

PDRS Operations Checklist

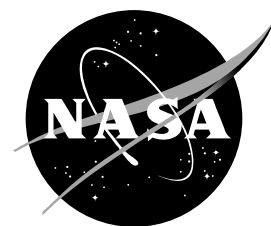
STS-124 Flight Supplement

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

**Final, Rev A
May 12, 2008**

National Aeronautics and
Space Administration

Lyndon B. Johnson Space Center
Houston, Texas



MISSION OPERATIONS DIRECTORATE

**PDRS OPERATIONS CHECKLIST
STS-124 FLIGHT SUPPLEMENT**

FINAL, REVISION A
May 12, 2008

PREPARED BY:

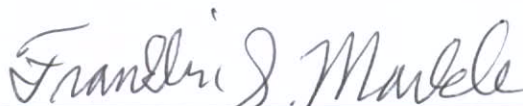


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Incorporates the following:	
482#:	PDRS FS-0045 (R) PDRS FS-0062 (R) PDRS FS-0063 PDRS FS-0064A PDRS FS-0065 PDRS FS-0066 PDRS FS-0067

(R) – Remainder

AREAS OF TECHNICAL RESPONSIBILITY

Book Manager

DX22/M. Hart

281-483-2584

PDRS OPERATIONS CHECKLIST
 STS-124 FLIGHT SUPPLEMENT

LIST OF EFFECTIVE PAGES

FINAL 03/21/08
 REV A 05/12/08

Sign Off	*	124/FIN A	FS 3-10	124/FIN A
FS ii	*	124/FIN A	FS 3-11	124/FIN A
FS iii	*	124/FIN A	FS 3-12	124/FIN A
FS iv	*	124/FIN A	FS 3-13	124/FIN A
FS v		124/FIN A	FS 3-14	124/FIN A
FS vi		124/FIN A	FS 3-15	124/FIN A
FS 1-1		124/FIN A	FS 3-16	124/FIN A
FS 1-2		124/FIN A	FS 3-17	124/FIN A
FS 1-3		124/FIN A	FS 3-18	124/FIN A
FS 1-4		124/FIN A	FS 4-1	124/FIN A
FS 1-5		124/FIN A	FS 4-2	124/FIN A
FS 1-6		124/FIN A	FS 4-3	124/FIN A
FS 1-7		124/FIN A	FS 4-4	124/FIN A
FS 1-8		124/FIN A	FS 4-5	124/FIN A
FS 1-9		124/FIN A	FS 4-6	124/FIN A
FS 1-10		124/FIN A	FS 4-7	124/FIN A
FS 1-11		124/FIN A	FS 4-8	124/FIN A
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FS 1-13		124/FIN A	FS 4-10	124/FIN A
FS 1-14		124/FIN A	FS 4-11	124/FIN A
FS 1-15		124/FIN A	FS 4-12	124/FIN A
FS 1-16		124/FIN A	FS 4-13	124/FIN A
FS 1-17		124/FIN A	FS 4-14	124/FIN A
FS 1-18		124/FIN A	FS 4-15	124/FIN A
FS 2-1		124/FIN A	FS 4-16	124/FIN A
FS 2-2		124/FIN A	FS 4-17	124/FIN A
FS 2-3		124/FIN A	FS 4-18	124/FIN A
FS 2-4		124/FIN A	FS 5-1	124/FIN A
FS 2-5		124/FIN A	FS 5-2	124/FIN A
FS 2-6		124/FIN A	FS 5-3	124/FIN A
FS 2-7		124/FIN A	FS 5-4	124/FIN A
FS 2-8		124/FIN A	FS 5-5	124/FIN A
FS 2-9		124/FIN A	FS 5-6	124/FIN A
FS 2-10		124/FIN A	FS 6-1	* 124/FIN A
FS 2-11		124/FIN A	FS CC 6-2	* 124/FIN A
FS 2-12		124/FIN A		
FS 3-1		124/FIN A		
FS 3-2		124/FIN A		
FS 3-3		124/FIN A		
FS 3-4		124/FIN A		
FS 3-5		124/FIN A		
FS 3-6		124/FIN A		
FS 3-7		124/FIN A		
FS 3-8		124/FIN A		
FS 3-9		124/FIN A		

* – Omit from flight book

PDRS CUE CARDS

<u>Title</u>	<u>Ref. Page</u>	<u>Card No.</u>
OBSS GRAPPLE AT HANDOFF WRIST CCTV OVERLAY	FS CC 6-2	PDRS-9a/124/O/B I

<u>CONTENTS</u>	<u>PAGE</u>
<u>UNDOCKED OPS</u>	FS 1-1
STBD MRL RELEASE	FS 1-2
RMS EE RCC WING SURVEY	FS 1-3
OBSS MNVR TO FLAT FIELD.....	FS 1-15
<u>EVA 1</u>	FS 2-1
ELBOW CAMERA STRAP REMOVAL	FS 2-2
OBSS GRAPPLE AT HANDOFF	FS 2-6
JPM INSTALL VIEWING.....	FS 2-10
<u>VIEWING SUPPORT</u>	FS 3-1
OBSS SENSOR CHECKOUT	FS 3-2
RETURN TO JPM INSTALL VIEWING	FS 3-8
JLP RELOCATE VIEWING	FS 3-10
EVA 3 VIEWING SUPPORT	FS 3-12
JEM RMS DEPLOY VIEWING	FS 3-14
OBSS UNDOCK CONFIG.....	FS 3-16
<u>CONTINGENCY</u>	FS 4-1
OBSS SJ HANDOFF TO SRMS	FS 4-2
JPM INSTALL VIEWING TO CONTINGENCY UNDOCK.....	FS 4-10
EVA 2 VIEWING TO CONTINGENCY UNDOCK	FS 4-12
JLP RELOCATE VIEWING TO UNDOCK.....	FS 4-14
EVA 3 VIEWING TO UNDOCK.....	FS 4-16
<u>REFERENCE DATA</u>	FS 5-1
JOINT ANGLES VS POR COORDINATES	FS 5-2
PL ID 5 – END EFFECTOR COORDINATE SYSTEM.....	FS 5-4
OBSS HANDOFF CAMERA MATRIX.....	FS 5-5
<u>CUE CARD CONFIGURATION</u>	FS 6-1

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UNDOCKED OPS

STBD MRL RELEASE	FS 1-2
RMS EE RCC WING SURVEY	FS 1-3
OBSS MNVR TO FLAT FIELD	FS 1-15

UNDOCKED OPS

STBD MRL RELEASE

WARNING
 Perform only when SRMS cradled
 and latched and OBSS not berthed

NOTE
 Stbd MRLs assumed latched

R13L 1. CONFIGURE POWER
 PL BAY MECH PWR SYS (two) – ON

2. STBD MRL RELEASE
SM 94 PDRS CONTROL
 RMS STBD – ITEM 2 EXEC (*)

√STBD AFT, MID, FWD REL (six) = 0

- * If any REL MSW shows '1', ignore tb and *
- * drive MRL for single motor time (18 sec) *

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

If motor drive time > 8 sec, √MCC

SM 94 PDRS CONTROL
 RMS PORT – ITEM 1 EXEC (*)

R13L 3. RECONFIGURE POWER
 PL BAY MECH PWR SYS (two) – OFF

RMS EE RCC WING SURVEY

WARNING
Port and stbd PLBD radiators must be stowed

NOTE

Daylight is required while survey data is being taken

1. SETUP

Mon 1	A
DwnInk	D
Mon 2	C
DTV	EE

SM 94 PDRS CONTROL

- √ PL ID – ITEM 3 +0 EXEC
- √ INIT ID – ITEM 24 +0 EXEC

	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	

SM 94 PDRS CONTROL

AUTO MODES – ITEM 13 +7 +8 +9 +1 0 EXEC

RHC

2. MNVR TO STBD SURVEY START

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

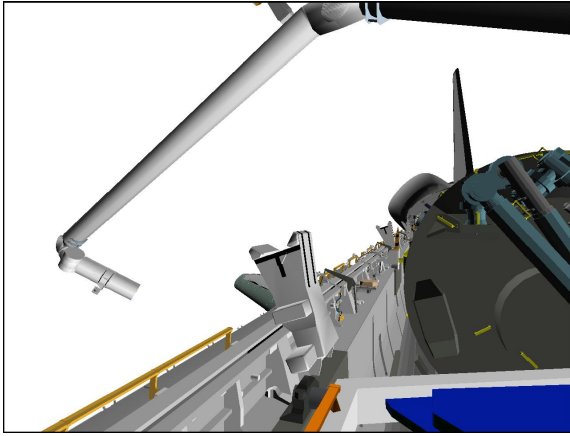
Clearance Views	Cameras
EE-to-RCC	C
RMS-to-PLBD	D

Mnvr to STBD SURVEY START posn:

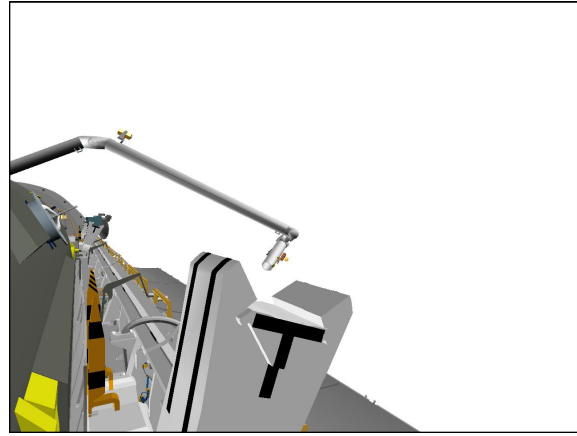
	SY	SP	EP	WP	WY	WR	
Pre-cradle	0.0	+25.0	-25.0	+5.0	0.0	0.0	
1: SY –	-71.0						
2: WP –				-113.1			[1]
3: WY +					+47.9		
4: WR +						+54.0	
5: EP –			-49.3				
6: SP –		+4.8					[1]
Stbd Survey start	-71.0	+4.8	-49.3	-113.1	+47.9	+54.0	
	X	Y	Z	PITCH	YAW	ROLL	PL ID
	-850	+303	-382	314	44	279	0

[1] Approaching REACH LIMIT

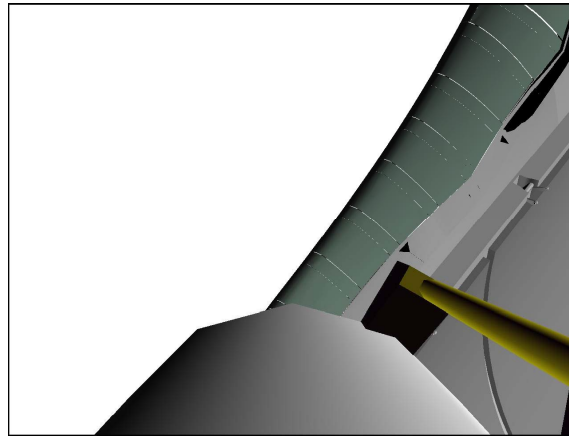
BRAKES – ON (tb-ON)



CCTV D (-20,0)



CCTV C (30,0)



EE HFOV: 50

3. STBD UPPER CARRIER TILES

SM 94 PDRS CONTROL

PL ID – ITEM 3 +5 EXEC

INIT ID – ITEM 24 +5 EXEC

A7U

DTV ← RMS

CCTV – RMS WRIST, ZOOM: 50.0 HFOV

L10(VTR)

REC pb – push, hold

PLAY pb – push, simo (red ●)

RATE – VERN (RATE MIN tb-ON)

BRAKES – OFF (tb-OFF)

MODE – SINGLE, ENTER

Drive WR positive to +185.0 deg

4. STBD ACAS

	X	Y	Z	PITCH	YAW	ROLL	PL ID
√	-850	+303	-382	314	44	50	5
	SY	SP	EP	WP	WY	WR	
√	-71.0	+4.8	-49.3	-113.1	+47.9	+185	

A7U

CCTV – RMS WRIST, ZOOM: 13.5 HFOV

MODE – AUTO 1, ENTER (READY It on)

- * If unable to enter AUTO mode (no AUTO READY It): *
- * √POR and adjust as reqd *

SM 94 PDRS CONTROL

√START PT, ITEM 17: 148

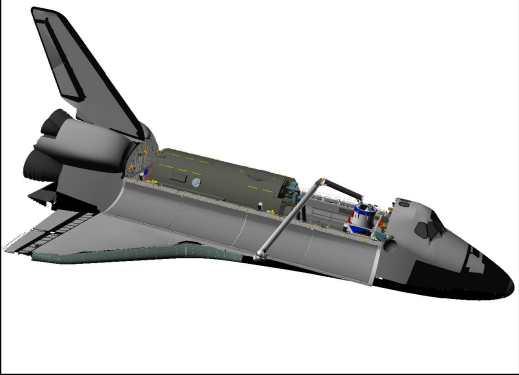
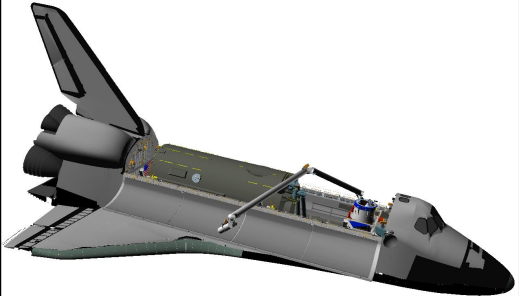
SM 169 PDRS STATUS

Monitor ACAS progress

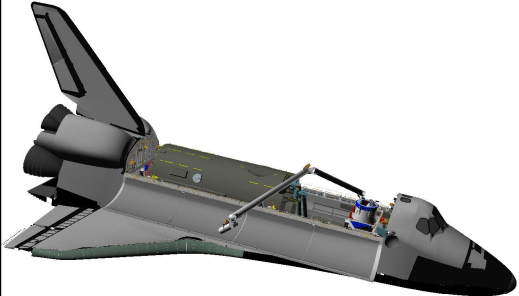
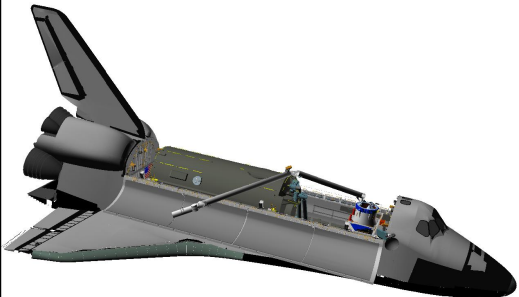
STBD ACAS Clearance Views	Cameras
EE-to-RCC	C
RMS-to-PLBD	D

AUTO SEQ – PROCEED (IN PROG It on)

(05:05)

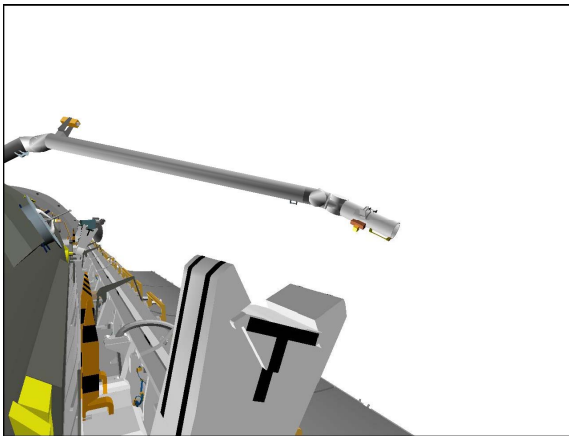
Pt	X	Y	Z	Pitch	Yaw	Roll	●
148P	-850	+303	-382	314	44	50	
149	-876	+298	-389	314	44	47	
150	-931	+319	-446	309	29	43	
151P	-944	+308	-419	315	26	38	

AUTO SEQ IN PROG It – off

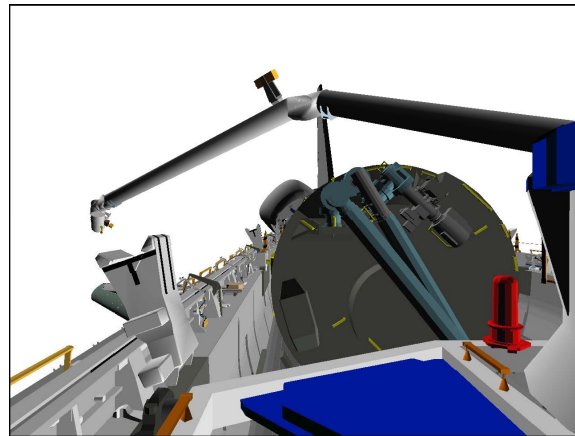
Pt	X	Y	Z	Pitch	Yaw	Roll	●
151P	-944	+308	-419	315	26	38	
152	-1006	+297	-420	318	0	36	
153	-1067	+312	-426	329	335	51	
154P	-1068	+317	-437	333	335	113	

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

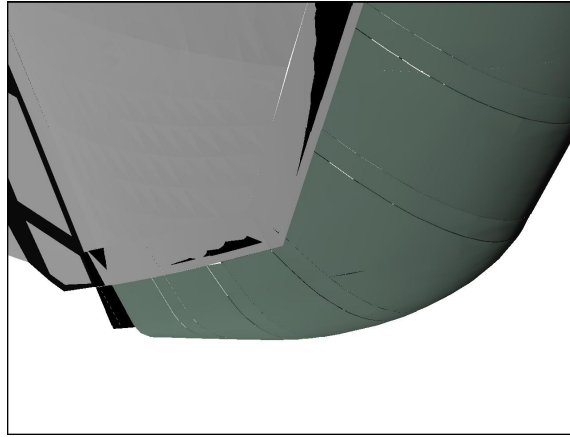
L10(VTR) STOP pb – push (no red ●)



CCTV C (30,0)



CCTV D (0,0)



EE HFOV: 13.5

5. MNVR TO PORT UPPER ACAS START

	X	Y	Z	PITCH	YAW	ROLL	PL ID
√	-1068	+317	-437	333	335	113	5
	SY	SP	EP	WP	WY	WR	
√	-48.2	+4.6	-32.1	-8.3	+25.3	+140.9	

RATE – COARSE (RATE MIN tb-OFF)
 BRAKES – OFF (tb-OFF)
 MODE – AUTO 2, ENTER (READY lt on)

* If unable to enter AUTO mode (no AUTO READY lt): *
 * √POR and adjust as reqd *

SM 94 PDRS CONTROL

√START PT, ITEM 17: 155

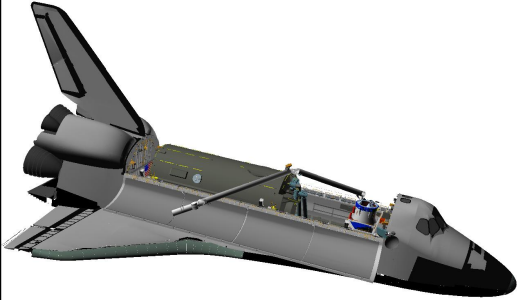
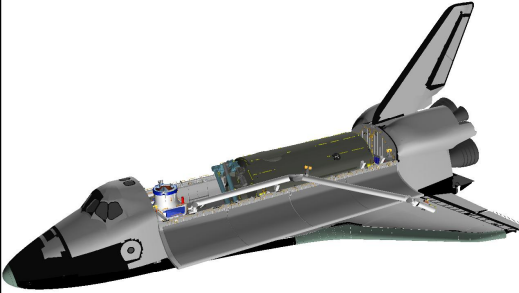
SM 169 PDRS STATUS

Monitor ACAS progress

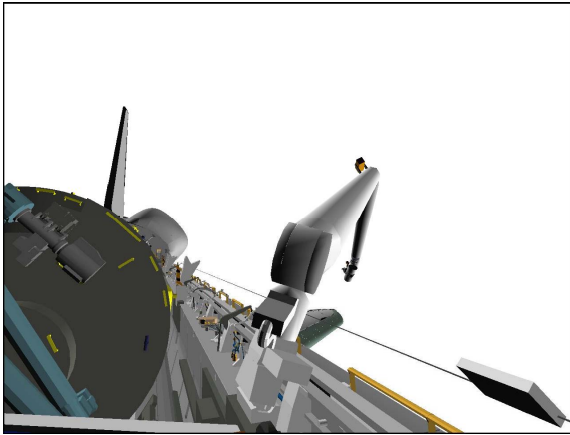
Clearance Views	Cameras
EE-to-JPM	C, B
RMS-to-PLBD	B, A

AUTO SEQ – PROCEED (IN PROG It on)

