

ISS/SHUTTLE JOINT OPERATIONS

28 JUN 05

06 JUL 05

Sheet 1 of 1

## List of Implemented CR(s):

Joint_OpsU468A	Joint_OpsU481	Joint_OpsU487
Joint_OpsU469B	Joint_OpsU482	Joint_OpsU488
Joint_OpsU470B	Joint_OpsU483	Joint_OpsU489
Joint_OpsU478A	Joint_OpsU485	
Joint_OpsU479	Joint_OpsU486	

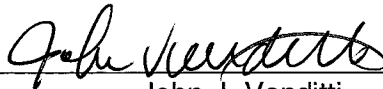
Uplinked Messages (or Approved Flight Notes) replaced by this PCN, remove from Book:

None

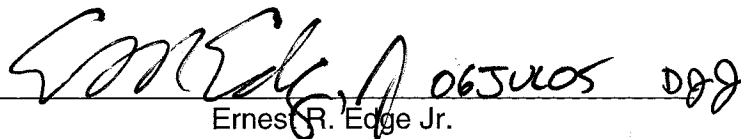
## Incorporates the following:

1. Replace cover
2. Replace iii thru x
3. After 188, add 188a thru 188h  
Replace 283 thru 288, 295 thru 300, 305 thru 308, 313 thru 322  
After 322, add 322a thru 322af

APPROVED BY:



John J. Venditti  
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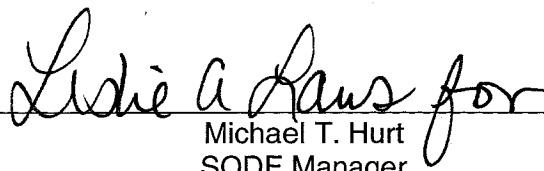


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**File this PCN immediately behind the front cover as a permanent record**





# International Space Station ISS/Shuttle Joint Operations Book

**Mission Operations Directorate  
Operations Division**

**06 JUL 05**

*These procedures are available  
electronically on the SODF Homepage  
at <http://mod.jsc.nasa.gov/do3>*

National Aeronautics and  
Space Administration

Lyndon B. Johnson Space Center  
Houston, Texas





**INTERNATIONAL SPACE STATION  
ISS/SHUTTLE JOINT OPERATIONS BOOK**

**LIST OF EFFECTIVE PAGES**

28 JUN 05  
06 JUL 05

Sign Off.....*	28 JUN 05	35 .....	16 FEB 05
ii .....	* 28 JUN 05	36 .....	16 FEB 05
iii .....	* 06 JUL 05	37 .....	16 FEB 05
iv .....	* 06 JUL 05	38 .....	16 FEB 05
v .....	* 06 JUL 05	39 .....	16 FEB 05
vi .....	* 06 JUL 05	40 .....	28 JUN 05
vii .....	06 JUL 05	41 .....	20 OCT 04
viii .....	06 JUL 05	42 .....	28 JUN 05
ix .....	06 JUL 05	43 .....	27 APR 05
x .....	06 JUL 05	44 .....	27 APR 05
1 .....	28 JUN 05	45 .....	27 APR 05
2 .....	28 JUN 05	46 .....	27 APR 05
3 .....	11 JUL 03	47 .....	27 APR 05
4 .....	11 JUL 03	48 .....	27 APR 05
5 .....	11 JUL 03	49 .....	27 APR 05
6 .....	11 JUL 03	50 .....	27 APR 05
7 .....	08 OCT 03	51 .....	27 APR 05
8 .....	08 OCT 03	52 .....	28 JUN 05
9 .....	08 OCT 03	53 .....	05 FEB 02
10 .....	08 OCT 03	54 .....	05 FEB 02
11 .....	12 JUL 04	55 .....	05 FEB 02
12 .....	28 JUN 05	56 .....	05 FEB 02
13 .....	04 APR 05	57 .....	16 MAY 05
14 .....	04 APR 05	58 .....	16 MAY 05
15 .....	04 APR 05	59 .....	16 MAY 05
16 .....	04 APR 05	60 .....	16 MAY 05
17 .....	04 APR 05	61 .....	16 MAY 05
18 .....	04 APR 05	62 .....	16 MAY 05
19 .....	04 APR 05	63 .....	16 MAY 05
20 .....	28 JUN 05	64 .....	16 MAY 05
21 .....	21 MAR 02	65 .....	16 MAY 05
22 .....	28 JUN 05	66 .....	16 MAY 05
23 .....	26 JAN 05	67 .....	20 MAY 05
24 .....	26 JAN 05	68 .....	20 MAY 05
25 .....	26 JAN 05	69 .....	20 MAY 05
26 .....	26 JAN 05	70 .....	28 JUN 05
27 .....	04 APR 05	71 .....	20 MAY 05
28 .....	04 APR 05	72 .....	20 MAY 05
29 .....	04 APR 05	73 .....	20 MAY 05
30 .....	28 JUN 05	74 .....	28 JUN 05
31 .....	28 JUN 05	75 .....	28 JUN 05
32 .....	28 JUN 05	76 .....	28 JUN 05
33 .....	29 APR 03	77 .....	16 SEP 04
34 .....	28 JUN 05	78 .....	16 SEP 04

\* - Omit from flight book

79.....	16 SEP 04	129 .....	15 APR 05
80.....	28 JUN 05	130 .....	28 JUN 05
81.....	21 MAR 05	131 .....	15 FEB 05
82.....	21 MAR 05	132 .....	15 FEB 05
83.....	21 MAR 05	133 .....	15 FEB 05
84.....	21 MAR 05	134 .....	28 JUN 05
85.....	04 APR 05	135 .....	10 JAN 05
86.....	04 APR 05	136 .....	10 JAN 05
87.....	04 APR 05	137 .....	10 JAN 05
88.....	28 JUN 05	138 .....	28 JUN 05
89.....	22 OCT 02	139 .....	06 MAY 05
90.....	22 OCT 02	140 .....	06 MAY 05
91.....	22 OCT 02	141 .....	06 MAY 05
92.....	22 OCT 02	142 .....	06 MAY 05
93.....	05 FEB 02	143 .....	06 MAY 05
94.....	05 FEB 02	144 .....	06 MAY 05
95.....	05 FEB 02	145 .....	24 MAR 05
96.....	28 JUN 05	146 .....	24 MAR 05
97.....	05 FEB 02	147 .....	24 MAR 05
98.....	28 JUN 05	148 .....	24 MAR 05
99.....	14 APR 05	149 .....	24 MAR 05
100.....	14 APR 05	150 .....	24 MAR 05
101.....	29 APR 03	151 .....	24 MAR 05
102.....	29 APR 03	152 .....	24 MAR 05
103.....	16 MAY 05	153 .....	24 MAR 05
104.....	16 MAY 05	154 .....	24 MAR 05
105.....	16 MAY 05	155 .....	24 MAR 05
106.....	16 MAY 05	156 .....	28 JUN 05
107.....	16 MAY 05	157 .....	05 APR 05
108.....	28 JUN 05	158 .....	05 APR 05
109.....	20 APR 05	159 .....	05 APR 05
110.....	20 APR 05	160 .....	05 APR 05
111.....	20 APR 05	161 .....	05 APR 05
112.....	28 JUN 05	162 .....	05 APR 05
113.....	27 APR 05	163 .....	05 APR 05
114.....	27 APR 05	164 .....	28 JUN 05
115.....	27 APR 05	165 .....	14 APR 05
116.....	27 APR 05	166 .....	14 APR 05
117.....	27 APR 05	167 .....	14 APR 05
118.....	28 JUN 05	168 .....	14 APR 05
119.....	27 APR 05	169 .....	14 APR 05
120.....	27 APR 05	170 .....	14 APR 05
121.....	27 APR 05	171 .....	22 MAR 05
122.....	27 APR 05	172 .....	22 MAR 05
123.....	15 APR 05	173 .....	22 MAR 05
124.....	15 APR 05	174 .....	22 MAR 05
125.....	15 APR 05	175 .....	22 MAR 05
126.....	15 APR 05	176 .....	28 JUN 05
127.....	15 APR 05	177 .....	24 APR 05
128.....	15 APR 05	178 .....	24 APR 05

\* - Omit from flight book

179.....	24 APR 05	221 .....	23 JUN 04
180.....	24 APR 05	222 .....	23 JUN 04
181.....	24 APR 05	223 .....	29 APR 03
182.....	24 APR 05	224 .....	28 JUN 05
183.....	23 APR 05	225 .....	01 MAY 02
184.....	23 APR 05	226 .....	01 MAY 02
185.....	23 APR 05	227 .....	01 MAY 02
186.....	23 APR 05	228 .....	01 MAY 02
187.....	23 APR 05	229 .....	01 MAY 02
188.....	28 JUN 05	230 .....	01 MAY 02
188a.....	01 JUL 05	231 .....	01 MAY 02
188b.....	01 JUL 05	232 .....	01 MAY 02
188c.....	01 JUL 05	233 .....	01 MAY 02
188d.....	01 JUL 05	234 .....	28 JUN 05
188e.....	01 JUL 05	235 .....	15 JUL 03
188f.....	01 JUL 05	236 .....	28 JUN 05
188g.....	01 JUL 05	237 .....	11 JUL 03
188h.....	01 JUL 05	238 .....	28 JUN 05
189.....	28 JUN 05	239 .....	27 APR 05
190.....	28 JUN 05	240 .....	27 APR 05
191.....	24 OCT 02	241 .....	27 APR 05
192.....	24 OCT 02	242 .....	28 JUN 05
193.....	24 OCT 02	243 .....	20 APR 05
194.....	24 OCT 02	244 .....	28 JUN 05
195.....	22 APR 04	245 .....	14 NOV 00
196.....	22 APR 04	246 .....	14 NOV 00
197.....	22 APR 04	247 .....	14 NOV 00
198.....	22 APR 04	248 .....	14 NOV 00
199.....	11 SEP 02	249 .....	07 MAR 02
200.....	28 JUN 05	250 .....	07 MAR 02
201.....	02 MAY 05	251 .....	04 OCT 01
202.....	02 MAY 05	252 .....	04 OCT 01
203.....	02 MAY 05	253 .....	14 NOV 00
204.....	02 MAY 05	254 .....	28 JUN 05
205.....	28 JUN 05	255 .....	14 NOV 00
206.....	28 JUN 05	256 .....	14 NOV 00
207.....	30 JAN 05	257 .....	14 NOV 00
208.....	30 JAN 05	258 .....	28 JUN 05
209.....	30 JAN 05	259 .....	28 JUN 05
210.....	30 JAN 05	260 .....	28 JUN 05
211.....	17 FEB 05	261 .....	24 MAY 05
212.....	17 FEB 05	262 .....	24 MAY 05
213.....	17 FEB 05	263 .....	24 MAY 05
214.....	17 FEB 05	264 .....	24 MAY 05
215.....	01 FEB 05	265 .....	24 MAY 05
216.....	01 FEB 05	266 .....	28 JUN 05
217.....	01 FEB 05	267 .....	28 FEB 02
218.....	01 FEB 05	268 .....	28 FEB 02
219.....	28 JUN 05	269 .....	20 APR 05
220.....	28 JUN 05	270 .....	20 APR 05

\* - Omit from flight book

271.....	20 APR 05	321 .....	06 JUL 05
272.....	20 APR 05	322 .....	06 JUL 05
273.....	20 APR 05	322a .....	06 JUL 05
274.....	20 APR 05	322b .....	05 JUL 05
275.....	20 APR 05	322c .....	05 JUL 05
276.....	28 JUN 05	322d .....	05 JUL 05
277.....	28 JUN 05	322e .....	05 JUL 05
278.....	28 JUN 05	322f .....	05 JUL 05
279.....	10 JUN 05	322g .....	05 JUL 05
280.....	10 JUN 05	322h .....	05 JUL 05
281.....	20 APR 05	322i .....	05 JUL 05
282.....	20 APR 05	322j .....	05 JUL 05
283.....	22 JUN 05	322k .....	05 JUL 05
284.....	22 JUN 05	322l .....	05 JUL 05
285.....	22 JUN 05	322m .....	05 JUL 05
286.....	22 JUN 05	322n .....	05 JUL 05
287.....	22 JUN 05	322o .....	05 JUL 05
288.....	22 JUN 05	322p .....	05 JUL 05
289.....	15 APR 05	322q .....	05 JUL 05
290.....	15 APR 05	322r .....	05 JUL 05
291.....	14 APR 05	322s .....	05 JUL 05
292.....	14 APR 05	322t .....	05 JUL 05
293.....	14 APR 05	322u .....	05 JUL 05
294.....	28 JUN 05	322v .....	05 JUL 05
295.....	01 JUL 05	322w.....	05 JUL 05
296.....	01 JUL 05	322x .....	05 JUL 05
297.....	01 JUL 05	322y .....	05 JUL 05
298.....	01 JUL 05	322z .....	05 JUL 05
299.....	01 JUL 05	322aa .....	05 JUL 05
300.....	01 JUL 05	322ab .....	05 JUL 05
301.....	16 MAY 05	322ac .....	05 JUL 05
302.....	16 MAY 05	322ad .....	05 JUL 05
303.....	16 MAY 05	322ae .....	05 JUL 05
304.....	28 JUN 05	322af .....	05 JUL 05
305.....	29 JUN 05	323 .....	05 FEB 02
306.....	29 JUN 05	324 .....	28 JUN 05
307.....	29 JUN 05	325 .....	05 FEB 02
308.....	29 JUN 05	326 .....	28 JUN 05
309.....	04 APR 05	327 .....	28 JUN 05
310.....	04 APR 05	328 .....	28 JUN 05
311.....	28 JUN 05	329 .....	05 FEB 02
312.....	28 JUN 05	330 .....	05 FEB 02
313.....	06 JUL 05	331 .....	27 APR 05
314.....	06 JUL 05	332 .....	27 APR 05
315.....	06 JUL 05	333 .....	28 JUN 05
316.....	06 JUL 05	334 .....	28 JUN 05
317.....	06 JUL 05	335 .....	23 MAY 03
318.....	06 JUL 05	336 .....	23 MAY 03
319.....	06 JUL 05		
320.....	06 JUL 05		

\* - Omit from flight book



CONTENTS

<b>ARRIVAL</b> .....	1
1.101 ISS Powerdown and Recovery - Channel 2B Only .....	3
1.102 ISS Powerdown and Recovery - Channel 4B Only .....	7
1.104 ODS Volume Preparation For Docking .....	11
1.106 PMA2 Pre-Arrival Configuration .....	13
1.107 Station-Orbiter Docking Script .....	21
1.108 PMA2 Arrival .....	23
1.109 PMA2 Post Arrival Configuration .....	27
<b>INGRESS STATION</b> .....	31
2.101 Post Docking Hatch Leak Check .....	33
2.102 Post Docking Hatch Leak Check - ISS .....	35
2.103 ODS Volume Preparation for Ingress .....	41
2.104 Hatch Opening and Shuttle/ISS Duct Installation .....	43
2.105 ISS Interim Ingress .....	53
2.106 Hatch Open and Duct Install (Bypass Config) .....	57
2.107 Shuttle Airlock/Tunnel Fan Activation (Bypass Duct Installed) .....	67
2.108 Shuttle Airlock/Tunnel Fan Deactivation (Bypass Duct Installed) .....	71
<b>MATED OPERATIONS</b> .....	75
3.101 Compound Specific Analyzer - Combustion Products: CSA-CP Resupply .....	77
3.102 Nitrogen Transfer Initiation.....	81
3.103 Nitrogen Transfer Termination .....	85
3.104 Lab FWD Hatch Thermal Cover Removal/Installation .....	89
3.105 O2 Repress.....	93
3.106 N2 Repress .....	95
3.107 Generic Depress .....	97
3.108 Generic Repress .....	99
3.109 Configure C&W for Ingress/Depress/Repress .....	101
3.110 Handover Attitude Control CMG TA to Orbiter.....	103
3.111 Handover Attitude Control Orbiter to CMG TA.....	109
3.112 VDS Shuttle Auto Route - Deroute .....	113
3.113 VDS Shuttle Manual Route - Deroute .....	119
3.115 Oxygen Transfer Setup .....	123
3.116 High Pressure Tank O2 Transfer .....	131
3.117 Low Pressure Tank O2 Transfer .....	135
3.118 Oxygen Transfer Teardown .....	139
3.119 Radiation Area Monitor Dosimeters - Installation of Dosimeters on ISS .....	145
3.120 Prebreathe Using Shuttle O2 Setup.....	157
3.121 Prebreathe Using Shuttle O2 Setup (Post O2 Transfer).....	165
3.122 Prebreathe Using Shuttle O2 Teardown .....	171
3.123 O2 Transfer Setup (Post Prebreathe Using Shuttle O2).....	177
3.124 Active and Passive CBM Inspection Criteria.....	183
3.125 Shuttle/ISS Crewlock Depress Using ISS Depress Pump .....	188a

<b>EGRESS STATION</b> .....	189
4.101 ISS Interim Egress .....	191
4.102 Shuttle/ISS Duct Removal and Hatch Closing .....	195
4.103 ODS Vestibule/PMA Depressurization and Hatch Leak Check .....	199
4.104 DUCT Removal and Hatch Close (Bypass Config).....	201
<b>DEPARTURE</b> .....	205
5.101 PMA2 Pre-Departure Configuration .....	207
5.102 PMA2 Departure .....	211
5.103 PMA2 Post Departure Configuration.....	215
<b>COMM/DATA</b> .....	219
6.101 Audio Loss of Docked Voice .....	221
6.102 Audio Configuration for Proximity Operations Voice Comm .....	223
6.103 Hardline Audio Configuration (ISS) .....	225
6.104 Hardline Audio Configuration (ISS) Backout.....	229
6.105 SSOR Activation .....	235
6.106 SSOR Deactivation .....	237
6.107 PCS Setup - Shuttle.....	239
6.108 ICOM Audio Config with Hatch Closed .....	243
2.302 Onboard File Transfer.....	245
2.303 PCS Deactivation.....	249
2.304 PCS Log File Save.....	251
2.306 PCS Reconnect .....	253
2.307 PCS Screen Capture .....	255
2.309 Transferring Log Files To Floppy Disk .....	257
<b>MALFUNCTION</b> .....	259
HATCH	
1.3.501 Hatch Mechanism Malfunction.....	261
2.305 PCS Reboot.....	267
3.301 Loss of PCS Telemetry .....	269
<b>CONTINGENCY</b> .....	277
8.101 Handover Attitude Control Orbiter to RS Thrusters .....	279
8.102 Handover Attitude Control RS Thrusters to Orbiter .....	281
8.103 PMA2 Pre-Arrival Configuration (Thrusters) .....	283
8.104 PMA2 Arrival (Thrusters) .....	289
8.105 PMA2 Post Arrival Configuration (Thrusters).....	291
8.106 PMA2 Pre-Departure Configuration (Thrusters) .....	295
8.107 PMA2 Departure (Thrusters).....	301
8.108 PMA2 Post Departure Configuration (Thrusters) .....	305
8.109 ORCA Safing .....	309
<b>EMERGENCY RESPONSE</b> .....	311
9.101 Joint Expedited Undocking and Separation .....	313
9.102 ISS Safing.....	322c
9.103 Utilize ISS Atmosphere .....	323
9.104 TMAX Determination For Utilize ISS Atmosphere .....	325

<b>CUE CARD</b> .....	327
10.101 Big Loop Reactivation .....	329
10.102 Joint Emergency Egress .....	331
<b>REFERENCE DATA</b> .....	333
11.103 O2 and N2 Transfer Schematic .....	335

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### 3.125 SHUTTLE/ISS CREWLOCK DEPRESS USING ISS DEPRESS PUMP

(JNT OPS/LF1 - ALL/FIN) Page 1 of 8 pages

#### OBJECTIVE:

This procedure is used to depress the shuttle/ODS/PMA 2 volume using the ISS Depress Pump, then complete the ISS Crew Lock Depress to vacuum.

