



International Space Station Assembly Malfunction

ISS-1E GROUND

Mission Operations Directorate
Operations Division

12 SEP 07

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

National Aeronautics and
Space Administration

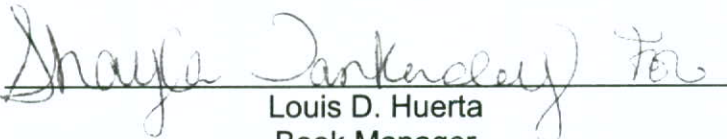
Lyndon B. Johnson Space Center
Houston, Texas




**INTERNATIONAL SPACE STATION
ASSEMBLY MALFUNCTION
ISS-1E GROUND**

12 SEP 07

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This document is under the configuration control of the Systems Operations Data File Control Board (SODFCB).

Incorporates the following:
CR: Assy_MalU30 Multi_FileU385 Multi_FileU386

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

None

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SINGLE PDU1 COLUMBUS BERTHED SURVIVAL MODE ACTIVATION

(ASSY MAL/1E/FIN/MULTI E)

Page 1 of 11 pages

OBJECTIVE:

Initial activation of Columbus Module through HCU activation and checkout with the power outlets of only PDU1 active. The PDU2 valve driving section will be powered by the PDU1 cross strapped power outlet and working properly. This procedure will end the thermal clock started when the module is removed from the PL Bay.

INITIAL CONDITIONS:

MULTIPLE PDU PWR STATUS FAILURES Mal procedure identifies a PDU failure

DDCUs N2D4B and N2D1B repowered

N2-1 and N2-2 MDMs nominal

Hardwired connectors mated

1553 connections mated

COL POWER jumper (W5013) mated

VTC Redundancy Management inhibited

1. VERIFYING NODE MDMS ARE NOMINAL

PCS

1.1 Verifying N2-1 MDM

CDH Summary: N2-1

Node 2-1 MDM

Verify Frame Count – <incrementing>

Verify Processing State – Operational

1.2 Verifying N2-2 MDM

CDH Summary: N2-2

Node 2-2 MDM

Verify Frame Count – <incrementing>

Verify Processing State – Operational

2. ACTIVATING PDU

PCS

2.1 Activating PDU1 MB1 Nominal Main Auxiliary Converter

Task: COL Berthed Survival Mode

COL Berthed Survival Mode

'Power Distribution Unit'

cmd PDU1 Nom Pwr – On

Verify PDU1 Nom Pwr Status – On

Verify PDU1 VTC1 Pwr Bus Status – On

Verify PDU1 Main Input Current < 5 A

2.2 Activating PDU1 MB1 Redundant Main Auxiliary Converter

COL Berthed Survival Mode

'Power Distribution Unit'

cmd PDU1 Redun Pwr – On

Verify PDU1 Redun Pwr Status – On
Verify PDU1 VTC2 Pwr Bus Status – On
Verify PDU1 Main Input Current < 5 A

3. [ENABLING COMMUNICATION WITH C&C MDM](#)

<p><u>NOTE</u> Expect VTC-1 and VTC-2 failed C&W messages</p>

PCS

3.1 [Inhibiting VTC Redundancy Management](#)

Task: COL Berthed Survival Mode

COL Berthed Survival Mode

'Vital Telemetry and Telecommand Controller'
'Inhibit VTC Redun Management'

√Master VTC Recovery Step 1 – Inh
√Master VTC Recovery Step 2 – Inh
√Slave VTC Recovery – Inh

3.2 [Enabling RT I/O with VTC1](#)

Task: COL Berthed Survival Mode: CB INT 1 RT Status

CB INT 1 RT Status

cmd 21 VTC 1 RT Status – Enable **Execute** (Verify – Ena)

3.3 [Enabling RT I/O with VTC2](#)

Task: COL Berthed Survival Mode: CB INT 2 RT Status

CB INT 2 RT Status

cmd 21 VTC 2 RT Status – Enable **Execute** (Verify – Ena)

4. [ACTIVATING AND INITIALIZING VTC1 AND VTC2](#)

<p><u>NOTE</u> 1. Steps 4.1 through 4.4 require AOS. 2. VTC1 Ready Status indication can be acquired only when VTC2 is in Idle Mode.</p>
--

PCS

4.1 [Activating VTC1 Idle Mode via Nom Power A](#)

Task: COL Berthed Survival Mode

COL Berthed Survival Mode

'VTC1 Nominal Config'

cmd VTC1 Nom Pwr A – On

Verify VTC1 Nom Pwr A Status – On
Verify VTC1 Nom Pwr A Current < 2.14 A
Verify VTC1 Idle Config Mode – Idle Mode

MCC-H gives COL-CC “Go” to continue

COL-CC

- 4.2 [Enabling VTC1 Pre-emptive telemetry packets \(Ground Only\)](#)
COL-CC to enable VTC1 pre-emptive telemetry packets.

Wait for “Go” to continue.

NOTE

Packet swapping initiated from COL-CC:
Enable VTC1_Gnd_Tlm_Pkt_PHY1_VTC (1Hz)

Perform [{2.2.41 VTC GROUND PACKET SWAPPING}](#) (ESA SODF: GROUND: NOMINAL). then:

COL-CC to give a “Go” to continue.

- 4.3 [Activating VTC2 Idle Mode via Nom Power B](#)

COL Berthed Survival Mode

'VTC2 Nominal Config'

cmd VTC2 Nom Pwr B – On

Verify VTC2 Nom Pwr B Status – On
Verify VTC2 Nom Pwr B Current < 2.14 A
Verify VTC2 Idle Config Mode – Idle Mode

Verify VTC1 Nom Ready Status – Ready
Verify VTC2 Nom Ready Status – Ready

Verify VTC1 Nom Temp < 48 °C
Verify VTC2 Nom Temp < 48 °C

cmd VTC2_Nom_Pwr_B_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify VTC2_Nom_Pwr_B_Stat_VTC – ON

Verify VTC2_Nom_Pwr_B_Current_VTC – <2.14 A

Verify VTC2_Nom_Ready_Stat_VTC – READY

Verify VTC2_Nom_Temp_VTC – < 48 °C

Verify VTC1_INT_DATA_IDLE_CONF_MODE_SW – IDLE

COL-CC

- 4.4 [Enabling VTC2 Pre-emptive telemetry packets \(Ground Only\)](#)
COL-CC to enable VTC2 pre-emptive telemetry packets.

Wait for "Go" to continue.

NOTE

Packet swapping initiated from COL-CC:
Enable VTC2_Gnd_Tlm_Pkt_PHY1_VTC (1Hz)

Perform [{2.2.41 VTC GROUND PACKET SWAPPING}](#) (ESA SODF: GROUND: NOMINAL). then:

Verify VTC1_Nom_Ready_Stat_VTC – READY

Verify VTC1_Nom_Temp_VTC – < 48 °C

COL-CC to give a "Go" to continue.

5. [CONFIGURING VTC1 TO MASTER AND VTC2 TO SLAVE](#)

PCS

5.1 [Initializing VTC2 in Slave Mode](#)

Task: COL Berthed Survival Mode

COL Berthed Survival Mode

'Vital Telemetry and Telecommand Controller'

cmd VTC 2 Initialization (Default) – Slave

Verify VTC2 Mode – Slave

Verify VTC2 Idle Config Mode – Not Idle

cmd VTC_Initialization_Cmd_SW

prm Init_Mode – 0 (SLAVE)

prm Init_Limit_Set – 0 (DEFAULT)

prm Init_APM_Mode – 2 (N/A)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify VTC2_INT_DATA_MASTER_SLAVE_MODE_SW – SLAVE

Verify VTC2_INT_DATA_IDLE_CONF_MODE_SW – NOT_IDLE

5.2 [Enabling Physical Telemetry Packets](#)

COL Berthed Survival Mode

'Vital Telemetry and Telecommand Controller'

cmd Tlm Packets Physical 4 – Enable

cmd Tlm Packets Physical 5 – Enable

cmd VTC_Tlm_Pkt_Ena_Cmd_SW

prm Packet_ID – VTC2_Tlm_Pkt_PHY4_VTC

prm Action – 1 (ENABLE)

prm Checksum_Flag – 1 (ENABLE)

prm Dump_Pipe – 0 (TLM_P)

```

prm APID_Value – 1268
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

cmd VTC_Tlm_Pkt_Ena_Cmd_SW
prm Packet_ID – VTC2_Tlm_Pkt_PHY5_VTC
prm Action – 1 (ENABLE)
prm Checksum_Flag – 1 (ENABLE)
prm Dump_Pipe – 0 (TLM_P)
prm APID_Value – 1268
data Onboard_Node – SYS_CCSDS_End_Point_VTC2
    
```

5.3 [Notifying VTC1 that VTC2 is in Slave Mode](#)

COL Berthed Survival Mode

'Vital Telemetry and Telecommand Controller'

cmd Notify VTC1 - VTC2 in Slave – Notify

```

cmd VTC_Notify_Mode_Cmd_SW
prm New_Mode – 0 (SLAVE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1
    
```

5.4 [Initializing VTC1 in Master Mode](#)

COL Berthed Survival Mode

'Vital Telemetry and Telecommand Controller'

cmd VTC 1 Initialization (Default, Vital) – Master

Verify VTC1 Mode – Master
 Verify VTC1 DMS Mode – Vital
 Verify VTC1 Idle Config Mode – Not Idle

```

cmd VTC_Initialization_Cmd_SW
prm Init_Mode – 1 (MASTER)
prm Init_Limit_Set – 0 (DEFAULT)
prm Init_APM_Mode – 1 (VITAL)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify VTC1_INT_DATA_MASTER_SLAVE_MODE_SW – MASTER
Verify VTC1_INT_DATA_APM_MODE_SW – VITAL
Verify VTC1_INT_DATA_IDLE_CONF_MODE_SW – NOT_IDLE
    
```

5.5 [Enabling Logical Telemetry Packets](#)

COL Berthed Survival Mode

'Vital Telemetry and Telecommand Controller'

cmd Tlm Packets Logical 1 – Enable

cmd Tlm Packets Logical 2 – Enable

```
cmd VTC_Tlm_Pkt_Ena_Cmd_SW
prm Packet_ID – VTC_Tlm_Pkt_LOG1_VTC
prm Action – 1 (ENABLE)
prm Checksum_Flag – 1 (ENABLE)
prm Dump_Pipe – 0 (TLM_P)
prm APID_Value – 1267
data Onboard_Node – SYS_CCSDS_End_Point_VTC1
```

```
cmd VTC_Tlm_Pkt_Ena_Cmd_SW
prm Packet_ID – VTC_Tlm_Pkt_LOG2_VTC
prm Action – 1 (ENABLE)
prm Checksum_Flag – 1 (ENABLE)
prm Dump_Pipe – 0 (TLM_P)
prm APID_Value – 1267
data Onboard_Node – SYS_CCSDS_End_Point_VTC1
```

COL-CC

5.6 [Swapping DMS Telemetry Packets \(Ground Only\)](#)

COL-CC to swap VTC telemetry packets.

Wait for “Go” to continue.

NOTE

Packet swapping initiated from **COL-CC**:
Disable VTC1_Gnd_Tlm_Pkt_PHY2_VTC (1Hz)
Disable VTC2_Gnd_Tlm_Pkt_PHY2_VTC (1Hz)
Enable VTC_Gnd_Tlm_Pkt_LOG1_VTC (1Hz)
Enable VTC_Gnd_Tlm_Pkt_LOG2_VTC (1Hz)

Perform [{2.2.41 VTC GROUND PACKET SWAPPING}](#) (ESA SODF: GROUND NOMINAL). then:

COL-CC to give a “Go” to continue.

PCS

5.7 [Enabling VTC Vital Bus FDIR](#)

Task: COL Berthed Survival Mode: CDH: Vital Bus

COL Vital Bus

cmd Vital Bus Recon – Enable

Verify Vital Bus Recon – Enable

```
cmd VTC_Vital_Sys_Bus_Recon_Ena_Cmd_SW
prm BUS_ID – 0 (Vital)
prm RECONFIGURATION_ENABLE – 1 (Enable)
data Onboard_Node – SYS_CCSDS_End_Point_VTCM
```

Verify VTC_MASTER_Vital_Bus_Recon_Ena_SW_PP – ENABLE

5.8 [Enabling VTC System Bus FDIR](#)

Task: COL Berthed Survival Mode: CDH: System Bus

COL System Bus

cmd System Bus Recon – Enable

Verify System Bus Recon – Enable

cmd VTC_Vital_Sys_Bus_Recon_Ena_Cmd_SW

prm BUS_ID – 1 (System)

prm RECONFIGURATION_ENABLE – 1 (Enable)

data Onboard_Node – SYS_CCSDS_End_Point_VTCM

Verify VTC_MASTER_System_Bus_Recon_Ena_SW_PP – ENABLE

5.9 [Enabling RT FDIR with VTC1](#)

Task: COL Berthed Survival Mode: CB INT 1 RT Status

CB INT 1 RT Status

cmd 21 VTC 1 RT FDIR Status – Enable FDIR **Execute** (Verify – Ena)

5.10 [Enabling RT FDIR with VTC2](#)

Task: COL Berthed Survival Mode: CB INT 2 RT Status

CB INT 2 RT Status

cmd 21 VTC 2 RT FDIR Status – Enable FDIR **Execute** (Verify – Ena)

5.11 [Enabling VTC Redundancy Management](#)

PCS

Task: COL Berthed Survival Mode

COL Berthed Survival Mode

'Vital Telemetry and Telecommand Computer'

'Enable VTC Redun Management'

cmd Master VTC Recovery Step 1 – Enable (Verify – Ena)

cmd Master VTC Recovery Step 2 – Enable (Verify – Ena)

cmd Slave VTC Recovery – Enable (Verify – Ena)

5.12 [Enabling C&W for VTC Redundancy Management \(Ground Only\)](#)

MCC-H

Enable the following events in the Primary and Backup C&C MDMs.

If ground unable to complete,
 Perform [{2.101 CAUTION AND WARNING EVENT MANAGEMENT}](#), Step 2 (SODF: C&DH: NOMINAL)
 per Table 1, then

Table 1. C&W Events for DMS Master & Slave Recovery

Event	Text	Class
13608	DMS MASTER VTC Recovery Step 1 Failure - COL	C
13609	DMS MASTER VTC Recovery Step 2 Failure - COL	C
13610	DMS SLAVE VTC Recovery Failure - COL	C

6. [ACTIVATING PDU CROSS STRAPPED POWER BUS](#)

PCS

6.1 [Verifying Microcontroller Status](#)

Task: COL Berthed Survival Mode

COL Berthed Survival Mode

'PDU Redun Pwr Bus Act'

Verify PDU1 Nom Cntl – On

Verify Redun Cntl – Off

Verify PDU1_Nom_Cntl_Stat_VTC – ON

Verify PDU1_Redun_Cntl_Stat_VTC – OFF

6.2 [Verifying VTC1 Two-Stage Buffer Status](#)

COL Berthed Survival Mode

'PDU Redun Pwr Bus Act'

√VTC1 Buffer – Empty

```

*****
*           If VTC1 Buffer – Full
*           |
*           |           cmd VTC1 Buffer – Clear
*           |           Verify VTC1 Buffer – Empty
*           |
*****
    
```



```

√VTC1_INT_DATA_TWOSTEP_FULL_SW – EMPTY

If VTC1_INT_DATA_TWOSTEP_FULL_SW – FULL
|
|   cmd VTC_Cancel_Two_Stage_Cmd_Cmd_SW
|   data Onboard_Node – SYS_CCSDS_End_Point_VTC1
|
|   Verify VTC1_INT_DATA_TWOSTEP_FULL_SW –
|   EMPTY
    
```

6.3 [Activating All PDU1 Aux Converters for 120V Outlets](#)

COL Berthed Survival Mode

'Aux Supplies Activation'

Record PCS ID: _____

cmd Start ACS PDU Config – Arm

pick PCS/C-X to VTC-Com1 (where X=PCS ID)

cmd Start ACS PDU Config – Set

COL-CC to verify PDU SSPC Aux Converter status.

Wait for “Go” to continue.

```

cmd PDU_Config_ACS (ARM)
data SW_CMD – VTC_Start_Terminate_ACS_Cmd_SW
data Action – 1 (START)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify VTC1_INT_DATA_TWOSTEP_FULL_SW – FULL

cmd VTC_Execute_2_Stage_Cmd_SW (EXEC)

Verify PDU1_SSPC_Aux_Conv1_Stat_VTC – ON
Verify PDU1_SSPC_Aux_Conv2_Stat_VTC – ON
Verify PDU1_SSPC_Aux_Conv3_Stat_VTC – ON
Verify PDU1_SSPC_Aux_Conv4_Stat_VTC – ON
Verify PDU1_SSPC_Aux_Conv5_Stat_VTC – ON
Verify PDU1_SSPC_Aux_Conv6_Stat_VTC – ON
Verify PDU1_SSPC_Aux_Conv7_Stat_VTC – ON
Verify PDU1_SSPC_Aux_Conv8_Stat_VTC – ON
Verify PDU1_SSPC_Aux_Conv9_Stat_VTC – ON

COL-CC to give a “Go” to continue.
    
```

6.4 [Activating PDU1 to PDU2 Power Outlet](#)

COL Berthed Survival Mode

'Cross Strapped Power Bus Activation'

cmd PDU 1/2 Redun Pwr Bus – On

Verify PDU 1/2 Redun Pwr Bus Status – On

cmd PDU1_PDU2_Redun_Pwr_Bus_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU1_PDU2_Redun_Pwr_Bus_On_Off_Stat_VTC_PP – ON

6.5 [Activating PDU2 Cross Strapped Converter](#)

COL Berthed Survival Mode

'Converter Activation'

cmd PDU2 Cross Strapped Conv – On

Verify PDU2 Cross Strapped Conv Status – On

cmd PDU2_Cross_Strapped_Conv_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify PDU2_Cross_Strapped_Conv_Stat_VTC – ON

6.6 [Activating PDU Lights Power Bus](#)

PCS

COL: EPS: Lights

COL PDU 1-2 Lights VTC1

cmd PDU 1 Outlet 21 – On (Verify – On)

cmd PDU1_MLU_Pwr_Bus_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU1_MLU_Pwr_Bus_On_Off_Stat_VTC_PP – ON

7. [ACTIVATING HEATER CONTROL UNIT](#)

PCS

7.1 [Activating HCU1 Power Bus](#)

Task: COL Berthed Survival Mode

COL Berthed Survival Mode

'Heater Control Unit'

SINGLE PDU1 COLUMBUS BERTHED SURVIVAL MODE ACTIVATION

(ASSY MAL/1E/FIN/MULTI E)

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cmd PDU1 HCU1 Pwr Bus On – On

Verify PDU1 HCU1 Pwr Bus Status – On

Verify PDU1 HCU1 Input Current < 10 A

cmd PDU1_HCU1_Pwr_Bus_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU1_HCU1_Pwr_Bus_On_Off_Stat_VTC_PP – ON

Verify PDU1_HCU1_Pwr_Bus_Current_VTC_PP – < 10 A

Verifying Heater Control Loop Status (Ground Only)

NOTE

TLM only available after 30 sec delay following HCU power on because of HCU SW initialization

Verify HCU1_AO_Htr_Cntl_Loop_Stat_VTC – ENABLED

Verify HCU1_AD_Htr_Cntl_Loop_Stat_VTC – ENABLED

Verify HCU1_AR_Htr_Cntl_Loop_Stat_VTC – ENABLED

Verify HCU1_FD_Htr_Cntl_Loop_Stat_VTC – ENABLED

Verify HCU1_FO_Htr_Cntl_Loop_Stat_VTC – ENABLED

Verify HCU1_FR_Htr_Cntl_Loop_Stat_VTC – ENABLED

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SINGLE PDU 1 COLUMBUS FINAL ACTIVATION

(ASSY MAL/1E/FIN/MULTI E)

Page 1 of 56 pages

OBJECTIVE:

Continuing activation of Columbus Module with only the power outlets of PDU1 active. The PDU2 valve driving section is powered by the PDU1 cross strapped power outlet and working properly.

INITIAL CONDITIONS:

Single PDU1 Columbus Berthed Survival Mode Activation is complete.

1. ACTIVATING PDU OUTLET

PCS

1.1 Activating PDU1 Subsystem Power Buses 1 thru 5

Task: COL Final Activation - Part 1

COL Final Activation - Part 1

'PDU Outlet Activation'

PDU1 Subsys Pwr Bus [X] where [X] = [1] [2] [3] [4] [5]

cmd PDU1 Subsys Pwr Bus [X] – On

Verify PDU1 Subsys Pwr Bus Posn [X] – On

Repeat

cmd PDU1_Subsys_Pwr_Bus1_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

cmd Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU1_Subsys_Pwr_Bus1_On_Off_Stat_VTC_PP – ON

cmd PDU1_Subsys_Pwr_Bus2_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU1_Subsys_Pwr_Bus2_On_Off_Stat_VTC_PP – ON

cmd PDU1_Subsys_Pwr_Bus3_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU1_Subsys_Pwr_Bus3_On_Off_Stat_VTC_PP – ON

cmd PDU1_Subsys_Pwr_Bus4_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU1_Subsys_Pwr_Bus4_On_Off_Stat_VTC_PP – ON

cmd PDU1_Subsys_Pwr_Bus5_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

SINGLE PDU 1 COLUMBUS FINAL ACTIVATION

(ASSY MAL/1E/FIN/MULTI E)

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data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU1_Subsys_Pwr_Bus5_On_Off_Stat_VTC_PP – ON

1.2 [Activating PDU1 Subsystem Power Buses 6 thru 10](#)

COL Final Activation - Part 1

'PDU Outlet Activation'

PDU1 Subsys Pwr Bus [X] where [X] = [6] [7] [8] [9] [10]

cmd PDU1 Subsys Pwr Bus [X] – On

Verify PDU1 Subsys Pwr Bus Posn [X] – On

Repeat

cmd PDU1_Subsys_Pwr_Bus6_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

cmd Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU1_Subsys_Pwr_Bus6_On_Off_Stat_VTC_PP – ON

cmd PDU1_Subsys_Pwr_Bus7_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU1_Subsys_Pwr_Bus7_On_Off_Stat_VTC_PP – ON

cmd PDU1_Subsys_Pwr_Bus8_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU1_Subsys_Pwr_Bus8_On_Off_Stat_VTC_PP – ON

cmd PDU1_Subsys_Pwr_Bus9_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU1_Subsys_Pwr_Bus9_On_Off_Stat_VTC_PP – ON

cmd PDU1_Subsys_Pwr_Bus10_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU1_Subsys_Pwr_Bus10_On_Off_Stat_VTC_PP – ON

1.3 [Activating PDU1 D1 Rack Power](#)

COL Final Activation - Part 1

'PDU Outlet Activation'

'PDU1'

cmd Rack D1 Pwr Bus – On

Verify Rack D1 Pwr Bus – On

cmd PDU1_Rack_D1_Pwr_Bus_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU1_Rack_D1_Pwr_Bus_On_Off_Stat_VTC_PP – ON

1.4 [Activating WPA1 and WPA2 Accumulator Pressure Sensors \(Ground Only\)](#)

COL-CC

COL-CC to activate WPA1 and WPA2 Accumulator Pressure Sensors.

Wait for “Go” to continue.

NOTE

1. This step can only be performed by **COL-CC**.
2. If the sensor readings show values below 165 kPa a pressurization of the accumulator is required prior to payload rack connector mate. Continue with step 1.5.
3. If both readings of either pair of WPA Accumulator Pressure sensors are out of limits after the monitoring has been enabled, the system will automatically safe to Berthed Survival Mode.

cmd WPA1_Accum_Press_Snsr1_Pwr_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WPA1_Accum_Abs_Press1_VTC – 165 - 195 kPa

cmd WPA1_Accum_Press_Snsr2_Pwr_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify WPA1_Accum_Abs_Press2_VTC – 165 - 195 kPa

cmd WPA2_Accum_Press_Snsr1_Pwr_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify WPA2_Accum_Abs_Press1_VTC – 165 - 195 kPa

cmd WPA2_Accum_Press_Snsr2_Pwr_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WPA2_Accum_Abs_Press2_VTC – 165 - 195 kPa

Activation of the VTC C&W monitoring for the WPA1 and WPA2 Accumulator Pressure Sensors

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – WPA1_Accum_Abs_Press1_VTC
prm Action – 1(ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WPA1_Accum_Abs_Press1_VTC_MEF – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – WPA1_Accum_Abs_Press2_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify WPA1_Accum_Abs_Press2_VTC_MEF – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – WPA2_Accum_Abs_Press1_VTC
prm Action – 1(ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify WPA2_Accum_Abs_Press1_VTC_MEF – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – WPA2_Accum_Abs_Press2_VTC
prm Action – 1(ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WPA2_Accum_Abs_Press2_VTC_MEF – ENABLED

COL-CC gives "Go" to continue..

- MCC-H 1.5 [Enabling C&W for Previous Monitorings \(Ground Only\)](#)
 Enable the following events in the Primary and Backup C&C MDMs.

 If ground unable to complete,
 | Perform [{2.101 CAUTION AND WARNING EVENT MANAGEMENT}](#), step 2 (SODF: C&DH: NOMINAL)
 | per Table 1, then

Table 1. C&W Events for WPA1 and WPA2

Event	Text	Class
13538	'WPA1 Accumulator Pressure Sensor 1 High - COL'	W
13539	'WPA1 Accumulator Pressure Sensor 2 High - COL'	W
13540	'WPA2 Accumulator Pressure Sensor 1 High - COL'	W
13541	'WPA2 Accumulator Pressure Sensor 2 High - COL'	W

1.6 [Verifying Total Pressure Sensors](#)

COL Final Activation - Part 1

'Total Pressure Sensor'

Verify TPS1 Air Pressure: 719 to 783 mmHg

Verify TPS2 Air Pressure: 719 to 783 mmHg

Verify TPS1_Air_Press_VTC – 719 - 783 mmHg

Verify TPS2_Air_Press_VTC – 719 - 783 mmHg

2. [ACTIVATING CMU 1-4](#)

NOTE

1. CMU1 needs to be activated for CMU4 Ready Status to be available
2. The water loop must be activated within 5 hours of CMU activation.

2.1 [Activating Power B Supplies](#)

PCS

COL: CDH: COL Overview Activation: CMU4

COL CMU4 Act

'CMU 4 Redundant'

cmd CMU4 Redun Pwr B – On

Verify CMU4 Redun Pwr B Status – On

Verify CMU4 Redun Pwr B Current < 1.35A

Task: COL Final Activation - Part 1

COL Final Activation - Part 1

'Command and Measurement Unit Activation'

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cmd CMU1 Nom Pwr B – On

Verify CMU1 Nom Pwr B Status – On

Verify CMU1 Nom Pwr B Current < 1.35A

Verify CMU1 Ready Status – Ready

Verify CMU4 Ready Status – Ready

cmd CMU2 Nom Pwr B – On

Verify CMU2 Nom Pwr B Status – On

Verify CMU2 Nom Pwr B Current < 1.35A

Verify CMU2 Ready Status – Ready

cmd CMU3 Nom Pwr B – On

Verify CMU3 Nom Pwr B Status – On

Verify CMU3 Nom Pwr B Current < 1.35A

Verify CMU3 Ready Status – Ready

cmd CMU4_Redun_Pwr_B_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CMU4_Redun_Pwr_B_Stat_VTC – ON

Verify CMU4_Redun_Pwr_B_Current_VTC < 1.35A

cmd CMU1_Nom_Pwr_B_On_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CMU1_Nom_Pwr_B_Stat_ACT_PP – ON

Verify CMU1_Nom_Pwr_B_Current_ACT_PP < 1.35A

Verify CMU1_Nom_Ready_Stat_ACT_PP – READY

Verify CMU4_Nom_Ready_Stat_ACT_PP – READY

cmd CMU2_Nom_Pwr_B_On_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CMU2_Nom_Pwr_B_Stat_ACT_PP – ON

Verify CMU2_Nom_Pwr_B_Current_ACT_PP – <1.35A

Verify CMU2_Nom_Ready_Stat_ACT_PP – READY

cmd CMU3_Nom_Pwr_B_On_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CMU3_Nom_Pwr_B_Stat_ACT_PP – ON
Verify CMU3_Nom_Pwr_B_Current_ACT_PP – <1.35A
Verify CMU3_Nom_Ready_Stat_ACT_PP – READY

3. [ACTIVATING WATER LOOP](#)

NOTE

1. TCS Jumpers must be installed prior to beginning this step.
2. Expect valve operations to take up to 15 seconds for verification.

3.1 [Configuring Loop A IFHX and Loop B IFHX for Water Loop Activation](#)

COL: TCS: MTL IFHX

COL MTL IFHX Commands

'COL MTL IFHX NH3'

'Isol Vlv'

Verify Position – Closed

cmd Cntrl Avail Open – Ena (Verify Cntrl Avail – Ena)

cmd Position – Open (Verify Position – Open)

'Byp Vlv'

Verify Position – Bypass

cmd Cntrl Avail Flothru – Ena (Verify Cntrl Avail – Ena)

cmd Position – Flothru (Verify Position – Flothru)

COL: TCS: LTL IFHX

COL LTL IFHX Commands

'COL LTL IFHX NH3'

'Isol Vlv'

Verify Position – Closed

cmd Cntrl Avail Open – Ena (Verify Cntrl Avail – Ena)

cmd Position – Open (Verify Position – Open)

'Byp Vlv'

Verify Position – Bypass

cmd Cntrl Avail Flothru – Ena (Verify Cntrl Avail – Ena)

cmd Position – Flothru (Verify Position – Flothru)

3.2 [Configuring Water On/Off Valves](#)

Task: COL Final Activation - Part 2

COL Final Activation - Part 2

'Water Loop Activation'

'Water On Off Valves'

Verify WOOV1 Posn – Open

Verify WOOV2 Posn – Closed

Verify WOOV3 Posn – Open

Verify WOOV4 Posn – Open

Verify WOOV5 Posn – Open

Verify WOOV6 Posn – Open

Verify WOOV7 Posn – Open

Verify WOOV8 Posn – Open

Verify WOOV9 Posn – Open

Verify WOOV10 Posn – Closed

Verify WOOV1_Open_Stat_VTC_PP – OPEN

Verify WOOV2_Close_Stat_VTC_PP – CLOSED

Verify WOOV3_Open_Stat_VTC_PP – OPEN

Verify WOOV4_Open_Stat_VTC_PP – OPEN

Verify WOOV5_Open_Stat_VTC_PP – OPEN

Verify WOOV6_Open_Stat_VTC_PP – OPEN

Verify WOOV7_Open_Stat_VTC_PP – OPEN

Verify WOOV8_Open_Stat_VTC_PP – OPEN

Verify WOOV9_Open_Stat_VTC_PP – OPEN

Verify WOOV10_Close_Stat_VTC_PP – CLOSED

Water Flow Selection Valve Configuration Verification

Verify WFSV_ISPR_A1_Open_Stat_VTC – OPEN

Verify WFSV_ISPR_A2_Open_Stat_VTC – OPEN

Verify WFSV_ISPR_A3_Open_Stat_VTC – OPEN

Verify WFSV_ISPR_A4_Open_Stat_VTC – OPEN

Verify WFSV_ISPR_F1_Open_Stat_VTC – OPEN

Verify WFSV_ISPR_F2_Open_Stat_VTC – OPEN

Verify WFSV_ISPR_F3_Open_Stat_VTC – OPEN

Verify WFSV_ISPR_F4_Open_Stat_VTC – OPEN

Verify WFSV_ISPR_O1_Open_Stat_VTC – OPEN

Verify WFSV_ISPR_O2_Open_Stat_VTC – OPEN

3.3 [Activating and Verifying WMV1 Shutoff Valve](#)

COL Final Activation - Part 2

'3 Way Modulating Valves'
'WMV1'

cmd WMV1 SOV Pwr – On

Verify WMV1 SOV Pwr – On
Verify WMV1 SOV1 Posn – Open
Verify WMV1 SOV2 Posn – Open

cmd WMV1_SOV_Pwr_On_ACT
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WMV1_SOV_Pwr_Stat_ACT_PP – ON
Verify WMV1_SOV1_Open_Stat_ACT_PP – OPEN
Verify WMV1_SOV2_Open_Stat_ACT_PP – OPEN

3.4 [Deactivating WMV1 Shutoff Section](#)

COL Final Activation - Part 2

'3 Way Modulating Valves'
'WMV1'

cmd WMV1 SOV Pwr – Off

Verify WMV1 SOV Pwr – Off

cmd WMV1_SOV_Pwr_Off_ACT
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WMV1_SOV_Pwr_Stat_ACT_PP – OFF

3.5 [Activating and Verifying WMV2 Shutoff Valve](#)

Task: COL Final Activation - Part 2: TCS: WMV2

COL WMV1 AND 2 ACT VTC1

'Commands'
'WMV 2 MDV'

cmd WMV 2 MDV – Redun

Verify WMV2 Pwr Status – Redun

'WMV2 SOV1'

cmd WMV2 SOV1 Pwr – On

Verify WMV2 SOV1 Pwr – On
Verify WMV2 SOV1 Position – Closed
Verify WMV2 SOV2 Position – Closed

cmd WMV2_Redun_Pwr_Sel_ACT
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WMV2_MDV_Nom_Redun_Pwr_Stat_ACT_PP – REDUN

cmd WMV2_SOV_Pwr_On_ACT
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WMV2_SOV_Pwr_Stat_ACT_PP – ON
Verify WMV2_SOV1_Close_Stat_ACT_PP – CLOSED
Verify WMV2_SOV2_Close_Stat_ACT_PP – CLOSED

3.6 [Deactivating WMV2 Shutoff Section](#)

COL WMV1 AND 2 ACT VTC1

'Commands'
'WMV 2 SOV1'

cmd WMV2 SOV1 Pwr – Off

Verify WMV2 SOV1 Pwr – Off

cmd WMV2_SOV_Pwr_Off_ACT
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WMV2_SOV_Pwr_Stat_ACT_PP – OFF

3.7 [Activating and Verifying WMV3 Shutoff Valve](#)

Task: COL Final Activation - Part 2

COL Final Activation - Part 2

'3 Way Modulating Valves'
'WMV3'

cmd WMV3 SOV Pwr – On

Verify WMV3 SOV Pwr – On
Verify WMV3 SOV1 Posn – Open
Verify WMV3 SOV2 Posn – Open

cmd WMV3_SOV_Pwr_On_ACT
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WMV3_SOV_Pwr_Stat_ACT_PP – ON

Verify WMV3_SOV1_Open_Stat_ACT_PP – OPEN

Verify WMV3_SOV2_Open_Stat_ACT_PP – OPEN

3.8 [Deactivating WMV3 Shutoff Section](#)

COL Final Activation - Part 2

'3 Way Modulating Valves'

'WMV3'

cmd WMV3 SOV Pwr – Off

Verify WMV3 SOV Pwr – Off

cmd WMV3_SOV_Pwr_Off_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WMV3_SOV_Pwr_Stat_ACT_PP – OFF

3.9 [Activating and Verifying WMV4 Shutoff Valve](#)

Task: COL Final Activation - Part 2: TCS: WMV3

COL WMV3 AND 4 ACT VTC1

'Commands'

cmd WMV 4 MDV – Redun

Verify WMV4 Pwr Status – Redun

'WMV4 SOV'

cmd WMV4 SOV Pwr – On

Verify WMV4 SOV Pwr – On

Verify WMV4 SOV1 Posn – Closed

Verify WMV4 SOV2 Posn – Closed

cmd WMV4_Redun_Pwr_Sel_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WMV4_MDV_Nom_Redun_Pwr_Stat_ACT_PP – REDUN

cmd WMV4_SOV_Pwr_On_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WMV4_SOV_Pwr_Stat_ACT_PP – ON
 Verify WMV4_SOV1_Close_Stat_ACT_PP – CLOSED
 Verify WMV4_SOV2_Close_Stat_ACT_PP – CLOSED

3.10 [Deactivating WMV4 Shutoff Section](#)

COL WMV3 AND 4 ACT VTC1

'Commands'
 'WMV4 SOV'

cmd WMV4 SOV Pwr – Off

Verify WMV4 SOV Pwr – Off

cmd WMV4_SOV_Pwr_Off_ACT
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1
 Verify WMV4_SOV_Pwr_Stat_ACT_PP – OFF

3.11 [Closing Bypass Valve WOOV5 and WOOV7](#)

Task: COL Final Activation - Part 2

COL Final Activation - Part 2

'Bypass Valves'

cmd WOOV5 – Close

Verify WOOV5 Posn – Closed

cmd WOOV7 – Close

Verify WOOV7 Posn – Closed

cmd WOOV5_Vlv_Close_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1
 Verify WOOV5_Close_Stat_VTC_PP – CLOSED

cmd WOOV7_Vlv_Close_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1
 Verify WOOV7_Close_Stat_VTC – CLOSED

3.12 [Activating WMV1 Modulating Section](#)

COL Final Activation - Part 2

'WMV1 MDV Pwr'

cmd WMV1 MDV Pwr – On

Verify WMV1 MDV Pwr – On

cmd WMV1_MDV_Pwr_On_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WMV1_MDV_Pwr_Stat_ACT_PP – ON

3.13 [Activating WPA1](#)

COL Final Activation - Part 2

'WPA1 Pwr'

cmd WPA1 Pwr – On

Verify WPA1 Pwr – On

cmd WPA1_Pwr_On_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WPA1_Pwr_Stat_ACT_PP – ON

3.14 [Starting up WPA1 Pump Operation](#)

COL Final Activation - Part 2

'WPA1 Pump'

NOTE

This step activates active cooling via the water loop and terminates the thermal clock started with CMU Activation in step 2.

cmd WPA1 Pump – Init

Verify Pump dP > 30 KPa

Verify Mass Flow > 230 kg/hr

Verify Nom Plenum dP > 18 kPa

cmd WPA1_Pump_Init_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WPA1_Pump_DP_ACT_PP – > 30 kPa

Verify WPA1_Mass_Flow_ACT_PP – > 230 kg/h

Verify DPSB1_Nom_Plenum_DP_VTC – > 18 kPa

3.15 [Enabling Monitoring of Delta Pressure Sensor Block](#)

COL Final Activation - Part 2

'Delta Pressure Sensor Block'

NOTE

If the reading of the DPSB dP is out of limits after the monitoring has been enabled, the system will automatically safe to Berthed Survival Mode.

cmd DPSB1 Nom Plenum dP Mon – Enable

Verify DPSB1 Nom Plenum dP Mon Status – Enabled

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – DPSB1_Nom_Plenum_DP_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify DPSB1_Nom_Plenum_DP_VTC_MEF – ENABLED

3.16 [Verifying Wet Temperatures](#)

COL Final Activation - Part 2

'Wet Temperature Sensor Block'

'WTSB1 Nom Plenum Temp 3'

Verify WTSB1 Nom Plenum Temp 3 < 24 deg C

'WTSB2 Redun Plenum Temp 3'

Verify WTSB2 Redun Plenum Temp 3 < 24 deg C

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```
*****
*       If WTSB1 Nom Plenum Temp 3 ≥ 24 deg C
*       or
*       WTSB2 Redun Plenum Temp 3 ≥ 24 deg C
*       |
*       |           Wait five minutes then re-verify
*       |
*****
```

Verify WTSB1_Nom_Plenum_Temp3_VTC – < 24°C
Verify WTSB2_Redun_Plenum_Temp3_VTC – < 24°C

3.17 [Enabling Monitoring of WTSB Measurements](#)

COL Final Activation - Part 2

'Wet Temperature Sensor Block'

NOTE

If both readings of the WTSB Plenum Temp3 are out of limits after the monitoring has been enabled, the system will automatically safe to Berthed Survival Mode.

cmd WTSB1 Nom Plenum Temp 3 Monitor – Enable

Verify WTSB1 Nom Plenum Temp 3 Monitor Status – Enabled

cmd WTSB2 Redun Plenum Temp 3 Monitor – Enable

Verify WTSB2 Redun Plenum Temp 3 Monitor Status – Enabled

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – WTSB1_Nom_Plenum_Temp3_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WTSB1_Nom_Plenum_Temp3_VTC_MEF – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – WTSB2_Redun_Plenum_Temp3_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify WTSB2_Redun_Plenum_Temp3_VTC_MEF – ENABLED

3.18 [Enabling C&W in USOS for Previous Monitorings \(Ground Only\)](#)

MCC-H

Enable the following events in the Primary and Backup C&C MDMs.

If ground unable to complete,

|

Perform [{2.101 CAUTION AND WARNING EVENT MANAGEMENT}](#), Step 2 (SODF: C&DH: NOMINAL) per Table 2, then

Table 2. C&W Events for DPSB & WTSB

Event	Text	Class
13534	'Cooling Loop Delta Pressure Sensor 1 Low – COL'	W
14165	'Cooling Loop Temperature Sensor 1 High – COL'	W
14166	'Cooling Loop Temperature Sensor 2 High – COL'	W

PCS

3.19 [Activating ATU Power Bus](#)

COL: EPS: PDU1 120V Outlets Subsys/Payloads

COL PDU1 120V Outlets VTC1

'PDU1'

'Outlet Num 20'

cmd ATU1 Pwr Bus – On

Verify ATU1 Pwr Pwr – On

cmd PDU1_ATU1_Pwr_Bus_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU1_ATU1_Pwr_Bus_On_Off_Stat_VTC_PP – ON

4. [ACTIVATING NETWORK CLSW](#)

4.1 [Activating CLSW 1 Power A](#)

Task: COL Final Activation - Part 3

COL Final Activation - Part 3

'Network CLSW'

cmd CLSW 1 Pwr A – On

Verify CLSW 1 Pwr A Status – On

Verify CLSW 1 Pwr A Current < 2.5 A

Verify CLSW 1 Pwr A Ready Status – Ready

cmd CLSW1_Pwr_A_On_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CLSW1_Pwr_A_Stat_ACT_PP – ON
Verify CLSW1_Pwr_A_Current_ACT_PP < 2.5 A
Verify CLSW1_Ready_Stat_ACT_PP – READY

4.2 [Activating CLSW2 Power B](#)

COL Final Activation - Part 3

'Network CLSW'

cmd CLSW 2 Pwr B – On

Verify CLSW 2 Pwr B Status – On
Verify CLSW 2 Pwr B Current < 2.6 A
Verify CLSW 2 Pwr A Ready Status – Ready

cmd CLSW2_Pwr_B_On_ACT
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CLSW2_Pwr_B_Stat_ACT_PP – ON
Verify CLSW2_Pwr_B_Current_ACT_PP – < 2.6 A
Verify CLSW2_Ready_Stat_ACT_PP – READY

5. [ACTIVATING MASS MEMORY UNIT](#)

5.1 [Activating MMU2 Power A](#)

Task: COL Final Activation - Part 3

COL Final Activation - Part 3

'Mass Memory Unit'

cmd MMU2 Pwr A – On

Verify MMU2 Pwr A Status – On
Verify MMU2 Pwr A Current < 1.58 A

cmd MMU2_Pwr_A_On_ACT
data SW_CMD: – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node: – SYS_CCSDS_End_Point_VTC1

Verify MMU2_Pwr_A_Stat_ACT_PP – ON
Verify MMU2_Pwr_A_Current_ACT_PP < 1.58 A

5.2 [Commanding MMU2 to Slave Mode](#)

COL Final Activation - Part 3

'Mass Memory Unit'

cmd Boot MMU 2 – Slave

Wait up to 5 minutes for MMU2 Ready Status to be displayed

Verify MMU2 Ready Status – Ready

cmd VTC_Boot_SPC_Cmd_SW

prm RT_Address – 27 (RT address of MMU2)

prm Mode – 9 (MMU_SLAVE)

prm Session Number – 1

data Onboard_Node – SYS_CCSDS_End_Point_VTCM

Verify MMU2_Ready_Stat_ACT_PP – READY

5.3 [Activating MMU1 Power B](#)

COL Final Activation - Part 3

'Mass Memory Unit'

cmd MMU1 Pwr B – On

Verify MMU1 Pwr B Status – On

Verify MMU1 Pwr B Current < 1.87 A

cmd MMU1_Pwr_B_On_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify MMU1_Pwr_B_Stat_ACT_PP – ON

Verify MMU1_Pwr_B_Current_ACT_PP < 1.87 A

5.4 [Commanding MMU1 to Master Mode](#)

COL Final Activation - Part 3

'Mass Memory Unit'

cmd Boot MMU 1 – Master

Wait up to 5 minutes for MMU1 Ready Status to be displayed

Verify MMU1 Ready Status – Ready

cmd VTC_Boot_SPC_Cmd_SW

prm RT_Address – 17 (RT address of MMU1)

prm Mode – 7 (MMU_MASTER_DEFAULT)

prm Session Number – 1

data Onboard_Node – SYS_CCSDS_End_Point_VTCM

Verify MMU1_Ready_Stat_ACT_PP – READY

6. [ACTIVATING MISSION MANAGEMENT COMPUTER](#)

NOTE

1. Steps 6.3 through 6.6 require AOS
2. Expect DMS C&W messages

6.1 [Inhibiting Redun Management for MMC](#)

Task: COL Final Activation - Part 3

COL Final Activation - Part 3

'Mission Management Computer'

√MMC Redun Management – Inh

6.2 [Enabling RT I/O for MMC](#)

Task: COL Final Activation - Part 3: CB INT 2 RT Status

CB INT 2 RT Status

cmd 22 MMC RT Status – Enable **Execute** (Verify – Ena)

6.3 [Activating MMC Power A](#)

Task: COL Final Activation - Part 3

COL Final Activation - Part 3

'Mission Management Computer'

cmd MMC Pwr A – On

Verify MMC Pwr A Status – On

Verify MMC Pwr A Current < 1.19 A

cmd MMC_Pwr_A_On_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify MMC_Pwr_A_Stat_ACT_PP – ON

Verify MMC_Pwr_A_Current_ACT_PP – < 1.19 A

6.4 [Initializing Command MMC S/W](#)

COL Final Activation - Part 3

'Mission Management Computer'

NOTE

During the MMC boot process, the configuration FLAPs 'MMC Cold Start' and 'MMC Start-Up' are executed automatically.

The MMC Cold Start FLAP:

Starts monitorings of the MMC node

Executes the MMC Startup FLAP

The MMC Start-Up FLAP:

Resets the station mode compatibility variable and venting valve inhibit status

Activates MMC hosted application software (COAP IDF task)

Starts the SNCD TIm packet to the US MDM

Starts the pre-emptive TIm packet for DMS data to COL-CC

Starts the pre-emptive TIm packet for USM data to COL-CC

cmd MMC Boot – MMC Default

Verify SPC2 Boot Report – 66048

Wait up to 5 minutes for MMC to boot before checking Ready Status

Verify MMC Ready Status – Ready

Wait for "Go" to continue.

cmd VTC_Boot_SPC_Cmd_SW

prm RT_Address – 8 (RT address of SPC2)

prm Mode – 1(MMC_DEFAULT)

prm Session Number – 1 (TBC)

data Onboard_Node – SYS_CCSDS_End_Point_VTCM

Verify VTC_MASTER_SPC2_Boot_Report_SW_PP – 66048

Verify MMC_Ready_Stat_ACT_PP – READY

COL-CC to give a "Go" to continue.

6.5 [Enabling RT FDIR for MMC](#)

Task: COL Final Activation - Part 3: CB INT 2 RT Status

CB INT 2 RT Status

cmd 22 MMC RT FDIR Status – Enable FDIR **Execute** (Verify – Ena)

6.6 [Enabling MMC Redundancy Management](#)

Task: COL Final Activation - Part 3

COL Final Activation - Part 3

'Mission Management Computer'

cmd MMC Redun Management – Ena (Verify – Ena)

6.7 [Enabling CCSDS Checksum Validation on MMC \(Ground only\)](#)

cmd DMS_CCSDS_Checksum_Ena_Cmd_SW
data ONBOARD_NODE –
 SYS_CCSDS_End_Point_MMC_DMS_SERV

6.8 [Enabling CCSDS Checksum Validation on MMU\(Ground only\)](#)

cmd DMS_CCSDS_Checksum_Ena_Cmd_SW
data ONBOARD_NODE –
 SYS_CCSDS_End_Point_MMU_DMS_SERV

7. [ACTIVATING DATA MANAGEMENT COMPUTER](#)

NOTE

1. Steps 7.1 through 7.5 require AOS
2. Expect DMS C&W messages

7.1 [Activating DMC Power A](#)

Task: COL Final Activation - Part 3

COL Final Activation - Part 3

'Data Management Computer'

cmd DMC Pwr A – On

Verify DMC Pwr A Status – On

Verify DMC Pwr A Current < 1.19 A

cmd DMC_Pwr_A_On_ACT
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify DMC_Pwr_A_Stat_VTC – ON

Verify DMC_Pwr_A_Current_VTC – < 1.19 A

7.2 [Initializing DMC S/W](#)

COL Final Activation - Part 3

'Data Management Computer'

cmd DMC Boot – DMC Default

Wait up to 5 minutes for DMC to boot before checking the SPC1 Boot Report

Verify SPC1 Boot Report – 4096

cmd VTC_Boot_SPC_Cmd_SW

```

prm RT_Address – 7
prm Mode – 0
prm Session Number – 1
data Onboard_Node – SYS_CCSDS_End_Point_VTCM

Verify VTC_MASTER_SPC1_Boot_Report_SW_PP – 4096

```

7.3 [Configuring DMC as Bus Controller](#)

NOTE

All activation telemetry on PCS and ground displays will be invalid at the completion of step 7.3. These invalid parameters will be indicated by a cyan telemetry field.

COL Final Activation - Part 3

'Data Management Computer'

NOTE

During the DMC boot process, the configuration FLAPs 'DMC Cold Start' and 'DMC Start-Up' are executed automatically.

The DMC Cold Start FLAP:

- Starts several monitorings on the DMC node
- Starts the RT acquisition of active DMS equipment
- Initializes several DMS related S/W variables
- Executes the DMC Startup FLAP

The DMC Start-Up FLAP:

- Starts several monitorings of system measurements
- Starts the RT acquisition of active system equipment
- Initializes several S/W variables

cmd VTC Vital To Nominal Mode – Nominal

Wait up to 15 minutes for DMC to boot before checking Ready Status

Verify DMC Ready Status – Ready

```

cmd VTC_Vital_To_Nom_Mode_Chg_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTCM

Verify DMC_Ready_Stat_VTC – READY

```

7.4 [Enabling DMC and SPARE Monitoring to Support DMC FDIR in VTC \(Ground Only\)](#)

COL-CC DMC and SPARE monitoring to be enabled by ground

Wait for "Go" to continue.

