Space Shuttle Program
FLIGHT DATA FILE

JSC-48040-133

PDRS Operations Checklist

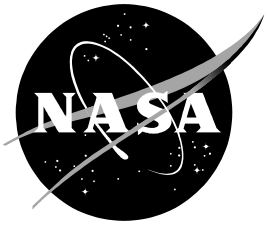
STS-133 Flight Supplement

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

Final, Rev A
October 15, 2010

National Aeronautics and
Space Administration

Lyndon B. Johnson Space Center
Houston, Texas



MISSION OPERATIONS DIRECTORATE

PDRS OPERATIONS CHECKLIST
STS-133 FLIGHT SUPPLEMENT

FINAL, REVISION A
October 15, 2010

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PDRS OPERATIONS CHECKLIST
STS-133 FLIGHT SUPPLEMENT

LIST OF EFFECTIVE PAGES

FINAL	08/20/10
REV A	10/15/10

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⊗ – Flight copies of this page contain color

PDRS CUE CARDS

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CONTENTS PAGE

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ELC4 NOMINAL

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ELC4 UNBERTH VIEWING

1. SETUP

Verify SSRMS at ELC4 PRE-GRAPPLE posn:

SR	SY	SP	EP	WP	WY	WR
+74.5	-173.6	-189.1	-131.7	-128.6	-164.6	+177.2

SM 94 PDRS CONTROL

√PL ID, ITEM 3: 0

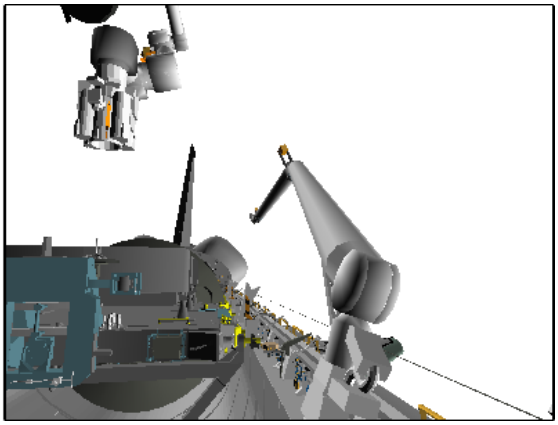
√INIT ID, ITEM 24: 0

Verify SRMS at PRE-CRADLE posn:

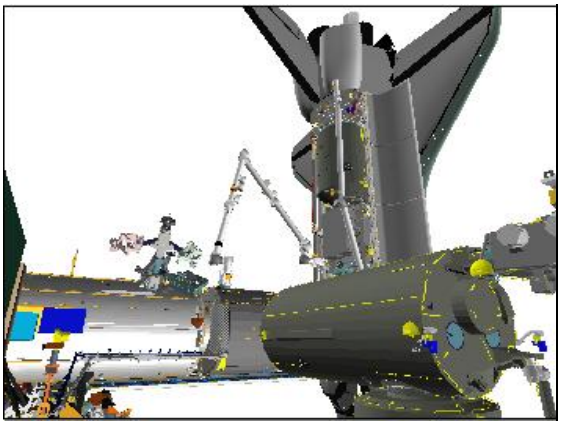
	X	Y	Z	PITCH	YAW	ROLL	PL ID
√	-1261	-146	-551	5	2	0	0
	SY	SP	EP	WP	WY	WR	
√	0.0	+25.0	-25.0	+5.0	0.0	0.0	

R12 Green Jumper – ISS

V10/L	P1 LOOB
V10/R	Elbow
MON 1	A
MON 2	B (EE)



CCTV A (10,10)



P1 LOOB (120,20)

2. MNVR TO ELC4 UNBERTH VIEWING

NOTE

Clearance between SRMS Upper Boom and JEM is 27 inches. Monitor with CCTV A.

Clearance between EE and Port Sill is 65 inches. Monitor with CCTV B

SM 94 PDRS CONTROL

END POS – ITEM 18 -9 8 6 -1 5 8 -4 7 1 EXEC

ATT – ITEM 21 +2 7 0 +2 8 7 +1 8 0 EXEC

CMD CK – ITEM 25 EXEC (GOOD)

RHC RATE – VERN (RATE MIN tb-ON)

BRAKES – OFF (tb-OFF)

MODE – OPR CMD, ENTER (READY lt on)

After PROCEED, if motion no longer apparent but POR is within 1 in/1 deg and IN PROG lt – on:
AUTO SEQ – STOP

AUTO SEQ – PROCEED (IN PROG lt on)

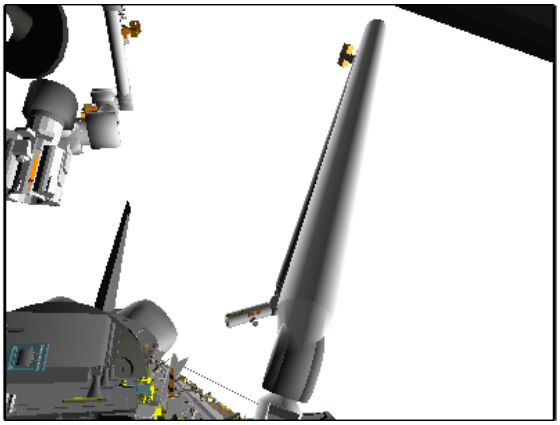
When AUTO SEQ IN PROG lt – off:
BRAKES – ON (tb-ON)

ELC4 UNBERTH VIEWING posn: (01:04)

	X	Y	Z	PITCH	YAW	ROLL	PL ID
√	-986	-158	-471	270	287	180	0
	SY	SP	EP	WP	WY	WR	
√	+15.2	+71.3	-103.8	-77.1	-50.9	-184.9	

√MODE – not DIRECT (lt off)

PARAM – PORT TEMP
JOINT – CRIT TEMP



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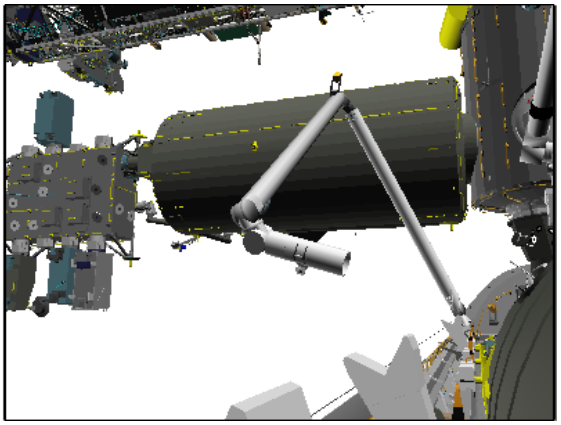
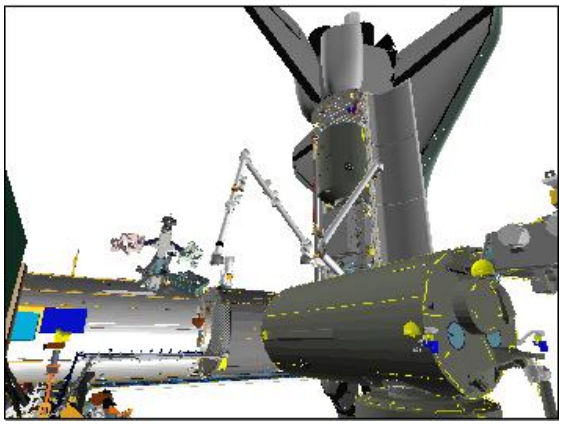
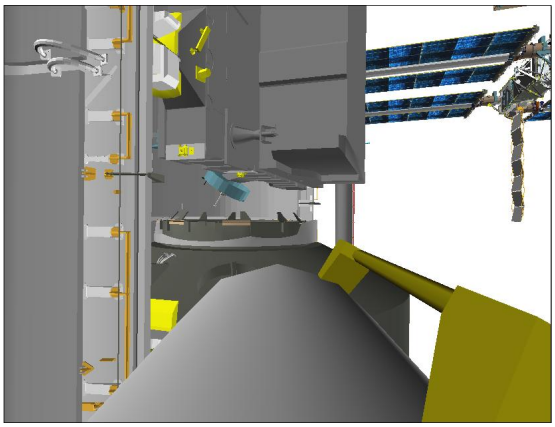


CCTV B (-20,10)



P1 LOOB (120,20)



EE

ELC4 HANDOFF

1. SETUP

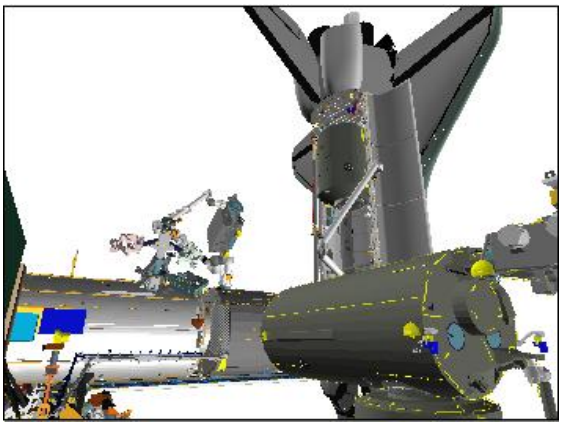
On SSRMS Operator, "SRMS is GO for ELC4 grapple at Handoff"

SM 94 PDRS CONTROL

√PL ID, ITEM 3: 0

√INIT ID, ITEM 24: 0

V10/L	P1 LOOB
V10/R	Elbow → C
MON 1	A
MON 2	B → D



P1 LOOB (120,20)

2. MNVR TO ELC4 PRE-GRAPPLE POSN

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

Mnvr to ELC4 INTERMEDIATE posn:

	SY	SP	EP	WP	WY	WR	
ELC4 Viewing	+15.2	+71.3	-103.8	-77.1	-50.9	-184.9	
1: EP +			-50.0				
2: SP –		+50.0					
ELC4 Int	+15.2	+50.0	-50.0	-77.1	-50.9	-184.9	
	X	Y	Z	PITCH	YAW	ROLL	PL ID
	-1131	-229	-553	315	299	197	0

SM 94 PDRS CONTROL

END POS – ITEM 18 -9 9 8 +2 2 7 -6 1 7 EXEC
ATT – ITEM 21 +2 0 2 +2 8 4 +2 7 8 EXEC
CMD CK – ITEM 25 EXEC (GOOD)

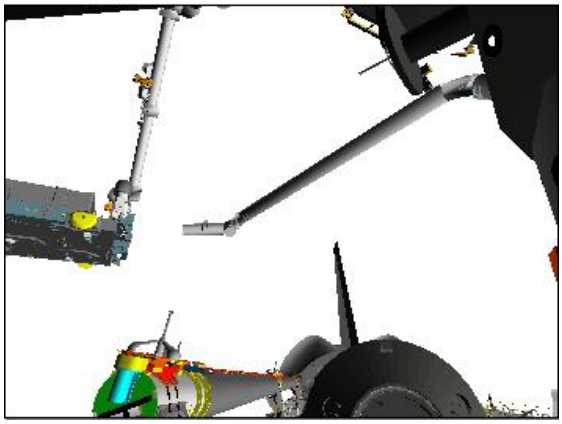
RHC √RATE – VERN (RATE MIN tb-ON)
MODE – OPR CMD, ENTER (READY lt on)

AUTO SEQ – PROCEED (IN PROG lt on)

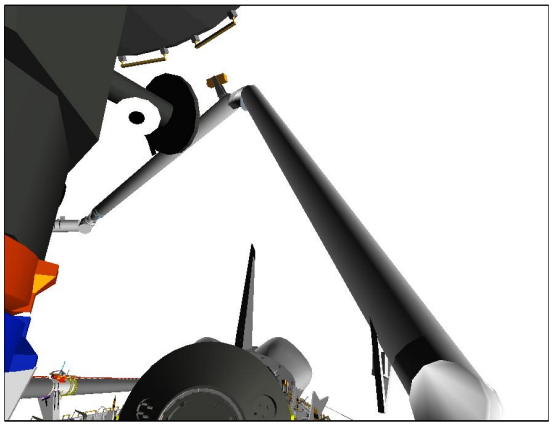
When AUTO SEQ IN PROG lt – off:
BRAKES – ON (tb-ON)

ELC4 PRE-GRAPPLE posn: (01:18)

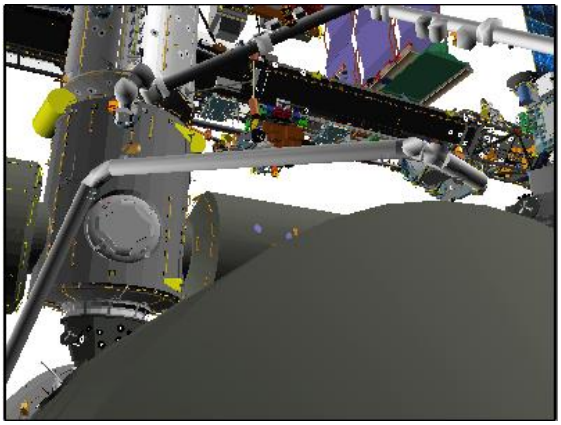
	X	Y	Z	PITCH	YAW	ROLL	PL ID
√	-998	+227	-617	202	284	278	0
	SY	SP	EP	WP	WY	WR	
√	-44.4	+44.0	-62.9	-22.8	-52.1	-294.4	



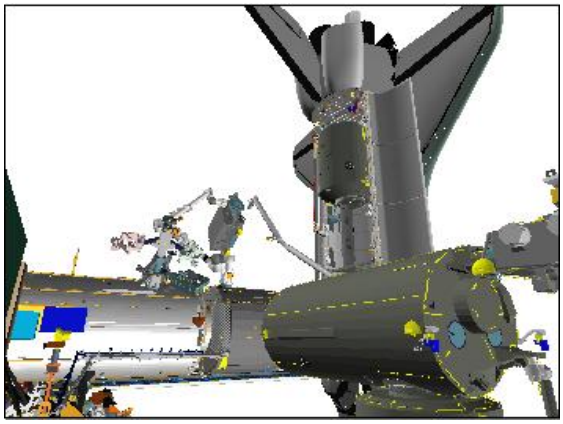
CCTV D (-5,25)



CCTV A (0,25)



CCTV B (25,20)



P1 LOOB (120,20)

3. SETUP FOR ELC4 GRAPPLE

V10/L	LAB (P1 LOOB)
V10/R	C
MON 1	EE
MON 2	D (A)

A7U CCTV – config for grapple
– install PDRS TARGET OVERLAY FOR CTVM
– RMS WRIST, ZOOM 34.0 HFOV
FOCUS 5 ft
Maintain eyepoint approx 18 inches when using grapple overlay

* If using shuttle attitude control *
* Verify in attitude, then DAP: FREE *

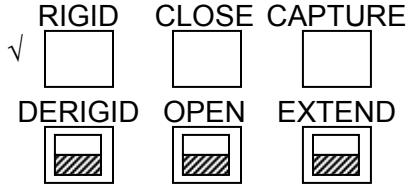
4. ELC4 GRAPPLE

RHC √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

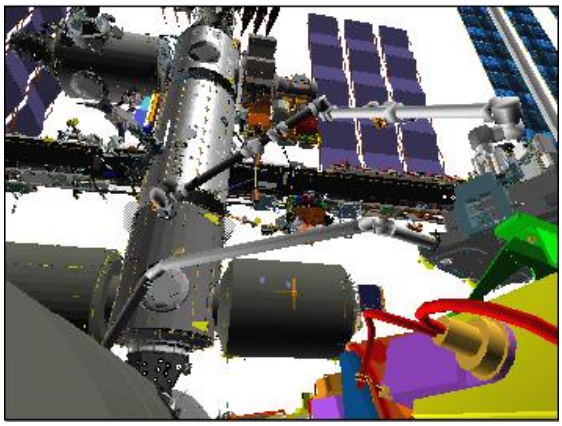
BRAKES – ON (tb-ON)
MODE – not DIRECT (lt off)

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

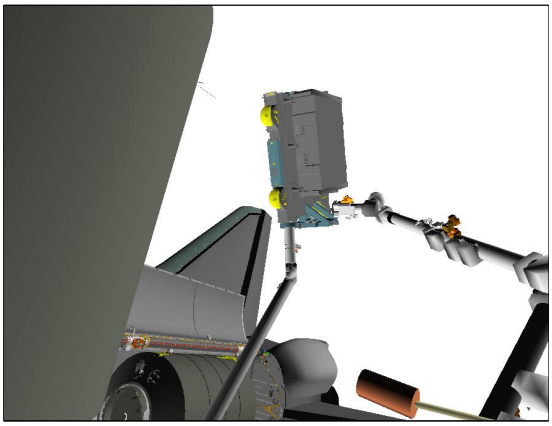
Expected ELC4 HANDOFF posn:

	X	Y	Z	PITCH	YAW	ROLL	PL ID
√	-986	+405	-611	180	300	180	3
	SY	SP	EP	WP	WY	WR	
√	-50.9	+32.1	-48.5	-21.0	-47.3	-288.4	

Notify SSRMS Operator, "SSRMS is GO for ELC4 Release"



CCTV C (10,30)



US LAB (-30,0)

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

ELC4 HANDBACK

1. SETUP

On SSRMS Operator, "SRMS is GO for maneuver to ELC4 Handback"

SM 94 PDRS CONTROL

√PL ID, ITEM 3: 3

√INIT ID, ITEM 24: 3

V10/L	S1 LOOB
V10/R	C
MON 1	Elbow
MON 2	D

* If using shuttle attitude control *
* Verify in attitude, then DAP: FREE *

2. MNVR TO ELC4 HANDBACK POSN

RHC RATE – as reqd (VERN within 10 ft)
A8U BRAKES – OFF (tb-OFF)
MODE – SINGLE, ENTER

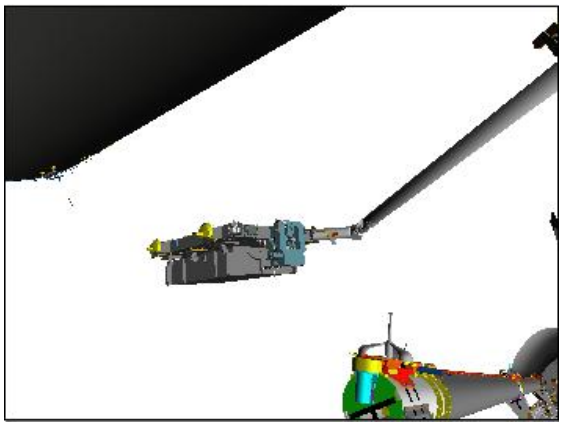
Mnvr to ELC4 HANDBACK posn:

	SY	SP	EP	WP	WY	WR	
Handoff	-50.9	+32.1	-48.5	-21.0	-47.3	-288.4	
1: WP +				-3.5			
2: WR +						-109.2	
Handback	-50.9	+32.1	-48.5	-3.5	-47.3	-109.2	
	X	Y	Z	PITCH	YAW	ROLL	PL ID
	-942	+397	-621	30	279	197	3

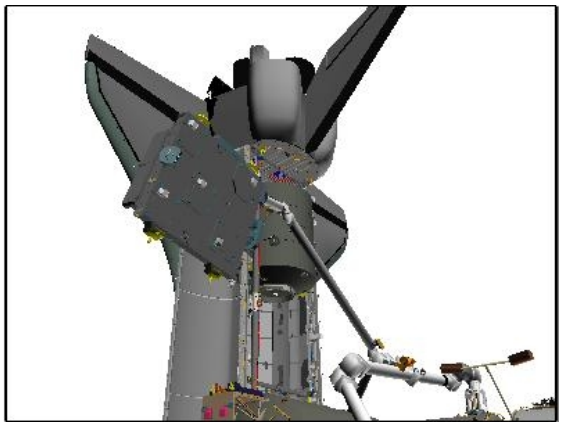
BRAKES – ON (tb-ON)

Notify MCC-H, "SRMS is at the ELC4 Handback posn"

* If using shuttle attitude control: ROBOTICS ATTITUDE MAINTENANCE *
* (ORB OPS, REBOOST/DAP) steps 1, 2 *



CCTV D (-35,25)

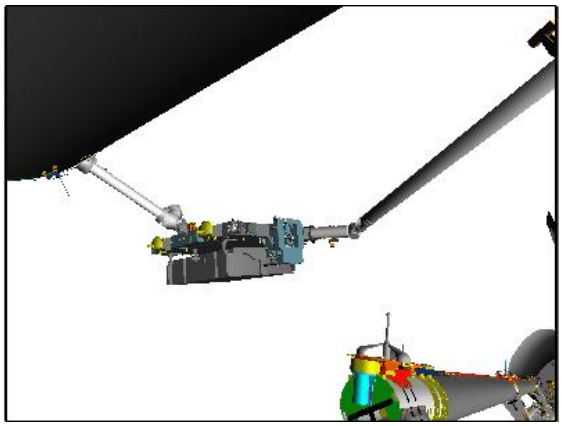


S1 LOOB (50,30)

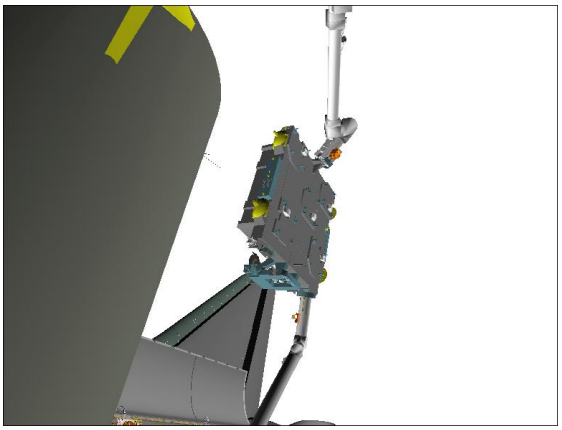
3. ELC4 UNGRAPPLE

On SSRMS Operator, "SRMS is GO for ELC4 Release"

V10/L	LAB
V10/R	A
MON 1	C (EE)
MON 2	D



CCTV D (-35,25)



LAB (-30,10)

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

NOTE

CONTR ERR lt 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)

NOTE

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

	RIGID	CLOSE	CAPTURE
√	☒	☒	☒
	DERIGID	OPEN	EXTEND
	☐	☐	☐

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

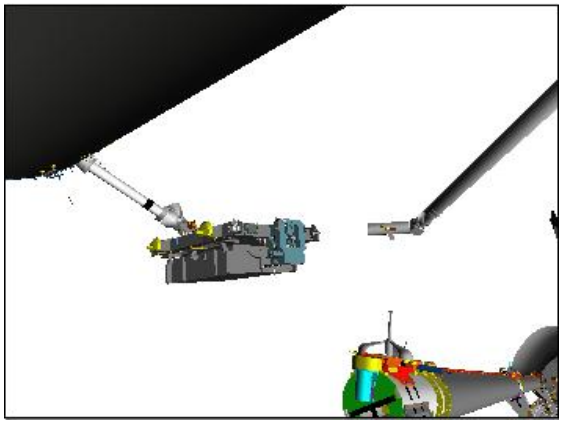
* If manual release reqd: *
* EE MODE – MAN *
* MAN CONTR – DERIGID (hold until DERIGID tb-gray, 5 sec max) *
* RELEASE sw – depress (hold until OPEN tb-gray, 3 sec max) *
* Mnvr arm clear, then *
* EE MAN CONTR – DERIGID (hold until EXTEND tb-gray, 20 sec max) *
* MODE – OFF *

THC/RHC Mnvr to ELC4 BACKOFF posn:

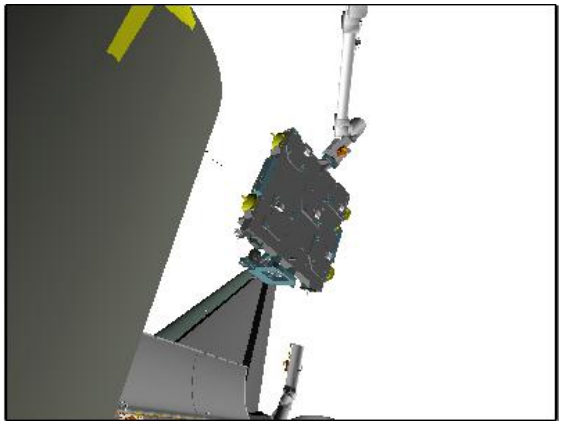
X	Y	Z	PITCH	YAW	ROLL	PL ID
-998	+227	-620	146	281	28	0
SY	SP	EP	WP	WY	WR	
-44.4	+44.7	-66.9	+0.6	-53.4	-112.9	

BRAKES – ON (tb-ON)

Notify SSRMS Operator, "SSRMS is GO for ELC4 maneuver"



CCTV D (-35,25)



LAB (-30,10)

MNVR TO OBSS HANDOFF PRE-GRAPPLE

1. SETUP

On SSRMS Operator, "SRMS is GO for mnvr to OBSS HANDOFF PRE-GRAPPLE"

SM 94 PDRS CONTROL

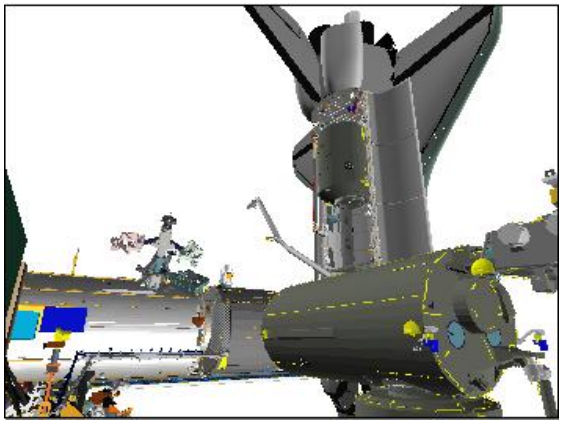
√PL ID, ITEM 3: 0

√INIT ID, ITEM 24: 0

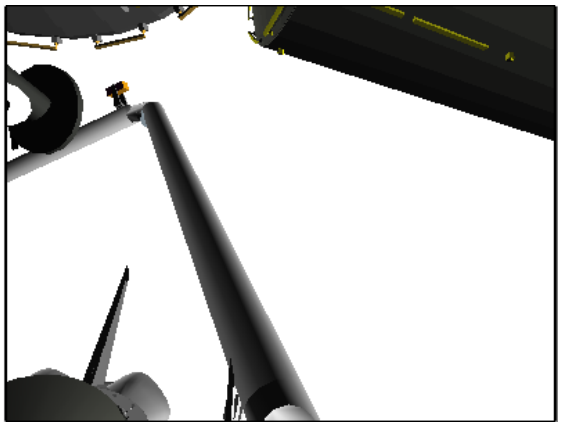
Verify SRMS at ELC4 BACKOFF posn:

	X	Y	Z	PITCH	YAW	ROLL	PL ID
√	-998	+227	-620	149	281	32	0
	SY	SP	EP	WP	WY	WR	
√	-44.4	+44.7	-66.9	+0.6	-53.4	-112.9	

V10/L	P1 LOOB
V10/R	A
MON 1	Elbow
MON 2	B



P1 LOOB (120,20)



CCTV A (20,30)

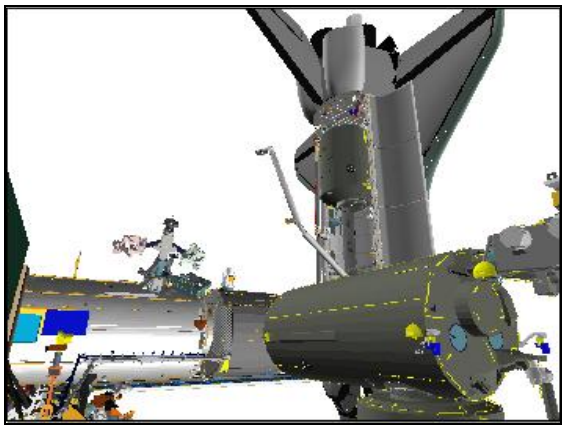
2. MNVR TO OBSS INTERMEDIATE POSN

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

Mnvr to OBSS PRE-GRAPPLE INTERMEDIATE posn:

	SY	SP	EP	WP	WY	WR
ELC4 Backoff	-44.4	+44.7	-66.9	+0.6	-53.4	-112.9
1: EP +			-50.0			
2: SY +	-25.0					
3: WR +						0.0
OBSS Intermediate	-25.0	+44.7	-50.0	+0.6	-53.4	0.0

X	Y	Z	PITCH	YAW	ROLL	PL ID
-1124	+85	-669	54	290	41	0



P1 LOOB (120,20)

CCTV A (20,30)

3. MNVR TO OBSS HANDOFF PRE-GRAPPLE

NOTE

Closest clearance between SRMS Upper Boom and JEM is 24 inches, increases to 45 inches. Monitor with CCTV A

SM 94 PDRS CONTROL

END POS – ITEM 18 -1 0 1 8 -3 6 2 -6 7 6 EXEC
ATT – ITEM 21 +2 8 4 +0 +2 7 0 EXEC
CMD CK – ITEM 25 EXEC (GOOD)

RHC √RATE – VERN (RATE MIN tb-ON)
MODE – OPR CMD, ENTER (READY lt on)

AUTO SEQ – PROCEED (IN PROG lt on)

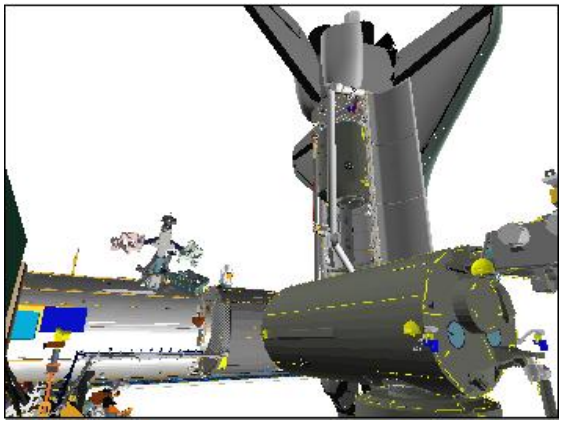
When AUTO SEQ IN PROG lt – off:
BRAKES – ON (tb-ON)

OBSS HANDOFF PRE-GRAPPLE posn: (01:18)

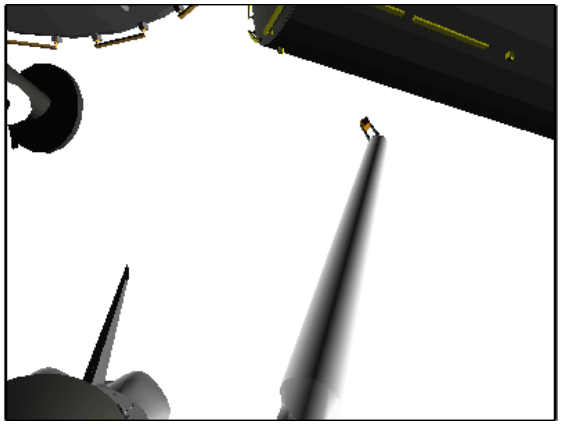
	X	Y	Z	PITCH	YAW	ROLL	PL ID
√	-1018	-362	-676	284	0	270	0
	SY	SP	EP	WP	WY	WR	
√	+23.9	+64.7	-34.2	-99.4	+11.4	-99.0	

√MODE – not DIRECT (lt off)

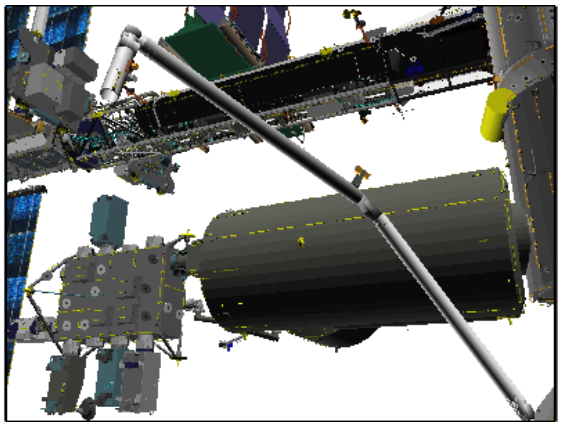
PARAM – PORT TEMP
JOINT – CRIT TEMP



P1 LOOB (120,20)



CCTV A (20,30)



CCTV B (-25,20)

ELC4 CONTINGENCY

ELC4 SJ UNBERTH VIEWING

ELC4 CONTINGENCY

1. SETUP

On SSRMS Operator, "SSRMS is at ELC4 Pre-grapple"

Verify SSRMS at ELC4 PRE-GRAPPLE posn:

SR	SY	SP	EP	WP	WY	WR
+74.5	-173.6	-189.1	-131.7	-128.6	-164.6	+177.2

SM 94 PDRS CONTROL

√PL ID, ITEM 3: 0

√INIT ID, ITEM 24: 0

Verify SRMS at PRE-CRADLE 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 √Green Jumper – ISS

V10/L	P1 LOOB
V10/R	Elbow
MON 1	A
MON 2	B (EE)

2. MNVR TO ELC4 UNBERTH VIEWING

If SINGLE mode available:

RHC RATE – as reqd (VERN within 10 ft)

BRAKES – OFF (tb-OFF)

MODE – best available

NOTE

Clearance between SRMS Upper Boom and JEM is 27 inches during second SP mnvr (line 7). Monitor with CCTV A.