#### MATERIALS:

Gray Tape

#### TOOLS:

35 ft VAJ P/N 683-17111-2

Internal Sampling Adapter (ISA) P/N 97M55830-1

Drawer 2:

5/32" Hex Head, 1/4" Drive

Ratchet, 3/8" Drive

Ratchet, 1/4" Drive

(10-50 in-lbs) Trq Wrench, 1/4" Drive

1/4" to 3/8" Adapter

Drawer 3:

1-5/8" Crowfoot, 3/8" Drive

1-1/4" Crowfoot, 3/8" Drive

(150-1000 in-lbs) Trq Wrench, 3/8" Drive

#### NOTE

This procedure assumes the following procedures have been completed:

The Male-to-Male (M-M) Adapter has been removed from the Internal Sample Adapter (ISA).

The VAJ installed in the Airlock, hereafter referred to as the "Airlock VAJ," has been partially removed to extend into the NOD1.

The Depress Air Return hose has been demated from the NOD1 STBD A06 feedthru.

#### 1. LAB FWD IMV RECONFIGURATION

PCS

1.1 US Lab: ECLSS: IMV Fwd Stbd Fan

LAB IMV Fwd Stbd Fan

'Off'

**cmd** Arm (√Status – Armed)

**cmd** Off

√State – Off

√Speed, rpm: ~7164 ± 50

1.2 sel RPCM LA2B B RPC 09

**cmd** RPC Position – Open (√ – Op)

### 3.125 SHUTTLE/ISS CREWLOCK DEPRESS USING ISS DEPRESS PUMP

(JNT OPS/LF1 - ALL/FIN) Page 2 of 8 pages

#### 1.3 US Lab: ECLSS: IMV Fwd Stbd Valve

LAB IMV Fwd Stbd Vlv

'Close'

**cmd** Arm (√Arm Status – Armed)

**cmd** Close

√Postion – In Transit

Wait 25 seconds, then:

√Postion – Closed

#### 1.4 'Inhibit'

**cmd** Arm (√Arm Status – Armed)

**cmd** Inhibit (√State – Inhibited)

#### 1.5 sel RPCM LA1B B RPC 16

**cmd** RPC Position – Open (√ – Op)

## 2. CONFIGURING DEPRESS PUMP

Airlock: ECLSS: Depress Pump: RPCM AL1A4A A RPC 01

RPCM AL1A4A A RPC 01

√Close Cmd – Ena

**cmd** RPC Position – Close (Verify – Cl)

#### NOTE

ISS crew can perform steps 5 to 15 in parallel with shuttle crew performing steps 3 and 4.

3. To clear ODS Upper hatchway, perform ISS EGRESS FOR SHUTTLE EVA, steps 1 to 3 only (EVA FS, DEPRESS/REPRESS), then:

#### **WARNING**

1. Do not depress orbiter below 12.5 psi until EV1 and EV2 have completed 45 minutes of mask prebreathe.
2. Do not terminate prebreathe until cabin pressure at 10.2 psia and 1hr mask prebreathe completed.

4. Perform CABIN DEPRESS TO 10.2 PSI (EVA, 10.2 PSI CABIN) steps 1 to 4 leaving AIRLK DEPRESS vlv - CL, then:

Shuttle report to ISS, "Shuttle is ready for Depress Pump Activation." (step 16.2)

### 3.125 SHUTTLE/ISS CREWLOCK DEPRESS USING ISS DEPRESS PUMP

(JNT OPS/LF1 - ALL/FIN) Page 3 of 8 pages

- NOD1S2 5. Remove Closeout Panel NOD1S2-13 (four fasteners),  
(Ratchet, 1/4" Drive; 5/32" Hex Head, 1/4" Drive).  
Temporarily stow panel.
6. Gamah Cap (683-16347-843) ←|→ Depress Air Return Feedthrough (A06)  
Temporarily stow Gamah Cap next to Feedthrough (Gray Tape).

#### WARNING

Connecting the Airlock VAJ to the M-M Adapter will create a continuous VAJ hose from the LAB FWD Hatch to the Airlock EMPEV. In case of an emergency requiring isolation of USOS modules demate VAJ hoses as required at the Male-to-Male Adapter and stow in LAB, A/L as needed.

- A/L 7. Cap ←|→ Bent end of Airlock VAJ.  
Verify soft seal installed in VAJ Gamah fitting.  
Inspect soft seal for damage, debris.

Route Airlock VAJ to N1 Stbd.  
Refer to Figure 1 for VAJ routing and configuration.

- N1 Stbd 8. Bent end of Airlock VAJ →|← ISA M-M Adapter, hand tight
9. Cap ←|→ straight end of 35 ft VAJ  
Verify soft seal installed in VAJ Gamah fitting.  
Inspect soft seal for damage, debris.
10. Straight end of 35 ft VAJ →|← ISA M-M Adapter, hand tight

Route 35 ft VAJ to Lab Fwd Hatch.

#### WARNING

Verify all crew members are on their home vehicle prior to closing LAB Fwd Hatch. Closing the LAB Fwd Hatch will isolate the two vehicles.

- LAB Fwd 11. Close LAB Forward Hatch per decal.  
ISS report to shuttle, **MCC-H** "LAB Fwd Hatch is closed."
12. Cap ←|→ Bent End of 35 ft VAJ  
Verify soft seal installed in VAJ Gamah fitting.  
Inspect soft seal for damage, debris.
13. Bent End of 35 ft VAJ →|← LAB Fwd Hatch MPEV, hand tighten

### 3.125 SHUTTLE/ISS CREWLOCK DEPRESS USING ISS DEPRESS PUMP

(JNT OPS/LF1 - ALL/FIN) Page 4 of 8 pages

#### NOTE

Expect possible klaxon (-dP/dt) during equalization with ISS.

14. LAB Fwd Hatch MPEV → OPEN

A/L1A2 15. EMPEV → Open

#### WARNING

Do not depress orbiter below 12.5 psi until EV1 and EV2 have completed 45 minutes of mask prebreathe.

Do not terminate prebreathe until orbiter cabin pressure at 10.2 psia and 1hr mask prebreathe completed

#### 16. ACTIVATING DEPRESS PUMP

U/A

16.1 √DEPRESS PUMP ENABLE LED – ON

16.2 On shuttle CDR GO for Depress Pump Activation (step 4)  
sw DEPRESS PUMP PWR → ON  
Wait 10 seconds.

C-Lk

16.3 DEPRESS PUMP MAN ISOV → OPEN

16.4 Start Depress Pump PET clock.

#### 17. INITIATING SHUTTLE DEPRESS

Eq Lk

17.1 Immediately egress the crewlock, then:

17.2 IV Hatch → CLOSE, lock

17.3 √IV Hatch equalization valve – OFF (√cap installed)

PCS

Airlock: ECLSS

Airlock: ECLSS

17.4 √Crew Lock Press ↓

17.5 Report to shuttle, **MCC-H** “Shuttle depress in work”

X: SM SYS SUMM 1

18. When CABIN PRESS < 12.6 psia, inform ISS crew “Stop Depress Pump operations.”

√**MCC-H** to continue orbiter 10.2 depress



### 3.125 SHUTTLE/ISS CREWLOCK DEPRESS USING ISS DEPRESS PUMP

(JNT OPS/LF1 - ALL/FIN) Page 5 of 8 pages

19. On shuttle call, "Stop Depress Pump operations," or Depress Pump PET = 30 minutes, or Equipment Lock Cab Press  $\geq$  770 mmHg (Caution messages '**Cabin Press Above Normal-E/L**' and '**Cabin Press Above Normal-LAB**' received)

A/L1A2 19.1 EMPEV  $\rightarrow$  CLOSED

LAB 19.2 LAB Fwd Hatch MPEV  $\rightarrow$  CLOSED  
Fwd

19.3 Report to shuttle, **MCC-H** "EMPEV and Lab Fwd MPEV are closed"

20. Perform ISS EGRESS FOR SHUTTLE EVA (EVA FS, DEPRESS/REPRESS) steps 4 and 5 only, to close ODS Upper Hatch and isolate shuttle from ISS/PMA2/ODS Vestibule.

21. Continue depress to 10.2 psia performing step 3 to 5 of the CABIN DEPRESS TO 10.2 PSI.  
Configure all valves (including the AIRLK DEPRESS vlv) per the 10.2 PSI DEPRESS CHART (EVA, 10.2 PSI CABIN).

**NOTE**

Shuttle crew actions in this procedure are now complete.

PCS 22. Airlock: ECLSS

Airlock: ECLSS

When Crew Lock Press  $\leq$  103 mm Hg, or Depress Pump PET  $\geq$  60 minutes, or if Equipment Lock Cab Press  $\geq$  770 mmHg (Caution messages '**Cabin Press Above Normal-E/L**' and '**Cabin Press Above Normal-LAB**' received)

sel Depress Pump

AL Depress Pump

sel RPCM AL1A4A A RPC 01

**cmd** RPC Position – Open ( $\surd$  – Op)

23. Airlock VAJ  $\leftarrow$  |  $\rightarrow$  ISA M-M Adapter

A/L1D0 24. Remove A/L1D0 Beta Cloth Cover.

Remove, temporarily stow stowage items from behind Closeout Panels.

25. Vacuum Access Port (VAP) Gamah Cap  $\leftarrow$  |  $\rightarrow$  AL PCA VAP

Restrain VAP Gamah Cap next to VRA (Gray Tape).

26. Airlock VAJ  $\rightarrow$  |  $\leftarrow$  AL PCA VAP, hand tighten

### 3.125 SHUTTLE/ISS CREWLOCK DEPRESS USING ISS DEPRESS PUMP

(JNT OPS/LF1 - ALL/FIN) Page 6 of 8 pages

#### WARNING

Outlet may be hot. Wear protective gloves, if required.

#### CAUTION

1. A reaction force must be applied to feedthrough to prevent feedthrough from rotating while torquing connector nut.
2. Rotation of feedthrough may compromise seal between feedthrough and bulkhead.

#### 27. INSTALL CAP ON DEPRESS OUTLET A06 FEEDTHROUGH **On MCC-H GO**

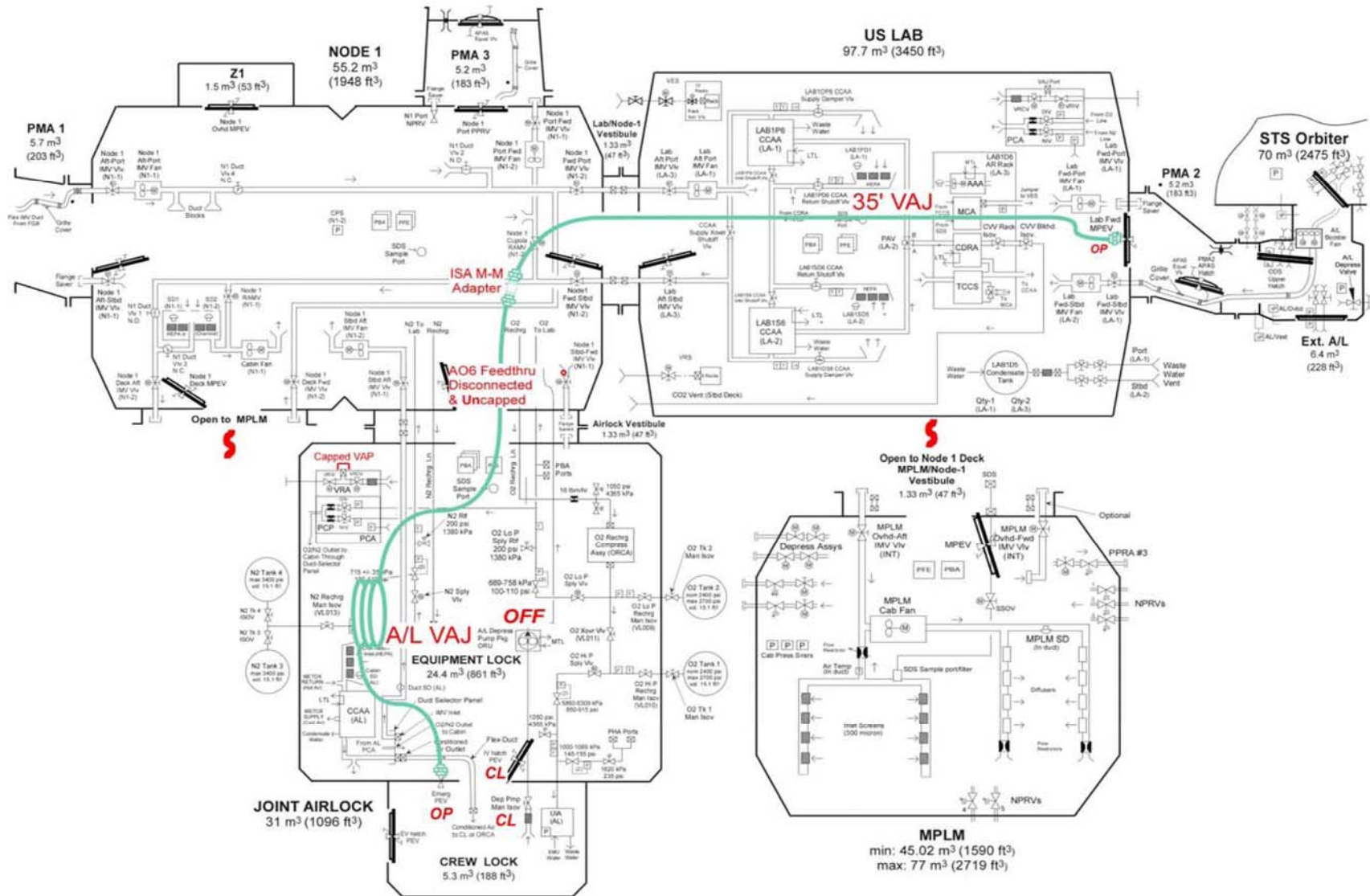
- NODE 1 Install the Gamah Cap (683-16347-843) on the Depress Air Return Feedthrough (A06).
- Tighten Cap, torque to 270 in-lbs [(150-1000 in-lbs) Trq Wrench, 3/8" Drive; 1-5/8" Crowfoot; Ratchet, 3/8" Drive; 1-1/4" Crowfoot].
- A/L1A2 28. EMPEV → OPEN.
- Notify **MCC-H**, "EMPEV OPEN."
- A/L1D0 29. Restow items behind Beta Cloth Cover.  
Install A/L1D0 Beta Cloth Cover around partially uninstalled Airlock VAJ.
- N1 Stbd 30. 35 ft VAJ ←|→ ISA M-M Adapter
- LAB  
Fwd 31. 35 ft VAJ ←|→ LAB Fwd Hatch MPEV
32. Caps (2) →|← both ends of 35 ft VAJ
33. ISA M-M Adapter →|← ISA.  
Torque to 40 in-lbs [(10-50 in-lbs) Trq Wrench, 1/4" Drive; 1/4" to 3/8" Adapter; 1-5/8" Crowfoot; Ratchet, 3/8" Drive; 1-1/4" Crowfoot].  
Install Cap on ISA M-M Adapter, hand tighten.
34. Stow 35 ft VAJ, ISA.
- NOD1S2 35. Install Closeout Panel NOD1S2-13 (Ratchet, 1/4" Drive; 5/32" Hex Head, 1/4" Drive).
- PCS 36. Airlock: ECLSS: PCA: VRIV  
AL PCA VRIV  
'Open'
- cmd** Arm (√Status – Armed)  
**cmd** Open (√Position – Open)

### 3.125 SHUTTLE/ISS CREWLOCK DEPRESS USING ISS DEPRESS PUMP

(JNT OPS/LF1 - ALL/FIN) Page 7 of 8 pages

- PCS 37. Airlock: ECLSS  
Airlock: ECLSS  
√Crew Lock Press '↓'
- PCS 38. When Crew Lock Press  $\leq$  25 mm Hg (~20 min from VRIV Open)  
Airlock: ECLSS: PCA: VRIV  
AL PCA VRIV  
'Close'  
**cmd** Close (√Position – Closed)
- A/L1A2 39. **On MCC-H GO**, EMPEV → CLOSED
- LAB 40. **On MCC-H GO**, open LAB Fwd Hatch per decal.  
Fwd

### 3.125 SHUTTLE/ISS CREWLOCK DEPRESS USING ISS DEPRESS PUMP



188h

Figure 1.- STS-114(LF-1) FD 4 Shuttle/Crewlock Depress Setup Prior to Depress Start.

