

PDRS Operations Checklist

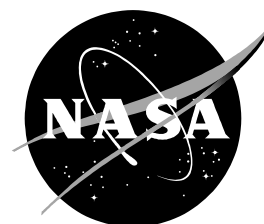
STS-135 Flight Supplement

**Mission Operations Directorate
EVA, Robotics, & Crew Systems
Operations Division**

**Final
June 24, 2011**

National Aeronautics and
Space Administration

Lyndon B. Johnson Space Center
Houston, Texas

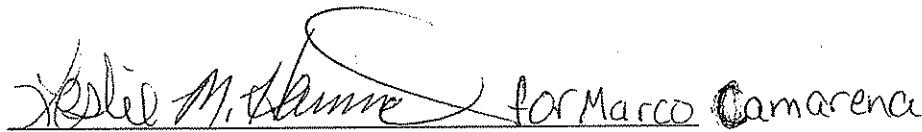


MISSION OPERATIONS DIRECTORATE

**PDRS OPERATIONS CHECKLIST
STS-135 FLIGHT SUPPLEMENT**

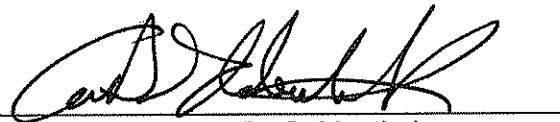
FINAL
June 24, 2011

PREPARED BY:

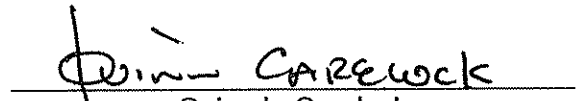
 for Marco Camarena

Marco Camarena
Book Manager

APPROVED BY:



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PDRS OPERATIONS CHECKLIST
 STS-135 FLIGHT SUPPLEMENT

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FS 2-8.....	⊗	135/FIN	FS 2-54.....	⊗	135/FIN
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FS 2-16.....	⊗	135/FIN	FS 2-62.....		135/FIN
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* – Omit from flight book

⊗ – Flight copies of this page contain color

PDRS CUE CARDS

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OBSS NOMINAL

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**OBSS
NOMINAL**

OBSS HANDOFF FROM SSRMS TO SRMS

OBSS
NOMINAL

1. SETUP

SM 94 PDRS CONTROL

√ PL ID, ITEM 3: 0

√ INIT ID, ITEM 24: 0

Verify at PRECRADLE posn:

X	Y	Z	PITCH	YAW	ROLL	PL ID
-1261	-146	-551	5	2	0	0
SY	SP	EP	WP	WY	WR	
0.0	+25.0	-25.0	+5.0	0.0	0.0	

R12(VPU) √ Green Jumper – ISS

MON 1	P1 LOOB
MON 2	B
DNLK	A
DTV	ELBOW (EE)

2. MNVR TO OBSS PRE-GRAPPLE AT HANDOFF

√ MCC to verify SSRMS at Stage Park posn

SM 94 PDRS CONTROL

END POS – ITEM 18 -1 0 4 7 -3 6 0 -6 5 8 EXEC

ATT – ITEM 21 +2 8 4 +0 +2 7 0 EXEC

CMD CK – ITEM 25 EXEC (GOOD)

RHC

RATE – as reqd (VERN within 10 ft)

BRAKES – OFF (tb-OFF)

MODE – OPR CMD, ENTER (READY It on)

AUTO SEQ – PROCEED (IN PROG It on)

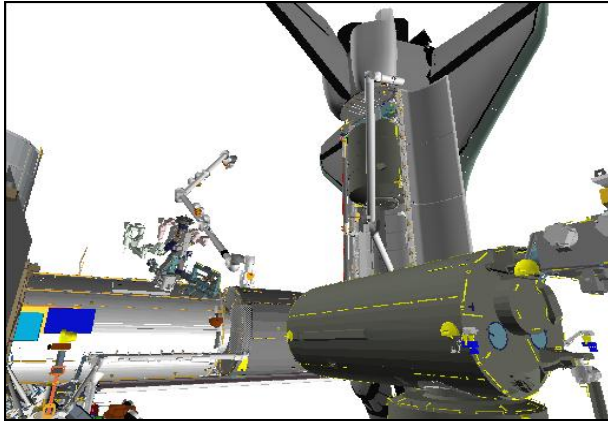
When AUTO SEQ IN PROG It – off:

BRAKES – ON (tb-ON)

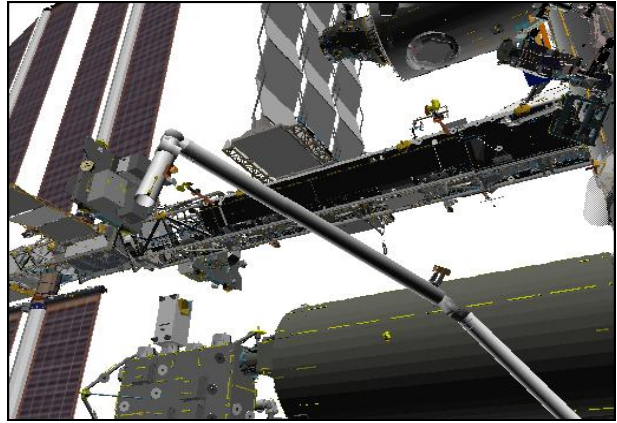
OBSS PRE-GRAPPLE AT HANDOFF posn:

X	Y	Z	PITCH	YAW	ROLL	PL ID
√ -1047	-360	-658	284	0	270	0
SY	SP	EP	WP	WY	WR	
√ +22.7	+57.5	-27.4	-99.3	+11.8	-97.9	

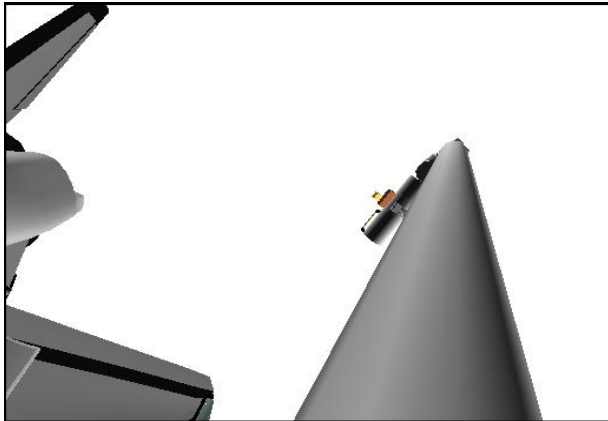
**Notify SSRMS Operator that SRMS at OBSS Pre-Grapple at Handoff posn,
GO for OBSS Grapple**



P1 LOOB (120,20)



CCTV B (-30,30)



ELBOW (-20,-15)



CCTV A (20,20)

3. CONFIGURE POWER

CAUTION
 SPEE power must be applied within 90 min
 to prevent sensor package damage

**On SSRMS Operator GO to release STBD MRLs,
 STBD RMS HTR A,B (two) – OFF**

- | | |
|---------|--|
| A6U | EVENT TIMER MODE – UP
CNTL – START |
| MA73C:C | cb MCA PWR AC3 3Φ MID 2 – op
√AC2 3Φ MID 2 – op |
| MA73C:D | √AC3 3Φ MID 4 – op |
| R13L | PL BAY MECH PWR SYS (two) – ON |

4. STBD MRL RELEASE

SM 94 PDRS CONTROL

RMS STBD – ITEM 2 EXEC (*)
√STBD AFT,MID,FWD REL (six) = 0

NOTE

Expect single motor drive time for MRL release

STBD RMS RETEN LAT – REL (tb-REL) (18 sec max)
– OFF

If motor drive time > 18 sec, √MCC

SM 94 PDRS CONTROL

√STBD AFT,MID,FWD REL (six) = 1

5. RECONFIGURE POWER

R13L PL BAY MECH PWR SYS (two) – OFF

MA73C:C cb MCA PWR AC3 3Φ MID 2 – cl
√AC2 3Φ MID 2 – op

MA73C:D √AC3 3Φ MID 4 – op

Give SSRMS Operator GO for OBSS Unberth

Monitor R-F-L Status

After OBSS Unberth,

SM 94 PDRS CONTROL

RMS PORT – ITEM 1 EXEC (*)

6. SETUP FOR GRAPPLE

A7U CCTV – config for grapple
– install PDRS TARGET OVERLAY FOR CTVM
– RMS WRIST, ZOOM: 34.0 HFOV
FOCUS: 5 ft

Maintain eyepoint approx 18 in when using grapple overlay

MON 1	BASE ELBOW
MON 2	B
DNLK	EE (ELBOW)
DTV	A

R12(OBSS) √SPEE PWR – OFF
SSP √APCU 2 OUTPUT RLY – OP (tb-bp)

I

7. OBSS GRAPPLE AT HANDOFF POSN

RHC

On SSRMS Operator GO for OBSS Grapple,

RATE – VERN (RATE MIN tb-ON)

BRAKES – OFF (tb-OFF)

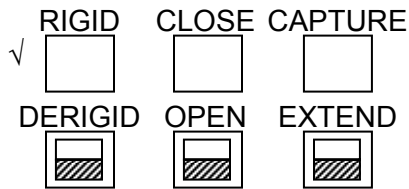
MODE – END EFF, ENTER

Mnvr to grapple envelope

CAUTION
Monitor EE tb timing to prevent EE motor burnout

EE MODE – AUTO

CAPTURE sw – depress (mom)



CRITICAL TIMES (28 sec total):

CAPTURE tb – gray, then

CLOSE tb – gray, 3 sec max, then

RIGID tb – gray, 25 sec max

EE MODE – OFF

- * If manual capture required: *
- * EE MODE – MAN *
- * CAPTURE sw – depress (hold until CLOSE tb-gray, 3 sec max) *
- * MAN CONTR – RIGID (hold until RIGID tb-gray, 25 sec max) *
- * MODE – OFF *

MODE – TEST, ENTER

Wait 5 sec

BRAKES – ON (tb-ON)

SM 94 PDRS CONTROL
PL ID – ITEM 3 +1 EXEC
INIT ID – ITEM 24 +1 EXEC

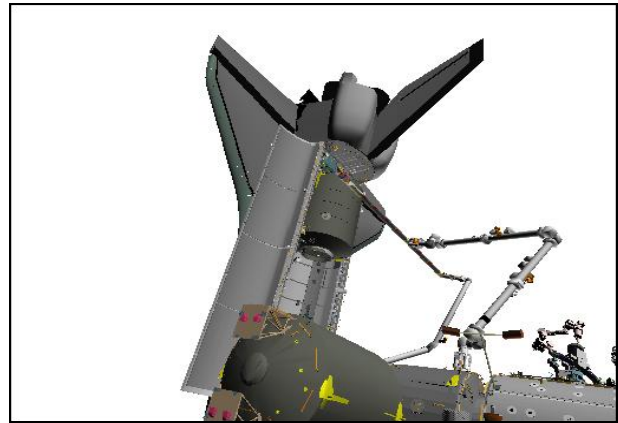
Expected OBSS HANDOFF posn:

	X	Y	Z	PITCH	YAW	ROLL	PL ID	
√	-1070	-360	-584	44	270	0	1	*
	SY	SP	EP	WP	WY	WR		
√	+24.5	+59.0	-42.1	-85.9	+11.2	-99.4		

*Display singularity



CCTV A (10,20)



S1 LOOB (70,70)

Review GENERIC END EFFECTOR CUE CARD – ISS/SHUTTLE DOCKED OPS

Give SSRMS Operator GO for OBSS Ungripple

- Perform ACTIVATION (LDRI/ITVC Cue Card, PHOTO/TV)
- Perform LCH ACTIVATION (LCS Cue Card, PHOTO/TV)
- Perform LCC ACTIVATION (LCS Cue Card, PHOTO/TV), step 2
- Perform LCC DEACTIVATION (LCS Cue Card, PHOTO/TV), step 1

8. MNVR TO MPLM VIEWING

R12(VPU) ✓Green Jumper – ISS

MON 1	S1 LOOB
MON 2	B
DNLK	RSC
DTV	A

SM 94 PDRS CONTROL

END POS – ITEM 18 -9 6 7 -6 4 3 -3 8 6 EXEC
 ATT – ITEM 21 +6 0 +3 4 9 +2 8 2 EXEC
 CMD CK – ITEM 25 EXEC (GOOD)

On SSRMS Operator GO for mnvr to MPLM Viewing

RHC RATE – as reqd (VERN within 10 ft)
 BRAKES – OFF (tb-OFF)
 MODE – SINGLE, ENTER

SM 169 PDRS STATUS

Mnvr to OBSS HANDOFF INTERMEDIATE posn:

	SY	SP	EP	WP	WY	WR	
OBSS HANDOFF	+24.5	+59.0	-42.1	-85.9	+11.2	-99.4	
1: WR +						-87.8	
OBSS HANDOFF INTERMEDIATE	+24.5	+59.0	-42.1	-85.9	+11.2	-87.8	
	X	Y	Z	PITCH	YAW	ROLL	PL ID
	-1070	-361	-584	14	281	330	1

MODE – OPR CMD, ENTER (READY It on)

AUTO SEQ – PROCEED (IN PROG It on)

When AUTO SEQ IN PROG It – off:

BRAKES – ON (tb-ON)

MPLM VIEWING posn:

(02:30)

X	Y	Z	PITCH	YAW	ROLL	PL ID
-967	-643	-386	60	349	282	1
SY	SP	EP	WP	WY	WR	
+62.5	+25.0	-23.0	0.0	-13.2	-21.9	

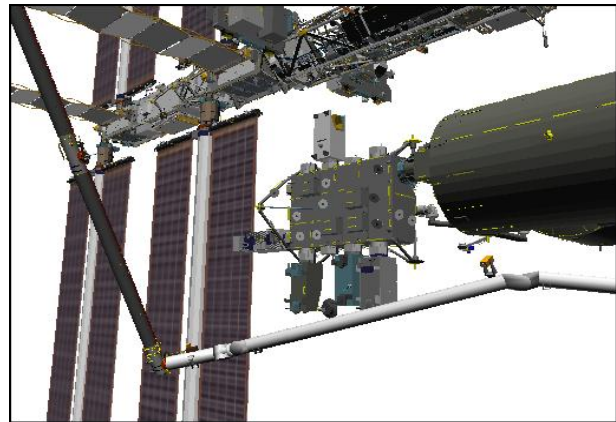
√MODE – not DIRECT (It off)

PARAM – PORT TEMP

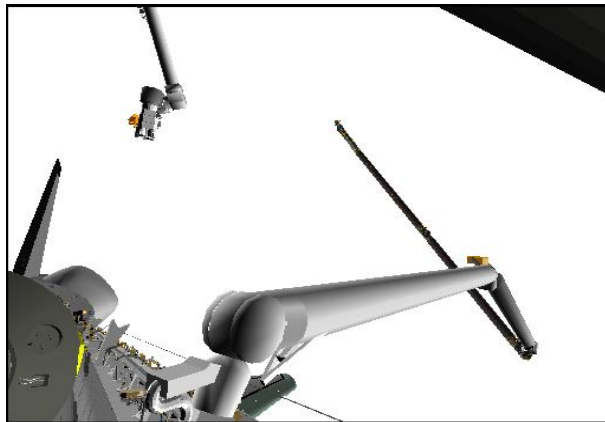
JOINT – CRIT TEMP



S1 LOOB (60,20)



CCTV B (-45,10)



CCTV A (30,15)

9. CONFIGURE CAMERAS FOR MPLM INSTALL

R12(VPU)
A7U

Green Jumper – LDRI/ITVC

DTV ← PL2

CAMR CMD PAN/TILT – HI RATE

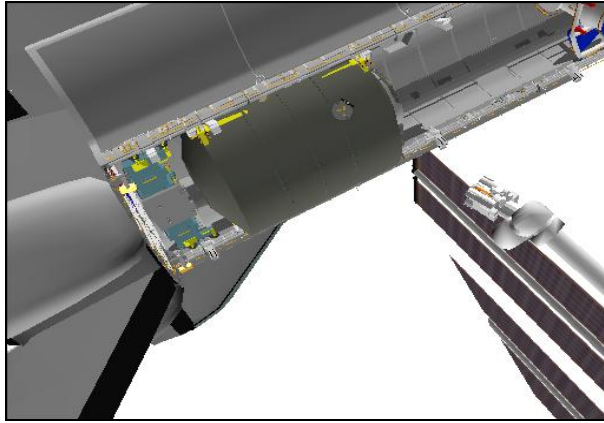
PAN – L (to hard stop)

TILT – UP (to hard stop)

PAN/TILT – RESET, HI RATE (LO within 10°)

PAN: +130 (right)

TILT: -60 (down)



OBSS ITVC (130,-60)

MUX 1 L ← MIDDECK
LDRI MODE 2 pb – push (ITVC video)
VIDEO OUT – as desired (not DTV)
√VIDEO IN – not PL2

OBSS MNVR TO UNDOCK

1. SETUP

SM 94 PDRS CONTROL

√ PL ID, ITEM 3: 1

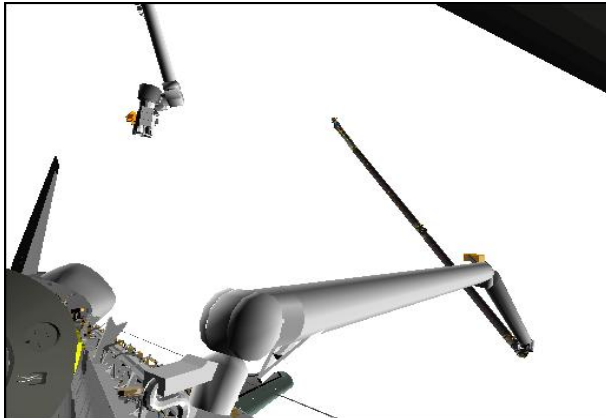
√ INIT ID, ITEM 24: 1

Verify at MPLM VIEWING posn:

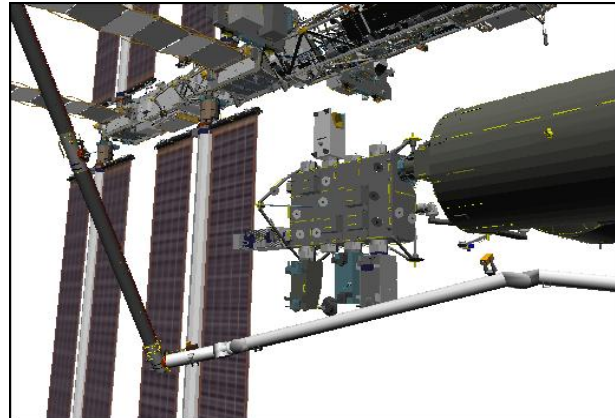
	X	Y	Z	PITCH	YAW	ROLL	PL ID
√	-967	-643	-386	60	349	282	1
	SY	SP	EP	WP	WY	WR	
√	+62.5	+25.0	-23.0	0.0	-13.2	-21.9	

R12(VPU) √ Green Jumper – ISS

MON 1	P1 LOOB
MON 2	B
DNLK	RSC
DTV	A



CCTV A (30,15)



CCTV B (-45,10)

2. OBSS MNVR TO UNDOCK

SM 94 PDRS CONTROL

END POS – ITEM 18 -1 0 4 1 -3 6 2 -6 0 2 EXEC

ATT – ITEM 21 +4 4 +2 7 0 +0 EXEC

CMD CK – ITEM 25 EXEC (GOOD)

RHC

RATE – as reqd (VERN within 10 ft)

BRAKES – OFF (tb-OFF)

MODE – OPR CMD, ENTER (READY lt on)

AUTO SEQ – PROCEED (IN PROG lt on)

When AUTO SEQ IN PROG lt – off:

BRAKES – ON (tb-ON)

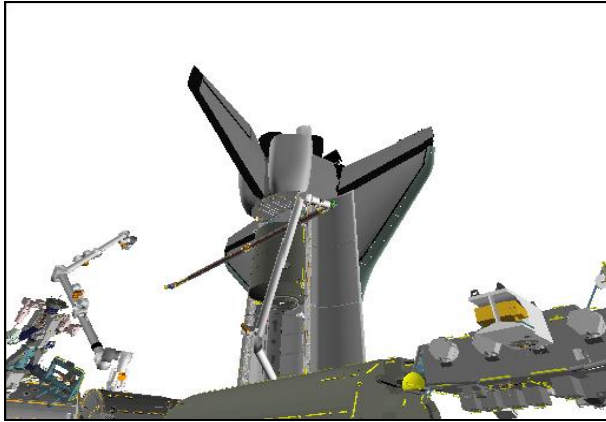
OBSS UNDOCK posn:

(02:30)

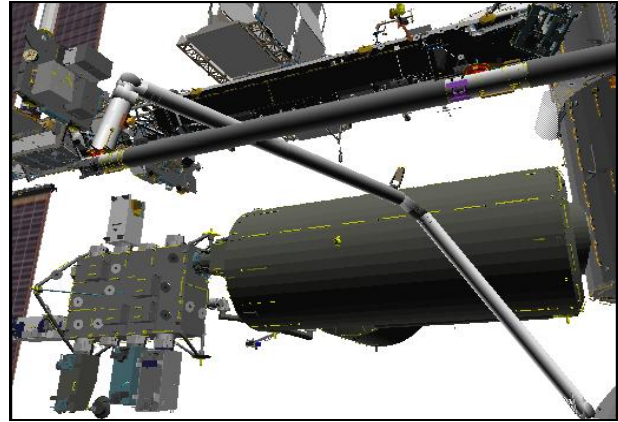
	X	Y	Z	PITCH	YAW	ROLL	PL ID	
√	-1041	-362	-602	44	270	0	1	*
	SY	SP	EP	WP	WY	WR		
√	+25.8	+66.3	-49.0	-85.9	+10.7	-100.7		

*Display singularity

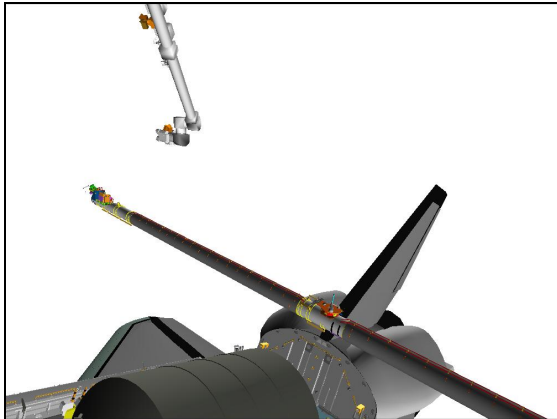
√MODE – not DIRECT (It off)
 PARAM – PORT TEMP
 JOINT – CRIT TEMP



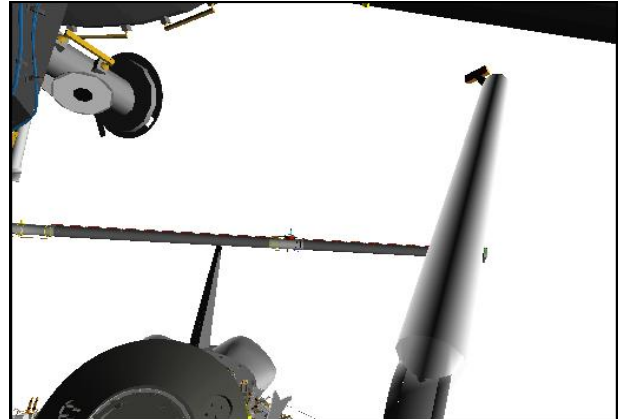
P1 LOOB (135,35)



CCTV B (-25,20)



ELBOW (-65,20)



CCTV A (10,25)

OBSS MNVR TO FLAT FIELD

WARNING
For UNDOCKED ops only

1. SETUP

SM 94 PDRS CONTROL

PL ID – ITEM 3 +2 EXEC
 INIT ID – ITEM 24 +2 EXEC
 AUTO MODES – ITEM 13 +7 EXEC

Verify at OBSS UNDOCK posn:

	X	Y	Z	PITCH	YAW	ROLL	PL ID	
√	-1029	+229	-614	14	270	0	2	*
	SY	SP	EP	WP	WY	WR		
√	+25.8	+66.3	-49.0	-85.9	+10.7	-100.7		

*Display singularity

MON 1	C
MON 2	D
DNLK	ELBOW
DTV	A (B)

RHC

2. MNVR TO FLAT FIELD START

RATE – COARSE (RATE MIN tb-OFF)
 BRAKES – OFF (tb-OFF)
 MODE – AUTO 1, ENTER (READY It on)

- * If unable to enter AUTO mode (no AUTO READY It): *
- * END POS – ITEM 18 -1029 +229 -614 EXEC *
- * ATT – ITEM 21 +14 +270 +0 EXEC *
- * CMD CK – ITEM 25 EXEC (GOOD) *
- * *
- * MODE – OPR CMD, ENTER (READY It on) *
- * AUTO SEQ – PROCEED (IN PROG It on) *
- * *
- * When AUTO SEQ IN PROG It – off: *
- * MODE – AUTO 1, ENTER *

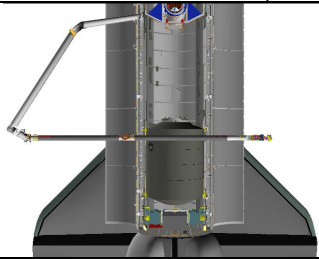
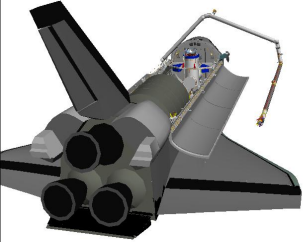
SM 94 PDRS CONTROL

√START PT, ITEM 17: 148

SM 169 PDRS STATUS

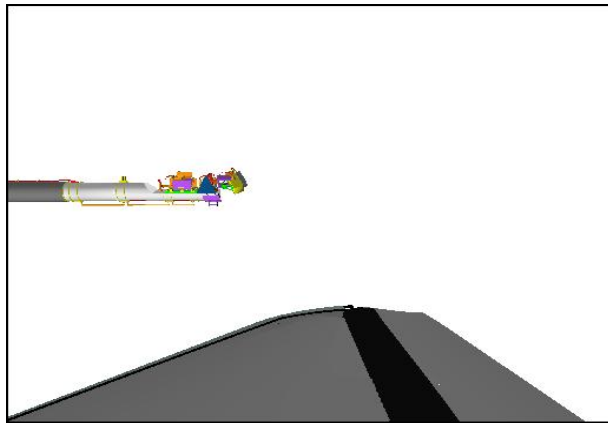
Monitor ACAS progress

AUTO SEQ – PROCEED (IN PROG It on)

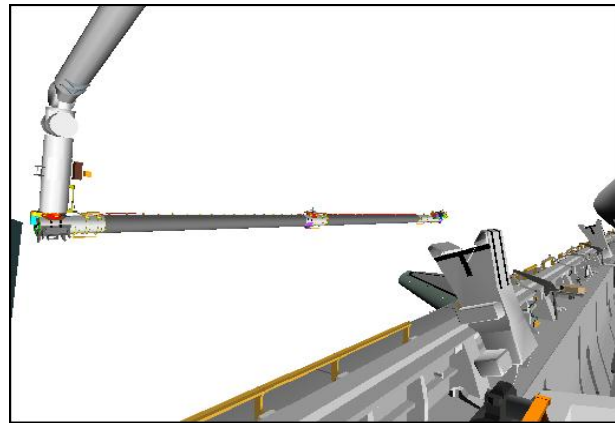
Pt	X	Y	Z	PITCH	YAW	ROLL	
148P	-1029	+229	-614	284	270*	270	
149	-800	+500	-250	281	333	95	
150	-1130	+350	-400	325	336	30	
151P	-1270	+350	-445	0	0	11	

