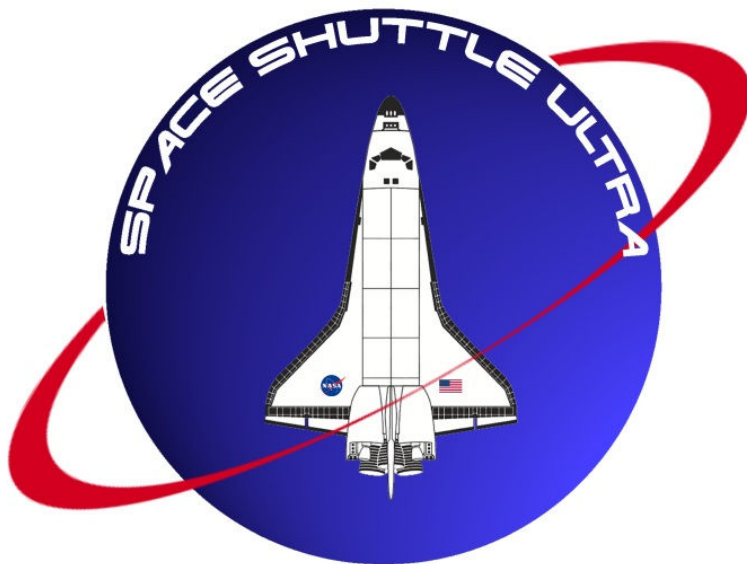


Rendezvous Checklist

**Generic
Rev 1.0
Sep 2017**



**Space Shuttle Ultra 4.2
Orbiter 2010-2016**

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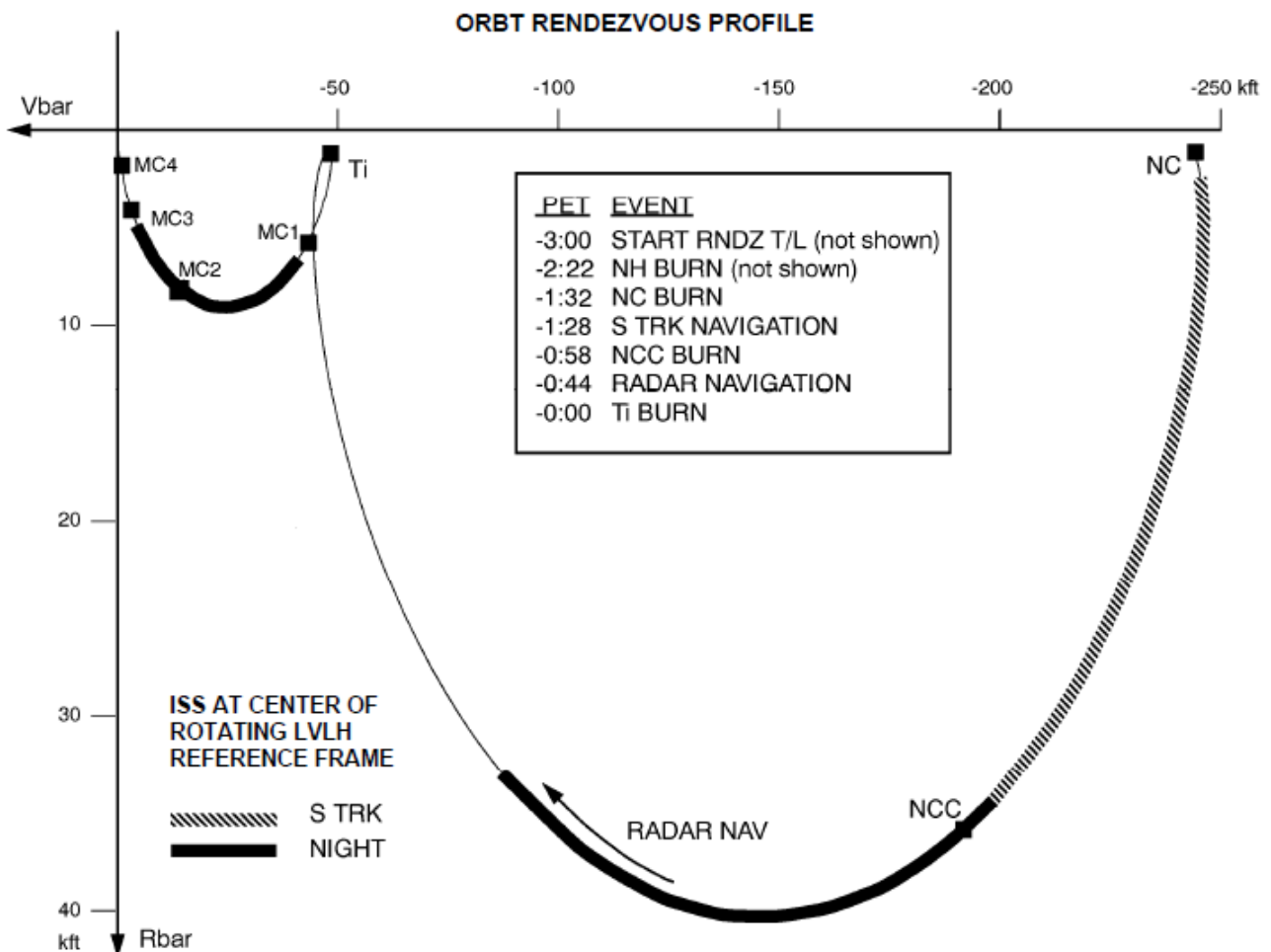
NOTE

Rendezvous contains the nominal procedures from:
Ti Burn - 03:00 to post Undocking

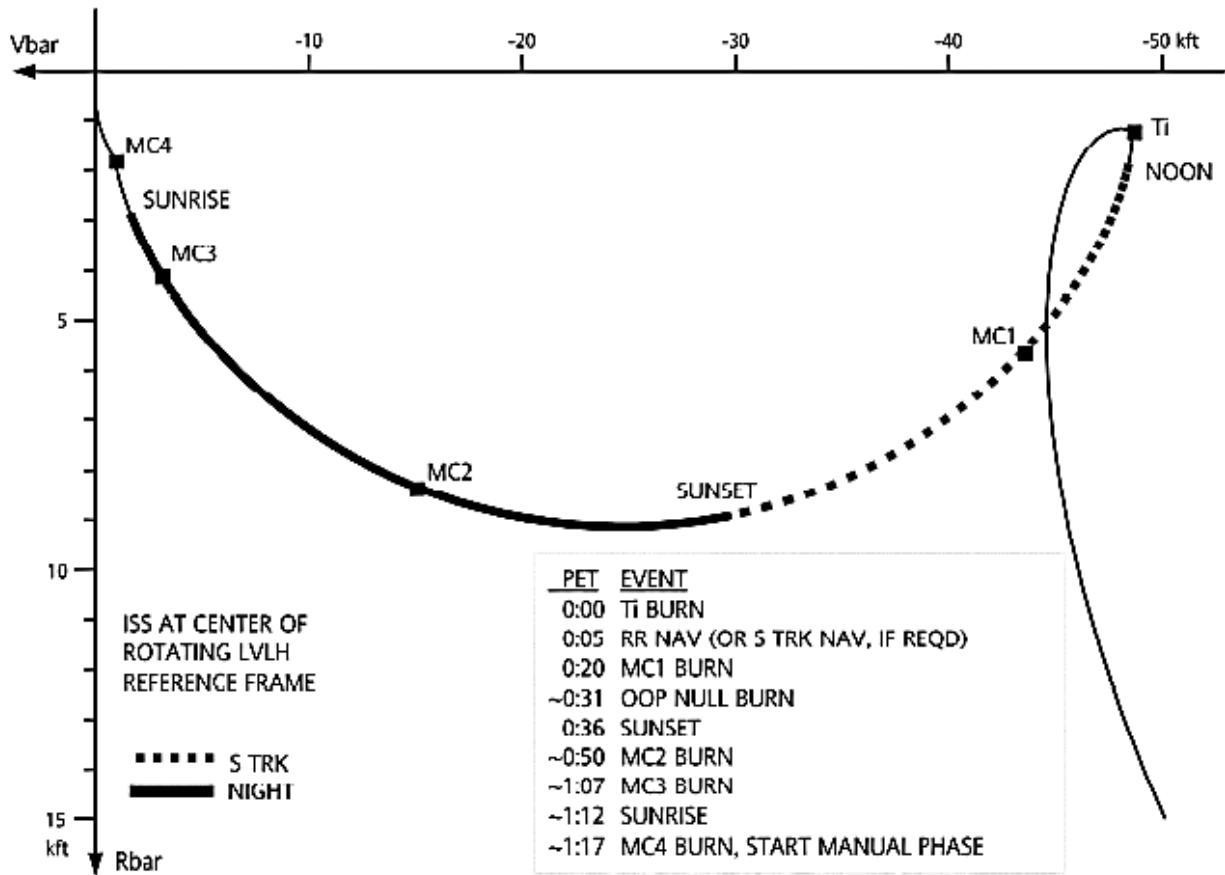
FLIGHT RULES SUMMARY AND FLIGHT PROFILE

RNDZ BURN ENGINE SELECTION GUIDELINES

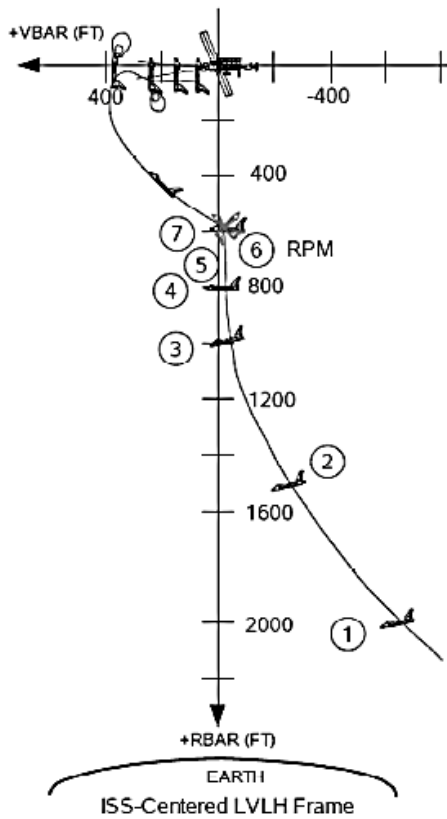
DELTA V	ENGINE
< 4 fps	RCS – Primary technique is multi-axis
4 to 6 fps	RCS – Primary technique is +X
> 6 fps	OMS – Single engine