## 8.103 PMA2 PRE-ARRIVAL CONFIGURATION (THRUSTERS)

(JNT OPS/LF1 - ALL/FIN 8/MULTI) Page 1 of 6 pages

### OBJECTIVE:

Operational sequence used to configure the CCS Attitude Control System Moding software for docking on RS control.

#### 1. GNC COMMAND RESPONSE COUNTERS RESET

PCS MCG: GNC Command Response Counters

GNC Command Response Counters

sel Reset

Verify the Since Reset column values are all blank.

Do not close this window until the procedure is complete.

If while executing a command, the Command Accept counter on the display does not increment

Reselect GNC Command Response Counters to determine if a command was rejected.

√**MCC-H**

#### 2. VERIFYING FLIGHT SPECIFIC PAD

If the following information is not recorded elsewhere, record it here.

Is Checkpointing normally enabled or inhibited? \_\_\_\_\_

Is Checkpointing to be enabled or inhibited for docking? \_\_\_\_\_

### 8.103 PMA2 PRE-ARRIVAL CONFIGURATION (THRUSTERS)

(JNT OPS/LF1 - ALL/FIN 8/MULTI) Page 2 of 6 pages

Table1. Pre-Arrival Requirements

Req'd for Pre-Arrival	ADO	Pri	B/U	Ver ID	Comments
1 Mass Properties	ps21			_____	Post Dock Mass Properties
2 CCDB SLOT X CCDB SLOT X Yaw CCDB SLOT X Pitch CCDB SLOT X Roll	ca1X			_____ _____ _____ _____	Post Docking attitude
3 Version ID for CCS PPL 180 (ACS FDIR Adaptation Data) with RS_ACS_Safing_Status set to "0" (off) to be loaded to the backup and standby C&C MDM.				_____	Must be built as File Uplink.
4 Version ID for CCS PPL 181 - CCS RM PPL for GNC RM with or without Checkpointing to be loaded on all C&C MDMs.				_____	If GNC RM with Checkpointing is to be inhibited for docking, uplink PPL to all C&C MDMs. Must be built as File Uplink.

### 3. VERIFYING INITIAL CONDITIONS

PCS

MCG

MCG Summary

'MCG Status'

Verify US Station Mode – Prox Ops  
 Verify RS Station Mode – Prox Ops  
 Verify RS SUDN Mode – Thrusters Only

'Primary GNC MDM'

Verify Frame Count – incrementing

'Backup GNC MDM'

Verify Frame Count – incrementing

## 8.103 PMA2 PRE-ARRIVAL CONFIGURATION (THRUSTERS)

(JNT OPS/LF1 - ALL/FIN 8/MULTI) Page 3 of 6 pages

### 4. LOADING PPLs TO THE PRIMARY GNC MDM

#### CAUTION

Since a PPL load error that corrupts memory in the Primary GNC would be checkpointed to the Backup GNC, checkpointing should be stopped until the Primary GNC is successfully loaded. Failure to do this may result in corrupted memory in both the Primary and Backup GNC MDMs.

PCS

#### 4.1 Disabling Checkpointing in Primary GNC MDM

MCG: Dock and Undock: Pre-Node 2 PMA 2 Dock

Pre Node 2 PMA 2 Dock

'Pre Arrival'

If Pri GNC Checkpoint – Ena

sel Pri

Primary GNC Checkpointing Status

'Checkpoint Inhibit Status'

**cmd Inh Execute** (Verify – Inhibited)

Pre Node 2 PMA 2 Dock

sel Bkup

Backup GNC Checkpoint Status

Verify Idle Read/Start counter – incrementing

MCC-H

#### 4.2 Loading the PPLs

For all PPLs designated in step 2 to be loaded to the Primary GNC MDM, coordinate with ODIN.

PCS

#### 4.3 Enabling Checkpointing in Primary GNC MDM

If Checkpointing is normally enabled per step 2

MCG: Dock and Undock: Pre-Node 2 PMA 2 Dock: Pri

Primary GNC Checkpoint Status

'Checkpoint Inhibit Status'

**cmd Ena Execute** (Verify – Enabled)

Pre Node 2 PMA 2 Dock

sel Bkup

Backup GNC Checkpoint Status

Verify Idle Read/Start counter: 0

## 8.103 PMA2 PRE-ARRIVAL CONFIGURATION (THRUSTERS)

(JNT OPS/LF1 - ALL/FIN 8/MULTI) Page 4 of 6 pages

### **MCC-H** 5. LOADING PPLS TO THE BACKUP GNC MDM

If Checkpointing is normally inhibited per step 2, or if loading PPLs that are not checkpointed in R4, which are GC, SD, and RG PPLs

For all PPLs designated in step 2 to be loaded to the Backup GNC MDM, coordinate with ODIN.

### **MCC-H** 6. LOADING REQUIRED PPLs TO THE BACKUP/STANDBY C&C MDM

For all PPLs designated in step 2 to be loaded to the Backup and Standby C&C MDM, coordinate with ODIN.

### 7. CONFIGURING RUSSIAN SEGMENT FOR DOCKING

#### NOTE

**MCC-M** can send these commands any time prior to orbiter docking.

### **MCC-M**

YBLQ F8\_10 (inf0=9, inf1=1) Inhibit RS takeover due to Tier 1 Loss of Comm

YBLQ F1\_44 Update unmated Mass Properties into TBM buffer for Joint Expedited Undocking and Separation (JEUS).

Verify RS Give Control/Take Control flag = 0

Verify RS Auto Handover into CMG TA flag – Inh

**MCC-M** will uplink cyclogram contents to channel 34 for JEUS.

**MCC-M** ⇒ **MCC-H**, “Step 7 complete.”

### PCS 8. UPDATING POST DOCKING CCDB COMMANDED ATTITUDE

MCG: MCS Configuration

MCS Configuration

‘CCDB Slots’



## 8.103 PMA2 PRE-ARRIVAL CONFIGURATION (THRUSTERS)

(JNT OPS/LF1 - ALL/FIN 8/MULTI) Page 5 of 6 pages

For CCDB Slot X (from step 2)

sel Cmd Att X

Cmd Att X

If Slot X Yaw, Pitch, Roll does not match Yaw, Pitch, Roll in step 2

If in step 2, CCDB Slot X Yaw, Pitch, Roll is (0,0,0)

**cmd** YPR 0,0,0

If in step 2, CCDB Slot X Yaw, Pitch, Roll is not (0,0,0)

'Command Input'

input Yaw – (from step 2)

Pitch – (from step 2)

Roll – (from step 2)

**cmd** Set

Verify Slot X Yaw – (as commanded)

Pitch – (as commanded)

Roll – (as commanded)

### 9. VERIFYING STATUS OF ACS MODING SIGNALS

MCG: Dock and Undock: Pre-Node 2 PMA 2 Dock

Pre Node 2 PMA 2 Dock

'Final Approach'

Verify Manual Dock Sequence Init – Not Init

Verify LA-1, LA-2 Capture – No/No

Verify Arrival Flag – No

Verify Docked Indication – NOT Docked

### 10. INHIBITING GNC CHECKPOINTING

If GNC Checkpointing is to be inhibited for docking per step 2, perform

{2.702 DISABLE GNC CHECKPOINTING}, all (SODF: MCS:

NOMINAL: CHECKPOINTING), then:

### 11. ENABLING ARRIVAL SOFTWARE

Pre Node 2 PMA 2 Dock

'Pre Arrival'

sel PMA2 Manual Arrival SW

Manual Arrival SW

'PMA 2'

**cmd** Manual Arrival SW Enable

## 8.103 PMA2 PRE-ARRIVAL CONFIGURATION (THRUSTERS)

(JNT OPS/LF1 - ALL/FIN 8/MULTI) Page 6 of 6 pages

Verify PMA2 Docking Vehicle – Shuttle  
Verify PMA2 Manual Arrival SW – Ena

Pre Node 2 PMA 2 Dock

'Pre Arrival'

sel PMA 2 Arrival Automatic Arrival SW

Automatic Arrival SW

'PMA 2'

**cmd** Enable

Verify PMA2 Docking Vehicle – Shuttle  
Verify PMA2 Automatic Arrival SW – Ena

### 12. ENABLING APAS LEDs

Pre Node 2 PMA 2 Dock

'Pre Arrival'

sel LED Control SW

LED Control SW

**cmd** Enable

Verify LED Control SW – Ena  
Verify LED State – On

### 13. VERIFYING STATUS OF AUTO HANDOVER

Pre Node 2 PMA 2 Dock

'Pre Arrival'

If Auto Att Control Handover to RS – Ena

| **cmd** Arm

| **cmd** Inhibit (Verify – Inh)

## 8.106 PMA2 PRE-DEPARTURE CONFIGURATION (THRUSTERS)

(JNT OPS/LF1 - ALL/FIN 9/SPN/MULTI) Page 1 of 6 pages

### OBJECTIVE:

Operational sequence used to configure CCS Attitude Control System (ACS) Moding software to allow for RS GNC control after departure of orbiter.

#### 1. VERIFYING FLIGHT-SPECIFIC PAD

If the following information is not recorded elsewhere, record it here.

Is Checkpointing normally enabled or inhibited? \_\_\_\_\_

Is Checkpointing to be enabled or inhibited for undocking? \_\_\_\_\_

Table 1. Post Arrivals Requirement

Req'd for Post Departure	ADO	Pri	B/U	Ver ID	Comments
1	Mass Properties	PS21			
2	Version ID for CCS PPL 181 - CCS RM PPL For GNC RM with or without Checkpointing to be loaded to all C&C MDMs.				If GNC RM with Checkpointing is to be inhibited for undocking, uplink PPL to all C&C MDMs. Must be built as File Uplink.

#### 2. VERIFYING INITIAL CONDITIONS

PCS

MCG

MCG Summary

'MCG Status'

Verify US Station Mode – Prox Ops

Verify RS Station Mode – Prox Ops

Verify US GNC Mode – CMG TA (Drift, UDG)

Verify RS SUDN Mode – CMG TA (Indicator)

Verify RS Control – Slave (Master)

#### 3. LOADING PPLS TO THE PRIMARY GNC MDM

##### CAUTION

Since a PPL load error that corrupts memory in the Primary GNC would be checkpointed to the Backup GNC, checkpointing should be stopped until the Primary GNC is successfully loaded. Failure to do this may result in corrupted memory in both the Primary and Backup GNC MDMs.

PCS

##### 3.1 Disabling Checkpointing in Primary GNC MDM

MCG: Dock and Undock: Pre-Node 2 PMA 2 Undock

Pre Node 2 PMA 2 Undock

'Pre Departure'

## 8.106 PMA2 PRE-DEPARTURE CONFIGURATION (THRUSTERS)

(JNT OPS/LF1 - ALL/FIN 9/SPN/MULTI) Page 2 of 6 pages

If Pri GNC Checkpoint – Ena  
sel Pri  
 Primary GNC Checkpoint Status  
'Checkpoint Inhibit Status'  
**cmd Inh Execute** (Verify – Inhibited)  
 Pre Node 2 PMA 2 Undock  
sel Bkup  
 Backup GNC Checkpoint Status  
Verify Idle Read/Start Counter – incrementing

**MCC-H**

### 3.2 Loading the PPLs

For all PPLs designated in step 1 to be loaded to the Primary GNC MDM, coordinate with ODIN.

**PCS**

### 3.3 Enabling Checkpointing in Primary GNC MDM

If Checkpointing is normally enabled per step 1

MCG: Dock and Undock: Pre-Node 2 PMA 2 Undock: Pri

Primary GNC Checkpoint Status

'Checkpoint Inhibit Status'

**cmd Ena Execute** (Verify – Enabled)

Pre Node 2 PMA 2 Undock

sel Bkup

Backup GNC Checkpoint Status

Verify Idle Read/Start Counter: 0

**MCC-H**

## 4. LOADING PPLS TO THE BACKUP GNC MDM

If Checkpointing is normally inhibited per step 1, or if loading PPLs that are not checkpointed in R4, which are GC, SD, and RG PPLs

For all PPLs designated in step 1 to be loaded to Backup GNC MDM, coordinate with ODIN.

**PCS**

## 5 VERIFYING STATUS OF ACS MODING SIGNALS

MCG: Dock and Undock: Pre-Node 2 PMA 2 Undock

Pre Node 2 PMA 2 Undock

'Pre Departure'

Verify Auto Att Control Handover to RS – Inh

'Undocking'

## 8.106 PMA2 PRE-DEPARTURE CONFIGURATION (THRUSTERS)

(JNT OPS/LF1 - ALL/FIN 9/SPN/MULTI) Page 3 of 6 pages

Verify Manual Undock Sequence Init – Not Init  
Verify LA-1/LA-2 Interface Sealed – Yes/Yes  
Verify LA-1/LA-2 Separation – No/No  
Verify Docked Indication – Docked  
Verify Departure Flag – No

### 6. INHIBITING GNC CHECKPOINTING

If GNC Checkpointing is to be inhibited for undocking per step 1, perform  
| {2.702 DISABLE GNC CHECKPOINTING},all (SODF: MCS:  
| NOMINAL: CHECKPOINTING), then:

### 7. SETTING BACK OFF TIME

Pre Node 2 PMA 2 Undock

'Pre Departure'

sel Back Off Time

Back Off Time

'Pending Time'

**cmd** 100 Seconds

Verify Pending Back Off Time: 100 sec

Verify Arm State – Arm

**cmd** Incorporate Pending Back Off Time

Verify Back Off Time: 100 sec

Verify Arm State – Disarm

### 8. SETTING POST DEPARTURE CONTROL MODE

Pre Node 2 PMA 2 Undock

'Pre Departure'

If Post Departure Control Mode – CMG TA (CMG Only)

sel Post Departure Control Mode

Post Dprtr Cntl Mode

**cmd** RS Control

Verify Post Departure Control Mode – RS Control

## 8.106 PMA2 PRE-DEPARTURE CONFIGURATION (THRUSTERS)

(JNT OPS/LF1 - ALL/FIN 9/SPN/MULTI) Page 4 of 6 pages

### 9. ENABLING DEPARTURE SOFTWARE

#### NOTE

As stated in SPN 3366, which is only applicable to CCS R4, if there is an INT MDM failure and INT Redundancy Management (RM) software is executing in the C&C MDM, then the Manual Undocking Sequence Init command will be accepted but will not execute until INT RM processing is complete. Due to the low probability of an INT MDM failure occurring during the undocking timeframe, Manual Departure ACS Moding software will be enabled which will allow use of the Manual Undock Sequence Init command as a backup to automatic ACS moding software. If INT RM executes during undocking and delays execution of Manual Undock Sequence Init command, then steps in the PMA2 Departure (Thrusters) procedure direct the ISS crew to command from the Russian Segment.

Pre Node 2 PMA 2 Undock

'Pre Departure'

sel PMA 2 Manual Departure SW

Manual Departure SW

'PMA 2'

**cmd** Manual Departure SW Enable

Verify PMA 2 Undocking Vehicle - Shuttle

Verify PMA 2 Manual Dprtr SW - Ena

Pre Node 2 PMA 2 Undock

'Pre Departure'

sel PMA 2 Automatic Departure SW

Automatic Departure SW

'PMA 2'

**cmd** Arm

Verify State – Arm

**cmd** Enable

Verify PMA 2 Undocking Vehicle – Shuttle

Verify PMA 2 Automatic Departure SW – Ena

Verify State – Disarm

### 10. VERIFYING TIME SINCE SEPARATION TELEMETRY

Pre Node 2 PMA 2 Undock

'Undocking'

## 8.106 PMA2 PRE-DEPARTURE CONFIGURATION (THRUSTERS)

(JNT OPS/LF1 - ALL/FIN 9/SPN/MULTI) Page 5 of 6 pages

Verify Time Since Separation: 0

### CAUTION

If the Time Since Separation is observed to be incrementing any time prior to planned departure, ISS will take attitude control after 100 seconds, which could result in a force fight or collision with the orbiter. IMMEDIATE ACTION IS REQUIRED to prevent ISS from taking attitude control.

\*\*\*\*\*

\* If Time Since Separation is observed to be incrementing any time  
\* prior to planned departure, send all of the following commands  
\* to inhibit both manual and automatic SW, even if either is  
\* already inhibited, to ensure timer stops.