```

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – DMC_Pwr_A_Current_VTC

```

SINGLE PDU 1 COLUMBUS FINAL ACTIVATION

(ASSY MAL/1E/FIN/MULTI E)

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prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify DMC_Pwr_A_Current_VTC_MEF – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – DMC_Temp_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify DMC_Temp_VTC_MEF – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – DMC_Sec_Voltage_Stat_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify DMC_Sec_Voltage_Stat_VTC_MEF – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – DMC_Ready_Stat_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify DMC_Ready_Stat_VTC_MEF – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – SPARE_Pwr_B_Stat_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify SPARE_Pwr_B_Stat_VTC_MEF – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – SPARE_Pwr_B_Current_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify SPARE_Pwr_B_Current_VTC_MEF – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – SPARE_Temp_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify SPARE_Temp_VTC_MEF – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW

```

prm Monitored_Item_ID – SPARE_Sec_Voltage_Stat_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify SPARE_Sec_Voltage_Stat_VTC_MEF – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – SPARE_Ready_Stat_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify SPARE_Ready_Stat_VTC_MEF – ENABLED

COL-CC to give a “Go” to continue.
    
```

7.5 [Enabling DMC FDIR in VTC](#)

COL Final Activation - Part 3

'Data Management Computer'

cmd Enable DMC FDIR – Enable (Verify – Enabled)

```

cmd VTC_DMC_Recon_Ena_Cmd_SW
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTCM

Verify VTC_MASTER_DMC_Recon_Enable_SW_PP –
ENABLED
    
```

MCC-H 7.6 [Enabling C&W for the DMS and PDU1 Cautions \(Ground Only\)](#)

Enable the following events in the Primary and Backup C&C MDMs.

If ground unable to complete,

 Perform [{2.101 CAUTION AND WARNING EVENT MANAGEMENT}](#), step 2 (SODF: C&DH: NOMINAL) per Table 3, then:

Table 3. C&W Events for DMS and PDU1

Event	Text	Class
13570	'DMS I/O Unit (CMU1) Redundant Branch Failure – COL'	C
13572	'DMS I/O Unit (CMU2) Redundant Branch Failure – COL'	C
13574	'DMS I/O Unit (CMU3) Redundant Branch Failure – COL'	C
13576	'DMS I/O Unit (CMU4) Redundant Branch Failure – COL'	C
13579	'Power Distribution Unit (PDU1) Redun Controller Failure – COL'	C

7.7 [Enabling CCSDS Checksum Validation on DMC \(Ground only\)](#)

```
cmd DMS_CCSDS_Checksum_Ena_Cmd_SW
data ONBOARD_NODE –
SYS_CCSDS_End_Point_DMC_DMS_SERV
```

7.8 [Swapping DMS telemetry packets \(Ground Only\)](#)

COL-CC

COL-CC to swap nominal DMS telemetry packets.

Wait for “Go” to continue.

<p>NOTE</p> <p>Packet swapping initiated from COL-CC: Disable VTC_Gnd_Tlm_Pkt_LOG1_VTC (1Hz) Disable VTC_Gnd_Tlm_Pkt_LOG2_VTC (1Hz) Disable VTC1_Gnd_Tlm_Pkt_PHY1_VTC (1Hz) Disable VTC2_Gnd_Tlm_Pkt_PHY1_VTC (1Hz)</p> <p>Perform {2.2.41 VTC GROUND PACKET SWAPPING} (ESA SODF: GROUND: NOMINAL), then:</p>

NOTE

Automatically started TIm Packets:

MMC_Gnd_TIm_Pkt_DMS1_DMC (0.1 Hz)

MMC_Gnd_TIm_Pkt_USM3_DMC (0.1 Hz)

Packet swapping initiated from **COL-CC**:

Enable MMC_Gnd_TIm_Pkt_COAP_DMC (0.1Hz)

Enable MMC_Gnd_TIm_Pkt_DMS2_DMC (0.1Hz)

Enable MMC_Gnd_TIm_Pkt_EPDS1_DMC (0.1Hz)

Enable MMC_Gnd_TIm_Pkt_EPDS2_DMC (0.1Hz)

Enable MMC_Gnd_TIm_Pkt_TCS1_DMC (0.1Hz)

Enable MMC_Gnd_TIm_Pkt_TCS2_DMC (0.1Hz)

Enable MMC_Gnd_TIm_Pkt_ECLSS1_DMC (0.1Hz)

Enable MMC_Gnd_TIm_Pkt_ECLSS2_DMC (0.1Hz)

Enable MMC_Gnd_TIm_Pkt_USM1_DMC (0.1Hz)

Enable MMC_Gnd_TIm_Pkt_USM2_DMC (0.1Hz)

Enable MMC_Gnd_TIm_Pkt_Monitoring_Stat1_DMC (0.1Hz)

Enable MMC_Gnd_TIm_Pkt_Monitoring_Stat2_DMC (0.1Hz)

Enable MMC_Gnd_TIm_Pkt_FLAP_Variables1_DMC (0.1Hz)

Enable MMC_Gnd_TIm_Pkt_FLAP_Variables2_DMC (0.1Hz)

Enable MMC_Gnd_TIm_Pkt_LAPAP_DMC (0.1Hz)

Enable MMC_Gnd_TIm_Pkt_DMS_Off_Nominal_DMC (0.1 Hz)

Enable MMC_Gnd_TIm_Pkt_System_Activation_DMC (1 Hz)

Perform [{2.2.42 NOMINAL DMS PACKET SWAPPING}](#) (ESA SODF: GROUND: NOMINAL). then:

COL-CC to give "Go" to continue.

8. [ACTIVATING PORTABLE WORKSTATION](#)

NOTE

1. Steps 1 through 7 must be complete before PWS activation.

2. Ground can continue to step 9.

Perform [{PWS ACTIVATION}](#), all (SODF: ASSY OPS: ACTIVATION AND CHECKOUT), then:

9. [ENABLING PDU FOR NOMINAL SYSTEM SUPPORT](#)

NOTE

Steps 9.1 through 9.3 can only be verified by the **COL-CC**.

9.1 [Enabling Nominal System Bus Control for PDU1 Subsys Power Buses](#)

PCS

Task: COL Final Activation - Part 3: COL EPDS Auto Cmd Sequences

COL EPDS Automated Command Sequences VTC1

√VTC1 Buffer Status – Empty

```

*****
*       If VTC1 Buffer – Full
*       |
*       |       sel VTC1 Cancel 2 Step Command
*       |
*       |       COL Cancel 2 - Stage Cmd VTC 1
*       |
*       |       cmd Cancel 2 – Stage Cmd Execute (Verify
*       |       – Empty)
*
*****
  
```

'PDU1'
 'Subsys Pwr Bus Control Enable ACS'

Verify Status – Enabled

Record PCS ID: _____

cmd Start – Arm

pick PCS/C-X to VTC-Com1 (where X=PCS ID)

cmd Start – Set

```

√VTC1_Two_Stage_Buffer_Status_SW_PP – EMPTY

If VTC1_Two_Stage_Buffer_Status_SW_PP – FULL
|
|       cmd VTC_Cancel_Two_Stage_Cmd_Cmd_SW
|       data Onboard_Node – SYS_CCSDS_End_Point_VTC1
|
|       Verify VTC1_Two_Stage_Buffer_Status_SW_PP –
|       EMPTY
  
```

```

cmd PDU1_Subsys_Pwr_Bus_Sys_Cntl_Ena_ACS (ARM)
data SW_CMD – VTC_Start_Terminate_ACS_Cmd_SW
data Action – 1 (START)
data Onboard_Node – SYS_CCSDS_END_POINT_VTC1

cmd VTC_Execute_2_Stage_Cmd_SW (EXEC)

Verify PDU1_ATU1_Pwr_Bus_Sys_Cntl_Stat_DMC – ENABLED
Verify PDU1_CTCU1_Pwr_Bus_Sys_Cntl_Stat_DMC –
ENABLED
Verify PDU1_Rack_D1_Pwr_Bus_Sys_Cntl_Stat_DMC –
ENABLED
Verify PDU1_Fan_Pwr_Bus_Sys_Cntl_Stat_DMC – ENABLED
  
```

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(ASSY MAL/1E/FIN/MULTI E)

```

Verify PDU1_PDU2_Redun_Pwr_Bus_Sys_Cntl_Stat_DMC – ENABLED
Verify PDU1_Subsys_Pwr_Bus1_Sys_Cntl_Stat_DMC – ENABLED
Verify PDU1_Subsys_Pwr_Bus2_Sys_Cntl_Stat_DMC – ENABLED
Verify PDU1_Subsys_Pwr_Bus3_Sys_Cntl_Stat_DMC – ENABLED
Verify PDU1_Subsys_Pwr_Bus4_Sys_Cntl_Stat_DMC – ENABLED
Verify PDU1_Subsys_Pwr_Bus5_Sys_Cntl_Stat_DMC – ENABLED
Verify PDU1_Subsys_Pwr_Bus6_Sys_Cntl_Stat_DMC – ENABLED
Verify PDU1_Subsys_Pwr_Bus7_Sys_Cntl_Stat_DMC – ENABLED
Verify PDU1_Subsys_Pwr_Bus8_Sys_Cntl_Stat_DMC – ENABLED
Verify PDU1_Subsys_Pwr_Bus9_Sys_Cntl_Stat_DMC – ENABLED
Verify PDU1_Subsys_Pwr_Bus10_Sys_Cntl_Stat_DMC – ENABLED
Verify PDU1_SUP1_Pwr_Out1_SSFC1_Sys_Cntl_Stat_DMC – ENABLED
Verify PDU1_SUP1_Pwr_Out2_SSFC1_Sys_Cntl_Stat_DMC – ENABLED
Verify PDU1_SUP1_Pwr_Out3_SSFC1_Sys_Cntl_Stat_DMC – ENABLED
Verify PDU1_SUP2_Pwr_Out1_SSFC1_Sys_Cntl_Stat_DMC – ENABLED
Verify PDU1_SUP2_Pwr_Out2_SSFC1_Sys_Cntl_Stat_DMC – ENABLED
Verify PDU1_SUP2_Pwr_Out3_SSFC1_Sys_Cntl_Stat_DMC – ENABLED
Verify PDU1_VDPU_Pwr_Bus_Sys_Cntl_Stat_DMC – ENABLED

```

9.2 [Enabling Nominal System Bus Control for ECLSS Valves](#)

Task: COL Final Activation - Part 3: COL ECLSS Auto Cmd Sequences

ECLSS Automatic Command Sequences VTC1

√VTC1 Buffer Status – Empty

```

*****
*      If VTC1 Buffer – Full
*      |
*      | sel VTC1 Cancel 2 Step Command
*      |
*      | COL Cancel 2 - Stage Cmd VTC 1
*      |
*      |
*      |
*      |
*      |
*      |
*      |
*      |
*      |
*      |
*      ~

```


SINGLE PDU 1 COLUMBUS FINAL ACTIVATION

(ASSY MAL/1E/FIN/MULTI E)

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```
* ~
* |
* |
* |
* |
* |
*****
      cmd Cancel 2 – Stage Cmd Execute (Verify
      – Empty)
```

'ECLSS Valve System Control'

Verify VTC1 Enable Status – Ena

Record PCS ID: _____

cmd Start – Arm

pick PCS/C-X to VTC-Com1 (where X=PCS ID)

cmd Start – Set

√VTC1_Two_Stage_Buffer_Status_SW_PP – EMPTY

If VTC1_Two_Stage_Buffer_Status_SW_PP – FULL

cmd VTC_Cancel_Two_Stage_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify VTC1_Two_Stage_Buffer_Status_SW_PP –
EMPTY

cmd ECLSS_Vlv_Sys_Cntl_Ena_ACS (ARM)

data SW_CMD – VTC_Start_Terminate_ACS_Cmd_SW

data Action – 1 (START)

data Onboard_Node – SYS_CCSDS_END_POINT_VTC1

cmd VTC_Execute_2_Stage_Cmd_SW (EXEC)

Verify NLSOV1_Sys_Cntl_Stat_DMC – ENABLED

Verify NLSOV2_Sys_Cntl_Stat_DMC – ENABLED

Verify NLSOV3_Sys_Cntl_Stat_DMC – ENABLED

Verify NLSOV4_Sys_Cntl_Stat_DMC – ENABLED

Verify VADD_Vlv1_Sys_Cntl_Stat_DMC – ENABLED

Verify VADD_Vlv2_Sys_Cntl_Stat_DMC – ENABLED

Verify VEDD_Vlv1_Sys_Cntl_Stat_DMC – ENABLED

Verify VEDD_Vlv2_Sys_Cntl_Stat_DMC – ENABLED

Verify WLSOV_ISPR_A1_Sys_Cntl_Stat_DMC – ENABLED

Verify WLSOV_ISPR_A2_Sys_Cntl_Stat_DMC – ENABLED

Verify WLSOV_ISPR_A3_Sys_Cntl_Stat_DMC – ENABLED

Verify WLSOV_ISPR_A4_Sys_Cntl_Stat_DMC – ENABLED

Verify WLSOV_ISPR_F1_Sys_Cntl_Stat_DMC – ENABLED

```
Verify WLSOV_ISPR_F2_Sys_Cntl_Stat_DMC – ENABLED
Verify WLSOV_ISPR_F3_Sys_Cntl_Stat_DMC – ENABLED
Verify WLSOV_ISPR_F4_Sys_Cntl_Stat_DMC – ENABLED
Verify WLSOV_ISPR_O1_Sys_Cntl_Stat_DMC – ENABLED
Verify WLSOV_ISPR_O2_Sys_Cntl_Stat_DMC – ENABLED
```

9.3 [Enabling Nominal System Bus Control for TCS Valves](#)

Task: COL Final Activation - Part 3: COL TCS Auto Cmd Sequences

COL TCS Automatic Command Sequences VTC 1

√VTC1 Buffer Status – Empty

```
*****
*           If VTC1 Buffer – Full
*           |
*           |           sel VTC1 Cancel 2 Step Command
*           |
*           |           COL Cancel 2 - Stage Cmd VTC 1
*           |
*           |           cmd Cancel 2 – Stage Cmd Execute (Verify
*           |           – Empty)
*****
```

'TCS Valve System Control Enable ACS'

Verify Status – Enabled

Record PCS ID: _____

cmd Start – Arm

pick PCS/C-X to VTC-Com1 (where X=PCS ID)

cmd Start – Set

Wait for “Go” to continue.

```
√VTC1_Two_Stage_Buffer_Status_SW_PP – EMPTY

If VTC1_Two_Stage_Buffer_Status_SW_PP – FULL
|
|           cmd VTC_Cancel_Two_Stage_Cmd_Cmd_SW
|           data Onboard_Node – SYS_CCSDS_End_Point_VTC1
|
|           Verify VTC1_Two_Stage_Buffer_Status_SW_PP –
|           EMPTY
```

```
cmd TCS_Vlv_Sys_Cntl_Ena_ACS (ARM)
```

```

data SW_CMD – VTC_Start_Terminate_ACS_Cmd_SW
data Action – 1 (START)
data Onboard_Node – SYS_CCSDS_END_POINT_VTC1

cmd VTC_Execute_2_Stage_Cmd_SW (EXEC)

Verify WOOV1_Sys_Cntl_Stat_DMC – ENABLED
Verify WOOV2_Sys_Cntl_Stat_DMC – ENABLED
Verify WOOV3_Sys_Cntl_Stat_DMC – ENABLED
Verify WOOV4_Sys_Cntl_Stat_DMC – ENABLED
Verify WOOV5_Sys_Cntl_Stat_DMC – ENABLED
Verify WOOV6_Sys_Cntl_Stat_DMC – ENABLED
Verify WOOV7_Sys_Cntl_Stat_DMC – ENABLED
Verify WOOV8_Sys_Cntl_Stat_DMC – ENABLED
Verify WOOV9_Sys_Cntl_Stat_DMC – ENABLED
Verify WOOV10_Sys_Cntl_Stat_DMC – ENABLED
Verify WFSV_ISPR_A1_Sys_Cntl_Stat_DMC – ENABLED
Verify WFSV_ISPR_A2_Sys_Cntl_Stat_DMC – ENABLED
Verify WFSV_ISPR_A3_Sys_Cntl_Stat_DMC – ENABLED
Verify WFSV_ISPR_A4_Sys_Cntl_Stat_DMC – ENABLED
Verify WFSV_ISPR_F1_Sys_Cntl_Stat_DMC – ENABLED
Verify WFSV_ISPR_F2_Sys_Cntl_Stat_DMC – ENABLED
Verify WFSV_ISPR_F3_Sys_Cntl_Stat_DMC – ENABLED
Verify WFSV_ISPR_F4_Sys_Cntl_Stat_DMC – ENABLED
Verify WFSV_ISPR_O1_Sys_Cntl_Stat_DMC – ENABLED
Verify WFSV_ISPR_O2_Sys_Cntl_Stat_DMC – ENABLED

COL-CC to give a “Go” to continue.
    
```

PWS

9.4

[Activating PDU Outlet via DMC](#)

Activation Part 1

COL Activation Part 1

'PDU Outlet Activation'

'PDU1 CTCU1 Pwr Bus'

cmd Pwr On **Execute** (OK)

Verify Pwr – ON

'PDU1 VDPU Pwr Bus'

cmd Pwr On **Execute** (OK)

Verify Pwr – ON

'PDU1 Fan Pwr Bus'

cmd Pwr On Execute (OK)

Verify Pwr – ON

cmd PDU1_CTCU1_Pwr_Bus_On_AP

data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV

data Onboard_Execution_Node –
USM SW DMC USS Swop Instance

Verify PDU1_CTCU1_Pwr_Bus_On_Off_Stat_DMC – ON

cmd PDU1_VDPU_Pwr_Bus_On_AP

data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV

data Onboard_Execution_Node –
USM SW DMC USS Swop Instance

Verify PDU1_VDPU_Pwr_Bus_On_Off_Stat_DMC – ON

cmd PDU1_Fan_Pwr_Bus_On_AP

data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV

data Onboard_Execution_Node –
USM SW DMC USS Swop Instance

Verify PDU1_Fan_Pwr_Bus_On_Off_Stat_DMC – ON

10. [ACTIVATING AND CONFIGURING HIGH RATE MULTIPLEXER](#)

NOTE

1. Fiber Optic Jumper installation must be complete before starting this step.
2. The HRM can route COL data to the USOS Ku Band system upon completion of this step. Downlink of this data stream to **COL-CC** will require configuration of the Ku-Band system.

COL-CC

- 10.1 [Swapping DMS telemetry packets \(Ground Only\)](#)
COL-CC to swap nominal DMS telemetry packets.

Wait for “Go” to continue.

NOTE

Packet swapping initiated from **COL-CC**:
 Enable MMC_Gnd_TIm_Pkt_COMMS1_DMC (0.1Hz)
 Enable MMC_Gnd_TIm_Pkt_HRM_Diagnostics_DMC (0.1Hz)

Perform [{2.2.42 NOMINAL DMS PACKET SWAPPING}](#) (ESA SODF: GROUND: NOMINAL), then:

COL-CC to give a "Go" to continue.

PWS

10.2

Activating HRM

Activation Part 1

COL Activation Part 1

'HRM Activation'

NOTE

The following command starts the FLAP 'HRM Activation', which:

- Switches ON both HRM Pwr converter A
- Activates the nominal HRM-core, if the nominal HRM-core activation fails, the redundant HRM-core is automatically activated instead
- Starts RT acquisition & monitoring of HRM data
- Enables the HRM-MMU link (Master MMU)

cmd Activate Execute (OK)

Wait up to 1 minute for verification

Verify Pwr A – ON

Verify Pwr A Current < 2.12 A

Verify Nom Core Stat – ON

Verify Nom Ready Stat – READY

cmd HRM_Activation_AP

data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV

data Onboard_Execution_Node –
USM SW DMC USS Swop Instance

Verify HRM_Pwr_A_Stat_DMC – ON

Verify HRM_Pwr_A_Current_DMC – < 2.12 A

Verify HRM_Nom_Core_Stat_DMC – ON

Verify HRM_Nom_Ready_Stat_DMC – READY

Verify HRM_Nom_Branch_Avail_Stat_SW – AVAIL

Verify HRM_Nom_Sec_Voltage_Stat_DMC – OK

10.3

Configuring HRM

COL Activation Part 1

'HRM Configuration (with CDI)'

cmd Configure Execute (OK)

Verify Serial Path TIm Input Selected – AUTO_SEL

Verify Output Datarate = 86 x 0.5 Mbps

```

cmd HRM_Configuration_with_CDI_AP
data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV
data Onboard_Execution_Node –
USM SW DMC USS Swop Instance
prm Alloc_VCID_CDI – COMMON_ALLOC_VCID
prm Config_IF_CDI – CONFIG01_CONFIG_HRM
prm Execute_Setup_Flag – 1 (TRUE)
prm CMD_Delay – 0.1 [s]
prm Stop_Start_RT_Acq – 0 (FALSE)
prm Silent – 0 (RECEIVE MESSAGE)

```

```

Verify HRM_Serial_Path_TIm_Input_Selected_DMC –
AUTO_SEL
Verify HRM_LAN_Input_Selected_DMC – AUTO_SEL
Verify HRM_High_Speed_Output_Selected_DMC – BOTH_ON
Verify HRM_Output_Datarate_DMC – 86
Verify HRM_Config_Interface_CDI_SW – 278640513
Verify HRM_VCID_Allocation_CDI_SW – 278640531

```

After starting Ku band data flow **COL-CC** to coordinate with **POIC** the HRM and Ku-Band System configuration

Wait for “Go” to continue.

11. [ACTIVATING WATER PUMP ASSEMBLY CONDENSING HEAT EXCHANGER CONTROL LOOP](#)

11.1 [Starting WPA1 RT \(Ground Only\)](#)

```

cmd DMS_RT_Start_RT_Acquisition_Cmd
prm REMOTE_TERMINAL_ID –
MIL 1553B Bus RT Svstem Bus WPA1
data Onboard_Node –
SYS CCSDS End Point DMC DMS SERV
Verify WPA1_Sys_Bus_Ena_Stat_SW – ENABLED

```

11.2 [Checking WPA1 Delta Pressure Values](#)

TCS

[TCS Functional Overview](#)

'Delta Pressure Sensor Blocks'

Verify DPSB 1 WPA1 DP1: > 18 kPa

Verify DPSB 3 WPA1 DP2: > 18 kPa

```
Verify WPA1_DPSB1_Plenum_DP1_DMC > 18 kPa
```

```
Verify WPA1_DPSB3_Plenum_DP2_DMC > 18 kPa
```

11.3 [Activating WPA Condensing Heat Exchanger Control Loop](#)

Activation Part 1

COL Activation Part 1

'WPA Final Activation (CHX Cntl Loop Activation)'

NOTE

The following command starts the FLAP 'WPA Final Activation' that:

- Determines active WPA
- Starts data acquisition from the WPA
- Enables the plenum delta pressure control loop
- Enables the CHX inlet temperature control loop

During the execution of the FLAP expect the following event message on the System Message Panel:

```
FLAP WPA_Final_Activation_AP RT MIL_1553B_Bus_RT_
System_Bus_WPA1 on Node
USM_SW_DMC_USS_Swop_Instance already started when
Receiving a Start Cmd
```

cmd Activate Execute (OK)

Verify WPA1 CHX Temp Cntl Loop Stat: ACTIVE

Verify WPA1 Plenum Delta Press Cntl Loop Stat: ACTIVE

Verify WMV3 MDV Pwr: ON

Verify WPA1 Accum Liq Qty1: 1 to 12 L

Verify WPA1 Accum Liq Qty2: 1 to 12 L

TCS:

TCS Functional Overview

'Delta Pressure Sensor Blocks'

Verify DPSB 1 WPA1 DP1: 40 to 44 kPa

Verify DPSB 3 WPA1 DP2: 40 to 44 kPa

cmd WPA_Final_Activation_AP**data** Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV**data** Onboard_Execution_Node –
USM SW DMC USS Swop Instance

Verify WPA1_CHX_Temp_Cntl_Loop_Stat_DMC – ACTIVE

Verify WMV3_MDV_Pwr_Stat_DMC – ON

Verify WPA1_Plenum_Delta_Press_Cntl_Loop_Stat_DMC –
ACTIVE

Verify WPA1_Accum_Liq_Qty1_DMC = 1 to 12 L

Verify WPA1_Accum_Liq_Qty2_DMC = 1 to 12 L

Verify WPA1_DPSB1_Plenum_DP1_DMC = 40 to 44 kPa
Verify WPA1_DPSB3_Plenum_DP2_DMC = 40 to 44 kPa

Verify WPA_Active_Pump_SW – WPA 1

11.4 [Enabling Automatic Reaction to Water Leakage](#)

DMS: FDIR Configuration

'LTHX Overtemperature FDIR'

cmd Enable **Execute** (OK)

Verify Status – ENABLE

cmd DMS_ACQ_Write_Dis_SW_Variable_Cmd_SW
prm Item_SID – WPA_Enter_BSM_FDIR_Ena_Stat_SW
prm Value – \$ENABLED

data Onboard_Node –
SYS CCSDS End Point DMC DMS SERV

Verify WPA_Enter_BSM_FDIR_Ena_Stat_SW – ENABLED

11.5 [Start LTHX Temperature Monitoring](#)

Menu Bar: DMS Monitoring: 5 - COMMS TCS Payload

'TCS'

Verify WTSB6 Low HX Temp1: ≤ 7.6 DegC

Verify WTSB6 Low HX Temp2: ≤ 7.6 DegC

'DMS Monitoring'

'Enable/Disable'

sel TCS

'Enable Monitoring WTSB'

cmd WTSB6 Low HX Temp1 **Execute** (OK)

cmd WTSB6 Low HX Temp2 **Execute** (OK)

sel Close

'TCS'

Verify the background color of measurements

WTSB6 Low HX Temp1: Green

WTSB6 Low HX Temp2: Green

Verify WTSB6_Low_HX_Temp1_DMC – ≤ 7.6 °C

Verify WTSB6_Low_HX_Temp2_DMC – ≤ 7.6 °C

cmd DMS_MONIT_Ena_Monitoring_Cmd_SW
prm MT_ID – DMC_Sys_Monitoring_Table_SW
prm EI_ID – WTSB6_Low_HX_Temp1_DMC
prm LIMIT_SET_ID – 0 (limit set 1)

data Onboard_Execution_Node –
 SYS CCSDS End Point DMC DMS SERV

Verify WTSB6_Low_HX_Temp1_DMC_MS – NORMAL_1

cmd DMS_MONIT_Ena_Monitoring_Cmd_SW
prm MT_ID – DMC_Sys_Monitoring_Table_SW
prm EI_ID – WTSB6_Low_HX_Temp2_DMC
prm LIMIT_SET_ID – 0 (limit set 1)

data Onboard_Execution_Node –
 SYS CCSDS End Point DMC DMS SERV

Verify WTSB6_Low_HX_Temp2_DMC_MS – NORMAL_1

12. ACTIVATING SMOKE DETECTOR

COL-CC

12.1 Swapping DMS telemetry packets (Ground Only)

COL-CC to swap VTC telemetry packets.

Wait for “Go” to continue.

NOTE

Packet swapping initiated from **COL-CC**:
 Enable VTC1_Gnd_Tlm_Pkt_PHY1_VTC (1Hz)
 Enable VTC2_Gnd_Tlm_Pkt_PHY1_VTC (1Hz)

Perform {2.2.41 VTC GROUND PACKET SWAPPING} (ESA SODF: GROUND: NOMINAL). then:

COL-CC to give “Go” to continue.

PCS

12.2 Powering Up Smoke Detector 1

Task: Columbus Final Activation – Part 3: Smoke Detector Activation

COL Fire Display

'Smoke Detectors'

sel Cabin SD1

COL Cabin Smoke Detector 1

sel PDU1 120V Outlets

COL PDU1 120V Outlets_VTC1

'PDU 1'

cmd Outlet No. 24 SD1 Pwr Bus – On (Verify – On)

cmd PDU1_SD1_Pwr_Bus_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU1_SD1_Pwr_Bus_On_Off_Stat_VTC_PP – ON

12.3 [Verifying Smoke Detector 1 Power Status](#)

COL Cabin Smoke Detector 1

Verify Obscuration, % Contamination < 25

Verify Scatter, % Obscuration per Meter < 1

Verify Cabin_SD1_Obscuration_VTC_PP – < 25

Verify Cabin_SD1_Scatter_VTC_PP – < 1

12.4 [Enabling Smoke Detector 1](#)

COL Cabin Smoke Detector 1

'Monitoring'

cmd Enable

Verify Status – Enabled

'Active BIT'

Verify Failure – blank

'Fire Status'

Verify Lens Status – Clean

Verify Out of Range – blank

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – Cabin_SD_1

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify Cabin_SD_1_EF – ENABLED

Verify VTC1_Cabin_SD_1_Stat_MVD – OK

MCC-H

12.5 [Enabling US C&W for Columbus Smoke Detector 1 \(Ground Only\)](#)

Enable the following events in the Primary and Backup C&C MDMs.

If ground unable to complete,

Perform [{2.101 CAUTION AND WARNING EVENT MANAGEMENT}](#), Step 2 (SODF: C&DH: NOMINAL) per Table 4, then

Table 4. C&W Events for COL Smoke Detector 1

Event	Text	Class
13500	'FIRE Smoke Detector 1 Cabin - COL'	E

13. [ACTIVATING CONDENSATE WATER SEPARATOR ASSEMBLY](#)

NOTE

Condensate Jumper must be installed prior to beginning this step.

PCS

13.1 [Opening Columbus Condensate Line Shut Off Valve](#)

COL: ECLSS: CLSOV

COL CLSOV VTC1

cmd Position – Open

Verify Position Ind – Open

cmd CLSOV_Vlv_Open_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CLSOV_Vlv_Open_Stat_VTC_PP – OPEN

PWS

13.2 [Activating CWSA](#)

Activation Part 1: Activation Part 2: Activation Part 3

COL Activation Part 3

'CWSA1 Activation'

NOTE

The following command starts FLAP 'CWSA1 Activation' that:
 Checks the availability of the CWSA
 Powers on the CWSA
 Enables the monitoring of the CWSA parameters
 Enables the monitoring of the LCOS parameters

SINGLE PDU 1 COLUMBUS FINAL ACTIVATION

(ASSY MAL/1E/FIN/MULTI E)

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cmd Activate **Execute** (OK)

Wait 20 seconds for telemetry stabilization

Verify Pwr: ON

Verify Delta P Air: > 0.5 kPa

Verify Motor Speed: 4500 to 6800 rpm

Verify Input Current: < 0.50 A

cmd CWSA1_Activation_AP

data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV

data Onboard_Execution_Node –
USM SW DMC USS Swop Instance

Verify CWSA1_Pwr_Stat_DMC – ON

Verify CWSA1_Delta_P_Air_DMC – >0.5 kPa

Verify CWSA1_Motor_Speed_DMC – 4500-6800 rpm

Verify CWSA1_Input_Current_DMC – <0.5 A

14. ACTIVATING CABIN FAN ASSEMBLY

Activation Part 1: Activation Part 2: Activation Part 3

COL Activation Part 3

'CFA1 Activation (w/o monitoring)'

cmd Pwr_On **Execute** (OK)

Verify Pwr: ON

Verify Delta P: > 0.25 kPa

Verify Fan Speed: 7500 to 8500 rpm

Verify Input Current: < 1.5A

cmd CFA1_Pwr_On_AP

data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV

data Onboard_Execution_Node – USM_SW_DMC_USS_Swop_Instance

Verify CFA1_Pwr_Stat_DMC – ON

Verify CFA1_Delta_P_DMC – >0.25 kPa

Verify CFA1_Fan_Speed_DMC – 7500-8500 rpm

Verify CFA1_Input_Current_DMC – <1.5 A

15. ACTIVATING CABIN TEMP CONTROL UNIT

Activation Part 1: Activation Part 2: Activation Part 3

COL Activation Part 3

'CTCU1 Activation'

SINGLE PDU 1 COLUMBUS FINAL ACTIVATION

(ASSY MAL/1E/FIN/MULTI E)

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NOTE

The following command starts the FLAP 'CTCU1 Activation' that:
Checks that the other CTCU is not controlling the TCV
Checks the availability of the CTCU
Checks that at least one CFA is active
Powers on the CTCU
Enables monitoring of the CTCU parameters
Activates the TCV
Enables cabin temperature control

cmd Activate **Execute** (OK)

NOTE

The cabin temperature may need time to stabilize to the nominal temperature range. If the cabin temperature is out of the expected values, continue with the procedure.

Verify Pwr: ON
Verify Health Stat: OK
Verify TCV_Cntl Stat: ENABLED
Verify Cntl Loop Stat: ENABLED
Verify Avg Cabin Temp: 18 to 27 deg C

cmd CTCU1_Activation_AP

data Onboard_Reception_Node –

SYS CCSDS End Point DMC DMS SERV

data Onboard_Execution_Node – USM_SW_DMC_USS_Swop_Instance

Verify CTCU1_Pwr_Stat_DMC – ON

Verify CTCU1_Health_Stat_DMC – OK

Verify CTCU1_TCV_Cntl_Stat_DMC – ENABLED

Verify CTCU1_Cntl_Loop_Stat_DMC – ENABLED

Verify CTCU1_Avg_Cabin_Temp_DMC – 18-27 °C

16. OPENING SAMPLE LINE SHUTOFF VALVE

NOTE

1. The AR Sample Jumper must be installed prior to opening the Sample Line Shutoff Valve.
2. Pressure equalization of the Columbus Module must be performed before opening the Sample Line Shutoff Valves.

PCS

COL: ECLSS: Air Loop: SLSOV

COL SLSOV VTC1

cmd Position – Open

Verify Position Ind – Open

cmd SLSOV_Vlv_Open_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify SLSOV_Vlv_Open_Stat_VTC_PP – OPEN

17. [ESTABLISHING INTERMODULE VENTILATION](#)

NOTE

1. IMV duct installation must be completed before starting this step.
2. NPRA Valve removal and IMV installation must be completed prior to this step.

17.1 [Activating Node 2 IMV Stbd Aft Valve](#)

Node 2: ECLSS: IMV Stbd Aft Vlv

sel RPCM N22A3B C RPC 02

cmd RPC Position – Close (Verify – Cl)

'Enable'

cmd Arm (√Arm Status – Armed)

cmd Enable (√State – Enabled)

17.2 [Opening Node 2 IMV Stbd Aft Valve](#)

'Open'

cmd Arm (√Arm Status – Armed)

cmd Open

√Position – In Transit

Wait 25 seconds.

√Position – Open

17.3 [Activating Node 2 IMV Stbd Fwd Valve](#)

Node 2: ECLSS: IMV Stbd Fwd Vlv

sel RPCM N22A3B C RPC 06

RPCM_N22A3B_C_RPC_06

cmd RPC Position – Close (Verify – Cl)

Node 2 IMV Stbd Fwd Vlv

'Enable'

cmd Arm (√Arm Status – Armed)

cmd Enable (√State – Enabled)

17.4 [Opening Node 2 IMV Stbd Fwd Valve](#)

Node 2 IMV Stbd Fwd Vlv

'Open'

cmd Arm (√Arm Status – Armed)

cmd Open

√Position – In Transit

Wait 25 seconds.

√Position – Open

17.5 [Closing Columbus IMV valves](#)

COL: ECLSS: Air Loop: ISSOV

COL IMV Valves VTC1

'IMV Return Shutoff Valve'

cmd Position – Closed

Verify Position Ind – Closed

'IMV Supply Shutoff Valve'

cmd Position – Close

Verify Position Ind – Closed

cmd IRSOV_Vlv_Close_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify IRSOV_Vlv_Close_Stat_VTC_PP – CLOSED

cmd ISSOV_Vlv_Close_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify ISSOV_Vlv_Close_Stat_VTC_PP – CLOSED

17.6 [Opening Columbus IMV valves](#)
 COL: ECLSS: Air Loop: ISSOV

COL IMV Valves VTC1

'IMV Return Shutoff Valve'

cmd Position – Open

Verify Position Ind – Open

'IMV Supply Shutoff Valve'

cmd Position – Open

Verify Position Ind – Open

cmd IRSOV_Vlv_Open_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify IRSOV_Vlv_Open_Stat_VTC_PP – OPEN

cmd ISSOV_Vlv_Open_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify ISSOV_Vlv_Open_Stat_VTC_PP – OPEN

17.7 [Activating Columbus IMV Return Fan](#)

COL: ECLSS: Air Loop: IRFA

COL IMV Fans

√VTC1 Buffer Status – Empty

```
*****
*           If VTC1 Buffer – Full
*           |
*           |   sel VTC1 Cancel 2 Step Command
*           |
*           |   COL Cancel 2 - Stage Cmd VTC 1
*           |
*           |   cmd Cancel 2 - Stage Cmd Execute (Verify –
*           |   Empty)
*           |
*****
```

'Set Speed - VTC1 hardwire'

SINGLE PDU 1 COLUMBUS FINAL ACTIVATION

(ASSY MAL/1E/FIN/MULTI E)

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NOTE

The following ACS sets the IMV Return Fan speed to 8800 rpm.

Record PCS ID: _____

cmd Start – Arm

pick PCS/C-X to VTC-Com1 (where X=PCS ID)

cmd Start – Set

'IMV Return Fan Assembly'

cmd State – On

Verify Delta P: > 0.3 kPa

Verify Fan Speed: 8300 to 9300 rpm

Verify Fan Temp: < 60 degC

Verify IRFA Power: On

√VTC1_Two_Stage_Buffer_Status_SW_PP – EMPTY

If VTC1_Two_Stage_Buffer_Status_SW_PP – FULL

cmd VTC_Cancel_Two_Stage_Cmd_Cmd_SW

data Onboard_Node SYS_CCSDS_End_Point_VTC1

Verify VTC1_Two_Stage_Buffer_Status_SW_PP –
EMPTY

cmd IRFA_Speed_Set_ACS (ARM)

data SW_CMD – VTC_Start_Terminate_ACS_Cmd_SW

data Action – 1 (START)

data Onboard_Node – SYS_CCSDS_END_POINT_VTC1

cmd VTC_Execute_2_Stage_Cmd_SW (EXEC)

cmd IRFA_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node: – SYS_CCSDS_End_Point_VTC1

Verify IRFA_Delta_P_MVD – >0.3 kPa

Verify IRFA_Fan_Speed_MVD – 8300-9300 rpm

Verify IRFA_Fan_Temp_VTC – < 60 degC

Verify IRFA_Pwr_Stat_MVD – ON

17.8 [Enabling VTC Monitoring for IRFA \(Ground Only\)](#)

COL-CC

COL-CC to enable IRFA monitoring

SINGLE PDU 1 COLUMBUS FINAL ACTIVATION

(ASSY MAL/1E/FIN/MULTI E)

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Wait for "Go" to continue.

```
cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – IRFA_Fan_Temp_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1
```

Verify IRFA_Fan_Temp_VTC_MEF – ENABLED

```
cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – IRFA_Delta_P_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1
```

Verify IRFA_Delta_P_VTC_MEF – ENABLED

```
cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – IRFA_Fan_Speed_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1
```

Verify IRFA_Fan_Speed_VTC_MEF – ENABLED

COL-CC to give a "Go" to continue.

18. [ACTIVATING COLUMBUS ECLSS FDIR FOR NOMINAL OPS](#)

18.1 [Configuring for CFA to Nominal Ops](#)

PWS

Activation Part 1: Activation Part 2: Activation Part 3

COL Activation Part 3

'Cabin Loop Final Activation'

'CFA1'

NOTE

Due to missing IMV Supply Fan expect C&W messages and FLAP event messages on the PWS.

NOTE

The following command starts the FLAP 'CFA1 Activation' that:

- Checks the availability of the CFA
- Sets the Cabin Fan speed to 9200 rpm
- Powers on the CFA
- Enables monitoring of the CFA parameters

cmd Activate Execute (OK)

SINGLE PDU 1 COLUMBUS FINAL ACTIVATION

(ASSY MAL/1E/FIN/MULTI E)

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Verify CFA1 Pwr: ON

Verify CFA1 Fan Speed: 8700 to 9700 rpm

Verify CFA1 Input Current: < 1.5 A

cmd CFA1_Activation_AP

data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV

data Onboard_Execution_Node –
USM SW DMC USS Swop Instance

Verify CFA1_Pwr_Stat_DMC – ON

Verify CFA1_Fan_Speed_DMC – 8700 - 9700 rpm

Verify CFA1_Input_Current_DMC – <1.5 A

ECLSS: ECLSS Commands:

ECLSS Commands

'ECLSS Configuration Commands'

'Set CFA 1 Speed'

NOTE

1. ISFA and CFA2 are not powered, therefore the CFA1 Fan Speed has to be increased to the maximum speed.
2. After increasing the CFA1 Fan Speed the following two measurements will show Out-Of-Limit conditions:
 - CFA1 Input Current
 - CFA1 Fan Speed

cmd 12900 **Execute** (OK)

Verify CFA1 Fan Speed: 12400 - 13400 rpm

ECLSS: AFS

AFS

'Air Flow Sensors'

Verify CFA1 Delta P: 0.61 to 1.2 kPa

Verify AFS1 Cab Air Massflow: 240 to 510 m³/h

cmd CFA1_Set_Speed_AP

prm Speed: 12900

data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV

data Onboard_Execution_Node –
USM SW DMC USS Swop Instance

Verify CFA1_Fan_Speed_DMC – 12400 - 13400 rpm

Verify CFA1_Delta_P_DMC – 0.61 - 1.2 kPa

SINGLE PDU 1 COLUMBUS FINAL ACTIVATION

(ASSY MAL/1E/FIN/MULTI E)

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Verify AFS1_Cab_Air_Massflow_MVD – 240 - 510 m³/h

PCS

18.2 [Activating VTC Monitoring for Air Flow Sensor 1](#)

COL: ECLSS: Atmos

Columbus Atmosphere

Verify Airflow Sensor 1 Massflow: > 240 m³/hr

cmd Airflow Sensor 1 Massflow Monitoring – Enable (Verify – Enabled)

Verify AFS1_Cab_Air_Massflow_VTC – > 240 m³/h

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – AFS1_Cab_Air_Massflow_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify AFS1_Cab_Air_Massflow_VTC_MEF – ENABLED

MCC-H

18.3 [Enabling USOS C&W for Air Flow Sensor 1 \(Ground Only\)](#)

Enable the following events in the Primary and Backup C&C MDMs.

If ground unable to complete,

Perform [{2.101 CAUTION AND WARNING EVENT MANAGEMENT}](#), Step 2 (SODF: C&DH: NOMINAL) per Table 5, then

Table 5. C&W Event for Cabin Air Flow

Event	Text	Class
13532	'Cabin Air Flow Sensor 1 Low - COL'	W

PCS

18.4 [Activating VTC Monitoring for TPS Sensors](#)

COL: ECLSS: Atmos

Columbus Atmosphere

Verify Air Press 1 – 719 to 770 mmHg

cmd Air Press 1 Monitoring Status – Enable (Verify – Enabled)

Verify Air Press 2 – 719 to 770 mmHg

cmd Air Press 2 Monitoring Status – Enable (Verify – Enabled)

Verify TPS1_Air_Press_VTC – 719 to 770 mmHg

```

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – TPS1_Air_Press_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify TPS1_Air_Press_VTC_MEF – ENABLED

Verify TPS2_Air_Press_VTC – 719 to 770 mmHg

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – TPS2_Air_Press_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify TPS2_Air_Press_VTC_MEF – ENABLED
    
```

MCC-H

18.5 [Enabling USOS C&W for TPS \(Ground Only\)](#)

Enable the following events in the Primary and Backup C&C MDMs.