*Display singularity

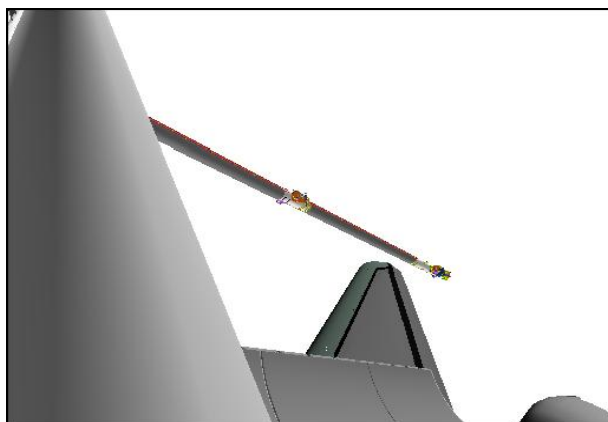
When AUTO SEQ IN PROG It – off:
BRAKES – ON (tb-ON)



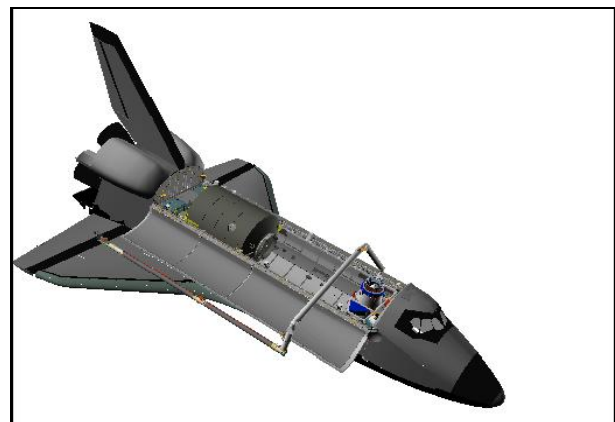
CCTV C (95,-5)



CCTV D (-40,0)



ELBOW (25,-40)



BIRD'S EYE

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OBSS CONTINGENCY

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**OBSS
CONTINGENCY**

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OBSS HANDOFF FROM SRMS TO SSRMS

1. SETUP

SM 94 PDRS CONTROL

√ PL ID, ITEM 3: 1

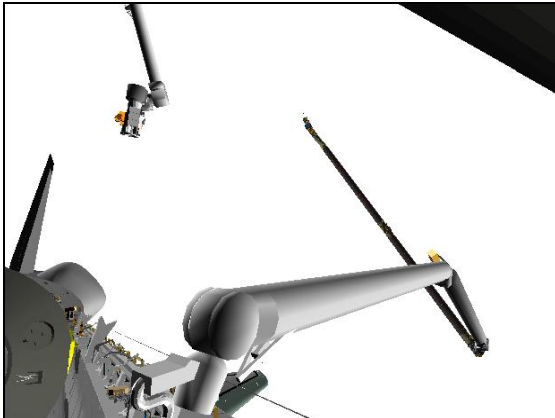
√ INIT ID, ITEM 24: 1

Verify at MPLM VIEWING posn:

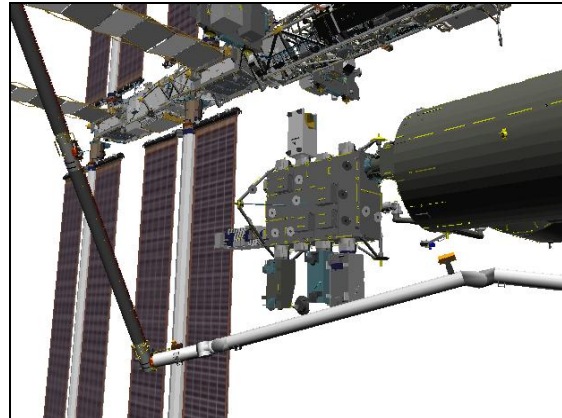
	X	Y	Z	PITCH	YAW	ROLL	PL ID
√	-967	-643	-386	60	349	282	1
	SY	SP	EP	WP	WY	WR	
√	+62.5	+25.0	-23.0	0.0	-13.2	-21.9	

R12(VPU) √ Green Jumper – ISS

MON 1	S1 LOOB
MON 2	B
DNLK	RSC
DTV	A



CCTV A (30,15)



CCTV B (-45,10)

Review GENERIC END EFFECTOR CUE CARD – ISS/SHUTTLE DOCKED OPS

2. MNVR TO OBSS HANDOFF

SM 94 PDRS CONTROL

END POS – ITEM 18 -1 0 7 0 -3 6 1 -5 8 4 EXEC

ATT – ITEM 21 +1 4 +2 8 1 +3 3 0 EXEC

CMD CK – ITEM 25 EXEC (GOOD)

On SSRMS Operator GO for mnvr to OBSS Handoff

RHC

RATE – as reqd (VERN within 10 ft)

BRAKES – OFF (tb-OFF)

MODE – OPR CMD, ENTER (READY lt on)

AUTO SEQ – PROCEED (IN PROG lt on)

When AUTO SEQ IN PROG It – off

OBSS HANDOFF INTERMEDIATE posn: (02:30)

	X	Y	Z	PITCH	YAW	ROLL	PL ID
√	-1070	-361	-584	14	281	330	1
	SY	SP	EP	WP	WY	WR	
√	+24.5	+59.0	-42.1	-85.9	+11.2	-87.8	

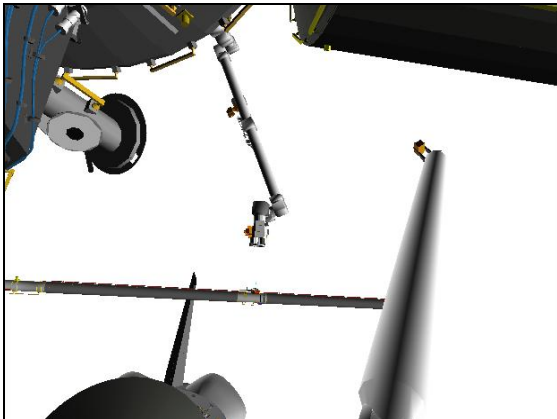
MODE – SINGLE, ENTER

Mnvr to OBSS HANDOFF posn:

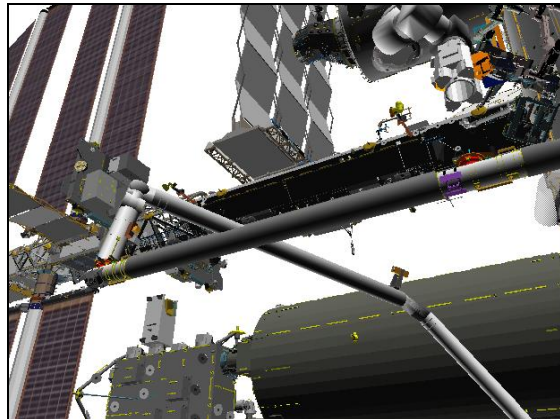
	SY	SP	EP	WP	WY	WR	
OBSS HANDOFF INTERMEDIATE	+24.5	+59.0	-42.1	-85.9	+11.2	-87.8	
1: WR –						-99.4	
OBSS HANDOFF	+24.5	+59.0	-42.1	-85.9	+11.2	-99.4	
	X	Y	Z	PITCH	YAW	ROLL	PL ID
	-1070	-360	-584	44	270	0	1

*Display singularity

BRAKES – ON (tb-ON)



CCTV A (10,30)



CCTV B (-30,30)

Give SSRMS Operator GO for OBSS Grapple

3. STOW PTU
R12(VPU) Green Jumper – LDRI/ITVC

A7U DTV ← PL2

CAMR CMD PAN/TILT – HI RATE
 PAN – L (to hard stop)
 TILT – UP (to hard stop)
 PAN/TILT – RESET
 PAN: +108 (right)
 TILT: -175 (down)

R12(VPU) Green Jumper – ISS

On SSRMS Operator GO for OBSS ungrapple

CAUTION
STBD RMS HTR power must be applied within 90 min
to prevent sensor package damage

Perform LCC DEACTIVATION (LCS Cue Card, PHOTO/TV)
Perform LCH DEACTIVATION (LCS Cue Card, PHOTO/TV)
Perform DEACTIVATION (LDRI/ITVC Cue Card, PHOTO/TV)

4. OBSS UNGRAPPLE

A7U CCTV – config for ungrapple
– RMS WRIST, ZOOM: 34.0 HFOV
FOCUS: 5 ft

NOTE

CONTR ERR It and 'S96 PDRS CNTL' msg may
occur due to Consistency/Envelope Check error

RHC RATE – COARSE (RATE MIN tb-OFF)

SM 94 PDRS CONTROL

AUTO BRAKE INH – ITEM 10 EXEC (*)

BRAKES – OFF (tb-OFF)
MODE – TEST, ENTER
Wait 5 sec

BRAKES – ON (tb-ON)

SM 94 PDRS CONTROL

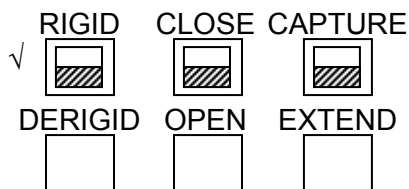
AUTO BRAKE ENA – ITEM 9 EXEC (*)
PL ID – ITEM 3 +0 EXEC
INIT ID – ITEM 24 +0 EXEC

RHC RATE – VERN (RATE MIN tb-ON)
BRAKES – OFF (tb-OFF)
MODE – END EFF, ENTER

CAUTION
Monitor EE tb timing to prevent EE motor burnout

EE MODE – AUTO
RELEASE sw – depress (mom)

When OPEN tb – gray, mnvr arm clear of grapple pin



CRITICAL TIMES (28 sec total):
DERIGID tb – gray, 5 sec max, then
OPEN tb – gray, 3 sec max, then
EXTEND tb – gray, 20 sec max

EE MODE – OFF

- * If manual release reqd: *
- * EE MODE – MAN *
- * MAN CONTR – DERIGID (hold until DERIGID tb-gray, 5 sec max) *
- * RELEASE sw – depress (hold until OPEN tb-gray, 3 sec max) *
- * Mnvr arm clear of grapple pin, then *
- * EE MAN CONTR – DERIGID (hold until EXTEND tb-gray, 20 sec max) *
- * MODE – OFF *

Mnvr to OBSS BACKOFF posn:

X	Y	Z	PITCH	YAW	ROLL	PL ID
-1047	-360	-658	284	0	270	0
SY	SP	EP	WP	WY	WR	
+22.7	+57.5	-27.4	-99.3	+11.8	-97.9	

BRAKES – ON (tb-ON)
 MODE – not DIRECT (It off)
 PARAM – PORT TEMP
 JOINT – CRIT TEMP

- * If using Shuttle attitude control and attitude maintenance reqd: *
- * DAP: LVLH *
- * When rates damped: *
- * DAP: FREE > 2 sec *
- * DAP: AUTO *

Give SSRMS Operator GO for OBSS Berth Sequence

- 5. CONFIGURE CIRCUIT BREAKERS
 MA73C:C cb MCA PWR AC3 3Φ MID 2 – op
 √AC2 3Φ MID 2 – op
 MA73C:D √AC3 3Φ MID 4 – op

- 6. CONFIGURE FOR MONITORING
On SSRMS notification to watch for STBD RMS R-F-Ls,
SM 94 PDRS CONTROL
 RMS STBD – ITEM 2 EXEC (*)

Notify SSRMS operator when STBD RMS R-F-L tb (three) – gray

- 7. STBD MRL LATCH
On SSRMS Operator GO to latch STBD MRLs to Topological Capture,
 √STBD RMS R-F-L tb (three) – gray

SM 94 PDRS CONTROL
 √STBD AFT, MID, FWD LAT (six) = 0

R13L PL BAY MECH PWR SYS (two) – ON

NOTE

Expect single motor drive time for MRL latching (18 sec max).
 The following STBD RMS RETEN LAT – OFF and PL BAY
 MECH PWR SYS (two) – OFF actions are to be performed simo

Verify AOS for latching to Topological Capture

STBD RMS RETEN LAT – LAT 6 sec only (tb-bp)
– OFF

R13L PL BAY MECH PWR SYS (two) – OFF
Give SSRMS Operator GO to Limp All SSRMS Joints and Derigidize

R13L **On SSRMS Operator GO to complete STBD MRL Latching,**
PL BAY MECH PWR SYS (two) – ON

STBD RMS RETEN LAT – LAT (tb-LAT) (12 sec max)
– OFF

8. RECONFIGURE POWER
PL BAY MECH PWR SYS (two) – OFF

STBD RMS HTR A,B (two) – AUTO

A6U EVENT TIMER CNTL – STOP

SM 94 PDRS CONTROL

√STBD AFT, MID, FWD LAT (six) = 1
RMS PORT – ITEM 1 EXEC (*)

MA73C:C cb MCA PWR AC3 3Φ MID 2 – cl
√AC2 3Φ MID 2 – op

MA73C:D √AC3 3Φ MID 4 – op

Give SSRMS Operator GO for OBSS Ungripple

9. MNVR TO PRECRADLE
Verify SSRMS at Berthed OBSS Backoff or Overnight Park posn

MON 1	P1 LOOB
MON 2	B
DNLK	ELBOW
DTV	A

SM 94 PDRS CONTROL

END POS – ITEM 18 -1 2 6 1 -1 4 6 -5 5 1 EXEC
ATT – ITEM 21 +5 +2 +0 EXEC
CMD CK – ITEM 25 EXEC (GOOD)

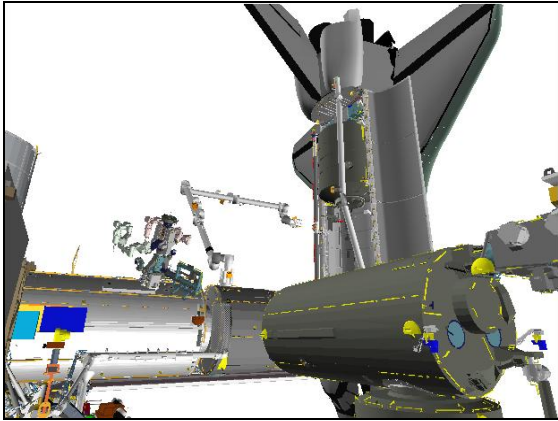
RHC RATE – as reqd (VERN within 10 ft)
BRAKES – OFF (tb-OFF)
MODE – OPR CMD, ENTER (READY lt on)

AUTO SEQ – PROCEED (IN PROG lt on)

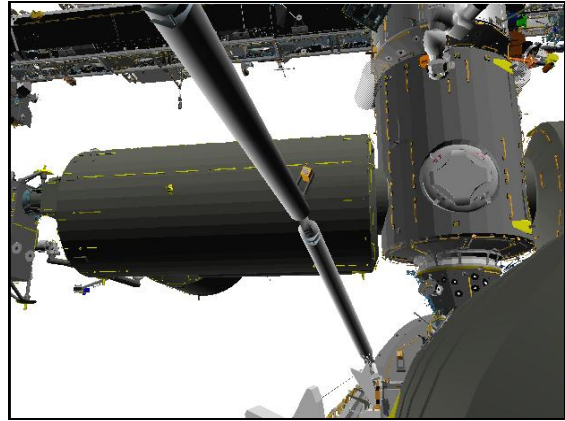
When AUTO SEQ IN PROG lt – off:
Verify at PRECRADLE posn:

√	X	Y	Z	PITCH	YAW	ROLL	PL ID
	-1261	-146	-551	5	2	0	0
	SY	SP	EP	WP	WY	WR	
√	0.0	+25.0	-25.0	+5.0	0.0	0.0	

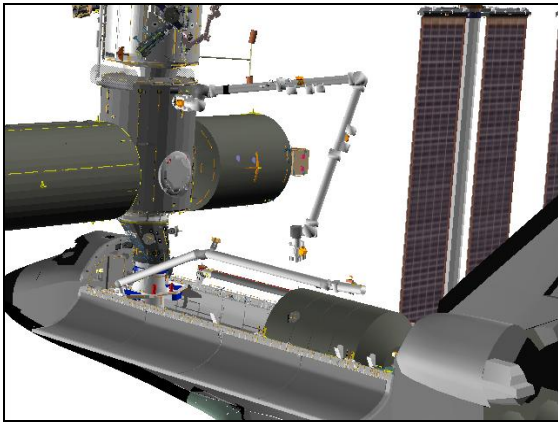
BRAKES – ON (tb-ON)
MODE – not DIRECT (lt off)
PARAM – PORT TEMP
JOINT – CRIT TEMP



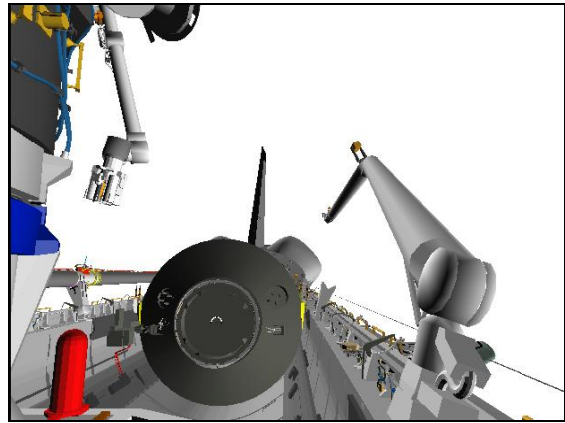
P1 LOOB (120,20)



CCTV B (-10,15)



BIRD'S EYE



CCTV A (0,10)

OBSS MNVR TO CONTINGENCY UNDOCK

1. SETUP

SM 94 PDRS CONTROL

√ PL ID, ITEM 3: 1

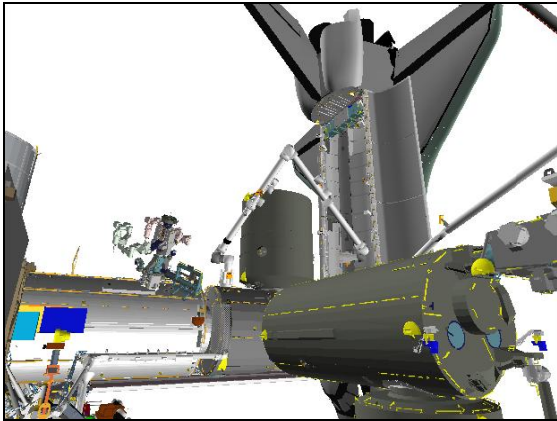
√ INIT ID, ITEM 24: 1

Verify at MPLM VIEWING posn:

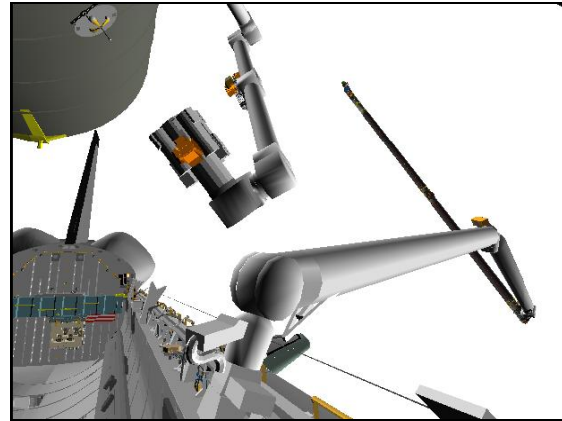
	X	Y	Z	PITCH	YAW	ROLL	PL ID
√	-967	-643	-386	60	349	282	1
	SY	SP	EP	WP	WY	WR	
√	+62.5	+25.0	-23.0	0.0	-13.2	-21.9	

R12(VPU) √ Green Jumper – ISS

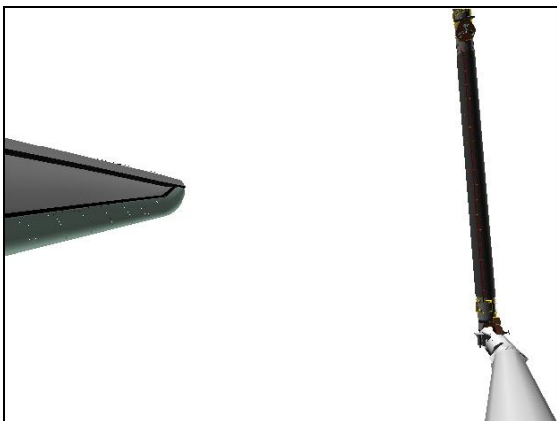
MON 1	P1 LOOB
MON 2	A
DNLK	ELBOW
DTV	B



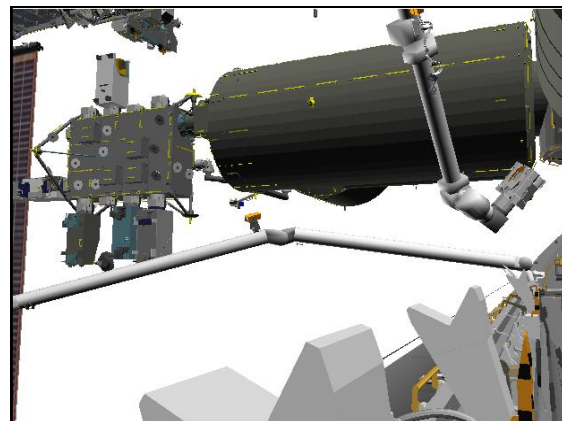
P1 LOOB (140,40)



CCTV A (25,10)



ELBOW (-30,15)



CCTV B (-25,5)

2. MNVR TO OBSS CONTINGENCY UNDOCK POSN

SM 94 PDRS CONTROL

END POS – ITEM 18 -1 1 3 1 -4 9 6 -5 8 6 EXEC
 ATT – ITEM 21 +6 2 +3 2 4 +2 8 2 EXEC
 CMD CK – ITEM 25 EXEC (GOOD)

RHC

RATE – VERN (RATE MIN tb-ON)
 BRAKES – OFF (tb-OFF)
 MODE – OPR CMD, ENTER (READY It on)

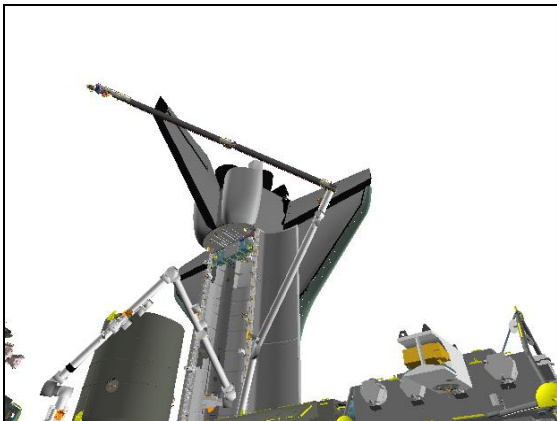
AUTO SEQ – PROCEED (IN PROG It on)

When AUTO SEQ IN PROG It – off:
 BRAKES – ON (tb-ON)

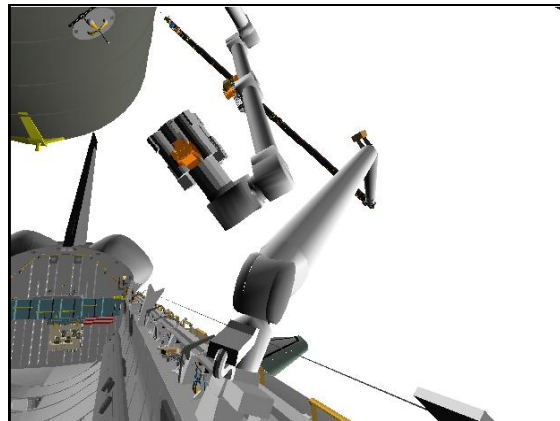
OBSS CONTINGENCY UNDOCK posn:

	X	Y	Z	PITCH	YAW	ROLL	PL ID
√	-1131	-496	-586	62	324	282	1
	SY	SP	EP	WP	WY	WR	
√	+35.0	+38.7	-22.8	-0.5	-0.3	-40.0	

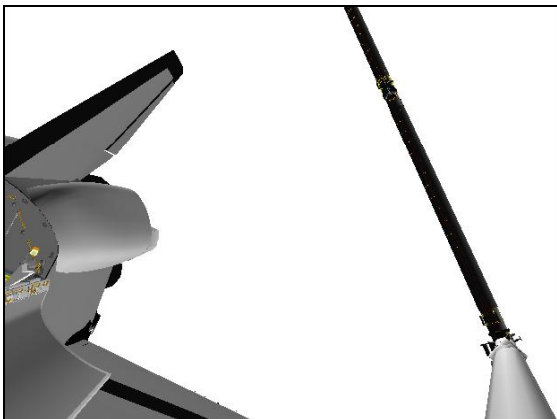
MODE – not DIRECT (It off)
 PARAM – PORT TEMP
 JOINT – CRIT TEMP



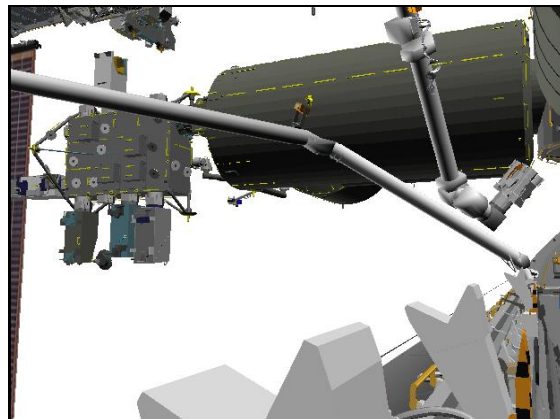
P1 LOOB (140,40)



CCTV A (25,10)



ELBOW (-30,15)



CCTV B (-25,5)

OBSS MNVR CONT UNDOCK TO NOM UNDOCK

1. SETUP

SM 94 PDRS CONTROL

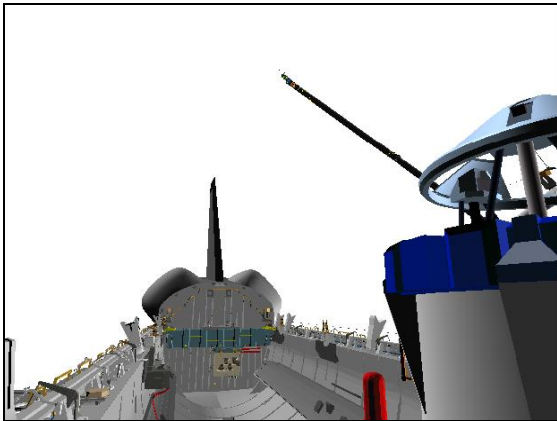
√ PL ID, ITEM 3: 1

√ INIT ID, ITEM 24: 1

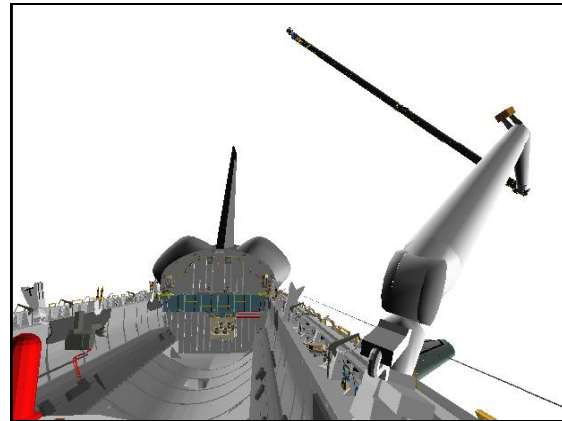
Verify at OBSS CONTINGENCY UNDOCK posn:

	X	Y	Z	PITCH	YAW	ROLL	PL ID
√	-1131	-496	-586	62	324	282	1
	SY	SP	EP	WP	WY	WR	
√	+35.1	+38.6	-22.9	-0.4	-0.2	-40.1	

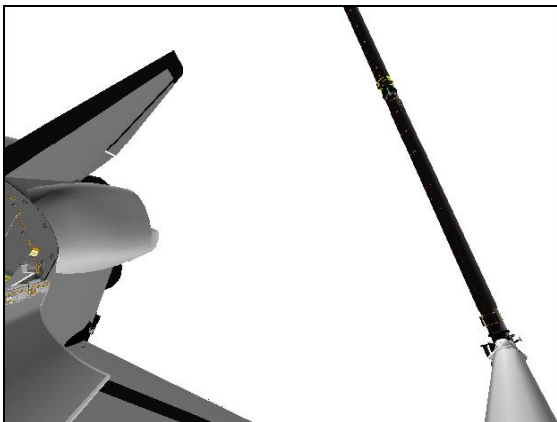
MON 1	D
MON 2	A
DNLK	ELBOW
DTV	B



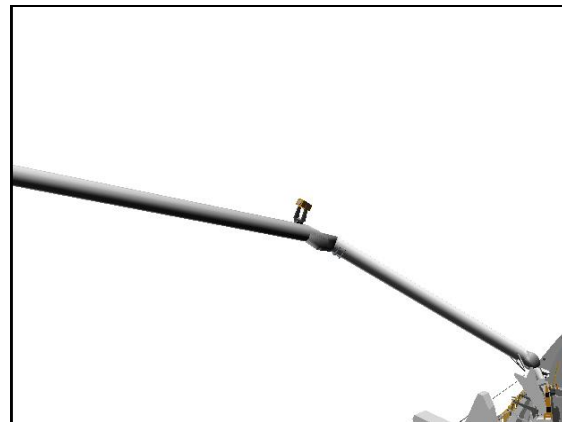
CCTV D (15,15)



CCTV A (5,10)



ELBOW (-30,-5)



CCTV B (-25,15)

2. MNVR TO NOMINAL UNDOCK POSN

SM 94 PDRS CONTROL

END POS – ITEM 18 -1041 -362 -602 EXEC
 ATT – ITEM 21 +44 +270 +0 EXEC
 CMD CK – ITEM 25 EXEC (GOOD)

RHC

RATE – VERN (RATE MIN tb-ON)
 BRAKES – OFF (tb-OFF)
 MODE – OPR CMD, ENTER (READY It on)

AUTO SEQ – PROCEED (IN PROG It on)

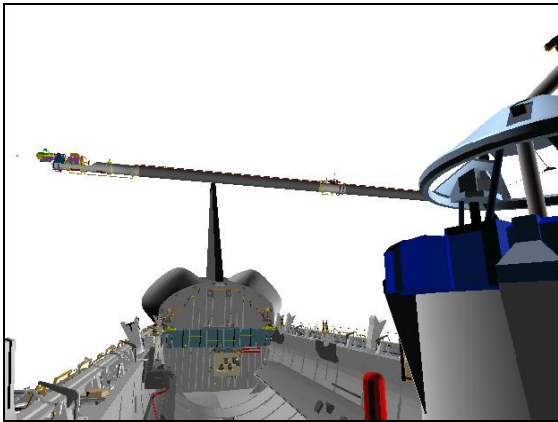
When AUTO SEQ IN PROG It – off:
 BRAKES – ON (tb-ON)

OBSS UNDOCK posn:

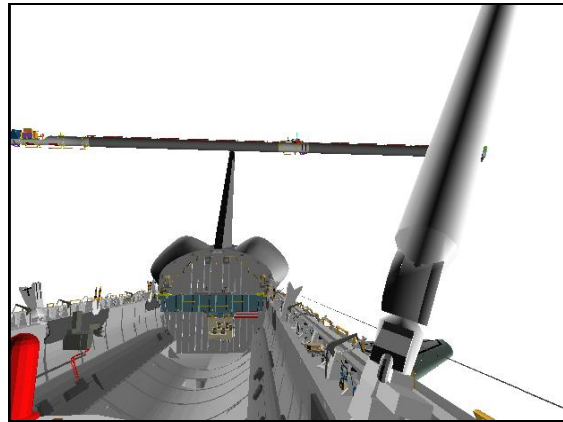
	X	Y	Z	PITCH	YAW	ROLL	PL ID	
√	-1041	-362	-602	44	270	0	1	*
	SY	SP	EP	WP	WY	WR		
√	+25.8	+66.3	-49.0	-85.9	+10.7	-100.7		

*Display singularity

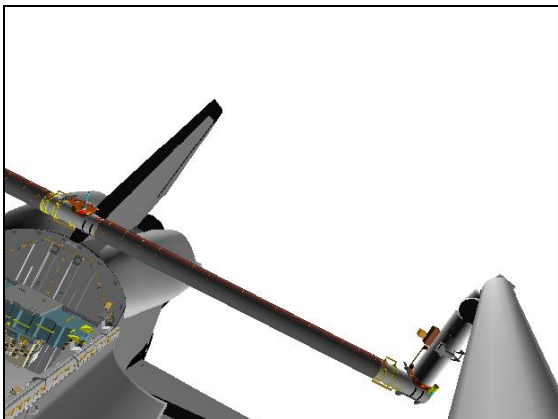
MODE – not DIRECT (It off)
 PARAM – PORT TEMP
 JOINT – CRIT TEMP



CCTV D (15,15)



CCTV A (5,10)



ELBOW (-30,5)



CCTV B (-25,15)

OBSS SJ HANDOFF FROM SSRMS TO SRMS

1. SETUP

SM 94 PDRS CONTROL

√PL ID, ITEM 3: 0

√INIT ID, ITEM 24: 0

A7U CCTV – config as reqd
 – perform PAN/TILT RESET for PLB cameras
 ZOOM – full OUT

R12(VPU) √Green Jumper – ISS

MON 1	A
MON 2	B
DNLK	ELBOW (EE)
DTV	P1 LOOB

2. SINGLE JOINT MANUEVER TO OBSS PRE-GRAPPLE AT HANDOFF

√MCC to verify SSRMS at Stage Park posn

If SINGLE mode available:

RHC RATE – as reqd (VERN within 10 ft)
 BRAKES – OFF (tb-OFF)

MODE – best available

Mnvr to OBSS PRE-GRAPPLE AT HANDOFF posn:

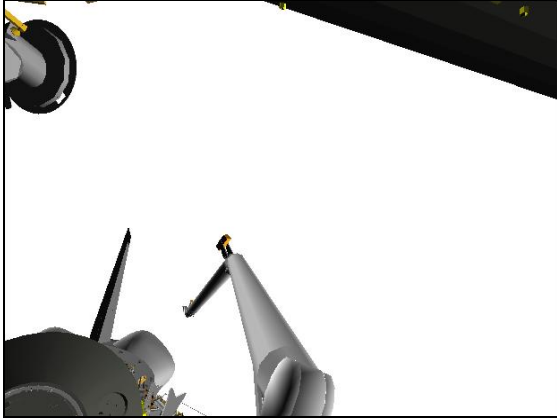
	SY	SP	EP	WP	WY	WR	
PRECRADLE	0.0	+25.0	-25.0	+5.0	0.0	0.0	
1: SP +		+57.5					
2: WP –				-99.3			
3: WY +					+11.8		
4: WR –						-97.9	
5: EP –			-27.4				
6: SY +	+22.7						
OBSS PRE-GRAPPLE AT HANDOFF	+22.7	+57.5	-27.4	-99.3	+11.8	-97.9	
	X	Y	Z	PITCH	YAW	ROLL	PL ID
	-1047	-360	-658	284	0	270	0

BRAKES – ON (tb-ON)
 MODE – not DIRECT (lt off)
 PARAM – PORT TEMP
 JOINT – CRIT TEMP

**Notify SSRMS Operator that SRMS at OBSS Pre-Grapple at Handoff posn,
 GO for OBSS Grapple**

Start:
PRECRADLE

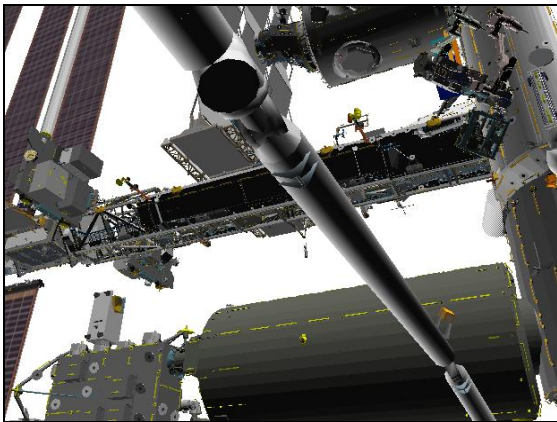
Step 1:
Drive SP (+) from +25.0 to +57.5



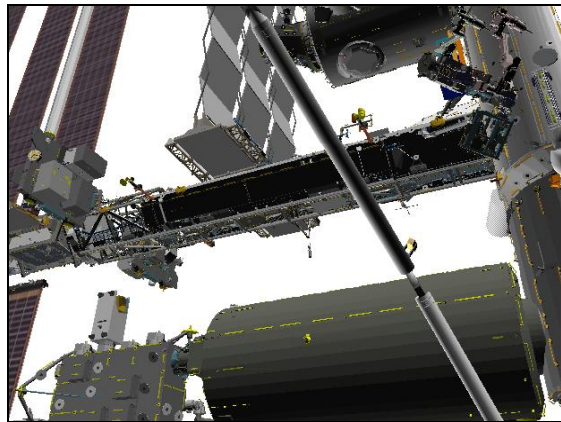
CCTV A (20,25)



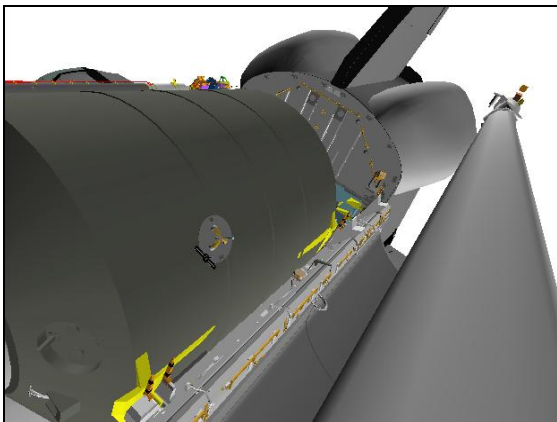
CCTV A (20,25)



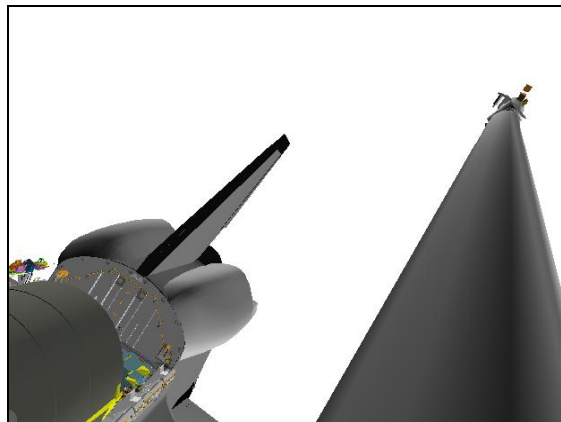
CCTV B (-25,30)



CCTV B (-25,30)



ELBOW (-30,-20)



ELBOW (-30,-20)

Step 2:
Drive WP (-) from +5.0 to -99.3

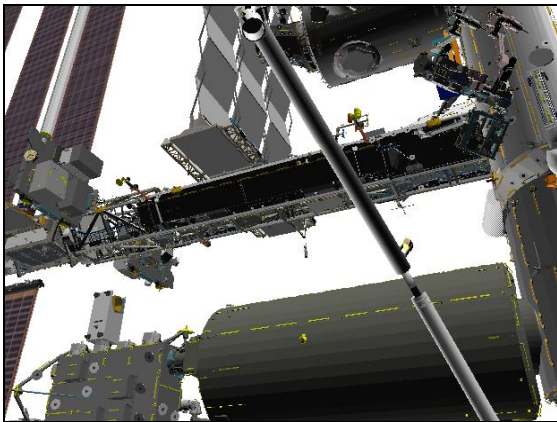
Step 3:
Drive WY (+) from 0.0 to +11.8



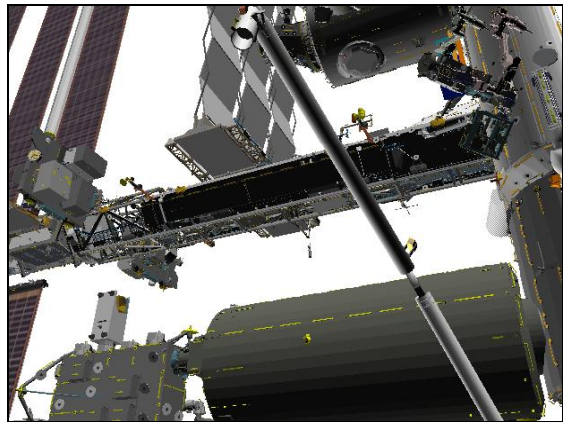
CCTV A (20,25)



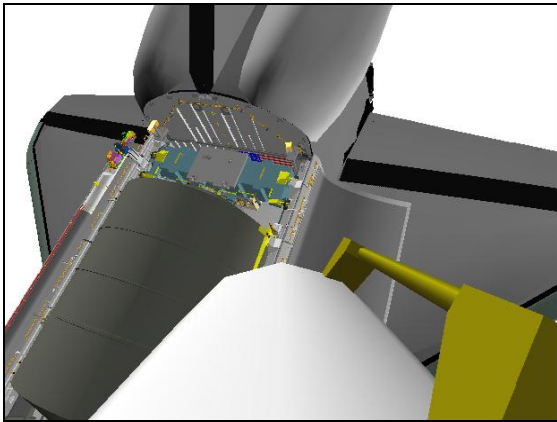
CCTV A (20,25)



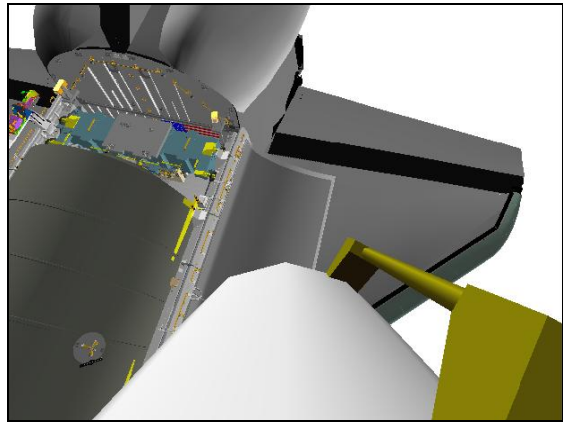
CCTV B (-25,30)



CCTV B (-25,30)



EE



EE

Step 4:
Drive WR (-) from 0.0 to -97.9

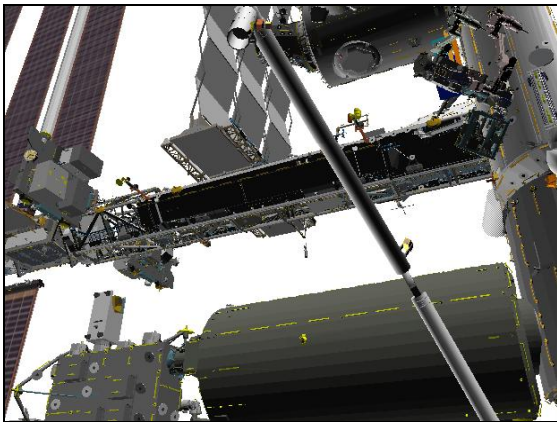
Step 5:
Drive EP (-) from -25.0 to -27.4



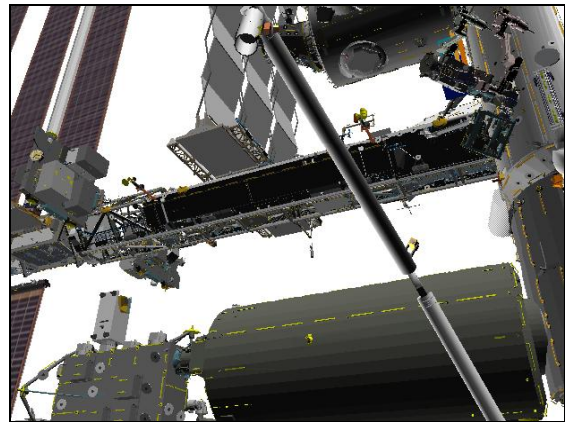
CCTV A (20,25)



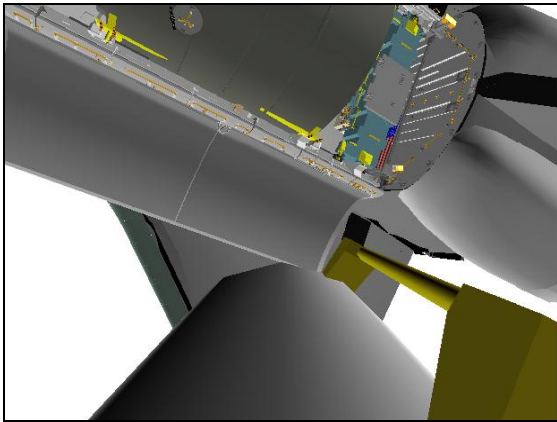
CCTV A (20,25)



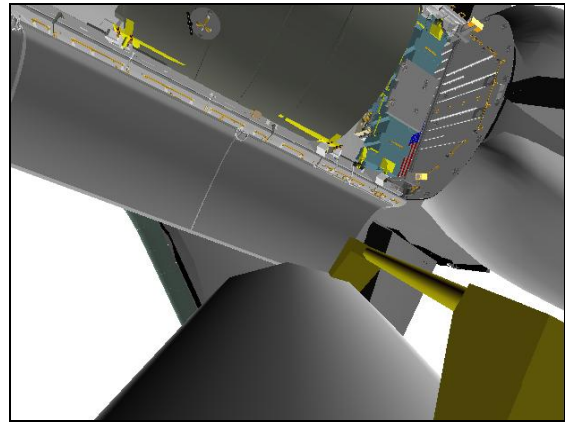
CCTV B (-25,30)



CCTV B (-25,30)



EE

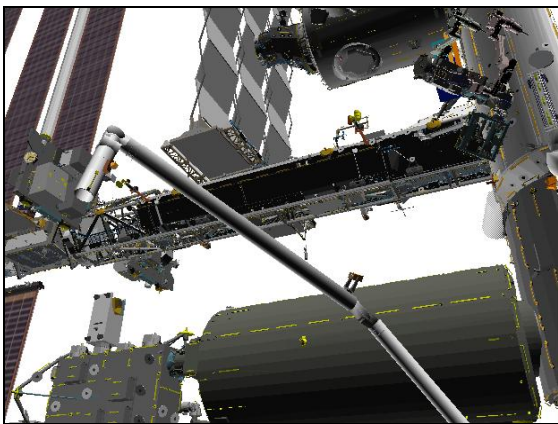


EE

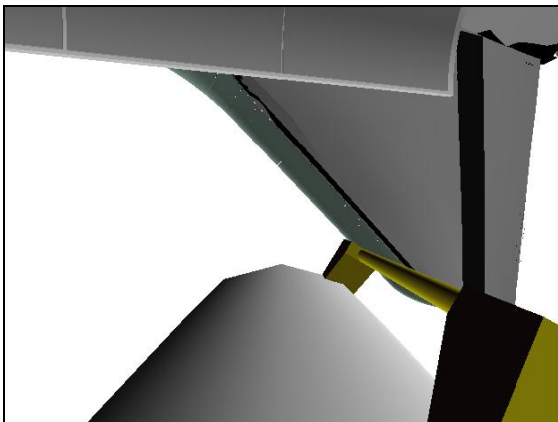
Step 6:
Drive SY (+) from 0.0 to +22.7



CCTV A (20,25)



CCTV B (-25,30)



EE

3. CONFIGURE POWER

<p>CAUTION SPEE power must be applied within 90 min to prevent sensor package damage</p>

**On SSRMS Operator GO to release STBD MRLs,
STBD RMS HTR A,B (two) – OFF**

A6U EVENT TIMER MODE – UP
 CNTL – START

MA73C:C cb MCA PWR AC3 3Φ MID 2 – op
 √AC2 3Φ MID 2 – op

MA73C:D √AC3 3Φ MID 4 – op

R13L PL BAY MECH PWR SYS (two) – ON

4. STBD MRL RELEASE

<p>SM 94 PDRS CONTROL</p>

RMS STBD – ITEM 2 EXEC (*)
√STBD AFT, MID, FWD REL (six) = 0

NOTE

Expect single motor drive time for MRL release

STBD RMS RETEN LAT – REL (tb-REL) (18 sec max)
– OFF

If motor drive time > 18 sec, √MCC

<p>SM 94 PDRS CONTROL</p>

√STBD AFT, MID, FWD REL (six) = 1

5. RECONFIGURE POWER

R13L PL BAY MECH PWR SYS (two) – OFF

MA73C:C cb MCA PWR AC3 3Φ MID 2 – cl
 √AC2 3Φ MID 2 – op

MA73C:D √AC3 3Φ MID 4 – op

Give SSRMS Operator GO for OBSS Unberth

Monitor R-F-L Status

After OBSS Unberth,

<p>SM 94 PDRS CONTROL</p>

RMS PORT – ITEM 1 EXEC (*)

- A7U 6. SETUP FOR GRAPPLE
 CCTV – config for grapple
 – install OBSS SJ GRAPPLE AT HANDOFF OVERLAY
 – RMS WRIST, ZOOM: 34.0 HFOV
 FOCUS: 5 ft
 Maintain eyepoint approx 18 in when using grapple overlay

MON 1	A
MON 2	B
DNLK	EE (ELBOW)
DTV	BASE ELBOW

- R12(OBSS) √SPEE PWR – OFF
 SSP √APCU 2 OUTPUT RLY – OP (tb-bp)

7. OBSS SJ GRAPPLE AT HANDOFF POSN
On SSRMS Operator GO for OBSS Grapple

- RHC If SINGLE mode available:
 RATE – VERN (RATE MIN tb-ON)
 BRAKES – OFF (tb-OFF)

MODE – best available

Drive joints per OBSS SJ GRAPPLE AT HANDOFF OVERLAY and diagram until EE within grapple envelope

CAUTION
 Monitor EE tb timing to prevent EE motor burnout

EE MODE – AUTO
 CAPTURE sw – depress (mom)

<p>√ RIGID</p> <div style="border: 1px solid black; width: 40px; height: 40px; margin: 5px auto;"></div> <p>DERIGID</p> <div style="border: 1px solid black; width: 40px; height: 40px; margin: 5px auto; background: repeating-linear-gradient(45deg, transparent, transparent 2px, black 2px, black 4px);"></div>	<p>CLOSE</p> <div style="border: 1px solid black; width: 40px; height: 40px; margin: 5px auto;"></div> <p>OPEN</p> <div style="border: 1px solid black; width: 40px; height: 40px; margin: 5px auto; background: repeating-linear-gradient(45deg, transparent, transparent 2px, black 2px, black 4px);"></div>	<p>CAPTURE</p> <div style="border: 1px solid black; width: 40px; height: 40px; margin: 5px auto;"></div> <p>EXTEND</p> <div style="border: 1px solid black; width: 40px; height: 40px; margin: 5px auto; background: repeating-linear-gradient(45deg, transparent, transparent 2px, black 2px, black 4px);"></div>	<p>CRITICAL TIMES (28 sec total): CAPTURE tb – gray, then CLOSE tb – gray, 3 sec max, then RIGID tb – gray, 25 sec max</p>
---	--	--	--

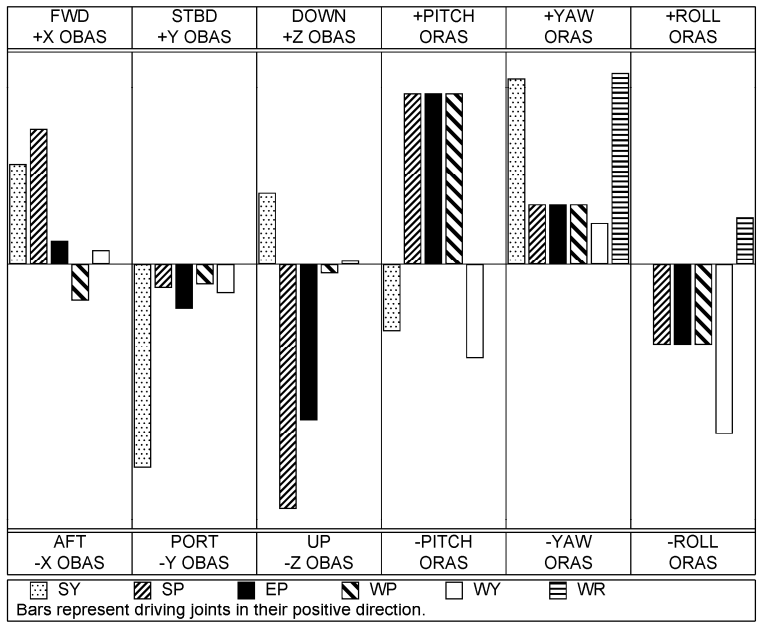
EE MODE – OFF

- * If manual capture required: *
- * EE MODE – MAN *
- * CAPTURE sw – depress (hold until CLOSE tb-gray, 3 sec max) *
- * MAN CONTR – RIGID (hold until RIGID tb-gray, 25 sec max) *
- * MODE – OFF *

If TEST mode available:
 MODE – TEST, ENTER
 Wait 5 sec

BRAKES – ON (tb-ON)
 MODE – not DIRECT (It off)
 JOINT – CRIT TEMP

OBSS SJ GRAPPLE AT HANDOFF



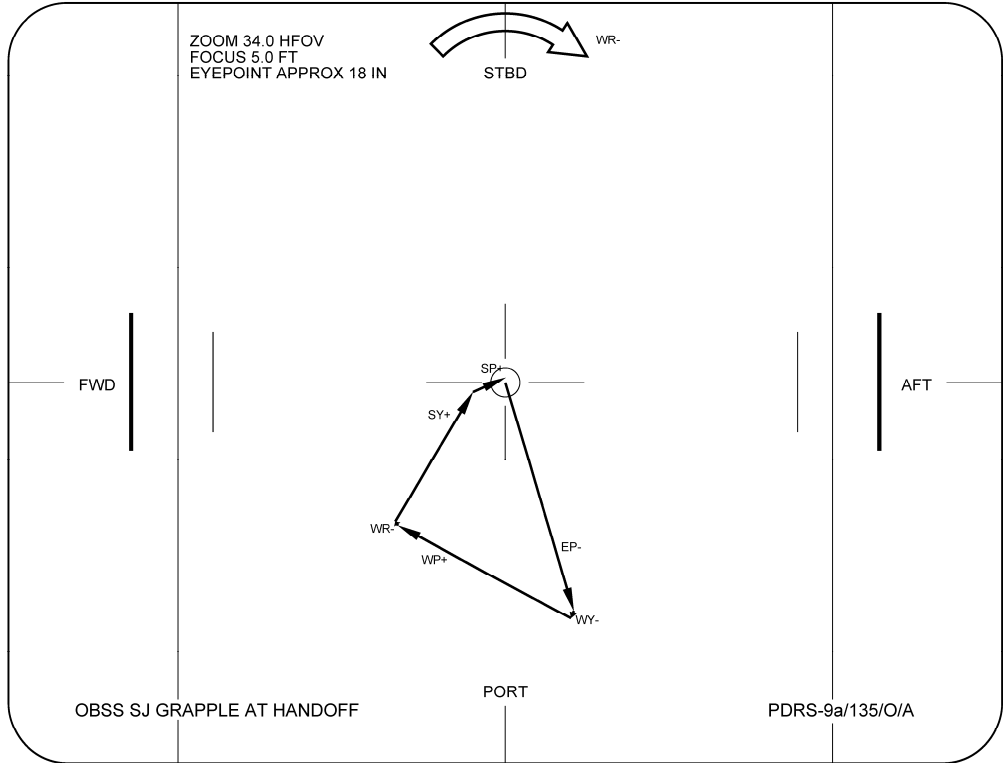
To get:	Drive:
+X (fwd)	+SP, +SY
+Y (stbd)	-SY
+Z (down)	-SP, -EP