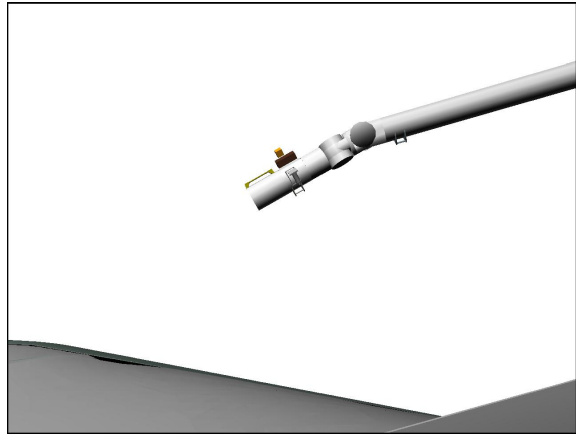
(02:05)

Pt	X	Y	Z	Pitch	Yaw	Roll	•
155P	-1068	+317	-437	333	335	113	
156	-1094	+120	-560	313	356	50	
157	-1127	-120	-560	313	356	50	
158P	-1176	-395	-399	330	15	354	

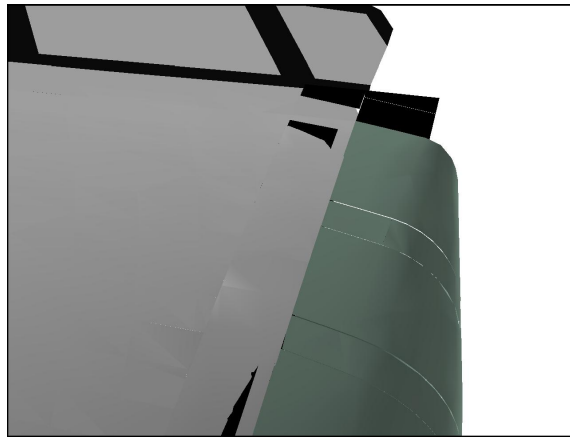
When AUTO SEQ IN PROG It – off:
BRAKES – ON (tb-ON)



CCTV A (20,5)



CCTV B (-65,-10)



EE HFOV: 13.5

6. PORT UPPER ACAS

	X	Y	Z	PITCH	YAW	ROLL	PL ID
√	-1176	-395	-399	330	153	54	5
	SY	SP	EP	WP	WY	WR	
√	+30.3	+26.5	-33.3	-15.0	-4.1	-16.6	

RATE – VERN (RATE MIN tb-ON)

L10(VTR) REC pb – push, hold
PLAY pb – push, simo (red ●)

A7U CCTV – RMS WRIST, ZOOM: 10.0 HFOV

BRAKES – OFF (tb-OFF)
MODE – AUTO 3, ENTER (READY lt on)

- * If unable to enter AUTO mode (no AUTO READY lt): *
- * √POR and adjust as reqd *

SM 94 PDRS CONTROL

√START PT, ITEM 17: 159

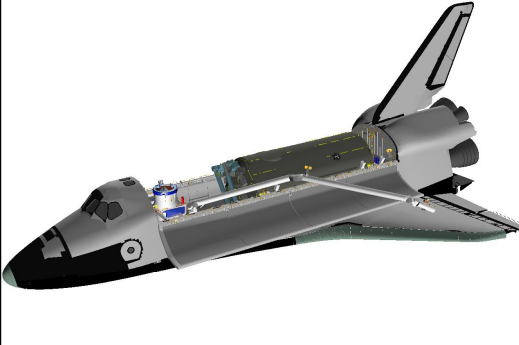
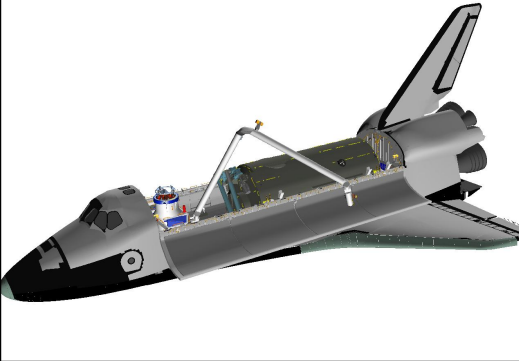
SM 169 PDRS STATUS

Monitor ACAS progress

PORT ACAS Clearance Views	Cameras
EE-to-RCC	B
RMS-to-PLBD	B, A

AUTO SEQ – PROCEED (IN PROG It on)

(09:50)

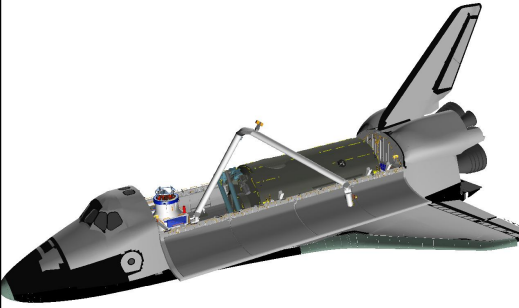
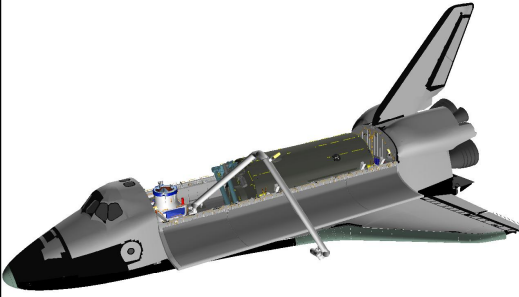
Pt	X	Y	Z	Pitch	Yaw	Roll	●
159P	-1176	-395	-399	330	15	354	
160	-1176	-395	-400	315	7	49	
161	-1169	-393	-413	309	0	50	
162	-1142	-363	-420	298	352	53	
163P	-1005	-264	-435	295	340	44	

When AUTO SEQ IN PROG It – off:
 CCTV – RMS WRIST, ZOOM: 16.0 HFOV

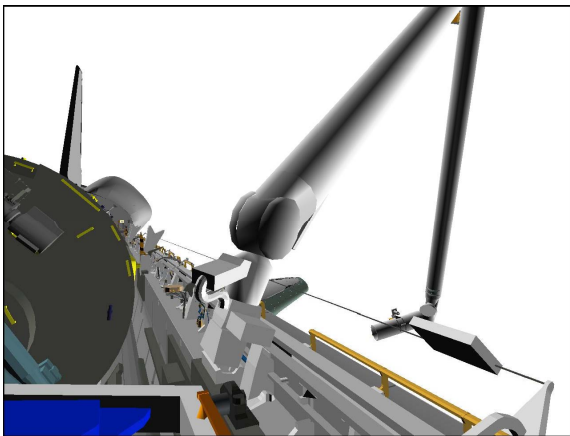
A7U

AUTO SEQ – PROCEED (IN PROG It on)

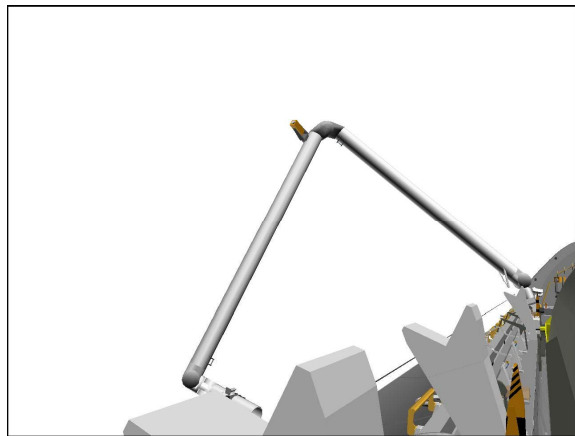
(05:30)

Pt	X	Y	Z	Pitch	Yaw	Roll	●
163P	-1005	-264	-435	295	340	44	
164	-1002	-300	-409	294	319	26	
165P	-885	-300	-339	316	290	48	

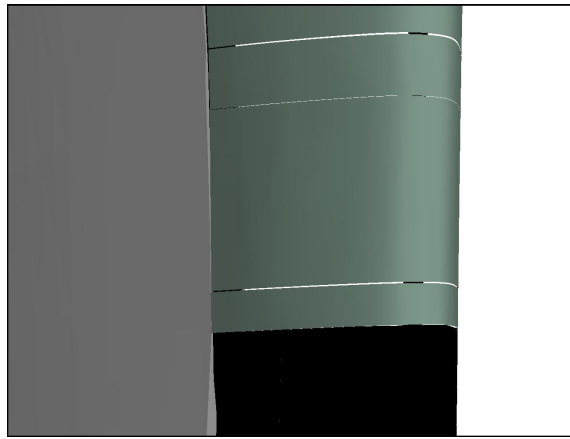
When AUTO SEQ IN PROG It – off:



CCTV A (25,0)



CCTV B (-45,-10)



EE HFOV: 16.0

7. PORT APEX ACAS

PORT ACAS Clearance Views	Cameras
EE-to-RCC	A, B
RMS-to-PLBD	B, A

A7U

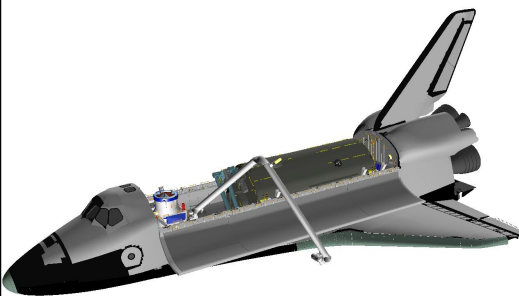
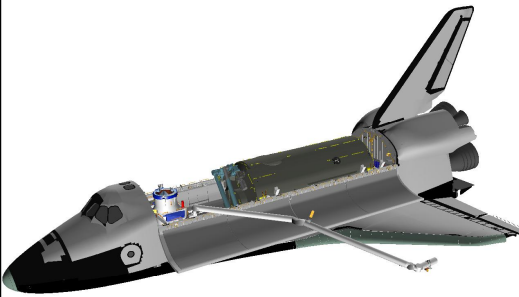
CCTV – RMS WRIST, ZOOM: 10.0 HFOV

NOTE

Expect singularity warning between points 167 and 168

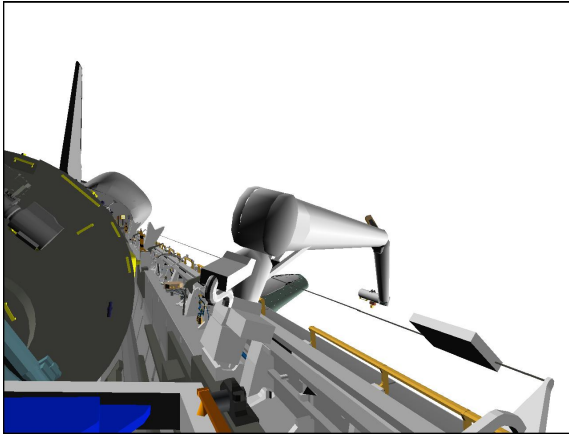
AUTO SEQ – PROCEED (IN PROG It on)

(12:25)

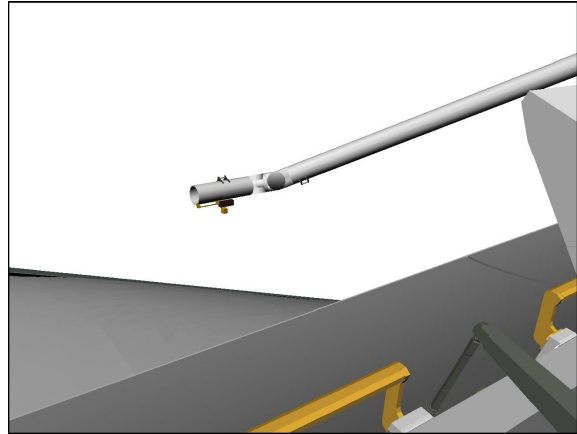
Pt	X	Y	Z	Pitch	Yaw	Roll	•
165P	-885	-300	-339	316	290	48	
166	-881	-316	-313	358	286	178	
167	-968	-324	-309	357	304	179	
168	-1072	-433	-314	0	319	177	
169	-1119	-441	-316	0	338	178	
170P	-1124	-459	-317	2	357	178	

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

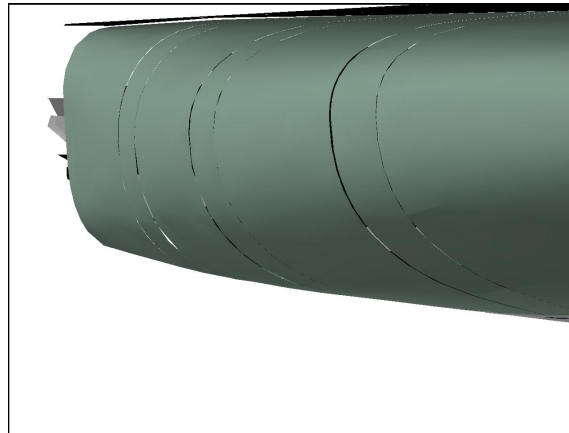
L10(VTR) STOP pb – push (no red ●)



CCTV A (25,0)



CCTV B (-55,-20)



EE HFOV: 10.0

8. RETURN TO PRE-CRADLE

SM 94 PDRS CONTROL

PL ID – ITEM 3 +0 EXEC

INIT ID – ITEM 24 +0 EXEC

RATE – as reqd (VERN within 10 ft)

BRAKES – OFF (tb-OFF)

MODE – AUTO 4, ENTER (READY It on)

- * If unable to enter AUTO mode (no AUTO READY It): *
- * √POR and adjust as reqd *

SM 94 PDRS CONTROL

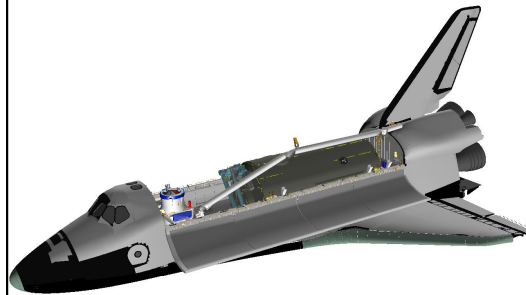
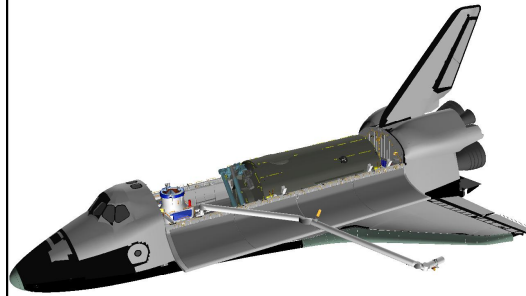
√START PT, ITEM 17: 171

	X	Y	Z	PITCH	YAW	ROLL	PL ID
√	-1124	-459	-317	2	357	178	0
	SY	SP	EP	WP	WY	WR	
√	+44.1	+9.9	-19.7	-10.9	-48.0	+178.7	

AUTO SEQ – PROCEED (IN PROG It on)

(01:00)

Pt	X	Y	Z	Pitch	Yaw	Roll	•
171P	-1124	-459	-317	2	357	178	
172	-1151	-447	-377	13	36	60	
173P	-1261	-146	-551	5	2	0	



When AUTO SEQ IN PROG It – off:
 BRAKES – ON (tb-ON)
 MODE – not DIRECT (It off)

PARAM – PORT TEMP
 JOINT – CRIT TEMP

OBSS MNVR TO FLAT FIELD

WARNING
For UNDOCKED ops only

1. SETUP

Mon 1	D
DwnInk	ELBOW
Mon 2	C
DTV	A

SM 94 PDRS CONTROL

- √ PL ID – ITEM 3: 2
- √ INIT ID – ITEM 24: 2
- AUTO MODES – ITEM 13 +1 1 EXEC

Verify UNDOCK 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

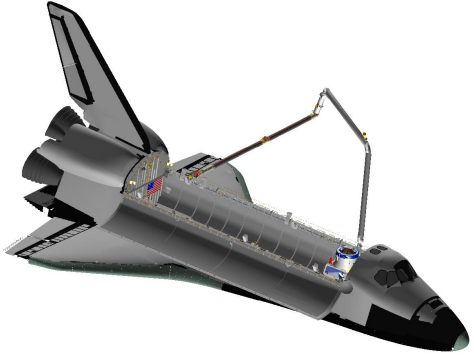
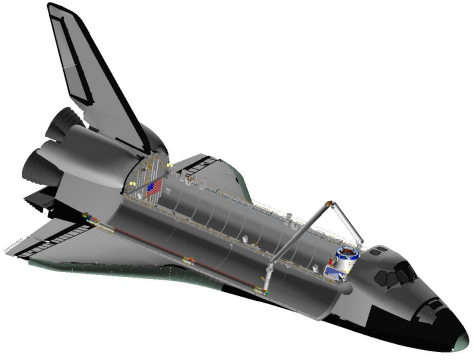
- RHC
- ## 2. ACAS TO STBD SURVEY START
- RATE – COARSE (RATE MIN tb – OFF)
 - BRAKES – OFF (tb-OFF)
 - MODE – AUTO 1, ENTER

- * If unable to enter AUTO mode (no AUTO READY lt): *
- * √POR and adjust as reqd *

√START PT, ITEM 17: 174

SM 169 PDRS STATUS

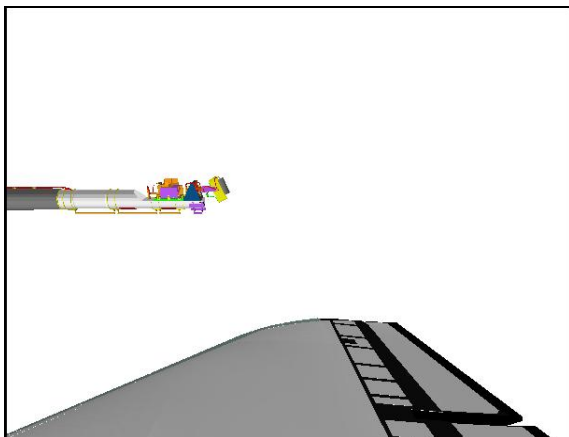
Monitor ACAS progress

Pt	X	Y	Z	Pitch	Yaw	Roll	•
174P	-1029	+229	-614	284	270	270	
175	-800	+500	-250	281	333	95	
176	-1130	+350	-400	325	336	30	
177P	-1270	+350	-445	0	0	11	

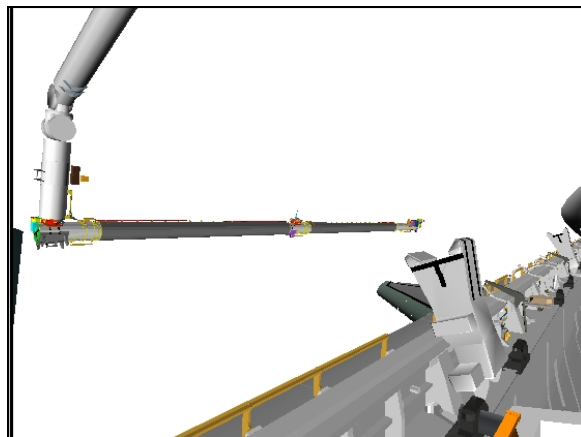
When AUTO SEQ IN PROG It – off:
BRAKES – ON (tb-ON)

Verify FLAT FIELD posn:

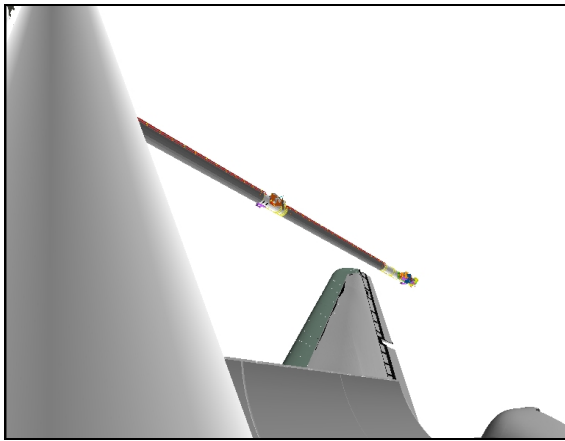
	X	Y	Z	PITCH	YAW	ROLL	PL ID
√	-1270	+350	-445	0	0	11	2
	SY	SP	EP	WP	WY	WR	
√	-90.1	+25.0	-65.8	-57.6	0.0	-249.9	



