STAR TRACKER NAV 10A, steps 2 and 3

PET

00:00 PLT TARGET MC 1 BURN 17A (Preliminary)
A7(B7)

CDR When MNVR to att cmlpt:
POST TI NAV 16A

00:05

MCC UPDATE
Prox Ops Cov Matrix

00:10 PLT When NAV converged, (SV UPDATES small and stable):
TARGET MC 1 BURN 17A (Intermediate)

MS √Time of OOP null

00:15

← TIG-3 MIN
PLT TARGET MC 1 BURN 17A (Final)
Perform RCS BURN (Cue Card)

00:20 ← [MC 1 TIG]

PLT TARGET MC 2 BURN 17B (Preliminary)

00:25

PLT When Y = 0:
MANUAL OUT-OF-PLANE NULL 19A

IF S TRK NAV
At sunset-2 minutes:
PLT NIGHTTIME STRK OPS 16B

00:30

TARGET MC 1 BURN 17A

CRT √SV SEL correct
GNC 34 ORBIT TGT
TGT NO - ITEM 1 +1 1 EXEC
√TGT Set data:
T1 TIG = MC1 BURN SOLUTION TIG
EL +0
ΔT +56.9
ΔX -0.9
ΔY +0
ΔZ +1.8
COMPUTE T1 - ITEM 28 EXEC
Record solution in PAD

MC 1 BURN SOLUTION

TIG	[] [] [] []	/	[] [] [] []	:	[] [] [] []	:	[] [] [] []	
	PRELIMINARY				INTERMEDIATE			
ΔVX	()	[]	[]	[]	[]	[]	[]	
ΔVY	()	[]	[]	[]	[]	[]	[]	
ΔVZ	()	[]	[]	[]	[]	[]	[]	
ΔVT	[]	[]	[]	[]	[]	[]	[]	
	FINAL				MEAN ± (3σ VARIATION)			
ΔVX	()	[]	[]	[]	[]	[]	0.1 ± (0.6)	
ΔVY	()	[]	[]	[]	[]	[]	0.2 ± (0.6)	
ΔVZ	()	[]	[]	[]	[]	[]	-0.1 ± (1.4)	
ΔVT	[]	[]	[]	[]	[]	[]		

TARGET MC 2 17B (Preliminary)

CRT √SV SEL correct
GNC 34 ORBIT TGT
TGT NO - ITEM 1 +1 2 EXEC
√TGT Set data:
T1 TIG = MC2 BURN SOLUTION TIG
EL +29.07
ΔT +27.0
ΔX -0.9
ΔY +0
ΔZ +1.8
COMPUTE T1 - ITEM 28 EXEC
NOTE
If TGT EL ANG Alarm,
ΔV still valid for current TIG,
TIG slip limits still apply
Record solution in PAD

TARGET MC 2 BURN 18A (Intermediate)

CRT √SV SEL correct
 GNC 34 ORBIT TGT
 TGT NO - ITEM 1 +1 2 EXEC
 COMPUTE T1 - ITEM 28 EXEC
 Record solution in PAD

TARGET MC 2 BURN 18B (Final)

CRT √SV SEL correct
 GNC 34 ORBIT TGT
 TGT NO - ITEM 1 +1 2 EXEC
 COMPUTE T1 - ITEM 28 EXEC
 √TIG change

IF TIG CHANGE < -3 OR > +7 MIN

Set BASE TIME to (Nominal MC 2 TIG -3 or +7 min as appropriate)

LOAD - ITEM 26 EXEC
 TGT NO - ITEM 1 +1 9 EXEC

√TGT Set data:

T1 TIG = BASE TIME
 EL +0
 ΔT +27.0
 ΔX -0.9
 ΔY +0
 ΔZ +1.8

COMPUTE T1 - ITEM 28 EXEC

Set EVENT TIMER counting to MC 2 TIG
 Record solution in PAD

GNC 33 REL NAV

CRT FLTR TO PROP - ITEM 8 EXEC

END S TRK NAV 18C

GNC 33 REL NAV

CRT INH Angles - ITEM 24 EXEC (*)

GNC 21 IMU ALIGN

IMU DES - ITEM 7(8,9) EXEC (no *)

MC 2 BURN SOLUTION

PRELIMINARY

ΔVX	()			.	
ΔVY	()			.	
ΔVZ	()			.	
ΔVT				.	

INTERMEDIATE

()			.	
()			.	
()			.	
			.	

FINAL

ΔVX	()			.	
ΔVY	()			.	
ΔVZ	()			.	
ΔVT				.	

MEAN ± (3σ VARIATION)

+0.0 ± (0.4)

+0.0 ± (0.2)

+0.2 ± (2.0)

TIG

TIG SLIP
(COMPUTED-NOM)

PREL	<input type="text"/>	/	<input type="text"/>	:	<input type="text"/>	:	<input type="text"/>	_____	:	_____
INTER	<input type="text"/>	/	<input type="text"/>	:	<input type="text"/>	:	<input type="text"/>	_____	:	_____
FINAL	<input type="text"/>	/	<input type="text"/>	:	<input type="text"/>	:	<input type="text"/>	_____	:	_____
NOMINAL	<input type="text"/>	/	<input type="text"/>	:	<input type="text"/>	:	<input type="text"/>	_____	:	_____

-Z AXIS TARGET TRACK 18D

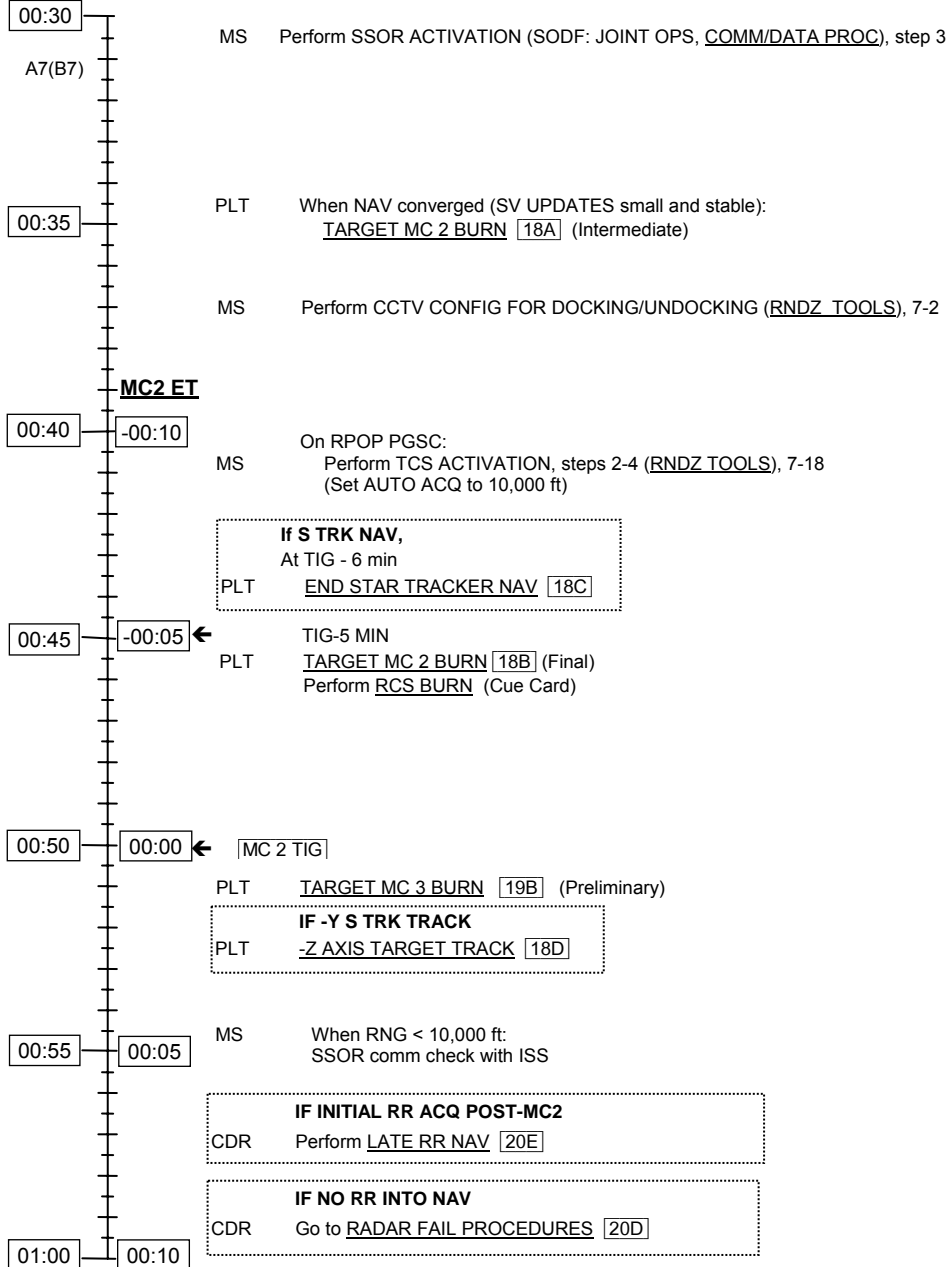
GNC UNIV PTG

CRT √TGT ID +1
 BODY VECT +3 (-Z)
 OM +0

C3 DAP: B/AUTO/ALT
 CRT TRK - ITEM 19 EXEC (CUR - *)

When MNVR cmplt,
 DAP: A/AUTO/VERN(ALT)

PET



MANUAL OUT-OF-PLANE NULL 19A

GNC 33 REL NAV

CRT When Y = 0:
F7 FLT CNTLR PWR - ON
DAP: A/AUTO/PRI
DAP TRANS: as reqd
THC: Null YDOT

If -Z AXIS TRACK,
+YDOT = FWD THC left
AFT THC right

If -Y S TRK TRACK,
+YDOT = FWD THC down
AFT THC out

F7 FLT CNTLR PWR - OFF
DAP: A/AUTO/ALT
When rates nulled:
DAP: VERN(ALT)

TARGET MC 3 19B

CRT √SV SEL correct
GNC 34 ORBIT TGT
TGT NO - ITEM 1 + 1 3 EXEC
√TGT Set data:
T1 TIG = BASE TIME + 0/00:17:00
EL +0
ΔT +10.0
ΔX -0.9
ΔY +0
ΔZ +1.8
COMPUTE T1 - ITEM 28 EXEC
Record solution in PAD

MC 3 BURN SOLUTION

TIG / : :

	PRELIMINARY	FINAL	MEAN ± (3σ VARIATION)
ΔVX	()	()	-0.4 ± (1.9)
ΔVY	()	()	-0.1 ± (0.5)
ΔVZ	()	()	-0.5 ± (2.9)
ΔVT	()	()	

MC 4 BURN SOLUTION

TIG / : :

	PRELIMINARY				FINAL				MEAN ± 3σ VARIATION
ΔVX	()			.	()			.	+1.9 ± (3.6)
ΔVY	()			.	()			.	+0.0 ± (0.5)
ΔVZ	()			.	()			.	+1.1 ± (3.4)
ΔVT				.				.	

TARGET MC 4 BURN **20A**

CRT √SV SEL correct
GNC 34 ORBIT TGT
 TGT NO - ITEM 1 +14 EXEC
 √TGT Set data:
 T1 TIG = BASE TIME + 0/00:27:00
 EL +0
 ΔT +13.0
 ΔX +0
 ΔY +0
 ΔZ +0.6
 COMPUTE T1 - ITEM 28 EXEC
 Record solution in PAD

ESTABLISH RBAR **20C**

A6U FLT CNTLR PWR - ON
GNC UNIV PTG
 CRT TRK - ITEM 19 EXEC (CUR - *)
 DAP: A/AUTO/VERN(PRI)
 THC: as reqd to control TGT motion in COAS

CONFIG FOR RBAR **20B**

GNC UNIV PTG
 √ERR TOT - ITEM 23 EXEC (*)

When ERR <2 deg each axis
GNC 20 DAP CONFIG
 Config DAP A,B to A8,B8

GNC UNIV PTG
 TGT ID +2
 BODY VECT +5
 P +270
 Y +0
 OM +0

Do not initiate Target Track until **ESTABLISH RBAR 20C**

LATE RADAR NAV **20E**

GNC 33 REL NAV
 CRT FLTR TO PROP - ITEM 8 EXEC
 SV SEL, ITEM 4 - PROP
 √RR - ITEM 13 EXEC (*)
 AUTO RNG - ITEM 17 EXEC (*)
 RDOT - ITEM 20 EXEC (*)
 Angles - ITEM 23 EXEC (*)
 Go to **RADAR FAIL PROCEDURE 20D**

RADAR FAIL PROCEDURE **20D**

Note: When TGT visible, report TGT Tally-Ho to MCC
 MS If TGT outside COAS reticle, config CCTV as reqd to measure vertical position

- At MC2 TIG+14:00 (MC3 TIG-3:00):
 PLT **TARGET MC3 19B** (final)
 CDR Perform **RCS BURN** (Cue Card)

**AT MC2+18 IF NO VISUAL ACQUISITION OR
 TARGET > 30 DEG FROM COAS HORIZONTAL**
 CDR Go to RNDZ BREAKOUT (**CONTINGENCY OPS**), 5-18 >>

- At MC2 TIG + 19:00:
 A6U FLT CNTLR PWR - ON
 √SENSE - -Z
 DAP: A/LVLH/PRI
 √COAS for TGT vertical position
 THC: +X (or -X) per COAS LOGIC:
 If TGT = N deg high in COAS, perform 2N +X (up) pulses
 If TGT = N deg low in COAS, perform 1N -X (down) pulses
 DAP: A/LVLH/VERN(PRI)
 Inform MCC of TGT vertical position in COAS and number of pulses performed
 Following radar fail X correction,
 THC: As reqd to control out of plane motion and manage RDOT
 Perform **CONFIG FOR RBAR 20B**
- At MC2 TIG + 24:00 or 2000 ft, whichever comes first:
GNC UNIV PTG
 CRT TRK - ITEM 19 EXEC (CUR - *)
 A6U DAP: A/AUTO/VERN (PRI)
 THC: as reqd to stabilize and maintain TGT docking port between 0 and 10 deg high in COAS

At 2000 ft:
 Perform **APPROACH** (Cue Card)

PET **MC2 ET**

01:00 00:10

A7(B7)



TIG-3 MIN

01:05 00:15

PLT

TARGET MC3 BURN [19B] (Final)
Perform RCS BURN (Cue Card)



MC 3 TIG

CREW REPORT
ISS tally-ho

PLT

TARGET MC 4 BURN [20A] (Preliminary)

A8(B8)

CDR

CONFIG FOR RBAR [20B]

01:10 00:20

MS

Perform HHL OPS (RNDZ TOOLS), 7-7



TIG-3 MIN

01:15 00:25

PLT

TARGET MC 4 [20A] (Final)
Perform RCS BURN (Cue Card)

HHL REPORT
R and Rdot



MC 4 TIG

CDR

ESTABLISH RBAR [20C]
Perform APPROACH (Cue Card)

MANUAL TRAJECTORY CONTROL

01:20 00:30

Transition to APPROACH (Cue Card)

01:25 00:35

01:30 00:40

TERMINATE RNDZ OPS [22A]

PLT [GNC 23 RCS]
CRT RCS F – ITEM 1 EXEC (*)
JET DES F3F – ITEM 33 EXEC (*)
F1U – ITEM 17 EXEC (*)
F3U – ITEM 19 EXEC (*)
F2U – ITEM 21 EXEC (*)

Exit RPOP - [Shift]/[F10]
Perform TCS DEACTIVATION (RNDZ TOOLS), 7-20
-Z COAS - OFF

[GNC 20 DAP CONFIG]

Config DAP A,B to A12,B12
X JET ROT ENA – ITEM 7 EXEC (*)

DAP: LO Z

If Loss of Verns:

DAP: B/ALT

DAP: LVLH

If VERN:

DAP: LVLH

* If ISS attitude control required, *

* Perform HANDOVER ATTITUDE CONTROL ORBITER TO *

* CMG TA, (SODF: JOINT OPS, MATED OPERATIONS) *

MS Perform DOCKING MECHANISM POWERDOWN (APDS), 8-6
Perform HHL STOW (RNDZ TOOLS), 7-6

CDR A6U ✓FLT CNTLR PWR - OFF

[GNC 33 REL NAV]

RNDZ NAV ENA - ITEM 1 EXEC (no *)

[GNC 22 S TRK/COAS CNTL]

-Z(-Y) STAR TRK - ITEM 4(3) EXEC (*)

-Z THOLD - ITEM 14 + 0 EXEC

-Y THOLD - ITEM 13 + 0 EXEC

[GNC 55 GPS STATUS]

DES RCVR - ITEM 27 (no *)

A6L LTS TRUSS FWD, AFT (two) - OFF
VEST PORT, STBD (two) - OFF

CONTINGENCY OPS

RNDZ OMS BURN.....	5-3
SENSOR FAIL	5-7
S TRK NAV – HIGH INITIAL RESID	5-8
FLTR MINUS PROP	5-9
COAS NAVIGATION.....	5-10
BACKOUT/BREAKOUTS	5-11
VBAR CORRIDOR BACKOUT	5-12
BREAKOUT.....	5-14
SHUTTLE NOSE IN-PLANE BREAKOUT (R < 500 ft)	5-16
RNDZ BREAKOUT	5-18
EXPEDITED SEPS.....	5-19
SHUTTLE EMERGENCY SEPARATION	5-21
ANY ATTITUDE SEPARATION	5-23
Ti DELAY BURN.....	5-25
RNDZ NAV RECOVERY	5-27
LOSS OF VRCS	5-28
LO Z BRAKING	5-29
TGT ITER.....	5-30

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RNDZ OMS BURN

RNDZ OMS BURN

RNDZ OMS
BURN

1. OMS BURN PREP
C2 Wedge Install OMS2/ORBIT OMS BURNS (Cue Cards) (two) and ORBIT BURN MONITOR (Cue Cards) (two) (F6,F8)

1: GNC 20 DAP CONFIG

CRT1 √DAP config A7,B7
GNC, OPS 202 PRO

1: GNC ORBIT MNVR EXEC

2: GNC SYS SUMM 2

2. LOAD TGT DATA
If onboard computed burn:
| √Eng sel, TV ROLL, TRIM LOAD, and WT per Burn Pad
| √TIG and TGT PEG 7 ΔVs per Final ORBIT TGT solution
| √Guidance option is LAMBERT
If ground computed burn:
√TGT data per Burn Pad (reload WT as reqd)
LOAD – ITEM 22 EXEC
TIMER – ITEM 23 EXEC
√Burn data

C3 DAP: A/AUTO/ALT(B/ALT as reqd)

CRT1 MNVR – ITEM 27 EXEC (*)

If RR ops:
A1U KU sel – AUTO TRK

1: GNC 33 REL NAV

CRT1 INH Angles – ITEM 24 EXEC (*)

1: GNC ORBIT MNVR EXEC

When mnvr to att complete:
C3 √DAP: A/AUTO/ALT

3. PERFORM RNDZ OMS BURN

CAUTION
LAMBERT burn must be completed by
T1 TIG + 1:30 to avoid guidance errors

* If start of LAMBERT burn delayed: *
* Retarget burn, then go to step 2 *

TIG-3 F7/F8 FLT CNTLR PWR (two) – ON
Perform OMS2/ORBIT OMS BURNS (Cue Card)

Cont next page

4. OMS POST BURN RECONFIGURATION
 F7/F8 FLT CNTLR PWR (two) – OFF
 O8 L,R OMS He PRESS/VAP ISOL (four) – CL
 C3 DAP: B/INRTL/ALT
 DAP TRANS: PULSE/PULSE/PULSE
 CRT1 RCS SEL – ITEM 4 EXEC (*)
 Perform OMS TVC GMBL CK per Burn Pad

* If down arrow(s) or M(s), *
 * select good GMBL *

GNC, OPS 201 PRO

5. MNVR TO POST BURN ATTITUDE

1: GNC UNIV PTG

√Desired UNIV PTG load active

C3 DAP: B/AUTO/ALT

A1U If RR ops, when ATT ERR < 30 deg:
 KU sel – GPC
 √KU TRACK tb – gray

1: GNC 33 REL NAV

CRT1 AUTO Angles – ITEM 23 EXEC (*)

1: GNC UNIV PTG

C3 When in attitude and rates nulled:
 DAP: A/AUTO/VERN(ALT)

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**SENSOR
FAIL**

SENSOR FAIL

S TRK NAV – HIGH INITIAL RESID

1. NAV SAFING

1: GNC 33 REL NAV

CRT1 √INH Angles – ITEM 24 EXEC (*)

On MCC GO (if no comm, continue):

2. CHECK FOR S TRK FALSE LOCK

2: GNC 22 S TRK/COAS CNTL

If -Z S TRK, perform COAS visual check:

NOTE

GNC 33 REL NAV: COAS X (+up) and COAS Y (+left)
provide approx TGT position in COAS based on -Z
S TRK measurement

√For debris near TGT position

If no debris near TGT position or TGT not visible:

Go to step 3

If debris near TGT position:

-Z BREAK TRK – ITEM 8 EXEC

When S PRES – (*):

CRT2
CRT1 Monitor RESID V and H. Repeat BREAK TRK as reqd until
stable lock-on

Go to STAR TRACKER NAV, step 2 **10A**

If -Y S TRK, perform visual check through W1:

√For debris near TGT line-of-sight

If no debris near TGT line-of-sight or TGT not visible:

Go to step 3

If debris near TGT line-of-sight:

-Y BREAK TRK – ITEM 7 EXEC

When S PRES – (*):

CRT2
CRT1 Monitor RESID V and H. Repeat BREAK TRK as reqd until
stable lock-on

Go to STAR TRACKER NAV, step 2 **10A**

3. CHECK IMU MISALIGNMENT

2: GNC 21 IMU ALIGN

CRT2 Nav sel IMU – des,sel (If Nav sel IMU unknown, pick one of two remaining IMUs)

CRT1 Record RESID V _____ and H _____

If RESID V and H < 0.6:

Go to STAR TRACKER NAV, step 3 **10A**

CRT2 Other IMU – des,sel

CRT1 Record RESID V _____ and H _____

4. RESUME PASS

Continue with pass per STAR TRACKER NAV, step 3 **10A**, then:

After S TRK pass, on MCC GO:

NOTE

SELF-TEST may false fail. √MCC for S TRK status

2: GNC 22 S TRK/COAS CNTL

CRT2 -Z(-Y) SELF-TEST – ITEM 2(1) EXEC (*)

SENSOR
FAIL

S TRK NAV – HIGH FLTR MINUS PROP

1. NAV SAFING

1: GNC 33 REL NAV

CRT1 INH Angles – ITEM 24 EXEC (*)

On MCC GO (continue if no comm):

2. CHECK FOR S TRK FALSE LOCK

2: GNC 22 S TRK/COAS CNTL

If -Z S TRK, perform COAS visual check:

NOTE

GNC 33 REL NAV: COAS X (+up) and COAS Y (+left)
provide approx TGT position in COAS based on -Z
S TRK measurement

√For debris near TGT position

If no debris near TGT position or TGT not visible:

Go to step 3

If debris near TGT position:

SV SEL – ITEM 4 EXEC (PROP)

PROP TO FLTR – ITEM 9 EXEC

-Z BREAK TRK – ITEM 8 EXEC

CRT2

When S PRES – (*):

CRT1

Monitor RESID V and H. Repeat BREAK TRK as reqd until stable
lock-on

Go to STAR TRACKER NAV, step 2 **10A**

If -Y S TRK, perform visual check through W1:

√For debris near TGT line-of-sight

If no debris near TGT line-of-sight or TGT not visible:

Go to step 3

If debris near TGT line-of-sight:

SV SEL – ITEM 4 EXEC (PROP)

PROP TO FLTR – ITEM 9 EXEC

-Y BREAK TRK – ITEM 7 EXEC

CRT2

When S PRES – (*):

CRT1

Monitor RESID V and H. Repeat BREAK TRK as reqd until stable
lock-on

Perform STAR TRACKER NAV, step 2 **10A**

3. RESUME PASS

AUTO Angles – ITEM 23 EXEC (*)

Continue -Z S TRK pass

After S TRK pass, on MCC GO:

NOTE

SELF-TEST may false fail. √MCC for S TRK status

2: GNC 22 S TRK/COAS CNTL

CRT2

-Z(-Y) SELF-TEST – ITEM 2(1) EXEC (*)

COAS NAVIGATION

NOTE

Do not execute MC1 or Out-Of-Plane null.
Prior COAS cal reqd to perform COAS NAV.
VERNs reqd to perform COAS NAV.
COAS Nav must be started within ~10 min of Ti to guarantee adequate geometry for nav convergence.
Breakout – If tgt not visible at MC2+18, refer to 1-4 for breakout criteria

1. COAS NAV CONFIG
A6U √SENSE: -Z
√DAP: B7/AUTO/VERN(ALT)

CRT GNC 22 STRK/COAS CNTL
COAS: SIGHT MODE – ITEM 22 EXEC (*)
REQD ID – ITEM 21 +1 EXEC
√POS -Z: ITEM 27 (*)

GNC 33 REL NAV
INH Angles – ITEM 24 EXEC (*)
√SV SEL, ITEM 4 – FLTR
If TGT NOT in COAS FOV:
| √MCC
If TGT in COAS FOV:
FLTR TO PROP – ITEM 8 EXEC
COAS – ITEM 14 EXEC (*)

Upon MCC uplink of COVARIANCE MATRIX,
COVAR REINIT – ITEM 16 EXEC
2. COAS MARKS
A6U FLT CNTLR PWR – ON
DAP: B/FREE/PRI
RHC: As reqd to move TGT near COAS center and maintain BODY YAW
ERR < 10 deg
DAP: B/FREE/VERN
RHC: As reqd to maintain TGT at COAS center and maintain BODY YAW
ERR < 10 deg

When TGT centered in COAS, ATT REF pb – push

CRT GNC 33 REL NAV
If X and Y RESID magnitudes ≥ 1.0:
| √MCC
If X and Y RESID magnitudes < 1.0:
FOR – ITEM 25 EXEC
√SV UPDATE – non-zero (within 8 sec), then
– 0.0 (after 8 sec more)

Repeat step 2 per schedule:
One mark every 10 to 20 sec until sunset Post-Ti

At sunset,
3. END COAS NAV
A6U DAP: A7/AUTO/VERN(ALT)
FLT CNTLR PWR – OFF

CRT GNC 22 STRK/COAS CNTL
COAS: DES – ITEM 25 EXEC (*)

Resume rendezvous timeline

BACKOUT/BREAKOUTS

**BACKOUTS/
BREAKOUTS**

VBAR CORRIDOR BACKOUT

CAUTION

Constraints for use:
Orbiter on + Vbar in approach corridor

1. ESTABLISH OPENING RATE

If RNG < 75 ft:

| √DAP: B/AUTO, NO LO Z

If RNG > 75 ft:

| √DAP: A(B)/AUTO, LO Z

THC: +Z (out) as reqd to establish +0.1 ft/sec opening rate

When opening rate established:

2. PERFORM CORRIDOR BACKOUT OR BREAKOUT

DAP: B

Maintain +0.1 ft/sec opening rate

NOTE: DAP A allowed for ±X and -Z (in) THC inside 75 ft

If PCT ARMED:

DISARM PCT: SPDBRK/THROT pb – AUTO
√lt – OFF

If BREAKOUT desired:

| Perform VBAR BREAKOUT, 5-14

If 30 ft STATIONKEEPING desired:

Maintain tgt in 5 deg corridor

When RNG = 30 ft:

√DAP: B/AUTO

THC: -Z (in) as reqd establish 30 ± 5 ft stationkeeping

Verify angular alignment and perform AUTO ANGULAR FLYOUT (Cue Card)
if reqd

Else:

DAP config: A9/B9

Maintain 8 deg corridor

When RNG = 75 ft:

GNC 23 RCS

RCS F – ITEM 1 EXEC (*)

JET DES F1F – ITEM 31 EXEC (no *)

F2F – ITEM 35 EXEC (no *)

DAP: LO Z

NOTE: DAP A allowed for ±X and ±Z THC outside 75 ft

DAP A allowed for all THC inputs outside 150 ft

When desired stationkeeping range reached:

√DAP: AUTO

THC: -Z (in) as reqd to establish stationkeeping range

3. REAPPROACH

If reqd, set GNC TIMER to count down to new docking time

Approach PET 0:00 =

		/			:			:		
--	--	---	--	--	---	--	--	---	--	--

Go to VBAR APPROACH (Cue Card) from current stationkeeping range

VBAR BREAKOUT

I

CAUTION

Constraints for use:

- Orbiter on \pm Vbar in approach attitude
- Range < 500 ft cg to cg
- Tgt stable on orbiter -Z axis
- Orbiter X and Z axes are in-plane

If RNG < 75 ft:

1. INITIATE CORRIDOR BACKOUT

DAP: B/LVLH/VERN(PRI), no LO Z

NOTE: DAP A allowed for \pm X and -Z (in) THC

THC: +Z (out) to establish a +0.1 ft/sec opening rate
Maintain 8 deg corridor

When RNG > 50 ft:

GNC 23 RCS

RCS F – ITEM 1 EXEC (*)

JET DES F1F – ITEM 31 EXEC (no *)

F2F – ITEM 35 EXEC (no *)

If (when) 75 < RNG < 150 ft:

2. INITIATE(CONTINUE) CORRIDOR BACKOUT

DAP: A(B)/LVLH/VERN(PRI), LO Z

NOTE: DAP A allowed for \pm X and \pm Z THC

THC: +Z (out) to establish a +0.1 ft/sec opening rate
Maintain 8 deg corridor

DAP: B(A)

If (when) RNG > 150 ft:

3. PERFORM RADIAL BURN ON \pm VBAR

If Rdot negative (closing on the target):

THC: +Z (out) to null closing rate (Rdot \geq 0 fps)

Config DAP A,B to A7,B7

DAP: A/LVLH/VERN(PRI), LO Z

DAP TRANS: NORM/PULSE/PULSE

THC: +X (up) for 6 sec (1.5 fps)

DAP TRANS: PULSE/PULSE/PULSE

FLT CNTLR PWR – OFF

DAP: A/INRTL/VERN(ALT)

Record Radial Burn TIG ___/___:___:___

Inform MCC when SEP complete

4. PERFORM POSIGRADE/RETROGRADE BURN

√MCC for breakout direction

NOTE: Posigrade burn performed if second docking attempt desired

GNC, OPS 202 PRO

GNC ORBIT MNVR EXEC

√RCS SEL – ITEM 4 EXEC (*)

If radial burn from +Vbar:

| TV ROLL – ITEM 5 +1 8 0 EXEC

If radial burn from -Vbar:

TV ROLL – ITEM 5 +0 EXEC

Set TIG to Radial Burn +28 min:

If Posigrade Sep:

| TGT PEG 7 ΔV_X – ITEM 19 +3 EXEC

ΔV_Y – ITEM 20 +0 EXEC

ΔV_Z – ITEM 21 +0 EXEC

If Retrograde Sep:

TGT PEG 7 ΔV_X – ITEM 19 -3 EXEC

ΔV_Y – ITEM 20 +0 EXEC

ΔV_Z – ITEM 21 +0 EXEC

LOAD – ITEM 22 EXEC

TIMER – ITEM 23 EXEC

When RNG > 1000 ft:

DAP: NO LO Z

At TIG -8:00:

DAP: B/AUTO/ALT

MNVR – ITEM 27 EXEC

At TIG -0:30:

DAP: A/INRTL/PRI

FLT CNTLR PWR – ON

At TIG, deflect THC to null VGOs

FLT CNTLR PWR – OFF

DAP: A/INRTL/VERN(ALT)

Inform MCC when SEP complete

GNC, OPS 201 PRO

SHUTTLE NOSE IN-PLANE BREAKOUT (R < 500 ft)

CAUTION

Constraints for use:

Orbiter X and Z axes in-plane

Range \leq 500 ft cg to cg*

Tgt stable on orbiter -Z axis

*On approach use RNDZ Breakout until TORVA init
(+X burns to start TORVA are complete)

If RNG < 75 ft:

1. INITIATE CORRIDOR BACKOUT

√DAP: B/LVLH/VERN(PRI), no LO Z

THC: +Z (out) to establish a +0.1 ft/sec opening rate

Maintain 8 deg corridor

NOTE

DAP A allowed for \pm X and -Z (in) THC

When RNG > 75 ft:

If single -X jet configuration:

GNC 23 RCS

RCS F – ITEM 1 EXEC (*)

JET DES F1F – ITEM 31 EXEC (no *)

F2F – ITEM 35 EXEC (no *)

