

# PDRS Operations Checklist

## STS-120 Flight Supplement

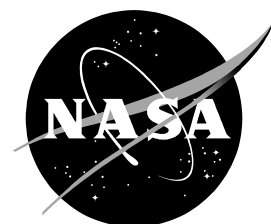
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**Mission Operations Directorate  
EVA, Robotics, & Crew Systems  
Operations Division**

**Final  
May 15, 2007**

National Aeronautics and  
Space Administration

**Lyndon B. Johnson Space Center**  
Houston, Texas



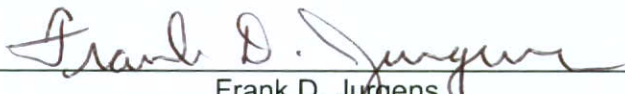
<b>SMS FDF CHANGE NOTIFICATION</b>		<b>SIM PACK</b>		DATE INITIATED 5/18/07	DATE RECEIVED (PMO) 05/18/07
BOOK TITLE STS-120 PDRS FS		BK ISSUE (Ed, Rev, PCN) FIN		SIM PACK NUMBER SIM-186	
Change is for flights (Also give SMS load if load dependent): STS-120				SMS UNIQUE? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	DEVELOPMENTAL? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
FABRICATED ITEM CHANGE? <input checked="" type="checkbox"/> NONE <input type="checkbox"/> CUE CARDS <input type="checkbox"/> TRANSPARENCIES <input type="checkbox"/> Other _____					
INSTRUCTIONS TO USER: Replace Section 1 Replace FS 2-7 through FS 2-12 Replace Section 3					
AUTHORITY FOR CHANGE* (Approved 482 numbers, approved issue at print shop, supervisors deem mandatory, etc.): Required for integrated training. Corrects problems identified since FOR and incorporates crew comments.					
*Refer to Crew Procedures Management Plan					
OTHER AFFECTED FDF BOOKS				Are all SIM PACKS submitted? <input type="checkbox"/> YES <input type="checkbox"/> NO	
IMPLEMENTATION REQUIREMENTS		<input type="checkbox"/> Limited Distribution (List in comments)	<input type="checkbox"/> NO EARLIER THAN _____ (Date and/or Sim ID)		
			<input checked="" type="checkbox"/> NO LATER THAN 5/30/07 (Date and/or Sim ID)		
BOOK MGR (Signature/Date) <i>Frank Dwyer</i> 5/18/07		SUPERVISOR (if required, Signature/Date) <i>[Signature]</i> 5/18/07		FDF COORD or FDF MGR (Signature/Date) <i>Renee U.M. Ross</i> 05/18/07	
COMMENTS:					

MISSION OPERATIONS DIRECTORATE


**PDRS OPERATIONS CHECKLIST  
STS-120 FLIGHT SUPPLEMENT**

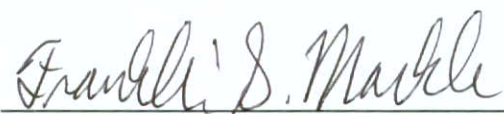
FINAL  
May 15, 2007

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482#:	PDRS FS-0016 PDRS FS-0019

AREAS OF TECHNICAL RESPONSIBILITY

Book Manager

DX22/F. Jurgens

281-244-5448



PDRS OPERATIONS CHECKLIST  
 STS-120 FLIGHT SUPPLEMENT

**LIST OF EFFECTIVE PAGES**

FINAL 05/15/07

Sign Off .....	*	120/FIN	FS 2-27 .....	120/FIN
FS ii .....	*	120/FIN	FS 2-28 .....	120/FIN
FS iii .....	*	120/FIN	FS 2-29 .....	120/FIN
FS iv .....	*	120/FIN	FS 2-30 .....	120/FIN
FS v .....		120/FIN	FS 3-1 .....	120/FIN
FS vi .....		120/FIN	FS 3-2 .....	120/FIN
FS 1-1 .....		120/FIN	FS 4-1 .....	120/FIN
FS 1-2 .....		120/FIN	FS 4-2 .....	120/FIN
FS 1-3 .....		120/FIN	FS 4-3 .....	120/FIN
FS 1-4 .....		120/FIN	FS 4-4 .....	120/FIN
FS 1-5 .....		120/FIN	FS 4-5 .....	120/FIN
FS 1-6 .....		120/FIN	FS 4-6 .....	120/FIN
FS 1-7 .....		120/FIN	FS 4-7 .....	120/FIN
FS 1-8 .....		120/FIN	FS 4-8 .....	120/FIN
FS 1-9 .....		120/FIN	FS 4-9 .....	120/FIN
FS 1-10 .....		120/FIN	FS 4-10 .....	120/FIN
FS 1-11 .....		120/FIN	FS 5-1 .....	120/FIN
FS 1-12 .....		120/FIN	FS 5-2 .....	120/FIN
FS 1-13 .....		120/FIN	FS 5-3 .....	120/FIN
FS 1-14 .....		120/FIN	FS 5-4 .....	120/FIN
FS 2-1 .....		120/FIN	FS 5-5 .....	120/FIN
FS 2-2 .....		120/FIN	FS 5-6 .....	120/FIN
FS 2-3 .....		120/FIN	FS 5-7 .....	120/FIN
FS 2-4 .....		120/FIN	FS 5-8 .....	120/FIN
FS 2-5 .....		120/FIN	FS 5-9 .....	120/FIN
FS 2-6 .....		120/FIN	FS 5-10 .....	120/FIN
FS 2-7 .....		120/FIN	FS 5-11 .....	120/FIN
FS 2-8 .....		120/FIN	FS 5-12 .....	120/FIN
FS 2-9 .....		120/FIN	FS 5-13 .....	120/FIN
FS 2-10 .....		120/FIN	FS 5-14 .....	120/FIN
FS 2-11 .....		120/FIN	FS 5-15 .....	120/FIN
FS 2-12 .....		120/FIN	FS 5-16 .....	120/FIN
FS 2-13 .....		120/FIN	FS 5-17 .....	120/FIN
FS 2-14 .....		120/FIN	FS 5-18 .....	120/FIN
FS 2-15 .....		120/FIN	FS 6-1 .....	120/FIN
FS 2-16 .....		120/FIN	FS 6-2 .....	120/FIN
FS 2-17 .....		120/FIN	FS 6-3 .....	120/FIN
FS 2-18 .....		120/FIN	FS 6-4 .....	120/FIN
FS 2-19 .....		120/FIN	FS 7-1 .....	120/FIN
FS 2-20 .....		120/FIN	FS 7-2 .....	120/FIN
FS 2-21 .....		120/FIN	FS 7-3 .....	120/FIN
FS 2-22 .....		120/FIN	FS 7-4 .....	120/FIN
FS 2-23 .....		120/FIN	FS 7-5 .....	120/FIN
FS 2-24 .....		120/FIN	FS 7-6 .....	120/FIN
FS 2-25 .....		120/FIN	FS 7-7 .....	120/FIN
FS 2-26 .....		120/FIN	FS 7-8 .....	120/FIN

\* – Omit from flight book

FS 7-9 .....	120/FIN
FS 7-10 .....	120/FIN
FS 8-1 .....	120/FIN
FS 8-2 .....	120/FIN
FS 8-3 .....	120/FIN
FS 8-4 .....	120/FIN
FS 8-5 .....	120/FIN
FS 8-6 .....	120/FIN
FS 9-1 .....	* 120/FIN
FS CC 9-2 .....	* 120/FIN
FS CC 9-3 .....	* 120/FIN
FS CC 9-4 .....	* 120/FIN
FS CC 9-5 .....	* 120/FIN
FS 9-6 .....	* 120/FIN

PDRS CUE CARDS

<u>Title</u>	<u>Ref. Page</u>	<u>Card No.</u>
OBSS SJ GRAPPLE AT HANDOFF OVERLAY .....	FS CC 9-2	PDRS-9a/120/O/B
UNGRAPPLE AT HANDOFF OVERLAY....	FS CC 9-3	PDRS-10a/120/O/B
P6 SJ GRAPPLE WRIST CCTV .....	FS CC 9-4	PDRS-11a/120/O/A
UNGRAPPLE WRIST CCTV .....	FS CC 9-5	PDRS-12a/120/O/A

\* – Omit from flight book

<u>CONTENTS</u>	<u>PAGE</u>
<u>OBSS HANDOFF</u> .....	FS 1-1
<u>VERIFY UPLINKS</u> .....	FS 1-2
<u>OBSS HANDOFF FROM SSRMS TO SRMS</u> .....	FS 1-4
<u>SRMS TO SSRMS</u> .....	FS 1-9
<u>OBSS CONTINGENCY</u> .....	FS 2-1
<u>OBSS SJ HANDOFF FROM SSRMS TO SRMS</u> .....	FS 2-2
<u>SRMS TO SSRMS</u> .....	FS 2-17
<u>OBSS REFERENCE DATA</u> .....	FS 3-1
<u>OBSS JOINT ANGLES VS POR COORDINATES</u> .....	FS 3-2
<u>P6 NOMINAL</u> .....	FS 4-1
<u>P6 HANDOFF FROM SSRMS TO SRMS</u> .....	FS 4-2
<u>SRMS TO SSRMS</u> .....	FS 4-5
<u>INSTALL VIEWING</u> .....	FS 4-8
<u>P6 CONTINGENCY</u> .....	FS 5-1
<u>P6 SJ HANDOFF FROM SSRMS TO SRMS</u> .....	FS 5-2
<u>SRMS TO SSRMS</u> .....	FS 5-10
<u>P6 REFERENCE DATA</u> .....	FS 6-1
<u>P6 JOINT ANGLES VS POR COORDINATES</u> .....	FS 6-2
<u>COORDINATE SYSTEM – PL ID 3</u> .....	FS 6-3
<u>EVA 3</u> .....	FS 7-1
<u>EVA 3 SUPPORT</u> .....	FS 7-2
<u>EVA 3 REFERENCE DATA</u> .....	FS 8-1
<u>EVA 3 JOINT ANGLES VS POR COORDINATES</u> .....	FS 8-2
<u>COORDINATE SYSTEM – PL ID 4</u> .....	FS 8-4
<u>– PL ID 5</u> .....	FS 8-5
<u>CUE CARD CONFIGURATION</u> .....	FS 9-1

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OBSS HANDOFF

I

VERIFY UPLINKS.....	FS 1-2
OBSS HANDOFF FROM SSRMS TO SRMS .....	FS 1-4
SRMS TO SSRMS .....	FS 1-10 I

**OBSS  
HANDOFF**

## VERIFY UPLINKS

OBSS  
HANDOFF

### 1. CHECK PL ID 1

SM 94 PDRS CONTROL

PL ID – ITEM 3 +1 EXEC

	X	Y	Z	PITCH	YAW	ROLL	PL ID
√	-1279	-151	-553	95	359	328	1
	SY	SP	EP	WP	WY	WR	
√	0.0	+25.0	-25.0	+5.0	0.0	0.0	

### 2. CHECK PL ID 2

SM 94 PDRS CONTROL

PL ID – ITEM 3 +2 EXEC

	X	Y	Z	PITCH	YAW	ROLL	PL ID
√	-1216	-141	-1141	95	359	358	2

### 3. CHECK AUTOSEQUENCES 1, 2, AND 3 START POINTS

SM 94 PDRS CONTROL

√PL ID, ITEM 3: 2

AUTO 1 – ITEM 13 +1 +2 +3 EXEC

BRAKES – OFF (tb-OFF)

MODE – AUTO 1, ENTER

SM 94 PDRS CONTROL

√START PT, ITEM 17: 1

MODE – AUTO 2, ENTER

SM 94 PDRS CONTROL

√START PT, ITEM 17: 54

MODE – AUTO 3, ENTER

SM 94 PDRS CONTROL

√START PT, ITEM 17: 58

BRAKES – ON (tb-ON)

### 4. CHECK AUTOSEQUENCES 4, 5, AND 6 START POINTS

SM 94 PDRS CONTROL

√PL ID, ITEM 3: 2

AUTO 1 – ITEM 13 +4 +5 +6 EXEC

BRAKES – OFF (tb-OFF)

MODE – AUTO 1, ENTER

SM 94 PDRS CONTROL

√START PT, ITEM 17: 90

MODE – AUTO 2, ENTER

SM 94 PDRS CONTROL

√START PT, ITEM 17: 95

MODE – AUTO 3, ENTER

SM 94 PDRS CONTROL

√START PT, ITEM 17: 145

BRAKES – ON (tb-ON)

5. CHECK PL ID 3

SM 94 PDRS CONTROL

PL ID – ITEM 3 +3 EXEC

√

X	Y	Z	PITCH	YAW	ROLL	PL ID
-1308	-108	-632	274	1	2	3

6. CHECK PL ID 4

SM 94 PDRS CONTROL

PL ID – ITEM 3 +4 EXEC

√

X	Y	Z	PITCH	YAW	ROLL	PL ID
-1236	-94	-466	306	36	237	4

7. CHECK PL ID 5

SM 94 PDRS CONTROL

PL ID – ITEM 3 +5 EXEC

√

X	Y	Z	PITCH	YAW	ROLL	PL ID
-1244	-130	-506	306	36	237	5

8. RESET TO PL ID 0

SM 94 PDRS CONTROL

PL ID – ITEM 3 +0 EXEC

√

X	Y	Z	PITCH	YAW	ROLL	PL ID
-1261	-146	-551	5	2	0	0



## OBSS HANDOFF FROM SSRMS TO SRMS

### 1. SETUP

SM 94 PDRS CONTROL

√PL ID, ITEM 3: 0

√INIT ID, ITEM 24: 0

A7U CCTV – config as reqd

### 2. PRE-GRAPPLE MNVR

On SSRMS Operator GO for mnvr to OBSS PRE-GRAPPLE AT HANDOFF posn,

RHC RATE – as reqd (VERN within 10 ft)

BRAKES – OFF (tb-OFF)

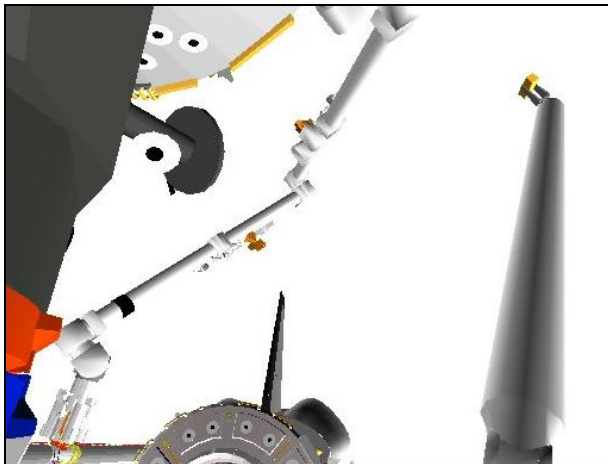
MODE – ORB UNL, ENTER

Mnvr to OBSS PRE-GRAPPLE AT HANDOFF posn:

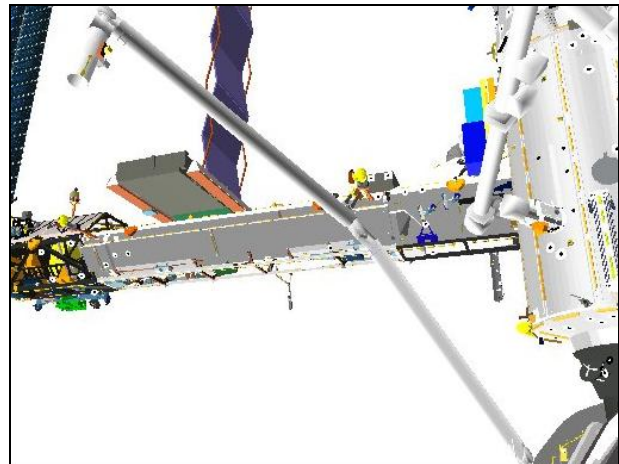
X	Y	Z	PITCH	YAW	ROLL	PL ID
-1015	-362	-688	284	0	270	0
SY	SP	EP	WP	WY	WR	
+23.5	+63.5	-29.6	-102.9	+11.5	-98.6	

BRAKES – ON (tb-ON)

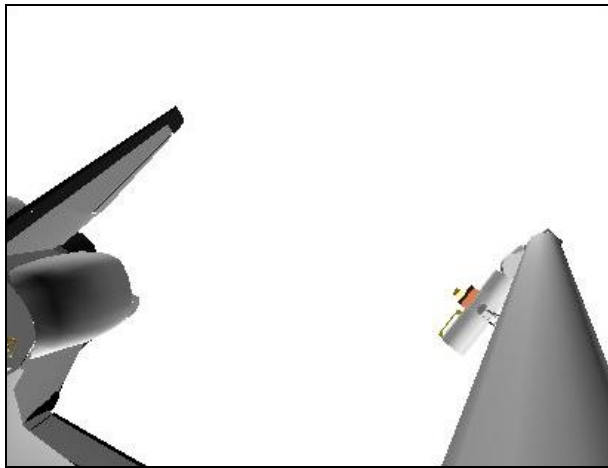
Notify SSRMS Operator that SRMS at OBSS PRE-GRAPPLE AT HANDOFF posn



CCTV A (0,28)



CCTV B (-20,20)



**ELBOW (-30,-5)**

3. CONFIGURE POWER

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

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

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

4. STBD MRL RELEASE

SM 94 PDRS CONTROL  
RMS STBD – ITEM 2 EXEC (\*)  
√STBD AFT, MID, FWD REL (six) = 0

NOTE  
Expect single motor drive time for MRL release

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

If motor drive time > 18 sec, √MCC

SM 94 PDRS CONTROL  
√STBD AFT, MID, FWD REL (six) = 1

5. RECONFIGURE POWER

- R13L          PL BAY MECH PWR SYS (two) – OFF
- MA73C:C       cb MCA PWR AC3 3Φ MID 2 – cl  
                  √AC2 3Φ MID 2 – op
- MA73C:D       √AC3 3Φ MID 4 – op

Give SSRMS Operator GO for OBSS Unberth  
Monitor RFL Status

After OBSS Unberth,

**SM 94 PDRS CONTROL**

RMS PORT – ITEM 1 EXEC (\*)

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

R12(OBSS) √SPEE PWR – OFF  
A15 APCU 2 CONV - OFF

**SM 179 POWER TRANSFER**

√PTU 2 APCU OUT VOLTS: <10V

A15 APCU 2 OUTPUT - OFF

- RHC 7. OBSS GRAPPLE AT HANDOFF POSN  
On SSRMS Operator GO for SRMS OBSS GRAPPLE posn,  
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)

√	RIGID	CLOSE	CAPTURE
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	DERIGID	OPEN	EXTEND
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

CRITICAL TIMES (28 sec total):  
CAPTURE tb – gray, then  
CLOSE tb – gray, 3 sec max, then  
RIGID tb – gray, 25 sec max

EE MODE – OFF

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

MODE – TEST, ENTER  
Wait 5 sec

BRAKES – ON (tb-ON)

**SM 94 PDRS CONTROL**

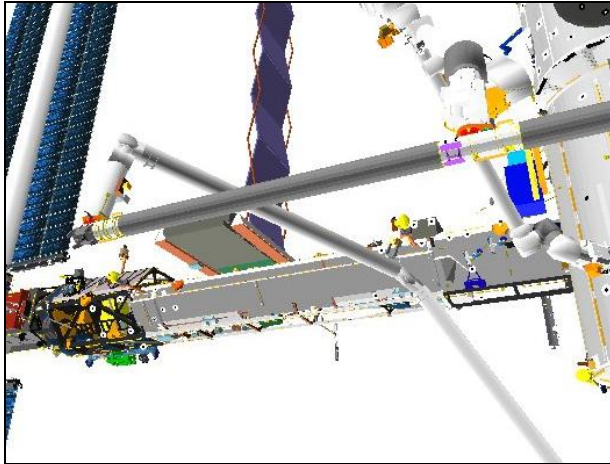
PL ID – ITEM 3 +2 EXEC

INIT ID – ITEM 24 +2 EXEC

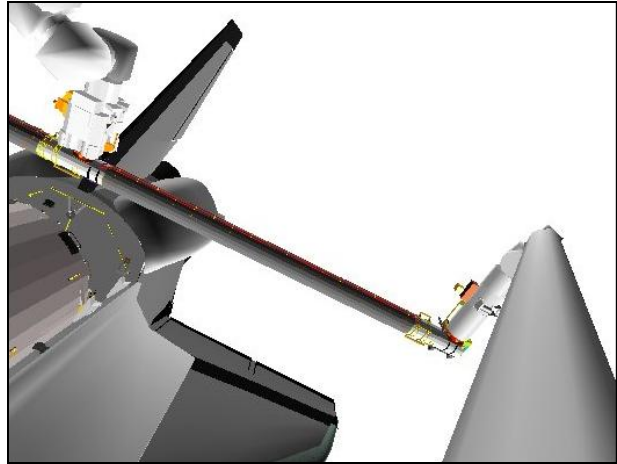
Expected OBSS HANDOFF posn:

X	Y	Z	PITCH	YAW	ROLL	PL ID
-1029	+229	-614	284	270	270	2
SY	SP	EP	WP	WY	WR	
+25.8	+66.3	-49.0	-85.9	+10.7	-100.7	

\* display singularity



**CCTV B (-25,25)**



**ELBOW (-30,-5)**

R12(OBSS) RSC PWR – OFF, ON

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

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

Perform LCC ACTIVATION (LCS Cue Card, PHOTO/TV), steps 1 and 2

Give SSRMS Operator GO for OBSS Ungrapple

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

8. MNVR TO NODE 2 VIEWING

RHC

On SSRMS Operator GO for mnvr to NODE 2 VIEWING posn,

RATE – as required (VERN within 10 ft)

BRAKES – OFF (tb-OFF)

MODE – SINGLE, ENTER

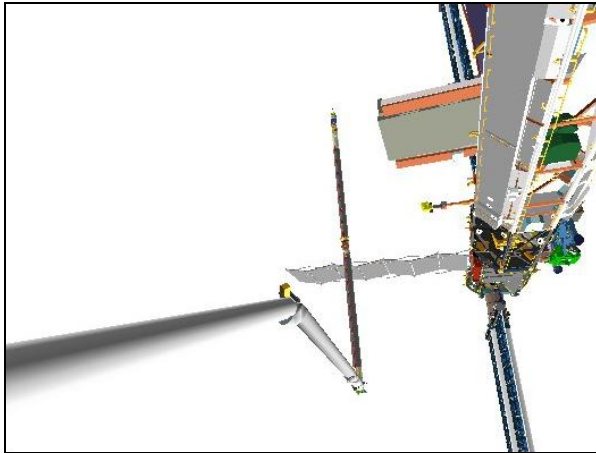
Mnvr to NODE 2 VIEWING posn:

HANDOFF

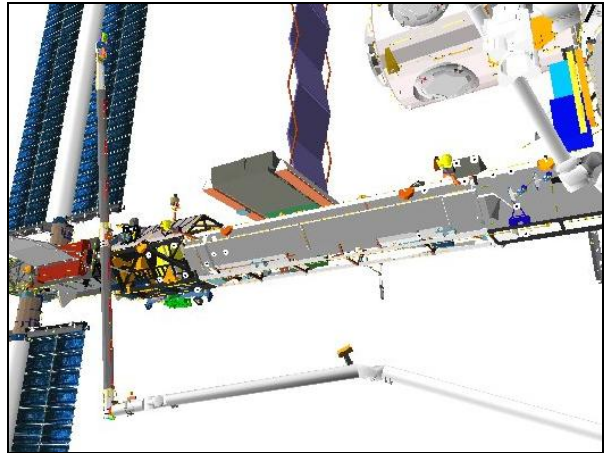
- 1: SY +
  - 2: EP +
  - 3: WR +
  - 4: WY -
  - 5: SP -
  - 6: WP +
  - 7: SY +
- NODE 2  
VIEW

SY	SP	EP	WP	WY	WR	
+25.8	+66.3	-49.0	-85.9	+10.7	-100.7	
+35.0						
		-22.8				
					+15.0	
				-0.5		
	+36.7					
			-2.0			
+85.0						
+85.0	+36.7	-22.8	-2.0	-0.5	+15.0	
X	Y	Z	PITCH	YAW	ROLL	PL ID
-767	-775	-1068	86	7	276	2

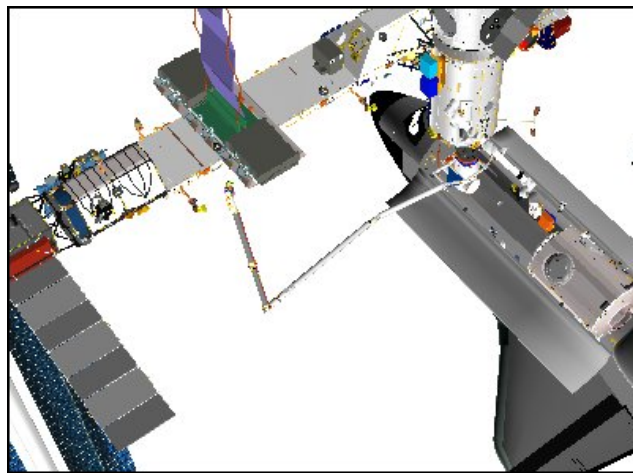
- BRAKES – ON (tb-ON)
- MODE – not DIRECT
- PARAM – PORT TEMP
- JOINT – CRIT TEMP



CCTV A (70,25)



CCTV B (-30,20)



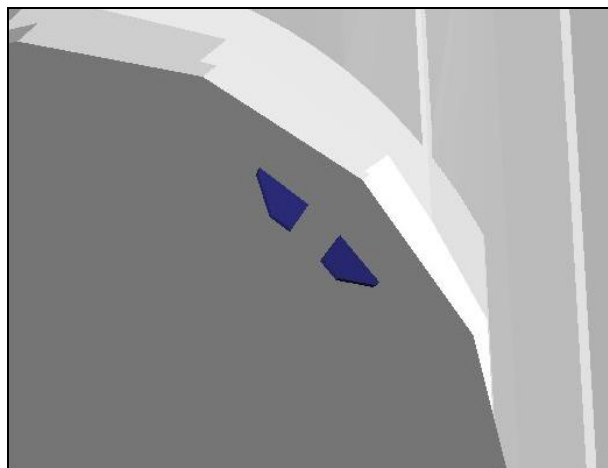
BIRD'S EYE

A7U 9. RECONFIG PTU  
VIDEO OUT MON2 pb – push  
IN PL2(VPU) pb – push

CAMR CMD PAN/TILT – HI RATE  
PAN – L (to hard stop)  
TILT – UP (to hard stop)  
PAN/TILT – RESET  
PAN: +70 (right)  
TILT: -68 (dn)  
ZOOM – IN (full in)

VIDEO OUT MUX 1 L pb – push (MIDDECK It on)  
LDR1 MODE 2 pb – push (ITVC video)

Give SSRMS Operator GO for mnvr to EVA 1 SETUP posn



**OBSS ITVC (70,-68)**

# OBSS HANDOFF FROM SRMS TO SSRMS

## 1. SETUP

SM 94 PDRS CONTROL

√PL ID, ITEM 3: 2

√INIT ID, ITEM 24: 2

A7U CCTV – config as reqd

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

## 2. MANEUVER TO OBSS HANDOFF

RHC On SSRMS Operator GO for mnvr to OBSS HANDOFF posn,  
 RATE – as reqd (VERN within 10 ft)  
 BRAKES – OFF (tb-OFF)  
 MODE – SINGLE, ENTER

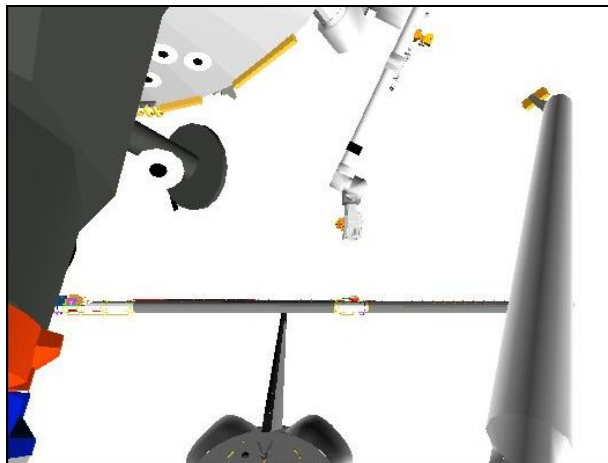
Mnvr to OBSS HANDOFF posn:

	SY	SP	EP	WP	WY	WR	
NODE 2 VIEW	+85.0	+36.7	-22.8	-2.0	-0.5	+15.0	
1: SY –	+35.0						
2: WP –				-85.9			
3: SP +		+66.3					
4: WY +					+10.7		
5: WR –						-100.7	
6: EP –			-49.0				
7: SY –	+25.8						
HANDOFF POSN	+25.8	+66.3	-49.0	-85.9	+10.7	-100.7	
	X	Y	Z	PITCH	YAW	ROLL	PL ID
	-1029	+229	-614	284	270	270	2

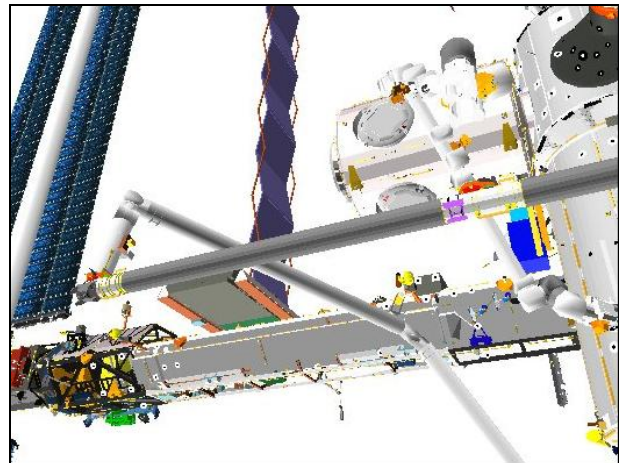
\* display singularity

BRAKES – ON (tb-ON)

Give SSRMS Operator GO for OBSS Grapple

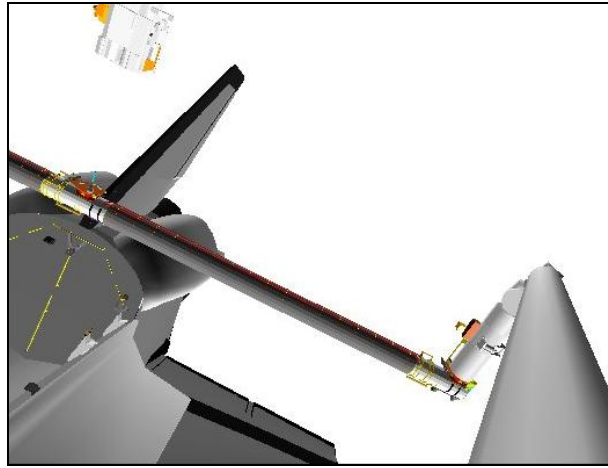


CCTV A (0,30)



CCTV B (-25,30)





**ELBOW (-30,0)**

3. STOW PTU

A7U

On SSRMS Operator GO for OBSS Ungrapple,  
 VIDEO OUT MON2 pb – push  
 IN PL2(VPU) pb – push

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: +108 (right)

TILT: -175 (down)

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

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

**CAUTION**

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

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

4. OBSS UNGRAPPLE

A7U

CCTV – config for ungrapple

– RMS WRIST, ZOOM: 34.0 HFOV

FOCUS: 5 ft

**NOTE**

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

RHC

RATE – COARSE (RATE MIN tb-OFF)

**SM 94 PDRS CONTROL**

AUTO BRAKE INH – ITEM 10 EXEC (\*)

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

BRAKES – ON (tb-ON)







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

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

**CAUTION**  
 Monitor EE tb timing to prevent EE motor burnout

EE MODE – AUTO  
 RELEASE sw – depress (mom)