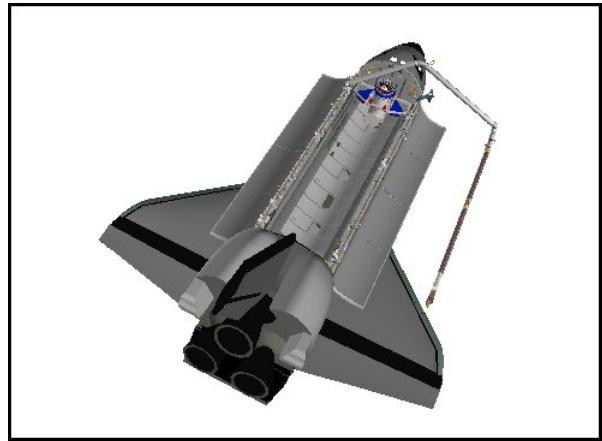
CCTV C (95,-5)



CCTV D (-40,0)



ELBOW (25,-40)



BIRD'S EYE

3. SETUP FOR STBD SURVEY

SM 94 PDRS CONTROL

AUTO MODES – ITEM 13 +1 +2 +3 +4 EXEC

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

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

A15 APCU 2 CONV – OFF
Wait 10 sec
APCU 2 CONV – ON

Perform LCC ACTIVATION (LCS, Cue Card, P/TV)
Perform IDC SOFTWARE ACTIVATION (IDC, Cue Card, P/TV) steps 1 and 2

A7U MUX 1 L ← MIDDECK
LDRI MODE 6 pb – push (flickering LDRI video)
MON2 ← PL2

CAMR CMD PAN/TILT – HI RATE
PAN – L (to hard stop)
TILT – UP (to hard stop)
PAN/TILT – RESET, HI RATE (LO within 10°)
PAN: +103 (right)
TILT: -260 (down)

DTV ← PL2
VIDEO OUT – as desired (not DTV)
√VIDEO IN – not PL2

L10(VTR) REC pb – push, hold
PLAY pb – push, simo (red ●)

Go to OBSS LDRI/IDC RCC SURVEY – STBD (OBSS OPERATIONS); review notes at beginning of procedure, then proceed to step 3

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EVA 1

ELBOW CAMERA STRAP REMOVAL	FS 2-2
OBSS GRAPPLE AT HANDOFF	FS 2-6
JPM INSTALL VIEWING.....	FS 2-10

EVA 1

ELBOW CAMERA STRAP REMOVAL

1. SETUP

Verify SSRMS at OBSS grapple posn

Mon 1	C
DwnInk	B
Mon 2	A (ELBOW)
DTV	P1 LOOB

SM 94 PDRS CONTROL

√ PL ID – ITEM 3: 0

√ INIT ID – ITEM 24: 0

Verify at PRE-CRADLE posn:

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

2. MNVR TO STRAP REMOVAL SETUP POSN

RATE – as reqd (VERN within 10 ft)

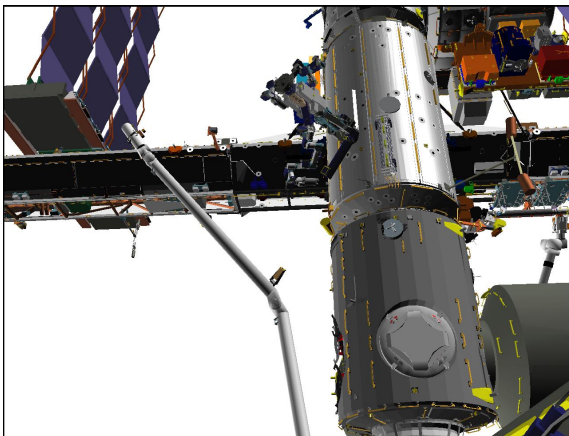
BRAKES – OFF (tb-OFF)

MODE – SINGLE, ENTER

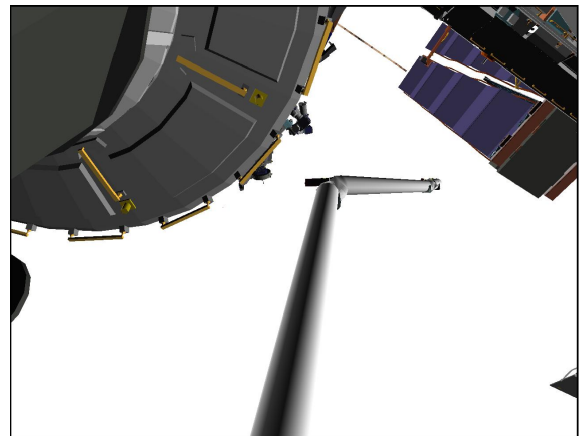
Mnvr to STRAP REMOVAL SETUP posn:

	SY	SP	EP	WP	WY	WR	
Pre-Cradle	0.0	+25.0	-25.0	+5.0	0.0	0.0	
1: SP +		+60.0					
2: SY +	+85.0						
3: EP –			-31.0				
4: SP +		+100.0					
Strap Removal Setup	+85.0	+100.0	-31.0	+5.0	0.0	0.0	
	X	Y	Z	PITCH	YAW	ROLL	PL ID
	-686	-374	-967	88	36	256	0

BRAKES – ON (tb-ON)



CCTV B (-5,30)



CCTV A (30,60)

3. GCA TO STRAP REMOVAL POSN

WARNING
Clearance between SRMS and CBM Petals is 37 inches and will decrease during GCA. Monitor clearance using CCTV B
Minimum expected clearance between SRMS and SPDM is 30 in. Monitor clearance using CCTV B

NOTE

Expect singularity for SP between +103 and +111 deg

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

To Move Elbow Camera: Single Joint Input:

Orbiter Forward/Aft	SY - / +
Orbiter Port/Stbd	SP - / +
Orbiter Roll Left/Right	EP - / +

When EVA GCA complete:
BRAKES – ON (tb-ON)

4. ELBOW CAMERA VERIFICATION

When strap removal complete and EVA clear, Pan/Tilt elbow camera in each direction to ensure proper operation

5. RETURN TO SETUP POSN

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

Mnvr back to STRAP REMOVAL SETUP posn:

X	Y	Z	PITCH	YAW	ROLL	PL ID
-686	-374	-967	88	36	256	0
SY	SP	EP	WP	WY	WR	
+85.0	+100.0	-31.0	+5.0	0.0	0.0	

6. MNVR TO OCAS SETUP POSN

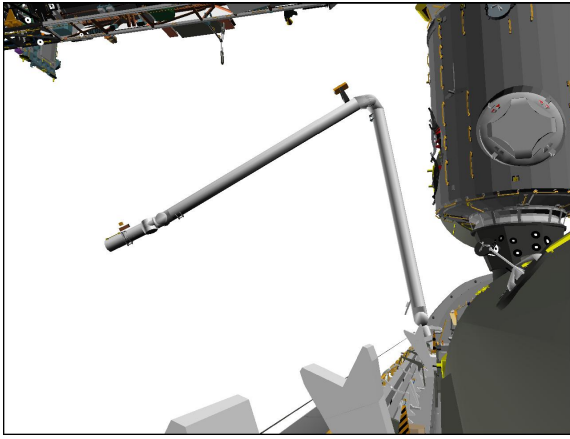
RATE – as reqd (VERN within 10 ft)

Mnvr to OCAS SETUP posn:

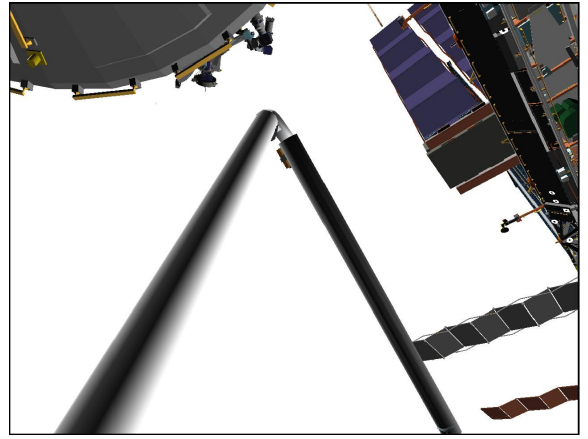
Strap
Removal Setup
1: EP –
OCAS Setup

SY	SP	EP	WP	WY	WR	
+85.0	+100.0	-31.0	+5.0	0.0	0.0	
		-110.0				
+85.0	+100.0	-110.0	+5.0	0.0	0.0	
X	Y	Z	PITCH	YAW	ROLL	PL ID
-707	-466	-530	281	65	60	0

BRAKES – ON (tb-ON)



CCTV B (-15,10)



CCTV A (50,50)

7. OCAS TO OBSS PRE-GRAPPLE AT HANDOFF

SM 94 PDRS CONTROL

END POS – ITEM 18 -17 1 -23 1 -36 3 EXEC
 ATT – ITEM 21 +17 3 +1 1 +23 1 EXEC
 CMD CK – ITEM 25 EXEC (GOOD)

RHC

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

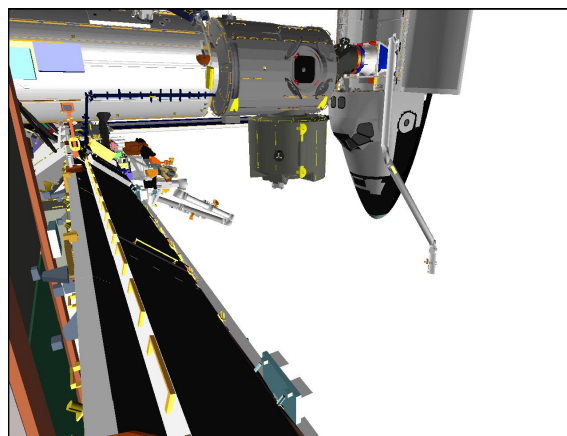
After PROCEED, if motion no longer apparent but POR is within
 1 in/1 deg and IN PROG It – on:
 AUTO SEQ – STOP

AUTO SEQ – PROCEED (IN PROG It on)

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

OBSS PRE-GRAPPLE AT HANDOFF posn: (01:35)

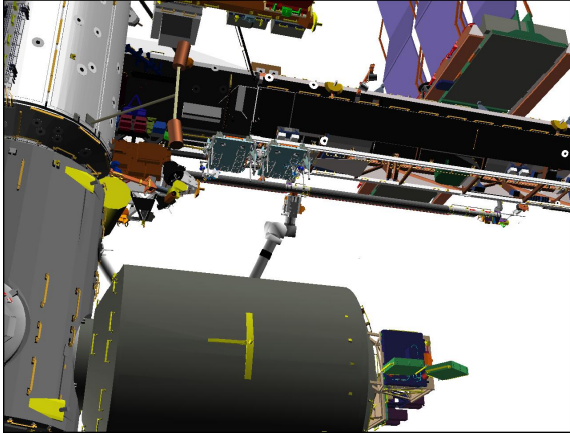
	X	Y	Z	PITCH	YAW	ROLL	PL ID
√	-171	-231	-363	173	11	231	0
	SY	SP	EP	WP	WY	WR	
√	+163.4	+26.9	-62.5	+45.9	+8.3	+87.1	



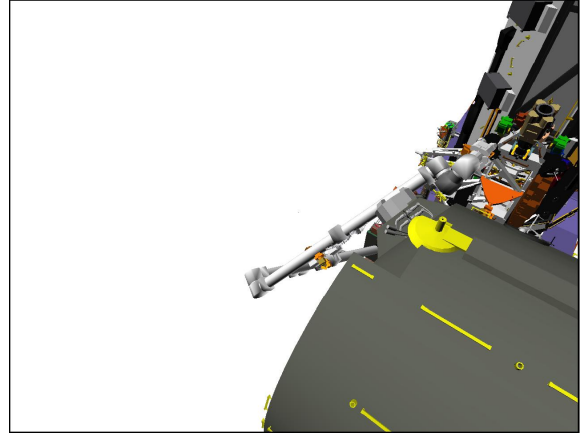
P1 LOOB (120,-20)

8. CAMERA SETUP

Set up cameras for SSRMS Operator viewing



CCTV C (15,27)



ELBOW (90,-30)

Notify SSRMS Operator: SRMS at OBSS Pregrapple at Handoff posn

OBSS GRAPPLE AT HANDOFF

1. SETUP

On SSRMS Operator GO for SRMS OBSS Grapple (SSRMS at OBSS Handoff)

A7U

CCTV – config for OBSS Grapple

– install PDRS TARGET OVERLAY FOR CTVM

– RMS WRIST, zoom 34.0 HFOV

focus 5 ft

Maintain eyepoint approx 18 in when using grapple overlay

Mon 1	ELBOW / EE
DwnInk	B
Mon 2	BASE ELBOW / P1 LOOB
DTV	A

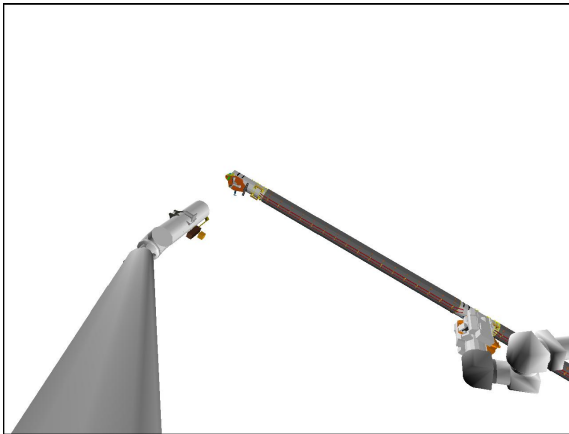
SM 94 PDRS CONTROL

√PL ID – ITEM 3: 0

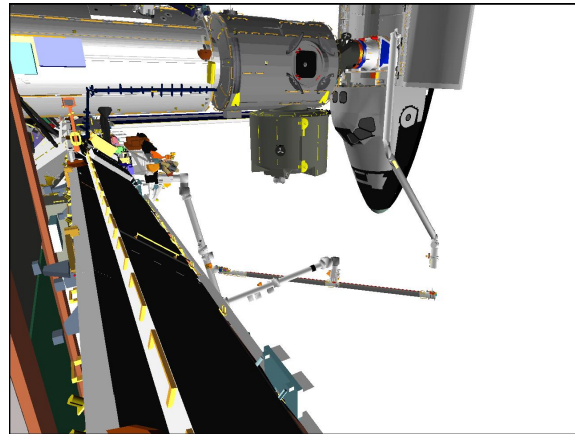
√INIT ID – ITEM 24: 0

Verify at OBSS PRE-GRAPPLE posn:

X	Y	Z	PITCH	YAW	ROLL	PL ID
-171	-231	-363	173	11	231	0
SY	SP	EP	WP	WY	WR	
+163.4	+26.9	-62.5	+45.9	+8.3	+87.1	



ELBOW (20,0)



P1 LOOB (120,-20)

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

2. OBSS GRAPPLE AT HANDOFF POSN

- * If using Shuttle attitude control, verify in attitude; *
- * then DAP: FREE *

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

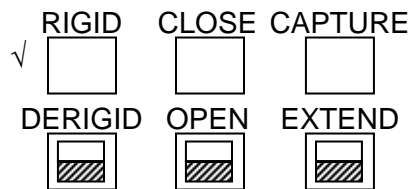
THC/RHC Mnvr to grapple envelope

CAUTION
 Monitor EE tb timing to prevent EE motor burnout

SM 169 PDRS STATUS

Monitor msw status

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

- * 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

MODE – TEST, ENTER
 Wait 5 sec

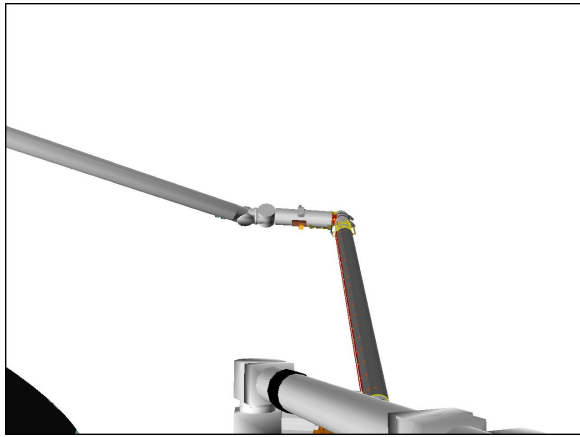
BRAKES – ON (tb-ON)

SM 94 PDRS CONTROL

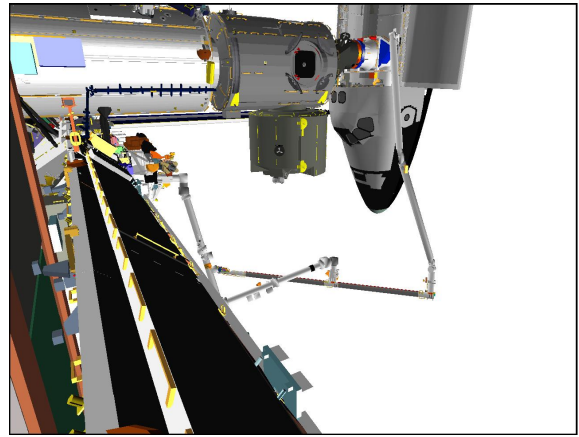
PL ID – ITEM 3 +2 EXEC
 INIT ID – ITEM 24 +2 EXEC

Expected OBSS HANDOFF posn:

	X	Y	Z	PITCH	YAW	ROLL	PL ID
✓	-71	+201	-758	96	311	197	2
	SY	SP	EP	WP	WY	WR	
✓	+164.3	+10.6	-28.4	+28.5	+7.2	+86.6	



BASE ELBOW (110,7)



P1 LOOB (120,-20)

R12(OBSS) RSC PWR – OFF, ON

NOTE

SPEE power ON stops the thermal clock for Sensor Package 1.

APCU 2 stops the thermal clock for Sensor Package 2. This activity must be decoupled from JPM LTA cable disconnect task due to EVA inhibits requiring APCU 2 to be off

R12(OBSS) SPEE PWR – ON

A15 On MCC and EVA GO:
 √PTU 2 tb – ON
 APCU 2 OUTPUT – ON
 CONV – ON

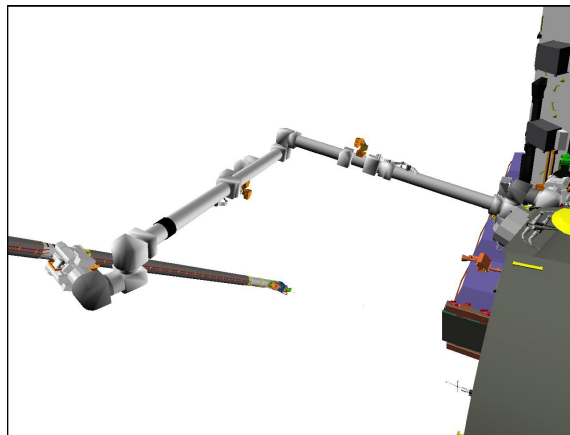
SM 179 POWER TRANSFER

√PTU 2 APCU OUT VOLTS: 123V to 126V
 √OUTPUT – ON

A31p PGSC Pwr – ON
 Sel 'Shuttle Apps' > 'LCC' (Wait 2-3 min from APCU CONV – ON for GUI Status)
 √Laser off – blue
 √Comm – green
 If Laser off and Comm status not correct: √MCC

3. CAMERA SETUP

Set up Elbow camera for SSRMS Operator viewing



ELBOW (75,-15)

Give SSRMS Operator GO for OBSS Ungrapple

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

JPM INSTALL VIEWING

WARNING
Port PLBD radiator must be stowed

1. SETUP

On SSRMS operator GO (SSRMS Node 2 grapple complete)

Mon 1	B
Dwnlнк	ELBOW
Mon 2	A
DTV	P1 LOOB

Verify at OBSS HANDOFF posn:

	X	Y	Z	PITCH	YAW	ROLL	PL ID
√	-71	+201	-758	96	311	197	2
	SY	SP	EP	WP	WY	WR	
√	+164.3	+10.6	-28.4	+28.5	+7.2	+86.6	

2. MNVR TO JPM INSTALL VIEWING

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

Mnvr to JPM INSTALL VIEWING posn:

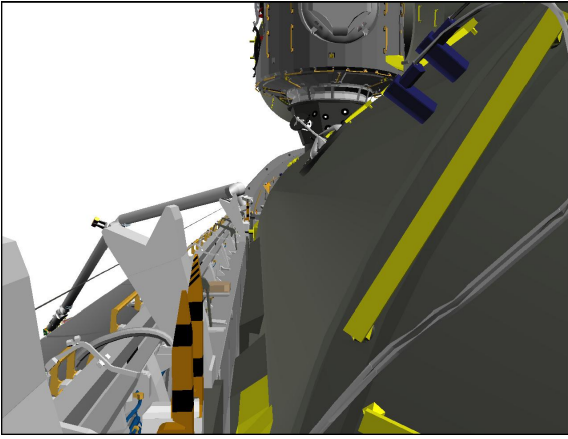
	SY	SP	EP	WP	WY	WR	
OBSS Handoff	+164.3	+10.6	-28.4	+28.5	+7.2	+86.6	
1: SY –	+135.0						
2: EP +			-25.9				
3: WP –				0.0			
4: WY –					-6.0		
5: WR +						+110.0	
6: SP –		+3.6					
JPM Install	+135.0	+3.6	-25.9	0.0	-6.0	+110.0	
	X	Y	Z	PITCH	YAW	ROLL	PL ID
	+183	-98	-296	167	322	225	2