Config DAP A,B to A9,B9

DAP: LO Z

2. PERFORM +X OR -X BURN

DAP TRANS: NORM/PULSE/PULSE

If Nose-Forward (TGT ID = 2 and OM = 0):

| THC: +X (up) for 6 sec (1.5 fps)

If Tail-Forward (TGT ID = 2 and OM = 180):

THC: -X (down) for 6 sec (1.5 fps)

DAP TRANS: PULSE/PULSE/PULSE

DAP: A/INRTL/VERN(ALT)

Record (\pm X) Burn TIG ___/___:___:___

Report Tig to MCC

A6U

FLT CNTLR PWR – OFF

3. PERFORM FINAL BURN (+X Burn, Posigrade/Retrograde and Out-of-Plane)

GNC, OPS 202 PRO

GNC ORBIT MNVR EXEC

√RCS SEL – ITEM 4 EXEC (*)

√MCC for breakout direction and TV ROLL

NOTE

Posigrade burn will be performed if second docking attempt desired

Set TIG to (\pm X) burn + 30 min

If Posigrade Sep:

TGT PEG 7 Δ VX – ITEM 19 +3.5 EXEC

Δ VY – ITEM 20 +3 EXEC

Δ VZ – ITEM 21 +0 EXEC

If Retrograde Sep:

TGT PEG 7 Δ VX – ITEM 19 -3.5 EXEC

Δ VY – ITEM 20 +3 EXEC

Δ VZ – ITEM 21 +0 EXEC

TV ROLL – ITEM 5 + EXEC

LOAD – ITEM 22 EXEC

TIMER – ITEM 23 EXEC

Config DAP A,B to A7,B7

At TIG -8 min:

DAP: B/ALT, NO LO Z

MNVR – ITEM 27 EXEC (*)

DAP: AUTO

At TIG -0:30:

DAP TRANS: as reqd

DAP: A/INRTL/PRI

F7 FLT CNTLR PWR – ON

At TIG, THC: Trim VGOs < 0.2 fps

F7 FLT CNTLR PWR – OFF

DAP TRANS: PULSE/PULSE/PULSE

DAP: A/INRTL/VERN(ALT)

GNC, OPS 201 PRO

On MCC call:

Go to TERMINATE SEP OPS 8C, 2-8

RNDZ BREAKOUT

NOTE

This procedure may be performed anytime between Ti and TORVA init (+X burns to start TORVA are complete)

1. BREAKOUT BURN PREP
DAP: A/AUTO/PRI
FLT CNTLR PWR – ON

 2. 3 FPS RETROGRADE
OPS 202 PRO

GNC ORBIT MNVR EXEC

√RCS SEL – ITEM 4 (*)
Set TIG to current time
TGT PEG 7 ΔV_X – ITEM 19 -3 EXEC
 ΔV_Y – ITEM 20 +0 EXEC
 ΔV_Z – ITEM 21 +0 EXEC
LOAD – ITEM 22 EXEC
TIMER – ITEM 23 EXEC
DO NOT MNVR TO BURN ATT
DAP TRANS: as reqd
Deflect THC to null VGOs
FLT CNTLR PWR – OFF
- CRT
- OPS 201 PRO
DAP: A/AUTO/VERN(ALT)

EXPEDITED SEPS

**EXPEDITED
SEPS**

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SHUTTLE EMERGENCY SEPARATION

1. 1st BURN (+Z)

- √SENSE: -Z
- DAP: NO LO Z
- √DAP: A7(B7)
- √FLT CNTLR PWR – ON

When petals clear:

- DAP: A7/INRTL/VERN(PRI)
- DAP TRANS: PULSE/PULSE/NORM
- THC: +Z (out) 2 sec (approx 0.6 ft/s)
- Wait 1 min
- THC: +Z (out) 2 sec (approx 0.6 ft/s)
- Wait 1 min
- THC: +Z (out) 2 sec (approx 0.6 ft/s)

Record final Burn TIG ___/___:___:___

DAP: LO Z

2. 2nd BURN (Out-of-Plane)

- OPS 202 PRO
- | |
|---------------------|
| GNC ORBIT MNVR EXEC |
|---------------------|
- RCS SEL – ITEM 4 EXEC (*)

- Set TIG to 1st Burn + 12 min
- TGT PEG 7 ΔV_X – ITEM 19 +0 EXEC
- ΔV_Y – ITEM 20 +5.4 EXEC
- ΔV_Z – ITEM 21 +0 EXEC
- LOAD – ITEM 22 EXEC
- TIMER – ITEM 23 EXEC

√VGO Z \geq 0; if VGO Z < 0 then:

- * TGT PEG 7 ΔV_Y – ITEM 20 -5.4 EXEC *
- * LOAD – ITEM 22 EXEC *
- * TIMER – ITEM 23 EXEC *
- *√VGO Z \geq 0 *

Do not MNVR to BURN ATT

At TIG -00:30:
DAP: NO LO Z

At TIG, deflect THC to null VGOs

Record second Burn TIG ___/___:___:___

3. 3rd BURN

- If ΔV_Y (step 2) +5.4:
TV ROLL – ITEM 5 +2 7 0 EXEC
- If ΔV_Y (step 2) -5.4:
TV ROLL – ITEM 5 +9 0 EXEC

Perform OMS BURN no earlier than 6 min after Out-of-Plane Burn

If Deorbit Burn in less than 30 min:

√MCC/PGSC for Deorbit Burn TIG/PAD

TV ROLL – ITEM 5 +1 8 0 EXEC

Go to EMERGENCY DEORBIT PREP/ENTRY (CONT DEORBIT,
EMERGENCY) >>

If PROP leak:

Go to LEAKING OMS PRPLT/He BURN (ORB PKT, OMS) >>

Otherwise:

Set TIG to 2nd BURN + 22 min

TGT PEG 7 Δ VX – ITEM 19 +3.6 EXEC

Δ VY – ITEM 20 +0 EXEC

Δ VZ – ITEM 21 +0 EXEC

LOAD – ITEM 22 EXEC

TIMER – ITEM 23 EXEC

MNVR – ITEM 27 EXEC (*)

DAP: B/AUTO/PRI

At TIG, deflect THC to null VGOs

OPS 201 PRO

ANY ATTITUDE SEPARATION

CAUTION

This procedure is valid for stack angular rates ≤ 0.12 deg/sec per axis

1. 1st BURN (+Z)

DAP: B9/FREE/VERN(ALT), NO LO Z

√SENSE: -Z

√FLT CNTLR PWR – ON

When capture latches/hooks open:

THC: +Z (out) 4 pulses at 10 sec intervals

Record final pulse TIG ___/___:___:___

If no spring-assisted separation:

DAP: FREE

If spring-assisted separation:

DAP: INRTL

THC: as reqd to maintain 8 deg corridor

At final pulse TIG +3:00 and when RNG > 30 ft (DP to DP):

DAP: A(B)/INRTL/VERN(ALT)

THC: as reqd to maintain RDOT > 0.2 fps and maintain 8 deg corridor

When RNG > 75 ft (DP to DP):

GNC 23 RCS

RCS FWD – ITEM 1 EXEC (*)

JET DES F1F – ITEM 31 EXEC (no *)

F2F – ITEM 35 EXEC (no *)

Config DAP A,B to A7,B7

DAP: LO Z

2. 2nd BURN (+X)

When RNG > 150 ft (Interface-to-Interface):

DAP TRANS: NORM/PULSE/PULSE

THC: +X (up) for 8 sec (2.0 fps)

DAP TRANS: PULSE/PULSE/PULSE

3. ROTATE TO PLACE AND MAINTAIN ISS IN OVHD WINDOW

DAP: A7/INRTL/PRI

Perform manual pitch rotation as reqd

DAP ROT: DISC/PULSE/DISC

RHC: \pm PITCH as reqd to place and maintain ISS in OVHD Window

4. 3rd BURN (Out-Of-Plane)

When RNG > 1000 ft:

DAP: NO LO Z

DAP ROT: DISC/DISC/DISC

GNC, OPS 202 PRO

GNC ORBIT MNVR EXEC

√RCS SEL – ITEM 4 EXEC (*)

Set TIG to current time + 1 min

TGT PEG 7 Δ VX – ITEM 19 +0 EXEC

Δ VY – ITEM 20 +2 EXEC

Δ VZ – ITEM 21 +0 EXEC

LOAD – ITEM 22 EXEC
TIMER – ITEM 23 EXEC

√VGO Z ≥ 0; if VGO Z < 0 then:

* TGT PEG 7 ΔVY – ITEM 20 -2 EXEC *
* LOAD – ITEM 22 EXEC *
* TIMER – ITEM 23 EXEC *
*√VGO Z ≥ 0 *

Do not MNVR to BURN ATT

At TIG, deflect THC to null VGOs

Record 3rd Burn TIG ____/____:____:____

5. 4th BURN (Posigrade/Retrograde)

√MCC for breakout direction

If Posigrade Sep:

If ΔVY (step 4) +2:
| TV ROLL – ITEM 5 +2 7 0 EXEC
If ΔVY (step 4) -2:
TV ROLL – ITEM 5 +9 0 EXEC
Set TIG to 3rd Burn + 22 min
TGT PEG 7 ΔVX – ITEM 19 +6.0 EXEC
ΔVY – ITEM 20 +0 EXEC
ΔVZ – ITEM 21 +0 EXEC

If Retrograde Sep:

If ΔVY (step 4) +2:
| TV ROLL – ITEM 5 +9 0 EXEC
If ΔVY (step 4) -2:
TV ROLL – ITEM 5 +2 7 0 EXEC
Set TIG to 3rd Burn + 22 min
TGT PEG 7 ΔVX – ITEM 19 -6.0 EXEC
ΔVY – ITEM 20 +0 EXEC
ΔVZ – ITEM 21 +0 EXEC

LOAD – ITEM 22 EXEC
TIMER – ITEM 23 EXEC
MNVR – ITEM 27 EXEC (*)
DAP: B/AUTO/PRI

At TIG -0:30:
DAP: A/INRTL/PRI

At TIG, deflect THC to null VGOs
FLT CNTLR PWR – OFF
DAP: A/INRTL/VERN(ALT)
GNC, OPS 201 PRO

Ti DELAY BURN

1. OPS 202 PRO

GNC ORBIT MNVR EXEC

Load Ti Delay ΔV from final Ti PAD, 3-7

If RCS:

Perform RCS BURN (Cue Card)

If OMS:

Perform RNDZ OMS BURN, 5-4

2. Reload new BASETIME per final Ti PAD, 3-7

GNC 34 ORBIT TGT

TGT NO – ITEM 1 +1 EXEC

Set BASETIME to new Ti TIG ___/___:___:___

Load – ITEM 26 EXEC

Reset ET, SM timers to new Ti TIG

3. Perform Post Ti Nav 16A, 4-16, then

Return to RENDEZVOUS TIMELINE at PET: -01:25, 4-11

NOTE

Extra NCC Burn and Ti Onboard Solution pads, 5-26

NCC BURN SOLUTION

TIG

			/			:			:		
--	--	--	---	--	--	---	--	--	---	--	--

PRELIMINARY

INTERMEDIATE

ΔVX
ΔVY
ΔVZ
ΔVT

()			.	
()			.	
()			.	
			.	

()			.	
()			.	
()			.	
			.	

FINAL

GROUND

FINAL-GROUND LIMITS

ΔVX
ΔVY
ΔVZ
ΔVT

()			.	
()			.	
()			.	
			.	

()			.	
()			.	
()			.	
			.	

(.)
(.)
(.)
(.)

Ti ONBOARD SOLUTIONS

PREL FLTR

1ST INTER FLTR

2ND INTER FLTR (IF REQD)

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()			.	
()			.	
			.	

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			.	

()			.	
()			.	
()			.	
			.	

FINAL FLTR

PROP (IF REQD)

FINAL-GROUND LIMITS

()			.	
()			.	
()			.	
			.	

()			.	
()			.	
()			.	
			.	

()			.	
()			.	
()			.	
			.	

FINAL Ti PAD (MNVR PADS)

RNDZ NAV RECOVERY

1. If Recovery from OPS MODE RECALL:
(add/delete GPC to/from redundant set)

GNC 33 REL NAV

NOTE

Asterisks will not change until RNDZ NAV enabled

CRT

Inhibit RNG – ITEM 18 EXEC
 RDOT – ITEM 21 EXEC
 Angles – ITEM 24 EXEC
 RNDZ NAV ENA – ITEM 1 EXEC (*)
GNC UNIV PTG
 TRK – ITEM 19 (CUR-*)
 Go to step 3

2. If Recovery from OPS TRANSITION (G8/G3 to G2):

GNC 34 ORBIT TGT

TGT NO – ITEM 1 +1 EXEC
 Set BASE TIME to Ti TIG (Ti Burn Pad, 3-6)
 LOAD – ITEM 26 EXEC

GNC 33 REL NAV

Upon MCC uplink of TGT SV,
 RNDZ NAV ENA – ITEM 1 EXEC (*)

NOTE

If RNDZ NAV not enabled (no *),

DO NOT PROCEED. √MCC

Select appropriate target track attitude

GNC UNIV PTG

	-Z	-Y (STRK)	+Y
TGT ID	+1	+1	+1
BODY VECT	+3	+4	+5
P	√+90	√+0	+0
Y	√+0	√+280.6	+90
OM	+0	+90	+180

TRK – ITEM 19 (CUR-*)

C3

3. DAP: ALT
 DAP: A/AUTO
 DAP ROT: DISC/DISC/DISC
 When in attitude, DAP: VERN

If NAV sensor data available:

If STRK NAV:

Go to STAR TRACKER NAV 10A, 4-10 >>

If RR NAV:

GNC 33 REL NAV

CRT

KU ANT ENA – ITEM 2 (*)
 GNC I/O RESET
 Go to RR NAVIGATION 13B, 4-13

LOSS OF VRCS

NOTE

This procedure overrides LOSS OF VERNIERS (ORB OPS, RCS) during rendezvous ops

Utilize VERN fail downmodes (PRI/ALT) specified in parentheses and follow VERN fail starred blocks per timeline. If VERN fail downmode not specified, use PRI Nose and Tail control

COAS NAV cannot be performed if VERN fail

Attitude deadbands must be increased to 2 deg for TORVA (per Approach Cue Card) and for flyarounds (per Separation timeline, 2-8)

Additional braking pulses (+Z) may be reqd due to LO Z PRI attitude control cross coupling

PCT modes to FREE/VERN. In the event of failed capture, mode DAP to PRI per FAILED CAPTURE block, step 2

Twelve hooks reqd for mated attitude control in ALT

LOSS OF LO Z BRAKING

No NORM Z braking allowed between 1000 ft and 75 ft

During approach:

√DAP: LO Z/NO LO Z per VBAR APPROACH (Cue Card)

Continue approach; if braking reqd, then:

If prior to +VBAR arrival:

| Wait for natural RDOT bleed-down

If on +VBAR:

When $R < 75$ ft, perform NO LO Z braking per VBAR APPROACH (Cue Card)

For Undocking and Separation:

Perform nominal corridor sep through 150 ft

Do not perform +Z translations when $75 < RNG < 150$ ft

When $RNG > 150$ ft (DP-DP), go to VBAR BREAKOUT, 5-14

TGT ITER

When in Lambert Targeting and TGT ITER occurs:

If PRED MATCH other than 999999 (all 9s):

√MCC and read down PRED MATCH from SPEC 34 (MCC has delta Vs)

On MCC GO or if no comm:

Recall TGT set and recompute

If TGT ITER recurs and PRED MATCH less than 400:

Contact MCC and read down PRED MATCH from SPEC 34

On MCC GO or if no comm:

Load current delta Vs and execute as Lambert burn >>

If TGT ITER recurs and PRED MATCH greater than 400:

Contact MCC and read down PRED MATCH from SPEC 34

On MCC GO or if no comm:

Load ground solution and execute as EXT DV burn

(If MC burn, uplink of ground solution reqd) >>

If ground solution not available: No burn >>

If PRED MATCH 999999 (all 9s):

On MCC GO or if no comm:

Load ground solution and execute as EXT DV burn

(If MC burn, uplink of ground solution reqd) >>

If ground solution not available: No burn >>

REFERENCE DATA

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**REFERENCE
DATA**

ISS RNDZ OPS DAP CONFIGURATIONS

	RNDZ		TERMINAL PHASE		PROX OPS		DOCKING		SPEC 20 ITEM #	
	A7	B7	A8	B8	A9	B9	A10	B10	A	B
PRI										
ROT RATE	0.200	0.500	0.050	0.050	0.130	0.130	0.050	0.050	10	30
ATT DB	2.00	2.00	2.00	2.00	2.00	2.00	0.60	0.60	11	31
RATE DB	0.20	0.20	0.20	0.20	0.10	0.10	0.10	0.10	12	32
ROT PLS	0.10	0.04	0.10	0.04	0.10	0.04	0.10	0.04	13	33
COMP	.000	.000	.000	.000	.000	.000	.000	.000	14	34
P OPTION	ALL	ALL	ALL	ALL	TAIL	TAIL	TAIL	TAIL	15	35
Y OPTION	ALL	ALL	ALL	ALL	TAIL	TAIL	TAIL	TAIL	16	36
TRANS PLS	0.10	0.05	0.10	0.05	0.05	0.01	0.05	0.01	17	37
ALT										
RATE DB	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	18	38
JET OPT	ALL	ALL	ALL	ALL	TAIL	TAIL	TAIL	TAIL	19	39
# JETS	2	2	2	2	2	2	2	2	20	40
ON TIME	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	21	41
DELAY	0.00	0.00	0.00	0.00	0.00	10.00	0.00	0.00	22	42
VERN										
ROT RATE	0.016	0.200	0.050	0.050	0.130	0.130	0.050	0.050	23	43
ATT DB	1.00	1.00	1.00	1.00	1.00	1.00	0.50	0.50	24	44
RATE DB	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	25	45
ROT PLS	0.010	0.002	0.05	0.020	0.050	0.020	0.050	0.020	26	46
COMP	.000	.000	.000	.000	.000	.000	.000	.000	27	47
CNTL ACC	0	0	0	0	0	0	0	0	28	48

POST-CONTACT THRUST (PCT) REFERENCE DATA

PBI FUNCTION WHENEVER IN OPS 2:

PBI	When PCT is disarmed. . .	When PCT is armed. . .	When PCT is active. . .
L or R AUTO SB PBI (PBI lit when PCT armed/active)	Arms PCT	Disarms PCT	Disarms and Terminates PCT ¹
L AUTO/MAN BF PBI or DAP: Spare PBI (PBI lit when PCT active)	No Effect	Modes to DAP: FREE/PRI and activates PCT ²	Terminates PCT ¹
DAP: FREE PBI	Normal Function	Normal Function	Terminates PCT ¹

¹ The following actions occur when PCT terminated by either automatic timeout or manual abort via above PBIs:

- PCT firing sequence terminated
- DAP moded to A/VERN
- DAP A,B configured to A9,B9 (Prox Ops DAP)

² Once PBI is depressed, PCT sequence will be initiated within maximum of 0.28 sec. The PCT sequence for ISS docking missions consists of 0.56 sec jet firing sequence, followed by 0.96 delay, completed with 0.88 sec jet firing sequence, giving total PCT sequence duration of 2.4 sec. Two nose jets and two tail jets fire during sequence

- PCT firing sequence can also be aborted by taking RHC/THC out of detent.

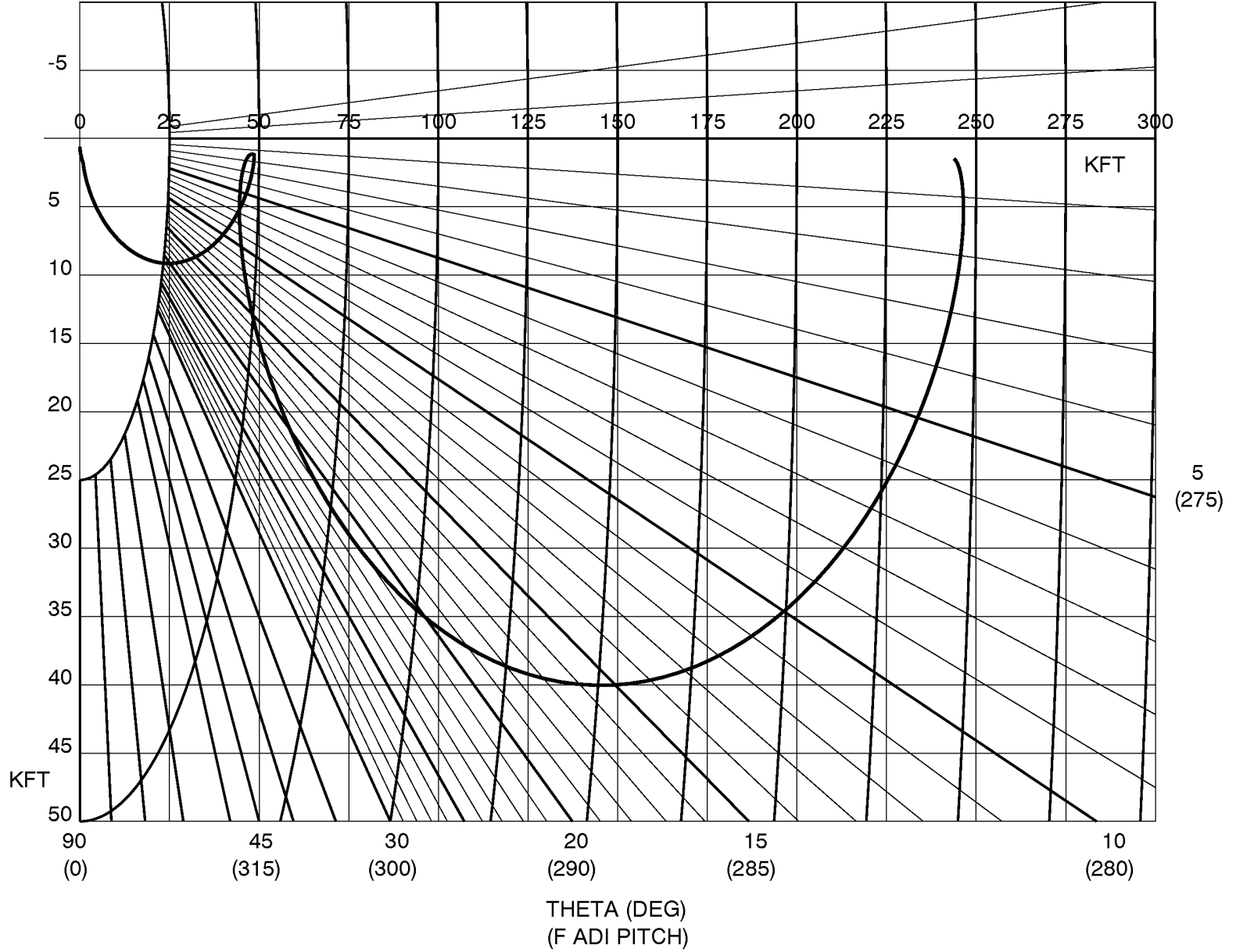
TARGETING DATA

SPEC 34 ITEM NO	1			6	17	18	19	20	
TGT ALTITUDE	TGT NO	DESCRIPTION	T1 REL TO BASETIME	EL (DEG)	DT (MIN)	DX (KFT)	DY (KFT)	DZ (KFT)	NOTES
130	9	NCC	-0/00:55:48	0	55.8	-48.6	0	+1.2	BASETIME = Ti TIG
	10	Ti	0/00:00:00	0	74.4	-0.9	0	+1.8	
	11	MC1	0/00:20:00	0	54.4	-0.9	0	+1.8	
	12	MC2	0/00:47:24	28.45	27.0	-0.9	0	+1.8	BASETIME = MC2 TIG
	13	MC3	0/00:17:00	0	10.0	-0.9	0	+1.8	
	14	MC4	0/00:27:00	0	13.0	0	0	+0.6	
	19	MC2 ON TIME	0/00:00:00	0	27.0	-0.9	0	+1.8	
150	9	NCC	-0/00:56:18	0	56.3	-48.6	0	+1.2	BASETIME = Ti TIG
	10	Ti	0/00:00:00	0	75.1	-0.9	0	+1.8	
	11	MC1	0/00:20:00	0	55.1	-0.9	0	+1.8	
	12	MC2	0/00:48:06	28.46	27.0	-0.9	0	+1.8	BASETIME = MC2 TIG
	13	MC3	0/00:17:00	0	10.0	-0.9	0	+1.8	
	14	MC4	0/00:27:00	0	13.0	0	0	+0.6	
	19	MC2 ON TIME	0/00:00:00	0	27.0	-0.9	0	+1.8	
170	9	NCC	-0/00:56:48	0	56.8	-48.6	0	+1.2	BASETIME = Ti TIG
	10	Ti	0/00:00:00	0	75.7	-0.9	0	+1.8	
	11	MC1	0/00:20:00	0	55.7	-0.9	0	+1.8	
	12	MC2	0/00:48:42	28.66	27.0	-0.9	0	+1.8	BASETIME = MC2 TIG
	13	MC3	0/00:17:00	0	10.0	-0.9	0	+1.8	
	14	MC4	0/00:27:00	0	13.0	0	0	+0.6	
	19	MC2 ON TIME	0/00:00:00	0	27.0	-0.9	0	+1.8	
190	9	NCC	-0/00:57:12	0	57.2	-48.6	0	+1.2	BASETIME = Ti TIG
	10	Ti	0/00:00:00	0	76.3	-0.9	0	+1.8	
	11	MC1	0/00:20:00	0	56.3	-0.9	0	+1.8	
	12	MC2	0/00:49:18	28.85	27.0	-0.9	0	+1.8	BASETIME = MC2 TIG
	13	MC3	0/00:17:00	0	10.0	-0.9	0	+1.8	
	14	MC4	0/00:27:00	0	13.0	0	0	+0.6	
	19	MC2 ON TIME	0/00:00:00	0	27.0	-0.9	0	+1.8	
210	9	NCC	-0/00:57:42	0	57.7	-48.6	0	+1.2	BASETIME = Ti TIG
	10	Ti	0/00:00:00	0	76.9	-0.9	0	+1.8	
	11	MC1	0/00:20:00	0	56.9	-0.9	0	+1.8	
	12	MC2	0/00:49:54	29.07	27.0	-0.9	0	+1.8	BASETIME = MC2 TIG
	13	MC3	0/00:17:00	0	10.0	-0.9	0	+1.8	
	14	MC4	0/00:27:00	0	13.0	0	0	+0.6	
	19	MC2 ON TIME	0/00:00:00	0	27.0	-0.9	0	+1.8	

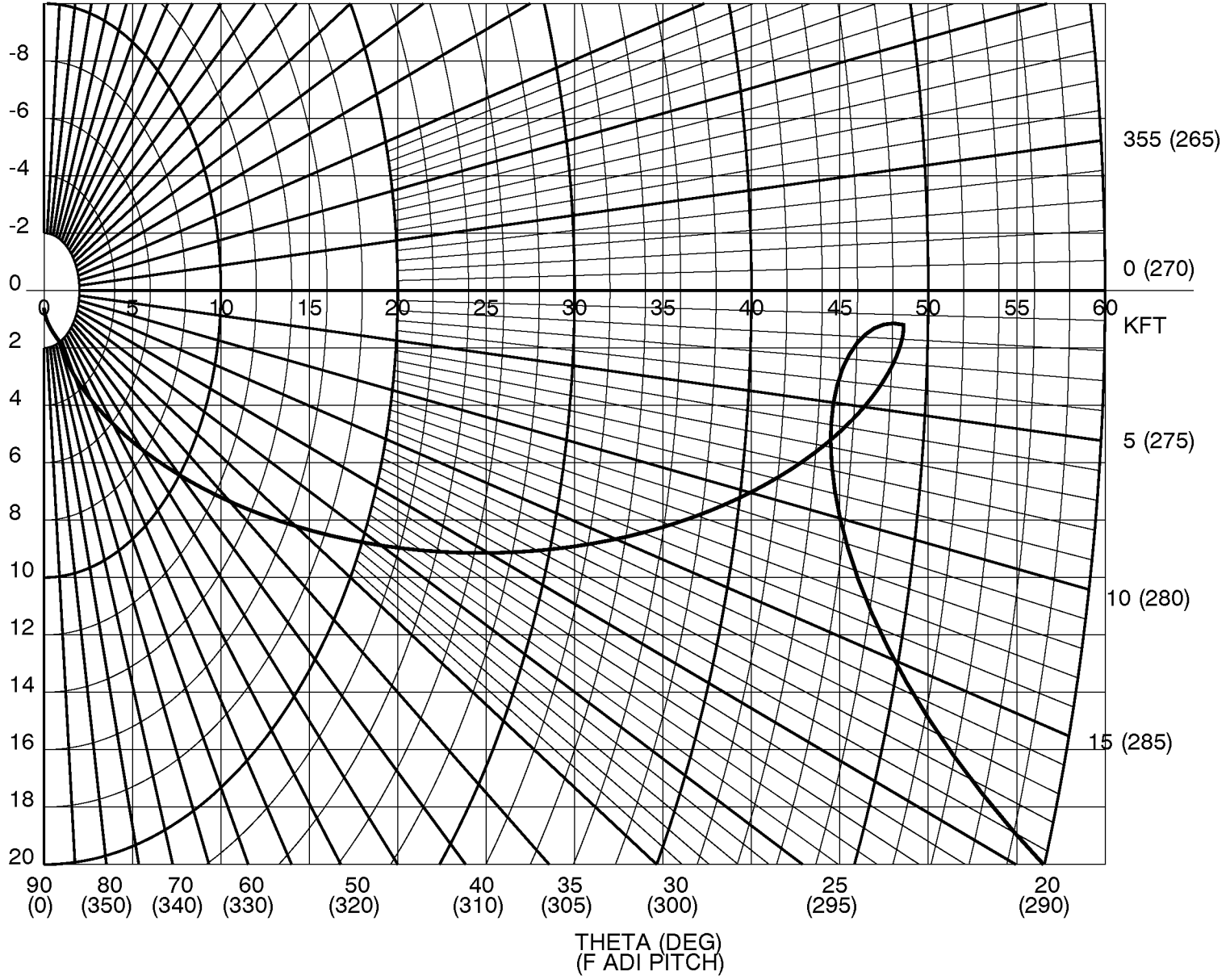
TARGETING DATA (Cont)

SPEC 34 ITEM NO	1			6	17	18	19	20	
TGT ALTITUDE	TGT NO	DESCRIPTION	T1 REL TO BASETIME	EL (DEG)	DT (MIN)	DX (KFT)	DY (KFT)	DZ (KFT)	NOTES
230	9	NCC	-0/00:58:12	0	58.2	-48.6	0	+1.2	BASETIME = Ti TIG
	10	Ti	0/00:00:00	0	77.6	-0.9	0	+1.8	
	11	MC1	0/00:20:00	0	57.6	-0.9	0	+1.8	
	12	MC2	0/00:50:36	29.32	27.0	-0.9	0	+1.8	BASETIME = MC2 TIG
	13	MC3	0/00:17:00	0	10.0	-0.9	0	+1.8	
	14	MC4	0/00:27:00	0	13.0	0	0	+0.6	
	19	MC2 ON TIME	0/00:00:00	0	27.0	-0.9	0	+1.8	
250	9	NCC	-0/00:58:42	0	58.7	-48.6	0	+1.2	BASETIME = Ti TIG
	10	Ti	0/00:00:00	0	78.2	-0.9	0	+1.8	
	11	MC1	0/00:20:00	0	58.2	-0.9	0	+1.8	
	12	MC2	0/00:51:12	29.55	27.0	-0.9	0	+1.8	BASETIME = MC2 TIG
	13	MC3	0/00:17:00	0	10.0	-0.9	0	+1.8	
	14	MC4	0/00:27:00	0	13.0	0	0	+0.6	
	19	MC2 ON TIME	0/00:00:00	0	27.0	-0.9	0	+1.8	
270	9	NCC	-0/00:59:06	0	59.1	-48.6	0	+1.2	BASETIME = Ti TIG
	10	Ti	0/00:00:00	0	78.9	-0.9	0	+1.8	
	11	MC1	0/00:20:00	0	58.9	-0.9	0	+1.8	
	12	MC2	0/00:51:54	29.80	27.0	-0.9	0	+1.8	BASETIME = MC2 TIG
	13	MC3	0/00:17:00	0	10.0	-0.9	0	+1.8	
	14	MC4	0/00:27:00	0	13.0	0	0	+0.6	
	19	MC2 ON TIME	0/00:00:00	0	27.0	-0.9	0	+1.8	
290	9	NCC	-0/00:59:36	0	59.6	-48.6	0	+1.2	BASETIME = Ti TIG
	10	Ti	0/00:00:00	0	79.5	-0.9	0	+1.8	
	11	MC1	0/00:20:00	0	59.5	-0.9	0	+1.8	
	12	MC2	0/00:52:30	30.03	27.0	-0.9	0	+1.8	BASETIME = MC2 TIG
	13	MC3	0/00:17:00	0	10.0	-0.9	0	+1.8	
	14	MC4	0/00:27:00	0	13.0	0	0	+0.6	
	19	MC2 ON TIME	0/00:00:00	0	27.0	-0.9	0	+1.8	
310	9	NCC	-0/00:60:06	0	60.1	-48.6	0	+1.2	BASETIME = Ti TIG
	10	Ti	0/00:00:00	0	80.1	-0.9	0	+1.8	
	11	MC1	0/00:20:00	0	60.1	-0.9	0	+1.8	
	12	MC2	0/00:53:06	30.25	27.0	-0.9	0	+1.8	BASETIME = MC2 TIG
	13	MC3	0/00:17:00	0	10.0	-0.9	0	+1.8	
	14	MC4	0/00:27:00	0	13.0	0	0	+0.6	
	19	MC2 ON TIME	0/00:00:00	0	27.0	-0.9	0	+1.8	