Clearance between EE and Port Sill is 65 inches during second EP mnvr (line 8). Monitor with CCTV B

Mnvr to ELC4 UNBERTH VIEWING posn:

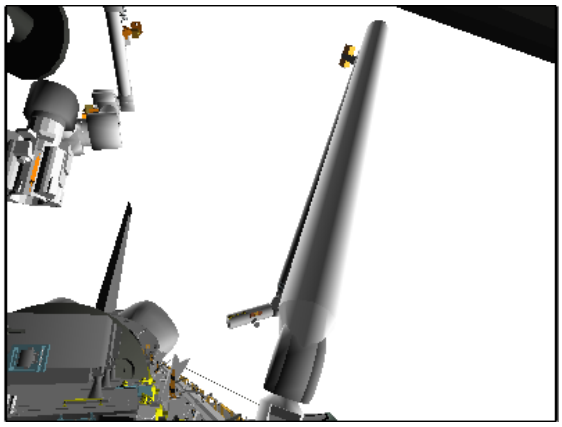
	SY	SP	EP	WP	WY	WR
Pre-cradle	0.0	+25.0	-25.0	+5.0	0.0	0.0
1: SY +	+15.2					
2: SP +		+50.0				
3: WR –						-184.9
4: WY –					-50.9	
5: WP –				-77.1		
6: EP –			-60.0			
7: SP +		+71.3				
8: EP –			-103.8			
ELC4 Viewing	+15.2	+71.3	-103.8	-77.1	-50.9	-184.9

X	Y	Z	PITCH	YAW	ROLL	PL ID
-986	-158	-471	270	287	180	0

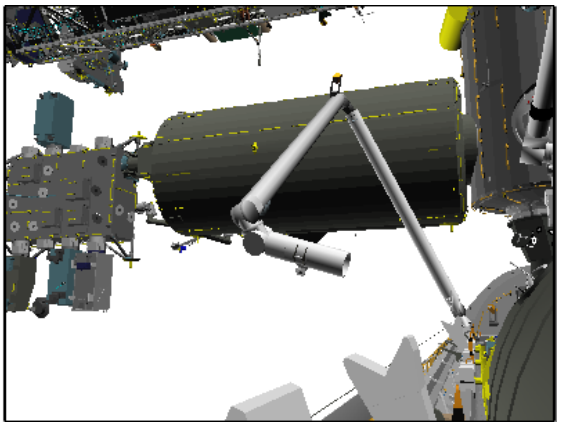
If SINGLE mode available:
BRAKES – ON (tb-ON)

MODE – not DIRECT

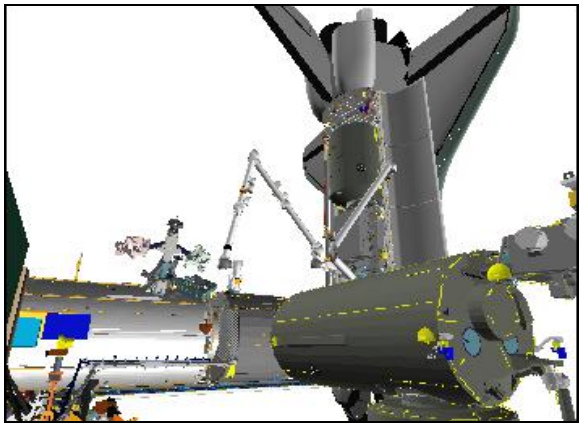
PARAM – PORT TEMP
JOINT – CRIT TEMP



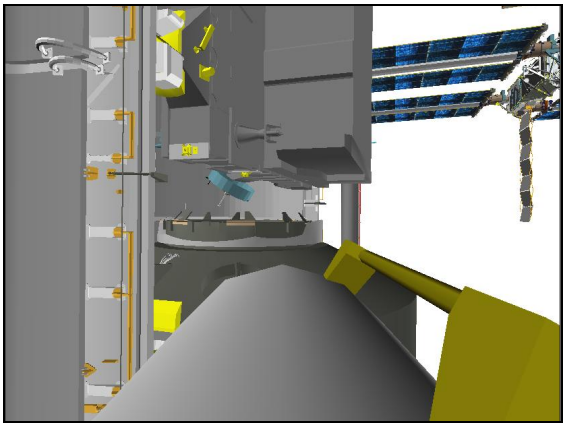
CCTV A (20,20)



CCTV B (-20,10)

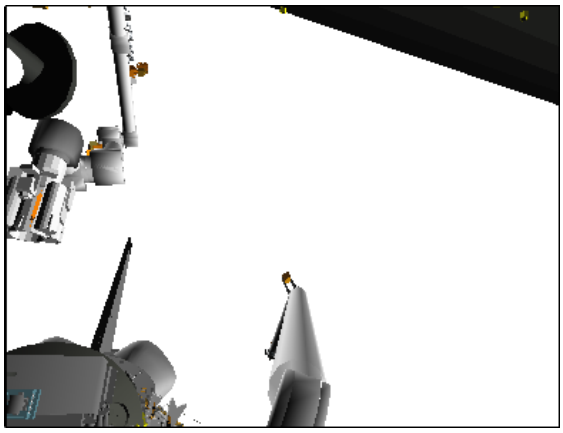


P1 LOOB (120,20)

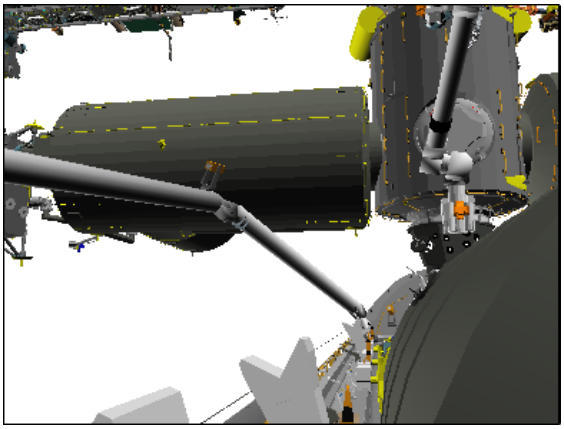


EE

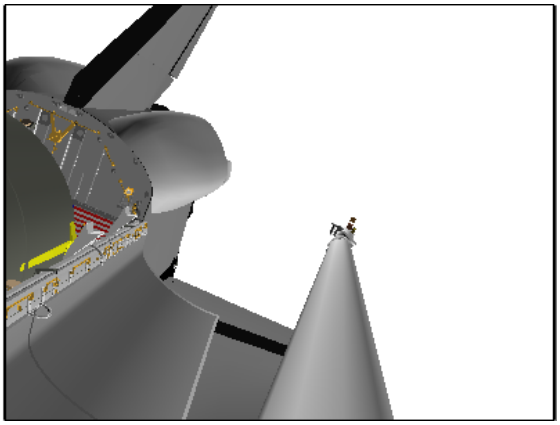
Step 1:
Drive SY (+) from 0 to +15.2



CCTV A (20,25)

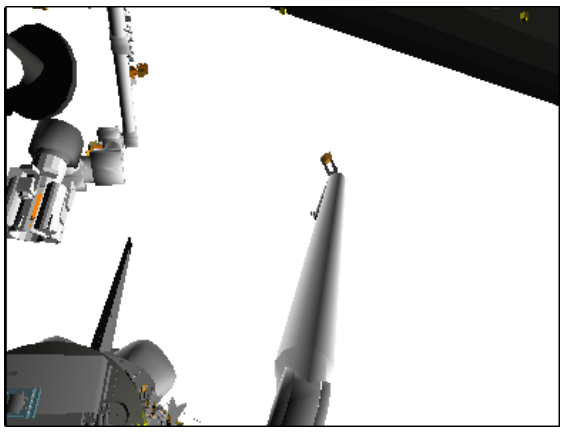


CCTV B (-10,10)

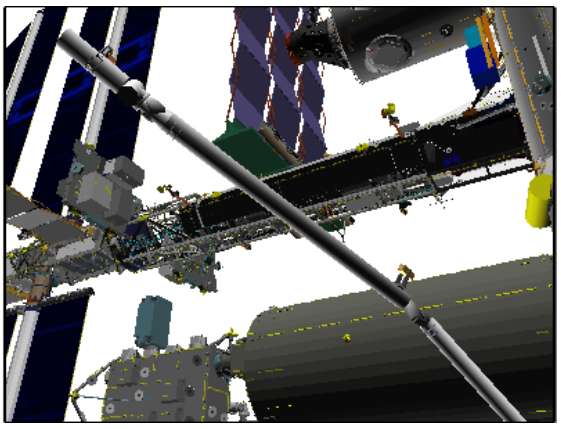


ELBOW (-10,0)

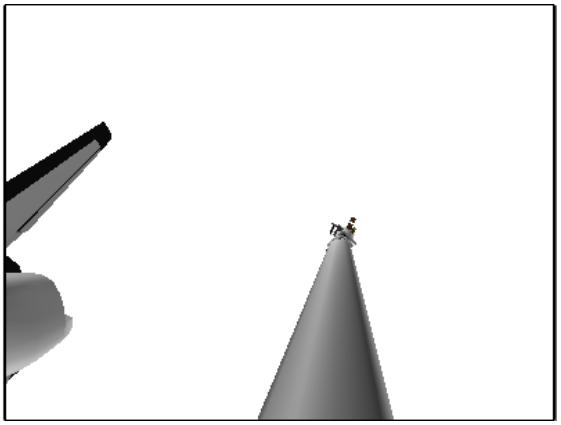
Step 2:
Drive SP (+) from +25.0 to +50.0



CCTV A (20,25)

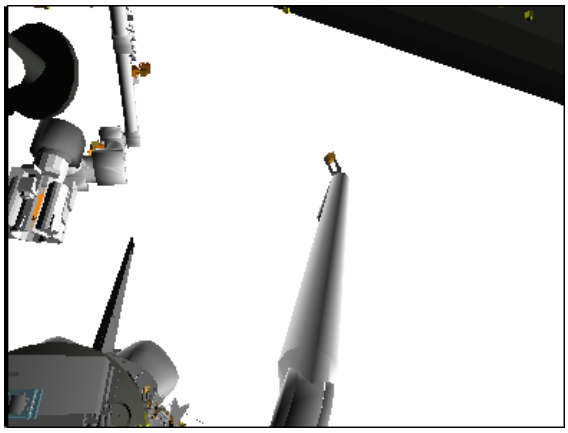


CCTV B (-30,30)

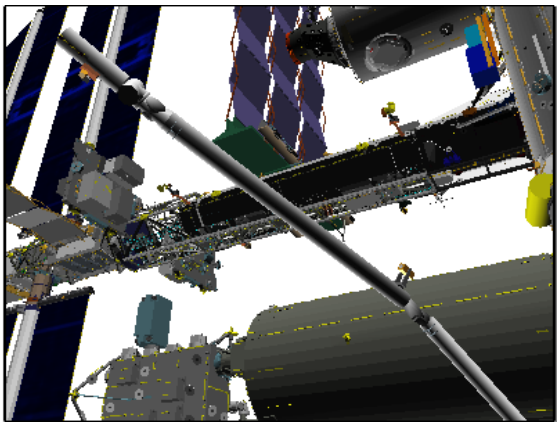


ELBOW (-10,0)

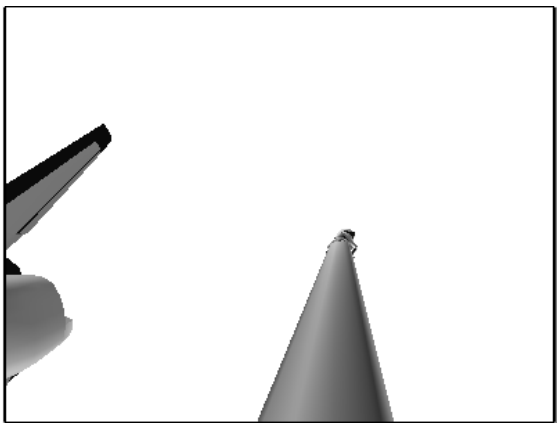
Step 3:
Drive WR (-) from 0 to -184.9



CCTV A (20,25)

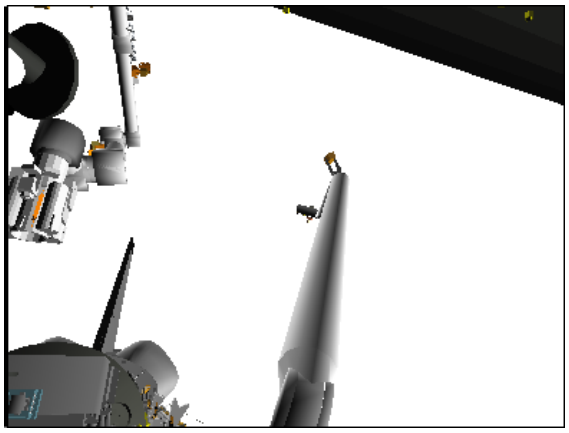


CCTV B (-30,30)

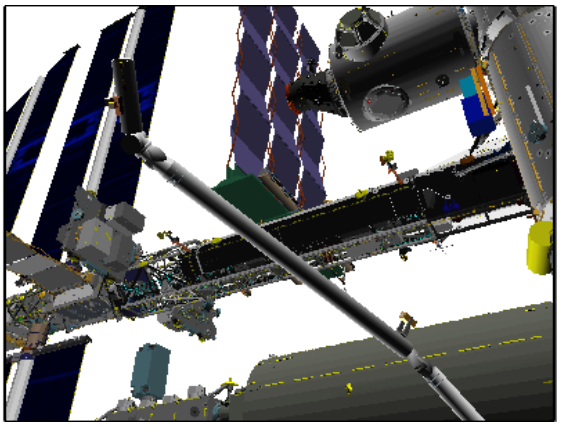


ELBOW (-10,0)

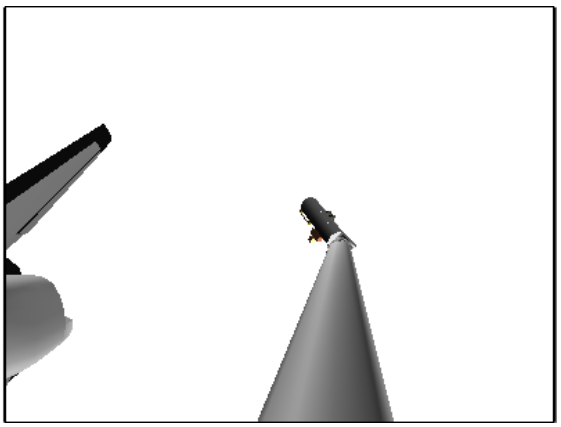
Step 4:
Drive WY (-) from 0 to -50.9



CCTV A (20,25)

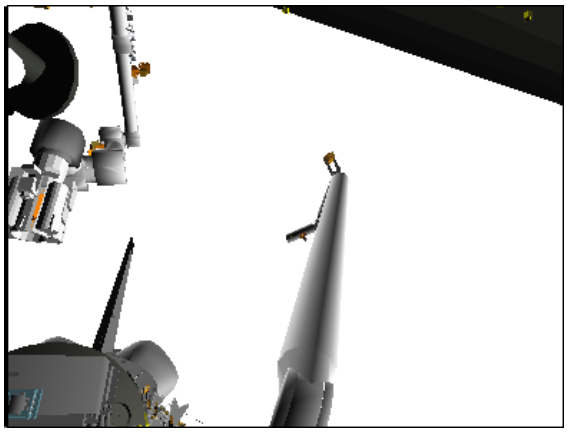


CCTV B (-30,35)

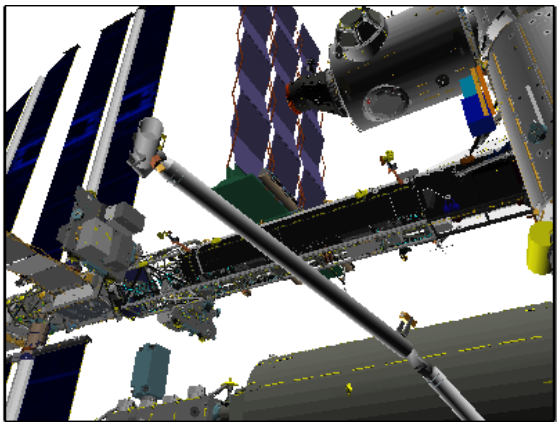


ELBOW (-10,0)

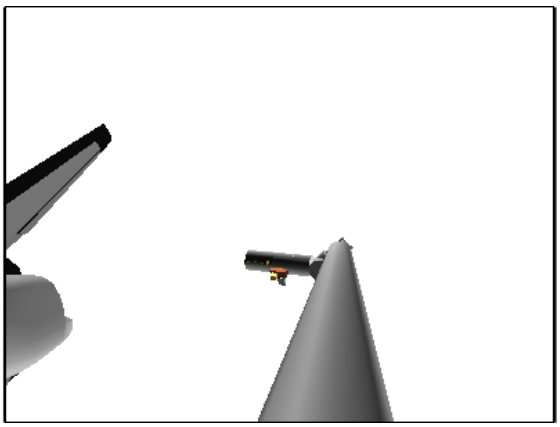
Step 5:
Drive WP (-) from +5.0 to -77.1



CCTV A (20,25)

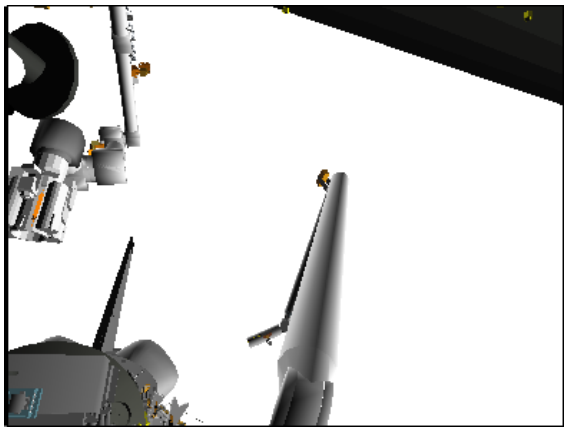


CCTV B (-30,35)

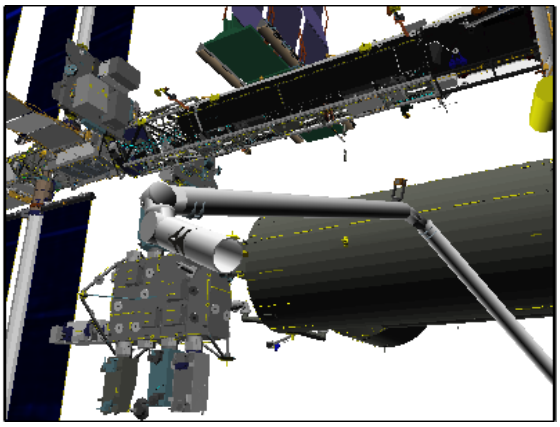


ELBOW (-10,0)

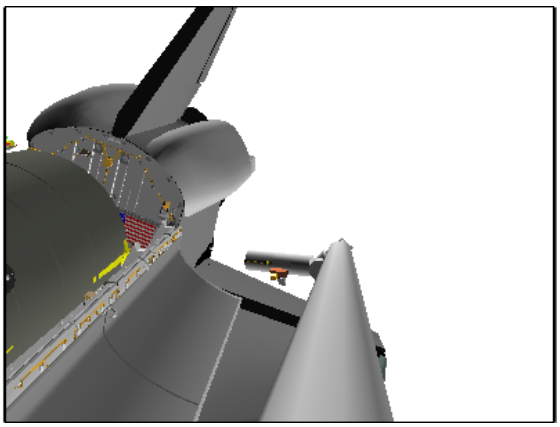
Step 6:
Drive EP (-) from -25.0 to -60.0



CCTV A (20,25)

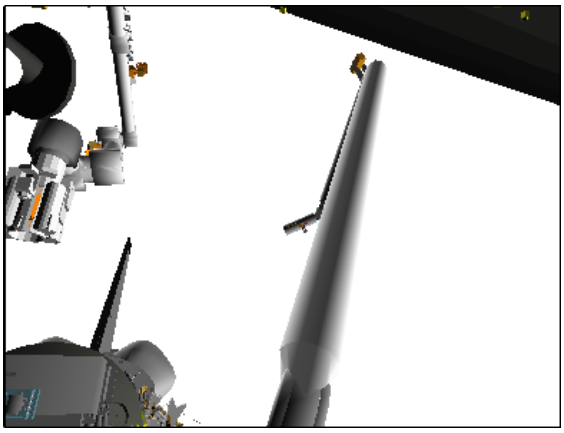


CCTV B (-30,20)

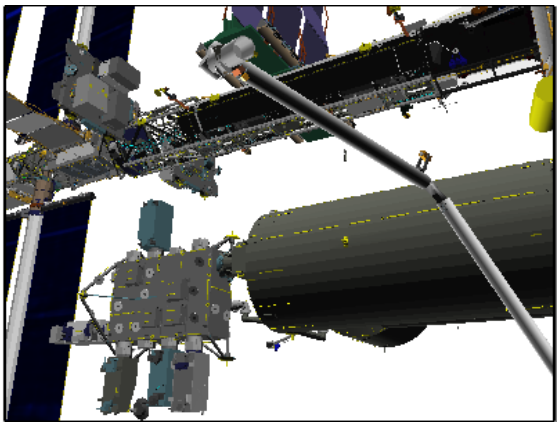


ELBOW (-10,0)

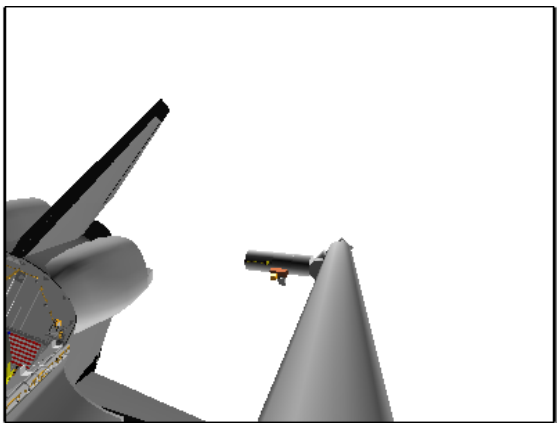
Step 7:
Drive SP (+) from +50.0 to +71.3



CCTV A (20,25)

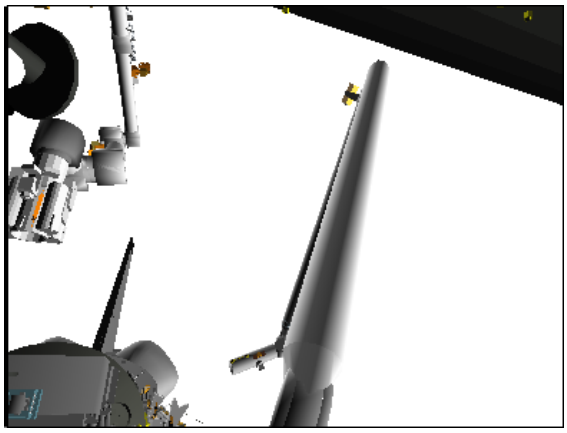


CCTV B (-30,20)

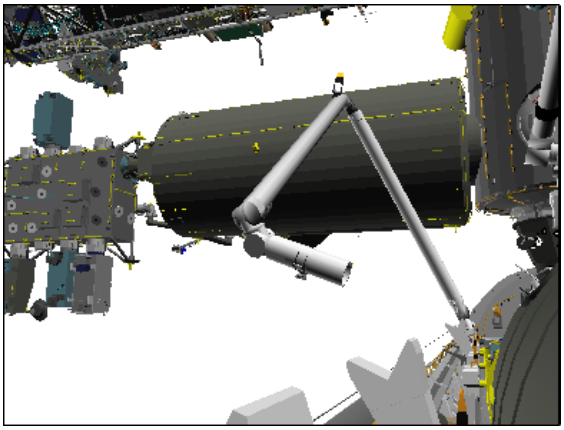


ELBOW (-10,0)

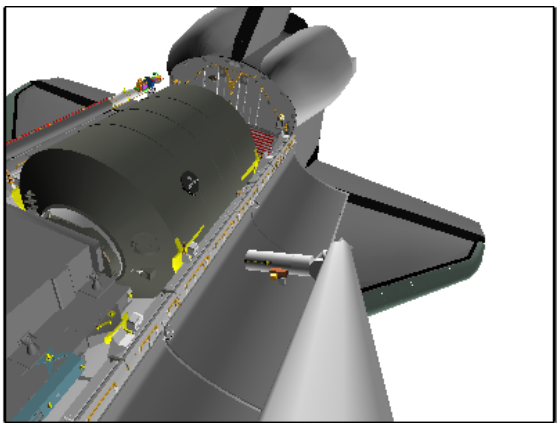
Step 8:
Drive EP (-) from -60.0 to -103.8



CCTV A (20,25)



CCTV B (-20,10)



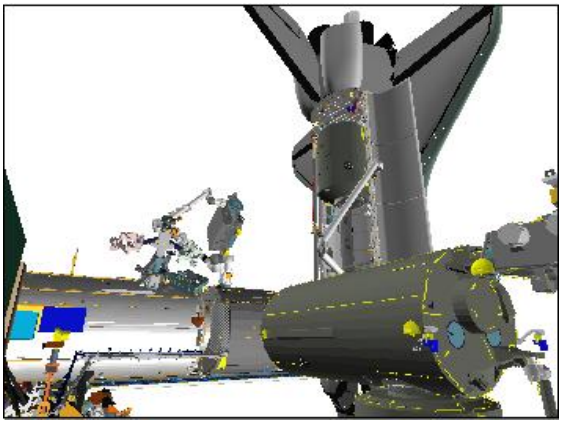
ELBOW (-10,0)

ELC4 SJ HANDOFF

1. SETUP
   On SSRMS Operator, "SRMS is GO for ELC4 grapple at Handoff"

   SM 94 PDRS CONTROL
   √PL ID, ITEM 3: 0
   √INIT ID, ITEM 24: 0

V10/L	P1 LOOB
V10/R	Elbow
MON 1	A → C
MON 2	B → D



P1 LOOB (120,20)

2. MNVR TO ELC4 PRE-GRAPPLE POSN
   If SINGLE mode available:

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

   MODE – best available

   Mnvr to ELC4 PRE-GRAPPLE posn:

	SY	SP	EP	WP	WY	WR
ELC Viewing	+15.2	+71.3	-103.8	-77.1	-50.9	-184.9
1: EP +			-62.8			
2: WP +				-22.8		
3: WY –					-52.1	
4: WR -						-294.4
5: SP –		+50.0				
6: SY –	-44.4					
7: SP –		+44.0				
Pre-grapple	-44.4	+44.0	-62.9	-22.8	-52.1	-294.4

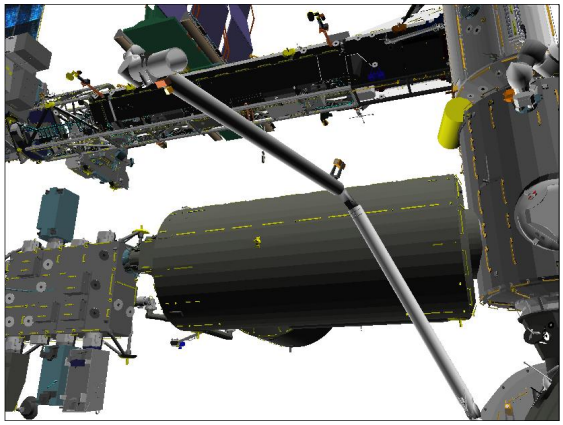
X	Y	Z	PITCH	YAW	ROLL	PL ID
-998	+227	-617	202	284	278	0

   If SINGLE mode available:
   BRAKES – ON (tb-ON)

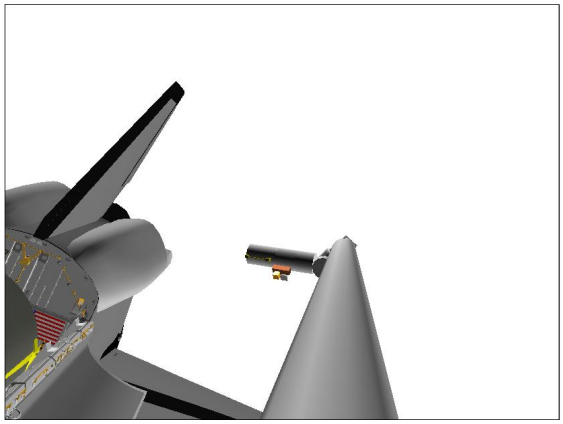
   MODE – not DIRECT

Step 1:
Drive EP (+) from -103.8 to -62.9

CCTV A (10,30)



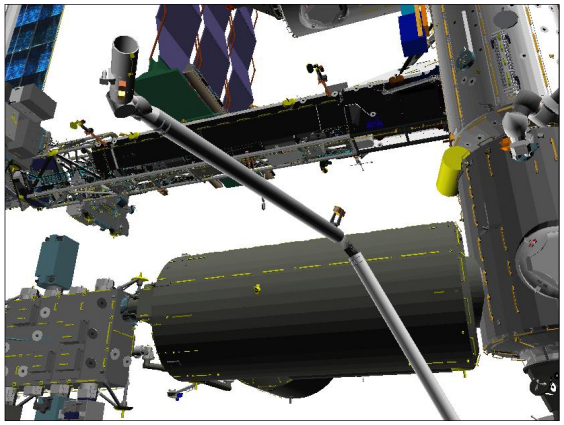
CCTV B (-20,20)



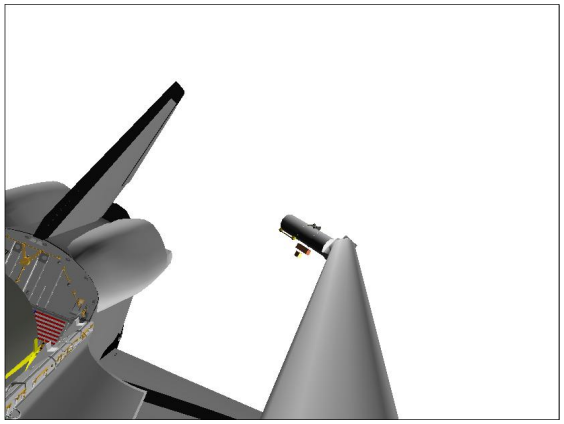
ELBOW (-10,0)

Step 2:
Drive WP (+) from -77.1 to -22.8

CCTV A (10,30)



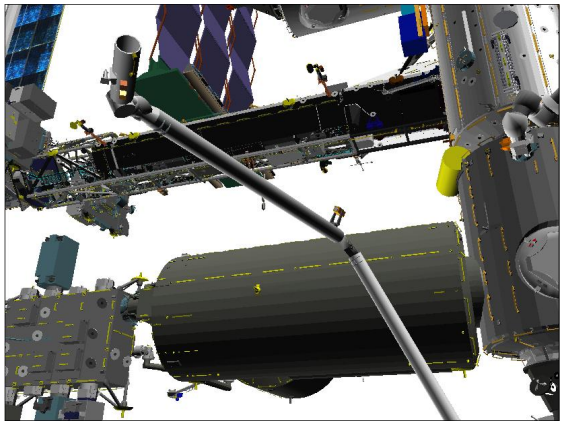
CCTV B (-20,25)



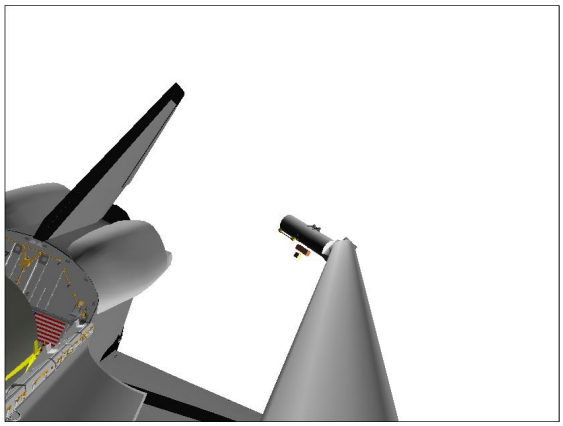
ELBOW (-10,0)

Step 3:
Drive WY (-) from -50.9 to -52.1

CCTV A (10,30)

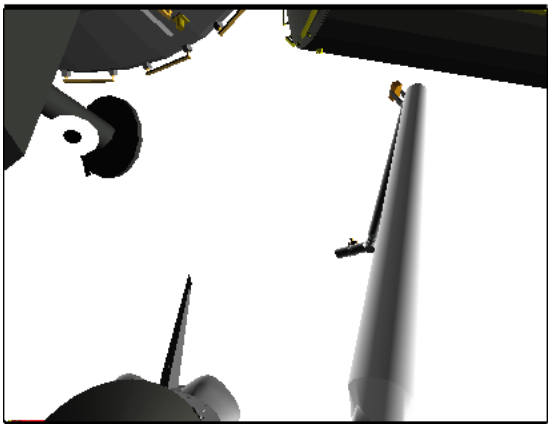


CCTV B (-20,25)

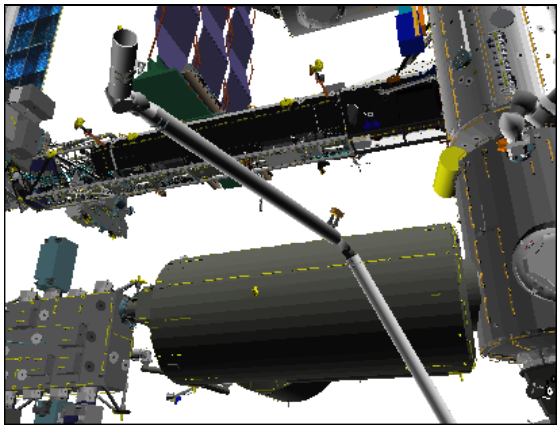


ELBOW (-10,0)