BRAKES – ON (tb-ON)

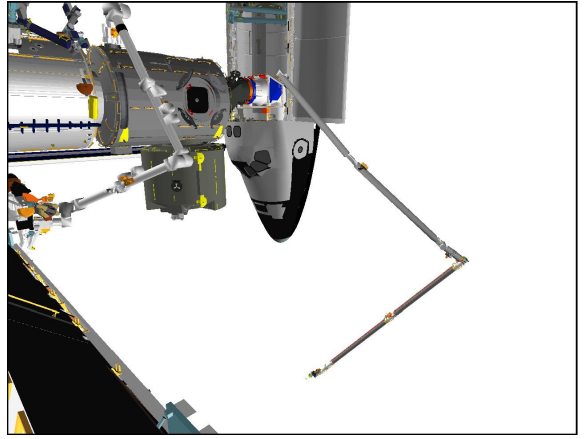
JPM INSTALL VIEWING posn:

	X	Y	Z	PITCH	YAW	ROLL	PL ID
√	+183	-98	-296	167	322	225	2
	SY	SP	EP	WP	WY	WR	
√	+135.0	+3.6	-25.9	0.0	-6.0	+110.0	

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



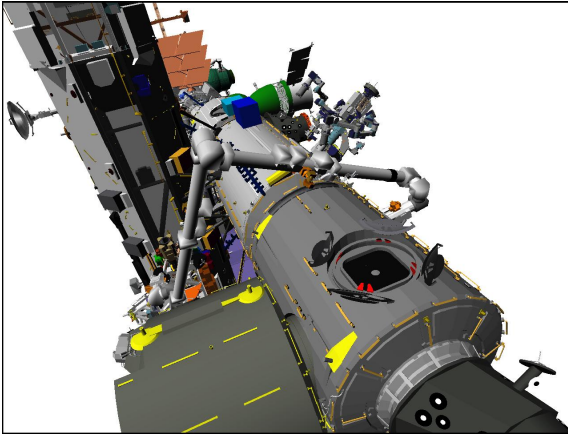
CCTV B (3,-3)



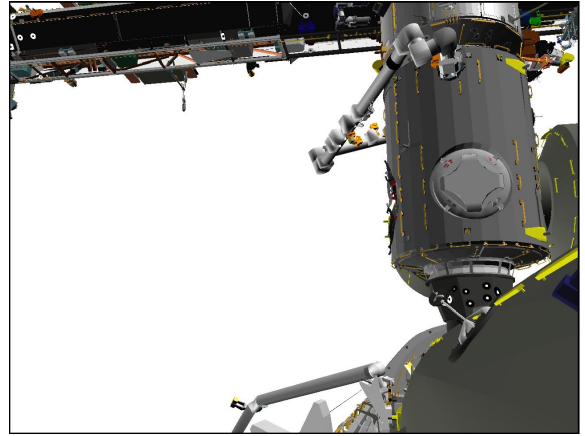
P1 LOOB (135,-15)

3. CAMERA SETUP

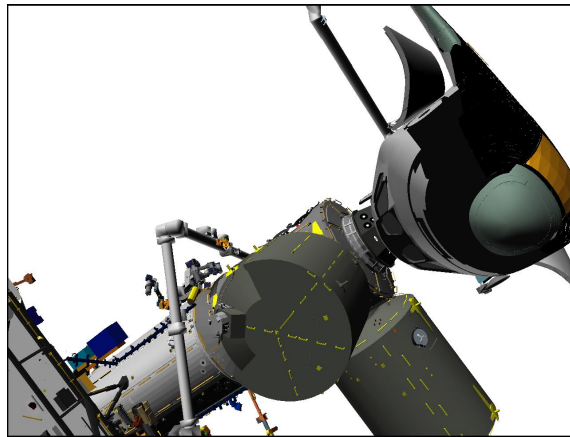
Set up cameras for SSRMS Operator viewing per pictures below:



ELBOW (150,-5)



CTVC B (-10,15)



ITVC (82,-45)

Give SSRMS Operator GO for JPM Ops

PARAM – PORT TEMP

JOINT – CRIT TEMP

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VIEWING SUPPORT

OBSS SENSOR CHECKOUT.....	FS 3-2
RETURN TO JPM INSTALL VIEWING.....	FS 3-8
JLP RELOCATE VIEWING.....	FS 3-10
EVA 3 VIEWING SUPPORT.....	FS 3-12
JEM RMS DEPLOY VIEWING.....	FS 3-14
OBSS UNDOCK CONFIG.....	FS 3-16

**VIEWING
SUPPORT**

OBSS SENSOR CHECKOUT

WARNING
Port PLBD radiator must be stowed

1. SETUP

Mon 1	A
Dwnlk	P1 LOOB
Mon 2	ELBOW / RSC
DTV	ITVC / LDRI

SM 94 PDRS CONTROL

- √ PL ID, ITEM 3: 2
- √ INIT ID, ITEM 24: 2

JPM INSTALL VIEWING posn:

	X	Y	Z	PITCH	YAW	ROLL	PL ID
√	+183	-98	-296	167	322	225	2
	SY	SP	EP	WP	WY	WR	
√	+135	+3.6	-25.9	0.0	-6.0	+110.0	

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

A15 APCU 2 CONV – OFF
Wait 10 sec
APCU 2 CONV – ON

Perform LCC ACTIVATION (LCS Cue Card, P/TV)
Perform IDC SOFTWARE ACTIVATION (IDC Cue Card, P/TV)

2. MANEUVER TO SENSOR CHECKOUT

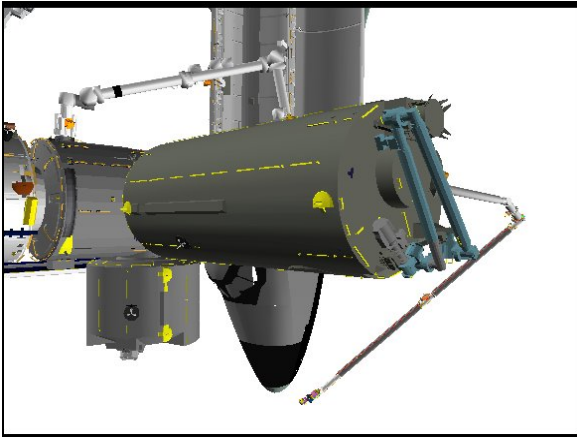
RHC RATE – as reqd (VERN within 10 ft)
BRAKES – OFF (tb-OFF)
MODE – SINGLE, ENTER

Mnvr to SENSOR CHECKOUT posn:

	SY	SP	EP	WP	WY	WR	
JPM Install	+135.0	+3.6	-25.9	0.0	-6.0	+110.0	
1: SY –	+97.0						
2: WP +				+10.2			
3: WY +					+30.0		
4: WR +						+137.0	
5: EP –			-74.0				
Sensor C/O	+97.0	+3.6	-74.0	+10.2	+30.0	+137.0	
	X	Y	Z	PITCH	YAW	ROLL	PL ID
	-196	+1	-255	151	322	187	2

BRAKES – ON (tb-ON)

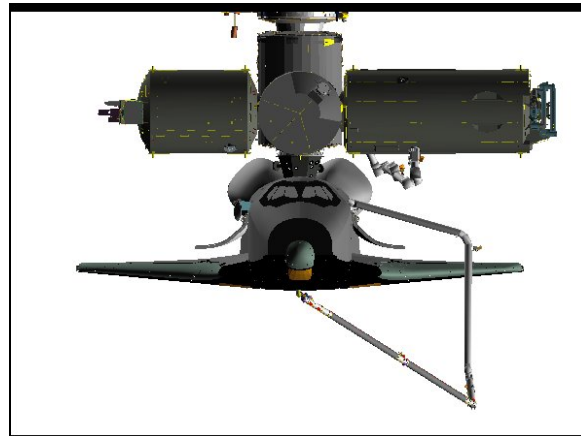
VIEWING
SUPPORT



P1 LOOB (135,0)



RSC



ISS ZENITH VIEW

3. SENSOR CHECKOUT

Perform LDRI ACTIVATION (LDRI/ITVC Cue Card, P/TV), steps 1 and 5

MON2 ← PL2

CAMR CMD PAN/TILT -HI RATE

PAN -L (to hard stop)

TILT -UP (to hard stop)

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

PAN: +78 (right)

TILT: -76 (down)

3.1 LDRI CALIBRATION

NOTE

Ensure GMT is set on DSR-25

A7U

MUX 1 L ← MIDDECK

LDRI MODE 3 pb – push (LDRI video)

√MON2 ← PL2

PAN/TILT to match LDRI view shown below



LDRI: (78,-76)

√MCC to verify correct sensor view
Note PAN/TILT: _____, _____

A7U DTV ← PL2
 VIDEO OUT – not DTV
 IN – not PL2

L10(VTR) REC pb – push, hold
 PLAY pb – push, simo (red ●)

NOTE

Do not stop recording until end of step 3.2

Record for 30 sec

MUX 1 L ← MIDDECK

A7U LDRI MODE 4 pb – push (brighter LDRI video)

Record for 30 sec

LDRI MODE 5 pb – push (flickering LDRI video)

Record for 30 sec

LDRI MODE 6 pb – push (brighter flickering LDRI video)

Record for 30 sec

3.2 LDRI FLAT FIELDS

MON2 ← PL2

PAN: +98 (right)

TILT: -91 (down)

PAN: +78 (left)

TILT: -76 (up)

TILT: -91 (down)

PAN: +98 (right)

TILT: -76 (up)

PAN: +78 (left)

MUX 1 L ← MIDDECK
LDRI MODE 2 pb – push (ITVC Video)

L10(VTR) STOP pb – push (no red ●)

LCC/PGSC 3.3 LCS/IDC CHECKOUT |

Minimize, do not close IDC software
Maximize LCC software
sel 'Scanning' 'Detailed Area Scan'
sel – Area Scan 11
cmd Start Area Scan (verify Scan Status: Complete)

sel – Area Scan 12
cmd Start Area Scan (verify Scan Status: Complete)

sel – Area Scan 13
cmd Start Area Scan (verify Scan Status: Complete)

Minimize, do not close LCC software
Maximize IDC software
√'Use AE' checked
Sel 'Scan Lo-Res'
Resize and posn AE box as reqd (pause 2 sec)
Sel 'Scan Hi-Res'
Sel 'Stop Scan' after 30 sec
√'Waiting for User Command' displayed
From Scenario File drop-list, sel 'White Tile-Day' or 'White Tile-Night' from
drop-down menu per real-time conditions
sel 'Acquire Set'
√'Acquiring Set' displayed
√'Waiting for User Command' displayed after set
sel 'Power Off'
Close IDC Software

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

4. MANEUVER TO EVA 2 VIEWING

Mon 1	B
Dwnlk	P1 LOOB
Mon 2	ELBOW
DTV	ITVC

NOTE

At EVA 2 position, minimum clearance between SRMS upper boom and SSRMS wrist cluster is 20 inches. Monitor clearance during SP drive in line 6 using SRMS Elbow camera

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

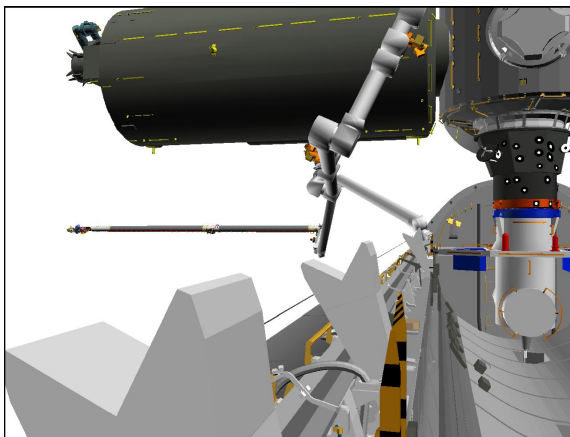
Mnvr to EVA 2 VIEWING posn:

	SY	SP	EP	WP	WY	WR	
Sensor C/O	+97.0	+3.6	-74.0	+10.2	+30.0	+137.0	
1: WP +				+60.0			
2: WY +					+31.0		
3: WR –						-70.0	
4: SY +	+155.0						
5: EP +			-45.0				
6: SP +		+25.0					
EVA 2 View	+155.0	+25.0	-45.0	+60.0	+31.0	-70.0	
	X	Y	Z	PITCH	YAW	ROLL	PL ID
	-176	-909	-428	10	90	225	2

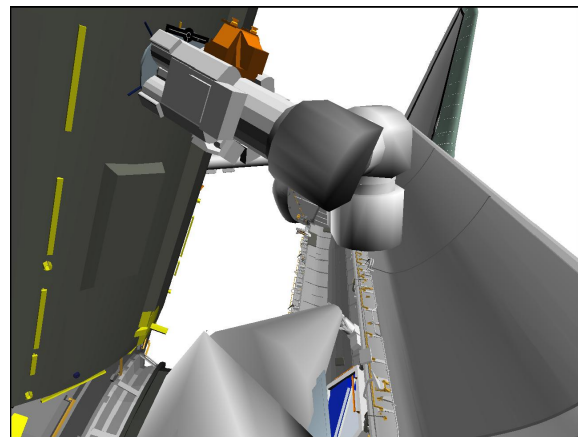
*Display singularity

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

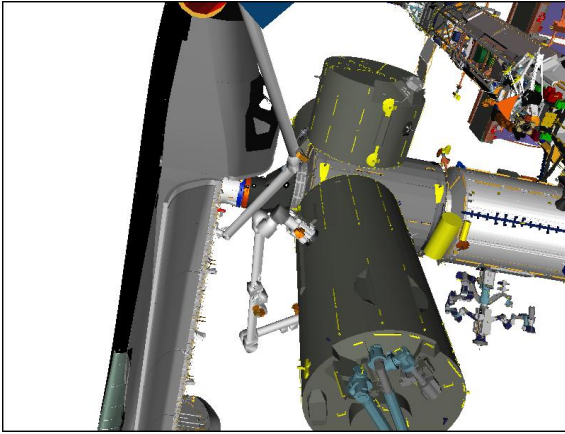
PARAM – PORT TEMP
 JOINT – CRIT TEMP



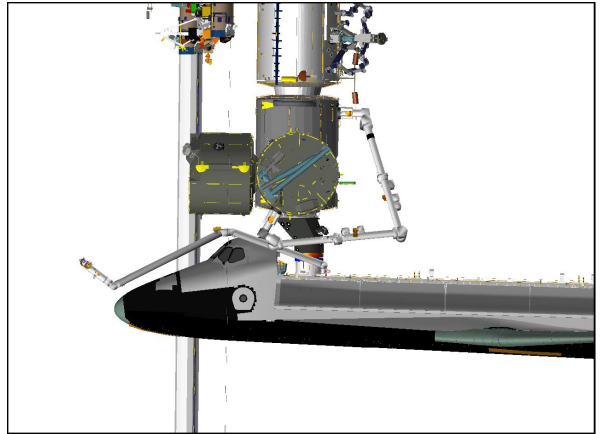
CCTV B (-15,0)



ELBOW (-155,-20)



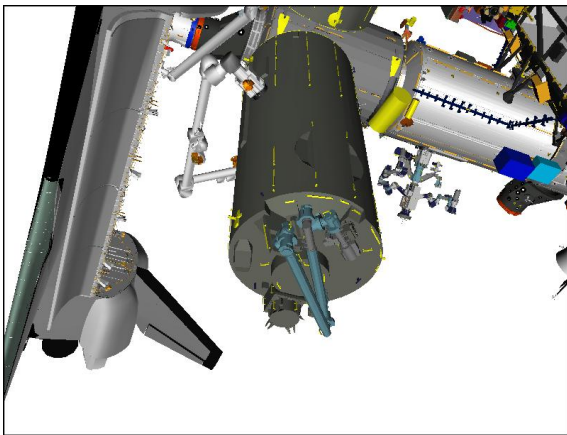
ITVC (30,-25)



PORT

5. CAMERA SETUP

Set up ITVC and Elbow cameras as shown to support EVA 2



ITVC (20,-40)



ELBOW (-170,60)

RETURN TO JPM INSTALL VIEWING

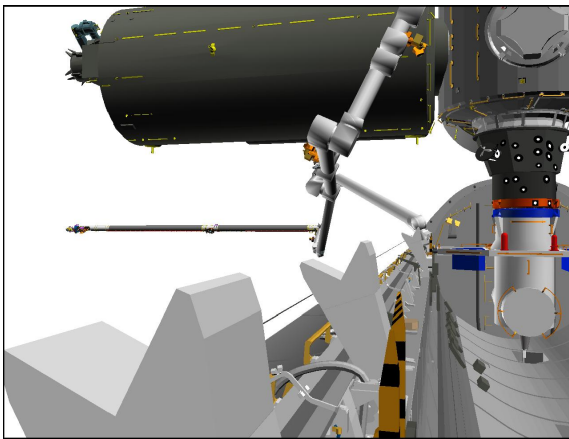
1. SETUP

Mon 1	B
DwnInk	ELBOW
Mon 2	ITVC
DTV	A

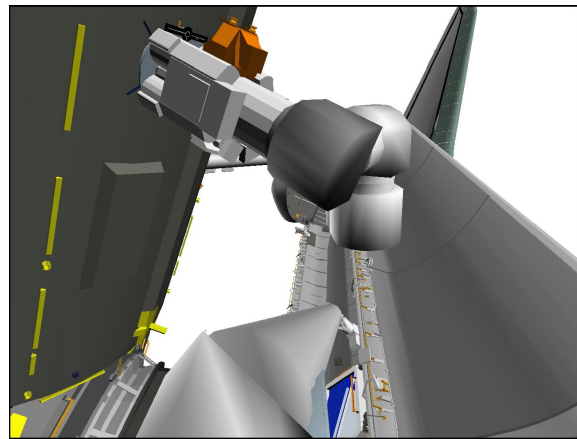
Verify at EVA 2 VIEWING posn:

√	X	Y	Z	PITCH	YAW	ROLL	PL ID	*
	-176	-909	-428	10	90	225	2	
	SY	SP	EP	WP	WY	WR		
√	+155.0	+25.0	-45.0	+60.0	+31.0	-70.0		

*Display singularity



CCTV B (-15,0)



ELBOW (-155,-20)

2. MNVR TO JPM INSTALL VIEWING POSN

NOTE

At start, minimum clearance between SRMS upper boom and SSRMS wrist cluster is 20 inches. Monitor clearance during SP drive in line 1 using SRMS Elbow camera

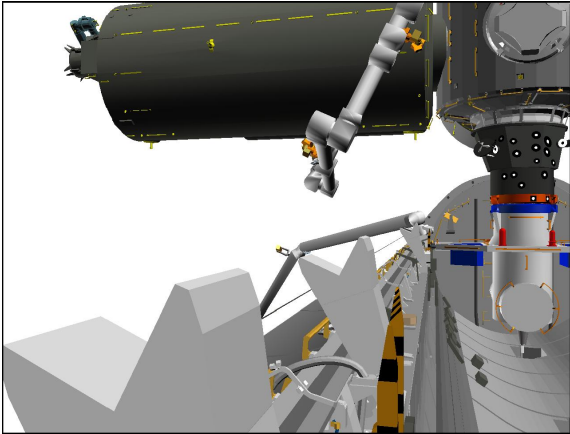
RHC RATE – as reqd (VERN within 10 ft)
 BRAKES – OFF (tb-OFF)
 MODE – SINGLE, ENTER

Mnvr to JPM INSTALL VIEWING posn:

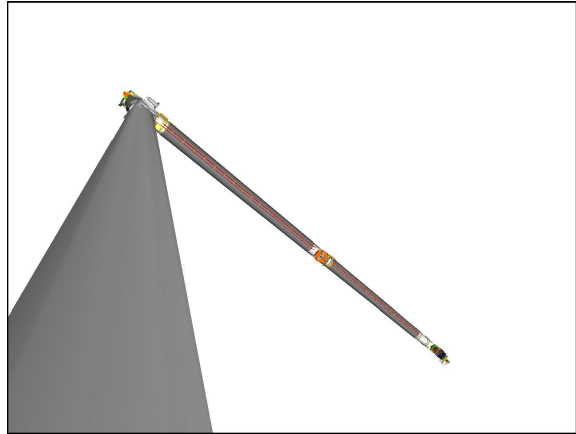
EVA2 View	SY	SP	EP	WP	WY	WR	
	+155.0	+25.0	-45.0	+60.0	+31.0	-70.0	
1: SP –		+3.6					
2: WP –				0.0			
3: WY –					-6.0		
4: WR +						+110.0	
5: EP +			-25.9				
6: SY –	+135.0						
JPM Install	+135.0	+3.6	-25.9	0.0	-6.0	+110.0	
	X	Y	Z	PITCH	YAW	ROLL	PL ID
	+183	-98	-296	167	322	225	2

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

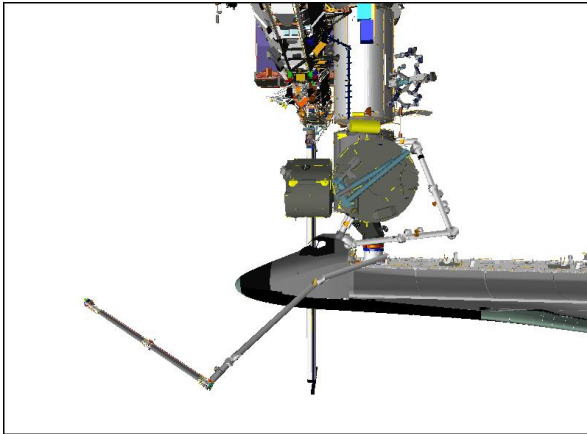
PARAM – PORT TEMP
JOINT – CRIT TEMP



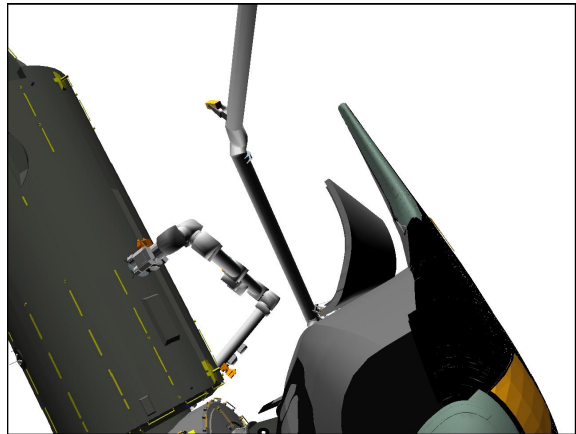
CCTVB (-15,0)



ELBOW (20,-20)



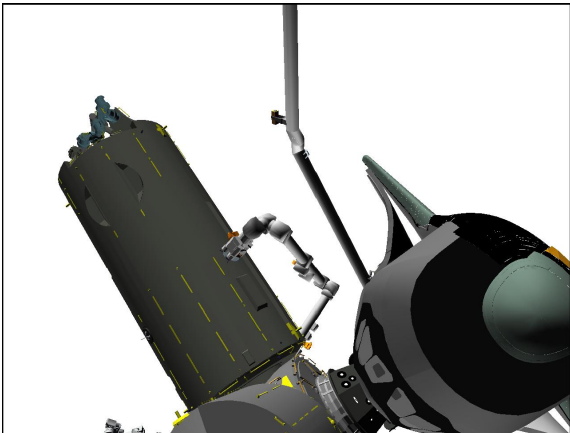
PORT



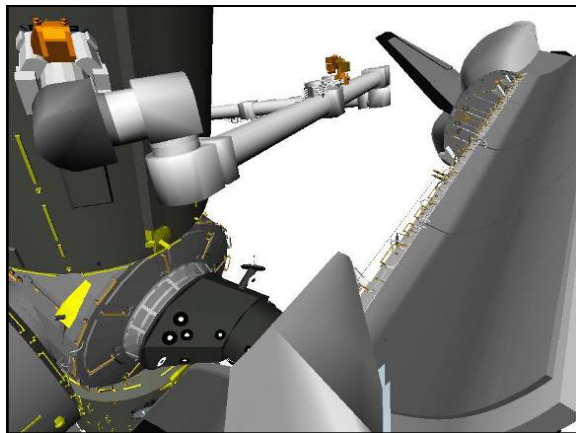
ITVC (70,-30)

3. CAMERA SETUP

Set up ITVC and Elbow cameras as shown to support SSRMS Release



ITVC (80,-35)



ELBOW (-170,-15)

JLP RELOCATE VIEWING

1. SETUP

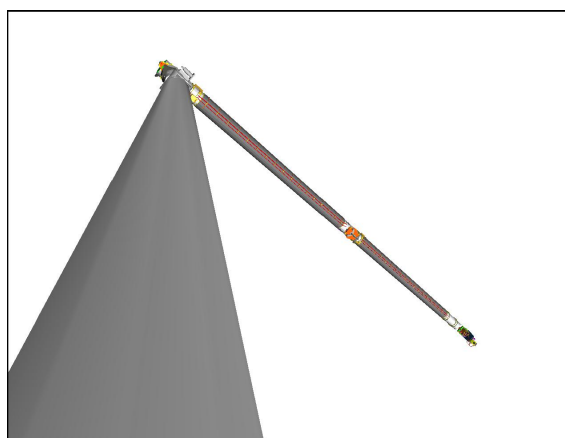
Mon 1	B
DwnInk	ELBOW
Mon 2	A
DTV	ITVC

Verify at JPM INSTALL VIEWING posn:

√	X	Y	Z	PITCH	YAW	ROLL	PL ID
	+183	-98	-296	167	322	225	2
√	SY	SP	EP	WP	WY	WR	
	+135.0	+3.6	-25.9	0.0	-6.0	+110.0	



ITVC (52,-24)



ELBOW (15,-25)

2. MNVR TO JLP RELOCATE VIEWING POSN

RHC

RATE – as reqd (VERN within 10 ft)

BRAKES – OFF (tb-OFF)

MODE – SINGLE, ENTER

Mnvr to JLP RELOCATE VIEWING posn:

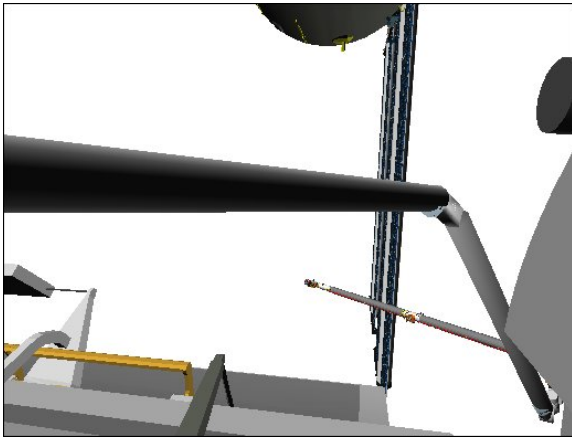
	SY	SP	EP	WP	WY	WR	
JPM Install	+135.0	+3.6	-25.9	0.0	-6.0	+110.0	
1: WY +					+20.0		
2: EP -			-45.0				
3: WR -						-70.0	
4: SY -	+125.0						
5: WP +				+60.0			
6: SP +		+10.0					
JLP Relocate	+125.0	+10.0	-45.0	+60.0	+20.0	-70.0	
	X	Y	Z	PITCH	YAW	ROLL	PL ID
	-700	-960	-144	348	53	268	2

BRAKES – ON (tb-ON)

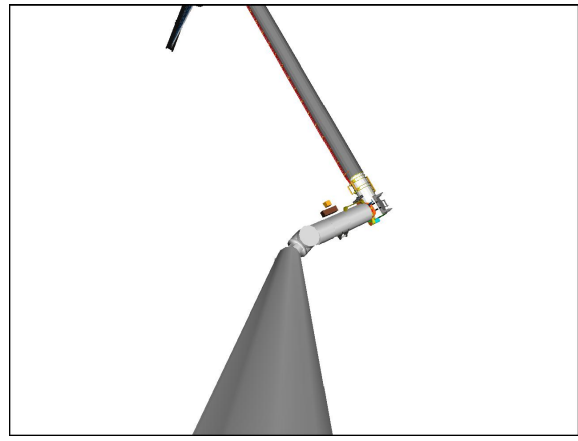
MODE – not DIRECT (It off)

PARAM – PORT TEMP

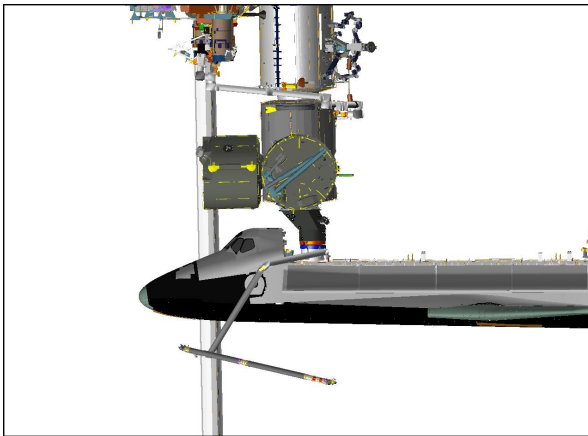
JOINT – CRIT TEMP



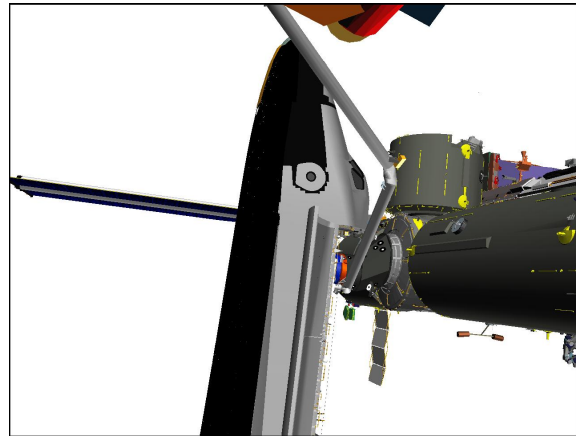
CCTV A (80,-10)



ELBOW (0,0)



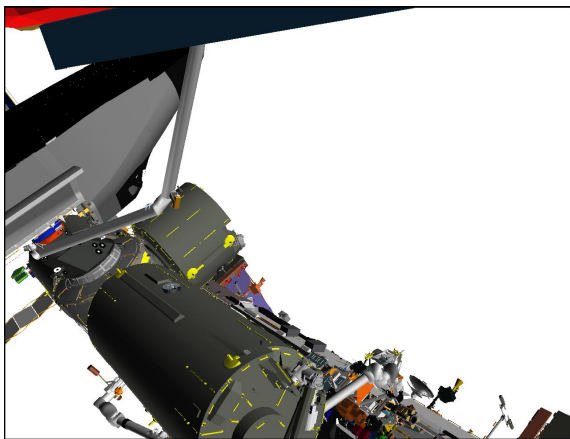
PORT



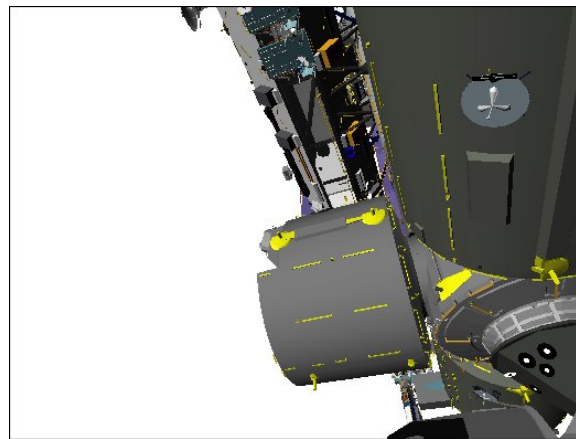
ITVC (52,24)

3. CAMERA SETUP

Set up ITVC and Elbow cameras as shown to support SSRMS JLP Relocate



ITVC (0,-20)



ELBOW (143,-30)

EVA 3 VIEWING SUPPORT

1. SETUP

Mon 1	B
Dwnlnk	ITVC
Mon 2	ELBOW
DTV	A

Verify at JLP RELOCATE VIEWING posn:

√	X	Y	Z	PITCH	YAW	ROLL	PL ID
	-700	-960	-144	348	53	268	2
√	SY	SP	EP	WP	WY	WR	
	+125.0	+10.0	-45.0	+60.0	+20.0	-70.0	

2. MNVR TO EVA 3 VIEWING POSN

RATE – as reqd (VERN within 10 ft)

BRAKES – OFF (tb-OFF)

MODE – SINGLE, ENTER

Mnvr to EVA 3 VIEWING POSN posn:

	SY	SP	EP	WP	WY	WR	
JLP Relocate Viewing	+125.0	+10.0	-45.0	+60.0	+20.0	-70.0	
1: SY +	+155.0						
2: SP +		+25.0					
3: WY +					+31.0		
EVA 3 Viewing	+155.0	+25.0	-45.0	+60.0	+31.0	-70.0	
	X	Y	Z	PITCH	YAW	ROLL	PL ID
	-176	-909	-428	146	90	88	2

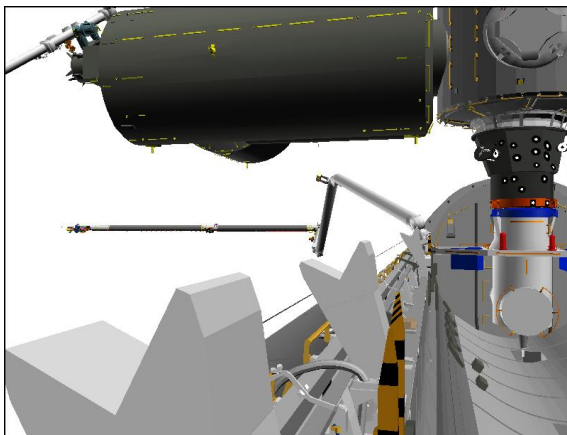
*Display singularity

BRAKES – ON (tb-ON)

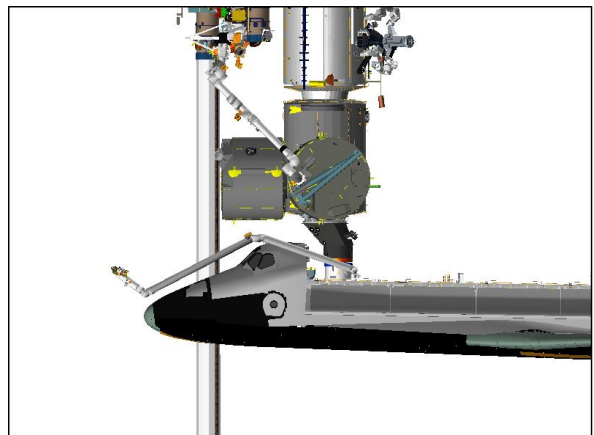
MODE – not DIRECT (lt off)

PARAM – PORT TEMP

JOINT – CRIT TEMP



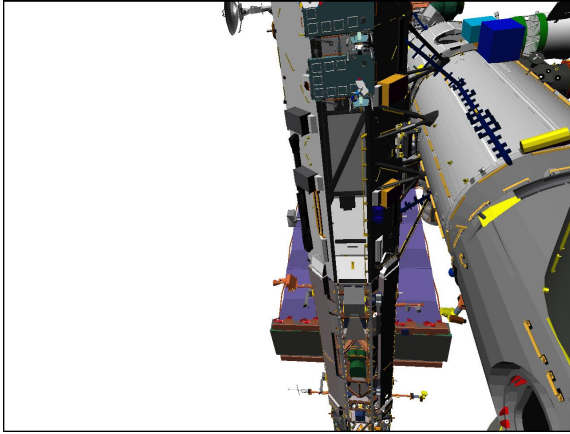
CCTV B (-15,0)



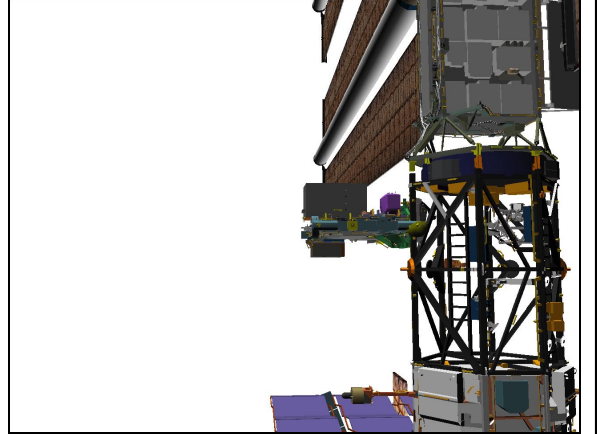
PORT

3. CAMERA SETUP

Set up ITVC and Elbow cameras as shown to support EVA 3



ELBOW (110,-15)



ITVC (135,-260)

JEM RMS DEPLOY VIEWING

1. SETUP

Mon 1	B
DwnInk	C
Mon 2	A
DTV	P1 LOOB

Verify at EVA 3 VIEWING posn:

√	X	Y	Z	PITCH	YAW	ROLL	PL ID	*
	-176	-909	-428	146	90	88	2	
	SY	SP	EP	WP	WY	WR		
√	+155.0	+25.0	-45.0	+60.0	+31.0	-70.0		

*Display singularity

2. MNVR TO JEM RMS DEPLOY VIEWING POSN

RATE – as reqd (VERN within 10 ft)

BRAKES – OFF (tb-OFF)

MODE – SINGLE, ENTER

Mnvr to JEM RMS VIEWING posn:

	SY	SP	EP	WP	WY	WR	
EVA 3 Viewing	+155.0	+25.0	-45.0	+60.0	+31.0	-70.0	
1: WP –				+30.0			
2: WY +					+74.0		*
3: WR –						-110.0	
JEM RMS Viewing	+155.0	+25.0	-45.0	+30.0	+74.0	-110.0	
	X	Y	Z	PITCH	YAW	ROLL	PL ID
	+218	-480	-16	225	20	48	2

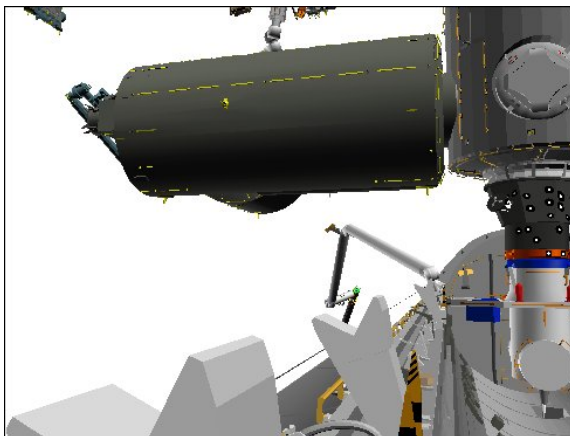
*Approaching singularity

BRAKES – ON (tb-ON)

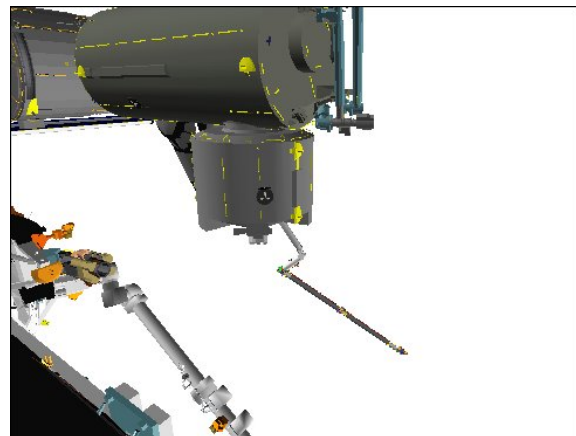
MODE – not DIRECT (lt off)

PARAM – PORT TEMP

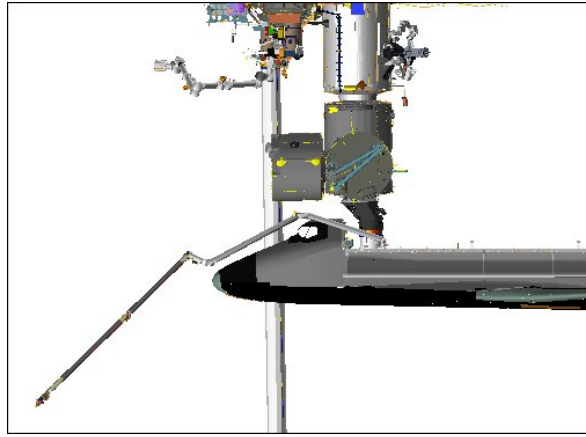
JOINT – CRIT TEMP



CCTV B (-16,5)