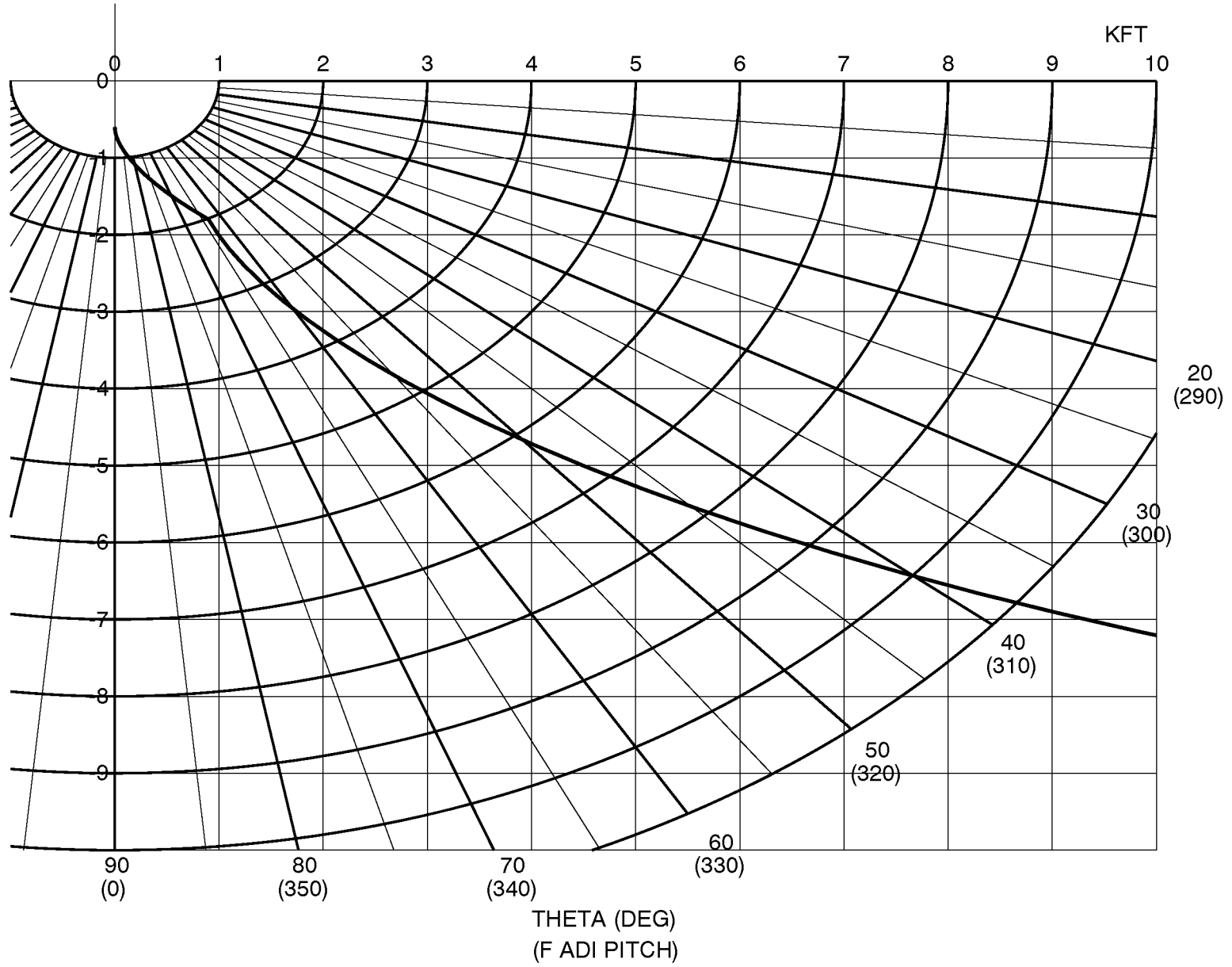
POST NC



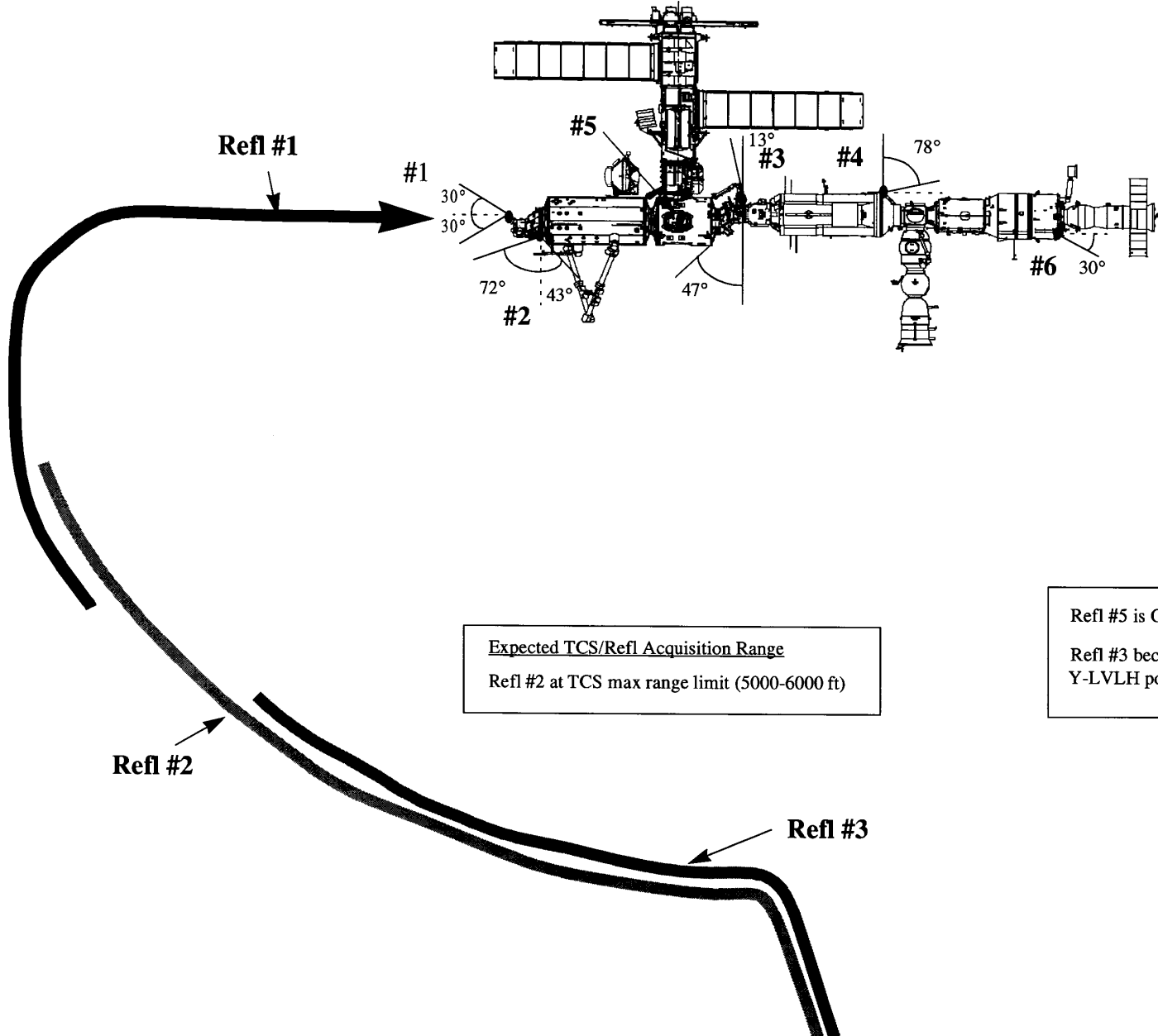
POST Ti



POST MC3

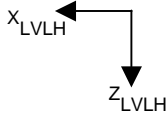


TCS REFLECTOR VISIBILITY DURING APPROACH



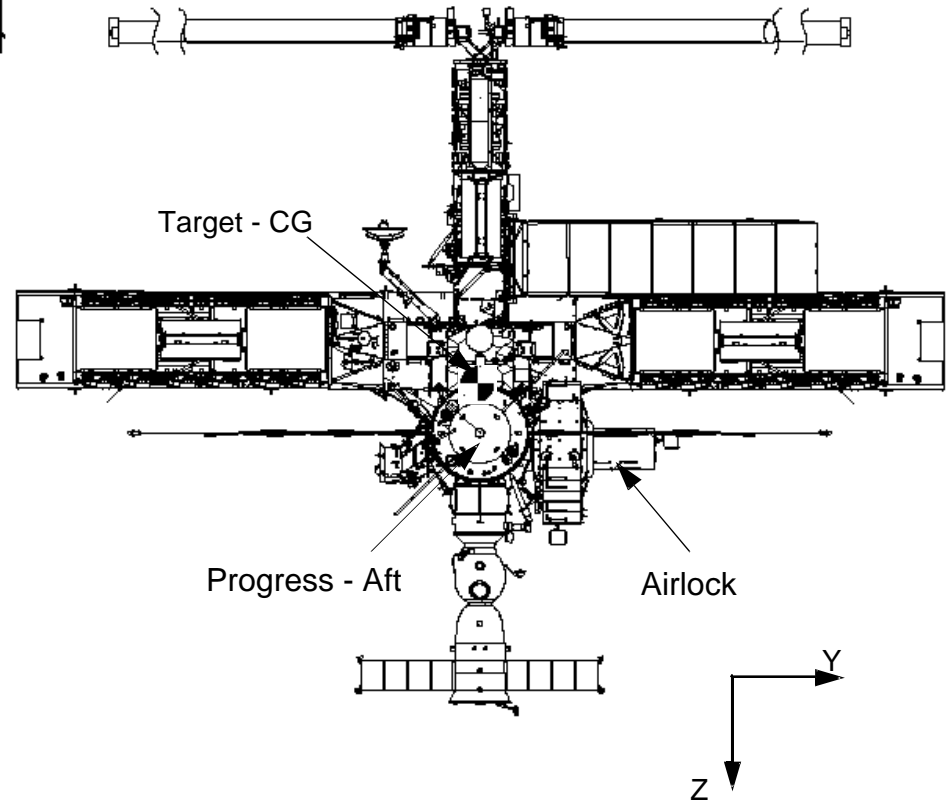
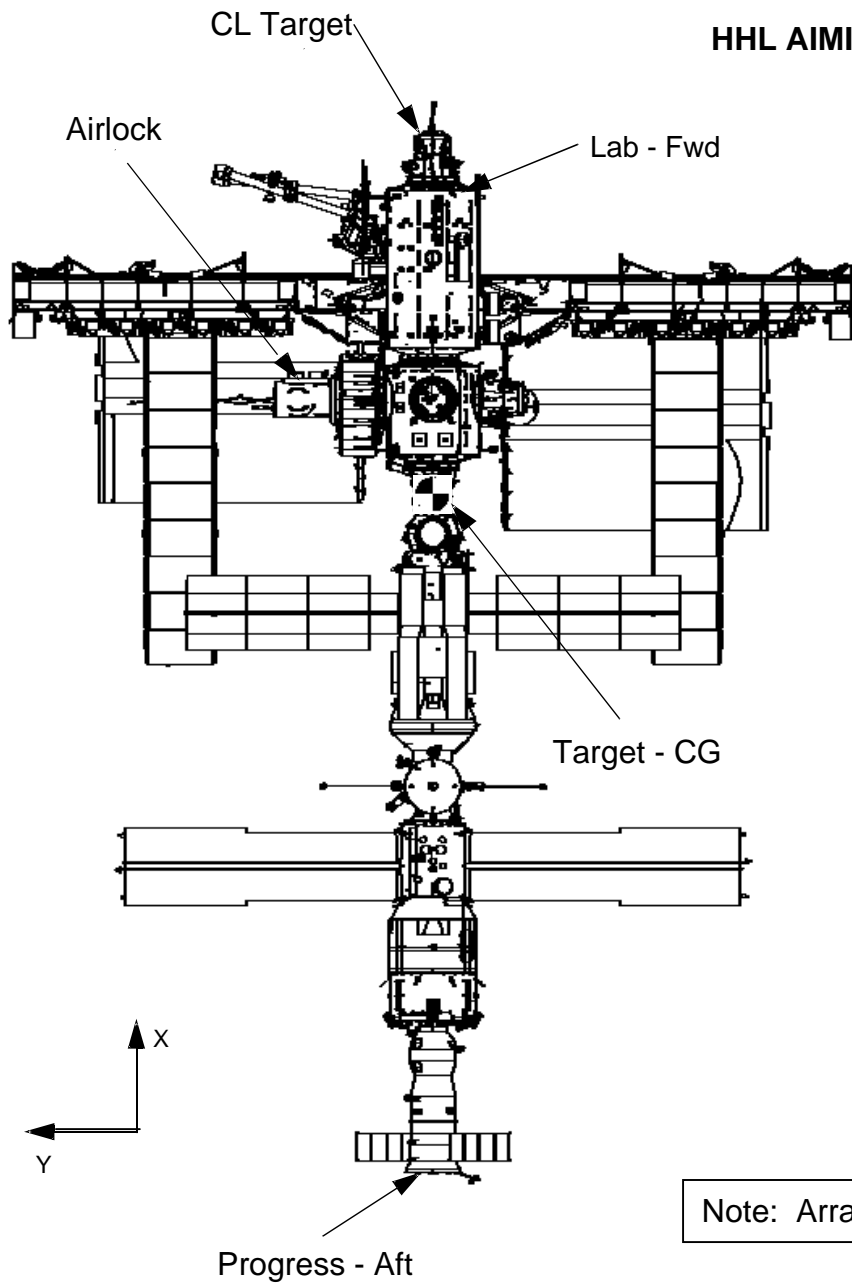
Expected TCS/Refl Acquisition Range
 Refl #2 at TCS max range limit (5000-6000 ft)

Refl #5 is Out of Plane (Out of Page)
 Refl #3 becomes less visible as Orbiter Y-LVLH position becomes more positive



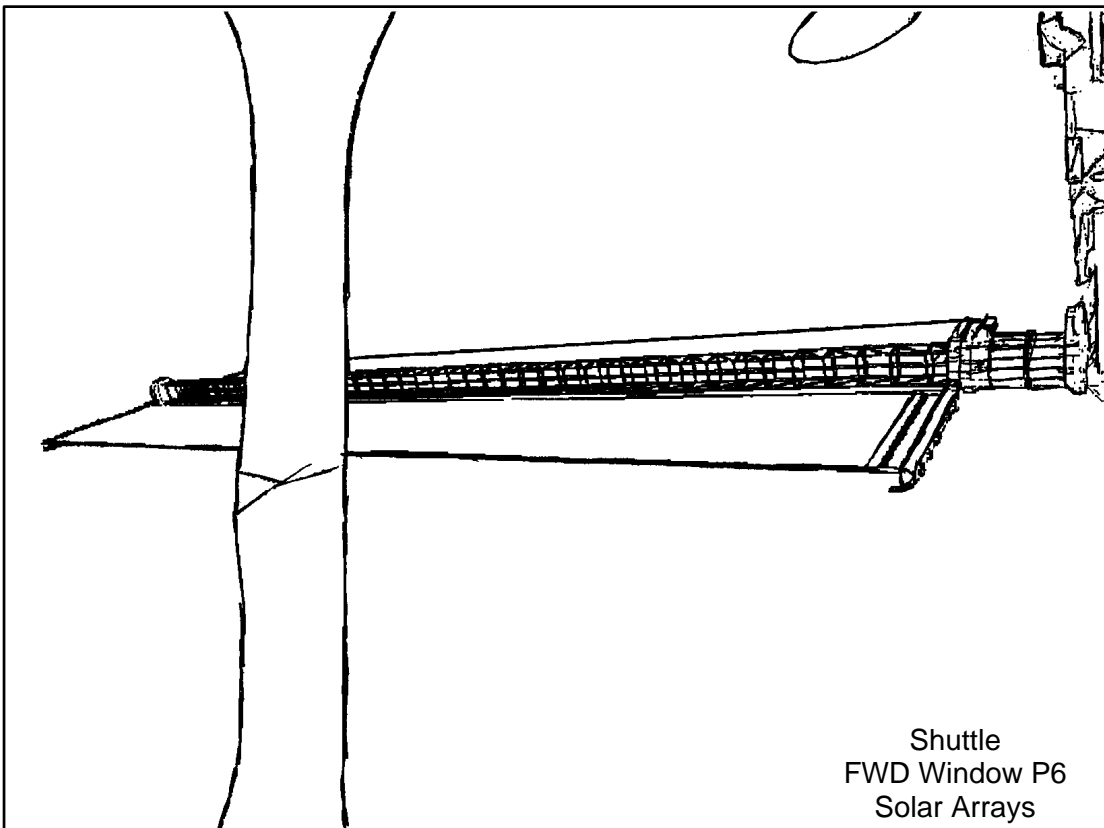
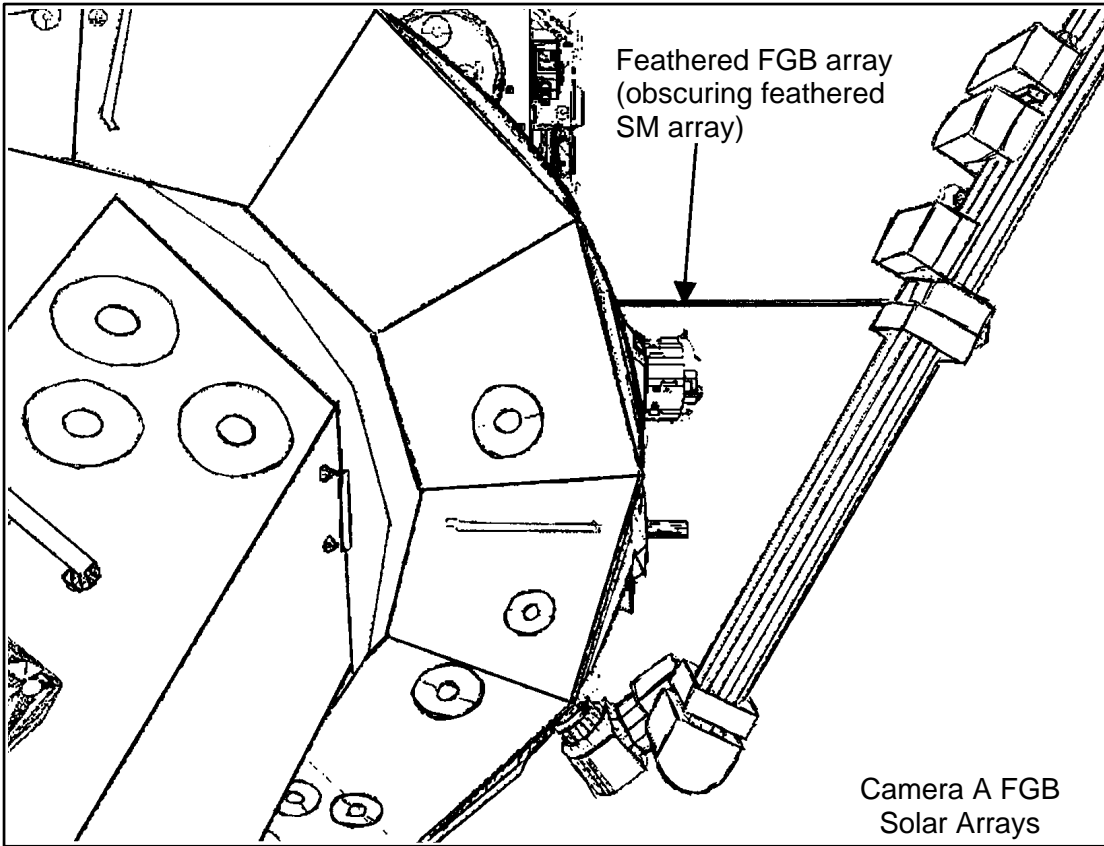
**Trajectory
 NOT TO
 SCALE**

HHL AIMING LOCATIONS

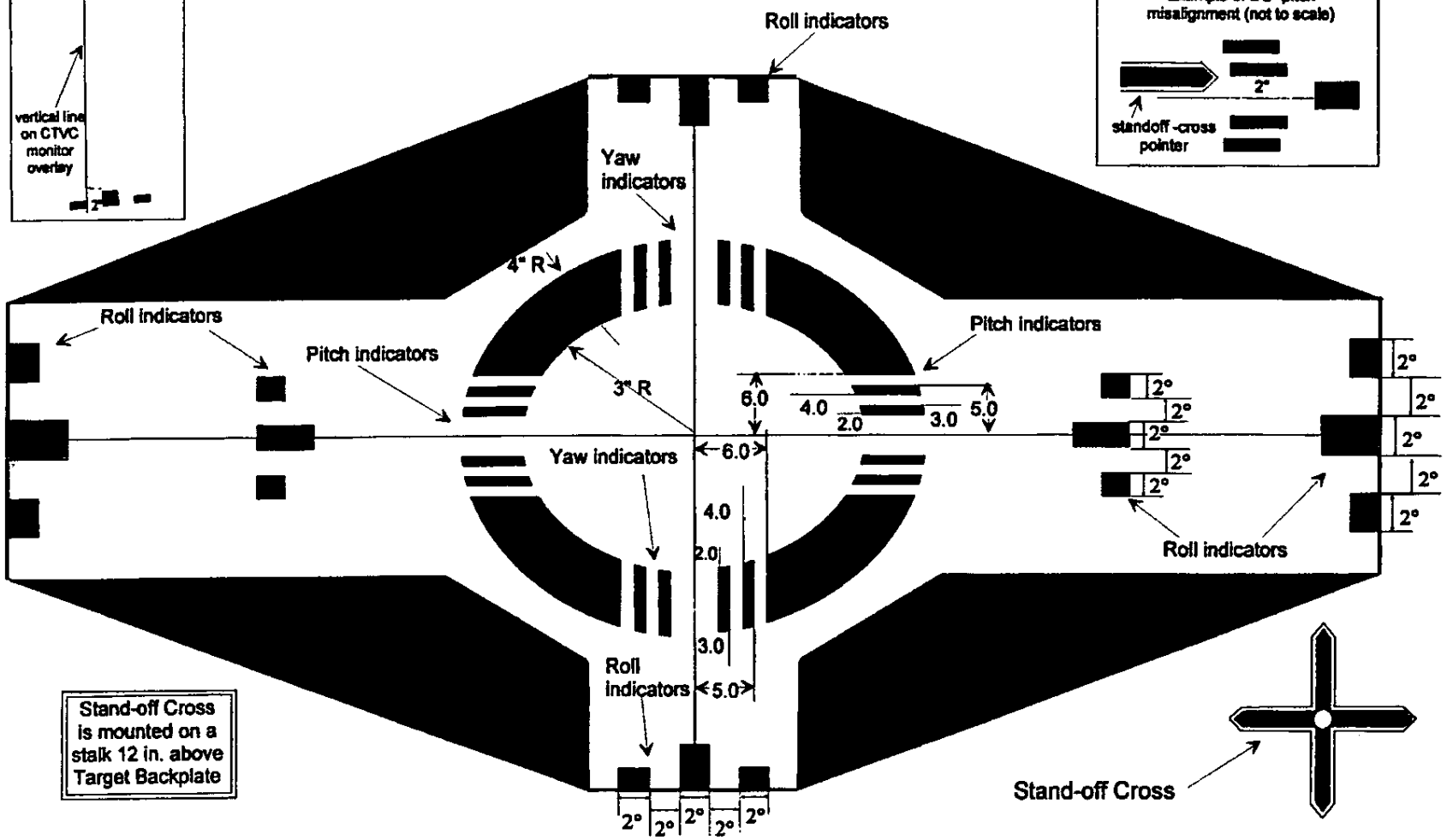
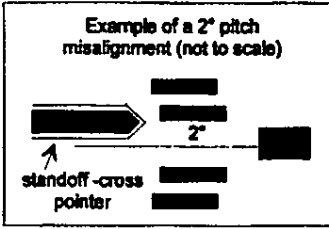
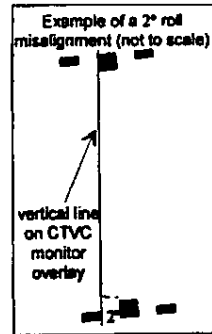


Note: Array Feathering Not Shown

SEPARATION SOLAR ARRAY CONFIGURATION



SHUTTLE CENTERLINE TARGET



Stand-off Cross is mounted on a stalk 12 in. above Target Backplate

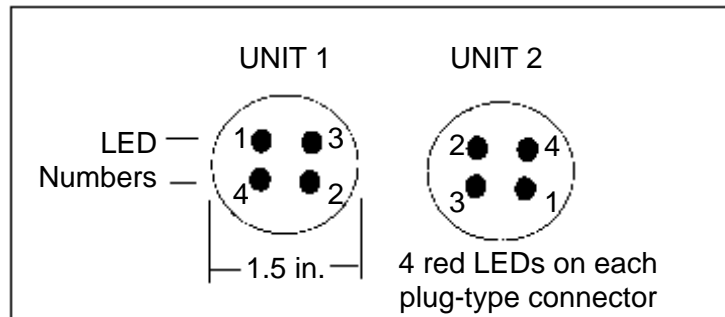
Roll indicators are to be used with the vertical and horizontal lines on the CTVC monitor overlays. All six sets of roll indicators are sized to give roll misalignments in increments of 2 degrees. At least two sets of roll indicators on opposite sides of the target backplate are required during roll misalignment determination (see roll misalignment example). The outer roll indicators (extra set on horizontal axis) may not be used with the inner roll indicators.

Pitch and yaw indicators are to be used with the pointers on the stand-off cross (see pitch misalignment example). Both sets of pitch indicator and yaw indicators are sized to give misalignments in increments of 2, 3, 4, 5, and 6 degrees.

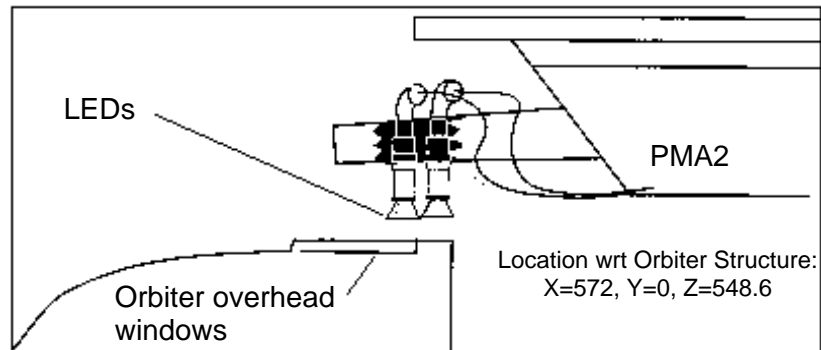
ISS ATTITUDE CONTROL SYSTEM MODING INDICATORS

- INDICATOR LIGHTS STEADY — ISS ACS ACTIVE
- INDICATOR LIGHTS FLASHING — ISS IN FREE DRIFT
- INDICATOR LIGHTS OFF — LIGHTS FAILED OR SOFTWARE OFF

<u>Unit/LEDs</u>	<u>MDM</u>	<u>Card/Channel</u>
Unit 1 LEDs 1 & 2	LA-1	DIO Card Slot 4 Channel 13
Unit 1 LEDs 3 & 4	LA-1	DIO Card Slot 4 Channel 14
Unit 2 LEDs 1 & 2	LA-2	DIO Card Slot 4 Channel 13
Unit 2 LEDs 3 & 4	LA-2	DIO Card Slot 4 Channel 14



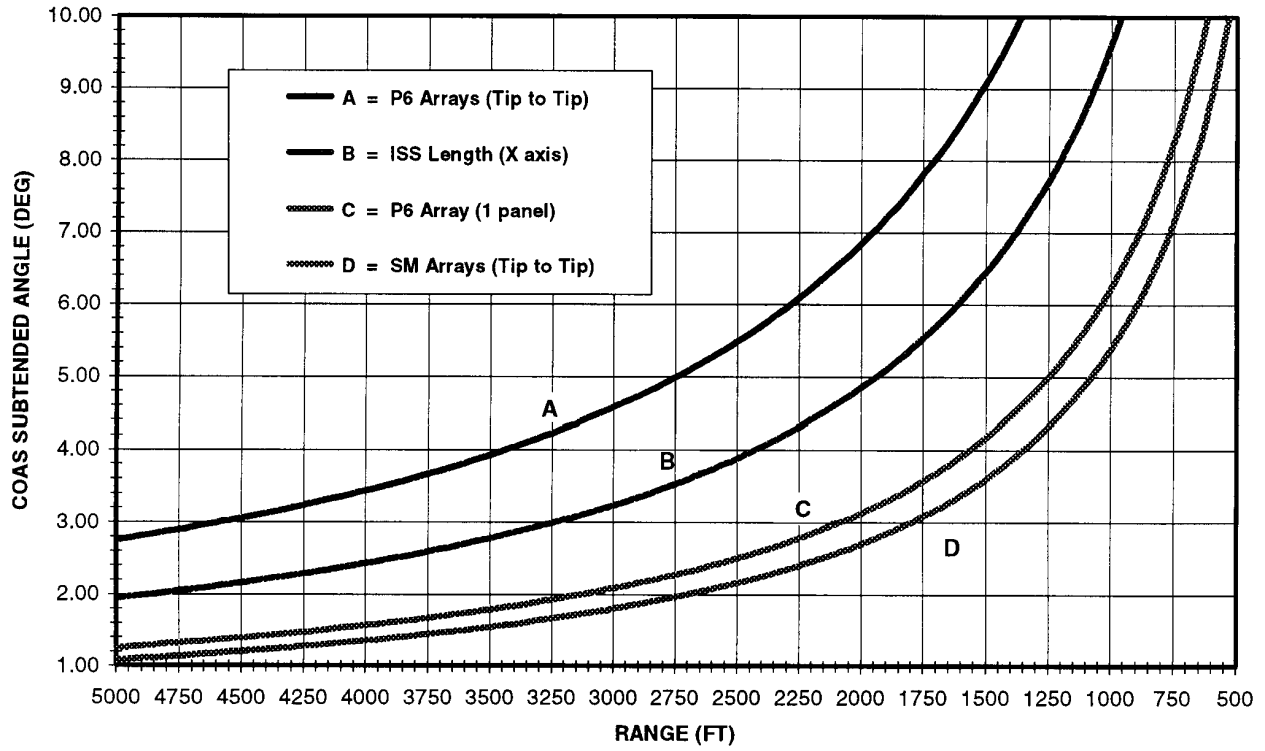
Bottom View



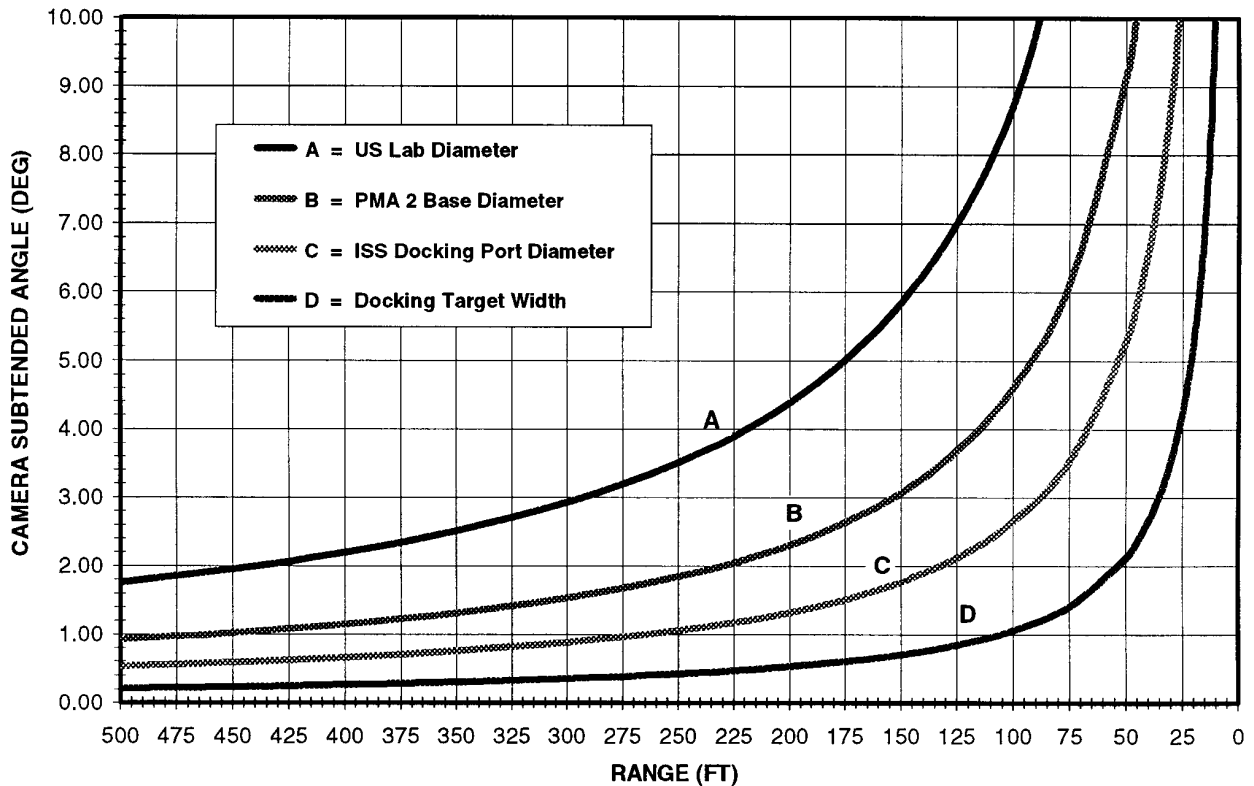
Side View

RANGING CHARTS

COAS SUBTENDED ANGLE VS RANGE



CAMERA SUBTENDED ANGLE VS RANGE



**COAS SUBTENDED ANGLES (DEG) VS RANGE (FT)
(SA DIMENSIONS TIP TO TIP)**

Deg	US SA	SM SA	FGB SA	Lab Dia.
0.5	27490	11178	9046	1730
1	13745	5589	4523	865
1.5	9163	3726	3015	577
2	6872	2794	2261	433
2.5	5497	2235	1809	346
3	4581	1863	1507	288
3.5	3926	1596	1292	247
4	3435	1397	1130	216
4.5	3053	1241	1005	192
5	2747	1117	904	173
5.5	2497	1015	822	157
6	2289	931	753	144
6.5	2112	859	695	133
7	1961	797	645	123
7.5	1830	744	602	115
8	1715	698	564	108
8.5	1614	656	531	102
9	1524	620	502	96
9.5	1444	587	475	91
10	1371	558	451	86
10.5	1305	531	430	82
11	1246	507	410	78
11.5	1191	484	392	75
12	1141	464	376	72