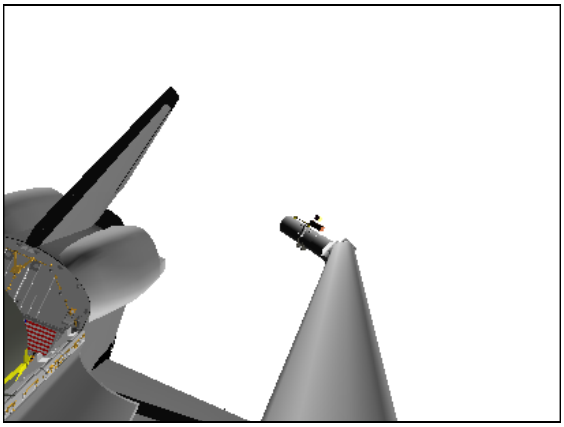
Step 4:
Drive WR (-) from -184.9 to -294.4



CCTV A (10,30)

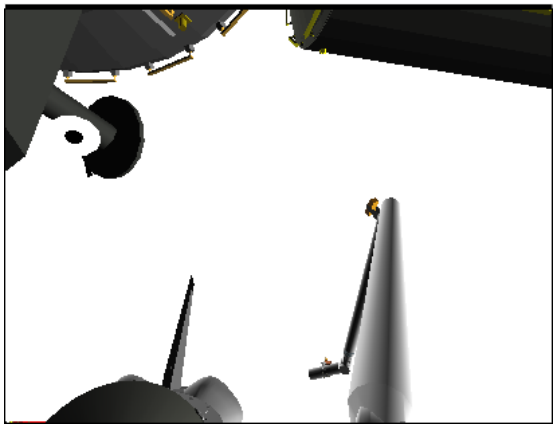


CCTV B (-20,25)

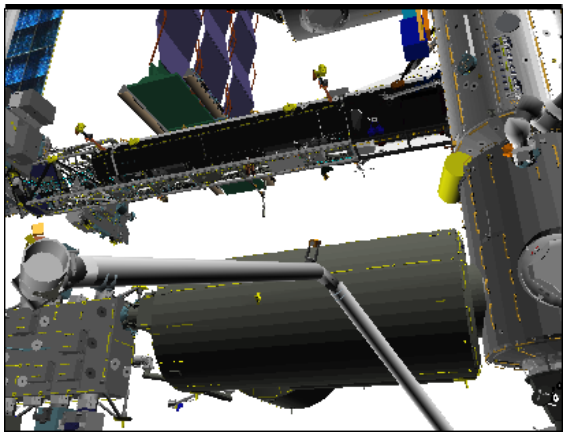


ELBOW (-10,0)

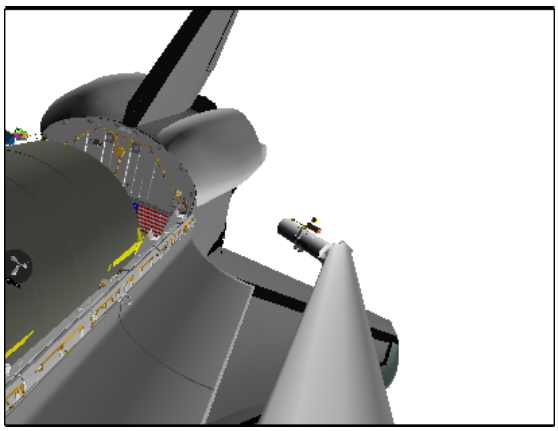
Step 5:
Drive SP (-) from +71.3 to +50.0



CCTV A (10,30)

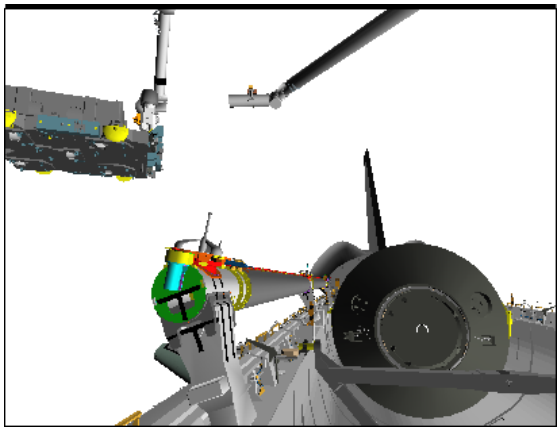


CCTV B (-20,25)

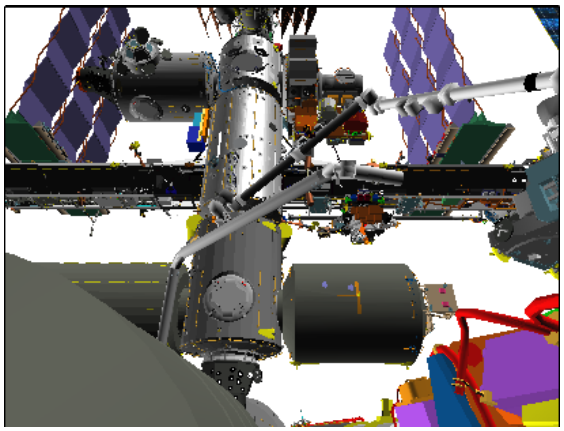


ELBOW (-10,0)

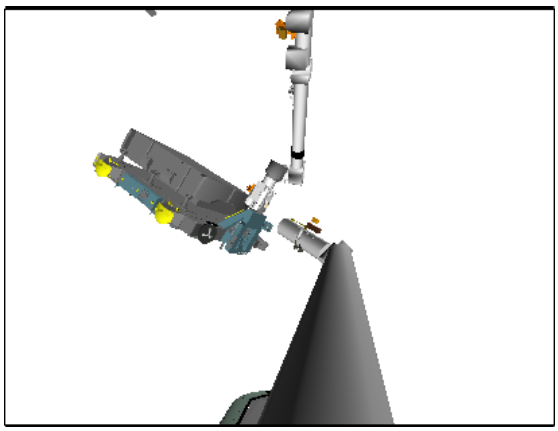
Step 6:
Drive SY (-) from +15.2 to -44.4



CCTV D (-10,10)



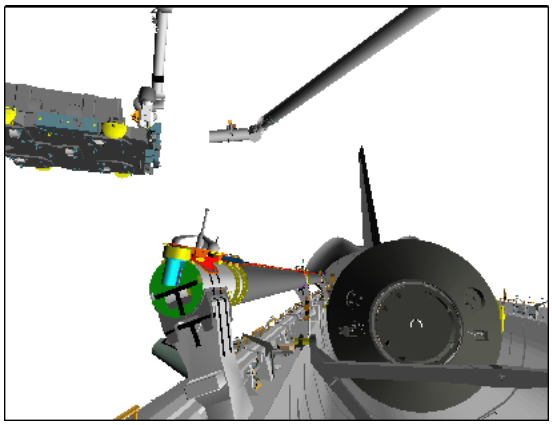
CCTV C (0,30)



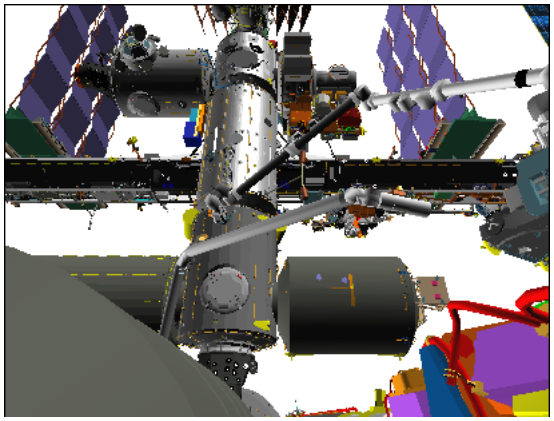
ELBOW (-10,0)

Step 7:

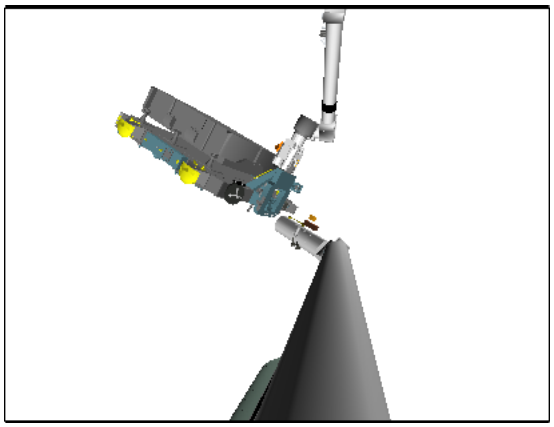
Drive SP (-) from +50.0 to +44.0



CCTV D (-10,10)



CCTV C (0,30)



ELBOW (-10,0)

3. SETUP FOR ELC4 GRAPPLE

V10/L	LAB (P1 LOOB)
V10/R	C
MON 1	EE
MON 2	D (A)

A7U CCTV – config for grapple
– install PDRS TARGET OVERLAY FOR CTVM
– RMS WRIST, ZOOM 34.0 HFOV
FOCUS 5 ft
Maintain eyepoint approx 18 inches when using grapple overlay

* If using shuttle attitude control *
* Verify in attitude, then DAP: FREE *

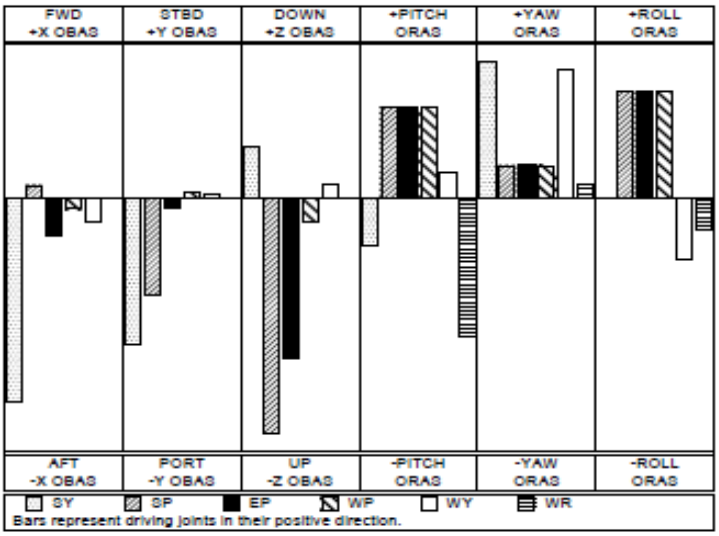
4. SJ MNVR TO ELC4 GRAPPLE
If SINGLE mode available:

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

MODE – best available

Drive joints per ELC4 SJ GRAPPLE WRIST CCTV OVERLAY and diagram until EE within grapple envelope

ELC4 SJ GRAPPLE CCTV OVERLAY

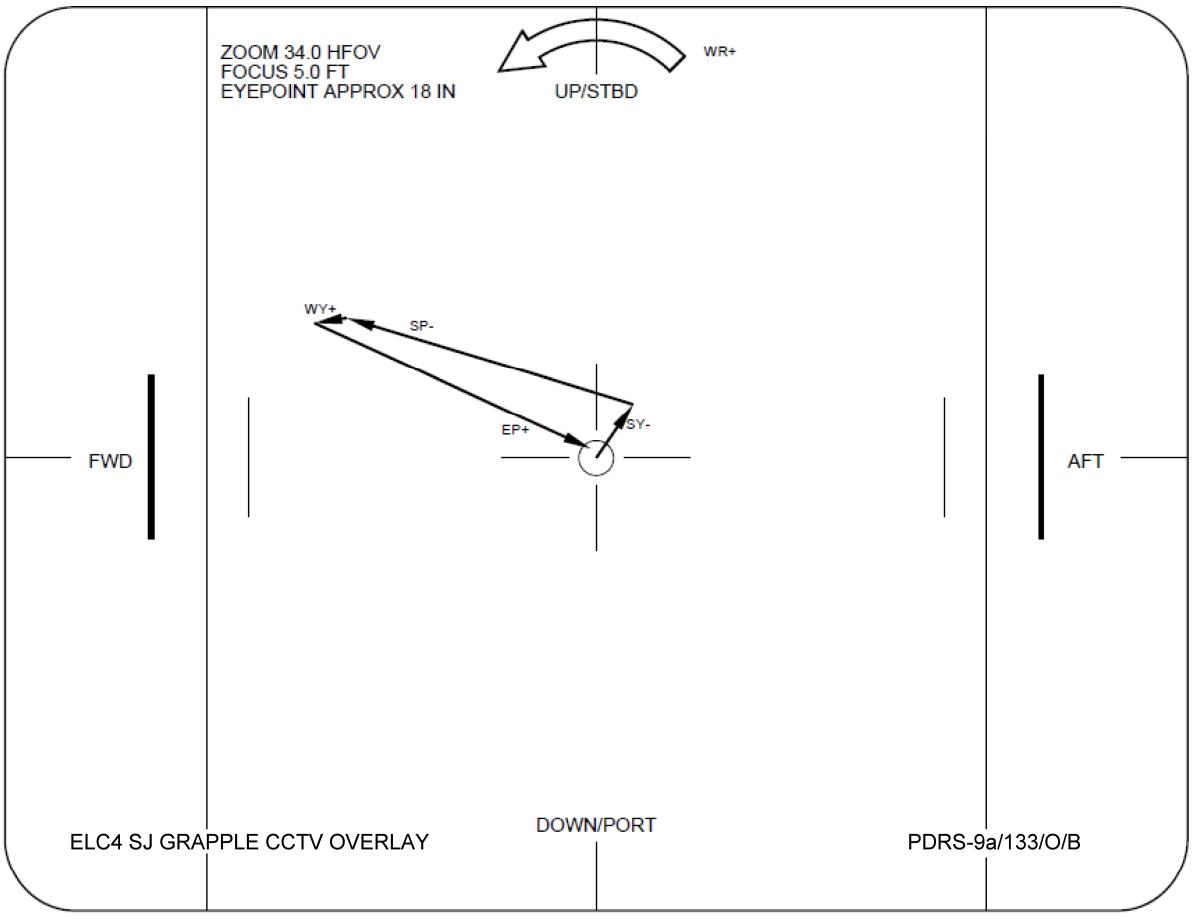


To get:	Drive:	To get:	Drive:
+X (fwd)	-SY	+PITCH	-WR, +WP
+Y (stbd)	-SY, -SP	+YAW	+WY, +SY
+Z (down)	-SP, -EP	+ROLL	+WP, +EP

Driving:	Results In:
+SY	-X (aft), +YAW
+SP	-Z (up), +ROLL
+EP	-Z (up), +ROLL

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

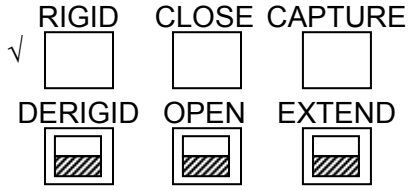
ΔSY	ΔSP	ΔEP	ΔWP	ΔWY	ΔWR
-6.6	-11.9	+14.3	+1.8	+4.8	+6.0



5. ELC4 GRAPPLE

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 *

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

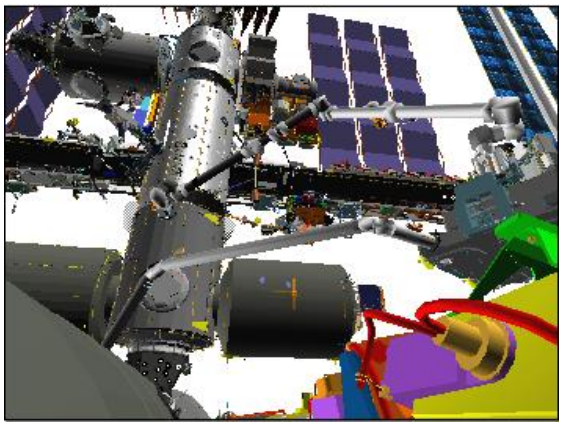
BRAKES – ON (tb-ON)
MODE – not DIRECT

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

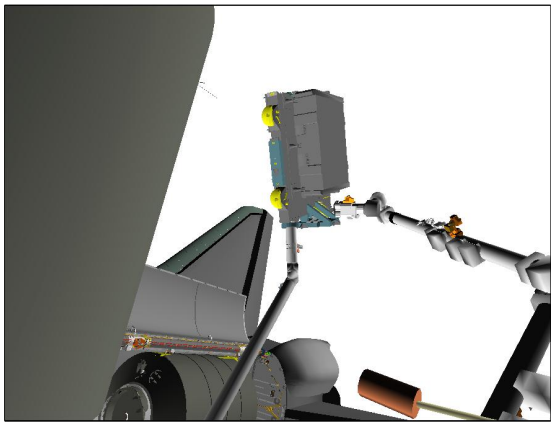
Expected ELC4 HANDOFF posn:

	X	Y	Z	PITCH	YAW	ROLL	PL ID
√	-986	+405	-611	180	300	180	3
	SY	SP	EP	WP	WY	WR	
√	-50.9	+32.1	-48.5	-21.0	-47.3	-288.4	

Notify SSRMS Operator, "SSRMS is GO for ELC4 Release"



CCTV C (10,30)



US LAB (-30,0)

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

ELC4 SJ HANDBACK

1. SETUP

On SSRMS Operator, "SRMS is GO for maneuver to ELC4 Handback"

SM 94 PDRS CONTROL

√PL ID, ITEM 3: 3

√INIT ID, ITEM 24: 3

V10/L	S1 LOOB
V10/R	C
MON 1	Elbow
MON 2	D

* If using shuttle attitude control *
* Verify in attitude, then DAP: FREE *

2. MNVR TO ELC4 HANDBACK POSN

If SINGLE mode available:

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

MODE – best available

Mnvr to ELC4 HANDBACK posn:

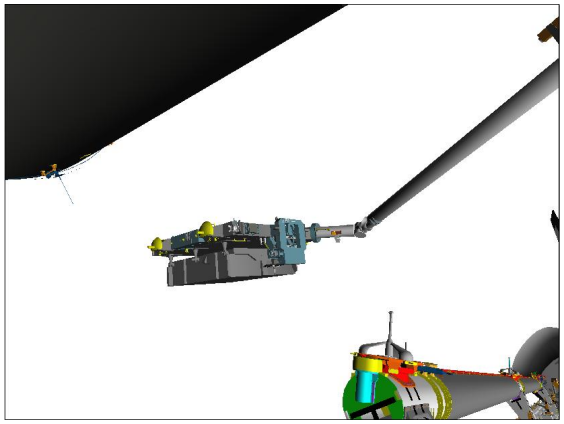
	SY	SP	EP	WP	WY	WR	
Handoff	-50.9	+32.1	-48.5	-21.0	-47.3	-288.4	
1: WP +				-3.5			
2: WR +						-109.2	
Handback	-50.9	+32.1	-48.5	-3.5	-47.3	-109.2	
	X	Y	Z	PITCH	YAW	ROLL	PL ID
	-942	+397	-621	30	279	197	3

If SINGLE mode available:
BRAKES – ON (tb-ON)

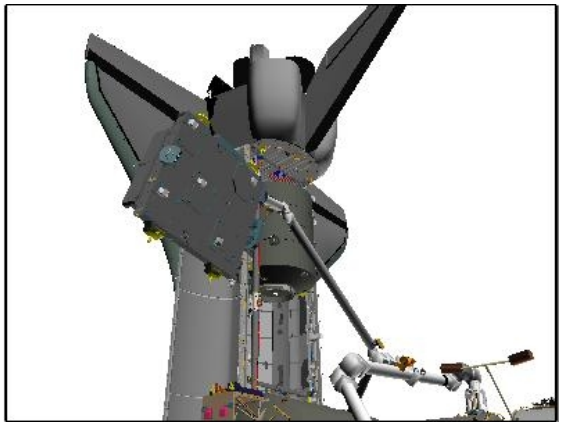
MODE – not DIRECT

Notify MCC-H, "SRMS is at the ELC4 Handback posn"

* If using shuttle attitude control: ROBOTICS ATTITUDE MAINTENANCE *
* (ORB OPS, REBOOST/DAP) steps 1,2 *

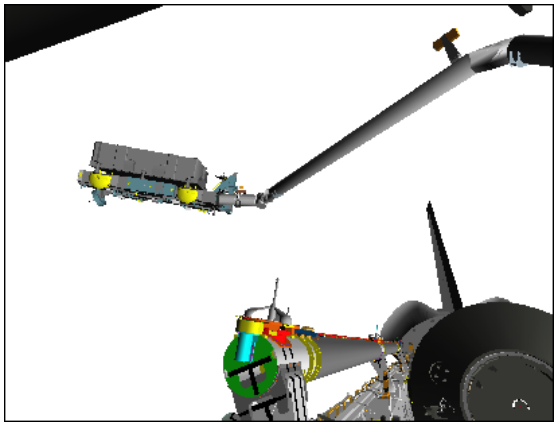


CCTV D (-35,25)

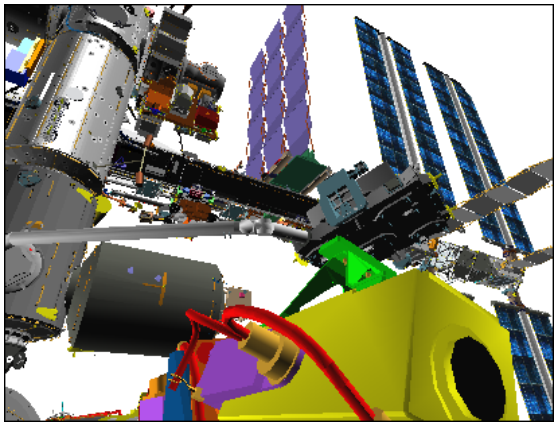


S1 LOOB (50,30)

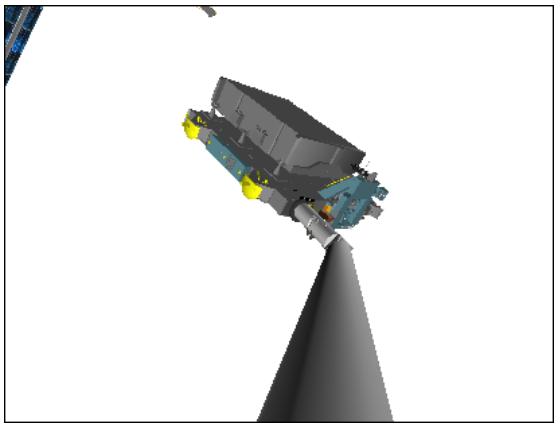
Step 1:
Drive WP (+) from -21.0 to -3.5



CCTV D (-20,20)

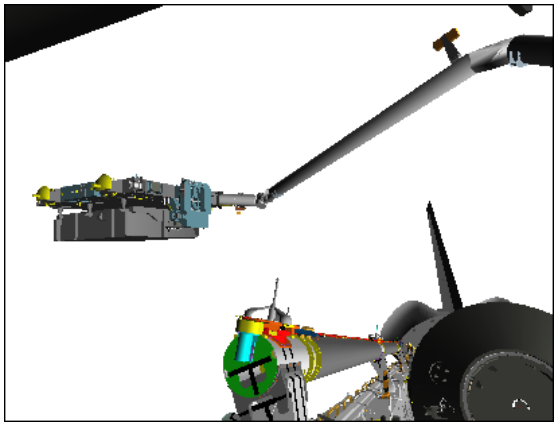


CCTV C (30,30)

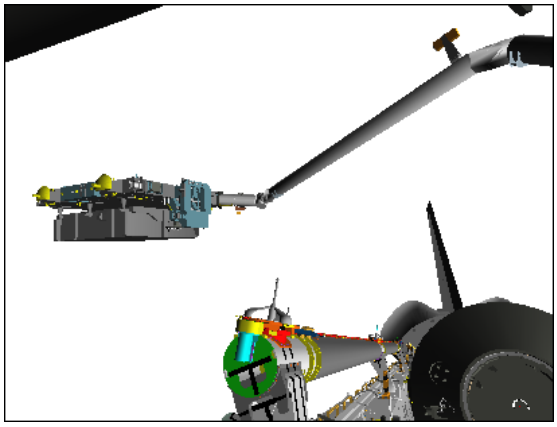


ELBOW (-10,0)

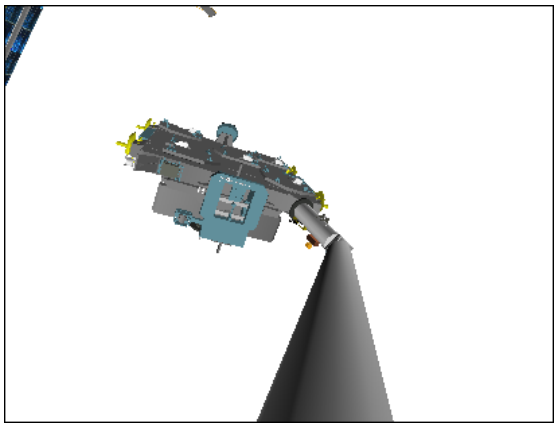
Step 2:
Drive WR (+) from -288.4 to +-109.2



CCTV D (-20,20)



CCTV C (30,30)



ELBOW (-10,0)

3. ELC4 UNGRAPPLE

On SSRMS Operator, "SRMS is GO for ELC4 Release"

CCTV – RMS WRIST, ZOOM: 34.0 HFOV
FOCUS: 5 ft

V10/L	LAB
V10/R	A
MON 1	C (EE)
MON 2	D

If SINGLE MODE available:

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

RATE – COARSE (RATE MIN tb-OFF)

SM 94 PDRS CONTROL
AUTO BRAKE INH – ITEM 10 EXEC (**)

BRAKES – OFF (tb-OFF)

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

BRAKES – ON (tb-ON)

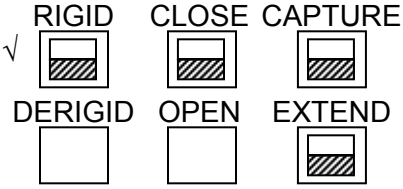
SM 94 PDRS CONTROL
AUTO BRAKE ENA – ITEM 9 EXEC (**)
PL ID – ITEM 3 +0 EXEC
INIT ID – ITEM 24 +0 EXEC

If SINGLE mode available:
RHC
RATE – as reqd (VERN within 10 ft)
BRAKES – OFF (tb-OFF)

MODE – best available

CAUTION
Monitor EE tb timing to prevent EE motor burnout

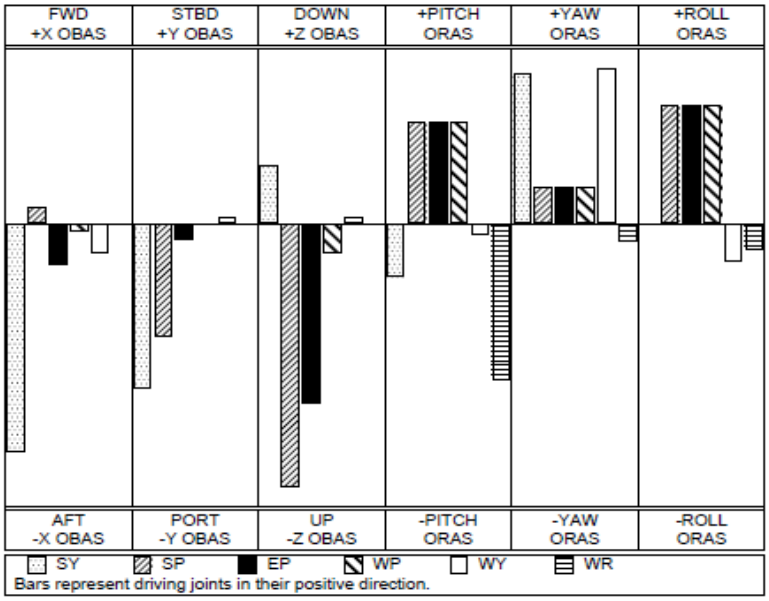
EE MODE – MAN
MAN CONTR – DERIG (hold until DERIGID tb-gray, 5 sec max)
RELEASE sw – depress (hold until OPEN tb-gray, 3 sec max)



CRITICAL TIMES (8 sec total):
DERIGID tb – gray, 5 sec max, then
OPEN tb – gray, 3 sec max

4. MNVR ARM CLEAR OF ELC4
   Drive joints per ELC4 SJ UNGRAPPLE WRIST CCTV OVERLAY until EE clear of grapple fixture

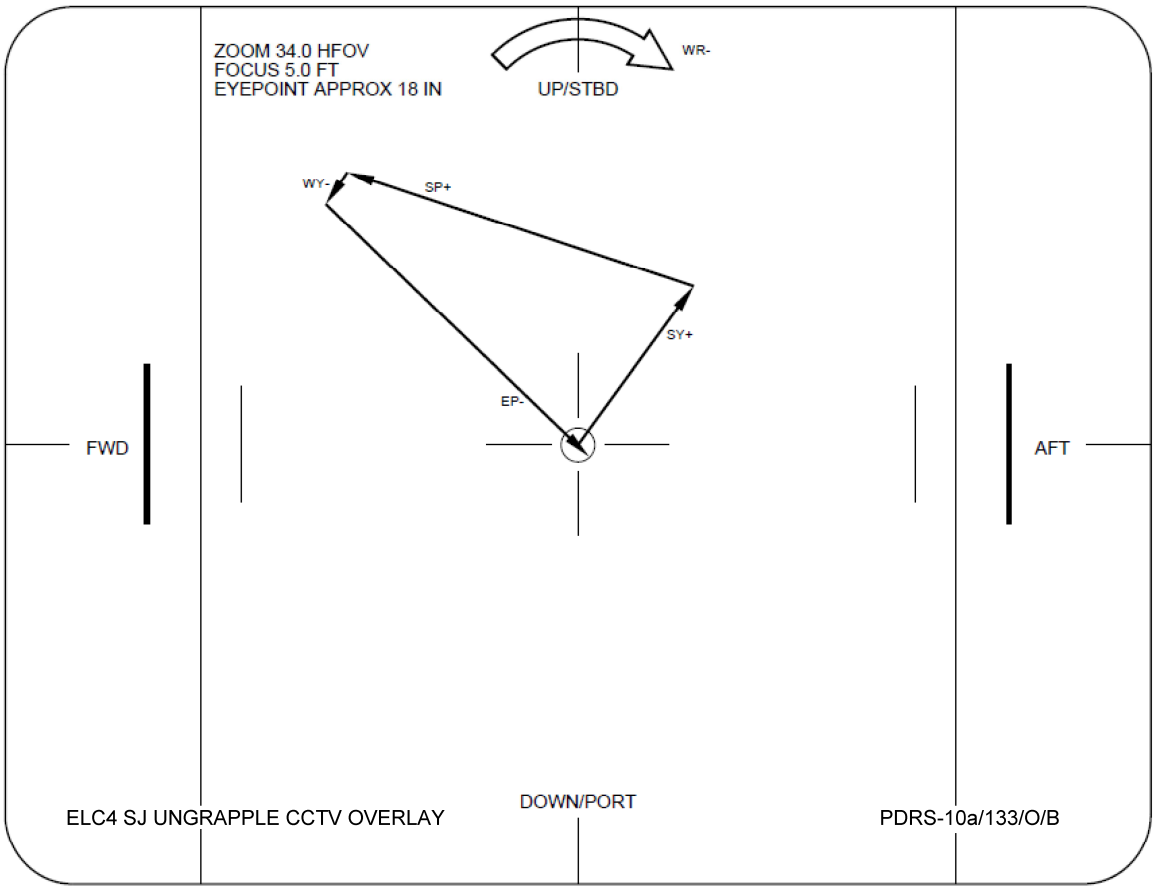
ELC4 SJ UNGRAPPLE CCTV OVERLAY



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

Driving:	Results In:	Driving:	Results In:
+SY	-X (aft), +YAW	+WP	-Z (up), +ROLL
+SP	-Z (up), +ROLL	+WY	-X (aft), +YAW
+EP	-Z (up), +ROLL	+WR	-PITCH

ΔSY	ΔSP	ΔEP	ΔWP	ΔWY	ΔWR
+6.5	+12.6	-18.4	+4.1	-6.1	-3.7



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

	RIGID	CLOSE	CAPTURE
√	▣	▣	▣
	DERIGID	OPEN	EXTEND
	☐	☐	☐

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

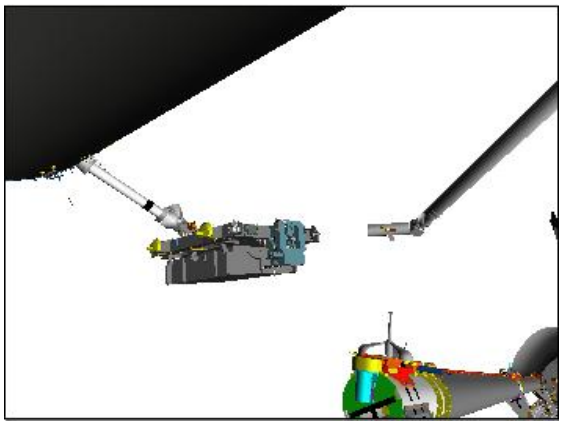
Mnvr to ELC4 BACKOFF posn:

X	Y	Z	PITCH	YAW	ROLL	PL ID
-998	+227	-620	146	281	28	0
SY	SP	EP	WP	WY	WR	
-44.4	+44.7	-66.9	+0.6	-53.4	-112.9	

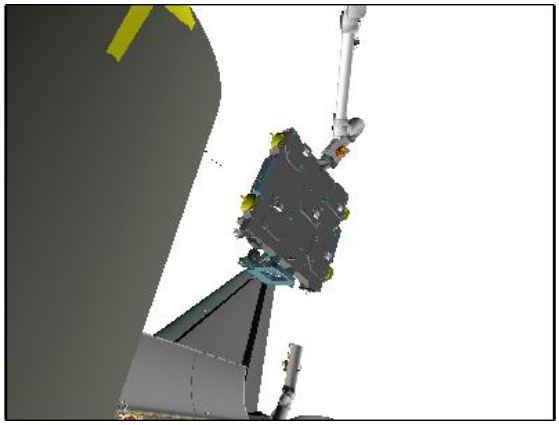
If SINGLE mode available:
BRAKES – ON (tb-ON)