ORBT POST Ti PROFILE

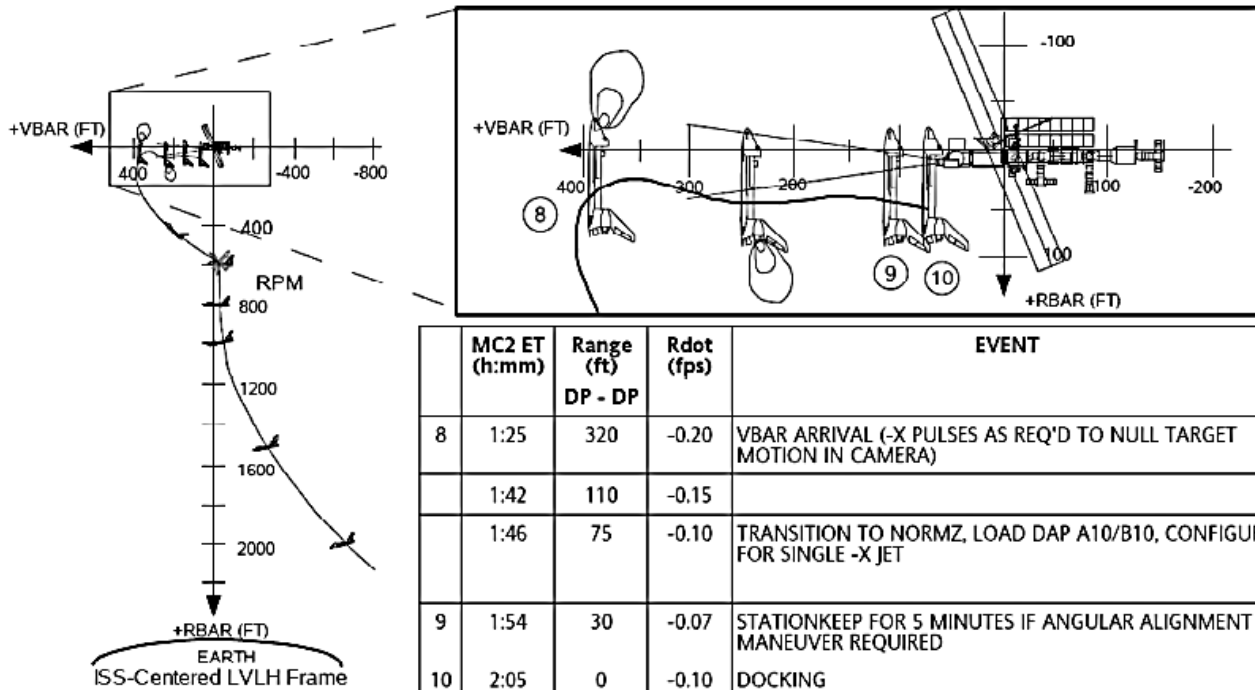


TERMINAL PHASE, RPM, AND TORVA



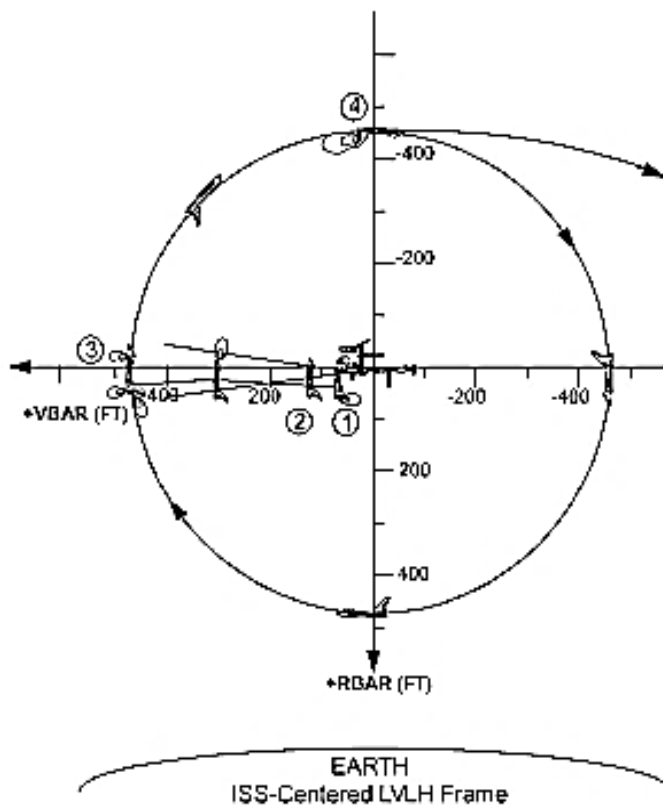
	MC2 ET (h:mm)	Range (ft) CG - CG	Rdot (fps)	EVENT
1	0:27	2000	-3.0	MANUAL PHASE TAKEOVER (POST-MC4)
	0:29	1700	-2.4	
2	0:31	1500	-2.1	
3	0:36	1000	-1.3	TRANSITION TO LOWZ
	0:37	900	-1.1	
4				WHEN IN RBAR ATTITUDE: LOAD DAP A9/B9 MOD DAP A PRI/VERN ROT RATE TO 0.75 DEG/SEC AND YAW JET OPTION TO BOTH NOSE & TAIL (ALL) LOAD UNIV PTG P=145 DEG
		800	-0.9	
		700	-0.6	
		650	0.4	
5	0:46	620	0.0	STATIONKEEP TO AVOID SHADOWING IF REQUIRED
6	1:00	DP TION N 620 600 580	-0.35 -0.25 -0.15	INITIATE RPM: DAP A/PRI, ITEM 19 WHEN -Z ADI PITCH > 100 DEG; DAP A/VERN WHEN -Z ADI PITCH > 170 DEG; DAP FREE, RESET UNIV PTG P=270 DEG, ITEM 19, DAP PRI DIGITAL IMAGERY TAKEN FROM ISS SM WHEN -Z ADI PITCH > 10 DEG; DAP AUTO WHEN RPM COMPLETE: DAP VERN
7	1:11	DP TION N 600 550 500	-0.7 -0.6 -0.4	RELOAD DAP A9, LOAD UNIV PTG P=179 DEG, REESTABLISH RDOT PER TORVA ICS INITIATE TORVA: DAP A, ITEM 19 (+X PULSES AS REQ'D TO NULL TARGET MOTION IN CAMERA)

VBAR APPROACH



	MC2 ET (h:mm)	Range (ft) DP - DP	Rdot (fps)	EVENT
8	1:25	320	-0.20	VBAR ARRIVAL (-X PULSES AS REQ'D TO NULL TARGET MOTION IN CAMERA)
	1:42	110	-0.15	
	1:46	75	-0.10	TRANSITION TO NORMZ, LOAD DAP A10/B10, CONFIGURE FOR SINGLE -X JET
9	1:54	30	-0.07	STATIONKEEP FOR 5 MINUTES IF ANGULAR ALIGNMENT MANEUVER REQUIRED
10	2:05	0	-0.10	DOCKING

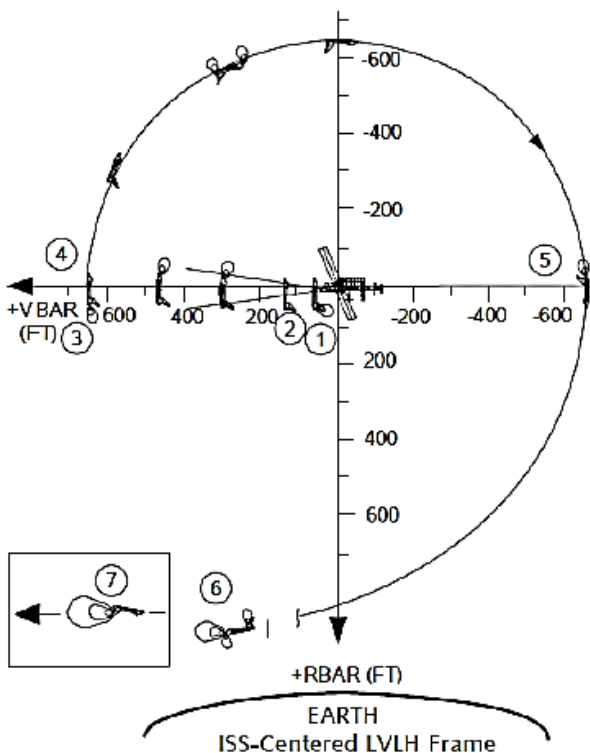
UNDocking, TORF, AND FINAL SEPARATION



	APPROX PET (h:mm)	EVENT
	-0:03	BEGIN UNHOOKING PROCESS - ORBITER & ISS IN FREE DRIFT (ISS LVLH 0,0,0 ATTITUDE)
1	0:00	AT SS-10 min, UNDOCK AT 2 FT - MODE TO LVLH HOLD & 4 DAP B (10 SEC INTERVALS) +Z NORM Z BURNS 3 MIN LATER & > 30 FT - +Z NORM Z BURNS (Rdot = +0.15 FPS) MAINTAIN THE 8 DEGREE CORRIDOR
	0:04	> 50 FT - RESELECT F RCS -X JETS (F1F & F2F)
2	0:07	75 FT - LOW Z
	0:14	150 FT - DAP TO AUTO (MANUEVER TO UNDOCKING ATT) MAINTAIN 8 DEG. CORRIDOR, Rdot = +0.15 FPS UNTIL CG-CG IS APPROXIMATELY R>400 FT
		450 FT - NULL Rdot
3	0:46*	POST SUNRISE & WITH R 400 - 500 FT CG-CG - INITIATE TORF CONTINUE FOR 1 & 1/2 LAP*
4	1:44*	2 ND RBAR CROSSING - FINAL SEP BURN +X, LOW Z, 3 FPS RETROGRADE BURN

*BASED ON ZERO DEGREE BETA ANGLE

-RBAR SEPARATION



	UNDOCK ET (h:mm)	RANGE (ft) DP-DP	EVENT
	-0:03	0	ORBITER AND ISS IN FREE DRIFT TO BEGIN UNHOOKING (ISS LVLH PYR 0, 0, 0, ATTITUDE)
1	0:00	0 2	UNDOCKING; DAP B/ALT; MODE TO LVLH; MAINTAIN CORRIDOR
	0:01		SELECT VERNIS; PERFORM DAP B +Z NORMZ BURNS AT 10 SEC INTERVALS TO BUILD OPENING RATE TO 0.15 FT/S
	>0:03	>30	DAP B +Z NORMZ BURNS AT 10 SEC INTERVALS TO BUILD OPENING RATE TO 0.3 FT/S
		50	RE-SELECT -X JETS
2	0:05	75	TRANSITION TO LOWZ
3	0:32	>600 (CG-CG)	ISS BEGINS 90 DEG YAW TO +/-YV ORBITER MODES TO AUTO AND BEGINS STATIONKEEPING BETWEEN 600 FT AND 700 FT
4	0:59	~650 (CG-CG)	BEGIN 1/2 LAP TORF BETWEEN 600 FT AND 700 FT
5	1:22		SEP 1: 1.5 FT/S +X RADIAL DOWN BURN
6	1:50	>6000 (CG-CG)	SEP 2: 7 FT/S -X RETROGRADE BURN
7	NEXT DAY		SEP 3: 7 FT/S SINGLE OMS RETROGRADE BURN

RENDEZVOUS TIMELINE

AFT FLT STATION CONFIG FOR RNDZ

Ti -03:00

A6U	ADI ATT	- LVLH
	ERR	- MED
	RATE	- MED
	SENSE	- minus Z
R13	√KU ANT	- GND
A1U	PWR	- STBY
	sel	- MAN SLEW
	MODE	- RDR PASSIVE
	RADAR OUTPUT	- HI
	CNTL	- PNL (wait 3 seconds)
	PWR	- ON
	SIG STRENGTH sel	- KU
	SLEW RATE	- as reqd
A2	DIGI-DIS sel	- R/RDOT
	X-PNTR SCALE	- X1
A1U	√ KU SCAN WARN tb	- gray
	√ TRACK tb	- gray
	√ SEARCH tb	- gray
A2	√ RANGE	- 888.8
	DIGI-DIS sel	-EL/AZ
A1U	KU MODE	- COMM
	sel	- GPC
	CNTL	- CMD

-02:23 **NH TIG** (If reqd)

RNDZ OPS INITIALIZATION

C3 Config DAP A,B to A7,B7

-02:15 ENABLE RENDEZVOUS NAV

GNC SPEC 34 PRO (ORBIT TGT)
Set BASE TIME to Ti TIG

ITEM 2 ____ / ____ : ____ : ____

RPOP OPS

RPOP Initialization

WARNING

RPOP MFD only works with Orbiter 2010

WARNING

Before use RPOP MFD must be initialized first by pressing the INIT button. Failure to initialize WILL result in incorrect information being displayed

A1U Monitor – ON
 Select RPOP MFD
 Initialize RPOP
 INI pb – push
 Target – ISS
 POR – CG - CG
 RNG – AUTO
 Tgt LVLH – $\sqrt{z-x}$
 Set Overlay: Flyaround zone
 OVR – ON
 COR – $\sqrt{550/650}$ ft

RNDZ BURNS

(Ti TIG)

-02:00

LOAD TARGET TRACK

C3 \sqrt{DAP} : A/LVLH/VERN(ALT)

CRT1 GNC OPS 201 PRO (UNIV PTG)
 CNCL - ITEM 21 EXEC
 TGT ID + 2 -Z AXIS -Y STRK
 BODY VECT +5 (-Z) +4
 P +270 $\sqrt{+0}$
 Y +0 $\sqrt{+280.57}$
 OM +0 +90

Do not INITIATE TARGET TRACK until post NC

NOTE

If NH performed, delay mnvr to +X or OMS burn attitude until NC TIG – 5 min to minimize attitude mnvr

If OMS BURN, Perform RNDZ OMS BURN Cuecard

If +X RCS burn, Perform +XRCS BURN Cuecard

-01:30 **NC TIG**

-01:30 INITIATE TARGET TRACK

GNC UNIV PTG (ORB MNVR EXEC)
TRK - ITEM 19 EXEC (CUR - *)
DAP: B/AUTO/ALT

C3 When MNVR complt
DAP: A/AUTO/VERN (ALT)

TARGET NCC BURN

-01:07 TIG – 10 min $\sqrt{\text{burn type}}$

If $\Delta VT > 6$ fps:
Perform RNDZ OMS BURN
If $\Delta VT > 4$ fps:
Perform +X Burn, RCS BURN

-01:00
C3 DAP: A/AUTO/ALT(B/ALT as reqd)

LOAD TGT DATA

CRT1 GNC OPS 202 PRO (ORBIT MNVR EXEC)