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RENDEZVOUS TOOLS

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CCTV CONFIG FOR DOCKING/UNDOCKING

RNDZ
TOOLS

1. ACTIVATION

Perform ACTIVATION (Cue Card, TV)

√Monitors set to USCAN – ON

√MCC: VSU Sync/Async configuration

Pwr up Cameras for Docking/Undocking:

CENTERLINE

Camrs A,C,D

Camr B

Install Monitor Sunshades

2. SET CCTV CAMERA FUNCTIONS

2.1 For Centerline Camera:

ALC pb – press

AVG pb – press

√GAM BLK STR – ON

√COLOR BAL – SUN

2.2 For Cameras A,C,D:

ALC pb – press

AVG pb – press

GAM BLK STR – ON

√COLOR BAL – SUN

SHUTTER – ON pb press as reqd

2.3 For Camera B:

ALC pb – press

AVG pb – press

LT LEVEL pb – press

NIGHT pb – press

GAM BLK STR – ON

3. SET CAMERA ZOOM SETTINGS

CAMERA

ZOOM

OVERLAY

Centerline

40.0° (Corridor)

Corridor

10.1° (full zoom)

Grid

4. MONITOR SETUP

MON 1,2 L-DATA – on

C-DATA – grn

XHAIR – grn

5. ZERO PTU ANGLES

MON 2 – Camr A

Zoom to full zoom out

Center A on B

Zoom to full zoom in

MON 2 – Camr B

Zoom to full zoom out

Center B on A

Zoom to full zoom in

MON 2 – Camr A

Recenter A on B (slow rate)

Pan/Tilt – Reset

MON 2 – Camr B

Recenter B on A (slow rate)

Pan/Tilt – Reset

Repeat for Camrs D,C

A7

6. CAMERA SETUP – CAMERA A,D

MON 2 – Camr A (Range Ruler), D (Backup Range Ruler)

Zoom = 74.4° FOV (full unzoom), Focus = 12 ft

Pan: as reqd to center ODS in monitor (see figure below)

Tilt: as reqd until bottom of ODS Interface Ring touches bottom of screen (see figure below)

7. FINAL CONFIG FOR APPROACH AND UNDOCKING/SEP

MON 1 – CENTERLINE

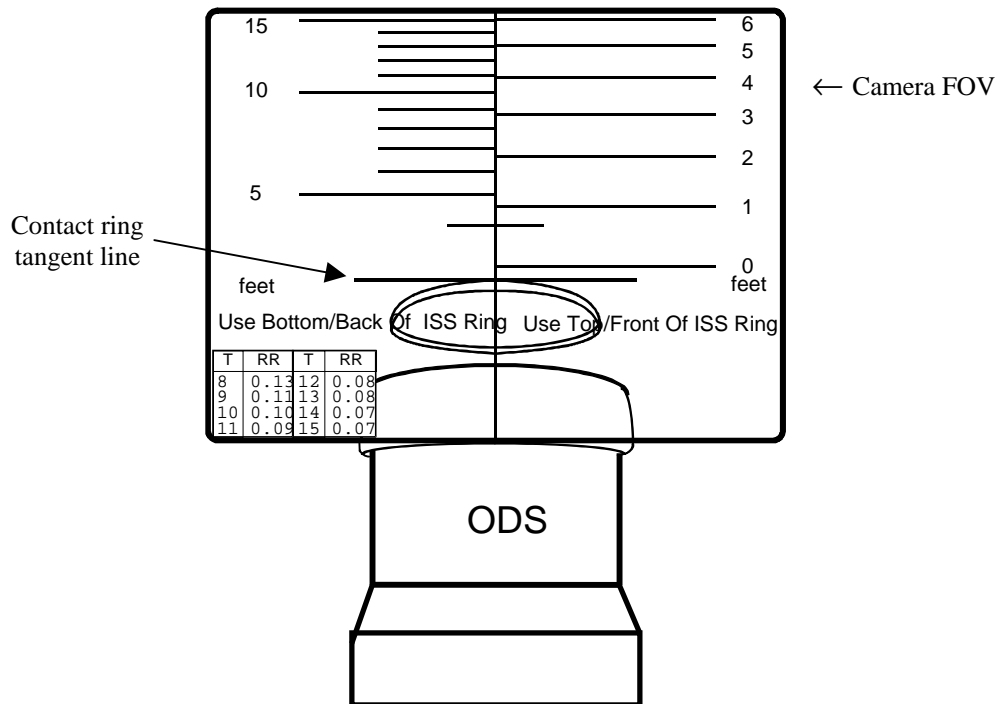
MON 2 – RANGE RULER

Install CORRIDOR overlay:

Use green XHair to center overlay

Install RANGE RULER overlay:

Place contact ring tangent line on top of ODS Contact Ring (see figure below)



**Camr A,D Range Ruler View
Approach Config**

RNDZ TOOLS CHECKOUT

1. √MCC uplink to TGT SV
 GNC 33 REL NAV
 RNDZ NAV ENA – ITEM 1 EXEC (*)
2. √RNDZ TOOLS connected per PGSC Usage Chart (if available) or UTILITY
 OUTLET PLUG-IN PLAN ORBIT CONFIGURATION (REF DATA FS,
 UTIL PWR)
3. Perform WINDECOM OPS – ACT (ORB OPS, PGSC)
4. Perform RPOP INITIALIZATION, steps 1 thru 6, 7-8

 On MCC GO:
5. Perform TCS ACTIVATION, steps 1 and 2, 7-18
6. Perform HAND-HELD LIDAR CHECKOUT, 7-6
7. When checkout complete, perform TCS DEACTIVATION, 7-20, then:
 Exit RPOP – [SHIFT]/[F10], then:
 HHL PWR SW – OFF, then:
 Temp stow Rndz Tools as reqd
8. GNC 33 REL NAV
 RNDZ NAV ENA – ITEM 1 EXEC (no *)

RNDZ TOOLS TROUBLESHOOTING

Notify MCC of problem; then perform each step from appropriate procedure, one at a time, until functionality restored. Troubleshooting steps assume RPOP is configured to receive PCMMU data via the RS-422 data cable

TCS CADS NOT RECEIVING TCS DATA

1. ✓Windows system tray for PC card icon to verify good connection to MCIU/Quatech card
2. ✓TX/RX end of TCS data cable connected to MCIU/Quatech card COM2
3. ✓Correct port config in TCS CADS s/w
4. Quit and restart TCS CADS
5. Change out TCS data cable and MCIU/Quatech card
6. Reboot PGSC and restart TCS CADS
7. On MCC GO, perform TCS DEACTIVATION, 7-20, followed by TCS ACTIVATION, 7-18
8. ✓MCC

RPOP NOT RECEIVING PCMMU DATA

1. ✓Windows system tray for PC card icon to verify good connection to MCIU/Quatech card
2. ✓Correct end of RS-422 Y data cable connected to MCIU/Quatech card COM4
3. ✓Correct port config in RPOP s/w
4. Quit and restart RPOP
5. Change out RS-422 Y data cable and MCIU/Quatech card
6. Reboot PGSC and restart RPOP
7. ✓MCC

RPOP NOT RECEIVING HHL DATA

1. ✓HHL cable securely connected to HHL unit and COM1
2. ✓RPOP port config set to COM1 for HHL
3. Quit and restart RPOP
4. Reboot RPOP PGSC and restart RPOP
5. Connect HHL cable to backup RPOP PGSC COM1 to check data flow. Swap to backup HHL data cable or backup HHL as reqd
6. ✓MCC

RPOP NOT RECEIVING TCS DATA (TCS CADS IS RECEIVING DATA ON SAME PGSC)

1. ✓RPOP configured to receive TCS data via DLL
2. Quit and restart RPOP
3. Reboot RPOP PGSC and restart RPOP and TCS CADS
4. ✓MCC

HAND-HELD LIDAR CHECKOUT

1. Unstow HHL, Battery Pack(s), and RS-232 cable

Connect RS-232 cable from HHL to PGSC
Plug Battery Pack into HHL

Verify RPOP program enabled per RPOP INITIALIZATION, 7-8

2. Perform HAND-HELD LIDAR OPS, 7-7
3. Take multiple (~10) Range and Velocity measurements using top center of aft PLB bulkhead or S0 Truss Segment as TGT
√HHL data received by RPOP (HHL trajectory source must be selected)

Range check:

√Range from aft port window to bulkhead = 60 ft
or

√Range from overhead window to S0 Truss Segment = ~23 ft

Velocity check:

Depress trigger for 5 sec

√Velocity = 0.0 fps

Report range and velocity discrepancies to MCC

Self-Test: Press and hold Test Mode button, √8.8.8.8. Select range

HAND-HELD LIDAR STOW

Power sw – OFF

Remove RS-232 cable
Unplug Battery Pack

Stow HHL, Battery Pack(s), and RS-232 cable

HAND-HELD LIDAR OPS

Power sw – ON

NOTE

If msg 'LoB' or flashing 8888 on display or irregular tone emitted, replace battery

Display Intensity knob – Adjust intensity to minimum acceptable level

Select Range or Velocity decimal place by toggling RANGE/VELOCITY buttons

Range pb – 1 ft or 0.1 ft

Velocity pb – 0.1 fps or 0.01 fps

Center red dot on TGT

Depress trigger for each measurement

Hold trigger for velocity measurements

Velocity accuracy increases with trigger hold duration:

<u>Duration</u>	<u>Accuracy</u>
0.5	0.15
1.0	0.06
2.0	0.03
5.0	0.01

To verify lock-on (if desired):

1. Push Test Mode button
2. Center red dot on TGT
3. Depress and hold trigger. Pitch on tone proportional to received signal strength
4. Press Range or Velocity button to return to Operational Mode

Error Codes:

E01 Never acquired target because target out of range or target too close

E02 Excessive percentage of total laser pulses in measurement sample unsatisfactory

E03 Excessive number of consecutive laser pulses in measurement sample unsatisfactory

RPOP INITIALIZATION

NOTE

Do not connect RS232 cable (with data flowing over it) to PGSC prior to PGSC powerup

1. Power on RPOP/TCS PGSCs
√Data, pwr cables installed per PGSC Usage Chart (if available) or UTILITY OUTLET PLUG-IN PLAN, ON-ORBIT CONFIG (REF DATA FS, UTIL PWR)
2. From Startup Menu, select appropriate Expansion Chassis config
3. Select Shuttle Apps Icon
Select RPOP folder
Select appropriate RPOP icon
RPOP logo display
RPOP Initialization
4. Enter current MET:
Days>____/Hrs>__:Min>__:Sec>__

Click [OK] to continue

NOTE

Time synchronized on [OK]

5. √PCM selected – status displayed above F6 ([CTRL]/[F6] to enable/disable)
√RPOP is receiving PCMMU data

If no target state vector on board, expect flashing error msg
If target state vector on board but rel nav not enabled, expect bad relative state
6. Update target LVLH attitude as reqd – [SHIFT]/[F6]
Enter Target Vehicle Attitude Info
Select appropriate Attitude (PYR Seq.)

Pitch > _____ Yaw > _____ Roll > _____

Select appropriate attitude rate

Enter rates (as reqd)

Click [OK] to continue

RPOP OPS

1. ✓RPOP SETUP complete:
 - ✓RPOP window title bar – verify mission specific scenario
 - In upper right corner of Trajectory Display:
 - ✓Time – counting as reqd
 - ✓RPOP configuration – as reqd (Pitch, Alt)
 2. Begin processing trajectory data:
 - Configure/input trajectory data as needed per RPOP FUNCTION KEY SUMMARY (Trajectory Data Keys)
 3. Update MET (as reqd):
 - [CNTL]/[F10]
 - RPOP Configuration

 - Select [Update MET. . .] button
 - Update MET

 - Update MET and click [OK] when finished
 4. Reconfig Serial Ports (as reqd):
 - [CNTL]/[F10]
 - RPOP Configuration

 - Select [Comm Ports. . .] button
 - RPOP Communications Setup

 - Reconfig desired com ports/DLL and click [OK] when finished
- NOTE**
TCS source for RPOP must be set to DLL
5. Reconfig TCS No./Reflector No. Settings (as reqd):
 - [CNTL]/[F10]
 - RPOP Configuration

 - Select [TCS/Refl. . .] button
 - Select TCS/Reflector Set

 - Reconfig desired TCS No. and/or Reflector No. and click [OK] when finished
 6. Config Average Rdot guidance (as reqd):
 - Select Guid – [CTRL]/[F5]
 - Select Guidance Type

 - Select [Average Rdot] button – [A]
 - Enter time until docking (countdown time)
 - Min > _____
 - Sec > _____
 - Select [Start]. Timer starts when [Start] pressed
 - Click [OK] when finished

7. Configure TCS NAV (as reqd):
 - Select [Data] key for the TCS (CTRL row in columns F1 through F4)
 - If there is no [Data] key for TCS, reconfigure data source for TCS
[F#-TCS]
 - Select Nav option – [N]
 - Click [OK] when finished

8. Configure HHL NAV (as reqd):
 - Select [Data] key for the HHL (CTRL row in columns F1 through F4)
 - If there is no [Data] key for HHL, reconfigure data source for HHL
[F#-HHL]
 - Select [HHL Nav. . .] config button – [ALT]/[H]
HHL Nav Configuration
 - Enable HHL Nav (if unchecked) – [H]
 - Click [OK] to close HHL Nav dialog
 - Click [OK] or [Update Settings] to close HHL dialog

9. Configure OOP, Glideslope, or +Vbar Acquisition Guidance (as reqd):
 - Select Guid – [CTRL]/[F5]
 - [Select Guidance Type]
 - Select [OOP Control] – [O]
 - Select [Glideslope Control] – [G]
 - Select [+Vbar Acquisition] – [V]
 - Click [OK] when finished.

NOTE

Glideslope Control with Init:Auto must first be selected to make +Vbar Acquisition available

10. Change configuration and/or input data as reqd per RPOP FUNCTION KEY SUMMARY
 - Move axes or zoom in/out as desired per RPOP KEYSTROKE SUMMARY
 - Use [SPACEBAR] to toggle on-screen Function Key Menu ON/OFF
 - Use [F10] for HELP
 - Use [F11] to cycle thru declutter levels
 - Use [F12] to snap a range ruler mark; [SHIFT]/[F12] to delete it

11. To exit RPOP program – [SHIFT]/[F10]

RPOP FUNCTION KEY SUMMARY

TRAJECTORY DATA KEYS (Columns F1 → F4)

- [F1→F4]** PRIME KEY
(SV, RR, HHL, CCTV or TCS)
Make this Trajectory Prime Trajectory
- Only one trajectory can be Prime at a time
 - Prime Trajectory has orbiter graphics, predictors, and color-coordinated digital data
- [SHIFT]/[F1→F4]** SHOW/HIDE KEY
(Show/Hide)
Show or Hide this Trajectory (toggle)
- Prime Trajectory cannot be hidden
 - Background processing of trajectory continues even when hidden
(Exception: HHL trajectory data will not prompt for user input when hidden)
- [CTRL]/[F1→F4]** DATA KEY
(Data)
Configure/input data for trajectory
- Allows user to configure specific Trajectory Data Source Options
 - Allows user to input manual data
 - Allows user to reconfigure function key to another Trajectory Data Source
 - Duplicate Trajectory Data Source configurations are permitted (e.g., HHL could be configured for both F3 and F4, if desired)

NOTE

Although duplicate data source configurations are permitted, duplicate automatic data modes (namely, State Vector, RR Auto, TCS Auto and TCS Nav) are not permitted. In such a situation, duplicated auto mode option grayed out in Trajectory Data Source Options dialog box

GENERAL FUNCTION KEYS (Columns F5 → F12)

[F5] (Rdot)	RDOT WINDOW Toggles display of Rdot Window
[SHIFT]/[F5] (Orb Att)	ORBITER ATTITUDE Update orbiter attitude and attitude rate
[CTRL]/[F5] (Guid)	GUIDANCE Select guidance cues on demand Available options are: CW Targeting - given a burn time, transfer time, and desired LVLH position, CW Targeting will provide required THC inputs OOP Control - provides THC recommendations for controlling out-of-plane motion Glideslope Control - provides THC recommendations for flying the final approach along a glideslope +Vbar Acquisition - provides THC recommendations for acquiring the +Vbar in preparation for final approach LVLH Velocity Null - provides THC recommendations for nulling LVLH velocities in each direction Average Rdot - information for timed approach
[F6] (Sub Ang)	SUBTENDED ANGLE Enter subtended angle in Rdot Window to get range and range rate. Only active when SubAng source active on Rdot Window
[SHIFT]/[F6] (Tgt Att)	TARGET ATTITUDE Update Target attitude and attitude rate
[CTRL]/[F6] (PCMMU)	PCMMU MODE No PCM mode (displays No PCM) Requires orbiter attitude data to be entered manually with each sensor mark PCM MODE (displays PCM) Orbiter attitude is automatically computed using PCMMU data
[F7] (View)	VIEW If Tgt-Centered LVLH, cycle through views: XZ, XY, YZ If Orb-Centered LVLH, cycle through views: XZ, XY, YZ, CAM View identification displayed upper left-hand corner of Trajectory Display
[SHIFT]/[F7] (Ovrlay)	OVERLAY Cycle through displays of overlays
[CTRL]/[F7] (OvrOrgn)	OVERLAY ORIGIN (<i>Available only if Overlay is enabled</i>) Toggle anchor point of corridor overlay between Target vehicle attach point and orbiter attach point
[F8] (Tgt/Orb)	REFERENCE FRAME Toggle display between Tgt-Centered LVLH plot and Orb-Centered LVLH plot
[SHIFT]/[F8] (Low Z)	LO Z Toggle jet-select between No Low Z and Low Z for making THC "What If" inputs. Displays Low Z
[CTRL]/[F8] (POR)	POINT OF REFERENCE Cycle through preselected orbiter Point-Of-Reference to Target Point-Of-Reference sets (e.g., CG to CG, Dock Port to Dock Port)

GENERAL FUNCTION KEYS (Columns F5 → F12) (Cont)

[F9] (THC Clr)	THC CLEAR Clear THC “What if” inputs from the Prime Trajectory
[SHIFT]/[F9] (TrajClr)	TRAJECTORY CLEAR Clear Prime Trajectory history of all but 2 most recent data inputs
[CTRL]/[F9] (Back 1)	BACK 1 Delete last data input from the Prime Trajectory

[F10]
(Help) HELP
Access on-line help information

[SHIFT]/[F10]
(Exit) EXIT
Save output files and exit RPOP program

[CTRL]/[F10]
(Config) RPOP CONFIGURATION
Configure following RPOP options:

Debug

Enable serial port I/O debug text to be displayed. Displays Debug

Data Freq...

Change frequency of automatic acceptance (plotting) of PCM data (SV or RR Auto) or TCS data (TCS Auto)

Predictors...

Change number and/or time increment of displayed predictors

Update MET...

Change the mission elapsed time

Altitude...

Change altitude of target vehicle

Comm Ports...

Reconfigure serial ports and/or the DLL

TCS/Refl...

Select TCS ID number (1-2) and reflector ID number (1-6)

Views...

Enable/disable Tgt- and Orb-Centered views

NOTE

Currently displayed view (both Tgt- and Orb-Centered) cannot be disabled

THC “What if”...

Select DAP setting (trans pulse size) to be used for THC “What if” inputs
Options include: Rndz DAP, Prox Ops DAP, and a User-Configurable DAP

GENERAL FUNCTION KEYS (Columns F5 → F12) (Cont)

- [F11]** DECLUTTER
Cycle RPOPs display through three different levels of declutter
- [F12]** RANGE RULER SNAP
Computes range rate based on time between snaps and assumed delta range interval. Feature available only if I-loaded delta range interval has non zero value
- [SHIFT]/[F12]** RANGE RULER CLEAR
Clears range ruler display from screen. Feature available only if I-loaded delta range interval has non zero value

RPOP KEYSTROKE SUMMARY

[CTRL]/[←] or l	Move Vertical axis left
[CTRL]/[→] or r	Move Vertical axis right
[CTRL]/[↑] or u	Move Horizontal axis up
[CTRL]/[↓] or d	Move Horizontal axis down

[CTRL]/[PGUP]	Zoom IN on Trajectory Display
[CTRL]/[X]/[PGUP]	Zoom IN on X axis only
[CTRL]/[Y]/[PGUP]	Zoom IN on Y axis only
[CTRL]/[Z]/[PGUP]	Zoom IN on Z axis only

[CTRL]/[PGDN]	Zoom OUT on Trajectory Display
[CTRL]/[X]/[PGDN]	Zoom OUT on X axis only
[CTRL]/[Y]/[PGDN]	Zoom OUT on Y axis only
[CTRL]/[Z]/[PGDN]	Zoom OUT on Z axis only

NOTE

Use [SHIFT] in combination with any of above keystrokes in order to scale/move axes in finer increments. Each view may be independently scaled and/or autoscaled

[CTRL]/[HOME]	Resume autoscaling and reset scale
[SPACEBAR]	Toggle on-screen Function Key Menu ON/OFF

THC "What if" (-Z sense) Keystrokes (Prime Trajectory only)

	<u>DAP A8</u>	<u>DAP B8</u>
Z IN	[SHIFT]/[→]	[→]
Z OUT	[SHIFT]/[←]	[←]
X UP	[SHIFT]/[↑]	[↑]
X DOWN	[SHIFT]/[↓]	[↓]

TRAJECTORY DATA SOURCE OPTIONS

SV STATE VECTOR
Options include:
State Vector – Enable automatic acceptance of the Onboard Nav states
None – Turn State Vector processing off
Config... – Reconfigure Trajectory Data Source for this function key

RR RENDEZVOUS RADAR
Options include:
Manual – Manually enter Radar RNG, EL and AZ
Auto – Enable automatic acceptance of Radar RNG, EL and AZ
None – Turn Radar processing off
Config... – Reconfigure the Trajectory Data Source for this function key

HHL HANDHELD LASER
Manually select HHL Aim Point, Angle Source, and Angle Source Aim Point
Manually enter HHL RNG and two Angle Source angles (an in-plane and out-of-plane)

Options include:
Lock – Hold the in-plane angle constant (locked) for each HHL mark
Lock – Hold the out-of-plane angle constant (locked) for each HHL mark
Uppdate Settings – Accept configuration changes to Aim Points, Angle Source, and Lock option without incorporating a trajectory mark
HHL Nav. . . – HHL Nav activation (on/off) and configuration (display resids and ratios, force measurements, reinitialize, length of trigger pull (short/long or long only))
Config... – Reconfigure the Trajectory Data Source for this function key

Angle Source options include:
Fwd CCTV, Aft CCTV, Dock Cam, COAS, Radar, TCS, *Other*, None

NOTE

Manual inputs reqd for all angle sources except Radar, TCS and None. If Radar or TCS selected, angles will be automatically snapped (if available). *Other* camera is *optional*, and may be completely specified via I-load

Aim Point options include:
HHL Aim Pt, Tgt CG, *Point of Interest #1, Point of Interest #2, Point of Interest #3*

NOTE

HHL Aim Pt is always available and may be completely specified via I-load. Tgt CG is always available *Points of Interest 1-3* are *optional*, and may be completely specified via I-load. For Angle Source Radar, angle aim point is Tgt CG. For Angle Source TCS, angle aim point is current reflector no

CCTV CLOSED CIRCUIT TELEVISION CAMERAS
Manually enter FWD and AFT CCTV tilt angles
Options include:

Config... – Reconfigure Trajectory Data Source for this function key

TCS

TRAJECTORY CONTROL SENSOR

Options include:

Manual – Manually enter TCS RNG, EL and AZ

Auto – Enable automatic acceptance of TCS RNG, EL and AZ

Nav – Enable TCS NAV (Kalman Filtering)

Display Resids and Ratios

Force Measurements

Re-Initialize on [OK]

None – Turn TCS processing off

Config – Reconfigure the Trajectory Data Source for this function key

TCS ACTIVATION

1. CADS BOOTUP
√RPOP/TCS PGSC powered ON
PGSC √Data cables installed per PGSC Usage Chart (if available) or UTILITY OUTLET PLUG-IN PLAN ORBIT CONFIGURATION (REF DATA FS, UTIL PWR)

SHUTTLE APPS
> TCS

2. TCS PWRUP/INITIALIZATION
L12 TCS PWR – ON (tb-gray)

- * If tb – bp, cycle sw *
- * If no joy, notify MCC *

PGCS

TCS Self Test

	<u>Status</u>	<u>Override</u>
√Shutter:	Passed	Off
√Z Latch:	Passed	Off
√CW Laser:	Passed	Off
√Pulse Laser:	Passed	Off

√MSG: INITIALIZATION COMPLETE

- * If error msg received during initialization, *
- * √MCC *

TCS OPS

√Mode: Stby
√Z Latch: Unlocked
√Pulse: Avail
√CW: Active

- * If not in config, *
- * √MCC *

3. TIME REFERENCE SELECT

TCS C&DI

Commands > Send TCS Time

CAD Clock

Enter MET
> Send

√Messages – 'TCS Clock has been set'

4. ENABLE AUTO ACQUISITION

TCS C&DI

> Config > Automatic > Acquisition

Update 'Maximum Range' for auto acquisition to begin as desired

> OK

Inform MCC of range entered

TCS MANUAL ACQUISITION

1. ACQUIRE

PGSC

TCS OPS

√Pulse: Avail
√CW: Active
√Skin Trk: Dis
√Att: Inact

TCS C&DI

>Macros>ACQUISITION

Target Acquisition Data

Input current estimate of range to Target and zero for Azimuth and Elevation:

RANGE > _____
AZIMUTH > _____
ELEVATION > _____

√95% RANGE GATE – (no X)

>SEND

TCS OPS

If first acquisition:

√Shutter – Open (after ~22 sec)

* If shutter fails to open: *
* > Commands > Standby *
* > Commands > Open Shutter *
* > Commands > Acquire *

√Data – Good (and active tracking data)

* If TCS not tracking and no RPOP or Auto Seed *
* Update disabled, *
* TCS C&DI *
* > Commands > Acquire *
* Update Range estimate and zero AZ & EL *
* > Send *

2. ENABLE RPOP TCS NAV

Perform RPOP OPS, step 7, 7-10

3. ENABLE AUTO ACQUISITION

√Data – Good (and active tracking data)

TCS C&DI

>Config>Automatic

If Seed Update – (no √)

>Seed Update

√Maximum Range (ft): 5000

>OK

>Config>Automatic

If Acquisition – (no √)

>Acquisition

√Maximum Range (ft): 5000

>OK

>Config>Automatic

√Initialization – (√)

√Seed Update – (√)

√Acquisition – (√)

TCS DEACTIVATION

1. SHUTDOWN
PGSC
>Macros>SHUTDOWN
- * If error msg received during SHUTDOWN, *
 - * √MCC *
- √Shutter: Closed (takes ~22 sec)
- * If shutter fails to close: *
 - * > Commands > Close shutter *
- If Final TCS deactivation for mission:
2. SECURE Z AXIS
> Commands > Lock Z Axis Latch
- √Z Latch: Locked
- * If Z Latch fails to lock: *
 - * > Commands > Lock Z Axis Latch *
3. POWERDOWN
L12 TCS PWR – OFF (tb-bp)
- * If tb – gray, cycle sw *
 - * If no joy, notify MCC *
- PGSC
> File > Exit TCS CAD

TCS LIMITS

TEMPERATURE (degC)	LOW ALERT	HIGH	
		ALERT	AUTOSAFE
CW Laser	-40.0	45.0	50.0
APD	-40.0	65.0	70.0
CPU	-40.0	80.0	85.0
DC Power	-40.0	80.0	85.0
Galvos	-40.0	80.0	85.0

VOLTAGES	LOW ALERT	HIGH ALERT
5V	4.75	5.25
5.5V	5.00	6.00
12V	11.00	12.75
15V	14.25	15.50

TRAD FAIL RANGE AND RANGE RATE DETERMINATION

1. Maintain a prime and a backup range and rdot estimate
2. Prime and backup range and rdot estimates shall have independent sensor sources
3. Maintain prime and backup RPOP PGSCs
4. Refer to tables below for the recommended prime and backup source/configuration for NOMINAL OPS, RADAR FAIL, TCS FAIL, HHL FAIL, PCMMU/WINDECOM FAIL, and PGSC FAIL (No RPOP, No TCS) scenarios

NOMINAL OPS

Phase	Prime Source: Configuration	Backup Source: Configuration
1. Manual Takeover thru TCS lock-on (R > 3000 ft assumed for TCS nominal lock-on*)	State data: SV	Rdot window: HHL FLTR NOTE: Configure HHL angle source to Dock Cam and lock angles to 0
2. TCS lock-on thru 15 ft	State data: TCS NAV	Rdot window: HHL FLTR NOTE: Configure HHL angle source to Dock Cam and lock angles to 0
3. 15 ft thru dock	Rdot Window: Range Ruler (F12) Raw data: TCS Raw	

*If no joy on TCS lock-on by 1200 ft, start subtended angle operations so that subtended angle estimates can back up the HHL Fltr inside of 1000 ft

RADAR FAIL

Phase	Prime Source: Configuration	Backup Source: Configuration
1. Manual Takeover thru TCS lock-on* <u>NOTE:</u> RPOP State data: (HHL/SV) can be suspect	Rdot window: HHL FLTR & HHL/Dt <u>NOTE:</u> Configure HHL angle source to Dock Cam and lock angles to 0	Rdot window: Subtended angles
2. TCS lock-on thru 15 ft	State data: TCS NAV	Rdot window: HHL FLTR <u>NOTE:</u> Configure HHL angle source to Dock Cam and lock angles to 0
3. 15 ft thru dock	Rdot Window: Range Ruler(F12) Raw data: TCS Raw	