MODE – not DIRECT

Notify SSRMS Operator, "SSRMS is GO for ELC4 maneuver"



CCTV D (-35,25)



LAB (-30,10)

SJ MNVR TO OBSS HANDOFF PRE-GRAPPLE

1. SETUP

On SSRMS Operator, "SRMS is GO for mnvr to OBSS HANDOFF PRE-GRAPPLE"

SM 94 PDRS CONTROL

√PL ID, ITEM 3: 0

√INIT ID, ITEM 24: 0

Verify SRMS at ELC4 BACKOFF posn:

	X	Y	Z	PITCH	YAW	ROLL	PL ID
√	-998	+227	-620	146	281	28	0
	SY	SP	EP	WP	WY	WR	
√	-44.4	+44.7	-66.9	+0.6	-53.4	-112.9	

V10/L	P1 LOOB
V10/R	A
MON 1	Elbow
MON 2	B

2. MNVR TO OBSS HANDOFF PRE-GRAPPLE

If SINGLE mode available:

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

MODE – best available

NOTE

Closest clearance between SRMS Upper Boom and JEM is 45 inches during SP mnvr (line 3). Monitor with CCTV A

Mnvr to OBSS HANDOFF PRE-GRAPPLE posn:

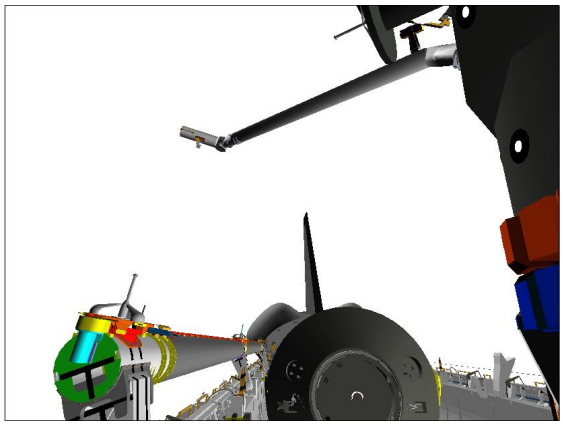
	SY	SP	EP	WP	WY	WR	
ELC4 Backoff	-44.4	+44.7	-66.9	+0.6	-53.4	-112.9	
1: EP +			-50.0				
2: SY +	+23.9						
3: SP +		+64.7					
4: WY +					+11.4		
5: WP –				-99.4			
6: WR +						-99.0	
7: EP +			-34.2				
OBSS Pre-grapple	+23.9	+64.7	-34.2	-99.4	+11.4	-99.0	

X	Y	Z	PITCH	YAW	ROLL	PL ID
-1018	-362	-676	284	0	270	0

BRAKES – ON (tb-ON)
MODE – not DIRECT (lt off)

PARAM – PORT TEMP
JOINT – CRIT TEMP

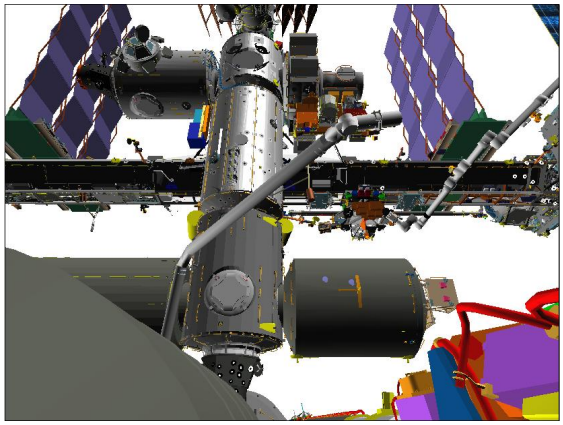
Step 1:
Drive EP (+) from -66.9 to -50.0



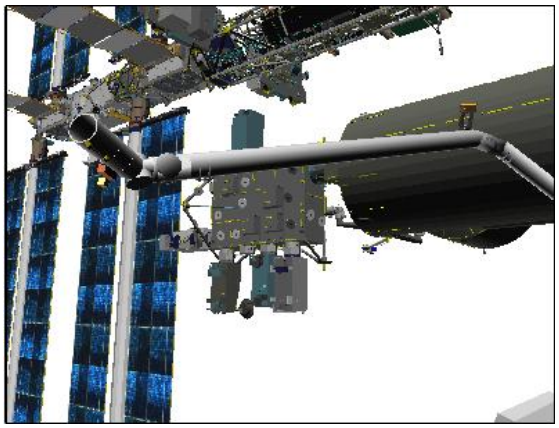
CCTV D (0,20)

Step 2:
Drive SY (+) from -44.4 to +23.9

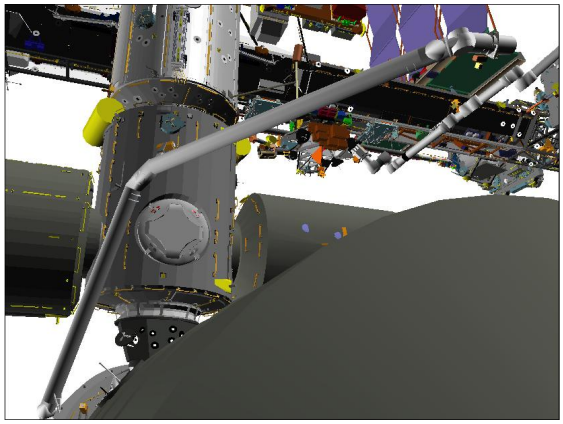
CCTV A (20,25)



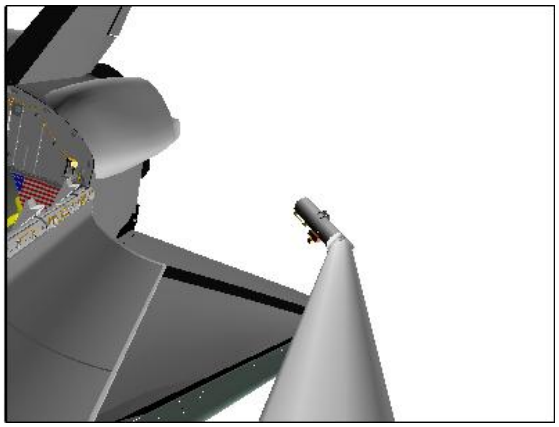
CCTV C (0,30)



CCTV B (-40,10)

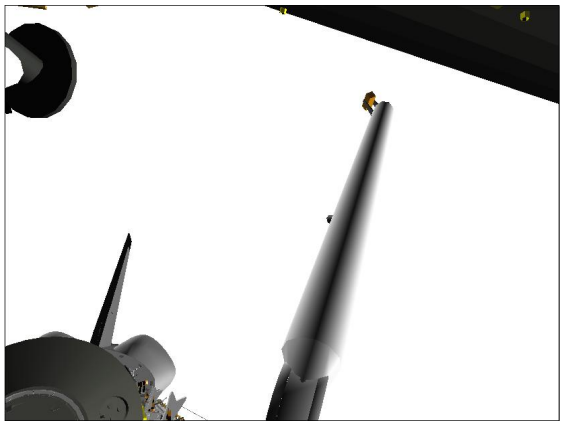


CCTV B (20,20)

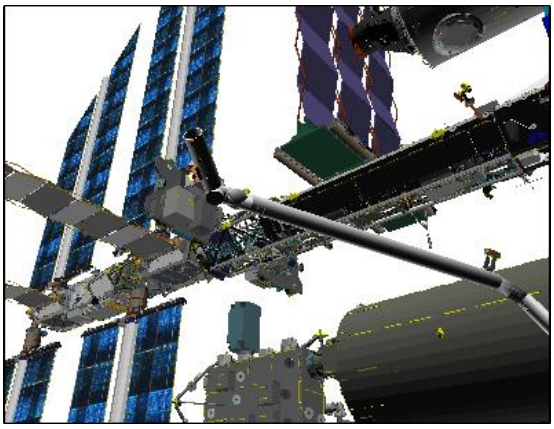


ELBOW (-10,0)

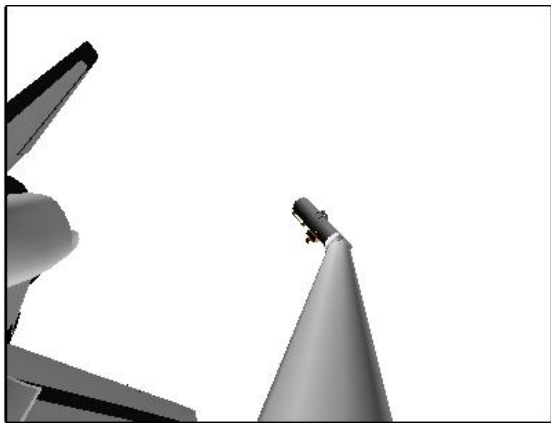
Step 3:
Drive SP (+) from +44.7 to +64.7



CCTV A (20,25)

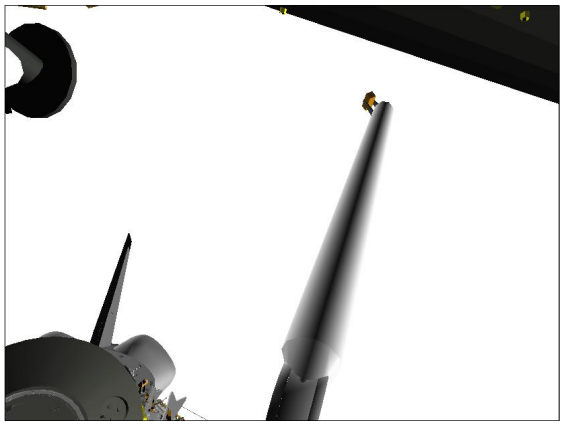


CCTV B (-40,30)

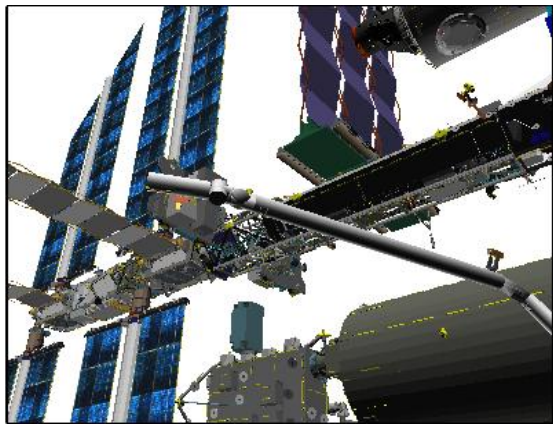


ELBOW (-10,0)

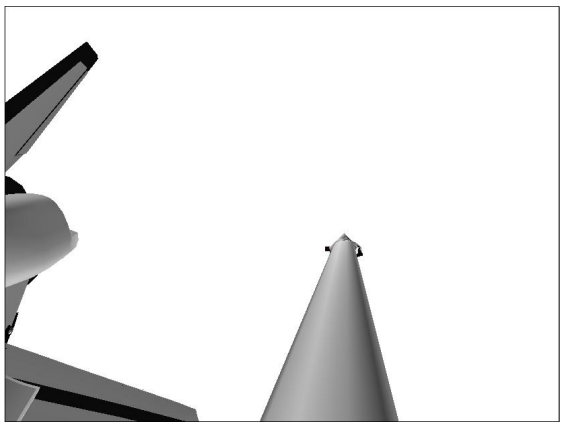
Step 4:
Drive WY (+) from -53.4 to +11.4



CCTV A (20,25)

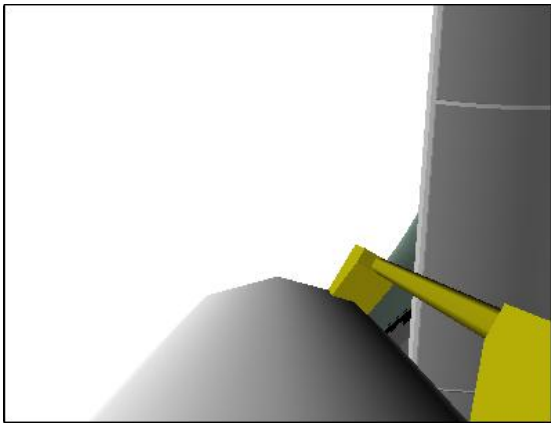


CCTV B (-40,30)

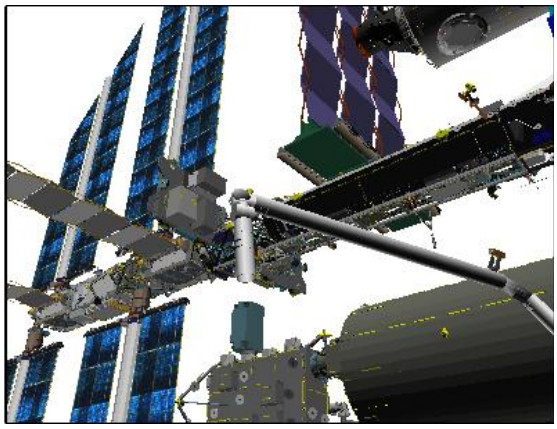


ELBOW (-10,0)

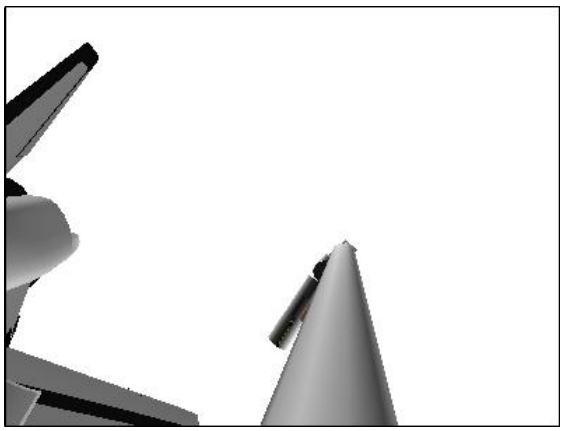
Step 5:
Drive WP (-) from -0.6 to -99.4



EE

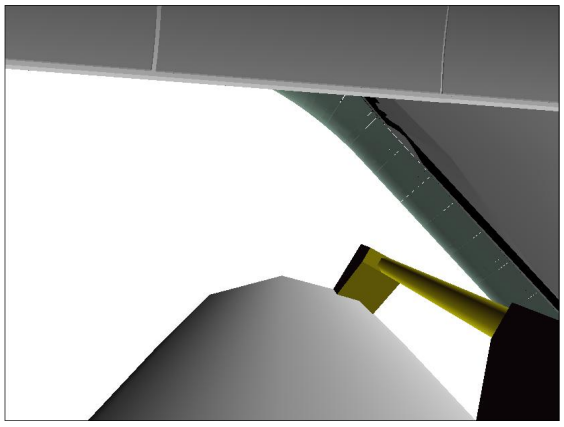


CCTV B (-40,30)

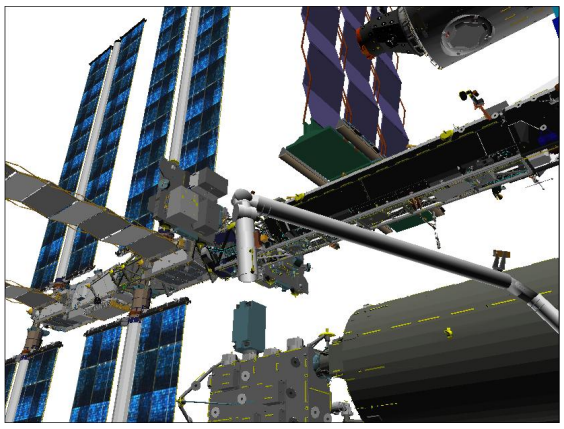


ELBOW (-10,0)

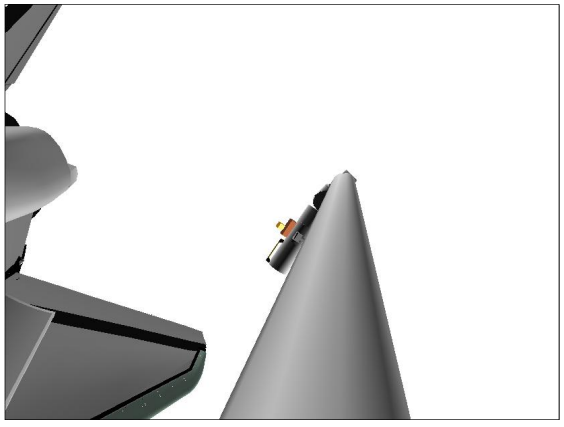
Step 6:
Drive WR (+) from -112.9 to -99.0



EE



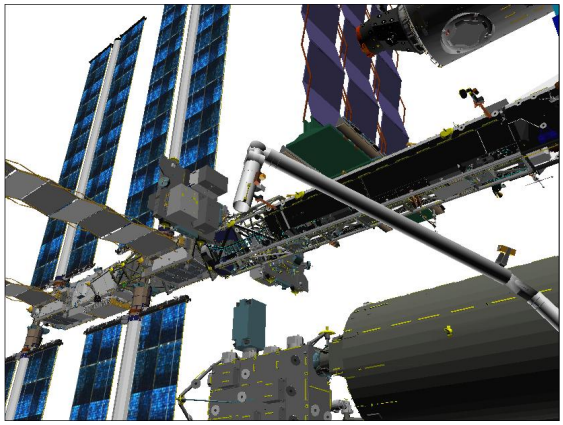
CCTV B (-40,30)



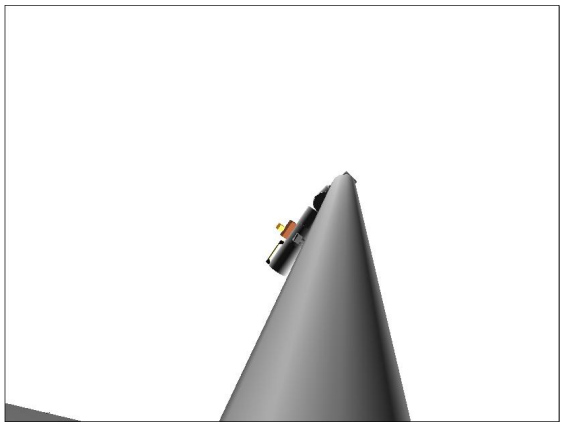
ELBOW (-10,0)

Step 7:
Drive EP (+) from -50.0 to -34.2

CCTV A (20,25)



CCTV B (-40,30)



ELBOW (-10,0)

OBSS NOMINAL

OBSS HANDOFF FROM SSRMS

1. CONFIGURE POWER

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

Record OBSS thermal clock start time:

____/____:____:____

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

2. STBD MRL RELEASE

OBSS NOMINAL

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

3. 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 and Mnvr to Handoff"
Monitor RFL Status

After OBSS Unberth,
SM 94 PDRS CONTROL
RMS PORT – ITEM 1 EXEC (*****)

4. SETUP FOR GRAPPLE

Verify SRMS at OBSS HANDOFF PRE-GRAPPLE posn:

	X	Y	Z	PITCH	YAW	ROLL	PL ID
√	-1018	-362	-676	284	0	270	0
	SY	SP	EP	WP	WY	WR	
√	+23.9	+64.7	-34.2	-99.4	+11.4	-99.0	

R12 √Green Jumper – ISS

V10/L	A
V10/R	P1 LOOB
MON 1	B
MON 2	EE

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

Maintain eyepoint approx 18 inches when using grapple overlay

R12 (OBSS) √SPEE PWR – OFF
A15 √APCU power disabled

SM 179 POWER TRANSFER
√PTU 2 APCU OUT VOLTS: < 10V
√OUTPUT – OFF

5. OBSS GRAPPLE AT HANDOFF POSN

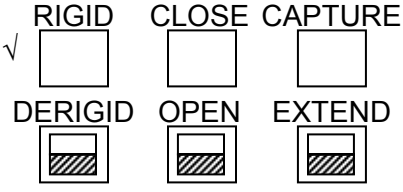
On SSRMS Operator, "GO for SRMS OBSS Grapple"

RHC 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)

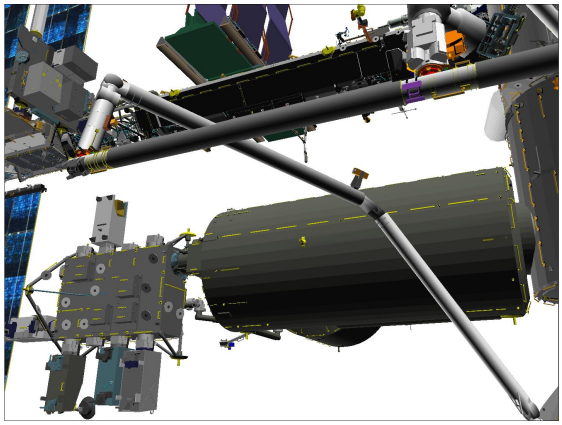
PARAM – PORT TEMP
JOINT – CRIT TEMP

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

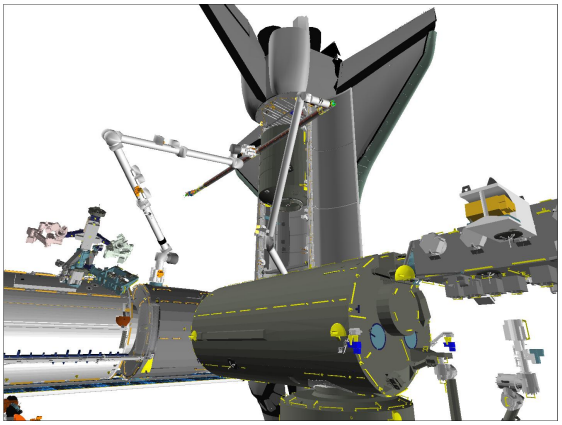
OBSS HANDOFF posn:

	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	-100.2		

*Display singularity



CCTV B (-25,20)



P1 LOOB (130,20)

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

R12 Green Jumper – LDRI/ITVC

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

Give SSRMS Operator, "GO for OBSS ungrapple"

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

R12 Green Jumper – ISS

OBSS MNVR TO PMM INSTALL VIEWING

1. SETUP
On SSRMS Operator, "GO for mnvr to PMM Viewing posn"

SM 94 PDRS CONTROL
√PL ID, ITEM 3: 1
√INIT ID, ITEM 24: 1

R12 √Green Jumper – ISS

V10/L	P1 LOOB
V10/R	A
MON 1	Elbow (RSC)
MON 2	C (B)

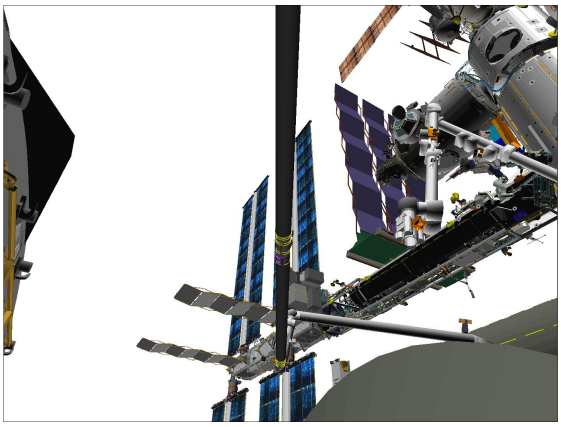
2. MNVR TO INTERMEDIATE POSN

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

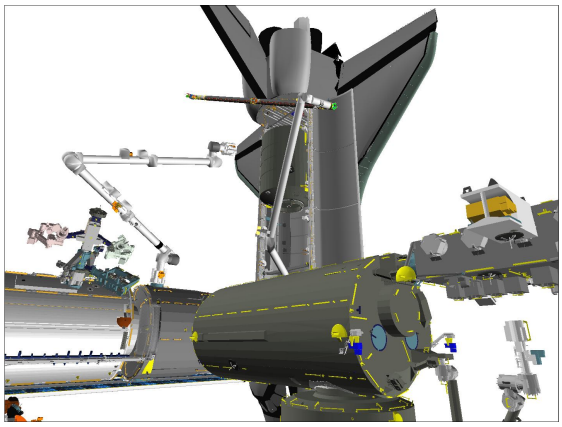
Mnvr to OBSS INTERMEDIATE posn:

OBSS Handoff 1: WR + OBSS Inter. Posn

SY	SP	EP	WP	WY	WR	
+25.8	+66.3	-49.0	-85.9	+10.7	-100.2	
					-70.0	
+25.8	+66.3	-49.0	-85.9	+10.7	-70.0	
X	Y	Z	PITCH	YAW	ROLL	PL ID
-1040	-365	-602	14	300	330	1



CCTV C (-60,40)



P1 LOOB (130,20)

3. MNVR TO PMM INSTALL VIEWING POSN
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)
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)

PMM INSTALL VIEWING posn: (02:00)

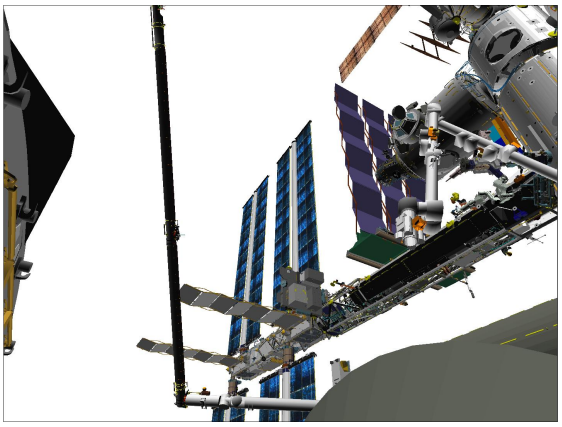
	X	Y	Z	PITCH	YAW	ROLL	PL ID
√	-1131	-496	-586	62	324	282	1
	SY	SP	EP	WP	WY	WR	
√	+35.1	+38.6	-22.7	-0.4	-0.7	-40.1	

√MODE – not DIRECT (lt off)

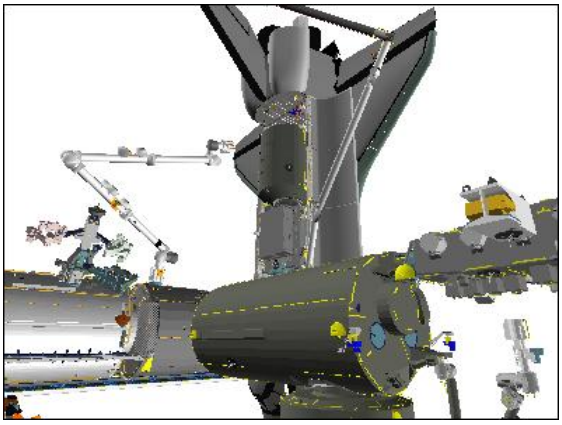
PARAM – PORT TEMP
JOINT – CRIT TEMP

Notify SSRMS Operator, "Go for Walkoff"

CCTV A (10,25)



CCTV C (-60,40)



P1 LOOB (130,20)

OBSS MNVR TO PM VENT SENSOR CLEAR

1. SETUP

SM 94 PDRS CONTROL

√PL ID, ITEM 3: 1

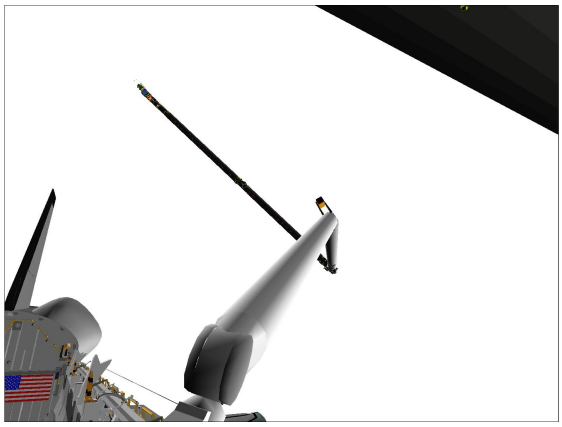
√INIT ID, ITEM 24: 1

Verify SRMS at PMM INSTALL VIEWING posn:

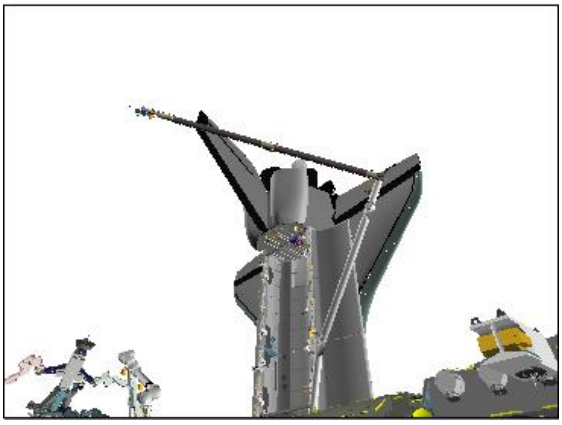
	X	Y	Z	PITCH	YAW	ROLL	PL ID
√	-1131	-496	-586	62	324	282	1
	SY	SP	EP	WP	WY	WR	
√	+35.1	+38.6	-22.7	-0.4	-0.7	-40.1	

R12 √Green Jumper – ISS

V10/L	P1 LOOB
V10/R	A
MON 1	Elbow (RSC)
MON 2	C (B)



CCTV A (30,20)



P1 LOOB (130,40)

2. MNVR TO PM VENT SENSOR CLEAR

SM 94 PDRS CONTROL

END POS – ITEM 18 -9 6 6 -6 4 3 -3 8 3 EXEC

ATT – ITEM 21 +8 8 +1 5 +2 8 1 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)

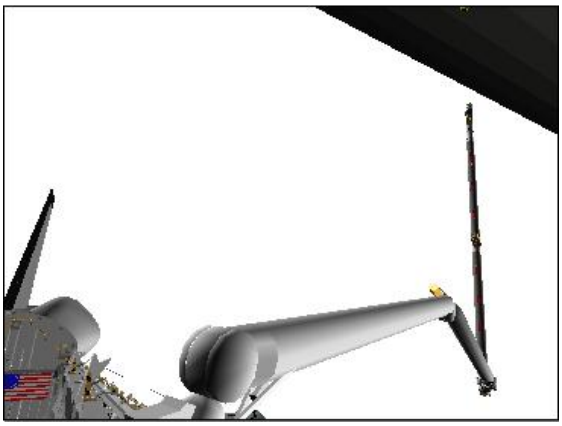
PM VENT SENSOR CLEAR posn: (02:30)

	X	Y	Z	PITCH	YAW	ROLL	PL ID
√	-966	-643	-383	88	15	281	1
	SY	SP	EP	WP	WY	WR	
√	+62.5	+25.2	-23.4	+0.4	-13.0	+16.1	

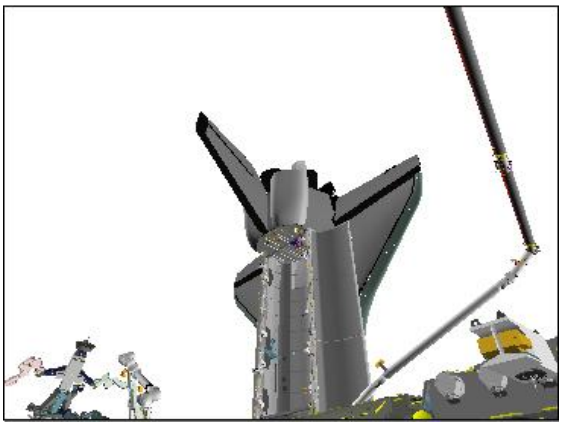
√MODE – not DIRECT (lt off)

PARAM – PORT TEMP
JOINT – CRIT TEMP

Notify MCC-H, "SRMS at PM Vent Sensor Clear posn with Brakes On, GO for PM Venting"



CCTV A (30,20)



P1 LOOB (130,40)

OBSS MNVR TO EVA 2 VIEWING

1. SETUP

On MCC-H, "GO for mnvr to EVA 2 Viewing posn"

SM 94 PDRS CONTROL

√PL ID, ITEM 3: 1

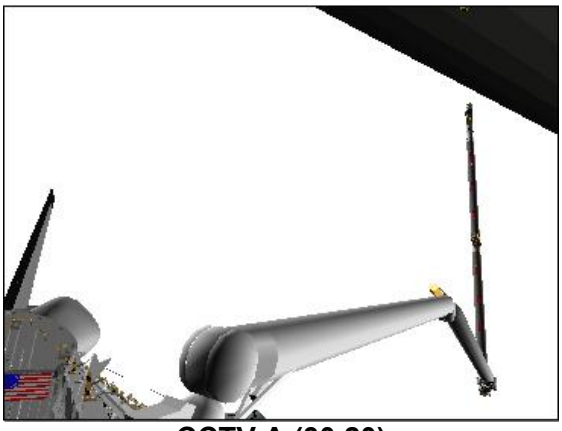
√INIT ID, ITEM 24: 1

Verify SRMS at PM VENT SENSOR CLEAR posn:

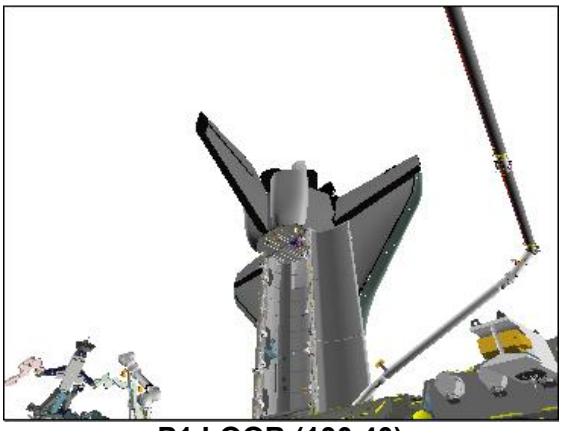
	X	Y	Z	PITCH	YAW	ROLL	PL ID
√	-966	-643	-383	88	15	281	1
	SY	SP	EP	WP	WY	WR	
√	+62.5	+25.2	-23.4	0.4	-13.0	+16.1	