If ground unable to complete,

Perform [{2.101 CAUTION AND WARNING EVENT MANAGEMENT}](#), Step 2 (SODF: C&DH: NOMINAL) per Table 6, then

Table 6. C&W Events for TPS1

Event	Text	Class
13526	'Total Pressure Sensor 1 Low - COL'	W

PCS

18.6 [Enabling Monitoring for PPOS and PPCS](#)

COL: ECLSS: Atmos

COL Atmosphere

Verify ppO2 Sensor 1: 124 to 188 mmHg

cmd ppO2 Sensor 1 Monitoring Status – Enable (Verify – Enabled)

Verify ppCO2 Sensor 1: < 10 mmHg

cmd ppCO2 Sensor 1 Monitoring Status – Enable (Verify – Enabled)

```

Verify PPOS1_Press_VTC – 124 to 188 mmHg

cmd VTC_Monitoring_Ena_Cmd_SW
    
```

```

prm Monitored_Item_ID – PPOS1_Press_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PPOS1_Press_VTC_MEF – ENABLED

Verify PPCS1_Press_VTC – < 10 mmHg

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – PPCS1_Press_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PPCS1_Press_VTC_MEF – ENABLED
    
```

COL-CC 18.7 [Swapping DMS telemetry packets \(Ground Only\)](#)
COL-CC to swap VTC DMS telemetry packets.

Wait for “Go” to continue.

<p>NOTE</p> <p>Packet swapping initiated from COL-CC: Disable VTC1_Gnd_Tlm_Pkt_PHY1_VTC (1Hz) Disable VTC2_Gnd_Tlm_Pkt_PHY1_VTC (1Hz)</p> <p>Perform {2.2.41 VTC GROUND PACKET SWAPPING} (ESA SODF: GROUND: NOMINAL). then:</p> <p>COL-CC to give “Go” to continue.</p>
--

19. [DISABLING PPR FUNCTION](#)

PCS 19.1 [Closing PPRA Valves](#)
 Task: COL Final Activation – Part 3: COL PPRAs
COL PPRA 1-2 VTC1

√PPRA1 Position – Close (Verify Ind – Closed)

√PPRA2 Position – Close (Verify Ind – Closed)

```

√PPRA1_Vlv_Close_Stat_VTC_PP – CLOSED

If PPRA1_Vlv_Close_Stat_VTC_PP – OPEN
|
|   cmd PPRA1_Vlv_Close_VTC
|   data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
|   data Onboard_Node – SYS_CCSDS_End_Point_VTC1
|
|   Verify PPRA1_Vlv_Close_Stat_VTC_PP – CLOSED
    
```

```

√PPRA2_Vlv_Close_Stat_VTC_PP – CLOSED

If PPRA2_Vlv_Close_Stat_VTC_PP – OPEN
    cmd PPRA2_Vlv_Close_VTC
    data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
    data Onboard_Node – SYS_CCSDS_End_Point_VTC1

    Verify PPRA2_Vlv_Close_Stat_VTC_PP – CLOSED
    
```

19.2 [Enabling VTC Monitoring of PPRAs](#)

COL PPRa 1-2 VTC1

cmd PPRa1 Close Status Monitoring – Enabled (Verify – Enabled)

cmd PPRa2 Close Status Monitoring – Enabled (Verify – Enabled)

```

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – PPRa1_Vlv_Close_Stat_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PPRa1_Vlv_Close_Stat_Monitoring_Ena_VTC_PP – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – PPRa2_Vlv_Close_Stat_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PPRa2_Vlv_Close_Stat_Monitoring_Ena_VTC_PP – ENABLED
    
```

19.3 [Enabling VTC monitoring of CDAs](#)

COL: ECLSS: Cabin Depress Assemblies

Columbus Cabin Depress Assemblies

sel CDA 1 Vlv 1 Vlv 2

COL CDA 1-2 Valve Control VTC1

'CDA 1 Valve 1'

cmd Close Status Monitoring – Enable (Verify – Enabled)

'CDA 1 Valve 2'

SINGLE PDU 1 COLUMBUS FINAL ACTIVATION

(ASSY MAL/1E/FIN/MULTI E)

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cmd Close Status Monitoring – Enable (Verify – Enabled)

'CDA 2 Valve 1'

cmd Close Status Monitoring – Enable (Verify – Enabled)

'CDA 2 Valve 2'

cmd Close Status Monitoring – Enable (Verify – Enabled)

Columbus Cabin Depress Assemblies

sel CDA 3 Vlv 1 Vlv 2

COL CDA 3-4 Valve Control VTC1

'CDA 3 Valve 1'

cmd Close Status Monitoring – Enable (Verify – Enabled)

'CDA 3 Valve 2'

cmd Close Status Monitoring – Enable (Verify – Enabled)

'CDA 4 Valve 1'

cmd Close Status Monitoring – Enable (Verify – Enabled)

'CDA 4 Valve 2'

cmd Close Status Monitoring – Enable (Verify – Enabled)

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – CDA1_Vlv1_Close_Stat_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CDA1_Vlv1_Close_Stat_Monitoring_Ena_VTC_PP –
ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – CDA1_Vlv2_Close_Stat_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CDA1_Vlv2_Close_Stat_Monitoring_Ena_VTC_PP –
ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW

SINGLE PDU 1 COLUMBUS FINAL ACTIVATION

(ASSY MAL/1E/FIN/MULTI E)

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prm Monitored_Item_ID – CDA2_Vlv1_Close_Stat_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CDA2_Vlv1_Close_Stat_Monitoring_Ena_VTC_PP –
ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – CDA2_Vlv2_Close_Stat_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CDA2_Vlv2_Close_Stat_Monitoring_Ena_VTC_PP –
ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – CDA3_Vlv1_Close_Stat_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CDA3_Vlv1_Close_Stat_Monitoring_Ena_VTC_PP –
ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – CDA3_Vlv2_Close_Stat_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CDA3_Vlv2_Close_Stat_Monitoring_Ena_VTC_PP –
ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – CDA4_Vlv1_Close_Stat_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CDA4_Vlv1_Close_Stat_Monitoring_Ena_VTC_PP –
ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – CDA4_Vlv2_Close_Stat_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CDA4_Vlv2_Close_Stat_Monitoring_Ena_VTC_PP –
ENABLED

19.4 [Enabling VTC monitoring of VVMRVs](#)

COL: ECLSS: Payload VV

Columbus Payload Vacuum and Venting

sel VEMRV

Columbus VEDD - VTC1

'Venting Manual Repressurization Valve'

cmd Close Monitoring – Enable (Verify – Enabled)

Columbus Payload Vacuum and Venting

sel VAMRV

Columbus VADD - VTC1

'Vacuum Manual Repressurization Valve'

cmd Close Monitoring – Enable (Verify – Enabled)

```

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – VEMRV_Vlv_Close_Stat_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify VEMRV_Vlv_Close_Stat_Monitoring_Ena_VTC_PP –
ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – VAMRV_Vlv_Close_Stat_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify VAMRV_Vlv_Close_Stat_Monitoring_Ena_VTC_PP –
ENABLED

```

20. [ACTIVATING PLCU](#)

20.1 [Powering up PLCU](#)

PWS

Activation Part 1: Activation Part 2: Activation Part 3:
Activation Part 4

COL Activation Part 4

'PLCU Activation (In Default Mode)'

NOTE
Expect FLAP exception messages after the following command.

NOTE

The following command starts the FLAP 'PLCU Act In Default Mode' that:

- Checks that the SPC3 is not active
- Switches SPC3 power A and power B on
- Boot the PLCU in default mode
- Enables the monitoring of the SPC3 ready status

cmd Activate Execute (OK)

- Verify Pwr B – On
- Verify Ready Stat – Ready
- Verify Pwr B Current < 1.39 A
- Verify Sec Voltage Stat – OK

cmd PLCU_Act_In_Default_Mode_AP

data Onboard_Reception_Node –
 SYS CCSDS End Point DMC DMS SERV
data Onboard_Execution_Node –
 USM SW DMC USS Swop Instance

- Verify PLCU_Pwr_B_Stat_DMC – ON
- Verify PLCU_Ready_Stat_DMC – READY
- Verify PLCU_Pwr_B_Current_DMC – < 1.39 A
- Verify PLCU_Sec_Voltage_Stat_DMC – OK

20.2 [Enabling CCSDS Checksum Validation on PLCU \(Ground only\)](#)

cmd DMS_CCSDS_Checksum_Ena_Cmd_SW

data ONBOARD_NODE –
 SYS_CCSDS_End_Point_PLCU_DMS_SERV

21. [ACTIVATING XCMU](#)

Activation Part 1: Activation Part 2: Activation Part 3: Activation Part 4:

COL Activation Part 4

'XCMU Activation'

NOTE

Expect FLAP exception messages after the following command.

NOTE

The following command starts the FLAP 'XCMU Activation' that:
 Checks that the XCMU is available
 Checks that the redundant XCMU is off
 Switches XCMU nom power A and nom power B on
 Enables the monitoring of the nominal XCMU ready status

cmd Activate Execute (OK)

SINGLE PDU 1 COLUMBUS FINAL ACTIVATION

(ASSY MAL/1E/FIN/MULTI E)

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Verify Nom Pwr B – On
Verify Nom Ready Stat – Ready
Verify Nom Pwr B Current < 1.13 A
Verify Nom Sec Voltage Stat – OK

cmd XCMU_Activation_AP

data Onboard_Reception_Node –

SYS CCSDS End Point DMC DMS SERV

data Onboard_Execution_Node – USM_SW_DMC_USS_Swop_Instance

Verify XCMU_Nom_Pwr_B_Stat_DMC – ON

Verify XCMU_Nom_Ready_Stat_DMC – READY

Verify XCMU_Nom_Pwr_B_Current_DMC – <1.13 A

Verify XCMU_Nom_Sec_Voltage_Stat_DMC – OK

SINGLE PDU 2 COLUMBUS BERTHED SURVIVAL MODE ACTIVATION

(ASSY MAL/1E/FIN/MULTI E)

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OBJECTIVE:

Initial activation of Columbus Module through HCU activation and checkout with the power outlets of only PDU2 active. The PDU1 valve driving section will be powered by the PDU2 cross strapped power outlet and working properly. This procedure will end the thermal clock started when the module is removed from the PL Bay.

INITIAL CONDITIONS:

MULTIPLE PDU PWR STATUS FAILURES Mal procedure identifies a PDU failure

DDCUs N2P2A and N2P3A repowered

N2-1 and N2-2 MDMS nominal

Hardwired connectors mated

1553 connections mated

COL POWER jumper (W5012) mated

VTC Redundancy Management inhibited

1. VERIFYING NODE MDMS ARE NOMINAL
 - 1.1 Verifying N2-1 MDM

CDH Summary: N2-1

Node 2-1 MDM

Verify Frame Count – <incrementing>
Verify Processing State – Operational
 - 1.2 Verifying N2-2 MDM

CDH Summary: N2-2

Node 2-2 MDM

Verify Frame Count – <incrementing>
Verify Processing State – Operational
2. ACTIVATING PDU
 - 2.1 Activating PDU2 MB2 Nominal Main Auxiliary Converter

Task: COL Berthed Survival Mode

COL Berthed Survival Mode

'Power Distribution Unit'

cmd PDU2 Nom Pwr – On

Verify PDU2 Nom Pwr Status – On
Verify PDU2 VTC2 Pwr Bus Status – On
Verify PDU2 Main Input Current < 5 A
 - 2.2 Activating PDU2 MB2 Redundant Main Auxiliary Converter

COL Berthed Survival Mode

'Power Distribution Unit'

cmd PDU2 Redun Pwr – On

Verify PDU2 Redun Pwr Status – On
Verify PDU2 VTC1 Pwr Bus Status – On
Verify PDU2 Main Input Current < 5 A

3. [ENABLING COMMUNICATION WITH C&C MDM](#)

<p><u>NOTE</u> Expect VTC-1 and VTC-2 failed C&W messages</p>

3.1 [Inhibiting VTC Redundancy Management](#)

Task: COL Berthed Survival Mode

COL Berthed Survival Mode

'Vital Telemetry and Telecommand Controller'
'Inhibit VTC Redun Management'

√Master VTC Recovery Step 1 – Inh
√Master VTC Recovery Step 2 – Inh
√Slave VTC Recovery – Inh

3.2 [Enabling RT I/O with VTC1](#)

Task: COL Berthed Survival Mode: CB INT 1 RT Status

CB INT 1 RT Status

cmd 21 VTC 1 RT Status – Enable **Execute** (Verify – Ena)

3.3 [Enabling RT I/O with VTC2](#)

Task: COL Berthed Survival Mode: CB INT 2 RT Status

CB INT 2 RT Status

cmd 21 VTC 2 RT Status – Enable **Execute** (Verify – Ena)

4. [ACTIVATING AND INITIALIZING VTC1 AND VTC2](#)

<p><u>NOTE</u> 1. Steps 4.1 through 4.4 require AOS. 2. VTC2 Ready Status indication can be acquired only when VTC1 is in Idle Mode.</p>
--

4.1 [Activating VTC2 Idle Mode via Nom Power A](#)

Task: COL Berthed Survival Mode

COL Berthed Survival Mode

'VTC2 Nominal Config'

cmd VTC2 Nom Pwr A – On

Verify VTC2 Nom Pwr A Status – On
 Verify VTC2 Nom Pwr A Current < 2.14 A
 Verify VTC2 Idle Config Mode – Idle Mode

MCC-H gives COL-CC “Go” to continue

COL-CC

4.2 [Enabling VTC2 Pre-emptive telemetry packets \(Ground Only\)](#)
COL-CC to enable VTC2 pre-emptive telemetry packets.

Wait for “Go” to continue.

NOTE

Packet swapping initiated from **COL-CC**: Enable
 VTC2_Gnd_Tlm_Pkt_PHY1_VTC (1Hz)

Perform [{2.2.41 VTC GROUND PACKET SWAPPING}](#) (ESA
 SODF: GROUND: NOMINAL). then:

COL-CC to give a “Go” to continue.

PCS

4.3 [Activating VTC1 Idle Mode via Nom Power B](#)

COL Berthed Survival Mode

'VTC1 Nominal Config'

cmd VTC1 Nom Pwr B – On

Verify VTC1 Nom Pwr B Status – On
 Verify VTC1 Nom Pwr B Current < 2.14 A
 Verify VTC1 Idle Config Mode – Idle Mode

Verify VTC1 Nom Ready Status – Ready
 Verify VTC2 Nom Ready Status – Ready

Verify VTC1 Nom Temp < 48 °C
 Verify VTC2 Nom Temp < 48 °C

cmd VTC1_Nom_Pwr_B_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify VTC1_Nom_Pwr_B_Stat_VTC = ON
 Verify VTC1_Nom_Pwr_B_Current_VTC – <2.14 A
 Verify VTC1_INT_DATA_IDLE_CONF_MODE_SW – IDLE
 Verify VTC1_Nom_Ready_Stat_VTC – READY
 Verify VTC1_Nom_Temp_VTC – < 48 °C

COL-CC

4.4 [Enabling VTC1 Pre-emptive telemetry packets \(Ground Only\)](#)
COL-CC to enable VTC1 pre-emptive telemetry packets.

Wait for "Go" to continue.

NOTE

Packet swapping initiated from COL-CC: Enable
VTC1_Gnd_Tlm_Pkt_PHY1_VTC (1Hz)

Perform [{2.2.41 VTC GROUND PACKET SWAPPING}](#) (ESA SODF: GROUND: NOMINAL). then:

Verify VTC2_Nom_Ready_Stat_VTC – READY

Verify VTC2_Nom_Temp_VTC – < 48 °C

COL-CC to give a "Go" to continue.

5. [CONFIGURING VTC1 TO MASTER AND VTC2 TO SLAVE](#)

PCS

5.1 [Initializing VTC2 in Slave Mode](#)

Task: COL Berthed Survival Mode

COL Berthed Survival Mode

'Vital Telemetry and Telecommand Controller'

cmd VTC 2 Initialization (Default) – Slave

Verify VTC2 Mode – Slave

Verify VTC2 Idle Config Mode – Not Idle

cmd VTC_Initialization_Cmd_SW

prm Init_Mode – 0 (SLAVE)

prm Init_Limit_Set – 0 (DEFAULT)

prm Init_APM_Mode – 2 (N/A)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify VTC2_INT_DATA_MASTER_SLAVE_MODE_SW – SLAVE

Verify VTC2_INT_DATA_IDLE_CONF_MODE_SW – NOT_IDLE

5.2 [Enabling Physical Telemetry Packets](#)

COL Berthed Survival Mode

'Vital Telemetry and Telecommand Controller'

cmd Tlm Packets Physical 4 – Enable

cmd Tlm Packets Physical 5 – Enable

cmd VTC_Tlm_Pkt_Ena_Cmd_SW

prm Packet_ID – VTC2_Tlm_Pkt_PHY4_VTC

prm Action – 1 (ENABLE)

prm Checksum_Flag – 1 (ENABLE)

prm Dump_Pipe – 0 (TLM_P)


```

prm APID_Value – 1268
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

cmd VTC_Tlm_Pkt_Ena_Cmd_SW
prm Packet_ID – VTC2_Tlm_Pkt_PHY5_VTC
prm Action – 1 (ENABLE)
prm Checksum_Flag – 1 (ENABLE)
prm Dump_Pipe – 0 (TLM_P)
prm APID_Value – 1268
data Onboard_Node – SYS_CCSDS_End_Point_VTC2
    
```

5.3 [Notifying VTC1 that VTC2 is in Slave Mode](#)

COL Berthed Survival Mode

'Vital Telemetry and Telecommand Controller'

cmd Notify VTC1 - VTC2 in Slave – Notify

```

cmd VTC_Notify_Mode_Cmd_SW
prm New_Mode – 0 (SLAVE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1
    
```

5.4 [Initializing VTC1 in Master Mode](#)

COL Berthed Survival Mode

'Vital Telemetry and Telecommand Controller'

cmd VTC 1 Initialization (Default, Vital) – Master

Verify VTC1 Mode – Master
 Verify VTC1 DMS Mode – Vital
 Verify VTC1 Idle Config Mode – Not Idle

```

cmd VTC_Initialization_Cmd_SW
prm Init_Mode – 1 (MASTER)
prm Init_Limit_Set – 0 (DEFAULT)
prm Init_APM_Mode – 1 (VITAL)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify VTC1_INT_DATA_MASTER_SLAVE_MODE_SW – MASTER
Verify VTC1_INT_DATA_APM_MODE_SW – VITAL
Verify VTC1_INT_DATA_IDLE_CONF_MODE_SW – NOT_IDLE
    
```

5.5 [Enabling Logical Telemetry Packets](#)

COL Berthed Survival Mode

'Vital Telemetry and Telecommand Controller'

cmd Tlm Packets Logical 1 – Enable

cmd Tlm Packets Logical 2 – Enable

```

cmd VTC_Tlm_Pkt_Ena_Cmd_SW
prm Packet_ID – VTC_Tlm_Pkt_LOG1_VTC
prm Action – 1 (ENABLE)
prm Checksum_Flag – 1 (ENABLE)
prm Dump_Pipe – 0 (TLM_P)
prm APID_Value – 1267
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

cmd VTC_Tlm_Pkt_Ena_Cmd_SW
prm Packet_ID – VTC_Tlm_Pkt_LOG2_VTC
prm Action – 1 (ENABLE)
prm Checksum_Flag – 1 (ENABLE)
prm Dump_Pipe – 0 (TLM_P)
prm APID_Value – 1267
data Onboard_Node – SYS_CCSDS_End_Point_VTC1
    
```

COL-CC

5.6 [Swapping DMS Telemetry Packets \(Ground Only\)](#)

COL-CC to swap VTC telemetry packets.

Wait for “Go” to continue.

NOTE

Packet swapping initiated from COL-CC:
 Disable VTC1_Gnd_Tlm_Pkt_PHY2_VTC (1Hz)
 Disable VTC2_Gnd_Tlm_Pkt_PHY2_VTC (1Hz)
 Enable VTC_Gnd_Tlm_Pkt_LOG1_VTC (1Hz)
 Enable VTC_Gnd_Tlm_Pkt_LOG2_VTC (1Hz)

Perform [{2.2.41 VTC GROUND PACKET SWAPPING}](#) (ESA SODF: GROUND: NOMINAL). then:

COL-CC to give a “Go” to continue.

PCS

5.7 [Enabling VTC Vital Bus FDIR](#)

Task: COL Berthed Survival Mode: CDH: Vital Bus
 COL Vital Bus

cmd Vital Bus Recon – Enable

Verify Vital Bus Recon – Enable

```

cmd VTC_Vital_Sys_Bus_Recon_Ena_Cmd_SW
prm BUS_ID – 0 (Vital)
prm RECONFIGURATION_ENABLE – 1 (Enable)
data Onboard_Node – SYS_CCSDS_End_Point_VTCM
    
```

Verify VTC_MASTER_Vital_Bus_Recon_Ena_SW_PP – ENABLE

5.8 [Enabling VTC System Bus FDIR](#)

Task: COL Berthed Survival Mode: CDH: System Bus

COL System Bus

cmd System Bus Recon – Enable

Verify System Bus Recon – Enable

cmd VTC_Vital_Sys_Bus_Recon_Ena_Cmd_SW

prm BUS_ID – 1 (System)

prm RECONFIGURATION_ENABLE – 1 (Enable)

cmd Onboard_Node – SYS_CCSDS_End_Point_VTCM

Verify VTC_MASTER_System_Bus_Recon_Ena_SW_PP – ENABLE

5.9 [Enabling RT FDIR with VTC1](#)

Task: COL Berthed Survival Mode: CB INT 1 RT Status

CB INT 1 RT Status

cmd 21 VTC 1 RT FDIR Status – Enable FDIR **Execute** (Verify – Ena)

5.10 [Enabling RT FDIR with VTC2](#)

Task: COL Berthed Survival Mode: CB INT 2 RT Status

CB INT 2 RT Status

cmd 21 VTC 2 RT FDIR Status – Enable FDIR **Execute** (Verify – Ena)

5.11 [Enabling VTC Redundancy Management](#)

Task: COL Berthed Survival Mode

COL Berthed Survival Mode

'Vital Telemetry and Telecommand Computer'

'Enable VTC Redun Management'

cmd Master VTC Recovery Step 1 – Enable (Verify – Ena)

cmd Master VTC Recovery Step 2 – Enable (Verify – Ena)

cmd Slave VTC Recovery – Enable (Verify – Ena)

5.12 [Enabling C&W for VTC Redundant Management \(Ground Only\)](#)

Enable the following events in the Primary and Backup C&C MDMs.

If ground unable to complete,

|

~

MCC-H

Perform [{2.101 CAUTION AND WARNING EVENT MANAGEMENT}](#), step 2 (SODF: C&DH: NOMINAL) per Table 1, then

Table 1. C&W Events for DMS Master & Slave Recovery

Event	Text	Class
13608	DMS MASTER VTC Recovery Step 1 Failure - COL	C
13609	DMS MASTER VTC Recovery Step 2 Failure - COL	C
13610	DMS SLAVE VTC Recovery Failure - COL	C

6. [ACTIVATING PDU CROSS STRAPPED POWER BUS](#)

PCS

6.1 [Verifying Microcontroller Status](#)

Task: COL Berthed Survival Mode

COL Berthed Survival Mode

'PDU Redun Pwr Bus Act'

Verify PDU2 Nom Cntl – On

Verify PDU2 Redun Cntl – Off

Verify PDU2_Nom_Cntl_Stat_VTC – ON
 Verify PDU2_Redun_Cntl_Stat_VTC – OFF

6.2 [Verifying VTC1 two stage buffer status](#)

COL Berthed Survival Mode

'PDU Redun Pwr Bus Act'

√VTC1 Buffer – Empty

```

*****
*           If VTC1 Buffer – Full
*           |
*           |           cmd VTC1 Buffer – Clear
*           |           Verify VTC1 Buffer – Empty
*           |
*****
    
```

√VTC1_INT_DATA_TWOSTEP_FULL_SW – EMPTY

If VTC1_INT_DATA_TWOSTEP_FULL_SW - FULL

cmd VTC_Cancel_Two_Stage_Cmd_Cmd_SW
data Onboard_Node - SYS_CCSDS_End_Point_VTC1

Verify VTC1_INT_DATA_TWOSTEP_FULL_SW -
 EMPTY

6.3 [Activating All PDU2 Aux Converters for 120V Outlets](#)

COL Berthed Survival Mode

'Aux Supplies Activation'

Record PCS ID: _____

cmd Start ACS PDU Config - Arm

pick PCS/C-X to VTC-Com1 (where X=PCS ID)

cmd Start ACS PDU Config - Set

COL-CC to verify PDU SSPC Aux Converter status.

Wait for "Go" to continue.

cmd PDU_Config_ACS (ARM)

data SW_CMD - VTC_Start_Terminate_ACS_Cmd_SW

data Action - 1 (START)

data Onboard_Node - SYS_CCSDS_End_Point_VTC1

Verify VTC1_INT_DATA_TWOSTEP_FULL_SW - FULL

cmd VTC_Execute_2_Stage_Cmd_SW (EXEC)

Verify PDU2_SSPC_Aux_Conv1_Stat_VTC - ON

Verify PDU2_SSPC_Aux_Conv2_Stat_VTC - ON

Verify PDU2_SSPC_Aux_Conv3_Stat_VTC - ON

Verify PDU2_SSPC_Aux_Conv4_Stat_VTC - ON

Verify PDU2_SSPC_Aux_Conv5_Stat_VTC - ON

Verify PDU2_SSPC_Aux_Conv6_Stat_VTC - ON

Verify PDU2_SSPC_Aux_Conv7_Stat_VTC - ON

Verify PDU2_SSPC_Aux_Conv8_Stat_VTC - ON

Verify PDU2_SSPC_Aux_Conv9_Stat_VTC - ON

COL-CC to give a "Go" to continue.

6.4 [Activating PDU2 to PDU1 Power Outlet](#)

COL Berthed Survival Mode

'Cross Strapped Power Bus Activation'

cmd PDU 2/1 Redun Pwr Bus – On

Verify PDU 2/1 Redun Pwr Bus Status – On

cmd PDU2_PDU1_Redun_Pwr_Bus_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU1_PDU2_Redun_Pwr_Bus_On_Off_Stat_VTC_PP – ON

6.5 [Activating PDU1 Cross Strapped Converter](#)

COL Berthed Survival Mode

'Converter Activation'

cmd PDU1 Cross Strapped Conv – On

Verify PDU1 Cross Strapped Conv Status – On

cmd PDU1_Cross_Strapped_Conv_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU1_Cross_Strapped_Conv_Stat_VTC – ON

6.6 [Activating PDU Lights Power Bus](#)

COL: EPS: Lights

COL PDU 1-2 Lights VTC1

cmd PDU 2 Outlet 21 – On (Verify – On)

cmd PDU2_MLU_Pwr_Bus_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU2_MLU_Pwr_Bus_On_Off_Stat_VTC_PP – ON

7. [ACTIVATING HEATER CONTROL UNIT](#)7.1 [Activating HCU2 Power Bus](#)

Task: COL Berthed Survival Mode

COL Berthed Survival Mode

'Heater Control Unit'

SINGLE PDU 2 COLUMBUS BERTHED SURVIVAL MODE ACTIVATION

(ASSY MAL/1E/FIN/MULTI E)

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cmd PDU2 HCU2 Pwr Bus – On

Verify PDU2 HCU2 Pwr Bus Status – On

Verify PDU2 HCU2 Input Current < 10 A

cmd PDU2_HCU2_Pwr_Bus_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU2_HCU2_Pwr_Bus_On_Off_Stat_VTC_PP – ON

Verify PDU2_HCU2_Pwr_Bus_Current_VTC_PP – < 10 A

Verifying Heater Control Loop Status (Ground Only)

NOTE

TLM only available after 30 sec delay following HCU power on because of HCU SW initialization.

Verify HCU2_AO_Htr_Cntl_Loop_Stat_VTC – ENABLED

Verify HCU2_AD_Htr_Cntl_Loop_Stat_VTC – ENABLED

Verify HCU2_AR_Htr_Cntl_Loop_Stat_VTC – ENABLED

Verify HCU2_FD_Htr_Cntl_Loop_Stat_VTC – ENABLED

Verify HCU2_FO_Htr_Cntl_Loop_Stat_VTC – ENABLED

Verify HCU2_FR_Htr_Cntl_Loop_Stat_VTC – ENABLED

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SINGLE PDU2 COLUMBUS FINAL ACTIVATION

(ASSY MAL/1E/FIN/MULTI E)

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OBJECTIVE:

Continuing activation of Columbus Module with only the power outlets of PDU2 active. The PDU1 valve driving section is powered by the PDU2 cross strapped power outlet and working properly.

INITIAL CONDITIONS:

Single PDU2 Columbus Berthed Survival Mode Activation is complete.

1. ACTIVATING PDU OUTLET

PCS

1.1 Activating PDU2 Subsystem Power Buses 1 thru 5

Task: COL Final Activation - Part 1

COL Final Activation - Part 1

'PDU Outlet Activation'

PDU2 Subsys Pwr Bus [X] where [X] = [1] [2] [3] [4] [5]

cmd PDU2 Subsys Pwr Bus [X] – On

Verify PDU2 Subsys Pwr Bus Posn [X] – On

Repeat

cmd PDU2_Subsys_Pwr_Bus1_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU2_Subsys_Pwr_Bus1_On_Off_Stat_VTC_PP – ON

cmd PDU2_Subsys_Pwr_Bus2_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU2_Subsys_Pwr_Bus2_On_Off_Stat_VTC_PP – ON

cmd PDU2_Subsys_Pwr_Bus3_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU2_Subsys_Pwr_Bus3_On_Off_Stat_VTC_PP – ON

cmd PDU2_Subsys_Pwr_Bus4_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU2_Subsys_Pwr_Bus4_On_Off_Stat_VTC_PP – ON

cmd PDU2_Subsys_Pwr_Bus5_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

SINGLE PDU2 COLUMBUS FINAL ACTIVATION

(ASSY MAL/1E/FIN/MULTI E)

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data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU2_Subsys_Pwr_Bus5_On_Off_Stat_VTC_PP – ON

1.2 [Activating PDU2 Subsystem Power Buses 6 thru 10](#)

COL Final Activation - Part 1

'PDU Outlet Activation'

PDU2 Subsys Pwr Bus where [X] = [6] [7] [8] [9] [10]

cmd PDU2 Subsys Pwr Bus [X] – On

Verify PDU2 Subsys Pwr Bus Posn [X] – On

Repeat

cmd PDU2_Subsys_Pwr_Bus6_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU2_Subsys_Pwr_Bus6_On_Off_Stat_VTC_PP – ON

cmd PDU2_Subsys_Pwr_Bus7_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU2_Subsys_Pwr_Bus7_On_Off_Stat_VTC_PP – ON

cmd PDU2_Subsys_Pwr_Bus8_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU2_Subsys_Pwr_Bus8_On_Off_Stat_VTC_PP – ON

cmd PDU2_Subsys_Pwr_Bus9_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU2_Subsys_Pwr_Bus9_On_Off_Stat_VTC_PP – ON

cmd PDU2_Subsys_Pwr_Bus10_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU2_Subsys_Pwr_Bus10_On_Off_Stat_VTC_PP – ON

1.3 [Activating PDU2 D1 Rack Power](#)

COL Final Activation - Part 1

'PDU Outlet Activation'

'PDU2'

cmd Rack D1 Pwr Bus – On

Verify Rack D1 Pwr Bus – On

```
cmd PDU2_Rack_D1_Pwr_Bus_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1
```

Verify PDU2_Rack_D1_Pwr_Bus_On_Off_Stat_VTC_PP – ON

1.4 [Activating WPA1 and WPA2 Accumulator Pressure Sensors \(Ground Only\)](#)

COL-CC

COL-CC to activate WPA1 and WPA2 Accumulator Pressure Sensors.

Wait for “Go” to continue.

NOTE

1. This step can only be performed by **COL-CC**.
2. If the sensor readings show values below 165 kPa a pressurization of the accumulator is required prior to payload rack connector mate. Continue with [step 1.5](#).
3. If both readings of either pair of WPA Accumulator Pressure sensors are out of limits after the monitoring has been enabled, the system will automatically safe to Berthed Survival Mode.

```
cmd WPA1_Accum_Press_Snsr1_Pwr_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1
```

Verify WPA1_Accum_Abs_Press1_VTC – 165 -195 kPa

```
cmd WPA1_Accum_Press_Snsr2_Pwr_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC2
```

Verify WPA1_Accum_Abs_Press2_VTC – 165 -195 kPa

```
cmd WPA2_Accum_Press_Snsr1_Pwr_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC2
```

Verify WPA2_Accum_Abs_Press1_VTC – 165 -195 kPa

```

cmd WPA2_Accum_Press_Snsr2_Pwr_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WPA2_Accum_Abs_Press2_VTC – 165 -195 kPa

Activation of the VTC C&W monitoring for the WPA1 and WPA2
Accumulator Pressure Sensors

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – WPA1_Accum_Abs_Press1_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WPA1_Accum_Abs_Press1_VTC_MEF – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – WPA1_Accum_Abs_Press2_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify WPA1_Accum_Abs_Press2_VTC_MEF – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – WPA2_Accum_Abs_Press1_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify WPA2_Accum_Abs_Press1_VTC_MEF – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – WPA2_Accum_Abs_Press2_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WPA2_Accum_Abs_Press2_VTC_MEF – ENABLED

COL-CC gives "Go" to continue..
    
```

MCC-H

1.5

[Enabling C&W for Previous Monitorings \(Ground Only\)](#)

Enable the following events in the Primary and Backup C&C MDMs.

If ground unable to complete,

 | Perform [{2.101 CAUTION AND WARNING EVENT MANAGEMENT}](#), Step 2 (SODF: C&DH: NOMINAL) per Table 1, then

Table 1. C&W Events for WPA1 and WPA2

Event	Text	Class
13538	'WPA1 Accumulator Pressure Sensor 1 High - COL'	W
13539	'WPA1 Accumulator Pressure Sensor 2 High - COL'	W
13540	'WPA2 Accumulator Pressure Sensor 1 High - COL'	W
13541	'WPA2 Accumulator Pressure Sensor 2 High - COL'	W

1.6 [Verifying Total Pressure Sensors](#)

COL Final Activation - Part 1

'Total Pressure Sensor'

Verify TPS3 Air Pressure: 719 to 783 mmHg

Verify TPS4 Air Pressure: 719 to 783 mmHg

Verify TPS3_Air_Press_VTC – 719 - 783 mmHg

Verify TPS4_Air_Press_VTC – 719 - 783 mmHg

2. [ACTIVATING CMU 1-4](#)

NOTE

1. CMU4 needs to be activated for CMU1 Ready Status to be available

2. The water loop must be activated within five hours of CMU activation.

2.1 [Activating Nominal Power A Supplies](#)

PCS

Task: COL Final Activation - Part 1

COL Final Activation - Part 1

'Command and Measurement Unit Activation'

cmd CMU 1 Nom Pwr A – On

Verify CMU 1 Nom Pwr A Status – On

Verify CMU 1 Nom Pwr A Current < 1.35 A

cmd CMU 2 Nom Pwr A – On

SINGLE PDU2 COLUMBUS FINAL ACTIVATION

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Verify CMU 2 Nom Pwr A Status – On
Verify CMU 2 Nom Pwr A Current < 1.35 A
Verify CMU 2 Ready Status – Ready

cmd CMU 3 Nom Pwr A – On

Verify CMU 3 Nom Pwr A Status – On
Verify CMU 3 Nom Pwr A Current < 1.35 A
Verify CMU 3 Ready Status – Ready

cmd CMU 4 Nom Pwr A – On

Verify CMU 4 Nom Pwr A Status – On
Verify CMU 4 Nom Pwr A Current < 1.35 A
Verify CMU 4 Ready Status – Ready

Verify CMU 1 Ready Status – Ready

cmd CMU1_Nom_Pwr_A_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CMU1_Nom_Pwr_A_Stat_VTC – ON
Verify CMU1_Nom_Pwr_A_Current_VTC < 1.35 A

cmd CMU2_Nom_Pwr_A_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CMU2_Nom_Pwr_A_Stat_VTC – ON
Verify CMU2_Nom_Pwr_A_Current_VTC < 1.35 A
Verify CMU2_Nom_Ready_Stat_ACT_PP – READY

cmd CMU3_Nom_Pwr_A_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CMU3_Nom_Pwr_A_Stat_VTC – ON
Verify CMU3_Nom_Pwr_A_Current_VTC < 1.35 A
Verify CMU3_Nom_Ready_Stat_ACT_PP – READY

cmd CMU4_Nom_Pwr_A_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CMU4_Nom_Pwr_A_Stat_VTC – ON
Verify CMU4_Nom_Pwr_A_Current_VTC < 1.35 A

Verify CMU4_Nom_Ready_Stat_ACT_PP – READY
Verify CMU1_Nom_Ready_Stat_ACT_PP – READY

3. [ACTIVATING WATER LOOP](#)

NOTE

1. TCS Jumpers must be installed prior to beginning this step.
2. Expect valve operations to take up to 15 seconds for verification.

3.1 [Configuring Loop A IFHX and Loop B IFHX for Water Loop Activation](#)

COL: TCS: MTL IFHX

COL MTL IFHX Commands

'COL MTL IFHX NH3'

'Isol Vlv'

Verify Position – Closed

cmd Cntrl Avail Open – Ena (Verify Cntrl Avail – Ena)

cmd Position – Open (Verify Position – Open)

'Byp Vlv'

Verify Position – Bypass

cmd Cntrl Avail Flothru – Ena (Verify Cntrl Avail – Ena)

cmd Position – Flothru (Verify Position – Flothru)

COL: TCS: LTL IFHX

COL LTL IFHX Commands

'COL LTL IFHX NH3'

'Isol Vlv'

Verify Position – Closed

cmd Cntrl Avail Open – Ena (Verify Cntrl Avail – Ena)

cmd Position – Open (Verify Position – Open)

'Byp Vlv'

Verify Position – Bypass

cmd Cntrl Avail Flothru – Ena (Verify Cntrl Avail – Ena)

cmd Position – Flothru (Verify Position – Flothru)

3.2 [Configuring Water On/Off Valve](#)

Task: COL Final Activation - Part 2

COL Final Activation - Part 2

'Water Loop Activation'

'Water On Off Valves'

Verify WOOV1 Posn – Open

Verify WOOV2 Posn – Closed

Verify WOOV3 Posn – Open

Verify WOOV4 Posn – Open

Verify WOOV5 Posn – Open

Verify WOOV6 Posn – Open

Verify WOOV7 Posn – Open

Verify WOOV8 Posn – Open

Verify WOOV9 Posn – Open

Verify WOOV10 Posn – Closed

Verify WOOV1_Open_Stat_VTC_PP – OPEN

Verify WOOV2_Close_Stat_VTC_PP – CLOSED

Verify WOOV3_Open_Stat_VTC_PP – OPEN

Verify WOOV4_Open_Stat_VTC_PP – OPEN

Verify WOOV5_Open_Stat_VTC_PP – OPEN

Verify WOOV6_Open_Stat_VTC_PP – OPEN

Verify WOOV7_Open_Stat_VTC_PP – OPEN

Verify WOOV8_Open_Stat_VTC_PP – OPEN

Verify WOOV9_Open_Stat_VTC_PP – OPEN

Verify WOOV10_Close_Stat_VTC_PP – CLOSED

Water Flow Selection Valve Configuration Verification

Verify WFSV_ISPR_A1_Open_Stat_VTC – OPEN

Verify WFSV_ISPR_A2_Open_Stat_VTC – OPEN

Verify WFSV_ISPR_A3_Open_Stat_VTC – OPEN

Verify WFSV_ISPR_A4_Open_Stat_VTC – OPEN

Verify WFSV_ISPR_F1_Open_Stat_VTC – OPEN

Verify WFSV_ISPR_F2_Open_Stat_VTC – OPEN

Verify WFSV_ISPR_F3_Open_Stat_VTC – OPEN

Verify WFSV_ISPR_F4_Open_Stat_VTC – OPEN

Verify WFSV_ISPR_O1_Open_Stat_VTC – OPEN

Verify WFSV_ISPR_O2_Open_Stat_VTC – OPEN

3.3 [Activating and Verifying WMV1 Shutoff Valve](#)

Task: COL Final Activation - Part 2: TCS: WMV1

COL WMV1 AND 2 ACT VTC1

'Commands'

'WMV 1 MDV'

cmd WMV 1 MDV – Redun

Verify WMV1 Pwr Status – Redun

'WMV1 SOV1'

cmd WMV1 SOV1 Power – On

Verify WMV1 SOV1 Power – On

cmd WMV1 SOV1 Position – Closed

Verify WMV1 SOV1 Position – Closed

Verify WMV1 SOV2 Position – Closed

cmd WMV1_Redun_Pwr_Sel_ACT

data SW_CMD: – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node: – SYS_CCSDS_End_Point_VTC1

Verify WMV1_MDV_Nom_Redun_Pwr_Stat_ACT_PP – REDUN

cmd _WMV1_SOV_Pwr_On_ACT

data SW_CMD: – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node: – SYS_CCSDS_End_Point_VTC1

Verify WMV1_SOV_Pwr_Stat_ACT_PP – ON

cmd WMV1_SOV_Close_ACT

data SW_CMD: – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node: – SYS_CCSDS_End_Point_VTC1

Verify WMV1_SOV1_Close_Stat_ACT_PP – CLOSED

Verify WMV1_SOV2_Close_Stat_ACT_PP – CLOSED

3.4 [Deactivating WMV1 Shutoff Section](#)

COL WMV1 AND 2 Act VTC1

'Commands'

'WMV 1 SOV1'

cmd WMV1 SOV1 Power – Off

Verify WMV1 SOV1 Power – Off

cmd WMV1_SOV_Pwr_Off_ACT
data SW_CMD: – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node: – SYS_CCSDS_End_Point_VTC1

Verify WMV1_SOV_Pwr_Stat_ACT_PP – OFF

3.5 [Activating and Verifying WMV2 Shutoff Valve](#)

COL WMV1 AND 2 Act VTC1

'Commands'
'WMV2 SOV1'

cmd WMV2 SOV1 Power – On

Verify WMV2 SOV1 Pwr Status – On

cmd WMV2 SOV1 Position – Open

Verify WMV2 SOV1 Position – Open
Verify WMV2 SOV2 Position – Open

cmd WMV2_SOV_Pwr_On_ACT
data SW_CMD - VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WMV2_SOV_Pwr_Stat_ACT_PP – ON

cmd WMV2_SOV_Open_ACT
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WMV2_SOV1_Open_Stat_ACT_PP – OPEN
Verify WMV2_SOV2_Open_Stat_ACT_PP – OPEN

3.6 [Deactivating WMV2 Shutoff Section](#)

COL WMV1 AND 2 Act VTC1

'Commands'
'WMV2 SOV1'

cmd WMV2 SOV1 Power – Off

Verify WMV2 SOV1 Power – Off

cmd WMV2_SOV_Pwr_Off_ACT
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WMV2_SOV_Pwr_Stat_ACT_PP – OFF

3.7 [Activating and Verifying WMV3 Shutoff Valve](#)

Task: COL Final Activation - Part 2: TCS: WMV3

COL WMV3 AND 4 Act VTC1

'WMV 3 MDV'

cmd WMV 3 MDV – Redun

Verify WMV3 Pwr Status – Redun

'WMV3 SOV1'

cmd WMV3 SOV1 Power – On

Verify WMV3 SOV1 Power – On

cmd WMV3 SOV1 Position – Closed

Verify WMV3 SOV1 Position – Closed

Verify WMV3 SOV2 Position – Closed

cmd WMV3_Redun_Pwr_Sel_ACT**data** SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW**data** Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WMV3_MDV_Nom_Redun_Pwr_Stat_ACT_PP – REDUN

cmd WMV3_SOV_Pwr_On_ACT**data** SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW**data** Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WMV3_SOV_Pwr_Stat_ACT_PP – ON

cmd WMV3_SOV_Close_ACT**data** SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW**data** Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WMV3_SOV1_Close_Stat_ACT_PP – CLOSED

Verify WMV3_SOV2_Close_Stat_ACT_PP – CLOSED

3.8 [Deactivating WMV3 Shutoff Section](#)

COL WMV3 AND 4 Act VTC1

'Commands'

'WMV 3 SOV1'

cmd WMV3 SOV1 Power – Off

Verify WMV3 SOV Power – Off

cmd WMV3_SOV_Pwr_Off_ACT
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

 Verify WMV3_SOV_Pwr_Stat_ACT_PP – OFF

3.9 [Activating and Verifying WMV4 Shutoff Valve](#)

COL WMV3 AND 4 Act VTC1

'Commands'
 'WMV 4 SOV1'

cmd WMV4 SOV1 Power – On

 Verify WMV4 SOV1 Pwr Status – On

cmd WMV4 SOV1 Position – Open

 Verify WMV4 SOV1 Position – Open
 Verify WMV4 SOV2 Position – Open

cmd WMV4_SOV_Pwr_On_ACT
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

 Verify WMV4_SOV_Pwr_Stat_ACT_PP – ON

cmd WMV4_SOV_Open_ACT
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

 Verify WMV4_SOV1_Open_Stat_ACT_PP – OPEN
 Verify WMV4_SOV2_Open_Stat_ACT_PP – OPEN

3.10 [Deactivating WMV4 Shutoff Section](#)

COL WMV3 AND 4 Act VTC1

'Commands'
 'WMV 4 SOV1'

cmd WMV4 SOV1 Power – Off

 Verify WMV4 SOV1 Power – Off

cmd WMV4_SOV_Pwr_Off_ACT
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

 Verify WMV4_SOV_Pwr_Stat_ACT_PP – OFF

3.11 [Closing Bypass Valves WOOV5 and WOOV7](#)

Task: COL Final Activation - Part 2

COL Final Activation - Part 2

'Bypass Valves'

cmd WOOV5 – Close

Verify WOOV5 Posn – Closed

cmd WOOV7 – Close

Verify WOOV7 Posn – Closed

cmd WOOV5_Vlv_Close_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WOOV5_Close_Stat_VTC_PP – CLOSED

cmd WOOV7_Vlv_Close_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WOOV7_Close_Stat_VTC_PP – CLOSED

3.12 [Opening WPA2 Inlet Valve WOOV2](#)

Task: COL Final Activation - Part 2: TCS: WOOV2

COL WOOV 1 AND 2 VTC 1

'Commands'

'WOOV 2'

cmd WOOV2 Position – Open

Verify WOOV2 Position – Open

cmd WOOV2_Vlv_Open_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WOOV2_Open_Stat_VTC_PP – OPEN