To get:	Drive:
+PITCH	+WP, +EP
+YAW	+WR, +SY
+ROLL	-WY, -WP

Driving:	Results In:
+SY	-Y (port), +YAW
+SP	-Z (up), +PITCH
+EP	-Z (up), +PITCH

Driving:	Results In:
+WP	-X (aft), +PITCH
+WY	-Y (port), -ROLL
+WR	+YAW

ΔSY	ΔSP	ΔEP	ΔWP	ΔWY	ΔWR
+1.8	+1.5	-14.7	+13.4	-0.6	-1.5



If digitals available:

SM 94 PDRS CONTROL

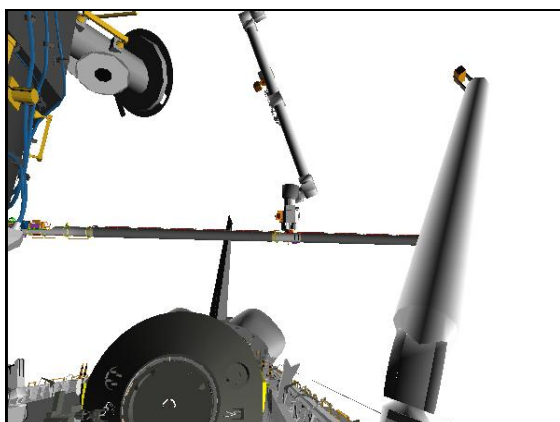
PL ID – ITEM 3 +2 EXEC

INIT ID – ITEM 24 +2 EXEC

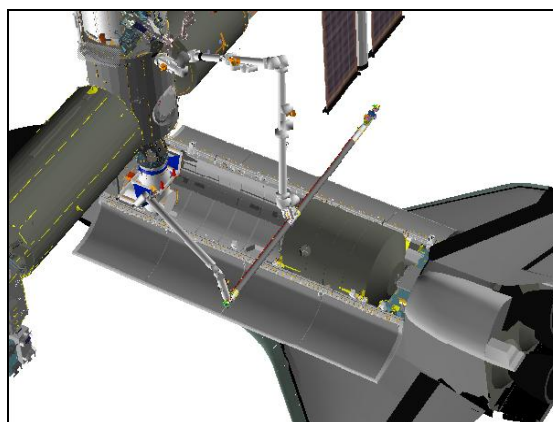
Expected OBSS HANDOFF posn:

	X	Y	Z	PITCH	YAW	ROLL	PL ID
√	-1059	+231	-597	14	270	0	2
	SY	SP	EP	WP	WY	WR	
√	+24.5	+59.0	-42.1	-85.9	+11.2	-99.4	

*Display singularity



CCTV A (5,20)



BIRD'S EYE

Review GENERIC END EFFECTOR CUE CARD – ISS/SHUTTLE DOCKED OPS

Give SSRMS Operator GO for OBSS Ungrapple

Perform ACTIVATION (LDRI/ITVC Cue Card, PHOTO/TV)

Perform LCH ACTIVATION (LCS Cue Card, PHOTO/TV)

Perform LCC ACTIVATION (LCS Cue Card, PHOTO/TV), step 2

Perform LCC DEACTIVATION (LCS Cue Card, PHOTO/TV), step 1

8. SINGLE JOINT MNVR TO MPLM VIEWING

On SSRMS Operator GO for mnvr to MPLM Viewing

R12(VPU) √Green Jumper – ISS

MON 1	A
MON 2	B
DNLK	ELBOW
DTV	S1 LOOB

RHC

If SINGLE mode available:

RATE – as reqd (VERN within 10 ft)

BRAKES – OFF (tb-OFF)

MODE – best available

Mnvr to MPLM VIEWING posn:

OBSS
HANDOFF

- 1: WR +
- 2: WY -
- 3: WP +
- 4: EP +
- 5: WP +
- 6: SP -
- 7: SY +
- 8: SP -
- 9: WR +
- 10: WY -

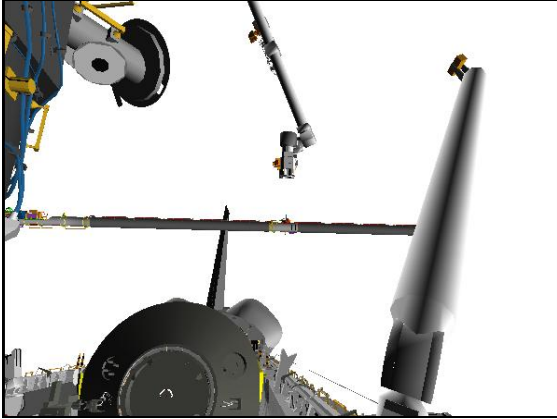
MPLM
VIEWING

SY	SP	EP	WP	WY	WR	
+24.5	+59.0	-42.1	-85.9	+11.2	-99.4	
					-75.0	
				0.0		
			-60.0			
		-23.0				
			0.0			
	+49.0					
+62.5						
	+25.0					
					-21.9	
				-13.2		
+62.5	+25.0	-23.0	0.0	-13.2	-21.9	
X	Y	Z	PITCH	YAW	ROLL	PL ID
-1252	-520	-889	60	349	312	2

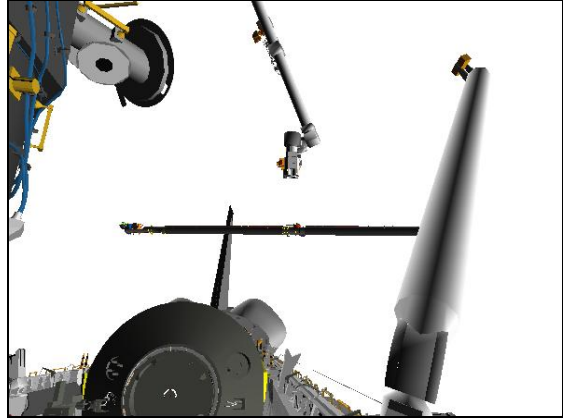
- BRAKES – ON (tb-ON)
- MODE – not DIRECT (It off)
- PARAM – PORT TEMP
- JOINT – CRIT TEMP

Start:
OBSS HANDOFF posn

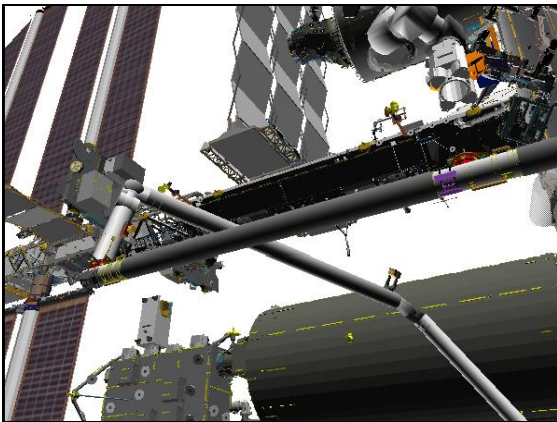
Step 1:
Drive WR (+) from -99.4 to -75.0



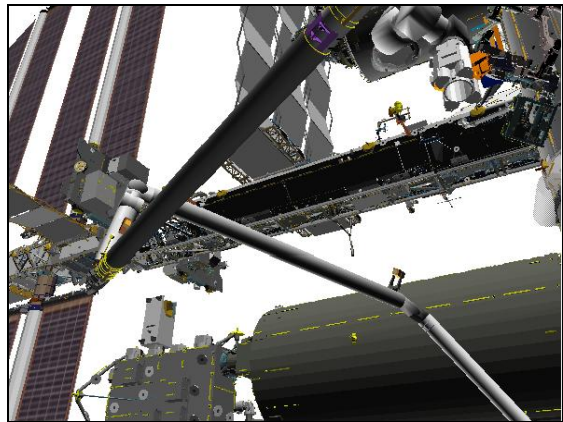
CCTV A (5,20)



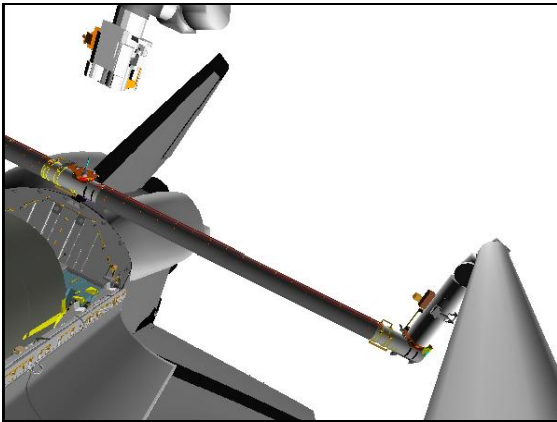
CCTV A (5,20)



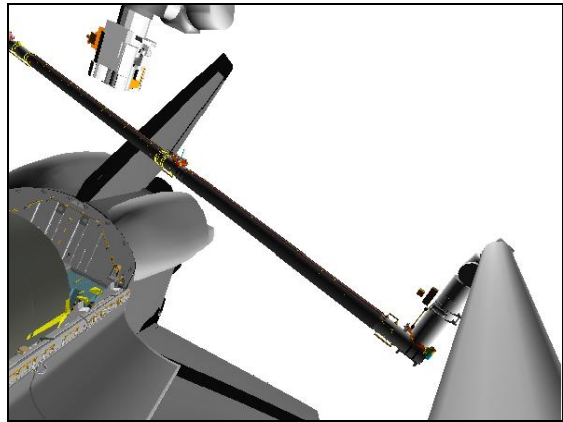
CCTV B (-30,30)



CCTV B (-30,30)



ELBOW (-30,0)



ELBOW (-30,0)

Step 2:
Drive WY (-) from +11.2 to 0.0

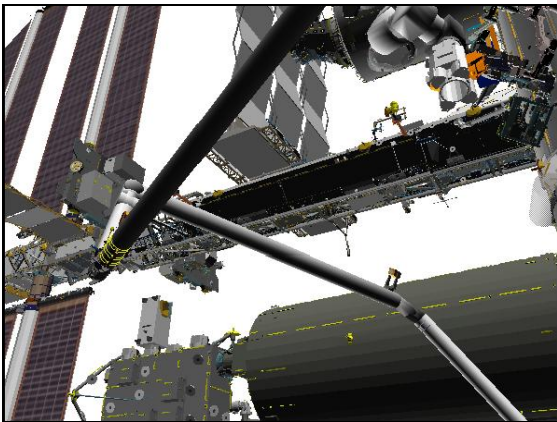
Step 3:
Drive WP (+) from -85.9 to -60.0



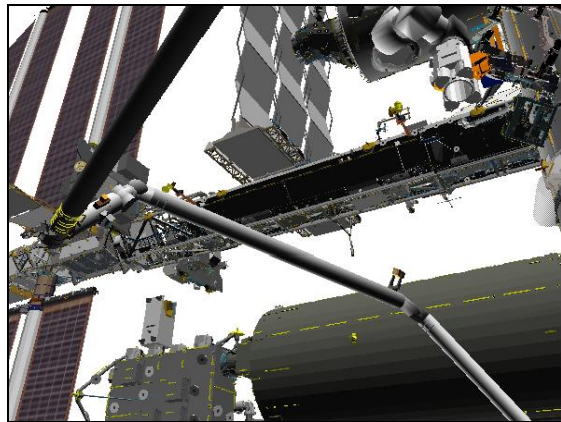
CCTV A (5,20)



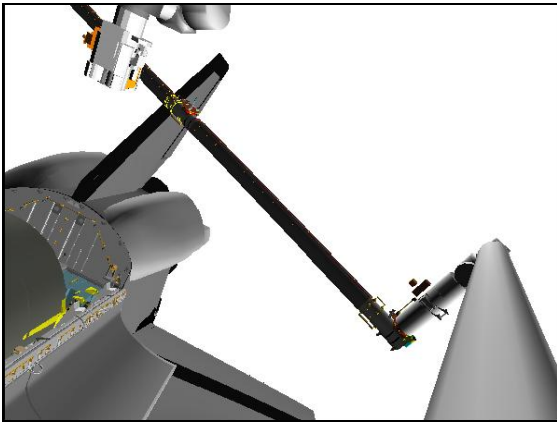
CCTV A (5,20)



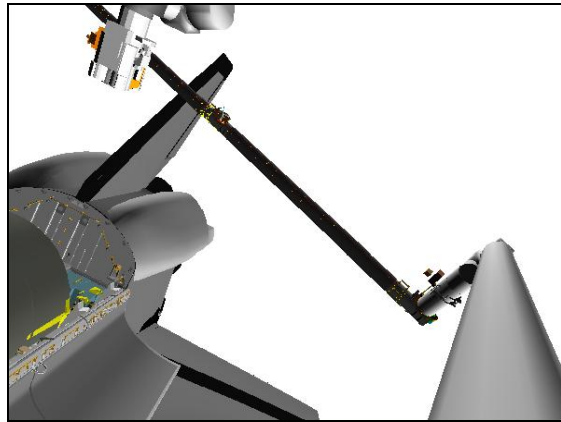
CCTV B (-30,30)



CCTV B (-30,30)



ELBOW (-30,0)



ELBOW (-30,0)

Step 4:
Drive EP (+) from -42.1 to -23.0

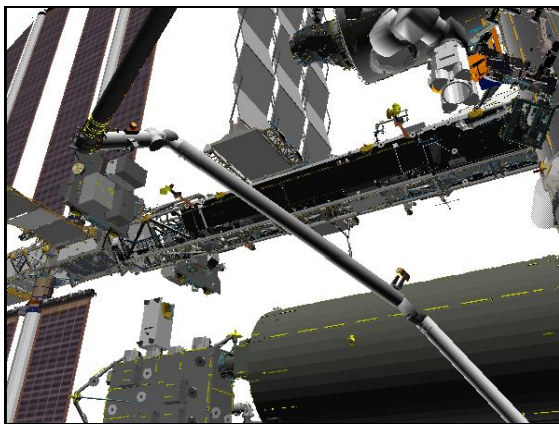


CCTV A (5,20)

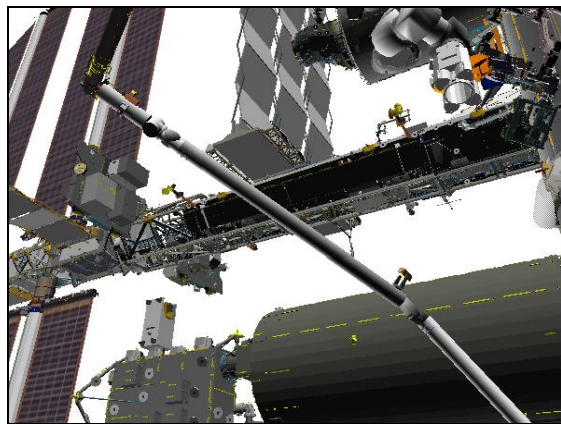
Step 5:
Drive WP (+) from -60.0 to 0.0



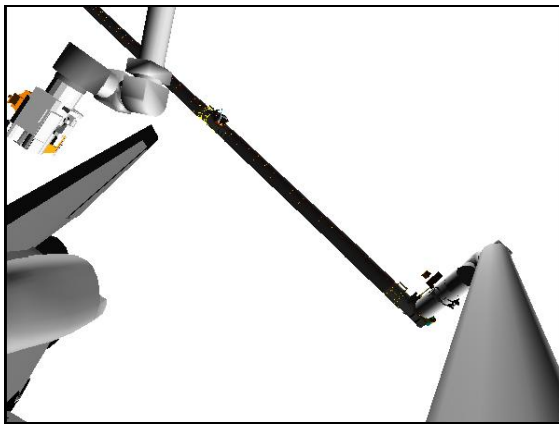
CCTV A (5,20)



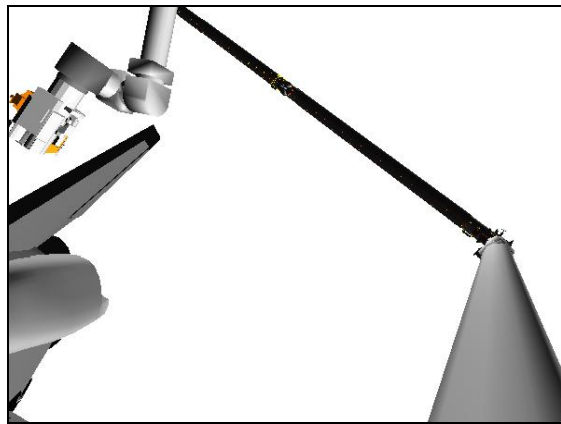
CCTV B (-30,30)



CCTV B (-30,30)



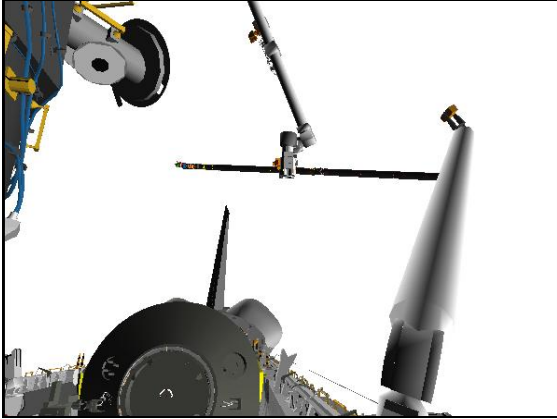
ELBOW (-30,0)



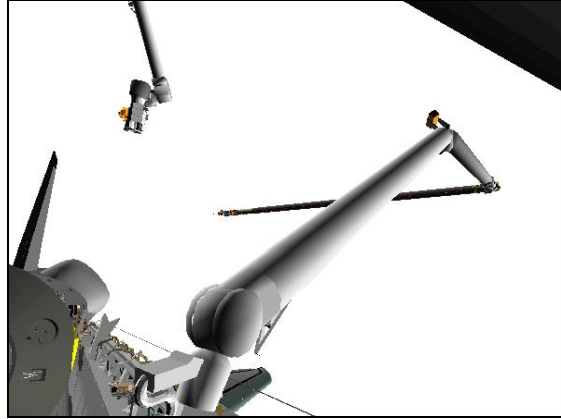
ELBOW (-30,0)

Step 6:
Drive SP (-) from +59.0 to +49.0

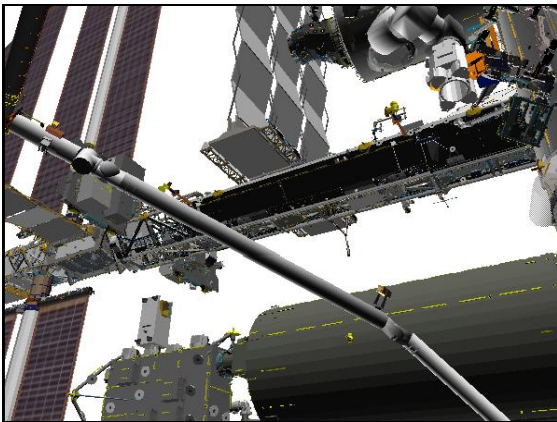
Step 7:
Drive SY (+) from +24.5 to +62.5



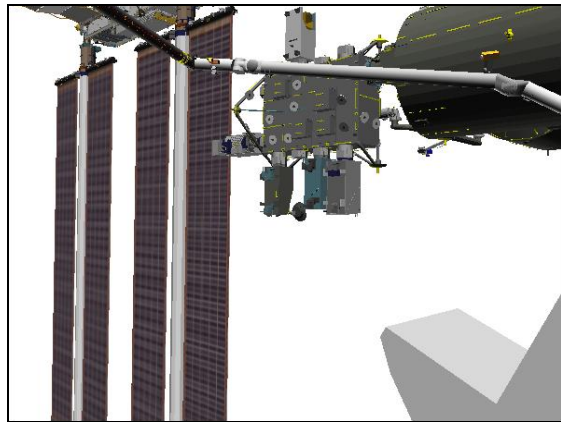
CCTV A (5,20)



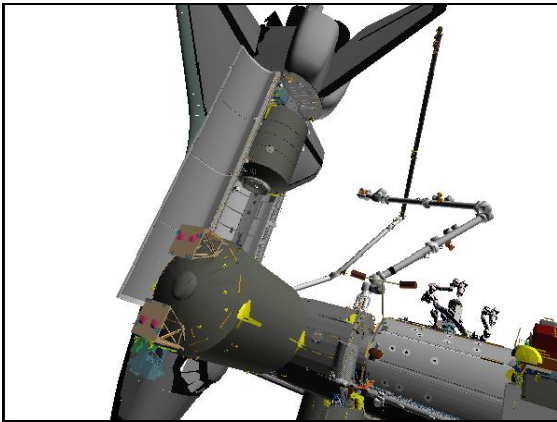
CCTV A (30,15)



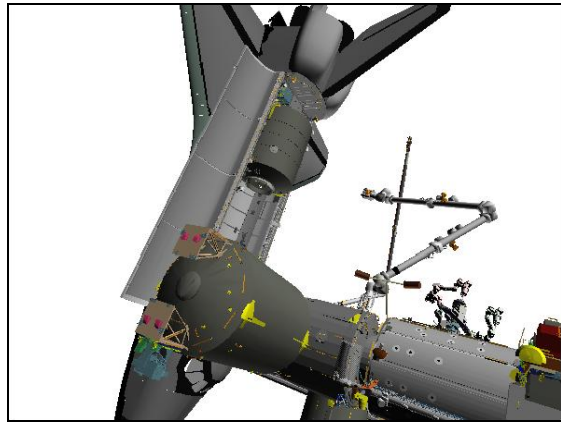
CCTV B (-30,30)



CCTV B (-45,0)



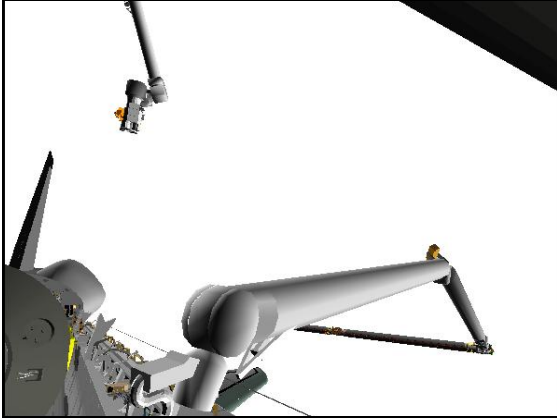
S1 LOOB (80,60)



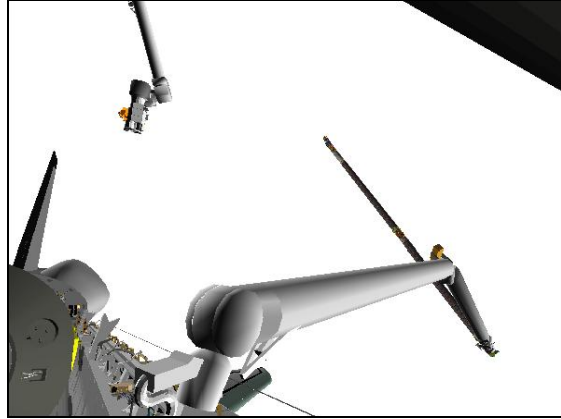
S1 LOOB (80,60)

Step 8:
Drive SP (-) from +49.0 to +25.0

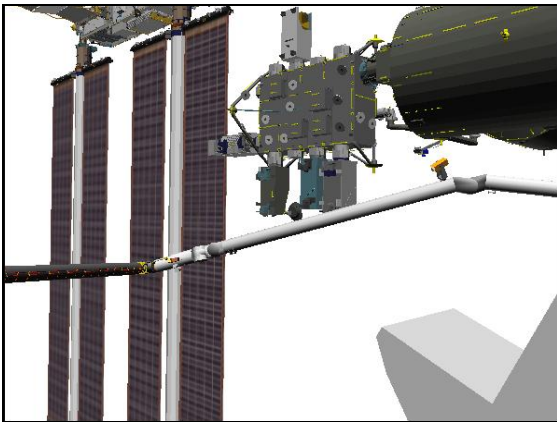
Step 9:
Drive WR (+) from -75.0 to -21.9



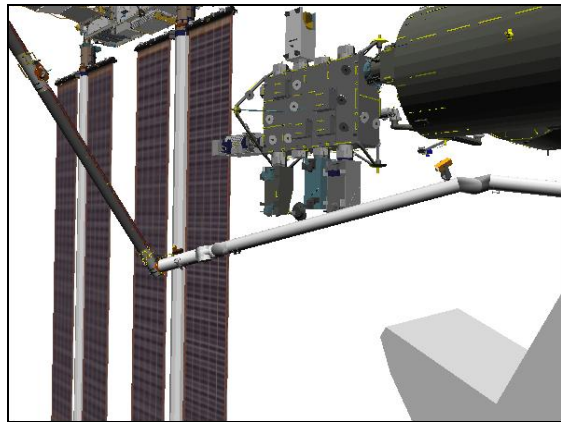
CCTV A (30,15)



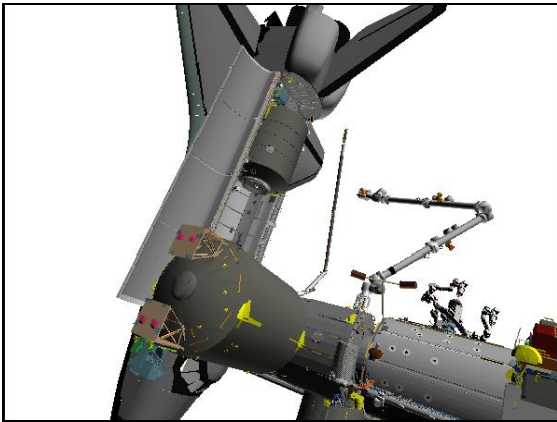
CCTV A (30,15)



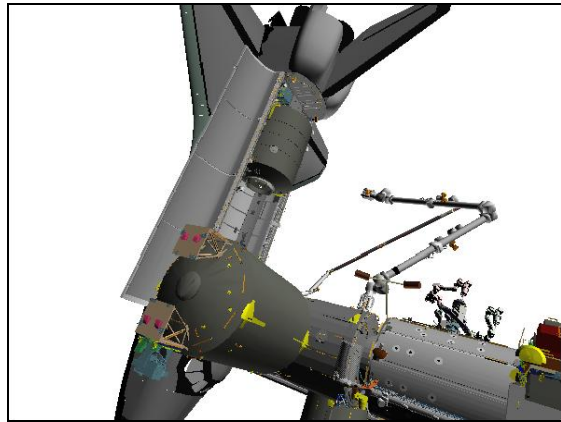
CCTV B (-45,0)



CCTV B (-45,0)

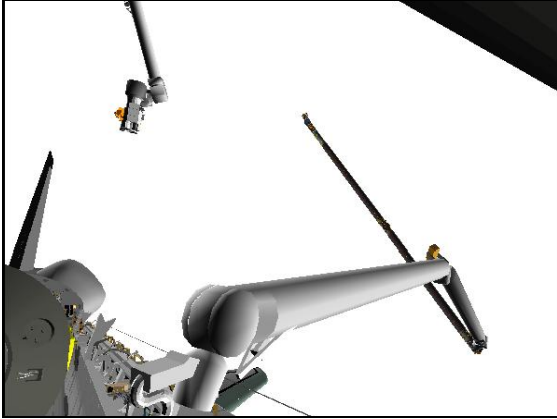


S1 LOOB (80,60)