R12 √Green Jumper – ISS

V10/L	P1 LOOB
V10/R	A
MON 1	Elbow (RSC)
MON 2	C (B)



CCTV A (30,20)



P1 LOOB (130,40)

2. MNVR TO EVA 2 VIEWING POSN

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

Mnvr to EVA 2 Viewing posn:

PM Vent Sensor Clear

1: WR - EVA 2 Viewing

SY	SP	EP	WP	WY	WR	
+62.5	+25.2	-23.4	0.4	-13.0	+16.1	
					-21.8	
+62.5	+25.2	-23.4	0.4	-13.0	-21.8	
X	Y	Z	PITCH	YAW	ROLL	PL ID
-967	-643	-386	60	349	282	1

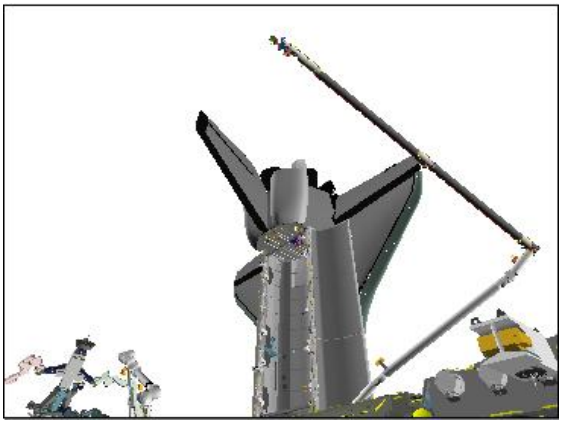
BRAKES – ON (tb-ON)

√MODE – not DIRECT (lt off)

PARAM – PORT TEMP
JOINT – CRIT TEMP

Notify MCC-H, “SRMS at EVA 2 Viewing posn with Brakes On”

CCTV A (30,20)



P1 LOOB (130,40)

OBSS MNVR TO UNDOCK

1. SETUP

   SM 94 PDRS CONTROL

   √PL ID, ITEM 3: 1

   √INIT ID, ITEM 24: 1

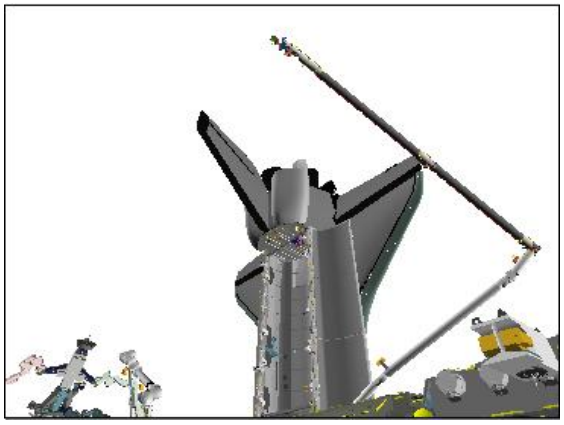
   Verify SRMS at EVA 2 VIEWING posn:

	X	Y	Z	PITCH	YAW	ROLL	PL ID
√	-967	-643	-386	60	349	282	1
	SY	SP	EP	WP	WY	WR	
√	+62.5	+25.2	-23.4	0.4	-13.0	-21.8	

R12 √Green Jumper – ISS

MON 1	P1 LOOB (D)
MON 2	A
DNLK	Elbow (RSC)
DTV	C (B)

CCTV A (30,20)



P1 LOOB (130,40)

2. MNVR TO UNDOCK POSN

   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 – VERN (RATE MIN tb-ON)

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:

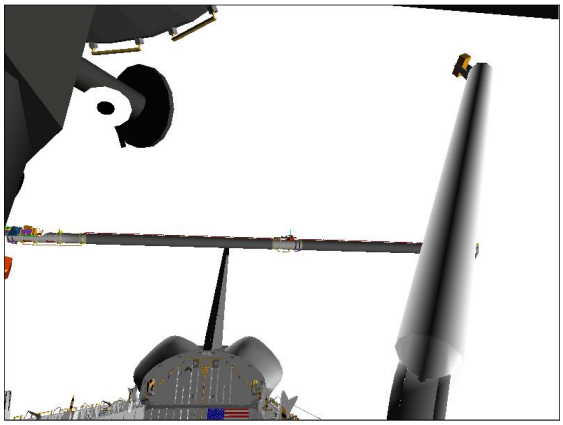
BRAKES – ON (tb-ON)

OBSS UNDOCK posn: (02:30)

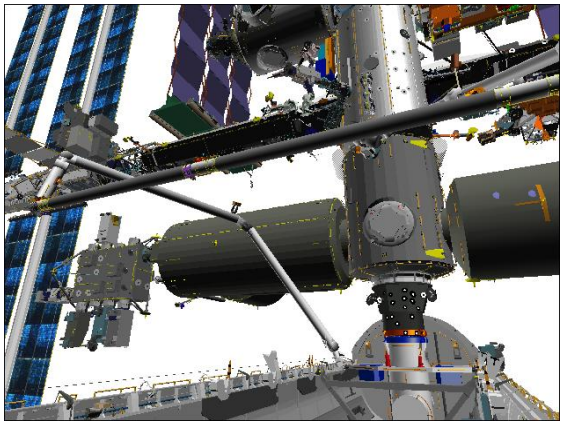
	X	Y	Z	PITCH	YAW	ROLL	PL ID	
√	-1041	-362	-602	44	270	0	1	*
	SY	SP	EP	WP	WY	WR		
√	+25.8	+66.3	-49.0	-85.9	+10.7	-100.2		

*Display singularity

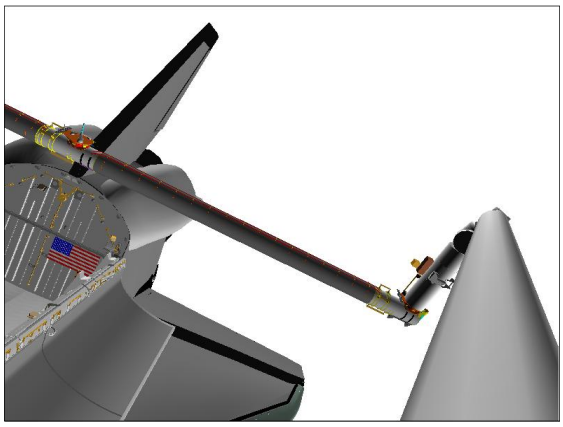
MODE – not DIRECT (lt off)
PARAM – PORT TEMP
JOINT – CRIT TEMP



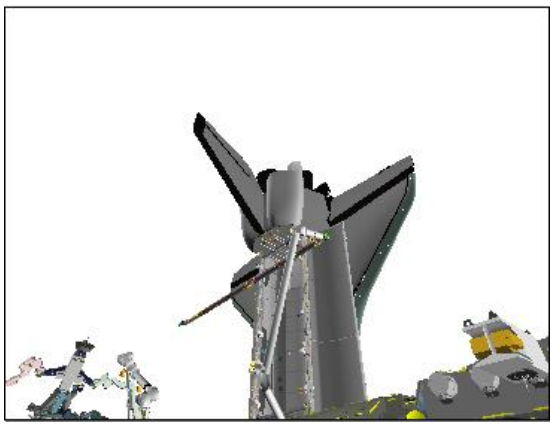
CCTV A (5,25)



CCTV C (-25,20)



ELBOW (-30,-5)



P1 LOOB (130,40)

OBSS MNVR TO FLAT FIELD

WARNING
For UNDOCKED ops only

1. SETUP

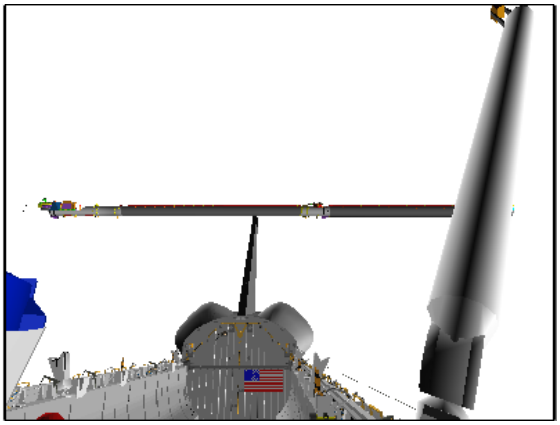
V10/L	Elbow
V10/R	D (C)
MON 1	A
MON 2	B

SM 94 PDRS CONTROL
PL ID, ITEM 3: 2
INIT ID, ITEM 24: 2
AUTO MODES – ITEM 13 +7 EXEC

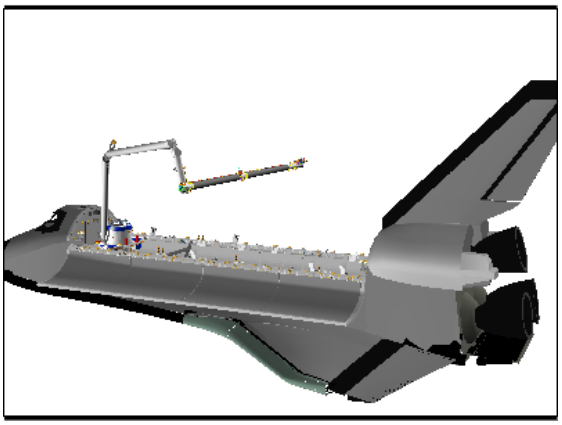
Verify SRMS at OBSS UNDOCK posn:

	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	-100.2		

*Display singularity



CCTV A (0,20)



BIRD'S EYE

2. ACAS TO STBD SURVEY START

RHC
RATE – COARSE (RATE MIN tb-OFF)
BRAKES – OFF (tb-OFF)
MODE – AUTO 1, ENTER

* If unable to enter AUTO mode (no AUTO READY lt): *
* END POS – ITEM 18 -1 0 2 9 +2 2 9 -6 1 4 EXEC *
* ATT – ITEM 21 +1 4 +2 7 0 +0 EXEC *
* CMD CK – ITEM 25 EXEC (GOOD) *
* *
* MODE – OPR CMD, ENTER (READY lt on) *
* AUTO SEQ – PROCEED (IN PROG lt on) *
* *
* When AUTO SEQ IN PROG lt – off: *
* MODE – AUTO 1, ENTER *

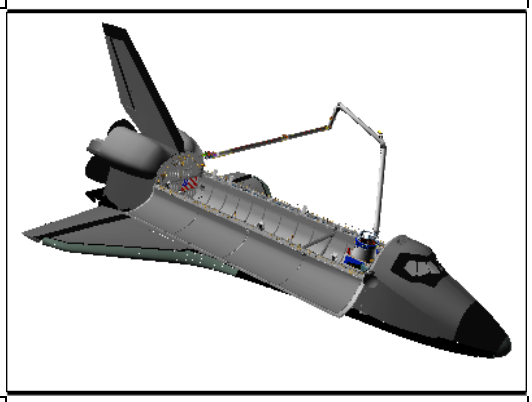
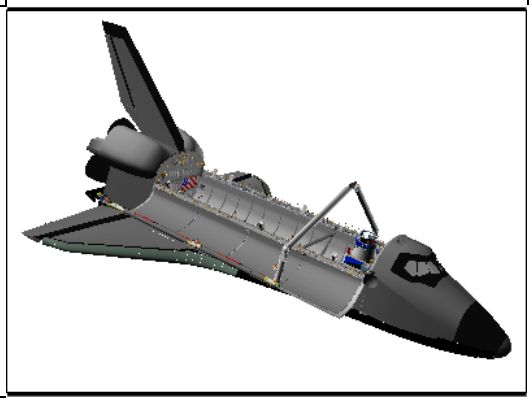
√START PT, ITEM 17: 148

SM 169 PDRS STATUS

Monitor ACAS progress

AUTO SEQ – PROCEED (IN PROG lt on)

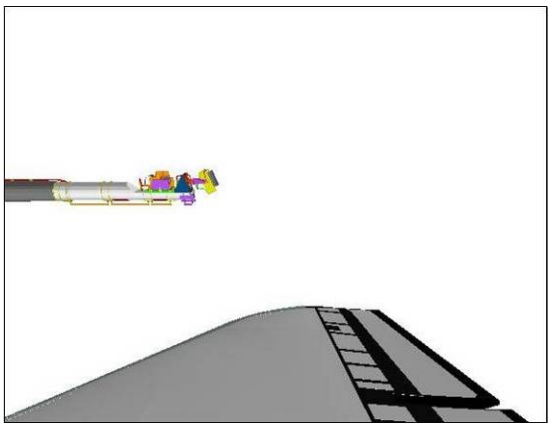
(11:00)

Pt	X	Y	Z	Pitch	Yaw	Roll	●	
148P	**-1029**	**+229**	**-614**	**14**	**270**	**0**		
149	-800	+500	-250	281	333	95		
150	-1130	+350	-400	325	336	30		
151P	**-1270**	**+350**	**-445**	**0**	**0**	**11**		

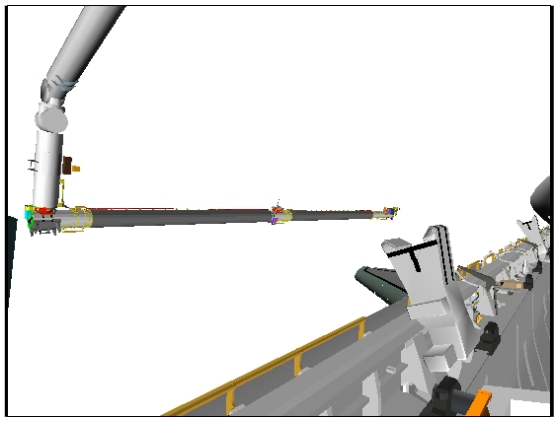
When AUTO SEQ IN PROG lt – off:

Verify SRMS at FLAT FIELD posn:

	X	Y	Z	PITCH	YAW	ROLL	PL ID
√	-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	



CCTV C (95,-5)



CCTV D (-40,0)

3. SETUP FOR STBD SURVEY

SM 94 PDRS CONTROL

AUTO MODES – ITEM 13 +1 +2 +3 +4 EXEC

For survey scan pattern, refer to OBSS SCAN PATTERN CUE CARDS – STBD & PORT, AND WING GLOVE & CREW CABIN

Perform ACTIVATION (LDRI/ITVC Cue Card, PHOTO/TV) steps 1,3,4,5

A15

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 1,2

A7U

MUX 1 L ← MIDDECK
LDRI MODE 6 pb – push (brighter flickering LDRI video)
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: +103 (right)
TILT: -260 (down)

VID OUT – as desired (not DTV)
√VID IN – not PL2

L10(VTR)

REC pb – push, hold
PLAY pb – push, simo (red ●)

Go to OBSS LDRI/IDC RCC SURVEY – STBD (OBSS OPERATIONS), step 5.
Reference procedure notes prior to beginning surveys

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OBSS CONTINGENCY

OBSS SJ HANDOFF FROM SSRMS

1. CONFIGURE POWER

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

Record OBSS thermal clock start time:

____/____:____:____

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

2. 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

3. 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 and Mnvr to Handoff"
Monitor RFL Status

After OBSS Unberth,
SM 94 PDRS CONTROL
RMS PORT – ITEM 1 EXEC (*****)

OBSS CONTINGENCY

4. SETUP FOR GRAPPLE

Verify SRMS at OBSS HANDOFF PRE-GRAPPLE posn:

	X	Y	Z	PITCH	YAW	ROLL	PL ID
√	-1018	-362	-676	284	0	270	0
	SY	SP	EP	WP	WY	WR	
√	+23.9	+64.7	-34.2	-99.4	+11.4	-99.0	

R12 √Green Jumper – ISS

V10/L	A
V10/R	P1 LOOB
MON 1	B
MON 2	EE

A7U CCTV – configure for grapple
– install OBSS SJ GRAPPLE AT HANDOFF OVERLAY
– RMS WRIST, ZOOM: 34.0 HFOV
FOCUS: 5 ft

Maintain eyepoint approx 18 inches when using grapple overlay

R12(OBSS) √SPEE PWR – OFF
A15 √APCU power disabled

SM 179 POWER TRANSFER
√PTU 2 APCU OUT VOLTS: < 10V
√OUTPUT – OFF

5. OBSS SJ GRAPPLE AT HANDOFF POSN

On SSRMS Operator, "GO for SRMS OBSS grapple,"

If SINGLE mode available:

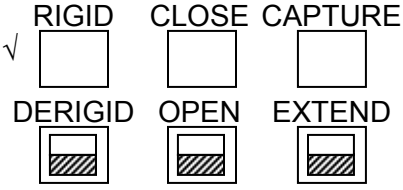
RHC RATE – VERN (RATE MIN tb-ON)
BRAKES – OFF (tb-OFF)

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)



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 *

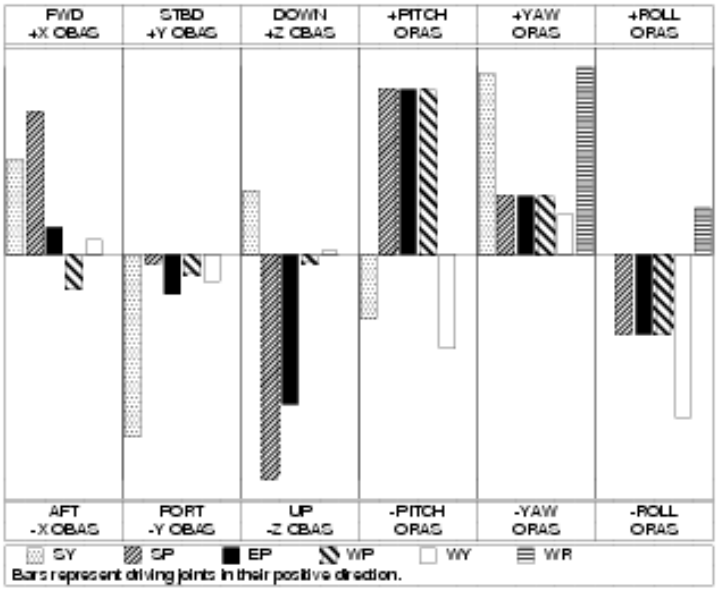
If TEST mode available,
MODE – TEST, ENTER
Wait 5 sec

If SINGLE mode available:
BRAKES – ON (tb-ON)

MODE – not DIRECT (lt off)

PARAM – PORT TEMP
JOINT – CRIT TEMP

OBSS SJ GRAPPLE AT HANDOFF OVERLAY



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

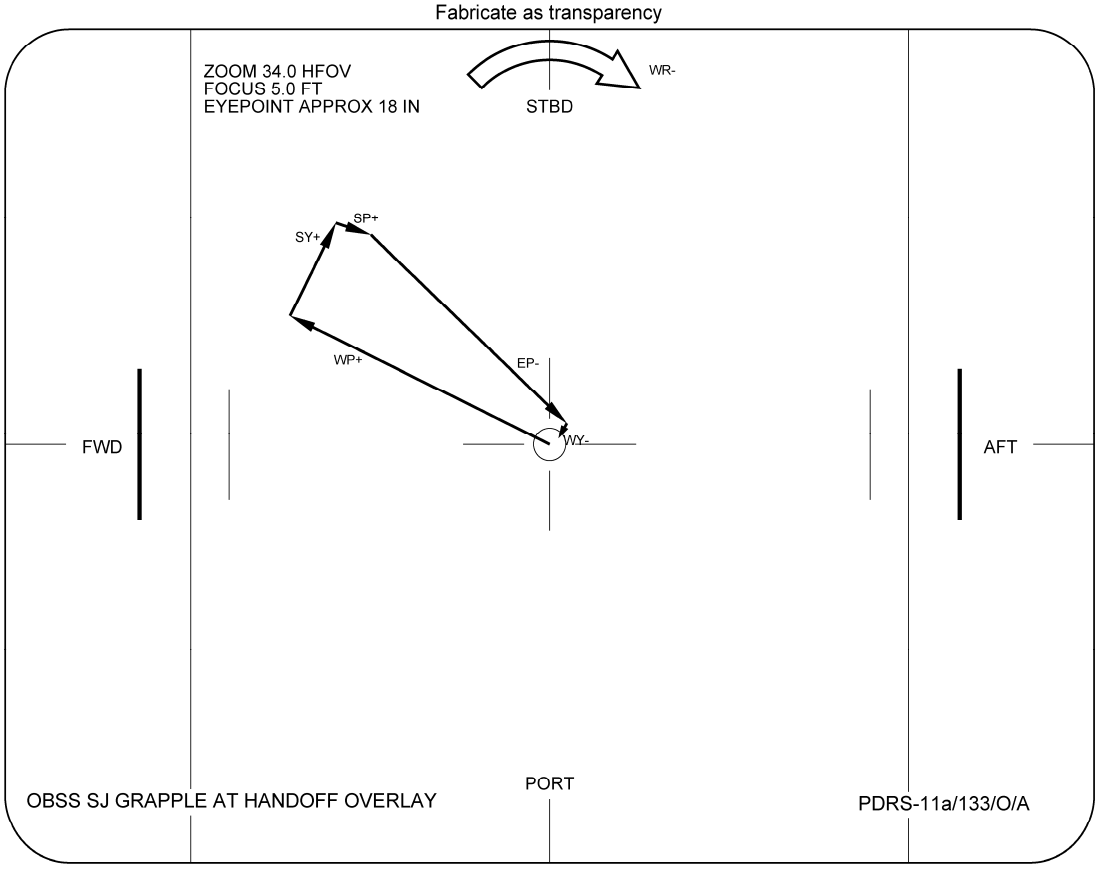
To get:	Drive:
+PITCH	+WP, +EP
+YAW	+WR, +SY
+ROLL	-WY, -WP

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
+2.3	+2.8	-19.4	+17.0	-0.8	-2.1

Fabricate as transparency



SM 94 PDRS CONTROL

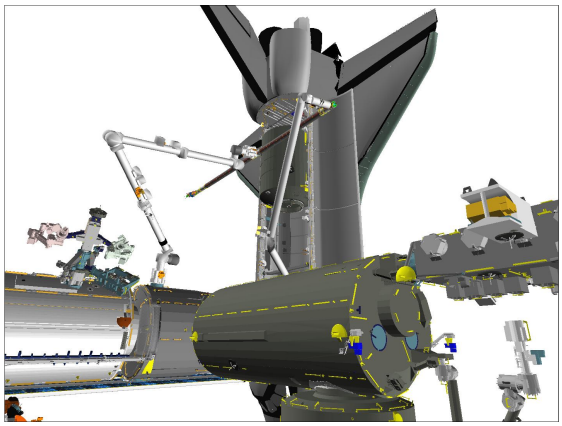
PL ID – ITEM 3 +1 EXEC

INIT ID – ITEM 24 +1 EXEC

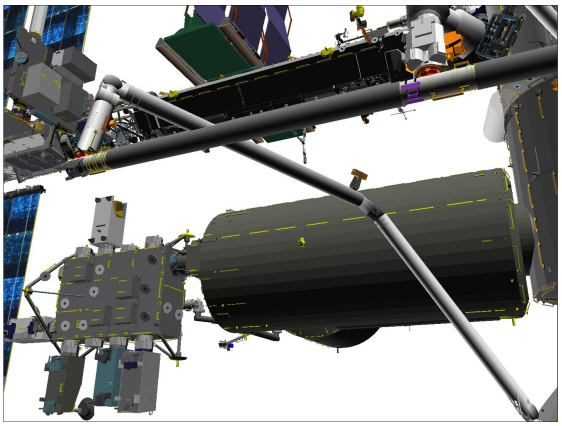
Expected OBSS HANDOFF posn:

	X	Y	Z	PITCH	YAW	ROLL	PL ID	
							1	
√	-1041	-362	-602	44	270	0	1	*
	SY	SP	EP	WP	WY	WR		
√	+25.8	+66.3	-49.0	-85.9	+10.7	-100.2		

*Display singularity



P1 LOOB (130,20)



CCTV B (-25,20)

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

R12 Green Jumper – LDRI/ITVC

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

Give SSRMS Operator, "GO for OBSS ungrapple"

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

R12 Green Jumper – ISS

OBSS SJ MNVR TO PMM INSTALL VIEWING

1. SETUP

On SSRMS Operator, "GO for mnvr to PMM Viewing posn,"

SM 94 PDRS CONTROL

√PL ID, ITEM 3: 1

√INIT ID, ITEM 24: 1

R12 √Green Jumper – ISS

V10/L	P1 LOOB
V10/R	A
MON 1	Elbow (RSC)
MON 2	C (B)

Verify SRMS at OBSS HANDOFF 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	-100.2		

*Display singularity

2. MNVR TO PMM INSTALL VIEWING

NOTE

Clearance between SRMS Upper Boom and JEM is 36 inches during SY mnvr (line 1). Monitor with CCTV A.

Clearance between OBSS and Orbiter Tail is 93 inches during WR mnvr (line 4). Monitor with CCTV A(RSC)

If SINGLE mode available:

RHC RATE – as reqd (VERN within 10 ft)

BRAKES – OFF (tb-OFF)

MODE – best available

Mnvr to PMM INSTALL VIEWING posn:

	SY	SP	EP	WP	WY	WR	
OBSS Handoff	+25.8	+66.3	-49.0	-85.9	+10.7	-100.2	
1: SY +	+35.1						
2: WP +				-75.0			
3: WY –					-0.7		
4: WR +						-40.1	
5: WP +				-0.4			
6: EP +			-22.7				
7: SP –		+38.6					
PMM Install Viewing	+35.1	+38.6	-22.7	-0.4	-0.7	-40.1	

X	Y	Z	PITCH	YAW	ROLL	PL ID
-1131	-496	-586	62	324	282	1

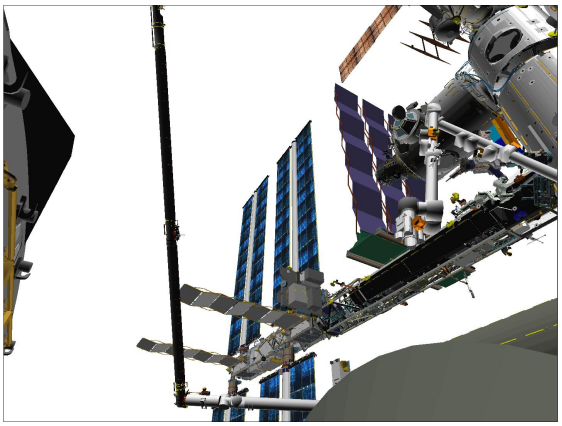
If SINGLE mode available:
BRAKES – ON (tb-ON)

MODE – not DIRECT

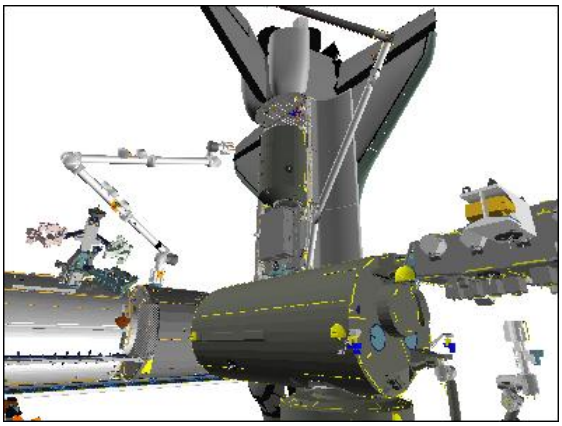
PARAM – PORT TEMP
JOINT – CRIT TEMP

Notify SSRMS Operator, "Go for Walkoff"

CCTV A (10,25)



CCTV C (-60,40)

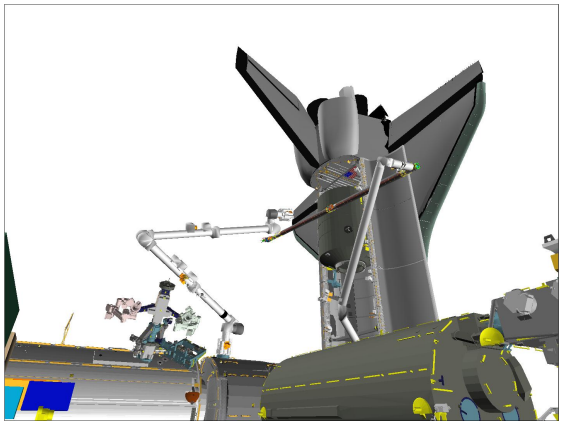


P1 LOOB (130,20)

Step 1:
Drive SY (+) from +25.8 to +35.1

CCTV A (10,25)

CCTV D (10,20)

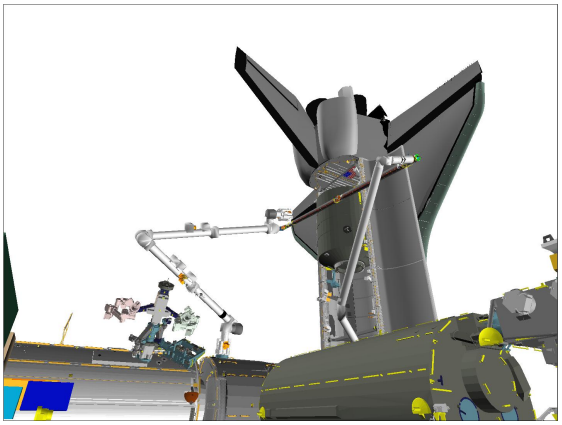


P1 LOOB (120,30)

Step 2:
Drive WP (+) from -85.9 to -75.0

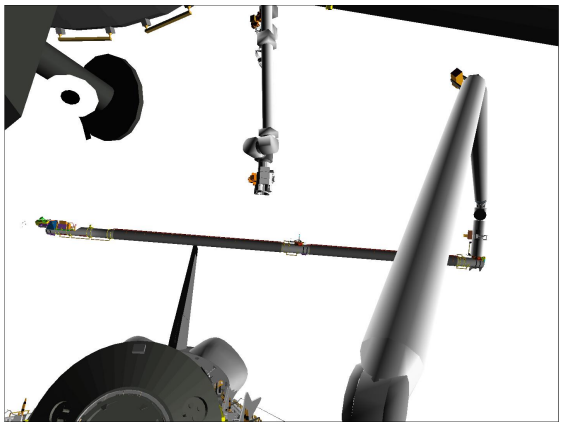
CCTV A (10,25)

CCTV D (10,20)

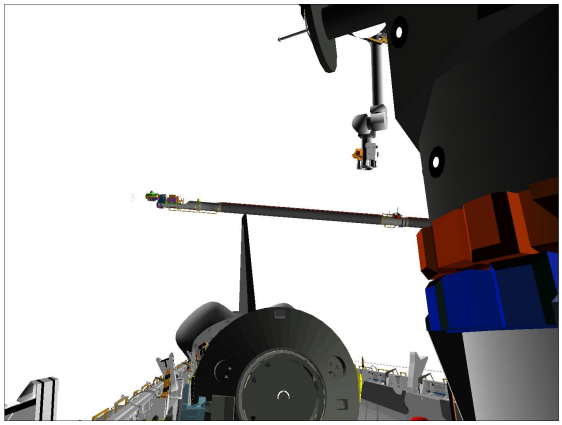


P1 LOOB (120,30)

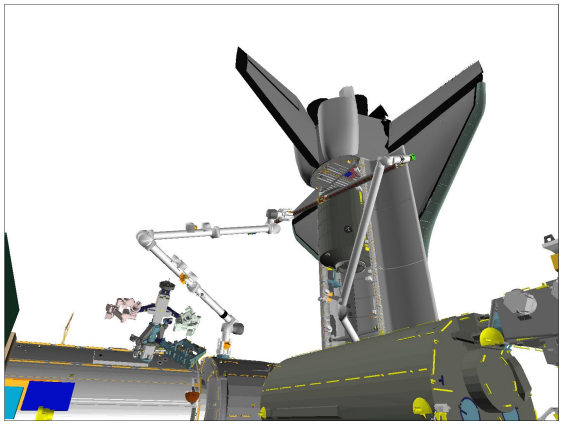
Step 3:
Drive WY (-) from +10.7 to -0.7



CCTV A (10,25)



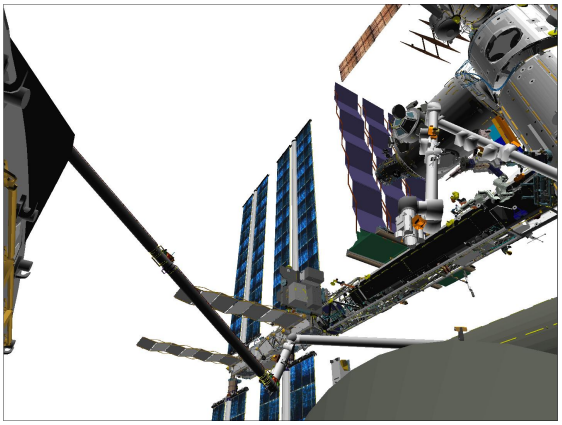
CCTV D (10,20)