3.13 [Closing WPA1 Inlet Valve WOOV1](#)

COL WOOV 1 AND 2 VTC 1

'Commands'

'WOOV 1'

cmd WOOV1 Position – Close

Verify WOOV1 Position – Closed

```
cmd WOOV1_Vlv_Close_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WOOV1_Close_Stat_VTC_PP – CLOSED
```

3.14 [Opening CHX2 Inlet Valve WOOV10](#)

Task: COL Final Activation - Part 2: TCS: WOOV10

COL WOOV 9 AND 10 VTC 1

'Commands'
'WOOV 10'

cmd WOOV10 Position – Open

Verify WOOV10 Position – Open

```
cmd WOOV10_Vlv_Open_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WOOV10_Open_Stat_VTC_PP – OPEN
```

3.15 [Closing CHX1 Inlet Valve WOOV9](#)

COL WOOV 9 AND 10 VTC 1

'Commands'
'WOOV 9'

cmd WOOV9 Position – Close

Verify WOOV9 Position – Closed

```
cmd WOOV9_Vlv_Close_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WOOV9_Close_Stat_VTC_PP – CLOSED
```

3.16 [Activating WMV2 Modulating Section](#)

Task: COL Final Activation - Part 2: TCS: WMV2

COL WMV 1 AND 2 Act VTC 1

'Commands'
'WMV2 MDV'

cmd WMV2 MDV Power – On

Verify WMV2 MDV Power – On

```
cmd WMV2_MDV_Pwr_On_ACT
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1
```

Verify WMV2_MDV_Pwr_Stat_ACT_PP – ON

3.17 [Activating WPA2](#)

Task: COL Final Activation - Part 2: TCS: WPA2

COL WPA2 Act VTC 1

'Commands'

cmd WPA2 Power – On

Verify WPA 2 Power – On

```
cmd WPA2_Pwr_On_ACT
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1
```

Verify WPA2_Pwr_Stat_ACT_PP – ON

3.18 [Starting up WPA2 Pump Operation](#)

COL WPA2 Act VTC 1

'Commands'

NOTE

This step activates active cooling via the water loop and terminates the thermal clock started with CMU Activation in step 2

cmd WPA2 Pump Initialization – Start

Verify Pump dP > 30 kPa

Verify Mass Flow > 230 kg/h

Verify Redun Plenum dP > 18 kPa

```
cmd WPA2_Pump_Init_ACT -
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1
```

Verify WPA2_Pump_DP_ACT_PP – > 30 kPa

Verify WPA2_Mass_Flow_ACT_PP – > 230 kg/h

Verify DPSB2_Redun_Plenum_DP_VTC – > 18 kPa

3.19 [Enabling Monitoring of Delta Pressure Sensor Block](#)

COL Final Activation - Part 2

'Delta Pressure Sensor Block'

NOTE

If the reading of the DPSB dP is out of limits after the monitoring has been enabled, the system will automatically safe to Berthed Survival Mode.

cmd DPSB2 Redun Plenum dP Mon – Enable

Verify DPSB2 Redun Plenum dP Mon Status – Enabled

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID: – DPSB2_Redun_Plenum_DP_VTC

prm Action – 1 (ENABLE)

data Onboard_Node: – SYS_CCSDS_End_Point_VTC2

Verify DPSB2_Redun_Plenum_DP_VTC_MEF – ENABLED

3.20 [Verifying Wet Temperatures](#)

COL Final Activation - Part 2

'Wet Temperature Sensor Block'

'WTSB1 Nom Plenum Temp 3'

Verify WTSB1 Nom Plenum Temp 3 < 24 deg C

'WTSB2 Redun Plenum Temp 3'

Verify WTSB2 Redun Plenum Temp 3 < 24 deg C

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```
*****
*       If WTSB1 Nom Plenum Temp 3 ≥ 24 deg C
*       or
*       WTSB2 Redun Plenum Temp 3 ≥ 24 deg C
*
*       Wait five minutes then re-verify
*****
```

Verify WTSB1_Nom_Plenum_Temp3_VTC – < 24°C
Verify WTSB2_Redun_Plenum_Temp3_VTC – < 24°C

3.21 [Enabling Monitoring of WTSB measurements](#)

COL Final Activation - Part 2

'Wet Temperature Sensor Block'

NOTE

If both readings of the WTSB Plenum Temp3 are out of limits after the monitoring has been enabled, the system will automatically safe to Berthed Survival Mode.

cmd WTSB1 Nom Plenum Temp 3 Monitor – Enable

Verify WTSB1 Nom Plenum Temp 3 Monitor Status – Enabled

cmd WTSB2 Redun Plenum Temp 3 Monitor – Enable

Verify WTSB2 Redun Plenum Temp 3 Monitor Status – Enabled

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – WTSB1_Nom_Plenum_Temp3_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WTSB1_Nom_Plenum_Temp3_VTC_MEF – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – WTSB2_Redun_Plenum_Temp3_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify WTSB2_Redun_Plenum_Temp3_VTC_MEF – ENABLED

3.22 [Enabling C&W in USOS for Previous Monitorings \(Ground Only\)](#)

MCC-H

Enable the following events in the Primary and Backup C&C MDMs.

If ground unable to complete,

Perform [{2.101 CAUTION AND WARNING EVENT MANAGEMENT}](#), Step 2 (SODF: C&DH: NOMINAL) per Table 2, then

Table 2. C&W Events for DPSB & WTSB

Event	Text	Class
13535	'Cooling Loop Delta Pressure Sensor 2 Low - COL'	W
14165	'Cooling Loop Temperature Sensor 1 High - COL'	W
14166	'Cooling Loop Temperature Sensor 2 High - COL'	W

PCS

3.23 [Activating ATU Power Bus](#)

COL: EPS: PDU2 120V Outlets Subsys/Payloads:

COL PDU2 120V Outlets VTC1

'PDU2'

'Outlet Num 20'

cmd ATU2 Pwr Bus – On

Verify ATU2 Pwr Pwr – On

cmd PDU2_ATU2_Pwr_Bus_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU2_ATU2_Pwr_Bus_On_Off_Stat_VTC_PP – ON

4. [ACTIVATING NETWORK CLSW](#)

4.1 [Activating CLSW1 Power B](#)

Task: COL Final Activation - Part 3

COL Final Activation - Part 3

'Network CLSW'

cmd CLSW 1 Pwr B – On

Verify CLSW 1 Pwr B Status – On

Verify CLSW 1 Pwr B Current < 2.6 A

Verify CLSW 1 Pwr A Ready Status – Ready

cmd CLSW1_Pwr_B_On_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CLSW1_Pwr_B_Stat_ACT_PP – ON

Verify CLSW1_Pwr_B_Current_ACT_PP – <2.6 A
Verify CLSW1_Ready_Stat_ACT_PP – READY

4.2 [Activating CLSW 2 Power A](#)

COL Final Activation - Part 3

'Network CLSW'

cmd CLSW 2 Pwr A – On

Verify CLSW 2 Pwr A Status – On

Verify CLSW 2 Pwr A Current < 2.5 A

Verify CLSW 2 Pwr A Ready Status – Ready

cmd CLSW2_Pwr_A_On_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CLSW2_Pwr_A_Stat_ACT_PP – ON

Verify CLSW2_Pwr_A_Current_ACT_PP – <2.5 A

Verify CLSW2_Ready_Stat_ACT_PP – READY

5. [ACTIVATING MASS MEMORY UNIT](#)

5.1 [Activating MMU2 Power B](#)

Task: COL Final Activation - Part 3

COL Final Activation - Part 3

'Mass Memory Unit'

cmd MMU2 Pwr B – On

Verify MMU2 Pwr B Status – On

Verify MMU2 Pwr B Current < 1.87 A

cmd MMU2_Pwr_B_On_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify MMU2_Pwr_B_Stat_ACT_PP – ON

Verify MMU2_Pwr_B_Current_ACT_PP – <1.87 A

5.2 [Commanding MMU2 to Slave Mode](#)

COL Final Activation - Part 3

'Mass Memory Unit'

cmd Boot MMU 2 – Slave

Wait up to 5 minutes for MMU2 Ready Status to be displayed

Verify MMU2 Ready Status – Ready

```
cmd VTC_Boot_SPC_Cmd_SW
prm RT_Address – 27 (RT address of MMU2)
prm Mode – 9 (MMU_SLAVE)
prm Session Number – 1
data Onboard_Node – SYS_CCSDS_END_POINT_VTCM
```

Verify MMU2_Ready_Stat_ACT_PP – READY

5.3 [Activating MMU1 Power A](#)

COL Final Activation - Part 3

'Mass Memory Unit'

cmd MMU1 Pwr A – On

Verify MMU1 Pwr A Status – On

Verify MMU1 Pwr A Current < 1.58 A

```
cmd MMU1_Pwr_A_On_ACT
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1
```

Verify MMU1_Pwr_A_Stat_ACT_PP – ON

Verify MMU1_Pwr_A_Current_ACT_PP – <1.58 A

5.4 [Commanding MMU1 to Master Mode](#)

COL Final Activation - Part 3

'Mass Memory Unit'

cmd Boot MMU 1 – Master

Wait up to 5 minutes for MMU1 Ready Status to be displayed

Verify MMU1 Ready Status – Ready

```
cmd VTC_Boot_SPC_Cmd_SW
prm RT_Address – 17 (RT address of MMU1)
prm Mode – 7 (MMU_MASTER_DEFAULT)
prm Session Number – 1
data Onboard_Node – SYS_CCSDS_END_POINT_VTCM
```

Verify MMU1_Ready_Stat_ACT_PP – READY

6. [ACTIVATING MISSION MANAGEMENT COMPUTER](#)

NOTE

1. Steps 6.3 through 6.6 require AOS
2. Expect DMS C&W messages

6.1 [Inhibiting Redun Management for MMC](#)

Task: COL Final Activation - Part 3

COL Final Activation - Part 3

'Mission Management Computer'

√MMC Redun Management – Inh

6.2 [Enabling RT I/O for MMC](#)

Task: COL Final Activation - Part 3: CB INT 2 RT Status

CB INT 2 RT Status

cmd 22 MMC RT Status – Enable **Execute** (Verify – Ena)

6.3 [Activating MMC Power B](#)

Task: COL Final Activation - Part 3

COL Final Activation - Part 3

'Mission Management Computer'

cmd MMC Pwr B – On

Verify MMC Pwr B Status – On

Verify MMC Pwr B Current < 1.39 A

cmd MMC_Pwr_B_On_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify MMC_Pwr_B_Stat_ACT_PP – ON

Verify MMC_Pwr_B_Current_ACT_PP – < 1.39 A

6.4 [Initializing Command MMC S/W](#)

COL Final Activation - Part 3

'Mission Management Computer'

NOTE

During the MMC boot process, the configuration FLAPs 'MMC Cold Start' and 'MMC Start-Up' are executed automatically.

The MMC Cold Start FLAP:
 Starts monitorings of the MMC node
 Executes the MMC Startup FLAP

The MMC Start-Up FLAP:
 Resets the station mode compatibility variable and venting valve inhibit status
 Activates MMC hosted application software (COAP IDF task)
 Starts the SNCD TIm packet to the US MDM
 Starts the pre-emptive TIm packet for DMS data to **COL-CC**
 Starts the pre-emptive TIm packet for USM data to **COL-CC**

cmd MMC Boot – MMC Default

Verify SPC2 Boot Report – 66048

Wait up to 5 minutes for MMC to boot before checking Ready Status

Verify MMC Ready Status – Ready

Wait for “Go” to continue

cmd VTC_Boot_SPC_Cmd_SW
prm RT_Address – 8 (RT address of SPC2)
prm Mode – 1 (MMC_DEFAULT)
prm Session Number – 1 (TBC)
data Onboard_Node – SYS_CCSDS_END_POINT_VTCM

Verify VTC_MASTER_SPC2_Boot_Report_SW_PP – 66048
 Verify MMC_Ready_Stat_ACT_PP – READY

COL-CC to give a “Go” to continue.

6.5 [Enabling RT FDIR for MMC](#)

Task: COL Final Activation - Part 3: CB INT 2 RT Status

CB INT 2 RT Status

cmd 22 MMC RT FDIR Status – Enable FDIR **Execute** (Verify – Ena)

6.6 [Enabling MMC Redundancy Management](#)

Task: COL Final Activation - Part 3

COL Final Activation - Part 3

'Mission Management Computer'

cmd MMC Redun Management – Ena (Verify – Ena)

6.7 [Enabling CCSDS Checksum Validation on MMC \(Ground only\)](#)

```
cmd DMS_CCSDS_Checksum_Ena_Cmd_SW
data ONBOARD_NODE –
SYS_CCSDS_End_Point_MMC_DMS_SERV
```

6.8 [Enabling CCSDS Checksum Validation on MMU \(Ground only\)](#)

```
cmd DMS_CCSDS_Checksum_Ena_Cmd_SW
data ONBOARD_NODE –
SYS_CCSDS_End_Point_MMU_DMS_SERV
```

7. [ACTIVATING DATA MANAGEMENT COMPUTER](#)

NOTE

1. Steps 7.1 through 7.5 require AOS
2. Expect DMS C&W messages

7.1 [Activating DMC Power B](#)

Task: COL Final Activation - Part 3

COL Final Activation - Part 3

'Data Management Computer'

```
cmd DMC Pwr B – On
```

Verify DMC Pwr B Status – On

Verify DMC Pwr B Current < 1.39 A

```
cmd DMC_Pwr_B_On_ACT
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1
```

Verify DMC_Pwr_B_Stat_VTC – ON

Verify DMC_Pwr_B_Current_VTC – < 1.39 A

7.2 [Initializing DMC S/W](#)

COL Final Activation - Part 3

'Data Management Computer'

```
cmd DMC Boot – DMC Default
```

Wait up to 5 minutes for DMC to boot before checking the SPC1 Boot Report

Verify SPC1 Boot Report – 4096

```
cmd VTC_Boot_SPC_Cmd_SW
prm RT_Address – 7
prm Mode – 0
```

prm Session_Number – 1
data Onboard_Node – SYS_CCSDS_END_POINT_VTCM
 Verify VTC_MASTER_SPC1_Boot_Report_SW_PP – 4096

7.3 [Configuring DMC as Bus Controller](#)

NOTE

All activation telemetry on PCS and ground displays will be invalid at the completion of step 7.3. These invalid parameters will be indicated by a cyan telemetry field.

COL Final Activation - Part 3
 'Data Management Computer'

NOTE

During the DMC boot process, the configuration FLAPs 'DMC Cold Start' and 'DMC Start-Up' are executed automatically.
 The DMC Cold Start FLAP:
 Starts several monitorings on the DMC node
 Starts the RT acquisition of active DMS equipment
 Initializes several DMS related S/W variables
 Executes the DMC Startup FLAP
 The DMC Start-Up FLAP:
 Starts several monitorings of system measurements
 Starts the RT acquisition of active system equipment
 Initializes several S/W variables

cmd VTC Vital To Nominal Mode – Nominal

Wait up to 15 minutes for DMC to boot before checking Ready Status

Verify DMC Ready Status – Ready

cmd VTC_Vital_To_Nom_Mode_Chg_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTCM
 Verify DMC_Ready_Stat_VTC – READY

7.4 [Enabling DMC and SPARE Monitoring to Support DMC FDIR in VTC \(Ground Only\)](#)

COL-CC

DMC and SPARE monitoring to be enabled by ground.

Wait for "Go" to continue.

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – DMC_Pwr_B_Current_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify DMC_Pwr_B_Current_VTC_MEF – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – DMC_Temp_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify DMC_Temp_VTC_MEF – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – DMC_Sec_Voltage_Stat_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify DMC_Sec_Voltage_Stat_VTC_MEF – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – DMC_Ready_Stat_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify DMC_Ready_Stat_VTC_MEF – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – SPARE_Pwr_A_Stat_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify SPARE_Pwr_A_Stat_VTC_MEF – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – SPARE_Pwr_A_Current_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify SPARE_Pwr_A_Current_VTC_MEF – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – SPARE_Temp_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify SPARE_Temp_VTC_MEF – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – SPARE_Sec_Voltage_Stat_VTC

prm Action – 1 (ENABLE)

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```
data Onboard_Node – SYS_CCSDS_End_Point_VTC2
Verify SPARE_Sec_Voltage_Stat_VTC_MEF – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – SPARE_Ready_Stat_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC2
Verify SPARE_Ready_Stat_VTC_MEF – ENABLED

COL-CC to give a “Go” to continue.
```

7.5 [Enabling DMC FDIR in VTC](#)

COL Final Activation - Part 3

'Data Management Computer'

```
cmd Enable DMC FDIR – Enable (Verify – Enabled)
```

```
cmd VTC_DMC_Recon_Ena_Cmd_SW
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_END_POINT_VTCM
Verify VTC_MASTER_DMC_Recon_Enable_SW_PP –
ENABLED
```

7.6 [Enabling C&W for the DMS and PDU2 Cautions \(Ground Only\)](#)

MCC-H

Enable the following events in the Primary and Backup C&C MDMs.

If ground unable to complete,

Perform [{2.101 CAUTION AND WARNING EVENT MANAGEMENT}](#), Step 2 (SODF: C&DH: NOMINAL) per Table 3, then;

Table 3. C&W Events for DMS and PDU2

Event	Text	Class
13570	'DMS I/O Unit (CMU1) Redundant Branch Failure - COL'	C
13572	'DMS I/O Unit (CMU2) Redundant Branch Failure - COL'	C
13574	'DMS I/O Unit (CMU3) Redundant Branch Failure - COL'	C
13576	'DMS I/O Unit (CMU4) Redundant Branch Failure - COL'	C
13581	'Power Distribution Unit (PDU2) Redun Controller Failure - COL'	C

7.7 [Enabling CCSDS Checksum Validation on DMC \(Ground only\)](#)

```
cmd DMS_CCSDS_Checksum_Ena_Cmd_SW
data ONBOARD_NODE -
SYS_CCSDS_End_Point_DMC_DMS_SERV
```

7.8 [Swapping DMS telemetry packets \(Ground Only\)](#)

COL-CC

COL-CC to swap nominal DMS telemetry packets.

Wait for “Go” to continue.

<p>NOTE</p> <p>zHz</p> <p>Packet swapping initiated from COL-CC:</p> <p>Disable VTC_Gnd_Tlm_Pkt_LOG1_VTC (1Hz)</p> <p>Disable VTC_Gnd_Tlm_Pkt_LOG2_VTC (1Hz)</p> <p>Disable VTC1_Gnd_Tlm_Pkt_PHY1_VTC (1Hz)</p> <p>Disable VTC2_Gnd_Tlm_Pkt_PHY1_VTC (1Hz)</p> <p>Perform {2.2.41 VTC GROUND PACKET SWAPPING} (ESA SODF: GROUND: NOMINAL), then:</p>

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NOTE

Automatically started TIm Packets:

MMC_Gnd_TIm_Pkt_DMS1_DMC (0.1 Hz)

MMC_Gnd_TIm_Pkt_USM3_DMC (0.1 Hz)

zHz

Packet swapping initiated from **COL-CC**:

Enable MMC_Gnd_TIm_Pkt_COAP_DMC (0.1Hz)

Enable MMC_Gnd_TIm_Pkt_DMS2_DMC (0.1Hz)

Enable MMC_Gnd_TIm_Pkt_EPDS1_DMC (0.1Hz)

Enable MMC_Gnd_TIm_Pkt_EPDS2_DMC (0.1Hz)

Enable MMC_Gnd_TIm_Pkt_TCS1_DMC (0.1Hz)

Enable MMC_Gnd_TIm_Pkt_TCS2_DMC (0.1Hz)

Enable MMC_Gnd_TIm_Pkt_ECLSS1_DMC (0.1Hz)

Enable MMC_Gnd_TIm_Pkt_ECLSS2_DMC (0.1Hz)

Enable MMC_Gnd_TIm_Pkt_USM1_DMC (0.1Hz)

Enable MMC_Gnd_TIm_Pkt_USM2_DMC (0.1Hz)

Enable MMC_Gnd_TIm_Pkt_Monitoring_Stat1_DMC (0.1Hz)

Enable MMC_Gnd_TIm_Pkt_Monitoring_Stat2_DMC (0.1Hz)

Enable MMC_Gnd_TIm_Pkt_FLAP_Variables1_DMC (0.1Hz)

Enable MMC_Gnd_TIm_Pkt_FLAP_Variables2_DMC (0.1Hz)

Enable MMC_Gnd_TIm_Pkt_LAPAP_DMC (0.1Hz)

Enable MMC_Gnd_TIm_Pkt_DMS_Off_Nominal_DMC (0.1 Hz)

Enable MMC_Gnd_TIm_Pkt_System_Activation_DMC (1 Hz)

Perform [{2.2.42 NOMINAL DMS PACKET SWAPPING}](#) (ESA SODF: GROUND: NOMINAL). then:

COL-CC to give "Go" to continue.

8. [ACTIVATNG PORTABLE WORKSTATION](#)

NOTE

1. Steps 1 through 7 must be complete before PWS activation.

2. Ground can continue to step 9.

Perform [{PWS ACTIVATION}](#), all (SODF: ASSY OPS: ACTIVATION AND CHECKOUT), then

9. [ENABLING PDU FOR NOMINAL SYSTEM SUPPORT](#)

NOTE

Steps 9.1 through 9.3 can only be verified by the **COL-CC**.

9.1 [Enabling Nominal System Bus Control for PDU2 Subsys Power Buses](#)

PCS

Task: COL Final Activation - Part 3: COL EPDS Auto Cmd Sequences

[COL_EPDS_Automated_Command_Sequences_VTC1](#)

√VTC1 Buffer Status – Empty

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```
*****
*          If VTC1 Buffer - Full
*          |
*          |   sel VTC1 Cancel 2 Step Command
*          |
*          |   COL Cancel 2 - Stage Cmd VTC 1
*          |
*          |   cmd Cancel 2 - Stage Cmd - Execute (Verify
*          |   - Empty)
*          |
*          |
*****
```

'PDU2'

'Subsys Pwr Bus Control Enable ACS'

Verify Status – Enabled

Record PCS ID: _____

cmd Start – Arm

pick PCS/C-X to VTC-Com1 (where X=PCS ID)

cmd Start – Set

√VTC1_Two_Stage_Buffer_Status_SW_PP – EMPTY

If VTC1_Two_Stage_Buffer_Status_SW_PP – FULL

```
      cmd VTC_Cancel_Two_Stage_Cmd_Cmd_SW
      data Onboard_Node SYS_CCSDS_End_Point_VTC1

      Verify VTC1_Two_Stage_Buffer_Status_SW_PP –
      EMPTY
```

cmd PDU2_Subsys_Pwr_Bus_Sys_Cntl_Ena_ACS (ARM)

data SW_CMD – VTC_Start_Terminate_ACS_Cmd_SW

data Action – 1 (START)

data Onboard_Node – SYS_CCSDS_END_POINT_VTC1

cmd VTC_Execute_2_Stage_Cmd_SW (EXEC)

Verify PDU2_ATU2_Pwr_Bus_Sys_Cntl_Stat_DMC – ENABLED

Verify PDU2_CTCU2_Pwr_Bus_Sys_Cntl_Stat_DMC –
ENABLED

Verify PDU2_Rack_D1_Pwr_Bus_Sys_Cntl_Stat_DMC –
ENABLED

Verify PDU2_Fan_Pwr_Bus_Sys_Cntl_Stat_DMC – ENABLED

Verify PDU2_PDU1_Redun_Pwr_Bus_Sys_Cntl_Stat_DMC –
ENABLED

```

Verify PDU2_Subsys_Pwr_Bus1_Sys_Cntl_Stat_DMC –
ENABLED
Verify PDU2_Subsys_Pwr_Bus2_Sys_Cntl_Stat_DMC –
ENABLED
Verify PDU2_Subsys_Pwr_Bus3_Sys_Cntl_Stat_DMC –
ENABLED
Verify PDU2_Subsys_Pwr_Bus4_Sys_Cntl_Stat_DMC –
ENABLED
Verify PDU2_Subsys_Pwr_Bus5_Sys_Cntl_Stat_DMC –
ENABLED
Verify PDU2_Subsys_Pwr_Bus6_Sys_Cntl_Stat_DMC –
ENABLED
Verify PDU2_Subsys_Pwr_Bus7_Sys_Cntl_Stat_DMC –
ENABLED
Verify PDU2_Subsys_Pwr_Bus8_Sys_Cntl_Stat_DMC –
ENABLED
Verify PDU2_Subsys_Pwr_Bus9_Sys_Cntl_Stat_DMC –
ENABLED
Verify PDU2_Subsys_Pwr_Bus10_Sys_Cntl_Stat_DMC –
ENABLED
Verify PDU2_SUP3_Pwr_Out1_Sys_Cntl_Stat_DMC –
ENABLED
Verify PDU2_SUP3_Pwr_Out2_Sys_Cntl_Stat_DMC –
ENABLED
Verify PDU2_SUP3_Pwr_Out3_Sys_Cntl_Stat_DMC –
ENABLED
Verify PDU2_SUP4_Pwr_Out1_Sys_Cntl_Stat_DMC –
ENABLED
Verify PDU2_SUP4_Pwr_Out2_Sys_Cntl_Stat_DMC –
ENABLED
Verify PDU2_SUP4_Pwr_Out3_Sys_Cntl_Stat_DMC –
ENABLED
Verify PDU2_VDPU_Pwr_Bus_Sys_Cntl_Stat_DMC –
ENABLED
    
```

9.2 [Enabling Nominal System Bus Control for ECLSS Valves](#)

Task: COL Final Activation - Part 3: COL ECLSS Auto Cmd Sequences

ECLSS Automatic Command Sequences VTC1

√VTC1 Buffer Status – Empty

```

*****
*           If VTC1 Buffer – Full
*           |
*           | sel VTC1 Cancel 2 Step Command
*           |
*           | COL Cancel 2 - Stage Cmd VTC 1
*           |
*           |
*           | cmd Cancel 2 - Stage Cmd - Execute (Verify
*           | – Empty)
*           |
*****
    
```

'ECLSS Valve System Control'

Verify VTC1 Enable Status – Ena

Record PCS ID: _____

cmd Start – Arm

pick PCS/C-X to VTC-Com1 (where X=PCS ID)

cmd Start – Set

√VTC1_Two_Stage_Buffer_Status_SW_PP – EMPTY

If VTC1_Two_Stage_Buffer_Status_SW_PP – FULL

cmd VTC_Cancel_Two_Stage_Cmd_Cmd_SW
data Onboard_Node SYS_CCSDS_End_Point_VTC1

Verify VTC1_Two_Stage_Buffer_Status_SW_PP –
 EMPTY

cmd ECLSS_Vlv_Sys_Cntl_Ena_ACS (ARM)

data SW_CMD – VTC_Start_Terminate_ACS_Cmd_SW

data Action – 1 (START)

data Onboard_Node – SYS_CCSDS_END_POINT_VTC1

cmd VTC_Execute_2_Stage_Cmd_SW (EXEC)

Verify NLSOV1_Sys_Cntl_Stat_DMC – ENABLED

Verify NLSOV2_Sys_Cntl_Stat_DMC – ENABLED

Verify NLSOV3_Sys_Cntl_Stat_DMC – ENABLED

Verify NLSOV4_Sys_Cntl_Stat_DMC – ENABLED

Verify VADD_Vlv1_Sys_Cntl_Stat_DMC – ENABLED

Verify VADD_Vlv2_Sys_Cntl_Stat_DMC – ENABLED

Verify VEDD_Vlv1_Sys_Cntl_Stat_DMC – ENABLED

Verify VEDD_Vlv2_Sys_Cntl_Stat_DMC – ENABLED

Verify WLSOV_ISPR_A1_Sys_Cntl_Stat_DMC – ENABLED

Verify WLSOV_ISPR_A2_Sys_Cntl_Stat_DMC – ENABLED

Verify WLSOV_ISPR_A3_Sys_Cntl_Stat_DMC – ENABLED

Verify WLSOV_ISPR_A4_Sys_Cntl_Stat_DMC – ENABLED

Verify WLSOV_ISPR_F1_Sys_Cntl_Stat_DMC – ENABLED

Verify WLSOV_ISPR_F2_Sys_Cntl_Stat_DMC – ENABLED

Verify WLSOV_ISPR_F3_Sys_Cntl_Stat_DMC – ENABLED

Verify WLSOV_ISPR_F4_Sys_Cntl_Stat_DMC – ENABLED

Verify WLSOV_ISPR_O1_Sys_Cntl_Stat_DMC – ENABLED

Verify WLSOV_ISPR_O2_Sys_Cntl_Stat_DMC – ENABLED

9.3 [Enabling Nominal System Bus Control for TCS Valves](#)
Task: COL Final Activation - Part 3: COL TCS Auto Cmd Sequences

COL TCS Automated Command Sequences VTC 1

√VTC1 Buffer Status – Empty

```
*****  
*      If VTC1 Buffer – Full  
*      |  
*      | sel VTC1 Cancel 2 Step Command  
*      |  
*      | COL Cancel 2 - Stage Cmd VTC 1  
*      |  
*      | cmd Cancel 2 - Stage Cmd - Execute (Verify  
*      | – Empty)  
*      |  
*****
```

'TCS Valve System Control Enable ACS'

Verify Status – Enabled

Record PCS ID: _____

cmd Start – Arm

pick PCS/C-X to VTC-Com1 (where X=PCS ID)

cmd Start – Set

Wait for “Go” to continue.

√VTC1_Two_Stage_Buffer_Status_SW_PP – EMPTY

```
If VTC1_Two_Stage_Buffer_Status_SW_PP – FULL  
|  
| cmd VTC_Cancel_Two_Stage_Cmd_Cmd_SW  
| data Onboard_Node SYS_CCSDS_End_Point_VTC1  
|  
| Verify VTC1_Two_Stage_Buffer_Status_SW_PP –  
| EMPTY
```

```
cmd TCS_Vlv_Sys_Cntl_Ena_ACS (ARM)  
data SW_CMD – VTC_Start_Terminate_ACS_Cmd_SW  
data Action – 1 (START)  
data Onboard_Node – SYS_CCSDS_END_POINT_VTC1  
cmd VTC_Execute_2_Stage_Cmd_SW (EXEC)
```


Verify WOOV1_Sys_Cntl_Stat_DMC – ENABLED
Verify WOOV2_Sys_Cntl_Stat_DMC – ENABLED
Verify WOOV3_Sys_Cntl_Stat_DMC – ENABLED
Verify WOOV4_Sys_Cntl_Stat_DMC – ENABLED
Verify WOOV5_Sys_Cntl_Stat_DMC – ENABLED
Verify WOOV6_Sys_Cntl_Stat_DMC – ENABLED
Verify WOOV7_Sys_Cntl_Stat_DMC – ENABLED
Verify WOOV8_Sys_Cntl_Stat_DMC – ENABLED
Verify WOOV9_Sys_Cntl_Stat_DMC – ENABLED
Verify WOOV10_Sys_Cntl_Stat_DMC – ENABLED
Verify WFSV_ISPR_A1_Sys_Cntl_Stat_DMC – ENABLED
Verify WFSV_ISPR_A2_Sys_Cntl_Stat_DMC – ENABLED
Verify WFSV_ISPR_A3_Sys_Cntl_Stat_DMC – ENABLED
Verify WFSV_ISPR_A4_Sys_Cntl_Stat_DMC – ENABLED
Verify WFSV_ISPR_F1_Sys_Cntl_Stat_DMC – ENABLED
Verify WFSV_ISPR_F2_Sys_Cntl_Stat_DMC – ENABLED
Verify WFSV_ISPR_F3_Sys_Cntl_Stat_DMC – ENABLED
Verify WFSV_ISPR_F4_Sys_Cntl_Stat_DMC – ENABLED
Verify WFSV_ISPR_O1_Sys_Cntl_Stat_DMC – ENABLED
Verify WFSV_ISPR_O2_Sys_Cntl_Stat_DMC – ENABLED

COL-CC to give a “Go” to continue.

PWS

9.4 [Activating PDU Outlet via DMC](#)

Activation Part 1

COL Activation Part 1

'PDU Outlet Activation'

'PDU2 CTCU2 Pwr Bus'

cmd Pwr On Execute (OK)

Verify Pwr – ON

'PDU2 VDPU Pwr Bus'

cmd Pwr On Execute (OK)

Verify Pwr – ON

'PDU2 Fan Pwr Bus'

cmd Pwr On Execute (OK)

Verify Pwr – ON

cmd PDU2_CTCU2_Pwr_Bus_On_AP

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data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV
data Onboard_Execution_Node –
USM SW DMC USS Swoop Instance

Verify PDU2_CTCU2_Pwr_Bus_On_Off_Stat_DMC – ON

cmd PDU2_VDPU_Pwr_Bus_On_AP
data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV
data Onboard_Execution_Node –
USM SW DMC USS Swoop Instance

Verify PDU2_VDPU_Pwr_Bus_On_Off_Stat_DMC – ON

cmd PDU2_Fan_Pwr_Bus_On_AP
data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV
data Onboard_Execution_Node –
USM SW DMC USS Swoop Instance

Verify PDU2_Fan_Pwr_Bus_On_Off_Stat_DMC – ON

10. [ACTIVATING AND CONFIGURING HIGH RATE MULTIPLEXER](#)

NOTE

1. Fiber Optic Jumper installation must be complete before starting this step.
2. The HRM can route COL data to the USOS Ku Band system upon completion of this step. Downlink of this data stream to **COL-CC** will require configuration of the Ku-Band system.

COL-CC

- 10.1 [Swapping DMS telemetry packets \(Ground Only\)](#)
COL-CC to swap nominal DMS telemetry packets.

Wait for “Go” to continue.

NOTE

Packet swapping initiated from **COL-CC**:
Enable MMC_Gnd_Tlm_Pkt_COMMS1_DMC (0.1Hz)
Enable MMC_Gnd_Tlm_Pkt_HRM_Diagnostics_DMC (0.1Hz)

Perform [{2.2.42 NOMINAL DMS PACKET SWAPPING}](#) (ESA SODF: GROUND: NOMINAL). then:

COL-CC to give “Go” to continue.

PWS

- 10.2 [Activating HRM](#)
Activation Part 1

COL Activation Part 1

'HRM Activation'

NOTE

The following command starts the FLAP 'HRM Activation', which:

- Switches ON both HRM Pwr converters
- Activates the nominal HRM-core, if the nominal HRM-core activation fails, the redundant HRM-core is automatically activated instead
- Starts RT acquisition & monitoring of HRM data
- Enables the HRM-MMU link (Master MMU)

cmd Activate Execute (OK)

Wait up to 1 minute for verification

Verify Pwr B – ON

Verify Pwr B Current < 2.12 A

Verify Nom Core Stat – ON

Verify Nom Ready Stat – READY

cmd HRM_Activation_AP

data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV

data Onboard_Execution_Node –
USM SW DMC USS Swop Instance

Verify HRM_Pwr_B_Stat_DMC – ON

Verify HRM_Pwr_B_Current_DMC – < 2.12 A

Verify HRM_Nom_Core_Stat_DMC – ON

Verify HRM_Nom_Ready_Stat_DMC – READY

Verify HRM_Nom_Branch_Avail_Stat_SW – AVAIL

Verify HRM_Nom_Sec_Voltage_Stat_DMC – OK

10.3 [Configuring HRM](#)

COL Activation Part 1

'HRM Configuration (with CDI)'

cmd Configure Execute (OK)

Verify Serial Path TIm Input Selected – AUTO_SEL

Verify Output Datarate = 86 x 0.5 Mbps

cmd HRM_Configuration_with_CDI_AP

data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV

data Onboard_Execution_Node –
USM SW DMC USS Swop Instance

prm Alloc_VCID_CDI – COMMON_ALLOC_VCID

prm Config_IF_CDI – CONFIG01_CONFIG_HRM

```

prm Execute_Setup_Flag – 1 (TRUE)
prm CMD_Delay – 0.1 [s]
prm Stop_Start_RT_Acq – 0 (FALSE)
prm Silent – 0 (RECEIVE MESSAGE)
    
```

```

Verify HRM_Serial_Path_Tlm_Input_Selected_DMC –
AUTO_SEL
Verify HRM_LAN_Input_Selected_DMC – AUTO_SEL
Verify HRM_High_Speed_Output_Selected_DMC – BOTH_ON
Verify HRM_Output_Datarate_DMC – 86
Verify HRM_Config_Interface_CDI_SW – 278640513
Verify HRM_VCID_Allocation_CDI_SW – 278640531
    
```

After starting Ku band data flow **COL-CC** to coordinate with POIC the HRM and Ku-Band System configuration

Wait for “Go” to continue

11. [ACTIVATING WATER PUMP ASSEMBLY CONDENSING HEAT EXCHANGER CONTROL LOOP](#)

11.1 [Starting WPA1 RT \(Ground Only\)](#)

```

cmd DMS_RT_Start_RT_Acquisition_Cmd
prm REMOTE_TERMINAL_ID –
MIL 1553B Bus RT Svstem Bus WPA2
data Onboard_Node –
SYS CCSDS End Point DMC DMS SERV
    
```

Verify WPA2_Sys_Bus_Ena_Stat_SW – ENABLED

11.2 [Checking WPA1 Delta Pressure Values](#)

TCS

[TCS Functional Overview](#)

'Delta Pressure Sensor Blocks'

Verify DPSB 2 WPA2 DP1: > 18 kPa

Verify DPSB 3 WPA2 DP2: > 18 kPa

Verify WPA2_DPSB2_Plenum_DP1_DMC > 18 kPa

Verify WPA2_DPSB3_Plenum_DP2_DMC > 18 kPa

11.3 [Activating WPA Condensing Heat Exchanger Control Loop](#)

Activation Part 1

[COL Activation Part 1](#)

'WPA Final Activation (CHX Cntl Loop Activation)'

SINGLE PDU2 COLUMBUS FINAL ACTIVATION

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NOTE

The following command starts the FLAP 'WPA Final Activation' that:

- Determines active WPA
- Starts data acquisition from the WPA
- Enables the plenum delta pressure control loop
- Enables the CHX inlet temperature control loop

During the execution of the FLAP expect the following event message on the System Message Panel:

'FLAP WPA_Final_Activation_AP RT MIL_1553B_Bus_RT_System_Bus_WPA2 on Node USM_SW_DMC_USS_Swop_Instance already started when Receiving a Start Cmd'

cmd Activate Execute (OK)

TCS: WPA2: WPA2 Commands:

WPA2 Commands

'Control Law Commands'

Verify CHX Temp Cntl Loop Stat – ACTIVE

Verify Plenum Delta Press Cntl Loop Stat – ACTIVE

TCS: WPA2:

WPA2

'Accumulator'

Verify Liq Qty1: 1 to 12 L

Verify Liq Qty2: 1 to 12 L

TCS:

TCS Functional Overview

'Delta Pressure Sensor Blocks'

Verify DPSB 2 WPA2 DP1: 40 to 44 kPa

Verify DPSB 3 WPA2 DP2: 40 to 44 kPa

'WMV4 Pwr'

Verify MDV – ON

cmd WPA_Final_Activation_AP

**data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV**

**data Onboard_Execution_Node –
USM_SW_DMC_USS_Swop_Instance**

Verify WPA2_CHX_Temp_Cntl_Loop_Stat_DMC – ACTIVE
 Verify WPA2_Plenum_Delta_Press_Cntl_Loop_Stat_DMC – ACTIVE

Verify WPA2_Accum_Liq_Qty1_DMC = 1 to 12 L
 Verify WPA2_Accum_Liq_Qty2_DMC = 1 to 12 L

Verify WPA2_DPSB2_Plenum_DP1_DMC = 40 to 44 kPa
 Verify WPA2_DPSB3_Plenum_DP2_DMC = 40 to 44 kPa

Verify WMV4_MDV_Pwr_Stat_DMC – ON

Verify WPA_Active_Pump_SW – WPA 2

11.4 [Enabling Automatic Reaction to Water Leakage](#)

DMS: FDIR Configuration

'LTHX Overtemperature FDIR'

cmd Enable Execute (OK)

Verify Status – ENABLE

cmd DMS_ACQ_Write_Dis_SW_Variable_Cmd_SW
prm Item_SID – WPA_Enter_BSM_FDIR_Ena_Stat_SW
prm Value – \$ENABLED

data Onboard_Node –
 SYS CCSDS End Point DMC DMS SERV

Verify WPA_Enter_BSM_FDIR_Ena_Stat_SW – ENABLED

11.5 [Start LTHX Temperature Monitoring](#)

Menu Bar: DMS Monitoring: 5 - COMMS TCS Payload

'TCS'

Verify WTSB6 Low HX Temp1: ≤ 7.6 DegC

Verify WTSB6 Low HX Temp2: ≤ 7.6 DegC

'DMS Monitoring'

'Enable/Disable'

sel TCS

'Enable Monitoring WTSB'

cmd WTSB6 Low HX Temp1 **Execute** (OK)

cmd WTSB6 Low HX Temp2 **Execute** (OK)

sel Close

Monitoring 5 - COMMS TCS Payload

'TCS'

Verify the background color of measurements

WTSB6 Low HX Temp1: Green

WTSB6 Low HX Temp2: Green

Verify WTSB6_Low_HX_Temp1_DMC – ≤ 7.6 °C

Verify WTSB6_Low_HX_Temp2_DMC – ≤ 7.6 °C

cmd DMS_MONIT_Ena_Monitoring_Cmd_SW
prm MT_ID – DMC_Sys_Monitoring_Table_SW
prm EI_ID – WTSB6_Low_HX_Temp1_DMC
prm LIMIT_SET_ID – 0 (limit set 1)

data Onboard_Execution_Node –
 SYS CCSDS End Point DMC DMS SERV

Verify WTSB6_Low_HX_Temp1_DMC_MS – NORMAL_1

cmd DMS_MONIT_Ena_Monitoring_Cmd_SW
prm MT_ID – DMC_Sys_Monitoring_Table_SW
prm EI_ID – WTSB6_Low_HX_Temp2_DMC
prm LIMIT_SET_ID – 0 (limit set 1)

data Onboard_Execution_Node –
 SYS CCSDS End Point DMC DMS SERV

Verify WTSB6_Low_HX_Temp2_DMC_MS – NORMAL_1

12. [ACTIVATING SMOKE DETECTOR](#)

12.1 [Swapping DMS telemetry packets \(Ground Only\)](#)

COL-CC

COL-CC to swap VTC telemetry packets.

Wait for “Go” to continue.

NOTE

Packet swapping initiated from **COL-CC**:
 Enable VTC1_Gnd_TIm_Pkt_PHY1_VTC (1Hz)
 Enable VTC2_Gnd_TIm_Pkt_PHY1_VTC (1Hz)

Perform [{2.2.41 VTC GROUND PACKET SWAPPING}](#) (ESA SODF: GROUND: NOMINAL). then:

COL-CC to give “Go” to continue.

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- PCS 12.2 [Powering Up Smoke Detector 2](#)
Task: Columbus Final Activation – Part 3: Smoke Detector Activation

'Smoke Detectors'
- sel Cabin SD2
-
- sel PDU2 120V Outlets
- 'PDU2'
- cmd** Outlet No. 24 SD2 Pwr Bus – On (Verify – On)
- cmd** PDU2_SD2_Pwr_Bus_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1
- Verify PDU2_SD2_Pwr_Bus_On_Off_Stat_VTC_PP – ON
- 12.3 [Verifying Smoke Detector 2 Power Status](#)
- Verify Obscuration, % Contamination < 25
Verify Scatter, % Obscuration per Meter < 1
- Verify Cabin_SD2_Obscuration_VTC_PP – < 25
Verify Cabin_SD2_Scatter_VTC_PP – < 1
- 12.4 [Enabling Smoke Detector 2](#)

'Monitoring'
- cmd** Enable
- Verify Status – Enabled
- 'Active BIT'
- Verify Failure – blank
- 'Fire Status'
- Verify Lens Status – Clean

Verify Out of Range – blank

```

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – Cabin_SD_2
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify Cabin_SD_2_EF – ENABLED
Verify VTC2_Cabin_SD_2_Stat_MVD – OK
    
```

MCC-H 12.5 [Enabling US C&W for Columbus Smoke Detector 2 \(Ground Only\)](#)
 Enable the following events in the Primary and Backup C&C MDMs.

If ground unable to complete,
 Perform [{2.101 CAUTION AND WARNING EVENT MANAGEMENT}](#), Step 2 (SODF: C&DH: NOMINAL) per Table 4, then

Table 4. C&W Event for COL Smoke Detector 2

Event	Text	Class
13501	'FIRE Smoke Detector 2 Cabin - COL'	E

13. [ACTIVATING CONDENSATE WATER SEPARATOR ASSEMBLY](#)

<p><u>NOTE</u> Condensate Jumper must be installed prior to beginning this step.</p>

PCS 13.1 [Opening Columbus Condensate Line Shut Off Valve](#)
 COL: ECLSS: CLSOV
COL CLSOV VTC1

cmd Position – Open

Verify Position Ind – Open

```

cmd CLSOV_Vlv_Open_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CLSOV_Vlv_Open_Stat_VTC_PP – OPEN
    