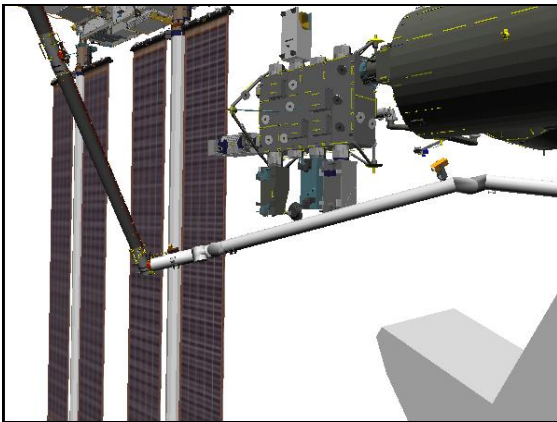


S1 LOOB (80,60)

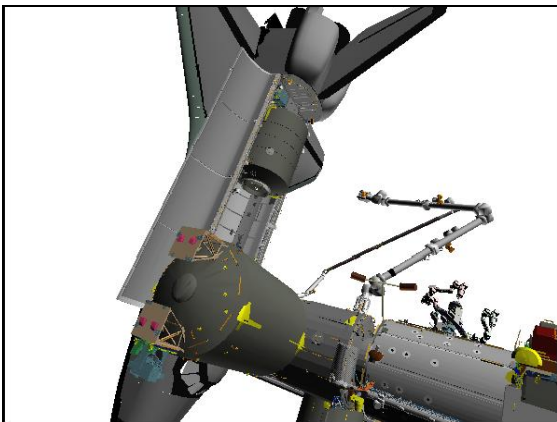
Step 10:
Drive WY (-) from 0.0 to -13.2



CCTV A (30,15)



CCTV B (-45,0)



S1 LOOB (80,60)

MPLM VIEWING posn:

	X	Y	Z	PITCH	YAW	ROLL	PL ID
√	-1252	-520	-889	60	349	312	2
	SY	SP	EP	WP	WY	WR	
√	+62.5	+25.0	-23.0	0.0	-13.2	-21.9	

9. CONFIGURE CAMERAS FOR MPLM INSTALL
R12(VPU) Green Jumper – LDRI/ITVC
A7U DTV ← PL2

CAMR CMD PAN/TILT – HI RATE

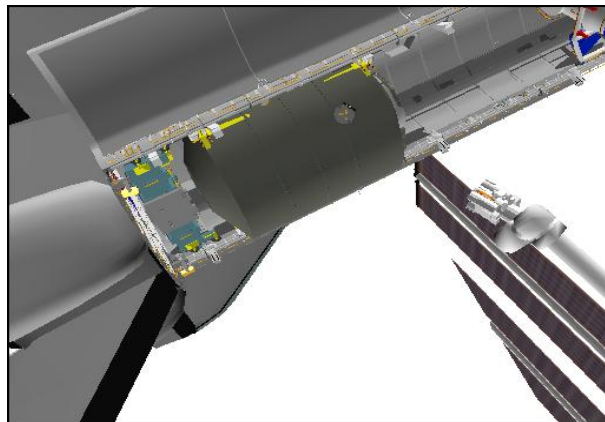
PAN – L (to hard stop)

TILT – UP (to hard stop)

PAN/TILT – RESET, HI RATE (LO within 10°)

PAN: +130 (right)

TILT: -60 (down)



OBSS ITVC (130,-60)

- MUX 1 L ← MIDDECK
LDRI MODE 2 pb – push (ITVC video)
VIDEO OUT – as desired (not DTV)
√VIDEO IN – not PL2

OBSS SJ HANDOFF FROM SRMS TO SSRMS

1. SETUP

If digitals available:

SM 94 PDRS CONTROL

√ PL ID, ITEM 3: 2

√ INIT ID, ITEM 24: 2

Verify at MPLM VIEWING posn:

	X	Y	Z	PITCH	YAW	ROLL	PL ID
√	-1252	-520	-889	60	349	312	2
	SY	SP	EP	WP	WY	WR	
√	+62.5	+25.0	-23.0	0.0	-13.2	-21.9	

A7U

CCTV – config as reqd

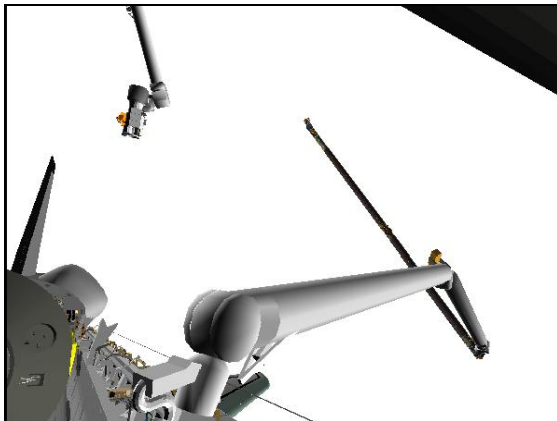
– perform PAN/TILT RESET for PLB cameras

ZOOM – full OUT

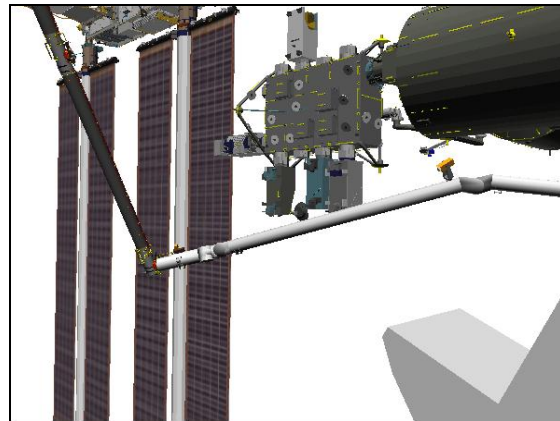
R12(VPU)

√ Green Jumper – ISS

MON 1	A
MON 2	B
DNLK	ELBOW
DTV	S1 LOOB



CCTV A (30,15)



CCTV B (-45,0)

Review GENERIC END EFFECTOR CUE CARD – ISS/SHUTTLE DOCKED OPS

2. SINGLE JOINT MNVR TO OBSS HANDOFF

On SSRMS Operator GO for mnvr to OBSS Handoff

If SINGLE mode available:

RHC

RATE – as reqd (VERN within 10 ft)

BRAKES – OFF (tb-OFF)

MODE – best available

Mnvr to OBSS HANDOFF posn:

MPLM
VIEWING

- 1: WY +
- 2: WR -
- 3: SP +
- 4: SY -
- 5: SP +
- 6: WP -
- 7: EP -
- 8: WP -
- 9: WY +
- 10: WR -

OBSS
HANDOFF

SY	SP	EP	WP	WY	WR	
+62.5	+25.0	-23.0	0.0	-13.2	-21.9	
				0.0		
					-75.0	
	+49.0					
+24.5						
	+59.0					
			-60.0			
		-42.1				
			-85.9			
				+11.2		
					-99.4	
+24.5	+59.0	-42.1	-85.9	+11.2	-99.4	
X	Y	Z	PITCH	YAW	ROLL	PL ID
-1059	+231	-597	14	270	0	2

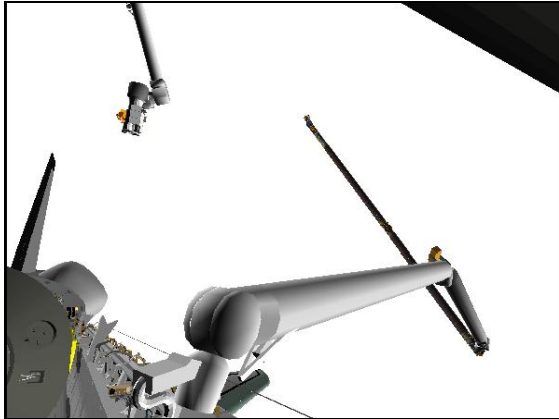
*Display singularity

- BRAKES – ON (tb-ON)
- MODE – not DIRECT (It off)
- JOINT – CRIT TEMP

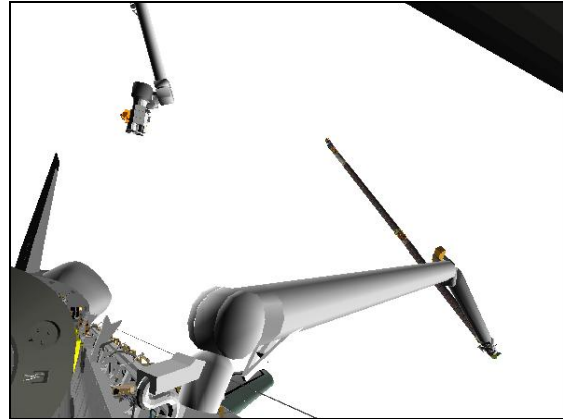
Give SSRMS Operator GO for OBSS Grapple

Start:
MPLM VIEWING posn

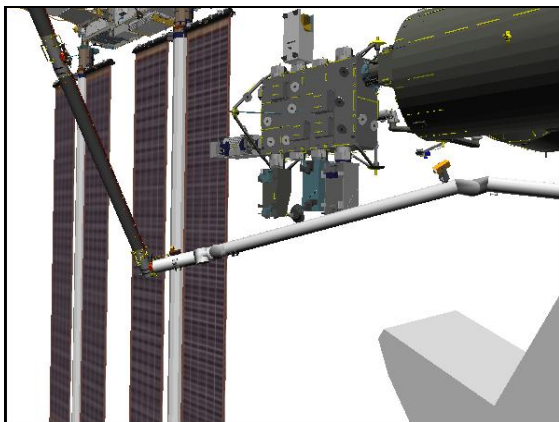
Step 1:
Drive WY (+) from -13.2 to 0.0



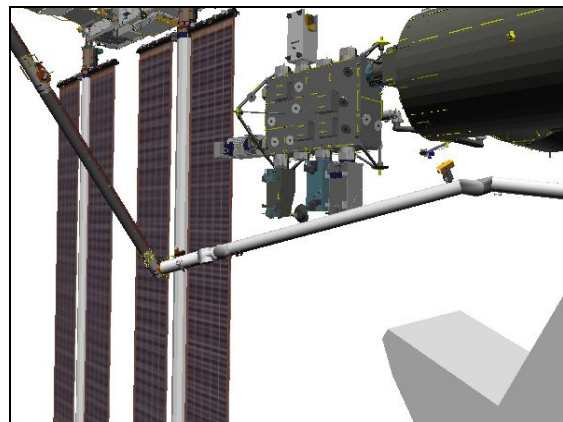
CCTV A (30,15)



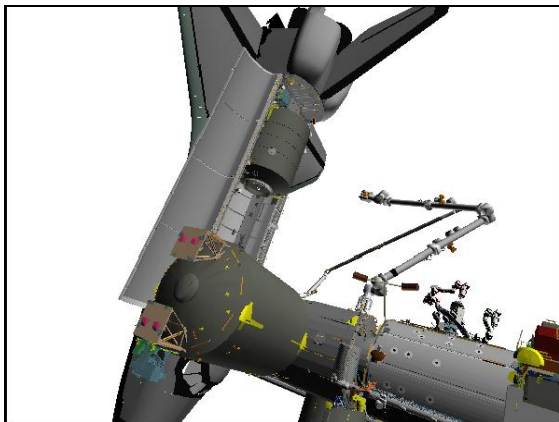
CCTV A (30,15)



CCTV B (-45,0)



CCTV B (-45,0)



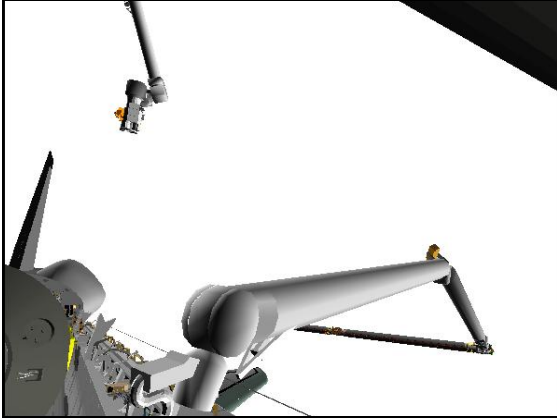
S1 LOOB (80,60)



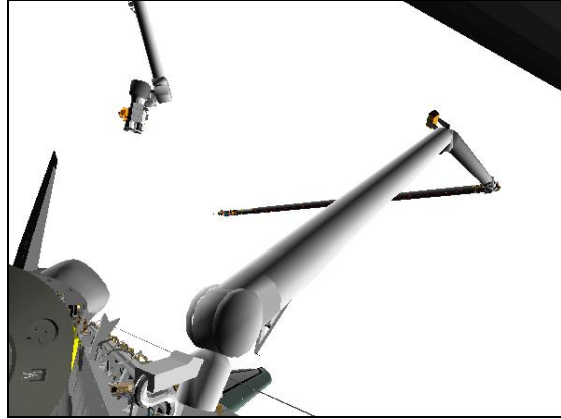
S1 LOOB (80,60)

Step 2:
Drive WR (-) from -21.9 to -75.0

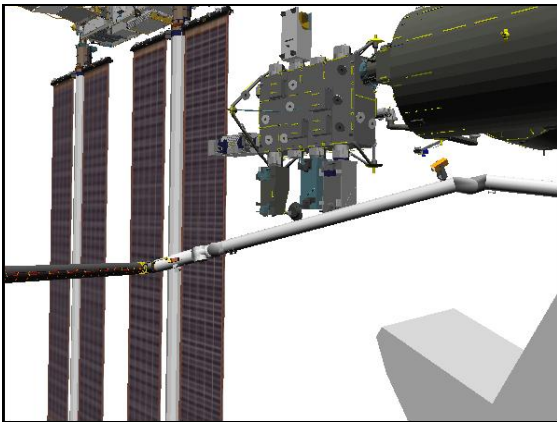
Step 3:
Drive SP (+) from +25.0 to +49.0



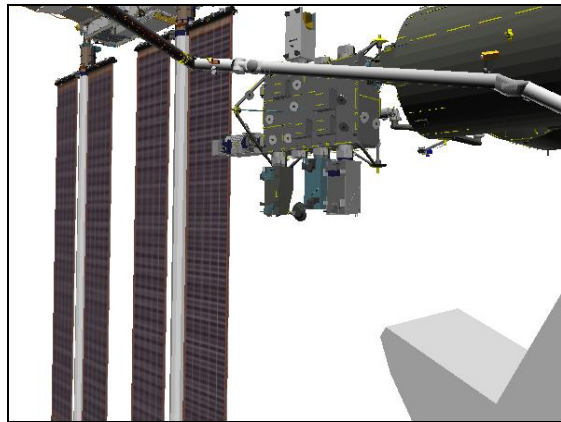
CCTV A (30,15)



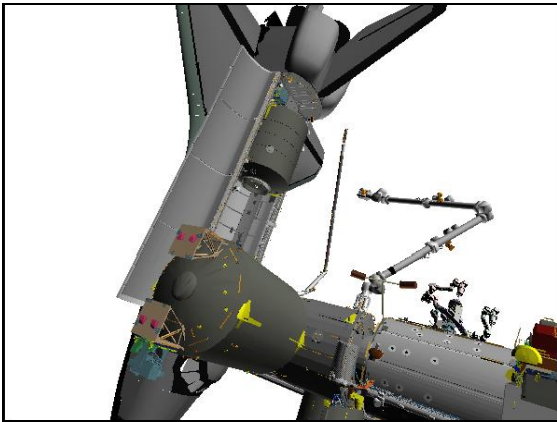
CCTV A (30,15)



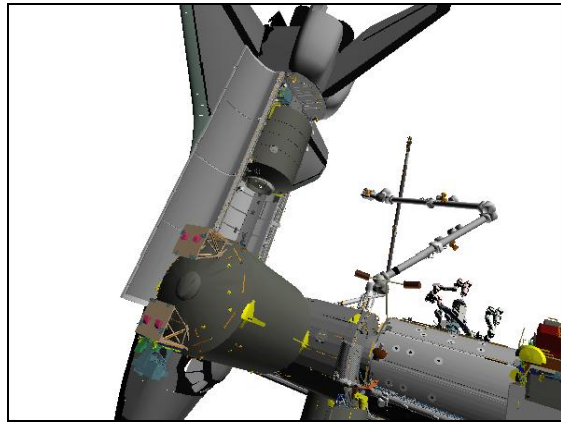
CCTV B (-45,0)



CCTV B (-45,0)



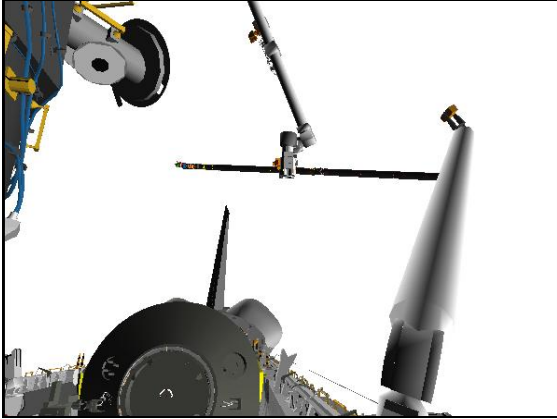
S1 LOOB (80,60)



S1 LOOB (80,60)

Step 4:
Drive SY (-) from +62.5 to +24.5

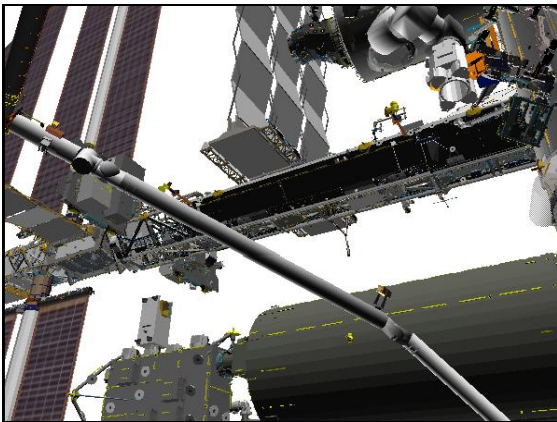
Step 5:
Drive SP (+) from +49.0 to +59.0



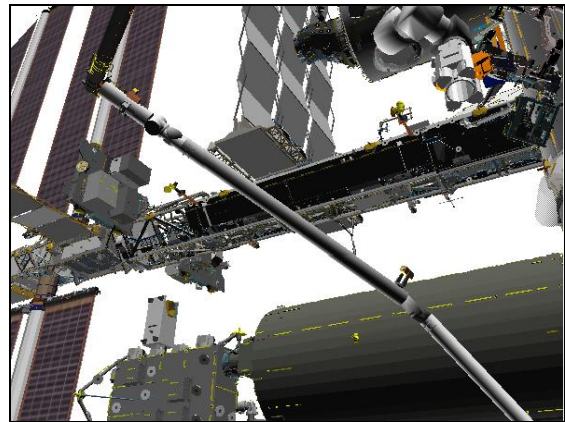
CCTV A (5,20)



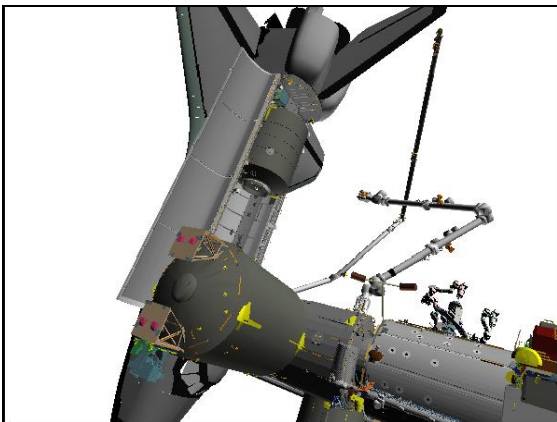
CCTV A (5,20)



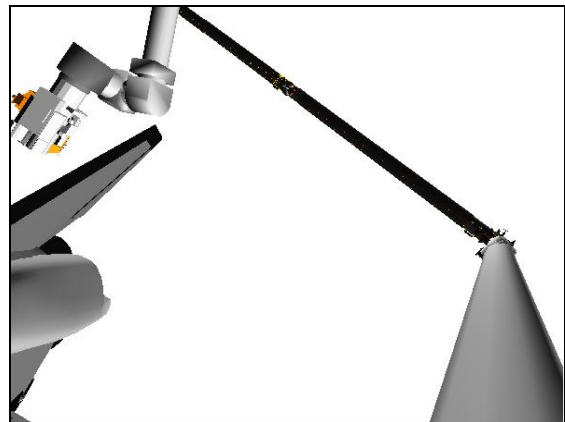
CCTV B (-30,30)



CCTV B (-30,30)



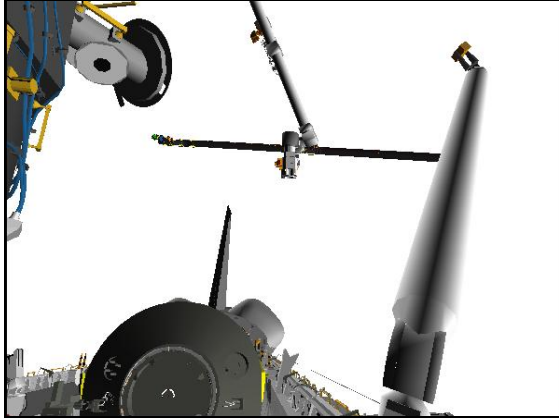
S1 LOOB (80,60)



ELBOW (-30,0)

Step 6:

Drive WP (-) from 0.0 to -60.0



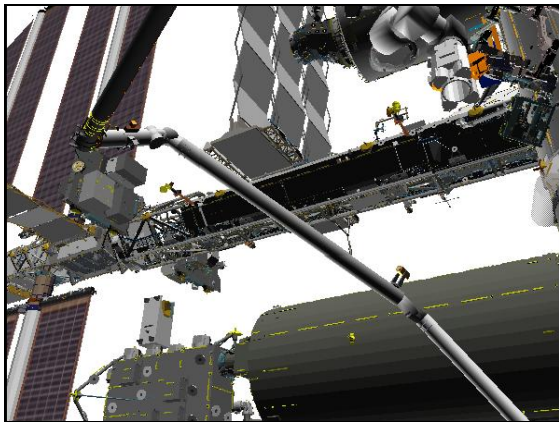
CCTV A (5,20)

Step 7:

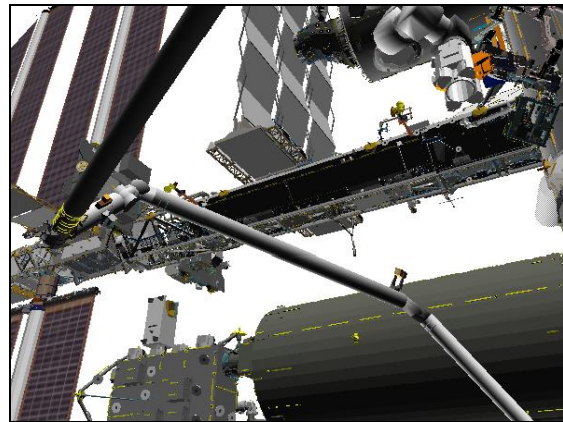
Drive EP (-) from -23.0 to -42.1



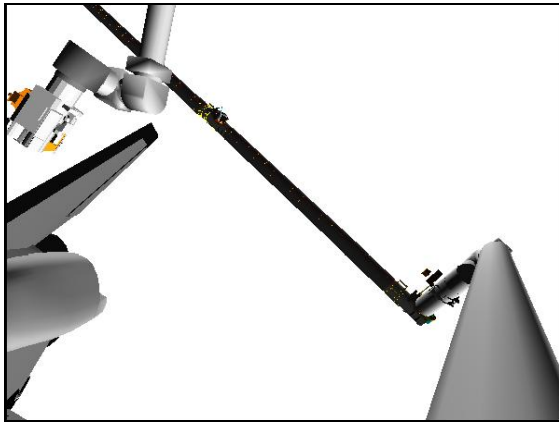
CCTV A (5,20)



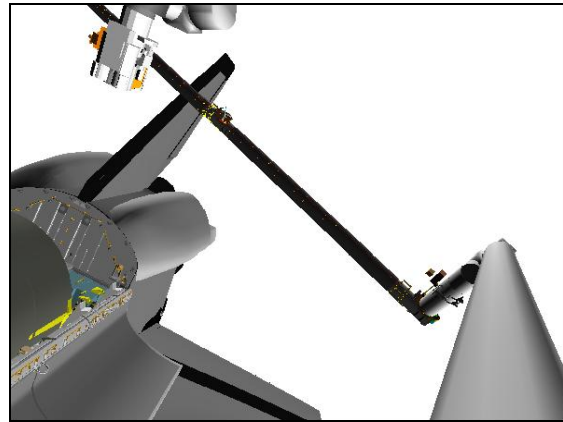
CCTV B (-30,30)



CCTV B (-30,30)



ELBOW (-30,0)



ELBOW (-30,0)

Step 8:
Drive WP (-) from -60.0 to -85.9

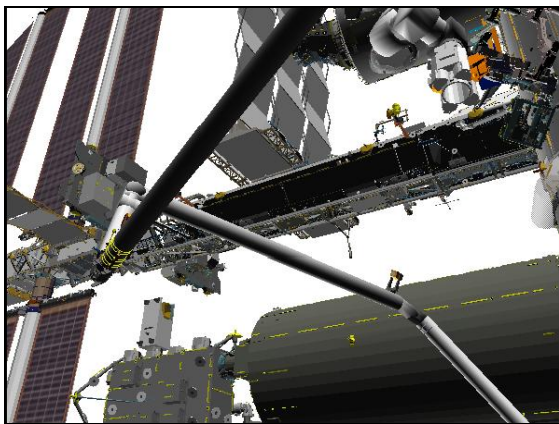


CCTV A (5,20)

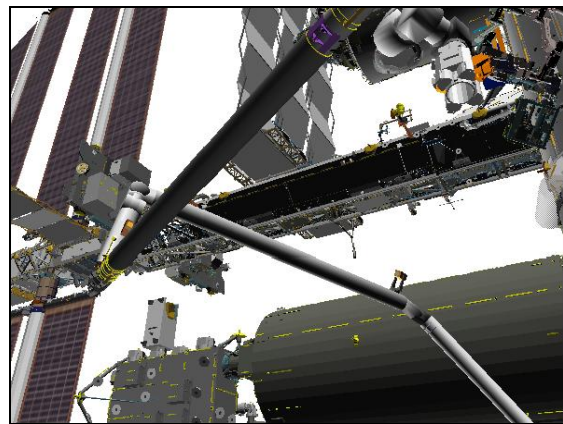
Step 9:
Drive WY (+) from 0.0 to +11.2



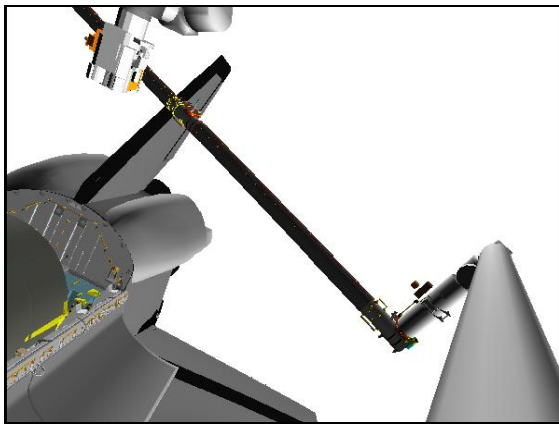
CCTV A (5,20)



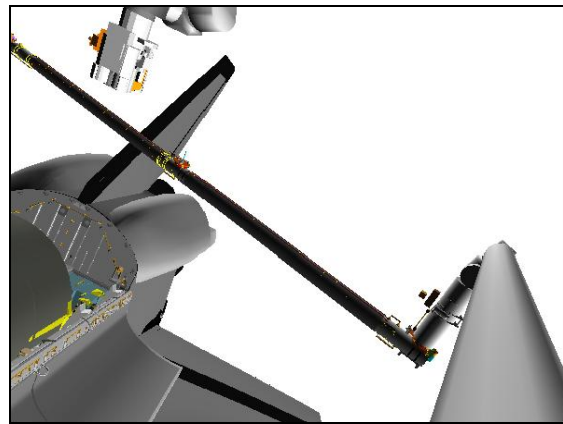
CCTV B (-30,30)