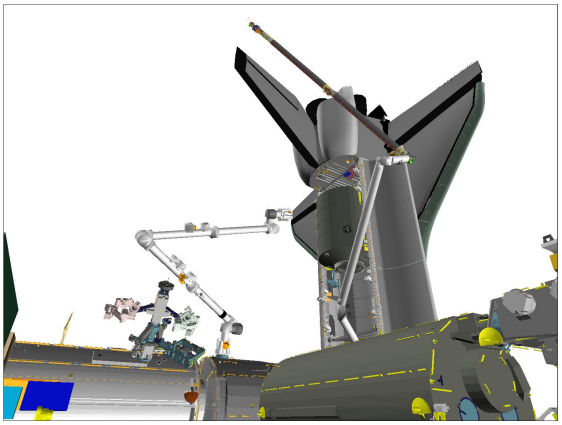
P1 LOOB (120,30)

Step 4:
Drive WR (+) from -100.7 to -40.1

CCTV A (10,25)



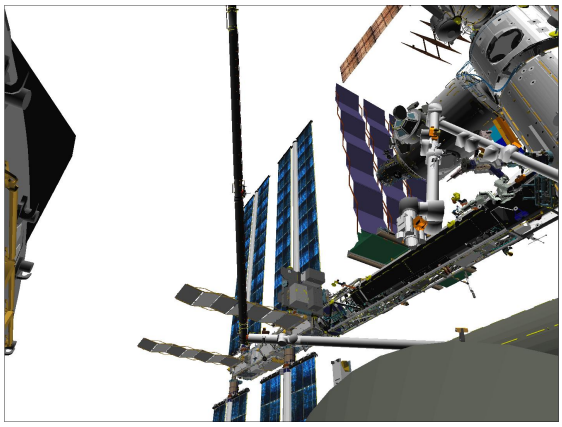
CCTV C (-60,40)



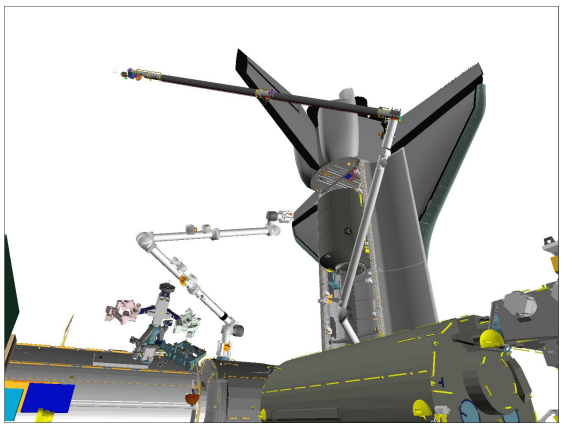
P1 LOOB (120,30)

Step 5:
Drive WP (+) from -75.0 to -0.4

CCTV A (10,25)



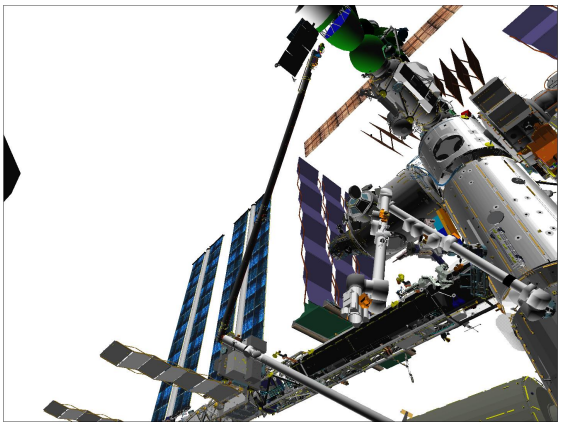
CCTV C (-60,40)



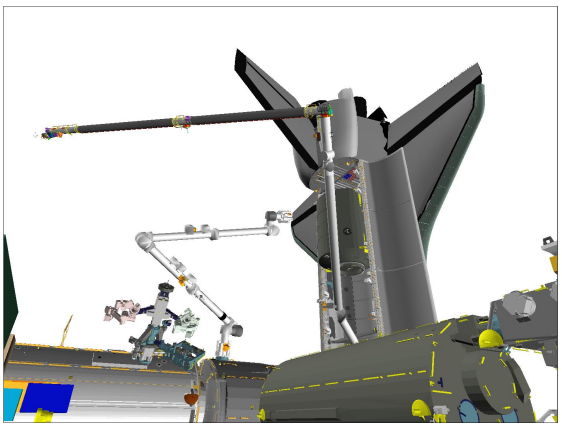
P1 LOOB (120,30)

Step 6:
Drive EP (+) from -49.0 to -22.7

CCTV A (10,25)



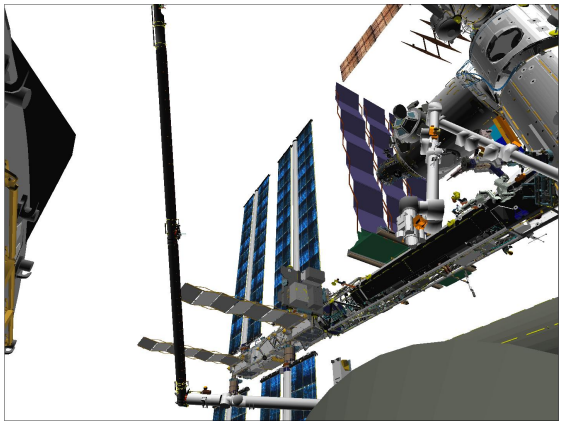
CCTV C (-50,50)



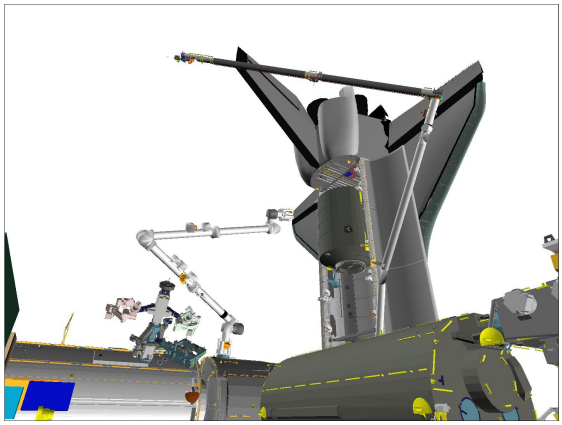
P1 LOOB (120,30)

Step 7:
Drive SP (-) from +66.3 to +38.6

CCTV A (10,25)



CCTV C (-60,40)



P1 LOOB (120,30)

OBSS SJ MNVR TO PM VENT SENSOR CLEAR

1. SETUP

SM 94 PDRS CONTROL

√PL ID, ITEM 3: 1

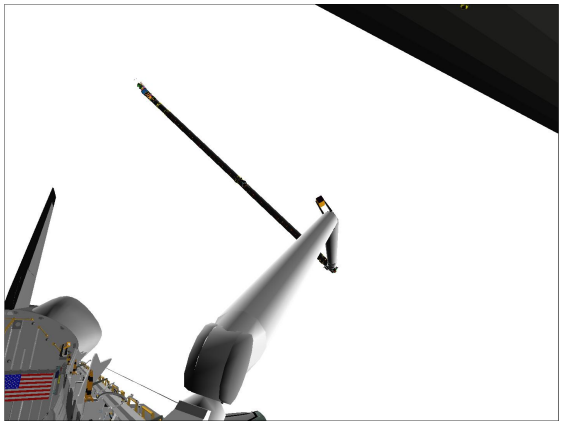
√INIT ID, ITEM 24: 1

Verify SRMS at PMM INSTALL VIEWING posn:

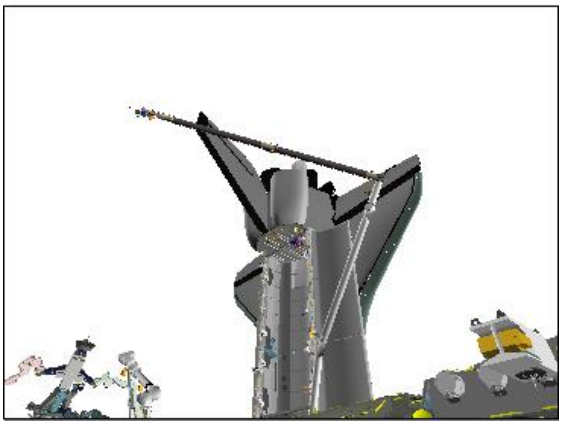
	X	Y	Z	PITCH	YAW	ROLL	PL ID
√	-1131	-496	-586	62	324	282	1
	SY	SP	EP	WP	WY	WR	
√	+35.1	+38.6	-22.7	-0.4	-0.7	-40.1	

R12 √Green Jumper – ISS

V10/L	P1 LOOB
V10/R	A
MON 1	Elbow (RSC)
MON 2	C (B)



CCTV A (30,20)



P1 LOOB (130,40)

2. MNVR TO PM VENT SENSOR CLEAR

If SINGLE mode available:

RHC RATE – as reqd (VERN within 10 ft)

BRAKES – OFF (tb-OFF)

MODE – best available

Mnvr to PM VENT SENSOR CLEAR posn:

	SY	SP	EP	WP	WY	WR
PMM Install Viewing	+35.1	+38.6	-22.7	-0.4	-0.7	-40.1
1: SY +	+62.5					
2: SP –		+25.2				
3: EP –			-23.4			
4: WP +				+0.4		
5: WY –					-13.0	
6: WR +						+16.1
PM Vent Sensor Clear	+62.5	+25.2	-23.4	+0.4	-13.0	+16.1

X	Y	Z	PITCH	YAW	ROLL	PL ID
-966	-643	-383	88	15	281	1

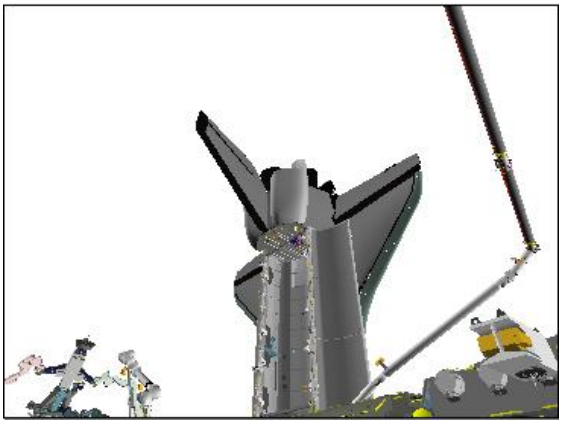
If SINGLE mode available:
BRAKES – ON (tb-ON)

MODE – not DIRECT

PARAM – PORT TEMP
JOINT – CRIT TEMP

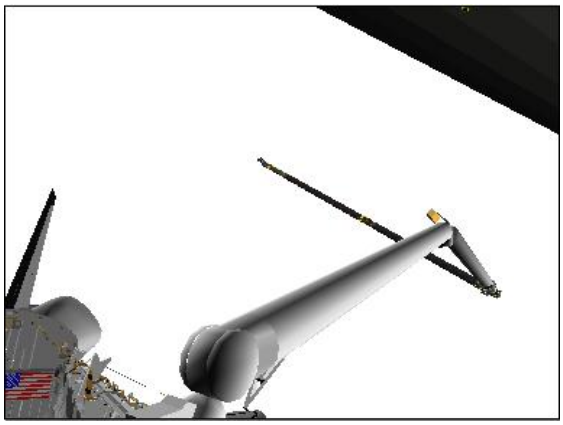
Notify MCC-H, "SRMS at PM Vent Sensor Clear posn with Brakes On, GO for PM Venting"

CCTV A (30,20)



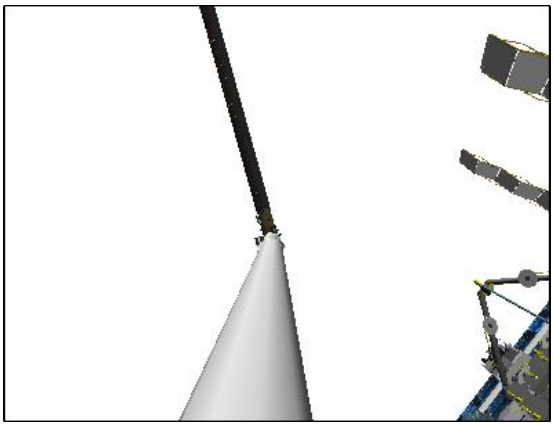
P1 LOOB (130,40)

Step 1:
Drive SY (+) from +35.1 to +62.5



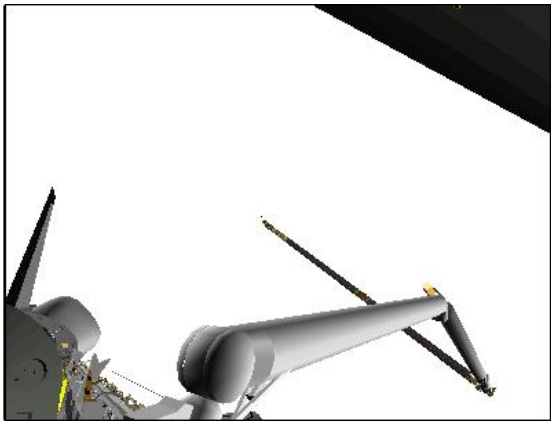
CCTV A (30,20)

P1 LOOB (130,40)

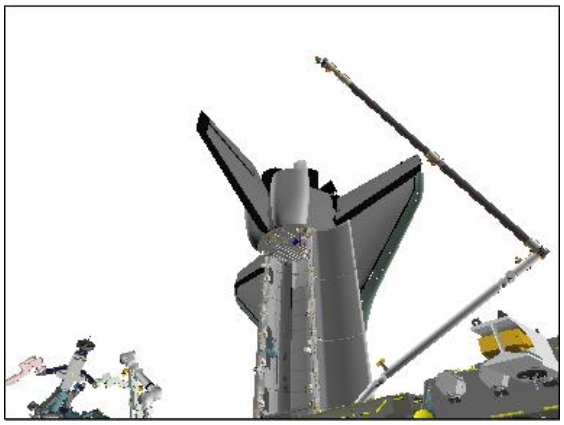


ELBOW (0,0)

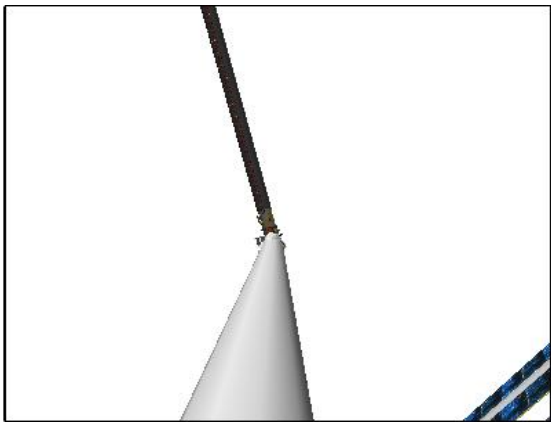
Step 2:
Drive SP (-) from +38.6 to +25.2



CCTV A (30,20)

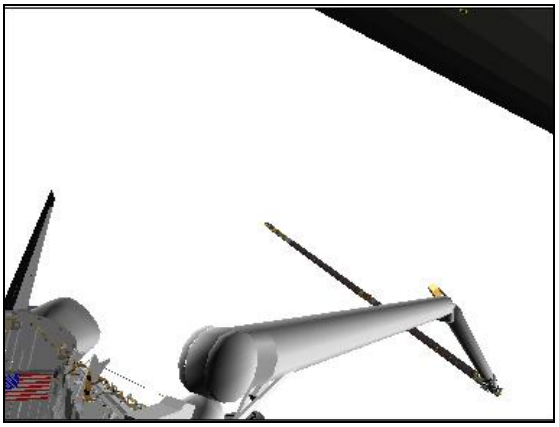


P1 LOOB (130,40)

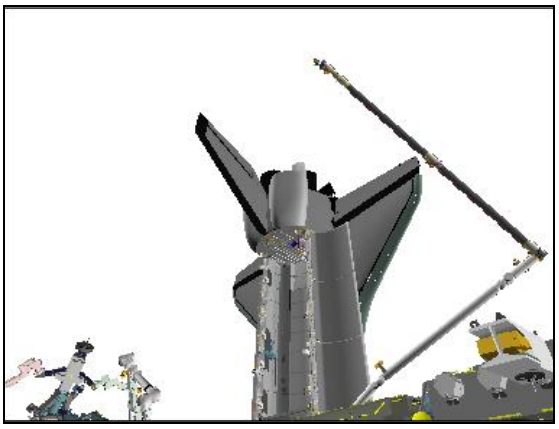


ELBOW (0,0)

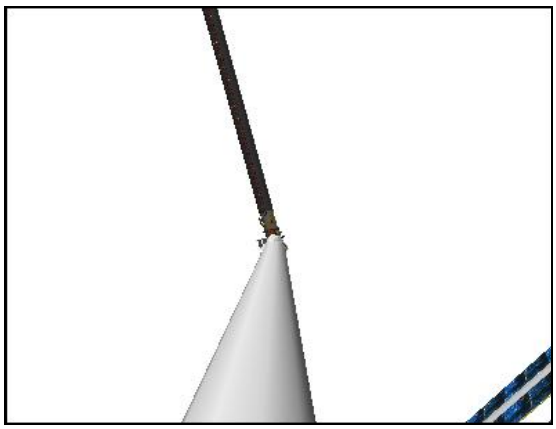
Step 3:
Drive EP (-) from -22.7 to -23.4



CCTV A (30,20)

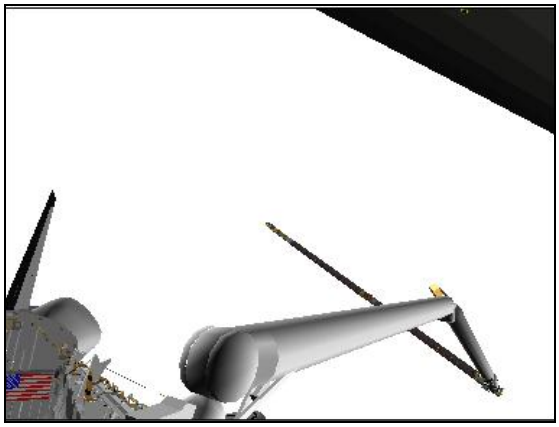


P1 LOOB (130,40)

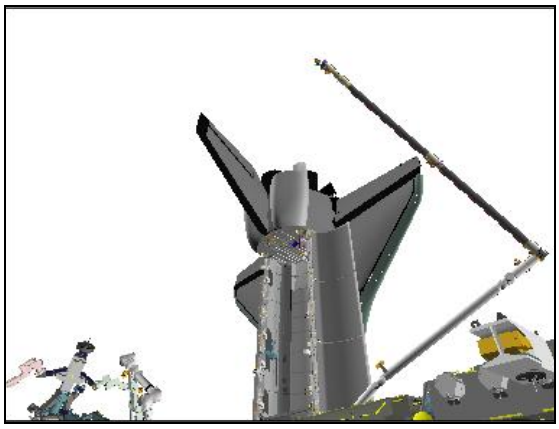


ELBOW (0,0)

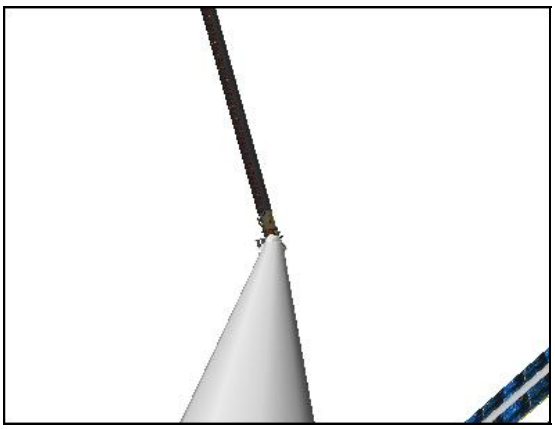
Step 4:
Drive WP (+) from -0.4 to +0.4



CCTV A (30,20)

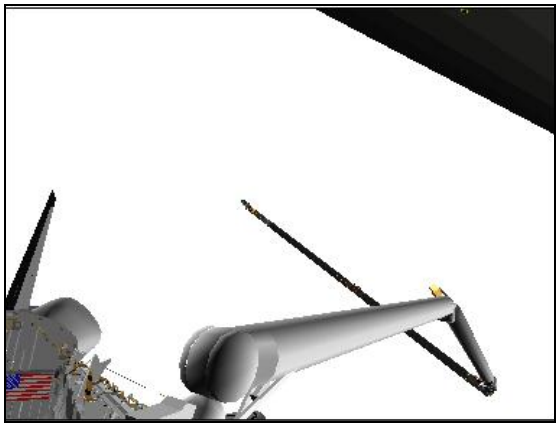


P1 LOOB (130,40)

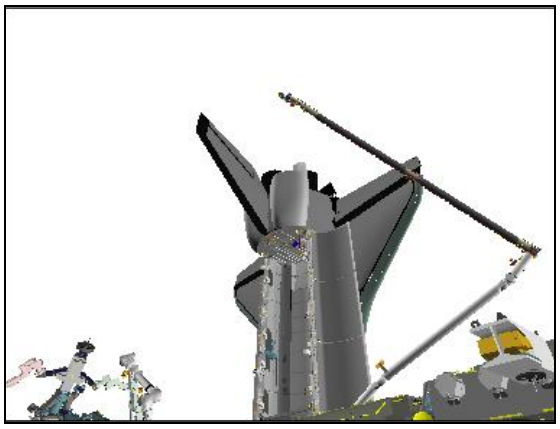


ELBOW (0,0)

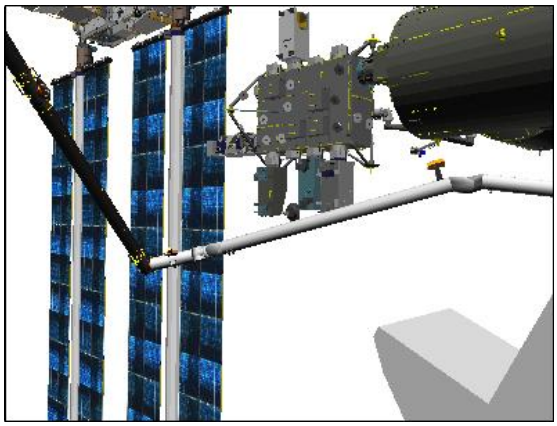
Step 5:
Drive WY (-) from -0.7 to -13.0



CCTV A (30,20)

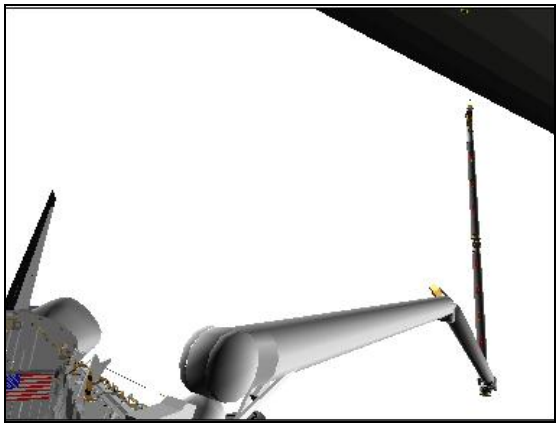


P1 LOOB (130,40)

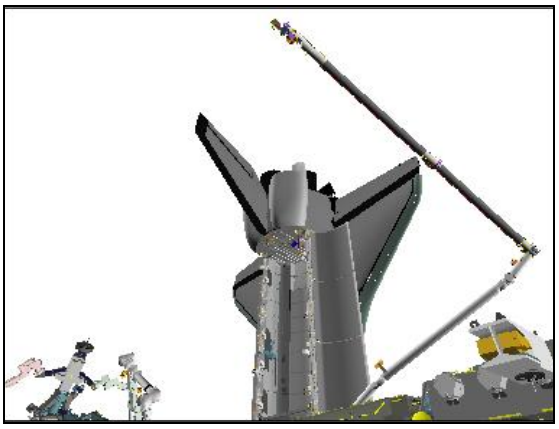


CCTV B (-45,0)

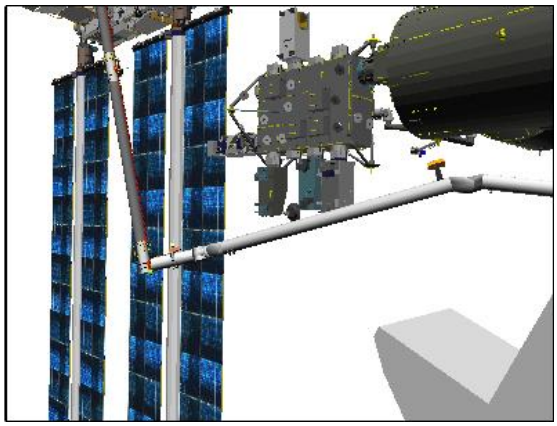
Step 6:
Drive WR (+) from -40.1 to +16.1



CCTV A (30,20)



P1 LOOB (130,40)



CCTV B (-45,0)

OBSS MNVR TO EVA 2 VIEWING

1. SETUP

On MCC-H, "GO for mnvr to EVA 2 Viewing posn,"

SM 94 PDRS CONTROL

√PL ID, ITEM 3: 1

√INIT ID, ITEM 24: 1

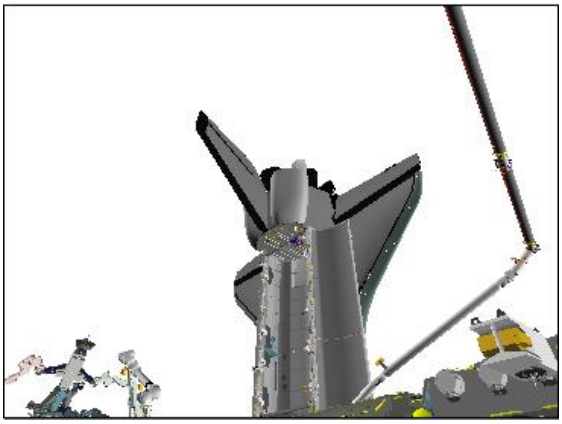
Verify SRMS at PM VENT SENSOR CLEAR posn:

	X	Y	Z	PITCH	YAW	ROLL	PL ID
√	-966	-643	-383	88	15	281	1
	SY	SP	EP	WP	WY	WR	
√	+62.5	+25.2	-23.4	0.4	-13.0	+16.1	

R12 √Green Jumper – ISS

V10/L	P1 LOOB
V10/R	A
MON 1	Elbow (RSC)
MON 2	C (B)

CCTV A (30,20)



P1 LOOB (130,40)

2. MNVR TO EVA 2 VIEWING POSN

If SINGLE mode available:

RHC RATE – as reqd (VERN within 10 ft)

BRAKES – OFF (tb-OFF)

MODE – best available

Mnvr to EVA 2 Viewing posn:

	SY	SP	EP	WP	WY	WR	
PM Vent Sensor Clear	+62.5	+25.2	-23.4	+0.4	-13.0	+16.1	
1: WR -						-21.8	
EVA 2 Viewing	+62.5	+25.2	-23.4	+0.4	-13.0	-21.8	
	X	Y	Z	PITCH	YAW	ROLL	PL ID
	-967	-643	-386	60	349	282	1

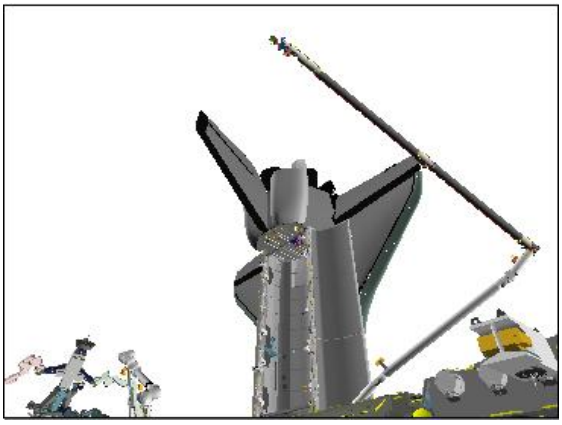
If SINGLE mode available:
BRAKES – ON (tb-ON)

MODE – not DIRECT

PARAM – PORT TEMP
JOINT – CRIT TEMP

Notify MCC-H, "SRMS at EVA 2 Viewing posn with Brakes On"

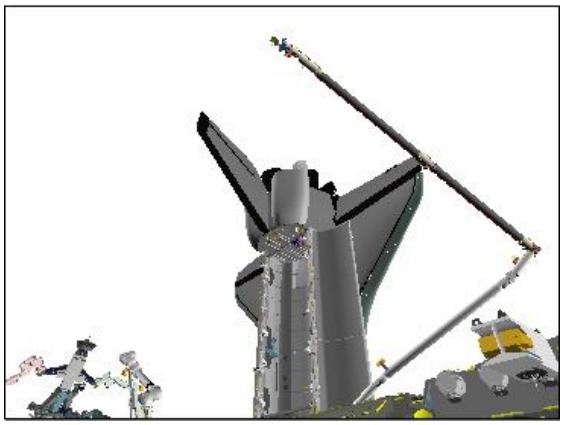
CCTV A (30,20)



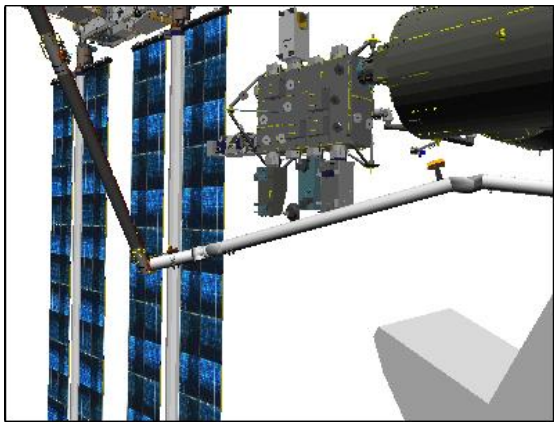
P1 LOOB (130,40)

Step 1:
Drive WR (-) from +16.1 to -21.8

CCTV A (30,20)



P1 LOOB (130,40)



CCTV B (-45,0)

OBSS SJ MNVR TO OBSS UNDOCK

1. SETUP

SM 94 PDRS CONTROL

√PL ID, ITEM 3: 1

√INIT ID, ITEM 24: 1

Verify SRMS at EVA 2 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	+25.2	-23.5	+0.9	-13.1	-21.8	

R12 Green Jumper – ISS

MON 1	P1 LOOB (D)
MON 2	A
V10/L	Elbow (RSC)
V10/R	C (B)

2. MNVR TO OBSS UNDOCK

If SINGLE mode available:

RHC RATE – as reqd (VERN within 10 ft)

BRAKES – OFF (tb-OFF)

MODE – best available

Mnvr to OBSS UNDOCK posn:

	SY	SP	EP	WP	WY	WR	
EVA 1 Viewing	+62.5	+25.2	-23.5	+0.9	-13.1	-21.8	
1: SP +		+50.0					
2: WR –						-60.0	
3: SY –	+25.8						
4: SP +		+66.3					
5: WP –				-85.9			
6: WY +					+10.7		
7: WR –						-100.2	
8: EP –			-49.0				
OBSS Undock	+25.8	+66.3	-49.0	-85.9	+10.7	-100.2	

X	Y	Z	PITCH	YAW	ROLL	PL ID
-1041	-362	-602	44	270	0	1

If SINGLE mode available:

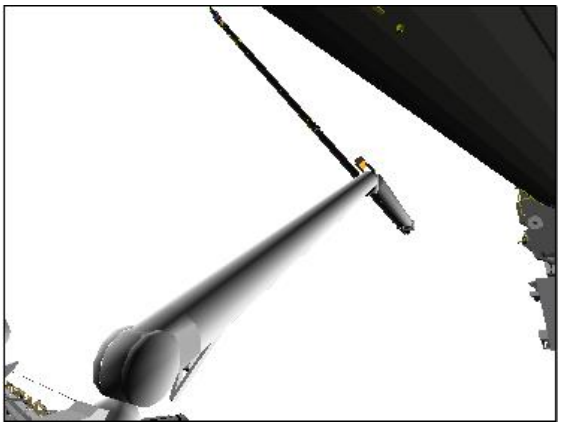
BRAKES – ON (tb-ON)

MODE – not DIRECT

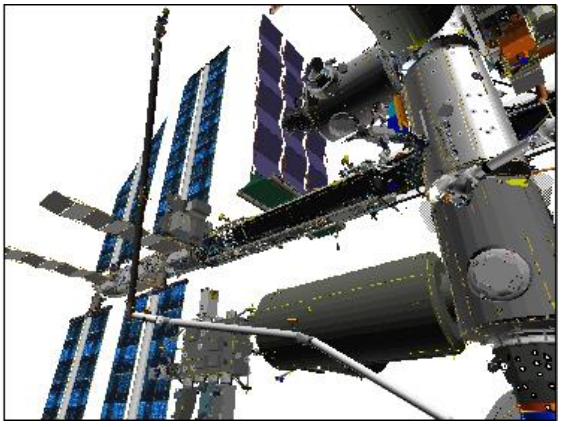
PARAM – PORT TEMP

JOINT – CRIT TEMP

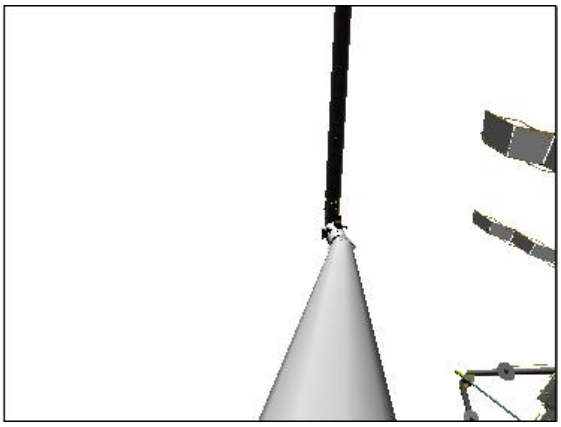
Step 1:
Drive SP (+) from +25.2 to +50.0