```

PWS

13.2 [Activating CWSA 2](#)

ECLSS: ECLSS Commands:

ECLSS Configuration Commands

'Activation Commands'

NOTE

The following command starts FLAP 'CWSA2 Activation' that:
Checks the availability of the CWSA
Powers on the CWSA
Enables the monitoring of the CWSA parameters
Enables the monitoring of the LCOS parameters

cmd CWSA 2 Activation Execute (OK)

Wait 20 seconds for telemetry stabilization

Verify CWSA2 Pwr – ON

ECLSS: CWSA2:

CWSA 2

Verify Delta P Air > 0.5 kPa

Verify Motor Speed – 4500 to 6800 rpm

Verify Input Current < 0.50 A

cmd CWSA2_Activation_AP

data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV

data Onboard_Execution_Node –
USM SW DMC USS Swoop Instance

Verify CWSA2_Pwr_Stat_DMC – ON

Verify CWSA2_Delta_P_Air_DMC – >0.5 kPa

Verify CWSA2_Motor_Speed_DMC – 4500-6800 rpm

Verify CWSA2_Input_Current_DMC – <0.50A

14. [ACTIVATING CABIN FAN ASSEMBLY](#)

ECLSS: CFA2:

CFA2

'Commands'

cmd Pwr_On Execute (OK)

Verify Pwr – ON

Verify Fan Speed – 7500 to 8500 rpm

Verify Delta P > 0.25 kPa

Verify Input Current < 1.5A

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cmd CFA2_Pwr_On_AP

data Onboard_Reception_Node –

SYS CCSDS End Point DMC DMS SERV

data Onboard_Execution_Node – USM_SW_DMC_USS_Swop_Instance

Verify CFA2_Pwr_Stat_DMC – ON

Verify CFA2_Fan_Speed_DMC – 7500-8500 rpm

Verify CFA2_Delta_P_DMC – >0.25 kPa

Verify CFA2_Input_Current_DMC – <1.5 A

15. ACTIVATING CABIN TEMP CONTROL UNIT

ECLSS: ECLSS Commands:

ECLSS Configuration Commands

'Activation Commands'

NOTE

The following command starts the FLAP 'CTCU2 Activation' that:

Checks that the other CTCU is not controlling the TCV

Checks the availability of the CTCU

Checks that at least one CFA is active

Powers on the CTCU

Enables monitoring of the CTCU parameters

Activates the TCV

Enables cabin temperature control

cmd CTCU2 Activation **Execute** (OK)

NOTE

The cabin temperature may need time to stabilize to the nominal temperature range. If the cabin temperature is out of the expected values, continue with the procedure.

ECLSS: CTCU2

CTCU2

Verify CTCU2 Pwr – ON

Verify Temp Cntl Stat – ENABLED

Verify TCV Cntl Stat – ENABLED

Verify Avg Cabin Temp: 18 to 27 deg C

Verify Health Stat – OK

cmd CTCU2_Activation_AP

data Onboard_Reception_Node –

SYS CCSDS End Point DMC DMS SERV

data Onboard_Execution_Node – USM_SW_DMC_USS_Swop_Instance

Verify CTCU2_Pwr_Stat_DMC – ON

Verify CTCU2_Cntl_Loop_Stat_DMC – ENABLED

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Verify CTCU2_TCV_Cntl_Stat_DMC – ENABLED
Verify CTCU2_Avg_Cabin_Temp_DMC – 18-27 °C
Verify CTCU2_Health_Stat_DMC – OK

16. OPENING SAMPLE LINE SHUTOFF VALVE

NOTE

1. The AR Sample Jumper must be installed prior to opening the Sample Line Shutoff Valve.
2. Pressure equalization of the Columbus Module must be performed before opening the Sample Line Shutoff Valves.

PCS

COL: ECLSS: Air Loop: SLSOV

COL SLSOV VTC1

cmd Position – Open

Verify Position Ind – Open

cmd SLSOV_Vlv_Open_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify SLSOV_Vlv_Open_Stat_VTC_PP – OPEN

17. ESTABLISHING INTERMODULE VENTILATION

NOTE

1. IMV duct installation must be completed before starting this step.
2. NPRA Valve removal and IMV installation must be completed prior to this step.

17.1 Activating Node 2 IMV Stbd Aft Valve

Node 2: ECLSS: IMV Stbd Aft Vlv

Node 2 IMV Stbd Aft Vlv

sel RPCM N22A3B C RPC 02

RPCM_N22A3B_C_RPC_02

cmd RPC Position – Close (Verify – Cl)

Node 2 IMV Stbd Aft Vlv

'Enable'

cmd Arm (√Arm Status – Armed)

cmd Enable (√State – Enabled)

17.2 [Opening Node 2 IMV Stbd Aft Valve](#)

'Open'

cmd Arm (√Arm Status – Armed)

cmd Open

√Position – In Transit

Wait 25 seconds, then:

√Position – Open

17.3 [Activating Node 2 IMV Stbd Fwd Valve](#)

Node 2: ECLSS: IMV Stbd Fwd Vlv

sel RPCM N22A3B C RPC 06

cmd RPC Position – Close (Verify – CI)

'Enable'

cmd Arm (√Arm Status – Armed)

cmd Enable (√State – Enabled)

17.4 [Opening Node 2 IMV Stbd Fwd Valve](#)

'Open'

cmd Arm (√Arm Status – Armed)

cmd Open

√Position – In Transit

Wait 25 seconds, then:

√Position – Open

17.5 [Closing Columbus IMV valves](#)

COL: ECLSS: Air Loop: ISSOV

'IMV Return Shutoff Valve'

cmd Position – Close

Verify Position Ind – Closed

'IMV Supply Shutoff Valve'

cmd Position – Close

Verify Position Ind – Closed

cmd IRSOV_Vlv_Close_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify IRSOV_Vlv_Close_Stat_VTC_PP – CLOSED

cmd ISSOV_Vlv_Close_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify ISSOV_Vlv_Close_Stat_VTC_PP – CLOSED

17.6 [Opening Columbus IMV valves](#)

COL: ECLSS: Air Loop: ISSOV

COL IMV Valves VTC1

'IMV Return Shutoff Valve'

cmd Position – Open

Verify Position Ind – Open

'IMV Supply Shutoff Valve'

cmd Position – Open

Verify Position Ind – Open

cmd IRSOV_Vlv_Open_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify IRSOV_Vlv_Open_Stat_VTC_PP – OPEN

cmd ISSOV_Vlv_Open_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify ISSOV_Vlv_Open_Stat_VTC_PP – OPEN

17.7 [Activating Columbus IMV Supply Fan](#)

COL: ECLSS: Air Loop: ISFA

COL IMV Fans

√VTC2 Buffer Status – Empty

```
*****
*      If VTC2 Buffer – Full
*      |
*      |       sel VTC2 Cancel 2 Step Command
*      |
*      |       COL Cancel 2 - Stage Cmd VTC 2
*      |
*      |       cmd Cancel 2 - Stage Cmd - Execute (Verify
*      |       – Empty)
*      |
*****
```

'Set Speed - VTC2 hardwire'

NOTE

The following ACS sets the IMV Supply Fan speed to 9960 rpm.

Record PCS ID: _____

cmd Start – Arm

pick PCS/C-X to VTC-Com1 (where X=PCS ID)

cmd Start – Set

'IMV Supply Fan Assembly'

cmd State – On

Verify Delta P: > 0.4 kPa

Verify Fan Speed: 9460 to 10460 rpm

Verify Fan Temp: < 60 degC

Verify ISFA Power: On

```
√VTC1_Two_Stage_Buffer_Status_SW_PP – EMPTY

If VTC1_Two_Stage_Buffer_Status_SW_PP – FULL
|
|       cmd VTC_Cancel_Two_Stage_Cmd_Cmd_SW
|       data Onboard_Node SYS_CCSDS_End_Point_VTC1
|
|       Verify VTC1_Two_Stage_Buffer_Status_SW_PP –
|       EMPTY
```

```
cmd ISFA_Speed_Set_ACS (ARM)
data SW_CMD – VTC_Start_Terminate_ACS_Cmd_SW
data Action – 1 (START)
```

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data Onboard_Node – SYS_CCSDS_END_POINT_VTC1

cmd VTC_Execute_2_Stage_Cmd_SW (EXEC)

cmd ISFA_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify ISFA_Fan_Speed_MVD – 9460-10460 rpm

Verify ISFA_Delta_P_MVD – >0.4 kPa

Verify ISFA_Fan_Temp_VTC – < 60 degC

Verify ISFA_Pwr_Stat_MVD – ON

COL-CC

17.8 [Enabling VTC Monitoring for ISFA \(Ground Only\)](#)

COL-CC to enable ISFA monitoring.

Wait for “GO” to continue.

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – ISFA_Fan_Temp_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify ISFA_Fan_Temp_VTC_MEF – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – ISFA_Delta_P_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify ISFA_Delta_P_VTC_MEF – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – ISFA_Fan_Speed_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify ISFA_Fan_Speed_VTC_MEF – ENABLED

COL-CC to give a “Go” to continue.

18. [ACTIVATING COLUMBUS ECLSS FDIR FOR NOMINAL OPS](#)

PWS

18.1 [Configuring CFA2 to Nominal Ops](#)

ECLSS: ECLSS Commands:

ECLSS Configuration Commands

'Activation Commands'

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NOTE

The following command starts the FLAP 'CFA2 Activation' that:

- Checks the availability of the CFA
- Sets the Cabin Fan speed to 9000 rpm
- Powers on the CFA
- Enables monitoring of the CFA parameters

cmd CFA 2 Activate **Execute** (OK)

Verify CFA2 Pwr: ON

ECLSS: CFA2

CFA2

'ECLSS Cabin Fan Assembly 2'

Verify Delta P: 0.65 to 1.5 kPa

Verify Input Current: < 1.5 A

'Set Speed'

Verify Fan Speed: 8500 to 9500 rpm

ECLSS: AFS:

AFS

'Air Flow Sensors'

Verify AFS2 Cab Air Massflow: 240 to 510 m3/h

cmd CFA2_Activation_AP

data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV

data Onboard_Execution_Node –
USM SW DMC USS Swop Instance

Verify CFA2_Pwr_Stat_DMC – ON

Verify CFA2_Delta_P_DMC – 0.65 – 1.5 kPa

Verify CFA2_Input_Current_DMC – <1.5 A

Verify CFA2_Fan_Speed_DMC – 8500 to 9500 rpm

Verify AFS2_Cab_Air_Massflow_MVD – 240 - 510 m3/h

PCS

18.2

[Activating VTC Monitoring for Air Flow Sensor 2](#)

COL: ECLSS: Atmos

Columbus Atmosphere

Verify Airflow Sensor 2 Massflow > 240 m3/hr

cmd Airflow Sensor 2 Massflow Monitoring – Enable (Verify – Enabled)

Verify AFS2_Cab_Air_Massflow_VTC – > 240 m3/h

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – AFS2_Cab_Air_Massflow_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify AFS2_Cab_Air_Massflow_VTC_MEF – ENABLED

MCC-H

18.3 [Enabling C&W for the Previous Monitoring \(Ground Only\)](#)

Enable the following events in the Primary and Backup C&C MDMs.

If ground unable to complete,

Perform [{2.101 CAUTION AND WARNING EVENT MANAGEMENT}](#), Step 2 (SODF: C&DH: NOMINAL) per Table 5, then

Table 5. C&W Events for Cabin Air Flow

Event	Text	Class
13533	'Cabin Air Flow Sensor 2 Low - COL'	W

PCS

18.4 [Activating VTC Monitoring for TPS](#)

COL: ECLSS: Atmos

Columbus Atmosphere

Verify Air Press 3: 719 to 770 mmHg

cmd Air Press 3 Monitoring Status – Enable (Verify – Enabled)

Verify Air Press 4: 719 to 770 mmHg

cmd Air Press 4 Monitoring Status – Enable (Verify – Enabled)

Verify TPS3_Air_Press_VTC – 719 to 770 mmHg

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – TPS3_Air_Press_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify TPS3_Air_Press_VTC_MEF – ENABLED

Verify TPS4_Air_Press_VTC – 719 to 770 mmHg

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – TPS4_Air_Press_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify TPS4_Air_Press_VTC_MEF – ENABLED

MCC-H

18.5 [Enabling C&W for TPS \(Ground Only\)](#)

Enable the following events in the Primary and Backup C&C MDMs.

If ground unable to complete,
 Perform [{2.101 CAUTION AND WARNING EVENT MANAGEMENT}](#), Step 2 (SODF: C&DH: NOMINAL) per Table 6, then

Table 6. C&W Events for TPS3

Event	Text	Class
13527	'Total Pressure Sensor 3 Low - COL'	W

PCS

18.6 [Enabling Monitoring for PPOS and PPCS](#)

COL: ECLSS: Atmos

COL Atmosphere

Verify ppO2 Sensor 2: 124 -- 188 mmHg

cmd ppO2 Sensor 2 Monitoring Status – Enable (Verify – Enabled)

Verify ppCO2 Sensor 2: < 10 mmHg

cmd ppCO2 Sensor 2 Monitoring Status – Enable (Verify – Enabled)

Verify PPOS2_Press_VTC – 124 -- 188 mmHg

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – PPOS2_Press_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify PPOS2_Press_VTC_MEF – ENABLED

Verify PPCS2_Press_VTC – < 10 mmHg

```

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – PPCS2_Press_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify PPCS2_Press_VTC_MEF – ENABLED
    
```

COL-CC 18.7 [Swapping DMS telemetry packets \(Ground Only\)](#)
COL-CC to swap VTC DMS telemetry packets.

Wait for “Go” to continue.

<p>NOTE</p> <p>Packet swapping initiated from COL-CC: Disable VTC1_Gnd_Tlm_Pkt_PHY1_VTC (1Hz) Disable VTC2_Gnd_Tlm_Pkt_PHY1_VTC (1Hz)</p> <p>Perform {2.2.41 VTC GROUND PACKET SWAPPING} (ESA SODF: GROUND: NOMINAL). then:</p> <p>COL-CC to give “Go” to continue.</p>
--

19. [DISABLING PPR FUNCTION](#)

PCS 19.1 [Closing PPRA Valves](#)
 Task: COL Final Activation – Part 3: COL PPRAs
COL PPRA 1-2 VTC1

√PPRA1 Position – Close (Verify Ind – Closed)

√PPRA2 Position – Close (Verify Ind – Closed)

```

√PPRA1_Vlv_Close_Stat_VTC_PP – CLOSED

If PPRA1_Vlv_Close_Stat_VTC_PP – OPEN
|
|   cmd PPRA1_Vlv_Close_VTC
|   data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
|   data Onboard_Node – SYS_CCSDS_End_Point_VTC1
|
|   Verify PPRA1_Vlv_Close_Stat_VTC_PP – CLOSED
    
```

```

√PPRA2_Vlv_Close_Stat_VTC_PP – CLOSED

If PPRA2_Vlv_Close_Stat_VTC_PP – OPEN
|
|   cmd PPRA2_Vlv_Close_VTC
|   data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
|   data Onboard_Node – SYS_CCSDS_End_Point_VTC1
    
```

Verify PPRA2_Vlv_Close_Stat_VTC_PP – CLOSED

19.2 [Enabling VTC Monitoring of PPRAs](#)

COL PPRA 1-2 VTC1

cmd PPRA1 Close Status Monitoring – Enabled (Verify – Enabled)

cmd PPRA2 Close Status Monitoring – Enabled (Verify – Enabled)

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – PPRA1_Vlv_Close_Stat_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PPRA1_Vlv_Close_Stat_Monitoring_Ena_VTC_PP – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – PPRA2_Vlv_Close_Stat_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PPRA2_Vlv_Close_Stat_Monitoring_Ena_VTC_PP – ENABLED

19.3 [Enabling VTC monitoring of CDAs](#)

COL: ECLSS: Cabin Depress Assemblies

Columbus Cabin Depress Assemblies

sel CDA 1 Vlv 1 Vlv 2

COL CDA 1-2 Valve Control VTC1

'CDA 1 Valve 1'

cmd Close Status Monitoring – Enable (Verify – Enabled)

'CDA 1 Valve 2'

cmd Close Status Monitoring – Enable (Verify – Enabled)

'CDA 2 Valve 1'

cmd Close Status Monitoring – Enable (Verify – Enabled)

'CDA 2 Valve 2'

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cmd Close Status Monitoring – Enable (Verify – Enabled)

Columbus Cabin Depress Assemblies

sel CDA 3 Vlv 1 Vlv 2

COL CDA 3-4 Valve Control VTC1

'CDA 3 Valve 1'

cmd Close Status Monitoring – Enable (Verify – Enabled)

'CDA 3 Valve 2'

cmd Close Status Monitoring – Enable (Verify – Enabled)

'CDA 4 Valve 1'

cmd Close Status Monitoring – Enable (Verify – Enabled)

'CDA 4 Valve 2'

cmd Close Status Monitoring – Enable (Verify – Enabled)

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – CDA1_Vlv1_Close_Stat_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CDA1_Vlv1_Close_Stat_Monitoring_Ena_VTC_PP –
ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – CDA1_Vlv2_Close_Stat_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CDA1_Vlv2_Close_Stat_Monitoring_Ena_VTC_PP –
ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – CDA2_Vlv1_Close_Stat_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CDA2_Vlv1_Close_Stat_Monitoring_Ena_VTC_PP –
ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW

```

prm Monitored_Item_ID – CDA2_Vlv2_Close_Stat_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CDA2_Vlv2_Close_Stat_Monitoring_Ena_VTC_PP –
ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – CDA3_Vlv1_Close_Stat_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CDA3_Vlv1_Close_Stat_Monitoring_Ena_VTC_PP –
ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – CDA3_Vlv2_Close_Stat_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CDA3_Vlv2_Close_Stat_Monitoring_Ena_VTC_PP –
ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – CDA4_Vlv1_Close_Stat_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CDA4_Vlv1_Close_Stat_Monitoring_Ena_VTC_PP –
ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – CDA4_Vlv2_Close_Stat_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CDA4_Vlv2_Close_Stat_Monitoring_Ena_VTC_PP –
ENABLED
    
```

19.4 [Enabling VTC monitoring of VVMRVs](#)

COL: ECLSS: Payload VV

Columbus Payload Vacuum and Venting

sel VEMRV

Columbus VEDD - VTC1

'Venting Manual Repressurization Valve'

cmd Close Monitoring – Enable (Verify – Enabled)

Columbus Payload Vacuum and Venting

sel VAMRV

Columbus VADD - VTC1

'Vacuum Manual Repressurization Valve'

cmd Close Monitoring – Enable (Verify – Enabled)

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – VEMRV_Vlv_Close_Stat_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify VEMRV_Vlv_Close_Stat_Monitoring_Ena_VTC_PP – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – VAMRV_Vlv_Close_Stat_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify VAMRV_Vlv_Close_Stat_Monitoring_Ena_VTC_PP – ENABLED

20. ACTIVATING PLCU

20.1 Powering up PLCU

PWS

Activation Part 1: Activation Part 2: Activation Part 3:
Activation Part 4:

COL Activation Part 4

'PLCU Activation (In Default Mode)'

NOTE

Expect FLAP exception messages after the following command.

NOTE

The following command starts the FLAP 'PLCU Act In Default Mode' that:

- Checks that the SPC3 is not active
Switches SPC3 power A and power B on
Boot the PLCU in default mode
Enables the monitoring of the SPC3 ready status

cmd Activate Execute (OK)

Verify Pwr A – On

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Verify Ready Stat – Ready
Verify Pwr A Current < 1.19 A
Verify Sec Voltage Stat – OK

```
cmd PLCU_Act_In_Default_Mode_AP
data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV
data Onboard_Execution_Node –
USM SW DMC USS Swop Instance
```

Verify PLCU_Pwr_A_Stat_DMC – ON
Verify PLCU_Ready_Stat_DMC – READY
Verify PLCU_Pwr_A_Current_DMC – <1.19 A
Verify PLCU_Sec_Voltage_Stat_DMC – OK

```
cmd PLCU_Act_In_Default_Mode_AP
data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV
data Onboard_Execution_Node –
USM SW DMC USS Swop Instance
```

Verify PLCU_Pwr_A_Stat_DMC – ON
Verify PLCU_Ready_Stat_DMC – READY
Verify PLCU_Pwr_A_Current_DMC – <1.19 A
Verify PLCU_Sec_Voltage_Stat_DMC – OK

20.2 [Enabling CCSDS Checksum Validation on PLCU \(Ground only\)](#)

```
cmd DMS_CCSDS_Checksum_Ena_Cmd_SW
data ONBOARD_NODE –
SYS_CCSDS_End_Point_PLCU_DMS_SERV
```

21. [ACTIVATING XCMU](#)

Activation Part 1: Activation Part 2: Activation Part 3: Activation Part 4:

COL Activation Part 4

'XCMU Activation'

NOTE

Expect FLAP exception messages after the following command.

NOTE

The following command starts the FLAP 'XCMU Activation' that:
Checks that the XCMU is available
Checks that the redundant XCMU is off
Switches XCMU nom power A and nom power B on
Enables the monitoring of the nominal XCMU ready status

cmd Activate Execute (OK)

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(ASSY MAL/1E/FIN/MULTI E)

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Verify Nom Pwr A – On
Verify Nom Ready Stat – Ready
Verify Nom Pwr A Current < 1.13 A
Verify Nom Sec Voltage Stat – OK

cmd XCMU_Activation_AP

data Onboard_Reception_Node –

SYS CCSDS End Point DMC DMS SERV

data Onboard_Execution_Node – USM_SW_DMC_USS_Swop_Instance

Verify XCMU_Nom_Pwr_A_Stat_DMC – ON

Verify XCMU_Nom_Ready_Stat_DMC – READY

Verify XCMU_Nom_Pwr_A_Current_DMC – <1.13 A

Verify XCMU_Nom_Sec_Voltage_Stat_DMC – OK

COLUMBUS SINGLE VTC1 BERTHED SURVIVAL MODE ACTIVATION

(ASSY MAL/1E/FIN/MULTI E)

Page 1 of 10 pages

OBJECTIVE:

Initial activation of Columbus module through HCU activation performed with only VTC1 available. Completion of this procedure will end the thermal clock started when the module is removed from the PL Bay.

INITIAL CONDITIONS:

DDCUs N2D4B and N2D1B repowered

DDCUs N2P2A and N2P3A repowered

N2-1 and N2-2 MDMs nominal

Hardwired connectors mated

1553 connections mated

Power connections mated

VTC Redundancy Management inhibited

VTC2 RT Status – Inh

1. VERIFYING NODE MDMS ARE NOMINAL

PCS

1.1 Verifying N2-1 MDM

CDH Summary: N2-1

Verify Frame Count – <incrementing>

Verify Processing State – Operational

1.2 Verifying N2-2 MDM

CDH Summary: N2-2

Verify Frame Count – <incrementing>

Verify Processing State – Operational

2. ACTIVATING PDU

2.1 Activating PDU1 MB1 Nominal Main Auxiliary Converter

Task: COL Berthed Survival Mode

'Power Distribution Unit'

cmd PDU1 Nom Pwr – On

Verify PDU1 Nom Pwr Status – On

Verify PDU1 VTC1 Pwr Bus Status – On

Verify PDU1 Main Input Current < 5 A

2.2 [Activating PDU1 MB1 Redundant Main Auxiliary Converter](#)

COL Berthed Survival Mode

'Power Distribution Unit'

cmd PDU1 Redun Pwr – On

Verify PDU1 Redun Pwr Status – On

Verify PDU1 VTC2 Pwr Bus Status – On

Verify PDU1 Main Input Current < 5 A

2.3 [Activating PDU2 MB2 Nominal Main Auxiliary Converter](#)

COL Berthed Survival Mode

'Power Distribution Unit'

cmd PDU2 Nom Pwr – On

Verify PDU2 Nom Pwr Status – On

Verify PDU2 VTC2 Pwr Bus Status – On

Verify PDU2 Main Input Current < 5 A

2.4 [Activating PDU2 MB2 Redundant Main Auxiliary Converter](#)

COL Berthed Survival Mode

'Power Distribution Unit'

cmd PDU2 Redun Pwr – On

Verify PDU2 Redun Pwr Status – On

Verify PDU2 VTC1 Pwr Bus Status – On

Verify PDU2 Main Input Current < 5 A

3. [ENABLING COMMUNICATION WITH C&C MDM](#)

NOTE

Expect VTC1 and VTC2 failed C&W messages.

3.1 [Inhibiting VTC Redundancy Management](#)

Task: COL Berthed Survival Mode

COL Berthed Survival Mode

'Vital Telemetry and Telecommand Controller'

'Inhibit VTC Redun Management'

√Master VTC Recovery Step 1 – Inh

√Master VTC Recovery Step 2 – Inh

√Slave VTC Recovery – Inh

3.2 [Enabling RT I/O with VTC1](#)

Task: COL Berthed Survival Mode: CB INT 1 RT Status

CB INT 1 RT Status

cmd 21 VTC 1 RT Status – Enable **Execute** (Verify – Ena)

4. [ACTIVATING AND INITIALIZING VTC1](#)

NOTE

- 1. Steps 4.1 and 4.2 require AOS.
- 2. VTC1 Ready Status indication can not be acquired since VTC2 is not available.

4.1 [Activating VTC1 Idle Mode via Nom Power A](#)

Task: COL Berthed Survival Mode

COL Berthed Survival Mode

'VTC1 Nominal Config'

cmd VTC1 Nom Pwr A – On

Verify VTC1 Nom Pwr A Status – On

Verify VTC1 Nom Pwr A Current < 2.14 A

Verify VTC1 Idle Config Mode – Idle Mode

MCC-H gives COL-CC “GO” to continue

4.2 [Enabling VTC1 Pre-emptive telemetry packets \(Ground Only\)](#)

COL-CC

COL-CC to enable VTC1 Pre-emptive telemetry packets.

Wait for “Go” to continue.

NOTE

Packet swapping initiated from COL-CC:
Enable VTC1_Gnd_Tlm_Pkt_PHY1_VTC (1Hz)

Perform [{2.2.41 VTC GROUND PACKET SWAPPING}](#) (EODF: GROUND: NOMINAL). then:

COL-CC to give a “Go” to continue.

5. [CONFIGURING VTC1 TO MASTER](#)

5.1 [Initializing VTC1 in Master Mode](#)

PCS

Task: COL Berthed Survival Mode

COL Berthed Survival Mode

'Vital Telemetry and Telecommand Controller'

cmd Notify VTC1 – VTC2 in Slave Mode – Notify

cmd VTC 1 Initialization (Default, Vital) – Master

Verify VTC1 Mode – Master

Verify VTC1 DMS Mode – Vital

Verify VTC1 Idle Config Mode – Not Idle

cmd VTC_Notify_Mode_Cmd_SW

prm New_Mode – 0 (SLAVE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

cmd VTC_Initialization_Cmd_SW

prm Init_Mode – 1 (MASTER)

prm Init_Limit_Set – 0 (DEFAULT)

prm Init_APM_Mode – 1 (VITAL)

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify VTC1_INT_DATA_MASTER_SLAVE_MODE_SW – MASTER

Verify VTC1_INT_DATA_APM_MODE_SW – VITAL

Verify VTC1_INT_DATA_IDLE_CONF_MODE_SW – NOT_IDLE

5.2 [Enabling Logical Telemetry Packets](#)

COL Berthed Survival Mode

'Vital Telemetry and Telecommand Controller'

cmd Tlm Packet Logical1 – Enable

cmd Tlm Packet Logical2 – Enable

cmd VTC_Tlm_Pkt_Ena_Cmd_SW

prm Packet_ID – VTC_Tlm_Pkt_LOG1_VTC

prm Action – 1 (ENABLE)

prm Checksum_Flag – 1 (ENABLE)

prm Dump_Pipe – 0 (TLM_P)

prm APID_Value – 1267

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

cmd VTC_Tlm_Pkt_Ena_Cmd_SW

prm Packet_ID – VTC_Tlm_Pkt_LOG2_VTC

prm Action – 1 (ENABLE)

prm Checksum_Flag – 1 (ENABLE)

prm Dump_Pipe – 0 (TLM_P)

prm APID_Value – 1267

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

5.3 [Swapping DMS Telemetry Packets \(Ground Only\)](#)

COL-CC

COL-CC to swap VTC telemetry packets.

Wait for “Go” to continue.

NOTE

Packet swapping initiated from COL-CC:
Disable VTC1_Gnd_Tlm_Pkt_PHY2_VTC (1Hz)
Enable VTC_Gnd_Tlm_Pkt_LOG1_VTC (1Hz)
Enable VTC_Gnd_Tlm_Pkt_LOG2_VTC (1Hz)

Perform [{2.2.41 VTC GROUND PACKET SWAPPING}](#) (ESA SODF: GROUND: NOMINAL). then:

COL-CC to give a “Go” to continue.

PCS

5.4 [Enabling VTC Vital Bus FDIR](#)

Task: COL Berthed Survival Mode: CDH: Vital Bus

COL Vital Bus

cmd Vital Bus Recon – Enable

Verify Vital Bus Recon – Enable

cmd VTC_Vital_Sys_Bus_Recon_Ena_Cmd_SW
prm BUS_ID – 0 (Vital)
prm RECONFIGURATION_ENABLE – 1 (Enable)
data Onboard_Node – SYS_CCSDS_End_Point_VTCM

Verify VTC_MASTER_Vital_Bus_Recon_Ena_SW_PP –
ENABLE

5.5 [Enabling VTC System Bus FDIR](#)

Task: COL Berthed Survival Mode: CDH: System Bus

COL System Bus Act

cmd System Bus Recon – Enable

Verify System Bus Recon – Enable

cmd VTC_Vital_Sys_Bus_Recon_Ena_Cmd_SW
prm BUS_ID – 1 (System)
prm RECONFIGURATION_ENABLE – 1 (Enable)
data Onboard_Node – SYS_CCSDS_End_Point_VTCM

Verify VTC_MASTER_System_Bus_Recon_Ena_SW_PP –
ENABLE

5.6 [Enabling RT FDIR with VTC1](#)

Task: COL Berthed Survival Mode: CB INT 1 RT Status

CB INT 1 RT Status

MCC-H

cmd 21 VTC 1 RT FDIR Status – Enable FDIR Execute (Verify – Ena)

5.7 [Enabling VTC Redundancy Management](#)

CDH: Primary CCS MDM: Primary CCS Recovery Retry

COL Module Recovery

'Set VTC Master'

Verify Set VTC Master – VTC 1

'Master VTC Recovery to Redundant'

cmd Recovery Enable – Enable (Verify – Ena)

5.8 [Enabling C&W For VTC Redundancy Management \(Ground Only\)](#)

Enable the following events in the Primary and Backup C&C MDMs.

If ground unable to complete,

Perform [{2.101 CAUTION AND WARNING EVENT MANAGEMENT}](#), step 2 (SODF: C&DH: NOMINAL) per Table 1, then

Table 1. C&W Events for DMS Master Recovery

Event	Text	Class
13608	DMS MASTER VTC Recovery Step 1 Failure - COL	C

6. [ACTIVATING PDU CROSS STRAPPED POWER BUS](#)

PCS

6.1 [Verifying Microcontroller Status](#)

Task: COL Berthed Survival Mode

COL Berthed Survival Mode

'PDU Redun Pwr Bus Act'

Verify PDU1 Nom Cntl – On

Verify Redun Cntl – Off

Verify PDU1_Nom_Cntl_Stat_VTC – ON

Verify PDU1_Redun_Cntl_Stat_VTC – OFF

6.2 [Verifying VTC1 Two-Stage Buffer Status](#)

COL Berthed Survival Mode

'PDU Redun Pwr Bus Act'

√VTC1 Buffer – Empty

```
*****
*      If VTC1 Buffer – Full
*      |
*      |      cmd VTC1 Buffer – Clear
*      |
*      |      Verify VTC1 Buffer – Empty
*      |
*****
```

```
√VTC1_INT_DATA_TWOSTEP_FULL_SW – EMPTY

If VTC1_INT_DATA_TWOSTEP_FULL_SW – FULL
|
|      cmd VTC_Cancel_Two_Stage_Cmd_Cmd_SW
|      data Onboard_Node – SYS_CCSDS_End_Point_VTC1
|
|      Verify VTC1_INT_DATA_TWOSTEP_FULL_SW –
|      EMPTY
```

6.3 [Activating All PDU1 and PDU2 Aux Converters for 120V Outlets](#)

COL Berthed Survival Mode

'Aux Supplies Activation'

Record PCS ID: _____

cmd Start ACS PDU Config – Arm

pick PCS/C-X to VTC-Com1 (where X=PCS ID)

cmd Start ACS PDU Config – Set

COL-CC to verify PDU SSPC Aux Converter status.

Wait for “Go” to continue.

```
cmd PDU_Config_ACS (ARM)
data SW_CMD – VTC_Start_Terminate_ACS_Cmd_SW
data Action – 1 (START)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify VTC1_INT_DATA_TWOSTEP_FULL_SW – FULL

cmd VTC_Execute_2_Stage_Cmd_SW (EXEC)

Verify PDU1_SSPC_Aux_Conv1_Stat_VTC – ON
```

Verify PDU1_SSPC_Aux_Conv2_Stat_VTC – ON
 Verify PDU1_SSPC_Aux_Conv3_Stat_VTC – ON
 Verify PDU1_SSPC_Aux_Conv4_Stat_VTC – ON
 Verify PDU1_SSPC_Aux_Conv5_Stat_VTC – ON
 Verify PDU1_SSPC_Aux_Conv6_Stat_VTC – ON
 Verify PDU1_SSPC_Aux_Conv7_Stat_VTC – ON
 Verify PDU1_SSPC_Aux_Conv8_Stat_VTC – ON
 Verify PDU1_SSPC_Aux_Conv9_Stat_VTC – ON

Verify PDU2_SSPC_Aux_Conv1_Stat_VTC – ON
 Verify PDU2_SSPC_Aux_Conv2_Stat_VTC – ON
 Verify PDU2_SSPC_Aux_Conv3_Stat_VTC – ON
 Verify PDU2_SSPC_Aux_Conv4_Stat_VTC – ON
 Verify PDU2_SSPC_Aux_Conv5_Stat_VTC – ON
 Verify PDU2_SSPC_Aux_Conv6_Stat_VTC – ON
 Verify PDU2_SSPC_Aux_Conv7_Stat_VTC – ON
 Verify PDU2_SSPC_Aux_Conv8_Stat_VTC – ON
 Verify PDU2_SSPC_Aux_Conv9_Stat_VTC – ON

COL-CC to give a “Go” to continue.

6.4 [Activating PDU2 to PDU1 Power Outlet](#)

COL Berthed Survival Mode

'Cross Strapped Power Bus Activation'

cmd PDU 2/1 Redun Pwr Bus – On

Verify PDU 2/1 Redun Pwr Bus Status – On

cmd PDU2_PDU1_Redun_Pwr_Bus_On_VTC
 data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
 data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU2_PDU1_Redun_Pwr_Bus_On_Off_Stat_VTC_PP – ON

6.5 [Activating PDU1 Cross Strapped Converter](#)

COL Berthed Survival Mode

'Converter Activation'

cmd PDU1 Cross Strapped Conv – On

Verify PDU1 Cross Strapped Conv Status – On

cmd PDU1_Cross_Strapped_Conv_On_VTC
 data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
 data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU1_Cross_Strapped_Conv_Stat_VTC – ON

6.6 [Activating PDU Lights Power Buses](#)

COL Berthed Survival Mode: EPS: Lights

COL PDU 1-2 Lights VTC1

cmd PDU 2 Outlet 21 – On (Verify – On)

cmd PDU 1 Outlet 21 – On (Verify – On)

cmd PDU2_MLU_Pwr_Bus_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU2_MLU_Pwr_Bus_On_Off_Stat_VTC_PP – ON

cmd PDU1_MLU_Pwr_Bus_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU1_MLU_Pwr_Bus_On_Off_Stat_VTC_PP – ON

7. [ACTIVATING HEATER CONTROL UNIT](#)

7.1 [Activating HCU1 Power Bus](#)

Task: COL Berthed Survival Mode

COL Berthed Survival Mode

'Heater Control Unit'

cmd PDU1 HCU1 Pwr Bus On – On

Verify PDU1 HCU1 Pwr Bus Status – On

Verify PDU1 HCU1 Input Current < 10 A

cmd PDU1_HCU1_Pwr_Bus_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU1_HCU1_Pwr_Bus_On_Off_Stat_VTC_PP – ON

Verify PDU1_HCU1_Pwr_Bus_Current_VTC_PP – < 10 A

7.2 [Activating HCU2 Power Bus](#)

COL Berthed Survival Mode

'Heater Control Unit'

cmd PDU2 HCU2 Pwr Bus – On

Verify PDU2 HCU2 Pwr Bus Status – On

Verify PDU2 HCU2 Input Current < 10 A

COLUMBUS SINGLE VTC1 BERTHED SURVIVAL MODE ACTIVATION

(ASSY MAL/1E/FIN/MULTI E)

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cmd PDU2_HCU2_Pwr_Bus_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU2_HCU2_Pwr_Bus_On_Off_Stat_VTC_PP – ON

Verify PDU2_HCU2_Pwr_Bus_Current_VTC_PP – < 10 A

Verifying Heater Control Loop Status (Ground Only)

NOTE

TLM only available after 30 sec delay following HCU power on because of HCU SW initialization.

Verify HCU1_AO_Htr_Cntl_Loop_Stat_VTC – ENABLED

Verify HCU1_AD_Htr_Cntl_Loop_Stat_VTC – ENABLED

Verify HCU1_AR_Htr_Cntl_Loop_Stat_VTC – ENABLED

Verify HCU1_FD_Htr_Cntl_Loop_Stat_VTC – ENABLED

Verify HCU1_FO_Htr_Cntl_Loop_Stat_VTC – ENABLED

Verify HCU1_FR_Htr_Cntl_Loop_Stat_VTC – ENABLED

Verify HCU2_AO_Htr_Cntl_Loop_Stat_VTC – ENABLED

Verify HCU2_AD_Htr_Cntl_Loop_Stat_VTC – ENABLED

Verify HCU2_AR_Htr_Cntl_Loop_Stat_VTC – ENABLED

Verify HCU2_FD_Htr_Cntl_Loop_Stat_VTC – ENABLED

Verify HCU2_FO_Htr_Cntl_Loop_Stat_VTC – ENABLED

Verify HCU2_FR_Htr_Cntl_Loop_Stat_VTC – ENABLED

COLUMBUS SINGLE VTC1 FINAL ACTIVATION

(ASSY MAL/1E/FIN/MULTI E)

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OBJECTIVE:

Continuing activation of Columbus Module with only VTC1 available.

INITIAL CONDITIONS:

Columbus Single VTC1 Berthed Survival Mode Activation is complete.

1. ACTIVATING PDU OUTLET

PCS

1.1 Activating PDU1 Subsystem Power Buses 1 thru 5

Task: COL Final Activation - Part 1

COL Final Activation - Part 1

'PDU Outlet Activation'

PDU1 Subsys Pwr Bus [X] where [X] = [1] [2] [3] [4] [5]
cmd PDU1 Subsys Pwr Bus [X] – On
Verify PDU1 Subsys Pwr Bus Posn [X] – On
Repeat

```
cmd PDU1_Subsys_Pwr_Bus1_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU1_Subsys_Pwr_Bus1_On_Off_Stat_VTC_PP – ON

cmd PDU1_Subsys_Pwr_Bus2_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU1_Subsys_Pwr_Bus2_On_Off_Stat_VTC_PP – ON

cmd PDU1_Subsys_Pwr_Bus3_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU1_Subsys_Pwr_Bus3_On_Off_Stat_VTC_PP – ON

cmd PDU1_Subsys_Pwr_Bus4_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU1_Subsys_Pwr_Bus4_On_Off_Stat_VTC_PP – ON

cmd PDU1_Subsys_Pwr_Bus5_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1
```

Verify PDU1_Subsys_Pwr_Bus5_On_Off_Stat_VTC_PP – ON

1.2 [Activating PDU1 Subsystem Power Buses 6 thru 10](#)

COL Final Activation - Part 1

'PDU Outlet Activation'

PDU1 Subsys Pwr Bus [X] where [X] = [6] [7] [8] [9] [10]
cmd PDU1 Subsys Pwr Bus [X] – On
Verify PDU1 Subsys Pwr Bus Posn [X] – On
Repeat

```
cmd PDU1_Subsys_Pwr_Bus6_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU1_Subsys_Pwr_Bus6_On_Off_Stat_VTC_PP – ON

cmd PDU1_Subsys_Pwr_Bus7_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU1_Subsys_Pwr_Bus7_On_Off_Stat_VTC_PP – ON

cmd PDU1_Subsys_Pwr_Bus8_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU1_Subsys_Pwr_Bus8_On_Off_Stat_VTC_PP – ON

cmd PDU1_Subsys_Pwr_Bus9_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU1_Subsys_Pwr_Bus9_On_Off_Stat_VTC_PP – ON

cmd PDU1_Subsys_Pwr_Bus10_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU1_Subsys_Pwr_Bus10_On_Off_Stat_VTC_PP – ON
```

1.3 [Activating PDU2 Subsystem Power Buses 1 thru 5](#)

COL Final Activation - Part 1

'PDU Outlet Activation'

PDU2 Subsys Pwr Bus [X] where [X] = [1] [2] [3] [4] [5]
cmd PDU2 Subsys Pwr Bus [X] – On
Verify PDU2 Subsys Pwr Bus Posn [X] – On
Repeat

```
cmd PDU2_Subsys_Pwr_Bus1_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU2_Subsys_Pwr_Bus1_On_Off_Stat_VTC_PP – ON

cmd PDU2_Subsys_Pwr_Bus2_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU2_Subsys_Pwr_Bus2_On_Off_Stat_VTC_PP – ON

cmd PDU2_Subsys_Pwr_Bus3_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU2_Subsys_Pwr_Bus3_On_Off_Stat_VTC_PP – ON

cmd PDU2_Subsys_Pwr_Bus4_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU2_Subsys_Pwr_Bus4_On_Off_Stat_VTC_PP – ON

cmd PDU2_Subsys_Pwr_Bus5_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU2_Subsys_Pwr_Bus5_On_Off_Stat_VTC_PP – ON
```

1.4 [Activating PDU2 Subsystem Power Buses 6 thru 10](#)

COL Final Activation - Part 1

'PDU Outlet Activation'

PDU2 Subsys Pwr Bus [X] where [X] = [6] [7] [8] [9] [10]
cmd PDU2 Subsys Pwr Bus [X] – On
Verify PDU2 Subsys Pwr Bus Posn [X] – On
Repeat

```
cmd PDU2_Subsys_Pwr_Bus6_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU2_Subsys_Pwr_Bus6_On_Off_Stat_VTC_PP – ON

cmd PDU2_Subsys_Pwr_Bus7_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU2_Subsys_Pwr_Bus7_On_Off_Stat_VTC_PP – ON

cmd PDU2_Subsys_Pwr_Bus8_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU2_Subsys_Pwr_Bus8_On_Off_Stat_VTC_PP – ON

cmd PDU2_Subsys_Pwr_Bus9_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU2_Subsys_Pwr_Bus9_On_Off_Stat_VTC_PP – ON

cmd PDU2_Subsys_Pwr_Bus10_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU2_Subsys_Pwr_Bus10_On_Off_Stat_VTC_PP – ON
```

1.5 [Activating PDU1 D1 Rack Power](#)

COL Final Activation - Part 1

'PDU Outlet Activation'

'PDU1'

```
cmd Rack D1 Pwr Bus – On
```

Verify Rack D1 Pwr Bus – On

```
cmd PDU1_Rack_D1_Pwr_Bus_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU1_Rack_D1_Pwr_Bus_On_Off_Stat_VTC_PP – ON
```


1.6 [Activating PDU2 D1 Rack Power](#)

COL Final Activation - Part 1

'PDU Outlet Activation'
'PDU2'

cmd Rack D1 Pwr Bus – On

Verify Rack D1 Pwr Bus – On

cmd PDU2_Rack_D1_Pwr_Bus_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU2_Rack_D1_Pwr_Bus_On_Off_Stat_VTC_PP – ON

1.7 [Activating WPA1 and WPA2 Accumulator Pressure Sensors \(Ground Only\)](#)

COL-CC

COL-CC to activate WPA1 and WPA2 Accumulator Pressure Sensors.

Wait for “Go” to continue.

NOTE

1. This step can only be performed by **COL-CC**.
2. If the sensor readings show values below 165 kPa a pressurization of the accumulator is required prior to payload rack connector mate. Continue with [step 1.8](#).
3. If both readings of either pair of WPA Accumulator Pressure sensors are out of limits after the monitoring has been enabled, the system will automatically safe to Berthed Survival Mode.

cmd WPA1_Accum_Press_Snsr1_Pwr_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WPA1_Accum_Abs_Press1_VTC – 165 -195 kPa

cmd WPA2_Accum_Press_Snsr2_Pwr_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WPA2_Accum_Abs_Press2_VTC – 165 -195 kPa

Activation of the VTC C&W monitoring for the WPA1 and WPA2 Accumulator Pressure Sensors

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – WPA1_Accum_Abs_Press1_VTC

```

prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WPA1_Accum_Abs_Press1_VTC_MEF – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – WPA2_Accum_Abs_Press2_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WPA2_Accum_Abs_Press2_VTC_MEF – ENABLED

COL-CC gives "Go" to continue.
    