\*   
\* 'Pre Departure'

\* sel PMA2 Manual Departure SW

\*   
\* 'PMA 2'

\* **cmd** Manual Departure SW Inhibit

\* Verify PMA 2 Undocking Vehicle – None  
\* Verify PMA 2 Manual Dprtr SW – Inh

\* **cmd** Automatic Departure SW Inhibit

\* Verify PMA 2 Automatic Dprtr SW – Inh

\*\*\*\*\*

## 11 HANDOVER ATTITUDE CONTROL TO ORBITER

MCG: MCS Configuration

'MCS Moding'

If US GNC Mode – CMG TA

Perform {3.110 HANDOVER ATTITUDE CONTROL CMG TA TO ORBITER}, all (SODF: JNT OPS: MATED OPERATIONS), then:

MCG: MCS Configuration

'MCS Moding'

**MCC-H**

Verify RS SUDN Mode – CMG TA

## 8.106 PMA2 PRE-DEPARTURE CONFIGURATION (THRUSTERS)

(JNT OPS/LF1 - ALL/FIN 9/SPN/MULTI) Page 6 of 6 pages

### 12. PREPARING RUSSIAN SEGMENT FOR DEPARTURE

MCG: MCS Configuration

MCS Configuration

'MCS Moding'

If RS SUDN Mode is not Indicator, or RS Control is not Master.

**MCC-M**

YBT F14\_20 Take Master Flag from US and Mode RS to Indicator

**MCC-H**

MCS Configuration

'MCS Moding'

Verify RS SUDN Mode – Indicator

Verify RS Control – Master

**MCC-M**

Verify GTUBM\_B13.B.14 = 1 Inhibit dynamic checking flag bit set

**MCC-M** will prepare thrusters for attitude control approximately 3 minutes prior to undocking.

YBT F1\_198 Prepare thrusters for attitude control.

#### NOTE

1. **MCC-M** will also verify that Russian Segment is not using USOS calculated mass properties.
2. **MCC-M** mass properties will have been updated once station is in Attitude Control.
3. RS Control must be Master for the ACS moding software to mode RS to thruster control after undocking.

**MCC-M** ⇒ **MCC-H**, "Russian Segment is prepared for departure."



## 8.108 PMA2 POST DEPARTURE CONFIGURATION (THRUSTERS)

(JNT OPS/LF1 - ALL/FIN 9/MULTI) Page 1 of 4 pages

### OBJECTIVE:

Operational sequence used to reconfigure the departure software on RS Thrusters.

#### 1. GNC COMMAND RESPONSE COUNTERS RESET

PCS

MCG: GNC Command Response Counters

GNC Command Response Counters

sel Reset

Verify the Since Reset column values are all blank.

Do not close this window until the procedure is complete.

If while executing a command, the Command Accept counter on that display does not increment

Reselect GNC Command Response Counters to determine if a command was rejected.

√**MCC-H**

#### 2. VERIFYING FLIGHT SPECIFIC PAD

If the following information is not recorded elsewhere, record it here.

Is Checkpointing to be enabled or inhibited? \_\_\_\_\_

Table 1. Version ID

		Version ID	
1	Version ID for CCS PPL 180 (ACS FDIR Adaptation Data) with RS ACS_Safing_Status set to "0" (off) to be loaded to Backup and Standby C&C MDM.	_____	Must be built as File Uplink and uplinked to the backup and standby C&C.
2	Version ID for CCS PPL 181 - CCS RM PPL For GNC RM with or without Checkpointing to be loaded to all C&C MDMs.	_____	If GNC RM with Checkpointing was inhibited for undocking, and is to be enabled now, uplink PPL to all C&C MDMs. Must be built as File Uplink.

## 8.108 PMA2 POST DEPARTURE CONFIGURATION (THRUSTERS)

(JNT OPS/LF1 - ALL/FIN 9/MULTI) Page 2 of 4 pages

PCS 3. VERIFYING CORRECT CONFIGURATION  
MCG: Dock and Undock: Pre-Node 2 PMA 2 Undock  
Pre Node 2 PMA 2 Undock  
'System Configuration'

Verify US Station Mode – Prox Ops  
Verify RS Station Mode – Prox Ops  
Verify RS SUDN Mode – Thrusters Only

'Undocking'

Verify LA-1/LA-2 Interface Sealed – No/No  
Verify LA-1/LA-2 Separation – Yes/Yes  
Verify Time Since Separation > 100

If Docked Indication – Docked

**cmd** Not Docked

Verify Docked Indication – NOT Docked

### 4. ENABLING GNC CHECKPOINTING

If GNC Checkpointing is to be enabled per step 2

Perform {2.701 ENABLE GNC CHECKPOINTING}, all (SODF: MCS:  
NOMINAL: CHECKPOINTING), then:

### 5. INHIBITING THE DEPARTURE SOFTWARE

#### NOTE

1. The Time Since Separation gets reset to zero by commanding the automatic departure software inhibit, but it does not get reset by commanding the manual departure software inhibit. So there could be times when the automatic software was not used or already is inhibited, and it should still be commanded inhibited in this step to reset the timer.
2. If the Manual Undock Sequence Init command was sent, the software automatically inhibits the manual software. However, to configure the Manual Undock Seq Init telemetry to Not Init, the Manual Software must be commanded Inh even though its telemetry already reads Inh.

Pre Node 2 PMA 2 Undock

'Undocking'

## 8.108 PMA2 POST DEPARTURE CONFIGURATION (THRUSTERS)

(JNT OPS/LF1 - ALL/FIN 9/MULTI) Page 3 of 4 pages

If Manual SW Enable – Ena, or Manual Undock Sequence Init – Init

Pre Node 2 PMA 2 Undock

'Pre Departure'

sel PMA 2 Manual Departure SW

Pre Node 2 PMA 2 Undock

'PMA 2'

**cmd** Manual Departure SW Inhibit

Verify PMA 2 Undocking Vehicle – None

Verify PMA 2 Manual Dprtr SW – Inh

Pre Node 2 PMA 2 Undock

'Undocking'

Verify Manual Undock Sequence Init – Not Init

Pre Node 2 PMA 2 Undock

'Pre Departure'

If PMA 2 Automatic Departure SW – Ena

or

'Undocking'

If Time Since Separation is increasing

'Pre Departure'

sel PMA 2 Automatic Departure SW

Automatic Departure SW

'PMA 2'

**cmd** Inhibit

Verify PMA 2 Undocking Vehicle – None

Verify PMA 2 Automatic Departure SW – Inh

Pre Node 2 PMA 2 Undock

'Undocking'

Verify Time Since Separation: 0

## 6. INCORPORATING MASS PROPERTIES

Pre Node 2 PMA 2 Undock

'System Configuration'

**cmd** Mass

Verify Active Mass Properties PPL Version ID as expected per step 1 of 8.106 PMA2 Pre-Departure Configuration (Thrusters).

## 8.108 PMA2 POST DEPARTURE CONFIGURATION (THRUSTERS)

(JNT OPS/LF1 - ALL/FIN 9/MULTI) Page 4 of 4 pages

- MCC-H** 7. LOADING REQUIRED PPLs TO BACKUP/STANDBY C&C MDM  
Coordinate with ODIN to load CCS PPLs designated in step 2
- MCC-M** 8. CONFIGURING RS INHIBIT FOR STAGE OPERATIONS  
YBL F8\_10 (inf0=9, inf1=0) Enable the RS automatic takeover due to Tier  
1 Loss of Comm  
Verify RS Give Control/Take Control flag = 0  
Verify RS Auto Handover into GMG TA flag – Ena

## 9.101 JOINT EXPEDITED UNDOCKING AND SEPARATION

(JNT OPS/LF1 - ALL/FIN 7/MULTI/HC) Page 1 of 11 pages

### NOTE

1. This Expedited undocking should be used for the following shuttle failures
  - Cabin leak
  - Loss of cooling (2 water coolant loops or 2 Freon coolant loops)
2. This Expedited undocking may be used for the following shuttle failures **On MCC GO**
  - Non-isolatable prop leak
  - Loss of cooling (2 cabin fans)
  - Loss of 2 fuel cells
3. Entrance to this procedure based on Cabin Leak or Loss of Cooling scenario assumes that this procedure will be worked concurrently with the associated FDF ORB PKT and ENTRY PKT powerdown.
4. At least 20 minutes is required to perform mandatory activities (not including ISS SAFING actions, which could take up to 1:35 to complete) to configure for physical separation (10 minutes for JOINT EMERGENCY EGRESS + 10 minutes for undocking prep).

The SHUTTLE EMERGENCY SEPARATION procedure is 30 minutes in duration from physical undocking to Deorbit OMS burn.

**9.101 JOINT EXPEDITED UNDOCKING AND SEPARATION**  
 (JNT OPS/LF1 - ALL/FIN 7/MULTI/HC) Page 2 of 11 pages

314

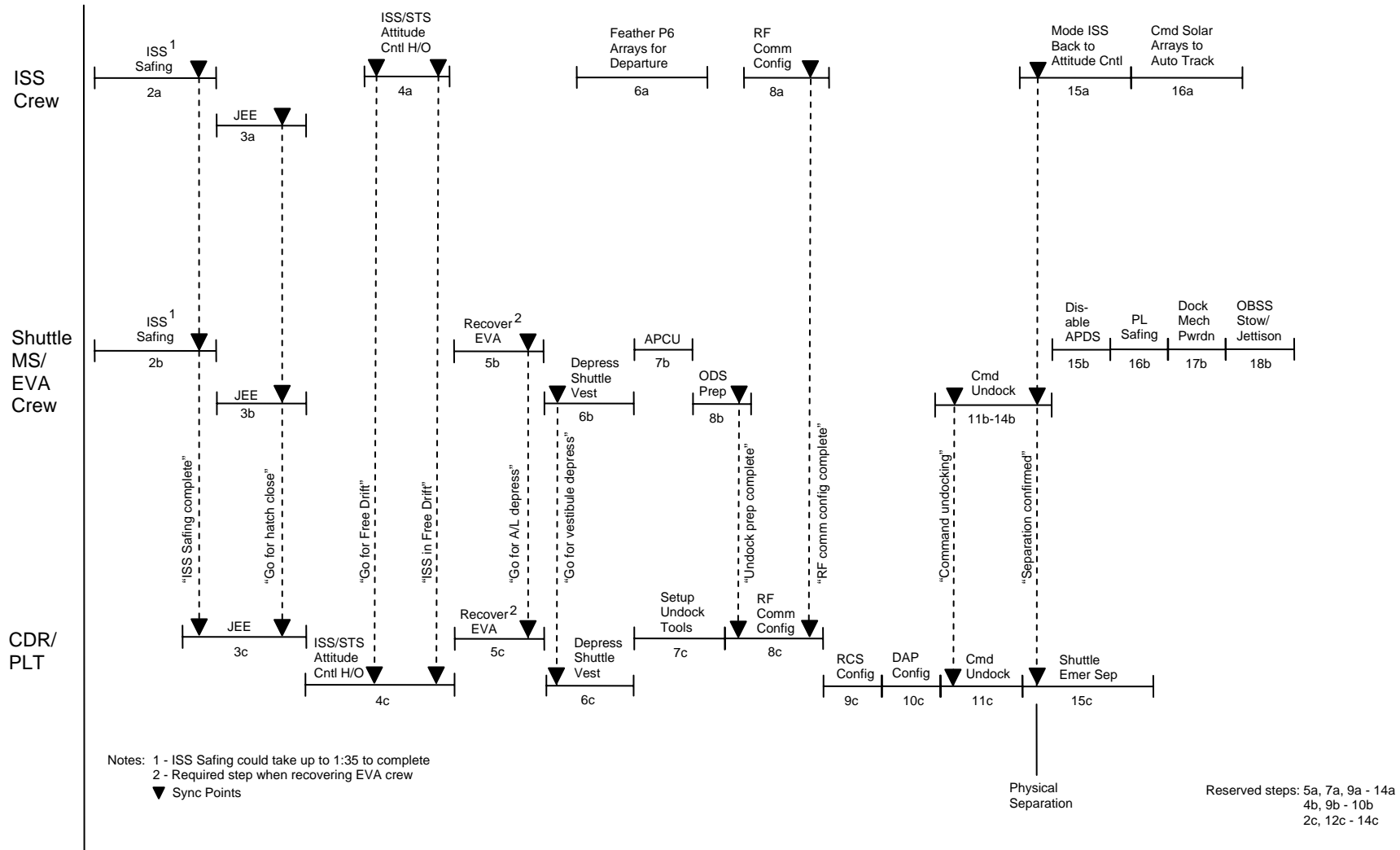


Figure 1.- Functional Overview.

## 9.101 JOINT EXPEDITED UNDOCKING AND SEPARATION

(JNT OPS/LF1 - ALL/FIN 7/MULTI/HC) Page 3 of 11 pages

	ISS CREW	SHUTTLE MS/EVA CREW	SHUTTLE CDR/PLT
	<p>1a. Report to shuttle crew, "JEUS in progress."</p> <div style="border: 1px solid black; padding: 5px; margin: 5px 0;"> <p style="text-align: center;"><b>NOTE</b></p> <p>If ISS crew available, steps 2a to 3a should be performed in parallel.</p> </div> <p>2a. <u>ISS SAFING</u> As required, perform {9.102 ISS SAFING}, all (SODF: JNT OPS: EMERGENCY RESPONSE), then:  Report to shuttle CDR, "ISS SAFING complete."</p> <p>3a. <u>JOINT EMERGENCY EGRESS</u> All crew return to home vehicle. If required, unstow and don masks.</p> <p>√Only ISS crew onboard ISS If APAS Hatch open and ODS Hatch closed</p> <p>LAB Fwd Open LAB Fwd Hatch per decal</p> <p>ODS Vest GN2 Xfer Pnl √FLOW → CL √VENT - CL</p> <p>GO2 Xfer Pnl FLOW → CL √VENT - CL</p> <p>Demate GO2/GN2 hoses from ODS Xfer Pnl Clear hatchway of cables, ducts, and hoses Stow PMA/ODS duct and GO2/GN2 hoses in PMA</p> <p>APAS Disconnect Hatch from Standoff Remove and stow covers for Hatch, Docking Target Baseplate Install Standoff Cross by hand</p>	<p>1b. Report to shuttle CDR, "JEUS in progress."</p> <div style="border: 1px solid black; padding: 5px; margin: 5px 0;"> <p style="text-align: center;"><b>NOTE</b></p> <p>If shuttle crew available, steps 2b to 3b should be performed in parallel.</p> </div> <p>2b. <u>ISS SAFING</u> As required, perform {9.102 ISS SAFING}, all (SODF: JNT OPS: EMERGENCY RESPONSE), then:  Report to shuttle CDR, "ISS SAFING complete."</p> <p>3b. <u>JOINT EMERGENCY EGRESS</u> All crew return to home vehicle. If required, unstow and don masks.</p> <p>√Only shuttle crew onboard shuttle If APAS Hatch open and ODS Hatch closed Go to step 5b</p>	<p>1c. Report to shuttle MS and ISS crew, "JEUS in progress."</p> <p>2c. <u>RESERVED</u></p> <p>3c. <u>JOINT EMERGENCY EGRESS</u> All crew return to home vehicle. If required, unstow and don masks.</p> <p>√Only shuttle crew onboard shuttle</p>

315

# 9.101 JOINT EXPEDITED UNDOCKING AND SEPARATION

316

ISS CREW	SHUTTLE MS/EVA CREW	SHUTTLE CDR/PLT
<p>LAB Fwd</p> <ul style="list-style-type: none"> <li>Close APAS Hatch using tool.</li> <li>√APAS EQUAL VLV → CL</li> <li>√LAB Fwd Stbd IMV vlv – CLOSED</li> <li>Close LAB Fwd Hatch per decal.</li> </ul> <p>Perform {10.102 JOINT EMERGENCY EGRESS}, steps 5 and 6 (SODF: JNT OPS: CUE CARD), then:</p> <p>4a. <u>ISS/STS ATTITUDE CNTL H/O</u> On shuttle CDR call, "GO for ISS to Free Drift"</p> <p>PCS</p> <p>MCG: MCS Configuration <u>MCS Configuration</u> 'MCS Moding'</p> <p>If ISS Att Cntl Config - In Control and US GNC mode is CMG TA sel Drift <u>Drift</u> √Mode Transition – Ena √Attitude Maneuver – Ena √Att Cntl Shutdown – Ena 'Moding' <b>cmd</b> Mode to Drift Verify US GNC Mode – Drift If ISS Att Cntl Config – In Control and RS SUDN Mode – Thrusters Only</p> <p>RS Laptop</p> <p>CM: TBM PROC <u>CM:TBM:Procedures</u></p> <p>sel F1_37 "Mode СУДН to Indicator, (ИР) with ОДУ OFF" <b>cmd Execute</b></p>	<p>Perform {10.102 JOINT EMERGENCY EGRESS}, all (SODF: JNT OPS:CUE CARD), then:</p> <p>4b. <u>RESERVED</u></p>	<p><b>NOTE</b> Shuttle CDR will give final "GO" for Hatch closure (steps 16 to 20 of JOINT EMERGENCY EGRESS).</p> <p>Report to MS, "GO for Hatch closure."</p> <p>4c. <u>ISS/STS ATTITUDE CNTL H/O</u> O14, O15, O16:F O14, O15, O16:E Pri RJD DRIVER, LOGIC (sixteen) – ON cb L, AFT DDU (four) – cl</p> <p>√<b>MCC</b> for undock attitude (if comm avail)</p> <p><u>GNC UNIV PTG</u> If +Vbar undock attitude   P = 180, Y = 0, OM = 0 If -Vbar undock attitude P = 180, Y = 0, OM = 180</p> <p>Check SRMS/SSRMS clear for shuttle attitude control.</p> <p>Report to ISS crew, "Go for ISS to Free Drift."</p>