CCTV B (-30,30)

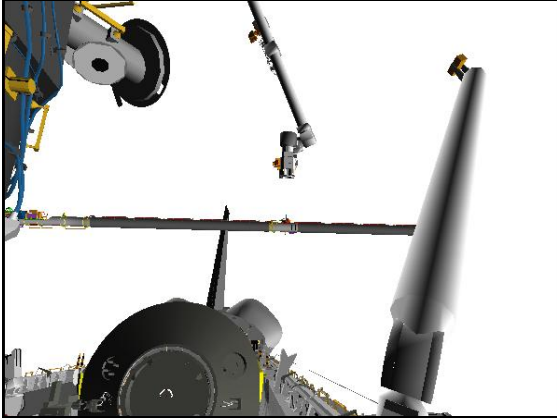


ELBOW (-30,0)

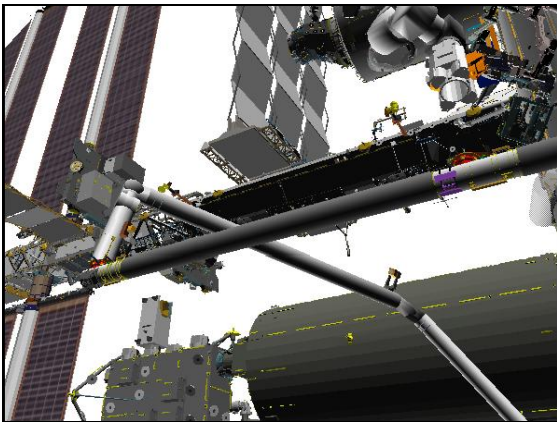


ELBOW (-30,0)

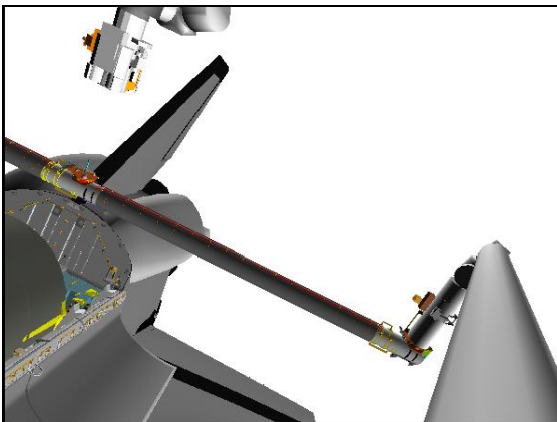
Step 10:
Drive WR (-) from -75.0 to -99.4



CCTV A (5,20)



CCTV B (-30,30)



ELBOW (-30,0)

3. STOW PTU
R12(VPU) Green Jumper – LDRI/ITVC

A7U DTV ← PL2

CAMR CMD PAN/TILT – HI RATE
PAN – L (to hard stop)
TILT – UP (to hard stop)
PAN/TILT – RESET
PAN: +108 (right)
TILT: -175 (down)

R12(VPU) Green Jumper – ISS

On SSRMS Operator GO for OBSS Ungrapple

<p><u>CAUTION</u> STBD RMS HTR power must be applied within 90 min to prevent sensor package damage</p>

Perform LCC DEACTIVATION (LCS Cue Card, PHOTO/TV)
Perform LCH DEACTIVATION (LCS Cue Card, PHOTO/TV)
Perform DEACTIVATION (LDRI/ITVC Cue Card, PHOTO/TV)

4. OBSS UNGRAPPLE
A7U CCTV – config for ungrapple
– RMS WRIST, ZOOM: 34.0 HFOV
FOCUS: 5 ft

If digitals available:

<p>SM 94 PDRS CONTROL PL ID – ITEM 3 +0 EXEC INIT ID – ITEM 24 +0 EXEC</p>
--

If SINGLE mode available:

NOTE

CONTR ERR It and 'S96 PDRS CNTL' msg may occur due to Consistency/Envelope Check error

RHC RATE – COARSE (RATE MIN tb-OFF)

<p>SM 94 PDRS CONTROL AUTO BRAKE INH – ITEM 10 EXEC (*)</p>

BRAKES – OFF (tb-OFF)
MODE – TEST, ENTER
Wait 5 sec

BRAKES – ON (tb-ON)

<p>SM 94 PDRS CONTROL AUTO BRAKE ENA – ITEM 9 EXEC (*)</p>
--

RATE – as reqd (VERN within 10 ft)
BRAKES – OFF (tb-OFF)

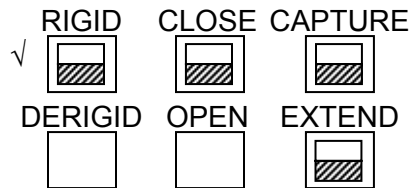
MODE – best available

<u>CAUTION</u> Monitor EE tb timing to prevent EE motor burnout
--

EE MODE – MAN

MAN CONTR – DERIGID (hold until DERIGID tb-gray, 5 sec max)

RELEASE sw – depress (hold until OPEN tb-gray, 3 sec max)



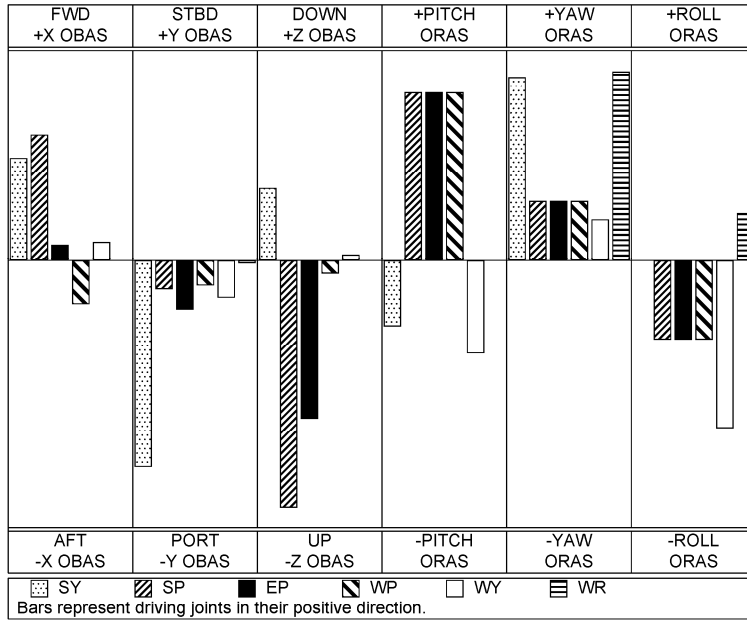
CRITICAL TIMES (8 sec total):

DERIGID tb – gray, 5 sec max, then

OPEN tb – gray, 3 sec max, then

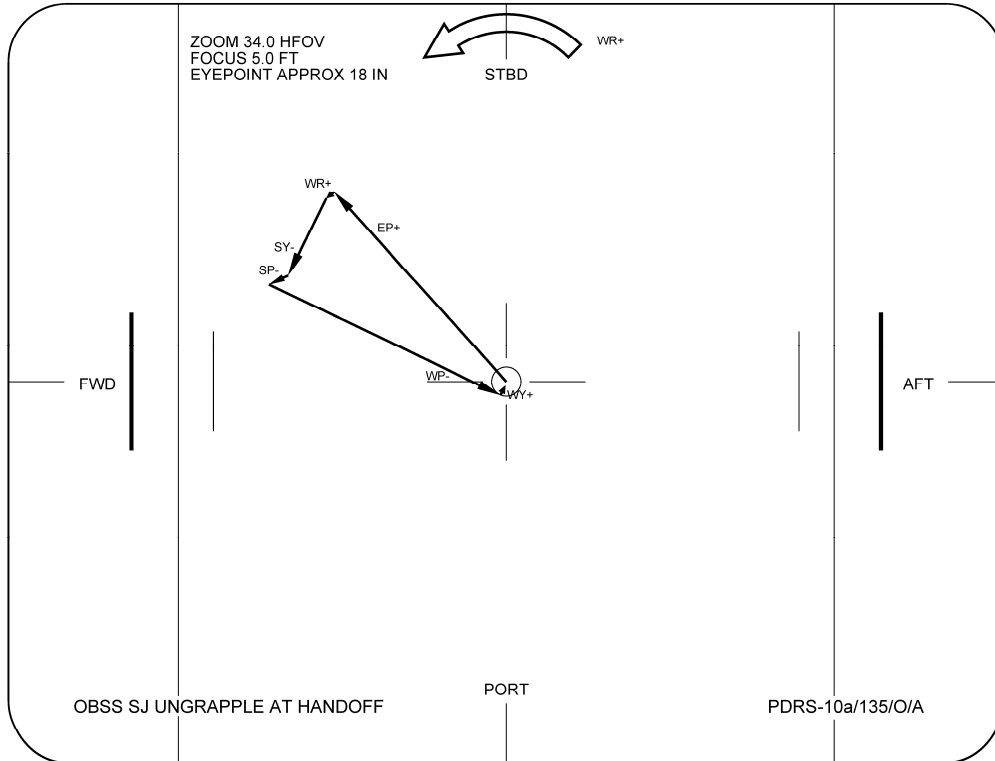
Drive joints per OBSS SJ UNGRAPPLE AT HANDOFF overlay until EE clear of grapple fixture

OBSS SJ UNGRAPPLE AT HANDOFF

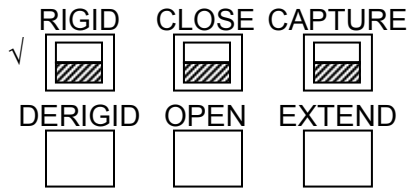


To get:	Drive:	To get:	Drive:	Driving:	Results In:	Driving:	Results In:
+X (fwd)	+SP, +SY	+PITCH	+WP, +EP	+SY	-Y (port), +YAW	+WP	-X (aft), +PITCH
+Y (stbd)	-SY	+YAW	+WR, +SY	+SP	-Z (up), +PITCH	+WY	-Y (port), -ROLL
+Z (down)	-SP, -EP	+ROLL	-WY, -WP	+EP	-Z (up), +PITCH	+WR	+YAW

ΔSY	ΔSP	ΔEP	ΔWP	ΔWY	ΔWR
-1.8	-1.5	+14.6	-13.4	+0.6	+2.1



EE MAN CONTR – DERIG (hold until EXTEND tb-gray, 20 sec max)
 MODE – OFF



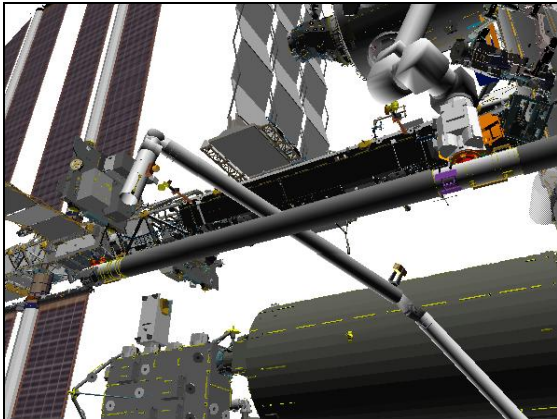
CRITICAL TIMES (20 sec total):
 EXTEND tb – gray, 20 sec max

Mnvr to OBSS BACKOFF posn:

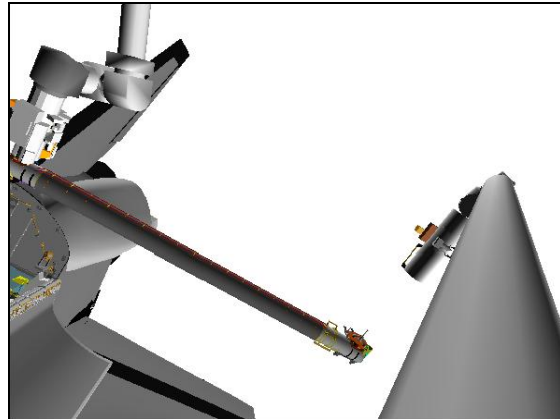
X	Y	Z	PITCH	YAW	ROLL	PL ID
-1047	-360	-658	284	0	270	0
SY	SP	EP	WP	WY	WR	
+22.7	+57.5	-27.4	-99.3	+11.8	-97.9	

BRAKES – ON (tb-ON)
 MODE – not DIRECT
 JOINT – CRIT TEMP

- * If using Shuttle attitude control and attitude maintenance reqd: *
- * DAP: LVLH *
- * When rates damped: *
- * DAP: FREE > 2 sec *
- * DAP: AUTO *



CCTV B (-30,30)



ELBOW (-30,-10)

Give SSRMS Operator GO for OBSS Berth Sequence

5. CONFIGURE CIRCUIT BREAKERS
 MA73C:C cb MCA PWR AC3 3Φ MID 2 – op
 √AC2 3Φ MID 2 – op
 MA73C:D √AC3 3Φ MID 4 – op

6. CONFIGURE FOR MONITORING
On SSRMS notification to watch for STBD RMS R-F-Ls,
 SM 94 PDRS CONTROL
 RMS STBD – ITEM 2 EXEC (*)

Notify SSRMS operator when STBD RMS R-F-L tb (three) – gray

7. STBD MRL LATCH
On SSRMS Operator GO to latch STBD MRLs to Topological Capture,
√STBD RMS R-F-L tb (three) – gray

SM 94 PDRS CONTROL

√STBD AFT, MID, FWD LAT (six) = 0

R13L PL BAY MECH PWR SYS (two) – ON

NOTE

Expect single motor drive time for MRL latching (18 sec max).
The following STBD RMS RETEN LAT – OFF and PL BAY
MECH PWR SYS (two) – OFF actions are to be performed simo

Verify AOS for latching to Topological Capture

STBD RMS RETEN LAT – LAT 6 sec only (tb-bp)
– OFF

R13L PL BAY MECH PWR SYS (two) – OFF

Give SSRMS Operator GO to Limp All SSRMS Joints and Derigidize

R13L **On SSRMS Operator GO to complete STBD MRL Latching,**
PL BAY MECH PWR SYS (two) – ON

STBD RMS RETEN LAT – LAT (tb-LAT) (12 sec max)
– OFF

8. RECONFIGURE POWER

R13L PL BAY MECH PWR SYS (two) – OFF

STBD RMS HTR A,B (two) – AUTO

A6U EVENT TIMER CNTL – STOP

SM 94 PDRS CONTROL

√STBD AFT, MID, FWD LAT (six) = 1
RMS PORT – ITEM 1 EXEC (*)

MA73C:C cb MCA PWR AC3 3Φ MID 2 – cl

√AC2 3Φ MID 2 – op

MA73C:D √AC3 3Φ MID 4 – op

Give SSRMS Operator GO for OBSS Ungripple

9. MNVR TO PRECRADLE

Verify SSRMS is at Berthed OBSS Backoff or Overnight Park posn and on SSRMS Operator GO for mnvr to PreCradle

MON 1	A
MON 2	B
DNLK	EE (ELBOW)
DTV	P1 LOOB

If SINGLE mode available:

RATE – as reqd (VERN within 10 ft)

BRAKES – OFF (tb-OFF)

MODE – best available

Mnvr to PRECRADLE posn:

	SY	SP	EP	WP	WY	WR	
	+22.7	+57.5	-27.4	-99.3	+11.8	-97.9	
OBSS	0.0						
BACKOFF							
1: SY –							
2: EP +			-25.0				
3: WR +						0.0	
4: WY –					0.0		
5: WP +				+5.0			
6: SP –		+25.0					
PRECRADLE	0.0	+25.0	-25.0	+5.0	0.0	0.0	
	X	Y	Z	PITCH	YAW	ROLL	PL ID
	-1261	-146	-551	5	2	0	0

BRAKES – ON (tb-ON)

MODE – not DIRECT (It off)

PARAM – PORT TEMP

JOINT – CRIT TEMP

Start:
OBSS BACKOFF posn

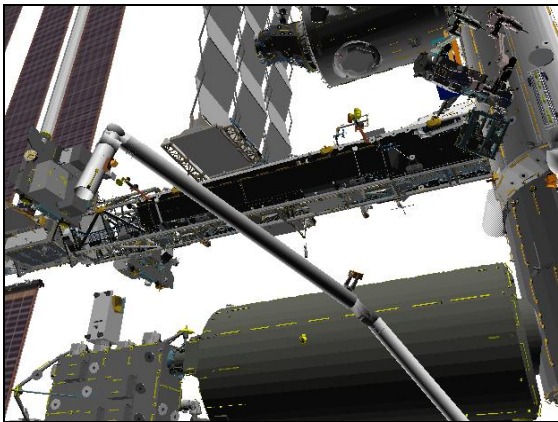
Step 1:
Drive SY (-) from +22.7 to 0.0



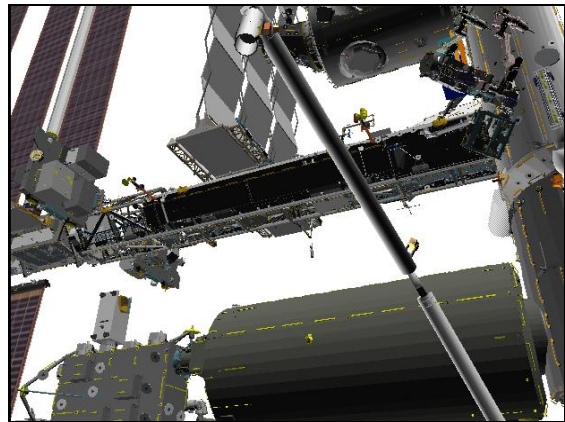
CCTV A (20,25)



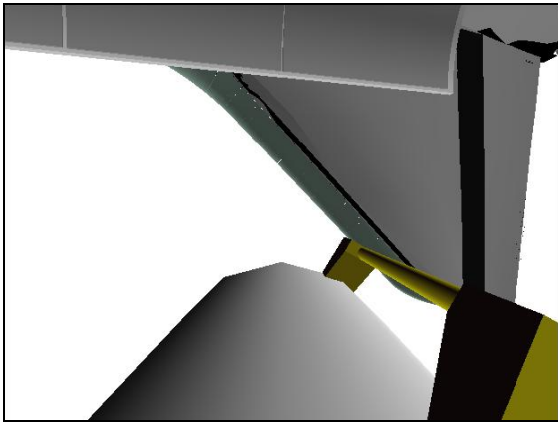
CCTV A (20,25)



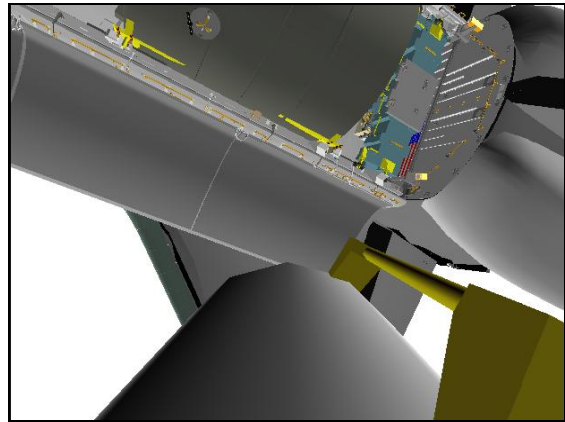
CCTV B (-25,30)



CCTV B (-25,30)



EE



EE

Step 2:
Drive EP (+) from -27.4 to -25.0

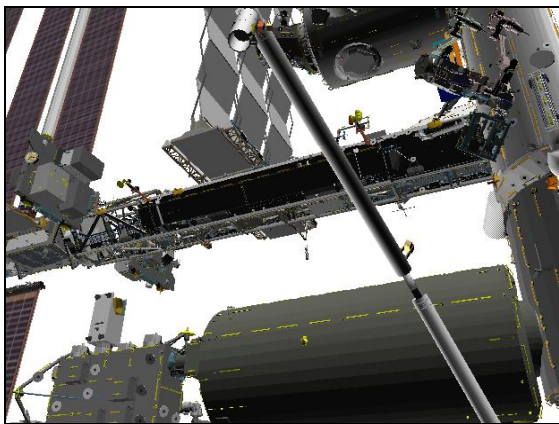


CCTV A (20,25)

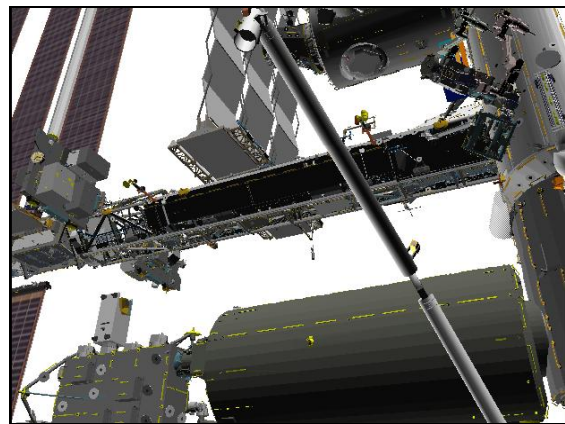
Step 3:
Drive WR (+) from -97.9 to 0.0



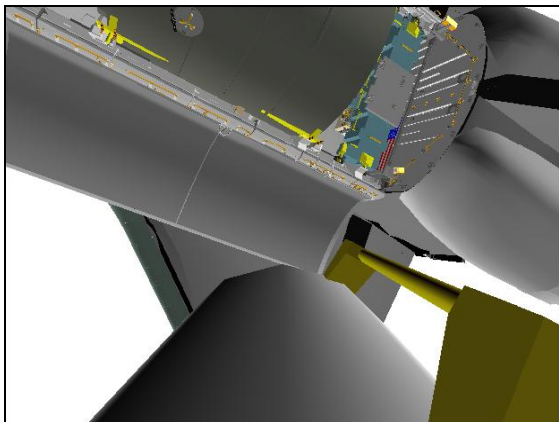
CCTV A (20,25)



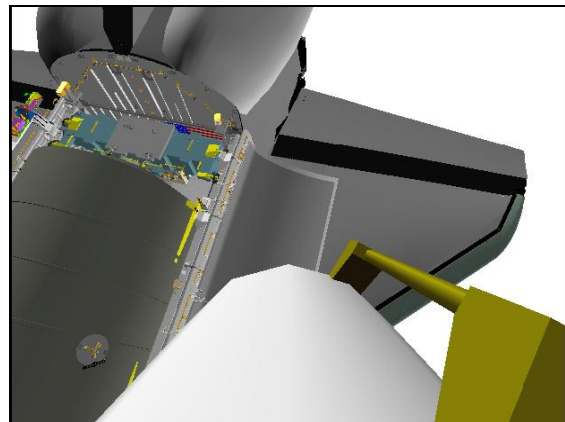
CCTV B (-25,30)



CCTV B (-25,30)



EE



EE

Step 4:
Drive WY (-) from +11.8 to 0.0

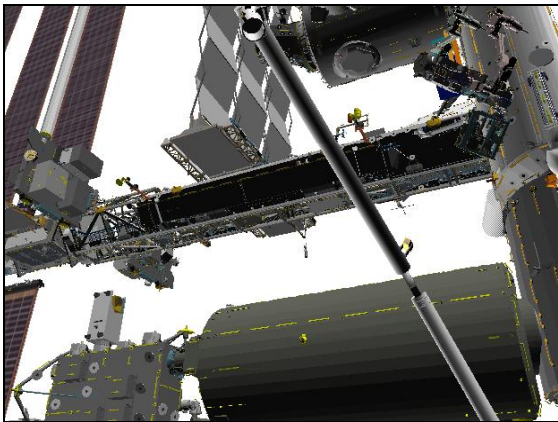


CCTV A (20,25)

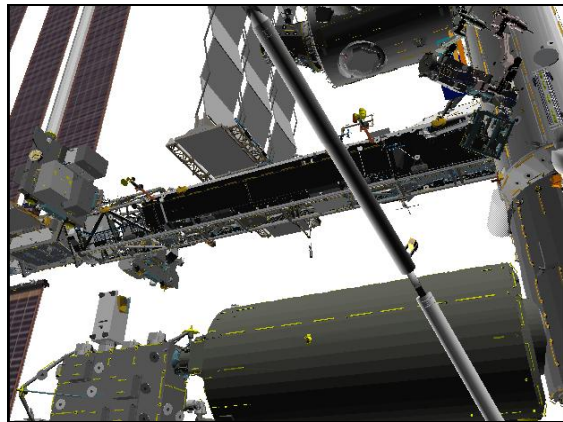
Step 5:
Drive WP (+) from -99.3 to +5.0



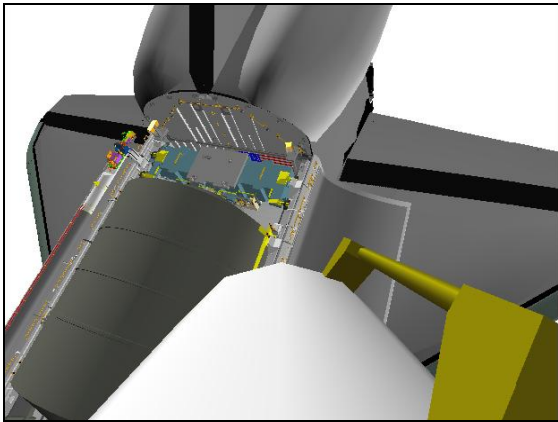
CCTV A (20,25)



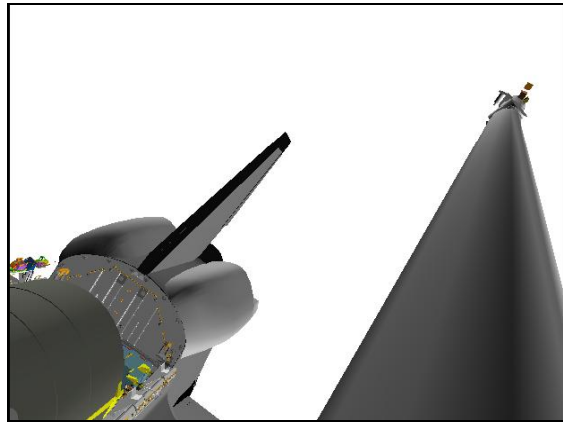
CCTV B (-25,30)



CCTV B (-25,30)

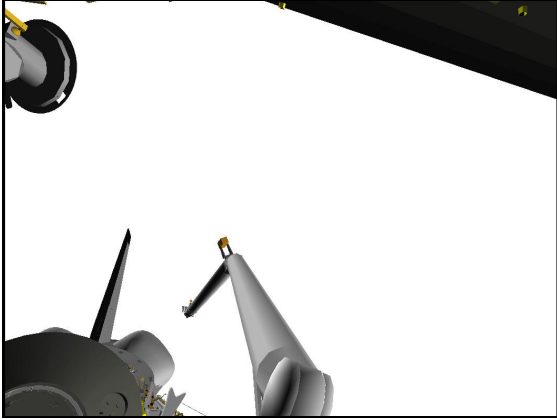


EE

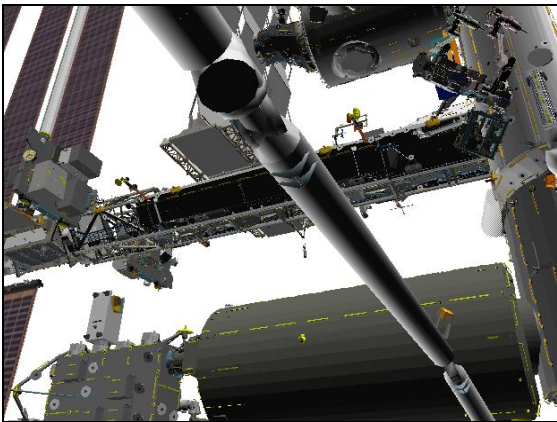


ELBOW (-30,-20)