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

√	RIGID 	CLOSE 	CAPTURE 	<u>CRITICAL TIMES (28 sec total):</u> DERIGID tb – gray, 5 sec max, then OPEN tb – gray, 3 sec max, then EXTEND tb – gray, 20 sec max
	DERIGID 	OPEN 	EXTEND 	

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 \*

RHC 5. MNVR TO OBSS PRE-GRAPPLE AT HANDOFF  
 RATE – VERN (RATE MIN tb-ON)  
 MODE – as desired

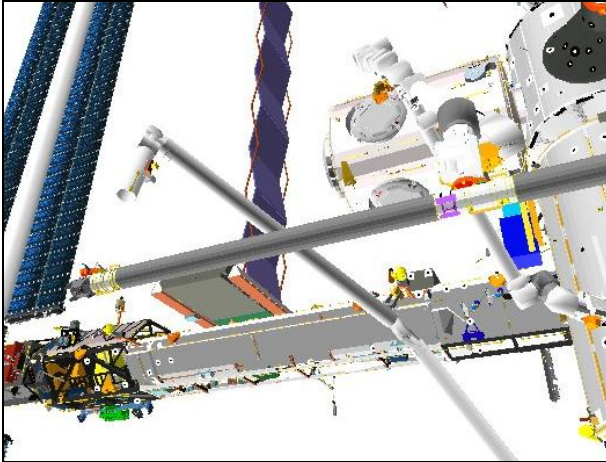
Mnvr to OBSS PRE-GRAPPLE AT HANDOFF posn:

X	Y	Z	PITCH	YAW	ROLL	PL ID
-1015	-362	-688	284	0	270	0
SY	SP	EP	WP	WY	WR	
+23.5	+63.5	-29.6	-102.9	+11.5	-98.6	

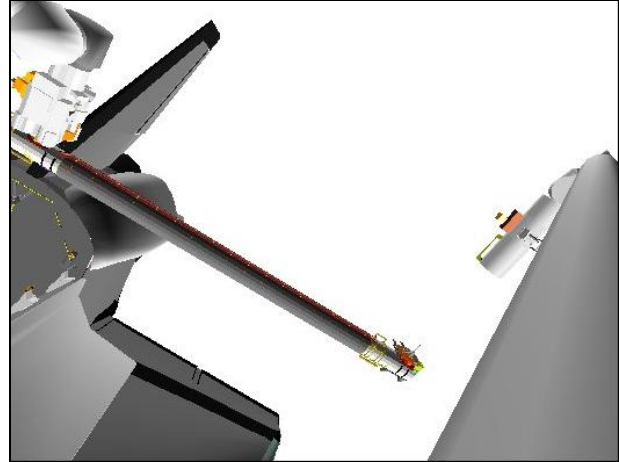
BRAKES – ON (tb-ON)  
 MODE – not DIRECT  
 JOINT – CRIT TEMP

If using Shuttle attitude control and attitude maintenance required:  
Configure DAP per RMS DAPs, then perform RATE DAMPING (ORB OPS FS,  
REBOOST/DAP; DOCKED DAP REFERENCE)

Give SSRMS Operator GO for OBSS Berth



**CCTV B (-25,30)**



**ELBOW (-35,-15)**

6. CONFIGURE CIRCUIT BREAKERS

MA73C:C     cb MCA PWR AC3 3 $\Phi$  MID 2 – op  
                    √AC2 3 $\Phi$  MID 2 – op  
MA73C:D     √AC3 3 $\Phi$  MID 4 – op

7. CONFIGURE FOR MONITORING

On SSRMS 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

8. STBD MRL LATCH

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

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

R13L        PL BAY MECH PWR SYS (two) – ON

NOTE

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

Verify AOS for latching to Topological Capture

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

R13L        PL BAY MECH PWR SYS (two) – OFF

Give SSRMS Operator GO to Limp All SSRMS Joints and Derigidize

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

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

9. 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

10. MNVR TO PRE-CRADLE

RHC On SSRMS Operator GO for mnvr to PRE-CRADLE posn,  
RATE – as reqd (VERN within 10 ft)  
BRAKES – OFF (tb-OFF)  
MODE – SINGLE, ENTER

Mnvr to PRE-CRADLE posn:

	SY	SP	EP	WP	WY	WR	
PRE-GRAPPLE	+23.5	+63.5	-29.6	-102.9	+11.5	-98.6	
1: WR +						0.0	
2: WY -					0.0		
3: WP +				+5.0			
4: SP -		+25.0					
5: EP +			-25.0				
6: SY -	0.0						
PRE-CRADLE	0.0	+25.0	-25.0	+5.0	0.0	0.0	
	X	Y	Z	PITCH	YAW	ROLL	PL ID
	-1261	-146	-551	5	2	0	0

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

Give SSRMS Operator GO for mnvr to MBS PDGF3 Pre-grapple

OBSS CONTINGENCY

OBSS SJ HANDOFF FROM SSRMS TO SRMS.....	FS 2-2
SRMS TO SSRMS.....	FS 2-17

OBSS  
CONTINGENCY

# OBSS SJ HANDOFF FROM SSRMS TO SRMS

## 1. SETUP

If SINGLE MODE available:

**SM 94 PDRS CONTROL**

√PL ID, ITEM 3: 0

√INIT ID, ITEM 24: 0

A7U

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

## 2. SJ OBSS PRE-GRAPPLE AT HANDOFF MANEUVER

On SSRMS Operator GO for mnvr to OBSS PRE-GRAPPLE AT HANDOFF posn,

If SINGLE MODE available:

RHC

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

MODE – best available

Mnvr to OBSS PRE-GRAPPLE AT HANDOFF posn:

	SY	SP	EP	WP	WY	WR	
PRE-CRADLE	0.0	+25.0	-25.0	+5.0	0.0	0.0	
1: SY +	+23.5						
2: SP +		+63.5					
3: EP –			-29.6				
4: WP –				-102.9			
5: WY +					+11.5		
6: WR –						-98.6	
OBSS PRE-GRAPPLE AT HAND-OFF	+23.5	+63.5	-29.6	-102.9	+11.5	-98.6	
	X	Y	Z	PITCH	YAW	ROLL	PL ID
	-1015	-362	-688	284	0	270	0

BRAKES – ON (tb-ON)

MODE – not DIRECT

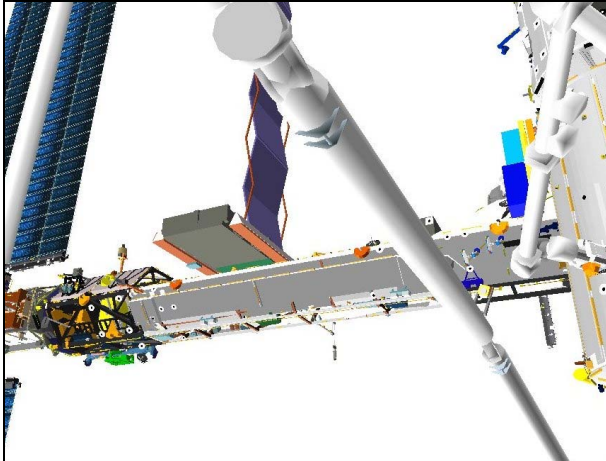
JOINT – CRIT TEMP

Notify SSRMS Operator that SRMS at OBSS PRE-GRAPPLE AT HANDOFF posn

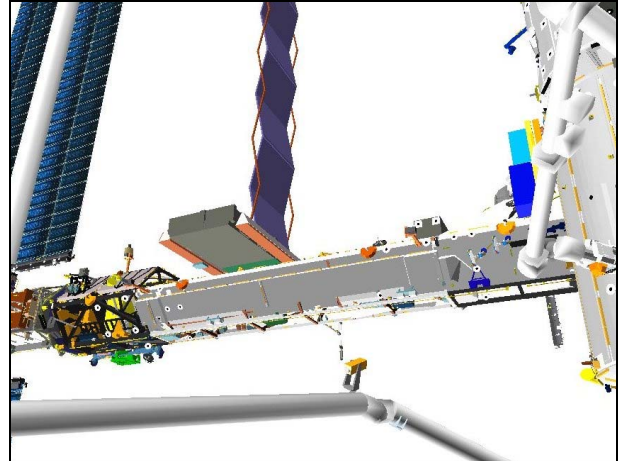
OBSS CONTINGENCY

Start:  
Pre-Cradle

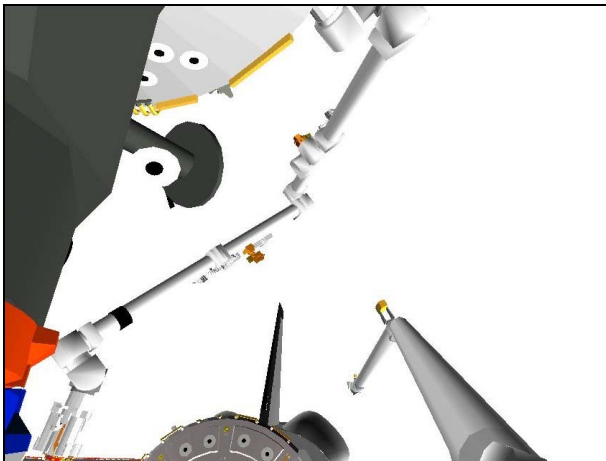
Step 1:  
Drive SY (+) from 0.0° to +23.5°



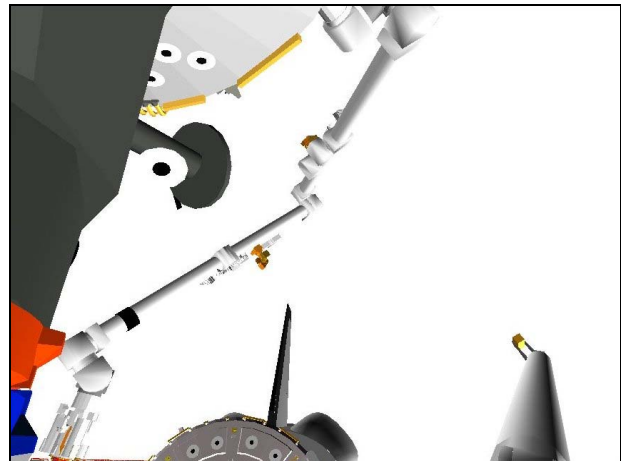
**CCTV B (-25,25)**



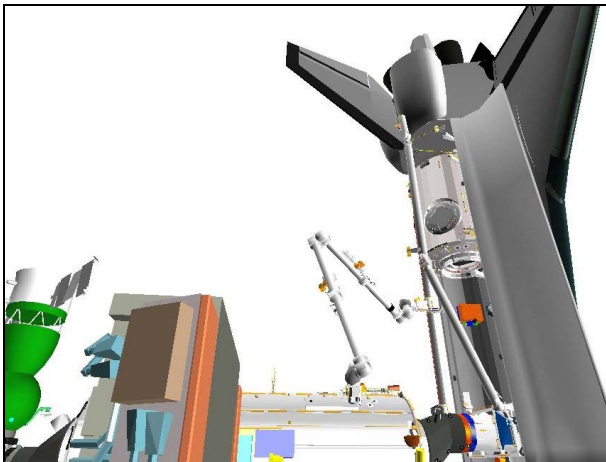
**CCTV B (-25,25)**



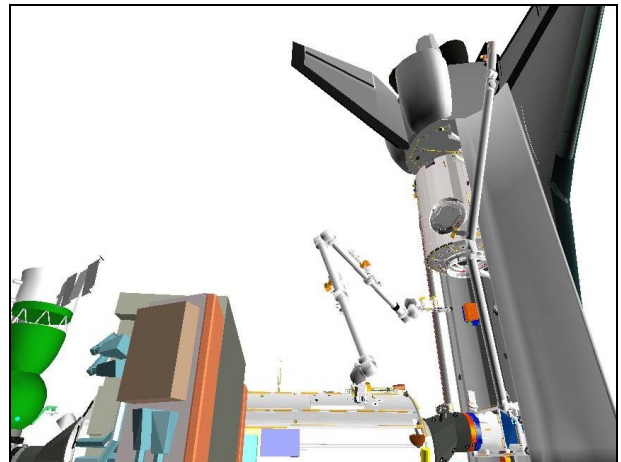
**CCTV A (0,30)**



**CCTV A (0,30)**



**P1 LOOB (95,30)**

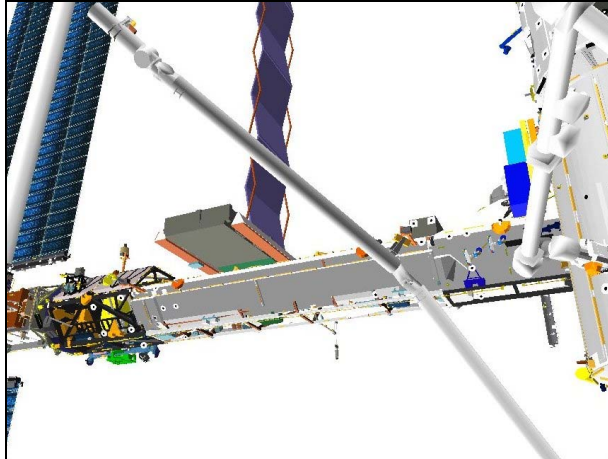


**P1 LOOB (95,30)**



Step 2:

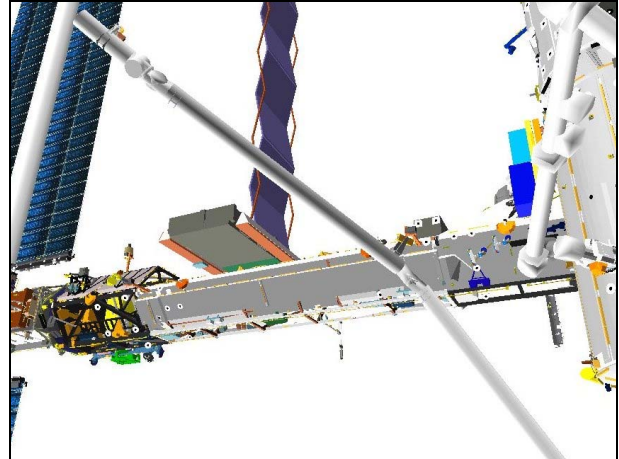
Drive SP (+) from  $+25.0^\circ$  to  $+63.5^\circ$



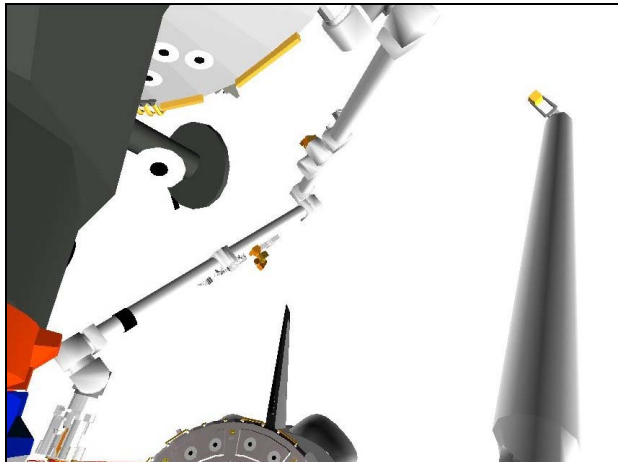
**CCTV B (-25,25)**

Step 3:

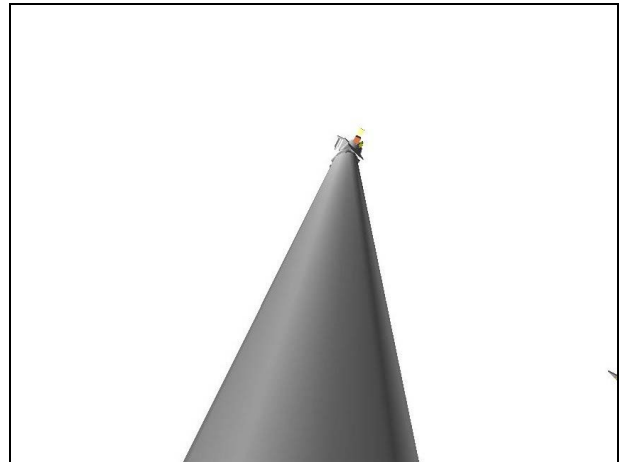
Drive EP (-) from  $-25.0^\circ$  to  $-29.6^\circ$



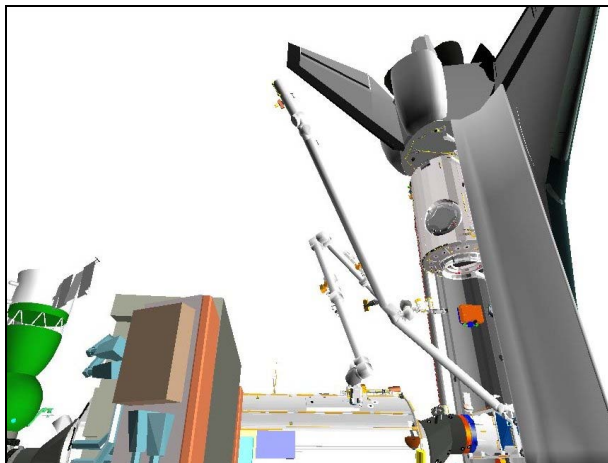
**CCTV B (-25,25)**



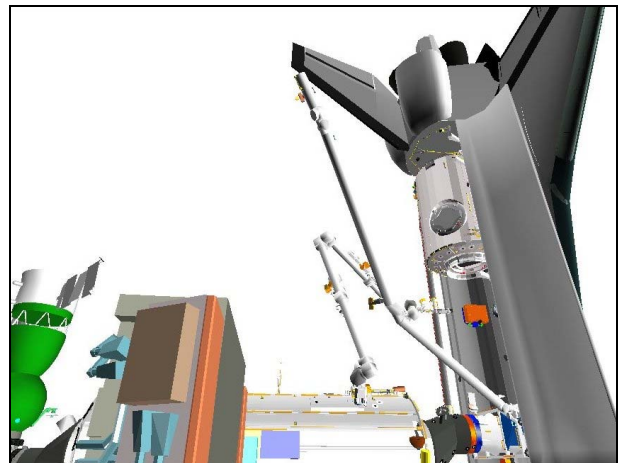
**CCTV A (0,30)**



**ELBOW (-5,-15)**



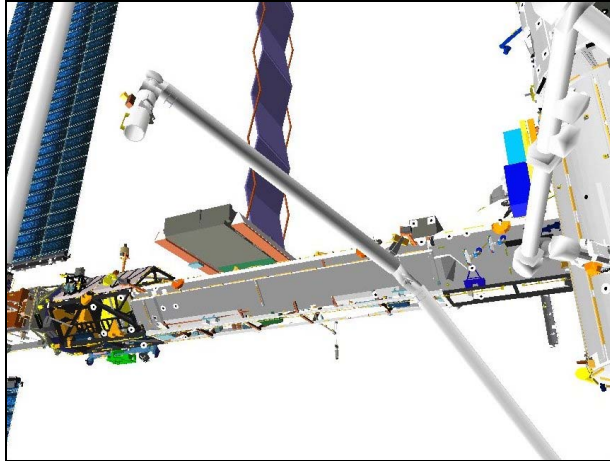
**P1 LOOB (95,30)**



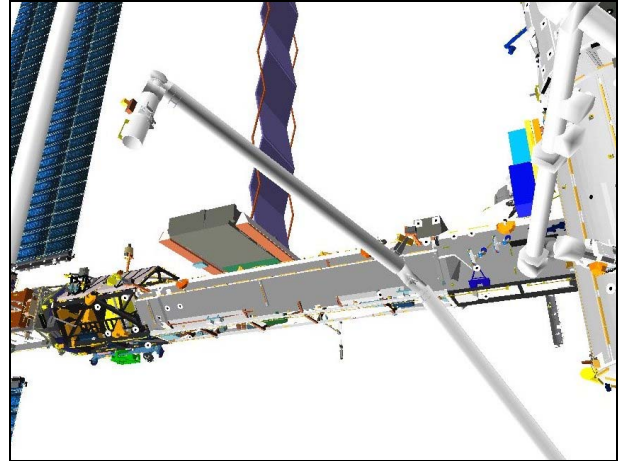
**P1 LOOB (95,30)**

Step 4:  
Drive WP (-) from +5.0° to -102.9°

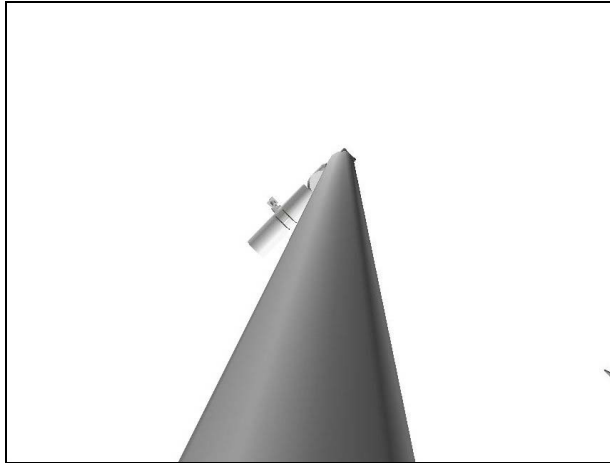
Step 5:  
Drive WY (+) from 0.0° to +11.5°



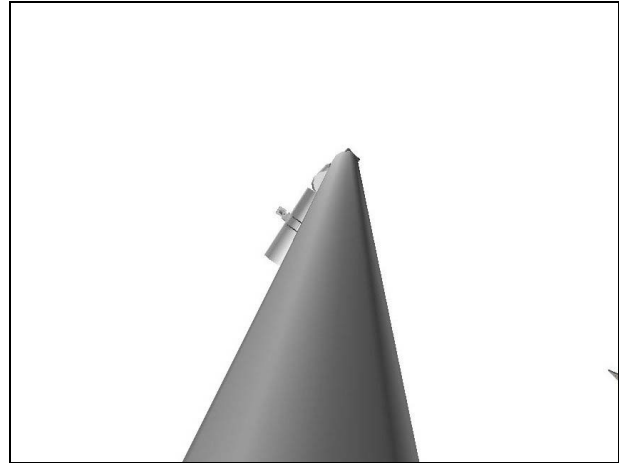
**CCTV B (-25,25)**



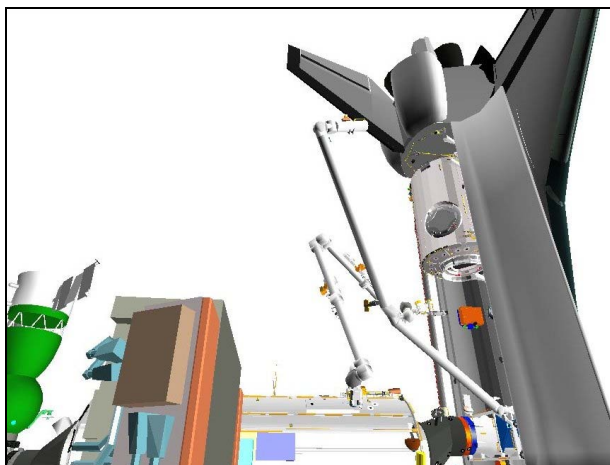
**CCTV B (-25,25)**



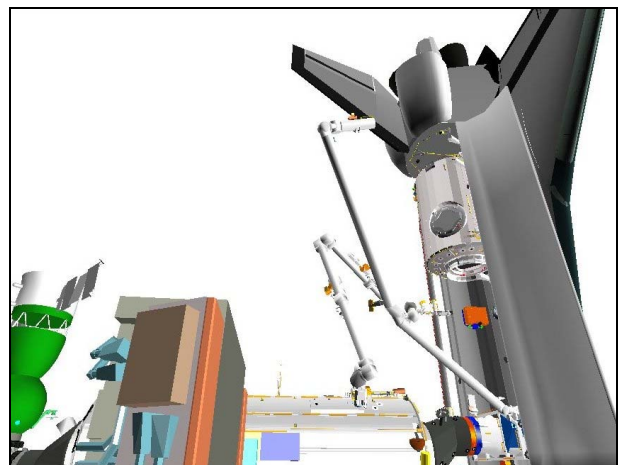
**ELBOW (-5,-15)**



**ELBOW (-5,-15)**



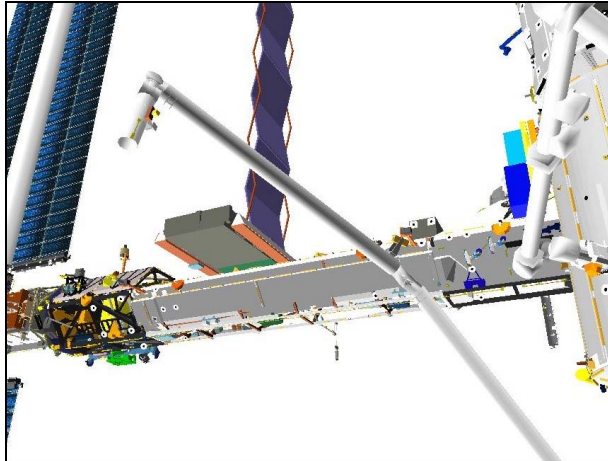
**P1 LOOB (95,30)**



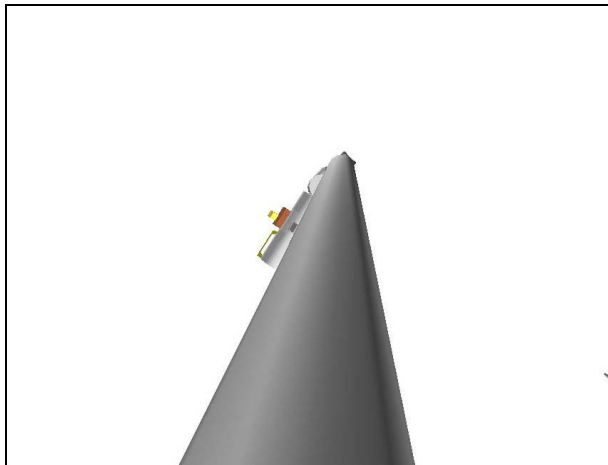
**P1 LOOB (95,30)**

Step 6:

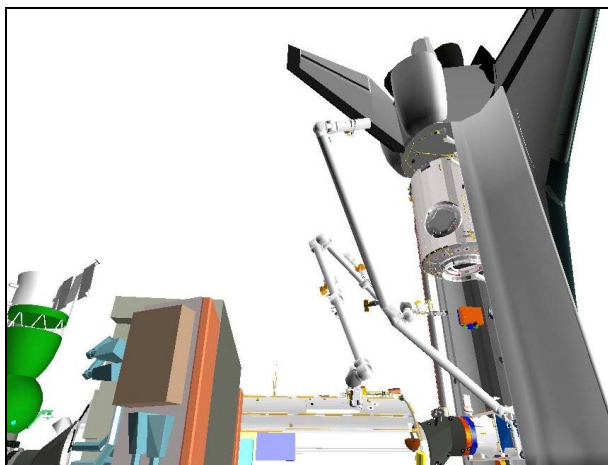
Drive WR (-) from 0.0° to -98.6°



**CCTV B (-25,25)**



**ELBOW (-5,-15)**



**P1 LOOB (95,30)**

3. CONFIGURE POWER

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

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

A6U           EVENT TIMER MODE – UP  
                  CNTL – START

MA73C:C      cb MCA PWR AC3 3Φ MID 2 – op  
                  √AC2 3Φ MID 2 – op  
          :D       √AC3 3Φ MID 4 – op

R13L           PL BAY MECH PWR SYS (two) – ON

4. STBD MRL RELEASE

SM 94 PDRS CONTROL  
RMS STBD – ITEM 2 EXEC (\*)  
√STBD AFT, MID, FWD REL (six) = 0

NOTE  
Expect single motor drive time for MRL release

STBD RMS RETEN LAT – REL (tb-REL) (18 sec max)  
– OFF  
If motor drive time > 18 sec, √MCC

SM 94 PDRS CONTROL  
√STBD AFT, MID, FWD REL (six) = 1

5. RECONFIGURE POWER

R13L           PL BAY MECH PWR SYS (two) – OFF

MA73C:C      cb MCA PWR AC3 3Φ MID 2 – cl  
                  √AC2 3Φ MID 2 – op  
          :D       √AC3 3Φ MID 4 – op

Give SSRMS Operator GO for OBSS Unberth  
Monitor RFL Status

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

6. SETUP FOR GRAPPLE

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

R12(OBSS) √SPEE PWR – OFF  
A15 APCU 2 CONV - OFF

**SM 179 POWER TRANSFER**

√PTU 2 APCU OUT VOLTS: <10V

A15 APCU 2 OUTPUT - OFF

7. SJ OBSS GRAPPLE AT HANDOFF

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

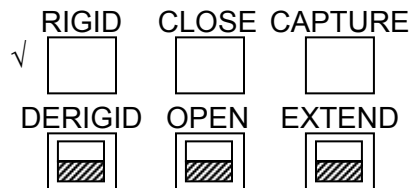
Drive joints per OBSS SJ HANDOFF SRMS GRAPPLE WRIST CCTV OVERLAY  
and diagram until EE within grapple envelope

**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

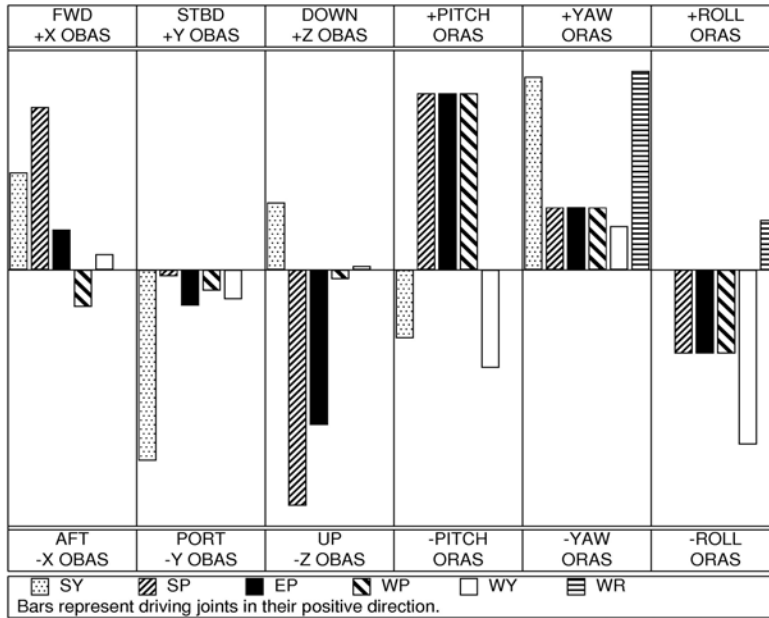
EE MODE – OFF

- \* 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

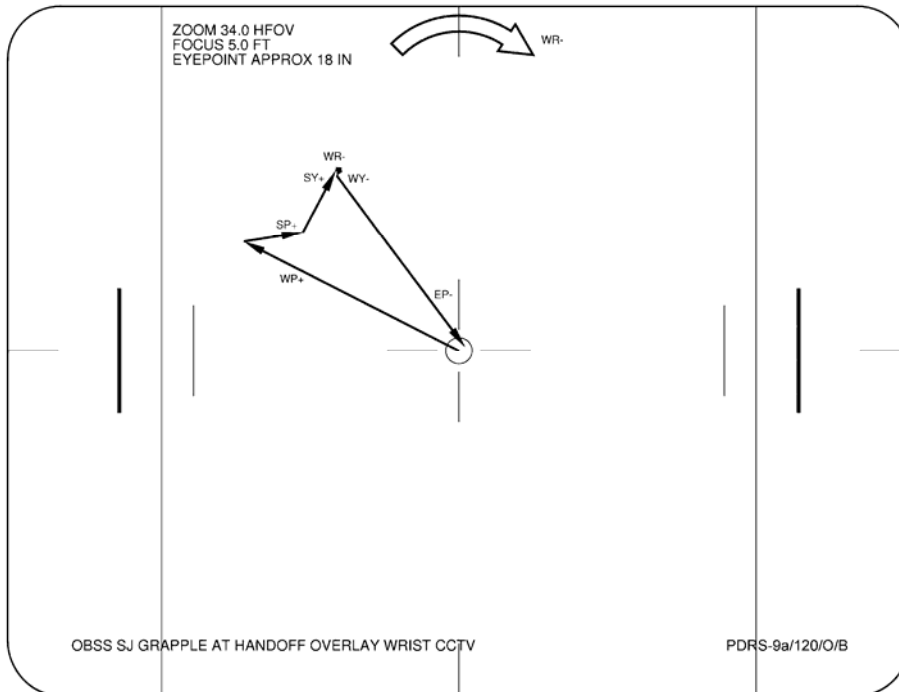
BRAKES – ON (tb-ON)  
MODE – not DIRECT  
JOINT – CRIT TEMP