# 9.101 JOINT EXPEDITED UNDOCKING AND SEPARATION

317

ISS CREW	SHUTTLE MS/EVA CREW	SHUTTLE CDR/PLT
<p>PCS</p> <p>CM: СУДН: Main  <span style="border: 1px solid black; padding: 2px;">CM: СУДН: Main</span></p> <p>Verify RS GNC Mode – Indicator: Master</p> <p>MCG: MCS Configuration  <span style="border: 1px solid black; padding: 2px;">MCS Configuration</span>                      'MCS Moding'</p> <p>Verify ISS Att Cntl Config – Free Drift (No Control)</p> <p>Report to shuttle CDR, "ISS in Free Drift."</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p style="text-align: center;"><b>NOTE</b></p> <p>ISS crew will mode station back to attitude control following shuttle undock. Since comm between the two vehicles may not be available, crew will verify separation via PCS.</p> </div> <p>5a. <u>RESERVED</u></p>	<p>5b. <u>RECOVER EVA CREW (if reqd)</u>                      If recovering EVA crew</p> <p>IV Remove hardware from external airlock for EV crew ingress.</p> <p>Ext A/L Outer Hatch Equal vlv (two) – vent, remove caps</p> <p>Close Inner Hatch per decal.                      Inner Hatch Equal vlv (two) – OFF</p> <p>EV Remove Ext A/L Outer Hatch thermal cover.</p> <p>IV Report to CDR, "Inner Hatch closed, GO for airlock depress."</p> <p>On shuttle CDR call, "GO for airlock depress."</p> <p>EV Ext A/L Outer Hatch Equal vlv (two) - EMER</p>	<p>On ISS crew call, "ISS in Free Drift."</p> <p>EXEC – ITEM 19 EXEC (*)</p> <p>C3(A6U) If shuttle A/L pressurized                      A12(B12)/AUTO/VERN(ALT), LO Z</p> <p>C3(A6U) If shuttle A/L not pressurized                      A13(B13)/AUTO/VERN(ALT), LO Z</p> <p><span style="border: 1px solid black; padding: 2px;">GNC UNIV PTG</span>                      √ERR TOT - ITEM 23 (*)</p> <p>5c. <u>RECOVER EVA CREW (if reqd)</u>                      If recovering EVA crew</p> <p><span style="border: 1px solid black; padding: 2px;">GNC 20 DAP CONFIG</span></p> <p>Config DAP A to A13                      Config DAP B to B13</p> <p>On MS call, "Inner Hatch closed," report to EVA, "GO for airlock depress."</p>

# 9.101 JOINT EXPEDITED UNDOCKING AND SEPARATION

318

ISS CREW	SHUTTLE MS/EVA CREW	SHUTTLE CDR/PLT
<p>6a. <u>FEATHER P6 SOLAR ARRAYS FOR DEPARTURE</u></p> <div data-bbox="331 367 716 480" style="border: 1px solid black; padding: 5px;"> <p><b>NOTE</b> It should take approx 8 minutes for solar arrays to reach feathered position.</p> </div> <p>PCS P6: EPS: BGA 2B sel Channel Targeted Modes <u>BGA 2B Ch Targeted Modes</u> 'Column = Non-Solar Tracking' 'Row = Directed Position' input Cmded Angle – <u>1 5 0</u> deg <b>cmd Set</b></p> <p>P6: EPS: BGA 4B sel Channel Targeted Modes <u>BGA 4B Ch Targeted Modes</u> 'Column = Non-Solar Tracking' 'Row = Directed Position' input Cmded Angle – <u>2 1 0</u> deg <b>cmd Set</b></p>	<p>EV IV EV</p> <p>***** * If -dP/dT or O2(N2) Flow Hi * alarm during airlock depress, * Ext A/L Outer Hatch Equal * vlv (two) – OFF * √Inner Hatch closed * √Equal vlv (two) - OFF *****</p> <p>Monitor Outer Hatch Delta Press ind. When ΔP &lt; 0.5 psi (~2 min), open Outer Hatch. Perform TERMINATE EVA (Cuff C/L), step 3 and subs. Close Hatch, lock</p> <p>Ext A/L Outer Hatch Equal vlv (two) - OFF</p> <p>Perform REPRESS (FDF: EVA C/L, <u>DEPRESS/REPRESS</u>), then:</p> <p>Go to Post-EVA (FDF:EVA C/L, <u>POST EVA</u>)</p> <p>6b. <u>DEPRESS SHUTTLE VESTIBULE</u> On shuttle CDR call, "GO for vestibule depress" -----</p> <p>A6L √cb ESS 1BC SYS PWR CNTL SYS 1 – cl √2CA SYS PWR CNTL SYS 2 – cl</p> <p>1BC DEP SYS 1 VENT ISOL – cl 2CA DEP SYS 2 VENT ISOL – cl MNA DEP SYS 1 VENT – cl MNB DEP SYS 2 VENT – cl</p> <p>√SYS PWR SYS 1, SYS 2 tb (two) – ON VEST DEP VLV SYS 1,2 VENT ISOL (two) – OP (tb-OP) VEST DEP VLV SYS 1,2 VENT (two) – OP (tb-OP)</p>	<p>6c. <u>DEPRESS SHUTTLE VESTIBULE</u> When JOINT EMERGENCY EGRESS (and UTILIZE ISS ATMOSPHERE, if required for cabin leak) complete,</p> <p>Report to MS, "GO for vestibule depress."</p>

# 9.101 JOINT EXPEDITED UNDOCKING AND SEPARATION

319

ISS CREW	SHUTTLE MS/EVA CREW	SHUTTLE CDR/PLT
<p>7a. <u>RESERVED</u></p>	<p>7b. <u>VERIFYING APCU DEACT</u> L12U √APCU 1,2 CONV (two) – OFF (tb-bp) √OUTPUT RLY tb (two) – bp √OUTPUT RLY (two) – OPEN</p> <p>8b. <u>ODS PREP FOR UNDOCKING</u> If required, perform PMA-2/3 HOOKS OPEN (FDF: RNDZ, <u>APDS</u>), then:</p> <p>Perform DOCKING MECHANISM PWRUP (FDF: RNDZ, <u>APDS</u>), then:</p> <div style="border: 2px solid black; background-color: yellow; padding: 5px; text-align: center;"> <p><b>CAUTION</b></p> <p>If Airlock Pressure &lt; 8.0 psia, expect hooks motor drive to fail during operation.</p> </div> <p>Perform UNDOCKING PREP (FDF: RNDZ, <u>APDS</u>), then:</p> <p>Report to shuttle CDR, “UNDOCKING PREP complete.”</p> <p>Go to step 11b, hold for shuttle CDR call, “Command undocking.”</p>	<p>7c. <u>SETUP UNDOCKING TOOLS</u> Unstow HHL with Nightscope. Install -Z COAS.</p> <p>Review SHUTTLE EMERGENCY SEPARATION (FDF: RNDZ, <u>CONTINGENCY OPS</u>)</p> <p>Review OBSS JETTISON (FDF: PDRS FS, <u>OBSS CONTINGENCY</u>)</p> <p>If time available (~15 min): Perform C/L CAMR INSTALL, steps 1-3 (FDF: PHOTO T/V FS, <u>CENTERLINE (C/L)</u>), then:</p> <p>Perform CCTV CONFIG FOR DOCKING/UNDOCKING (FDF: RNDZ, <u>RNDZ TOOLS</u>), then:</p>
<p>8a. <u>CONFIG FOR RF COMM (if reqd)</u> If not recovering EVA crew Perform {6.104 <u>HARDLINE AUDIO CONFIG (ISS) BACKOUT</u>}, step 2 (SODF: JNT OPS: COMM/DATA), then:</p> <p>Go to step 15a, hold for physical sep</p> <p>9a. <u>RESERVED</u></p>	<p>9b. <u>RESERVED</u></p>	<p>8c. <u>CONFIG FOR RF COMM (if reqd)</u> If not recovering EVA crew Perform {6.104 <u>HARDLINE AUDIO CONFIG (ISS) BACKOUT</u>}, steps 1,3,4 (SODF: JNT OPS: COMM/DATA), then:</p> <p>Report to shuttle CDR, “RF Comm config complete.”</p> <p>9c. <u>CONFIG RCS FOR UNDOCK</u> <u>GNC 23 RCS</u> Reselect manually deselected jets (no *) except for F1F and F2F.</p>

# 9.101 JOINT EXPEDITED UNDOCKING AND SEPARATION

320

ISS CREW	SHUTTLE MS/EVA CREW	SHUTTLE CDR/PLT
<p>10a. <u>RESERVED</u></p>	<p>10b. <u>RESERVED</u></p>	<p>10c. <u>CONFIG DAP FOR UNDOCK</u>            CDR reports to <b>MCC</b>, "ISS SAFING complete and ISS in Free Drift."            √<b>MCC</b> for "GO" for undocking (if time permits and comm available), then:  <div style="border: 1px solid black; padding: 2px; display: inline-block;">GNC UNIV PTG</div>            When in attitude, or if time critical and ERR &lt; 30 deg,            DAP: LVLH            When Rates &lt; 0.12 deg/sec            DAP: FREE            DAP: B/ALT, no LO Z  <div style="border: 1px solid black; padding: 2px; display: inline-block;">GNC 20 DAP CONFIG</div>            CRT X JETS ROT ENA, ITEM 7 EXEC (no*)            Config DAP A,B to A9,B9.            A6U FLT CNTLR PWR – ON</p>
<p>11a. <u>RESERVED</u></p>	<p>11b. <u>COMMAND UNDOCKING</u>            On shuttle CDR call, -----            "Command undocking,"            *****            * If HOOKS 1(2) OPEN It failed on            *   APDS PWR A<sub>DS</sub> - OFF            *   √A<sub>DS</sub>, failed Its off            *****            A7L APDS CIRC PROT OFF pb – push            √CIRCUIT PROTECT OFF It –            It on</p>	<p>11c. <u>COMMAND UNDOCKING</u>            Report to MS,            "Command undocking."            Go to step 15c, hold for shuttle MS call, "Separation confirmed."</p>
<p>12a. <u>RESERVED</u></p>	<p>-2:20 12b. UNDOCKING pb – push            √HOOKS 1,HOOKS 2 CLOSED It (two) –            It off</p>	<p>12c. <u>RESERVED</u></p>

### 9.101 JOINT EXPEDITED UNDOCKING AND SEPARATION

321

ISS CREW	SHUTTLE MS/EVA CREW	SHUTTLE CDR/PLT
	<p><u>SM 167 DOCKING STATUS</u></p> <p>√HK1, HK2 POS (two) &lt; 92 % and decreasing</p> <p>*****</p> <p>* If HOOKS 1(2) fail to drive (HK 1(2) DRV CMD – OFF)</p> <p>*   OP HOOKS pb – push</p> <p>* If HOOKS 1(2) appear to stop before reaching end-of-travel (HK1(2) POS &gt; 4 % and not decreasing), allow for single motor drive time (~4:40) before performing pnl A7L pwr cycle.</p> <p>*****</p> <p>-1:30 A7L 13b. √INTERF SEALED It – It off</p> <p>√READY TO HOOK It – It off (HK1, HK2 POS ~30 %)</p> <p>0:00 14b. √HOOKS 1, HOOKS 2 OPEN It (two) – It on</p> <p>CRT √HK1, HK2 POS (two): 4 %</p> <p>√UNDOCK COMPLET It – It on</p> <p>*****</p> <p>+2:20 A7L * If HOOKS 1(2) fail to open (confirmed by no physical separation)</p> <p>* PWR OFF pb – push, then:</p> <p>* √MCC (if time permits)</p> <p>* <u>FIRE PYROS</u></p> <p>A6L * PYRO PWR MN A, MN C (two) – ON</p> <p>A7L * PYROS Ap, Bp, Cp (three) – ON</p> <p>* √Ap, Bp, Cp It (three) – It on</p> <p>* PYRO CIRC PROT OFF pb – push</p> <p>* √CIRCUIT PROTECT OFF It – It on</p> <p>* ACT HOOKS FIRING pb – push</p>	<p>13c. <u>RESERVED</u></p> <p>14c. <u>RESERVED</u></p>

# 9.101 JOINT EXPEDITED UNDOCKING AND SEPARATION

322

ISS CREW	SHUTTLE MS/EVA CREW	SHUTTLE CDR/PLT
<p style="text-align: center;"><u>POST-PHYSICAL SEPARATION</u></p> <p>15a. <u>MODE ISS BACK TO ATTITUDE CNTL</u>            PCS MCG: Dock and Undock: Pre-Node 2            PMA 2 Undock            Pre Node 2 PMA 2 Undock            'Undocking'</p> <p>When LA-1 or LA-2 Separation = "Yes",            or if shuttle separation is confirmed,            wait 100 seconds then continue.</p> <p>RS Laptop CM: ЦБМ PROC            CM: ЦБМ: Procedures            sel F22_1            input param 1 – 3 4            input param 2 – 0  <b>cmd Execute</b></p> <p>It may take 2 minutes to get end item.</p> <p>RS Laptop CM: СУДН: Main            CM: СУДН: Main            Verify RS GNC Mode – Thrusters (ДЮ)            Only</p>	<p>A6L</p> <ul style="list-style-type: none"> <li>* Following separation</li> <li>* PYRO CIRC PROT ON pb – push</li> <li>* √CIRCUIT PROTECT OFF It</li> <li>* - It off</li> <li>* PYROS Ap, Bp, Cp (three) – OFF</li> <li>* √Ap, Bp, Cp It (three) – It off</li> <li>* PYROS PWR MN A, MN C (two) – OFF</li> <li>* OFF</li> <li>*****</li> </ul> <p style="text-align: center;"><u>POST-PHYSICAL SEPARATION</u></p> <p>A7L</p> <p>15b. <u>DISABLING APDS CONTROL CMDS</u>            PWR OFF pb – push            √STATUS It (eighteen) – It off</p> <p>16b. Perform PL SAFING (FDF: ORB PKT, <u>PL PWRDN</u>), then:</p> <p>17b. On CDR/PLT call:            Perform DOCKING MECHANISM            PWRDN (FDF: RNDZ, <u>APDS</u>), then:</p> <p>18b. <u>STOW/JETTISON OBSS</u>            If time available (~45 min)            Go to OBSS BERTH (FDF: PDRS FS, <u>NOMINAL</u>)</p> <p>If time not available            Go to OBSS JETTISON (FDF: PDRS FS, <u>OBSS CONTINGENCY</u>), MS steps 1 to 3. Hold on SRMS mnvr until shuttle in inertial attitude in step 2 of SHUTTLE EMERGENCY SEPARATION.</p>	<p style="text-align: center;"><u>POST-PHYSICAL SEPARATION</u></p> <p>On MS call,            "Separation confirmed."</p> <p>15c. <u>PERFORM SEP SEQUENCE</u>            Perform SHUTTLE EMERGENCY SEPARATION (FDF: RNDZ, <u>CONTINGENCY OPS</u>).</p> <p>If OBSS Jettison req'd            Go to OBSS JETTISON (FDF: PDRS FS, <u>OBSS CONTINGENCY</u>) after step 3 of SHUTTLE EMERGENCY SEPARATION.</p>

# 9.101 JOINT EXPEDITED UNDOCKING AND SEPARATION

ISS CREW	SHUTTLE MS/EVA CREW	SHUTTLE CDR/PLT
<p>16a. <a href="#">COMMAND SOLAR ARRAYS TO AUTO TRACK</a></p> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p style="text-align: center;"><b>NOTE</b></p> <p>Shuttle sep to 400 ft will take ~20 minutes.</p> </div> <p>PCS      When shuttle &gt; 400 ft:                      P6: EPS: BGA 2B</p> <div style="border: 1px solid black; padding: 2px; margin: 5px 0;"> <p>BGA 2B</p> </div> <p>sel Channel Targeted Modes</p> <div style="border: 1px solid black; padding: 2px; margin: 5px 0;"> <p>BGA 2B Ch Targeted Modes</p> </div> <p>'Column: Autonomous, Row: Autotrack'</p> <p><b>cmd Set</b></p> <p>Verify Ch 2B Mode – Autonomous            Verify BGA Mode – Autotrack</p> <p>P6: EPS: BGA 4B</p> <div style="border: 1px solid black; padding: 2px; margin: 5px 0;"> <p>BGA 4B</p> </div> <p>sel Channel Targeted Modes</p> <div style="border: 1px solid black; padding: 2px; margin: 5px 0;"> <p>BGA 4B Ch Targeted Modes</p> </div> <p>'Column:Autonomous, Row: Autotrack'</p> <p><b>cmd Set</b></p> <p>Verify Ch 4B Mode – Autonomous            Verify BGA Mode – Autotrack</p>		

322a

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<b>WARNING</b>
If SRMS deployed and grappled to OBSS, it must be moved to SRMS/SSRMS Handoff position or Modified CMG R&R Viewing position prior to undock

Determine activity from Table 1 and go to page listed Table 1. Activity

Activity	Page
MPLM INSTALL ON NODE 1 NADIR (USING SSRMS)	1 of 30
MPLM RETURN TO PLB (USING SSRMS)	5 of 30
OBSS UNBERTH (USING SSRMS)	8 of 30
OBSS STOW (USING SSRMS)	11 of 30
EVA 1	15 of 30
EVA 2	21 of 30
EVA 3	26 of 30
OTHER DOCKED ACTIVITIES	30 of 30

322c

MPLM INSTALL ON NODE 1 NADIR (USING SSRMS)

1. Determine phase completed from Table 2 and perform action(s).

Table 2. MPLM Install

Phase Completed	Action(s)	Time to Complete	Notes/Reference
<b>MPLM Grappled (PRLAs closed)</b>	1. Ungrapple MPLM. 2. MnvR SSRMS to Berthed MPLM pre-grapple posn.	0:15	1.224 BERTHED MPLM UNGRAPPLE (SODF: ROB FS)*
<b>ROEU Demate</b>	1. Ungrapple MPLM. 2. MnvR SSRMS to Berthed MPLM pre-grapple posn.	0:15	1.223 MPLM BERTH, steps 4 to 9*, 11* (SODF: ROB FS) 1.224 BERTHED MPLM UNGRAPPLE (SODF: ROB FS)*
<b>MPLM Grappled (PRLAs open)</b>	1. Close PRLAs. 2. Ungrapple MPLM. 3. MnvR SSRMS to Berthed MPLM pre-grapple posn.	0:25	1.223 MPLM BERTH, steps 3 to 9*, 11* (SODF: ROB FS) 1.224 BERTHED MPLM UNGRAPPLE (SODF: ROB FS)*
<b>Low Hover</b>	<u>Options:</u> A. None. SSRMS w/MPLM clear for undock. B. Return to orbiter (RTO). 1. Berth and ungrapple MPLM.	0:00  0:40	  1.223 MPLM BERTH, steps 3 to 9*, 11* (SODF: ROB FS) 1.224 BERTHED MPLM UNGRAPPLE (SODF: ROB FS)*

\* Joint angles will not match procedure. Fly to FOR numbers.