*Start Subtended angle ops after the radar fail correction if no joy on TCS lock-on

TCS FAIL

Phase	Prime Source: Configuration	Backup Source: Configuration
1. Manual Takeover thru ~1200 ft <u>NOTE:</u> Transition from phase 1 to phase 2 should be gradual. Start transition at ~1500 ft and complete it prior to 1000 ft braking gate	State data: SV	Rdot window: HHL FLTR & HHL/Dt <u>NOTE:</u> Configure HHL angle source to Dock Cam and lock angles to 0 Rdot window: HHL/DT
2. ~1200 ft thru 15 ft <u>NOTE:</u> Spec 33: FLTR, and State data: HHL can be suspect	Rdot window: HHL FLTR <u>NOTE:</u> Configure HHL angle source to Dock Cam and lock angles to 0	Rdot window: Subtended angles Spec 33: Raw Radar*
3. 15 ft thru dock	Rdot window: HHL FLTR** Rdot Window: Range Ruler(F12)	

*Radar data will be unusable at close ranges. The range at which the data becomes unusable is dependent on the target size, geometry, and physical characteristics, but can not be accurately predicted. For ISS the RR can become too noisy to use at ranges as great as 1000 ft

**HHL will not work if the aimpoint surface is closer than 12 feet (5 ft DP-DP)

HHL FAIL

Phase	Prime Source: Configuration	Backup Source: Configuration
1. Manual Takeover thru TCS lock-on	State data: SV	Rdot window: Subtended Angle
2. TCS lock-on thru 15 ft	State data: TCS NAV	Spec 33: Raw RR* Rdot window: Subtended Angle
3. 15 ft thru dock	Rdot Window: Range Ruler(F12) Raw data: TCS Raw	

*Radar data will be unusable at close ranges. The range at which the data becomes unusable is dependent on the target size, geometry, and physical characteristics, but cannot be accurately predicted. For ISS the RR can become too noisy to use at ranges as great as 1000 ft

PCMMU/WINDECOM FAIL

Phase	Prime Source: Configuration	Backup Source: Configuration
1. Manual Takeover thru ~1200 ft <u>NOTE:</u> Transition from phase 1 to 2 should be gradual. Start transition at ~1500 ft and complete it prior to 1000 ft braking gate <u>NOTE:</u> RPOP state data is bad	Spec 33: FLTR	Rdot window: HHL/Dt <u>NOTE:</u> RPOP prompts user for Orb attitude after 1 st HHL mark. Enter P/Y/R= (90/0/0)* and check "Do not prompt for attitude" TCS CADS: Raw TCS (pulse active) <u>NOTE:</u> Range data good, rdot can be quite noisy <u>NOTE:</u> Resize and reposition the RPOP window so that the TCS mode (pulse/CW) is visible
2. ~1200 ft thru TCS CW lock-on(~800 ft) <u>NOTE:</u> RPOP State data is bad	Rdot window: HHL/Dt <u>NOTE:</u> RPOP uses the last two marks with Dt > 30 sec to calculate the Rdot estimate	TCS CADS: Raw TCS (pulse active) <u>NOTE:</u> Range data good, rdot can be quite noisy Rdot window: Generic <u>NOTE:</u> Manually enter raw TCS range marks. RPOP uses the last two marks with Dt > 30 sec to calculate the Rdot estimate
3. TCS CW lock-on (~800 ft) thru Vbar arrival <u>NOTE:</u> RPOP State data is bad	TCS CADS: Raw TCS (cw active)	Rdot window: HHL/Dt
4. Vbar arrival thru 15 ft	TCS CADS: Raw TCS (cw active) and/or State Data: TCS AUTO <u>NOTE:</u> Check Orb Att = (90/0/0), and set TCS frequency to 30 sec[CNTRL F10]	Rdot window: HHL/Dt
5. 15 ft thru dock	TCS CADS: TCS Raw (cw active) Rdot window: Range Ruler(F12)	

*Orbiter attitude displayed on RPOP will not be correct until maneuver to Vbar attitude is complete. Until Vbar arrival, do not use the RPOP trajectory data other than the data in the Rdot Window

PGSC FAIL (NO RPOP, NO TCS)

Phase	Prime Source: Configuration	Backup Source: Configuration
1. Manual Takeover thru ~1200 ft (noisy RR angles)	Spec 33: SV, Raw RR	For range – HHL (back of unit): Raw HHL For Rdot – Rdot vs. $\Delta Rng/\Delta t$ Cue Card: Record Raw HHL range and times on cue card
2. ~1200 ft thru 15 ft	For Range: HHL (back of unit): Raw HHL(short pulls) For Rdot: HHL (back of unit): Raw HHL(long pulls)	For range – Subtended Angle table(6-16): COAS or Centerline Cam subtended angle For Rdot – Rdot vs. $\Delta Rng/\Delta t$ Cue Card: Record subtended angle range and times on cue card
3. 15 ft thru dock	For Range: Range Ruler Overlay: Camera A/D For Rdot: HHL (back of unit): Raw HHL (long trigger pulls) Rdot table on Range Ruler Overlay: Dt between 1 ft DRange	

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APDS

APDS

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APDS NOMINAL

DOCKING MECHANISM INITIALIZATION.....	8-4
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POWERDOWN	8-6
PREP	8-7
UNDOCKING PREP	8-7
DOCKING RING EXTENSION	8-8
RETRACTION (NOT MATED)	8-9

APDS
NOMINAL

DOCKING MECHANISM INITIALIZATION

- A6L 1. cb ESS 1BC SYS PWR CNTL SYS 1 – cl
2CA SYS PWR CNTL SYS 2 – cl
1BC DEP SYS 1 VENT ISOL – cl
2CA DEP SYS 2 VENT ISOL – cl
MN A DEP SYS 1 VENT – cl
B DEP SYS 2 VENT – cl
MN A,MN B DOCK LT (four) – cl
MN A,MN B,MN C LOGIC (six) – cl
√PMA2/3 GRP 1,GRP 2 HOOKS (eight) – op
√SYS PWR MN A,MN B (two) – ctr
√SYS 1,SYS 2 tb (two) – OFF
√PYRO PWR MN A,MN C (two) – OFF
√PMA2/3 HOOKS SYS A,SYS B (two) – ctr
√GRP 1,2 tb (two) – bp
√PSU PWR MN A,MN B (two) – OFF
√LT TRUSS,VEST (four) – OFF
- A7L 2. √CNTL PNL PWR A,B,C (three) – OFF
√HTRS/DCU PWR (three) – OFF
√APDS PWR A_{DS},B_{DS},C_{DS} (three) – OFF
√A_{DS},B_{DS},C_{DS} lts (three) – off
√STATUS lts (eighteen) – off
√PYROS A_P,B_P,C_P (three) – OFF
√A_P,B_P,C_P lts (three) – off
√PYRO CIRC PROT OFF lt – off
- A6L 3. SYS PWR MN A,MN B (two) – ON (hold 5 sec)
√SYS 1,SYS 2 tb (two) – ON
√VEST DEP VLV SYS 1,SYS 2 VENT (two) – ctr (tb-CL)
√ISOL (two) – ctr (tb-CL)
cb ESS 1BC DEP SYS 1 VENT ISOL – op
2CA DEP SYS 2 VENT ISOL – op
MN A DEP SYS 1 VENT – op
B DEP SYS 2 VENT – op
√VEST DEP VLV SYS 1,SYS 2 VENT tb (two) – bp
√ISOL tb (two) – bp
- ML86B:C cb MNA EXT ARLK HTR VEST Z1/2/3 – cl

APDS
NOMINAL

DOCKING MECHANISM POWERUP

SM 167 DOCKING STATUS

- A6L 1. √SYS PWR SYS 1, SYS 2 tb (two) – ON
 PSU PWR MN A, MN B (two) – ON
 If in Undocking timeline and ODS VEST/PMA HATCH LEAK CHECK complete:
 √VEST DEP VLV SYS 1(SYS 2) VENT – OP (tb-OP)
- A7L 2. HTRS/DCU PWR (three) – ON
 CRT √PWR – A/B/C
 √RNG DR BUS – 1/2
 √HKS DR BUS – 1/2
 √DAMPER BUS – 1/2
 √FIXER BUS – 1/2
- A7L 3. CNTL PNL PWR A,B,C (three) – ON
 CRT √PWR – A/B/C
- A7L 4. APDS PWR A_{DS}, B_{DS}, C_{DS} (three) – ON
 CRT √A_{DS}, B_{DS}, C_{DS} lts (three) – on
 √APDS PWR – A/B/C
- A7L 5. LAMP TEST pb – push
 √STATUS lts (eighteen) – on
 √PYRO CIRC PROT OFF lts – on
- CRT * If CNTL PNL PWR A(C) tlm blank, and STATUS lts nominal, *
 * tlm failure only >> *
- A7L * If CNTL PNL PWR B tlm blank: *
 * CNTL PNL PWR A(C) – OFF *
 * PWR ON pb – push (√ and report STATUS lts to MCC) *
 * If any STATUS lts – on, tlm failure only *
 * CNTL PNL PWR A(C) – ON *

DOCKING MECHANISM POWERDOWN

SM 167 DOCKING STATUS

- A7L 1. \sqrt STATUS lts (eighteen) – off
2. APDS PWR A_{DS}, B_{DS}, C_{DS} (three) – OFF
 \sqrt A_{DS}, B_{DS}, C_{DS} lts (three) – off
- CRT \sqrt APDS PWR (three) – blank
- A7L 3. CNTL PNL PWR A,B,C (three) – OFF
CRT \sqrt CNTL PNL PWR A,B,C (three) – blank
- A7L 4. HTRS/DCU PWR (three) – OFF
CRT \sqrt HTRS/DCU PWR (three) – blank
- A6L 5. PSU PWR MN A, MN B (two) – OFF
6. If post-undocking:
VEST DEP VLV SYS 1(SYS 2) VENT – CL (hold 5 sec) (tb-CL)
ISOL – CL (hold 5 sec) (tb-CL)
- cb MNA DEP SYS 1 VENT – op
 \sqrt MNB DEP SYS 2 VENT – op
ESS 1BC DEP SYS 1 VENT ISOL – op
 \sqrt 2CA DEP SYS 2 VENT ISOL – op
- ML86B:C MNB (MNA) EXT ARLK HTR VEST Z1/2/3 – op

DOCKING PREP

SM 167 DOCKING STATUS

- A6L 1. LTS TRUSS AFT,FWD (two) – ON
VEST PORT,STBD (two) – ON (if reqd)
- A7L 2. PWR ON pb – push (lt on)
√RING ALIGNED lt – on
√INIT POS lt – on
√HOOKS 1,HOOKS 2 OP lts (two) – on
√LAT CL lt – on
- CRT √CLUTCH – blank/SLIP

UNDOCKING PREP

- A6L 1. LTS TRUSS FWD,AFT (two) – ON (as reqd)
VEST PORT,STBD – ON (if reqd)
- A7L 2. PWR ON pb – push (lt on)
√RING ALIGNED lt – on
√RDY TO HK lt – on
√INTERF SEALED lt – on
√HOOKS 1,HOOKS 2 CL lts (two) – on
√LAT OP lt – on
√RING FNL POS lt – on

DOCKING RING EXTENSION

		SM 167 DOCKING STATUS	
	A7L	1. PWR ON pb – push (lt on)	
		√RING ALIGNED lt – on	
		√HOOKS 1,HOOKS 2 OP lt (two) – ON	
		√LAT CL lt – on	
		√RING FNL POS lt – on	
	CRT	√CLUTCH – LOCK/blank	
	A7L	2. APDS CIRC PROT OFF pb – push (lt on)	
0:00		3. RING OUT pb – push	
0:10		√FNL POS lt – off	
	CRT	√DRV CMD – ON	
		√FIXERS – ON	
		√PETAL POS BASE (three) incr	
	A7L	* If RING INIT POS lt failed on (ring stops after 1 sec, and	*
	CRT	* CLUTCH – blank/SLIP):	*
	A7L	* FIXER OFF pb – push (FIXERS OFF lt on)	*
		* RING OUT pb – push	*
	CRT	* When PETAL POS BASE (three) = $76 \pm 3\%$:	*
	A7L	* PWR OFF pb – push	*
		* ON pb – push	*
		* √FIXERS OFF lt – off	*
		* APDS CIRC PROT OFF pb – push	*
		* RING OUT pb – push	*
		* After 1 sec:	*
	CRT	* √RING DRV CMD – OFF	*
		*	*
	A7L	* If RING FWD POS lt failed on (ring stops after 10 sec):	*
		* RING OUT pb – push	*
		* Within 10 sec:	*
		* APDS PWR A _{DS} ,B _{DS} ,C _{DS} (three) – OFF	*
		* APDS PWR A _{DS} ,B _{DS} ,C _{DS} (three) – ON	*
		* CIRC PROT OFF pb – push (lt on)	*
		* When RING INIT POS lt – on:	*
		* RING OUT pb – push	*

3:40		4. √RING INIT POS It – on	
	CRT	√PETAL POS BASE (three): 76 ± 3%	
3:50		√CLUTCH – blank/SLIP	
		* If CLUTCH – blank/blank:	*
A7L		* √APDS CIRC PROT OFF It – on	*
		* RING OUT pb – push (expect 1 sec of drive), wait	*
		* 10 sec	*
CRT		* √RING DRV CMD – OFF	*
		*	*
		* If CLUTCH – LOCK/blank:	*
A7L		* √RING INIT POS It – on	*
		* √FIXERS OFF It – off	*
		* √APDS CIRC PROT OFF It – on	*
		* RING OUT pb – push (expect 1 sec of drive), wait	*
		* 10 sec	*
CRT		* √RING DRV CMD – OFF	*
		*	*
		* If not CLUTCH – blank/SLIP:	*
		* √MCC	*
A7L		5. PWR OFF pb – push	
		√STATUS lts (eighteen) – off	

DOCKING RING RETRACTION (NOT MATED)

		SM 167 DOCKING STATUS	
A7L		1. PWR ON pb – push (lt on)	
		√RING ALIGNED It – on	
		√INIT POS It – on	
		√HOOKS 1,HOOKS 2 OP It (two) – on	
		√LAT CL It – on	
CRT		√CLUTCH – blank/SLIP	
0:00	A7L	2. RING IN pb – push	
		√INIT POS It – off	
CRT		√CLUTCH – LOCK/blank	
	A7L	* If RING FNL POS It failed on (ring stops after 10 sec):	*
		* RING IN pb – push	*
3:40	CRT	* When PETAL POS BASE = 5 ± 3% and not decr:	*
		* Wait 10 sec, then:	*
	A7L	* PWR OFF pb – push (√STATUS lts off) >>	*
3:40		3. √RING FNL POS It – on	
3:50	CRT	√DRV CMD – OFF	
	A7L	4. PWR OFF pb – push	
		√STATUS lts (eighteen) – off	

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APDS OFF-NOMINAL

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POWER FAILED OFF (STATUS LTS OFF)

CAUTION

Pre-Contact, if all STATUS LTS off, **NO-GO** for docking until power recovered. Initiate CORRIDOR BACKOUT (CONTINGENCY OPS) while attempting power recovery steps

- A7L
1. CNTL PNL PWR A – OFF
PWR ON pb – push
If expected STATUS LTS on:
Continue in DOCKING SEQUENCE, as reqd >>
 2. CNTL PNL PWR A – ON
APDS PWR A_{DS} – OFF
PWR ON pb – push
If expected STATUS LTS on:
If Undocking:
| Continue in UNDOCKING OPERATIONS, as reqd >>
If Docking:
Continue in DOCKING SEQUENCE through step 16 then:
Go to POWER FAILED OFF step 4
 3. APDS PWR A_{DS} – ON
B_{DS} – OFF
PWR ON pb – push
If all STATUS LTS off
| √MCC >>
If expected STATUS LTS on:
If Undocking:
| Continue in UNDOCKING OPERATIONS, as reqd >>
If Docking:
Continue in DOCKING SEQUENCE through step 16 then:
Go to POWER FAILED OFF step 4
 4. APDS CIRC PROT OFF pb – push (It on)
OPEN LATCHES pb – push
√LAT CL It – off
APDS PWR C_{DS} – OFF
A_{DS}, B_{DS} (two) – ON
PWR ON pb – push
If all STATUS LTS off:
| APDS PWR B_{DS} – OFF
C_{DS} – ON
| PWR ON pb – push (It on)
APDS CIRC PROT OFF pb – push (It on)
Go to DOCKING SEQUENCE step 17

DAMPING FAILED ON

CAUTION

Pre-Contact, **NO-GO** for docking if DAMPING – ON.
Initiate CORRIDOR BACKOUT (CONTINGENCY OPS) while attempting to power off dampers

SM 167 DOCKING STATUS

- A6L 1. PSU PWR MNA – OFF
CRT If DAMPING – ON:
A6L | PSU PWR MNA – ON
| MNB – OFF
CRT If DAMPING – OFF:
Pre-Contact:
Continue Approach
Post-Capture:
A7L PWR OFF pb – push
ON pb – push
Continue in DOCKING SEQUENCE, as reqd >>
- A6L 2. PSU PWR MNA,MNB (two) – OFF
Pre-Contact:
Continue Approach
Post-Capture:
PSU PWR MNA,MNB (two) – ON
Continue in DOCKING SEQUENCE, as reqd

CAPTURE LT FAILED ON

CAUTION

Pre-Contact, **NO-GO** for docking if DAMPING – ON.
Initiate CORRIDOR BACKOUT (CONTINGENCY OPS) while attempting to power off dampers

SM 167 DOCKING STATUS

- CRT If Pre-Contact:
If DAMPING – OFF:
| Continue Approach >>
If DAMPING – ON:
A6L PSU PWR MNA,MNB (two) – OFF
Continue Approach
Post-Capture (no physical separation):
PSU PWR MNA,MNB (two) – ON
Continue in DOCKING SEQUENCE, as reqd

FIXERS FAILED ON

CAUTION

Pre-Contact, **NO-GO** for docking if FIXERS – ON.
Initiate CORRIDOR BACKOUT (CONTINGENCY OPS) while attempting to power off fixers

SM 167 DOCKING STATUS

- A7L 1. PWR OFF pb – push
CRT If FIXERS – ON:
A7L PWR ON pb – push
Continue Approach or DOCKING SEQUENCE, as reqd >>
2. PWR ON pb – push
APDS PWR A_{DS} – OFF
CRT If FIXERS – ON:
A7L | APDS PWR A_{DS} – ON
| B_{DS} – OFF
CRT If FIXERS – OFF:
Pre-Contact:
Continue Approach
Post-Capture, continue in DOCKING SEQUENCE, as reqd, with the following change:
After DOCKING SEQUENCE step 16:
A7L APDS PWR A_{DS} (B_{DS}) – ON >>
3. APDS PWR B_{DS} – ON
If pre-contact:
A6L PSU PWR MNA,MNB (two) – OFF
Continue Approach
After DOCKING SEQUENCE step 1:
Wait for RING ALIGN It – on continuously for 60 sec, then:
A7L PWR OFF pb – push
ON pb – push
A6L PSU PWR MNA,MNB (two) – ON
Go to DOCKING SEQUENCE step 8

FIXERS OFF LT FAILED ON

SM 167 DOCKING STATUS

- If performing DOCKING RING EXTENSION:
- CRT 1. If FIXERS – ON during ring drive:
Continue in DOCKING RING EXTENSION >>
- A7L 2. CNTL PNL PWR A – OFF
PWR OFF pb – push
ON pb – push
If FIXERS OFF It – off:
Continue in DOCKING RING EXTENSION >>
3. CNTL PNL PWR A – ON
APDS PWR A_{DS} – OFF
If FIXERS OFF It – on:
| APDS PWR A_{DS} – ON
| B_{DS} – OFF
If FIXERS OFF It – off:
Continue in DOCKING RING EXTENSION, as reqd
In DOCKING MECHANISM POWERUP prior to docking, leave
APDS PWR A_{DS}(B_{DS}) off
In DOCKING SEQUENCE, after step 16:
APDS PWR A_{DS} (B_{DS}) – ON >>
4. APDS PWR B_{DS} – ON
To complete ring extension:
APDS CIRC PROT OFF pb – push (It on)
RING OUT pb – push
When PETAL POS BASE (three) = $76 \pm 3\%$:
PWR OFF pb – push
Go to APDS DIRECT DRIVE USING BOB (IFM, PROCEDURES A THRU F)
to drive slip clutch to SLIP
- CRT
A7L

FIXERS OFF LT FAILED OFF

SM 167 DOCKING STATUS

- A7L APDS CIRC PROT OFF pb – push
FIXER OFF pb – push
- A6L PSU PWR MNA,MNB (two) – OFF
- A7L RING IN(OUT) pb – push (as reqd)
APDS PWR A_{DS},B_{DS},C_{DS} (three) – OFF
– ON
- A6L PSU PWR MNA,MNB (two) – ON
To stop ring drive:
- A7L PWR ON pb – push
- CRT √RING DRV CMD – OFF

RING FAILS TO DRIVE

I

- A7L SM 167 DOCKING STATUS
PWR ON pb – push
APDS CIRC PROT OFF pb – push (It on)
FIXERS OFF pb – push (It on)
RING OUT pb – push
- CRT If PETAL POS BASE (three) incr
A7L | PWR ON pb – push
| √MCC
- CRT If PETAL POS BASE (three) not incr:
If RING DRV CMD – ON:
A7L | If not CLUTCH – LOCK/blank:
| PWR OFF pb – push
| ON pb – push
| Go to CLUTCH NOT 'LOCK' >>
- CRT If RING DRV CMD – OFF:
Go to RING DRV CMD OFF

RING DRV CMD OFF

- A7L SM 167 DOCKING STATUS
- A7L 1. PWR OFF pb – push
ON pb – push
If all STATUS lts off:
CNTL PNL PWR A – OFF
PWR ON pb – push
If all STATUS lts off:
Go to step 3
Continue in DOCKING SEQUENCE, as reqd >>
2. APDS PWR A_{DS} – OFF
RING IN pb – push
- CRT If RING DRV CMD – OFF:
A7L APDS PWR A_{DS} – ON
C_{DS} – OFF
RING IN pb – push
- CRT If RING DRV CMD – OFF:
Go to step 3
- A7L PWR ON pb – push
Continue in DOCKING SEQUENCE through step 16 then:
APDS PWR A_{DS} (C_{DS}) – ON
OPEN LATCHES pb – push
After 5 sec:
√LAT OP It – on
APDS PWR A_{DS} (C_{DS}) – OFF
Go to DOCKING SEQUENCE step 18 >>
3. If free drift, comm, and power level constraints permit (√MCC):
Go to APDS DIRECT DRIVE USING BOB (IFM, PROCEDURES A THRU F)
to complete docking >>
4. Go to FAILED CAPTURE (VBAR APPROACH Cue Card) to undock

RING FINAL POSITION LT FAILED ON

SM 167 DOCKING STATUS

Continue in DOCKING SEQUENCE, as reqd, with the following changes:

- In step 8 after RING IN pb – push (expect ring to drive for 10 sec):
- A7L RING IN pb – push
- In step 11:
- PWR ON pb – push to stop ring drive
- CRT In step 18, when PETAL POS BASE (three) < 5% and not changing for 10 sec:
- A7L PWR OFF pb – push

FORCE RING ALIGNMENT

- A7L 1. APDS CIRC PROT OFF pb – push (lt on)
2. FIXER OFF pb – push (lt on)
- 0:00 3. RING OUT pb – push
- CRT √DRV CMD – ON [PETAL POS BASE (three) – incr]
- 0:05 √FIXERS – OFF
- A7L √CLUTCH – LOCK/blank
- ∗ If RING FWD POS lt failed on (ring stops after 10 sec): ∗
- ∗ RING OUT pb – push ∗
- ∗ Within 10 sec: ∗
- ∗ APDS PWR A_{DS}, B_{DS}, C_{DS} (three) – OFF ∗
- ∗ APDS PWR A_{DS}, B_{DS}, C_{DS} (three) – ON ∗
- ∗ CIRC PROT OFF pb – push (lt on) ∗
- CRT ∗ When PETAL POS BASE (any) = 92%: ∗
- A6L ∗ PSU PWR MNA, MNB (two) – OFF ∗
- CRT ∗ When PETAL POS BASE (three) not changing for 30 sec: ∗
- A6L ∗ PSU PWR MNA, MNB (two) – ON ∗
- CRT ∗ When PETAL POS BASE (three) = 98%: ∗
- A7L ∗ RING OUT pb – push ∗
- ∗ Go to step 8 ∗
- CRT 4. When PETAL POS BASE (any) = 92%:
- A7L PWR ON pb – push
- CRT 5. Allow relative motion to damp
6. When PETAL POS BASE (three) not changing for 30 sec:
- A7L RING OUT pb – push
- 0:00 7. √RING FWD POS lt – on [PETAL POS BASE (three) = 98%]
- 0:10 CRT 8. √RING DRV CMD – OFF
- A7L √FIXERS OFF lt – off
- ∗ √RING ALIGNED lt – on [PETAL POS RING (three) 50 ± 1%] and [PETAL POS BASE (three) within 1%]
9. Return to DOCKING SEQUENCE, step 8

CLUTCH NOT 'LOCK'

- CRT SM 167 DOCKING STATUS
If no ring motion when RING DRV CMD: ON
- A7L 1. APDS CIRC PROT OFF pb – push
FIXER OFF pb – push
RING OUT pb – push
After 10 sec:
 PWR OFF pb – push
 ON pb – push
- CRT If CLUTCH – LOCK/blank:
 Continue in DOCKING SEQUENCE, as reqd >>
- A7L 2. RING IN pb – push
After 10 sec:
 PWR ON pb – push
- CRT If CLUTCH – LOCK/blank:
 Continue in DOCKING SEQUENCE, as reqd >>
3. If free drift, comm, and power level constraints permit (\sqrt{MCC}):
 Go to APDS DIRECT DRIVE USING BOB (IFM, PROCEDURES A THRU F) to complete docking

APDS CIRCUIT PROTECT OFF LT FAILED OFF

- CRT SM 167 DOCKING STATUS
If APDS CIRC PROT – ON:
 Go to APDS DIRECT DRIVE USING BOB (IFM, PROCEDURES A THRU F)
 for RING OUT, OPEN HOOKS, OPEN LATCHES, and UNDOCKING pb commands

HOOKS 1(2) OPEN LT FAILED ON

NOTE

The following procedure should be performed immediately after DOCKING SEQUENCE completed or prior to undocking as applicable

- A7L 1. PWR ON pb – push
APDS PWR A_{DS} – OFF
If HOOKS 1(2) OPEN Lt – off:
 Go to nominal UNDOCKING OPERATIONS per nominal mission timeline with APDS PWR A_{DS} – OFF >>
2. Prior to nominal undocking:
 Go to APDS DIRECT DRIVE USING BOB (IFM, PROCEDURES A THRU F) to open affected hooks

HOOKS 1(2) NOT CLOSED WITHIN SINGLE MTR TIME

		SM 167 DOCKING STATUS
	CRT	1. If no hook motion when commanded:
	A7L	APDS PWR A _{DS} – OFF CLOSE HOOKS pb – push
	CRT	If no hook motion after 10 sec:
	A7L	APDS PWR A _{DS} – ON B _{DS} – OFF CLOSE HOOKS pb – push
	CRT	If Hook Pos increasing after 10 sec: Continue in DOCKING SEQUENCE with the following change: After step 16:
	A7L	APDS PWR A _{DS} (B _{DS}) – ON >>
		2. APDS PWR A _{DS} (B _{DS}) – ON PWR OFF pb – push ON pb – push
		3. If other hook gang closed: Continue in DOCKING SEQUENCE, as reqd After DOCKING SEQUENCE complete, go to PMA2/3 HOOKS CLOSE, 8-32, to secure interface with 12 hooks >>
		4. If neither hook gang closed: √MCC for IFM capability Go to APDS DIRECT DRIVE USING BOB (IFM, <u>PROCEDURES A THRU F</u>) and PMA2/3 HOOKS CLOSE, 8-32, as reqd, to secure interface with 12 hooks >>
		5. If no IFM capability or time does not permit IFM: APDS CIRC PROT OFF pb – push (lt on) OPEN HOOKS pb – push
0:00	CRT	√HOOKS 1,2 POS (two) – decr
	A7L	√OPEN lts (two) – on RING OUT pb – push
	CRT	√PETAL POS BASE (three) – incr
3:40	A7L	√RING INIT POS lt – on Go to FAILED CAPTURE (<u>VBAR APPROACH</u> Cue Card) to undock

READY TO HOOK LT FAILED ON

1. Post-Capture:
A7L APDS PWR A_{DS} – OFF
If RDY TO HK It – off:
If HOOKS 1(2) OPEN It – off:
APDS CIRC PROT OFF pb – push
OPEN HOOKS pb – push
√HOOKS 1,2 OPEN Its (two) – on
Continue in DOCKING SEQUENCE, as reqd, with the following change:
After hooks begin to drive closed:
APDS PWR A_{DS} – ON >>
2. APDS PWR A_{DS} – ON
Continue in DOCKING SEQUENCE, as reqd, with the following changes:
Immediately after RING IN pb – push in step 8:
APDS CIRC PROT OFF pb – push
OPEN HOOKS pb – push
CRT √HOOKS 1(2) POS decreasing to 5%
When PETAL POS BASE (three) ≤ 7%:
A7L CLOSE HOOKS pb – push

HOOKS 1(2) CLOSED LT FAILED ON

- Continue in DOCKING SEQUENCE through step 13 (affected hooks may not close):
- A7L APDS PWR A_{DS} – OFF
If HOOKS 1(2) CLOSED It – off:
CLOSE HOOKS pb – push
CRT After HK 1,2 IND (two) – CL:
A7L APDS PWR A_{DS} – ON
Continue in DOCKING SEQUENCE starting at step 14 >>
If HOOKS 1(2) CLOSED It – on:
Continue in DOCKING SEQUENCE
After DOCKING SEQUENCE complete:
Go to PMA2/3 HOOKS CLOSE, 8-32, to secure interface with 12 hooks

LATCHES OPEN LT FAILED OFF

SM 167 DOCKING STATUS

- CRT 1. If CAP LAT IND – OP/blank:
Continue in DOCKING SEQUENCE >>
- A7L 2. √APDS PWR A,B,C (three) – ON (A_{DS}, B_{DS}, C_{DS} lts on)
CIRC PROT OFF pb – push
OPEN LATCHES pb – push
- CRT If LAT OP lt – on or CAP LAT IND – OP/blank:
Continue in DOCKING SEQUENCE >>
3. Prior to Undocking timeline:
Use manual release to open capture latches
With hatches closed, perform DOCKING MECHANISM POWERUP, 8-5
- A7L PWR ON pb – push
RING IN pb – push
- CRT √DRV CMD – ON
After 20 sec:
- A7L √RING FNL POS lt – on
- CRT √DRV CMD – OFF
Go to DOCKING MECHANISM POWERDOWN, 8-6

APDS POWER FAILED OFF

- A7L If any APDS A_{DS}, B_{DS}, C_{DS} lt off:

CAUTION

Associated capture latch cannot be driven open, resulting in inability to separate interfaces
--

Post-Capture:

Continue in DOCKING SEQUENCE, deleting steps 17 and 18
Manual release of capture latches will be reqd prior to undocking

DOCKING MECHANISM DEMATE/REMate

NOTE

This procedure assumes vestibule leak check failed, or both ODS hook gangs jammed simultaneously. Docking ring will recapture interface, hooks will be driven open, interface will be separated, and second mating attempt will be performed. Procedure assumes DOCKING SEQUENCE completed

1. Perform G2 SET EXPANSION (ORB OPS, DPS) for TRIPLE G2
2. DAP: FREE
O14, Pri RJD LOGIC, DRIVER (sixteen) – ON
O15,
O16

GNC 25 RM ORBIT
3. SW RM INH, ITEM 16 EXEC (*)
CRT FLT CNTLR PWR – ON
A6U SW RM INH, ITEM 16 EXEC (no *)
CRT

GNC 20 DAP CONFIG
4. Config DAP A,B to A7,B7
DAP: B/FREE/VERN(PRI)
√DAP TRANS: NO LO Z
√DAP TRANS: PULSE/PULSE/PULSE
√SENSE: -Z
5. Perform DOCKING MECHANISM POWERUP, 8-5, if reqd

NOTE

PWR OFF pb – push must be performed within 10 sec of Capture (CAPTURE It on) to prevent capture latches from reopening automatically

6. Recapture interface:
SM 167 DOCKING STATUS
A7L PWR ON pb – push
0:00 √STATUS Its – on, as reqd
CLOSE LATCHES pb – push
0:05 √LAT OP It – off
√CL It – on

CRT √CLUTCH – LOCK/blank
A7L APDS CIRC PROT OFF pb – push (It on)
0:00 FIXER OFF pb – push (It on)
RING OUT pb – push
√FNL POS It – off

0:10 When CAPTURE It – on, immediately:
PWR OFF pb – push
ON pb – push
√CAPTURE It – off
√LAT CL It – on

7. Open Hooks:
 0:00 APDS CIRC PROT OFF pb – push (lt on)
 OPEN HOOKS pb – push
 √HOOKS 1,HOOKS 2 CL lt (two) – off
 2:20 √OP lt (two) – on
8. Extend ring to separate interface:
 0:00 CRT √CLUTCH – LOCK/blank
 A7L RING OUT pb – push
 √INTERF SEALED lt – off
 √RDY TO HK lt – off
 3:40 √RING INIT POS lt – on
 CRT √CLUTCH – blank/SLIP
9. √Interface clear of debris or other obstruction
10. Retract ring for second mating attempt:
 0:00 A7L √FIXERS OFF lt – off
 RING IN pb – push
 0:05 CRT √CLUTCH – LOCK/blank
 A7L √RING INIT POS lt – off
 3:35 √RDY TO HK lt – on
 <4:15 √INTERF SEALED lt – on
 √HOOKS 1,HOOKS 2 OP lt (two) – off
 6:15 √CL lt (two) – on
11. RING OUT pb – push
 0:00
 0:10 PWR ON pb – push
12. √APDS CIRC PROT OFF lt – on
 √PWR A_{DS},B_{DS},C_{DS} (three) – on (lt on)
 0:00 OPEN LATCHES pb – push
 √LAT CL lt – off
 0:05 √OP lt – on
13. RING IN pb – push
 0:00
 0:10 √FNL POS lt – on
 0:20 CRT √DRV CMD – OFF
- A7L 14. PWR OFF pb – push
 √STATUS lts (eighteen) – off
15. Perform DOCKING MECHANISM POWERDOWN, 8-6, if reqd
- A6U 16. FLT CNTLR PWR – OFF
 Config DAP A,B to A12,B12
 DAP: A/AUTO/VERN
17. Return to FLIGHT PLAN

ODS HOOKS OPEN – CONTINGENCY

NOTE

Procedure assumes PMA2/3 hooks have not been closed at any time during the mission, and either ODS hooks could not be opened nominally or ODS hooks were driven full open and physical separation did not occur. If PMA 2/3 hooks have been closed at any point during the mission, go to PMA2/3 HOOKS OPEN – CONTINGENCY. To undock, docking ring will recapture interface in preparation for firing ODS hook pyros. Actual separation will occur by extending ring to Initial Position, opening capture latches, and performing +Z jet pulses.