### OBSS SJ GRAPPLE AT HANDOFF OVERLAY



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

$\Delta SY$	$\Delta SP$	$\Delta EP$	$\Delta WP$	$\Delta WY$	$\Delta WR$
+2.3	+2.8	-19.4	+17.0	-0.8	-2.1



If SINGLE MODE available:

**SM 94 PDRS CONTROL**

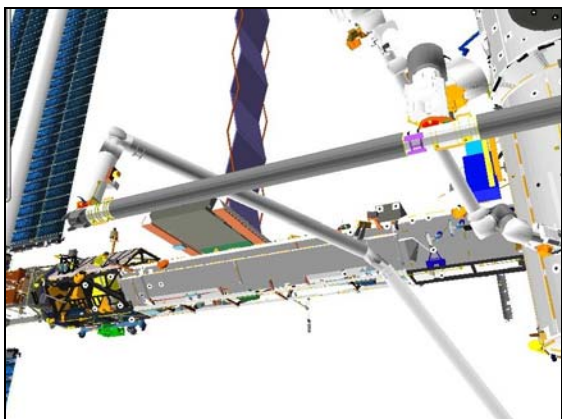
PL ID – ITEM 3 +2 EXEC

INIT ID – ITEM 24 +2 EXEC

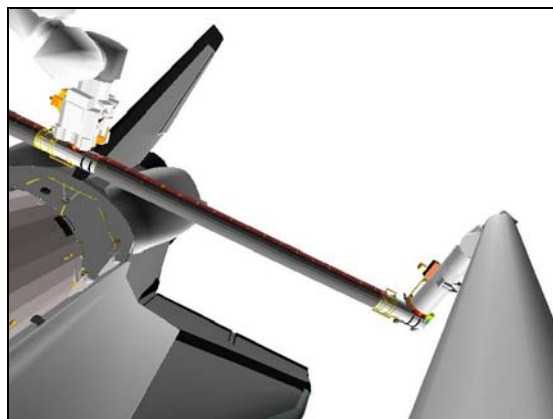
Expected OBSS HANDOFF posn:

X	Y	Z	PITCH	YAW	ROLL	PL ID
-1029	+229	-614	284	270	270	2
SY	SP	EP	WP	WY	WR	
+25.8	+66.3	-49.0	-85.9	+10.7	-100.7	

\* display singularity



**CCTV B (-25,25)**



**ELBOW (-5,-15)**

R12(OBSS) RSC PWR – OFF, ON

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

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

Perform LCC ACTIVATION (LCS Cue Card, PHOTO/TV), steps 1 and 2

Give SSRMS Operator GO for OBSS Ungrapple

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

8. MNVR TO NODE 2 VIEWING

On SSRMS Operator GO for mnvr to NODE 2 VIEWING posn,

If SINGLE MODE available:

RHC

RATE – as desired (VERN within 10 ft)

BRAKES – OFF (tb-OFF)

MODE – best available



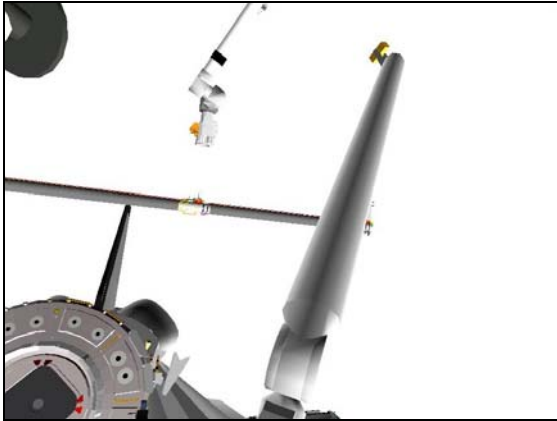
Mnvr to NODE 2 VIEWING posn:

	SY	SP	EP	WP	WY	WR	
HANDOFF	+25.8	+66.3	-49.0	-85.9	+10.7	-100.7	
1: SY +	+35.0						
2: EP +			-22.8				
3: WR +						+15.0	
4: WY -					-0.5		
5: SP -		+36.7					
6: WP +				-2.0			
7: SY +	+85.0						
NODE 2 VIEW	+85.0	+36.7	-22.8	-2.0	-0.5	+15.0	
	X	Y	Z	PITCH	YAW	ROLL	PL ID
	-767	-775	-1068	86	7	276	2

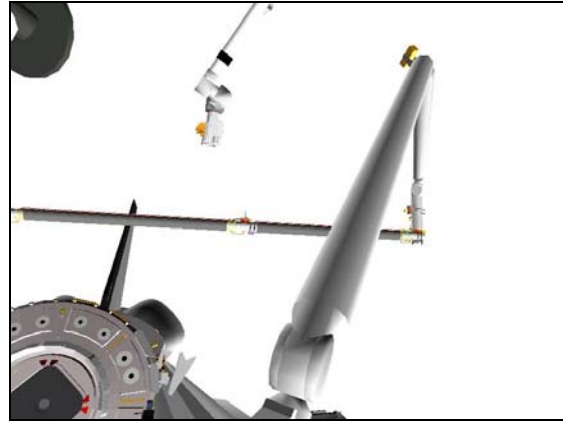
BRAKES – ON (tb-ON)  
 MODE – not DIRECT  
 PARAM – PORT TEMP  
 JOINT – CRIT TEMP

Start:  
OBSS Handoff

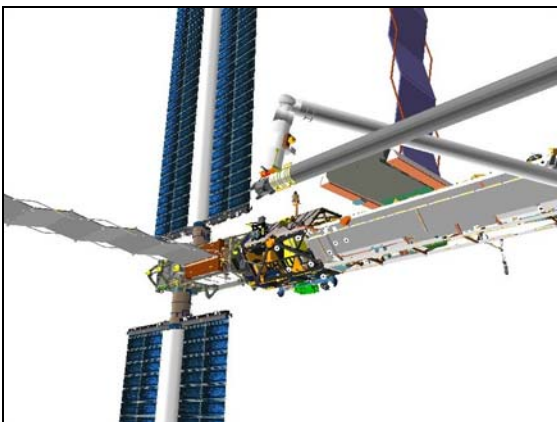
Step 1:  
Drive SY (+) from +25.8° to +35.0°



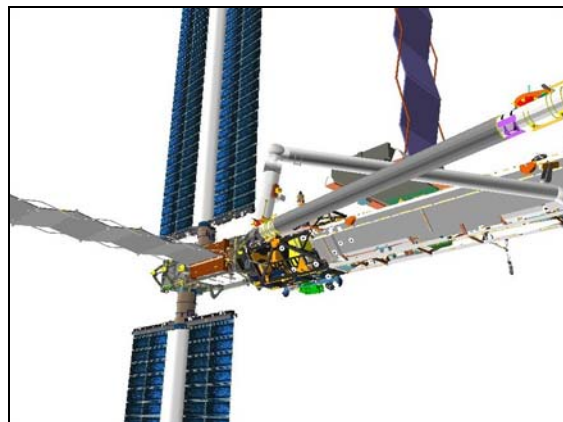
**CCTV A (20,20)**



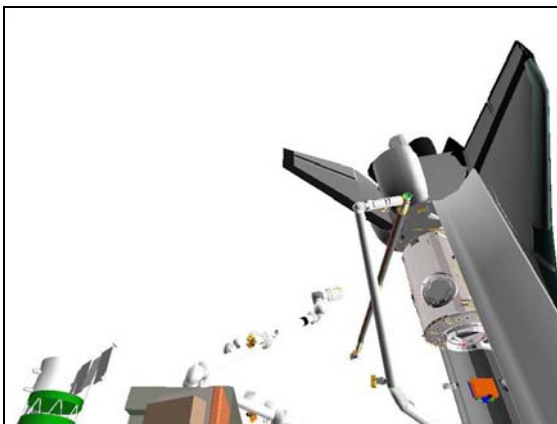
**CCTV A (20,20)**



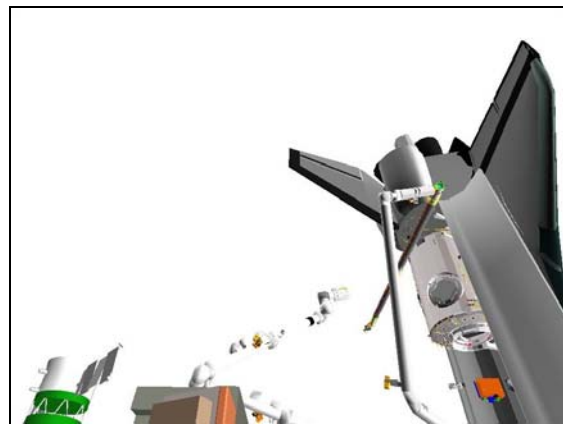
**CCTV B (-45,20)**



**CCTV B (-45,20)**



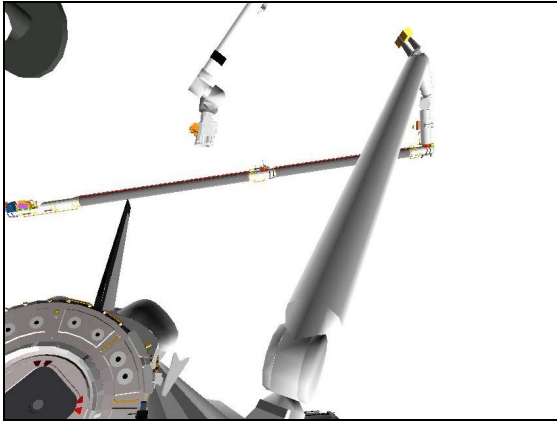
**P1 LOOB (90,45)**



**P1 LOOB (90,45)**

Step 2:

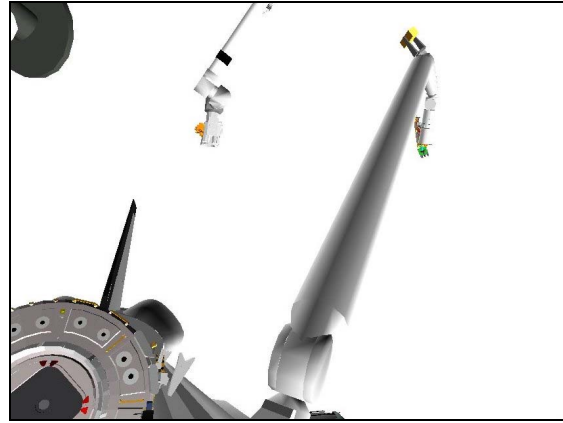
Drive EP (+) from  $-49.0^\circ$  to  $-22.8^\circ$



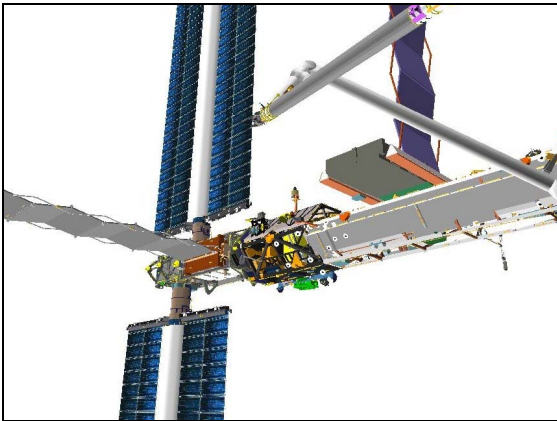
**CCTV A (20,20)**

Step 3:

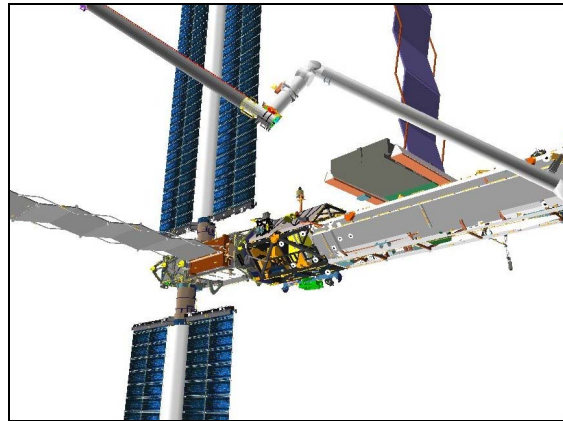
Drive WR (+) from  $-100.7^\circ$  to  $+15^\circ$



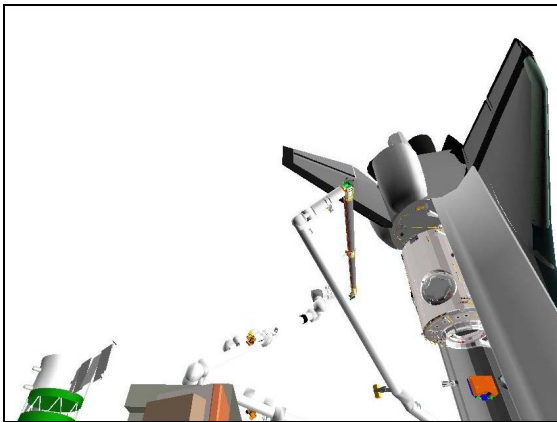
**CCTV A (20,20)**



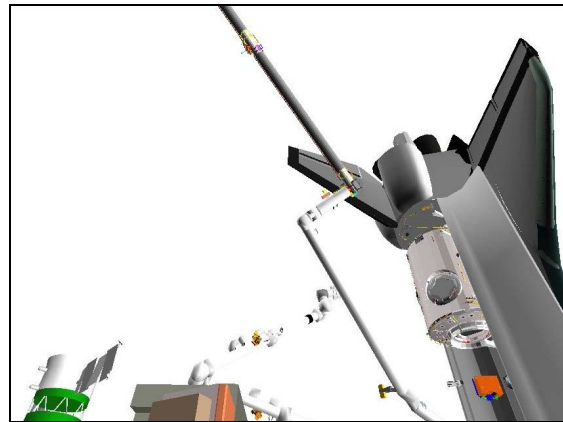
**CCTV B (-45,20)**



**CCTV B (-45,20)**



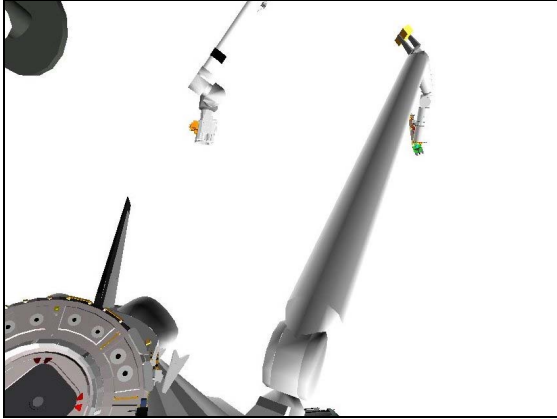
**P1 LOOB (90,45)**



**P1 LOOB (90,45)**

Step 4:

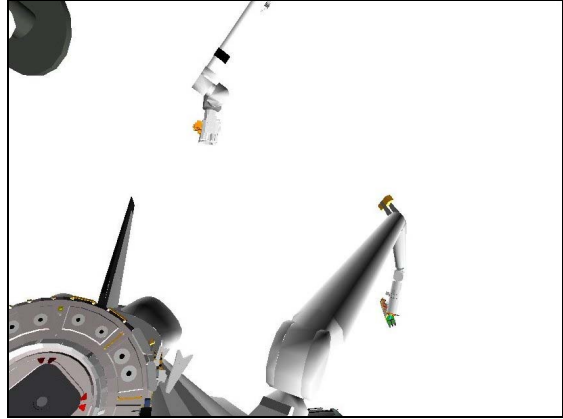
Drive WY (-) from  $+10.7^\circ$  to  $-0.5^\circ$



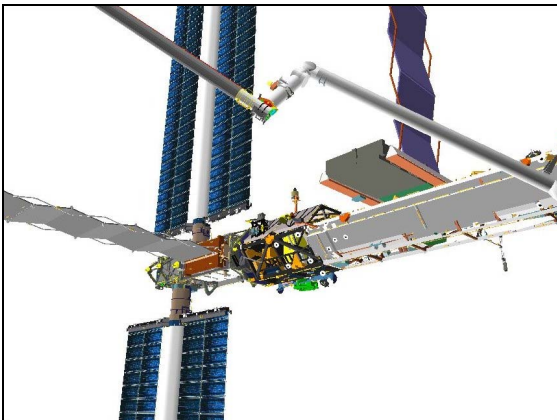
**CCTV A (20,20)**

Step 5:

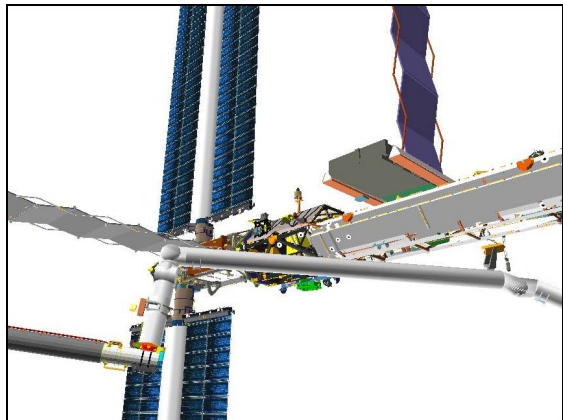
Drive SP (-) from  $+66.3^\circ$  to  $+36.7^\circ$



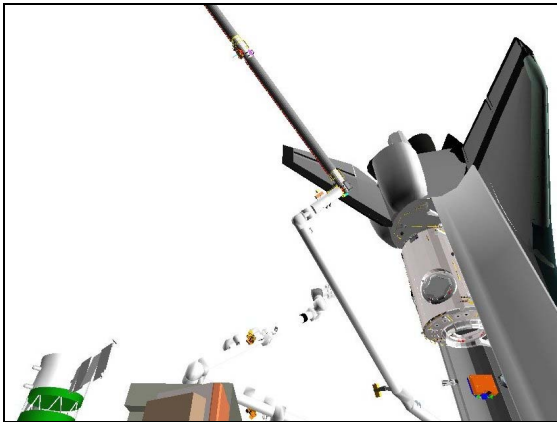
**CCTV A (20,20)**



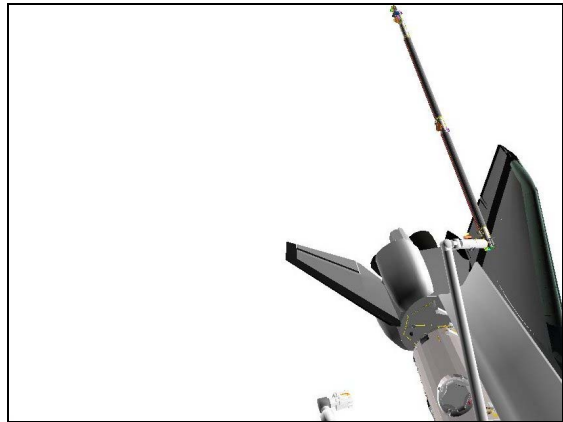
**CCTV B (-45,20)**



**CCTV B (-45,20)**



**P1 LOOB (90,45)**



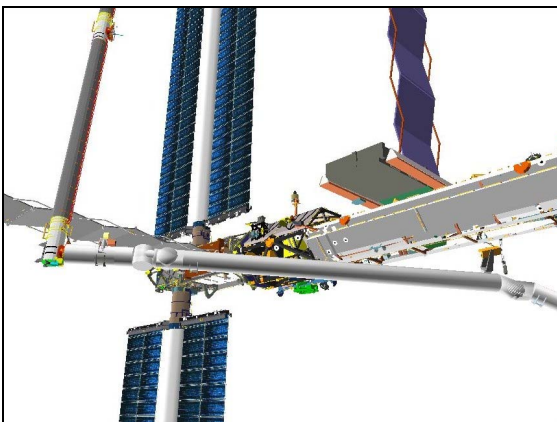
**P1 LOOB (90,60)**

Step 6:

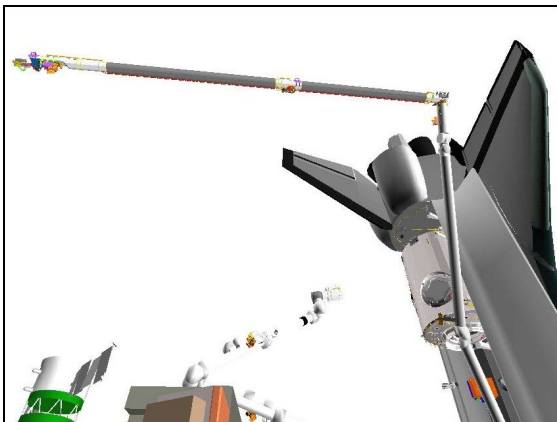
Drive WP (+) from  $-85.9^\circ$  to  $-2.0^\circ$



**CCTV A (20,20)**



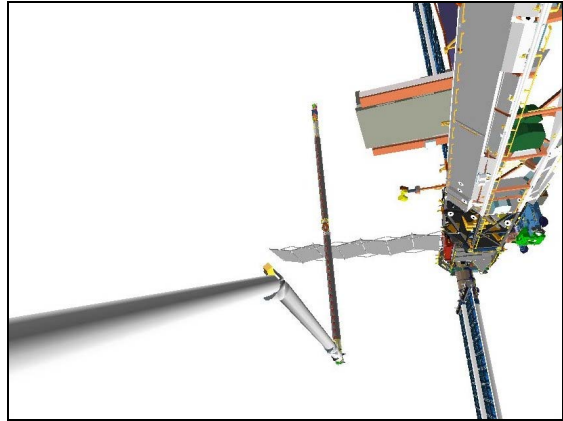
**CCTV B (-45,20)**



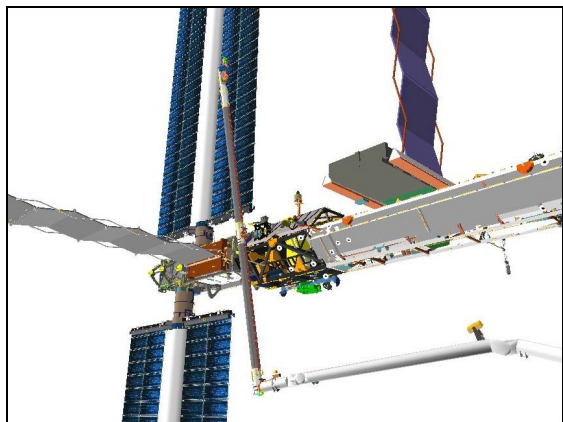
**P1 LOOB (90,45)**

Step 7:

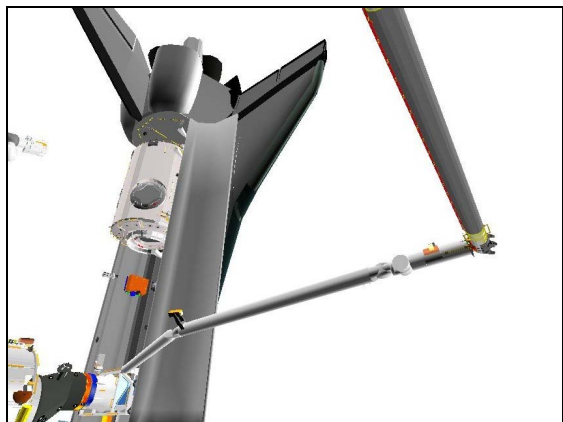
Drive SY (+) from  $+35.0^\circ$  to  $+85.0^\circ$



**CCTV A (70,25)**



**CCTV B (-45,20)**



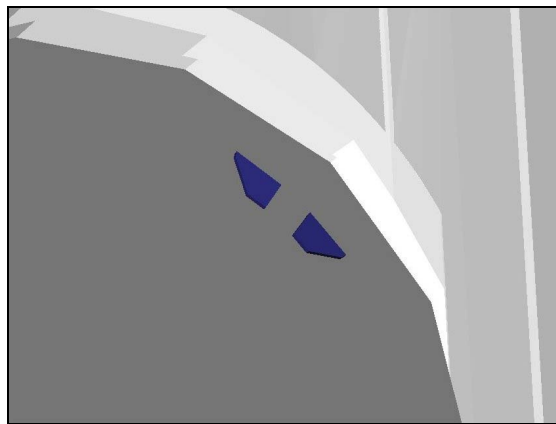
**P1 LOOB (140,30)**

A7U 9. RECONFIG PTU  
VIDEO OUT MON2 pb – push  
IN PL2(VPU) pb – push

CAMR CMD PAN/TILT – HI RATE  
PAN – L (to hard stop)  
TILT – UP (to hard stop)  
PAN/TILT – RESET  
PAN: +70 (right)  
TILT: -68 (dn)  
ZOOM – IN (full in)

VIDEO OUT MUX 1 L pb – push (MIDDECK It on)  
LDR1 MODE 2 pb – push (ITVC video)

Give SSRMS Operator GO for mnvr to EVA 1 SETUP posn



**ITVC (70,-68)**

# OBSS SJ HANDOFF FROM SRMS TO SSRMS

## 1. SETUP

If SINGLE MODE available:

SM 94 PDRS CONTROL

√PL ID, ITEM 3: 2

√INIT ID, ITEM 24: 2

A7U

CCTV – config as reqd

– perform PAN/TILT RESET for PLB cameras

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

## 2. MANEUVER TO OBSS HANDOFF

On SSRMS Operator GO for mnvr to OBSS HANDOFF posn,

If SINGLE MODE available:

RHC

RATE – as reqd (VERN within 10 ft)

BRAKES – OFF (tb-OFF)

MODE – best available

Mnvr to OBSS HANDOFF posn:

	SY	SP	EP	WP	WY	WR	
NODE 2 VIEW	+85.0	+36.7	-22.8	-2.0	-0.5	+15.0	
1: SY –	+35.0						
2: WP –				-85.9			
3: SP +		+66.3					
4: WY +					+10.7		
5: WR –						-100.7	
6: EP –			-49.0				
7: SY –	+25.8						
HANDOFF POSN	+25.8	+66.3	-49.0	-85.9	+10.7	-100.7	
	X	Y	Z	PITCH	YAW	ROLL	PL ID
	-1031	-44	-610	284	270	270	2

\* display singularity

BRAKES – ON (tb-ON)

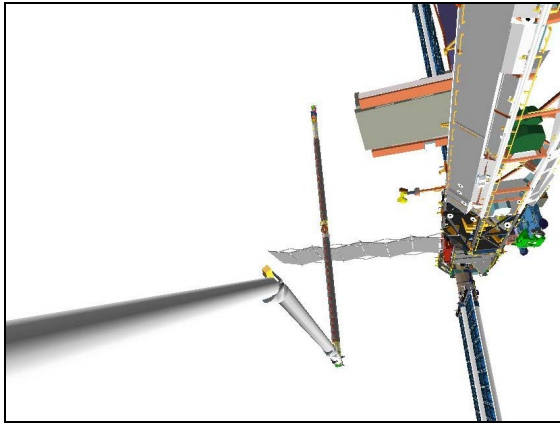
MODE – not DIRECT

JOINT – CRIT TEMP

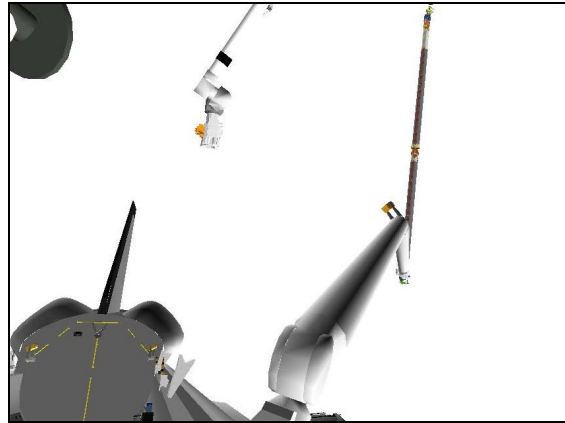
Give SSRMS Operator GO for OBSS Grapple

Start:  
NODE 2 VIEW

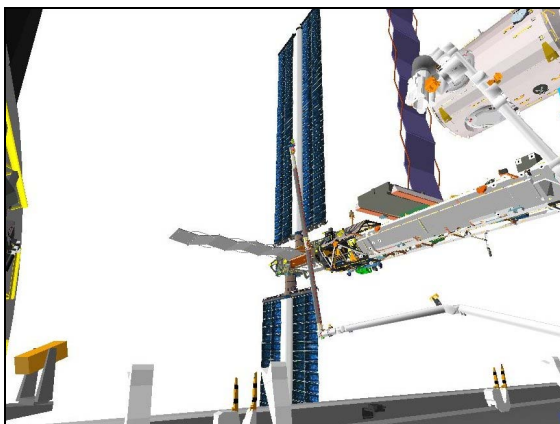
Step 1:  
Drive SY (-) from +85.0° to +35.0°



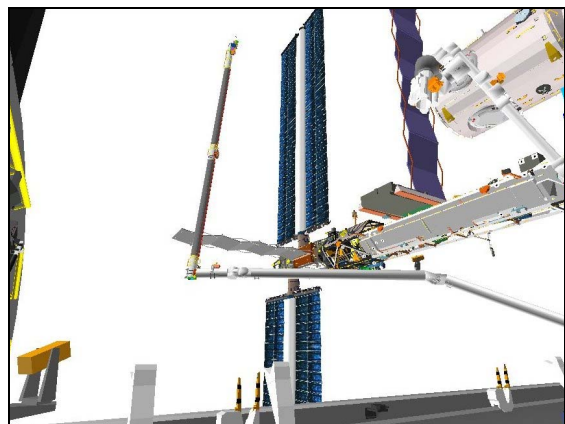
**CCTV A (70,20)**



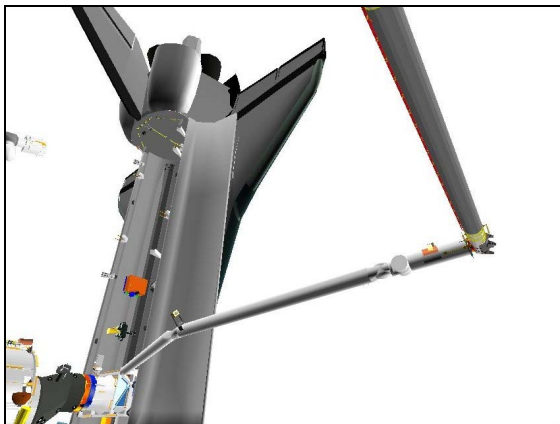
**CCTV A (20,20)**



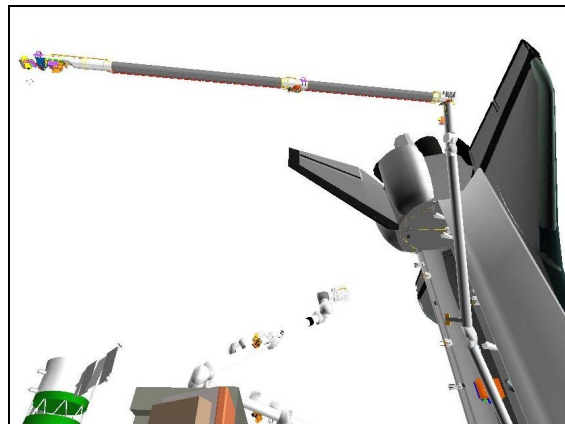
**CCTV C (-60,20)**



**CCTV C (-60,20)**



**P1 LOOB (140,30)**



**P1 LOOB (90,45)**



Step 2:

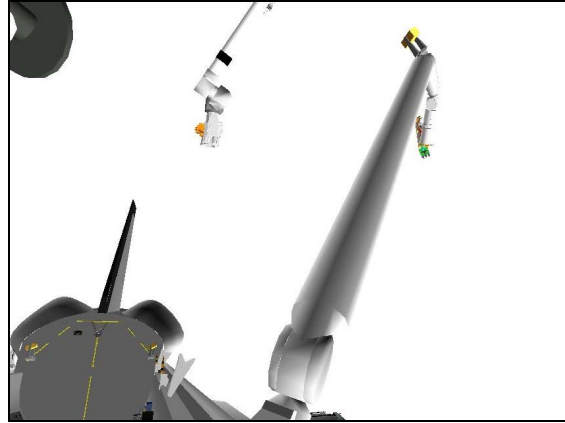
Drive WP (-) from  $-2.0^\circ$  to  $-85.9^\circ$



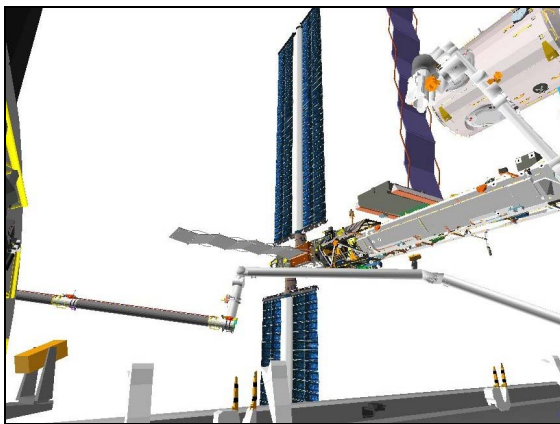
**CCTV A (20,20)**

Step 3:

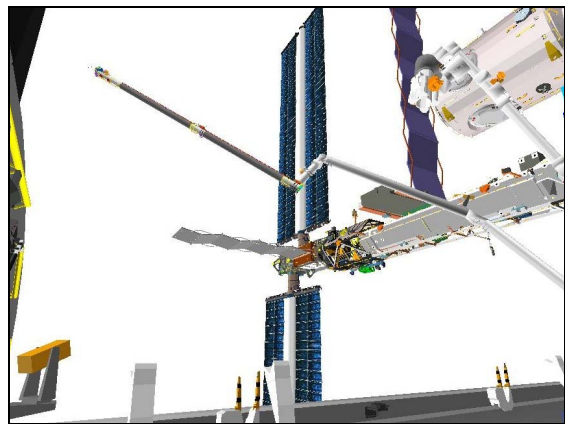
Drive SP (+) from  $+36.7^\circ$  to  $+66.3^\circ$



**CCTV A (20,20)**



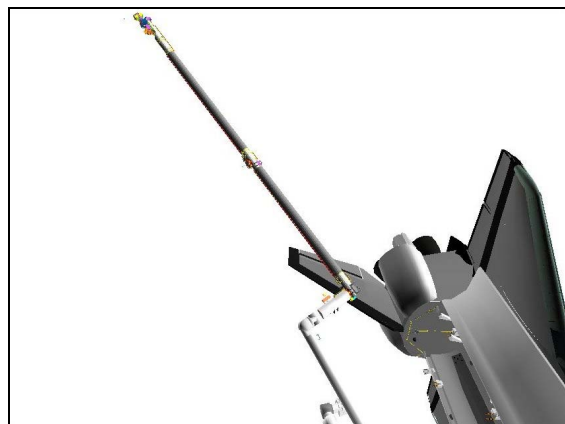
**CCTV C (-60,20)**



**CCTV C (-60,20)**

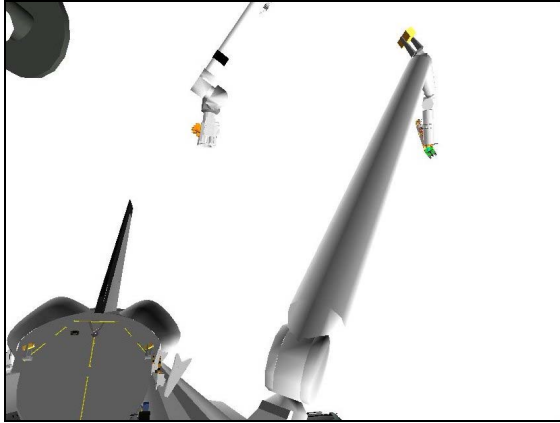


**P1 LOOB (90,60)**



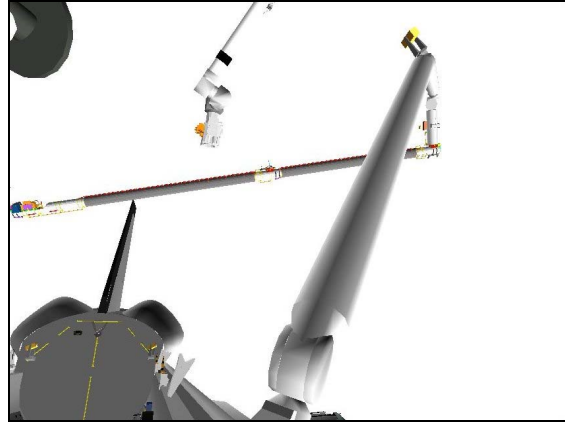
**P1 LOOB (90,60)**

Step 4:  
Drive WY (+) from  $-0.5^{\circ}$  to  $+10.7^{\circ}$



**CCTV A (20,20)**

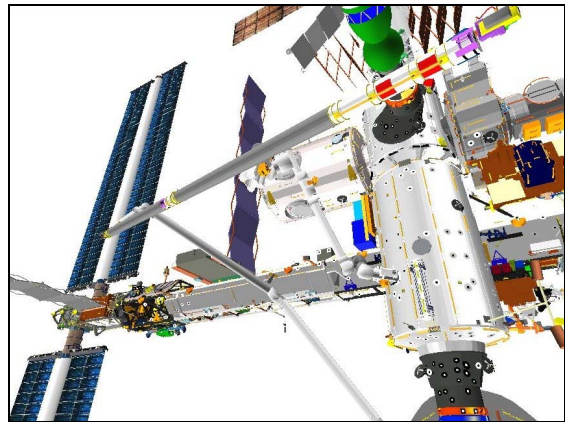
Step 5:  
Drive WR (-) from  $+15.0^{\circ}$  to  $-100.7^{\circ}$



**CCTV A (20,20)**



**CCTV C (-60,20)**



**CCTV C (-30,30)**



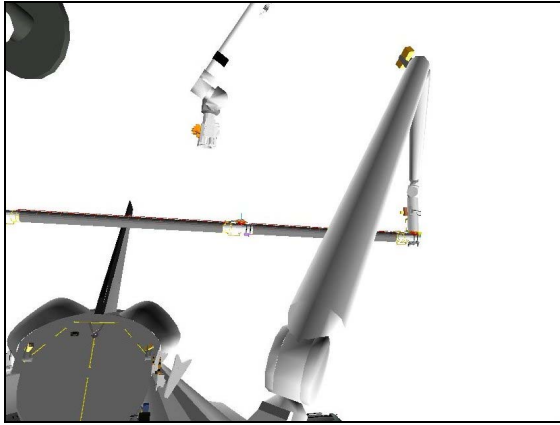
**P1 LOOB (95,35)**



**P1 LOOB (95,35)**

Step 6:

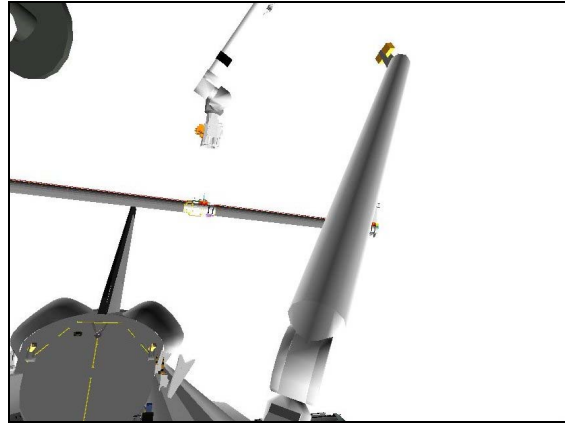
Drive EP (-) from  $-22.8^\circ$  to  $-49.0^\circ$



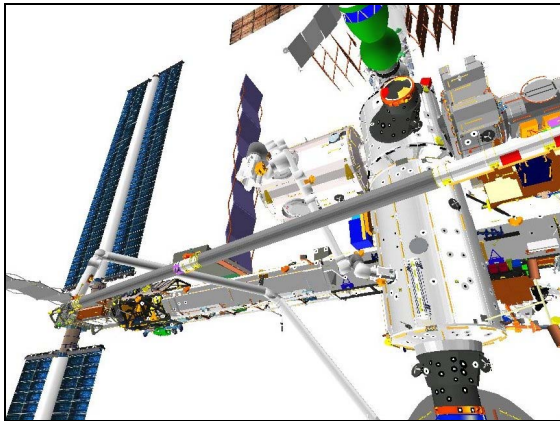
**CCTV A (20,20)**

Step 7:

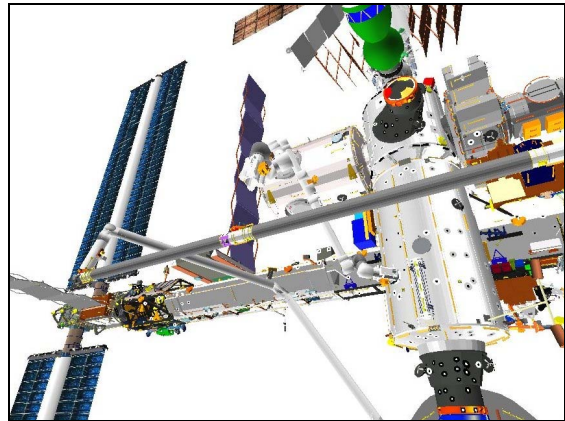
Drive SY (-) from  $+35.0^\circ$  to  $+25.8^\circ$



**CCTV A (20,20)**



**CCTV C (-30,30)**



**CCTV C (-30,30)**



**P1 LOOB (95,35)**



**P1 LOOB (95,35)**

3. STOW PTU

A7U On SSRMS Operator GO for OBSS Ungrapple,  
VIDEO OUT MON2 pb – push  
IN PL2(VPU) pb – push

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)

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

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

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

4. OBSS UNGRAPPLE

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

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

If TEST MODE available:

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 (\*)

If SINGLE MODE available:

RHC SM 94 PDRS CONTROL  
PL ID – ITEM 3 +0 EXEC  
INIT ID – ITEM 24 +0 EXEC  
  
RATE – VERN (RATE MIN tb-ON)  
BRAKES – OFF (tb-OFF)

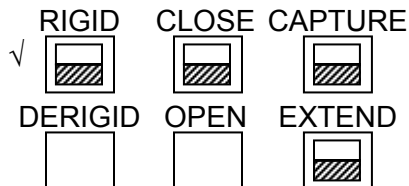
MODE – best available

**CAUTION**  
Monitor EE tb timing to prevent EE motor burnout

EE MODE – MAN

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

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



5. SJ MNVR TO OBSS PRE-GRAPPLE

Drive joints per OBSS SJ HANDOFF SRMS UNGRAPPLE WRIST CCTV OVERLAY and diagram until SRMS at OBSS PRE-GRAPPLE posn

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

√POS/ATT and Joint Angles at OBSS PRE-GRAPPLE AT HANDOFF posn:

X	Y	Z	PITCH	YAW	ROLL	PL ID
-1015	-362	-688	284	0	270	0
SY	SP	EP	WP	WY	WR	
+23.5	+63.5	-29.6	-102.9	+11.5	-98.6	

BRAKES – ON (tb-ON)

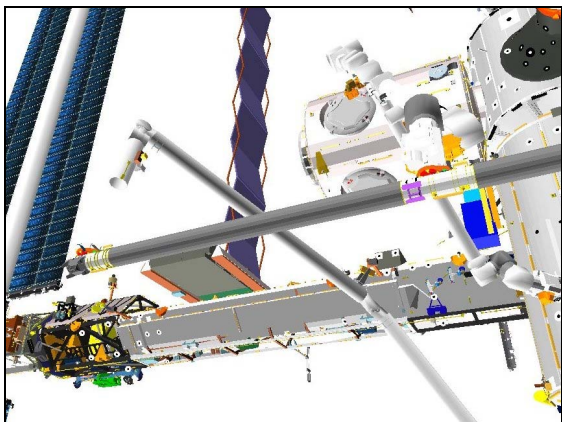
MODE – not DIRECT

JOINT – CRIT TEMP

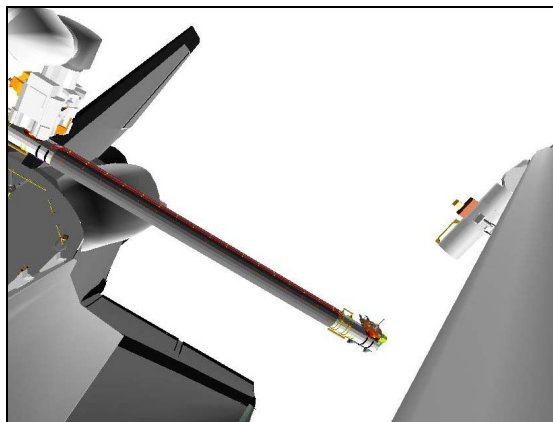
If using Shuttle attitude control and attitude maintenance required:

Configure DAP per RMS DAPs, then perform RATE DAMPING (ORB OPS FS, REBOOST/DAP; DOCKED DAP REFERENCE)

Give SSRMS Operator GO for OBSS Berth

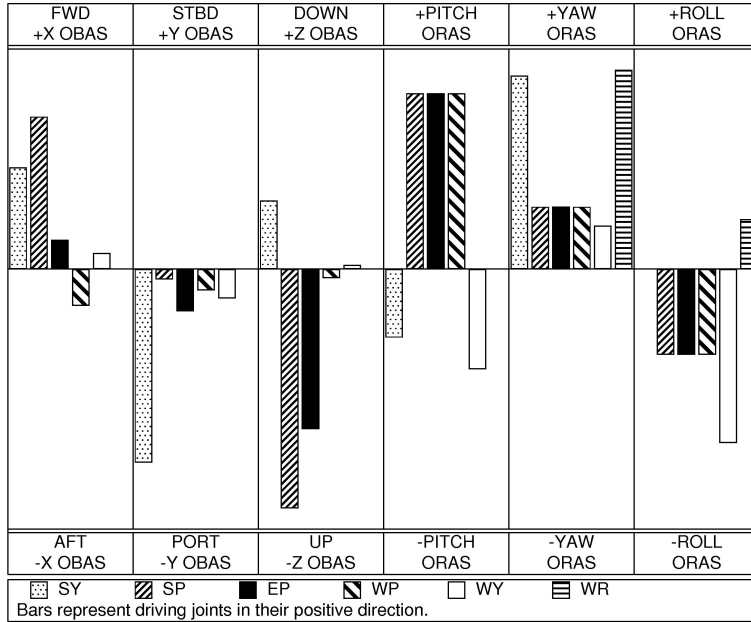


**CCTV B (-25,30)**



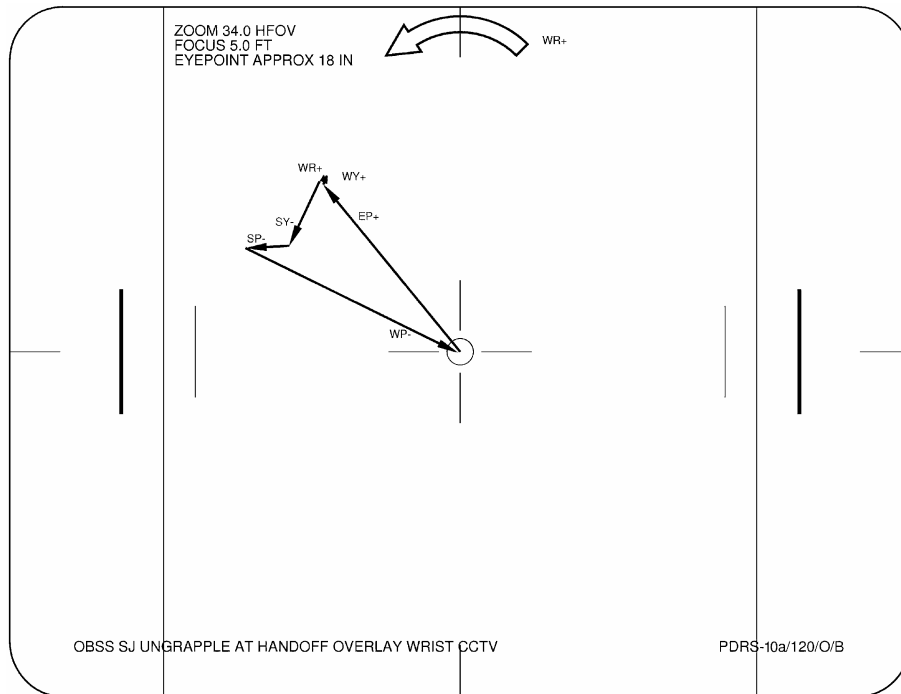
**ELBOW (-35,-15)**

### OBSS SJ UNGRAPPLE AT HANDOFF OVERLAY



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

$\Delta SY$	$\Delta SP$	$\Delta EP$	$\Delta WP$	$\Delta WY$	$\Delta WR$
-2.3	-2.8	+19.4	-17.0	+0.8	+2.1



6. CONFIGURE CIRCUIT BREAKERS

MA73C:C      cb MCA PWR AC3 3Φ MID 2 – op  
                  √AC2 3Φ MID 2 – op  
:D               √AC3 3Φ MID 4 – op

7. CONFIGURE FOR MONITORING

On SSRMS 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

8. STBD MRL LATCH

On SSRMS Operator GO to latch STBD MRLs to Topological Capture,

√STBD RMS R-F-L tb (three) – gray

SM 94 PDRS CONTROL

√STBD AFT, MID, FWD LAT (six) = 0

R13L            PL BAY MECH PWR SYS (two) – ON

NOTE

Expect single motor drive time for MRL latching (18 sec max).

The following STBD RMS RETEN LAT – OFF and PL BAY  
MECH PWR SYS (two) – OFF actions are to be performed simo

Verify AOS for latching to Topological Capture

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

R13L            PL BAY MECH PWR SYS (two) – OFF

Give SSRMS Operator GO to Limp All SSRMS Joints and Derigidize

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

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

9. 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  
:D               √AC3 3Φ MID 4 – op

Give SSRMS Operator GO for OBSS Ungrapple

10. MNVR TO PRE-CRADLE

On SSRMS Operator GO for mnvr to PRE-CRADLE,

If SINGLE MODE available:

RHC

RATE – as reqd (VERN within 10 ft)

BRAKES – OFF (tb-OFF)

MODE – best available

Mnvr to PRE-CRADLE posn:

	SY	SP	EP	WP	WY	WR	
PRE-GRAPPLE	+23.5	+63.5	-29.6	-102.9	+11.5	-98.6	
1: WR +						0.0	
2: WY -					0.0		
3: WP +				+5.0			
4: SP -		+25.0					
5: EP +			-25.0				
6: SY -	0.0						
PRE-CRADLE	0.0	+25.0	-25.0	+5.0	0.0	0.0	
	X	Y	Z	PITCH	YAW	ROLL	PL ID
	-1261	-146	-551	5	2	0	0

BRAKES – ON (tb-ON)

MODE – not DIRECT

PARAM – PORT TEMP

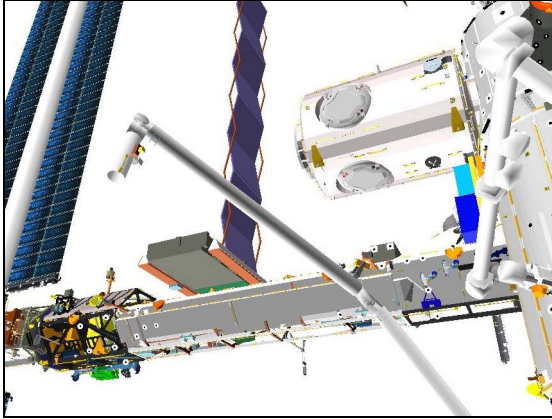
JOINT – CRIT TEMP

Give SSRMS Operator GO for mnvr to MBS PDGF 3 Pre-grapple

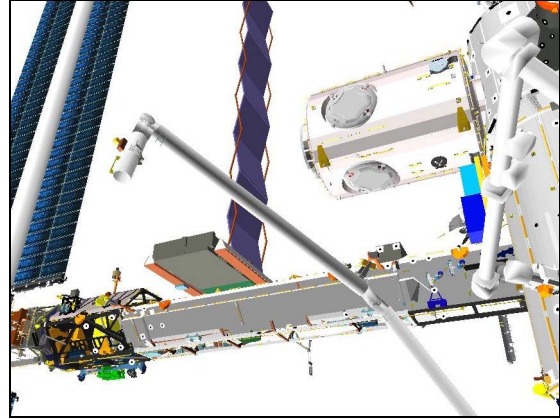


Start:  
OBSS Handoff

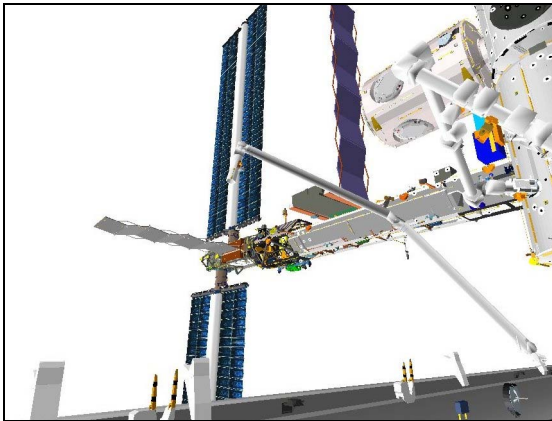
Step 1:  
Drive WR (+) from  $-98.6^\circ$  to  $0.0^\circ$



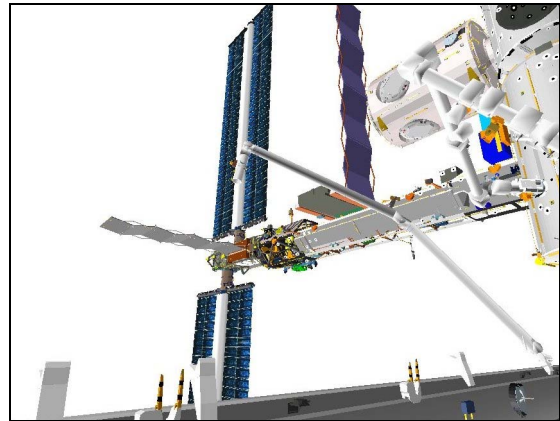
**CCTV B (-25,30)**



**CCTV B (-25,30)**



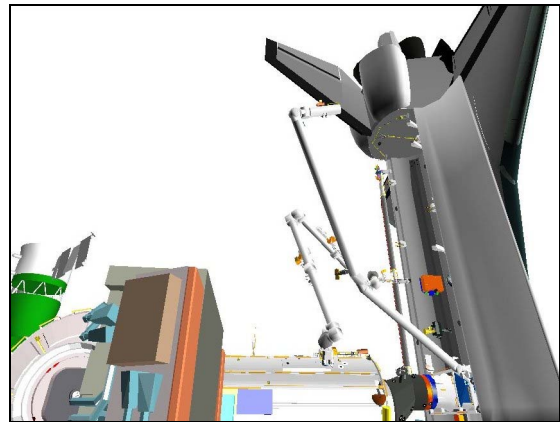
**CCTV C (-50,20)**



**CCTV C (-50,20)**



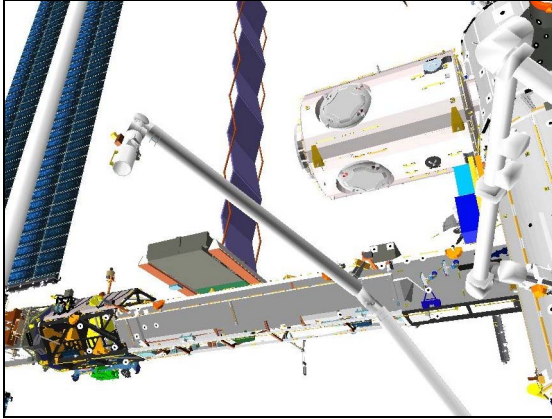
**P1 LOOB (95,30)**



**P1 LOOB (95,30)**

Step 2:

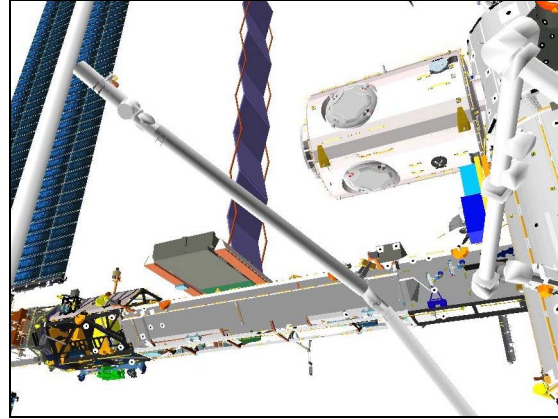
Drive WY (-) from  $+11.5^\circ$  to  $0.0^\circ$



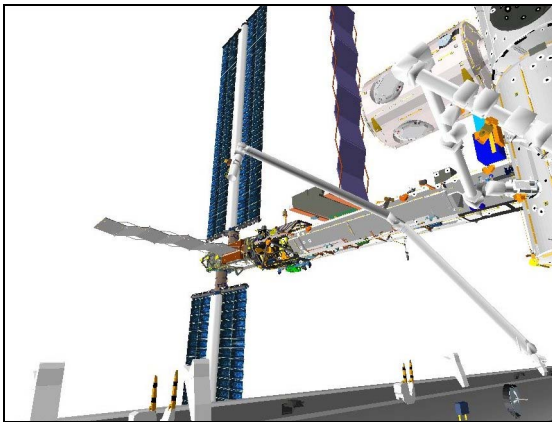
**CCTV B (-25,30)**

Step 3:

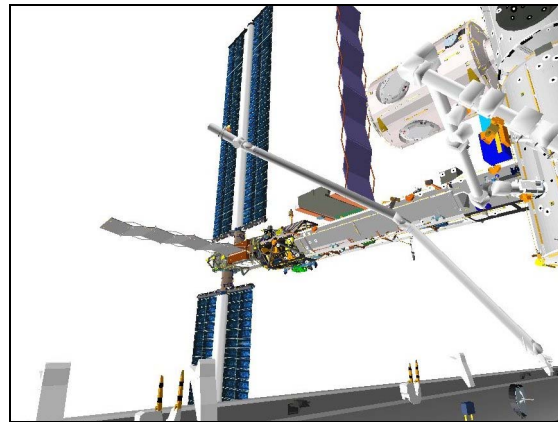
Drive WP (+) from  $-102.9^\circ$  to  $+5.0^\circ$



**CCTV B (-25,30)**



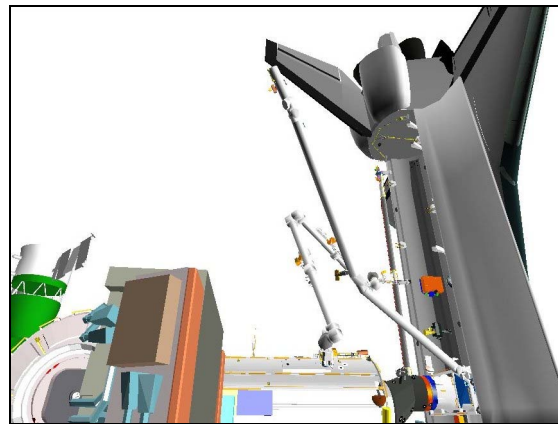
**CCTV C (-50,20)**



**CCTV C (-50,20)**



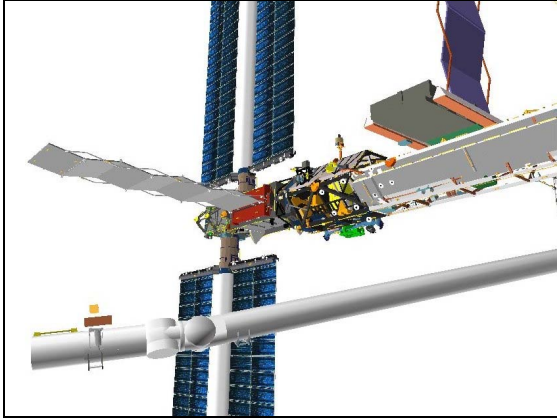
**P1 LOOB (95,30)**



**P1 LOOB (95,30)**

Step 4:

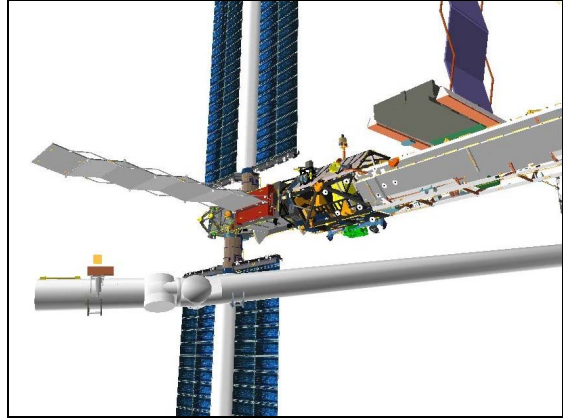
Drive SP (-) from +63.5° to +25.0°



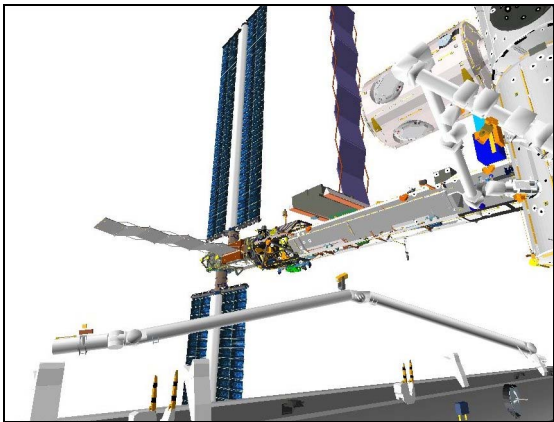
**CCTV B (-50,15)**

Step 5:

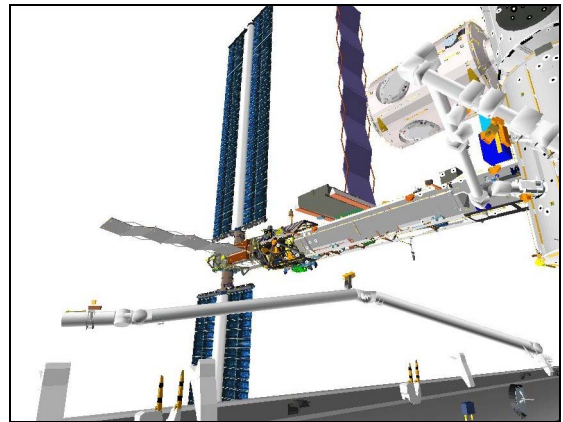
Drive EP (+) from -29.6° to -25.0°



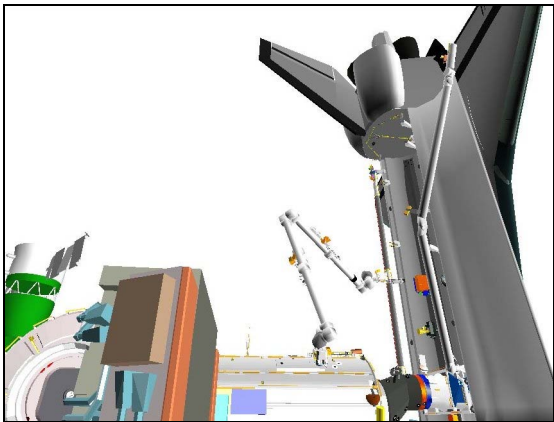
**CCTV B (-50,15)**



**CCTV C (-50,20)**



**CCTV C (-50,20)**



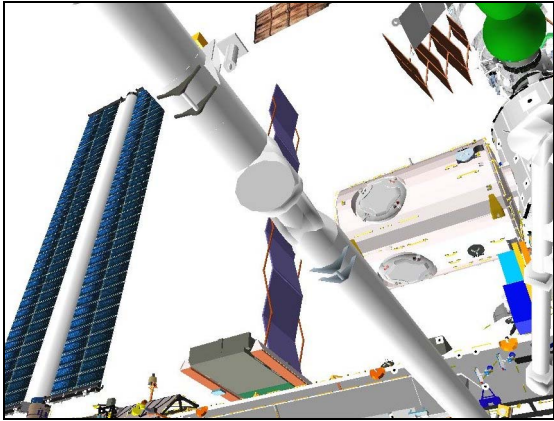
**P1 LOOB (95,30)**



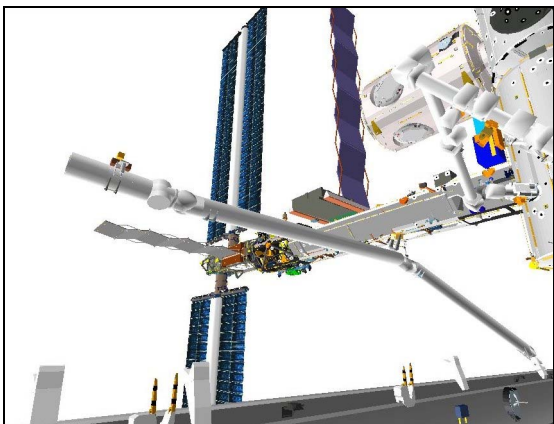
**P1 LOOB (95,30)**

Step 6:

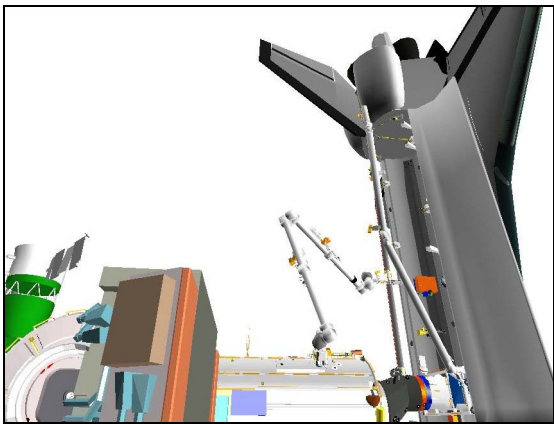
Drive SY (-) from +23.5° to 0.0°



**CCTV B (-30,40)**



**CCTV C (-50,20)**



**P1 LOOB (95,30)**

OBSS REFERENCE DATA

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

OBSS  
REF DATA

## OBSS JOINT ANGLES VS POR COORDINATES

### OBSS PRE-GRAPPLE AT HANDOFF

X	Y	Z	PITCH	YAW	ROLL	PL ID
-1012	+229	-685	284	270	270	2
-1015	-362	-688	284	0	270	0
SY	SP	EP	WP	WY	WR	
+23.5	+63.5	-29.6	-102.9	+11.5	-98.6	

\* display singularity

### OBSS HANDOFF

X	Y	Z	PITCH	YAW	ROLL	PL ID
-1029	+229	-614	284	270	270	2
-1032	-362	-618	284	360	270	
SY	SP	EP	WP	WY	WR	
+25.8	+66.3	-49.0	-85.9	+10.7	-100.7	

\* display singularity

### NODE 2 VIEWING

X	Y	Z	PITCH	YAW	ROLL	PL ID
-767	-775	-1068	86	7	276	2
-728	-698	-483	305	81	51	0
SY	SP	EP	WP	WY	WR	
+85.0	+36.7	-22.8	-2.0	-0.5	+15.0	

OBSS  
REF DATA

P6 NOMINAL

P6 HANDOFF FROM SSRMS TO SRMS .....	FS 4-2
SRMS TO SSRMS .....	FS 4-5
INSTALL VIEWING .....	FS 4-8

P6  
NOMINAL

# P6 HANDOFF FROM SSRMS TO SRMS

## 1. SRMS MNVR TO P6 PRE-GRAPPLE POSN

SM 94 PDRS CONTROL

√PL ID, ITEM 3: 0

√INIT ID, ITEM 24: 0

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

RATE – as required (VERN within 10 ft)

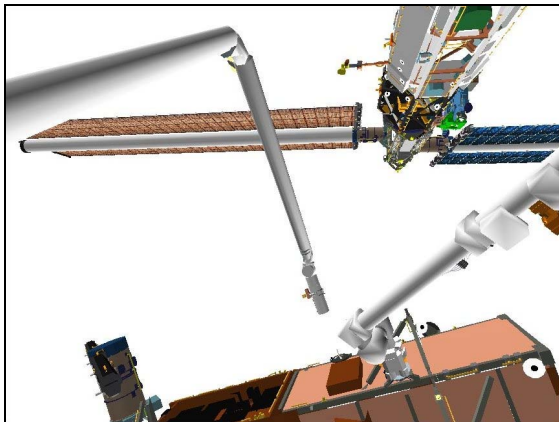
BRAKES – OFF (tb-OFF)

MODE – SINGLE, ENTER

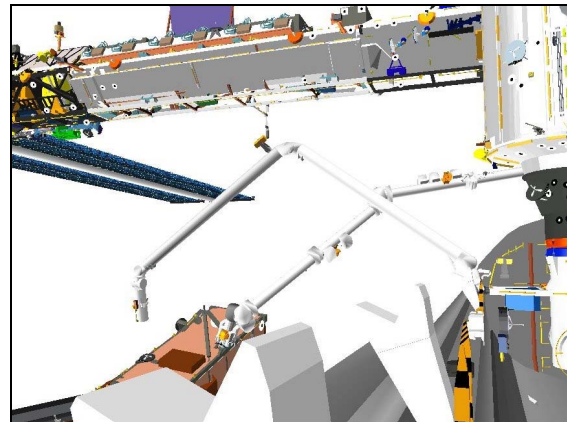
Mnvr to P6 PRE-GRAPPLE posn:

	SY	SP	EP	WP	WY	WR	
PRE-CRADLE	0.0	+25.0	-25.0	+5.0	0.0	0.0	
1: SP +		+55.1					
2: SY +	+95.3						
3: WP –				-48.7			
4: WY +					+16.7		
5: WR –						-71.5	
6: EP –			-70.4				
P6 PRE-GRAPPLE	+95.3	+55.1	-70.4	-48.7	+16.7	-71.5	
	X	Y	Z	PITCH	YAW	ROLL	PL ID
	-622	-552	-362	251	5	6	0

BRAKES – ON (tb-ON)



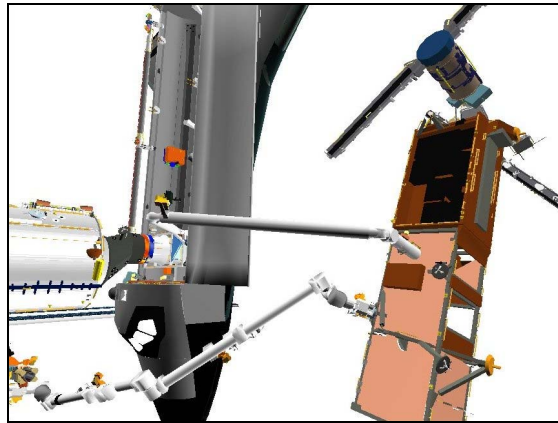
CCTV A (80,5)



CCTV B (-20,5)

P6  
NOMINAL





**P1 LOOB (135,10)**

2. ATTITUDE CONTROL CONFIGURATION

PCS

MSS: SSRMS: Thrusters: Thruster Controls for MSS Ops

Verify 'Desat Request:' – Inh

If using shuttle attitude control:  
DAP: FREE

3. P6 GRAPPLE

A7U

CCTV – config for grapple  
– install PDRS TARGET OVERLAY FOR CTVM  
– RMS WRIST, zoom 34.0 HFOV  
focus 5 ft

Maintain eyepoint approx 18 in when using grapple overlay

Notify SSRMS Operator, going in for P6 Grapple

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

Mnvr to grapple envelope

**CAUTION**  
Monitor EE tb timing to prevent EE motor burnout

EE MODE – AUTO  
CAPTURE sw – depress (mom)

√	RIGID <input type="checkbox"/>	CLOSE <input type="checkbox"/>	CAPTURE <input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	DERIGID <input type="checkbox"/>	OPEN <input type="checkbox"/>	EXTEND <input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

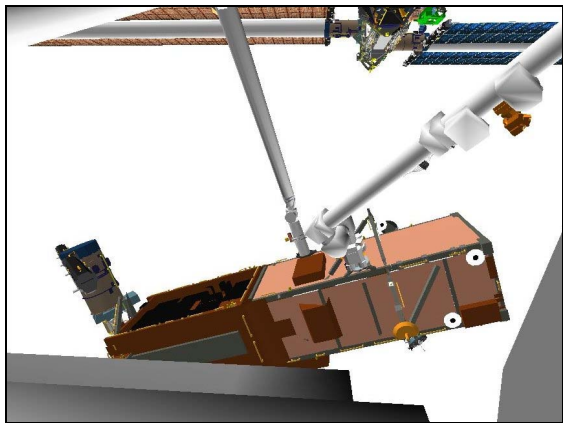
CRITICAL TIMES (28 sec total):  
CAPTURE tb – gray, then  
CLOSE tb – gray, 3 sec max, then  
RIGID tb – gray, 25 sec max

- \* If manual grapple reqd: \*
- \* 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) \*

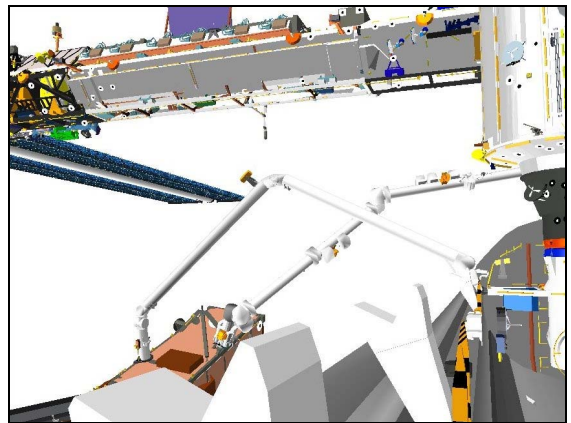
EE MODE – OFF  
 BRAKES – ON (tb-ON)

**SM 94 PDRS CONTROL**

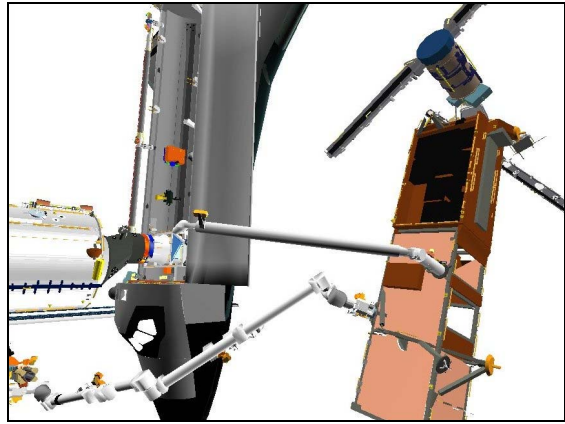
PL ID – ITEM 3 +3 EXEC  
 INIT ID – ITEM 24 +3 EXEC



**CCTV A (85,-10)**



**CCTV B (-20,5)**



**P1 LOOB (135,10)**

Record POS/ATT and Joint Angles:

X	Y	Z	PITCH	YAW	ROLL	PL ID
						3
SY	SP	EP	WP	WY	WR	
Expected +97.4	+45.3	-65.7	-43.1	+15.7	-73.6	

A8U  
 MODE – not DIRECT (It off)  
 PARAM – PORT TEMP  
 JOINT – CRIT TEMP

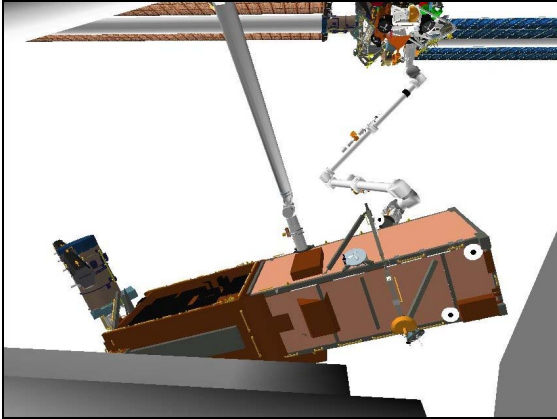
Give SSRMS Operator GO to Ungrapple P6

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

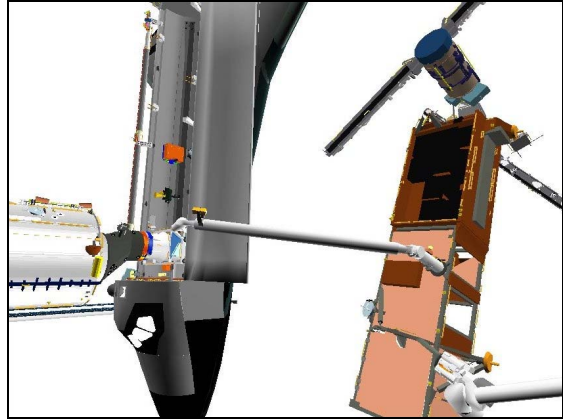
## P6 HANDOFF FROM SRMS TO SSRMS

### 1. SETUP

MON 1	A (SSRMS Base Elb)
MON 2	EE (B)
DNLK	P1 LOOB



**CCTV A (85,-10)**



**P1 LOOB (135,10)**

### 2. P6 UNGRAPPLE

On SSRMS Operator GO to Ungrapple P6 and maneuver to PRE-CRADLE,

**SM 94 PDRS CONTROL**

PL ID – ITEM 3 +0 EXEC

INIT ID – ITEM 24 +0 EXEC

#### NOTE

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

THC RATE – COARSE (RATE MIN tb-OFF)

**SM 94 PDRS CONTROL**

AUTO BRAKE INH – ITEM 10 EXEC (\*)

A8U BRAKES – OFF (tb-OFF)

MODE – TEST, ENTER  
Wait 5 sec

BRAKES – ON (tb-ON)

**SM 94 PDRS CONTROL**

AUTO BRAKE ENA – ITEM 9 EXEC (\*)

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

#### CAUTION

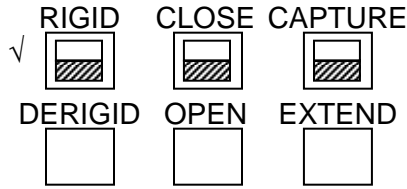
Monitor EE tb timing to prevent EE motor burnout

**NOTE**

When OPEN tb-gray, mnvr arm clear of GF

EE MODE – AUTO

RELEASE sw – depress (mom)



**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

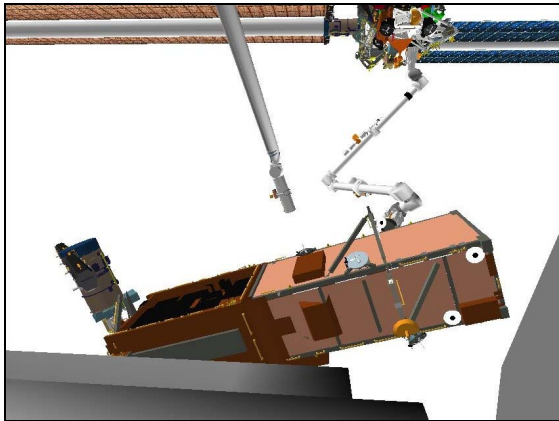
- |                                                      |   |
|------------------------------------------------------|---|
| * If manual release reqd:                            | * |
| * EE MODE – MAN                                      | * |
| * MAN CONTR – DERIGID (hold until DERIGID tb-gray,   | * |
| * 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

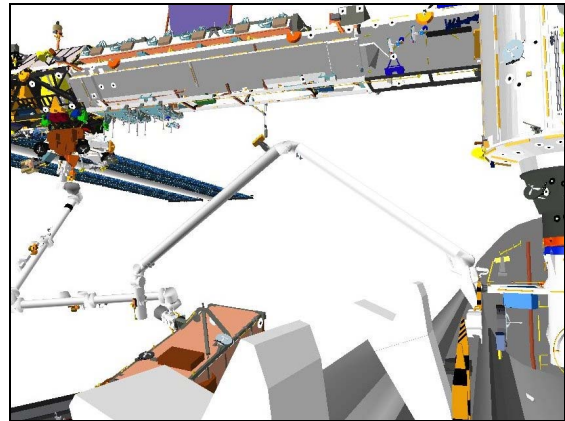
Mnvr to UNGRAPPLE BACKOFF posn:

X	Y	Z	PITCH	YAW	ROLL	PL ID
-622	-552	-362	251	5	6	0
SY	SP	EP	WP	WY	WR	
+95.3	+55.1	-70.4	-48.7	+16.7	-71.5	

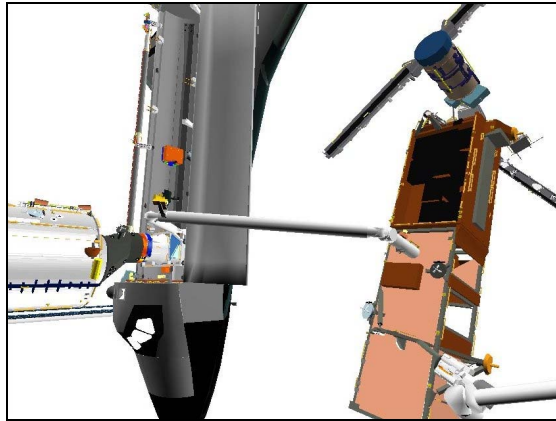
BRAKES – ON (tb-ON)



**CCTV A (85,-10)**



**CCTV B (-20,5)**



**P1 LOOB (135,10)**

If using shuttle attitude control and attitude maintenance required:  
 Configure DAP per RMS DAPs, then perform RATE DAMPING (ORB OPS FS, REBOOST/DAP; DOCKED DAP REFERENCE)

When in attitude,  
 DAP: FREE

Notify SSRMS Operator, P6 Ungrapple complete

3. SJ MNVR TO PRE-CRADLE

RATE – as reqd (VERN within 10 ft)

BRAKES – OFF (tb-OFF)

MODE – SINGLE, ENTER

Mnvr to PRE-CRADLE posn:

	SY	SP	EP	WP	WY	WR	
UNGRPL	+95.3	+55.1	-70.4	-48.7	+16.7	-71.5	
BACKOFF			-25.0				
1: EP +				+5.0			
2: WP +					0.0		
3: WY –						0.0	
4: WR +							
5: SY –	0.0						
6: SP –		+25.0					
PRE-CRADLE	0.0	+25.0	-25.0	+5.0	0.0	0.0	
	X	Y	Z	PITCH	YAW	ROLL	PL ID
	-1261	-146	-551	5	2	0	0

BRAKES – ON (tb-ON)

√MODE – not DIRECT

PARAM – PORT TEMP

JOINT – CRIT TEMP

## P6 INSTALL VIEWING

### 1. SETUP

SM 94 PDRS CONTROL

√PL ID, ITEM 3: 0

√INIT ID, ITEM 24: 0

MON 1	A
MON 2	Elbow (EE)
DNLK	P1 LOOB (MBS Mast)

### 2. MNVR TO P6 INSTALL VIEWING POSN

On SSRMS Operator GO, maneuver to P6 INSTALL VIEWING position

A8U

RATE – as required (VERN within 10 ft)

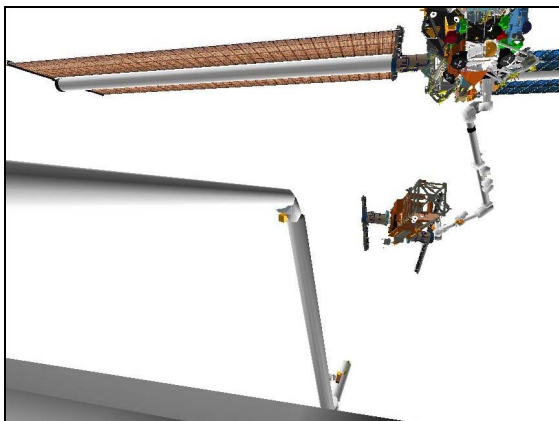
BRAKES – OFF (tb-OFF)

MODE – SINGLE, ENTER

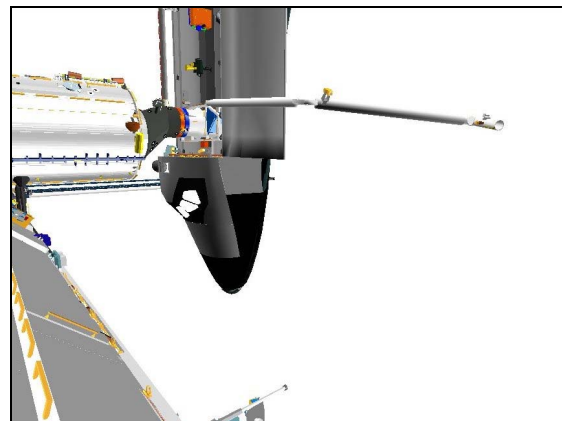
Mnvr to P6 INSTALL VIEWING posn:

	SY	SP	EP	WP	WY	WR	
PRE-CRADLE	0.0	+25.0	-25.0	+5.0	0.0	0.0	
1: WP +				+96.4			
2: WY +					+8.2		
3: WR +						+22.9	
4: SY +	+94.8						
5: SP –		+16.7					
6: EP –			-63.4				
P6 INSTALL VIEW	+94.8	+16.7	-63.4	+96.4	+8.2	+22.9	
	X	Y	Z	PITCH	YAW	ROLL	PL ID
	-631	-537	-213	111	57	252	0

BRAKES – ON (tb-ON)



**CCTV A (75,-5)**



**P1 LOOB (130,-10)**

√MODE – not DIRECT (It off)

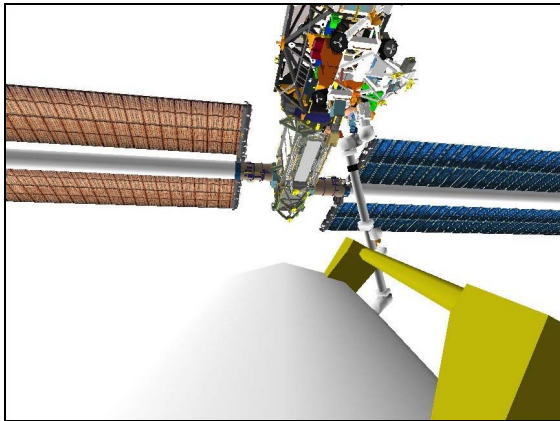
PARAM – PORT TEMP

JOINT – CRIT TEMP

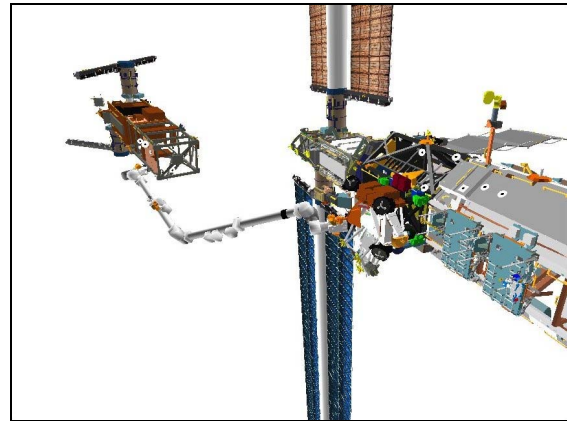
Give SSRMS Operator GO for P6 Install

3. CONFIG CAMERAS FOR VIEWING

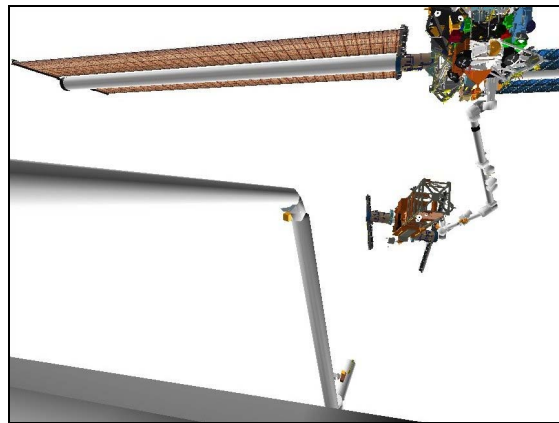
MON 1	EE (Elbow)
MON 2	A



**EE**



**ELBOW (80,25)**



**CCTV A (75,-5)**

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P6 CONTINGENCY

P6 SJ HANDOFF FROM SSRMS TO SRMS .....	FS 5-2
SRMS TO SSRMS .....	FS 5-10

# P6 SJ HANDOFF FROM SSRMS TO SRMS

- A7U 1. SJ MNVR TO PRE-GRAPPLE POSN  
CCTV – perform PAN/TILT RESET

SM 94 PDRS CONTROL

- √PL ID, ITEM 3: 0
- √INIT ID, ITEM 24: 0

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

RATE – as required (VERN within 10 ft)  
BRAKES – OFF (tb-OFF)  
MODE – best available

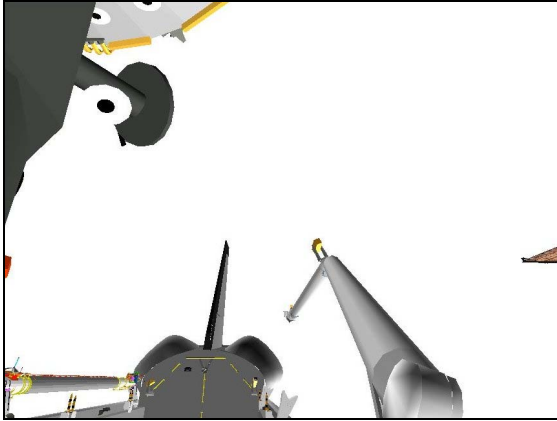
Mnvr to P6 PRE-GRAPPLE posn (reference pictures as reqd):

	SY	SP	EP	WP	WY	WR	
PRE-CRADLE	0.0	+25.0	-25.0	+5.0	0.0	0.0	
1: SP +		+55.1					
2: SY +	+95.3						
3: WP –				-48.7			
4: WY +					+16.7		
5: WR –						-71.5	
6: EP –			-70.4				
P6 PRE-GRAPPLE	+95.3	+55.1	-70.4	-48.7	+16.7	-71.5	
	X	Y	Z	PITCH	YAW	ROLL	PL ID
	-622	-552	-362	251	5	6	0

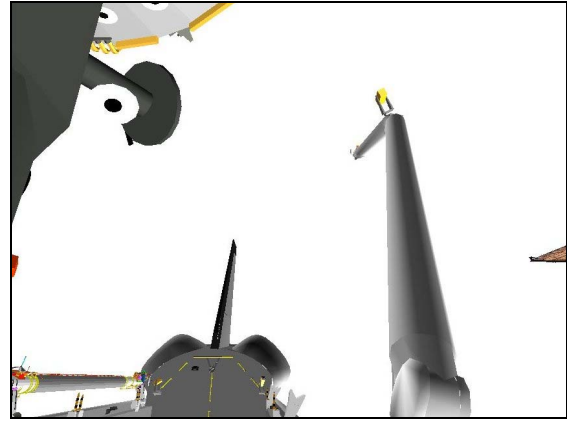
BRAKES – ON (tb-ON)

Start:  
Pre-cradle

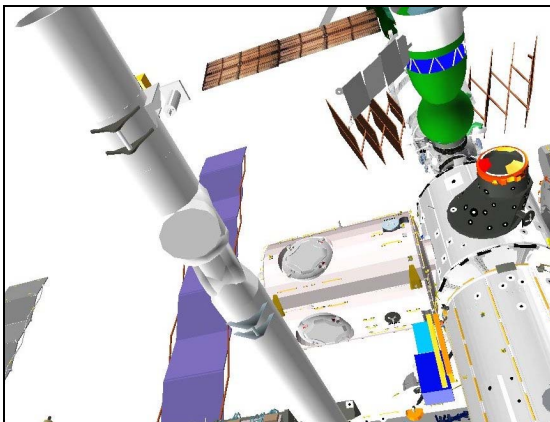
Step 1:  
Drive SP (+) 25.0 to 55.1



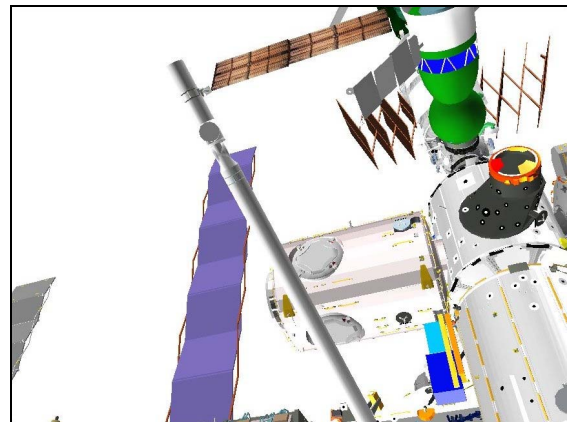
**CCTV A (5,25)**



**CCTV A (5,25)**



**CCTV B (-20,45)**



**CCTV B (-20,45)**

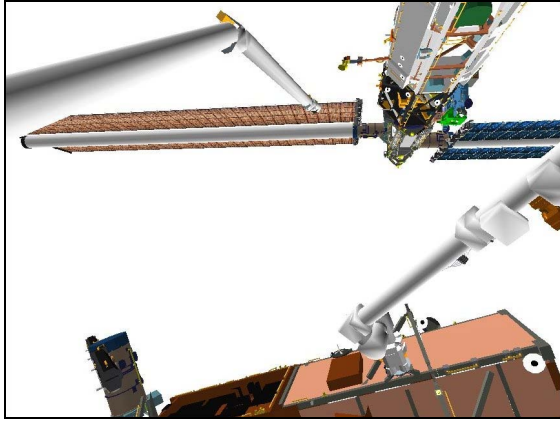


**P1 LOOB (125,30)**

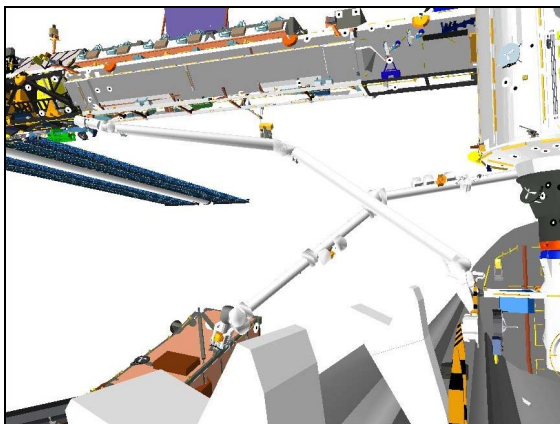


**P1 LOOB (125, 30)**

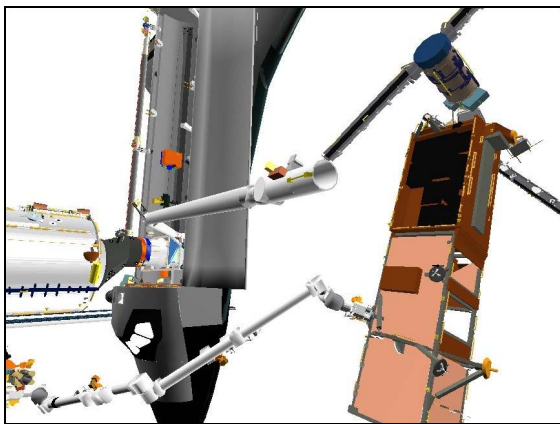
Step 2:  
Drive SY (+) for 0.0 to +95.3



**CCTV A (80,5)**

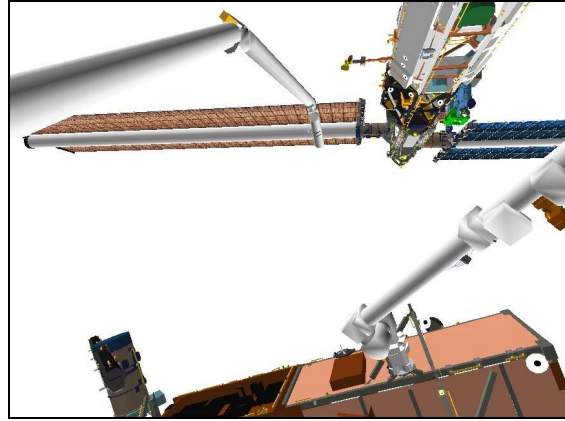


**CCTV B (-20,5)**

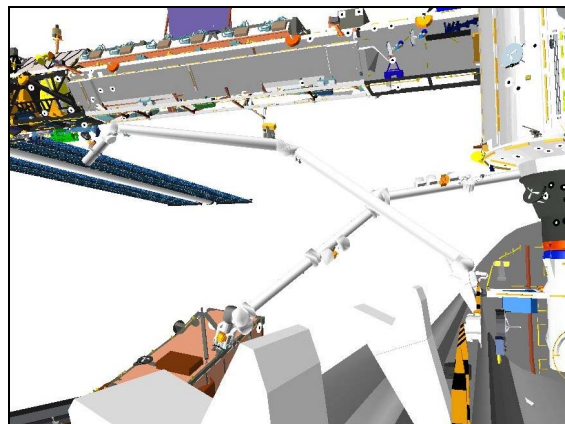


**P1 LOOB (135,10)**

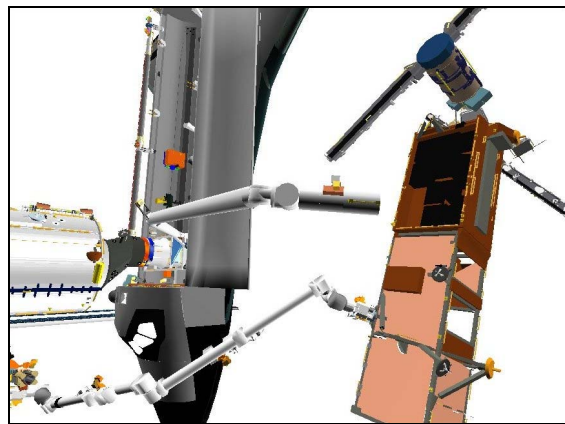
Step 3:  
Drive WP (-) from +5.0 to -48.7