MPLM INSTALL ON NODE 1 NADIR (USING SSRMS) (cont)

Continuation of Table 2

Phase Completed	Action(s)	Time to Complete	Notes/Reference
<b>MPLM Pre-Install Pause Posn</b>	<u>Options:</u> A. None. SSRMS w/MPLM clear for undock.	0:00	
	B. Return to orbiter (RTO). 1. Mnv, berth, and ungrapple MPLM.	0:50	Change Loaded Parameters MPLM>MPLM Berth SYH Change Display Frame LAB>MPLM Berth Enter FOR OCAS mode with SY locked Mnv to PLB Hover posn: X=0, Y=0, Z = -480, P=0.0, Y=0.0, R=0.0 1.223 MPLM BERTH , steps 1 to 9*, 11* (SODF: ROB FS) 1.224 BERTHED MPLM UNGRAPPLE (SODF: ROB FS)*
<b>Pre-install Posn</b>	<u>Options:</u> A. None. SSRMS w/MPLM clear for undock.	0:00	
	B. Return to orbiter (RTO). 1. Mnv, berth and ungrapple MPLM.	0:55	Change Loaded Parameters MPLM>MPLM Berth SYH Change Display Frame LAB>MPLM Berth Enter FOR OCAS mode with SY locked Mnv to PLB Hover posn: X=0, Y=0, Z = -480, P=0.0, Y=0.0, R=0.0 1.223 MPLM BERTH, steps 1 to 9*, 11*(SODF: ROB FS) 1.224 BERTHED MPLM UNGRAPPLE (SODF: ROB FS)*
<b>CBM RTL</b>	<u>Options:</u> A. Mnv MPLM to pre-install posn.	0:05	Change Loaded Parameters MPLM>MPLM Berth SYH 1.222 MPLM UNINSTALL, steps 2-3* (SODF: ROB FS)
	B. Attach to ISS (ATI). 1. 1st, 2nd stage capture. 2. Abolt loading.	1:00	1.212 MPLM INSTALL, step 9 (SODF: ROB FS) 1.506 NODE 1 CBM CAPTURE/ABOLT, steps 2 to 6 (SODF:S&M) 1.212 MPLM INSTALL, step 10 (SODF: ROB FS)
	C. Return to orbiter (RTO). 1. Mnv, berth, and ungrapple MPLM.	1:00	Change Loaded Parameters MPLM>MPLM Berth SYH 1.222 MPLM UNINSTALL, steps 2-3*(SODF: ROB FS) Change Display Frame LAB>MPLM Berth Enter FOR OCAS mode with SY locked Mnv to PLB Hover posn: X=0, Y=0, Z = -480, P=0.0, Y=0.0, R=0.0 1.223 MPLM BERTH, steps 1 to 9*, 11* (SODF: ROB FS) 1.224 BERTHED MPLM UNGRAPPLE (SODF: ROB FS)*

\*Joint angles will not match procedure. Fly to FOR numbers.

322d

MPLM INSTALL ON NODE 1 NADIR (USING SSRMS) (cont)

Continuation of Table 2

Phase Completed	<u>Action(s)</u>	Time to Complete	Notes/Reference
<b>1<sup>st</sup> Stage Capture</b>	<u>Options:</u> A. Mnv r MPLM to pre-install posn 1. Deploy CBM Latches. 2. Mnv r to pre-install posn.	0:15	Change Loaded Parameters MPLM>MPLM Berth SYH 1.509 NODE 1 CBM DEMATE, step 9 (SODF: S&M) 1.222 MPLM UNINSTALL, steps 2 & 3* (SODF: ROB FS)
	B. Attach to ISS (ATI) 1. 2 <sup>nd</sup> Stage Capture. 2. Abolt Loading.	0:45	1.506 NODE 1 CBM CAPTURE/ABOLT, steps 4 to 6 (SODF: SM) 1.212 MPLM INSTALL, step 10 (SODF: ROB FS)
	C. Return to orbiter (RTO). 1. Deploy CBM Latches. 2. Mnv r, berth, and ungrapple MPLM.	1:10	1.509 NODE 1 CBM DEMATE, step 9 (SODF: S&M) Change Loaded Parameters MPLM>MPLM Berth SYH 1.222 MPLM UNINSTALL, steps 2 & 3* (SODF: ROB FS) Change Display Frame LAB>MPLM Berth Enter FOR OCAS mode with SY locked Mnv r to PLB Hover posn: X=0, Y=0, Z = -480, P=0.0, Y=0.0, R=0.0 1.223 MPLM BERTH, steps 1 to 9*, 11* (SODF: ROB FS) 1.224 BERTHED MPLM UNGRAPPLE (SODF: ROB FS)*

\* Joint angles will not match procedure. Fly to FOR numbers.

322e

MPLM INSTALL ON NODE 1 NADIR (USING SSRMS) (cont)

Continuation of Table 2

Phase Completed	Action(s)	Time to Complete	Notes/Reference
<b>2<sup>nd</sup> Stage Capture</b>	<u>Options:</u> A. Mnvtr MPLM to pre-install posn. 1. Deploy CBM Latches. 2. Mnvtr to pre-install posn.	0:15	1.509 NODE 1 CBM DEMATE, step 9 (SODF: S&M) Change Loaded Parameters MPLM>MPLM Berth SYH 1.222 MPLM UNINSTALL, steps 2 & 3*(SODF: ROB FS)
	B. Attach to ISS (ATI) 1. Abolt Loading.	0:15	1.506 NODE 1 CBM CAPTURE/ABOLT, steps 5 & 6(SODF: S&M) Change Loaded Parameters MPLM>MPLM Berth SYH 1.212 MPLM INSTALL, step 10 (SODF: ROB FS)
	C. Return to orbiter (RTO). 1. Deploy CBM Latches. 2. Mnvtr, berth and ungrapple MPLM.	1:10	1.509 NODE 1 CBM DEMATE, step 9 (SODF: S&M) Change Loaded Parameters MPLM>MPLM Berth SYH 1.222 MPLM UNINSTALL (SODF: ROB FS) Change Display Frame LAB>MPLM Berth Enter FOR OCAS mode with SY locked Mnvtr to PLB Hover posn: X=0, Y=0, Z = -480, P=0.0, Y=0.0, R=0.0 1.223 MPLM BERTH, steps 1 to 9*, 11*(SODF: ROB FS) 1.224 BERTHED MPLM UNGRAPPLE (SODF: ROB FS)*
<b>Abolt Loading</b>	<u>Options:</u> A. None. SSRMS w/MPLM clear for undock.	0:00	
	B. Return to orbiter (RTO). 1. Retract bolts. 2. Deploy CBM Latches. 3. Mnvtr, berth, and ungrapple MPLM.	1:50	1.509 NODE 1 CBM DEMATE, steps 1 to 9 (SODF: S&M). Change Loaded Parameters MPLM>MPLM Berth SYH 1.222 MPLM UNINSTALL (SODF: ROB FS) Change Display Frame LAB>MPLM Berth. Enter FOR OCAS mode with SY locked. Mnvtr to PLB Hover posn: X=0, Y=0, Z = -480, P=0.0, Y=0.0, R=0. 1.223 MPLM BERTH, steps 1 to 9*, 11* (SODF: ROB FS). 1.224 BERTHED MPLM UNGRAPPLE (SODF: ROB FS)*

\* Joint angles will not match procedure. Fly to FOR numbers.

2. Verify SRMS w/OBSS at OBSS CMG R&R VIEWING position. Drive SRMS WR to -68 deg. Time to complete 0:05
3. Go to [JOINT EXPEDITED UNDOCKING AND SEPARATION](#), step 2b (SODF: JNT OPS: EMERGENCY RESPONSE).

322f

MPLM RETURN TO PLB (USING SSRMS)

1. Determine phase completed from Table 3 and perform action(s).

Table 3. MPLM Return

Phase Completed	Action(s)	Time to Complete	Notes/Reference
<b>MPLM Grappled</b>	None. SSRMS w/MPLM clear for undock.	0:00	
<b>LBOLT or RBOLT Unloading (1<sup>st</sup> Set)</b>	None. SSRMS w/MPLM clear for undock.	0:00	
<b>RBOLT Unload (2<sup>nd</sup> Set)</b>	<u>Options:</u> A. Reload bolts to Abolt.	0:10	Allow Rbolt actuation to complete before commanding Abolts 1.504 NODE 1 CBM PREP FOR MATE, step 19 (SODF: S&M) 1.506 NODE 1 CBM CAPTURE/ABOLT, steps 5 & 6(SODF: S&M)
	B. Complete demate, mnvr MPLM to pre-install posn.	0:30	1.509 NODE 1 CBM DEMATE, steps 7 to 9 (SODF: S&M) 1.222 MPLM UNINSTALL, steps 2 & 3 (SODF: ROB FS)
	C. Return to orbiter (RTO).	1:25	1.509 NODE 1 CBM DEMATE, steps 7 to 9 (SODF: S&M) 1.222 MPLM UNINSTALL (SODF: ROB FS) 1.223 MPLM BERTH, steps 1 to 9, 11(SODF: ROB FS) 1.224 BERTHED MPLM UNGRAPPLE (SODF: ROB FS)
<b>RBOLT Unload (3<sup>rd</sup> Set)</b>	<u>Options:</u> A. Reload bolts to Abolt.	0:10	Allow Rbolt actuation to complete before commanding Abolts 1.504 NODE 1 CBM PREP FOR MATE, step 19 (SODF: S&M) 1.506 NODE 1 CBM CAPTURE/ABOLT, steps 5 & 6 (SODF: S&M)
	B. Complete demate, mnvr MPLM to pre-install posn.	0:20	1.509 NODE 1 CBM DEMATE, steps 8 & 9 (SODF: S&M) 1.222 MPLM UNINSTALL, steps 2 & 3 (SODF: ROB FS)
	C. Return to orbiter (RTO).	1:15	1.509 NODE 1 CBM DEMATE, steps 8 & 9 (SODF: S&M) 1.222 MPLM UNINSTALL (SODF: ROB FS) 1.223 MPLM BERTH, steps 1 to 9, 11 (SODF: ROB FS) 1.224 BERTHED MPLM UNGRAPPLE (SODF: ROB FS)

3229

MPLM RETURN TO PLB (USING SSRMS)

Continuation of Table 3

Phase Completed	Action(s)	Time to Complete	Notes/Reference
<b>RBOLT Unload (4<sup>th</sup> Set)</b>	<u>Options:</u> A. Reload bolts to Abolt.	0:10	Allow Rbolt actuation to complete before commanding Abolts 1.504 NODE 1 CBM PREP FOR MATE, step 19 (SODF: S&M) 1.506 NODE 1 CBM CAPTURE/ABOLT, step 4 (SODF: S&M)
	B. Complete demate, mnvr MPLM to pre-install posn.	0:15	1.509 NODE 1 CBM DEMATE, step 9 (SODF: S&M) 1.222 MPLM UNINSTALL, steps 2 & 3 (SODF: ROB FS)
	C. Return to orbiter (RTO).	1:10	1.509 NODE 1 CBM DEMATE, step 9 (SODF: S&M) 1.222 MPLM UNINSTALL (SODF: ROB FS) 1.223 MPLM BERTH, steps 1 to 9, 11 (SODF: ROB FS) 1.224 BERTHED MPLM UNGRAPPLE (SODF: ROB FS)
<b>Deploy Latches</b>	<u>Options:</u> A. Mnvr MPLM to pre-install posn.	0:05	1.222 MPLM UNINSTALL, steps 2 & 3 (SODF: ROB FS)
	B. Return to orbiter (RTO).	1:00	1.222 MPLM UNINSTALL (SODF: ROB FS) 1.223 MPLM BERTH, steps 1 to 9, 11(SODF: ROB FS) 1.224 BERTHED MPLM UNGRAPPLE (SODF: ROB FS)
<b>Pre-Install Posn</b>	<u>Options:</u> A. None. SSRMS w/MPLM clear for undock.	0:00	
	B. Return to orbiter (RTO).	0:55	1.222 MPLM UNINSTALL, steps 4 to 6(SODF: ROB FS) 1.223 MPLM BERTH, steps 1 to 9, 11 (SODF: ROB FS) 1.224 BERTHED MPLM UNGRAPPLE (SODF: ROB FS)

322h

MPLM RETURN TO PLB (USING SSRMS) (cont)

Continuation of Table 3

Phase Completed	Action(s)	Time to Complete	Notes/Reference
<b>Low Hover</b>	<u>Options:</u> A. None. SSRMS w/MPLM clear for undock.	0:00	
	B. Return to orbiter (RTO).	0:40	1.223 MPLM BERTH, steps 1 to 9, 11 (SODF: ROB FS) 1.224 BERTHED MPLM UNGRAPPLE (SODF: ROB FS)
<b>MPLM Berthed (PRLAs open)</b>	1. Close PRLAs. 2. Ungrapple MPLM. 3. MnvR SSRMS to pre-grapple posn.	0:25	1.223 MPLM BERTH, steps 4 to 9, 11 (SODF: ROB FS)  1.224 BERTHED MPLM UNGRAPPLE (SODF: ROB FS)
<b>MPLM Berthed (PRLAs closed)</b>	1. Ungrapple MPLM. 2. MnvR to SSRMS to pre-grapple posn.	0:15	1.223 MPLM BERTH, step 11 (SODF: ROB FS) 1.224 BERTHED MPLM UNGRAPPLE (SODF: ROB FS)

2. Verify SRMS w/OBSS at MPLM VIEWING position. Drive SRMS SY to +35 deg then WR to -68 deg. Time to complete 0:05
3. Go to {JOINT EXPEDITED UNDOCKING AND SEPARATION}, step 2b (SODF: JNT OPS: EMERGENCY RESPONSE).