TV ROLL
If Posi Heads Up – ITEM 5 + 0 EXEC
If Posi Heads Dwn – ITEM 5 + 180 EXEC

Trim Load (*1 eng)
P – ITEM 6 = + 0.4 *(+ 0.4)
LY – ITEM 7 = - 5.7 *(+ 5.2)
RY – ITEM 8 = + 5.7 *(- 5.2)

GNC SPEC 34 PRO (ORBIT TGT)
 $\sqrt{\text{TGT Set data:}}$
T1 TIG = NCC BURN SOLUTION
TIG – ITEM 2 + ____ : ____ : ____ : ____
EL – ITEM 16 + 0
 ΔT – ITEM 17 + 57.7
 ΔX – ITEM 18 – 48.6
 ΔY – ITEM 19 + 0.0
 ΔZ – ITEM 20 + 1.2

COMPUTE T1 – ITEM 28 EXEC

CRT1	GNC	OPS 202 PRO (ORBIT MNVR EXEC)
		LOAD – ITEM 22 EXEC
		√TGT PEG 7 (ΔV_x , ΔV_y , ΔV_z , ΔV_{tot})
		TIMER – ITEM 23 EXEC
		√Eng sel
		OMS BOTH – ITEM 1 EXEC
		OMS L – ITEM 2 EXEC
		OMS R – ITEM 3 EXEC

-Z AXIS TARGET TRACK

	GNC	OPS 201 PRO (UNIV PTG)
CRT1		√ TGT ID + 2
		BODY VECT +5 (–Z)
		P +360 - ELEV angle
		Y +0
		OM +0

C3 DAP: B/AUTO/ALT

CRT1 TRK – ITEM 19 EXEC (CUR - *)
When MNVR cmplt,

C3 DAP: A/AUTO/VERN(ALT)

Go to **RNDVZ BURN CUECARDS**

KU OPS

-00:50 When NAV RNG < 150 KFT (45 Km):

1.CONFIGURE KU FOR RR TGT ACQ

A2	DIGI-DIS sel	– R/RDOT
A1U	KU PWR	– STBY
	MODE	– RDR PASSIVE
	RDR OUTPUT	– HI
	CNTL	– PNL (wait 3 sec)
	PWR	– ON
	KU SEL	– GPC

If no lock-on by 10 minutes after initial search:
Perform KU OPS step 2 below

2. AUTO TRK ACQ

KU SEL	– AUTO TRK
KU SEARCH	– SEARCH (tb–gray)

Repeat search as reqd

-00:40 When NAV RNG < 135 KFT (~41 Km):
Perform RR Navigation

-00:35 TARGET Ti BURN

CRT1 GNC OPS 202 PRO (ORBIT MNVR EXEC)
Load Eng Sel, TVR, WT and Trims for Ti Burn
LOAD – ITEM 22 EXEC

CRT1 GNC SPEC 34 (ORBIT TGT)
√TGT Set data:
T1 TIG = BASE TIME (ITEM 2)
ΔT – ITEM 17 + 76.9
ΔX – ITEM 18 – 0.9
ΔY – ITEM 19 + 0
ΔZ – ITEM 20 + 1.8

COMPUTE T1 - ITEM 28 EXEC

-00:30 CRT1 GNC OPS 202 PRO (ORBIT MNVR EXEC)
LOAD – ITEM 22 EXEC
√TGT PEG 7 (ΔVx, ΔVy, ΔVz , ΔVtot)
TIMER – ITEM 23 EXEC

√Eng sel
OMS BOTH – ITEM 1 EXEC
OMS L – ITEM 2 EXEC
OMS R – ITEM 3 EXEC

Go to **RNDVZ BURN CUECARDS**

If Ti is +X RCS burn: Go to **+ X RCS BURN** Cuecard

00:00 **Ti TIG**

POST Ti NAV

-Z AXIS TARGET TRACK

A6U √DAP: A/AUTO/VERN(ALT)

CRT1 GNC OPS 201 PRO (UNIV PTG)
√ TGT ID + 2
BODY VECT + 5 (–Z)
P + 360 – ELEV angle
Y + 0
OM + 0

C3 DAP: B/AUTO/ALT

CRT1 TRK - ITEM 19 EXEC (CUR - *)

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

17:00 (MC1 TIG – 3 min)

A1U KU sel – GPC

If no RR ACQ, assume RR Fail
If RR Fail:

Perform COAS NAVIGATION

1.COAS NAV CONFIG

A6U SENSE: -Z

C3 DAP: B7/AUTO/VERN(ALT)

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

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

TARGET MC 1 BURN

CRT1 GNC SPEC34 (ORBIT TGT)

√TGT Set data:

T1 TIG = MC1 BURN SOLUTION (BASETIME + 0/00:20:00)

ΔT – ITEM 17 + 56.9

ΔX – ITEM 18 – 0.9

ΔY – ITEM 19 + 0

ΔZ – ITEM 20 + 1.8

COMPUTE T1 – ITEM 28 EXEC

CRT1 GNC OPS 202 PRO (ORBIT MNVR EXEC)
 LOAD – ITEM 22 EXEC
 $\sqrt{\text{TGT}}$ PEG 7 (ΔV_x , ΔV_y , ΔV_z , ΔV_{tot})
 TIMER – ITEM 23 EXEC

$\sqrt{\text{Eng sel}}$
OMS BOTH – ITEM 1 EXEC
OMS L – ITEM 2 EXEC
OMS R – ITEM 3 EXEC

Go to **RNDVZ BURN CUECARDS**

20:00 **MC1 TIG**

45:00 MC2 TIG -5 min

TARGET MC 2 BURN

CRT1 GNC SPEC34 (ORBIT TGT)
 $\sqrt{\text{TGT}}$ Set data:
 T1 TIG = BASE TIME
 ΔT – ITEM 17 + 27.0
 ΔX – ITEM 18 – 0.9
 ΔY – ITEM 19 + 0
 ΔZ – ITEM 20 +1.8

COMPUTE T1 - ITEM 28 EXEC

GNC OPS 202 PRO (ORBIT MNVR EXEC)
 LOAD – ITEM 22 EXEC
 $\sqrt{\text{TGT}}$ PEG 7 (ΔV_x , ΔV_y , ΔV_z , ΔV_{tot})
 TIMER – ITEM 23 EXEC

$\sqrt{\text{Eng sel}}$
OMS BOTH – ITEM 1 EXEC
OMS L – ITEM 2 EXEC
OMS R – ITEM 3 EXEC

Set EVENT TIMER counting to MC 2 TIG

Go to **RNDVZ BURN CUECARDS** (p.16)

00:50 **MC2 TIG**

01:00 If no RR TGT acquired:

GO TO **RADAR FAIL PROCEDURE** (p.14)

RADAR FAIL PROCEDURE

If TGT outside COAS reticle, mnvr as reqd to acq visual contact

WARNING

At MC2+18 if no visual acquisition or
target > 30 deg from COAS horizontal Go to
RNDZ BREAKOUT (CONTINGENCY OPS)

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)

THC: As reqd to control out of plane motion and manage RDOT

Perform CONFIG FOR RBAR (p.22)

At MC2 TIG + 24:00 or 2000 ft, whichever comes first:

CRT

GNC OPS 201 PRO (UNIV PTG)
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 Cuecard (p.23)

01:05

TARGET MC 3 BURN

CRT

GNC SPEC34 PRO (ORBIT TGT)
√TGT Set data:
T1 TIG = BASE TIME + 0/00:17:00
ΔT – ITEM 17 +10.0
ΔX – ITEM 18 –0.9
ΔY – ITEM 19 +0
ΔZ – ITEM 20 +1.8
COMPUTE T1 - ITEM 28 EXEC

GNC OPS 202 PRO (ORBIT MNVR EXEC)
 LOAD – ITEM 22 EXEC
 $\sqrt{\text{TGT PEG 7 } (\Delta V_x, \Delta V_y, \Delta V_z, \Delta V_{\text{tot}})}$
 TIMER – ITEM 23 EXEC

$\sqrt{\text{Eng sel}}$
 OMS BOTH – ITEM 1 EXEC
 OMS L – ITEM 2 EXEC
 OMS R – ITEM 3 EXEC

Go to **RNDVZ BURN CUECARDS** (p.17)

01:07 **MC3 TIG**

01:10 **CONFIG FOR RBAR**

CRT GNC OPS 201 PRO (UNIV PTG)
 $\sqrt{\text{ERR TOT - ITEM 23 EXEC (*)}}$

When ERR <2 deg each axis

GNC SPEC 20 PRO (DAP CONFIG)
 Config DAP A,B to A8,B8

GNC OPS 201 PRO (UNIV PTG)
 TGT ID +2
 BODY VECT +5
 P + 270
 Y +0
 OM +0

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

MC4 TIG – 3 min

01:15 **TARGET MC 4 BURN**

GNC SPEC 34 PRO (ORBIT TGT)
 $\sqrt{\text{TGT Set data:}}$
 T1 TIG = BASE TIME + 0/00:27:00
 EL – ITEM 16 + 0
 ΔT – ITEM 17 + 13.0
 ΔX – ITEM 18 + 0
 ΔY – ITEM 19 + 0
 ΔZ – ITEM 20 + 0.6
 COMPUTE T1 - ITEM 28 EXEC

GNC OPS 202 PRO (ORBIT MNVR EXEC)
LOAD – ITEM 22 EXEC
 $\sqrt{\text{TGT PEG 7 } (\Delta V_x, \Delta V_y, \Delta V_z, \Delta V_{\text{tot}})}$
TIMER – ITEM 23 EXEC
 $\sqrt{\text{Eng sel}}$
OMS BOTH – ITEM 1 EXEC
OMS L – ITEM 2 EXEC
OMS R – ITEM 3 EXEC

Go to **+ RCS BURN** (p.20)

01:17 **MC4 TIG**

Go to **ESTABLISH RBAR** (p.22)

RNDVZ BURN CUECARDS

OMS BURN

CRT1 Terminate –Z TARGET TRACK
CANCEL – ITEM 21 EXEC

1.MNVR TO BURN ATT

C3 DAP: If OPS 2, B/AUTO/VERN

CRT1 GNC OPS 202 PRO (ORB MNVR)
MNVR – ITEM 27 EXEC (*)

2.PERFORM OMS BURN

CRT1 √ENG SEL

C3 √DAP TRANS – NORM

TIG-4 F6/F8 ADI RATE (two) – MED (1 deg/sec)
FLT CNTLR PWR (two) – ON
√DAP – AUTO(PASS)/DISC
√GMBL TRIM

TIG-2 C3 SEL OMS ENG(s) – ARM PRESS

WARNING

Do not burn aff engine if:
He TK P < 640

TIG-00:15 CRT1 EXEC

-00:58
(00:00) TIG: start watch (√Pc, ΔVTOT, ENG VLVs)

CUTOFF
+00:02 C3 OMS ENG(s) – OFF

Trim Residuals:

OMS2	TAIL ONLY CNTL	Orbit
VGO X < 0.2 fps	VGO X < 0.2 fps	All axes < 0.2 fps
VGO Y,Z < 2 fps		

F6/F8 FLT CNTLR PWR (two) – OFF

C3 DAP: B/INRTL/VERN

CRT1 GNC OPS 201 PRO (UNIV PTG) (√DAP)

WARNING

GPC must be switched back to MM201
before new target data are loaded in
MM202 for subsequent burn

3.OMS POST BURN RECONFIGURATION

F6,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 GNC OPS 202 PRO (ORB MNVR)
RCS SEL – ITEM 4 EXEC (*)

4.MNVR TO POST BURN ATTITUDE

CRT1 GNC OPS 201 PRO (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

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

+X RCS BURN

1. LOAD TGT DATA AND MNVR TO BURN ATT

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

CRT1 GNC OPS 201 PRO (UNIV PTG)
 CNCL – ITEM 21 EXEC
 GNC OPS 202 PRO (ORBIT MNVR EXEC)
 √RCS SEL, ITEM4 – (*)

CRT2 GNC SYS SUMM
 If onboard computed burn:

CRT1 Enter or verify TGT DATA
 LOAD – ITEM 22 EXEC
 TIMER – ITEM 23 EXEC
 √BURN DATA
 MNVR – ITEM 27 EXEC (*)

2. BURN EXEC

TIG-3:00 F6(F8) ADI ERR – MED
 ADI RATE – HI
 ADI ATT – INRTL
 √ADI ATT, then:
 ATT – REF
 REF pb – push

F6(F8) FLT CNTLR PWR – ON

C3 DAP TRANS: NORM/PULSE/PULSE
TIG-0:30 DAP: A1/INRTL/PRI

TIG If VGO Z is neg → Z,X,Y seq;
 Otherwise → X,Y,Z
 THC Trim VGOs < 0.2 fps

3. POST BURN RECONFIG

F6(F8) FLT CNTLR PWR – OFF

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

CRT1 GNC OPS 201 PRO (UNIV PTG)