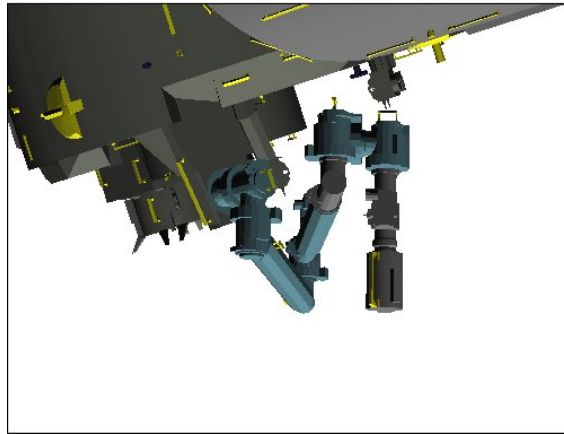
P1 LOOB (145,-20)



PORT

3. CAMERA SETUP

Set up ITVC camera as shown below to support JEM RMS Deploy



ITVC (55,-19)

OBSS UNDOCK CONFIG

1. SETUP

Mon 1	B
Dwnlnk	C
Mon 2	A
DTV	P1 LOOB

Verify at JEM RMS DEPLOY VIEWING posn:

√	X	Y	Z	PITCH	YAW	ROLL	PL ID
	+218	-480	-16	225	20	48	2
√	SY	SP	EP	WP	WY	WR	
	+155.0	+25.0	-45.0	+30.0	+74.0	-110.0	

2. MNVR TO OCAS START POSN

RATE – as reqd (VERN within 10 ft)

BRAKES – OFF (tb-OFF)

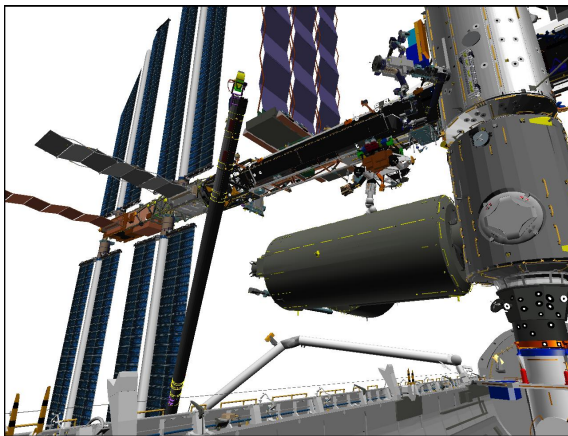
MODE – SINGLE, ENTER

Mnvr to UNDOCK OCAS SETUP posn:

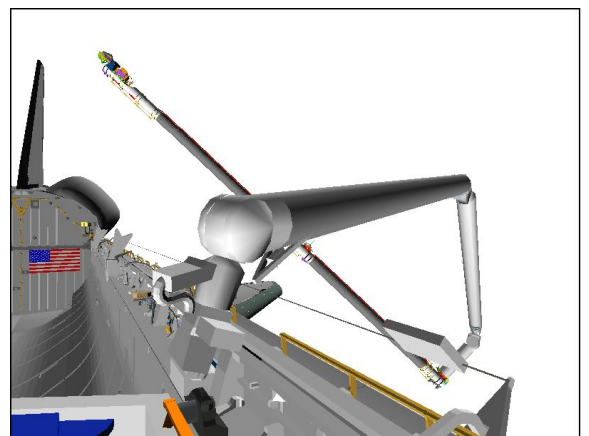
JEM RMS
Deploy
1: WY –
2: WP –
3: SY –
OCAS Start

	SY	SP	EP	WP	WY	WR	
	+155.0	+25.0	-45.0	+30.0	+74.0	-110.0	
					-27.0		
				-78.0			
	+63.0						
	+63.0	+25.0	-45.0	-78.0	-27.0	-110.0	
	X	Y	Z	PITCH	YAW	ROLL	PL ID
	-1125	-105	-656	64	320	51	2

BRAKES – ON (tb-ON)



CCTV C (-40,20)



CCTV A (30,0)

3. OCAS TO UNDOCK POSN

NOTE

Clearance between upper boom and JPM at Undock position is 36 in. Monitor clearance with Camera A

SM 94 PDRS CONTROL

END POS – ITEM 18 -1 0 2 9 +2 2 9 -6 1 4 EXEC

ATT – ITEM 21 +2 8 4 +2 7 0 +2 7 0 EXEC

CMD CK – ITEM 25 EXEC (GOOD)

BRAKES – OFF (tb-OFF)

MODE – OPR CMD, ENTER (READY It on)

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

AUTO SEQ – PROCEED (IN PROG It on)

When AUTO SEQ IN PROG It – off:

BRAKES – ON (tb-ON)

PARAM – PORT TEMP

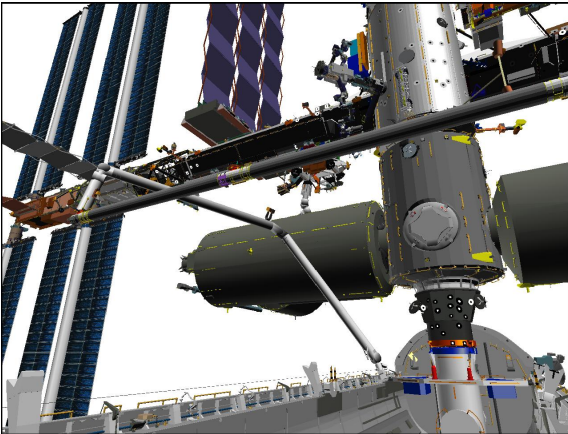
JOINT – CRIT TEMP

OBSS UNDOCK posn:

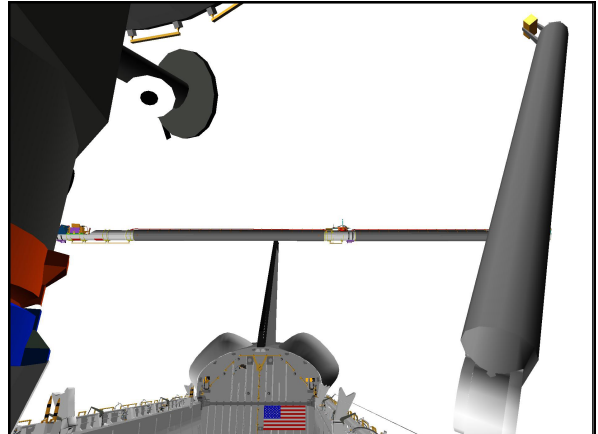
(03:35)

	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 C (-30,20)



CCTV A (0,22)

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CONTINGENCY

OBSS SJ HANDOFF TO SRMS	FS 4-2
JPM INSTALL VIEWING TO CONTINGENCY UNDOCK.....	FS 4-10
EVA 2 VIEWING TO CONTINGENCY UNDOCK	FS 4-12
JLP RELOCATE VIEWING TO UNDOCK	FS 4-14
EVA 3 VIEWING TO UNDOCK.....	FS 4-16

CONTINGENCY

OBSS SJ HANDOFF TO SRMS

WARNING
Port PLBD Radiator must be stowed

- A7U 1. SJ MNVR TO OBSS PRE-GRAPPLE AT HANDOFF
CCTV – perform PAN/TILT RESET
– fully zoom out for SJ pictures

Mon 1	ELBOW
Dwnlnk	B
Mon 2	A
DTV	P1 LOOB

SM 94 PDRS CONTROL

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

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

Mnvr to OBSS PRE-GRAPPLE AT HANDOFF posn (reference pictures as reqd):

	SY	SP	EP	WP	WY	WR	
Strap Removal Setup	+85.0	+100.0	-31.0	+5.0	0.0	0.0	
1: SP –		+26.9					
2: WP +				+45.9			
3: WY +					+8.3		
4: WR +						+87.1	
5: EP –			-62.5				
6: SY +	+163.4						
OBSS Pre-Grapple	+163.4	+26.9	-62.5	+45.9	+8.3	+87.1	
	X	Y	Z	PITCH	YAW	ROLL	PL ID
	-171	-231	-363	173	11	231	0

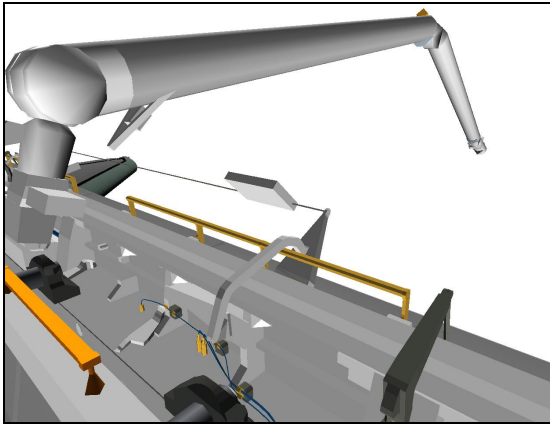
BRAKES – ON (tb-ON)
MODE – not DIRECT

Notify SSRMS Operator, SRMS at OBSS PRE-GRAPPLE AT HANDOFF posn.
Give GO for maneuver to OBSS HANDOFF

CONTINGENCY

Step 1:

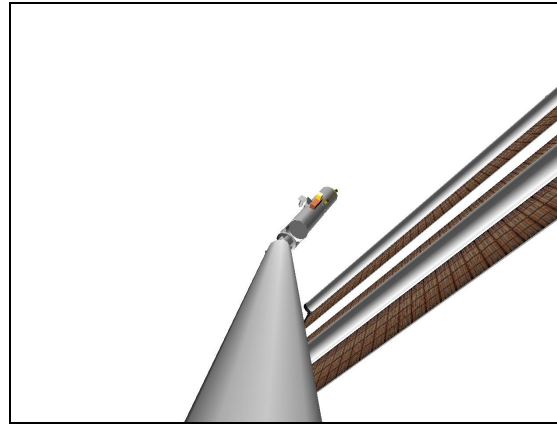
Drive SP- (for 73.1°)
From +100.0 to +26.9



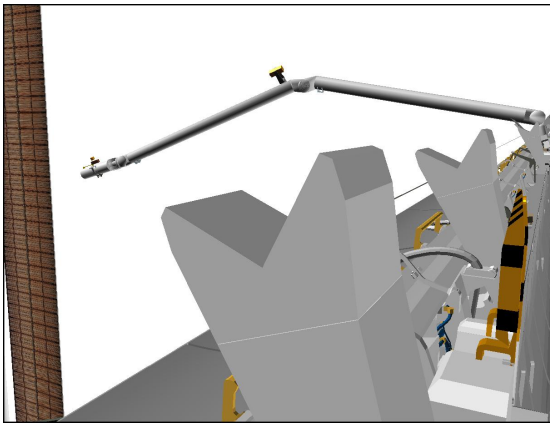
CCTV A (49,-18)

Step 2:

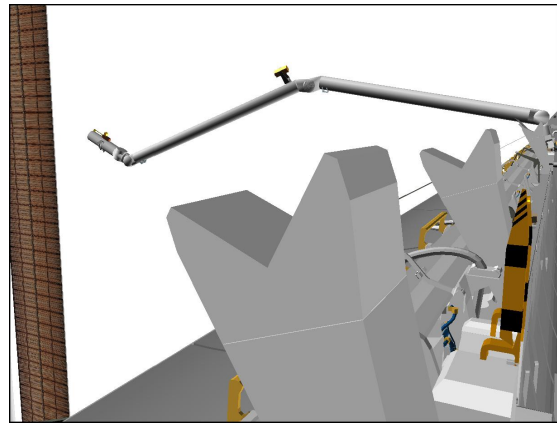
Drive WP+ (for 40.9°)
From +5.0 to +45.9



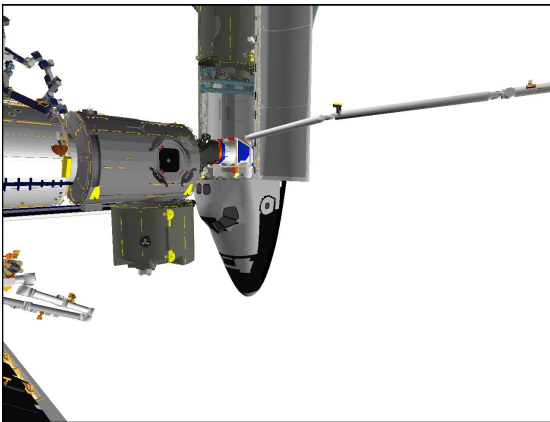
ELBOW (0,0)



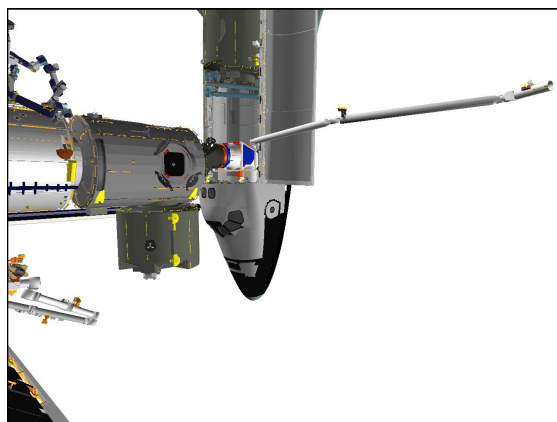
CCTV B (-27,-10)



CCTV B (-27,-10)



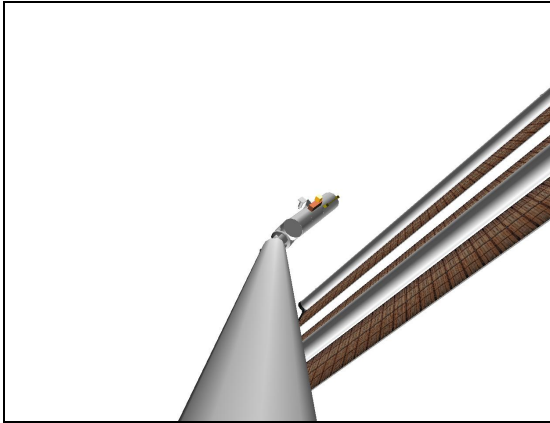
P1 LOOB (138,-6)



P1 LOOB (138,-6)

Step 3:

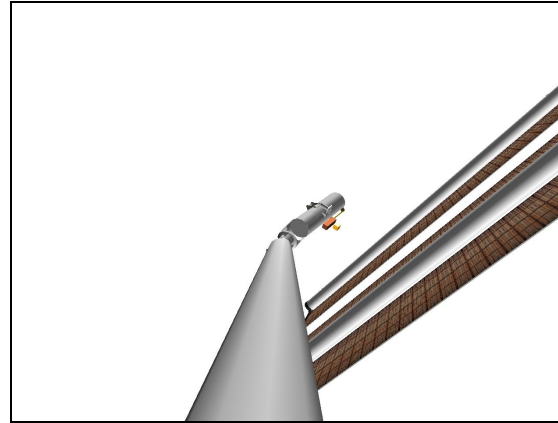
Drive WY+ (for 8.3°)
From 0.0 to +8.3



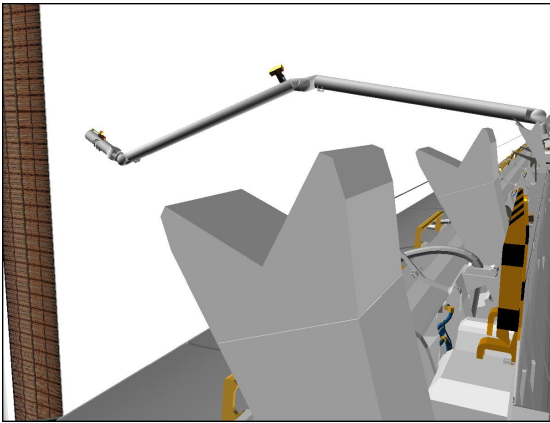
ELBOW (0,0)

Step 4:

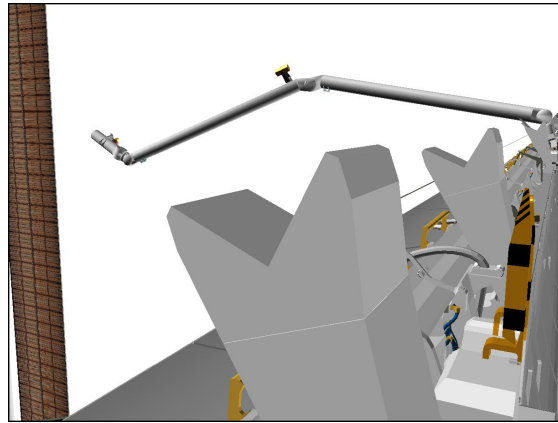
Drive WR+ (for 87.1°)
From 0.0 to +87.1



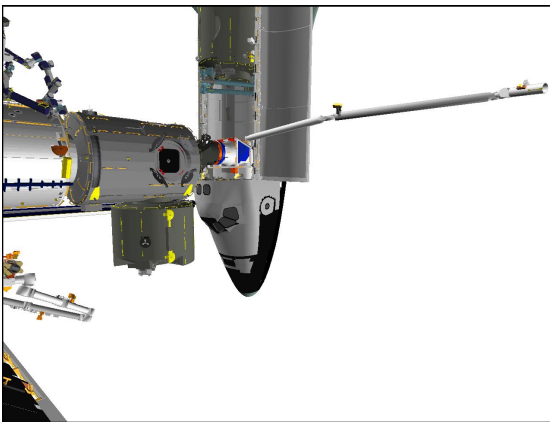
ELBOW (0,0)



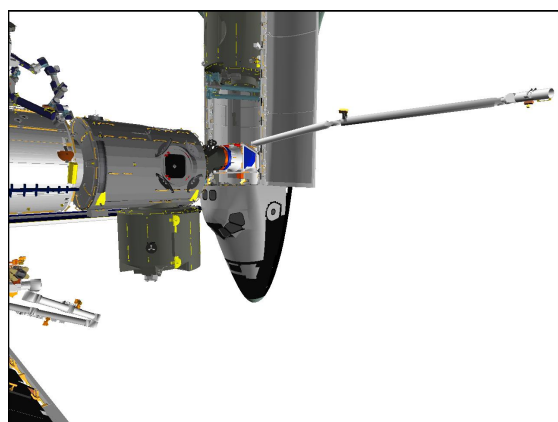
CCTV B (-27,10)



CCTV B (-27,10)



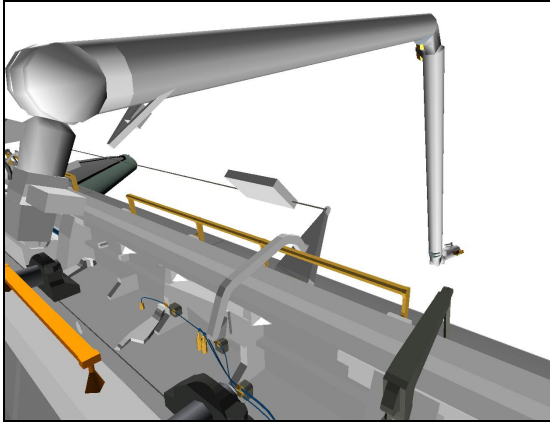
P1 LOOB (138,-6)



P1 LOOB (138,-6)

Step 5:

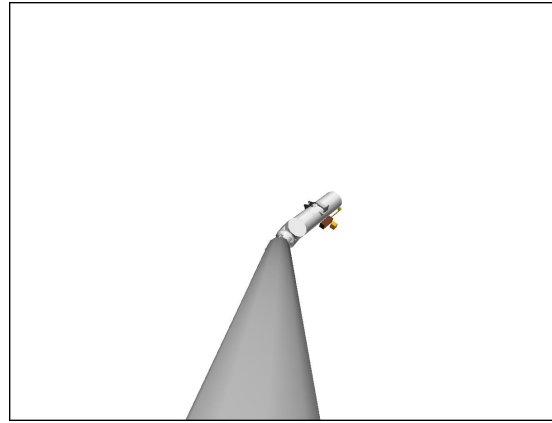
Drive EP- (for 31.5°)
From -31.0 to -62.5



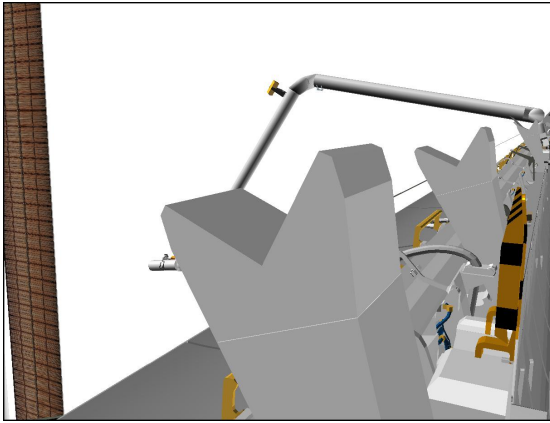
CCTV A (49,-18)