322i

OBSS UNBERTH (USING SSRMS)

1. Determine phase completed from Table 4 and perform action(s).

Table 4. OBSS Unberth

Phase Completed	Action(s)	Time to Complete	Notes/Reference
<b>SSRMS at Pre-grapple posn</b>	None. Shuttle clear for undock.	0:00	SRMS at Pre-cradle posn
<b>SSRMS Grappled OBSS (MRLs latched)</b>	1. Ungrapple OBSS. 2. Mnv SRMS to Grapple Fixture Backoff posn. 3. Mnv SRMS to pre-cradle posn.	0:20	1.124 BERTHED OBSS UNGRAPPLE (SODF: ROB FS) RMS PWRDN, step 1 (FDF: PDRS)
<b>SSRMS Grappled OBSS (MRLs released)</b>	1. Reacquire RTLs. 2. Latch MRLs. 3. Ungrapple OBSS. 4. Mnv SRMS to Grapple Fixture Backoff posn. 5. Mnv SRMS to pre-cradle posn.	0:30	1.123 OBSS BERTH, steps 4 to 7(SODF: ROB FS) OBSS HANDOFF FROM SRMS TO SSRMS (FDF: PDRS FS), steps 6 to 9 1.124 BERTHED OBSS UNGRAPPLE (SODF: ROB FS) RMS PWRDN, step 1 (FDF: PDRS)
<b>SSRMS w/OBSS at Low Hover Posn</b>	<u>Options:</u> A. Mnv SRMS w/OBSS to Clear UHF Antenna posn. Mnv SRMS to pre-cradle posn.	0:20	1.111 OBSS UNBERTH, steps 5 & 6 (SODF: ROB FS) RMS PWRDN, step 1 (FDF: PDRS)
	B. Return to orbiter (RTO). 1. Mnv SRMS w/OBSS to OBSS Berthed posn. 2. Latch MRLs. 3. Ungrapple OBSS w/SSRMS. 4. Mnv SRMS to pre-cradle posn.	0:40	1.123 OBSS BERTH, steps 3 to 7 (SODF: ROB FS) OBSS HANDOFF FROM SRMS TO SSRMS, steps 6 to 9 (FDF: PDRS FS), 1.124 BERTHED OBSS UNGRAPPLE (SODF: ROB FS) RMS PWRDN, step 1 (FDF: PDRS)
<b>SSRMS w/OBSS at Clear UHF Antenna Posn</b>	<u>Options:</u> A. SSRMS w/OBSS clear for undock. Mnv SRMS to pre-cradle posn.	0:05	RMS PWRDN, step 1 (FDF: PDRS)
	B. Return to orbiter (RTO). 1. Mnv SRMS to OBSS Berthed posn. 2. Latch MRLs. 3. Ungrapple OBSS w/SSRMS. 4. Mnv SRMS to pre-cradle posn.	0:50	1.123 OBSS BERTH (SODF: ROB FS) OBSS HANDOFF FROM SRMS TO SSRMS, steps 6 to 9 (FDF: PDRS FS) 1.124 BERTHED OBSS UNGRAPPLE (SODF: ROB FS) RMS PWRDN, step 1(FDF: PDRS)

3221



OBSS UNBERTH (USING SSRMS) (cont)

Continuation of Table 4

Phase Completed	Action(s)	Time to Complete	Notes/Reference
<b>SSRMS w/OBSS at Aft Posn</b>	<u>Options:</u> A. SSRMS w/OBSS clear for undock. Mnv SRMS to pre-cradle posn.	0:05	RMS PWRDN, step 1 (FDF: PDRS)
	B. Return to orbiter (RTO). 1. Mnv SSRMS to OBSS Berthed posn. 2. Latch MRLs. 3. Ungrapple OBSS w/SSRMS. 4. Mnv SRMS to pre-cradle posn.	1:00	1.122 OBSS MNVR TO CLEAR UHF, step 4 (SODF: ROB FS) 1.123 OBSS BERTH (SODF: ROB FS) OBSS HANDOFF FROM SRMS TO SSRMS, steps 6 to 9 (FDF: PDRS FS) 1.124 BERTHED OBSS UNGRAPPLE (SODF: ROB FS) RMS PWRDN, step 1 (FDF: PDRS)
<b>SSRMS w/OBSS at Handoff Posn</b>	<u>Options:</u> A. Mnv SSRMS w/OBSS to Aft posn. Mnv SRMS to pre-cradle posn.	0:25	1.122 OBSS MNVR TO CLEAR UHF, steps 1 to 4 (SODF: ROB FS), RMS PWRDN, step 1(FDF: PDRS)
	B. Return to orbiter (RTO). 1. Mnv SSRMS w/OBSS to OBSS Berthed posn. 2. Latch MRLs. 3. Ungrapple OBSS w/SSRMS. 4. Mnv SRMS to pre-cradle posn.	1:20	1.122 OBSS MNVR TO CLEAR UHF (SODF: ROB FS) 1.123 OBSS BERTH (SODF: ROB FS) OBSS HANDOFF FROM SRMS TO SSRMS steps 6 to 9 (FDF: PDRS FS) 1.124 BERTHED OBSS UNGRAPPLE (SODF: ROB FS) RMS PWRDN, step 1 (FDF: PDRS)
<b>SRMS Grappled OBSS</b>	<u>Options:</u> A. Ungrapple OBSS w/SSRMS, mnvr to Grapple Fixture Backoff posn. SRMS w/OBSS at handoff posn clear for undock.	0:15	1.113 OBSS UNGRAPPLE AT HANDOFF (SODF: ROB FS)
	B. Ungrapple OBSS w/SRMS, mnvr to pre-grapple posn. Mnv SSRMS w/OBSS to Aft posn. Mnv SRMS to pre-cradle posn.	0:35	OBSS HANDOFF FROM SRMS TO SSRMS, steps 4 to 5 (FDF: PDRS FS) 1.122 OBSS MNVR TO CLEAR UHF, steps 1 to 4 (SODF: ROB FS) RMS PWRDN, step 1 (FDF: PDRS)

322K

OBSS UNBERTH (USING SSRMS) (cont)

Continuation of Table 4

Phase Completed	Action(s)	Time to Complete	Notes/Reference
<b>SSRMS Released OBSS (SSRMS at Grapple Fixture Backoff posn)</b>	<u>Options:</u> A. None - SRMS w/OBSS at handoff posn clear for undock.	0:00	1.121 OBSS GRAPPLE AT HANDOFF (SODF: ROB FS) OBSS HANDOFF FROM SSRMS TO SRMS, steps 4 & 5 (FDF: PDRS FS) 1.122 OBSS MNVR TO CLEAR UHF, steps 1 to 4 (SODF: ROB FS) RMS PWRDN, step 1 (FDF: PDRS)
	B. Grapple OBSS w/SSRMS. Ungrapple OBSS w/SRMS. Mnv SRMS w/OBSS to Aft posn. Mnv SRMS to pre-cradle posn.	0:45	
<b>SRMS w/OBSS at OBSS CMG Viewing Posn</b>	Drive SRMS WR to -68 deg.	0:05	

2. Go to [JOINT EXPEDITED UNDOCKING AND SEPARATION](#), step 2b (SODF: JNT OPS: EMERGENCY RESPONSE).

3221

OBSS STOW (USING SSRMS)

1. Determine phase completed from Table 5 and perform action(s):

Table 5. OBSS Stow

Phase Completed	Action(s)	Time to Complete	Notes/Reference
<b>SSRMS at Berthed MPLM Pre-grapple posn</b>	1. Verify SRMS w/OBSS at OBSS CMG R&R posn. 2. Drive SRMS WR to -68 deg	0:05	
<b>SRMS w/OBSS at Handoff Posn</b>  <b>(SSRMS at OBSS Pre-grapple posn)</b>	<u>Options:</u> A. None. SRMS w/OBSS and SSRMS clear for undock.  B. Grapple OBSS w/SSRMS. Ungrapple OBSS w/SRMS and mnvr to pre-grapple posn. Mnvr SSRMS w/OBSS to Aft posn. Mnvr SRMS to pre-cradle posn.  C. Return to orbiter (RTO). 1. Grapple OBSS w/SSRMS. 2. Ungrapple OBSS w/SRMS. 3. Mnvr SSRMS w/OBSS to OBSS Berthed posn. 4. Latch MRLs. 5. Ungrapple OBSS w/SSRMS. 6. Mnvr SRMS to pre-cradle posn.	0:00  0:45  1:40	  1.121 OBSS GRAPPLE AT HANDOFF (SODF: ROB FS) OBSS HANDOFF FROM SRMS TO SSRMS, steps 4 & 5(FDF: PDRS FS) 1.122 OBSS MNVR TO CLEAR UHF, steps 1 to 4 (SODF: ROB FS) RMS PWRDN, step 1 (FDF: PDRS),  1.121 OBSS GRAPPLE AT HANDOFF, steps 2 to 4(SODF: ROB FS) 1.122 OBSS MNVR TO CLEAR UHF (SODF: ROB FS) 1.123 OBSS BERTH (SODF: ROB FS) OBSS HANDOFF FROM SRMS TO SSRMS, steps 6 to 9 (FDF: PDRS FS) 1.124 BERTHED OBSS UNGRAPPLE (SODF: ROB FS) RMS PWRDN, step 1 (FDF: PDRS)

322m

OBSS STOW (USING SSRMS) (cont)

Continuation of Table 5

Phase Completed	Action(s)	Time to Complete	Notes/Reference
<b>SSRMS grappled OBSS</b>	<u>Options:</u> A. Ungrapple OBSS w/SSRMS, mnvr to pre-grapple posn. SRMS w/OBSS at handoff posn clear for undock.	0:15	1.113 OBSS UNGRAPPLE AT HANDOFF (SODF: ROB FS)
	B. Ungrapple OBSS w/SRMS. Mnvr SSRMS w/OBSS to Aft posn. Mnvr SRMS to pre-cradle posn.	0:35	OBSS HANDOFF FROM SRMS TO SSRMS, steps 4 & 5 (FDF: PDRS FS) 1.122 OBSS MNVR TO CLEAR UHF, steps 1 to 4( SODF: ROB FS) RMS PWRDN, steps 1 & 2 (FDF: PDRS)
	C. Return to orbiter (RTO). 1. Ungrapple OBSS w/SRMS. 2. Mnvr SSRMS w/OBSS to OBSS Berthed posn. 3. Latch MRLs. 4. Ungrapple OBSS w/SSRMS. 5. Mnvr SRMS to pre-cradle posn.	1:30	OBSS HANDOFF FROM SRMS TO SSRMS, steps 4 & 5 (FDF: PDRS FS) 1.122 OBSS MNVR TO CLEAR UHF (SODF: ROB FS) 1.123 OBSS BERTH (SODF: ROB FS) OBSS HANDOFF FROM SRMS TO SSRMS, steps 6 to 9 (FDF: PDRS FS) 1.124 BERTHED OBSS UNGRAPPLE (SODF: ROB FS) RMS PWRDN, step 1 (FDF: PDRS)
<b>SRMS Ungrappled OBSS</b>	<u>Options:</u> A. Mnvr SSRMS w/OBSS to Aft posn. Mnvr SRMS to pre-cradle posn.	0:25	OBSS HANDOFF FROM SRMS TO SSRMS, step 5 (PDRS FS) 1.122 OBSS MNVR TO CLEAR UHF, steps 1 to 4(SODF: ROB FS) RMS PWRDN, step 1 (FDF: PDRS)
	B. Return to orbiter (RTO). 1. Mnvr SSRMS w/OBSS to OBSS Berthed posn. 2. Latch MRLs. 3. Ungrapple OBSS w/SSRMS. 4. Mnvr SRMS to pre-cradle posn.	1:20	1.122 OBSS MNVR TO CLEAR UHF (SODF: ROB FS) 1.123 OBSS BERTH (SODF: ROB FS) OBSS HANDOFF FROM SRMS TO SSRMS, steps 6 to 9 (FDF: PDRS FS) 1.124 BERTHED OBSS UNGRAPPLE (SODF: ROB FS) RMS PWRDN, step 1 (FDF: PDRS)

322n

OBSS STOW (USING SSRMS) (cont)

Continuation of Table 5

SSRMS w/OBSS at Aft posn	Options: A. None - SSRMS w/OBSS clear for undock. Mnv SRMS to pre-cradle posn.	0:05	RMS PWRDN (FDF: PDRS), step 1
	B. Return to orbiter (RTO). 1. Mnv SSRMS w/OBSS to OBSS Berthed posn. 2. Latch MRLs. 3. Ungrapple OBSS w/SSRMS. 4. Mnv SRMS to pre-cradle posn.	1:00	1.122 OBSS MNVR TO CLEAR UHF, step 4 (SODF: ROB FS) 1.123 OBSS BERTH (SODF: ROB FS) OBSS HANDOFF FROM SRMS TO SSRMS steps 6 to 9 (FDF: PDRS FS) 1.124 BERTHED OBSS UNGRAPPLE (SODF: ROB FS) RMS PWRDN, step 1 (FDF: PDRS)
SSRMS w/OBSS at Clear UHF Antenna Posn	Options: A. SSRMS w/OBSS clear for undock. Mnv SRMS to pre-cradle posn.	0:05	RMS PWRDN, step 1 (FDF: PDRS)
	B. Return to orbiter (RTO). 1. Mnv SSRMS w/OBSS to OBSS Berthed posn. 2. Latch MRLs. 3. Ungrapple OBSS w/SSRMS. 4. Mnv SRMS to pre-cradle posn.	0:50	1.123 OBSS BERTH (SODF: ROB FS) OBSS HANDOFF FROM SRMS TO SSRMS, steps 6 to 9 (FDF: PDRS FS) 1.124 BERTHED OBSS UNGRAPPLE (SODF: ROB FS) RMS PWRDN, step 1 (FDF: PDRS)

3220

OBSS STOW (USING SSRMS) (cont)

Continuation of Table 5

Phase Completed	Action(s)	Time to Complete	Notes/Reference
<b>SSRMS w/OBSS at Low Hover Posn</b>	<u>Options:</u> A. Mnv SRMS w/OBSS to Clear UHF Antenna posn. Mnv SRMS to pre-cradle posn.	0:20	1.111 OBSS UNBERTH, steps 5 & 6 (SODF: ROB FS) RMS PWRDN, step 1(FDF: PDRS)
	B. Return to orbiter (RTO). 1. Mnv SSRMS w/OBSS to OBSS Berthed posn. 2. Latch MRLs. 3. Ungrapple OBSS w/SSRMS. 4. Mnv SRMS to pre-cradle posn.	0:40	1.123 OBSS BERTH, steps 3 to 7 (SODF: ROB FS) OBSS HANDOFF FROM SRMS TO SSRMS, steps 6 to 9 (FDF: PDRS FS) 1.124 BERTHED OBSS UNGRAPPLE (SODF: ROB FS) RMS PWRDN, step 1(FDF: PDRS)
<b>SSRMS w/OBSS at MRL Capture Posn</b>	<u>Options:</u> A. Mnv SSRMS w/OBSS to Clear UHF Antenna posn. Mnv SRMS to pre-cradle posn.	0:30	1.111 OBSS UNBERTH, steps 4 to 6 (SODF: ROB FS) RMS PWRDN, step 1 (FDF: PDRS)
	B. Return to orbiter (RTO). 1. Latch MRLs. 2. Ungrapple OBSS w/SSRMS and mnvr to pre-grapple posn. 3. Mnv SRMS to pre-cradle posn.	0:25	1.123 OBSS BERTH, step 6 (SODF: ROB FS) OBSS HANDOFF FROM SRMS TO SSRMS, steps 6 to 9 (FDF: PDRS FS) 1.124 BERTHED OBSS UNGRAPPLE (SODF: ROB FS)
<b>MRLs Captured</b>	1. Ungrapple OBSS w/SSRMS. 2. Mnv SSRMS to Grapple Fixture Backoff posn. 3. Mnv SRMS to pre-cradle posn.	0:20	1.124 BERTHED OBSS UNGRAPPLE (SODF: ROB FS) RMS PWRDN, step 1 (FDF: PDRS)
<b>SSRMS at Grapple Fixture Backoff Posn</b>	1. Mnv SRMS to pre-cradle posn. SSRMS clear for undock.	0:05	

322p

2. Go to [JOINT EXPEDITED UNDOCKING AND SEPARATION](#), step 2b (SODF: JNT OPS: EMERGENCY RESPONSE).

EVA 1

1. Determine EVA 1 task, phase completed from Table 6 and perform action(s).

Table 6. EVA 1

EVA Task	Phase Completed	Action(s)	Time to Complete	Notes/Reference
TPS DTO	Egress	1. Remove WIF adapter and safety tether from SSRMS. 2. Mnvrr SSRMS to ESPAD Removal Setup posn. 3. Translate to STS A/L. 4. Tether swap.	0:15	1.710 ESPAD INSTALL EVA SETUP, step 5 (SODF: ROB FS)
	ISS A/L hatch opened	1. Close ISS thermal cover. 2. Remove WIF adapter and safety tether from SSRMS. 3. Mnvrr SSRMS to ESPAD Removal Setup posn. 4. Translate to STS A/L. 5. Tether swap.	0:20	1.710 ESPAD INSTALL EVA SETUP, step 5 (SODF: ROB FS)
	Setup complete (DTO box open)	1. Close DTO box. 2. Retrieve and stow tools. 3. Retrieve APFR off bridge clamp and stow on PMA 2. 4. Remove WIF adapter and safety tether from SSRMS. 5. Mnvrr SSRMS to ESPAD Removal Setup posn. 6. Translate to STS A/L. 7. Tether swap.	0:20	DTO box must be closed for entry.  1.710 ESPAD INSTALL EVA SETUP, step 5 (SODF: ROB FS)

322q

EVA 1

Continuation of Table 6

EVA Task	Phase Completed	Action(s)	Time to Complete	Notes/References
	EWA/NOAX Demonstration	<ol style="list-style-type: none"> <li>1. Close DTO box.</li> <li>2. Retrieve and stow tools.</li> <li>3. Retrieve APFR off bridge clamp and stow on PMA 2.</li> <li>4. Remove WIF adapter and safety tether from SSRMS.</li> <li>5. MnvR SSRMS to ESPAD Removal Setup posn.</li> <li>6. Translate to STS A/L.</li> <li>7. Tether swap.</li> </ol>	0:25	DTO box must be closed for entry.  1.710 ESPAD INSTALL EVA SETUP, step 5 (SODF: ROB FS)
	DTO Clean up	<ol style="list-style-type: none"> <li>1. Close DTO box.</li> <li>2. Retrieve APFR off bridge clamp and stow on PMA 2.</li> <li>3. Remove WIF adapter and safety tether from SSRMS.</li> <li>4. MnvR SSRMS to ESPAD Removal Setup posn.</li> <li>5. Translate to STS A/L.</li> <li>6. Tether swap.</li> </ol>	0:20	DTO box must be closed for entry.  1.710 ESPAD INSTALL EVA SETUP, step 5 (SODF: ROB FS)

3221



EVA 1 (cont)

Continuation of Table 6

EVA Task	Phase Completed	Action(s)	Time to Complete	Notes/Reference
<b>ESPAD Removal*</b>	ESPAD strut deployed (and Launch Bolt A removed)	<ol style="list-style-type: none"> <li>1. Replace bolt A.</li> <li>2. Stow strut, attach wire ties.</li> <li>3. Remove WIF adapter and APFR from SSRMS.</li> <li>4. MnvR SSRMS to JOCAS Setup posn.</li> <li>5. Close DTO box.</li> <li>6. Translate to STS A/L.</li> <li>7. Tether swap.</li> </ol>	0:25	1.711 EVA - ESPAD INSTALL, step 4 (SODF: ROB FS), DTO box must be closed for entry.
	ESPAD bolts (3) removed	<ol style="list-style-type: none"> <li>1. Replace bolts (B, C, A).</li> <li>2. Reinstall EUTAS compliant bolts (2).</li> <li>3. Stow strut, attach wire ties.</li> <li>4. Remove WIF adapter and APFR from SSRMS.</li> <li>5. MnvR SSRMS to JOCAS Setup posn.</li> <li>6. Close DTO box.</li> <li>7. Translate to STS A/L.</li> <li>8. Tether swap.</li> </ol>	0:35	1.711 EVA - ESPAD INSTALL, step 4 (SODF: ROB FS) DTO box must be closed for entry.
<b>ESP 2 Pri Cable Routing*</b>	Primary pwr cable unstowed from TSA	<ol style="list-style-type: none"> <li>1. Stow primary pwr cable in TSA.</li> <li>2. Translate to STS A/L.</li> <li>3. Tether swap.</li> </ol>	0:10	
	At Node endcone worksite	<ol style="list-style-type: none"> <li>1. Temp stow primary pwr cable.</li> <li>2. Temp stow sec pwr cable.</li> <li>3. Translate to STS A/L.</li> <li>4. Tether swap.</li> </ol>	0:15	
	Primary pwr cable mated	<ol style="list-style-type: none"> <li>1. Translate to STS A/L.</li> <li>2. Tether swap.</li> </ol>	0:15	

\* Activities performed in parallel by EV1 and EV2. Each will need to perform separate safing actions.