CCTV A (40,20)

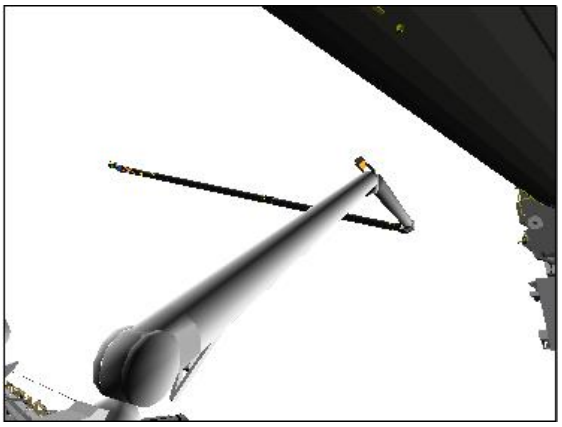


CCTV C (-40,30)

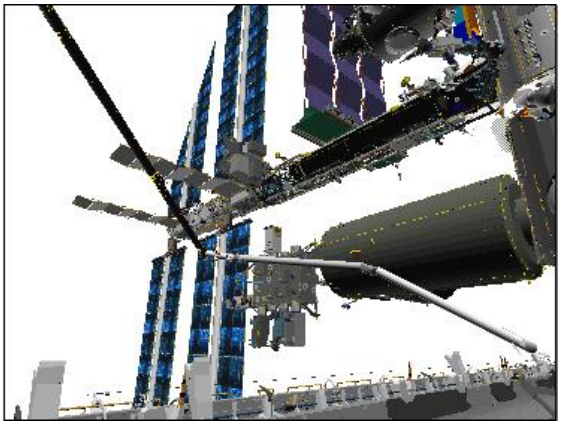


ELBOW (-10,0)

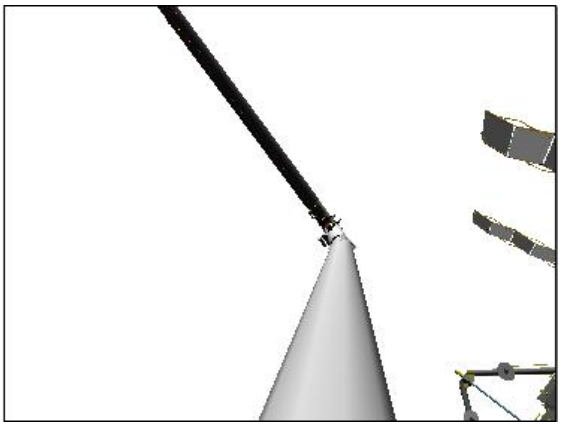
Step 2:
Drive WR (-) from -21.8 to -60.0



CCTV A (40,20)

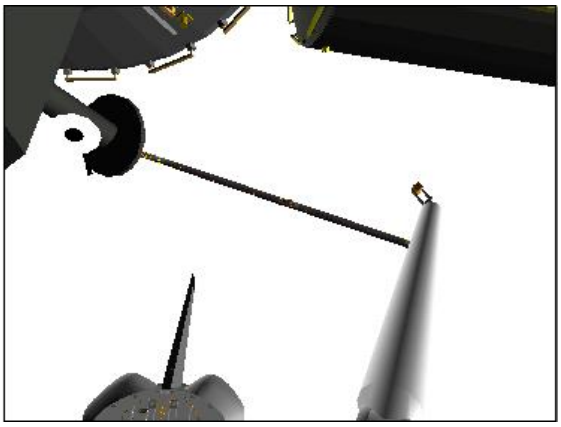


CCTV C (-50,20)

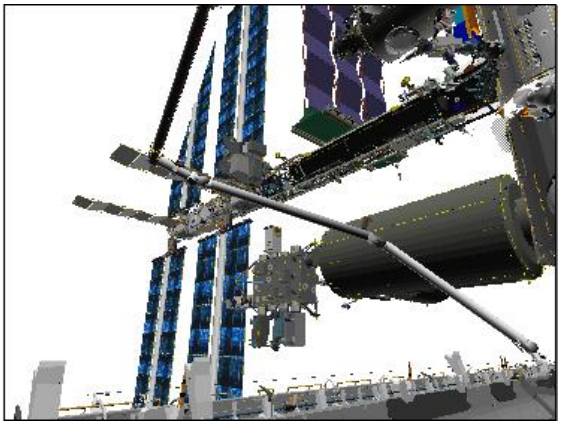


ELBOW (-10,0)

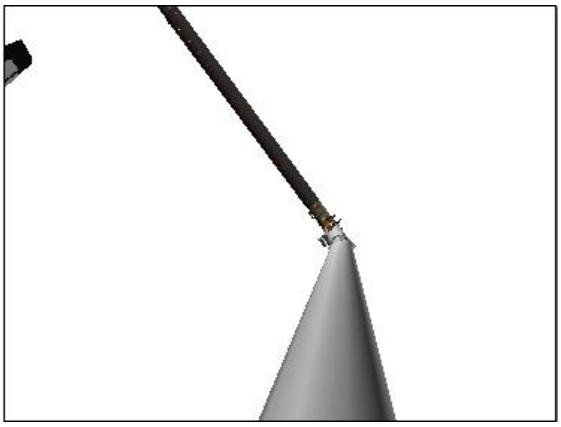
Step 3:
Drive SY (-) from +62.5 to +25.8



CCTV A (10,30)

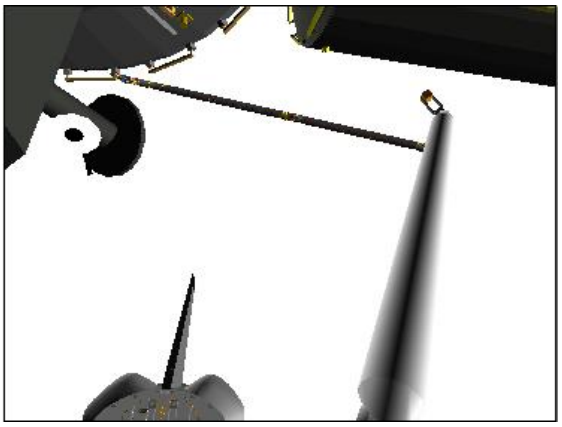


CCTV C (-50,20)

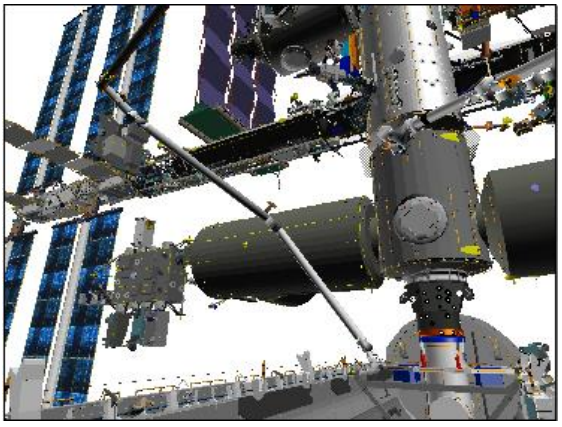


ELBOW (-10,0)

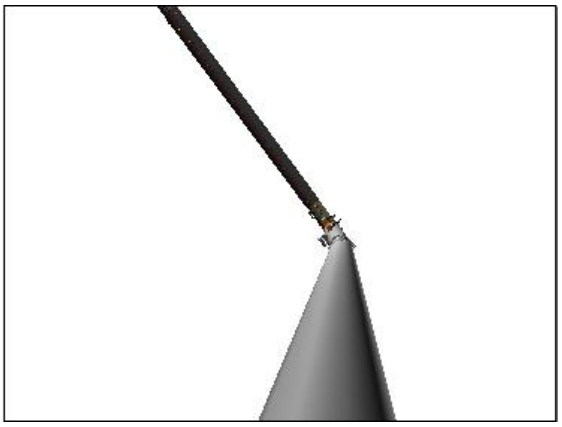
Step 4:
Drive SP (+) from +50.0 to +66.3



CCTV A (10,30)

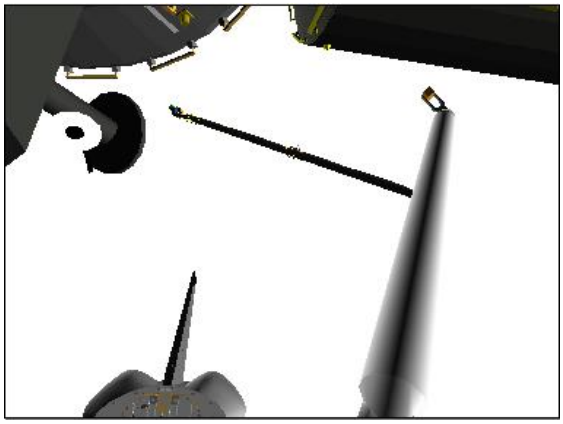


CCTV C (-30,20)

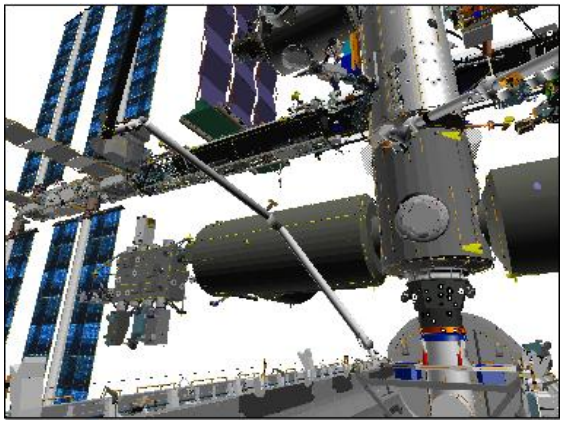


ELBOW (-10,0)

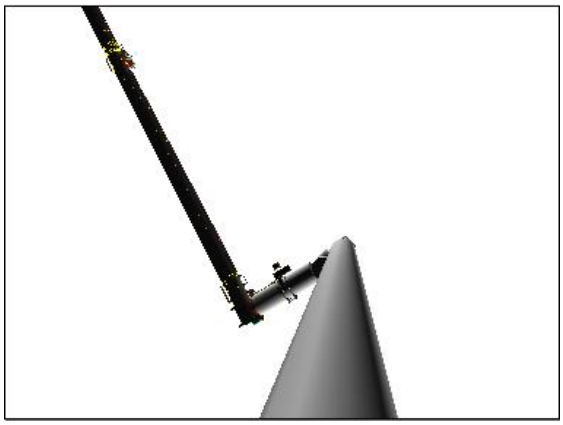
Step 5:
Drive WP (-) from +0.9 to -85.9



CCTV A (10,30)

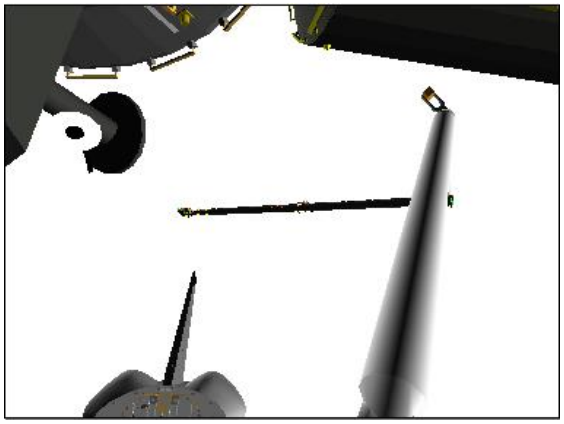


CCTV C (-30,20)

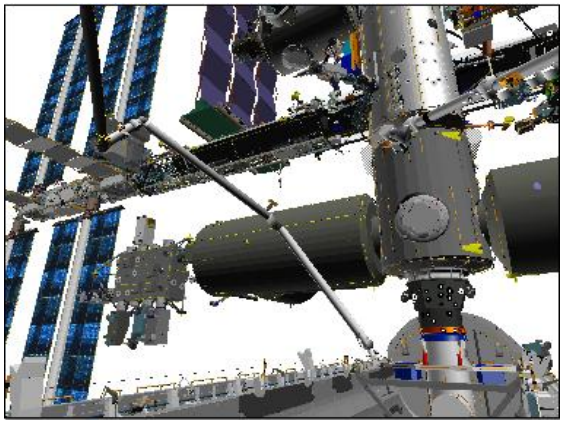


ELBOW (-10,0)

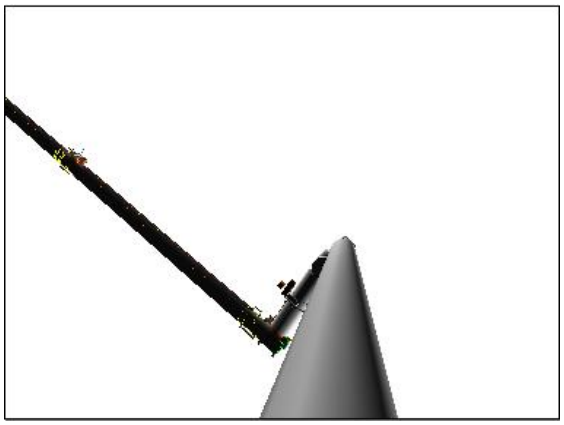
Step 6:
Drive WY (+) from -13.1 to +10.7



CCTV A (10,30)

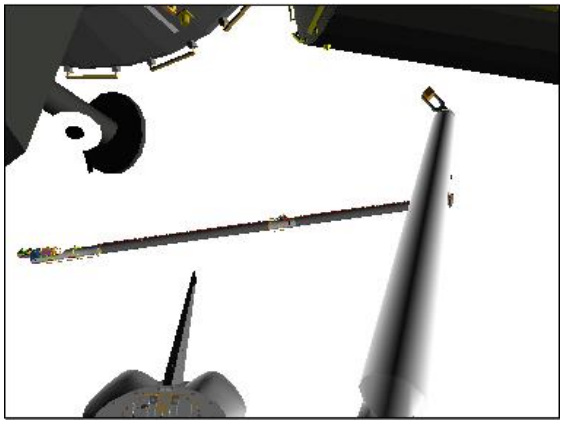


CCTV C (-30,20)

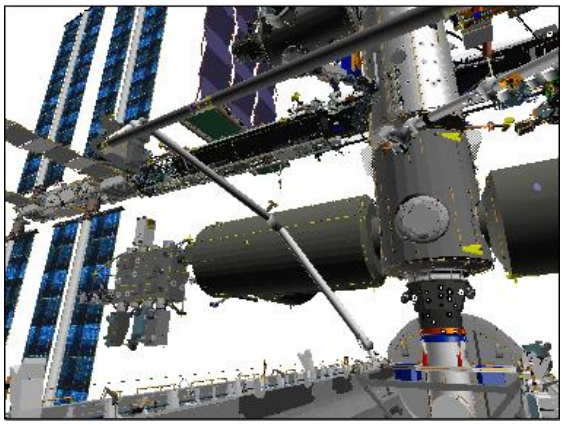


ELBOW (-10,0)

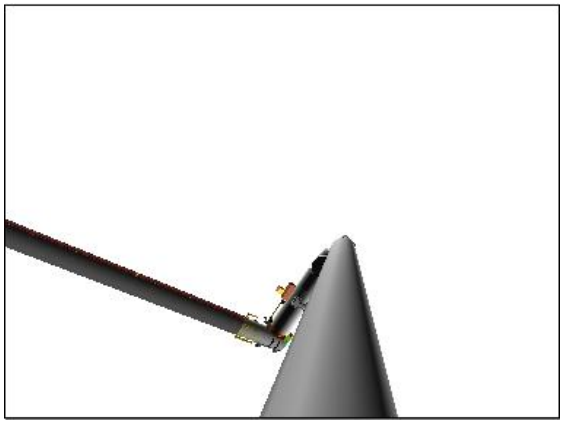
Step 7:
Drive WR (-) from -60.0 to -100.2



CCTV A (10,30)

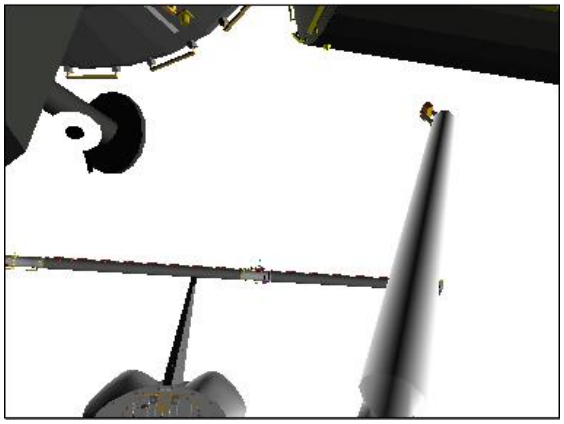


CCTV C (-50,20)

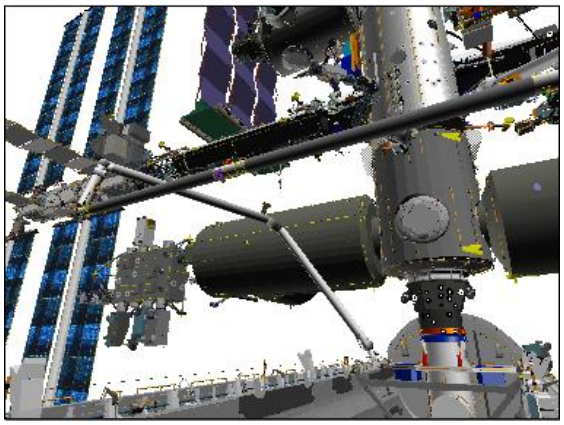


ELBOW (-10,0)

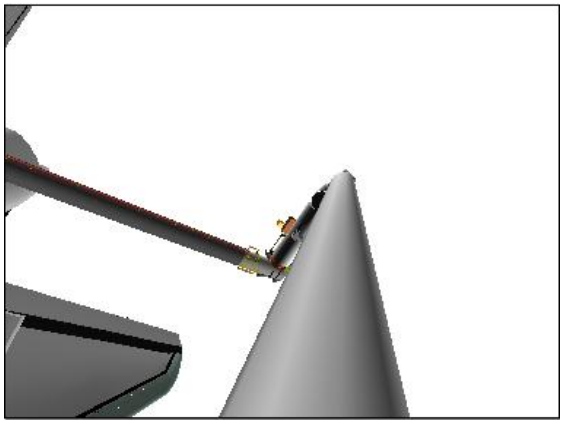
Step 8:
Drive EP (-) from -23.5 to -49.0



CCTV A (10,30)



CCTV C (-30,20)



ELBOW (-10,0)

OBSS HANDBACK TO SSRMS

1. SETUP

V10/L	A
V10/R	P1 LOOB
MON 1	B (C)
MON 2	Elbow (EE)

SM 94 PDRS CONTROL

√PL ID, ITEM 3: 1

√INIT ID, ITEM 24: 1

Verify SRMS at OBSS HANDOFF 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	-100.2		

*Display singularity

√BRAKES – ON (tb-ON)

* If using shuttle attitude control *
* Verify in attitude, then DAP: FREE *

Notify SSRMS Operator, "SRMS at OBSS Handoff with Brakes On, GO for SSRMS OBSS grapple"

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

2. STOW PTU

R12 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 SRMS OBSS ungrapple,"

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

Record OBSS thermal clock start time:

____/____:____:____

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

3. OBSS UNGRAPPLE

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

NOTE

CONTRL ERR lt 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)

If TEST mode available,
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

If SINGLE mode available:

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

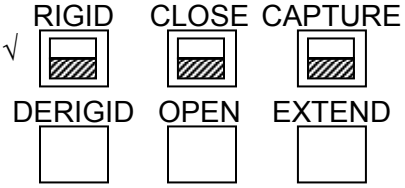
MODE – best available

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 *

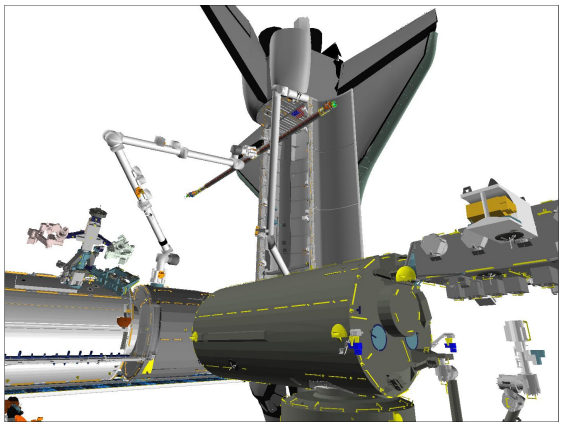
Mnvr to OBSS BACKOFF posn:

X	Y	Z	PITCH	YAW	ROLL	PL ID
-1018	-362	-676	284	0	270	0
SY	SP	EP	WP	WY	WR	
+23.9	+64.7	-34.2	-99.4	+11.4	-99.0	

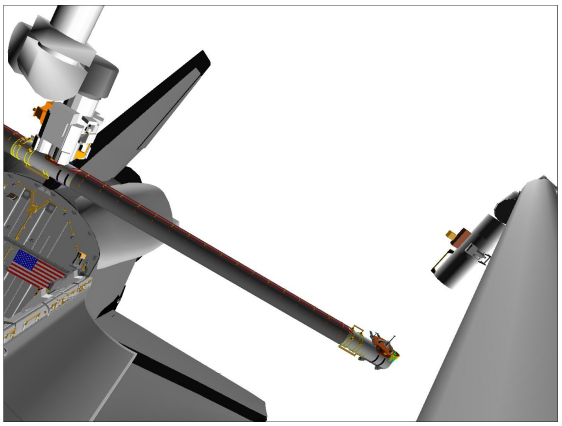
If SINGLE mode available:
BRAKES – ON (tb-ON)

MODE – not DIRECT

Notify SSRMS Operator, "SRMS at OBSS Backoff with Brakes On, GO for SSRMS OBSS Berth"



P1 LOOB (130,20)



ELBOW (-35,-10)

4. 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

5. CONFIGURE FOR MONITORING

On SSRMS Operator notification to watch for stbd RMS RFLs,
SM 94 PDRS CONTROL
RMS STBD – ITEM 2 EXEC (*)

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

6. 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

Verify AOS for latching to Topological Capture

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

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"

On SSRMS Operator GO, "to complete stbd MRL latching,"

R13L PL BAY MECH PWR SYS (two) – ON

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

7. 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 ungrapple"

After SSRMS ungrapple

* If using shuttle attitude control *
* Verify in attitude, then DAP: AUTO *

SJ MNVR TO OBSS HOVER

1. SETUP

WARNING
For UNDOCKED ops only

V10/L	B
V10/R	A
MON 1	Elbow
MON 2	D

SM 94 PDRS CONTROL

√PL ID, ITEM 3: 1

√INIT ID, ITEM 24: 1

Verify SRMS at OBSS UNDOCK posn:

	X	Y	Z	PITCH	YAW	ROLL	PL ID	
√	-1041	-362	-602	14	270	0	1	*
	SY	SP	EP	WP	WY	WR		
√	+25.8	+66.3	-49.0	-85.9	+10.7	-100.2		

*Display singularity

2. SINGLE JOINT TO OBSS HOVER

NOTE

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

If SINGLE mode available:

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

MODE – best available

Mnvr to OBSS HOVER posn:

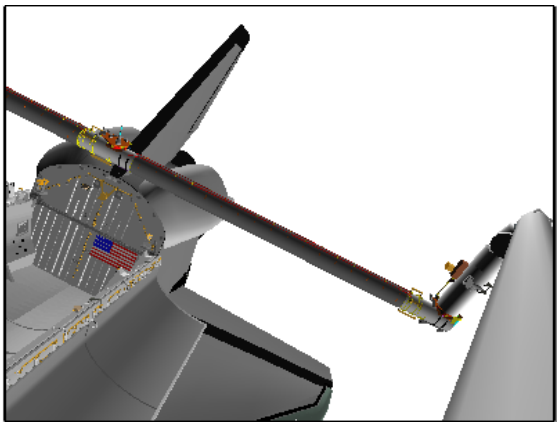
	SY	SP	EP	WP	WY	WR	
Undock posn	+25.8	+66.3	-49.0	-85.9	+10.7	-100.2	
1: WY –					0.0		
2: WP +				-59.8			
3: WR +						+110.0	
4: SY –	-90.0						
5: SP +		+80.2					
6: EP –			-118.8				
OBSS Hover	-90.0	+80.2	-118.8	-59.8	0.0	+110.0	
	X	Y	Z	PITCH	YAW	ROLL	PL ID
	-680	+133	-517	0	0	341	1

If SINGLE mode available:
BRAKES – ON (tb-ON)

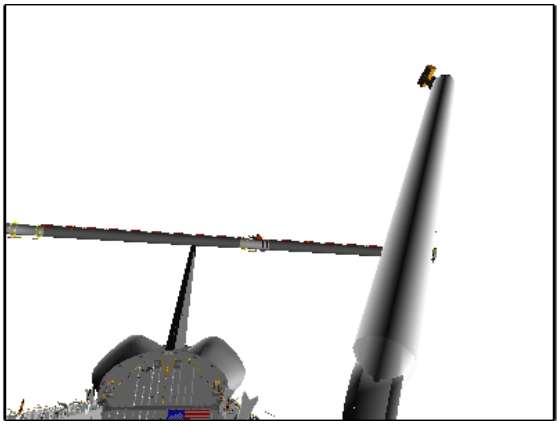
MODE – not DIRECT (lt off)

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

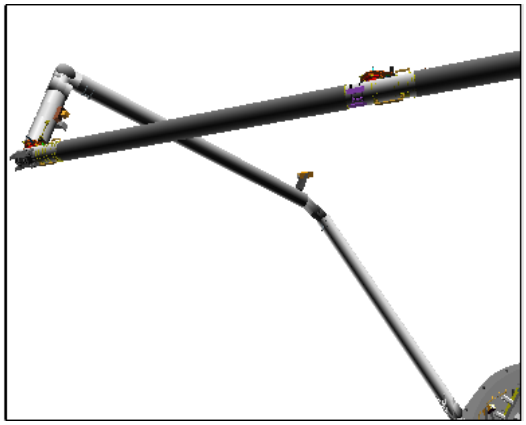
Start:
Undock Position



ELBOW (-35,-5)

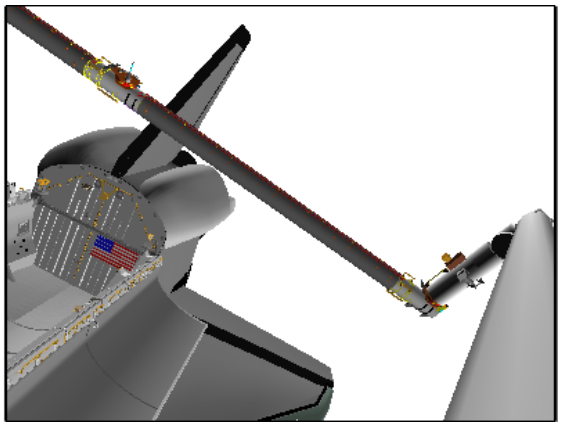


CCTV A (10,25)

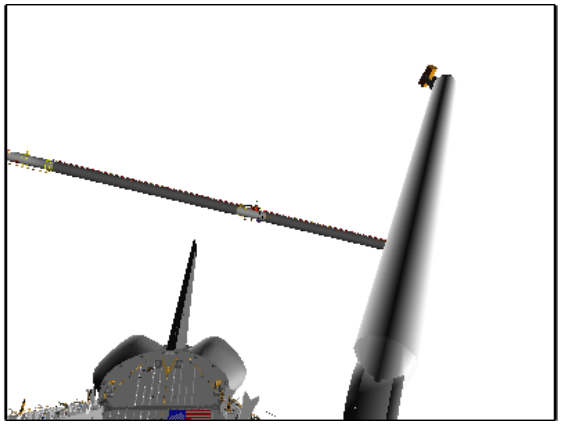


CCTV B (-20,20)

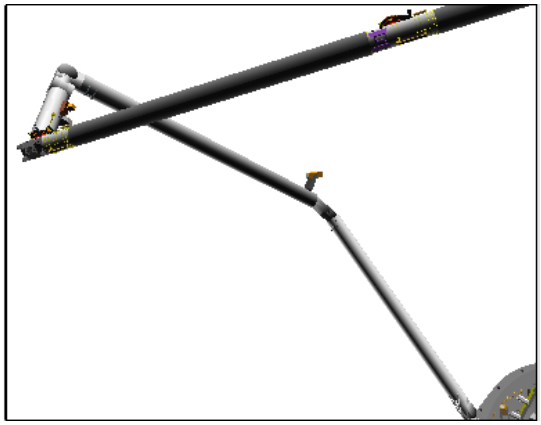
Step 1:
Drive WY (-) from +10.7 to 0.0



ELBOW (-35,-5)

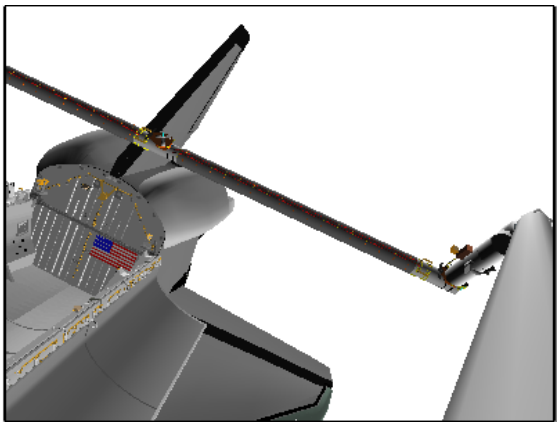


CCTV A (10,25)

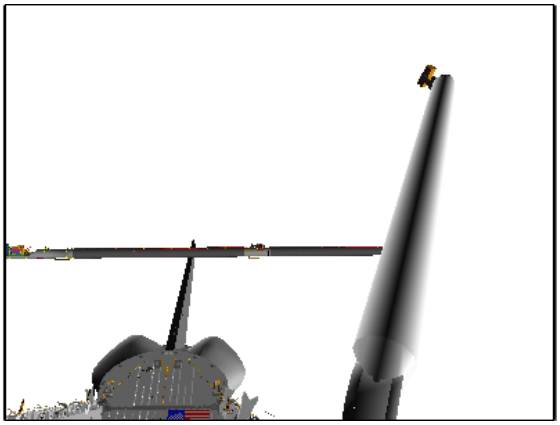


CCTV B (-20,20)

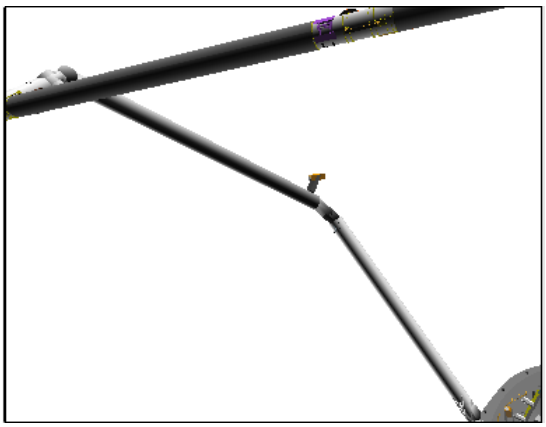
Step 2:
Drive WP (+) from -85.9 to -59.8



ELBOW (-35,-5)

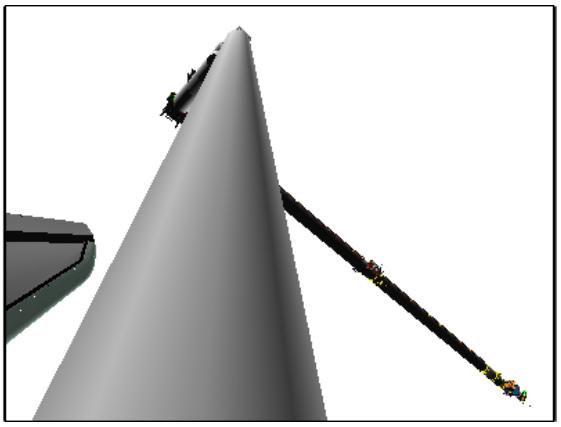


CCTV A (10,25)

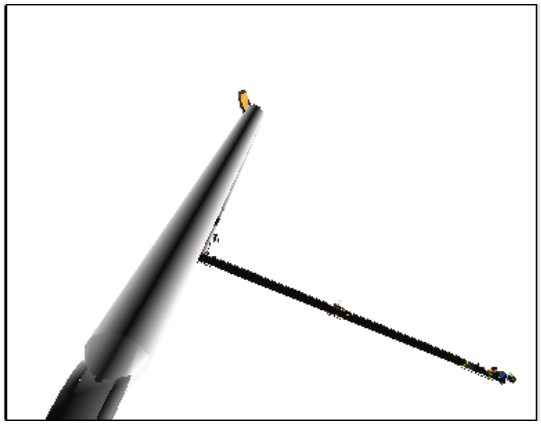


CCTV B (-20,30)

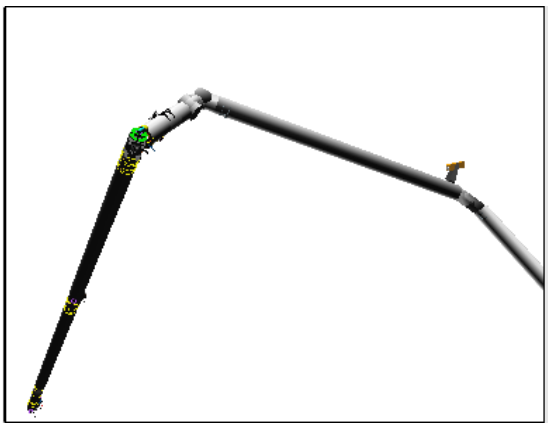
Step 3:
Drive WR (+) from -100.2 to +110.0