**CCTV A (80,5)**

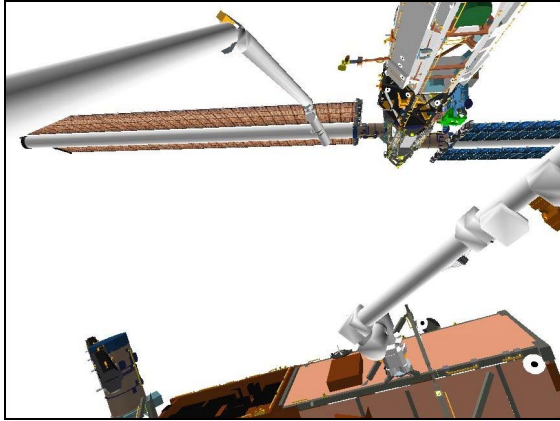


**CCTV B (-20,5)**



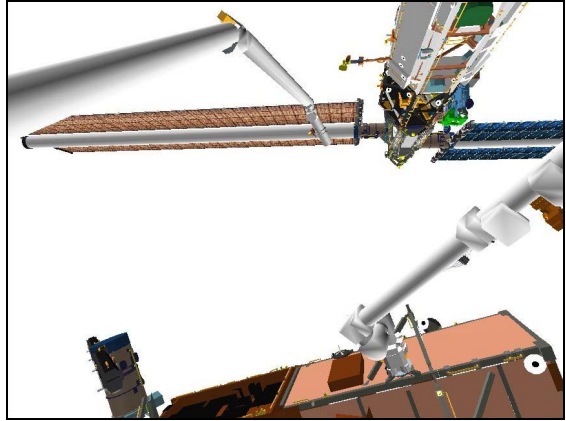
**P1 LOOB (135,10)**

Step 4:  
Drive WY (+) for 0.0 to +16.7

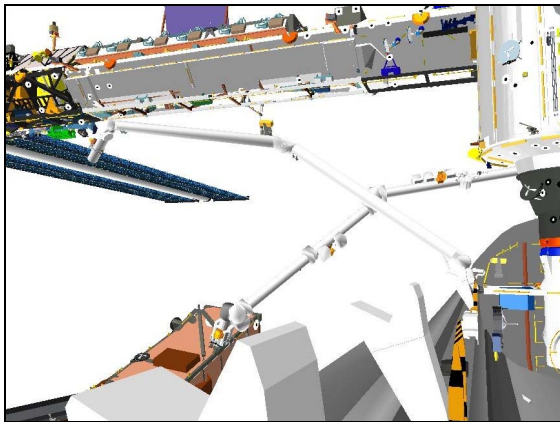


**CCTV A (80,5)**

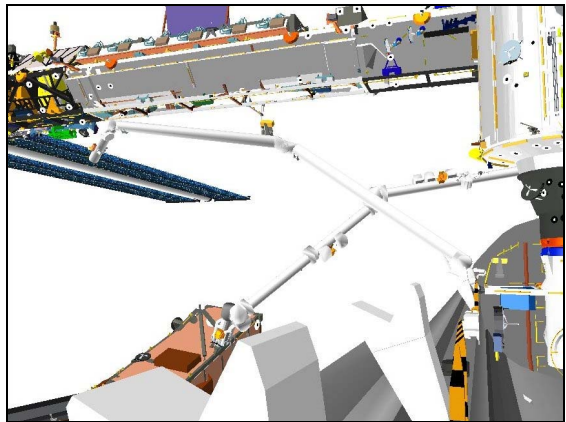
Step 5:  
Drive WR (-) from 0.0 to -71.5



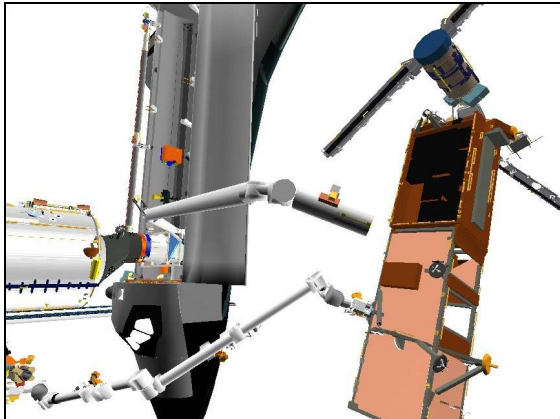
**CCTV A (80,5)**



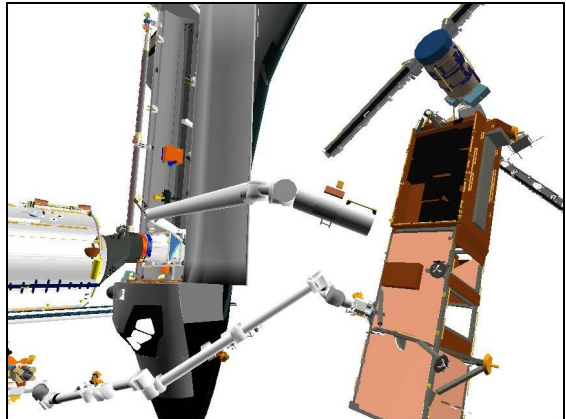
**CCTV B (-20,5)**



**CCTV B (-20,5)**

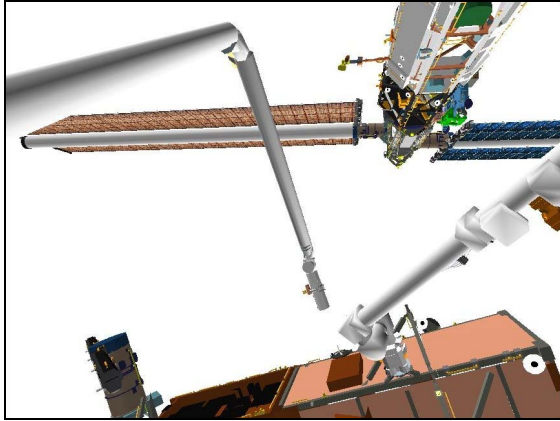


**P1 LOOB (135,10)**

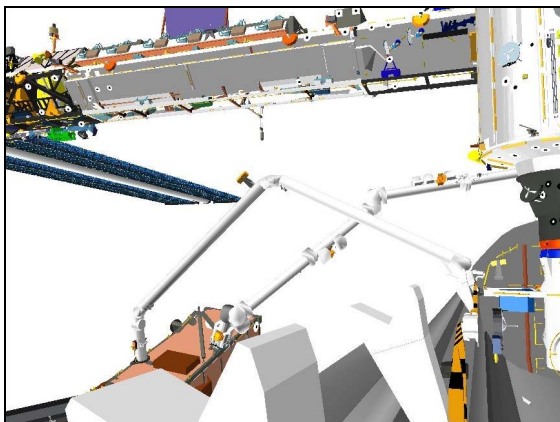


**P1 LOOB (135,10)**

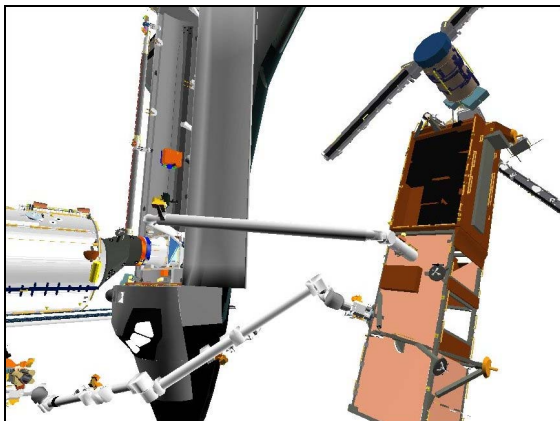
Step 6:  
Drive EP (-) from -25.0 to -70.4



**CCTV A (80,5)**



**CCTV B (-20,5)**



**P1 LOOB (135,10)**

2. ATTITUDE CONTROL CONFIGURATION

PCS

MSS: SSRMS: Thrusters: 

Thruster Controls for MSS Ops
-------------------------------

Verify 'Desat Request:' – Inh

If using shuttle attitude control:

DAP: FREE

3. SJ MNVR TO P6 GRAPPLE

A7U

CCTV – config for grapple

– install PDRS TARGET OVERLAY FOR CTVM

– RMS WRIST, zoom 34.0 HFOV

focus 5 ft

– fully zoom out for SJ pictures

Maintain eyepoint ~18 in when using grapple overlay

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

Notify SSRMS operator going in for P6 Grapple

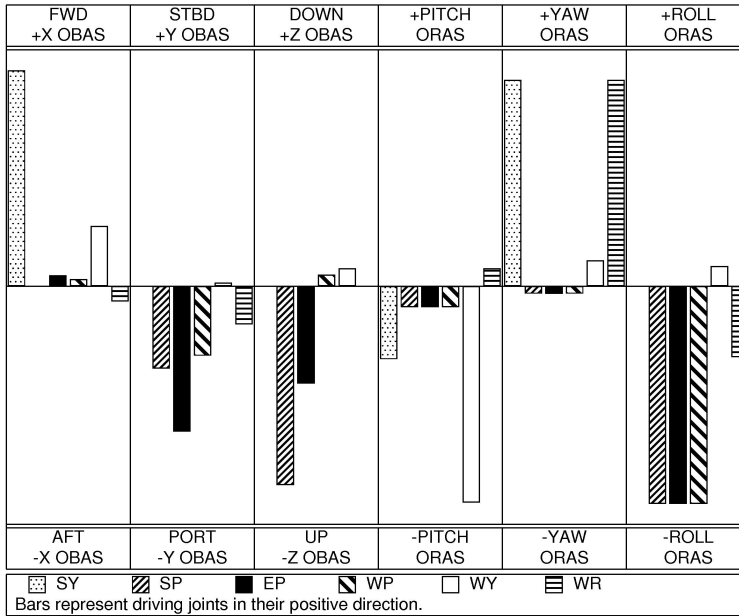
RATE – VERN (RATE MIN tb-ON)

BRAKES – OFF (tb-OFF)

MODE – best available

Drive joints per P6 SJ GRAPPLE WRIST CCTV OVERLAY and diagram until EE within grapple envelope

### P6 SJ GRAPPLE



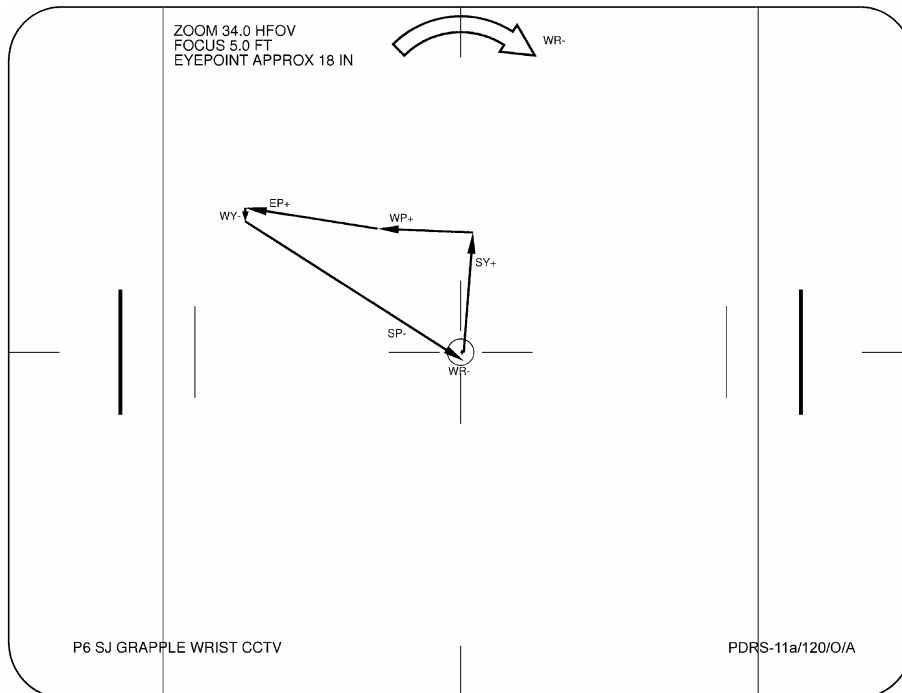
To get:	Drive:
+X (fwd)	+SY
+Y (stbd)	-EP, -WP
+Z (down)	-SP, -EP

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

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

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

$\Delta SY$	$\Delta SP$	$\Delta EP$	$\Delta WP$	$\Delta WY$	$\Delta WR$
+2.1	-9.8	+4.7	+5.6	-1.0	-2.1

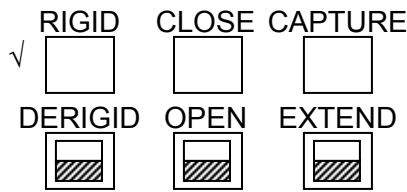




4. P6 GRAPPLE

**CAUTION**  
Monitor EE tb timing to prevent EE motor burnout

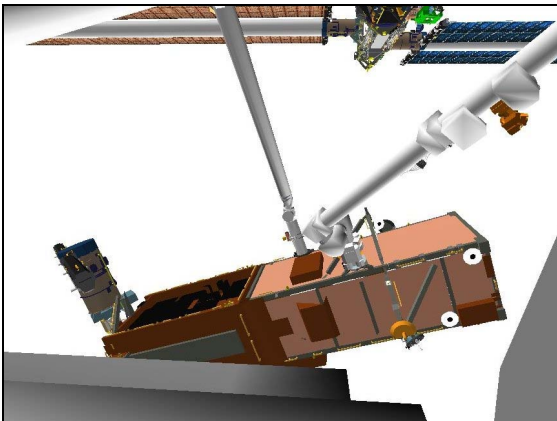
EE MODE – AUTO (if available)  
CAPTURE sw – depress (mom)



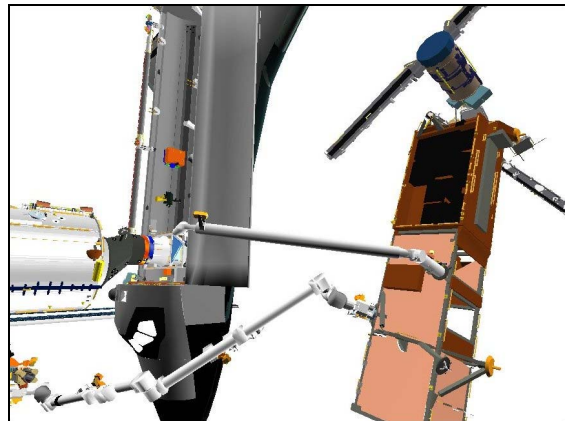
CRITICAL TIMES (28 sec total):  
CAPTURE tb – gray, then  
CLOSE tb – gray, 3 sec max, then  
RIGID tb – gray, 25 sec max

- \* If manual grapple reqd: \*
- \* 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) \*

EE MODE – OFF  
BRAKES – ON (tb-ON)



**CCTV A (85,-10)**



**P1 LOOB (135,10)**

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

Record POS/ATT and Joint Angles:

	X	Y	Z	PITCH	YAW	ROLL	PL ID
							3
	SY	SP	EP	WP	WY	WR	
Expected	+97.4	+45.3	-65.7	-43.1	+15.7	-73.6	

A8U  
MODE – not DIRECT (It off)  
PARAM – PORT TEMP  
JOINT – CRIT TEMP

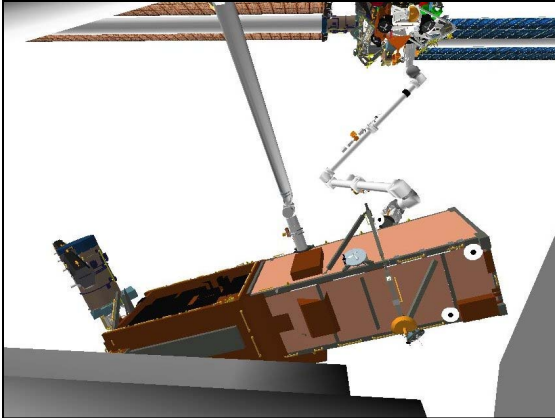
Give SSRMS Operator GO to Ungrapple P6

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

## P6 SJ HANDOFF FROM SRMS TO SSRMS

1. SETUP  
A7U CCTV – RMS WRIST, zoom 34.0 HFOV  
focus 5 ft

MON 1	A (SSRMS Base Elb)
MON 2	EE (B)
DNLK	P1 LOOB



**CCTV A (85,-10)**



**P1 LOOB (135,10)**

2. P6 UNGRAPPLE  
On SSRMS Operator GO to Ungrapple P6 and maneuver to PRE-CRADLE

### NOTE

If SINGLE MODE available, CONTR ERR It 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)

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

RATE – VERN (RATE MIN tb-ON)

BRAKES – OFF (tb-OFF)

MODE – best available

### CAUTION

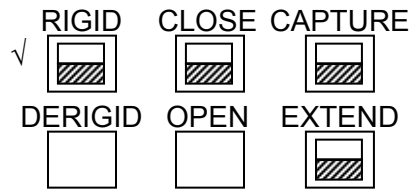
Monitor EE tb timing to prevent EE motor burnout

SM 169 PDRS STATUS

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):

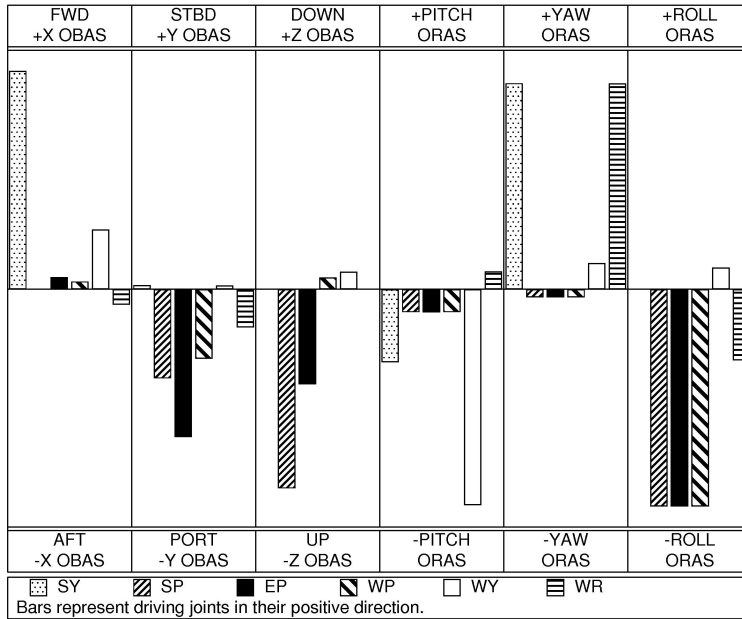
DERIGID tb – gray, 5 sec max, then

OPEN tb – gray, 3 sec max

3. MNVR ARM CLEAR OF P6

Drive joints per P6 SJ UNGRAPPLE WRIST CCTV OVERLAY until EE clear of grapple fixture

### P6 SJ UNGRAPPLE



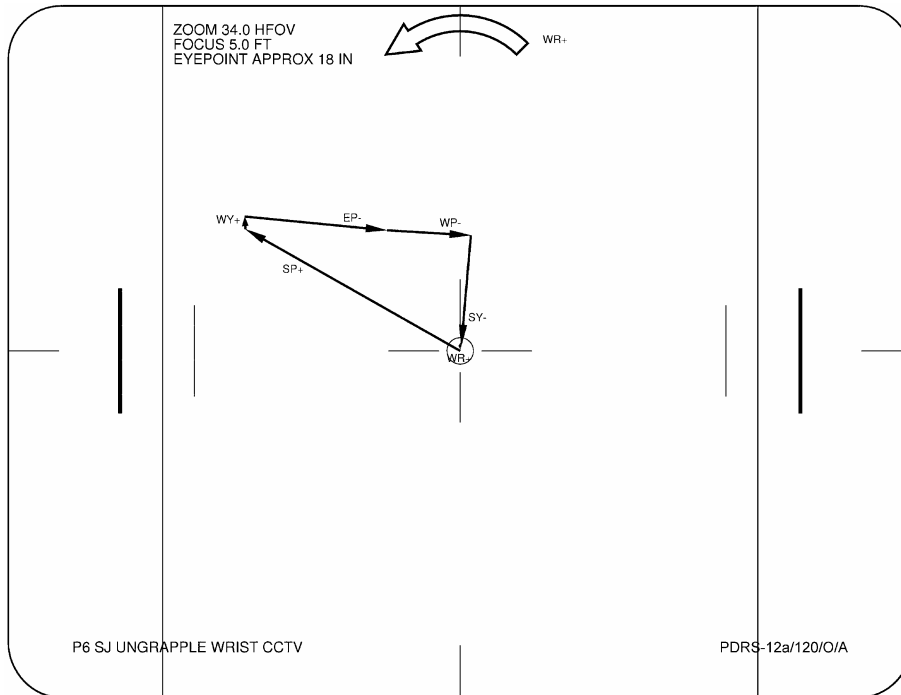
To get:	Drive:
+X (fwd)	+SY
+Y (stbd)	-EP, -WP
+Z (down)	-SP, -EP

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

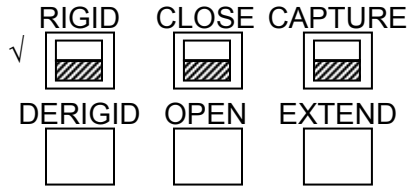
Driving:	Results In:
+SY	+X (fwd), +YAW
+SP	-Z (up), -ROLL
+EP	-Y (port), -ROLL

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

$\Delta SY$	$\Delta SP$	$\Delta EP$	$\Delta WP$	$\Delta WY$	$\Delta WR$
-2.1	+9.8	-4.7	-5.6	+1.0	+2.1

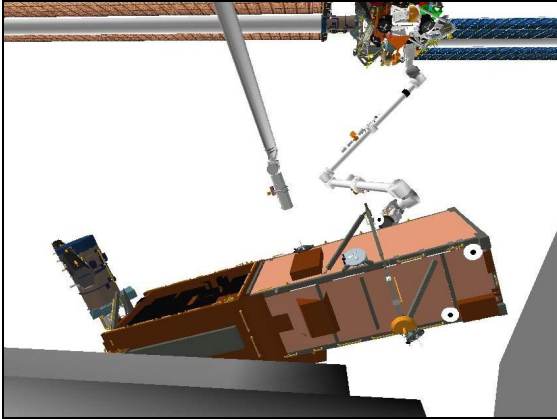


EE MAN CONTR – DERIG (hold until EXTEND tb-gray, 20 sec max)  
MODE – OFF

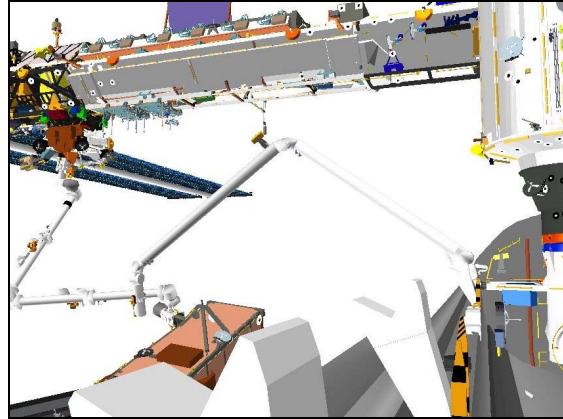


CRITICAL TIMES (20 sec total):  
EXTEND tb – gray, 20 sec max

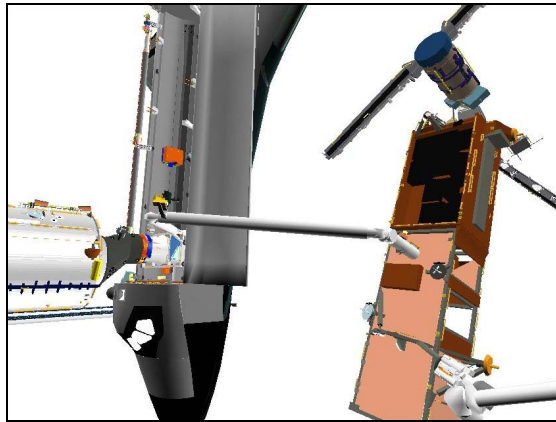
BRAKES – ON (tb-ON)  
✓MODE – not DIRECT



**CCTV A (85,-10)**



**CCTV B (-20,5)**



**P1 LOOB (135,10)**

If using shuttle attitude control and attitude maintenance required:  
Configure DAP per RMS DAPs, then perform RATE DAMPING (ORB OPS FS,  
REBOOST/DAP; DOCKED DAP REFERENCE)

When in attitude,  
DAP: FREE

Notify SSRMS Operator P6 Ungrapple complete

4. SJ MNVR TO PRE-CRADLE  
 RATE – as required (VERN within 10 ft)  
 BRAKES – OFF (tb-OFF)  
 MODE – best available

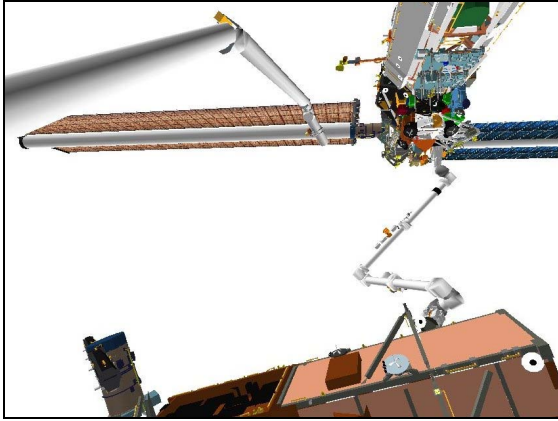
Mnvr to PRE-CRADLE posn (reference pictures as reqd):

	SY	SP	EP	WP	WY	WR	
UNGRPL	+95.3	+55.1	-70.4	-48.7	16.7	-71.5	
BACKOFF			-25.0				
1: EP +				+5.0			
2: WP +					0.0		
3: WY –						0.0	
4: WR +							
5: SY –	0.0						
6: SP –		+25.0					
PRE-CRADLE	0.0	+25.0	-25.0	+5.0	0.0	0.0	
	X	Y	Z	PITCH	YAW	ROLL	PL ID
	-1261	-146	-551	5	2	0	0

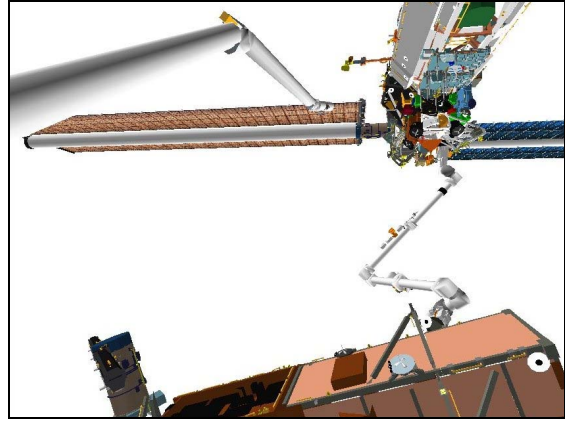
- BRAKES – ON (tb-ON)  
 √MODE – not DIRECT  
 PARAM – PORT TEMP  
 JOINT – CRIT TEMP

Step 1:  
Drive EP (+) from -70.4 to -25.0

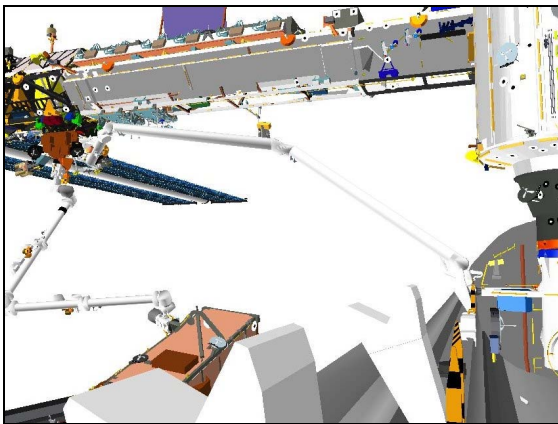
Step 2:  
Drive WP (+) from -48.7 to +5.0