 When in attitude:

C3 DAP: A/AUTO/VERN(ALT

MULTI-AXIS RCS BURN

1. EXECUTE MULTI-AXIS BURN

C3 DAP: B1/AUTO/VERN(PRI)

CRT1 GNC OPS 202 PRO (ORBIT MNVR EXEC)

CRT2 GNC SYS SUMM

CRT1 Enter or verify TGT DATA
 LOAD – ITEM 22 EXEC
 TIMER – ITEM 23 EXEC
 √BURN DATA

NOTE

Ignore computed attitude, perform
burn in current attitude

TIG-3:00 F6(F8) FLT CTRL PWR – ON

C3 DAP TRANS: as reqd

TIG-0:30 DAP: A1/AUTO/PRI (B1/AUTO/PRI)

TIG If VGO Z neg:
 Z,X,Y THC sequence
 If VGO Z not neg:
 X,Y,Z THC sequence

 THC: Trim VGOs < 0.2 fps

2. POST BURN RECONFIG

F6(F8) FLT CTRL PWR – OFF
 GNC OPS 201 PRO (UNIV PTG)

C3 DAP: A/AUTO/ VERN

CONFIG FOR RBAR

CRT GNC SPEC 20 PRO (DAP CONFIG)
 Config DAP A,B to A8,B8

GNC OPS 201 PRO (UNIV PTG)
 TGT ID + 2
 BODY VECT +5
 P +270
 Y +0
 OM +0

Do not initiate Target Track until ESTABLISH RBAR

ESTABLISH RBAR

A6U FLT CNTLR PWR - ON

CRT GNC OPS 201 PRO (UNIV PTG)
 TRK - ITEM 19 EXEC (CUR - *)

C3 DAP: A/AUTO/VERN(PRI)
 THC: as reqd to control TGT motion in COAS

01:20 Perform **APPROACH**

APPROACH

CG to CG RNG (ft)	RPM & CONT TORVA RDOT (ft/s)	MC2 ET w/ RPM (h:mm:ss)	DAP	EVENT	NO-RPM RDOT (ft/s)
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	-3.0
1700	-2.4	0:29:00			-2.6
1500	-2.1	0:31:00			-2.3
1000	-1.3	0:36:00	LO Z	If Go for RPM, proceed inside 600 FT If no-Go to proceed inside 600 ft, perform CONTINGENCY 600 FT TORVA [C]	-1.5
900	-1.1	0:37:00		If Go for RPM, report to ISS: 10 min to RPM start F6, A6U ADI ATT – LVLH	-1.3
99800 700	-0.9 -0.6	0:38:00 0:41:00	A9/B9	A1U KU BD RDR OUTPUT – LOW When in Rbar attitude, config DAP to A9,B9 Null ISS rates in C/L camera If Go for RPM, perform RPM SETUP [A]	
650	-0.4	0:42:30		Report to ISS: Range 650 ft If Go for RPM	
620 600 580	-0.4 < Rdot < -0.3 -0.3 < Rdot < -0.2 -0.2 < Rdot < -0.1			Null Xdot to 0 ± 0.1 ft/sec prior to mnvr start If reqd: stationkeep at 600-620 ft until RPM window opens Perform RBAR PITCH MNVR [B]	-0.8
600	-0.7	0:56:00		TORVA	-0.8
			A9/B9	GNC UNIV PTG	-0.7
550	-0.6			P ITEM 15 + 179 EXEC	
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 camera FOV	-0.5
400	0.0 to			RPOP POR – Orb DP to Tgt DP	0.0 to

	-0.1			Maintain RNG > 250 ft (DP-DP) until VBAR arrival ISS CG within 10 of C/L camr Start V10 recorder	-0.1
When Pitch Error < 2		1:10:00		<u>ESTABLISH VBAR</u> THC: -X (down) as reqd to null ISS in C/L camr, as reqd to maintain ISS in C/L camr FOV	
415-315 (350-250 DP-DP)	-0.2	1:10:30		Perform <u>CONFIGURE FOR DOCKING D</u> Perform VBAR APPROACH (Cue Card) _____	-0.2

RPM SETUP **A**

CRT GNC SPEC 20 PRO (DAP CONFIG)
 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)

 GNC OPS 201 PRO (UNIV PTG)
 P – ITEM 15 + 145.0 EXEC
 THC: center Node 1 in centerline camr ±

RBAR PITCH MNVR [B]

AFT (FWD) ADI Pitch	Actions	ISS Calls
P = 90 (0) (Rbar attitude)	A/AUTO/PRI TRK – ITEM 19 EXEC FLT CNTLR PWR – OFF	Initiating RPM (with mark)
P = 100 (10)	VERN (PRI) KU PWR – STBY	
P = 170 (80)	FREE P – ITEM 15 + 270 EXEC TRK – ITEM 19 EXEC	
P = 235 (145)		Start Photos
P = 305 (215)		End Photos
P = 10 (280)	PRI A/AUTO	
P = 60 (330)	KU PWR – ON	
P = 90 (0) (mnvr complete)	VERN (PRI) FLT CNTLR PWR – ON THC: set up for TORVA Reload DAP A9	

CONTINGENCY 600 FT TORVA [C]

If Go for RPM, perform nominal RPM actions per APPROACH cue card

Continue APPROACH cue card with the following deltas:

Initiate TORVA at range 700 ft Rdot -0.3 ft/s

(alternate range 650 ft Rdot -0.1 ft/s)

Maintain RNG > 600 ft (CG-CG) until VBAR arrival

On VBAR, stationkeep RNG 630-530 (DP-DP),
maintain ISS in C/L camr FOV

On MCC GO, perform **CONFIGURE FOR DOCKING [D]**
and **VBAR APPROACH**

CONFIGURE FOR DOCKING [D]

Perform DOCKING MECHANISM POWERUP (APDS)
Perform DOCKING PREP (APDS)

VBAR APPROACH

Interface RNG* (ft)	RDOT (ft/s)	Docking time	DAP	EVENT
250	-0.20 +/-0.05	-34:00	√LOZ	Maintain ISS docking tgt 8 deg corridor
170	-0.20 +/-0.05	-27:30	DAP: B	Note: DAP A allowed for +/-X and +/-Z THC If reqd THC: as reqd to null Rdot and Stationkeeping
110	-0.15 +/-0.05	-22:30		Perform <u>CONFIGURE KU FOR COMM</u> E
75	-0.10 +/-0.05	-18:30	No LO Z A10, B10	Note: DAP A allowed for +/-X and +/-Z THC √RCS FWD – ITEM 1 EXEC (*)
30 +/- 5	0.0	-11:00	√A10, B10 √DAP: B	√5° Corridor If Flyout reqd: THC: +Z (out) as reqd to Null Rdot
30	-0.07 +/-0.02	-06:00		√5° Corridor THC: as reqd to establish Rdot = -0.07 +/- 0.02 fps
3	-0.10 +/- 0.03	-00:30		Maintain 3 inch lateral alignment cylinder
CONTACT Or ~2 in	-0.10 +/- 0.03	-00:00		Perform <u>CAPTURE</u> Cuecard (p.24)

CONFIGURE KU FOR COMM **E**

A1U	KU PWR	– STBY
	MODE	– COMM
	sel	– GPC
	CNTL	– CMD
A2	DIGI-DIS sel – EL/AZ	

CAPTURE

START EVENT TIMER = 00:00:00

√ISS in FREE DRIFT

IF NO INDICATION OF ISS FREE DRIFT AT CAPTURE + 65 sec

Go to **FAILED CAPTURE** Cuecard

When capture confirmed and ISS in FREE DRIFT

A6U FLT CNTRL PWR – OFF

Go to **DOCKING SEQUENCE** (Dock Proc Step 5, p.30)

FAILED CAPTURE

1. APDS CIRC PROT OFF pb – push

√CIRC PROT OFF It – on

OPEN LATCHED pb – push

√LATCHES CLOSED It – off

√LATCHES OPEN It – on

2. √DAP: NO LO Z

If petals clear:

DAP: A(B)/LVLH

3. THC: +Z (out) to establish 0.1 fps opening rate

√DAP: B/LVLH

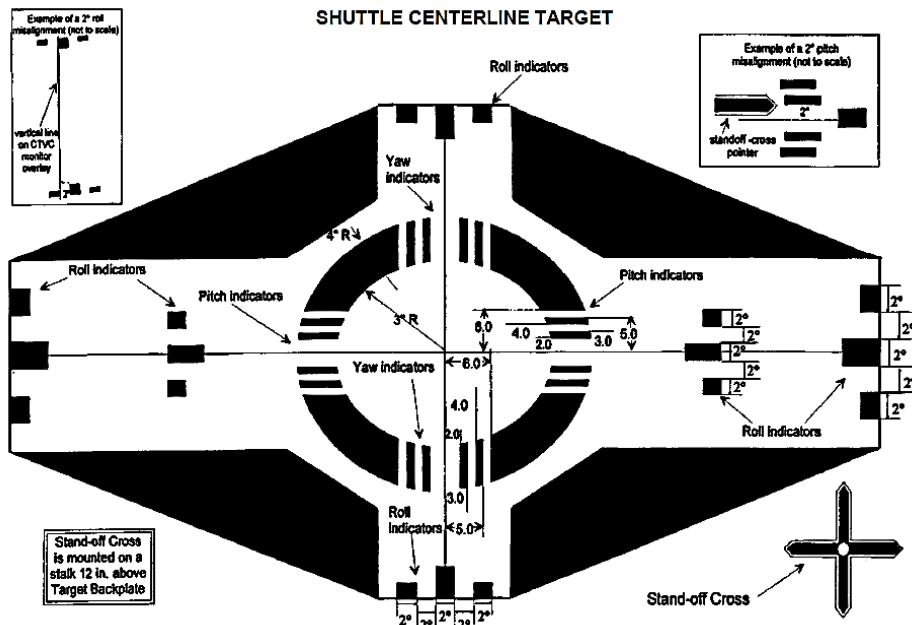
If ISS in FREE DRIFT

Use ISS CG as a corridor reference

Maintain 8 degrees corridor

Maintain Opening Rate of at least 0.1 fps

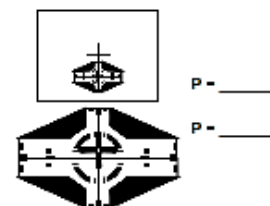
4. Go to **VBAR CORRIDOR BACKOUT**, **CONTINGENCY OPS** (p.43)



C/L CAMERA TARGET ALIGNMENT (+VBAR)

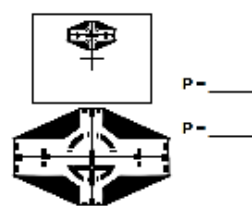
PITCH (P) ITEM 15

Target Displaced DOWN
(Cross Displaced UP)



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

Target Displaced UP
(Cross Displaced DOWN)



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

ROLL (R) ITEM 16

Rotated CW



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

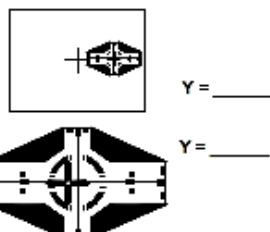
Rotated CCW



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

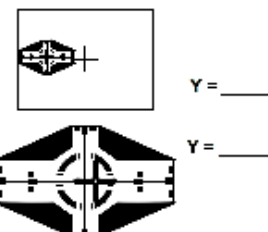
YAW (Y) ITEM 17

Target Displaced RIGHT
(Cross Displaced LEFT)



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

Target Displaced LEFT
(Cross Displaced RIGHT)



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

APDS

DOCKING PROCEDURE

1.DOCKING MECHANISM INITIALIZATION

-00:20

A7L	CONTROL PANEL POWER A,B,C (three)	– OFF
	HEATERS/DCU POWER (three)	– OFF
	APDS POWER ADS,BDS,CDS (three)	– OFF
	ADS,BDS,CDS It (three)	– OFF
	PYROS AP,BP,CP (three)	– OFF (lt off)
	PYRO CIRCUIT PROTECT OFF It	– OFF

2.DOCKING MECHANISM POWERUP

A7L	HEATERS/DCU POWER (three)	– ON
	CONTROL PANEL POWER A,B,C (three)	– ON
	APDS POWER ADS,BDS,CDS (three)	– ON
	ADS,BDS,CDS It (three)	– ON
	LAMP TEST pb	– push
	STATUS It (eighteen)	– ON
	PYRO CIRCUIT PROTECT OFF It	– ON