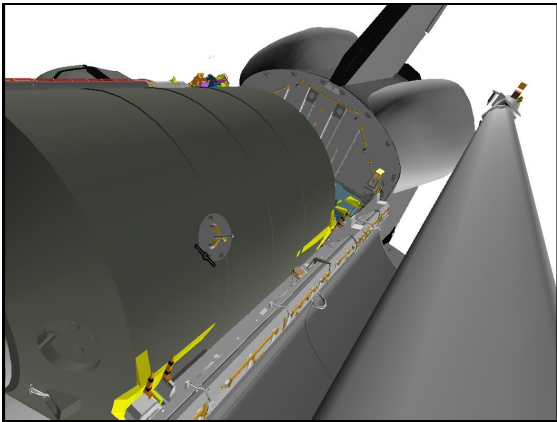
Step 6:
Drive SP (-) from +57.5 to +25.0



CCTV A (20,25)



CCTV B (-25,30)



ELBOW (-30,-20)

OBSS SJ MNVR TO UNDOCK

1. SETUP

If digitals available:

SM 94 PDRS CONTROL

√ PL ID, ITEM 3: 1

√ INIT ID, ITEM 24: 1

Verify at MPLM VIEWING posn:

	X	Y	Z	PITCH	YAW	ROLL	PL ID
√	-967	-643	-386	60	349	282	1
	SY	SP	EP	WP	WY	WR	
√	+62.5	+25.0	-23.0	0.0	-13.2	-21.9	

A7U

CCTV – config as reqd

– perform PAN/TILT RESET for PLB cameras

ZOOM – full OUT

R12(VPU)

√ Green Jumper – ISS

MON 1	A
MON 2	B
DNLK	ELBOW (RSC)
DTV	P1 LOOB

2. OBSS MNVR TO UNDOCK

If SINGLE mode available:

RHC

RATE – as reqd (VERN within 10 ft)

BRAKES – OFF (tb-OFF)

MODE – best available

SM 169 PDRS STATUS

Mnvr to OBSS UNDOCK posn:

	SY	SP	EP	WP	WY	WR	
MPLM VIEWING	+62.5	+25.0	-23.0	0.0	-13.2	-21.9	
1: SY –	+25.8						
2: WP –				-85.9			
3: SP +		+66.3					
4: WY +					+10.7		
5: WR –						-100.7	
6: EP –			-49.0				
OBSS UNDOCK	+25.8	+66.3	-49.0	-85.9	+10.7	-100.7	
	X	Y	Z	PITCH	YAW	ROLL	PL ID
	-1041	-362	-602	44	270	0	1

*Display singularity

BRAKES – ON (tb-ON)

MODE – not DIRECT (It off)

PARAM – PORT TEMP

JOINT – CRIT TEMP

Start:
MPLM VIEWING posn

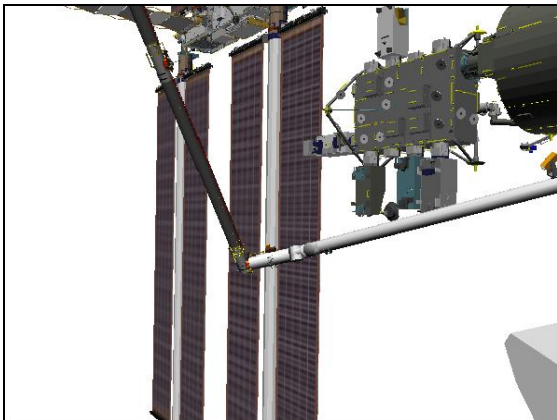
Step 1:
Drive SY (-) from +62.5 to +25.8



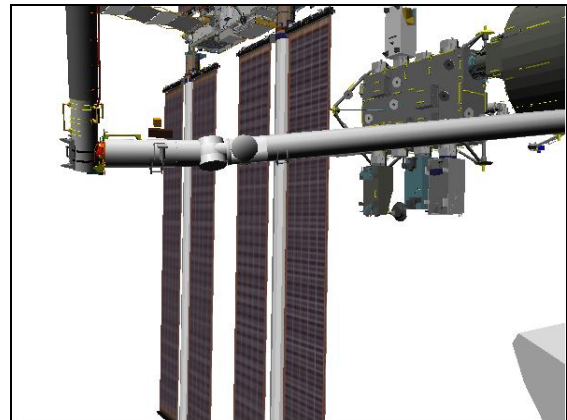
CCTV A (30,20)



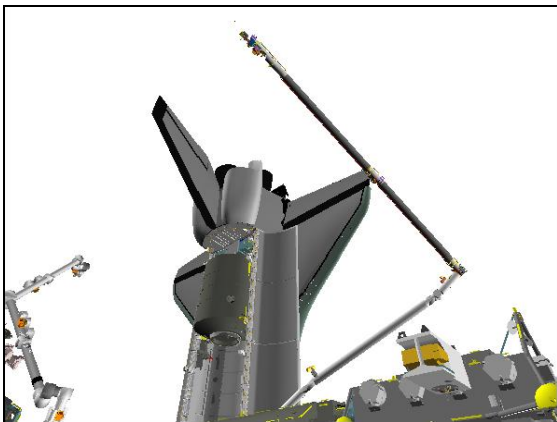
CCTV A (30,20)



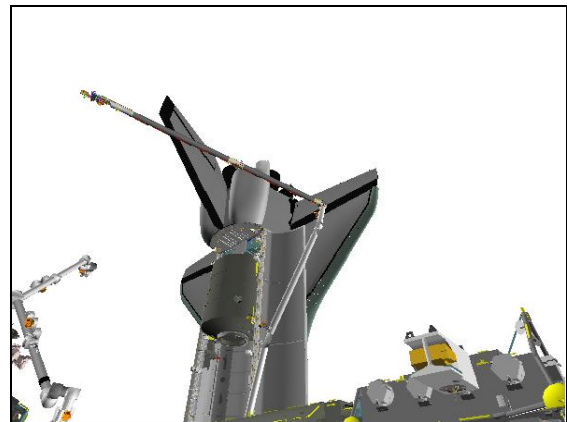
CCTV B (-55,0)



CCTV B (-55,0)



P1 LOOB (140,40)



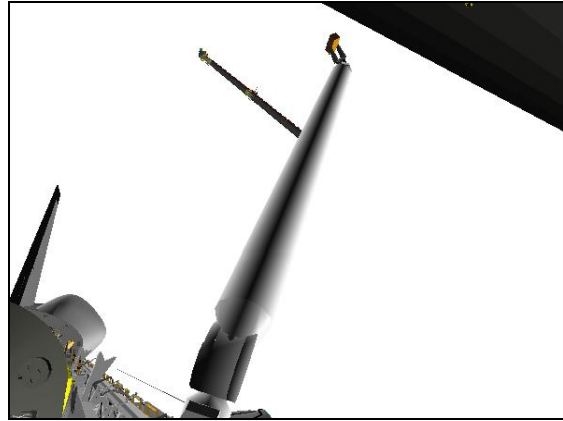
P1 LOOB (140,40)

Step 2:
Drive WP (-) from 0.0 to -85.9

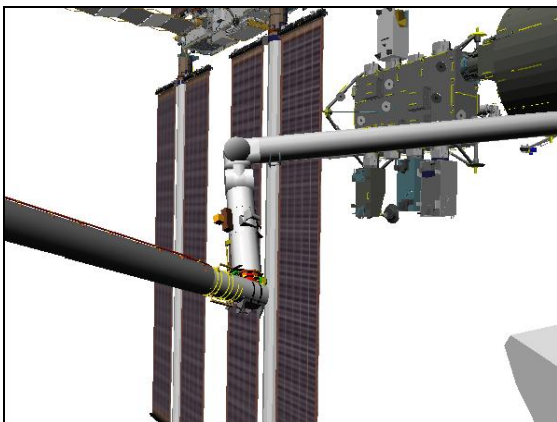
Step 3:
Drive SP (+) from +25.0 to +66.3



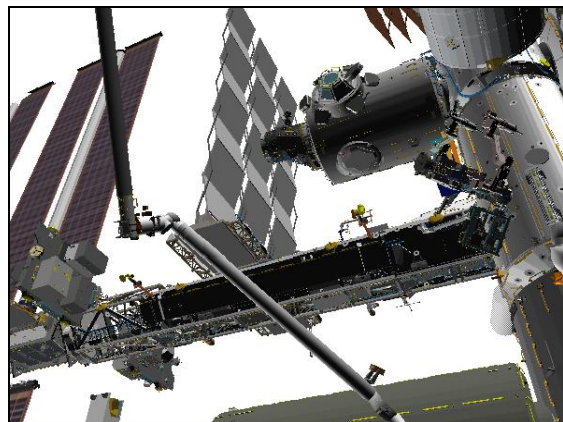
CCTV A (30,20)



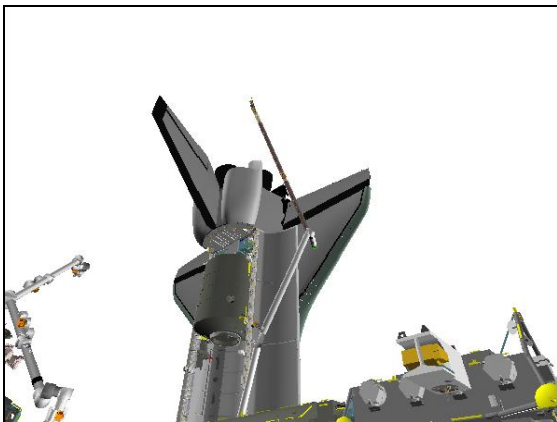
CCTV A (30,20)



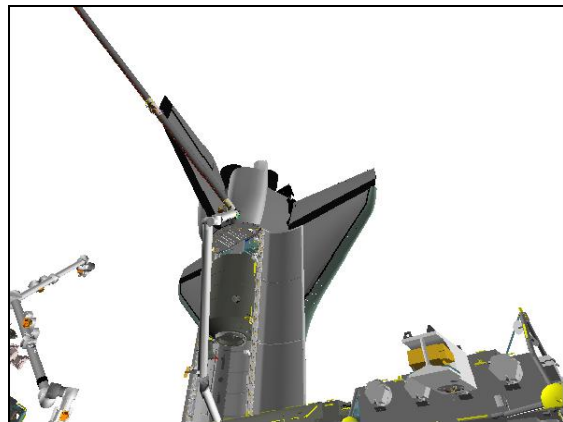
CCTV B (-55,0)



CCTV B (-25,40)



P1 LOOB (140,40)



P1 LOOB (140,40)

Step 4:
Drive WY (+) from -13.2 to +10.7

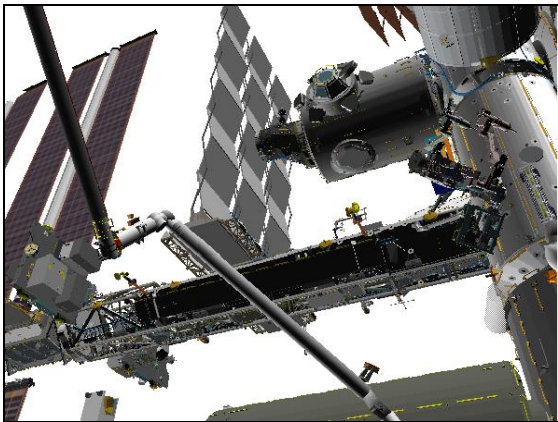


CCTV A (30,20)

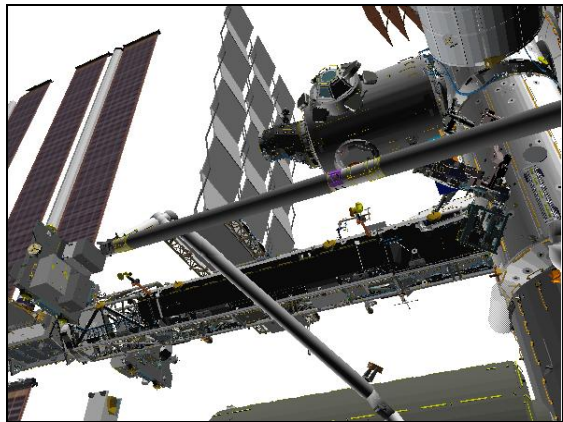
Step 5:
Drive WR (-) from -21.9 to -100.7



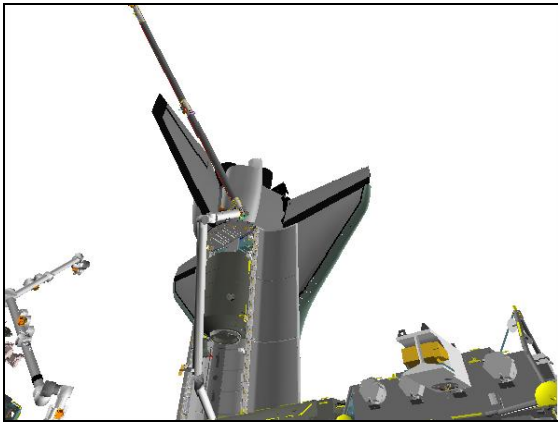
CCTV A (0,30)



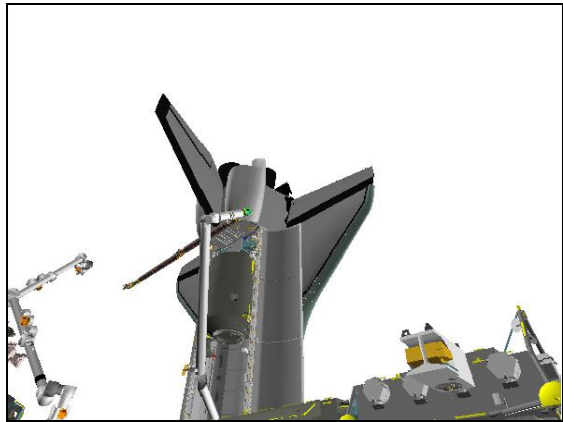
CCTV B (-25,40)



CCTV B (-25,40)

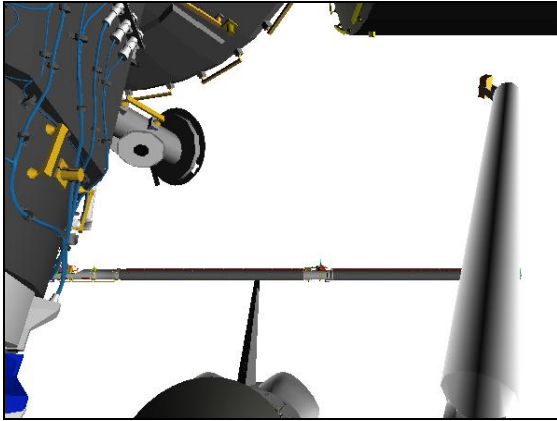


P1 LOOB (140,40)

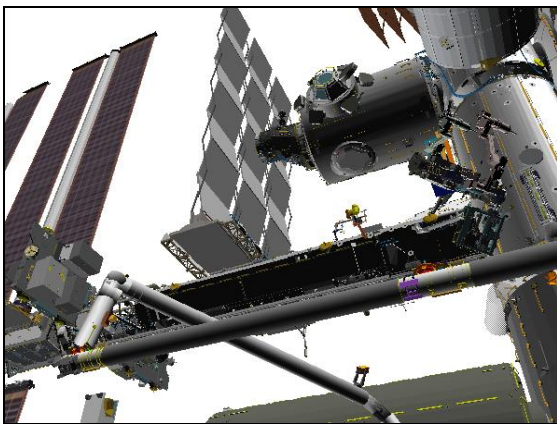


P1 LOOB (140,40)

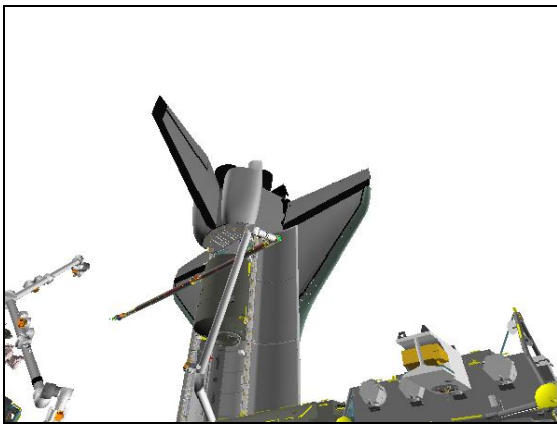
Step 6:
Drive EP (-) from -23.0 to -49.0



CCTV A (0,30)



CCTV B (-25,40)



P1 LOOB (140,40)

OBSS SJ MNVR TO OBSS HOVER

1. SETUP

If digitals available:

SM 94 PDRS CONTROL

√ PL ID, ITEM 3: 1

√ INIT ID, ITEM 24: 1

Verify at OBSS UNDOCK posn:

	X	Y	Z	PITCH	YAW	ROLL	PL ID
√	-1041	-362	-602	44	270	0	1
	SY	SP	EP	WP	WY	WR	
√	+25.8	+66.3	-49.0	-85.9	+10.7	-100.7	

*Display singularity

A7U

CCTV – config as reqd

– perform PAN/TILT RESET for PLB cameras

ZOOM – full OUT

MON 1	D
MON 2	A
DNLK	ELBOW (C)
DTV	B

2. SINGLE TO OBSS HOVER

NOTE

When SY joint is driving, minimum clearance between OBSS ITVC and orbiter tail is 95 inches. At the end of this single joint sequence, the OBSS ITVC is 66 inches from the starboard OMS pod

RHC

If SINGLE mode available:

RATE – as reqd (VERN within 10 ft)

BRAKES – OFF (tb-OFF)

MODE – best available

Mnvr to OBSS HOVER posn:

	SY	SP	EP	WP	WY	WR	
OBSS UNDOCK	+25.8	+66.3	-49.0	-85.9	+10.7	-100.7	
1: WY –					0.0		
2: WP +				-59.8			
3: WR +						+110.0	
4: SY –	-90.0						
5: SP +		+80.2					
6: EP –			-118.8				
OBSS HOVER	-90.0	+80.2	-118.8	-59.8	0.0	+110.0	
	X	Y	Z	PITCH	YAW	ROLL	PL ID
	-680	+133	-517	0	0	341	1

BRAKES – ON (tb-ON)

MODE – not DIRECT (It off)

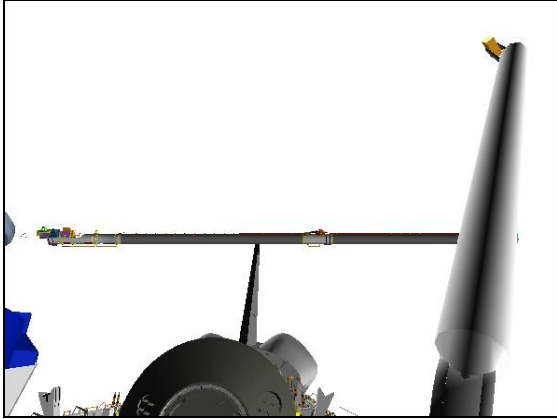
PARAM – PORT TEMP

JOINT – CRIT TEMP

If berthing OBSS, perform OBSS SJ BERTH (PDRS, OBSS OPERATIONS)

Start:
OBSS UNDOCK posn

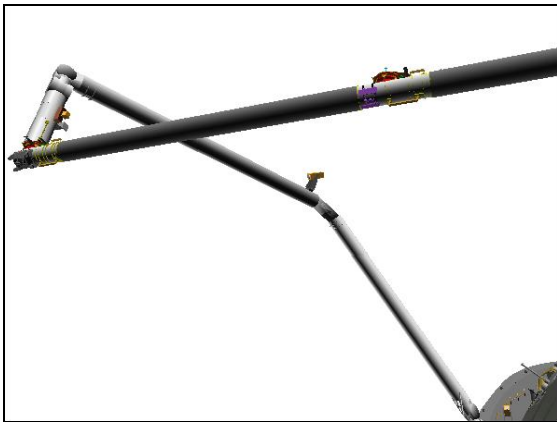
Step 1:
Drive WY (-) from +10.7 to 0.0



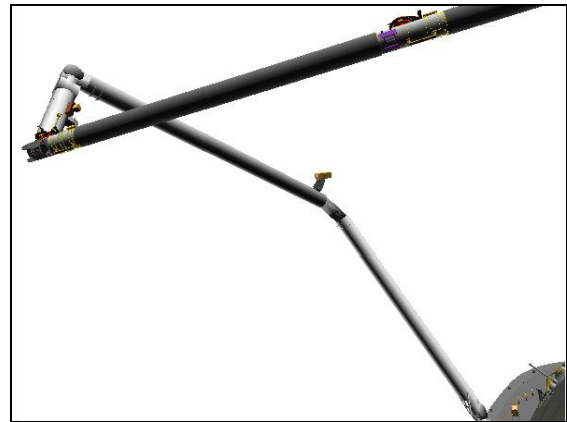
CCTV A (0,25)



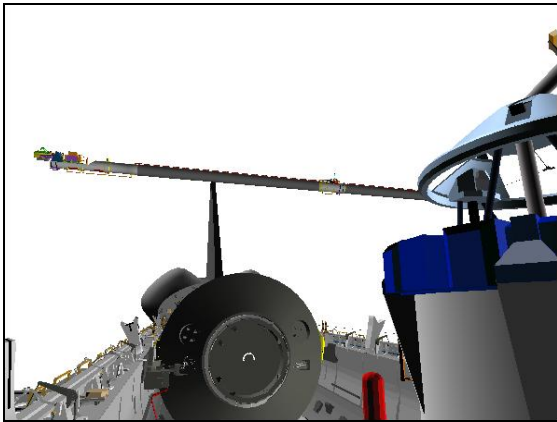
CCTV A (0,25)



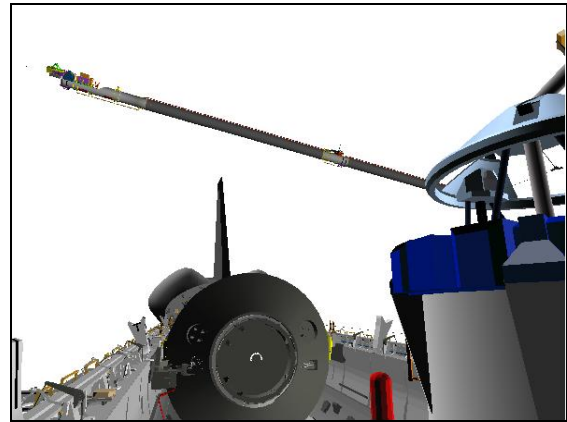
CCTV B (-25,20)



CCTV B (-25,20)



CCTV D (15,15)



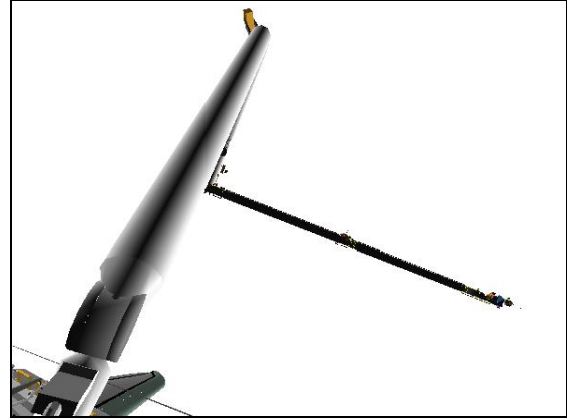
CCTV D (15,15)

Step 2:
Drive WP (+) from -85.9 to -59.8

Step 3:
Drive WR (+) from -100.7 to +110.0



CCTV A (0,25)



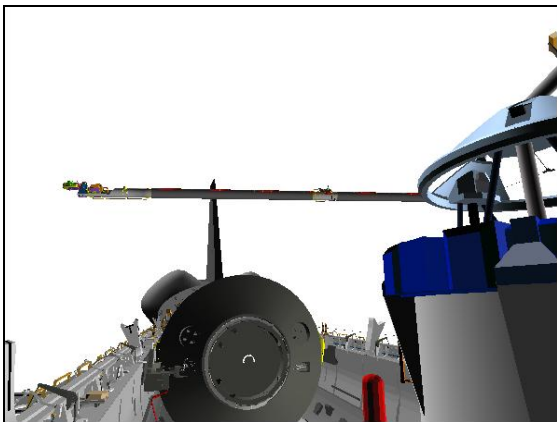
CCTV A (45,15)



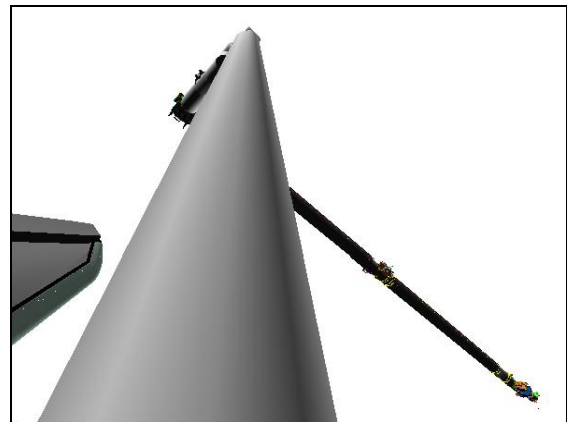
CCTV B (-25,20)



CCTV B (-35,15)



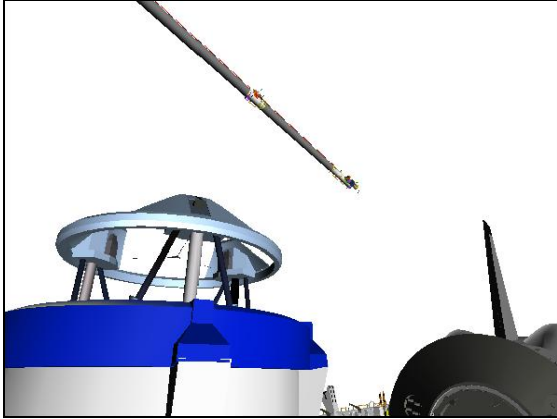
CCTV D (15,15)



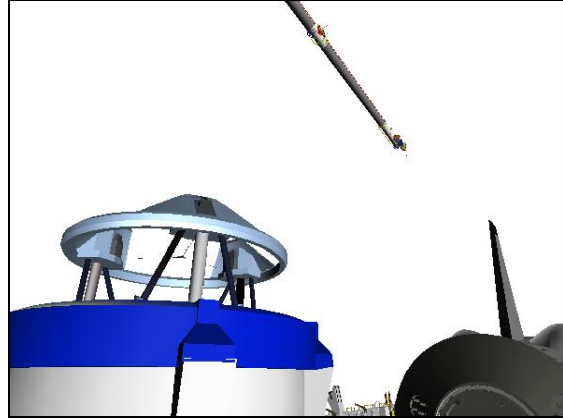
ELBOW (5,-30)

Step 4:
Drive SY (-) from +25.8 to -90.0

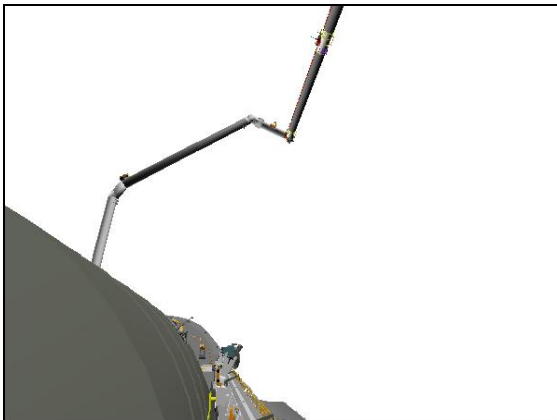
Step 5:
Drive SP (+) from +66.3 to +80.2