Procedure also assumes that an EVA crew is prepared to immediately perform the 96 BOLT EVA if ODS pyros are discharged, and physical separation does not occur.

APDS must be powered off within 10 sec of Capture to prevent the capture latches from automatically reopening

1. Perform DOCKING MECHANISM POWERUP, 8-5, if reqd
- A7L 2. PWR ON pb – push

SM 167 DOCKING STATUS

RECAPTURE INTERFACE

3. CLOSE LATCHES pb – push
 - √LAT OP It – off
 - √CL It – on
4. APDS CIRC PROT OFF pb – push (It on)
 - FIXER OFF pb – push (It on)
 - RING OUT pb – push
 - √FNL POS It – off [PETAL POS BASE (three) = 5%]

When CAPTURE It – on, immediately:

- PWR OFF pb – push
- ON pb – push
- √CAPTURE It – off
- √LAT CL It – on

RE-OPEN CLOSED HOOKS

5. DAP: A/FREE/VERN
6. APDS CIRC PROT OFF pb – push (It on)
 - OPEN HOOKS pb – push
- CRT 7. When good HOOKS 1(2) OP It – on and jammed HOOKS 2(1) POS not
decr:
 - A7L PWR OFF pb – push
 - ON pb – push

DISCHARGE ACTIVE HOOK PYROS

A6L 8. PYRO PWR MN A,MN C (two) – ON
A7L PYROS A_P,B_P,C_P (three) – ON (It on)
PYRO CIRC PROT OFF pb – push (It on)

9. ACT HOOKS FIRING pb – push

10. PYRO CIRC PROT ON pb – push (OFF It off)
PYROS A_P,B_P,C_P (three) – OFF (It off)

A6L PYRO PWR MN A,MN C (two) – OFF

EXTEND RING TO INITIAL POSITION FOR INTERFACE SEPARATION

A7L 11. APDS CIRC PROT OFF pb – push (It on)
FIXER OFF pb – push (It on)

0:00 RING OUT pb – push [PETAL POS BASE (three) > 6% and incr]
√INTERF SEALED It – off
√RDY TO HK It – off

If interface separates, proceed with step 16

CRT * If no interface separation (PETAL POS BASE (three) not *
* incr) after 20 sec: *

A7L * PWR ON pb – push *
* RING IN pb – push *

CRT * When PETAL POS BASE (three) = ~6% and not decr: *

A7L * PWR OFF pb – push *
* ON pb – push *

DISCHARGE PASSIVE HOOK PYROS

A6L 12. PYRO PWR MN A,MN C (two) – ON
A7L PYROS A_P,B_P,C_P (three) – ON (Its on)
PYRO CIRC PROT OFF pb – push (It on)

13. PAS HOOKS FIRING pb – push

14. PYRO CIRC PROT ON pb – push (OFF It off)
PYROS A_P,B_P,C_P (three) – OFF (It off)

A6L PYRO PWR MN A,MN C (two) – OFF

REATTEMPT EXTENDING RING TO INITIAL POSITION FOR INTERFACE SEPARATION

A7L 15. APDS CIRC PROT OFF pb – push (It on)
√FIXERS OFF It – on

0:00 RING OUT pb – push [PETAL POS BASE (three) > 6% and incr]
√INTERF SEALED It – off
√RDY TO HK It – off

If interface separates, proceed with step 16

CRT * If no interface separation (PETAL POS BASE (three) not *
* incr) after 20 sec: *

A7L * PWR ON pb – push *
* RING IN pb – push *

CRT * When PETAL POS BASE (three) = ~6% and not decr: *

A7L * PWR OFF pb – push *
* Perform DOCKING MECHANISM POWERDOWN, 8-6 *
* Go to 96 BOLT EVA TIMELINE (EVA, ORB CONT *
* EVA) >> *

~3:00

16. √RING INIT POS It – on [PETAL POS BASE (three) > 76 ± 3%]

PWR ON pb – push

OPEN LATCHES pb – push

√LAT CL It – off

√OP It – on

PWR OFF pb – push

* If no physical separation:	*
* √DAP: B/FREE/VERN(ALT)	*
* √DAP: NO LO Z	*
* THC: +Z (OUT) 4 Pulses at 10 sec intervals	*
* When Petals Clear	*
* DAP: B/LVLH/VERN(ALT)	*

17. Proceed with SEPARATION ACTIVITIES and RENDEZVOUS

18. Go to DOCKING RING RETRACTION (NOT MATED), 8-9, prior to DOCKING MECHANISM POWERDOWN, 8-6

PMA2/3 HOOKS OPEN – CONTINGENCY

NOTE

Procedure assumes PMA2/3 hooks could not be opened nominally or ODS hooks were driven fully open and physical separation did not occur and PMA2/3 were closed at some point during the mission. For these situations, docking ring will recapture interface in preparation for firing ODS passive hook pyros. Actual separation will occur by extending ring to Initial Position, opening capture latches, and performing +Z jet pulses.

Procedure also assumes that an EVA crew is prepared to immediately perform the 96 BOLT EVA if ODS pyros are discharged, and physical separation does not occur.

APDS must be powered off within 10 sec of Capture to prevent the capture latches from automatically reopening

1. Perform DOCKING MECHANISM POWERUP, 8-5, if reqd
- A7L 2. PWR ON pb – push

SM 167 DOCKING STATUS

RECAPTURE INTERFACE

3. CLOSE LATCHES pb – push
 - √LAT OP It – off
 - √CL It – on
4. APDS CIRC PROT OFF pb – push (It on)
 - FIXER OFF pb – push (It on)
 - RING OUT pb – push
 - √FNL POS It – off [PETAL POS BASE (three) = 5%]
5. When CAPTURE It – on [PETAL POS BASE (three) > 6%]:
 - PWR OFF pb – push
 - ON pb – push
 - √CAPTURE It – off
 - √LAT CL It – on

OPEN ODS HOOKS

6. DAP: A/FREE/VERN
7. APDS CIRC PROT OFF pb – push (It on)
- 0:00 8. UNDOCKING pb – push
 - √HOOKS 1,HOOKS 2 CL It (two) – off
 - CRT √POS < 92% and decr

		* If HOOKS 1(2) fail to drive [HOOKS 1(2) DRV	*
		* CMD – OFF]:	*
A7L		* OPEN HOOKS pb – push	*
CRT		* If HOOKS 1(2) appear to stop before reaching	*
		* end-of-travel [HOOKS 1(2) POS > 4% and	*
		* not decr]:	*
		* Allow for single motor drive time (~4:40)	*
		* before	*
A7L		* PWR OFF pb – push	*
		* ON pb – push	*

2:20 9. √HOOKS 1,HOOKS 2 OP It (two) – on [HOOKS 1,HOOKS 2 POS = 4%]
√UNDOCK COMPLETE It – on

ATTEMPT TO EXTEND RING TO INITIAL POSITION FOR INTERFACE SEPARATION

0:00 10. APDS CIRC PROT OFF pb – push (It on)
FIXER OFF pb – push (It on)
RING OUT pb – push [PETAL POS BASE (three) > 6% and incr]
If interface separates, proceed with step 19

CRT		* If no interface separation (PETAL POS BASE (three)	*
		* not incr) after 20 sec:	*
A7L		* PWR ON pb – push	*
		* RING IN pb – push	*
CRT		* When PETAL POS BASE (three) = ~6% and not decr:	*
A7L		* PWR ON pb – push	*

DISCHARGE PASSIVE HOOK PYROS

A6L 11. PYRO PWR MN A,MN C (two) – ON
A7L PYROS A_P,B_P,C_P (three) – ON (It on)
PYRO CIRC PROT OFF pb – push (It on)

12. PAS HOOKS FIRING pb – push

A6L 13. PYRO CIRC PROT ON pb – push (OFF It off)
PYROS A_P,B_P,C_P (three) – OFF (It off)
PYRO PWR MN A,MN C (two) – OFF

REATTEMPT EXTENDING RING TO INITIAL POSITION FOR INTERFACE SEPARATION

0:00 A7L 14. APDS CIRC PROT OFF pb – push (It on)
FIXER OFF pb – push (It on)
RING OUT pb – push [PETAL POS BASE (three) > 6% and incr]
√INTERF SEALED It – off
√RDY TO HK It – off
If interface separates, proceed with step 19

CRT If no interface separation (PETAL POS BASE (three) not incr) after
 20 sec:
 A7L PWR ON pb – push
 RING IN pb – push
 CRT When PETAL POS BASE (three) = ~6% and not decr:
 A7L PWR ON pb – push

DISCHARGE ACTIVE HOOK PYROS

A6L 15. PYRO PWR MN A,MN C (two) – ON
 A7L PYROS A_P,B_P,C_P (three) – ON (It on)
 PYRO CIRC PROT OFF pb – push (It on)
 16. ACT HOOKS FIRING pb – push
 17. PYRO CIRC PROT ON pb – push (OFF It off)
 PYROS A_P,B_P,C_P (three) – OFF (It off)
 A6L PYRO PWR MN A,MN C (two) – OFF

REATTEMPT EXTENDING RING TO INITIAL POSITION FOR INTERFACE SEPARATION

A7L 18. APDS CIRC PROT OFF pb – push (It on)
 √FIXERS OFF It – on
 0:00 RING OUT pb – push [PETAL POS BASE (three) > 6% and incr]
 √INTERF SEALED It – off
 √RDY TO HK It – off
 If interface separates, proceed with step 19

CRT * If no interface separation (PETAL POS BASE (three) not *
 * incr) after 20 sec: *
 A7L * PWR ON pb – push *
 * RING IN pb – push *
 CRT * When PETAL POS BASE (three) = 6% and not decr: *
 A7L * PWR OFF pb – push *
 * Perform DOCKING MECHANISM POWERDOWN, 8-6 *
 * Go to 96 BOLT EVA TIMELINE (EVA, ORB CONT *
 * EVA) >> *

OPEN LATCHES TO SEPARATE INTERFACE

~3:00 19. √RING INIT POS It on [PETAL POS BASE (three) > 76 ± 3%]
 PWR ON pb – push
 OPEN LATCHES pb – push
 √LAT CL It – off
 √OP It – on
 PWR OFF pb – push

* If no physical separation: *
 * √DAP: B/FREE/VERN(ALT) *
 * √DAP: NO LO Z *
 * THC: +Z (OUT) 4 Pulses at 10 sec intervals *
 * When Petals Clear *
 * DAP: B/LVLH/VERN(ALT) *

20. Proceed with SEPARATION ACTIVITIES, and RENDEZVOUS
 21. Go to DOCKING RING RETRACTION (NOT MATED), 8-9, prior to
 DOCKING MECHANISM POWERDOWN, 8-6

APDS FAILED CAPTURE RECONFIG

		SM 167 DOCKING STATUS		
0:00	A7L	1. If LAT OP It – on: CLOSE LATCHES pb – push √LAT OP It – off		
0:05		√CL It – on		
		2. √APDS CIRC PROT OFF It – on		
0:00		3. FIXER OFF pb – push (It on) RING OUT pb – push		
0:05	CRT	√PETAL POS BASE (three) – incr		
		√CLUTCH – LOCK/blank		
	A7L	√RING INIT POS It – on (for ~16 sec), then off		
		* If RING FWD POS It failed on (ring stops after 10 sec):	*	
		* RING OUT pb – push	*	
		* Within 10 sec:	*	
		* APDS PWR A _{DS} , B _{DS} , C _{DS} (three) – OFF	*	
		* APDS PWR A _{DS} , B _{DS} , C _{DS} (three) – ON	*	
		* CIRC PROT OFF pb – push (It on)	*	
		* √RING INIT POS It – on (for ~16 sec), then off	*	
	CRT	* When PETAL POS BASE (three) = 98 ± 2%:	*	
	A7L	* RING OUT pb – push	*	
		* After 10 sec:	*	
	CRT	* √RING DRV CMD – OFF	*	
1:15	A7L	4. √RING FWD POS It – on √ALIGNED It – on		
		√FIXERS OFF It – off		
	CRT	√PETAL POS BASE (three): 98 ± 2%		
0:00	A7L	5. RING IN pb – push		
	CRT	√CLUTCH – LOCK/blank		
	A7L	√RING FWD POS It – off		
1:15		√INIT POS It – on (for ~16 sec), then off		
		* If RING FNL POS It failed on (ring stops after 10 sec):	*	
0:00		* RING IN pb – push	*	
		* √RING FWD POS It – off	*	
1:15		* √INIT POS It – on (for ~16 sec), then off	*	
4:50	CRT	* When PETAL POS BASE (three) = 5 ± 3% and not decr:	*	
	A7L	* PWR ON pb – push	*	
		6. √RING FNL POS It – on		
5:00	CRT	√DRV CMD – OFF		
0:00	A7L	7. APDS CIRC PROT OFF pb – push (It on) RING OUT pb – push		
	CRT	√CLUTCH – LOCK/blank		
0:10	A7L	√RING FNL POS It – off		

CRT	* If RING INIT POS It failed on (ring stops after 1 sec, and	*
	* Clutch drives to SLIP):	*
A7L	* FIXER OFF pb – push (√FIXERS OFF It on)	*
	* RING OUT pb – push	*
CRT	* When PETAL POS BASE (three) = $76 \pm 3\%$:	*
A7L	* PWR OFF pb – push	*
	* PWR ON pb – push	*
	* √FIXERS OFF It – off	*
	* APDS CIRC PROT OFF pb – push	*
	* RING OUT pb – push	*
	* After 1 sec:	*
CRT	* √RING DRV CMD – OFF	*
	*	*
A7L	* If RING FWD POS It failed on (ring stops after 10 sec):	*
	* RING OUT pb – push	*
	* Within 10 sec:	*
	* APDS PWR A _{DS} , B _{DS} , C _{DS} (three) – OFF	*
	* APDS PWR A _{DS} , B _{DS} , C _{DS} (three) – ON	*
	* CIRC PROT OFF pb – push (It on)	*
	* When RING INIT POS It – on:	*
	* RING OUT pb – push	*

3:40

	8. √RING INIT POS It – on	
CRT	√PETAL POS BASE (three): $76 \pm 3\%$	
	√CLUTCH – blank/SLIP	
	* If CLUTCH – blank/blank:	*
A7L	* √APDS CIRC PROT OFF It – on	*
	* RING OUT pb – push (expect 1 sec of drive),	*
	* wait 10 sec	*
CRT	* √RING DRV CMD – OFF	*
	* If CLUTCH – LOCK/blank:	*
A7L	* √RING INIT POS It – ON	*
	* √FIXERS OFF It – off	*
	* √APDS CIRC PROT OFF It – on	*
	* RING OUT pb – push (expect 1 sec of drive),	*
	* wait 10 sec	*
CRT	* √RING DRV CMD – OFF	*
	* If not CLUTCH – blank/SLIP:	*
	* √MCC	*
A7L	9. PWR OFF pb – push	
	√STATUS Its (eighteen) – off	

PMA2/3 HOOKS CLOSE

WARNING

Procedure assumes one ODS Hook Gang has failed and one PMA2/3 Hook Gang can be used to recover a total of 12 hooks. ODS to PMA2/3 interface must be hard mated, as verified by the ODS X3/X4 connector mate indications, in order to provide PMA2/3 active hook control and tm through the interface X-connectors

SM 167 DOCKING STATUS

- CRT 1. √ODS CONN X3,X4 (two) – ON
- A6L 2. √cb PMA2/3 GRP 1,2 HOOKS (eight) – op
√PMA2/3 HOOKS SYS A,SYS B (two) – ctr (tb-bp)
- TO CLOSE HOOKS 1, PERFORM STEPS 3 THRU 6
3. cb PMA2/3 GRP 1 HOOKS SYS A OPEN,CLOSE (two) – cl
B OPEN,CLOSE (two) – cl
√PMA2/3 HOOKS GRP 1 tb – OP
- CRT √HK 1 IND OP – 1,2
√IND CL – blank
√HK CL 1/3/5, 7/9/11 (two) – blank
- * If any IND CL present, hooks will operate single motor: *
* √MCC *
- 0:00 A6L 4. PMA2/3 HOOKS SYS A,SYS B (two) – CL
√GRP 1 tb – bp
- CRT √HK 1 CMD CL – 1,2
√IND OP – blank
- 2:40 A6L 5. √PMA2/3 HOOKS GRP 1 tb – CL
CRT √HK 1 IND CL – 1,2
√CMD CL – blank
√HK CLS 1/3/5, 7/9/11 (two) – CL
- A6L 6. PMA2/3 HOOKS SYS A,SYS B (two) – ctr
cb PMA2/3 GRP 1 HOOKS SYS A OPEN,CLOSE (two) – op
B OPEN,CLOSE (two) – op
- TO CLOSE HOOKS 2, PERFORM STEPS 7 THRU 10
7. cb PMA2/3 GRP 2 HOOKS SYS A OPEN,CLOSE (two) – cl
B OPEN,CLOSE (two) – cl
√PMA2/3 HOOKS GRP 2 tb – OP
- CRT √HK 2 IND OP – 1,2
√CL – blank
√HK CL 2/4/6, 8/10/12 (two) – blank
- * If any IND CL present, hooks will operate single motor: *
* √MCC *
- 0:00 A6L 8. PMA2/3 HOOKS SYS A,SYS B (two) – CL
√GRP 2 tb – bp
- CRT √HK 2 CMD CL – 1,2
√IND OP – blank

- 2:40 A6L CRT 9. ✓PMA2/3 HOOKS GRP 2 tb – CL
✓HK 2 IND CL – 1,2
✓CMD CL – blank
✓HK CLS 2/4/6, 8/10/12 (two) – CL
- A6L 10. PMA2/3 HOOKS SYS A, SYS B (two) – ctr
cb PMA2/3 GRP 2 HOOKS SYS A OPEN, CLOSE (two) – op
B OPEN, CLOSE (two) – op

PMA2/3 HOOKS OPEN

WARNING
 ODS to PMA2/3 interface must remain hard mated by at least one gang of ODS hooks through entire procedure in order to provide hooks through entire procedure in order to provide PMA2/3 active hook control and tlm through the interface X-connectors

SM 167 DOCKING STATUS

- A6L 1. √cb PMA2/3 GRP 1,2 HOOKS (eight) – op
 √PMA2/3 HOOKS SYS A,SYS B (two) – ctr (tb-bp)
- TO OPEN HOOKS 1, PERFORM STEPS 2 THRU 5
- 0:00 A6L 2. cb PMA2/3 GRP 1 HOOKS SYS A OPEN,CLOSE (two) – cl
 B OPEN,CLOSE (two) – cl
 CRT √PMA2/3 HOOKS GRP 1 tb – CL
 √HK 1 IND CL – 1,2
 √OP – blank
 √HK CLS 1/3/5, 7/9/11 (two) – CL
 * If any IND OP present, hooks will operate single motor *
- 0:00 A6L 3. PMA2/3 HOOKS SYS A,SYS B (two) – OP
 CRT √GRP 1 tb – bp
 √HK 1 CMD OP – 1,2
 √IND CL – blank
 √HK CLS 1/3/5, 7/9/11 (two) – blank
- 2:40 A6L 4. √PMA2/3 HOOKS GRP 1 tb – OP
 CRT √HK 1 IND OP – 1,2
 √CMD OP – blank
 * If PMA2/3 HOOKS fail to drive, or do not reach end-of- *
 * travel after single motor drive time (~4:40): *
 A6L * PMA2/3 HOOKS SYS A,SYS B (two) – ctr *
 * cb PMA2/3 GRP 1 HOOKS SYS A OPEN,CLOSE *
 * (two) – op *
 * cb PMA2/3 GRP 1 HOOKS SYS B OPEN,CLOSE *
 * (two) – op *
 * Perform PMA2/3 HOOKS OPEN – CONTINGENCY, *
 * 8-27 *
5. PMA2/3 HOOKS SYS A,SYS B (two) – ctr
 cb PMA2/3 GRP 1 HOOKS SYS A OPEN,CLOSE (two) – op
 B OPEN,CLOSE (two) – op
- TO OPEN HOOKS 2, PERFORM STEPS 6 THRU 9
- CRT 6. cb PMA2/3 GRP 2 HOOKS SYS A OPEN,CLOSE (two) – cl
 B OPEN,CLOSE (two) – cl
 √PMA2/3 HOOKS GRP 2 tb – CL
 √HK 2 IND CL – 1,2
 √IND OP – blank
 √HK CLS 2/4/6, 8/10/12 (two) – CL
 * If any IND OP present, hooks will operate single motor *

0:00 A6L 7. PMA2/3 HOOKS SYS A,SYS B (two) – OP
 √GRP 2 tb – bp
 CRT √HK 2 CMD OP – 1,2
 √IND CL – blank
 √HK CLS 2/4/6/, 8/10/12 (two) – blank

2:40 A6L 8. √PMA2/3 HOOKS GRP 2 tb – OP
 CRT √HK 2 IND OP – 1,2
 √CMD OP – blank

A6L * If PMA2/3 HOOKS fail to drive, or do not reach *
 * end-of-travel after single motor drive time (~4:40): *
 * PMA2/3 HOOKS SYS A,SYS B (two) – ctr *
 * cb PMA2/3 GRP 2 HOOKS SYS A OPEN,CLOSE *
 * (two) – op *
 * cb PMA2/3 GRP 2 HOOKS SYS B OPEN,CLOSE *
 * (two) – op *
 * Perform PMA2/3 HOOKS OPEN – CONTINGENCY, *
 * 8-27 *

9. PMA2/3 HOOKS SYSA,SYS B (two) – ctr
 cb PMA2/3 GRP 2 HOOKS SYS A OPEN,CLOSE (two) – op
 B OPEN,CLOSE (two) – op

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REFERENCE DATA

APDS FAILURE/IMPACT MATRIX..... 8-38
(TLM) 8-40

REFERENCE
DATA

APDS FAILURE/IMPACT MATRIX

REFERENCE DATA

APDS Status It/tb	APDS FAILURE s = potential single failure m = multiple failures reqd	IMPACT
POWER ON	Failed ON (m)	Continuous PWR ON will inhibit ring and fixer commands. Relays may overheat preventing future powerup. [Detectable only during powerup or ring drive operations]
	Failed OFF (m)	If all STATUS Its are ↓, loss of all logic power to APDS. Docking system cannot be operated. [Even if power regained pre-capture, need to assess failure modes before continuing approach]
APDS CIRCUIT PROTECT OFF	Failed ON (m)	Manual Ring Out, Open Latches, Open Hooks, and Undocking pb commands are enabled
	Failed OFF (m)	No manual Ring Out, Open Latches, Open Hooks, or Undocking pb capability
RING ALIGNED	Failed ON (m)	Prime alignment cue disabled. Use CRT RING ALIGN and PETAL POS BASE ind as backup. Erroneous ind possible with significant pitch motion (sensors rotated 360°)
	Failed OFF (s)	Prime alignment cue disabled. Use CRT RING ALIGN and PETAL POS BASE ind as backup
RING INITIAL POSITION	Failed ON (s)	Ring will only drive for 1 sec with Ring Out commands. Slip clutch will drive alternately between the SLIP and LOCK positions. [FIXERS OFF command bypasses Initial Position logic]
	Failed OFF (m)	INITIAL CONTACT It disabled. IFM required to drive clutch to SLIP
FIXERS OFF	Failed ON (m)	IFM may be required to drive clutch to SLIP if failure occurs during ring extension. During docking, no backup system to maintain alignment during ring retraction
	Failed OFF (m)	Unable to inhibit fixer operation during manual ring operations without workaround
HOOKS 1(2) OPEN	Failed ON (s)	Logic prevents Hooks from driving open. [May regain function with APDS PWR A _{PS} off]
	Failed OFF (m)	Hooks will not stop driving at Open position, OR vehicles will not separate due to jammed hook drive
LATCHES CLOSED	Failed ON (s)	Ring will stall against Capture Latches if Capture Latches failed closed. No impact if latches open on SPEC 167
	Failed OFF (m)	No impact to nominal sequence. [May not be able to recapture, if reqd, if Capture Latches are not closed. Multiple failures reqd to inadvertently drive a latch motor open]
UNDOCK COMPLETE	Failed ON (s)	No impact. Indication is not used by any logic
	Failed OFF (m)	No impact. Indication is not used by any logic

APDS FAILURE/IMPACT MATRIX (Cont)

APDS Status It/tb	APDS FAILURE s = potential single failure m = multiple failures reqd	IMPACT
INITIAL CONTACT	Failed ON (s)	Prime contact cue disabled
	Failed OFF (m)	Prime contact cue disabled. [Not detectable prior to contact]
CAPTURE	Failed ON (m)	Auto Sequence may be active (dampers, fixers, ring/hook drive). May be unable to reset dampers. Potential Shuttle/PMA2/3 mechanism damage if no damping or damping failed on
	Failed OFF (m)	Must use visual cues (no sep) to verify capture
RING FORWARD POSITION	Failed ON (s)	Ring will only drive out for 10 sec at a time
	Failed OFF (m)	Ring will continue to drive at Forward Position until terminated by a PWR On/Off reset
READY TO HOOK	Failed ON (s)	Hooks will begin driving closed with manual Ring In command
	Failed OFF (m)	Manual CLOSE HOOKS command required to drive hooks closed. Ring will not stop driving at In-Between Hooks position
INTERF SEALED (no TLM)	Failed ON (s)	No impact to APDS operations. Indication is not used by any logic
	Failed OFF (m)	No impact to APDS operations. Indication is not used by any logic
HOOKS 1(2) CLOSED	Failed ON (s)	Logic prevents associated Hooks from driving closed. [May regain function with APDS PWR A _{DS} off]
	Failed OFF (m)	Hooks will not stop driving when Closed position reached. PMA2/3 hooks may be reqd if hook gang failed open or in mid-travel
LATCHES OPEN	Failed ON (s)	No impact to Docking Sequence if SPEC 167 indicates latches closed. [Need all three Latches in Open to enable a real Ind]
	Failed OFF (m)	If Latches failed closed, Ring will stall against Latches if Ring commanded to Final Position. If indication-only failure, Latches will not stop driving until Final Position +10 sec when Docking Sequence completes
RING FINAL POSITION	Failed ON (s)	During ring retraction, ring will only drive 10 sec 1st time. After 2nd Ring In command, ring will not stop driving at In-Between Hooks position and/or Final Position
	Failed OFF (m)	During Ring retraction to Final Position, ring will not stop driving at Final Position
APDS POWER	Failed ON (s)	One logic bus remains powered. Still two failures from any inadvertent ops
	Failed OFF (s)	Loss of one Capture Latch Mtr. Next failure results in loss of all APDS motor drive capability. [Next failure may require APDS Direct Drive IFM to complete docking or separate, or require manual capture latch release]
A6L SYSTEM POWER A(B) tb	Failed OFF (s)	Loss of redundancy. [Docking lights, Vestibule depress valves, APDS logic] [Two additional failures necessary before APDS Direct Drive IFM reqd to complete docking or SEP]

APDS FAILURE/IMPACT MATRIX (TLM)

APDS Status It/tb	APDS FAILURE s = potential single failure m = multiple failures reqd	IMPACT
DAMPING (TLM)	Failed ON (s) [Single open relay could cause indication]	If real, mechanism may not have compliance on contact; load capability may be exceeded. No Crit 1 concern. Powering off Dampers ensures failed on tlm does not mask a real failure. [May attempt ring drive to verify failure. Failed-on dampers slow ring drive to about single motor drive time]
	Failed OFF (s) [Single failure in DCU/MDM could cause indication]	No impact for single failure. If all dampers ↓, with large rates/misalignments mechanism may bottom out, exceeding its load capability. No Crit 1 concern
FIXERS (TLM)	Failed ON (s)	Mechanism may not have compliance on contact; load capability may be exceeded. No Crit 1 concern
	Failed OFF (s) [Single failure in DCU/MDM could cause indication]	No impact for single Fixer failure. For multiple failure case, alignment may be lost during ring retraction. [Detectable only during ring drive operations]
CLUTCH – SLIP (TLM)	Failed ON (s)	If slip clutch locking mechanism failed in SLIP, resistance created by dampers and/or pusher springs will load actuator sufficiently to prevent ring motion. Docking cannot be performed
	Failed OFF (s)	Need to verify clutch in SLIP for contact
CLUTCH – LOCK (TLM)	Failed ON (s)	None
	Failed OFF (s)	If slip clutch locking mechanism failed in SLIP, resistance created by dampers and/or pusher springs will load ring actuator sufficiently to prevent ring motion. Docking cannot be performed
MAN LATCH REL (TLM)	Failed OP (s)	If real, may be unable to complete docking [can't draw interfaces together]
CNTL PNL POWER (TLM)	Failed ON (s)	One logic bus remains powered. Still two failures from any inadvertent ops
	Failed OFF (s)	Next CNTL PNL POWER loss results in loss of PWR ON/PWR OFF and other pb functions. (Pyro pbs are not affected) [Next failure may require APDS Direct Drive IFM to complete docking or separate, or require manual capture latch release]
Any DRIVE BUS 1(2) (TLM)	Failed OFF (s)	BUS 1 (MN A): Fixers 1,2; Dampers 1,2; Hooks 1,2 Mtr 1; Ring Mtr 1 ↓ BUS 2 (MN B): Fixers 3,4,5; Damper 3; Hooks 1,2 Mtr 2; Ring Mtr 2 ↓