3.DOCKING PREP

A7L	POWER ON pb	– push (lt on)
	√RING ALIGNED It	– ON
	√HOOKS 1, HOOKS 2 OPEN It (two)	– ON
	√LATCHES CLOSED It	– ON
	√RING FINAL POSITION It	– ON

4.DOCKING RING EXTENSION

A7L	APDS CIRC PROT OFF pb	– push
	CIRCUIT PROTECT OFF It	– lt on
	RING OUT pb	– push
	RING INITIAL POSITION It	– lt on

5.DOCKING SEQUENCE

A7L	√CAPTURE	
	RING IN pb	– push
	RING INITIAL POSITION It	– OFF
	CLOSE HOOKS pb	– push
	RING FINAL POSITION It	– ON
	POWER OFF pb	– push
	STATUS It (eighteen)	– lt off

ORBITER CONFIG FOR MATED ATTITUDE CONTROL

A6U √FLT CNTLR PWR - OFF

CRT GNC SPEC 20 PRO (DAP CONFIG)
 Config DAP A,B to A12,B12
 EDIT A9 - ITEM 3 + 9 EXEC
 PRI RATE DB - ITEM 52 + 0.2 EXEC
 LOAD - ITEM 5 EXEC
 EDIT B9 - ITEM 4 + 9 EXEC
 PRI RATE DB - ITEM 52 + 0.2 EXEC
 LOAD - ITEM 5 EXEC

C3 DAP: LO Z
 If VERN:
 DAP: LVLH

ORBITER CONFIG FOR MATED OPS

Perform DOCKING MECHANISM POWERDOWN

DOCKING MECHANISM POWERDOWN

A7L STATUS It (eighteen) – It off
 APDS POWER ADS,BDS,CDS (three) – OFF
 ADS,BDS,CDS It (three) – It off
 CONTROL PANEL POWER A,B,C (three) – OFF
 HEATERS/DCU POWER (three) – OFF

A1U Exit RPOP

TERMINATE RNDZ OPS:

UNDocking/SEPARATION TIMELINE

(T Undocking)

-00:45

DPS config for Undocking Ops

C3

When in undock attitude:

DAP: B/AUTO/VERN

ENABLE RENDEZVOUS NAV

-00:40

RPOP OPS

RPOP INITIALIZATION

A1U

Select RPOP MFD

Initialize RPOP

INI pb – push

Target – ISS

POR – DP - DP

RNG – AUTO

Tgt LVLH – $\sqrt{z-x}$

Set RPOP Overlay: Flyaround zone

OVR – ON

COR – $\sqrt{550/650}$ ft

UNDOCKING PROCEDURE

1.DOCKING MECHANISM POWERUP

A7L

HEATERS/DCU POWER (three)

– ON

CONTROL PANEL POWER A,B,C (three)

– ON

APDS POWER ADS,BDS,CDS (three)

– ON

ADS,BDS,CDS It (three)

– on

LAMP TEST pb

– push

STATUS It (eighteen)

– on

PYRO CIRCUIT PROTECT OFF It

– on

2.UNDOCKING PREP

-00:20 C3

DAP: FREE

Wait 5 sec,

DAP: AUTO

3.DOCKING RING EXTENSION

A7L	POWER ON pb	– push (It on)
	√RING ALIGNED It	– on
	√HOOKS 1,HOOKS 2 OPEN It (two)	– on
	√LATCHES CLOSED It	– on
	√RING FINAL POSITION It	– on
	APDS CIRC PROT OFF pb	– push
	APDS CIRC PROT OFF It	– on
0:00	RING OUT pb	– push
0:10	RING FINAL POSITION It	– off
3:40	√RING INITIAL POSITION It	– on

4.CONFIGURE FOR SEPARATION

GNC SPEC 20 PRO (DAP CONFIG)

CRT √DAP config: A12, B12
 √DAP: LO Z
 √DAP: A/AUTO/VERN

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

CRT GNC OPS 201 PRO (UNIV PTG)
 TGT ID √2
 BODY VECT √5
 P √+180
 Y √+0
 OM √+0
 √TRK - ITEM 19 EXEC
 √ERR TOT - ITEM 23 EXEC (*)

GNC OPS 202 PRO (ORB MNVR EXEC)
 Set TIG to Undocking Time
 Enter any non-zero ΔV
 LOAD – ITEM 22 EXEC
 TIMER– ITEM 23 EXEC

GNC OPS 201 PRO (UNIV PTG)

5.PREP FOR UNDOCKING

When GO for Undocking:

A6U FLT CNTLR PWR – ON

6.RECONFIGURE DAP

GNC OPS 201 PRO (UNIVPTG)
When ATT and RATES in limits:

ATT ERR (Each Axis)	≤ 1.0 deg
RATE: ROLL, YAW PITCH	≤ 0.020 deg/sec -0.085 ≤ RATE ≤ -0.045

-03:00 > DAP: FREE
CRT GNC SPEC 20 PRO (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

7.COMMAND UNDOCKING

-02:20		
A7L	UNDOCKING pb	– push [CTRL+D]
	√HOOKS 1, HOOKS 2 CLOSED lt (two)	– lt off
-00:30	√INTERF SEALED lt	– off
	√READY TO HOOK lt	– off
00:00	√HOOKS 1, HOOKS 2 OPEN lt (two)	– on
	POWER OFF pb	– push
	STATUS lt (eighteen)	– lt off

8.DOCKING MECHANISM POWERDOWN

A7L	STATUS lt (eighteen)	– lt off
	APDS POWER ADS,BDS,CDS (three)	– OFF
	ADS,BDS,CDS lt (three)	– lt off
	CONTROL PANEL POWER A,B,C (three)	– OFF
	HEATERS/DCU POWER (three)	– OFF

POST UNDOCKING

00:00

Physical Separation

When petals clear:

DAP: B/LVLH/ALT

√DAP TRANS: PULSE/PULSE/PULSE, NO LO Z

THC: as reqd to maintain C/L target within 8 deg corridor on C/L camera

Note: DAP A allowed for $\pm X$ 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 (mm:ss) of VERN select or last pulse: ____ : ____

At last pulse TIG+2:00 and when RNG > 30 ft (DP-DP):

THC: +Z (out) pulses at 10 sec intervals as reqd to establish and maintain RDOT > 0.3 fps

A7L

POWER OFF pb - push

√STATUS lt (eighteen) - lt off

Go to **SEP/FLYAROUND**

SEP/FLYAROUND

1. When RNG > 75 ft (DP-DP):

A6U

DAP: LO Z

THC: Maintain RDOT > 0.3 fps

Maintain C/L tgt within 8 deg corridor on C/L camera

NOTE:

DAP A allowed for $\pm X$ and $\pm Z$ THC

2. When RNG > 150 ft (DP-DP):

If radar desired, perform **KU OPS INIT RADAR ACQ**

CONFIGURE KU FOR RR TGT ACQ

A2

DIGI-DIS sel – R/RDOT

A1U

KU PWR

– STBY

MODE

– RDR PASSIVE

RDR OUTPUT

– LOW

CNTL

– PNL (wait 3 sec)

PWR

– ON

KU SEL

– GPC

AUTO TRK ACQ

A1U KU SEL – AUTO TRK
 SLEW – as reqd (as seen in COAS)
 $\sqrt{\text{EL, AZ angles}} < 30 \text{ deg}$
 KU SEARCH – SEARCH (tb-gray)

NOTE:
DAP A allowed for all THC Inputs

3. When RNG > 250 ft:

A1U Select RPOP MFD
 Initialize RPOP
 INI pb – push
 Target – ISS
 POR – CG-CG
 RNG – AUTO
 Tgt LVLH – $\sqrt{z-x}$
 Set RPOP Overlay: Flyaround Zone
 OVR – ON
 COR – $\sqrt{550/650 \text{ ft}}$

Maintain ISS CG within ± 10 degrees of center on C/L camera

4. When RNG > 600 FT (CG-CG)

CRT GNC OPS 201 PRO (UNIV PTG)
 TGT ID $\sqrt{+2}$
 BODY VECT $\sqrt{+5}$
 P $\sqrt{+180 (+VBAR)}$
 Y $\sqrt{+0}$
 OM $\sqrt{+0}$
 $\sqrt{\text{ERR TOT}} - \text{ITEM 23 (*)}$
 TRK – ITEM 19 EXEC (CUR - *)

A6U DAP: A(B)/AUTO/VERN(PRI)

THC: Maintain range of $650 \pm 50 \text{ ft}$ (CG-CG)

5. If flyaround, stationkeep on +VBAR between 600 to 700 ft until ISS maneuver is complete

Go to **FLYAROUND** (p.36)

6. If no flyaround:

A7U DAP: A/LVLH/VERN(PRI)

CRT GNC OPS 201 PRO (UNIV PTG)
 P + 80 (-RBAR)
 TRK – ITEM 19 EXEC (CUR - *)

Go to **SEP BURNS**

SEP BURNS

SEP 1

A6U DAP TRANS: NORM/PULSE/PULSE
 THC: +X (up) 6 sec (1.5 fps)

DAP: A/AUTO/VERN(PRI)
DAP TRANS: PULSE/PULSE/PULSE
FLT CNTLR PWR – OFF

Record Radial Burn TIG _____ / _____ : _____ : _____

C3 Set TIMER counting to SEP 2 (Radial Burn TIG + 28 min)
 CONFIG FOR SEP 2 At burn TIG – 1 minute:

A6U √SENSE: –Z
 FLT CNTRL PWR – ON

CRT1 GNC SPEC 20 PRO (DAP CONFIG)
 Config DAP A,B to A7,B7

C3 DAP: A/AUTO/PRI
 DAP TRANS: NORM/PULSE/PULSE
 DAP: NO LO Z

SEP 2 (Retrograde Burn)

At SEP 2 burn TIG:

If SEP 1 was on -VBAR
 Aft THC: –X (Down) 30 sec (7.0 fps)

If SEP 1 was on +VBAR
 Aft THC: +X (Up) 30 sec (7.0 fps)

A6U DAP: A/AUTO/VERN(PRI)
 DAP TRANS: PULSE/PULSE/PULSE
 FLT CNTLR PWR – OFF

Go to **TERMINATE SEP OPS** (p.39)

TERMINATE SEP OPS

If KU MODE – RDR PASSIVE

CONFIGURE KU FOR COMM

A1U	KU PWR	– STBY
	MODE	– COMM
	sel	– GPC
	CNTL	– CMD
A2	DIGI-DIS sel – EL/AZ	
CRT1	GNC	SPEC20 (DAP CONFIG) Config DAP A,B to A1, B1
		Exit RPOP

FLYAROUND

If Breakout required during flyaround

Go to **SHUTTLE NOSE IN-PLANE BREAKOUT**
(CONTINGENCY OPS p.44)

C3	√DAP: A/AUTO/VERN(PRI)	
CRT1	GNC	Flyaround start from +Vbar OPS 201 PRO (UNIV PTG)
		TGT ID √ + 2
		BODY VECT √ + 5
		P + 90 (-RBAR)
		Y √ + 0
		OM √ + 0
		√ERR TOT – ITEM 23
		TRK – ITEM 19 EXEC

THC: Maintain flyaround range of 650 ± 50 ft (CG-CG)
Maintain ISS CG inside ± 15 degree vertical and
 ± 20 degrees horizontal on C/L camera

Prior to –Rbar crossing (Aft ADI P = 270):

GNC	OPS 201 PRO (UNIV PTG)
P	+ 0 (–VBAR)
	TRK - ITEM 19 EXEC

Prior to –Vbar crossing (Aft ADI P = 0):

GNC OPS 201 PRO (UNIV PTG)
P + 282 (+RBAR)
TRK - ITEM 19 EXEC

At flyaround completion – 10 minutes: If radar not tracking target:

FULL LAP FLYAROUND

If Breakout required during flyaround
Go to **SHUTTLE NOSE IN-PLANE BREAKOUT**
(CONTINGENCY OPS – p.42)

C3 DAP: A/AUTO/VERN(PRI)

THC: Maintain ISS CG inside ± 15 degree vertical and
 ± 20 degrees horizontal on C/L camera

Prior to –Rbar crossing (Aft ADI P = 270):

CRT1 GNC OPS 201 PRO (UNIV PTG)
P + 0 (–VBAR)
TRK - ITEM 19 EXEC (CUR - *)

When RNG > 600 ft (CG–CG):
THC: Maintain flyaround range of 650 ± 50 ft (CG-CG)

Prior to –Vbar crossing (Aft ADI P = 0):
P + 270 (+RBAR)
TRK - ITEM 19 EXEC (CUR - *)

Prior to +Rbar crossing (Aft ADI P = 90)
P + 180 (+VBAR)
TRK - ITEM 19 EXEC (CUR - *)