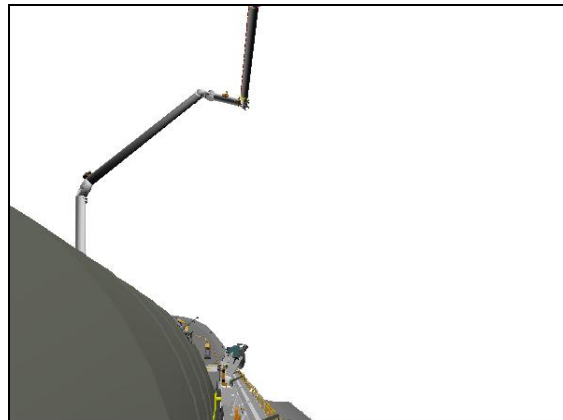
CCTV A (-35,25)



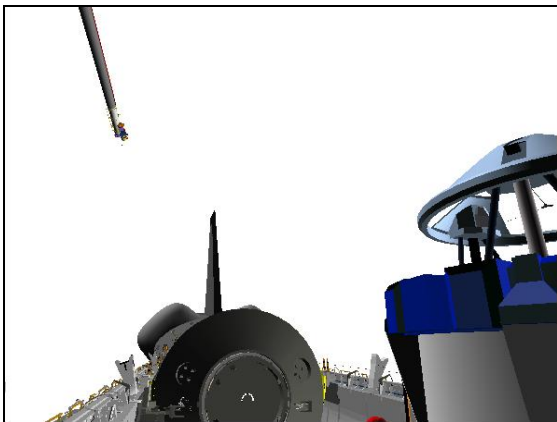
CCTV A (-35,25)



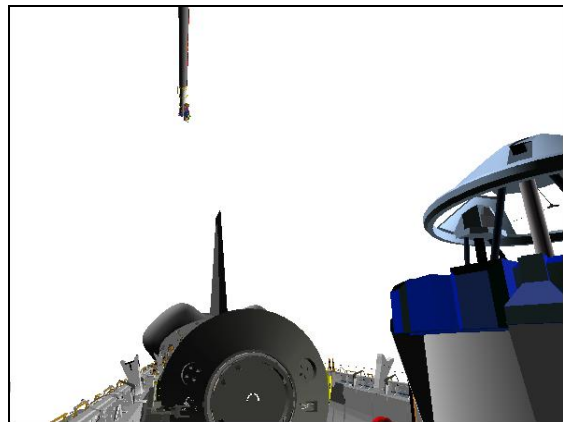
CCTV C (10,20)



CCTV C (10,20)

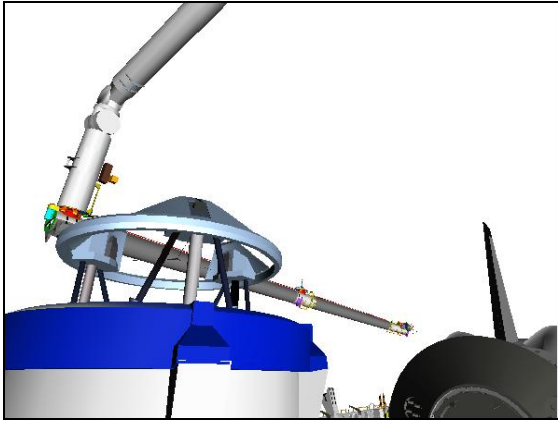


CCTV D (15,20)

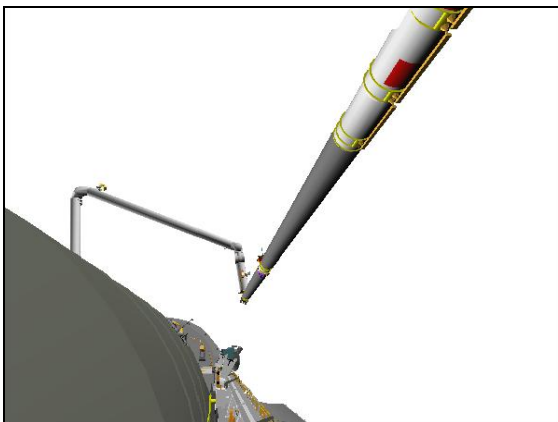


CCTV D (15,20)

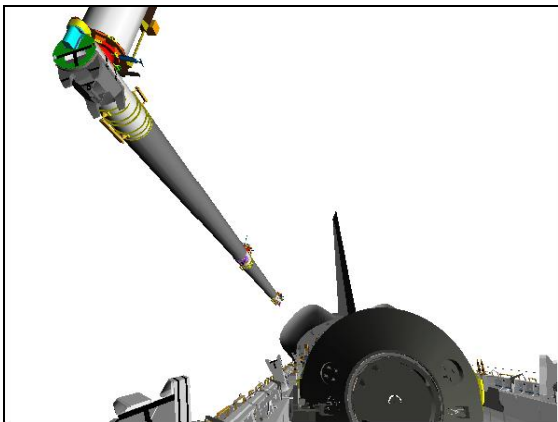
Step 6:
Drive EP (-) from -49.0 to -118.8



CCTV A (-35,25)



CCTV C (10,20)



CCTV D (-5,20)

MNVR TO CONTINGENCY MPLM VIEWING

1. SETUP

SM 94 PDRS CONTROL

√ PL ID, ITEM 3: 1

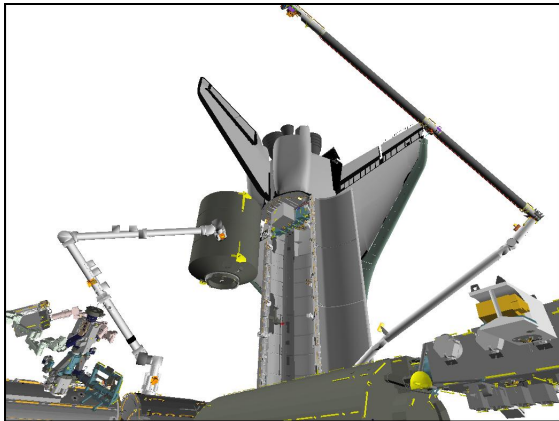
√ INIT ID, ITEM 24: 1

Verify at MPLM VIEWING posn:

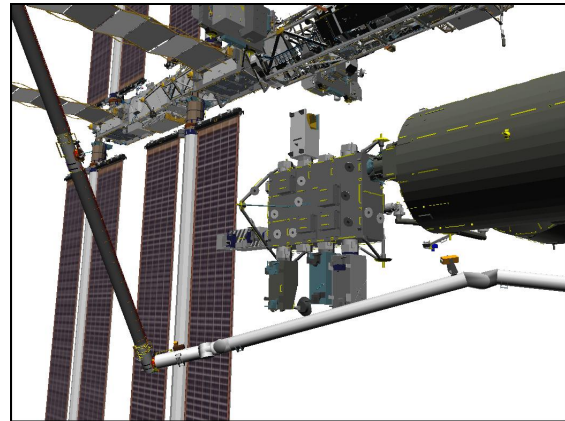
	X	Y	Z	PITCH	YAW	ROLL	PL ID
√	-967	-643	-386	60	349	282	1
	SY	SP	EP	WP	WY	WR	
√	+62.5	+25.0	-23.0	0.0	-13.2	-21.9	

R12(VPU) √ Green Jumper – ISS

MON 1	P1 LOOB
MON 2	RSC
DNLK	A
DTV	ELBOW



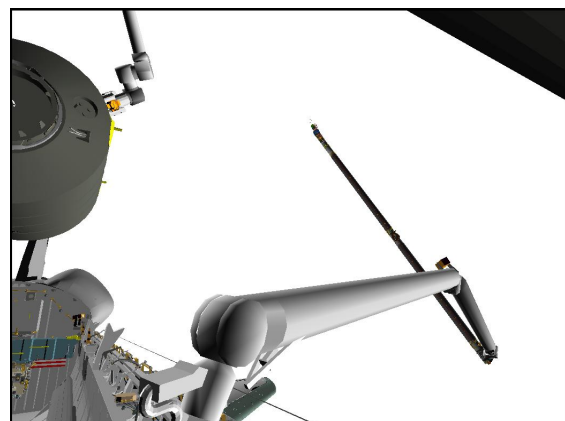
P1 LOOB (130,35)



CCTV B (-45,10)



ELBOW (-20,0)



CCTV A (30,15)

2. MNVR TO CONTINGENCY MPLM VIEWING INTERMEDIATE

SM 94 PDRS CONTROL

END POS – ITEM 18 -9 2 4 -4 5 0 -1 9 9 EXEC
 ATT – ITEM 21 +5 3 +3 3 3 +2 1 2 EXEC
 CMD CK – ITEM 25 EXEC (GOOD)

RHC

RATE – COARSE
 BRAKES – OFF (tb-OFF)
 MODE – OPR CMD, ENTER

AUTO SEQ – PROCEED (IN PROG It on)

When AUTO SEQ IN PROG It – off:
 BRAKES – ON (tb-ON)

CONTINGENCY MPLM VIEWING INTERMEDIATE posn: (02:00)

	X	Y	Z	PITCH	YAW	ROLL	PL ID
√	-924	-450	-199	53	333	212	1
	SY	SP	EP	WP	WY	WR	
√	+54.9	+2.7	-50.5	+114.3	+25.0	-44.7	

3. MNVR TO CONTINGENCY MPLM VIEWING

Verify MPLM is at Low Hover position (Z=-600cm)

NOTE

Minimum clearance between OBSS and Payload Bay Door is 45"
 Minimum clearance between OBSS and Port RCC is 48"
 Minimum clearance between OBSS and MPLM (during mnvr to berth) is 30"

RHC

RATE – VERN
 BRAKES – OFF (tb-OFF)
 MODE – SINGLE, ENTER

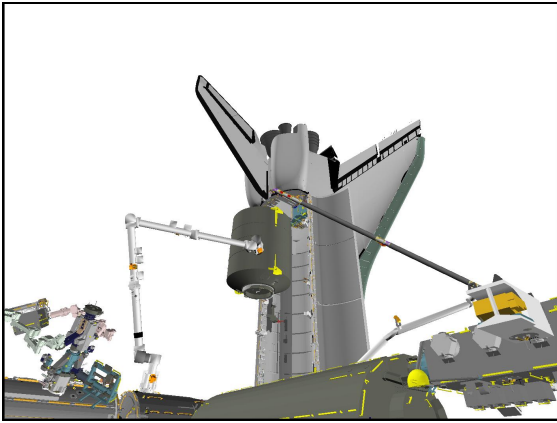
SM 169 PDRS STATUS

Mnvr to CONTINGENCY MPLM VIEWING posn:

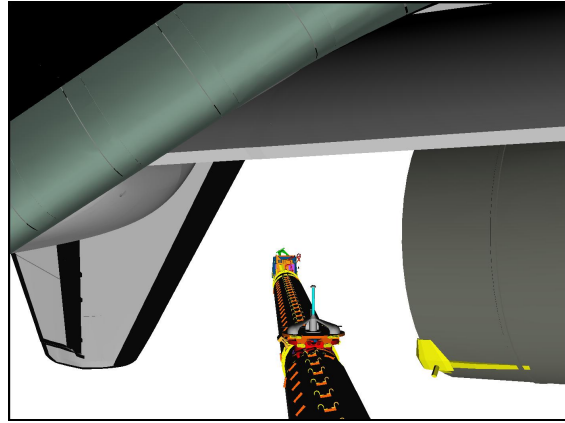
	SY	SP	EP	WP	WY	WR	
INTERMEDIATE 1: WY + CONTINGENCY VIEWING	+54.9	+2.7	-50.5	+114.3	+25.0	-44.7	
					+14.3		
	+54.9	+2.7	-50.5	+114.3	+14.3	-44.7	
	X	Y	Z	PITCH	YAW	ROLL	PL ID
	-935	-447	-205	48	324	213.7	1

BRAKES – ON (tb-ON)

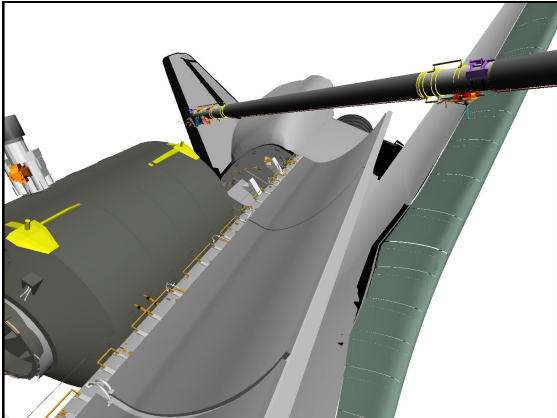
Give SSRMS Operator GO for MPLM Berth



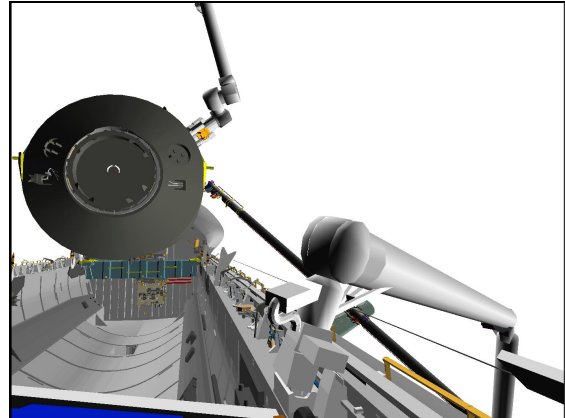
P1 LOOB (130,35)



RSC



ELBOW (-20,-20)



CCTV A (15,5)

√MODE – not DIRECT (It off)

PARAM – PORT TEMP
JOINT – CRIT TEMP

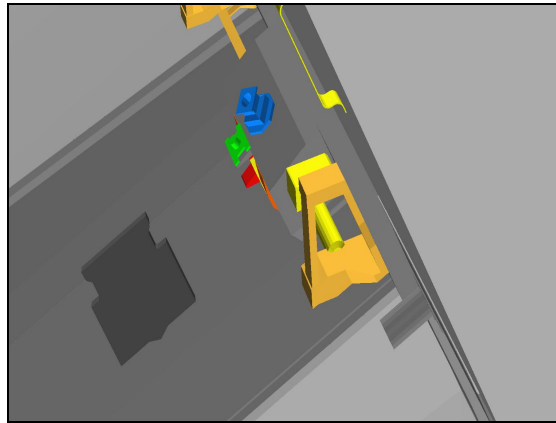
4. CONFIGURE IDC FOR MPLM BERTH VIEWING

- L12(SSP1) APCU 2 CONV – OFF
Wait 10 sec
APCU 2 CONV – ON

Perform LCC ACTIVATION (LCS Cue Card, PHOTO/TV)

Perform IDC SOFTWARE ACTIVATION (IDC Cue Card, PHOTO/TV) steps 1, 3

LCC/PGSC √'AE' checked
sel 'Scan Lo-Res'



OBSS IDC

5. MNVR TO MPLM VIEWING POSN
On SSRMS Operator GO for mnvr back to MPLM VIEWING

LCC/PGSC sel 'Stop Scan'

Perform IDC DEACTIVATION (IDC Cue Card, PHOTO/TV) step 1
 Maximize LCS Camera Controller
 Perform LCC DEACTIVATION (LCS Cue Card, P/TV)

MON 1	P1 LOOB
MON 2	B→RSC
DNLK	A
DTV	ELBOW

RHC RATE – VERN (RATE MIN tb-ON)
 BRAKES – OFF (tb-OFF)
 MODE – SINGLE, ENTER

SM 169 PDRS STATUS

Mnvr to CONTINGENCY MPLM VIEWING INTERMEDIATE posn:

	SY	SP	EP	WP	WY	WR	
CONTINGENCY VIEWING	+54.9	+2.7	-50.5	+114.3	+14.3	-44.7	
1: WY +					+25.0		
INTERMEDIATE	+54.9	+2.7	-50.5	+114.3	+25.0	-44.7	
	X	Y	Z	PITCH	YAW	ROLL	PL ID
	-924	-450	-199	53	333	212	1

SM 94 PDRS CONTROL

END POS – ITEM 18 -9 6 7 -6 4 3 -3 8 6 EXEC
 ATT – ITEM 21 +6 0 +3 4 9 +2 8 2 EXEC
 CMD CK – ITEM 25 EXEC (GOOD)

RHC RATE – as reqd (VERN within 10 ft)
 MODE – OPR CMD, ENTER

AUTO SEQ – PROCEED (IN PROG It on)

When AUTO SEQ IN PROG It – off:
BRAKES – ON (tb-ON)

MPLM VIEWING posn: (02:00)

	X	Y	Z	PITCH	YAW	ROLL	PL ID
√	-967	-643	-386	60	349	282	1
	SY	SP	EP	WP	WY	WR	
√	+62.5	+25.0	-23.0	0.0	-13.2	-21.9	

√MODE – not DIRECT (It off)

PARAM – PORT TEMP
JOINT – CRIT TEMP

REFERENCE DATA

OBSS JOINT ANGLES VS POR COORDINATES FS 3-2
AUTOSEQUENCE..... FS 3-4

REFERENCE
DATA

OBSS JOINT ANGLES VS POR COORDINATES

OBSS PRE-GRAPPLE AT HANDOFF/BACKOFF posn:

X	Y	Z	PITCH	YAW	ROLL	PL ID
-1047	-360	-658	284	0	270	0
-1056	-360	-642	44	270	0	1
-1043	+231	-655	14	270	0	2
SY	SP	EP	WP	WY	WR	
+22.7	+57.5	-27.4	-99.3	+11.8	-97.9	

*
*

*Display singularity

OBSS HANDOFF posn:

X	Y	Z	PITCH	YAW	ROLL	PL ID
-1062	-360	-600	284	0	270	0
-1070	-360	-584	44	270	0	1
-1059	+231	-597	14	270	0	2
SY	SP	EP	WP	WY	WR	
+24.5	+59.0	-42.1	-85.9	+11.2	-99.4	

*
*

*Display singularity

OBSS HANDOFF INTERMEDIATE posn:

X	Y	Z	PITCH	YAW	ROLL	PL ID
-1062	-360	-600	284	0	282	0
-1070	-361	-584	14	281	330	1
-1174	+219	-626	14	281	0	2
SY	SP	EP	WP	WY	WR	
+24.5	+59.0	-42.1	-85.9	+11.2	-87.8	

MPLM VIEWING posn:

X	Y	Z	PITCH	YAW	ROLL	PL ID
-959	-627	-387	341	47	345	0
-967	-643	-386	60	349	282	1
-1252	-520	-889	60	349	312	2
SY	SP	EP	WP	WY	WR	
+62.5	+25.0	-23.0	0.0	-13.2	-21.9	

CONTINGENCY MPLM VIEWING INTERMEDIATE posn:

X	Y	Z	PITCH	YAW	ROLL	PL ID
-930	-439	-187	103	52	228	0
-924	-450	-199	53	333	212	1
-1244	-171	-610	53	333	242	2
SY	SP	EP	WP	WY	WR	
+54.9	+2.7	-50.5	+114.3	+25.0	-44.7	

CONTINGENCY MPLM VIEWING posn:

X	Y	Z	PITCH	YAW	ROLL	PL ID
-939	-436	-191	88	47	239	0
-935	-447	-205	48	324	214	1
-1259	-92	-551	48	324	244	2
SY	SP	EP	WP	WY	WR	
+54.9	+2.7	-50.5	+114.3	+14.3	-44.7	

REFERENCE
DATA

OBSS UNDOCK posn:

X	Y	Z	PITCH	YAW	ROLL	PL ID
-1032	-362	-618	284	0	270	0
-1041	-362	-602	44	270	0	1
-1029	+229	-614	284	270	270	2
SY	SP	EP	WP	WY	WR	
+25.8	+66.3	-49.0	-85.9	+10.7	-100.7	

*
*

*Display singularity

OBSS HOVER posn:

X	Y	Z	PITCH	YAW	ROLL	PL ID
-680	+135	-535	270	349	1	0
-680	+133	-517	0	0	341	1
-1271	+134	-532	0	0	11	2
SY	SP	EP	WP	WY	WR	
-90.0	+80.2	-118.8	-59.8	0.0	+110.0	

FLAT FIELD posn:

X	Y	Z	PITCH	YAW	ROLL	PL ID
-679	+351	-448	270	349	1	0
-679	+349	-430	0	0	341	1
-1270	+350	-445	0	0	11	2
SY	SP	EP	WP	WY	WR	
-90.1	+25.0	-65.8	-57.6	0.0	-249.9	

OBSS CONTINGENCY UNDOCK posn:

X	Y	Z	PITCH	YAW	ROLL	PL ID
-1119	-483	-582	5	37	313	0
-1131	-496	-586	62	324	282	1
-1348	-141	-1006	62	324	312	2
SY	SP	EP	WP	WY	WR	
+35.0	+38.7	-22.8	-0.5	-0.3	-40.0	

OBSS AUTOSEQUENCE

Auto Seq ID	Auto posn	X/ SY	Y/ SP	Z/ EP	PITCH/ WP	YAW/ WY	ROLL/ WR	Pause
7	148	-1029	+229	-614	284	270	270	P
		+26.1	+67.7	-51.2	-85.0	+10.6	-100.6	
7	149	-800	+500	-250	281	333	95	
		-86.7	+72.7	-86.0	+21.2	-3.3	-169.3	
7	150	-1130	+350	-400	325	336	30	
		-80.4	+90.4	-94.6	-76.3	-43.9	-262.8	
7	151	-1270	+350	-445	0	0	11	P
		-90.1	+25.0	-65.8	-57.6	0.0	-249.9	

CUE CARD CONFIGURATION

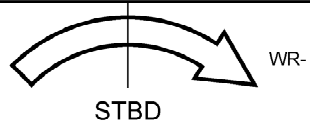
OBSS SJ GRAPPLE AT HANDOFF	FS CC 4-2
UNGRAPPLE AT HANDOFF	FS CC 4-3
OVERLAY FOR ROEU PL SEL POSITION.....	FS CC 4-4

CUE CARD
CONFIG

CUE CARD CONFIG

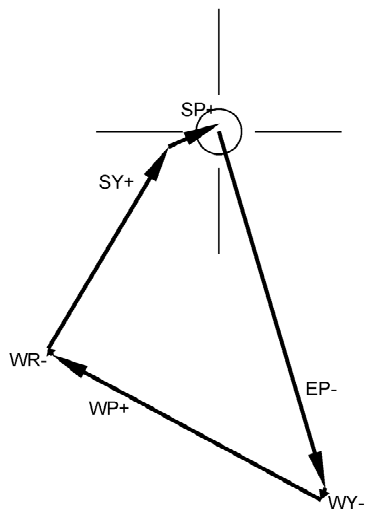
Fabricate as transparency

ZOOM 34.0 HFOV
FOCUS 5.0 FT
EYEPOINT APPROX 18 IN



FWD

AFT



OBSS SJ GRAPPLE AT HANDOFF

PORT

PDRS-9a/135/O/A

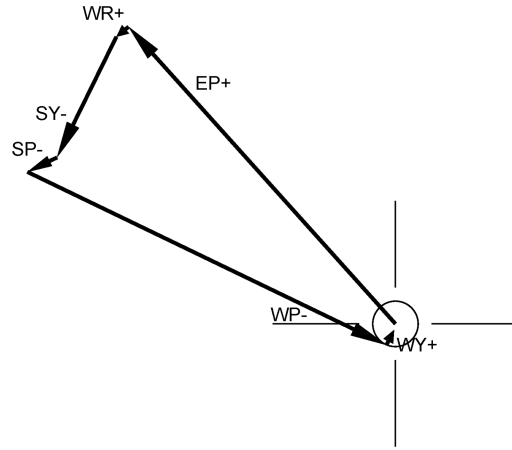
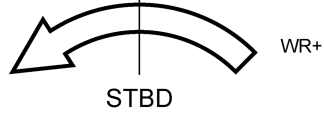
(reduced copy)

FS CC 4-2

PDRS/135/FIN

Fabricate as transparency

ZOOM 34.0 HFOV
FOCUS 5.0 FT
EYEPOINT APPROX 18 IN



FWD

AFT

OBSS SJ UNGRAPPLE AT HANDOFF

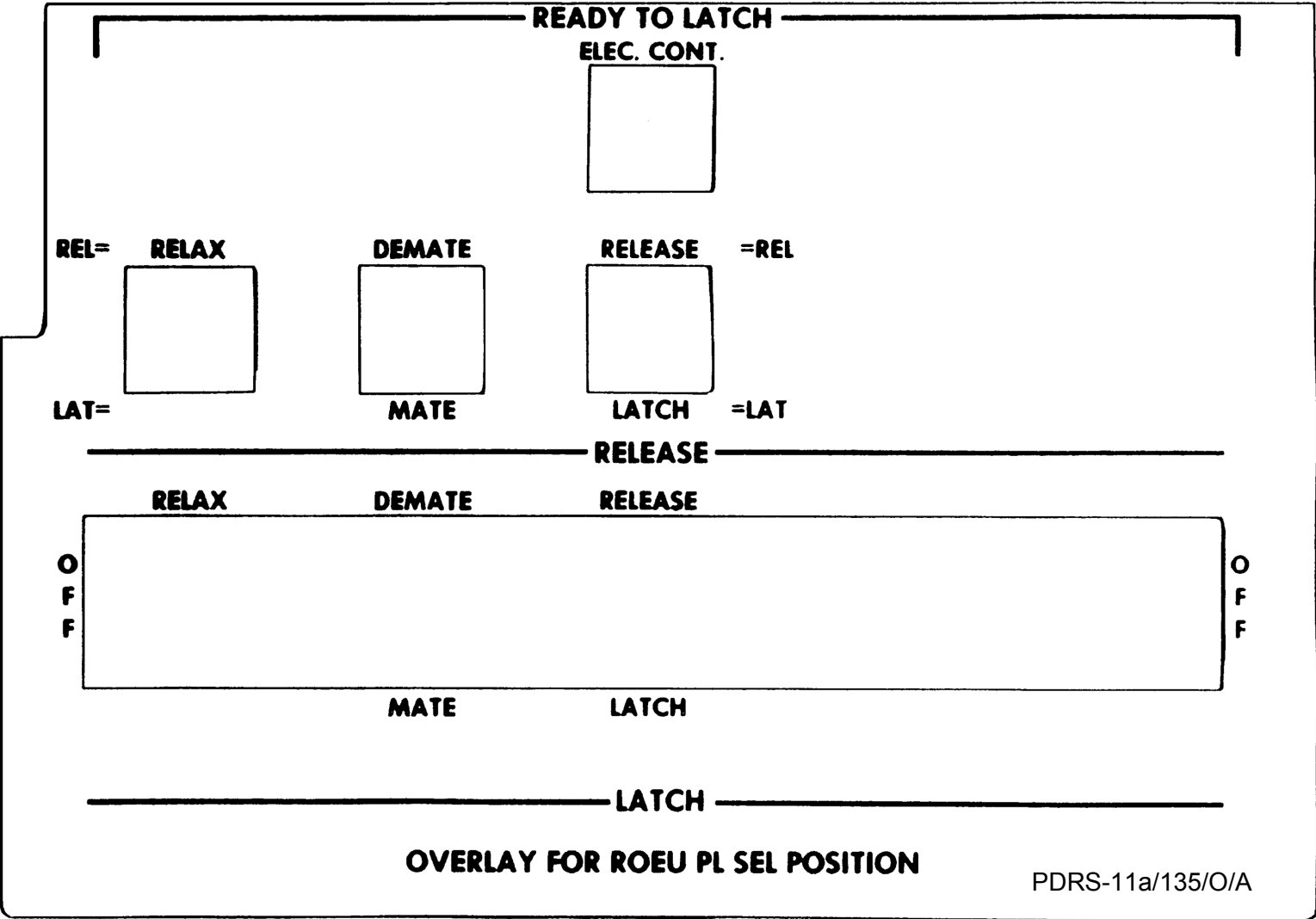
PORT

PDRS-10a/135/O/A

(reduced copy)

FS CC 4-3

PDRS/135/FIN



FS CC 4-4

PDRS/135/FIN



PDRS OPS C/L

**STS
135**