CUE CARD CONFIGURATION

RCS BURN (+X, -X, Multi-axis) (FRONT).....	CC 9-3
RENDEZVOUS PRPLT PAD (BACK).....	CC 9-4
KU OPS (FRONT).....	CC 9-5
(BACK).....	CC 9-6
APPROACH (FRONT).....	CC 9-7
VBAR APPROACH (BACK).....	CC 9-8
C/L CAMERA TARGET ALIGNMENT (FRONT).....	CC 9-9
(BACK).....	CC 9-10
DOCKING SEQUENCE (FRONT).....	CC 9-11
(BACK).....	CC 9-12
STOPWATCH RDOT CONVERSION (+ VBAR) (FRONT).....	CC 9-13
(BACK).....	CC 9-14
GPC/MDM FAILURE RESPONSE DURING RNDZ (FRONT).....	CC 9-15
RNDZ REF DATA (BACK).....	CC 9-16
C/L CAMERA CORRIDOR AND ALIGNMENT.....	CC 9-17
CAMERA A/D RANGE RULER.....	CC 9-18
C/L CAMERA ZOOM CALIBRATION (RING READY FOR DOCK).....	CC 9-19
760 PGSC DISPLAY OF C/L CAMERA CORRIDOR AND ALIGNMENT.....	CC 9-20
CAMERA A/D RANGE RULER.....	CC 9-21
SUB ANG RULER.....	CC 9-22
V10 MONITOR CORRIDOR.....	CC 9-23
APPROACH WITH RPM.....	CC 9-24
VBAR APPROACH POST RPM.....	CC 9-25

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RNDZ-1a/114/O/A

RCS BURN (+X, -X, Multi-axis)

1. GNC, OPS 202 PRO
GNC ORBIT MNVR EXEC
 √RCS SEL, ITEM 4 – (*)
2. If onboard computed burn:
 - √TIG and TGT PEG 7 ΔVs per Final solution
 - √Guidance option is LAMBERT
 If ground computed burn:
 - √TGT data per Burn Pad (reload WT as reqd)
 LOAD – ITEM 22 EXEC
 TIMER – ITEM 23 EXEC
3. If +X burn:
 - DAP: A/AUTO/ALT(B/ALT as reqd)
 - MNVR – ITEM 27 EXEC (*)
 - If RR ops:
 - KU – AUTO TRK
 - GNC 33 REL NAV
 - INH Angles – ITEM 24 EXEC (*)

TIG-0:30

4. FLT CNTLR PWR – ON
 DAP TRANS: as reqd
 If Multi-axis:
 - DAP: A/AUTO/PRI
 If +X or -X:
 - DAP: A/INRTL/PRI

CAUTION

LAMBERT burn must be completed by T1 TIG +1:30 to avoid guidance errors

- * If start of LAMBERT burn delayed: *
- * Retarget burn, then go to step 2 *

TIG

5. If VGO Z is neg, Z,X,Y seq;
 otherwise, X,Y,Z
 THC: Trim VGOs < 0.2 fps
 FLT CNTLR PWR – OFF
 DAP: ALT
 DAP TRANS: PULSE/PULSE/PULSE
 GNC, OPS 201 PRO
6. If +X burn:
 - DAP: A/AUTO(B/AUTO/ALT as reqd)
 - If RR ops, when ATT ERR < 30 deg:
 - KU – GPC
 - √KU TRACK tb – gray
 - GNC 33 REL NAV
 - AUTO Angles – ITEM 23 EXEC (*)
7. When in attitude:
 - DAP: A/AUTO/VERN(ALT)

(reduced copy)

TOP, BACK OF 'RCS BURN (+X, -X, Multi-axis)

HOOK
VELCRO

HOOK
VELCRO

RENDEZVOUS PRPLT PAD

When L or R RCS QTY < :

I'CNCT: OMS to RCS (ORB PKT, RCS)

When G23 OMS/RCS QTY > :

I'CNCT TK SWITCH: (ORB PKT, RCS)

When G23 OMS/RCS QTY > :

I'CNCT RETURN (ORB PKT, RCS)

When L or R RCS QTY < :

or when FRCS QTY < :

DAP: NO LO Z

When L or R RCS QTY < :

or when FRCS QTY < :

If prior to Ti:

Do not perform Ti

If after Ti, but prior to TORVA init (+X burns to start TORVA are complete):

Go to RNDZ BREAKOUT (CONTINGENCY OPS), 5-18

If during TORVA:

Go to SHUTTLE NOSE IN-PLANE BREAKOUT (CONTINGENCY OPS), 5-16

If stable on +VBAR:

Go to VBAR BREAKOUT (CONTINGENCY OPS), 5-14

RNDZ-1b/114/O/B

(reduced copy)

+

KU OPS

HOOK
VELCRO

1. CONFIGURE KU FOR RR TGT ACQ

CRT GNC 33 REL NAV
 √SV SEL, ITEM 4 – FLTR
 √INH RNG, ITEM 18 – (*)
 RDOT, ITEM 21 – (*)
 Angles, ITEM 24 – (*)

A2 KU ANT ENA – ITEM 2 EXEC (*)
 GNC I/O RESET

A1U DIGI-DIS sel – R/RDOT
 KU MODE – RDR PASSIVE
 √RDR OUTPUT – HI
 CNTL – PNL
 √PWR – ON

KU SEL – GPC >>

2. AUTO TRK ACQ

KU SEL – AUTO TRK
 SLEW – as reqd (as seen in COAS)
 √EL, AZ angles < 30 deg
 KU SEARCH – SEARCH (tb-gray)
 Repeat slew and search as reqd
 If acquisition not successful, √MCC >>

3. RR NAVIGATION

CRT GNC 33 REL NAV
 √RADAR, ITEM 13 – (*)

* If RATIO > 1.0: *
 * √MCC *

FLTR TO PROP – ITEM 8 EXEC (*)
 AUT RNG – ITEM 17 EXEC (*)
 RDOT – ITEM 20 EXEC (*)
 Angles – ITEM 23 EXEC (*) >>

4. CONFIGURE KU FOR COMM

CRT GNC 33 REL NAV
 INH RNG – ITEM 18 (*)
 RDOT – ITEM 21 (*)
 Angles – ITEM 24 (*)
 KU ANT ENA – ITEM 2 (no *)

A1U KU PWR – STBY
 MODE – COMM
 √sel – GPC
 CNTL – CMD

A2 DIGI-DIS sel – EL/AZ

HOOK
VELCRO

RNDZ-2a/114/O/A

+

TOP
BACK OF 'KU OPS'



HOOK
VELCRO



HOOK
VELCRO

RNDZ-2b/114/O/A

(reduced copy)

CC 9-6

RNDZ/114/FIN A

TOP

HOOK
VELCRO

APPROACH

RNDZ-3a/114/O/B

CG to CG RNG (ft)	RDOT (ft/s)	MC2 ET h:mm:ss	DAP	EVENT	HHL RNG (ft) (to ISS cg)	Raw TCS RNG* (ft) (Ref #2)
2000	-3.0	0:27:00	A8/B8 AUTO/VERN (PRI)	If RDOT falls below value for next gate, THC: -Z (in) as reqd to maintain RDOT	1990 HHL Report	2015
1700	-2.6	0:29:00			1690	1698
1500	-2.3	0:30:00			1490	1498
1000	-1.5	0:35:00	LO Z	Report to MCC: ISS solar array config MCC UPDATE: √Go to proceed within 400 ft A1U KU BD RDR OUTPUT – LOW	990	985
800	↓			IF U.S. SOLAR ARRAYS NOT FEATHERED: Maintain TORVA and VBAR RNG > 400 ft (cg-cg) When in Rbar attitude, config DAP to A9, B9 Null ISS rates in C/L camr prior to TORVA	790 HHL Report	786
600	-0.8	0:40:00	A9/B9	TORVA	590	586
550	-0.7			GNC UNIV PTG P ITEM 15 +1 7 9 EXEC TRK – ITEM 19 EXEC (CUR-*) THC: +X (up) as reqd to null tgt motion in C/L camr and initiate flyaround (approx 22 DAP A pulses)	540	536
500	-0.5			Maintain ISS within C/L camr FOV	490 HHL Report	486
400	0.0 to -0.1			MCC UPDATE: GO for Docking If reqd, PET reset per GROUND STATION COVERAGE APPROACH RPOP POR – Orb DP to Tgt DP Maintain RNG > 250 ft (dp-dp) until VBAR arrival Maintain ISS CG within 10° of C/L camr Start video recorders	390 HHL Report	343
When Pitch Error < 2°		0:51:30		ESTABLISH VBAR THC: -X (down) as reqd to null ISS in C/L camr, then THC: as reqd to maintain ISS in camr FOV	HHL RNG (to LAB)	TCS Ref. 1
415-315 (350–250 DP–DP)	-0.2	0:52:00		Perform <u>CONFIGURE FOR DOCKING</u> Perform <u>VBAR APPROACH</u> (Cue Card)	357–257 HHL Report	355–255

* Raw TCS Range assumes ISS in docking attitude

GROUND STATION COVERAGE APPROACH

PRIME GROUND STATION PASS

Approach PET 0:00 = / : : : : : : :

BACKUP GROUND STATION PASS

Approach PET 0:00 = / : : : : : : :

170 ft STATIONKEEPING Prime Backup

Estimated duration of 170 ft SK = min min

CONFIGURE FOR DOCKING

Perform DOCKING MECHANISM PWRUP (APDS), 8-5
Perform DOCKING PREP (APDS), 8-7
Perform ODS VOLUME PREP FOR DOCKING (SODE:
JOINT OPS, ARRIVAL)

(reduced copy)

TOP
BACK OF 'APPROACH'

HOOK
VELCRO

VBAR APPROACH

RNDZ-3b/114/O/B

Interface RNG (ft)	RDOT (ft/s)	MC2 ET h:mm:ss (doc-PET)	DAP	EVENT	HHL RNG (to US Lab) (ft)	Raw TCS RNG* (Ref #1)
250	-0.20 ±0.05	0:57:00 (-34:00)	√LO Z	Maintain ISS docking target within 8 deg Corridor	257 HHL Report	255
(170 ± 10) 170	(0.00) -0.20 ±0.05	1:03:30 (-27:30)	DAP: B	Note: DAP A allowed for ±X and ±Z THC If reqd, THC: as reqd to null Rdot and perform VBAR stationkeeping	177 HHL Report	175
110	-0.15 ±0.05	1:08:30 (-22:30)		Perform CONFIGURE KU FOR COMM (Cue Card, KU OPS)	117	115
75	-0.10 ±0.05	1:12:30 (-18:30)	No LO Z A10,B10 √DAP: B	Note: DAP A allowed for ±X and -Z THC (in) GNC 23 RCS (Maintain through contact) √RCS FWD – ITEM 1 EXEC (*) JET DES F1F – ITEM 31 EXEC (*) F2F – ITEM 35 EXEC (*)	82 HHL Report	80
30 ± 5	0.0	1:20:00 (-11:00)	√A10,B10 √DAP: B	5° Corridor If Flyout Reqd: THC: +Z (out) as reqd to null RDOT Perform AUTO ANGULAR FLYOUT (Cue Card) outside 25 ft Review FAILED CAPTURE , steps 1 thru 3. CAUTION (Cue Card, DOCKING SEQUENCE) √A7L Panel Config Set EVENT TIMER for CAPTURE (counting up from 00:00)	32-42 HHL Report	30-40
30	-0.07 ±0.02	1:25:00 (-06:00)		√5° Corridor THC: -Z (in) as reqd to establish RDOT = -0:07 ±0.02 fps Report to MCC and ISS: Initiating final approach	37	35
25	↑	1:26:00 (-05:00)		Maintain GNC 23 RCS through contact	32	30
10	-0.10 ±0.03	1:29:20 (-01:40)	√No LO Z	ARM PCT F2(F4) SPDBK/THROT pb – AUTO – √It on	17	15
3	-0.10 ±0.03	1:30:30 (-00:30)		Maintain 3 inch lateral alignment cylinder	N/A	8
CONTACT or ~2 in	-0.10 ±0.03	1:31:00 (00:00)	PCT (SPARE pbi)	CAPTURE IF NO CAPTURE (bounce-off) Go to FAILED CAPTURE	N/A	5

* Raw TCS Range assumes ISS in docking attitude

CAPTURE

√CAPTURE It – on
√INITIAL CONTACT It – off
Notify ISS and MCC-H: "Capture confirmed"
MS START EVENT TIMER = 00:00:00
Perform **DOCKING SEQUENCE** (Cue Card)
√ISS in FREE DRIFT
If ISS indicator lights flashing:
| ISS is in free drift
If ISS indicator lights steady on:
| ISS ACS active
If ISS indicator lights off:
| Indicator light has failed
√MCC
Confirm status with MCC and ISS Crew
IF ISS ACS STILL ACTIVE AT CAPTURE + 65 SEC:
Perform **FAILED CAPTURE**
When capture confirmed and ISS is in FREE DRIFT:
DISARM PCT:
F4 SPDBK/THROT pb – AUTO
– √It off
A6U FLT CNTLR PWR – OFF
When Docking Sequence complete:
Go to **TERMINATE RNDZ OPS** [22A], 4-22

FAILED CAPTURE

NOTE
There will be no spring-assisted separation from ISS. Opening rate of 0.1 fps must be achieved by THC inputs

- APDS CIRC PROT OFF pb – push
√OFF It – on
OPEN LATCHES pb – push
√LAT CL It – off
√OP It – on
- When petals clear:
IF VERN FAIL, DAP: A/PRI/LVLH
DAP: A/VERN(PRI)/LVLH
√DAP: NO LO Z
- THC: +Z (out) to establish 0.1 fps opening rate
If ISS in FREE DRIFT:
Use ISS CG as corridor reference
Maintain 8 degree corridor
DAP: B
Inform MCC-H and ISS: Failed Capture
Maintain opening rate of at least 0.1 fps
- Perform VBAR CORRIDOR BACKOUT, steps 2,3, **CONTINGENCY OPS**, 5-12
- If second docking attempt desired:
Perform APDS **FAILED CAPTURE RECONFIG** (APDS), 8-30
If reqd, perform **DOCKING MECHANISM POWERDOWN** (APDS), 8-6
Go to **VBAR APPROACH** Cue Card, RNG = 170 ft

(reduced copy)

HOOK
VELCRO

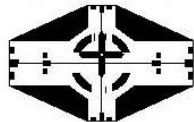
C/L CAMERA TARGET ALIGNMENT (+VBAR)

**PITCH (P)
ITEM 15**

Target Displaced DOWN
(Cross Displaced UP)



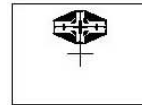
P = _____



P = _____

- 3. PITCH = 179 - P = _____ (A)
- 5. PITCH = PITCH - P = _____ (D)

Target Displaced UP
(Cross Displaced DOWN)



P = _____



P = _____

- 3. PITCH = 179 + P = _____ (A)
- 5. PITCH = PITCH + P = _____ (D)

**ROLL (R)
ITEM 16**

Rotated CW

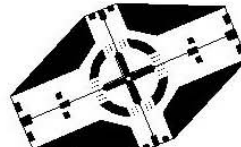


R = _____

R = _____

- 3. YAW = 360 - R = _____ (B)
- 5. YAW = YAW - R = _____ (E)

Rotated CCW



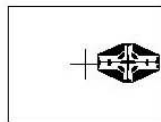
R = _____

R = _____

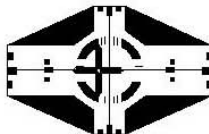
- 3. YAW = 0 + R = _____ (B)
- 5. YAW = YAW + R = _____ (E)

**YAW (Y)
ITEM 17**

Target Displaced RIGHT
(Cross Displaced LEFT)



Y = _____



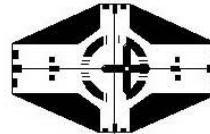
Y = _____

- 3. OM = 0 + Y = _____ (C)
- 5. OM = OM + Y = _____ (F)

Target Displaced LEFT
(Cross Displaced RIGHT)



Y = _____



Y = _____

- 3. OM = 360 - Y = _____ (C)
- 5. OM = OM - Y = _____ (F)

RNDZ-4a/114/O/B

TOP
BACK OF 'C/L CAMERA TARGET ALIGNMENT (+VBAR)'

HOOK
VELCRO

AUTO ANGULAR FLYOUT

CAUTION
AUTO ANGULAR FLYOUT must be
completed by RNG = 10 ft

1. RECORD ANGULAR MISALIGNMENT

√DAP: A10, B10

Read error from ISS centerline target

PITCH _____ (P)

YAW _____ (Y)

ROLL _____ (R)

Report misalignment to MCC

If all axes within 1.0 deg of zero, no mnvr reqd >>

2. CALCULATE UNIV PTG INPUTS

Use diagrams in TARGET ALIGNMENT (Cue Card) to determine
UNIV PTG inputs for step 3

3. EXECUTE ALIGNMENT MNVR

GNC UNIV PTG

√TGT ID +2

√BODY VECT +5

PITCH +(A)

YAW +(B)

OM +(C)

TRK – ITEM 19 EXEC (CUR-*)

When mnvr cplt,

4. RECORD REMAINING ANGULAR MISALIGNMENT

Record error from ISS centerline target:

PITCH _____ (P)

YAW _____ (Y)

ROLL _____ (R)

If all axes within 1.0 deg of zero, no additional mnvr reqd >>

Otherwise,

5. REPEAT ALIGNMENT

a. Calculate UNIV PTG inputs:

Use diagrams in TARGET ALIGNMENT (Cue Card) to
determine UNIV PTG inputs for step 5b

b. Execute alignment MNVR

GNC UNIV PTG

√TGT ID +2

√BODY VECT +5

PITCH +(D)

YAW +(E)

OM +(F)

TRK – ITEM 19 EXEC (CUR-*)

RNDZ-4b/114/O/A

(reduced copy)

HOOK
VELCRO

DOCKING SEQUENCE

CAUTION
If following failures occur during final approach (< 30 ft), **NO-GO** for docking. Initiate Corridor Backout. Then proceed with APDS OFF-NOMINAL procedures (APDS)

POWER Failed OFF (All STATUS lts ↓)	DAMPING tlm Failed ON
CAPTURE lts Failed ON	FIXERS tlm Failed ON

CAUTION
If any Docking Sequence command occurs out of order or if any STATUS lts functions erroneously:
A7L PWR OFF pb – push
ON pb – push
Proceed with APDS OFF-NOMINAL procedures (APDS)

Event Time

Contact/Capture/Damping

SM 167 DOCKING STATUS		
0:00	A7L	1. √CAPTURE lts – on (expect RING INIT POS lts off)
0:05	CRT	2. √DAMPING – ON

Disable and Release Dampers

		3. When no relative motion [PETAL POS BASE (three) not changing for 60 sec]:
	A7L	PWR ON pb – push
	CRT	√DAMPING – OFF
		4. When no relative motion [PETAL POS BASE (three) not changing for 30 sec]:
0:00	A7L	FIXER OFF pb – push (lts on)
		RING IN pb – push
	CRT	√DRV CMD – ON [PETAL POS BASE (three) – decr]
		√CLUTCH – LOCK/blank
0:05	A7L	5. PWR ON pb – push
	CRT	√RING DRV CMD – OFF
		6. When no relative motion [PETAL POS BASE (three) not changing for 30 sec]:
0:00	A7L	APDS CIRC PROT OFF pb – push (lts on)
		RING OUT pb – push
	CRT	√DRV CMD – ON [PETAL POS BASE (three) – incr]
0:05	A7L	7. PWR OFF pb – push
		ON pb – push
		√FIXERS OFF lts – OFF
	CRT	√RING DRV CMD – OFF

Retract Ring		
0:00	A7L CRT	8. On MCC GO (RING ALIGNED It on and [PETAL POS BASE (three) not changing] for 30 sec): RING IN pb – push √DRV CMD – ON [PETAL POS BASE (three) – decr] √FIXERS – ON √CLUTCH – LOCK/blank
	A7L	* If PETAL POS BASE (three) > 20 % and RING ALIGNED It – off: * * PWR ON pb – push * * Wait for ring alignment (up to 30 min) * * When RING ALIGNED It – on and [PETAL POS BASE (three) * * not changing] for 30 sec: * * RING IN pb – push *
3:15		9. √RDY TO HK It – on [PETAL POS BAS (three) ≤ 7 %]
Close Hooks		
0:00	CRT	10. √HOOKS 1,HOOKS 2 OP Its (two) – off [HOOK 1,2 POS (two) ≥ 4% & incr] √HK 1,2 DRV CMD (two) – ON * If no auto Hook drive, and HK 1(2) DRV CMD – OFF: * * CLOSE HOOKS pb – push *
0:20	CRT	11. √RING DRV CMD – OFF * If RING DRV CMD – ON 20 sec after RDY TO HK It on: * * PWR ON pb – push *
≤ 1:30	A7L	12. √INTERF SEALED It – on (expect intermittent It initially)
2:30	CRT	13. √HOOKS 1,HOOKS 2 CL Its (two) – on [HOOK 1,2 POS (two) = 92%] √HK 1,2 IND (two) – blank/CL √ODS INDIV HK CL (twelve) – CL
Load Relieve Capture Latches (Extend Ring)		
0:00	A7L	14. APDS CIRC PROT OFF pb – push (It on)
	CRT	15. RING OUT pb – push √DRV CMD – ON
0:10	A7L CRT	16. PWR ON pb – push √RING DRV CMD – OFF
Open Capture Latches		
0:00	A7L	17. OPEN LATCHES pb – push √LAT CL It – off
0:05		√OP It – on
Retract Ring to FNL POS		
0:00	CRT	18. RING IN pb – push √DRV CMD – ON [PETAL POS BASE (three) – decr] √FIXERS – ON
0:20	A7L CRT	√RING FNL POS It – on [PETAL POS BASE (three) = 5%] √DRV CMD – OFF
Power Off		
	A7L	19. PWR OFF pb – push √STATUS Its (eighteen) – off 20. Return to CAPTURE (APPROACH Cue Card) >>

TOP

HOOK
VELCRO

STOPWATCH RDOT CONVERSION

TIME BETWEEN 1 FT MARKS (SEC)	RANGE RATE (FT/SEC)
2	0.50
3	0.33
4	0.25
5	0.20
5.5	0.18
6	0.17
6.5	0.15
7	0.14
7.5	0.13
8	0.125
8.5	0.12
9	0.11
10	0.10
11	0.09
12	0.08
13	0.075
14	0.07
15	0.067
16	0.063
18	0.056
20	0.050

NOTE

HHL SPECS state that the HHL will not work if the aimpoint surface is closer than 12 ft from the HHL unit; therefore, no HHL use should be expected at an HHL range less than 12 ft (5 ft interface-to-interface)

RNDZ-6a/114/O/A

TOP
BACK OF 'STOPWATCH RDOT CONVERSION'

HOOK
VELCRO

RDOT vs DELTA RNG/DELTA TIME

ΔRng (ft) ΔT (m:ss)		Rdot (fps)													
		1000	800	700	600	500	400	300	250	200	150	100	50	25	10
0:45							8.9	6.7	5.6	4.4	3.3	2.2	1.1	0.56	0.22
0:50					10.0	8.0	6.0	5.0	4.0	3.0	2.0	1.0	0.50	0.20	
0:55					9.1	7.3	5.5	4.5	3.6	2.7	1.8	0.91	0.45	0.18	
1:00				10.0	8.3	6.7	5.0	4.2	3.3	2.5	1.7	0.83	0.42	0.17	
1:10			10.0	8.6	7.1	5.7	4.3	3.6	2.9	2.1	1.4	0.71	0.36	0.14	
1:20		10.0	8.8	7.5	6.3	5.0	3.8	3.1	2.5	1.9	1.3	0.63	0.31	0.13	
1:30		8.9	7.8	6.7	5.6	4.4	3.3	2.8	2.2	1.7	1.1	0.56	0.28	0.11	
1:40	10.0	8.0	7.0	6.0	5.0	4.0	3.0	2.5	2.0	1.5	1.0	0.50	0.25	0.10	
1:50	9.1	7.3	6.4	5.5	4.5	3.6	2.7	2.3	1.8	1.4	0.91	0.45	0.23	0.09	
2:00	8.3	6.7	5.8	5.0	4.2	3.3	2.5	2.1	1.7	1.3	0.83	0.42	0.21	0.08	
2:20	7.1	5.7	5.0	4.3	3.6	2.9	2.1	1.8	1.4	1.1	0.71	0.36	0.18	0.07	
2:40	6.3	5.0	4.4	3.8	3.1	2.5	1.9	1.6	1.3	0.9	0.63	0.31	0.16	0.06	
3:00	5.6	4.4	3.9	3.3	2.8	2.2	1.7	1.4	1.1	0.8	0.56	0.28	0.14	0.06	

NOTE:
If RPOP is available, use RPOP
subtended angle function.

TIME	DELTA TIME	RANGE	DELTA RANGE
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

RNDZ-6b/114/O/A

TOP

H
O
O
K
V
E
L
C
R
O

GPC/MDM FAILURE RESPONSE DURING RNDZ

H
O
O
K
V
E
L
C
R
O

NOTES

1. GPC assignments assume 1233 NBAT
2. Do NOT restrng for Non-Universal I/O Errors. Otherwise, a restrng for GPC 1,2,3 fails will recover everything (see expected restrng below)
3. If any GNC GPC fails, VERNs ↓
4. If IMUs not commfaulted, THCs are normally GO
5. Loss of FF2, FF4, FA3, and FA4 do not impact Rndz (unless other failures)

GPC	MDM	IMMEDIATE ACTION	MAJOR IMPACT
GPC1 (3232*)	FF1	1. If -Z ST NAV, INH ST to NAV 2. Work appropriate ORB PKT procedure 3. If not recovered: Use -Y ST, if reqd	1. C3 DAP lights latched (go out with MDM pwr fail) 2. -Z ST ↓
	FA1	Pre-MC4: DAP: ALT/AUTO Post-MC4: DAP: PRI/AUTO	VERNs ↓
GPC2 (1313*)	FA2	Pre-MC4: DAP: ALT/AUTO Post-MC4: DAP: PRI/AUTO	VERNs ↓
Man OMS Shutdown GPC3 (1212*) Loss of Aft DAP	FF3	1. Pre-MC4: DAP: ALT/AUTO Post-MC4: DAP: PRI/AUTO 2. If RR NAV, INH RR to NAV 3. If -Y ST NAV, INH ST to NAV 4. Work appropriate ORB PKT procedure 5. If not recovered: Work RR FAIL procedures	1. VERNs ↓ 2. RR → NAV/RPOP ↓ (Panel A2 OK) 3. A6 DAP lights latched (go out with MDM pwr fail) 4. -Y ST ↓ 5. Also for loss of GPC3: R OMS GMBL PRI/SEC ↓
GPC4 (1212*)	PL	If Ku breaks lock: Ku sel – AUTO TRK	1. GPC Ku ptg ↓, slew in AUTO TRK if Ku breaks lock 2. No Ku self-test

* Expect this NBAT if GPC fail

MALFUNCTION	>>

RNDZ-7a/114/O/A

TOP
BACK OF 'GPC/MDM FAILURE RESPONSE DURING RNDZ'

HOOK
VELCRO

RNDZ REF DATA

HOOK
VELCRO

FF1

F MANF 1 JETS
C3 DAP LTS
IMU 1
-Z STRK
L OMS GMBL PRI ENA
L ADI sw, ATT REF
F,A THC contact 1
L,A RHC channel 1
PNL 03 F,L,R RCS OX QTY
PNL 03 F,L RCS LOW QTY

FF2

F MANF 2 JETS
IMU 2
L OMS GMBL SEC ENA
R ADI sw, ATT REF
F,A THC contact 2
A RHC P,Y channel 2
L RHC channel 2
R RHC channel 1

FF3

VERNS
F MANF 4 JETS
A6 DAP LTS
IMU 3
RR→NAV/RPOP
-Y STRK
R OMS GMBL SEC ENA
A ADI sw, ATT REF
F,A THC contact 3
L,A RHC channel 3
R RHC channel 2
PNL 03 R RCS LOW QTY
PNL 03 F,L,R RCS FU QTY

FF4

F MANF 3 JETS
R OMS GMBL PRI ENA
A RHC Roll channel 2
R RHC channel 3

PL1

GPC KU PTG
KU self-test

FA1

VERNS
L,R MANF 1 JETS
L OMS GMBL PRI

FA2

VERNS
L,R MANF 3 JETS
L OMS GMBL SEC

FA3

L,R MANF 2 JETS
R OMS GMBL SEC

FA4

L,R MANF 4 JETS
R OMS GMBL PRI

MDM OA1(OA2)

L(R) OMS DEORB
ONLY

DSC OF2

VERNS & F MANF 3,4 RM
F RCS OX, FU QTY

DSC OF4

F MANF 1,2 RM

DSC OL1

VERNS & L MANF 1,2 RM
L OMS DEORB ONLY
L RCS OX QTY

DSC OL2

L MANF 3,4 RM
L RCS FU QTY

DSC OR1

VERNS & R MANF 1,2 RM
R OMS DEORB ONLY
R RCS OX QTY

DSC OR2

R MANF 3,4 RM
R RCS FU QTY

DSC OA2

VERNS RM

CNTL AB1

PLB LTS (Fwd-P, Aft-S, Bulkhead)
L ADI ATT REF
CCTV CONTR UNIT PRI

CNTL AB2

F MANF 1 JETS
L ADI switches, ATT REF

CNTL AB3

C3 DAP ROT,TRANS pbs

CNTL BC1

VERNS
PLB LTS (Fwd-S, Mid-P)
R ADI ATT REF
CCTV CONTR UNIT SEC

CNTL BC2

VERNS
F MANF 2 JETS
A6 DAP ROT,TRANS pbs (PCT)
R ADI switches, ATT REF

CNTL BC3

C3 DAP ROT,TRANS pbs

CNTL CA1

PLB LTS (Aft-P, Mid-S)
OVHD DOCK, RMS SPOT LTS
A ADI ATT REF

CNTL CA2

F MANF 3 JETS
A6 DAP ROT,TRANS pbs (PCT)
A ADI switches, ATT REF

CNTL CA3

F MANF 4 JETS

MAIN A

FPC1: MCIU
FLC1: F MANF 1 JETS
AC1B: PNL 03 RCS/OMS QTY
FWD EVENT TIMER
APC4:
APC1: VERNS
L OMS GMBL PRI
R OMS GMBL SEC
ALC1: VERNS
O14: -Z STRK
AFT EVENT TIMER
O14/A8: RMS PRI PWR
R14: CCTV CAM-C,D
CCTV MON-1
CCTV CONTR UNIT PRI
MPC1: APDS RING DAMP 1,2
APDS HK, RING MTR 1
RMS PRI PWR
OVHD DOCK, RMS LTS
PLB LTS (Fwd-P, Aft-S)

MAIN B

FPC2:
FLC2: F MANF 2 JETS
AC2C: PNL A2 DIGITALS
APC5:
APC2: VERNS
LOMS GMBL SEC
ALC2: VERNS
O15: -Y STRK
FWD EVENT TIMER
O15/A8: RMS B/U PWR
R14: KU COMM & RR
CCTV CAM-A, RMS
CCTV MON-2
CCTV CONTR UNIT SEC
VPU (C/L CAM CMDS)
MPC2: KU COMM & RR
APDS RING DAMP 3
APDS HK, RING MTR 2
RMS B/U PWR
PLB LTS(Fwd-S,
Mid-P, Bulkhead)
AUX PLB: TCS

MAIN C

FPC3: KU COMM & RR
FLC3: VERNS
F MANF 4 JETS
AC3A: COAS PWR
APC6:
APC3: R OMS GMBL PRI
O16: PNL 03 OMS/RCS QTY
R14: KU SIG PROC (RR OK)
CCTV CAM-B
CABIN TV UTIL PORT
MPC3: PLB LTS (Aft-P, Mid-S)

ESS 2CA

TCS

CABIN PL (Fit Specific)