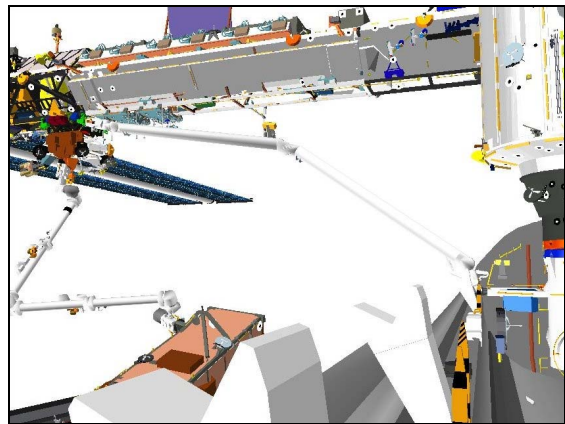
**CCTV A (80,5)**



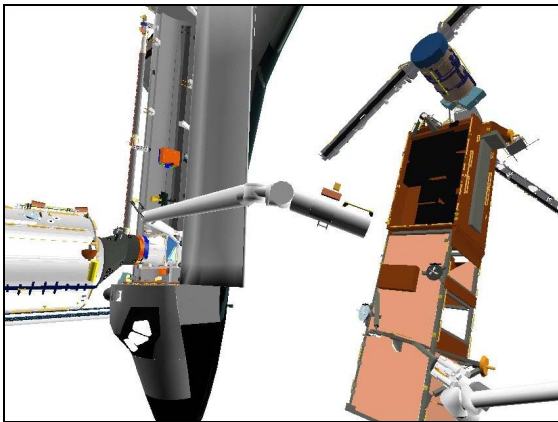
**CCTV A (80,5)**



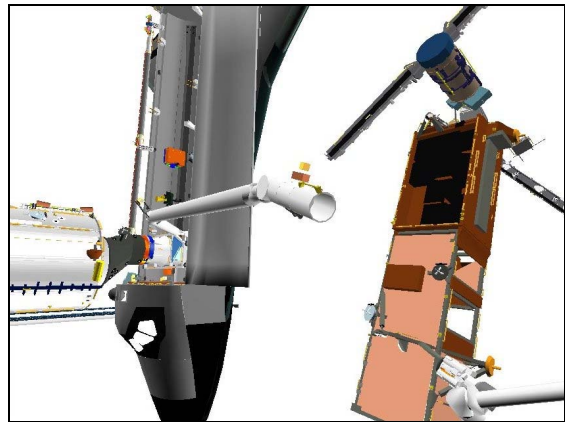
**CCTV B (-20,5)**



**CCTV B (-20,5)**



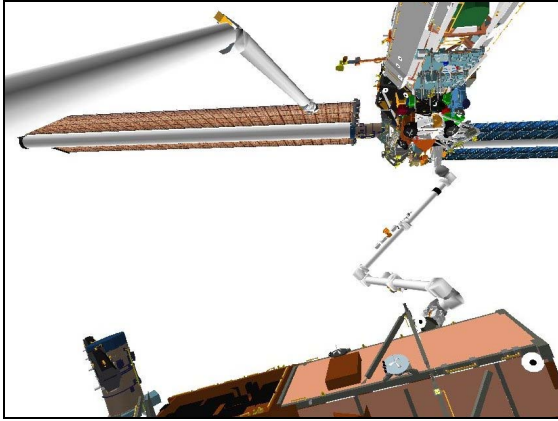
**P1 LOOB (135,10)**



**P1 LOOB (135,10)**

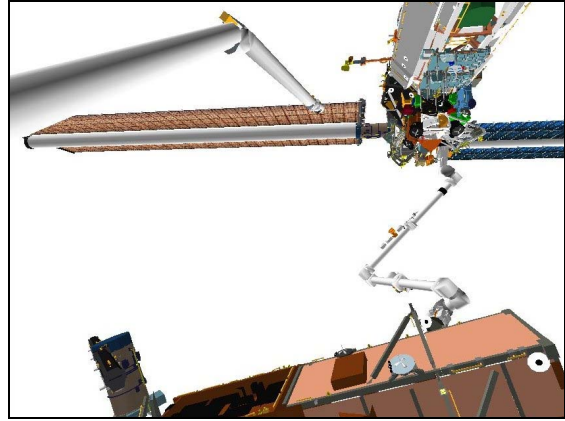


Step 3:  
Drive WY (-) from +16.7 to 0.0

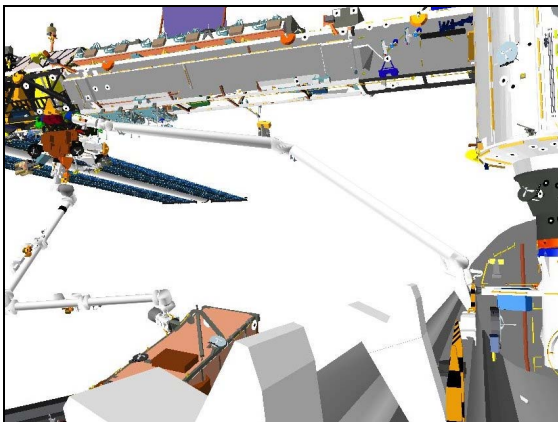


**CCTV A (80,5)**

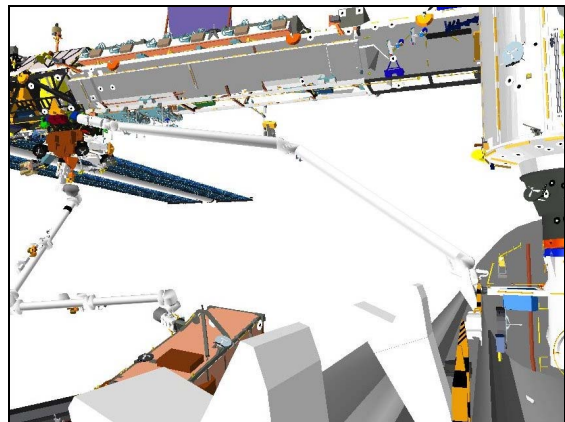
Step 4:  
Drive WR (+) from -71.5 to 0.0



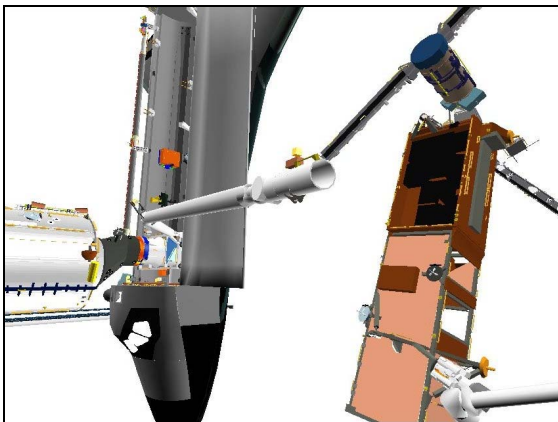
**CCTV A (80,5)**



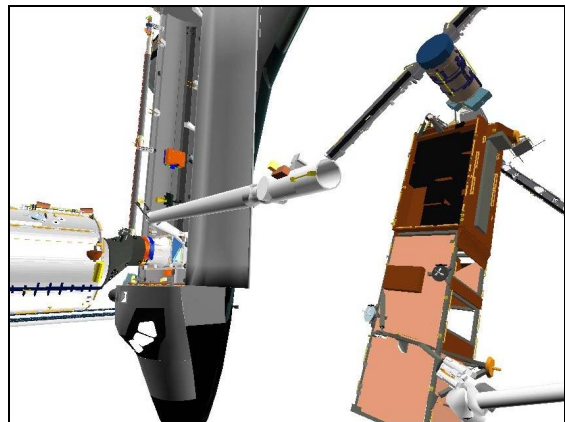
**CCTV B (-20,5)**



**CCTV B (-20,5)**



**P1 LOOB (135,10)**

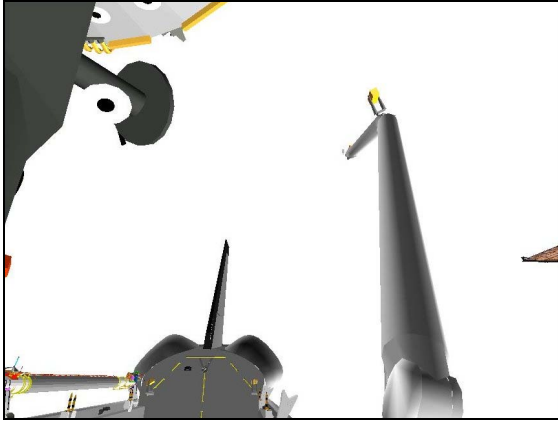


**P1 LOOB (135,10)**

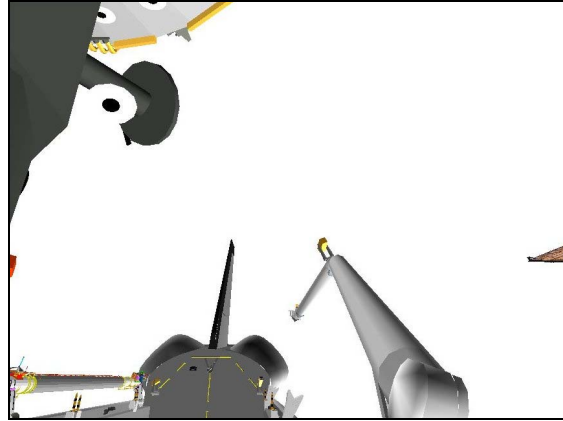


Step 5:  
Drive SY (-) from +95.3 to 0.0

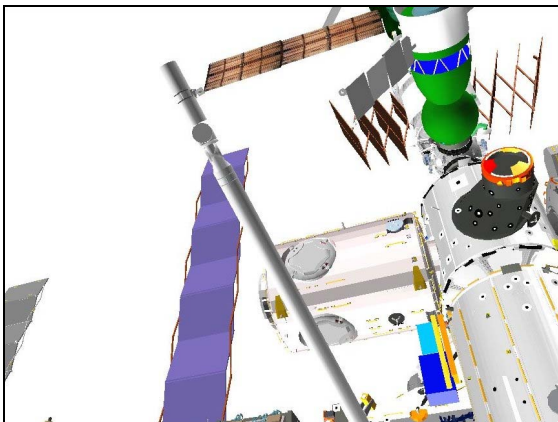
Step 6:  
Drive SP (-) from +55.1 to +25.0



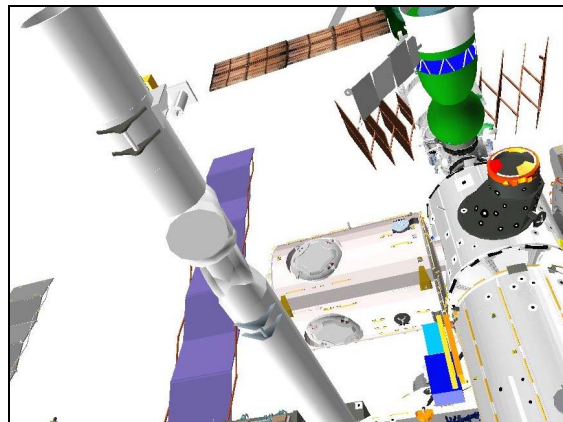
**CCTV A (5,25)**



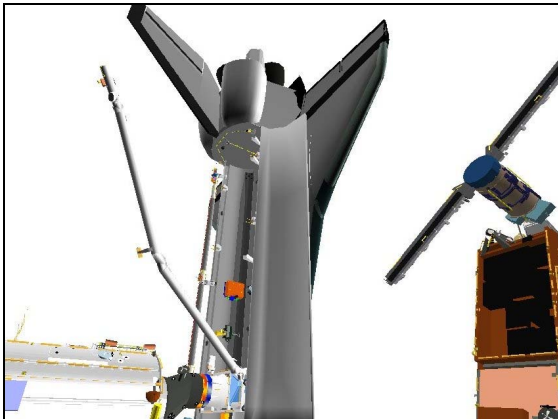
**CCTV A (5,25)**



**CCTV B (-20,45)**



**CCTV B (-20,45)**



**P1 LOOB (125,30)**



**P1 LOOB (125,30)**

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P6 REFERENCE DATA

P6 JOINT ANGLES VS POR COORDINATES..... FS 6-2  
COORDINATE SYSTEM – PL ID 3..... FS 6-3

P6  
REF DATA

## P6 JOINT ANGLES VS POR COORDINATES

### P6 HANDOFF

X	Y	Z	PITCH	YAW	ROLL	PL ID
-661	-530	-229	161	355	5	3
-603	-557	-306	251	5	6	0
SY	SP	EP	WP	WY	WR	
+97.4	+45.3	-65.7	-43.1	+15.7	-73.6	

### PRE-GRAPPLE/UNGRAPPLE

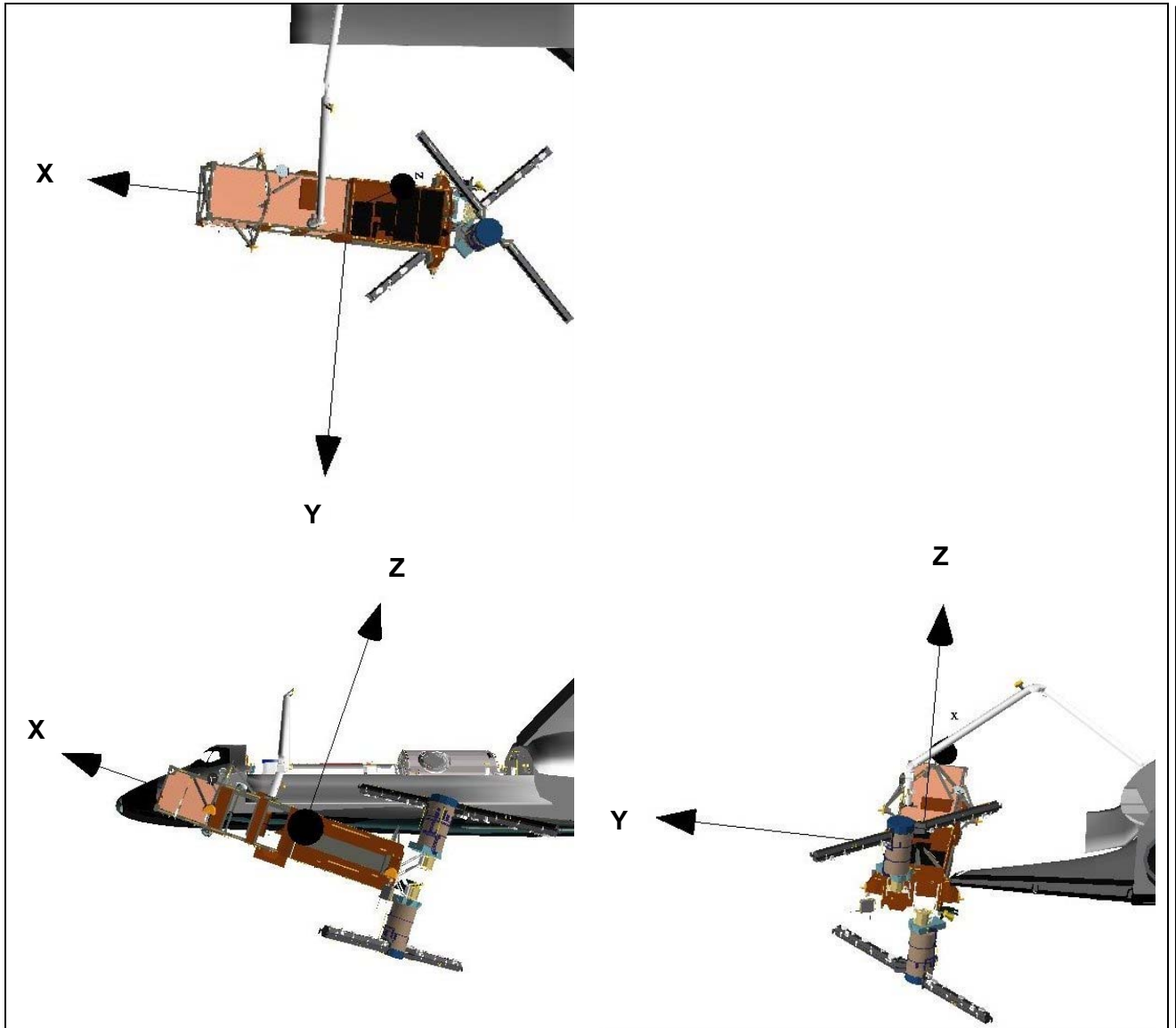
X	Y	Z	PITCH	YAW	ROLL	PL ID
-680	-525	-285	161	355	5	3
-622	-552	-362	251	5	6	0
SY	SP	EP	WP	WY	WR	
+95.3	+55.1	-70.4	-48.7	+16.7	-71.5	

### P6 INSTALL VIEWING

X	Y	Z	PITCH	YAW	ROLL	PL ID
-660	-549	-308	269	30	102	3
-631	-537	-213	111	57	252	0
SY	SP	EP	WP	WY	WR	
+94.8	+16.7	-63.4	+96.4	+8.2	+22.9	

P6  
REF DATA

# P6 COORDINATE SYSTEM – PL ID 3



POR: At P6 axial center, centered between trunions (shown in P6 handoff position)

PURPOSE: P6 Handoff

RATES:	<u>COARSE</u>	<u>VERN</u>
TRANS LIM ft/sec:	0.15	0.10
ROT LIM deg/sec:	0.50	0.16

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EVA 3

EVA 3 SUPPORT ..... FS 7-2

EVA 3

# EVA 3 SUPPORT

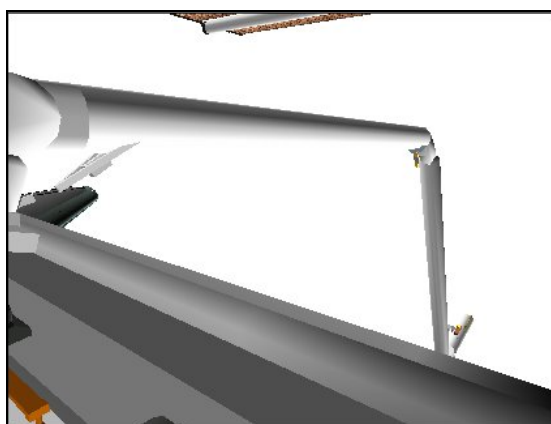
## 1. SETUP

SM 94 PDRS CONTROL

√ PL ID, ITEM 3: 0

√ INIT ID, ITEM 24: 0

MON 1	A (P1LOOB)
MON 2	B (C)
DWNLNK	RMS ELBOW



**CCTV A (55,-15)**



**CCTV B (-20,5)**

√	X	Y	Z	PITCH	YAW	ROLL	PL ID
	-631	-537	-213	111	57	252	0
√	SY	SP	EP	WP	WY	WR	
	+94.8	+16.7	-63.4	+96.4	+8.2	+22.9	

## 2. APFR INSTALL SETUP

RHC

On SSRMS Operator GO for maneuver to APFR INSTALL SETUP position:

RATE – as reqd (VERN within 10 ft)

BRAKES – OFF (tb-OFF)

MODE – SINGLE, ENTER

Mnvr to APFR INSTALL SETUP posn:

P6 VIEW

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

	SY	SP	EP	WP	WY	WR
	+94.8	+16.7	-63.4	+96.4	+8.2	+22.9
		+60.0				
	-15.0					
						+121.2
					-29.7	
				-60.8		
			-88.9			
		+111.0				
	-61.3					

APFR SETUP

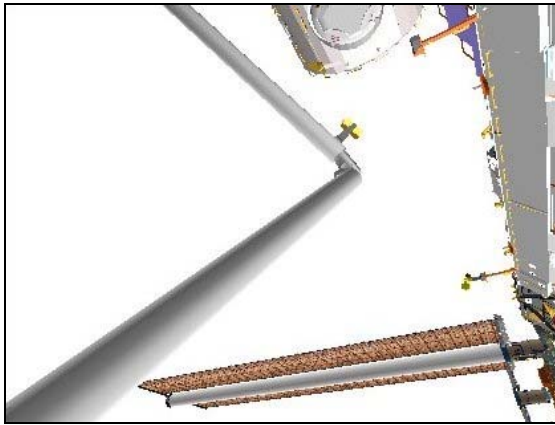
	SY	SP	EP	WP	WY	WR	
	-61.3	+111.0	-88.9	-60.8	-29.7	+121.2	
	X	Y	Z	PITCH	YAW	ROLL	PL ID
	-762	-13	-802	245	285	5	0

BRAKES – ON (tb-ON)

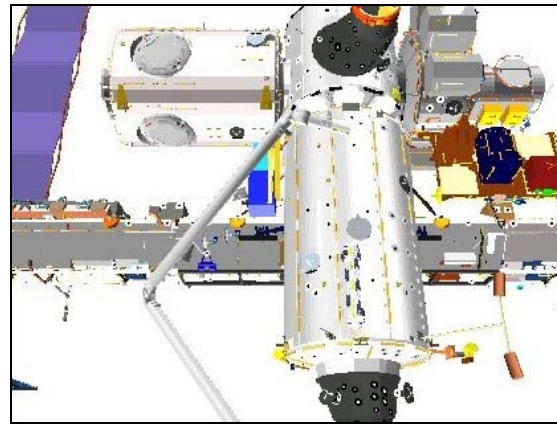
Notify IV/EVA, "SRMS ready for APFR Install"

EVA 3

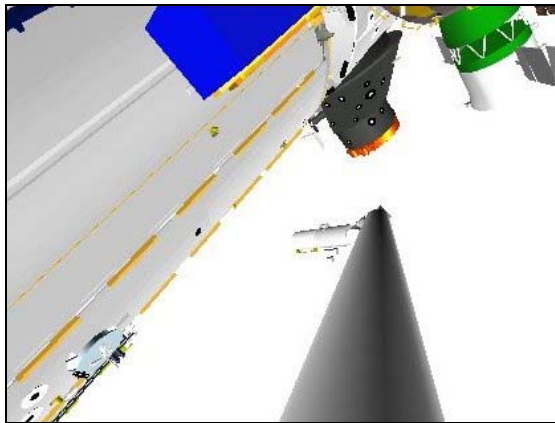




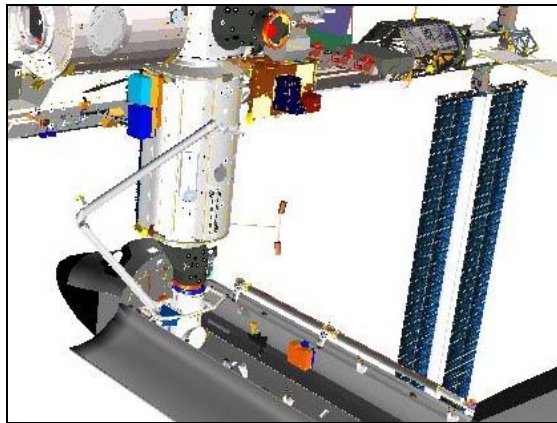
**CCTV A (60,40)**



**CCTV B (0,25)**



**RMS ELBOW (-15,-5)**



**BIRD'S EYE**

3. APFR INSTALL

RHC

On EVA GO for GCA to APFR install:

- RATE – VERN (RATE MIN tb-ON)
- BRAKES – OFF (tb-OFF)
- MODE – ORB UNL, ENTER

GCA per EVA call to APFR INSTALL posn (record actual): (APFR: 4/II/F/6)

	X	Y	Z	PITCH	YAW	ROLL	PL ID
Expected	-738	-13	-802	245	285	5	0
Expected	-695	-31	-894	195	343	178	4
	SY	SP	EP	WP	WY	WR	
Expected	-68.3	+113.3	-90.5	-59.3	-24.2	+126.0	

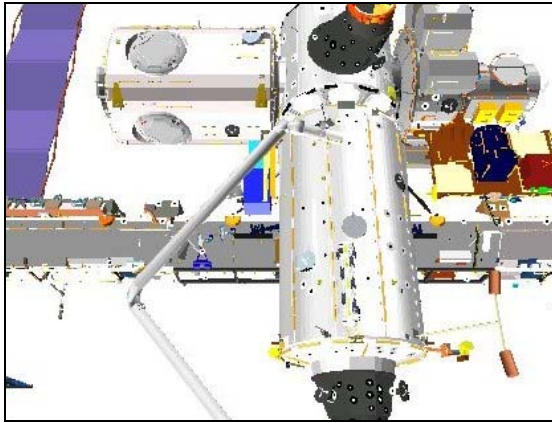
BRAKES – ON (tb-ON)

**SM 94 PDRS CONTROL**

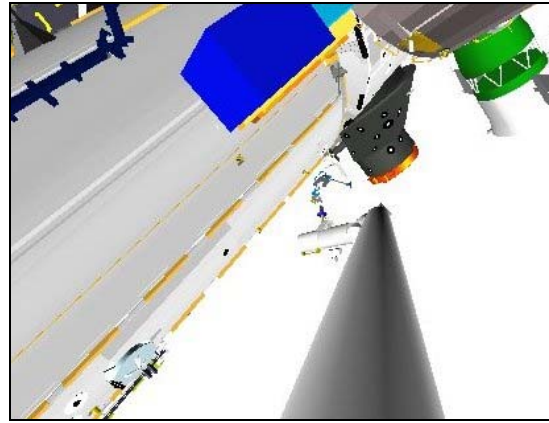
PL ID – ITEM 3 +4 EXEC  
INIT ID – ITEM 24 +4 EXEC

**SM 95 PDRS OVERRIDE**

LOADED RATE, ITEM 14 EXEC (\*)



**CCTV B (0,25)**



**RMS ELBOW (-15,-5)**

**4. APFR INGRESS**

When APFR install complete and on EVA GO for GCA to APFR ingress:

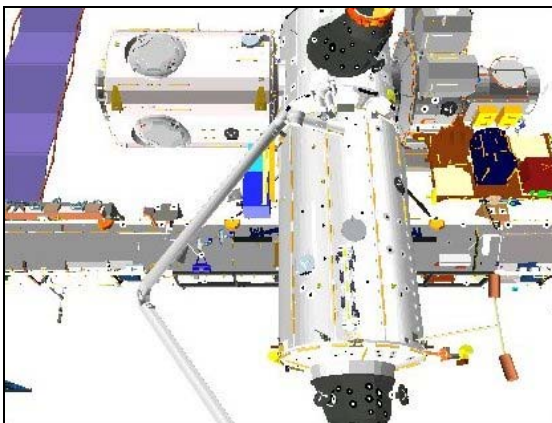
BRAKES – OFF (tb-OFF)

MODE – ORB LD, ENTER

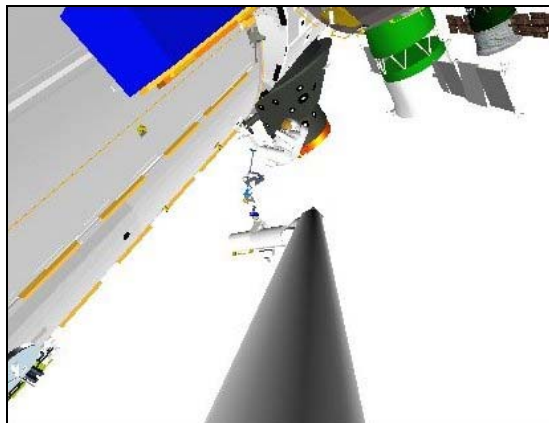
GCA per EVA call to APFR INGRESS posn (record actual): (APFR: 4/II/F/6)

	X	Y	Z	PITCH	YAW	ROLL	PL ID
Expected	-719	-31	-894	195	343	178	4
	SY	SP	EP	WP	WY	WR	
Expected	-61.3	+111.0	-88.9	-60.8	-29.7	+121.2	

BRAKES – ON (tb-ON)



**CCTV B (0,25)**



**RMS ELBOW (-5,-5)**

**5. MBSU RETRIEVAL**

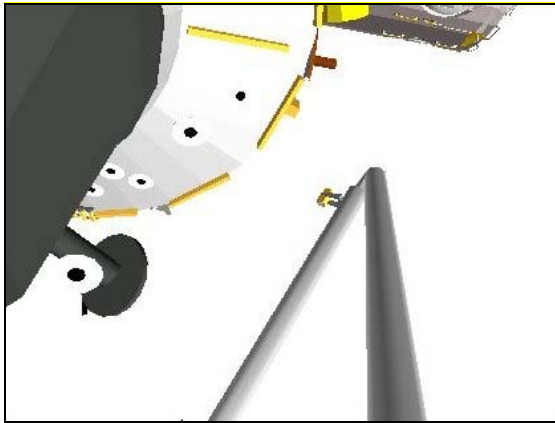
When APFR ingress complete and on EVA GO for mnvr to MBSU retrieval:

BRAKES – OFF (tb-OFF)

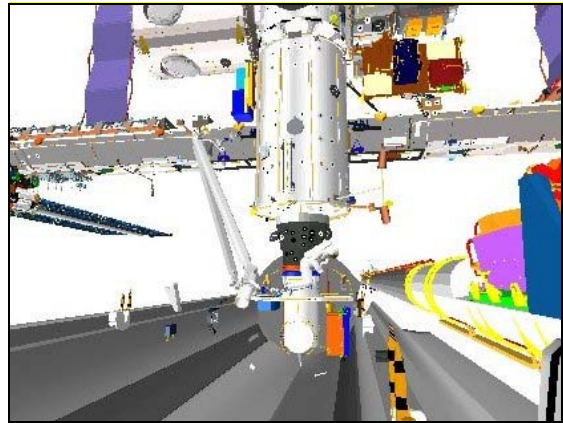
MODE – as desired

Mnvr to MBSU RETRIEVAL SETUP posn (within 2"/1°): (APFR: 4/II/F/6)

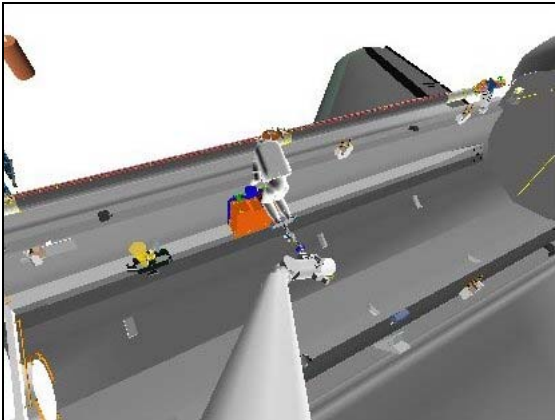
X	Y	Z	PITCH	YAW	ROLL	PL ID
-888	66	-461	266	331	268	4
SY	SP	EP	WP	WY	WR	
-22.9	+76.7	-142.7	+30.2	+27.2	+87.8	



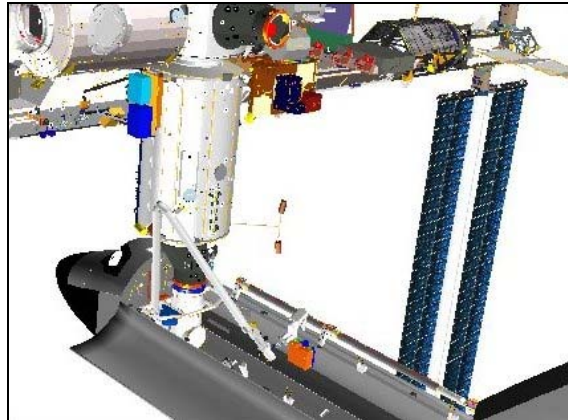
**CCTV A (10,50)**



**CCTV C (-10,10)**



**RMS ELBOW (0,5)**

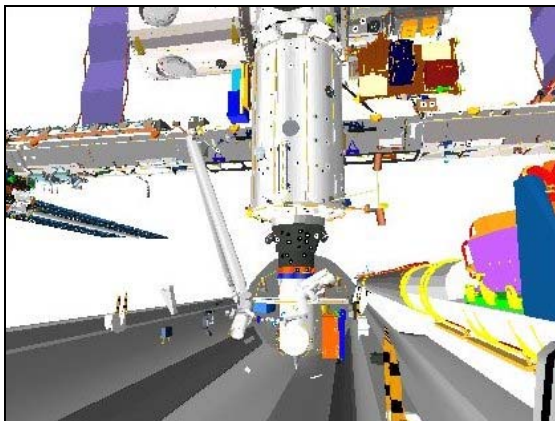


**BIRD'S EYE**

On EVA GO for GCA:

GCA per EVA call to MBSU RETRIEVAL posn: (APFR: 4/II/F/6)

	X	Y	Z	PITCH	YAW	ROLL	PL ID
Expected	-888	66	-433	266	331	268	4
	SY	SP	EP	WP	WY	WR	
Expected	-20.3	+68.2	-142.8	+39.5	+25.1	+86.1	



**CCTV C (-10,10)**



**RMS ELBOW (0,5)**

When MBSU removal complete and on EVA GO for GCA:

GCA per EVA call to MBSU Starboard Sill Clearance

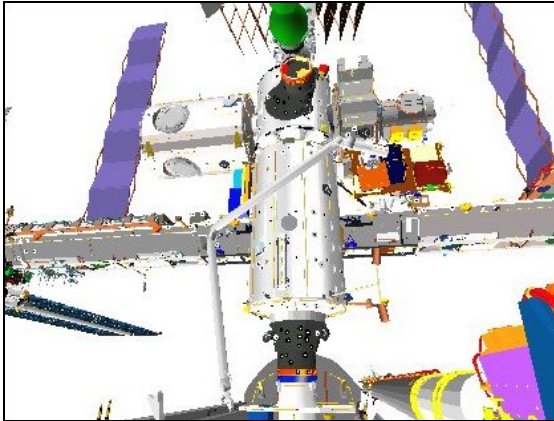


6. MBSU HANDOFF

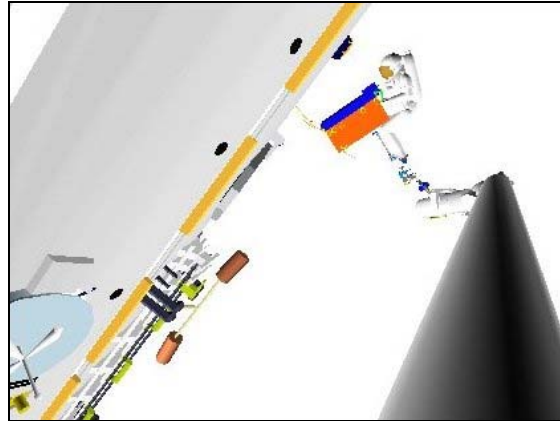
When MBSU clear of starboard sill and on EVA GO for MBSU handoff:

Mnvr to MBSU HANDOFF SETUP posn (within 2"/1°) (APFR: 4/II/F/6)

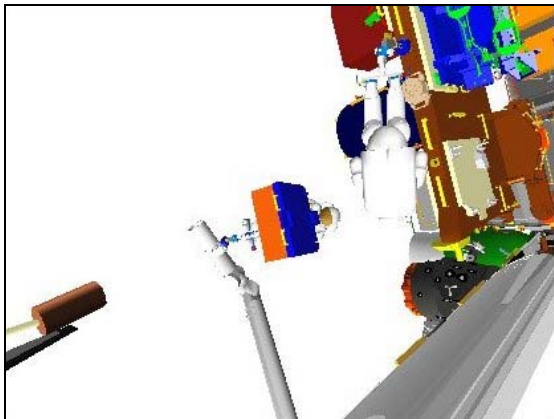
X	Y	Z	PITCH	YAW	ROLL	PL ID
-739	143	-785	238	355	180	4
SY	SP	EP	WP	WY	WR	
-64.1	+78.1	-79.3	-46.0	-17.6	+77.0	



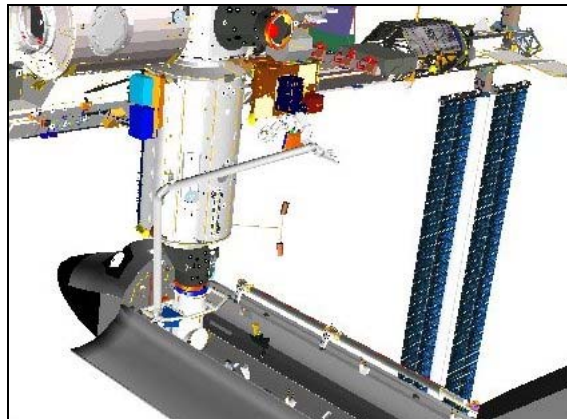
**CCTV C (-10,25)**



**RMS ELBOW (-30,-10)**



**US LAB (45,-15)**

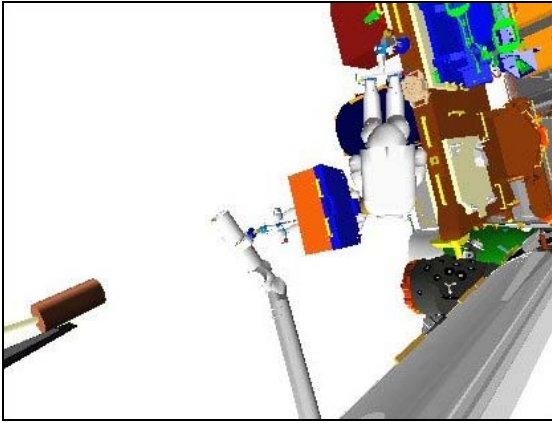


**BIRD'S EYE**

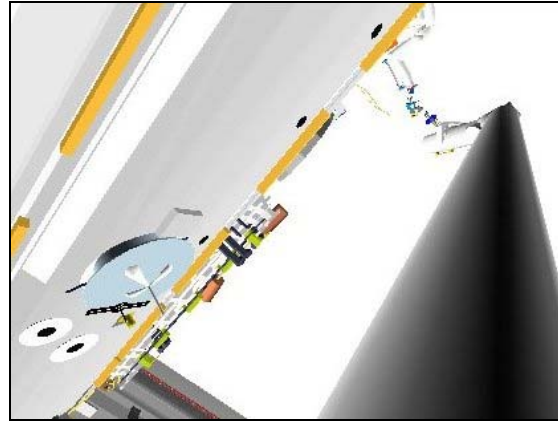
On EVA GO for GCA:

GCA per EVA call to MBSU HANDOFF posn: (APFR: 4/II/F/6)

	X	Y	Z	PITCH	YAW	ROLL	PL ID
Expected	-704	144	-784	238	355	180	4
	SY	SP	EP	WP	WY	WR	
Expected	-69.6	+81.4	-83.3	-44.2	-13.8	+81.1	



**US LAB (45,-15)**



**RMS ELBOW (-30,-20)**

When MBSU handoff complete and on EVA GO for GCA:  
GCA per EVA call to MBSU Install Support Position

**CAUTION**

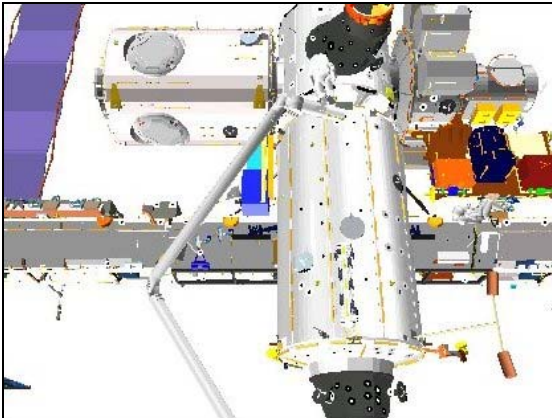
Monitor clearance between SRMS Lower Boom and US Lab. When X = -685 (PL ID 4) clearance between Lower Boom and US Lab will be 24"

**7. APFR EGRESS**

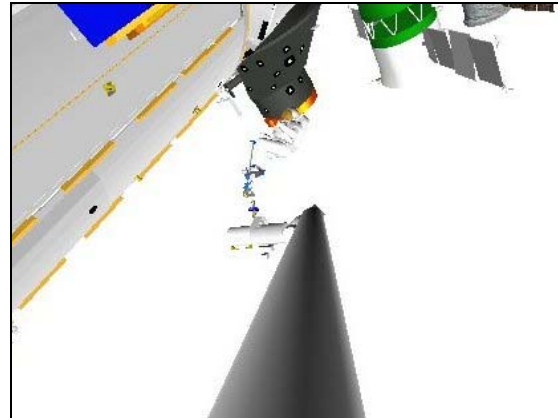
When MBSU install complete and on EVA GO for APFR egress:

Mnvr to APFR EGRESS SETUP posn (within 2"/1°): (APFR: 4/II/F/6)

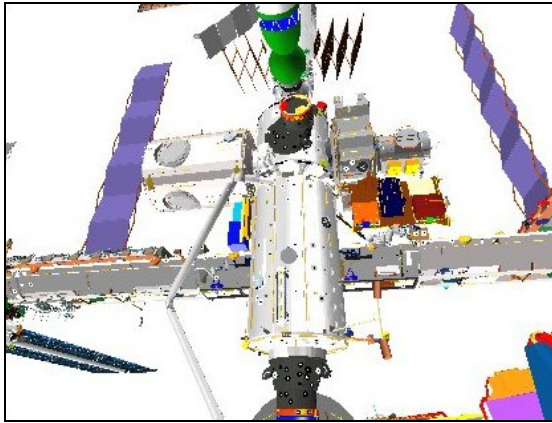
X	Y	Z	PITCH	YAW	ROLL	PL ID
-743	-31	-894	195	343	178	4
SY	SP	EP	WP	WY	WR	
-55.1	+108.2	-86.7	-62.4	-34.3	+116.5	



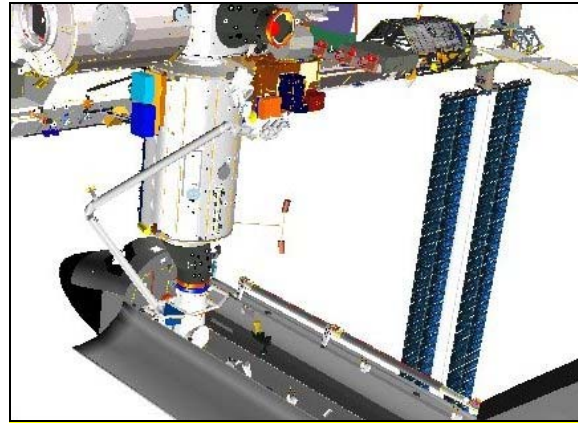
**CCTV B (0,25)**



**RMS ELBOW (-5,-5)**



**CCTV C (-10,30)**



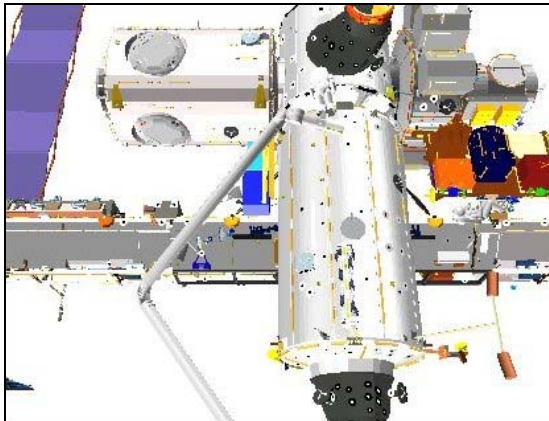
**BIRD'S EYE**

On EVA GO for GCA:

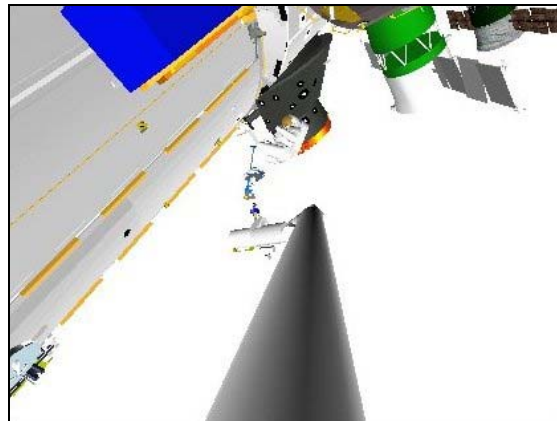
GCA per EVA call to APFR EGRESS posn: (APFR: 4/II/F/6)

	X	Y	Z	PITCH	YAW	ROLL	PL ID
Expected	-719	-31	-894	195	343	178	4
	SY	SP	EP	WP	WY	WR	
Expected	-61.3	+111.0	-88.9	-60.8	-29.7	+121.2	

**BRAKES – ON (tb-ON)**



**CCTV B (0,25)**



**RMS ELBOW (-5,-5)**

**8. APFR REMOVAL**

When APFR Egress complete and on EVA GO for GCA:

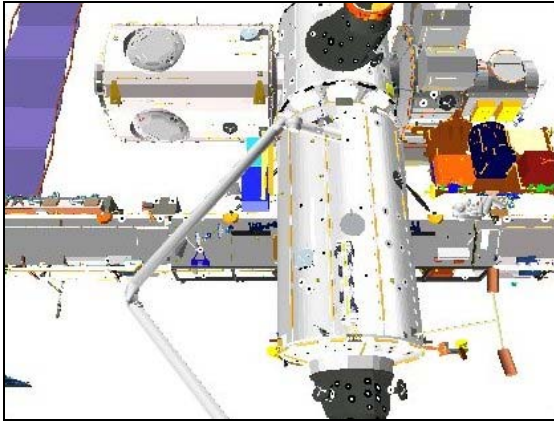
**BRAKES – OFF (tb-OFF)**

**MODE – ORB LD, ENTER**

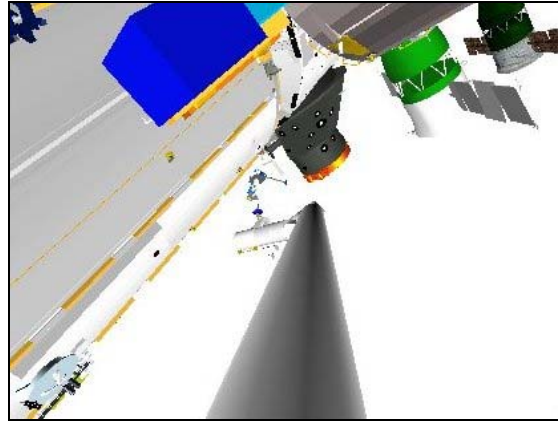
GCA per EVA call to APFR REMOVAL posn: (APFR: 4/II/F/6)

	X	Y	Z	PITCH	YAW	ROLL	PL ID
Expected	-695	-31	-894	195	343	178	4
Expected	-738	-13	-802	245	285	5	0
	SY	SP	EP	WP	WY	WR	
Expected	-68.3	+113.3	-90.5	-59.3	-24.2	+126.0	

**BRAKES – ON (tb-ON)**



**CCTV B (0,25)**



**RMS ELBOW (-15,-5)**

9. MANEUVER TO PRE-CRADLE

When APFR removal complete and on EVA GO for mnvr to PRE-CRADLE:

**SM 94 PDRS CONTROL**

PL ID – ITEM 3 +0 EXEC

INIT ID – ITEM 24 +0 EXEC

**SM 95 PDRS OVERRIDE**

LOADED RATE, ITEM 14 EXEC ()

RHC

RATE – as reqd (VERN within 10 ft)

BRAKES – OFF (tb-OFF)

MODE – as desired

Mnvr to PRE-CRADLE (within 2"/1°):

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

BRAKES – ON (tb-ON)

MODE – not DIRECT (lt off)

PARAM – PORT TEMP

JOINT – CRIT TEMP

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EVA 3 REFERENCE DATA

EVA 3 JOINT ANGLES VS POR COORDINATES ..... FS 8-2  
COORDINATE SYSTEM – PL ID 4 ..... FS 8-4  
– PL ID 5 ..... FS 8-5

EVA 3  
REF DATA

## EVA 3 JOINT ANGLES VS POR COORDINATES

### APFR INSTALL SETUP

X	Y	Z	PITCH	YAW	ROLL	PL ID
-719	-31	-894	195	343	178	4
-734	-29	-842	195	343	178	5
-762	-13	-802	245	285	5	0
SY	SP	EP	WP	WY	WR	
-61.3	+111.0	-88.9	-60.8	-29.7	+121.2	

### APFR INSTALL

X	Y	Z	PITCH	YAW	ROLL	PL ID
-695	-31	-894	195	343	178	4
-710	-29	-842	195	343	178	5
-738	-13	-802	245	285	5	0
SY	SP	EP	WP	WY	WR	
-68.3	+113.3	-90.5	-59.3	-24.2	+126.0	

### APFR INGRESS

X	Y	Z	PITCH	YAW	ROLL	PL ID
-719	-31	-894	195	343	178	4
-734	-29	-842	195	343	178	5
-762	-13	-802	245	285	5	0
SY	SP	EP	WP	WY	WR	
-61.3	+111.0	-88.9	-60.8	-29.7	+121.2	

### MBSU RETRIEVE SETUP

X	Y	Z	PITCH	YAW	ROLL	PL ID
-888	+66	-461	266	331	268	4
-888	+19	-435	266	331	268	5
-908	-27	-422	328	358	72	0
SY	SP	EP	WP	WY	WR	
-22.9	+76.7	-142.7	+30.2	+27.2	+87.8	

### MBSU RETRIEVE

X	Y	Z	PITCH	YAW	ROLL	PL ID
-888	+66	-433	266	331	268	4
-888	+19	-407	266	331	268	5
-908	-27	-394	327	358	72	0
SY	SP	EP	WP	WY	WR	
-20.3	+68.2	-142.8	+39.5	+25.1	+86.1	

### MBSU HANDOFF SETUP

X	Y	Z	PITCH	YAW	ROLL	PL ID
-739	143	-785	238	355	180	4
-785	143	-757	238	355	180	5
-832	161	-744	272	295	348	0
SY	SP	EP	WP	WY	WR	
-64.1	+78.1	-79.3	-46.0	-17.6	+77.0	

EVA 3  
REF DATA

MBSU HANDOFF

X	Y	Z	PITCH	YAW	ROLL	PL ID
-704	144	-784	238	355	180	4
-750	144	-756	238	355	180	5
-797	161	-744	272	295	348	0
SY	SP	EP	WP	WY	WR	
-69.6	+81.4	-83.3	-44.2	-13.8	+81.1	

APFR EGRESS SETUP

X	Y	Z	PITCH	YAW	ROLL	PL ID
-743	-31	-894	195	343	178	4
-758	-29	-842	195	343	178	5
-787	-13	-803	246	285	6	0
SY	SP	EP	WP	WY	WR	
-55.1	+108.2	-86.7	-62.4	-34.3	+116.5	

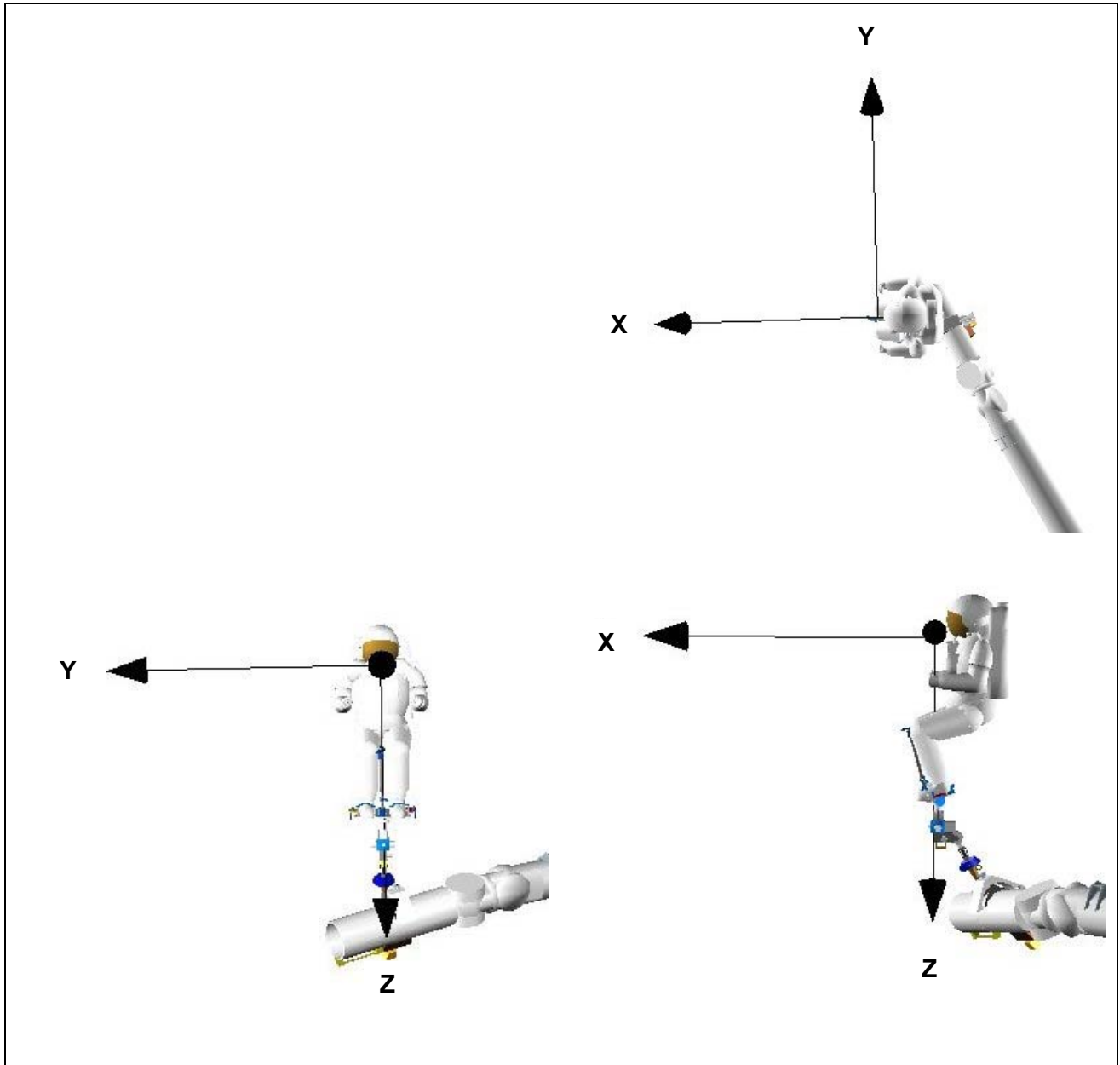
APFR EGRESS

X	Y	Z	PITCH	YAW	ROLL	PL ID
-719	-31	-894	195	343	178	4
-734	-29	-842	195	343	178	5
-762	-13	-802	245	285	5	0
SY	SP	EP	WP	WY	WR	
-61.3	+111.0	-88.9	-60.8	-29.7	+121.2	

APFR REMOVAL

X	Y	Z	PITCH	YAW	ROLL	PL ID
-695	-31	-894	195	343	178	4
-710	-29	-842	195	343	178	5
-738	-13	-802	245	285	5	0
SY	SP	EP	WP	WY	WR	
-68.3	+113.3	-90.5	-59.3	-24.2	+126.0	

**EVA 3 COORDINATE SYSTEM – PL ID 4**

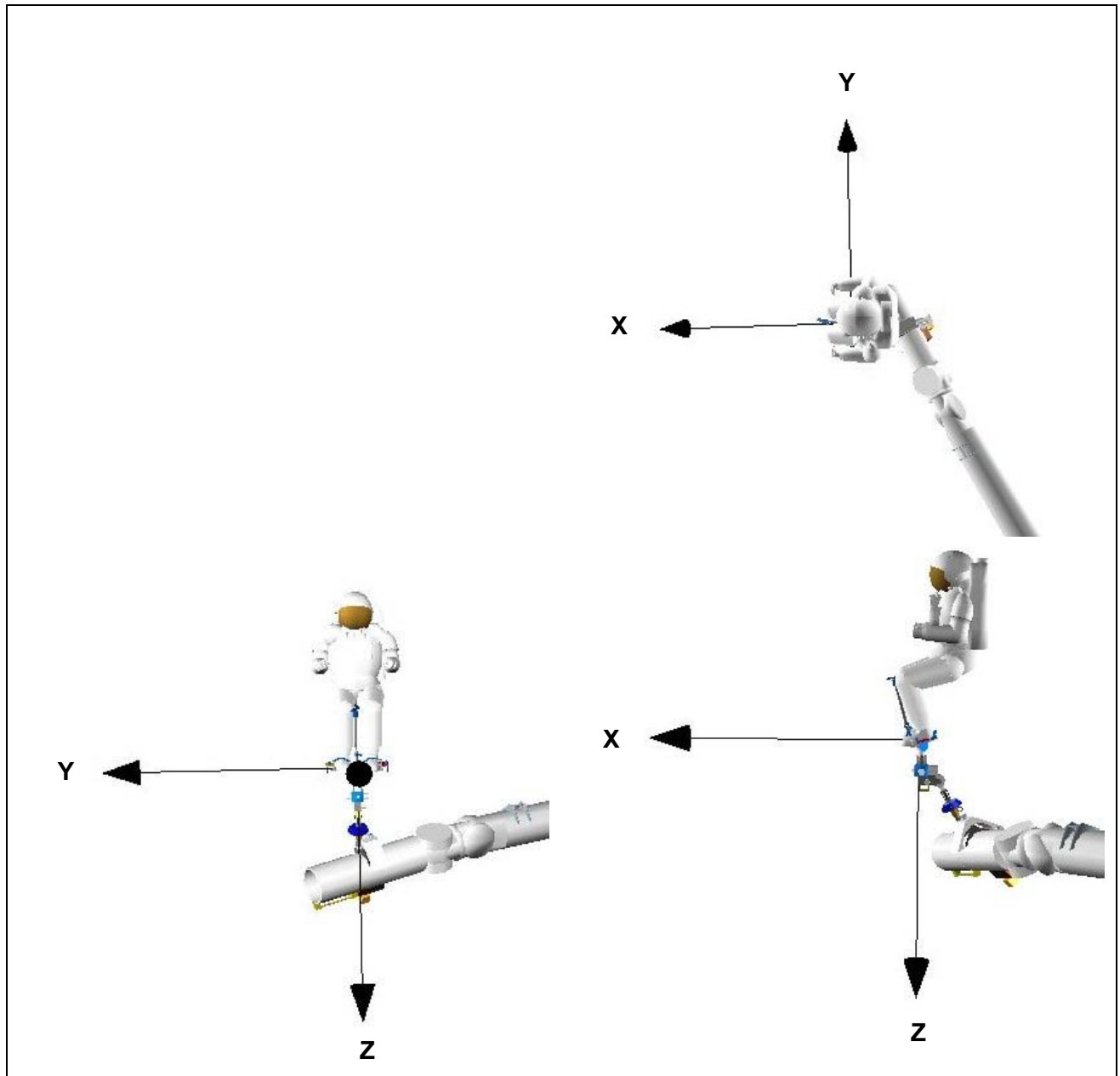


POR: At EVA's chest (EVA in APFR set at 4/II/F/6)

PURPOSE: EVA Operations

RATES:	<u>COARSE</u>	<u>VERN</u>
TRANS LIM ft/sec:	0.77	0.25
ROT LIM deg/sec:	2.79	0.92

# EVA 3 COORDINATE SYSTEM – PL ID 5



POR: At EVA's feet (EVA in APFR set at 4/III/F/6)

PURPOSE: EVA Operations

RATES:	<u>COARSE</u>	<u>VERN</u>
TRANS LIM ft/sec:	0.77	0.25
ROT LIM deg/sec:	2.79	0.92

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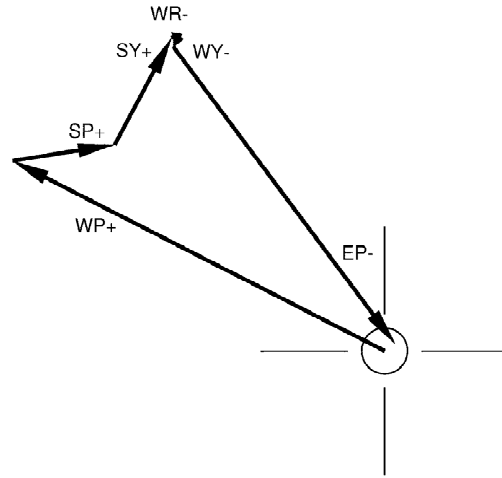
CUE CARD CONFIGURATION

CUE CARD  
CONFIGURATION

# CUE CARD CONFIGURATION

Fabricate as transparency

ZOOM 34.0 HFOV  
FOCUS 5.0 FT  
EYEPOINT APPROX 18 IN



OBSS SJ GRAPPLE AT HANDOFF OVERLAY WRIST CCTV

PDRS-9a/120/O/B

(reduced copy)

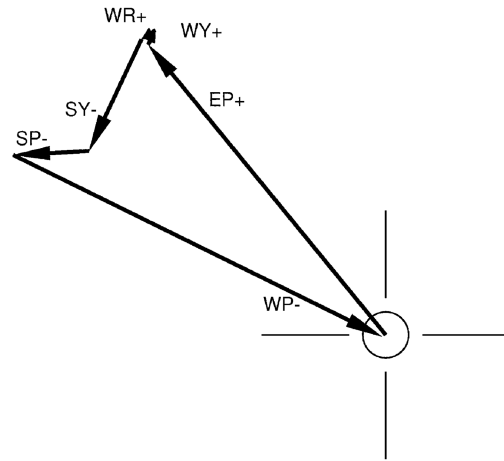
FS CC 9-2

PDRS/120/FIN



Fabricate as transparency

ZOOM 34.0 HFOV  
FOCUS 5.0 FT  
EYEPOINT APPROX 18 IN



OBSS SJ UNGRAPPLE AT HANDOFF OVERLAY WRIST CCTV

PDRS-10a/120/O/B

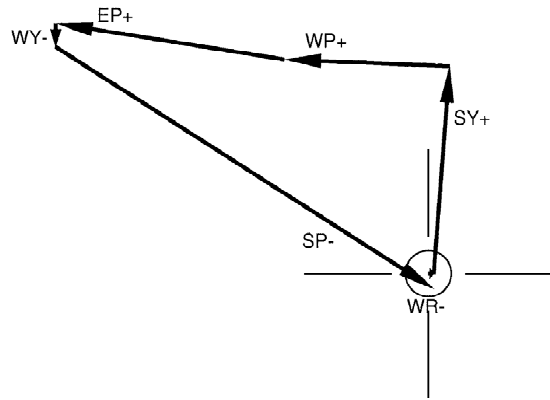
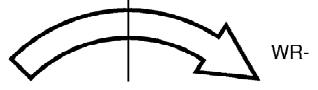
(reduced copy)

FS CC 9-3

PDRS/120/FIN

Fabricate as transparency

ZOOM 34.0 HFOV  
FOCUS 5.0 FT  
EYEPOINT APPROX 18 IN



P6 SJ GRAPPLE WRIST CCTV

PDRS-11a/120/O/A

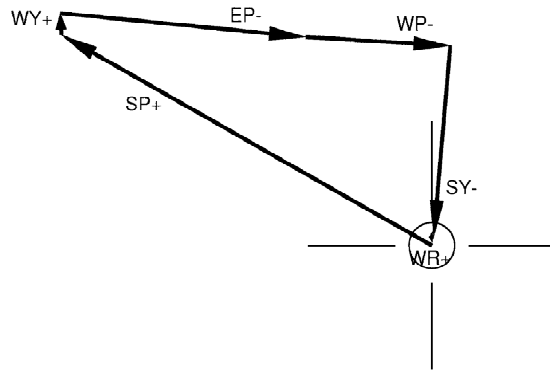
(reduced copy)

FS CC 9-4

PDRS/120/FIN

Fabricate as transparency

ZOOM 34.0 HFOV  
FOCUS 5.0 FT  
EYEPOINT APPROX 18 IN



P6 SJ UNGRAPPLE WRIST CCTV

PDRS-12a/120/O/A

(reduced copy)

FS CC 9-5

PDRS/120/FIN

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**PDRS OPS C/L**

**STS  
120**