Step 6:

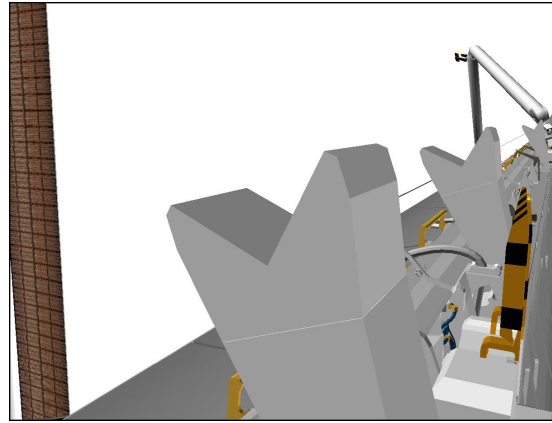
Drive SY+ (for 78.4°)
From +85.0 to +163.4



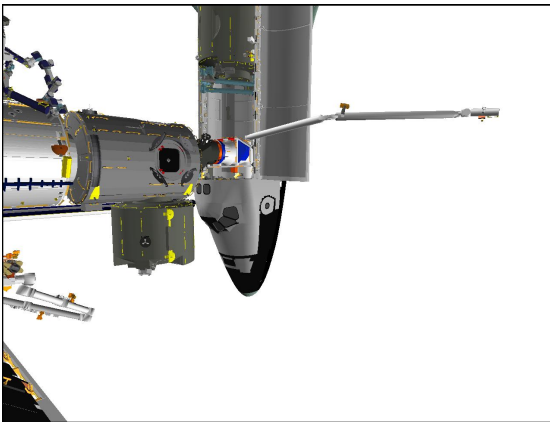
ELBOW (0,0)



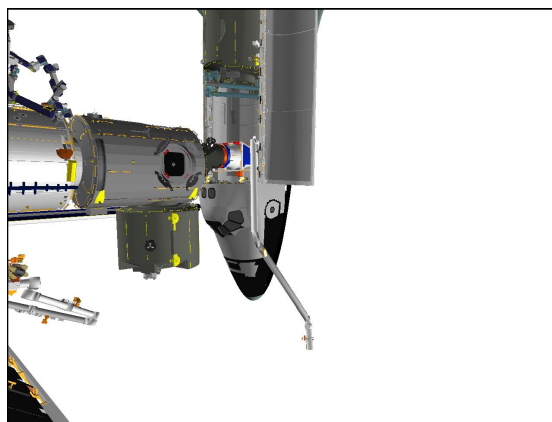
CCTV B (-27,-10)



CCTV B (-27,-10)



P1 LOOB (138,-6)



P1 LOOB (138,-6)

- A7U 2. 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

Mon 1	EE
DwnInk	B
Mon 2	A
DTV	BASE ELBOW

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

3. SJ MNVR TO OBSS GRAPPLE AT HANDOFF

On SSRMS Operator GO for SRMS OBSS Grapple (SSRMS at OBSS Handoff position)

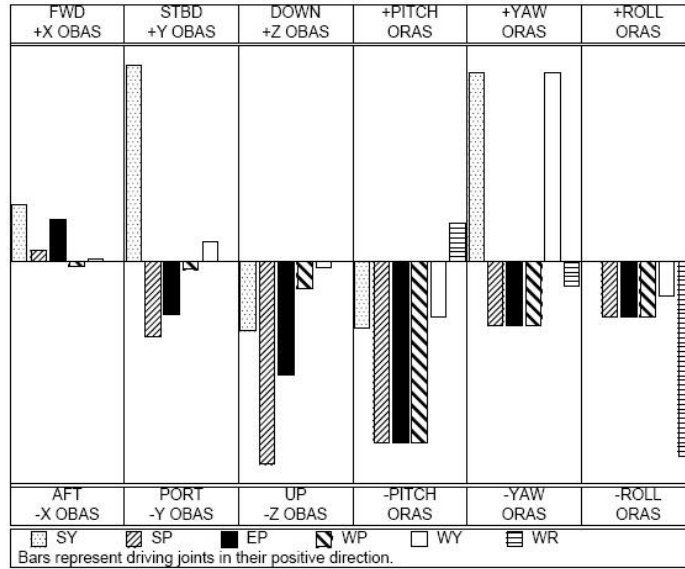
- * If using Shuttle attitude control, verify in attitude; *
- * then DAP: FREE *

RATE – VERN (RATE MIN tb-ON)

BRAKES – OFF (tb-OFF)

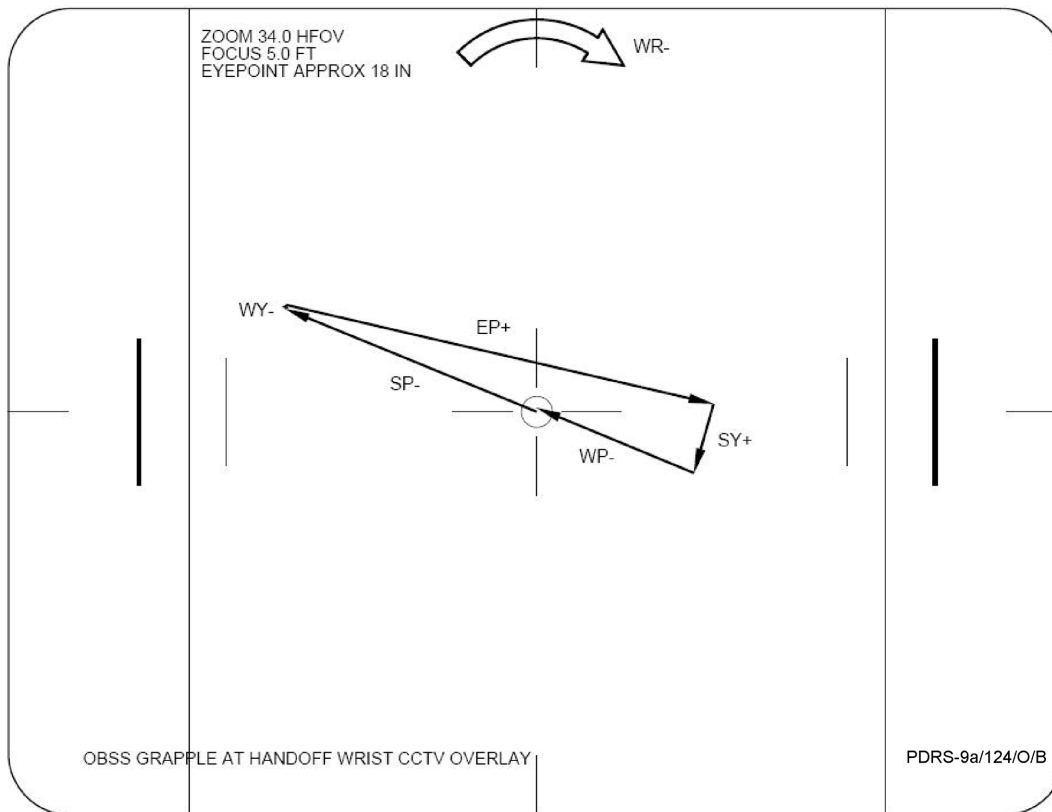
MODE – best available

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



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

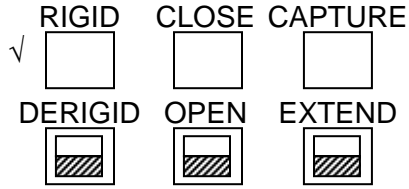
ΔSY	ΔSP	ΔEP	ΔWP	ΔWY	ΔWR
+0.9	-16.3	+34.1	-17.4	-1.1	-0.5



4. OBSS GRAPPLE

CAUTION
Monitor EE tb timing to prevent EE motor burnout

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



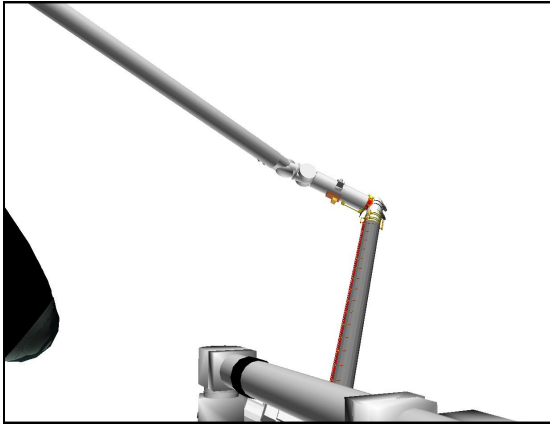
CRITICAL TIMES (28 sec total):
CAPTURE tb – gray, then
CLOSE tb – gray, 3 sec max, then
RIGID tb – gray, 25 sec max

- * 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) *

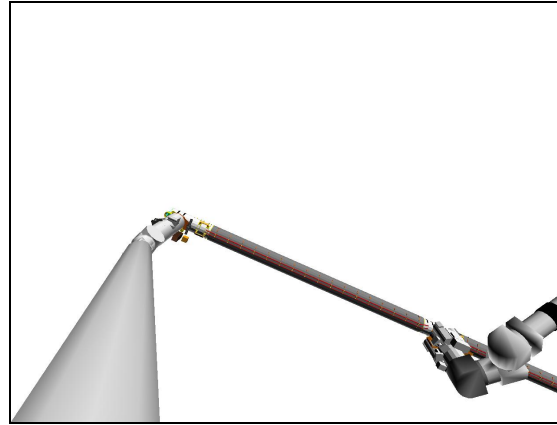
EE MODE – OFF

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

BRAKES – ON (tb-ON)
MODE – not DIRECT



BASE ELBOW (113,7)



ELBOW (20,0)

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
✓	-71	+201	-758	96	311	197	2
	SY	SP	EP	WP	WY	WR	
✓	+164.3	+10.6	-28.4	+28.5	+7.2	+86.6	

R12(OBSS) RSC PWR – OFF, ON

NOTE

SPEE power ON stops the thermal clock for Sensor Package 1.

APCU 2 stops the thermal clock for Sensor Package 2. This activity must be decoupled from JPM LTA cable disconnect task due to EVA inhibits requiring APCU 2 to be off

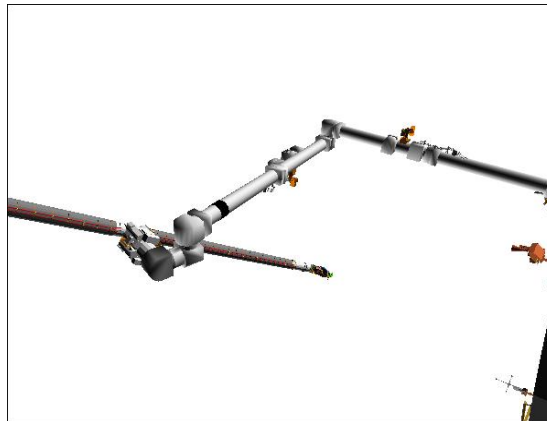
R12(OBSS) SPEE PWR – ON

A15 On MCC and EVA GO:
√PTU 2 tb – on
APCU 2 OUTPUT – ON
CONV – ON

SM 179 POWER TRANSFER

√PTU 2 APCU OUT VOLTS: 123V to 126V
√OUTPUT – ON

A31p PGSC Pwr – ON
Sel 'Shuttle Apps' > 'LCC' (Wait 2-3 min from APCU CONV – ON for GUI Status)
√Laser off – blue
√Comm – green
If Laser off and Comm status not correct: √MCC



ELBOW (65,-15)

Notify SSRMS Operator, OBSS Grapple complete. Give GO for OBSS
Ungrapple

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

JPM INSTALL VIEWING TO CONTINGENCY UNDOCK

1. SETUP

CAUTION
 Procedure assumes SSRMS at JPM Install posn
 (SR: -115.6, SY: +166.0, SP: -110.2, EP: +97.0,
 WP: -51.6, WY: -155.6, WR: +97.1)

Mon 1	B
DwnInk	C
Mon 2	A
DTV	ELBOW / P1 LOOB

Verify at JPM INSTALL VIEWING posn:

X	Y	Z	PITCH	YAW	ROLL	PL ID
√ +183	-98	-296	167	322	225	2
SY	SP	EP	WP	WY	WR	
√ +135.0	+3.6	-25.9	0.0	-6.0	+110.0	

√MCC if SSRMS not at JPM Install

2. MNVR TO CONTINGENCY UNDOCK POSN

NOTE

Minimum clearance from SRMS to SSRMS is 30 inches in line 1 of SJ table. Monitor clearance using CCTV A.

Minimum clearance from SRMS to Fwd MPM is 32 inches in line 6 of SJ table. Monitor clearance using CCTV A

RATE – as reqd (VERN within 10 ft)

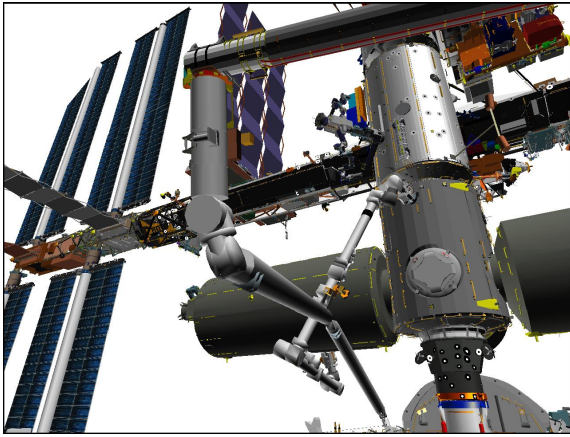
BRAKES – OFF (tb-OFF)

MODE – SINGLE, ENTER

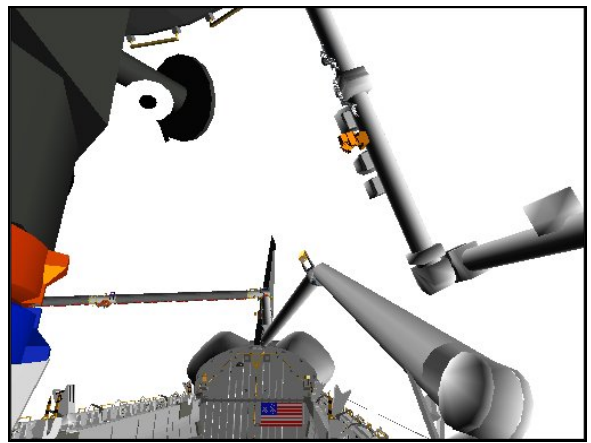
Mnvr to CONTINGENCY UNDOCK posn:

	SY	SP	EP	WP	WY	WR	
JPM Install	+135.0	+3.6	-25.9	0.0	-6.0	+110.0	
1: SP +		+9.0					
2: SY -	+56.0						
3: WR -						-40.0	
4: WP +				+77.0			
5: EP +			-8.0				
6: SY -	-11.0						
7: WR -						-80.0	
8: WY -					-21.0		
9: SP +		+18.0					
10: EP -			-30.0				
Cont Undock	-11.0	+18.0	-30.0	+77.0	-21.0	-80.0	
	X	Y	Z	PITCH	YAW	ROLL	PL ID
	-1110	+562	-527	203	280	42	2

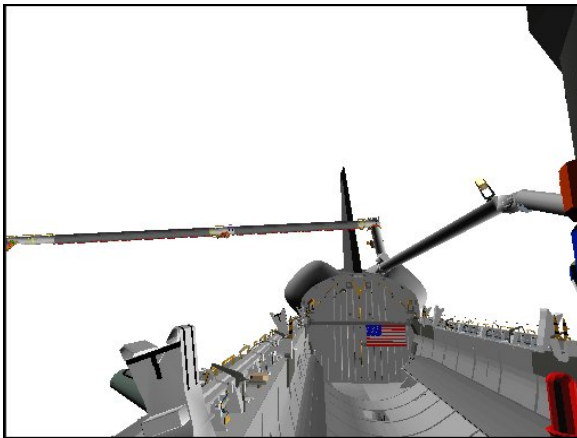
BRAKES – ON (tb-ON)



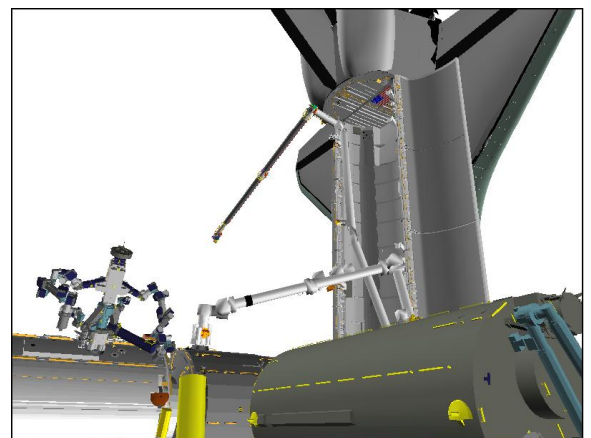
CCTV C (-30,27)



CCTV A (0,22)



CCTV D (-4,12)



P1 LOOB (122,22)

EVA 2 VIEWING TO CONTINGENCY UNDOCK

1. SETUP

CAUTION
 Procedure assumes SSRMS at JPM Install posn
 (SR: -115.6, SY: +166.0, SP: -110.2,
 EP: +97.0, WP: -51.6, WY: -155.6, WR: +97.1)

Mon 1	B
DwnInk	C
Mon 2	A / BASE ELBOW
DTV	ELBOW / P1 LOOB

Verify at EVA 2 VIEWING posn:

X	Y	Z	PITCH	YAW	ROLL	PL ID
√ -176	-909	-428	146	90	288	2 *
SY	SP	EP	WP	WY	WR	
√ +155.0	+25.0	-45.0	+60.0	+31.0	-70.0	

*Display singularity

√MCC if SSRMS not at JPM Install

2. MNVR TO CONTINGENCY UNDOCK POSN

NOTE

Minimum clearance from SRMS to SSRMS is 20 inches in line 3 of SJ table. Monitor clearance using Elbow or SSRMS Base Elbow.