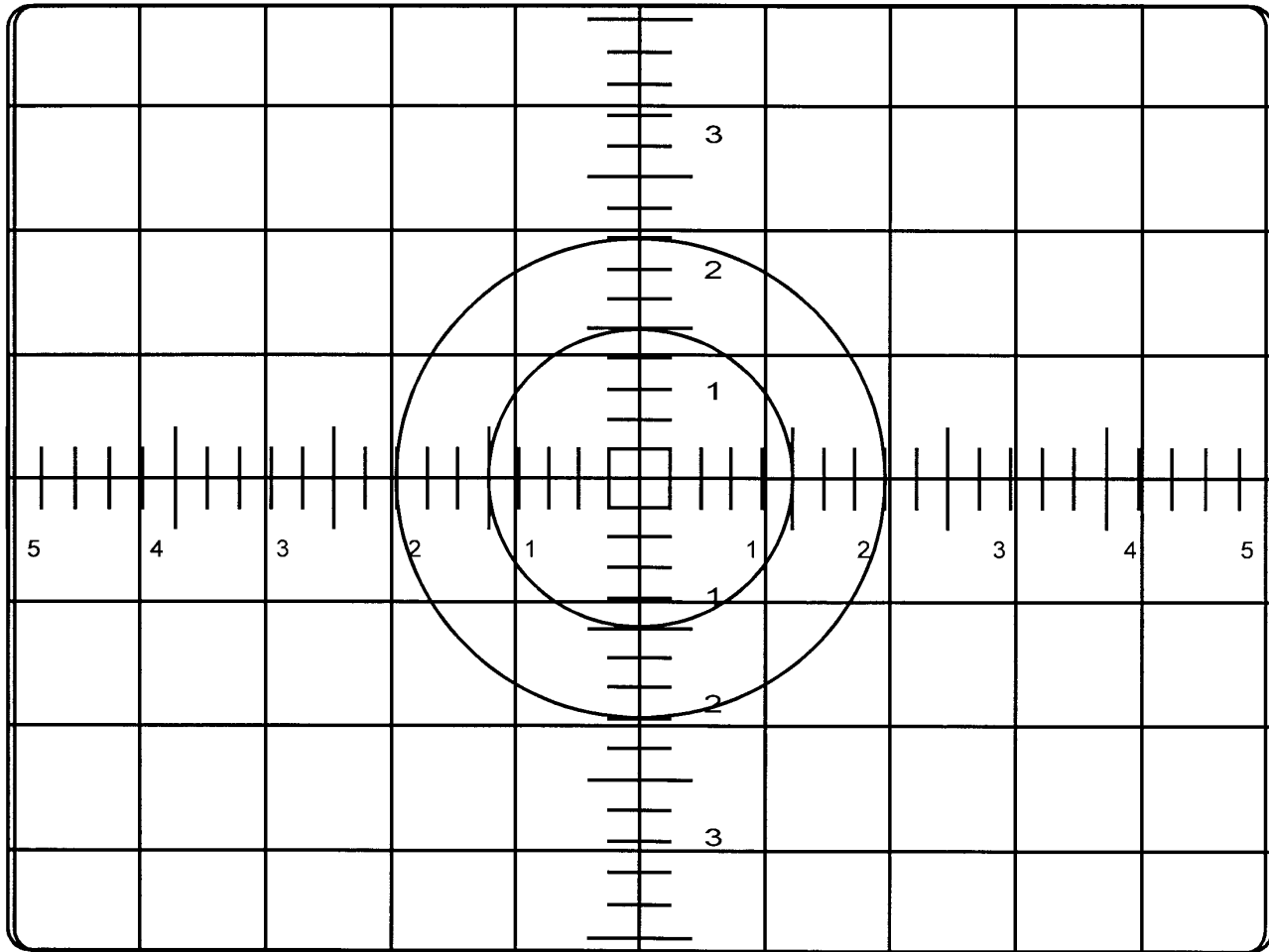
CCTV C/L CAM

RNDZ-7b/114/O/B

Note: Fabricate As Transparency

C/L CAMERA

CORRIDOR AND ALIGNMENT



CTVC 40.0 DEG HFOV - CORRIDOR
CTVC FULL ZOOM - ALIGNMENT

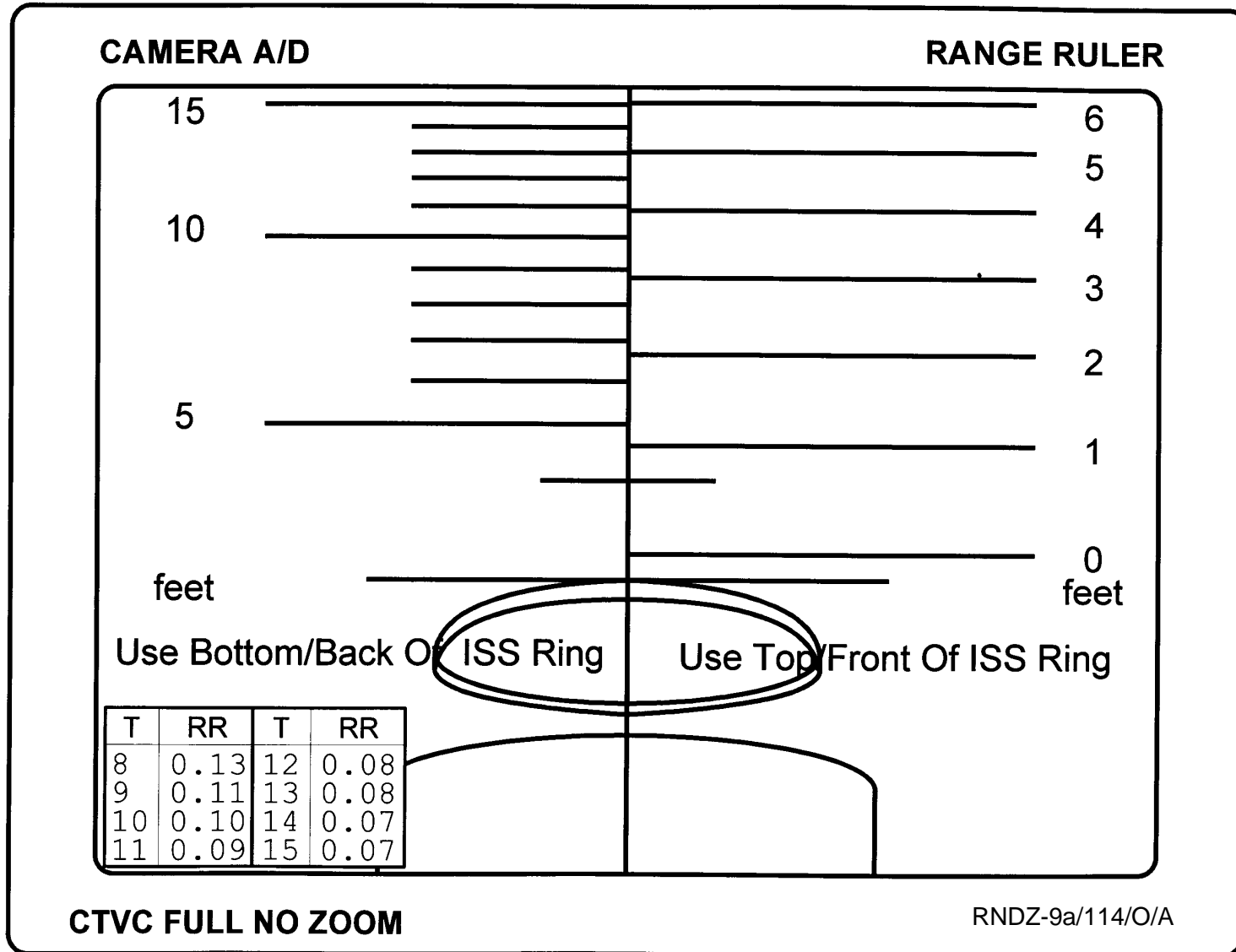
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CC 9-17

RNDZ/114/FIN A

Note: Fabricate As Transparency



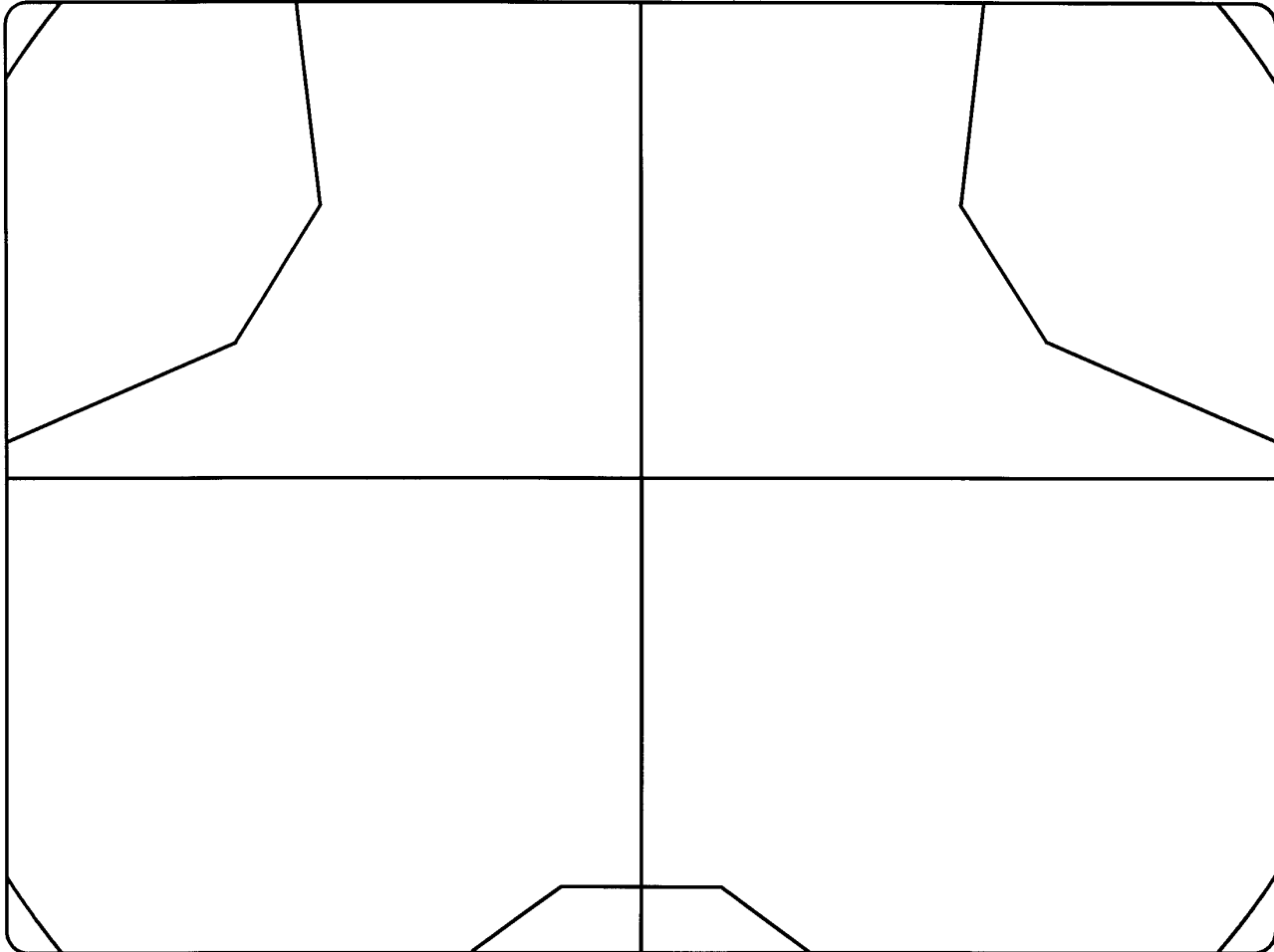
CC 9-18
(reduced copy)

RNDZ/114/FIN A

Note: Fabricate As Transparency

C/L CAMERA

ZOOM CALIBRATION (RING READY FOR DOCK)



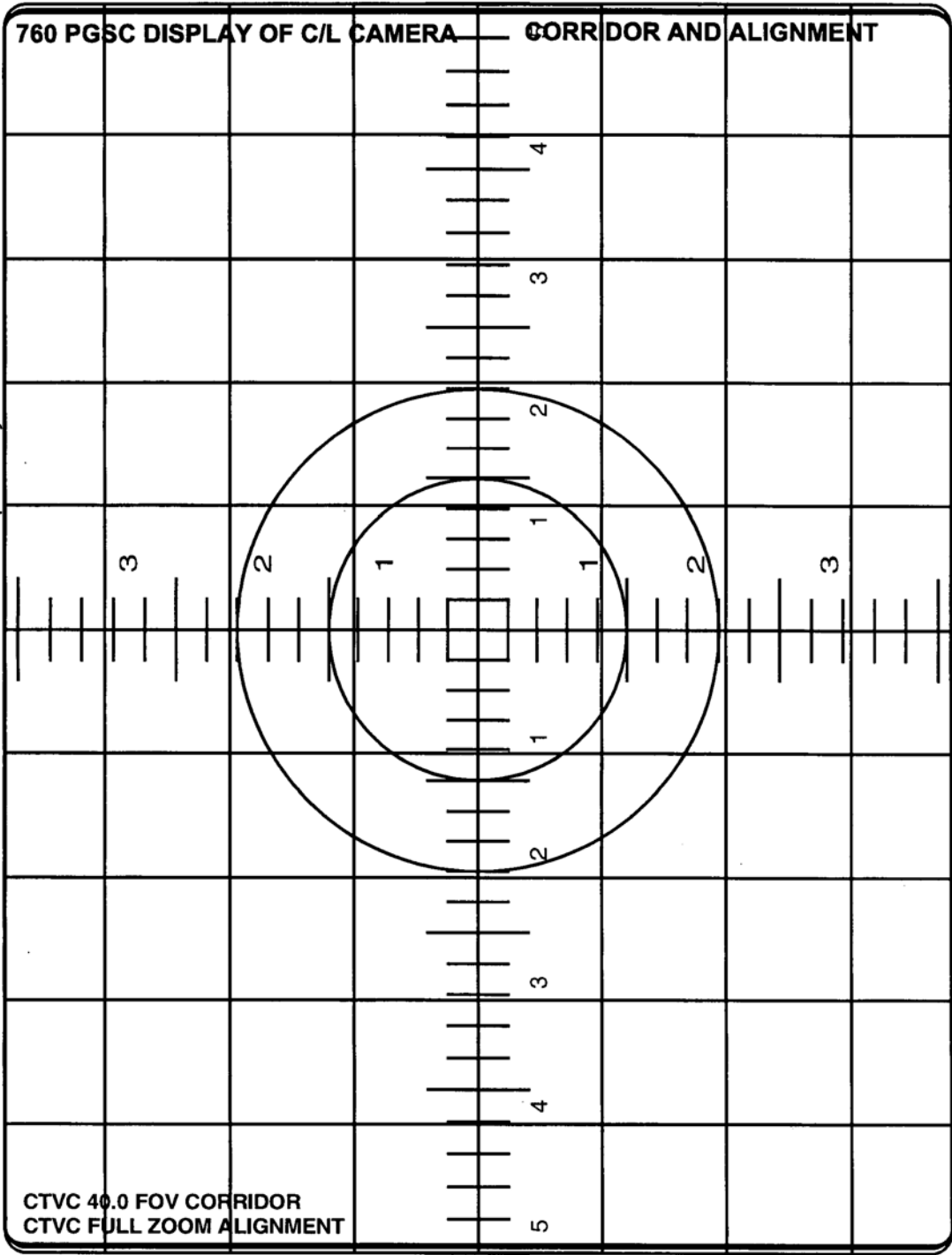
CTVC AT HFOV = 40.0 DEG

RNDZ-10a/114/O/A

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CC 9-19

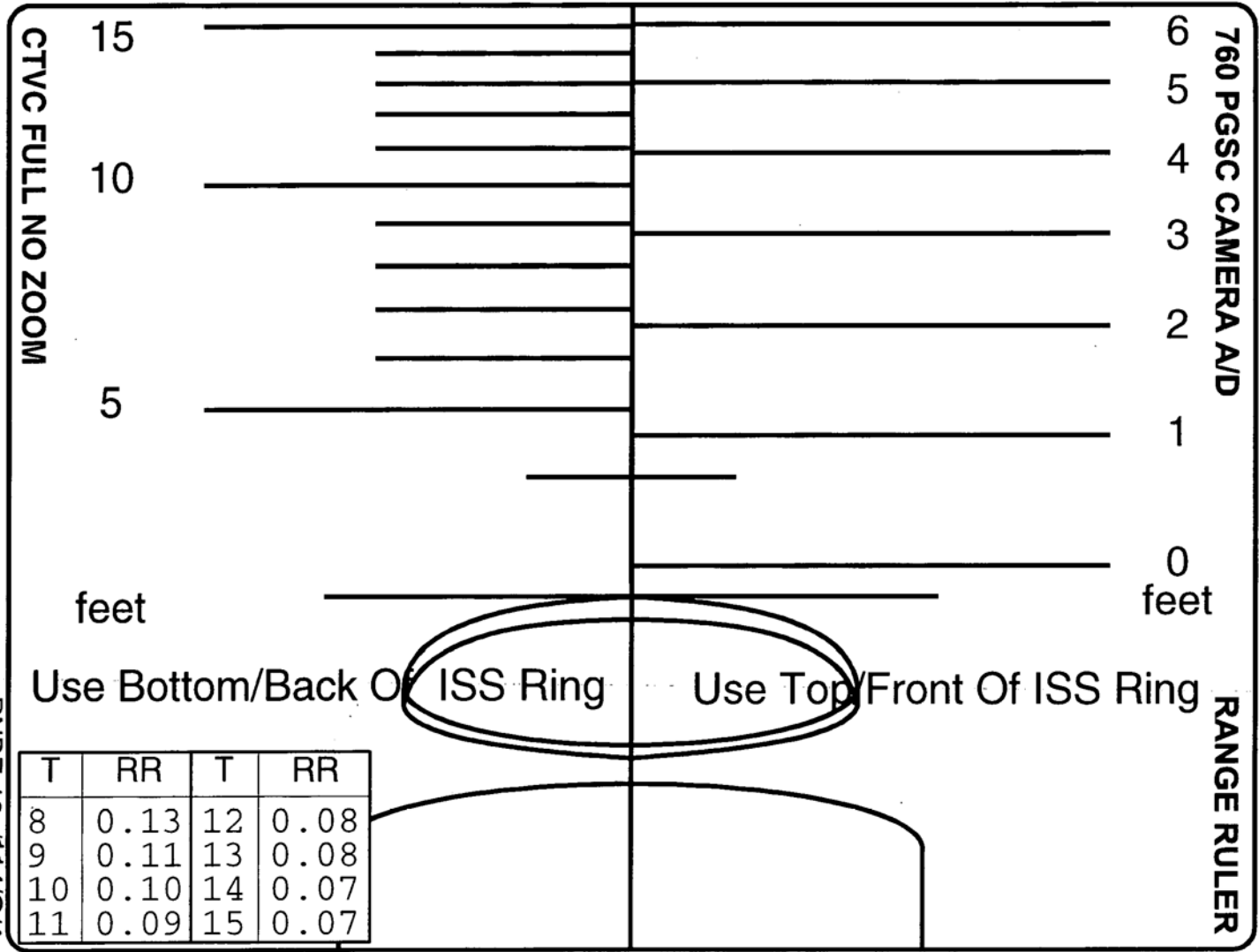
RNDZ/114/FIN A



RNDZ-11a/114/O/A

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Note: Fabricate As Transparency



RNDZ-12a/114/O/A

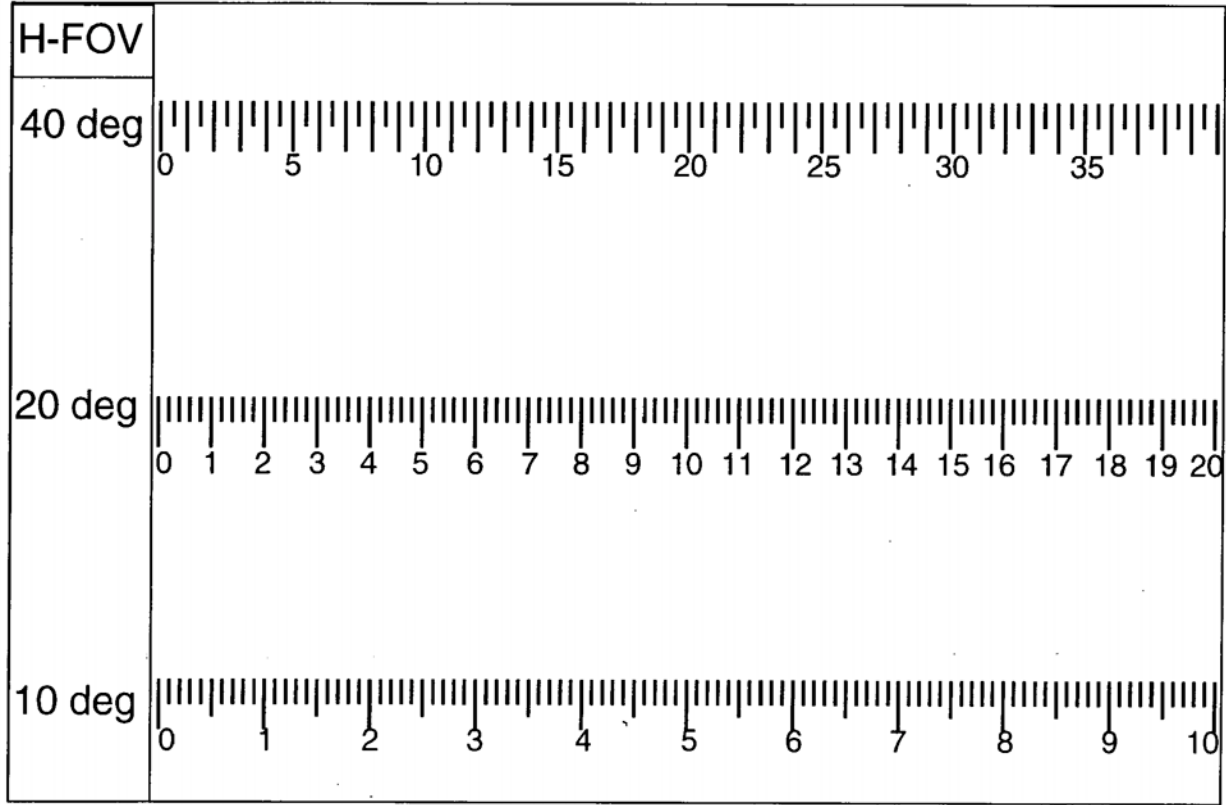
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CC 9-21

RNDZ/114/FIN A

FLIGHT

SUB ANG RULER



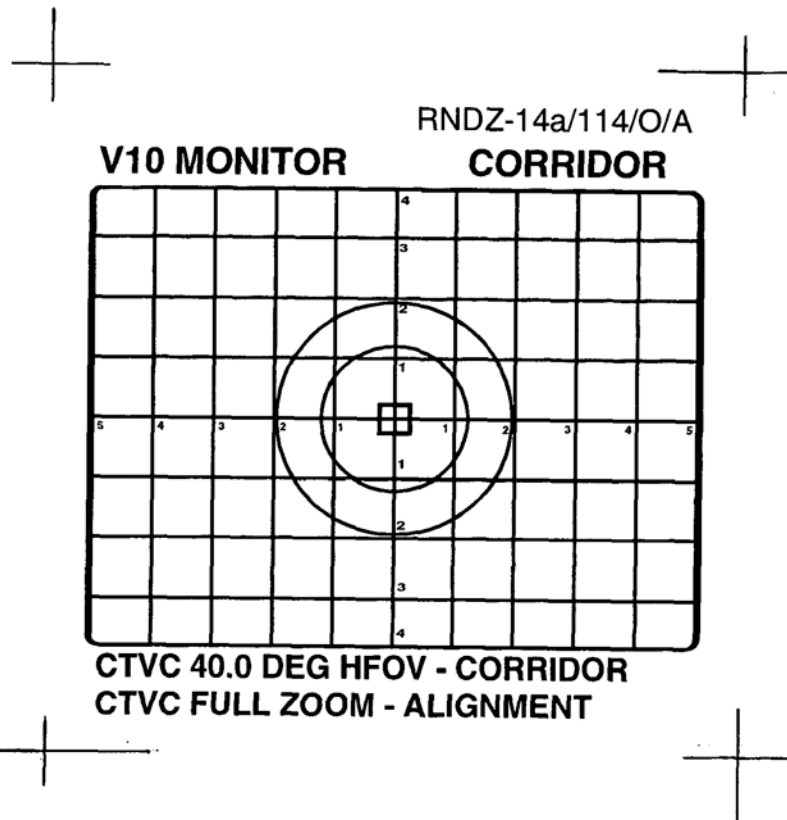
RNDZ-13a/114/O/A

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CC 9-22

RNDZ/114/FIN A

Note: Fabricate As Transparency



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CC 9-23

RNDZ/114/FIN A

HOOK
VELCRO

APPROACH WITH RPM

RNDZ-15a/114/O/A

CG to CG RNG (ft)	RDOT (ft/s)	MC2 ET h:mm:ss	DAP	EVENT	HHL RNG (ft) (to ISS cg)	Raw TCS RNG* (ft) (Ref #2)
2000	-3.0	0:27:00	A8/B8 AUTO/VERN (PRI)	If RDOT falls below value for next gate, THC: -Z (in) as reqd to maintain RDOT	1990 HHL Report	2015
1700	-2.4	0:29:00		Report to ISS: 10 minutes to RPM Start	1690	1698
1500	-2.1	0:31:00			1490	1498
1000	-1.3	0:36:00	LO Z	Report to MCC: ISS solar array config MCC UPDATE: Go for RPM, Go within 400 ft	990	985
900	-1.1	0:37:00		F6 A6U ADI ATT - √LVLH	890	885
800	-0.9	0:38:00		A1U KU RDR OUTPUT - LO, KU sel - AUTO TRK When in Rbar attitude	790 HHL Report	786
700	-0.6	0:41:00	A9/B9 A_/B9	GNC 20 DAP CONFIG Config DAP A,B to A9,B9 A PRI ROT RATE - ITEM 10 + 0.75 EXEC A VERN ROT RATE - ITEM 23 + 0.75 EXEC A PRI Y OPTION - ITEM 16 EXEC (ALL)	690	686
650	-0.4	0:42:30		GNC UNIV PTG P - ITEM 15 + 145.0 EXEC THC: center Node 1 in centerline camr ± 5 deg GNC 33 REL NAV INH RNG, RDOT, ANGLES	640	636
620	-0.4 < Rdot < -0.3			RBAR PITCH MANEUVER (RPM)	590	586
600	-0.3 < Rdot < -0.2			Null Xdot to 0 ± 0.1 ft/sec prior to maneuver start	570	566
580	-0.2 < Rdot < -0.1			If required: Stationkeep at 600-620 ft until RPM window opens	550	546
		AFT ADI (RPOP) P	FWD ADI P	DAP/UNIV PTG	ISS Calls / Other	
		P = 90 (Rbar attitude)	P = 0	A/AUTO/PRI TRK - ITEM 19 EXEC	FLT CNTLR PWR - OFF Initiating RPM (with mark)	
		P > 100	P > 10	VERN (PRI)		
		P > 170	P > 80	FREE P - ITEM 15 + 270 EXEC TRK - ITEM 19 EXEC PRI		
		P = 235	P = 145		Start photos	
		P = 305	P = 215		End photos	
		P > 10	P > 280	A/AUTO		
		P = 90 (mnvr cmplt)	P = 0	VERN (PRI) THC: set up for TORVA Reload DAP A9	FLT CNTLR PWR - ON KU SEL - GPC KU OPS step 3 (Cue Card)	
600	-0.7	0:56:00	A9/B9	TORVA	590	586
550	-0.6			GNC UNIV PTG P ITEM 15 + 179 EXEC	540	536
500	-0.4			TRK - ITEM 19 EXEC (CUR-*) THC: +X (up) as reqd to null tgt motion in C/L camr and initiate flyaround Maintain ISS within C/L camr FOV	490 HHL Report	486
400	0.0 to -0.1			MCC UPDATE: GO for Docking RPOP POR - Orb DP to Tgt DP Maintain RNG > 250 ft (dp-dp) until VBAR arrival ISS CG within 10° of C/L camr Start video recorders	390 HHL Report	343
When Pitch Error < 2°		1:10:00		ESTABLISH VBAR THC: -X (down) as reqd to null ISS in C/L camr as reqd to maintain ISS in C/L camr FOVR	HHL RNG (to LAB)	TCS Refl. 1
415-315 (350-250 DP-DP)	-0.2	1:10:30		Perform CONFIGURE FOR DOCKING Perform VBAR APPROACH POST RPM (Cue Card)	357-257 HHL Report	355-255

* Raw TCS Range assumes ISS in docking attitude

RPM START WINDOW (MET)
OPEN: __/__/__:__
CLOSE: __/__/__:__

CONFIGURE FOR DOCKING
Perform DOCKING MECHANISM PWRUP (APDS), 8-5
Perform DOCKING PREP (APDS), 8-7
Perform ODS VOLUME PREP FOR DOCKING (SODF: JOINT OPS, ARRIVAL)

(reduced copy)

HOOK
VELCRO

VBAR APPROACH POST RPM

RNDZ-15b/114/O/A

Interface RNG (ft)	RDOT (ft/s)	MC2 ET h:mm:ss (doc-PET)	DAP	EVENT	HHL RNG (to US Lab) (ft)	Raw TCS RNG* (Refl #1)
250	-0.20 ±0.05	0:57:00 (-34:00)	√LO Z	Maintain ISS docking target within 8 deg Corridor	257 HHL Report	255
(170 ± 10) 170	(0.00) -0.20 ±0.05	1:03:30 (-27:30)	DAP: B	Note: DAP A allowed for ±X and ±Z THC If reqd, THC: as reqd to null Rdot and perform VBAR stationkeeping	177 HHL Report	175
110	-0.15 ±0.05	1:08:30 (-22:30)		Perform CONFIGURE KU FOR COMM (Cue Card, KU OPS)	117	115
75	-0.10 ±0.05	1:12:30 (-18:30)	No LO Z A10,B10 √DAP: B	Note: DAP A allowed for ±X and -Z THC (in) GNC 23 RCS (Maintain through contact) √RCS FWD – ITEM 1 EXEC (*) JET DES F1F – ITEM 31 EXEC (*) F2F – ITEM 35 EXEC (*)	82 HHL Report	80
30 ± 5	0.0	1:20:00 (-11:00)	√A10,B10 √DAP: B	5° Corridor If Flyout Reqd: THC: +Z (out) as reqd to null RDOT Perform AUTO ANGULAR FLYOUT (Cue Card) outside 25 ft Review FAILED CAPTURE , steps 1 thru 3, CAUTION (Cue Card, DOCKING SEQUENCE) √A7L Panel Config Set EVENT TIMER for CAPTURE (counting up from 00:00)	32-42 HHL Report	30-40
30	-0.07 ±0.02	1:25:00 (-06:00)		√5° Corridor THC: -Z (in) as reqd to establish RDOT = -0:07 ±0.02 fps Report to MCC and ISS: Initiating final approach	37	35
25	↑	1:26:00 (-05:00)		Maintain GNC 23 RCS through contact	32	30
10	-0.10 ±0.03	1:29:20 (-01:40)	√No LO Z	ARM PCT F2(F4) SPDBK/THROT pb – AUTO – √It on	17	15
3	-0.10 ±0.03	1:30:30 (-00:30)		Maintain 3 inch lateral alignment cylinder	N/A	8
CONTACT or ~2 in	-0.10 ±0.03	1:31:00 (00:00)	PCT (SPARE pbi)	CAPTURE IF NO CAPTURE (bounce-off) Go to FAILED CAPTURE	N/A	5

* Raw TCS Range assumes ISS in docking attitude

CAPTURE
√CAPTURE It – on
√INITIAL CONTACT It – off
Notify ISS and MCC-H: "Capture confirmed"
MS START EVENT TIMER = 00:00:00
Perform **DOCKING SEQUENCE** (Cue Card)
√ISS in FREE DRIFT
If ISS indicator lights flashing:
| ISS is in free drift
If ISS indicator lights steady on:
| ISS ACS active
If ISS indicator lights off:
Indicator light has failed
√MCC
Confirm status with MCC and ISS Crew
IF ISS ACS STILL ACTIVE AT CAPTURE + 65 SEC:
Perform **FAILED CAPTURE**
When capture confirmed and ISS is in FREE DRIFT:
DISARM PCT:
SPDBK/THROT pb – AUTO
– √It off
A6U FLT CNTLR PWR – OFF
When Docking Sequence complete:
Go to **TERMINATE RNDZ OPS** [22A], 4-22

FAILED CAPTURE

NOTE

There will be no spring-assisted separation from ISS.
Opening rate of 0.1 fps must be achieved by THC inputs

- APDS CIRC PROT OFF pb – push
√OFF It – on
OPEN LATCHES pb – push
√LAT CL It – off
√OP It – on
- When petals clear: **IF VERN FAIL, DAP: A/PRI/LVLH**
DAP: A/VERN(PRI)/LVLH
√DAP: NO LO Z
- THC: +Z (out) to establish 0.1 fps opening rate
If ISS in FREE DRIFT:
Use ISS CG as corridor reference
Maintain 8 degree corridor
DAP: B
Inform MCC-H and ISS: Failed Capture
Maintain opening rate of at least 0.1 fps
- Perform VBAR CORRIDOR BACKOUT, steps 2,3, **CONTINGENCY OPS**, 5-12
- If second docking attempt desired:
Perform APDS FAILED CAPTURE RECONFIG (APDS), 8-30
If reqd, perform **DOCKING MECHANISM POWERDOWN** (APDS), 8-6
Go to **VBAR APPROACH** Cue Card, RNG = 170 ft

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RENDEZVOUS

**STS
114**