Prior to +Vbar crossing (Aft ADI P = 180):
P + 80 (–RBAR)
TRK - ITEM 19 EXEC (CUR - *)

Repeat steps 2 thru 5 as reqd to continue flyaround

At flyaround completion – 10 minutes:
If radar not tracking target:
Go to **INITIAL RADAR ACQ** (p.40)

When flyaround complete (in +Vbar attitude)
Go to **SEPBURNS** (p.38)

INITIAL RADAR ACQ

When flyaround complete (in -Vbar attitude),
Go to **SEP BURNS** (p.38)

A2	DIGI-DIS sel	- R/RDOT
A1U	KU PWR	- STBY
	MODE	- RR PASSIVE
	RADAR OUTPUT	- LO
	√sel	- GPC
	CNTL	- PNL (wait 3 seconds)
	PWR	- ON

CAUTION

If no radar lock-on within 2 min

KU sel - AUTO TRK

KU SEARCH - SEARCH (tb – gray)

CONTINGENCY OPS

RNDZ/PROX OPS BREAKOUT PROCEDURES OVERVIEW

RANGE BREAKOUT REQD	BREAKOUT PROCEDURE AND SUMMARY
Prior to Ti	Discontinue RNDZ burns; specific breakout only on MCC call
Ti - 5 Minutes	If GO for Ti not received, Perform Ti Delay Burn, 5-27
Between Ti and TORVA init (+X burns to start TORVA are complete)	<u>RNDZ BREAKOUT (p.49)</u> 3 fps retrograde
Between TORVA init (+X burns to start TORVA are complete) and Vbar arrival	<u>SHUTTLE NOSE IN-PLANE BREAKOUT (p.47)</u> 1.5 fps X burn, followed in 30 min by 4.3/3.6 fps retrograde/out-of-plane burn (posigrade if second approach is desired)
Between Vbar arrival and contact OR Between undock and flyaround start	<u>VBAR BREAKOUT (p.44)</u> If RNG < 150 ft, back out to 150 ft. When RNG > 150 ft, perform 1.5 fps radial up burn in LO Z, followed in 28 min by 3.0 fps posigrade/retrograde burn
During flyaround	<u>SHUTTLE NOSE IN-PLANE BREAKOUT (p.47)</u> 1.5 fps X burn, followed in 30 min by 4.3/3.6 fps retrograde/out-of-plane burn (posigrade if second approach is desired)
Otherwise:	<u>SEP MANEUVER (ORB OPS)</u> , 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 <u>VBAR CORRIDOR BACKOUT</u>

VBAR CORRIDOR BACKOUT

CAUTION

Constraints for use:
Orbiter on + Vbar in approach corridor

If RNG < 75 ft:

1. INITIATE CORRIDOR BACKOUT DAP: B/LVLH/VERN(PRI), no LOZ

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

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

If PCT ARMED:

F4

DISARM PCT: SPDBRK/THROT pb – AUTO It – OFF

If 30 ft STATIONKEEPING desired:
Maintain tgt in 5 deg corridor

When RNG = 30 ft:
THC: -Z (in) as reqd establish 30 +/-5 ft stationkeeping

A6U When RNG > 50 ft:
DAP config: A9/B9

If(When) RNG > 75 ft:

2.INITIATE(CONTINUE) CORRIDOR BACKOUT

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

NOTE: DAP A allowed for X and Z THC

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

When opening rate established and RNG > 150:

3.PERFORM CORRIDOR BACKOUT OR BREAKOUT

If BREAKOUT desired:
Go To **VBAR BREAKOUT**

Else:

Maintain 8 deg corridor

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

REAPPROACH DAP: AUTO

Go to VBAR APPROACH (p.26) from current stationkeeping range

VBAR BREAKOUT

CAUTION

Constraints for use:
Orbiter on Vbar in approach attitude

Range < 1000 ft cg to cg
Tgt stable on orbiter -Z axis
Orbiter X and Z axes are in-plane

If RNG < 75 ft:

1.INITIAE CORRIDOR BACKOUT

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

NOTE: DAP A allowed for 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:

A6U DAP config: A9/B9

If(When) 75 < RNG < 150 ft:

2.INITIAE(CONTINUE) CORRIDOR BACKOUT

A6U DAP: A(B)/LVLH/VERN(PRI), LO Z

NOTE: DAP A allowed for X and 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 VBAR

If Rdot negative (closing on the target):

THC: +Z (out) to null closing rate ($R_{dot} \geq 0$ fps)

A6U 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 ____ / ____ : ____ : ____

4.PERFORM POSIGRADE/RETROGRADE BURN

NOTE

Posigrade burn will be performed if
second docking attempt desired

CRT GNC OPS 202 PRO (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 Vx – ITEM 19 +3 EXEC
 Vy – ITEM 20 +0 EXEC
 Vz – ITEM 21 +0 EXEC

If Retrograde Sep:

TGT PEG 7 Vx – ITEM 19 –3 EXEC
 Vy – ITEM 20 +0 EXEC
 Vz – ITEM 21 +0 EXEC
 LOAD – ITEM 22 EXEC
 TIMER – ITEM 23 EXEC

When RNG > 1000 ft:
DAP: NO LO Z

A6U 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, THC: Trim VGOs 0.2 fps
FLT CNTLR PWR – OFF
DAP: A/INRTL/VERN(ALT)

CRT GNC OPS 201 PRO (UNIV PTG)

SHUTTLE NOSE IN-PLANE BREAKOUT (R < 700 ft)

CAUTION

Constraints for use:

Orbiter X and Z axes in-plane

Range 700 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

A6U DAP: B/LVLH/VERN(PRI), no LO Z

NOTE

DAP A allowed for 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:

DAP: config: A9/B9

If(When) 75 < RNG < 150 ft:

2. INITIATE (CONTINUE) CORRIDOR BACKOUT

A6U DAP: A(B)/LVLH/VERN(PRI), LO Z

NOTE

DAP A allowed for X and 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 +X OR -X BURN

A6U 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)

A6U DAP TRANS: PULSE/PULSE/PULSE

DAP: A/INRTL/VERN(ALT)

Record (X) Burn TIG ____ / ____ : ____ : ____

FLT CNTLR PWR – OFF

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

CRT GNC OPS 202 PRO (MNVR EXEC)
RCS SEL – ITEM 4 EXEC (*)

√breakout direction and TV ROLL

<p style="text-align: center;"><u>NOTE</u> Posigrade burn will be performed if second docking attempt desired</p>

Set TIG to (X) burn + 30 min

If Posigrade Sep:

TGT PEG 7 VX – ITEM 19 +4.3 EXEC
VY – ITEM 20 +3.6 EXEC
VZ – ITEM 21 +0 EXEC

If Retrograde Sep:

TGT PEG 7 VX – ITEM 19 -4.3 EXEC
VY – ITEM 20 +3.6 EXEC
VZ – ITEM 21 +0 EXEC
TV ROLL – ITEM 5 + ____ EXEC
LOAD – ITEM 22 EXEC
TIMER – ITEM 23 EXEC

C3 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)

CRT GNC OPS 201 PRO (UNIV PTG)

Go to **TERMINATE SEP OPS** (p.39)

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

A6U DAP: A/AUTO/PRI
FLT CNTLR PWR – ON

2. 3 FPS RETROGRADE

CRT GNC OPS 202 PRO (ORBIT MNVR EXEC)
RCS SEL – ITEM 4 (*)
Set TIG to current time
TGT PEG 7 Vx – ITEM 19 -3 EXEC
 Vy – ITEM 20 +0 EXEC
 Vz – ITEM 21 +0 EXEC
LOAD – ITEM 22 EXEC
TIMER – ITEM 23 EXEC

Do not maneuver to burn attitude

DAP TRANS: as reqd
Deflect THC to null VGOs

A6U FLT CNTLR PWR – OFF

CRT GNC OPS 201 PRO (UNIV PTG)
DAP: A/AUTO/VERN(ALT)

SHUTTLE EMERGENCY SEPARATION

CAUTION

Constraints for use:
Maneuver mated stack to the $\pm V_{bar}$ attitude
Attitude rates 0.12 deg/axis
Nominal Undock

Orbiter DAP and RCS config

1. INITIAL SEPARATION SEQUENCE When petals clear:

CRT DAP: B9/LVLH/ALT
 $\sqrt{}$ DAP TRANS: PULSE/PULSE/PULSE, no LO Z
 THC: as reqd to maintain target within 8 degree corridor on C/L
 camera or COAS

NOTE:

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

At physical sep + 1:00:

DAP: VERN(ALT)

THC: +Z (out) pulses at 10s intervals to establish $RDOT > 0.1 \text{fps}$

At physical sep + 3:00 and when $RNG > 30 \text{ ft}$ (DP-DP):

THC: +Z (out) as reqd at 10 sec intervals to establish and
maintain $RDOT > 0.2 \text{fps}$

When $RNG > 75 \text{ ft}$ (DP-DP):

A6U

DAP: LO Z

NOTE:

DAP A allowed for $\pm X$ and $\pm Z$ THC

When $RNG > 100 \text{ ft}$ (DP-DP):

If radar desired, perform INIT RADAR ACQ, Perform DOCKING
MECHANISM POWERDOWN (APDS p.35))

2. PERFORM RADIAL BURN ON $\pm V_{BAR}$

When $RNG > 150 \text{ ft}$ (DP-DP):

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

DAP TRANS: NORM/PULSE/PULSE

THC: +X (up) for 12 sec (3.0 fps)

DAP TRANS: PULSE/PULSE/PULSE

A6U FLT CNTLR PWR – OFF DAP: A/INRTL/VERN(ALT)
Record Radial Burn TIG ____ / ____ : ____ : ____

At radial burn TIG + 6 min or when RNG > 1000 ft confirmed:

CRT GNC SPEC 20 PRO (DAP CONFIG)

A6U Config DAP A,B to A7,B7
DAP: no LO Z

3.PERFORM FINAL BURN

NOTE:

OMS burns:

If initial sep from +Vbar attitude, Final burn TIG should be NET Radial
Burn TIG + 13 min and NLT Radial Burn TIG + 60 min

If initial sep from -Vbar attitude, Final burn TIG should be NET Radial
Burn TIG + 13 min and NLT Radial Burn TIG + 40 min

+ X burns:

Final Burn TIG is Radial Burn TIG + 13 min

If performing emergency deorbit:

√MCC/PGSC for deorbit burn TIG/PAD
TV ROLL ITEM 5 +1 8 0 EXEC

Go to EMERGENCY DEORBIT PREP/ENTRY (CONT
DEORBIT, EMERGENCY)
Use single OMS burn procedures

If other OMS burn:

Go to RNDZ OMS BURN, use single OMS burn procedures

If +X burn:

NOTE:

Posigrade burn should be performed if second docking
attempt desired or if deorbit same day

CRT GNC OPS 202 PRO (ORB MNVR EXEC)
√RCS SEL – ITEM 4 EXEC (*)

If posigrade sep desired:

TGT PEG 7 Vx – ITEM 19 +3 EXEC
Vy – ITEM 20 +0 EXEC
Vz – ITEM 21 +0 EXEC

If retrograde sep desired:

TGT PEG 7 Vx – ITEM 19 –3 EXEC

Vy – ITEM 20 +0 EXEC

Vz – ITEM 21 +0 EXEC

LOAD – ITEM 22 EXEC

TIMER – ITEM 23 EXEC

MNVR – ITEM 27 EXEC (*)

A6U

DAP: B/AUTO/PRI

At TIG -0:30:

A6U

FLT CNTLR PWR – ON

DAP: A/INRTL/PRI

At TIG:

A6U

THC: Trim VGOs 0.2 fps

FLT CNTLR PWR OFF

DAP: A/INRTL/VERN(ALT)

CRT

GNC OPS 201 PRO (UNIV PTG)

Go to **TERMINATE SEP OPS** (p.39)

ANY ATTITUDE SEPARATION

CAUTION

Constraints for use:

Stack angular rates 0.12 deg/sec per axis APDS ring
relative misalignment < 5° per axis (as read in C/L camr)

If RPOP setup reqd:

Perform RPOP INITIALIZATION (p.33)

1.CONFIGURE FOR UNDOCKING

ISS: FREE DRIFT

A6U

DAP: FREE

SENSE: -Z

AFT ADI ATT – LVLH

ERR – MED

RT – MED

CRT GNC SPEC 20 PRO (DAP CONFIG)

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

2.COMMAND SEPARATION

Perform UNDOCKING PREP (p.33)

When -0.12 ROLL, PITCH, YAW RATE 0.12

Perform UNDOCKING OPERATIONS step 7 (p.33)