```

MCC-H

1.8 [Enabling C&W for Previous Monitorings \(Ground Only\)](#)
 Enable the following events in the Primary and Backup C&C MDMs.

If ground unable to complete,
 Perform [{2.101 CAUTION AND WARNING EVENT MANAGEMENT}](#), Step 2 (SODF: C&DH: NOMINAL) per Table 1, then

Table 1. C&W Events for WPA1 and WPA2

Event	Text	Class
13538	'WPA1 Accumulator Pressure Sensor 1 High - COL'	W
13541	'WPA2 Accumulator Pressure Sensor 2 High - COL'	W

1.9 [Verifying Total Pressure Sensors](#)

COL Final Activation - Part 1

'Total Pressure Sensor'

Verify TPS3 Air Pressure: 719 to 783 mmHg
 Verify TPS4 Air Pressure: 719 to 783 mmHg

```

Verify TPS3_Air_Press_VTC – 719 - 783 mmHg
Verify TPS4_Air_Press_VTC – 719 - 783 mmHg
    
```

2. [ACTIVATING CMU 1-4](#)

NOTE

- 1. CMU4 needs to be activated for CMU1 Ready Status to be available.
- 2. The water loop must be activated within 5 hours of CMU activation.

PCS

2.1 [Activating Nominal Power A Supplies](#)

Task: COL Final Activation - Part 1

COL Final Activation - Part 1

'Command and Measurement Unit Activation'

cmd CMU 1 Nom Pwr A – On

Verify CMU 1 Nom Pwr A Status – On

Verify CMU 1 Nom Pwr A Current < 1.35 A

cmd CMU 2 Nom Pwr A – On

Verify CMU 2 Nom Pwr A Status – On

Verify CMU 2 Nom Pwr A Current < 1.35 A

Verify CMU 2 Ready Status – Ready

cmd CMU 3 Nom Pwr A – On

Verify CMU 3 Nom Pwr A Status – On

Verify CMU 3 Nom Pwr A Current < 1.35 A

Verify CMU 3 Ready Status – Ready

cmd CMU 4 Nom Pwr A – On

Verify CMU 4 Nom Pwr A Status – On

Verify CMU 4 Nom Pwr A Current < 1.35 A

Verify CMU 4 Ready Status – Ready

Verify CMU 1 Ready Status – Ready

cmd CMU1_Nom_Pwr_A_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CMU1_Nom_Pwr_A_Stat_VTC – ON

Verify CMU1_Nom_Pwr_A_Current_VTC – < 1.35 A

cmd CMU2_Nom_Pwr_A_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CMU2_Nom_Pwr_A_Stat_VTC – ON
Verify CMU2_Nom_Pwr_A_Current_VTC – < 1.35 A
Verify CMU2_Nom_Ready_Stat_ACT_PP – READY

cmd CMU3_Nom_Pwr_A_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CMU3_Nom_Pwr_A_Stat_VTC – ON
Verify CMU3_Nom_Pwr_A_Current_VTC – < 1.35 A
Verify CMU3_Nom_Ready_Stat_ACT_PP – READY

cmd CMU4_Nom_Pwr_A_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CMU4_Nom_Pwr_A_Stat_VTC – ON
Verify CMU4_Nom_Pwr_A_Current_VTC – < 1.35 A
Verify CMU4_Nom_Ready_Stat_ACT_PP – READY
Verify CMU1_Nom_Ready_Stat_ACT_PP – READY

2.2 [Activating Nominal Power B Supplies](#)

COL Final Activation - Part 1

'Command and Measurement Unit Activation'

cmd CMU 1 Nom Pwr B – On

Verify CMU 1 Nom Pwr B Status – On
Verify CMU 1 Nom Pwr B Current < 0.75 A
Verify CMU 1 Nom Pwr A Current < 0.75 A

cmd CMU 2 Nom Pwr B – On

Verify CMU 2 Nom Pwr B Status – On
Verify CMU 2 Nom Pwr B Current < 0.75 A
Verify CMU 2 Nom Pwr A Current < 0.75 A

cmd CMU 3 Nom Pwr B – On

Verify CMU 3 Nom Pwr B Status – On
Verify CMU 3 Nom Pwr B Current < 0.75 A
Verify CMU 3 Nom Pwr A Current < 0.75 A

cmd CMU 4 Nom Pwr B – On

Verify CMU 4 Nom Pwr B Status – On
Verify CMU 4 Nom Pwr B Current < 0.75 A

Verify CMU 4 Nom Pwr A Current < 0.75 A

cmd CMU1_Nom_Pwr_B_On_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CMU1_Nom_Pwr_B_Stat_ACT_PP – ON

Verify CMU1_Nom_Pwr_B_Current_ACT_PP – < 0.75 A

Verify CMU1_Nom_Pwr_A_Current_VTC – < 0.75 A

cmd CMU2_Nom_Pwr_B_On_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CMU2_Nom_Pwr_B_Stat_ACT_PP – ON

Verify CMU2_Nom_Pwr_B_Current_ACT_PP – < 0.75 A

Verify CMU2_Nom_Pwr_A_Current_VTC – < 0.75 A

cmd CMU3_Nom_Pwr_B_On_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CMU3_Nom_Pwr_B_Stat_ACT_PP – ON

Verify CMU3_Nom_Pwr_B_Current_ACT_PP – < 0.75 A

Verify CMU3_Nom_Pwr_A_Current_VTC – < 0.75 A

cmd CMU4_Nom_Pwr_B_On_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CMU4_Nom_Pwr_B_Stat_ACT_PP – ON

Verify CMU4_Nom_Pwr_B_Current_ACT_PP – < 0.75 A

Verify CMU4_Nom_Pwr_A_Current_VTC – < 0.75 A

3. [ACTIVATING WATER LOOP](#)

NOTE

- 1. TCS Jumpers must be installed prior to beginning this step.
- 2. Expect valve operations to take up to 15 seconds for verification.

3.1 [Configuring Loop A IFHX and Loop B IFHX for Water Loop Activation](#)

COL: TCS: MTL IFHX

COL MTL IFHX Commands

'COL MTL IFHX NH3'

'Isol Vlv'

Verify Position – Closed

cmd Cntrl Avail Open – Ena (Verify Cntrl Avail – Ena)

cmd Position – Open (Verify Position – Open)

'Byp Vlv'

Verify Position – Bypass

cmd Cntrl Avail Flothru – Ena (Verify Cntrl Avail – Ena)

cmd Position – Flothru (Verify Position – Flothru)

COL: TCS: LTL IFHX

COL LTL IFHX Commands

'COL LTL IFHX NH3'

'Isol Vlv'

Verify Position – Closed

cmd Cntrl Avail Open – Ena (Verify – Cntrl Avail Ena)

cmd Position – Open (Verify – Position Open)

'Byp Vlv'

Verify Position – Bypass

cmd Cntrl Avail Flothru – Ena (Verify – Cntrl Avail Ena)

cmd Position – Flothru (Verify – Position Flothru)

3.2 [Configuring Water On/Off Valve](#)

Task: COL Final Activation - Part 2

COL Final Activation - Part 2

'Water Loop Activation'

'Water On Off Valves'

Verify WOOV1 Posn – Open

Verify WOOV2 Posn – Closed

Verify WOOV3 Posn – Open

Verify WOOV4 Posn – Open

Verify WOOV5 Posn – Open

Verify WOOV6 Posn – Open

Verify WOOV7 Posn – Open

Verify WOOV8 Posn – Open

Verify WOOV9 Posn – Open

Verify WOOV10 Posn – Closed

Verify WOOV1_Open_Stat_VTC_PP – OPEN
Verify WOOV2_Close_Stat_VTC_PP – CLOSED
Verify WOOV3_Open_Stat_VTC_PP – OPEN
Verify WOOV4_Open_Stat_VTC_PP – OPEN
Verify WOOV5_Open_Stat_VTC_PP – OPEN
Verify WOOV6_Open_Stat_VTC_PP – OPEN
Verify WOOV7_Open_Stat_VTC_PP – OPEN
Verify WOOV8_Open_Stat_VTC_PP – OPEN
Verify WOOV9_Open_Stat_VTC_PP – OPEN
Verify WOOV10_Close_Stat_VTC_PP – CLOSED

Water Flow Selection Valve Configuration Verification

Verify WFSV_ISPR_A1_Open_Stat_VTC – OPEN
Verify WFSV_ISPR_A2_Open_Stat_VTC – OPEN
Verify WFSV_ISPR_A3_Open_Stat_VTC – OPEN
Verify WFSV_ISPR_A4_Open_Stat_VTC – OPEN
Verify WFSV_ISPR_F1_Open_Stat_VTC – OPEN
Verify WFSV_ISPR_F2_Open_Stat_VTC – OPEN
Verify WFSV_ISPR_F3_Open_Stat_VTC – OPEN
Verify WFSV_ISPR_F4_Open_Stat_VTC – OPEN
Verify WFSV_ISPR_O1_Open_Stat_VTC – OPEN
Verify WFSV_ISPR_O2_Open_Stat_VTC – OPEN

3.3 [Activating and Verifying WMV1 Shutoff Valve](#)

COL Final Activation - Part 2

'3 Way Modulating Valves'

'WMV1'

cmd WMV1 SOV Pwr – On

Verify WMV1 SOV Pwr – On

Verify WMV1 SOV1 Posn – Open

Verify WMV1 SOV2 Posn – Open

cmd WMV1_SOV_Pwr_On_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WMV1_SOV_Pwr_Stat_ACT_PP – ON

Verify WMV1_SOV1_Open_Stat_ACT_PP – OPEN

Verify WMV1_SOV2_Open_Stat_ACT_PP – OPEN

3.4 [Deactivating WMV1 Shutoff Section](#)

COL Final Activation - Part 2

'3 Way Modulating Valves'
'WMV1'

cmd WMV1 SOV Pwr – Off

Verify WMV1 SOV Pwr – Off

cmd WMV1_SOV_Pwr_Off_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WMV1_SOV_Pwr_Stat_ACT_PP – OFF

3.5 [Activating and Verifying WMV2 Shutoff Valve](#)

COL Final Activation - Part 2

'3 Way Modulating Valves'
'WMV2'

cmd WMV2 SOV Pwr – On

Verify WMV2 SOV Pwr – On

Verify WMV2 SOV1 Posn – Closed

Verify WMV2 SOV2 Posn – Closed

cmd WMV2_SOV_Pwr_On_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WMV2_SOV_Pwr_Stat_ACT_PP – ON

Verify WMV2_SOV1_Close_Stat_ACT_PP – CLOSED

Verify WMV2_SOV2_Close_Stat_ACT_PP – CLOSED

3.6 [Deactivating WMV2 Shutoff Section](#)

COL Final Activation - Part 2

'3 Way Modulating Valves'
'WMV2'

cmd WMV2 SOV Pwr – Off

Verify WMV2 SOV Pwr – Off

cmd WMV2_SOV_Pwr_Off_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WMV2_SOV_Pwr_Stat_ACT_PP – OFF

3.7 [Activating and Verifying WMV3 Shutoff Valve](#)

COL Final Activation - Part 2

'3 Way Modulating Valves'
'WMV3'

cmd WMV3 SOV Pwr – On

Verify WMV3 SOV Pwr – On
Verify WMV3 SOV1 Posn – Open
Verify WMV3 SOV2 Posn – Open

cmd WMV3_SOV_Pwr_On_ACT
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WMV3_SOV_Pwr_Stat_ACT_PP – ON
Verify WMV3_SOV1_Open_Stat_ACT_PP – OPEN
Verify WMV3_SOV2_Open_Stat_ACT_PP – OPEN

3.8 [Deactivating WMV3 Shutoff Section](#)

COL Final Activation - Part 2

'3 Way Modulating Valves'
'WMV3'

cmd WMV3 SOV Pwr – Off

Verify WMV3 SOV Pwr – Off

cmd WMV3_SOV_Pwr_Off_ACT
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WMV3_SOV_Pwr_Stat_ACT_PP – OFF

3.9 [Activating and Verifying WMV4 Shutoff Valve](#)

COL Final Activation - Part 2

'3 Way Modulating Valves'
'WMV4'

cmd WMV4 SOV Pwr – On

Verify WMV4 SOV Pwr – On
Verify WMV4 SOV1 Posn – Closed
Verify WMV4 SOV2 Posn – Closed

cmd WMV4_SOV_Pwr_On_ACT
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WMV4_SOV_Pwr_Stat_ACT_PP – ON
Verify WMV4_SOV1_Close_Stat_ACT_PP – CLOSED
Verify WMV4_SOV2_Close_Stat_ACT_PP – CLOSED

3.10 [Deactivating WMV4 Shutoff Section](#)

COL Final Activation - Part 2

'3 Way Modulating Valves'
'WMV4'

cmd WMV4 SOV Pwr – Off

Verify WMV4 SOV Pwr – Off

cmd WMV4_SOV_Pwr_Off_ACT
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WMV4_SOV_Pwr_Stat_ACT_PP – OFF

3.11 [Closing Bypass Valves WOOV5 and WOOV7](#)

COL Final Activation - Part 2

'Bypass Valves'

cmd WOOV5 – Close

Verify WOOV5 Posn – Closed

cmd WOOV7 – Close

Verify WOOV7 Posn – Closed

cmd WOOV5_Vlv_Close_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WOOV5_Close_Stat_VTC_PP – CLOSED

cmd WOOV7_Vlv_Close_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WOOV7_Close_Stat_VTC_PP – CLOSED

3.12 [Activating WMV1 Modulating Section](#)

COL Final Activation - Part 2

'WMV1 MDV Pwr'

cmd WMV1 MDV Pwr – On

Verify WMV1 MDV Pwr – On

cmd WMV1_MDV_Pwr_On_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WMV1_MDV_Pwr_Stat_ACT_PP – ON

3.13 [Activating WPA1](#)

COL Final Activation - Part 2

'WPA1 Pwr'

cmd WPA1 Pwr – On

Verify WPA1 Pwr – On

cmd WPA1_Pwr_On_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WPA1_Pwr_Stat_ACT_PP – ON

3.14 [Starting up WPA1 Pump Operation](#)

COL Final Activation - Part 2

'WPA1 Pump'

NOTE

This step activates active cooling via the water loop and terminates the thermal clock started with CMU Activation in step 2.

cmd WPA1 Pump – Init

Verify Pump dP > 30 kPa

Verify Mass Flow > 230 kg/h

Verify Nom Plenum dP > 18 kPa

cmd WPA1_Pump_Init_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WPA1_Pump_DP_ACT_PP – > 30 kPa

Verify WPA1_Massflow_ACT_PP – > 230 kg/h
Verify DPSB1_Nom_Plenum_DP_VTC – > 18 kPa

3.15 [Enabling Monitoring of Delta Pressure Sensor Block](#)

COL Final Activation - Part 2

'Delta Pressure Sensor Block'

NOTE

If reading of the DPSB1 Nom Plenum dP is out of limits after the monitoring has been enabled, the system will automatically safe to Berthed Survival Mode.

cmd DPSB1 Nom Plenum dP Mon – Enable

Verify DPSB1 Nom Plenum dP Mon Status – Enabled

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – DPSB1_Nom_Plenum_DP_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify DPSB1_Nom_Plenum_DP_VTC_MEF – ENABLED

3.16 [Verifying Wet Temperatures](#)

COL Final Activation - Part 2

'Wet Temperature Sensor Block'

'WTSB1 Nom Plenum Temp 3'

Verify WTSB1 Nom Plenum Temp 3 < 24 deg C

```
*****
*           If WTSB1 Nom Plenum Temp 3 ≥ 24 deg C
*           |
*           |           wait 5 minutes then re-verify
*           |
*           |
*****
```

Verify WTSB1_Nom_Plenum_Temp3_VTC – < 24°C

3.17 [Enabling Monitoring of WTSB Measurements](#)

COL Final Activation - Part 2

'Wet Temperature Sensor Block'

NOTE

If reading of the WTSB1 Nom Plenum Temp3 is out of limits after the monitoring has been enabled, the system will automatically safe to Berthed Survival Mode.

cmd WTSB1 Nom Plenum Temp 3 Monitor – Enable

Verify WTSB1 Nom Plenum Temp 3 Monitor Status – Enabled

```

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – WTSB1_Nom_Plenum_Temp3_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify WTSB1_Nom_Plenum_Temp3_VTC_MEF – ENABLED
    
```

MCC-H

3.18 [Enabling C&W in USOS for Previous Monitorings \(Ground Only\)](#)

Enable the following events in the Primary and Backup C&C MDMs.

If ground unable to complete,

Perform [{2.101 CAUTION AND WARNING EVENT MANAGEMENT}](#), Step 2 (SODF: C&DH: NOMINAL) per Table 2, then

Table 2. C&W Events for DPSB & WTSB

Event	Text	Class
13534	'Cooling Loop Delta Pressure Sensor 1 Low - COL'	W
14165	'Cooling Loop Temperature Sensor 1 High - COL'	W

PCS

3.19 [Activating ATU Power Bus](#)

COL Final Activation - Part 2: EPS: PDU1 120V Outlets Subsys/Payloads:

COL PDU1 120V Outlets VTC1

'PDU1'

'Outlet Num 20'

cmd ATU1 Pwr Bus – On

Verify ATU1 Pwr Bus – On

COL: EPS: PDU2 120V Outlets Subsys/Payloads:

COL PDU2 120V Outlets VTC1

'PDU2'

'Outlet Num 20'

cmd ATU2 Pwr Bus – On

Verify ATU2 Pwr Bus – On

```
cmd PDU1_ATU1_Pwr_Bus_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1
```

Verify PDU1_ATU1_Pwr_Bus_On_Off_Stat_VTC_PP – ON

```
cmd PDU2_ATU2_Pwr_Bus_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1
```

Verify PDU2_ATU2_Pwr_Bus_On_Off_Stat_VTC_PP – ON

4. [ACTIVATING NETWORK CLSW](#)

4.1 [Activating CLSW1 Power A](#)

Task: COL Final Activation - Part 3

COL Final Activation - Part 3

'Network CLSW'

cmd CLSW 1 Pwr A – On

Verify CLSW 1 Pwr A Status – On

Verify CLSW 1 Pwr A Current < 2.5 A

Verify CLSW 1 Pwr A Ready Status – Ready

```
cmd CLSW1_Pwr_A_On_ACT
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1
```

Verify CLSW1_Pwr_A_Stat_ACT_PP – ON

Verify CLSW1_Pwr_A_Current_ACT_PP – < 2.5 A

Verify CLSW1_Ready_Stat_ACT_PP – READY

4.2 [Activating CLSW1 Power B](#)

COL Final Activation - Part 3

'Network CLSW'

cmd CLSW 1 Pwr B – On

Verify CLSW 1 Pwr B Status – On

Verify CLSW 1 Pwr B Current < 2.2 A

Verify CLSW 1 Pwr A Current < 0.7 A

```
cmd CLSW1_Pwr_B_On_ACT
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
```

data Onboard_Node – SYS_CCSDS_End_Point_VTC1
Verify CLSW1_Pwr_B_Stat_ACT_PP – ON
Verify CLSW1_Pwr_B_Current_ACT_PP – < 2.2 A
Verify CLSW1_Pwr_A_Current_ACT_PP – < 0.7 A

4.3 [Activating CLSW2 Power A](#)

COL Final Activation - Part 3

'Network CLSW'

cmd CLSW 2 Pwr A – On

Verify CLSW 2 Pwr A Status – On
Verify CLSW 2 Pwr A Current < 2.5 A
Verify CLSW 2 Pwr A Ready Status – Ready

cmd CLSW2_Pwr_A_On_ACT
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1
Verify CLSW2_Pwr_A_Stat_ACT_PP – ON
Verify CLSW2_Pwr_A_Current_ACT_PP – < 2.5 A
Verify CLSW2_Ready_Stat_ACT_PP – READY

4.4 [Activating CLSW2 Power B](#)

COL Final Activation - Part 3

'Network CLSW'

cmd CLSW 2 Pwr B – On

Verify CLSW 2 Pwr B Status – On
Verify CLSW 2 Pwr B Current < 2.2 A
Verify CLSW 2 Pwr A Current < 0.7 A

cmd CLSW2_Pwr_B_On_ACT
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1
Verify CLSW2_Pwr_B_Stat_ACT_PP – ON
Verify CLSW2_Pwr_B_Current_ACT_PP – < 2.2 A
Verify CLSW2_Pwr_A_Current_ACT_PP – < 0.7 A

5. [ACTIVATING MASS MEMORY UNIT](#)

5.1 [Activating MMU2 Power A](#)

Task: COL Final Activation - Part 3

COL Final Activation - Part 3

'Mass Memory Unit'

cmd MMU2 Pwr A – On

Verify MMU2 Pwr A Status – On

Verify MMU2 Pwr A Current < 1.58 A

cmd MMU2_Pwr_A_On_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify MMU2_Pwr_A_Stat_ACT_PP – ON

Verify MMU2_Pwr_A_Current_ACT_PP – < 1.58 A

5.2 [Activating MMU2 Power B](#)

COL Final Activation - Part 3

'Mass Memory Unit'

cmd MMU2 Pwr B – On

Verify MMU2 Pwr B Status – On

Verify MMU2 Pwr B Current < 0.12 A

Verify MMU2 Pwr A Current < 1.58 A

cmd MMU2_Pwr_B_On_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify MMU2_Pwr_B_Stat_ACT_PP – ON

Verify MMU2_Pwr_B_Current_ACT_PP – < 0.12 A

Verify MMU2_Pwr_A_Current_ACT_PP – < 1.58 A

5.3 [Commanding MMU2 to Slave Mode](#)

COL Final Activation - Part 3

'Mass Memory Unit'

cmd Boot MMU 2 – Slave

Wait up to 5 minutes for MMU2 Ready Status to be displayed.

Verify MMU2 Ready Status – Ready

cmd VTC_Boot_SPC_Cmd_SW

prm RT_Address – 27 (RT address of MMU2)

prm Mode – 9 (MMU_SLAVE)

prm Session Number – 1

data Onboard_Node – SYS_CCSDS_End_Point_VTCM

Verify MMU2_Ready_Stat_ACT_PP – READY

5.4 [Activating MMU1 Power A](#)

COL Final Activation - Part 3

'Mass Memory Unit'

cmd MMU1 Pwr A – On

Verify MMU1 Pwr A Status – On

Verify MMU1 Pwr A Current < 1.58 A

cmd MMU1_Pwr_A_On_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify MMU1_Pwr_A_Stat_ACT_PP – ON

Verify MMU1_Pwr_A_Current_ACT_PP – < 1.58 A

5.5 [Activating MMU1 Power B](#)

COL Final Activation - Part 3

'Mass Memory Unit'

cmd MMU1 Pwr B – On

Verify MMU1 Pwr B Status – On

Verify MMU1 Pwr B Current < 0.12 A

Verify MMU1 Pwr A Current < 1.58 A

cmd MMU1_Pwr_B_On_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify MMU1_Pwr_B_Stat_ACT_PP – ON

Verify MMU1_Pwr_B_Current_ACT_PP – < 0.12 A

Verify MMU1_Pwr_A_Current_ACT_PP – < 1.58 A

5.6 [Commanding MMU1 to Master Mode](#)

COL Final Activation - Part 3

'Mass Memory Unit'

cmd Boot MMU 1 – Master

Wait up to 5 minutes for MMU1 Ready Status to be displayed.

Verify MMU1 Ready Status – Ready

cmd VTC_Boot_SPC_Cmd_SW

prm RT_Address – 17 (RT address of MMU1)

prm Mode – 7 (MMU_MASTER_DEFAULT)

prm Session Number – 1
data Onboard_Node – SYS_CCSDS_End_Point_VTCM
 Verify MMU1_Ready_Stat_ACT_PP – READY

6. [ACTIVATING MISSION MANAGEMENT COMPUTER](#)

<u>NOTE</u>
1. Steps 6.3 through 6.7 require AOS.
2. Expect DMS C&W messages.

6.1 [Inhibiting Redun Management for MMC](#)

Task: COL Final Activation - Part 3

COL Final Activation - Part 3

'Mission Management Computer'

√MMC Redun Management – Inh

6.2 [Enabling RT I/O for MMC](#)

COL Final Activation - Part 3: CB INT 2 RT Status

CB INT 2 RT Status

cmd 22 MMC RT Status – Enable **Execute** (Verify – Ena)

6.3 [Activating MMC Power A](#)

Task: COL Final Activation - Part 3

COL Final Activation - Part 3

'Mission Management Computer'

cmd MMC Pwr A – On

Verify MMC Pwr A Status – On

Verify MMC Pwr A Current < 1.19 A

cmd MMC_Pwr_A_On_ACT
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1
 Verify MMC_Pwr_A_Stat_ACT_PP – ON
 Verify MMC_Pwr_A_Current_ACT_PP – < 1.19 A

6.4 [Activating MMC Power B](#)

COL Final Activation - Part 3

'Mission Management Computer'

cmd MMC Pwr B – On

Verify MMC Pwr B Status – On
Verify MMC Pwr B Current < 0.12 A
Verify MMC Pwr A Current < 1.19 A

```
cmd MMC_Pwr_B_On_ACT
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1
```

Verify MMC_Pwr_B_Stat_ACT_PP – ON
Verify MMC_Pwr_B_Current_ACT_PP – < 0.12 A
Verify MMC_Pwr_A_Current_ACT_PP – < 1.19 A

6.5 [Initializing Command MMC S/W](#)

NOTE

During the MMC boot process, the configuration FLAPs MMC Cold Start and MMC Start-Up are executed automatically.

The MMC Cold Start FLAP:

- Starts monitorings of the MMC node
- Executes the MMC Startup FLAP

The MMC Start-Up FLAP:

- Resets the station mode compatibility variable and venting valve inhibit status
- Activates MMC hosted application software (COAP IDF task)
- Starts the SNCD CVT packet to the US MDM
- Starts the pre-emptive TIm packet for DMS data to Col-CC
- Starts the pre-emptive TIm packet for USM data to Col-CC

COL Final Activation - Part 3

'Mission Management Computer'

cmd MMC Boot – MMC Default

Verify SPC2 Boot Report – 66048

Wait up to 5 minutes for MMC to boot before checking Ready Status.

Verify MMC Ready Status – Ready

Wait for “Go” to continue.

```
cmd VTC_Boot_SPC_Cmd_SW
prm RT_Address – 8 (RT address of SPC2)
prm Mode – 1 (MMC_DEFAULT)
prm Session Number – 1 (TBC)
data Onboard_Node – SYS_CCSDS_End_Point_VTCM
```

Verify VTC_MASTER_SPC2_Boot_Report_SW_PP – 66048
Verify MMC_Ready_Stat_ACT_PP – READY

COL-CC to give a “Go” to continue.

6.6 [Enabling RT FDIR for MMC](#)

Task: COL Final Activation - Part 3: CB INT 2 RT Status

CB INT 2 RT Status

cmd 22 MMC RT FDIR Status – Enable FDIR **Execute** (Verify – Ena)

6.7 [Enabling MMC Redundancy Management](#)

Task: Columbus Final Act - Part 3

COL Final Activation - Part 3

'Mission Management Computer'

cmd MMC Redun Management – Ena (Verify – Ena)

6.8 [Enabling CCSDS Checksum Validation on MMC \(Ground Only\)](#)

cmd DMS_CCSDS_Checksum_Ena_Cmd_SW

data ONBOARD_NODE –

SYS_CCSDS_End_Point_MMC_DMS_SERV

6.9 [Enabling CCSDS Checksum Validation on MMU \(Ground Only\)](#)

cmd DMS_CCSDS_Checksum_Ena_Cmd_SW

data ONBOARD_NODE –

SYS_CCSDS_End_Point_MMU_DMS_SERV

7. [ACTIVATING DATA MANAGEMENT COMPUTER](#)

NOTE

- 1. Steps 7.1 through 7.5 require AOS.
- 2. Expect DMS C&W messages.

7.1 [Activating DMC Power A](#)

Task: COL Final Activation - Part 3

COL Final Activation - Part 3

'Data Management Computer'

cmd DMC Pwr A – On

Verify DMC Pwr A Status – On

Verify DMC Pwr A Current < 1.19 A

cmd DMC_Pwr_A_On_ACT

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data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify DMC_Pwr_A_Stat_VTC – ON
Verify DMC_Pwr_A_Current_VTC – < 1.19 A

7.2 [Activating DMC Power B](#)

COL Final Activation - Part 3
'Data Management Computer'

cmd DMC Pwr B – On

Verify DMC Pwr B Status – On
Verify DMC Pwr B Current < 0.12 A
Verify DMC Pwr A Current < 1.19 A

cmd DMC_Pwr_B_On_ACT
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify DMC_Pwr_B_Stat_VTC – ON
Verify DMC_Pwr_B_Current_VTC – < 0.12 A
Verify DMC_Pwr_A_Current_VTC – < 1.19 A

7.3 [Initializing DMC S/W](#)

COL Final Activation - Part 3
'Data Management Computer'

cmd DMC Boot – DMC Default

Wait up to 5 minutes for DMC to boot before checking the SPC1 Boot Report

Verify SPC1 Boot Report – 4096

cmd VTC_Boot_SPC_Cmd_SW
prm RT_Address – 7
prm Mode – 0
prm Session_Number – 1
data Onboard_Node – SYS_CCSDS_End_Point_VTCM

Verify VTC_MASTER_SPC1_Boot_Report_SW_PP – 4096

7.4 [Configuring DMC as Bus Controller](#)

NOTE

All activation telemetry on PCS and ground displays will be invalid at the completion of step 7.4. These invalid parameters will be indicated by a cyan telemetry field.

NOTE

During the DMC boot process, the configuration FLAPs 'DMC Cold Start' and 'DMC Start-Up' are executed automatically.

The DMC Cold Start FLAP:

- Starts several monitorings on the DMC node
- Starts the RT acquisition of active DMS equipment
- Initializes several DMS related S/W variables
- Executes the DMC Startup FLAP

The DMC Start-Up FLAP:

- Starts several monitorings of system measurements
- Starts the RT acquisition of active system equipment
- Initializes several S/W variables

COL Final Activation - Part 3

'Data Management Computer'

cmd VTC Vital To Nominal Mode – Nominal

Wait up to 15 minutes for DMC to boot up before checking Ready Status.

Verify DMC Ready Status – Ready

cmd VTC_Vital_To_Nom_Mode_Chg_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTCM

Verify DMC_Ready_Stat_VTC – READY

COL-CC 7.5 [Enabling DMC Monitoring \(Ground Only\)](#)

DMC monitoring to be enabled by ground.

Wait for "Go" to continue.

cmd DMS_RT_Stop_RT_Acquisition_Cmd_SW
prm Remote_Terminal_ID –
 MIL 1553B Bus RT Svsystem Bus VTC1
data Onboard_Node –
 SYS CCSDS End Point DMC DMS SERV

Verify VTC1_Sys_Bus_Ena_Stat_SW – DISABLED

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – DMC_Pwr_A_Current_VTC

```

prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify DMC_Pwr_A_Current_VTC_MEF – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – DMC_Pwr_B_Current_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify DMC_Pwr_B_Current_VTC_MEF – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – DMC_Temp_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify DMC_Temp_VTC_MEF – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – DMC_Sec_Voltage_Stat_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify DMC_Sec_Voltage_Stat_VTC_MEF – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – DMC_Ready_Stat_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify DMC_Ready_Stat_VTC_MEF – ENABLED

COL-CC to give a “Go” to continue.
    
```

- MCC-H** 7.6 [Enabling C&W for the DMS and PDU1/2 Cautions \(Ground Only\)](#)
 Enable the following events in the Primary and Backup C&C MDMs.
- If ground unable to complete,
 | Perform [{2.101 CAUTION AND WARNING EVENT MANAGEMENT}](#), Step 2 (SODF: C&DH: NOMINAL) per Table 3, then;

Table 3. C&W Events for DMS and PDU1

Event	Text	Class
13570	'DMS I/O Unit (CMU1) Redundant Branch Failure - COL'	C
13572	'DMS I/O Unit (CMU2) Redundant Branch Failure - COL'	C
13574	'DMS I/O Unit (CMU3) Redundant Branch Failure - COL'	C
13576	'DMS I/O Unit (CMU4) Redundant Branch Failure - COL'	C
13579	'Power Distribution Unit (PDU1) Redun Controller Failure - COL'	C

7.7 [Enabling CCSDS Checksum Validation on DMC \(Ground Only\)](#)

```
cmd DMS_CCSDS_Checksum_Ena_Cmd_SW
data ONBOARD_NODE -
SYS_CCSDS_End_Point_DMC_DMS_SERV
```

7.8 [Swapping DMS Telemetry Packets \(Ground Only\)](#)

COL-CC

COL-CC to swap nominal DMS telemetry packets.

Wait for “Go” to continue.

<p>NOTE</p> <p>Packet swapping initiated from Col-CC: Disable VTC_Gnd_Tlm_Pkt_LOG1_VTC (1Hz) Disable VTC_Gnd_Tlm_Pkt_LOG2_VTC (1Hz) Disable VTC1_Gnd_Tlm_Pkt_PHY1_VTC (1Hz)</p> <p>Perform {2.2.41 VTC GROUND PACKET SWAPPING} (ESA SODF: GROUND: NOMINAL), then:</p>

	<u>NOTE</u>
	<p>Automatically started TIm Packets: MMC_Gnd_TIm_Pkt_DMS1_DMC (0.1 Hz) MMC_Gnd_TIm_Pkt_USM3_DMC (0.1 Hz)</p> <p>Packet swapping initiated from Col-CC: Enable MMC_Gnd_TIm_Pkt_COAP_DMC (0.1Hz) Enable MMC_Gnd_TIm_Pkt_DMS2_DMC (0.1Hz) Enable MMC_Gnd_TIm_Pkt_EPDS1_DMC (0.1Hz) Enable MMC_Gnd_TIm_Pkt_EPDS2_DMC (0.1Hz) Enable MMC_Gnd_TIm_Pkt_TCS1_DMC (0.1Hz) Enable MMC_Gnd_TIm_Pkt_TCS2_DMC (0.1Hz) Enable MMC_Gnd_TIm_Pkt_ECLSS1_DMC (0.1Hz) Enable MMC_Gnd_TIm_Pkt_ECLSS2_DMC (0.1Hz) Enable MMC_Gnd_TIm_Pkt_USM1_DMC (0.1Hz) Enable MMC_Gnd_TIm_Pkt_USM2_DMC (0.1Hz) Enable MMC_Gnd_TIm_Pkt_Monitoring_Stat1_DMC (0.1Hz) Enable MMC_Gnd_TIm_Pkt_Monitoring_Stat2_DMC (0.1Hz) Enable MMC_Gnd_TIm_Pkt_FLAP_Variables1_DMC (0.1Hz) Enable MMC_Gnd_TIm_Pkt_FLAP_Variables2_DMC (0.1Hz) Enable MMU_Gnd_TIm_Pkt_LAPAP_DMC (0.1Hz) Enable MMC_Gnd_TIm_Pkt_DMS_Off_Nominal_DMC (0.1 Hz) Enable MMC_Gnd_TIm_Pkt_System_Activation_DMC (1 Hz)</p> <p>Perform {2.2.42 NOMINAL DMS PACKET SWAPPING} (ESA ODF: GROUND: NOMINAL). then:</p> <p>COL-CC to give "Go" to continue.</p>

8. [ACTIVATING PORTABLE WORKSTATION](#)

<u>NOTE</u>
<p>1. Steps 1 through 7 must be complete before PWS activation. 2. Ground can continue to step 9.</p>

Perform [{PWS ACTIVATION}](#), all (SODF: ASSY OPS: ACTIVATION AND CHECKOUT), then:

9. [ENABLING PDU FOR NOMINAL SYSTEM SUPPORT](#)

<u>NOTE</u>
Steps 9.1 through 9.5 can only be verified by the COL-CC .

9.1 [Verify PDU Microcontrollers Status](#)

PCS

Task: COL Final Activation - Part 3: EPS

[EPDS Overview](#)

'PDU1'

Verify Redundant Controller Status – Off

Verify Nominal Controller Status – On

EPDS Overview

'PDU2'

Verify Nominal Controller Status – On

Verify Redundant Controller Status – Off

Verify PDU1_Nom_Redun_CPU_Stat_DMC – Nominal

Verify PDU2_Nom_Redun_CPU_Stat_DMC – Nominal

9.2 [Enabling Nominal System Bus Control for PDU1 Subsys Power Buses](#)

COL Final Activation - Part 3: COL EPDS Auto Cmd Sequences

COL EPDS Automated Command Sequences VTC1

√VTC1 Buffer Status – Empty

```

*****
*           If VTC1 Buffer – Full
*           |
*           | sel VTC1 Cancel 2 Step Command
*           |
*           | COL Cancel 2 - Stage Cmd VTC 1
*           |
*           |
*           | cmd Cancel 2 – Stage Cmd Execute (Verify
*           | – Empty)
*           |
*           |
*****

```

'PDU1'

'Subsys Pwr Bus Control Enable ACS'

Verify Status – Enabled

Record PCS ID: _____

cmd Start – Arm

pick PCS/C-X to VTC-Com1 (where X=PCS ID)

cmd Start – Set

√VTC1_Two_Stage_Buffer_Status_SW_PP – EMPTY

```

If VTC1_Two_Stage_Buffer_Status_SW_PP – FULL
|
| cmd VTC_Cancel_Two_Stage_Cmd_Cmd_SW
| data Onboard_Node SYS_CCSDS_End_Point_VTC1
|

```

Verify VTC1_Two_Stage_Buffer_Status_SW_PP –
EMPTY

cmd PDU1_Subsys_Pwr_Bus_Sys_Cntl_Ena_ACS (ARM)

data SW_CMD – VTC_Start_Terminate_ACS_Cmd_SW

data Action – 1 (START)

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify VTC1_Two_Stage_Buffer_Status_SW_PP – FULL

cmd VTC_Execute_2_Stage_Cmd_SW (EXEC)

Verify PDU1_ATU1_Pwr_Bus_Sys_Cntl_Stat_DMC – ENABLED

Verify PDU1_CTCU1_Pwr_Bus_Sys_Cntl_Stat_DMC –
ENABLED

Verify PDU1_Rack_D1_Pwr_Bus_Sys_Cntl_Stat_DMC –
ENABLED

Verify PDU1_Fan_Pwr_Bus_Sys_Cntl_Stat_DMC – ENABLED

Verify PDU1_PDU2_Redun_Pwr_Bus_Sys_Cntl_Stat_DMC –
ENABLED

Verify PDU1_Subsys_Pwr_Bus1_Sys_Cntl_Stat_DMC –
ENABLED

Verify PDU1_Subsys_Pwr_Bus2_Sys_Cntl_Stat_DMC –
ENABLED

Verify PDU1_Subsys_Pwr_Bus3_Sys_Cntl_Stat_DMC –
ENABLED

Verify PDU1_Subsys_Pwr_Bus4_Sys_Cntl_Stat_DMC –
ENABLED

Verify PDU1_Subsys_Pwr_Bus5_Sys_Cntl_Stat_DMC –
ENABLED

Verify PDU1_Subsys_Pwr_Bus6_Sys_Cntl_Stat_DMC –
ENABLED

Verify PDU1_Subsys_Pwr_Bus7_Sys_Cntl_Stat_DMC –
ENABLED

Verify PDU1_Subsys_Pwr_Bus8_Sys_Cntl_Stat_DMC –
ENABLED

Verify PDU1_Subsys_Pwr_Bus9_Sys_Cntl_Stat_DMC –
ENABLED

Verify PDU1_Subsys_Pwr_Bus10_Sys_Cntl_Stat_DMC –
ENABLED

Verify PDU1_SUP1_Pwr_Out1_SSPC1_Sys_Cntl_Stat_DMC –
ENABLED

Verify PDU1_SUP1_Pwr_Out2_SSPC1_Sys_Cntl_Stat_DMC –
ENABLED

Verify PDU1_SUP1_Pwr_Out3_SSPC1_Sys_Cntl_Stat_DMC –
ENABLED

Verify PDU1_SUP2_Pwr_Out1_SSPC1_Sys_Cntl_Stat_DMC –
ENABLED

Verify PDU1_SUP2_Pwr_Out2_SSPC1_Sys_Cntl_Stat_DMC –
ENABLED

```
Verify PDU1_SUP2_Pwr_Out3_SSPC1_Sys_Cntl_Stat_DMC –
ENABLED
Verify PDU1_VDPU_Pwr_Bus_Sys_Cntl_Stat_DMC –
ENABLED
```

9.3 [Enabling Nominal System Bus Control for PDU2 Subsys Power Buses](#)

COL EPDS Automated Command Sequences VTC1

√VTC1 Buffer Status – Empty

```
*****
*           If VTC1 Buffer – Full
*           |
*           | sel VTC1 Cancel 2 Step Command
*           |
*           | COL Cancel 2 - Stage Cmd VTC 1
*           |
*           | cmd Cancel 2 – Stage Cmd Execute (Verify
*           | – Empty)
*           |
*****
```

'PDU2'

'Subsys Pwr Bus Control Enable ACS'

Verify Status – Enabled

Record PCS ID: _____

cmd Start – Arm

pick PCS/C-X to VTC-Com1 (where X=PCS ID)

cmd Start – Set

```
√VTC1_Two_Stage_Buffer_Status_SW_PP – EMPTY

If VTC1_Two_Stage_Buffer_Status_SW_PP – FULL
|
| cmd VTC_Cancel_Two_Stage_Cmd_Cmd_SW
| data Onboard_Node SYS_CCSDS_End_Point_VTC1
|
| Verify VTC1_Two_Stage_Buffer_Status_SW_PP –
| EMPTY
```

```
cmd PDU2_Subsys_Pwr_Bus_Sys_Cntl_Ena_ACS (ARM)
data SW_CMD – VTC_Start_Terminate_ACS_Cmd_SW
data Action – 1 (START)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify VTC1_Two_Stage_Buffer_Status_SW_PP – FULL
```

cmd VTC_Execute_2_Stage_Cmd_SW (EXEC)

Verify PDU2_ATU2_Pwr_Bus_Sys_Cntl_Stat_DMC – ENABLED
 Verify PDU2_CTCU2_Pwr_Bus_Sys_Cntl_Stat_DMC – ENABLED
 Verify PDU2_Rack_D1_Pwr_Bus_Sys_Cntl_Stat_DMC – ENABLED
 Verify PDU2_Fan_Pwr_Bus_Sys_Cntl_Stat_DMC – ENABLED
 Verify PDU2_PDU1_Redun_Pwr_Bus_Sys_Cntl_Stat_DMC – ENABLED
 Verify PDU2_Subsys_Pwr_Bus1_Sys_Cntl_Stat_DMC – ENABLED
 Verify PDU2_Subsys_Pwr_Bus2_Sys_Cntl_Stat_DMC – ENABLED
 Verify PDU2_Subsys_Pwr_Bus3_Sys_Cntl_Stat_DMC – ENABLED
 Verify PDU2_Subsys_Pwr_Bus4_Sys_Cntl_Stat_DMC – ENABLED
 Verify PDU2_Subsys_Pwr_Bus5_Sys_Cntl_Stat_DMC – ENABLED
 Verify PDU2_Subsys_Pwr_Bus6_Sys_Cntl_Stat_DMC – ENABLED
 Verify PDU2_Subsys_Pwr_Bus7_Sys_Cntl_Stat_DMC – ENABLED
 Verify PDU2_Subsys_Pwr_Bus8_Sys_Cntl_Stat_DMC – ENABLED
 Verify PDU2_Subsys_Pwr_Bus9_Sys_Cntl_Stat_DMC – ENABLED
 Verify PDU2_Subsys_Pwr_Bus10_Sys_Cntl_Stat_DMC – ENABLED
 Verify PDU2_SUP3_Pwr_Out1_SSPC1_Sys_Cntl_Stat_DMC – ENABLED
 Verify PDU2_SUP3_Pwr_Out2_SSPC1_Sys_Cntl_Stat_DMC – ENABLED
 Verify PDU2_SUP3_Pwr_Out3_SSPC1_Sys_Cntl_Stat_DMC – ENABLED
 Verify PDU2_SUP4_Pwr_Out1_SSPC1_Sys_Cntl_Stat_DMC – ENABLED
 Verify PDU2_SUP4_Pwr_Out2_SSPC1_Sys_Cntl_Stat_DMC – ENABLED
 Verify PDU2_SUP4_Pwr_Out3_SSPC1_Sys_Cntl_Stat_DMC – ENABLED
 Verify PDU2_VDPU_Pwr_Bus_Sys_Cntl_Stat_DMC – ENABLED

9.4 [Enabling Nominal System Bus Control for ECLSS Valves](#)

COL Final Activation - Part 3: COL ECLSS Auto Cmd Sequences

ECLSS Automated Command Sequences VTC1

COLUMBUS SINGLE VTC1 FINAL ACTIVATION

(ASSY MAL/1E/FIN/MULTI E)

Page 34 of 69 pages

√VTC1 Buffer Status – Empty

```
*****
*           If VTC1 Buffer – Full
*           |
*           |   sel VTC1 Cancel 2 Step Command
*           |
*           |   COL Cancel 2 - Stage Cmd VTC 1
*           |
*           |   cmd Cancel 2 – Stage Cmd Execute (Verify
*           |   – Empty)
*           |
*****
```

'ECLSS Valve System Control'

Verify VTC1 Enable Status – Ena

Record PCS ID: _____

cmd Start-VTC1 – Arm

pick PCS/C-X to VTC-Com1 (where X=PCS ID)

cmd Start - VTC1 – Set

√VTC1_Two_Stage_Buffer_Status_SW_PP – EMPTY

```
If VTC1_Two_Stage_Buffer_Status_SW_PP – FULL
|
|   cmd VTC_Cancel_Two_Stage_Cmd_Cmd_SW
|   data Onboard_Node SYS_CCSDS_End_Point_VTC1
|
|   Verify VTC1_Two_Stage_Buffer_Status_SW_PP –
|   EMPTY
```

cmd ECLSS_Vlv_Sys_Cntl_Ena_ACS (ARM)

data SW_CMD – VTC_Start_Terminate_ACS_Cmd_SW

data Action – 1 (START)

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify VTC1_Two_Stage_Buffer_Status_SW_PP – FULL

cmd VTC_Execute_2_Stage_Cmd_SW (EXEC)

Verify NLSOV1_Sys_Cntl_Stat_DMC – ENABLED

Verify NLSOV2_Sys_Cntl_Stat_DMC – ENABLED

Verify NLSOV3_Sys_Cntl_Stat_DMC – ENABLED

Verify NLSOV4_Sys_Cntl_Stat_DMC – ENABLED

Verify VADD_Vlv1_Sys_Cntl_Stat_DMC – ENABLED

```

Verify VADD_Vlv2_Sys_Cntl_Stat_DMC – ENABLED
Verify VEDD_Vlv1_Sys_Cntl_Stat_DMC – ENABLED
Verify VEDD_Vlv2_Sys_Cntl_Stat_DMC – ENABLED
Verify WLSOV_ISPR_A1_Sys_Cntl_Stat_DMC – ENABLED
Verify WLSOV_ISPR_A2_Sys_Cntl_Stat_DMC – ENABLED
Verify WLSOV_ISPR_A3_Sys_Cntl_Stat_DMC – ENABLED
Verify WLSOV_ISPR_A4_Sys_Cntl_Stat_DMC – ENABLED
Verify WLSOV_ISPR_F1_Sys_Cntl_Stat_DMC – ENABLED
Verify WLSOV_ISPR_F2_Sys_Cntl_Stat_DMC – ENABLED
Verify WLSOV_ISPR_F3_Sys_Cntl_Stat_DMC – ENABLED
Verify WLSOV_ISPR_F4_Sys_Cntl_Stat_DMC – ENABLED
Verify WLSOV_ISPR_O1_Sys_Cntl_Stat_DMC – ENABLED
Verify WLSOV_ISPR_O2_Sys_Cntl_Stat_DMC – ENABLED
    
```

9.5 [Enabling Nominal System Bus Control for TCS Valves](#)

COL Final Activation - Part 3: COL TCS Auto Cmd Sequences

COL TCS Automated Command Sequences VTC 1

√VTC1 Buffer Status – Empty

```

*****
*           If VTC1 Buffer – Full
*           |
*           |   sel VTC1 Cancel 2 Step Command
*           |
*           |   COL Cancel 2 - Stage Cmd VTC 1
*           |
*           |   cmd Cancel 2 – Stage Cmd Execute (Verify
*           |   – Empty)
*           |
*****
    
```

'TCS Valve System Control Enable ACS'

Verify Status – Enabled

Record PCS ID: _____

cmd Start – Arm

pick PCS/C-X to VTC-Com1 (where X=PCS ID)

cmd Start – Set

Wait for “Go” to continue.

```

√VTC1_Two_Stage_Buffer_Status_SW_PP – EMPTY
If VTC1_Two_Stage_Buffer_Status_SW_PP – FULL
|
    
```

```

cmd VTC_Cancel_Two_Stage_Cmd_Cmd_SW
data Onboard_Node SYS_CCSDS_End_Point_VTC1

Verify VTC1_Two_Stage_Buffer_Status_SW_PP -
EMPTY
    
```

```

cmd TCS_Vlv_Sys_Cntl_Ena_ACS (ARM)
data SW_CMD - VTC_Start_Terminate_ACS_Cmd_SW
data Action - 1 (START)
data Onboard_Node - SYS_CCSDS_End_Point_VTC1

Verify VTC1_Two_Stage_Buffer_Status_SW_PP - FULL

cmd VTC_Execute_2_Stage_Cmd_SW (EXEC)

Verify WOOV1_Sys_Cntl_Stat_DMC - ENABLED
Verify WOOV2_Sys_Cntl_Stat_DMC - ENABLED
Verify WOOV3_Sys_Cntl_Stat_DMC - ENABLED
Verify WOOV4_Sys_Cntl_Stat_DMC - ENABLED
Verify WOOV5_Sys_Cntl_Stat_DMC - ENABLED
Verify WOOV6_Sys_Cntl_Stat_DMC - ENABLED
Verify WOOV7_Sys_Cntl_Stat_DMC - ENABLED
Verify WOOV8_Sys_Cntl_Stat_DMC - ENABLED
Verify WOOV9_Sys_Cntl_Stat_DMC - ENABLED
Verify WOOV10_Sys_Cntl_Stat_DMC - ENABLED
Verify WFSV_ISPR_A1_Sys_Cntl_Stat_DMC - ENABLED
Verify WFSV_ISPR_A2_Sys_Cntl_Stat_DMC - ENABLED
Verify WFSV_ISPR_A3_Sys_Cntl_Stat_DMC - ENABLED
Verify WFSV_ISPR_A4_Sys_Cntl_Stat_DMC - ENABLED
Verify WFSV_ISPR_F1_Sys_Cntl_Stat_DMC - ENABLED
Verify WFSV_ISPR_F2_Sys_Cntl_Stat_DMC - ENABLED
Verify WFSV_ISPR_F3_Sys_Cntl_Stat_DMC - ENABLED
Verify WFSV_ISPR_F4_Sys_Cntl_Stat_DMC - ENABLED
Verify WFSV_ISPR_O1_Sys_Cntl_Stat_DMC - ENABLED
Verify WFSV_ISPR_O2_Sys_Cntl_Stat_DMC - ENABLED

COL-CC to give a "Go" to continue.
    