Minimum clearance from SRMS to Mid MPM is 32 inches in line 5 of SJ table. Monitor clearance using CCTV A

RATE – as reqd (VERN within 10 ft)

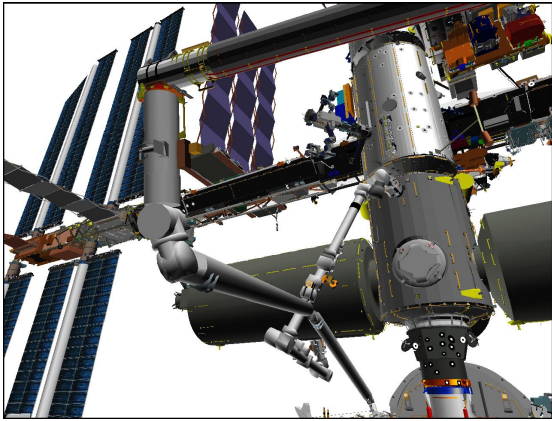
BRAKES – OFF (tb-OFF)

MODE – SINGLE, ENTER

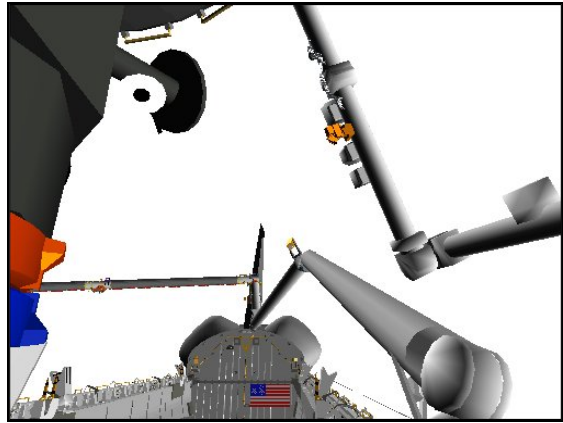
Mnvr to CONTINGENCY UNDOCK posn:

	SY	SP	EP	WP	WY	WR	
EVA 2 Viewing	+155.0	+25.0	-45.0	+60.0	+31.0	-70.0	
1: SP –		+13.0					
2: WP +				+77.0			
3: SY –	+65.0						
4: EP +			-17.0				
5: SY –	-11.0						
6: SP +		+18.0					
7: EP –			-30.0				
8: WY –					-21.0		
9: WR –						-80.0	
Cont Undock	-11.0	+18.0	-30.0	+77.0	-21.0	-80.0	
X	Y	Z	PITCH	YAW	ROLL	PL ID	
-1110	+562	-527	203	280	42	2	

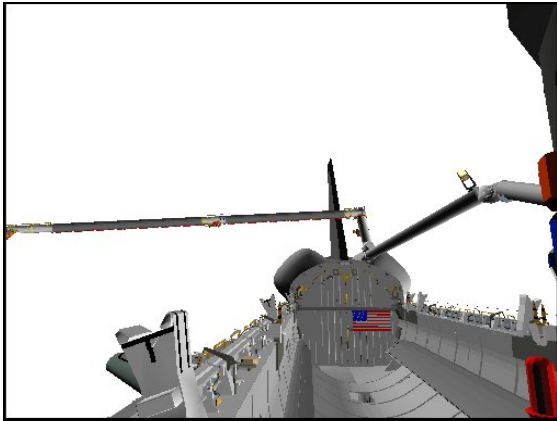
BRAKES – ON (tb-ON)



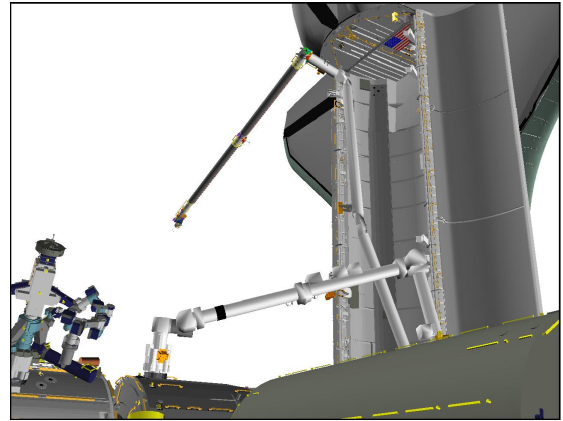
CCTV C (-30,27)



CCTV A (0,22)



CCTV D (-4,12)



P1 LOOB (122,22)

JLP RELOCATE VIEWING TO UNDOCK

1. SETUP

CAUTION
 Procedure assumes SSRMS at JLP Install posn
 (SR: +120.0, SY: +53.8, SP: -72.3, EP: +136.0,
 WP: +28.4, WY: -37.7, WR: +132.3)

Mon 1	B
DwnInk	C
Mon 2	A
DTV	ITVC

Verify at JLP RELOCATE VIEWING posn:

X	Y	Z	PITCH	YAW	ROLL	PL ID
√ -700	-960	-144	348	53	268	2
SY	SP	EP	WP	WY	WR	
√ +125.0	+10.0	-45.0	+60.0	+20.0	-70.0	

√MCC if SSRMS not at JLP Install

2. MNVR TO UNDOCK POSN

RATE – as reqd (VERN within 10 ft)

BRAKES – OFF (tb-OFF)

MODE – SINGLE, ENTER

NOTE

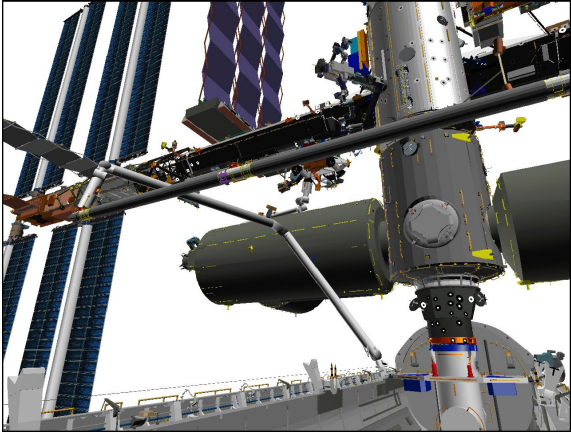
Minimum clearance from SRMS to JPM is 36 inches in line 2 of SJ table. Monitor clearance using CCTV A

Mnvr to UNDOCK posn:

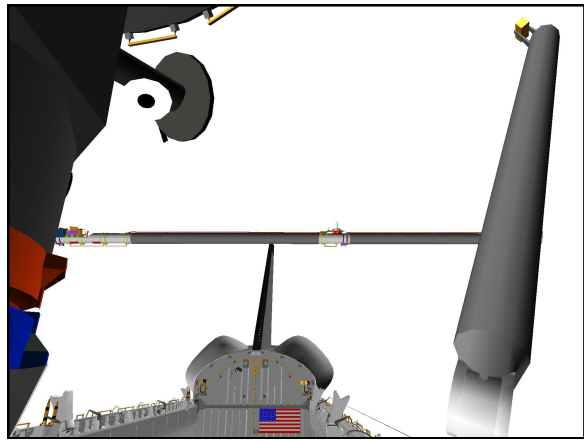
	SY	SP	EP	WP	WY	WR	
JLP Relocate	+125.0	+10.0	-45.0	+60.0	+20.0	-70.0	
1: SY –	+70.0						
2: SP +		+50.0					
3: EP –			-49.0				
4: SY –	+25.8						
5: SP +		+66.3					
6: WY –					+10.7		
7: WP –				-85.9			
8: WR –						-100.7	
Undock	+25.8	+66.3	-49.0	-85.9	+10.7	-100.7	
	X	Y	Z	PITCH	YAW	ROLL	PL ID
	-1029	+229	-614	284	270	270	2

*Display singularity

BRAKES – ON (tb-ON)



CCTV C (-30,20)



CCTV A (0,22)

EVA 3 VIEWING TO UNDOCK

1. SETUP

CAUTION
 Procedure assumes SSRMS at Stage Park posn
 (SR: +150.0, SY: +60.0, SP: -62.0, EP: -135.0,
 WP: -90.0, WY: -163.0, WR: 0.0)

Mon 1	B
DwnInk	C
Mon 2	A
DTV	ELBOW

Verify at EVA 3 VIEWING posn:

X	Y	Z	PITCH	YAW	ROLL	PL ID
-176	-909	-428	146	90	88	2
SY	SP	EP	WP	WY	WR	
+155.0	+25.0	-45.0	+60.0	+31.0	-70.0	

*Display singularity

√MCC if SSRMS not at Stage Park

2. MNVR TO UNDOCK POSN

NOTE

Minimum clearance from SRMS to JPM is 36 inches in
 line 3 of SJ table. Monitor clearance using CCTV A

RATE – as reqd (VERN within 10 ft)

BRAKES – OFF (tb-OFF)

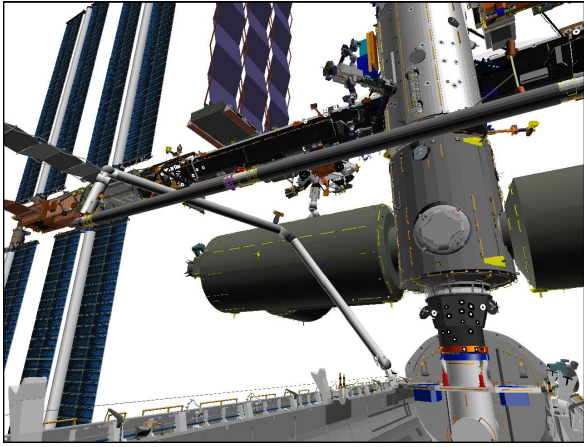
MODE – SINGLE, ENTER

Mnvr to UNDOCK posn:

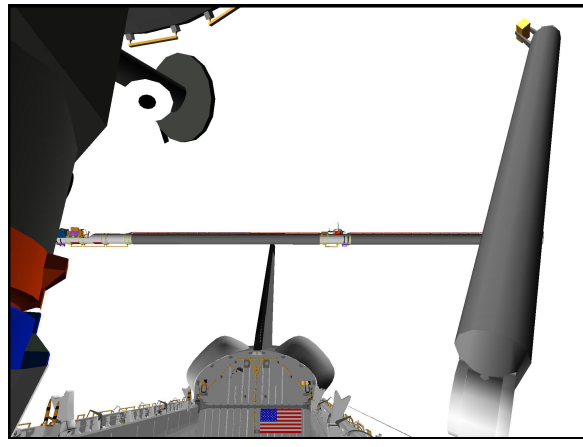
	SY	SP	EP	WP	WY	WR	
EVA 3 Viewing	+155.0	+25.0	-45.0	+60.0	+31.0	-70.0	
1: WY –					+10.7		
2: SY –	+65.0						
3: SP +		+50.0					
4: EP –			-49.0				
5: SY –	+25.8						
6: SP +		+66.3					
7: WP –				-85.9			
8: WR –						-100.7	
Undock	+25.8	+66.3	-49.0	-85.9	+10.7	-100.7	
X	Y	Z	PITCH	YAW	ROLL	PL ID	
-1029	+229	-614	284	270	270	2	

*Display singularity

BRAKES – ON (tb-ON)



CCTV C (-30,20)



CCTV A (0,22)

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REFERENCE DATA

JOINT ANGLES VS POR COORDINATES	FS 5-2
PL ID 5 – END EFFECTOR COORDINATE SYSTEM	FS 5-4
OBSS HANDOFF CAMERA MATRIX.....	FS 5-5

JOINT ANGLES VS POR COORDINATES

STBD ACAS START

X	Y	Z	PITCH	YAW	ROLL	PL ID
-850	+303	-382	314	44	50	0/5
SY	SP	EP	WP	WY	WR	
-71.0	+4.8	-49.3	-113.1	+47.9	+185	

PORT UPPER ACAS START

X	Y	Z	PITCH	YAW	ROLL	PL ID
-1176	-395	-399	330	153	54	0/5
SY	SP	EP	WP	WY	WR	
+30.3	+26.5	-33.3	-15.0	-4.1	-16.6	

PORT APEX START

X	Y	Z	PITCH	YAW	ROLL	PL ID
-885	-300	-339	316	290	48	0/5
SY	SP	EP	WP	WY	WR	
+53.8	+56.8	-103.8	-86.2	-42.5	-40.3	

ELBOW STRAP REMOVAL

X	Y	Z	PITCH	YAW	ROLL	PL ID
-686	-374	-967	88	36	256	0
SY	SP	EP	WP	WY	WR	
+85.0	+100.0	-31.0	+5.0	0.0	0.0	

OBSS PRE-GRAPPLE

X	Y	Z	PITCH	YAW	ROLL	PL ID
-171	-231	-363	173	11	231	0
SY	SP	EP	WP	WY	WR	
+163.4	+26.9	-62.5	+45.9	+8.3	+87.1	

EXPECTED OBSS GRAPPLE

X	Y	Z	PITCH	YAW	ROLL	PL ID
-113	-243	-370	173	11	231	0
-95	-243	-369	96	311	167	1
-71	+201	-758	96	311	197	2
SY	SP	EP	WP	WY	WR	
+164.3	+10.6	-28.4	+28.5	+7.2	+86.6	

JPM INSTALL VIEWING

X	Y	Z	PITCH	YAW	ROLL	PL ID
-275	-458	-196	226	34	228	0
-266	-465	-181	167	322	195	1
+183	-98	-296	167	322	225	2
SY	SP	EP	WP	WY	WR	
+135.0	+3.6	-25.9	0.0	-6.0	+110.0	

OBSS SENSOR CHECKOUT

X	Y	Z	PITCH	YAW	ROLL	PL ID
-605	-360	-29	237	5	218	0
-598	-358	-13	151	322	157	1
-196	+1	-255	151	322	187	2
SY	SP	EP	WP	WY	WR	
+97.0	+3.6	-74.0	+10.2	+30.0	+137.0	

REFERENCE DATA

JLP RELOCATE VIEWING

X	Y	Z	PITCH	YAW	ROLL	PL ID
-352	-488	-218	165	37	92	0
-340	-499	-226	348	53	238	1
-700	-960	-144	348	53	268	2
SY	SP	EP	WP	WY	WR	
+125.0	+10.0	-45.0	+60.0	+20.0	-70.0	

EVA 2 & 3 VIEWING SUPPORT

X	Y	Z	PITCH	YAW	ROLL	PL ID
-174	-318	-427	144	0	91	0
-163	-318	-442	114	90	91	1
-176	-909	-428	146	90	88	2
SY	SP	EP	WP	WY	WR	
+155.0	+25.0	-45.0	+60.0	+31.0	-70.0	

*Display singularity

JEM RMS VIEWING

X	Y	Z	PITCH	YAW	ROLL	PL ID
-180	-277	-403	156	316	29	0
-167	-268	-411	225	20	18	1
+218	-480	-16	225	20	48	2
SY	SP	EP	WP	WY	WR	
+155.0	+25.0	-45.0	+30.0	+74.0	-110.0	

UNDOCK CONFIG

X	Y	Z	PITCH	YAW	ROLL	PL ID
-1032	-362	-618	284	0	270	0
-1041	-362	-602	314	270	270	1
-1029	+229	-614	284	270	270	2
SY	SP	EP	WP	WY	WR	
+25.8	+66.3	-49.0	-85.9	+10.7	-100.7	

*Display singularity

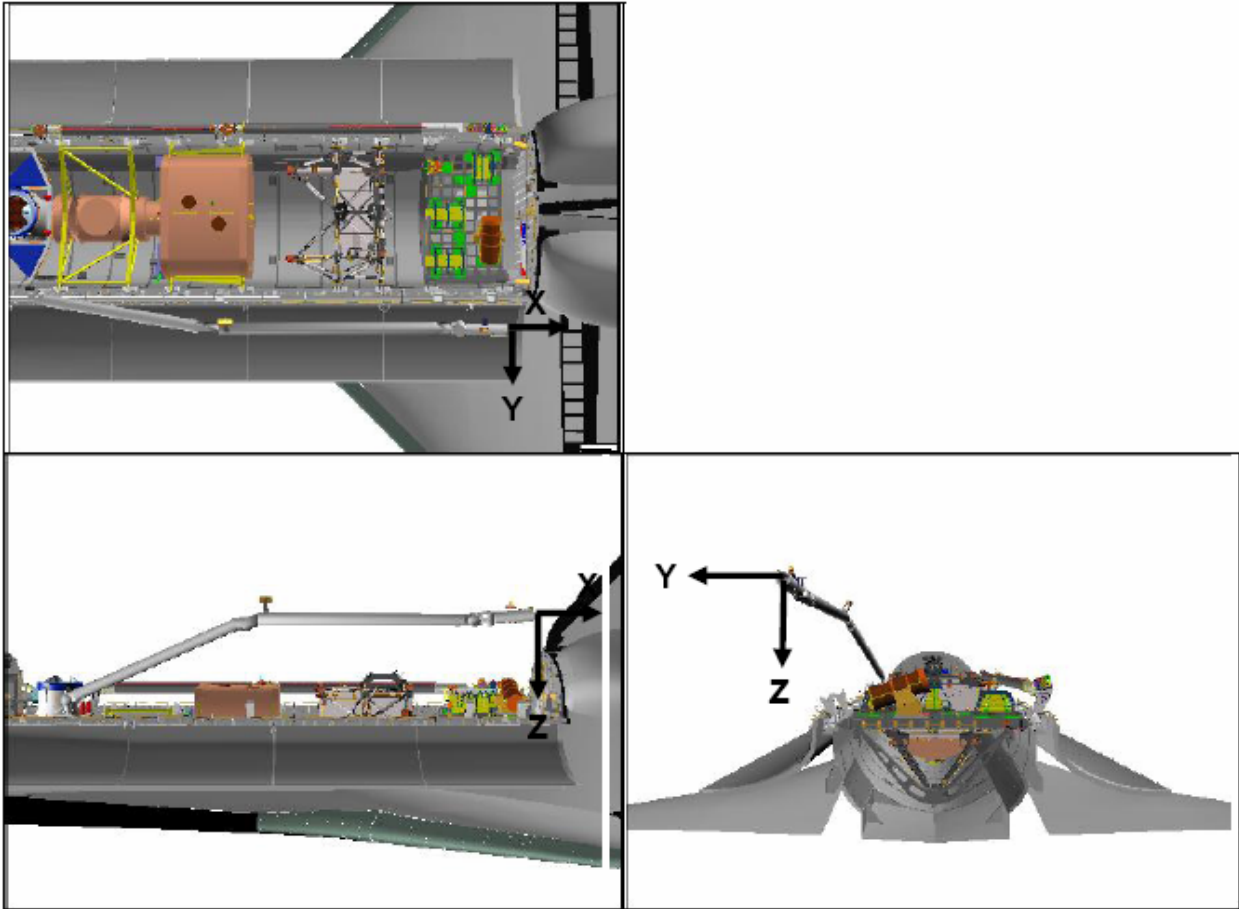
CONTINGENCY UNDOCK CONFIG

X	Y	Z	PITCH	YAW	ROLL	PL ID
-1209	-20	-565	71	353	278	0
-1210	-18	-583	203	280	12	1
-1110	+562	-527	203	280	42	2
SY	SP	EP	WP	WY	WR	
-11.0	+18.0	-30.0	+77.0	-21.0	-80.0	

FLAT FIELDS

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

PL ID 5 – END EFFECTOR COORDINATE SYSTEM



POR: Center of EE

PURPOSE: RCC Wing Survey using SRMS EE Camera

RATES:

	<u>COARSE</u>	<u>VERN</u>
TRANS Limit ft/sec	0.61	0.04
Rot Limit deg/sec	4.76	4.76

OBSS HANDOFF CAMERA MATRIX

	Task	Shuttle				Station				
		Mon 1	Mon 2	Downlink	DTV	Mon 1	Mon 2	Mon 3	To Orbiter	Downlink
P	Mnvr to OBSS H/O Posn	B	A	Elbow	Base Elbow P1 LOOB					
R	Mnvr to OBSS Pre-grapple					Lab Stbd	Base Elbow	MBS Mast		
R	OBSS Grapple at S1					Lab Stbd	Tip LEE	MBS Mast	B C	Elbow
R	OBSS Mnvr to H/O Posn					Base Elbow P1 LOOB	Lab Stbd	Tip Elbow MBS Mast	B C	Elbow EE
P	SRMS Grapple of OBSS	EE Elbow	Base Elbow P1 LOOB	Elbow A	B					
R	OBSS Ungrapple					P1 LOOB	Tip LEE	Elbow	B C	Elbow

Legend:

A, B, C, D:	Orbiter Payload Bay Camera A, B, C, D	R: ROBO Procedure
Elbow:	SRMS Elbow	P: PDRS Procedure
EE:	SRMS End Effector	
Base LEE:	SSRMS Base LEE (DCP: 21, PCS: 40)	
Base Elbow:	SSRMS Base Elbow (DCP: 22, PCS: 43)	
Tip Elbow:	SSRMS TIP Elbow (DCP: 24, PCS: 48)	
Tip LEE:	SSRMS TIP LEE (DCP: 25, PCS: 51)	
P1 LOOB:	P1 Lower Outboard (DCP: 09, PCS: 19)	
S1 LOOB:	S1 Lower Outboard (DCP: 03, PCS: 4)	
Lab Stbd:	Zenith: Lab Starboard Zenith (DCP: 13, PCS: 28)	

1. Cameras in parentheses are backup camera options
2. If specific cameras are not identified, DCPL 91 and 92 are displayed to the ISS crew for situational awareness
3. Images displayed on monitors 1 and 2 are recorded on the Orbiter
4. ISS video comes to Orbiter on PL2. The desired source is routed to 11 – VTR 2
5. Camera numbers on Mon 1 (Station), Mon 2 (Station), and Mon 3 (Station) are camera numbers for RWS DCP routing. Camera numbers in To Orbiter (Station) and Downlink (Station) are for video routing via the PCS

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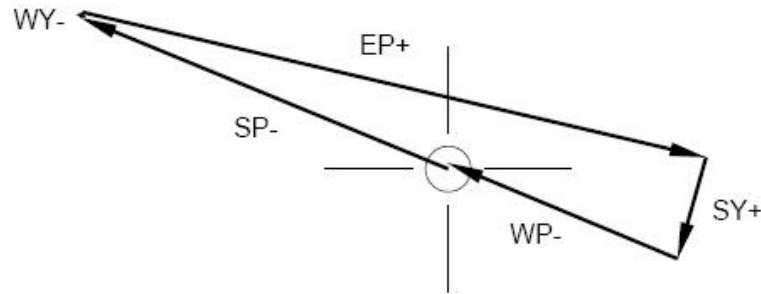
CUE CARD CONFIGURATION

Fabricate as transparency

ZOOM 34.0 HFOV
FOCUS 5.0 FT
EYEPOINT APPROX 18 IN



WR-



OBSS GRAPPLE AT HANDOFF WRIST CCTV OVERLAY

PDRS-9a/124/O/B

(reduced copy)

FS CC 6-2

PDRS/124/FIN A



PDRS OPS C/L

**STS
124**