3.INITIAL SEPARATION SEQUENCE

A6U FLT CNTLR PWR – ON

When petals clear:

DAP: B/LVLH/ALT, no LO Z
THC: as reqd to maintain target within 8 deg corridor on C/L
camera

At physical sep +1:00:

DAP: LVLH/VERN(PRI)
THC: as reqd to maintain target within 8 degree corridor on C/L
camera
THC: +Z (out) pulses at 10 sec intervals to establish RDOT >
0.1 fps, then no +Z (out) pulses until 30 ft step

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

If Rdot falls below 0.02 fps
establish opening rate ≤ 0.05 fps using +Z (out) pulses at 10
second intervals, then wait > 2 min to perform 30 ft step

At physical sep +3:00 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 > 75 ft (DP-DP):

DAP: LO Z

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

When RNG > 100 ft (DP-DP):

A7L If radar desired, perform INITIAL RADAR ACQ
 POWER OFF pb – push

 Perform DOCKING MECHANISM POWERDOWN (APDS)

4.PERFORM +X BURN AT RNG > 150 FT

When RNG > 150 ft (DP-DP):

A6U DAP: A/LVLH/VERN(PRI), LO Z
 DAP TRANS: NORM/PULSE/PULSE
 THC: +X (up) for 8 sec (2.0 fps)
 DAP TRANS: PULSE/PULSE/PULSE
 Record +X Burn TIG ___ / ___ : ___ : ___

 Stop maintaining 8 deg corridor

5.ROTATE TO PLACE AND MAINTAIN ISS IN OVHD WINDOW

A6U DAP: A/INRTL/PRI

 Perform manual pitch rotation as reqd:

 DAP ROT: DISC/PULSE/DISC
 RHC: PITCH as reqd to place and maintain ISS in OVHD
 Window

When RNG > 1000 ft (CG-CG): DAP: no LO Z

6.PERFORM OUT-OF-PLANE BURN

CRT GNC SPEC 20 PRO (DAP CONFIG)
 Config DAP A,B to A7/B7

 GNC OPS 202 PRO (ORB MNVR EXEC)
 RCS SEL – ITEM 4 EXEC (*)
 Set TIG to +X Burn TIG + 22 min
 TGT PEG 7 Vx – ITEM 19 +0 EXEC
 Vy – ITEM 20 +2.5 EXEC
 Vz – ITEM 21 +0 EXEC
 LOAD – ITEM 22 EXEC
 TIMER – ITEM 23 EXEC

 If VGO Z is negative:
 TGT PEG 7 VY – ITEM 20 -2.5 EXEC
 LOAD – ITEM 22 EXEC
 TIMER – ITEM 23 EXEC
 VGO Z = 0

Do not maneuver to burn attitude

At TIG:

RNG > 1500 ft (CG-CG)

A6U

FLT CNTLR PWR – OFF
DAP ROT: DISC/DISC/DISC

F6

FLT CNTLR PWR – ON
THC: trim VGOs 0.2 fps
FLT CNTLR PWR – OFF
Record Out-of-Plane Burn TIG ____/____:____:____

7.PERFORM FINAL BURN

NOTE:

Posigrade burn should be performed if second docking attempt desired or if deorbit same day

If single OMS burn:

Perform **RNDZ OMS BURN** Cuecard (p.18)

If + X burn:

If posigrade sep desired:

If VY from Out-of-Plane burn (step 3) was positive:
TV ROLL – ITEM 5 +2 7 0 EXEC

If VY from Out-of-Plane burn (step 3) was negative:
TV ROLL – ITEM 5 +9 0 EXEC

TGT PEG 7 Vx – ITEM 19 +7.0 EXEC
Vy – ITEM 20 +0 EXEC
Vz – ITEM 21 +0 EXEC

If retrograde sep desired:

If VY from Out-of-Plane burn (step 4) was positive:
TV ROLL – ITEM 5 +9 0 EXEC

If VY from Out-of-Plane burn (step 4) was negative:
TV ROLL – ITEM 5 +2 7 0 EXEC

TGT PEG 7 Vx – ITEM 19 +7.0 EXEC
Vy – ITEM 20 +0 EXEC
Vz – ITEM 21 +0 EXEC

Set TIG to Out-of-Plane Burn TIG + 22 min

LOAD – ITEM 22 EXEC
TIMER – ITEM 23 EXEC
MNVR – ITEM 27 EXEC (*)

A6U

DAP: B/AUTO/PRI

	At TIG -0:30:
F6	FLT CNTLR PWR – ON
A6U	DAP: A/INRTL/PRI
	At TIG:
	THC: trim VGOs 0.2 fps
F6	FLT CNTLR PWR – OFF
A6U	DAP: A/INRTL/VERN(ALT)
CRT	GNC OPS 201 PRO (UNIV PTG)
	Go to TERMINATE SEP OPS (p.39)

REFERENCE TABLES

UNIV PTG

TGT ID = 1 Orbiting Vehicle
 = 2 Earth Center
 = 3 Earth Target
 Input LAT (± 90)
 LON (± 180 , + = East)
 ALT (-3444.0 to 20000.0 nm)
 = 4 Sun Center
 = 5 Celestial Target
 Input RA (0-359.99)
 DEC (± 90)
 = 11-110 Nav Stars

BODY VECTOR = 1 +X*
 = 2 -X*
 = 3 -Z*
 = 4 -Y Star Tracker*
 = 5 Selectable
 Input P (0-359.99)
 Y (270-359.99, 0-90)
 *Input OM → OM (0-359.99)

MON AXIS = 1 +X
 = 2 -X

DAP OVERVIEW

DAP – Purpose
 A1 – Nominal
 A2 – PTC
 A3 – GG
 A4 –
 A5 – Loss of VERN (All)
 A6 – Loss of VERN (Tail Only)
 A7 – Rendezvous
 A8 – Terminal Phase
 A9 – PROX OPS/Flyaround
 A10 – Docking
 A11 – Auto Reboost
 A12 – Mated Stack (Mnvr, Robotics & Att Hold)
 A13 –
 A14 – Orbiter alone SRMS/OBSS Ops
 A15 –

DAP – Purpose
 B1 – OMS & RCS Burns (ORB OPS)
 B2 – Loss of VERN (Tail Only)
 B3 – Loss of VERN (All)
 B4 –
 B5 – COAS/HUD CAL
 B6 –
 B7 – Rendezvous
 B8 – Terminal Phase
 B9 – Flyaround
 B10 – Docking
 B11 –
 B12 – Mated Stack (Undocking and Att Hold)
 B13 – Mated Stack (VRCS Deadband Collapse)
 B14 –
 B15

DAP A1 THROUGH A8 CONFIGURATIONS

	ITEM #	A1	A2	A3	A4	A5	A6	A7	A8
PRI									
ROT RATE	10(50)	0.2000	0.4000	0.2000	0.5000	0.2000	0.2000	0.2000	0.0500
ATT DB	11(51)	5.00	1.00	0.30	3.00	5.00	5.00	2.00	2.00
RATE DB	12(52)	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
ROT PLS	13(53)	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
COMP	14(54)	.000	.000	.000	.000	.000	.000	.000	.000
P OPTION	15(55)	ALL	ALL	ALL	ALL	ALL	TAIL	ALL	ALL
Y OPTION	16(56)	ALL	ALL	TAIL	ALL	ALL	TAIL	ALL	ALL
TRAN PLS	17(57)	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
ALT									
RATE DB	18(58)	0.200	0.200	0.070	0.200	0.070	0.070	0.100	0.100
JET OPT	19(59)	ALL	ALL	ALL	ALL	ALL	TAIL	ALL	ALL
# JETS	20(60)	2	2	1	2	1	1	2	2
ON TIME	21(61)	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
DELAY	22(62)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VERN									
ROT RATE	23(63)	0.2000	0.4000	0.0080	0.2000	0.0500	0.0500	0.0160	0.0500
ATT DB	24(64)	1.000	1.000	0.070	1.000	1.000	1.000	1.000	1.000
RATE DB	25(65)	.020	.020	.010	.020	.020	.020	.020	.020
ROT PLS	26(66)	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.050
COMP	27(67)	.000	.000	.000	.000	.000	.000	.000	.000
CNTL ACC	28(68)	0	0	0	0	0	0	0	0
PURPOSE		NOMINAL	PTC	GG	PRE/POST DEPLOY	LOSS OF VERN (ALL)	LOSS OF VERN (TAIL ONLY)	RNDZ	TERMINAL PHASE

DAP A9 THROUGH A13 CONFIGURATIONS

	ITEM #	A9	A10	A11	A12	A13
PRI						
ROT RATE	10(50)	0.1300	0.0500	0.1000	0.1000	0.1000
ATT DB	11(51)	1.00	0.50	15.00	5.00	5.00
RATE DB	12(52)	0.10	0.10	0.20	0.20	0.20
ROT PLS	13(53)	0.100	0.100	0.100	0.040	0.040
COMP	14(54)	.000	.000	.000	.000	.000
P OPTION	15(55)	TAIL	TAIL	TAIL	TAIL	TAIL
Y OPTION	16(56)	TAIL	TAIL	TAIL	TAIL	TAIL
TRAN PLS	17(57)	0.050	0.050	0.100	0.010	0.100
ALT						
RATE DB	18(58)	0.100	0.100	0.070	0.070	0.070
JET OPT	19(59)	TAIL	TAIL	TAIL	TAIL	TAIL
# JETS	20(60)	2	2	3	3	3
ON TIME	21(61)	0.08	0.08	0.08	0.08	0.08
DELAY	22(62)	0.00	0.00	12.00	12.00	11.04
VERN						
ROT RATE	23(63)	0.1300	0.0500	0.1000	0.2000	0.1000
ATT DB	24(64)	1.000	0.500	5.000	1.000	3.000
RATE DB	25(65)	.020	.020	.050	.020	.080
ROT PLS	26(66)	0.050	0.050	0.010	0.010	0.002
COMP	27(67)	.000	.000	.000	.000	.000
CNTL ACC	28(68)	0	0	1,2*	1,2*	3,4**
PURPOSE		PROX OPS/ FLYAROUND	DOCKING	AUTO REBOOST	MATED STACK AND RMS OPS	A/L DEPRESS ATTITUDE CONTROL

DAP B1 THROUGH B8 CONFIGURATIONS

	ITEM #	B1	B2	B3	B4	B5	B6	B7	B8
PRI									
ROT RATE	10(50)	0.5000	0.2000	0.2000	0.2000	0.2000	0.5000	0.5000	0.0500
ATT DB	11(51)	3.00	3.00	3.00	0.30	3.00	3.00	2.00	2.00
RATE DB	12(52)	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
ROT PLS	13(53)	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040
COMP	14(54)	.000	.000	.000	.000	.000	.000	.000	.000
P OPTION	15(55)	ALL	TAIL	ALL	TAIL	TAIL	ALL	ALL	ALL
Y OPTION	16(56)	ALL	TAIL	ALL	TAIL	TAIL	ALL	ALL	ALL
TRAN PLS	17(57)	0.100	0.020	0.020	0.020	0.020	0.020	0.050	0.050
ALT									
RATE DB	18(58)	0.200	0.070	0.070	0.100	0.200	0.200	0.100	0.100
JET OPT	19(59)	ALL	TAIL	ALL	ALL	ALL	ALL	ALL	ALL
# JETS	20(60)	2	1	1	2	2	2	2	2
ON TIME	21(61)	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
DELAY	22(62)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VERN									
ROT RATE	23(63)	0.2000	0.2000	0.2000	0.0080	0.0160	0.2000	0.2000	0.0500
ATT DB	24(64)	1.000	1.000	1.000	0.100	0.033	1.000	1.000	1.000
RATE DB	25(65)	.020	.020	.020	.010	.020	.020	.020	.020
ROT PLS	26(66)	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.020
COMP	27(67)	.000	.000	.000	.000	.000	.000	.000	.000
CNTL ACC	28(68)	0	0	0	0	0	0	0	0
PURPOSE		NOMINAL	PTC	GG	PRE/POST DEPLOY	LOSS OF VERN (ALL)	LOSS OF VERN (TAIL ONLY)	RNDZ	TERMINAL PHASE