```

PWS 9.6 [Activating PDU Outlet via DMC](#)
 Activation Part 1
 COL Activation Part 1
 'PDU Outlet Activation'
 'PDU1 CTCU1 Pwr Bus'

cmd Pwr On Execute (OK)

Verify Pwr – ON

'PDU1 VDPU Pwr Bus'

cmd Pwr On **Execute** (OK)

Verify Pwr – ON

'PDU1 Fan Pwr Bus'

cmd Pwr On **Execute** (OK)

Verify Pwr – ON

'PDU2 CTCU2 Pwr Bus'

cmd Pwr On **Execute** (OK)

Verify Pwr – ON

'PDU2 VDPU Pwr Bus'

cmd Pwr On **Execute** (OK)

Verify Pwr – ON

'PDU2 Fan Pwr Bus'

cmd Pwr On **Execute** (OK)

Verify Pwr – ON

cmd PDU1_CTCU1_Pwr_Bus_On_AP

data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV
data Onboard_Execution_Node –
USM SW DMC USS Swop Instance

Verify PDU1_CTCU1_Pwr_Bus_On_Off_Stat_DMC – ON

cmd PDU1_VDPU_Pwr_Bus_On_AP

data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV
data Onboard_Execution_Node –
USM SW DMC USS Swop Instance

Verify PDU1_VDPU_Pwr_Bus_On_Off_Stat_DMC – ON

cmd PDU1_Fan_Pwr_Bus_On_AP

```

data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV
data Onboard_Execution_Node –
USM SW DMC USS Swop Instance

Verify PDU1_Fan_Pwr_Bus_On_Off_Stat_DMC – ON

cmd PDU2_CTCU2_Pwr_Bus_On_AP
data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV
data Onboard_Execution_Node –
USM SW DMC USS Swop Instance

Verify PDU2_CTCU2_Pwr_Bus_On_Off_Stat_DMC – ON

cmd PDU2_VDPU_Pwr_Bus_On_AP
data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV
data Onboard_Execution_Node –
USM SW DMC USS Swop Instance

Verify PDU2_VDPU_Pwr_Bus_On_Off_Stat_DMC – ON

cmd PDU2_Fan_Pwr_Bus_On_AP
data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV
data Onboard_Execution_Node –
USM SW DMC USS Swop Instance

Verify PDU2_Fan_Pwr_Bus_On_Off_Stat_DMC – ON

```

10. [ACTIVATING AND CONFIGURING HIGH RATE MULTIPLEXER](#)

<u>NOTE</u>
<ol style="list-style-type: none"> 1. Fiber Optic Jumper installation must be complete before starting this step. 2. The HRM can route COL data to the USOS Ku Band system upon completion of this step. Downlink of this data stream to COL-CC will require configuration of the Ku-Band system.

COL-CC 10.1 [Swapping DMS Telemetry Packets \(Ground Only\)](#)
COL-CC to swap nominal DMS telemetry packets.

Wait for "Go" to continue.

<u>NOTE</u>
Packet swapping initiated from COL-CC : Enable MMC_Gnd_Tlm_Pkt_COMMS1_DMC (0.1Hz) Enable MMC_Gnd_Tlm_Pkt_HRM_Diagnostics_DMC (0.1Hz)

Perform [{2.2.42 NOMINAL DMS PACKET SWAPPING}](#) (ESA SODF: GROUND: NOMINAL). then:

COL-CC to give a "Go" to continue.

PWS

10.2

Activating HRM

Activation Part 1

COL Activation Part 1

'HRM Activation'

NOTE

The following command starts the FLAP 'HRM Activation', which:

- Switches ON both HRM Pwr converters
- Activates the nominal HRM-core, if the nominal HRM-core activation fails, the redundant HRM-core is automatically activated instead
- Starts RT acquisition & monitoring of HRM data
- Enables the HRM-MMU link (Master MMU)

cmd Activate Execute (OK)

Wait up to one minute for verification

Verify Pwr A – ON

Verify Pwr B – ON

Verify Pwr A Current < 1.07 A

Verify Pwr B Current < 1.07 A

Verify Nom Core Stat – ON

Verify Nom Ready Stat – READY

cmd HRM_Activation_AP

data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV

data Onboard_Execution_Node –
USM SW DMC USS Swop Instance

Verify HRM_Pwr_A_Stat_DMC – ON

Verify HRM_Pwr_B_Stat_DMC – ON

Verify HRM_Pwr_A_Current_DMC – < 1.07 A

Verify HRM_Pwr_B_Current_DMC – < 1.07 A

Verify HRM_Nom_Branch_Avail_Stat_SW – AVAIL

Verify HRM_Nom_Core_Stat_DMC – ON

Verify HRM_Nom_Ready_Stat_DMC – READY

Verify HRM_Nom_Sec_Voltage_Stat_DMC – OK

PWS

10.3 [Configuring HRM](#)

Activation Part 1

COL Activation Part 1

'HRM Configuration (with CDI)'

cmd Configure **Execute** (OK)

Verify Serial Path TIm Input Selected – AUTO_SEL

Verify Output Datarate = 86 x 0.5 Mbps

cmd HRM_Configuration_with_CDI_AP

data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV

data Onboard_Execution_Node –
USM SW DMC USS Swop Instance

prm Alloc_VCID_CDI – COMMON_ALLOC_VCID

prm Config_IF_CDI – CONFIG01_CONFIG_HRM

prm Execute_Setup_Flag – 1 (TRUE)

prm Command_Delay – 0.1 [s]

prm Stop_Start_RT_Acq – 0 (FALSE)

prm Silent – 0 (RECEIVE MESSAGE)

Verify HRM_Serial_Path_TIm_Input_Selected_DMC –
AUTO_SEL

Verify HRM_LAN_Input_Selected_DMC – AUTO_SEL

Verify HRM_High_Speed_Output_Selected_DMC – BOTH_ON

Verify HRM_Output_Datarate_DMC = 86

Verify HRM_Config_Interface_CDI_SW – 278640513

Verify HRM_VCID_Allocation_CDI_SW – 278640531

After starting Ku band data flow **COL-CC** to coordinate with
POIC the HRM and Ku-Band System configuration

Wait for “Go” to continue.

11. [ACTIVATING WATER PUMP ASSEMBLY CONDENSING HEAT EXCHANGER CONTROL LOOP](#)

11.1 [Starting WPA1 RT \(Ground Only\)](#)

cmd DMS_RT_Start_RT_Acquisition_Cmd

prm REMOTE_TERMINAL_ID –
MIL 1553B Bus RT Svstem Bus WPA1

data Onboard_Node –
SYS CCSDS End Point DMC DMS SERV

Verify WPA1_Sys_Bus_Ena_Stat_SW – ENABLED

PWS

11.2 [Checking WPA1 Delta Pressure Values](#)

TCS

[TCS Functional Overview](#)

'Delta Pressure Sensor Blocks'

Verify DPSB 1 WPA1 DP1: > 18 kPa

Verify DPSB 3 WPA1 DP2: > 18 kPa

Verify WPA1_DPSB1_Plenum_DP1_DMC > 18 kPa

Verify WPA1_DPSB3_Plenum_DP2_DMC > 18 kPa

11.3 [Activating WPA Condensing Heat Exchanger Control Loop](#)

Activation Part 1

[COL Activation Part 1](#)

'WPA Final Activation (CHX Cntl Loop Activation)'

NOTE

The following command starts the FLAP 'WPA Final Activation' that:

- Determines active WPA
- Starts data acquisition from the WPA
- Enables the plenum delta pressure control loop
- Enables the CHX inlet temperature control loop

During the execution of the FLAP expect the following event message on the System Message Panel:

'FLAP WPA_Final_Activation_AP RT MIL_1553B_Bus_RT_System_Bus_WPA1 on Node USM_SW_DMC_USS_Swap_Instance already started when Receiving a Start Cmd'

cmd Activate Execute (OK)

Verify WPA1 CHX Temp Cntl Loop Stat: ACTIVE

Verify WPA1 Plenum Delta Press Cntl Loop Stat: ACTIVE

Verify WMV3 MDV Pwr: ON

Verify WPA1 Accum Liq Qty1: 1 to 12 L

Verify WPA1 Accum Liq Qty2: 1 to 12 L

Activation Part 1: TCS:

[TCS Functional Overview](#)

'Delta Pressure Sensor Blocks'

Verify DPSB 1 WPA1 DP1: 40 to 44 kPa

Verify DPSB 3 WPA1 DP2: 40 to 44 kPa

```

cmd WPA_Final_Activation_AP
data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV
data Onboard_Execution_Node –
USM SW DMC USS Swop Instance

Verify WPA1_CHX_Temp_Cntl_Loop_Stat_DMC – ACTIVE
Verify WPA1_Plenum_Delta_Press_Cntl_Loop_Stat_DMC –
ACTIVE
Verify WMV3_MDV_Pwr_Stat_DMC – ON
Verify WPA1_Accum_Liq_Qty1_DMC = 1 -- 12 L
Verify WPA1_Accum_Liq_Qty2_DMC = 1 -- 12 L

Verify WPA1_DPSB1_Plenum_DP1_DMC = 40 -- 44 kPa
Verify WPA1_DPSB3_Plenum_DP2_DMC = 40 -- 44 kPa

Verify WPA_Active_Pump_SW – WPA 1
    
```

11.4 [Enabling FDIR for Water Loop Reconfiguration](#)

Activation Part 1: DMS: FDIR Configuration

DMS FDIR Configuration Commands

'Accumulator Overpressure FDIR'

```

cmd Enable Execute (OK)
Verify Status – ENABLE
    
```

'WPA Switchover FDIR'

```

cmd Enable Execute (OK)
Verify Status – ENABLE
    
```

'LTHX Overtemperature FDIR'

```

cmd Enable Execute (OK)
Verify Status – ENABLE
    
```

```

cmd DMS_ACQ_Write_Dis_SW_Variable_Cmd_SW
prm Item_SID –
WPA Accum Overpressure FDIR Ena Stat SW
prm Value: – $ENABLED
data Onboard_Node –
SYS CCSDS End Point DMC DMS SERV

Verify WPA_Accum_Overpressure_FDIR_Ena_Stat_SW –
ENABLED

cmd DMS_ACQ_Write_Dis_SW_Variable_Cmd_SW
prm Item_SID – WPA_Recon_FDIR_Ena_Stat_SW
    
```

```
prm Value – $ENABLED
data Onboard_Node –
SYS CCSDS End Point DMC DMS SERV

Verify WPA_Recon_FDIR_Ena_Stat_SW – ENABLED

cmd DMS_ACQ_Write_Dis_SW_Variable_Cmd_SW
prm Item_SID – WPA_Enter_BSM_FDIR_Ena_Stat_SW
prm Value – $ENABLED
data Onboard_Node –
SYS CCSDS End Point DMC DMS SERV

Verify WPA_Enter_BSM_FDIR_Ena_Stat_SW – ENABLED
```

11.5 [Start LTHX Temperature Monitoring](#)

Menu Bar: DMS Monitoring: 5 - COMMS TCS Payload

'TCS'

Verify WTSB6 Low HX Temp1: ≤ 7.6 DegC

Verify WTSB6 Low HX Temp2: ≤ 7.6 DegC

'DMS Monitoring'

'Enable/Disable'

sel TCS

'Enable Monitoring WTSB'

cmd WTSB6 Low HX Temp1 **Execute** (OK)

cmd WTSB6 Low HX Temp2 **Execute** (OK)

sel Close

'TCS'

Verify the background color of measurements

WTSB6 Low HX Temp1: Green

WTSB6 Low HX Temp2: Green

```
Verify WTSB6_Low_HX_Temp1_DMC –  $\leq 7.6$  °C
```

```
Verify WTSB6_Low_HX_Temp2_DMC –  $\leq 7.6$  °C
```

```
cmd DMS_MONIT_Ena_Monitoring_Cmd_SW
```

```
prm MT_ID – DMC_Sys_Monitoring_Table_SW
```

```

prm EI_ID – WTSB6_Low_HX_Temp1_DMC
prm LIMIT_SET_ID – 0 (limit set 1)
data Onboard_Node –
SYS CCSDS End Point DMC DMS SERV

Verify WTSB6_Low_HX_Temp1_DMC_MS – NORMAL_1

cmd DMS_MONIT_Ena_Monitoring_Cmd_SW
prm MT_ID – DMC_Sys_Monitoring_Table_SW
prm EI_ID – WTSB6_Low_HX_Temp2_DMC
prm LIMIT_SET_ID – 0 (limit set 1)
data Onboard_Node –
SYS CCSDS End Point DMC DMS SERV

Verify WTSB6_Low_HX_Temp2_DMC_MS – NORMAL_1

```

12. [ACTIVATING SMOKE DETECTOR](#)

NOTE

Because of VTC2 unavailability, only Smoke Detector 1 will be activated.

COL-CC 12.1 [Swapping DMS Telemetry Packets \(Ground Only\)](#)
COL-CC to swap nominal DMS telemetry packets.

Wait for “Go” to continue.

NOTE

Packet swapping initiated from COL-CC:
Enable VTC1_Gnd_Tlm_Pkt_PHY1_VTC (1Hz)

Perform [{2.2.41 VTC GROUND PACKET SWAPPING}](#) (ESA SODF: GROUND: NOMINAL). then:

COL-CC to give “Go” to continue.

PCS 12.2 [Powering Up Smoke Detector 1](#)
COL: EPS: PDU1 120V Outlets
[COL PDU1 120V Outlets VTC1](#)
'PDU 1'

```

cmd Outlet Num 24 – On (Verify – On)

cmd PDU1_SD1_Pwr_Bus_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU1_SD1_Pwr_Bus_On_Off_Stat_VTC_PP – ON

```


12.3 [Verifying Smoke Detector 1 Power Status](#)

COL: ECLSS: SD1

COL Cabin Smoke Detector 1

Verify Obscuration, % Contamination < 25

Verify Scatter, % Obscuration per Meter < 1

Verify Cabin_SD1_Obscuration_VTC_PP – < 25

Verify Cabin_SD1_Scatter_VTC_PP – < 1

12.4 [Enabling Smoke Detector 1](#)

COL Cabin Smoke Detector 1

'Monitoring'

cmd Enable

Verify Status – Enabled

'Active BIT'

Verify Failure – blank

'Fire Status'

Verify Lens Status – Clean

Verify Out of Range – blank

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – Cabin_SD_1

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify Cabin_SD_1_EF – ENABLED

Verify VTC1_Cabin_SD_1_Stat_MVD – OK

12.5 [Enabling US C&W for Columbus Smoke Detector 1 \(Ground Only\)](#)

MCC-H

Enable the following events in the Primary and Backup C&C MDMs.

If ground unable to complete,

Perform [{2.101 CAUTION AND WARNING EVENT MANAGEMENT}](#), Step 2 (SODF: C&DH: NOMINAL) per Table 4, then

Table 4. C&W Events for COL Smoke Detectors 1

Event	Text	Class
13500	'FIRE Smoke Detector 1 Cabin - COL'	E

13. [ACTIVATING CONDENSATE WATER SEPARATOR ASSEMBLY](#)

NOTE

Condensate Jumper must be installed prior to beginning this step.

PCS

13.1 [Opening Columbus Condensate Line Shut Off Valve](#)

COL: ECLSS: CLSOV

COL CLSOV VTC1

cmd Position – Open

Verify Position Ind – Open

cmd CLSOV_Vlv_Open_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CLSOV_Vlv_Open_Stat_VTC_PP – OPEN

PWS

13.2 [Activating CWSA](#)

Activation Part 1: Activation Part 2: Activation Part 3

COL Activation Part 3

'CWSA1 Activation'

NOTE

The following command starts FLAP 'CWSA1 Activation' that:
 Checks the availability of the CWSA
 Powers on the CWSA
 Enables the monitoring of the CWSA parameters
 Enables the monitoring of the LCOS parameters

cmd Activate **Execute** (OK)

Wait 20 seconds for telemetry stabilization.

Verify Pwr: ON

Verify Delta P Air: > 0.5 kPa

Verify Motor Speed: 4500 to 6800 rpm

Verify Input Current: < 0.50 A

```
cmd CWSA1_Activation_AP
data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV
data Onboard_Execution_Node –
USM SW DMC USS Swop Instance

Verify CWSA1_Pwr_Stat_DMC – ON
Verify CWSA1_Delta_P_Air_DMC – >0.5 kPa
Verify CWSA1_Motor_Speed_DMC – 4500-6800 rpm
Verify CWSA1_Input_Current_DMC – < 0.5 A
```

13.3 [Enabling CWSA FDIR](#)

DMS: FDIR Configuration

DMS FDIR Configuration Commands

'CWSA Switchover FDIR'

cmd Enable **Execute** (OK)

Verify Status – ENABLE

```
cmd DMS_ACQ_Write_Dis_SW_Variable_Cmd_SW
prm Item SID – CWSA_FDIR_Ena_Stat_SW
prm Value – $ENABLED
data Onboard_Node –
SYS CCSDS End Point DMC DMS SERV

Verify CWSA_FDIR_Ena_Stat_SW – ENABLED
```

14. [ACTIVATING CABIN FAN ASSEMBLY](#)

Activation Part 1: Activation Part 2: Activation Part 3

COL Activation Part 3

'CFA1 Activation (w/o monitoring)'

cmd Pwr_On **Execute** (OK)

Verify Pwr: ON

Verify Delta P: > 0.25 kPa

Verify Fan Speed: 7500 to 8500 rpm

Verify Input Current: < 1.5A

```
cmd CFA1_Pwr_On_AP
data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV
data Onboard_Execution_Node – USM_SW_DMC_USS_Swop_Instance

Verify CFA1_Pwr_Stat_DMC – ON
Verify CFA1_Delta_P_DMC – > 0.25 kPa
Verify CFA1_Fan_Speed_DMC – 7500-8500 rpm
```

Verify CFA1_Input_Current_DMC – < 1.5 A

15. [ACTIVATING CABIN TEMP CONTROL UNIT](#)

15.1 [Activating CTCU](#)

Activation Part 1: Activation Part 2: Activation Part 3

COL Activation Part 3

'CTCU1 Activation'

NOTE

The following command starts the FLAP 'CTCU1 Activation' that:

- Checks that the other CTCU is not controlling the TCV
- Checks the availability of the CTCU
- Checks that at least one CFA is active
- Powers on the CTCU
- Enables monitoring of the CTCU parameters
- Activates the TCV
- Enables cabin temperature control

cmd Activate Execute (OK)

NOTE

The cabin temperature may need time to stabilize to the nominal temperature range. If the cabin temperature is out of the expected values, continue with the procedure.

Verify Pwr: ON

Verify Health Stat: OK

Verify Cntl Loop Stat: ENABLED

Verify TCV_Cntl Stat: ENABLED

Verify Avg Cabin Temp: 18 to 27 deg C

cmd CTCU1_Activation_AP

data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV

data Onboard_Execution_Node –
USM SW DMC USS Swop Instance

Verify CTCU1_Pwr_Stat_DMC – ON

Verify CTCU1_Health_Stat_DMC – OK

Verify CTCU1_Cntl_Loop_Stat_DMC – ENABLED

Verify CTCU1_TCV_Cntl_Stat_DMC – ENABLED

Verify CTCU1_Avg_Cabin_Temp_DMC – 18-27 °C

15.2 [Enabling FDIR for CTCU Reconfiguration](#)

DMS: FDIR Configuration

DMS FDIR Configuration Commands

'CTCU Switchover FDIR'

cmd Enable **Execute** (OK)
Verify Status – ENABLE

cmd DMS_ACQ_Write_Dis_SW_Variable_Cmd_SW
prm Item SID – CTCU_FDIR_Ena_Stat_SW
prm Value – \$ENABLED
data Onboard_Node –
SYS CCSDS End Point DMC DMS SERV
Verify CTCU_FDIR_Ena_Stat_SW – ENABLED

16. [OPENING SAMPLE LINE SHUTOFF VALVE](#)

NOTE

1. The AR Sample Jumper must be installed prior to opening the Sample Line Shutoff Valve.
2. Pressure equalization of the Columbus Module must be performed before opening the Sample Line Shutoff Valves.

PCS

COL: ECLSS: Air Loop: SLSOV

COL SLSOV VTC1

cmd Position – Open

Verify Position – Open

cmd SLSOV_Vlv_Open_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1
Verify SLSOV_Vlv_Open_Stat_VTC_PP – OPEN

17. [ESTABLISHING INTERMODULE VENTILATION](#)

NOTE

1. IMV duct installation must be completed before starting this step.
2. NPRA Valve removal and IMV valve installation must be completed prior to this step.

17.1 [Activating Node 2 IMV Stbd Aft Valve](#)

Node 2: ECLSS: IMV Stbd Aft Vlv

Node 2 IMV Stbd Aft Vlv

sel RPCM N22A3B C RPC 02

RPCM N22A3B C RPC 02

cmd RPC Position – Close (Verify – Cl)

Node 2 IMV Stbd Aft Vlv

'Enable'

cmd Arm (√Arm Status – Armed)

cmd Enable (√State – Enabled)

17.2 [Opening Node 2 IMV Stbd Aft Valve](#)

'Open'

cmd Arm (√Arm Status – Armed)

cmd Open

√Position – In Transit

Wait 25 seconds.

√Position – Open

17.3 [Activating Node 2 IMV Stbd Fwd Valve](#)

Node 2: ECLSS: IMV Stbd Fwd Vlv

Node 2 IMV Stbd Fwd Vlv

sel RPCM N22A3B C RPC 06

RPCM N22A3B C RPC 06

cmd RPC Position – Close (Verify – Cl)

Node 2 IMV Stbd Fwd Vlv

'Enable'

cmd Arm (√Arm Status – Armed)

cmd Enable (√State – Enabled)

17.4 [Opening Node 2 IMV Stbd Fwd Valve](#)

Node 2 IMV Stbd Fwd Vlv

'Open'

cmd Arm (√Arm Status – Armed)

cmd Open

√Position – In Transit

Wait 25 seconds.

√Position – Open

17.5 [Closing Columbus IMV Valves](#)

COL: ECLSS: Air Loop: ISSOV

COL IMV Valves VTC1

'IMV Return Shutoff Valve'

cmd Position – Close

Verify Position Ind – Closed

'IMV Supply Shutoff Valve'

cmd Position – Close

Verify Position Ind – Closed

cmd IRSOV_Vlv_Close_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify IRSOV_Vlv_Close_Stat_VTC_PP – CLOSED

cmd ISSOV_Vlv_Close_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify ISSOV_Vlv_Close_Stat_VTC_PP – CLOSED

17.6 [Opening Columbus IMV Valves](#)

COL: ECLSS: Air Loop: ISSOV

COL IMV Valves VTC1

'IMV Return Shutoff Valve'

cmd Position – Open

Verify Position Ind – Open

'IMV Supply Shutoff Valve'

cmd Position – Open

Verify Position Ind – Open

cmd ISSOV_Vlv_Open_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify ISSOV_Vlv_Open_Stat_VTC_PP – OPEN

COLUMBUS SINGLE VTC1 FINAL ACTIVATION

(ASSY MAL/1E/FIN/MULTI E)

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```
cmd IRSOV_Vlv_Open_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
cmd Onboard_Node – SYS_CCSDS_End_Point_VTC1
```

Verify IRSOV_Vlv_Open_Stat_VTC_PP – OPEN

17.7 [Activating Columbus Cabin Fan Assembly 2](#)

NOTE

IMV Supply Fan cannot be activated because of VTC2 unavailability; CFA2 is powered on instead.

PWS

COL: ECLSS: Cabin Fan Assemblies: CFA2

[ECLSS Cabin Fan Assembly 2](#)

'Commands'

cmd Pwr_On Execute (OK)

Verify Pwr: ON

Verify Fan Speed: 7500 to 8500 rpm

Verify Delta P: > 0.25 kPa

Verify Input Current: < 1.5A

```
cmd CFA2_Pwr_On_AP
data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV
data Onboard_Execution_Node –
USM SW DMC USS Swoop Instance
```

Verify CFA2_Pwr_Stat_DMC – ON

Verify CFA2_Fan_Speed_DMC – 7500-8500 rpm

Verify CFA2_Delta_P_DMC – > 0.25 kPa

Verify CFA2_Input_Current_DMC – < 1.5 A

17.8 [Activating Columbus IMV Return Fan](#)

PCS

COL: ECLSS: Air Loop: IRFA

[COL IMV Fans](#)

√VTC1 Buffer Status – Empty

```
*****
*           If VTC1 Buffer – Full
*           |
*           | sel VTC1 Cancel 2 Step Command
*           |
*           | COL Cancel 2 - Stage Cmd VTC 1
*           |
*           |
*           | cmd Cancel 2 – Stage Cmd Execute (Verify
*           | – Empty)
*           |
*****
```


COLUMBUS SINGLE VTC1 FINAL ACTIVATION

(ASSY MAL/1E/FIN/MULTI E)

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'IMV Return Fan Assembly (IMV Port Aft Fan)'

'Set Speed – VTC1 hardwire'

NOTE

The following ACS sets the IMV Return Fan speed to 8800 rpm.

Record PCS ID: _____

cmd Start – Arm

pick PCS/C-X to VTC-Com1 (where X=PCS ID)

cmd Start – Set

'IMV Return Fan Assembly'

cmd State – On

Verify dP: > 0.3 kPa

Verify Fan Speed: 8300 to 9300 rpm

Verify Fan Temp: < 60 degC

Verify IRFA Power: On

√VTC1_Two_Stage_Buffer_Status_SW_PP – EMPTY

If VTC1_Two_Stage_Buffer_Status_SW_PP – FULL

cmd VTC_Cancel_Two_Stage_Cmd_Cmd_SW

data Onboard_Node SYS_CCSDS_End_Point_VTC1

Verify VTC1_Two_Stage_Buffer_Status_SW_PP –
EMPTY

cmd IRFA_SPEED_SET_ACS (ARM)

data SW_CMD – VTC_Start_Terminate_ACS_Cmd_SW

data Action – 1 (START)

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify VTC1_Two_Stage_Buffer_Status_SW_PP – FULL

cmd VTC_Execute_2_Stage_Cmd_SW (EXEC)

cmd IRFA_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node: – SYS_CCSDS_End_Point_VTC1

Verify IRFA_Delta_P_MVD – > 0.3 kPa

COLUMBUS SINGLE VTC1 FINAL ACTIVATION

(ASSY MAL/1E/FIN/MULTI E)

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Verify IRFA_Fan_Speed_MVD – 8300-9300 rpm
Verify IRFA_Fan_Temp_VTC – < 60 degC
Verify IRFA_Pwr_Stat_MVD – ON

COL-CC

17.9 [Enabling VTC Monitoring for IRFA Safing \(Ground Only\)](#)

COL-CC to enable IRFA monitoring

Wait for “Go” to continue.

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – IRFA_Fan_Temp_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify IRFA_Fan_Temp_VTC_MEF – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – IRFA_Delta_P_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify IRFA_Delta_P_VTC_MEF – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – IRFA_Fan_Speed_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify IRFA_Fan_Speed_VTC_MEF – ENABLED

COL-CC to give a “Go” to continue.

18. [COMPLETE CFA1 AND CFA2 ACTIVATION](#)

PWS

18.1 [Configuring CFA1 and CFA2](#)

COL: ECLSS: Cabin Fan Assemblies: CFA1

ECLSS Cabin Fan Assembly 1

'Set Speed'

cmd 10000 rpm **Execute** (OK)

Verify Pwr: ON

Verify Fan Speed: 9500 to 10500 rpm

Verify Delta P: 0.61 to 1.5 kPa

Verify Input Current: < 1.5 A

COLUMBUS SINGLE VTC1 FINAL ACTIVATION

(ASSY MAL/1E/FIN/MULTI E)

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COL: ECLSS: Cabin Fan Assemblies: CFA2

ECLSS Cabin Fan Assembly 2

'Set Speed'

cmd 10000 rpm **Execute** (OK)

Verify Pwr: ON

Verify Fan Speed: 9500 to 10500 rpm

Verify Delta P: 0.65 to 1.5 kPa

Verify Input Current: < 1.5 A

ECLSS: AFS

AFS

'Air Flow Sensors'

Verify Cabin Air Mass Flow AFS1: 240 - 510 m3/h

cmd CFA1_Set_Speed_AP

prm Speed – 10000 rpm

data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV

data Onboard_Execution_Node –
USM SW DMC USS Swoop Instance

Verify CFA1_Pwr_Stat_DMC – ON

Verify CFA1_Fan_Speed_DMC – 9500 to 10500 rpm

Verify CFA1_Delta_P_DMC – 0.61 to 1.5 kPa

Verify CFA1_Input_Current_DMC – < 1.5 A

cmd CFA2_Set_Speed_AP

prm Speed – 10000 rpm

data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV

data Onboard_Execution_Node –
USM SW DMC USS Swoop Instance

Verify CFA2_Pwr_Stat_DMC – ON

Verify CFA2_Fan_Speed_DMC – 9500 to 10500 rpm

Verify CFA2_Delta_P_DMC – 0.65 to 1.5 kPa

Verify CFA2_Input_Current_DMC – < 1.5 A

Verify AFS1_Cab_Air_Massflow_MVD – 240 - 510 m3/h

18.2 [Enabling IMV Monitoring](#)

Main Panel: DMS Monitoring: 2 - ECLSS

DMS Monitoring 2 - ECLSS Commands

'DMS Monitoring'

sel Enable/Disable ECLSS

DMS Monitoring Enable / Disable Commands 2 - ECLSS

'Enable Monitoring'

cmd IRFA Delta P Execute (OK)

cmd IRFA Input Current Execute (OK)

Main Panel: DMS Monitoring: 2 - ECLSS

DMS Monitoring 2 - ECLSS

'System on DMC'

Verify the background color of measurements

IRFA Delta P: Green

IRFA Input Current: Green

```
cmd DMS_MONIT_Ena_Monitoring_Cmd_SW
prm MT_ID – DMC_Sys_Monnitoring_Table_SW
prm EI_ID – IRFA_Input_Current_DMC
prm LIMIT_SET_ID – 0 (limit set 1)
data Onboard_Node –
SYS CCSDS End Point MMC DMS SERV
```

```
cmd DMS_MONIT_Ena_Monitoring_Cmd_SW
prm MT_ID – DMC_Sys_Monnitoring_Table_SW
prm EI_ID – IRFA_Delta_P_MVD
prm LIMIT_SET_ID – 0 (limit set 1)
data Onboard_Node –
SYS CCSDS End Point MMC DMS SERV
```

Verify IRFA_Input_Current_DMC_MS – NORMAL_1

Verify IRFA_Delta_P_MVD_MS – NORMAL_1

PCS

18.3 [Activating VTC Monitoring for Air Flow Sensor 1](#)

COL: ECLSS: Atmos

COL Atmosphere

Verify Airflow Sensor 1 Massflow: > 240 m3/hr

cmd Airflow Sensor 1 Massflow Monitoring – Enable (Verify – Enabled)

Verify AFS1_Cab_Air_Massflow_VTC – > 240 m3/hr

```
cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – AFS1_Cab_Air_Massflow_VTC
```

prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1
 Verify AFS1_Cab_Air_Massflow_VTC_MEF – ENABLED

MCC-H

18.4 [Enabling C&W for the Cabin Air Flow Sensor \(Ground Only\)](#)

Enable the following events in the Primary and Backup C&C MDMs.

If ground unable to complete,

Perform [{2.101 CAUTION AND WARNING EVENT MANAGEMENT}](#), Step 2 (SODF: C&DH: NOMINAL) per Table 5, then

Table 5. C&W Events for Cabin Air Flow

Event	Text	Class
13532	'Cabin Air Flow Sensor 1 Low - COL'	W

PCS

18.5 [Activating VTC Monitoring for TPS](#)

COL: ECLSS: Atmos

COL Atmosphere

Verify Air Press 3: 719 to 770 mmHg

cmd Air Press 3 Monitoring Status – Enable (Verify – Enabled)

Verify TPS3_Air_Press_VTC – 719 to 770 mmHg
cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – TPS3_Air_Press_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1
 Verify TPS3_Air_Press_VTC_MEF – ENABLED

MCC-H

18.6 [Enabling C&W for TPS \(Ground Only\)](#)

Enable the following events in the Primary and Backup C&C MDMs.

If ground unable to complete,

Perform [{2.101 CAUTION AND WARNING EVENT MANAGEMENT}](#), Step 2 (SODF: C&DH: NOMINAL) per Table 6, then

Table 6. C&W Events for TPS3

Event	Text	Class
13527	'Total Pressure Sensor 3 Low - COL'	W

PCS

18.7 [Enabling Monitoring for PPOS and PPCS](#)

COL: ECLSS: Atmos

COL Atmosphere

Verify ppO2 Sensor 1: 124 to 188 mmHg

cmd ppO2 Sensor 1 Monitoring Status – Enable (Verify – Enabled)

Verify ppCO2 Sensor 1: < 10 mmHg

cmd ppCO2 Sensor 1 Monitoring Status – Enable (Verify – Enabled)

Verify PPOS1_Press_VTC – 124 to 188 mmHg

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – PPOS1_Press_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PPOS1_Press_VTC_MEF – ENABLED

Verify PPCS1_Press_VTC – < 10 mmHg

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – PPCS1_Press_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PPCS1_Press_VTC_MEF – ENABLED

COL-CC

18.8 [Swapping DMS Telemetry Packets \(Ground Only\)](#)

COL-CC to swap nominal DMS telemetry packets.

Wait for “Go” to continue.

NOTE

Packet swapping initiated from COL-CC:
Disable VTC1_Gnd_TIm_Pkt_PHY1_VTC (1Hz)

Perform [{2.2.41 VTC GROUND PACKET SWAPPING}](#) (ESA SODF: GROUND: NOMINAL), then:

COL-CC to give a “Go” to continue.

19. [DISABLING PPR FUNCTION](#)

PCS

19.1 [Closing PPRA Valves](#)

COL: ECLSS: Cabin Depress Assemblies: PPRA1 Vlv

COL PPRA 1-2 VTC1

√PPRA1 Position – Close

√PPRA2 Position – Close

√PPRA1_Vlv_Close_Stat_VTC_PP – CLOSED

If PPRA1_Vlv_Close_Stat_VTC_PP – OPEN

cmd PPRA1_Vlv_Close_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PPRA1_Vlv_Close_Stat_VTC_PP – CLOSED

√PPRA2_Vlv_Close_Stat_VTC_PP – CLOSED

If PPRA2_Vlv_Close_Stat_VTC_PP – OPEN

cmd PPRA2_Vlv_Close_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PPRA2_Vlv_Close_Stat_VTC_PP – CLOSED

19.2 [Enabling VTC Monitoring of PPRAs](#)

COL PPRA 1-2 VTC1

cmd PPRA1 Close Status Monitoring – Enabled (Verify – Enabled)

cmd PPRA2 Close Status Monitoring – Enabled (Verify – Enabled)

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – PPRA1_Vlv_Close_Stat_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PPRA1_Vlv_Close_Stat_Monitoring_Ena_VTC_PP – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – PPRA2_Vlv_Close_Stat_VTC

prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PPRA2_Vlv_Close_Stat_Monitoring_Ena_VTC_PP –
ENABLED

19.3 [Enabling VTC Monitoring of CDAs](#)

Cabin Depress Assemblies: CDA1

COL CDA 1-2 Valve Control VTC1

'CDA 1 Valve 1'

cmd Close Status Monitoring – Enable (Verify – Enabled)

'CDA 1 Valve 2'

cmd Close Status Monitoring – Enable (Verify – Enabled)

'CDA 2 Valve 1'

cmd Close Status Monitoring – Enable (Verify – Enabled)

'CDA 2 Valve 2'

cmd Close Status Monitoring – Enable (Verify – Enabled)

COL: ECLSS: Cabin Depress Assemblies: CDA3

COL CDA 3-4 Valve Control VTC1

'CDA 3 Valve 1'

cmd Close Status Monitoring – Enable (Verify – Enabled)

'CDA 3 Valve 2'

cmd Close Status Monitoring – Enable (Verify – Enabled)

'CDA 4 Valve 1'

cmd Close Status Monitoring – Enable (Verify – Enabled)

'CDA 4 Valve 2'

cmd Close Status Monitoring – Enable (Verify – Enabled)

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – CDA1_Vlv1_Close_Stat_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

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Verify CDA1_Vlv1_Close_Stat_Monitoring_Ena_VTC_PP –
ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – CDA1_Vlv2_Close_Stat_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CDA1_Vlv2_Close_Stat_Monitoring_Ena_VTC_PP –
ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – CDA2_Vlv1_Close_Stat_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CDA2_Vlv1_Close_Stat_Monitoring_Ena_VTC_PP –
ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – CDA2_Vlv2_Close_Stat_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CDA2_Vlv2_Close_Stat_Monitoring_Ena_VTC_PP –
ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – CDA3_Vlv1_Close_Stat_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CDA3_Vlv1_Close_Stat_Monitoring_Ena_VTC_PP –
ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – CDA3_Vlv2_Close_Stat_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CDA3_Vlv2_Close_Stat_Monitoring_Ena_VTC_PP –
ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – CDA4_Vlv1_Close_Stat_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CDA4_Vlv1_Close_Stat_Monitoring_Ena_VTC_PP – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – CDA4_Vlv2_Close_Stat_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify CDA4_Vlv2_Close_Stat_Monitoring_Ena_VTC_PP – ENABLED

19.4 [Enabling VTC Monitoring of VEMRV](#)

NOTE

VAMR status telemetry is not available because of VTC2 unavailability, therefore monitoring cannot be activated

COL: ECLSS: Payload VV: VEDD

Columbus VEDD VTC1

'Venting Manual Repressurization Valve'

cmd Close Monitoring – Enable (Verify – Enabled)

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – VEMRV_Vlv_Close_Stat_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify VEMRV_Vlv_Close_Stat_Monitoring_Ena_VTC_PP – ENABLED

20. [ACTIVATING PLCU](#)

20.1 [Powering up PLCU](#)

PWS

Activation Part 1: Activation Part 2: Activation Part 3:
Activation Part 4:

COL Activation Part 4

'PLCU Activation (In Default Mode)'

NOTE

The following command starts the FLAP 'PLCU Act In Default Mode' that:

- Checks that the SPC3 is not active
- Switches SPC3 power A and power B on
- Boot the PLCU in default mode
- Enables the monitoring of the SPC3 ready status

cmd Activate **Execute** (OK)

Wait up to 5 minutes for PLCU to boot before checking Ready Status

- Verify Pwr A: – On
- Verify Pwr B: – On
- Verify Ready Stat: – Ready
- Verify Pwr A Current: < 1.19 A
- Verify Pwr B Current: < 0.12 A
- Verify Sec Voltage Stat: – OK

```

cmd PLCU_Act_In_Default_Mode_AP
data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV
data Onboard_Execution_Node –
USM SW DMC USS Swoop Instance

Verify PLCU_Pwr_A_Stat_DMC – ON
Verify PLCU_Pwr_A_Current_DMC – < 1.19 A
Verify PLCU_Sec_Voltage_Stat_DMC – OK
Verify PLCU_Pwr_B_Stat_DMC – ON
Verify PLCU_Pwr_B_Current_DMC – < 0.12 A
Verify PLCU_Ready_Stat_DMC – READY

```

20.2 [Enabling CCSDS Checksum Validation on PLCU \(Ground Only\)](#)

```

cmd DMS_CCSDS_Checksum_Ena_Cmd_SW
data ONBOARD_NODE –
SYS_CCSDS_End_Point_PLCU_DMS_SERV

```

21. [ACTIVATING XCMU](#)

PWS

Activation Part 1: Activation Part 2: Activation Part 3: Activation Part 4

COL Activation Part 4

'XCMU Activation'

NOTE
The following command starts the FLAP 'XCMU Activation' that: Checks that the XCMU is available Checks that the redundant XCMU is off Switches XCMU nom power A and nom power B on Enables the monitoring of the nominal XCMU ready status

cmd Activate **Execute** (OK)

- Verify Nom Pwr A – On
- Verify Nom Pwr B – On
- Verify Nom Ready Stat – Ready
- Verify Nom Pwr A Current < 0.64 A

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Verify Nom Pwr B Current < 0.64 A

Verify Nom Sec Voltage Stat – OK

cmd XCMU_Activation_AP

data Onboard_Reception_Node –

SYS CCSDS End Point DMC DMS SERV

data Onboard_Execution_Node – USM_SW_DMC_USS_Swop_Instance

Verify XCMU_Nom_Pwr_A_Stat_DMC – ON

Verify XCMU_Nom_Pwr_A_Current_DMC – < 0.64 A

Verify XCMU_Nom_Sec_Voltage_Stat_DMC – OK

Verify XCMU_Nom_Pwr_B_Stat_DMC – ON

Verify XCMU_Nom_Pwr_B_Current_DMC – < 0.64 A

Verify XCMU_Nom_Ready_Stat_DMC – READY

22. ENABLING CABIN TEMPERATURE MONITORING

Main Panel: DMS Monitoring: 2 - ECLSS

DMS Monitoring 2 - ECLSS

'System on DMC'

Verify CTCU1 Cabin Temp1: 18 to 27 deg C

Verify CTCU1 Cabin Temp2: 18 to 27 deg C

Verify CTCU1 Cabin Temp3: 18 to 27 deg C

Verify HS1 Air Humidity: 20 to 73 %

Verify HS2 Air Humidity: 20 to 73 %

ECLSS: ECLSS Commands:

ECLSS Commands

'Monitoring Commands'

cmd CTCU Cabin Air Mon Ena **Execute** (OK)

Main Panel: DMS Monitoring: 2 - ECLSS

DMS Monitoring 2 - ECLSS

'System on DMC'

Verify the background color of measurements

CTCU1 Cabin Temp1: Green

CTCU1 Cabin Temp2: Green

CTCU1 Cabin Temp3: Green

HS1 Air Humidity: Green

HS2 Air Humidity: Green

Verify CTCU1_Cabin_Temp1_DMC – 18 - 27 °C

Verify CTCU1_Cabin_Temp2_DMC – 18 - 27 °C

COLUMBUS SINGLE VTC1 FINAL ACTIVATION

(ASSY MAL/1E/FIN/MULTI E)

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Verify CTCU1_Cabin_Temp3_DMC – 18 - 27 °C

Verify HS1_Air_Humidity_DMC – 20 - 73 %

Verify HS2_Air_Humidity_DMC – 20 - 73 %

cmd CTCU_Ena_Cabin_Air_Mon_AP

data Onboard_Reception_Node –

SYS CCSDS End Point DMC DMS SERV

data Onboard_Execution_Node – USM_SW_DMC_USS_Swop_Instance

Verify CTCU1_Cabin_Temp1_DMC_MS – NORMAL_1

Verify CTCU1_Cabin_Temp2_DMC_MS – NORMAL_1

Verify CTCU1_Cabin_Temp3_DMC_MS – NORMAL_1

Verify HS1_Air_Humidity_DMC_MS – NORMAL_1

Verify HS2_Air_Humidity_DMC_MS – NORMAL_1

23. [ENABLE WPA TEMPERATURE & FDIR MONITORINGS](#)

Main Panel: DMS Monitoring: 5 – COMMS TCS Payload

DMS Monitoring 5 – COMMS TCS Payload

'System on DMC'

'TCS'

NOTE

The following parameters initiate a Water Pump Switchover if values are out of limits after monitorings are enabled:

WTSB1 Nom Plenum Temp3

WPA1 WTSB1 Plenum Temp1/2

WPA1 WTSB3 CHX Temp1/2

Verify WTSB1 Nom Plenum Temp3: > 14 deg C

Verify WTSB5 Moderate HX Temp1: < 16 deg C

Verify WTSB5 Moderate HX Temp2: < 16 deg C

Verify WTSB6 Low HX Temp1: < 7.7 deg C

Verify WTSB6 Low HX Temp2: < 7.7 deg C

'WPA1'

Verify WPA1 WTSB1 Plenum Temp1: 15 - 22 deg C

Verify WPA1 WTSB1 Plenum Temp2: 15 - 22 degC

Verify WPA1 WTSB3 CHX Temp1: < 12 deg C

Verify WPA1 WTSB3 CHX Temp2: < 12 deg C

TCS: TCS Commands:

TCS Commands

'Monitoring Command'

cmd WTSB Mon Ena **Execute** (OK)

COLUMBUS SINGLE VTC1 FINAL ACTIVATION

(ASSY MAL/1E/FIN/MULTI E)

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Main Panel: DMS Monitoring: 5 – COMMS TCS Payload

DMS Monitoring 5 – COMMS TCS Payload

'System on DMC'

'TCS'

Verify the background color of measurements

WTSB1 Nom Plenum Temp3: Green
WTSB2 Redun Plenum Temp3: Purple
WTSB5 Moderate HX Temp1: Green
WTSB5 Moderate HX Temp2: Green
WTSB6 Low HX Temp1: Green
WTSB6 Low HX Temp2: Green

'WPA1'

Verify the background color of measurements

WPA1 WTSB1 Plenum Temp1: Green
WPA1 WTSB1 Plenum Temp2: Green
WPA1 WTSB3 CHX Temp1: Green
WPA1 WTSB3 CHX Temp2: Green

Verify WTSB1_Nom_Plenum_Temp3_MVD > 14 deg C
Verify WTSB5_Medium_HX_Temp2_DMC < 16 deg C
Verify WTSB5_Medium_HX_Temp1_DMC < 16 deg C
Verify WTSB6_Low_HX_Temp2_DMC < 7.7 deg C
Verify WTSB6_Low_HX_Temp1_DMC < 7.7 deg C
Verify WPA1_WTSB1_Plenum_Temp2_DMC – 15 - 22 degC
Verify WPA1_WTSB1_Plenum_Temp1_DMC – 15 - 22 deg C
Verify WPA1_WTSB3_CHX_Temp2_DMC < 12 deg C
Verify WPA1_WTSB3_CHX_Temp1_DMC < 12 deg C

cmd WTSB_Monitoring_Ena_AP

data Onboard_Reception_Node –

SYS CCSDS End Point DMC DMS SERV

data Onboard_Execution_Node – USM_SW_DMC_USS_Swop_Instance

Verify WTSB1_Nom_Plenum_Temp3_MVD_MS – NORMAL_1
Verify WTSB2_Redun_Plenum_Temp3_MVD_MS – NOTNOM_1
Verify WTSB5_Medium_HX_Temp2_DMC_MS – NORMAL_1
Verify WTSB5_Medium_HX_Temp1_DMC_MS – NORMAL_1
Verify WTSB6_Low_HX_Temp2_DMC_MS – NORMAL_1
Verify WTSB6_Low_HX_Temp1_DMC_MS – NORMAL_1
Verify WPA1_WTSB1_Plenum_Temp2_DMC_MS – NORMAL_1

Verify WPA1_WTSB1_Plenum_Temp1_DMC_MS – NORMAL_1
 Verify WPA1_WTSB3_CHX_Temp2_DMC_MS – NORMAL_1
 Verify WPA1_WTSB3_CHX_Temp1_DMC_MS – NORMAL_1

24. [CONFIGURING HCU FOR NOMINAL OPS](#)

NOTE

HCU monitoring was enabled automatically as part of DMC boot process.