ELBOW (5,-30)



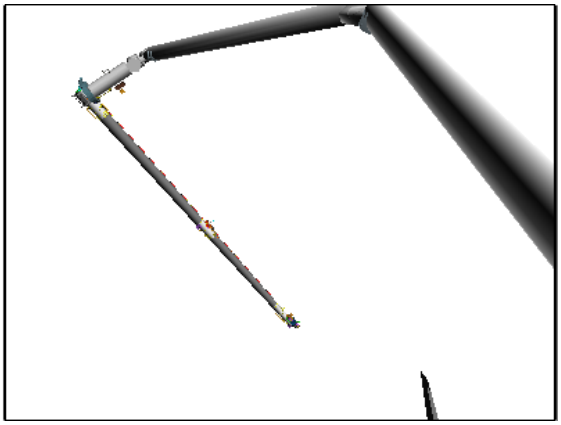
CCTV A (45,25)



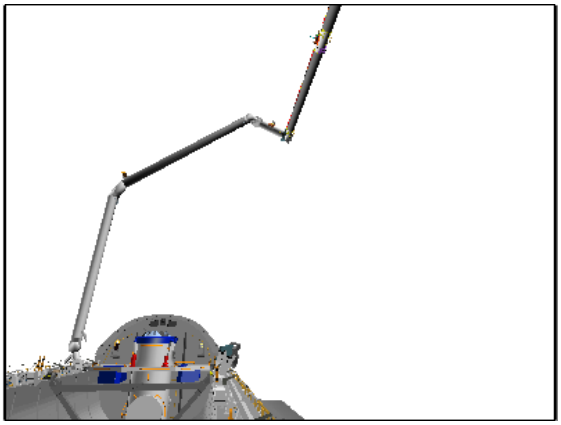
CCTV B (-35,20)

Step 4:
Drive SY (-) from +25.8 to -90

CCTV D (15,60)



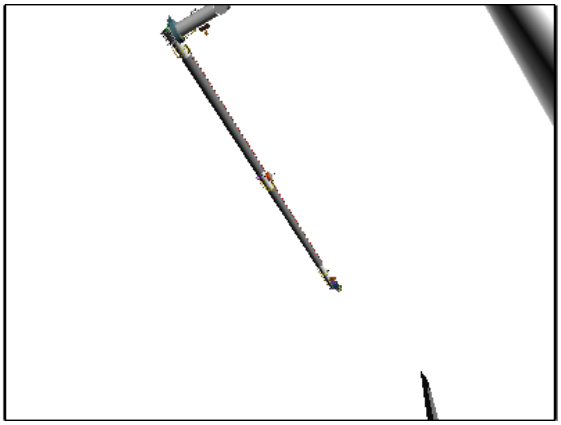
CCTV A (-25,45)



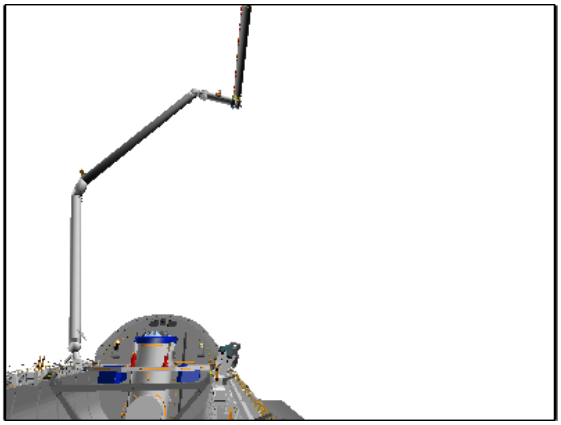
CCTV C (10,20)

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

CCTV D (15,60)



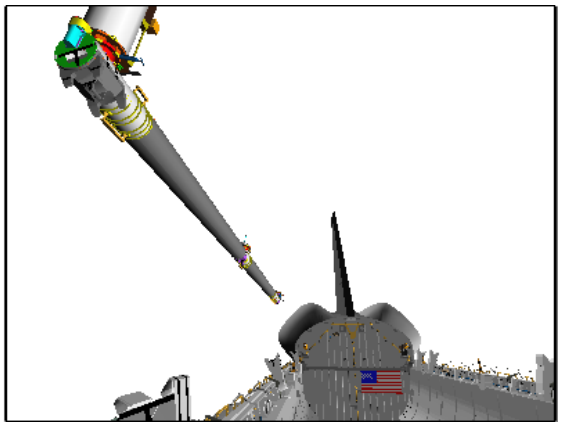
CCTV A (-25,45)



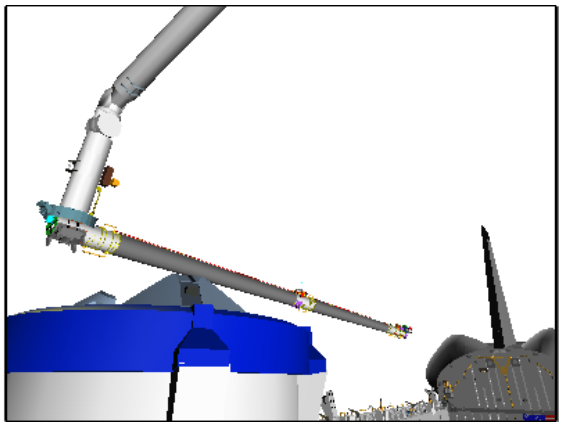
CCTV C (10,20)

Step 6:

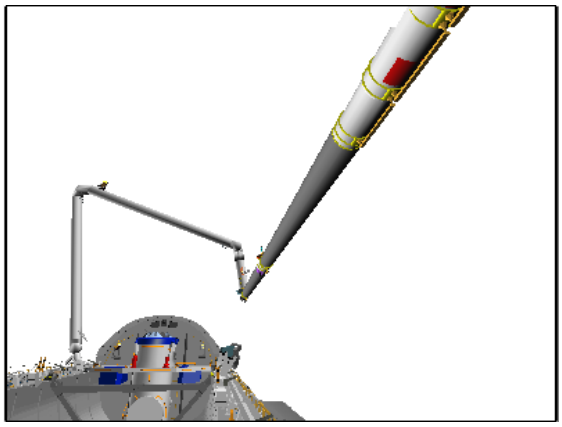
Drive EP (-) from -49.0 to -118.8



CCTV D (-5,20)



CCTV A (-35,25)



CCTV C (10,20)

REFERENCE DATA

ELC4 JOINT ANGLES VS POR COORDINATES

ELC4 UNBERTH VIEWING

X	Y	Z	PITCH	YAW	ROLL	PL ID
-986	-158	-471	270	287	180	0
SY	SP	EP	WP	WY	WR	
+15.2	+71.3	-103.8	-77.1	-50.9	-184.9	

ELC4 INTERMEDIATE

X	Y	Z	PITCH	YAW	ROLL	PL ID
-1131	-229	-553	315	299	197	0
SY	SP	EP	WP	WY	WR	
+15.2	+50.0	-50.0	-77.1	-50.9	-184.9	

ELC4 PRE-GRAPPLE

X	Y	Z	PITCH	YAW	ROLL	PL ID
-998	+227	-617	202	284	278	0
SY	SP	EP	WP	WY	WR	
-44.4	+44.0	-62.9	-22.8	-52.1	-294.4	

ELC4 HANDOFF

X	Y	Z	PITCH	YAW	ROLL	PL ID
-981	+296	-611	202	284	278	0
-986	+405	-611	180	300	180	3
SY	SP	EP	WP	WY	WR	
-50.9	+32.1	-48.5	-21.0	-47.3	-288.4	

ELC4 HANDBACK

X	Y	Z	PITCH	YAW	ROLL	PL ID
-986	+297	-627	149	281	32	0
-942	+397	-621	30	279	197	3
SY	SP	EP	WP	WY	WR	
-50.9	+32.1	-48.5	-3.5	-47.3	-109.2	

ELC4 BACKOFF

X	Y	Z	PITCH	YAW	ROLL	PL ID
-998	+227	-620	146	281	28	0
SY	SP	EP	WP	WY	WR	
-44.4	+44.7	-66.9	+0.6	-53.4	-112.9	

OBSS PRE-GRAPPLE INTERMEDIATE

X	Y	Z	PITCH	YAW	ROLL	PL ID
-1124	+85	-669	54	290	41	0
SY	SP	EP	WP	WY	WR	
-25.0	+44.7	-50.0	+0.6	-53.4	0.0	

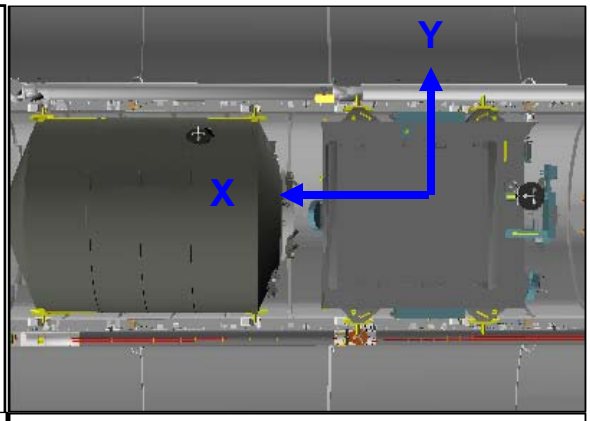
ELC4 COORDINATE SYSTEM – PL ID 3

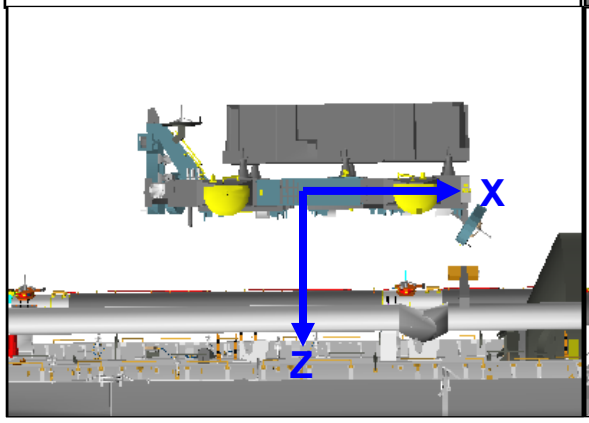
POR: at trunnion level and aligned w/ORAS

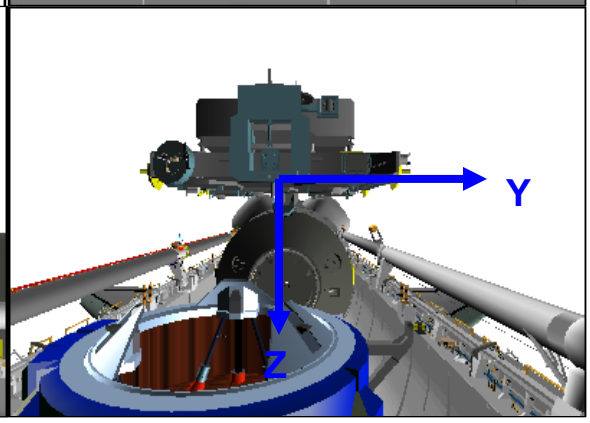
PURPOSE: ELC4 unberth and handoff

POR RATES:	COARSE	VERN
Trans Lim ft/sec	0.26	0.10
Rot Lim deg/sec	0.97	0.32

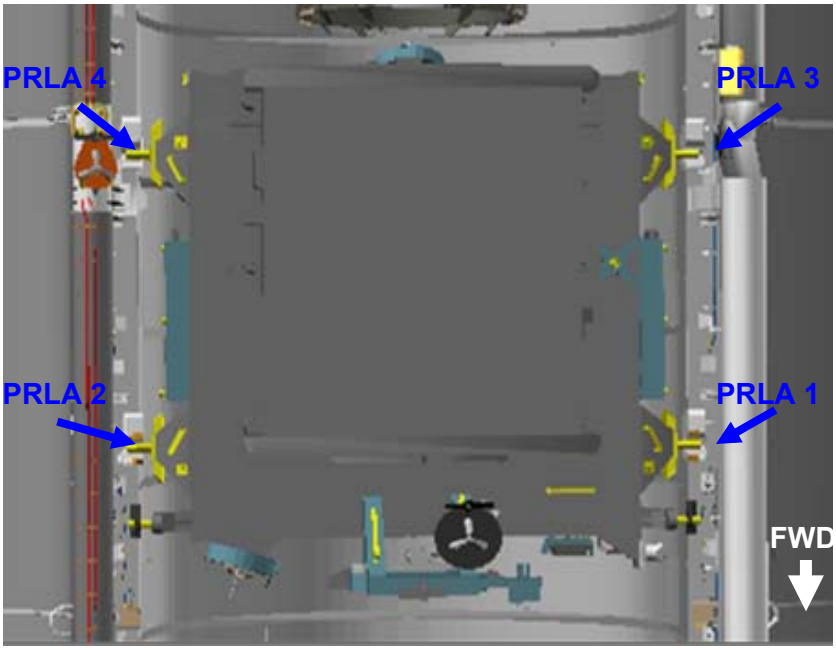
JOINT RATES:	COARSE	VERN
Shoulder Lim deg/sec	0.47	0.16
Elbow Lim deg/sec	0.66	0.22
Wrist Lim deg/sec	0.97	0.32





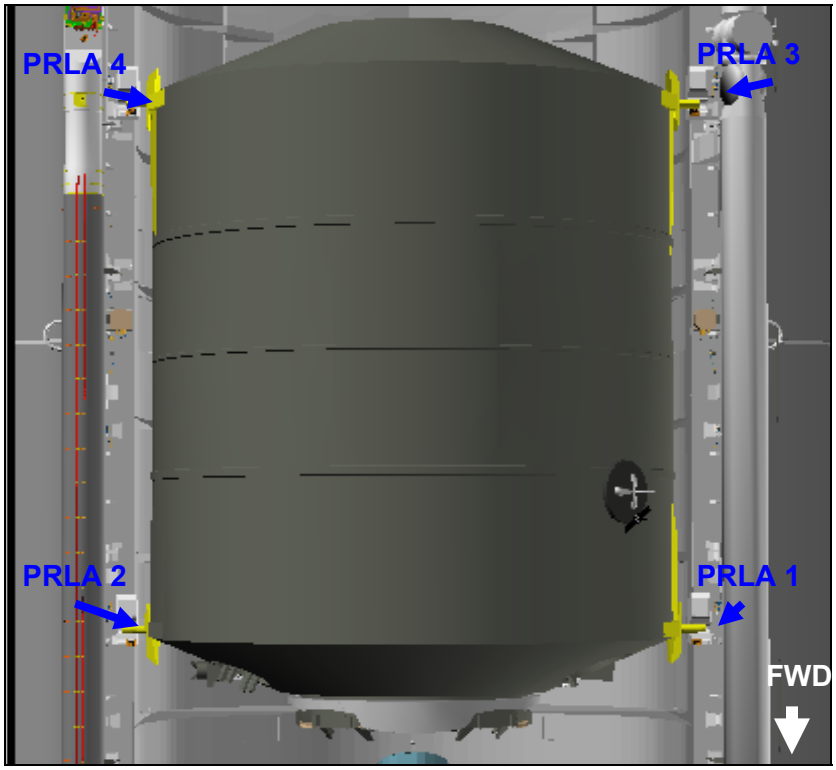


ELC4 PRLA CONFIGURATION



SEQUENCE	PL SEL	RELEASE	LATCH
PRLA 1,2	3	1,2 (fwd)	Not used
PRLA 3,4	3	3,4 (aft)	Not used

PMM PRLA CONFIGURATION



SEQUENCE	PL SEL	RELEASE	LATCH
ROEU	2	DEMATE/REL	Not used
AKA	1	AKA	Not used
PRLA 1,2	1	1,2 (fwd)	Not used
PRLA 3,4	1	3,4 (aft)	Not used

OBSS JOINT ANGLES VS POR COORDINATES

OBSS HANDOFF PRE-GRAPPLE

X	Y	Z	PITCH	YAW	ROLL	PL ID
-1018	-362	-676	284	0	270	0
SY	SP	EP	WP	WY	WR	
+23.9	+64.7	-34.2	-99.4	+11.4	-99.0	

OBSS HANDOFF/UNDOCK

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	14	270*	0	2
SY	SP	EP	WP	WY	WR	
+25.8	+66.3	-49.0	-85.9	+10.7	-100.2	

*Display singularity

OBSS INTERMEDIATE

X	Y	Z	PITCH	YAW	ROLL	PL ID
-1032	-362	-618	284	0	301	0
-1040	-365	-602	14	300	330	1
-1323	148	-688	14	300	0	2
SY	SP	EP	WP	WY	WR	
+25.8	+66.3	-49.0	-85.9	+10.7	-70.0	

PMM INSTALL VIEWING

X	Y	Z	PITCH	YAW	ROLL	PL ID
-1119	-483	-582	5	37	313	0
-1131	-496	-586	62	324	282	1
-1346	-138	-1004	62	324	312	2
SY	SP	EP	WP	WY	WR	
+35.1	+38.6	-22.7	-0.4	-0.7	-40.1	

PM VENT SENSOR CLEAR

X	Y	Z	PITCH	YAW	ROLL	PL ID
-959	-627	-387	342	47	22	0
-966	-643	-383	88	15	281	1
-979	-779	-958	88	15	311	2
SY	SP	EP	WP	WY	WR	
+62.5	+25.2	-23.4	+0.4	-13.0	+16.1	

EVA 2 VIEWING

X	Y	Z	PITCH	YAW	ROLL	PL ID
-958	-627	-388	341	47	345	0
-967	-643	-386	60	349	282	1
-1251	-521	-890	60	349	312	2
SY	SP	EP	WP	WY	WR	
+62.5	+25.2	-23.4	+0.4	-13.0	-21.8	

OBSS FLAT FIELD

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 AUTOSEQUENCE

Auto Seq ID	Auto posn	X/ SY	Y/ SP	Z/ EP	PITCH/ WP	YAW/ WY	ROLL/ WR	Pause
7	148	-1029	+229	-614	14	270	0	**P**
		+25.8	+66.3	-49.0	-85.9	+10.7	-100.2	
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	

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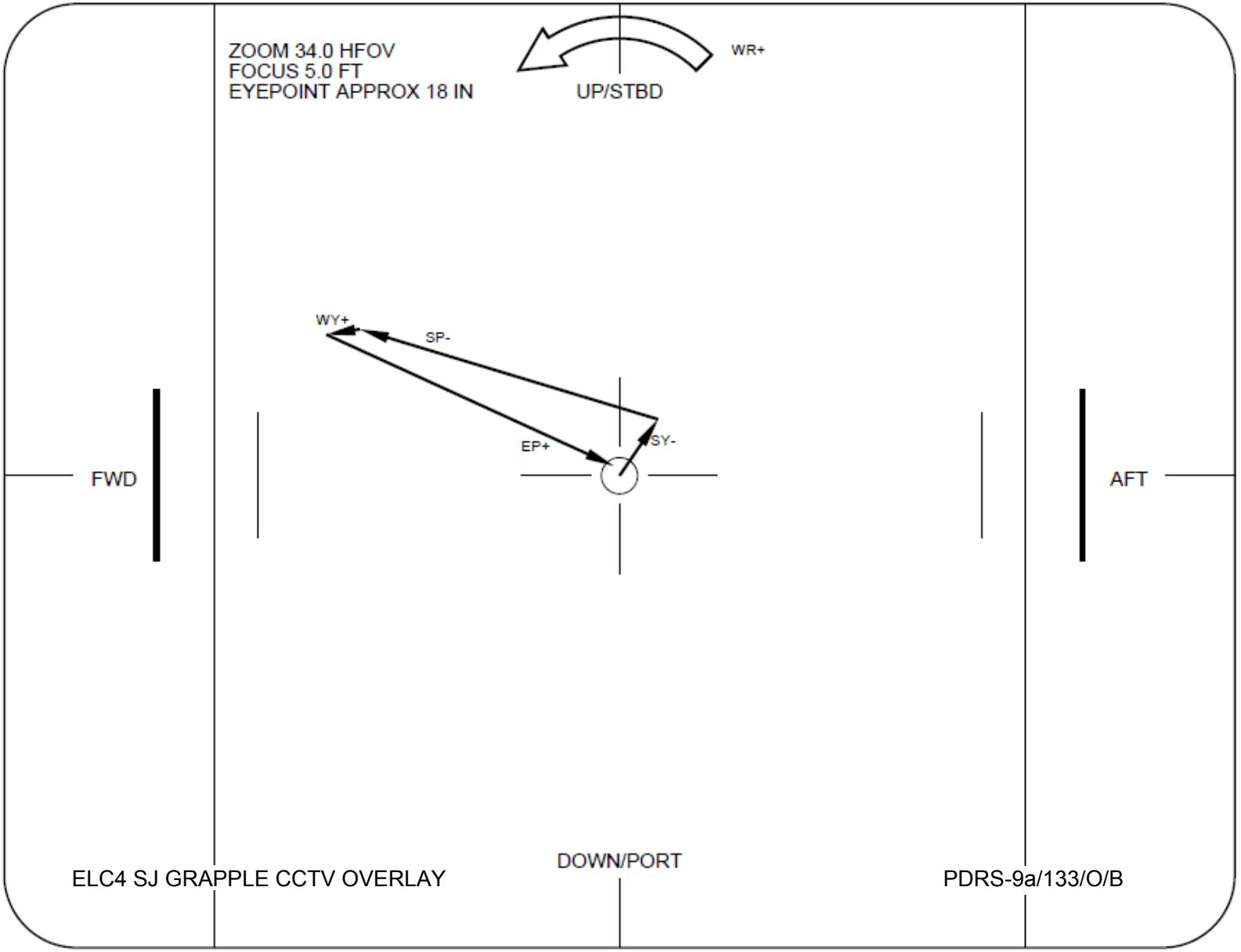
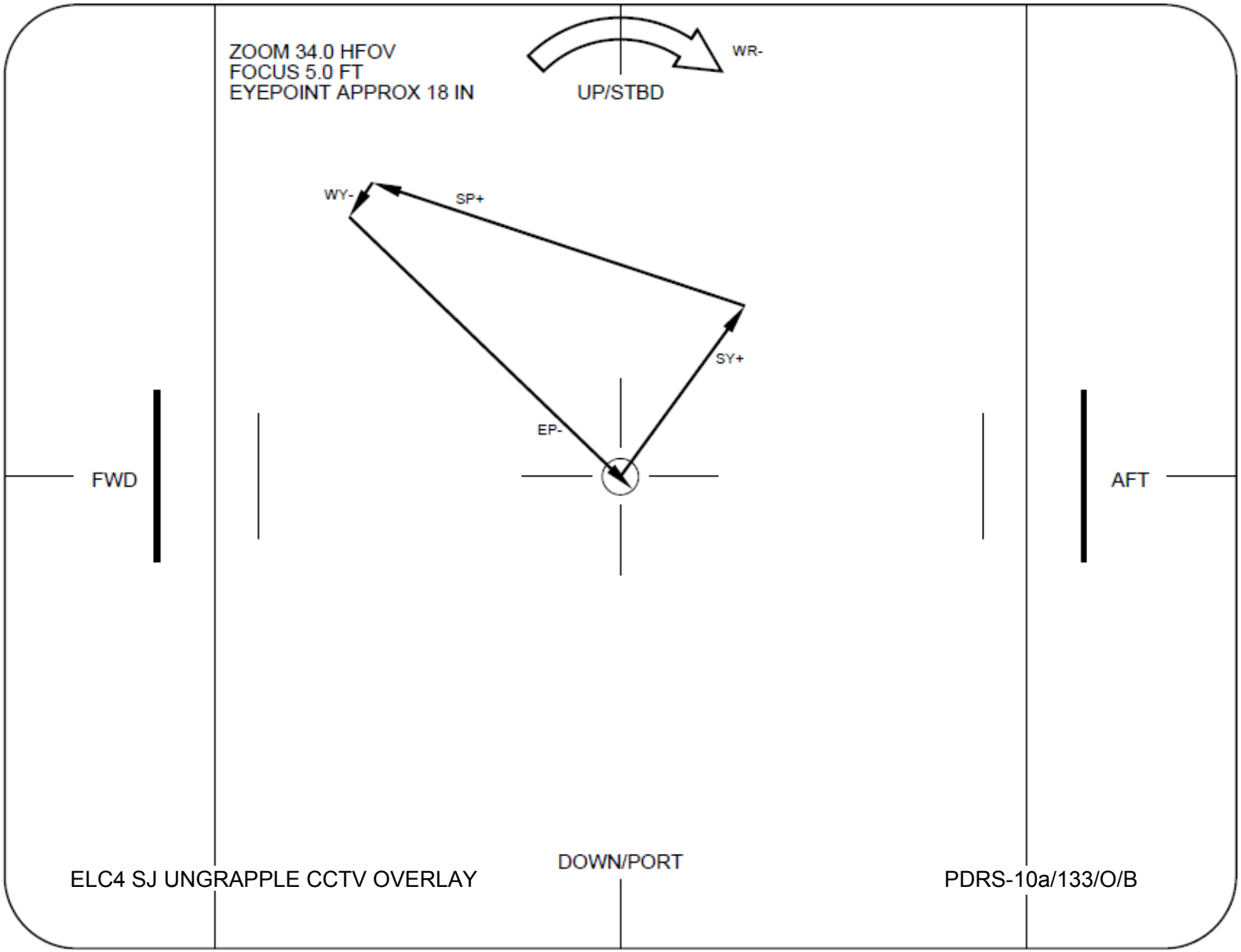
CUE CARD CONFIGURATION

Fabricate as transparency



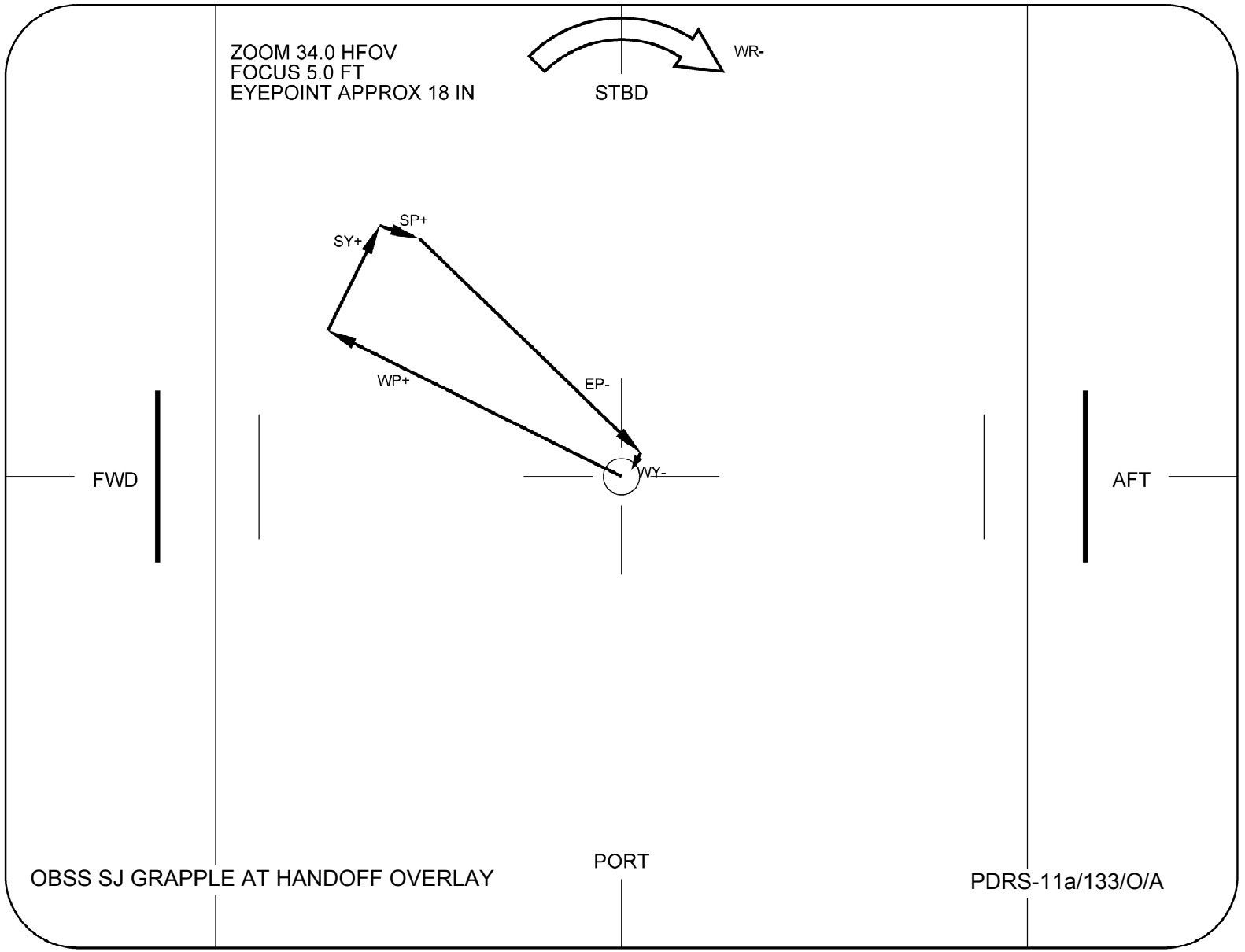
Fabricate as transparency



ELC4 SJ UNGRAPPLE CCTV OVERLAY

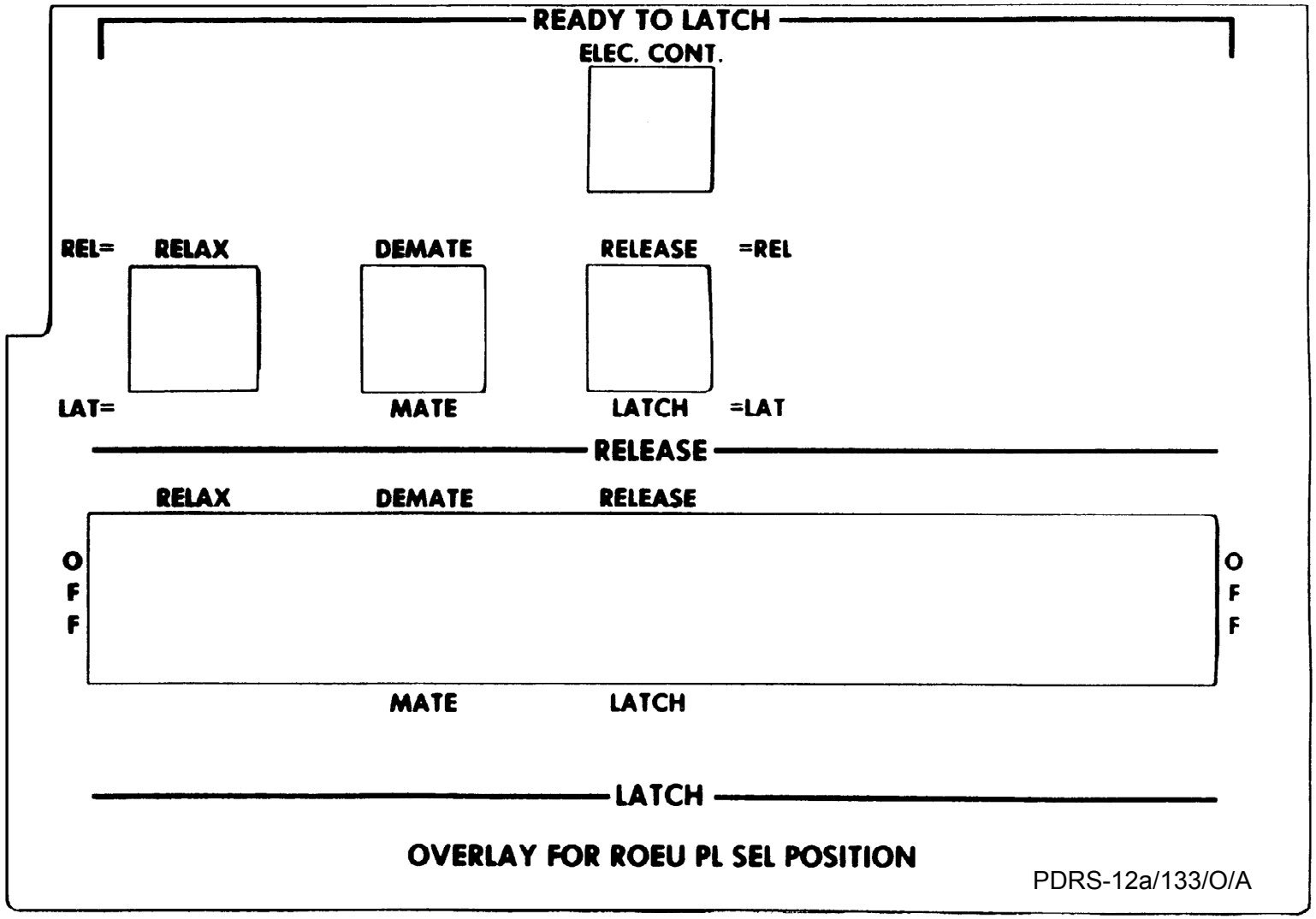
PDRS-10a/133/O/B

Fabricate as transparency



FS CC 6-4

PDRS/133/FIN A



OVERLAY FOR ROEU PL SEL POSITION

PDRS-12a/133/O/A

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Space Shuttle Program
FLIGHT DATA FILE

JSC-48040-133
FINAL, REV A

PDRS OPS C/L

STS
133

Flight Cover (trim bottom to expose tabs)