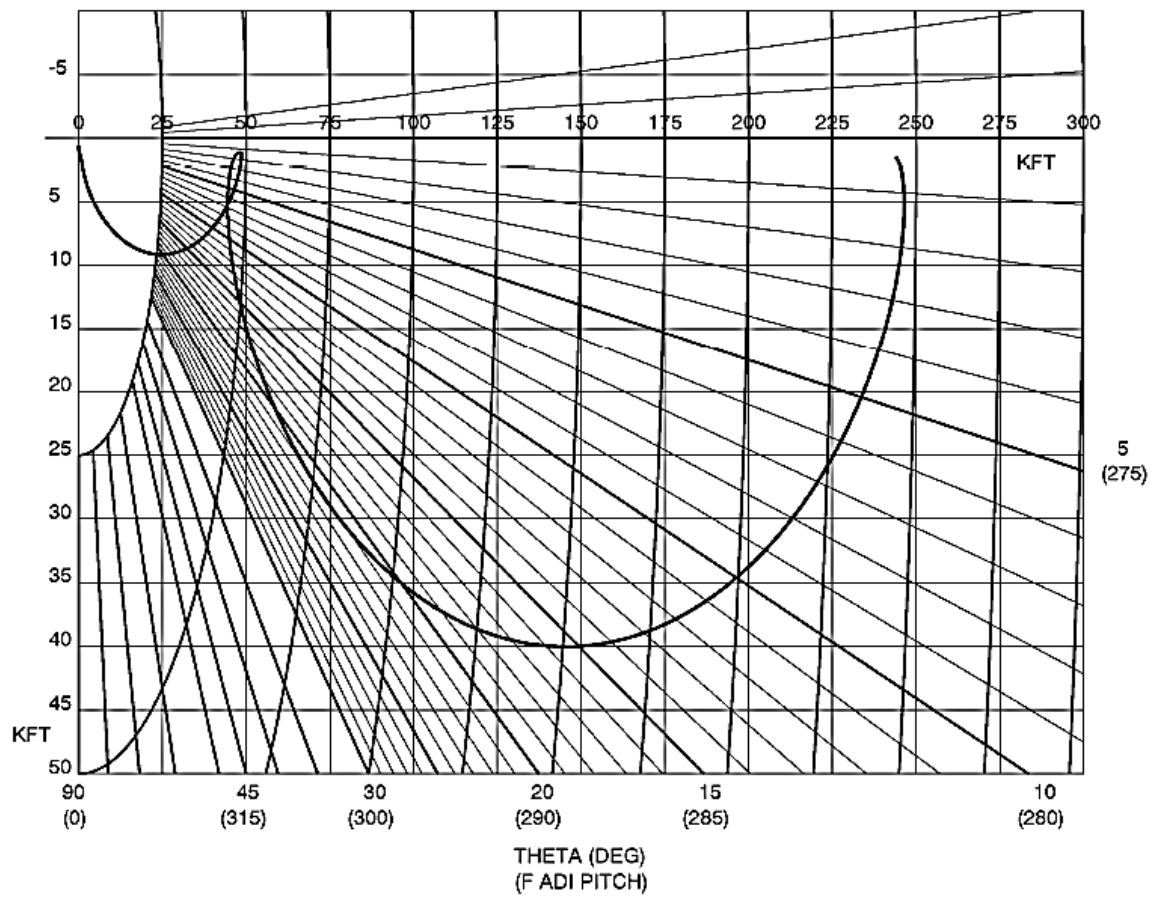
DAP B9 THROUGH B13 CONFIGURATIONS

	ITEM #	B9	B10	B12	B13
PRI					
ROT RATE	10(50)	0.1300	0.0500	0.1000	0.1000
ATT DB	11(51)	1.00	0.50	5.00	40.00
RATE DB	12(52)	0.10	0.10	0.20	0.20
ROT PLS	13(53)	0.040	0.040	0.040	0.040
COMP	14(54)	.000	.000	.000	.000
P OPTION	15(55)	TAIL	TAIL	TAIL	TAIL
Y OPTION	16(56)	TAIL	TAIL	TAIL	TAIL
TRAN PLS	17(57)	0.010	0.010	0.010	0.010
ALT					
RATE DB	18(58)	0.100	0.100	0.070	0.070
JET OPT	19(59)	TAIL	TAIL	TAIL	TAIL
# JETS	20(60)	2	2	3	3
ON TIME	21(61)	0.08	0.08	0.08	0.08
DELAY	22(62)	0.00	0.00	11.04	11.04
VERN					
ROT RATE	23(63)	0.1300	0.0500	0.1000	0.1000
ATT DB	24(64)	1.000	0.500	3.000	40.000
RATE DB	25(65)	.020	.020	.050	.080
ROT PLS	26(66)	0.020	0.020	0.002	0.002
COMP	27(67)	.000	.000	.000	.000
CNTL ACC	28(68)	0	0	2	3,4*
PURPOSE		PROX OPS/ FLYAROUND	DOCKING	MATED STACK AND RMS OPS	A/L DEPRESS RATE DUMPING

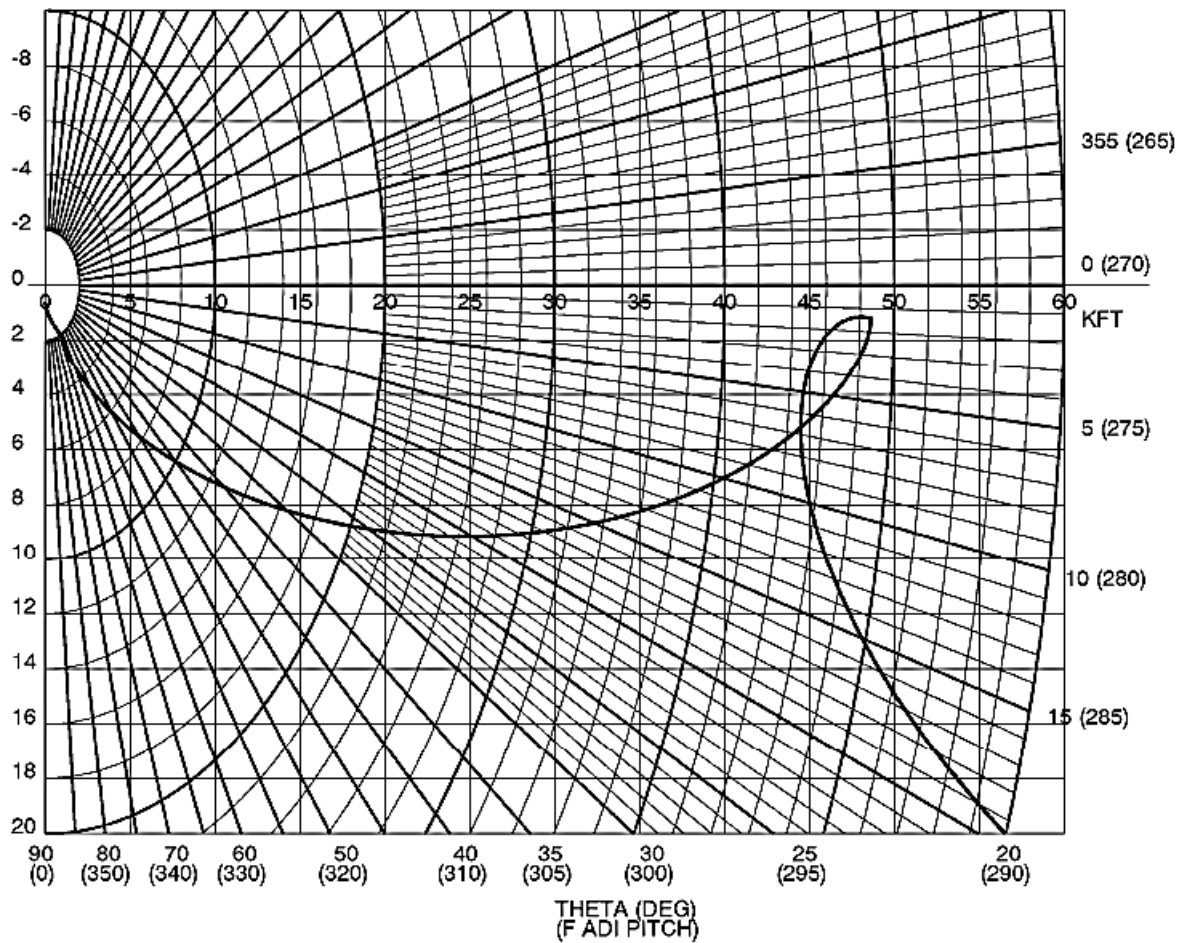
SPEC 34 ITEM NO	1			6	17	18	19	20	
TGT ALTITUDE	TGT NO	DESCRIPTION	T1 REL TO BASETIME	EL (DEG)	DT (MIN)	DX (KFT)	DY (KFT)	DZ (KFT)	NOTES
130	9	NCC	-0/00:55:48	0	55.8	-48.6	0	+1.2	BASETIME = Ti TIG
	10	Ti	0/00:00:00	0	74.4	-0.9	0	+1.8	
	11	MC1	0/00:20:00	0	54.4	-0.9	0	+1.8	
	12	MC2	0/00:47:24	28.45	27.0	-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	

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	

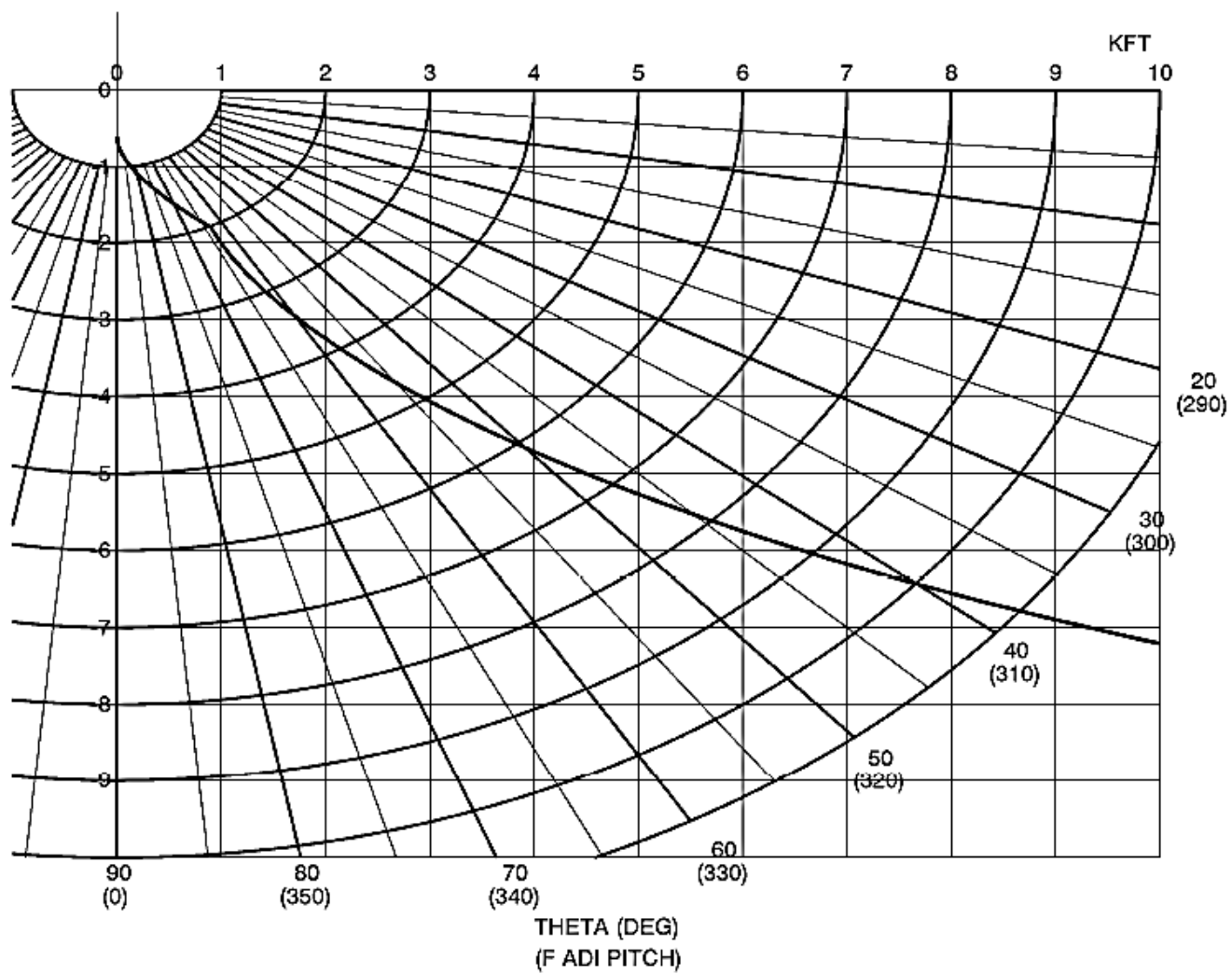
POST NC



POST Ti



POST MC3





**RENDEZVOUS
CHECKLIST**

**STS
ALL**

BACK COVER