322S

EVA 1 (cont)

Continuation of Table 6

EVA Task	Phase Completed	Action(s)	Time to Complete	Notes/Reference
<b>ESPAD Install</b>	ESPAD soft dock in A/L trunnion	<ol style="list-style-type: none"> <li>1. Torque and lock down EUTAS bolts (2).</li> <li>2. Remove WIF adapter, safety tether and APFR from SSRMS.</li> <li>3. MnvR SSRMS to Clear of Structure posn.</li> <li>4. Close DTO box.</li> <li>5. Translate to STS A/L.</li> <li>6. Tether swap.</li> </ol>	0:30	1.711 EVA - ESPAD INSTALL, step 8 (SODF: ROB FS), DTO box must be closed for entry.
	EUTAS bolts (4) tightened	<ol style="list-style-type: none"> <li>1. Remove WIF adapter, safety tether and APFR from SSRMS.</li> <li>2. MnvR SSRMS to Clear of Structure posn.</li> <li>3. Close DTO box.</li> <li>4. Translate to STS A/L.</li> <li>5. Tether swap.</li> </ol>	0:20	1.711 EVA - ESPAD INSTALL, step 8 (SODF: ROB FS) DTO box must be closed for entry.

3221

EVA 1 (cont)

Continuation of Table 6

EVA Task	Phase Completed	Action(s)	Time to Complete	Notes/Reference
<b>GPS Antenna R&amp;R**</b>	GPS antenna retrieval from ISS A/L	1. Stow GPS antenna in ISS A/L. 2. Close DTO box. 3. Translate to STS A/L. 4. Tether swap.	0:25	DTO box must be closed for entry.
	At GPS antenna work site (S0 port zenith)	1. Translate to ISS A/L. 2. Stow new GPS antenna in ISS A/L. 3. Close DTO box. 4. Translate to STS A/L. 5. Tether swap.	0:35	DTO box must be closed for entry.
	Old GPS antenna removed	1. Install new GPS antenna.  2. Close DTO box. 3. Translate to STS A/L. 4. Tether swap. 5. Stow old GPS antenna in STS A/L.	0:40	DTO box must be closed for entry.
	New GPS antenna installed	1. Close DTO box. 2. Translate to STS A/L. 3. Tether swap. 4. Stow old GPS antenna in STS A/L.	0:30	DTO box must be closed for entry.
<b>CMG Get Aheads**</b>	Gap spanner retrieval from ISS A/L	1. Translate to STS A/L. 2. Tether swap. 3. Bring tools into STS A/L.	0:15	
	At aft Z1 worksite	1. Translate to STS A/L. 2. Tether swap. 3. Bring tools into STS A/L.	0:20	
	Gap spanners installed	1. Translate to STS A/L. 2. Tether swap. 3. Bring tools into STS A/L.	0:20	

\*\* Activities performed in parallel by EV1 and EV2. Each will need to perform separate safing actions.

322u

EVA 1 (cont)

Continuation of Table 6

EVA Task	Phase Completed	Action(s)	Time to Complete	Notes/Reference
<b>CMG Get Aheads (cont)**</b>	Node light stanchion removed	1. Reinstall stanchion. 2. Translate to STS A/L. 3. Tether swap. 4. Bring tools into STS A/L.	0:40	
	Ball stack retrieval from TS on PMA 1	1. Replace ball stack. 2. Translate to STS A/L. 3. Tether swap. 4. Bring tools into STS A/L.	0:20	
<b>ESP 2 Sec Cable Routing</b>	CETA cart moved	1. Recouple CETA to MT. 2. Temp stow sec pwr cable bundle. 3. Close DTO box. 4. Translate to STS A/L. 5. Tether swap.	0:20	DTO box must be closed for entry.
	Connector P57 demated from J64	1. Mate connectors: ESP2 J57A to S0 P57 ESP2 P57A to S0 panel J64 2. Egress bay 3. 3. Recouple CETA to MT. 4. Close DTO box. 5. Translate to STS A/L. 6. Tether swap.	0:30	DTO box must be closed for entry.
	Connectors J57A and P57A mated	1. Egress bay 3. 2. Recouple CETA to MT. 3. Close DTO box. 4. Translate to STS A/L. 5. Tether swap.	0:25	DTO box must be closed for entry.

\*\* Activities performed in parallel by EV1 and EV2. Each will need to perform separate safing actions.

2. Verify SRMS w/OBSS at OBSS CMG R&R VIEWING position. Drive SRMS WR to -68 deg. Time to complete 0:05
3. Go to [JOINT EXPEDITED UNDOCKING AND SEPARATION](#), step 2b (SODF: JNT OPS: EMERGENCY RESPONSE).

322v

EVA 2

1. Determine EVA 2 task, phase completed from Table 7 and perform action(s).

Table 7. EVA 2

EVA Task	Phase Completed	Action(s)	Time to Complete	Notes/Reference
Remove Failed CMG	Removed failed CMG at Z1	1. Replace failed CMG bolts (4). 2. Connect pwr cables (J6 or J1 and J2). 3. Install CMG thermal shroud. 4. Remove WIF adapter, safety tether, and APFR from SSRMS. 5. MnvR SSRMS to CMG R&R Setup posn. 6. Translate to STS A/L. 7. Tether swap.	0:50	CMG thermal shroud install takes 20 minutes.  1.512 EVA - CMG R&R, step 2 (SODF: ROB FS)
	EVA crew w/failed CMG rides SSRMS to PL Bay	1. Return to Z1 w/failed CMG. 2. Replace failed CMG bolts (4). 3. Connect pwr cables (J6 or J1 and J2). 4. Install CMG thermal shroud. 5. Remove WIF adapter, safety tether, and APFR from SSRMS. 6. MnvR SSRMS to CMG R&R Setup posn. 7. Translate to STS A/L. 8. Retrieve 2 <sup>nd</sup> MUT ball stack from LMC (if req'd). 9. Tether swap.	1:25	CMG thermal shroud install takes 20 minutes.  1.512 EVA - CMG R&R, step 2 (SODF: ROB FS)

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EVA 2 (cont)

Continuation of Table 7

EVA Task	Phase Completed	Action(s)	Time to Complete	Notes/Reference
<b>Install Failed CMG</b>	Install failed CMG on FSE/LMC  (New CMG Temp Stowed on ball stack)	<u>Options:</u> A. Stow new CMG on SSRMS 1. Egress SSRMS. 2. Tether swap. 3. Remove new CMG from Temp Stow location. 4. Attach new CMG on SSRMS. 5. MnvR SSRMS to CMG Temp Stow posn. 6. Translate to STS A/L. 7. Tether swap. B. Install new CMG at Z1 1. Remove new CMG from temp stow location. 2. Return to Z1 w/new CMG. 3. Install new CMG bolts (4). 4. Connect pwr cable (J6 or J1 and J2). 5. Install CMG thermal shroud. 6. Remove WIF adapter, safety tether and APFR from SSRMS. 7. MnvR SSRMS to CMG R&R Setup posn. 8. Translate to STS A/L. 9. Retrieve 2 <sup>nd</sup> MUT ball stack from LMC (if req'd). 10. Tether swap.	0:30          1:25	2.220 CONTINGENCY CMG TEMP STOW ON SSRMS, step 3 (SODF: ROB FS)       CMG thermal shroud install takes 20 minutes.  1.512 EVA - CMG R&R, step 2 (SODF: ROB FS)
	EVA crew w/new CMG rides SSRMS to Z1	1. Install new CMG bolts (4). 2. Connect pwr cable (J6 or J1 and J2). 3. Install CMG thermal shroud. 4. Translate to STS A/L. 5. Retrieve 2 <sup>nd</sup> MUT ball stack from LMC (if req'd). 6. Tether swap.	1:05	CMG thermal shroud install takes 20 minutes.
	New CMG installed	1. Install CMG thermal shroud. 2. Translate to STS A/L. 3. Retrieve 2 <sup>nd</sup> MUT ball stack from LMC (if req'd). 4. Tether swap.	0:50	CMG thermal shroud install takes 20 minutes.

2. Verify SRMS w/OBSS at OBSS CMG R&R VIEWING position. Drive SRMS WR to -68 deg. Time to complete 0:05  
 3. Go to {JOINT EXPEDITED UNDOCKING AND SEPARATION}, step 2b (SODF: JNT OPS: EMERGENCY RESPONSE).

322aa

EVA 3

1. Determine EVA 3 task, phase completed from Table 8 and perform action(s).

Table 8. EVA 3

EVA Task	Phase Completed	Action(s)	Time to Complete	Notes/Reference
<b>ETVCG</b> <b>Install CP9</b>	VSSA launch bolts removed	1. Replace VSSA launch bolts (2). 2. Translate to STS A/L. 3. Tether swap.	0:15	If one bolt on VSSA fails: 1. Grapple ESP 2 w/SSRMS 2. Remove ESP 2 from PL Bay 3. Mnv'r ESP 2 to JOCAS 1 Start posn (1.613 ESP2 UNBERTH, steps 1 to 8 (SODF: ROB FS) Time to complete: 60 minutes.
	Dummy box bolts removed	1. Reinstall VSSA on ESP 2. 2. Translate to STS A/L (w/dummy box). 3. Tether swap.	0:20	
	Camera installed on stanchion	1. Remove Camera. 2. Reinstall VSSA on ESP 2. 3. Translate to STS A/L. 4. Tether swap.	0:30	
	Translated to S0 face with Camera group	1. Translate to CP9 Worksite. 2. Install Camera. 3. Connect VSSA pwr cables (3). 4. Translate to STS A/L. 5. Tether swap.	0:50	
	Translated to CP9 worksite w/Camera group	1. Install Camera. 2. Connect VSSA pwr cables (3). 3. Translate to STS A/L.	0:40	
	Camera group installed	1. Translate to STS A/L.	0:20	
	Node Light installed	1. Translate to STS A/L.	0:20	

322ab

EVA 3 (cont)

Continuation of Table 8

EVA Task	Phase Completed	Action(s)	Time to Complete	Notes/Reference
<b>ESP-2 Grapple</b>	ESP-2 grappled (PRLAs closed)	1. Translate to STS A/L. 2. Ungrapple ESP-2 w/SSRMS. 3. MnvR SSRMS to Clear of Structure posn.	0:25	2.120 CONTINGENCY BERTHED ESP 2 UNGRAPPLE (SODF: ROB FS)
	ESP-2 grappled (PRLAs open)	Options: A. Leave ESP 2 in PL Bay 1. Close PRLAs. 2. Ungrapple ESP 2 w/SSRMS. 3. MnvR SSRMS to Clear of Structure posn.	0:30	2.110 CONTINGENCY ESP 2 BERTH, steps 10 to 14 (SODF: ROB FS) 2.120 CONTINGENCY BERTHED ESP2 UNGRAPPLE (SODF: ROB FS)
		B. Unberth ESP 2 1. Unberth ESP 2. 2. MnvR to Low Hover posn. 3. MnvR to JOCAS 1 Start posn.	0:30	1.613 ESP2 UNBERTH (SODF: ROB FS), steps 6 to 8
	ESP 2 Low Hover	MnvR to JOCAS 1 Start posn.	0:15	1.613 ESP2 UNBERTH, steps 7 & 8 (SODF: ROB FS),
	Pre-install posn	None – SSRMS w/ESP 2 clear for undock.	0:00	

322ac

EVA 3 (cont)

Continuation of Table 8

EVA Task	Phase Completed	Action(s)	Time to Complete	Notes/Reference
<b>ESP-2 Install</b>	GCA ESP-2 Berthing posn	<u>Options:</u> A. Install ESP 2 1. Close capture claw. 2. Lock down port, stbd, nadir guide vanes. 3. Connect Pri/Sec pwr cables. 4. Remove WIF adapter and APFR from SSRMS. 5. Translate to STS A/L. 6. Tether swap. B. Leave ESP 2 at Berthing posn 1. Connect pri/sec pwr cables. 2. Translate to STS A/L. 3. Tether swap.	1:00          0:25	
	Capture claw to hard stop	1. Lock down port, stbd, nadir guide vanes. 2. Connect pri/sec pwr cables. 3. Remove WIF adapter and APFR from SSRMS. 4. Translate to STS A/L. 5. Tether swap.	0:35	
	Port, stbd, nadir guide vanes locked down	1. Connect pri/sec pwr cables. 2. Remove WIF adapter and APFR from SSRMS. 3. Translate to STS A/L.	0:25	
	Pri/Sec pwr cable attached	1. Translate to STS A/L. 2. Remove WIF adapter and APFR from SSRMS. 3. Tether swap.	0:25	
<b>ESP-2 FRGF Removal</b>	Translated to ESP 2 FRGF	1. Translate to STS A/L. 2. Tether swap.	0:15	
	Removed ESP 2 FRGF	1. Translate to stbd TSA. 2. Stow FRGF in TSA. 3. Translate to STS A/L. 4. Tether swap.	0:30	
	Translated to stbd TSA	1. Stow FRGF in TSA. 2. Translate to STS A/L. 3. Tether swap.	0:05	

322ad

EVA 3 (cont)

Continuation of Table 8

EVA Task	Phase Completed	Action(s)	Time to Complete	Notes/Reference
<b>MISSE 1&amp;2 Retrieval*</b>	Translated to MISSE 1	1. Translate to STS A/L. 2. Tether swap.	0:15	
	Removed MISSE 1	<u>Options:</u> A. Stow MISSE 1 in ISS A/L 1. Translate to ISS A/L. 2. Stow MISSE 1 in ISS A/L. 3. Translate to STS A/L. 4. Tether swap.	0:25	
		B. Return to STS A/L with MISSE 1 1. Translate to STS A/L. 2. Tether swap.	0:20	
	Temp stowed MISSE 1 in A/L	1. Translate to STS A/L. 2. Tether swap.	0:15	
	Translated to MISSE 2	1. Translate to STS A/L. 2. Tether swap.	0:15	
	Removed MISSE 2	<u>Options:</u> A. Stow MISSE 2 in ISS A/L 1. Translate to ISS A/L. 2. Stow MISSE 2 in ISS A/L. 3. Translate to STS A/L. 4. Tether swap.	0:25	
		B. Return to STS A/L with MISSE 2 1. Translate to STS A/L. 2. Tether swap.	0:20	
	Temp stowed MISSE 2 in A/L	1. Translate to STS A/L. 2. Tether swap.	0:15	

322ae

EVA 3 (cont)

Continuation of Table 8

EVA Task	Phase Completed	Action(s)	Time to Complete	Notes/Reference
<b>MISSE 5 Install*</b>	Egressed Airlock w/MISSE 5	1. Stow MISSE 5 in ISS A/L. 2. Translate to STS A/L. 3. Tether swap.	0:25	
	Translated to MISSE 5 worksite	<u>Options:</u> A. Return MISSE 5 to ISS A/L 1. Translate to ISS A/L. 2. Stow MISSE 5 in ISS A/L. 3. Translate to STS A/L. 4. Tether swap.	0:35	
		B. Install MISSE 5 1. Install MISSE 5. 2. Translate to STS A/L. 3. Tether swap.	0:45	
	Installed MISSE 5	1. Translate to STS A/L. 2. Tether swap.	0:25	
	Translated to ISS A/L	1. Translate to STS A/L. 2. Tether swap.	0:15	

\* Activities performed in parallel by EV1 and EV2. Each will need to perform separate safing actions.

2. Verify SRMS w/OBSS at OBSS CMG R&R VIEWING position. Drive SRMS WR to -68 deg. Time to complete 0:05.
3. Go to [{JOINT EXPEDITED UNDOCKING AND SEPARATION}](#), step 2b (SODF: JNT OPS: EMERGENCY RESPONSE).

OTHER DOCKED ACTIVITIES

1. Perform action in Table 9 if SRMS w/OBSS not in OBSS CMG R&R VIEWING position

Table 9. Other Docked Activities

Phase Completed	Action(s)	Time to Complete	Notes/Reference
<b>Other Docked Activities</b>	Return SRMS w/OBSS to CMG R&R Viewing posn.	0:45	Maximum time to return to OBSS CMG R&R Viewing position. OBSS CMG R&R Viewing (FDF: PDRS FS)

2. Verify SRMS w/OBSS at OBSS CMG R&R VIEWING position. Drive SRMS WR to -68 deg. Time to complete 0:05.
3. Go to [{JOINT EXPEDITED UNDOCKING AND SEPARATION}](#), step 2b (SODF: JNT OPS: EMERGENCY RESPONSE).

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