24.1 [Disabling Nominal Monitoring of HCU2](#)

Main Panel: DMS Monitoring: 2 - ECLSS

'DMS Monitoring'

'Enable/Disable'

sel Enable/Disable ECLSS

'Disable Monitoring'

cmd HCU2 Health Stat **Execute** (OK)

'System on DMC'

Verify the background color of measurement

HCU2 Health Stat: White

cmd DMS_MONIT_Dis_Monitoring_Cmd_SW

prm MT_ID – DMC_Sys_Monitoring_Table_SW

prm EI_ID – HCU2_Health_Stat_DMC

data Onboard_Node –

SYS CCSDS End Point DMC DMS SERV

Verify HCU2_Health_Stat_DMC_MS – NOTMON_1

24.2 [Swapping DMS Telemetry Packets \(Ground Only\)](#)

COL-CC

COL-CC to swap vital DMS telemetry packet.

Wait for “Go” to continue.

NOTE

Packet swapping initiated from **COL-CC**:
 Enable VTC_Gnd_Tlm_Pkt_LOG2_VTC (1Hz)

COLUMBUS SINGLE VTC1 FINAL ACTIVATION

(ASSY MAL/1E/FIN/MULTI E)

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Perform [{2.2.41 VTC GROUND PACKET SWAPPING}](#) (ESA SODF: GROUND: NOMINAL). then:

COL-CC to give a “Go” to continue.

PCS

24.3

[Deactivating HCU2 Power Bus](#)

COL: EPS: PDU 2 120 V Outlets Subsys/Payloads

COL PDU2 120V Outlets VTC1

'PDU2'

cmd Outlet Num 28 – Off (Verify – Off)

cmd PDU2_HCU2_Pwr_Bus_Off_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU2_HCU2_Pwr_Bus_On_Off_Stat_VTC_PP – OFF

COL-CC

24.4

[Enabling HCU1 Vital Monitoring \(Ground Only\)](#)

COL-CC to enable vital system monitoring for the HCU1 primary current and CDA1, CDA2 heaters temperature telemetries.

Wait for “Go” to continue.

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – HCU1_Prim_Current_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify HCU1_Prim_Current_VTC_MEF – ENABLED

NOTE

Because of VTC2 unavailability only the CDA1 and CDA2 assemblies are available for Columbus cabin depressurization

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – HCU1_CDA1_Htr_Temp_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify HCU1_CDA1_Htr_Temp_Monitoring_Ena_VTC_PP – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – HCU1_CDA2_Htr_Temp_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify HCU1_CDA2_Htr_Temp_Monitoring_Ena_VTC_PP – ENABLED

COL-CC 24.5 [Enable PDU1 HCU1 Power Bus Vital System Monitoring \(Ground Only\)](#)
COL-CC to enable the vital system monitoring for the PDU1-HCU1 power bus primary current and On/Off status telemetries.
 Wait for “Go” to continue.

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – PDU1_HCU1_Pwr_Bus_Current_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU1_HCU1_Pwr_Bus_Current_VTC_MEF – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID –
 PDU1_HCU1_Pwr_Bus_On_Off_Stat_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify PDU1_HCU1_Pwr_Bus_On_Off_Stat_VTC_MEF – ENABLED

COL-CC 24.6 [Swapping DMS Telemetry Packets \(Ground Only\)](#)
COL-CC to swap vital DMS telemetry packet.
 Wait for “Go” to continue.

NOTE

Packet swapping initiated from **COL-CC**:
 Disable VTC_Gnd_Tlm_Pkt_LOG2_VTC (1Hz)

Perform [{2.2.41 VTC GROUND PACKET SWAPPING}](#) (ESA SODF: GROUND: NOMINAL). then:

COL-CC to give a “Go” to continue.

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COLUMBUS SINGLE VTC2 BERTHED SURVIVAL MODE ACTIVATION

(ASSY MAL/1E/FIN/MULTI E)

Page 1 of 10 pages

OBJECTIVE:

Initial activation of Columbus module through HCU activation performed with only VTC2 available. Completion of this procedure will end the thermal clock started when the module is removed from the PL Bay.

INITIAL CONDITIONS:

DDCUs N2D4B and N2D1B repowered

DDCUs N2P2A and N2P3A repowered

N2-1 and N2-2 MDMs nominal

Hardwired connectors mated

1553 connections mated

Power connections mated

VTC Redundancy Management inhibited

VTC1 RT Status - Inh

1. VERIFYING NODE MDMS ARE NOMINAL

PCS

1.1 Verifying N2-1 MDM

CDH Summary: N2-1

Verify Frame Count – <incrementing>

Verify Processing State – Operational

1.2 Verifying N2-2 MDM

CDH Summary: N2-2

Verify Frame Count – <incrementing>

Verify Processing State – Operational

2. ACTIVATING PDU

2.1 Activating PDU1 MB1 Nominal Main Auxiliary Converter

Task: COL Berthed Survival Mode

'Power Distribution Unit'

cmd PDU1 Nom Pwr – On

Verify PDU1 Nom Pwr Status – On

Verify PDU1 VTC1 Pwr Bus Status – On

Verify PDU1 Main Input Current < 5 A

2.2 [Activating PDU1 MB1 Redundant Main Auxiliary Converter](#)

COL Berthed Survival Mode

'Power Distribution Unit'

cmd PDU1 Redun Pwr – On

Verify PDU1 Redun Pwr Status – On

Verify PDU1 VTC2 Pwr Bus Status – On

Verify PDU1 Main Input Current < 5 A

2.3 [Activating PDU2 MB2 Nominal Main Auxiliary Converter](#)

COL Berthed Survival Mode

'Power Distribution Unit'

cmd PDU2 Nom Pwr – On

Verify PDU2 Nom Pwr Status – On

Verify PDU2 VTC2 Pwr Bus Status – On

Verify PDU2 Main Input Current < 5 A

2.4 [Activating PDU2 MB2 Redundant Main Auxiliary Converter](#)

COL Berthed Survival Mode

'Power Distribution Unit'

cmd PDU2 Redun Pwr – On

Verify PDU2 Redun Pwr Status – On

Verify PDU2 VTC1 Pwr Bus Status – On

Verify PDU2 Main Input Current < 5 A

3. [ENABLING COMMUNICATION WITH C&C MDM](#)

NOTE

Expect VTC1 and VTC2 failed C&W messages.

3.1 [Inhibiting VTC Redundancy Management](#)

Task: COL Berthed Survival Mode

COL Berthed Survival Mode

'Vital Telemetry and Telecommand Controller'

'Inhibit VTC Redun Management'

√Master VTC Recovery Step 1 – Inh

√Master VTC Recovery Step 2 – Inh

√Slave VTC Recovery – Inh

3.2 [Enabling RT I/O with VTC2](#)

Task: COL Berthed Survival Mode: CB INT 2 RT Status

CB INT 2 RT Status

cmd 21 VTC 2 RT Status – Enable **Execute** (Verify – Ena)

4. [ACTIVATING AND INITIALIZING VTC2](#)

NOTE

1. Steps 4.1 and 4.2 require AOS.
2. VTC2 Ready Status indication can not be acquired since VTC1 is not available.

4.1 [Activating VTC2 Idle Mode via Nom Power A](#)

Task: COL Berthed Survival Mode

COL Berthed Survival Mode

'VTC2 Nominal Config'

cmd VTC2 Nom Pwr A – On

Verify VTC2 Nom Pwr A Status – On

Verify VTC2 Nom Pwr A Current < 2.14 A

Verify VTC2 Idle Config Mode – Idle Mode

MCC-H gives COL-CC “Go” to continue

COL-CC

4.2 [Enabling VTC2 Pre-emptive telemetry packets \(Ground Only\)](#)

COL-CC to enable VTC2 Pre-emptive telemetry packets.

Wait for “Go” to continue.

NOTE

Packet swapping initiated from COL-CC:
Enable VTC2_Gnd_Tlm_Pkt_PHY1_VTC (1Hz)

Perform [{2.2.41 VTC GROUND PACKET SWAPPING}](#) (ESA SODF: GROUND: NOMINAL). then:

COL-CC to give a “Go” to continue.

5. [CONFIGURING VTC2 TO MASTER](#)

PCS

5.1 [Initializing VTC2 in Master Mode](#)

Task: COL Berthed Survival Mode: CDH: VTC2

COL VTC 2

'VTC 2 Modes'

cmd Notify VTC2 – VTC1 in Slave Mode

cmd VTC2 Initialization – Master-Vital-Default

Verify DMS Mode – Vital

Verify Master/Slave Mode – Master

Verify Idle Mode – Not Idle

cmd VTC_Notify_Mode_Cmd_SW

prm New_Mode – 0 (SLAVE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

cmd VTC_Initialization_Cmd_SW

prm Init_Mode – 1 (MASTER)

prm Init_Limit_Set – 0 (DEFAULT)

prm Init_APM_Mode_Select – 1 (VITAL)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify VTC2_INT_DATA_APM_MODE_SW – VITAL

Verify VTC2_INT_DATA_MASTER_SLAVE_MODE_SW –
MASTER

Verify VTC2_INT_DATA_IDLE_CONF_MODE_SW – NOT_IDLE

5.2 [Enabling Logical Telemetry Packets](#)

VTC 2: VTC 2 Packet Enable

COL VTC 2 Packet Enable

cmd Log3 – Enable **Execute**

cmd Log4 – Enable **Execute**

cmd VTC_Tlm_Pkt_Ena_Cmd_SW

prm Packet_ID – VTC_Tlm_Pkt_LOG3_VTC

prm Action – 1 (ENABLE)

prm Checksum_Flag – 1 (ENABLE)

prm Dump_Pipe – 0 (TLM_P)

prm APID_Value – 1267

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

cmd VTC_Tlm_Pkt_Ena_Cmd_SW

prm Packet_ID – VTC_Tlm_Pkt_LOG4_VTC

prm Action – 1 (ENABLE)

prm Checksum_Flag – 1 (ENABLE)

prm Dump_Pipe – 0 (TLM_P)

prm APID_Value – 1267

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

5.3 [Swapping DMS Telemetry Packets \(Ground Only\)](#)

COL-CC

COL-CC to swap VTC telemetry packets.

Wait for "Go" to continue.

NOTE

Packet swapping initiated from COL-CC:
Disable VTC2_Gnd_Tlm_Pkt_PHY2_VTC (1Hz)
Enable VTC_Gnd_Tlm_Pkt_LOG1_VTC (1Hz)
Enable VTC_Gnd_Tlm_Pkt_LOG2_VTC (1Hz)

Perform [{2.2.41 VTC GROUND PACKET SWAPPING}](#) (ESA SODF: GROUND: NOMINAL). then:

COL-CC to give a "Go" to continue.

PCS 5.4 [Enabling VTC Vital Bus FDIR](#)
Task: COL Berthed Survival Mode: CDH: Vital Bus
[COL Vital Bus](#)

cmd Vital Bus Recon – Enable

Verify Vital Bus Recon – Enable

cmd VTC_Vital_Sys_Bus_Recon_Ena_Cmd_SW
prm BUS_ID – 0 (Vital)
prm RECONFIGURATION_ENABLE – 1 (Enable)
data Onboard_Node – SYS_CCSDS_End_Point_VTCM

Verify VTC_MASTER_Vital_Bus_Recon_Ena_SW_PP – ENABLE

5.5 [Enabling VTC System Bus FDIR](#)
Task: COL Berthed Survival Mode: CDH: System Bus
[COL System Bus Activation](#)

cmd System Bus Recon – Enable

Verify System Bus Recon – Enable

cmd VTC_Vital_Sys_Bus_Recon_Ena_Cmd_SW
prm BUS_ID – 1 (System)
prm RECONFIGURATION_ENABLE – 1 (Enable)
data Onboard_Node – SYS_CCSDS_End_Point_VTCM

Verify VTC_MASTER_System_Bus_Recon_Ena_SW – ENABLE

5.6 [Enabling RT FDIR with VTC2](#)
Task: COL Berthed Survival Mode: CB INT 2 RT Status
[CB INT 2 RT Status](#)

MCC-H

cmd 21 VTC 2 RT FDIR Status – Enable FDIR **Execute** (Verify – Ena)

5.7 [Enabling VTC Redundancy Management](#)

CDH: Primary CCS MDM: Primary CCS Recovery Retry:

COL Module Recovery

'Set VTC Master'

Verify Set VTC Master – VTC 2

'Master VTC Recovery to Redundant'

cmd Recovery Enable – Enable (Verify – Ena)

5.8 [Enabling C&W For VTC Redundancy Management \(Ground Only\)](#)

Enable the following events in the Primary and Backup C&C MDMs.

If ground unable to complete,

Perform [{2.101 CAUTION AND WARNING EVENT MANAGEMENT}](#), Step 2 (SODF: C&DH: NOMINAL) per Table 1, then

Table 1. C&W Events for DMS Master Recovery

Event	Text	Class
13608	DMS MASTER VTC Recovery Step 1 Failure - COL	C

6. [ACTIVATING PDU CROSS STRAPPED POWER BUS](#)

PCS

6.1 [Verifying Microcontroller Status](#)

Task: COL Berthed Survival Mode

COL Berthed Survival Mode

'PDU Redun Pwr Bus Act'

Verify PDU2 Nom Cntl – On

Verify Redun Cntl – Off

Verify PDU2_Nom_Cntl_Stat_VTC – ON

Verify PDU2_Redun_Cntl_Stat_VTC – OFF

6.2 [Verifying VTC2 Two-Stage Buffer Status](#)

COL Berthed Survival Mode: CDH: VTC 2: Cancel 2-Stage Cmd

COL Cancel 2-Stage Cmd VTC 2

'Cancel 2-Stage Cmd VTC 2'

√Cancel 2-Stage Cmd – Empty

```
*****
*      If Cancel 2-Stage Cmd – Full
*      |
*      |      cmd Cancel 2-Stage Cmd
*      |
*      |      Verify Cancel 2-Stage Cmd – Empty
*      |
*      |
*****
```

```
√VTC2_INT_DATA_TWOSTEP_FULL_SW – EMPTY
  If VTC2_INT_DATA_TWOSTEP_FULL_SW – FULL
  |
  |      cmd VTC_Cancel_Two_Stage_Cmd_Cmd_SW
  |      data Onboard_Node – SYS_CCSDS_End_Point_VTC2
  |
  |      Verify VTC2_INT_DATA_TWOSTEP_FULL_SW –
  |      EMPTY
```

6.3 [Activating All PDU1 and PDU2 Aux Converters for 120V Outlets](#)

COL Berthed Survival Mode: EPS: PDU1 Act

COL PDU 1 Act VTC2

'Aux Supplies Activation'

Record PCS ID: _____

cmd Start ACS PDU Config – Arm

pick PCS/C-X to VTC-Com2 (where X=PCS ID)

cmd Start ACS PDU Config – Set

COL-CC to verify PDU SSPC Aux Converter status.

Wait for “Go” to continue.

```
cmd PDU_Config_ACS (ARM)
data SW_CMD – VTC_Start_Terminate_ACS_Cmd_SW
data Action – 1 (START)
data Onboard_Node – SYS_CCSDS_End_Point_VTC2
```

Verify VTC2_INT_DATA_TWOSTEP_FULL_SW – FULL

cmd VTC_Execute_2_Stage_Cmd_SW (EXEC)

Verify PDU1_SSPC_Aux_Conv1_Stat_VTC – ON

Verify PDU1_SSPC_Aux_Conv2_Stat_VTC – ON

Verify PDU1_SSPC_Aux_Conv3_Stat_VTC – ON

Verify PDU1_SSPC_Aux_Conv4_Stat_VTC – ON

Verify PDU1_SSPC_Aux_Conv5_Stat_VTC – ON

Verify PDU1_SSPC_Aux_Conv6_Stat_VTC – ON

Verify PDU1_SSPC_Aux_Conv7_Stat_VTC – ON

Verify PDU1_SSPC_Aux_Conv8_Stat_VTC – ON

Verify PDU1_SSPC_Aux_Conv9_Stat_VTC – ON

Verify PDU2_SSPC_Aux_Conv1_Stat_VTC – ON

Verify PDU2_SSPC_Aux_Conv2_Stat_VTC – ON

Verify PDU2_SSPC_Aux_Conv3_Stat_VTC – ON

Verify PDU2_SSPC_Aux_Conv4_Stat_VTC – ON

Verify PDU2_SSPC_Aux_Conv5_Stat_VTC – ON

Verify PDU2_SSPC_Aux_Conv6_Stat_VTC – ON

Verify PDU2_SSPC_Aux_Conv7_Stat_VTC – ON

Verify PDU2_SSPC_Aux_Conv8_Stat_VTC – ON

Verify PDU2_SSPC_Aux_Conv9_Stat_VTC – ON

COL-CC to give a “Go” to continue.

6.4 [Activating PDU1 to PDU2 Power Outlet](#)

COL PDU1 Act VTC2: COL PDU2 Act VTC2

COL PDU 2 Act VTC2

cmd PDU 1/2 Redun Pwr Bus – On

Verify PDU 1/2 Redun Pwr Bus Status – On

cmd PDU1_PDU2_Redun_Pwr_Bus_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify PDU1_PDU2_Redun_Pwr_Bus_On_Off_Stat_VTC_PP – ON

6.5 [Activating PDU2 Cross Strapped Converter](#)

Task: COL Berthed Survival Mode

COL Berthed Survival Mode

'Converter Activation'

cmd PDU2 Cross Strapped Conv – On

Verify PDU2 Cross Strapped Conv Status – On

```
cmd PDU2_Cross_Strapped_Conv_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC2
```

Verify PDU2_Cross_Strapped_Conv_Stat_VTC – ON

6.6 [Activating PDU Lights Power Buses](#)

COL Berthed Survival Mode: EPS: Lights

COL PDU 1-2 Lights VTC2

cmd PDU 2 Outlet 21 – On (Verify – On)

cmd PDU 1 Outlet 21 – On (Verify – On)

```
cmd PDU2_MLU_Pwr_Bus_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC2
```

Verify PDU2_MLU_Pwr_Bus_On_Off_Stat_VTC_PP – ON

```
cmd PDU1_MLU_Pwr_Bus_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC2
```

Verify PDU1_MLU_Pwr_Bus_On_Off_Stat_VTC_PP – ON

7. [ACTIVATING HEATER CONTROL UNIT](#)

7.1 [Activating HCU1 Power Bus](#)

COL: EPS: PDU1 120 V Outlets Subsys/Payload

COL PDU 1 120 V Outlets VTC2

'PDU1'

cmd Outlet Num 28 – On

Verify SSPC1 Off/On 28 – On

Verify Current < 10 A

```
cmd PDU1_HCU1_Pwr_Bus_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Mode – SYS_CCSDS_End_Point_VTC2
```

Verify PDU1_HCU1_Pwr_Bus_On_Off_Stat_VTC_PP – ON

Verify PDU1_HCU1_Pwr_Bus_Current_VTC_PP < 10 A

7.2 [Activating HCU2 Power Bus](#)

EPS: PDU2 120V Outlets Subsys/Payload

COL PDU 2 120V Outlets VTC2

'PDU2'

cmd Outlet Num 28 – On

Verify SSPC1 Off/On 28 – On

Verify Current < 10 A

cmd PDU2_HCU2_Pwr_Bus_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify PDU2_HCU2_Pwr_Bus_On_Off_Stat_VTC_PP – ON

Verify PDU2_HCU2_Pwr_Bus_Current_VTC_PP < 10 A

Verifying Heater Control Loop Status (Ground Only)

NOTE

TLM only available after 30 sec delay following HCU power on because of HCU SW initialization.

Verify HCU1_AO_Htr_Cntl_Loop_Stat_VTC – ENABLED

Verify HCU1_AD_Htr_Cntl_Loop_Stat_VTC – ENABLED

Verify HCU1_AR_Htr_Cntl_Loop_Stat_VTC – ENABLED

Verify HCU1_FD_Htr_Cntl_Loop_Stat_VTC – ENABLED

Verify HCU1_FO_Htr_Cntl_Loop_Stat_VTC – ENABLED

Verify HCU1_FR_Htr_Cntl_Loop_Stat_VTC – ENABLED

Verify HCU2_AO_Htr_Cntl_Loop_Stat_VTC – ENABLED

Verify HCU2_AD_Htr_Cntl_Loop_Stat_VTC – ENABLED

Verify HCU2_AR_Htr_Cntl_Loop_Stat_VTC – ENABLED

Verify HCU2_FD_Htr_Cntl_Loop_Stat_VTC – ENABLED

Verify HCU2_FO_Htr_Cntl_Loop_Stat_VTC – ENABLED

Verify HCU2_FR_Htr_Cntl_Loop_Stat_VTC – ENABLED

COLUMBUS SINGLE VTC2 FINAL ACTIVATION

(ASSY MAL/1E/FIN/MULTI E)

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OBJECTIVE:

Continuing activation of Columbus Module with only VTC2 available.

INITIAL CONDITIONS:

Columbus Single VTC2 Berthed Survival Mode Activation is complete.

1. ACTIVATING PDU OUTLET

PCS

1.1 Activating PDU1 Subsystem Power Buses 1 thru 5

Task: COL Final Act – Part 1: EPS: PDU1 28 V Outlets
Subsys

COL PDU 1 28V Outlets VTC2

Outlet Num [X] where [X] = [30] [32] [35] [36] [40]

cmd Outlet Num [X] – On

Verify SSPC1 Off/On [X] – On

Repeat

cmd PDU1_Subsys_Pwr_Bus1_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify PDU1_Subsys_Pwr_Bus1_On_Off_Stat_VTC_PP – ON

cmd PDU1_Subsys_Pwr_Bus2_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify PDU1_Subsys_Pwr_Bus2_On_Off_Stat_VTC_PP – ON

cmd PDU1_Subsys_Pwr_Bus3_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify PDU1_Subsys_Pwr_Bus3_On_Off_Stat_VTC_PP – ON

cmd PDU1_Subsys_Pwr_Bus4_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify PDU1_Subsys_Pwr_Bus4_On_Off_Stat_VTC_PP – ON

cmd PDU1_Subsys_Pwr_Bus5_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify PDU1_Subsys_Pwr_Bus5_On_Off_Stat_VTC_PP – ON

1.2 [Activating PDU1 Subsystem Power Buses 6 thru 10](#)

COL PDU 1 28V Outlets VTC2

Outlet Num [X] where [X] = [31] [33] [34] [37] [41]

cmd Outlet Num [X] – On

 Verify SSPC1 Off/On [X] – On

Repeat

cmd PDU1_Subsys_Pwr_Bus6_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify PDU1_Subsys_Pwr_Bus6_On_Off_Stat_VTC_PP – ON

cmd PDU1_Subsys_Pwr_Bus7_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify PDU1_Subsys_Pwr_Bus7_On_Off_Stat_VTC_PP – ON

cmd PDU1_Subsys_Pwr_Bus8_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify PDU1_Subsys_Pwr_Bus8_On_Off_Stat_VTC_PP – ON

cmd PDU1_Subsys_Pwr_Bus9_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify PDU1_Subsys_Pwr_Bus9_On_Off_Stat_VTC_PP – ON

cmd PDU1_Subsys_Pwr_Bus10_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify PDU1_Subsys_Pwr_Bus10_On_Off_Stat_VTC_PP – ON

1.3 [Activating PDU2 Subsystem Power Buses 1 thru 5](#)

EPS: PDU2 28 V Outlets Subsys

COL PDU 2 28V Outlets VTC2

Outlet Num [X] where [X] = [30] [32] [35] [36] [40]

COLUMBUS SINGLE VTC2 FINAL ACTIVATION

(ASSY MAL/1E/FIN/MULTI E)

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||
|| **cmd** Outlet Num [X] – On
||
|| Verify SSPC1 Off/On [X] – On
||
|| Repeat

cmd PDU2_Subsys_Pwr_Bus1_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify PDU2_Subsys_Pwr_Bus1_On_Off_Stat_VTC_PP – ON

cmd PDU2_Subsys_Pwr_Bus2_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify PDU2_Subsys_Pwr_Bus2_On_Off_Stat_VTC_PP – ON

cmd PDU2_Subsys_Pwr_Bus3_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify PDU2_Subsys_Pwr_Bus3_On_Off_Stat_VTC_PP – ON

cmd PDU2_Subsys_Pwr_Bus4_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify PDU2_Subsys_Pwr_Bus4_On_Off_Stat_VTC_PP – ON

cmd PDU2_Subsys_Pwr_Bus5_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify PDU2_Subsys_Pwr_Bus5_On_Off_Stat_VTC_PP – ON

1.4 [Activating PDU2 Subsystem Power Buses 6 thru 10](#)

COL PDU 2 28V Outlets VTC2

||
|| Outlet Num [X] where [X] = [31] [33] [34] [37] [41]
||
|| **cmd** Outlet Num [X] – On
||
|| Verify SSPC1 Off/On [X] – On
||
|| Repeat

cmd PDU2_Subsys_Pwr_Bus6_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

COLUMBUS SINGLE VTC2 FINAL ACTIVATION

(ASSY MAL/1E/FIN/MULTI E)

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data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify PDU2_Subsys_Pwr_Bus6_On_Off_Stat_VTC_PP – ON

cmd PDU2_Subsys_Pwr_Bus7_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify PDU2_Subsys_Pwr_Bus7_On_Off_Stat_VTC_PP – ON

cmd PDU2_Subsys_Pwr_Bus8_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify PDU2_Subsys_Pwr_Bus8_On_Off_Stat_VTC_PP – ON

cmd PDU2_Subsys_Pwr_Bus9_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify PDU2_Subsys_Pwr_Bus9_On_Off_Stat_VTC_PP – ON

cmd PDU2_Subsys_Pwr_Bus10_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify PDU2_Subsys_Pwr_Bus10_On_Off_Stat_VTC_PP – ON

1.5 [Activating PDU1 D1 Rack Power](#)

EPS: PDU1 120 V Outlets Subsys/Payloads

COL PDU 1 120V Outlets VTC2

cmd Outlet Num 17 – On

Verify SSPC1 Off/On 17 – On

cmd PDU1_Rack_D1_Pwr_Bus_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify PDU1_Rack_D1_Pwr_Bus_On_Off_Stat_VTC_PP – ON

1.6 [Activating PDU2 D1 Rack Power](#)

EPS: PDU2 120 V Outlets Subsys/Payloads

COL PDU 2 120V Outlets VTC2

cmd Outlet Num 17 – On

Verify SSPC1 Off/On 17 – On

cmd PDU2_Rack_D1_Pwr_Bus_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify PDU2_Rack_D1_Pwr_Bus_On_Off_Stat_VTC_PP – ON

1.7 [Activating WPA1 and WPA2 Accumulator Pressure Sensors \(Ground Only\)](#)

COL-CC

COL-CC to activate WPA1 and WPA2 Accumulator Pressure Sensors.

Wait for “Go” to continue.

NOTE

1. This step can only be performed by COL-CC.
2. If the sensor readings show values below 165 kPa a pressurization of the accumulator is required prior to payload rack connector mate. Continue with step 1.8.
3. If both readings of either pair of WPA Accumulator Pressure sensors are out of limits after the monitoring has been enabled, the system will automatically safe to Berthed Survival Mode.

cmd WPA1_Accum_Press_Snsr2_Pwr_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify WPA1_Accum_Abs_Press2_VTC – 165 -195 kPa

cmd WPA2_Accum_Press_Snsr1_Pwr_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify WPA2_Accum_Abs_Press1_VTC – 165 -195 kPa

Activation of the VTC C&W monitoring for the WPA1 and WPA2 Accumulator Pressure Sensors

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – WPA1_Accum_Abs_Press2_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify WPA1_Accum_Abs_Press2_VTC_MEF – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – WPA2_Accum_Abs_Press1_VTC
prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2
 Verify WPA2_Accum_Abs_Press1_VTC_MEF – ENABLED
COL-CC gives "Go" to continue.

MCC-H

- 1.8 [Enabling C&W for Previous Monitorings \(Ground Only\)](#)
 Enable the following events in the Primary and Backup C&C MDMs.

If ground unable to complete,

Perform [{2.101 CAUTION AND WARNING EVENT MANAGEMENT}](#), Step 2 (SODF: C&DH: NOMINAL) per Table 1, then:

Table 1. C&W Events for WPA1 and WPA2

Event	Text	Class
13539	'WPA1 Accumulator Pressure Sensor 2 High - COL'	W
13540	'WPA2 Accumulator Pressure Sensor 1 High - COL'	W

PCS

- 1.9 [Verifying Total Pressure Sensors](#)

Task: COL Final Act – Part 1

COL Final Activation - Part 1

'Total Pressure Sensor'

Verify TPS1 Air Pressure: 719 to 783 mmHg

Verify TPS2 Air Pressure: 719 to 783 mmHg

Verify TPS1_Air_Press_VTC – 719 - 783 mmHg
 Verify TPS2_Air_Press_VTC – 719 - 783 mmHg

2. [ACTIVATING CMU 1-4](#)

NOTE

1. CMU1 needs to be activated for CMU4 Ready Status to be available.
2. The water loop must be activated within 5 hours of CMU activation.

2.1 [Activating Power B Supplies](#)

Task: COL Final Act – Part 1: CDH: CMU4

COL CMU 4 Act

'CMU 4 Redundant'

cmd CMU4 Redun Pwr B – On

Verify CMU4 Redun Pwr B Status – On

Verify CMU4 Redun Pwr B Current < 1.35 A

CDH: CMU1

COL CMU 1 Act

'CMU 1 Nominal'

cmd VTC 2 Master CMU1 Nom Pwr B – On

Verify CMU1 Nom Pwr B Status – On

Verify CMU1 Nom Pwr B Current < 1.35 A

Verify Ready Status – Ready

CDH: CMU2

COL CMU 2 Act

'CMU 2 Nominal'

cmd VTC 2 Master CMU2 Nom Pwr – On

Verify CMU2 Nom Pwr B Status – On

Verify CMU2 Nom Pwr B Current < 1.35 A

Verify Ready Status – Ready

CDH: CMU3

COL CMU 3 Act

'CMU 3 Nominal'

cmd VTC 2 Master CMU3 Nom Pwr B – On

Verify CMU3 Nom Pwr B Status – On

Verify CMU3 Nom Pwr B Current < 1.35 A

Verify Ready Status – Ready

CDH: CMU4

COL CMU 4 Act

'CMU 4 Redundant'

Verify Ready Status – Ready

cmd CMU4_Redun_Pwr_B_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify CMU4_Redun_Pwr_B_Stat_VTC – ON
Verify CMU4_Redun_Pwr_B_Current_VTC – <1.35 A

cmd CMU1_Nom_Pwr_B_On_ACT
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify CMU1_Nom_Pwr_B_Stat_ACT_PP – ON
Verify CMU1_Nom_Pwr_B_Current_ACT_PP – <1.35 A
Verify CMU1_Nom_Ready_Stat_ACT_PP – READY

cmd CMU2_Nom_Pwr_B_On_ACT
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify CMU2_Nom_Pwr_B_Stat_ACT_PP – ON
Verify CMU2_Nom_Pwr_B_Current_ACT_PP – <1.35 A
Verify CMU2_Nom_Ready_Stat_ACT_PP – READY

cmd CMU3_Nom_Pwr_B_On_ACT
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify CMU3_Nom_Pwr_B_Stat_ACT_PP – ON
Verify CMU3_Nom_Pwr_B_Current_ACT_PP – <1.35 A
Verify CMU3_Nom_Ready_Stat_ACT_PP – READY
Verify CMU4_Redun_Ready_Stat_ACT_PP – READY

2.2 [Activating CMU4 Redundant Power A Supply](#)

COL CMU 4 Act

'CMU 4 Redundant'

cmd VTC 2 Master CMU4 Redun Pwr A – On

Verify CMU 4 Redun Pwr A Status – On
Verify CMU 4 Redun Pwr A Current < 0.75 A
Verify CMU 4 Redun Pwr B Current < 0.75 A

cmd CMU4_Redun_Pwr_A_On_ACT
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify CMU4_Redun_Pwr_A_Stat_ACT_PP – ON

Verify CMU4_Redun_Pwr_A_Current_ACT_PP – <0.75 A
Verify CMU4_Redun_Pwr_B_Current_VTC – <0.75 A

3. [ACTIVATING WATER LOOP](#)

NOTE

1. TCS Jumpers must be installed prior to beginning this step.
2. Expect valve operations to take up to 15 seconds for verification.

3.1 [Configuring Loop A IFHX and Loop B IFHX for Water Loop Activation](#)

COL: TCS: MTL IFHX

COL MTL IFHX Commands

'COL MTL IFHX NH3'

'Isol Vlv'

Verify Position – Closed

cmd Cntrl Avail Open – Ena (Verify Cntrl Avail – Ena)

cmd Position – Open (Verify Position – Open)

'Byp Vlv'

Verify Position – Bypass

cmd Cntrl Avail Flothru – Ena (Verify Cntrl Avail – Ena)

cmd Position – Flothru (Verify Position – Flothru)

COL: TCS: LTL IFHX

COL LTL IFHX Commands

'COL LTL IFHX NH3'

'Isol Vlv'

Verify Position – Closed

cmd Cntrl Avail Open – Ena (Verify – Cntrl Avail Ena)

cmd Position – Open (Verify – Position Open)

'Byp Vlv'

Verify Position – Bypass

cmd Cntrl Avail Flothru – Ena (Verify – Cntrl Avail Ena)

cmd Position – Flothru (Verify – Position Flothru)

3.2 [Configuring Water On/Off Valve](#)

Task: COL Final Activation - Part 2

COL Final Activation - Part 2

'Water Loop Activation'

'Water On Off Valves'

Verify WOOV1 Posn – Open

Verify WOOV2 Posn – Closed

Verify WOOV3 Posn – Open

Verify WOOV4 Posn – Open

Verify WOOV5 Posn – Open

Verify WOOV6 Posn – Open

Verify WOOV7 Posn – Open

Verify WOOV8 Posn – Open

Verify WOOV9 Posn – Open

Verify WOOV10 Posn – Closed

Verify WOOV1_Open_Stat_VTC_PP – OPEN

Verify WOOV2_Close_Stat_VTC_PP – CLOSED

Verify WOOV3_Open_Stat_VTC_PP – OPEN

Verify WOOV4_Open_Stat_VTC_PP – OPEN

Verify WOOV5_Open_Stat_VTC_PP – OPEN

Verify WOOV6_Open_Stat_VTC_PP – OPEN

Verify WOOV7_Open_Stat_VTC_PP – OPEN

Verify WOOV8_Open_Stat_VTC_PP – OPEN

Verify WOOV9_Open_Stat_VTC_PP – OPEN

Verify WOOV10_Close_Stat_VTC_PP – CLOSED

Water Flow Selection Valve Configuration Verification

Verify WFSV_ISPR_A1_Open_Stat_VTC – OPEN

Verify WFSV_ISPR_A2_Open_Stat_VTC – OPEN

Verify WFSV_ISPR_A3_Open_Stat_VTC – OPEN

Verify WFSV_ISPR_A4_Open_Stat_VTC – OPEN

Verify WFSV_ISPR_F1_Open_Stat_VTC – OPEN

Verify WFSV_ISPR_F2_Open_Stat_VTC – OPEN

Verify WFSV_ISPR_F3_Open_Stat_VTC – OPEN

Verify WFSV_ISPR_F4_Open_Stat_VTC – OPEN

Verify WFSV_ISPR_O1_Open_Stat_VTC – OPEN

Verify WFSV_ISPR_O2_Open_Stat_VTC – OPEN

3.3 [Activating and Verifying WMV1 Shutoff Valve](#)

Task: COL Final Act – Part 2: TCS: WMV 1

COL WMV 1-2 Act VTC 2

'WMV 1 SOV'

cmd Power – On

Verify Pwr Status – On

Verify Position SOV1 – Open

Verify Position SOV2 – Open

cmd WMV1_SOV_Pwr_On_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify WMV1_SOV_Pwr_Stat_ACT_PP – ON

Verify WMV1_SOV1_Open_Stat_ACT_PP – OPEN

Verify WMV1_SOV2_Open_Stat_ACT_PP – OPEN

3.4 [Deactivating WMV1 Shutoff Section](#)

COL WMV 1-2 Act VTC 2

'WMV 1 SOV'

cmd Power – Off

Verify Pwr Status – Off

cmd WMV1_SOV_Pwr_Off_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify WMV1_SOV_Pwr_Stat_ACT_PP – OFF

3.5 [Activating and Verifying WMV2 Shutoff Valve](#)

COL WMV 1-2 Act VTC 2

'WMV 2 SOV'

cmd Power – On

Verify Pwr Status – On

Verify Position SOV1 – Closed

Verify Position SOV2 – Closed

cmd WMV2_SOV_Pwr_On_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify WMV2_SOV_Pwr_Stat_ACT_PP – ON
Verify WMV2_SOV1_Close_Stat_ACT_PP – CLOSED
Verify WMV2_SOV2_Close_Stat_ACT_PP – CLOSED

3.6 [Deactivating WMV2 Shutoff Section](#)

COL WMV 1-2 Act VTC 2

'WMV 2 SOV'

cmd Power – Off

Verify Pwr Status – Off

cmd WMV2_SOV_Pwr_Off_ACT
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify WMV2_SOV_Pwr_Stat_ACT_PP – OFF

3.7 [Activating and Verifying WMV3 Shutoff Valve](#)

TCS: WMV 3

WMV 3-4 Act VTC 2

'WMV 3 SOV'

cmd Power – On

Verify Pwr Status – On

Verify Position SOV1 – Open

Verify Position SOV2 – Open

cmd WMV3_SOV_Pwr_On_ACT
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify WMV3_SOV_Pwr_Stat_ACT_PP – ON

Verify WMV3_SOV1_Open_Stat_ACT_PP – OPEN

Verify WMV3_SOV2_Open_Stat_ACT_PP – OPEN

3.8 [Deactivating WMV3 Shutoff Section](#)

COL WMV 3-4 Act VTC 2

'WMV 3 SOV'

cmd Power – Off

Verify Pwr Status – Off

cmd WMV3_SOV_Pwr_Off_ACT
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify WMV3_SOV_Pwr_Stat_ACT_PP – OFF

3.9 [Activating and Verifying WMV4 Shutoff Valve](#)

COL WMV 3-4 Act VTC 2

'WMV 4 SOV'

cmd Power – On

Verify Pwr Status – On

Verify Position SOV1 – Closed

Verify Position SOV2 – Closed

cmd WMV4_SOV_Pwr_On_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify WMV4_SOV_Pwr_Stat_ACT_PP – ON

Verify WMV4_SOV1_Close_Stat_ACT_PP – CLOSED

Verify WMV4_SOV2_Close_Stat_ACT_PP – CLOSED

3.10 [Deactivating WMV4 Shutoff Section](#)

COL WMV 3-4 Act VTC 2

'WMV 4 SOV'

cmd Power – Off

Verify Pwr Status – Off

cmd WMV4_SOV_Pwr_Off_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify WMV4_SOV_Pwr_Stat_ACT_PP – OFF

3.11 [Closing Bypass Valves WOOV5 and WOOV7](#)

Task: COL Final Act – Part 2: TCS: WOOV 3-8

COL WOOV 3-8 VTC2

'WOOV 5'

cmd Position – Close

Verify Position – Closed

COL WOOV 3-8 VTC 2

'WOOV 7'

cmd Position – Close

Verify Position – Closed

cmd WOOV5_Vlv_Close_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify WOOV5_Close_Stat_VTC_PP – CLOSED

cmd WOOV7_Vlv_Close_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify WOOV7_Close_Stat_VTC_PP – CLOSED

3.12 [Activating WMV1 Modulating Section](#)

TCS: WMV 1

COL WMV 1-2 Act VTC 2

'WMV 1 MDV'

cmd Power – On

Verify Pwr Status – On

cmd WMV1_MDV_Pwr_On_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify WMV1_MDV_Pwr_Stat_ACT_PP – ON

3.13 [Activating WPA1](#)

TCS: WPA 1

COL WPA 1 Act VTC 2

'WPA 1'

cmd Power – On

Verify Power – On

cmd WPA1_Pwr_On_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify WPA1_Pwr_Stat_ACT_PP – ON

3.14 [Starting up WPA1 Pump Operation](#)

COL WPA 1 Act VTC 2

'WPA 1'

NOTE

This step activates active cooling via the water loop and terminates the thermal clock started with CMU Activation in step 2.

cmd Pump Initialization – Start

Verify Mass Flow > 230 kg/h

Verify Pump dP > 30 kPa

Task: COL Final Act – Part 2

COL Final Activation – Part 2

'WPA 1'

Verify Redun Plenum dP > 18 kPa

cmd WPA1_Pump_Init_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify WPA1_Pump_DP_ACT_PP – > 30 kPa

Verify WPA1_Mass_Flow_ACT_PP – > 230 kg/h

Verify DPSB2_Redun_Plenum_DP_VTC – > 18 kPa

3.15 [Enabling Monitoring of Delta Pressure Sensor Block](#)

COL Final Act – Part 2: TCS: TCS Monitoring Status

COL Monitoring Status

'VTC 2'

NOTE

If reading of the DPSB2 Redun Plenum dP is out of limits after the monitoring has been enabled, the system will automatically safe to Berthed Survival Mode.

cmd DPSB2 Redun Plenum dP Monitoring Status – Enable

Verify DPSB2 Redun Plenum dP Monitoring Status – Enabled

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – DPSB2_Redun_Plenum_DP_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify DPSB2_Redun_Plenum_DP_VTC_MEF – ENABLED

3.16 [Verifying Wet Temperatures](#)

COL Final Act – Part 2: TCS

TCS Overview Act

Verify WTSB2 Redun Plenum Temp 3 < 24 deg C

```
*****
*           If WTSB2 Redun Plenum Temp 3 ≥ 24 deg C
*           |
*           | wait 5 minutes then re-verify
*           |
*****
```

Verify WTSB2_Redun_Plenum_Temp3_VTC – < 24°C

3.17 [Enabling Monitoring of WTSB Measurements](#)

TCS: TCS Monitoring Status

COL Monitoring Status

'VTC 2'

NOTE

If reading of the WTSB2 Redun Plenum Temp3 is out of limits after the monitoring has been enabled, the system will automatically safe to Berthed Survival Mode.

cmd WTSB2 Redun Plenum Temp 3 Monitoring Status – Enable

Verify WTSB2 Redun Plenum Temp 3 Monitoring Status – Enabled

```
cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – WTSB2_Redun_Plenum_Temp3_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC2
```

Verify WTSB2_Redun_Plenum_Temp3_VTC_MEF – ENABLED

3.18 [Enabling C&W in USOS for Previous Monitorings \(Ground Only\)](#)

MCC-H

Enable the following events in the Primary and Backup C&C MDMs.

If ground unable to complete,
| Perform [{2.101 CAUTION AND WARNING EVENT MANAGEMENT}](#), Step 2 (SODF: C&DH: NOMINAL:)per Table 2, then

Table 2. C&W Events for DPSB & WTSB

Event	Text	Class
13535	'Cooling Loop Delta Pressure Sensor 2 Low – COL'	W
14166	'Cooling Loop Temperature Sensor 2 High – COL'	W

PCS

3.19 [Activating ATU Power Bus](#)

COL: EPS: PDU1 120V Outlets Subsys/Payloads

COL PDU 1 120V Outlets VTC2

'PDU1'

'Outlet Num 20'

cmd ATU1 Pwr Bus – On

Verify ATU1 Pwr Bus – On

COL: EPS: PDU2 120V Outlets Subsys/Payloads

COL PDU 2 120V Outlets VTC2

'PDU2'

'Outlet Num 20'

cmd ATU2 Pwr Bus – On

Verify ATU2 Pwr Bus – On

cmd PDU1_ATU1_Pwr_Bus_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify PDU1_ATU1_Pwr_Bus_On_Off_Stat_VTC_PP – ON

cmd PDU2_ATU2_Pwr_Bus_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify PDU2_ATU2_Pwr_Bus_On_Off_Stat_VTC_PP – ON

4. [ACTIVATING NETWORK CLSW](#)

4.1 [Activating CLSW1 Power A](#)

Task: COL Final Act – Part 3: CDH: CLSW 1

COL CLSW 1 Act

'VTC 2 Master'

cmd Pwr A – On

Verify CLSW1 Pwr A Ready Status – Ready

Verify CLSW1 Pwr A Status – On

Verify CLSW1 Pwr A Current < 2.5 A

cmd CLSW1_Pwr_A_On_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify CLSW1_Ready_Stat_ACT_PP – READY

Verify CLSW1_Pwr_A_Stat_ACT_PP – ON

Verify CLSW1_Pwr_A_Current_ACT_PP – < 2.5 A

4.2 [Activating CLSW1 Power B](#)

COL CLSW 1 Act

'VTC 2 Master'

cmd Pwr B – On

Verify CLSW1 Pwr B Status – On

Verify CLSW1 Pwr B Current < 2.2 A

Verify CLSW1 Pwr A Current < 0.7 A

cmd CLSW1_Pwr_B_On_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify CLSW1_Pwr_B_Stat_ACT_PP – ON

Verify CLSW1_Pwr_B_Current_ACT_PP – < 2.2 A

Verify CLSW1_Pwr_A_Current_ACT_PP – < 0.7 A

4.3 [Activating CLSW2 Power A](#)

CDH: CLSW 2

COL CLSW 2 Act

'VTC 2 Master'

cmd Pwr A – On

Verify CLSW2 Pwr A Ready Status – Ready

Verify CLSW2 Pwr A Status – On

Verify CLSW2 Pwr A Current < 2.5 A

cmd CLSW2_Pwr_A_On_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify CLSW2_Ready_Stat_ACT_PP – READY
Verify CLSW2_Pwr_A_Stat_ACT_PP – ON
Verify CLSW2_Pwr_A_Current_ACT_PP – < 2.5 A

4.4 [Activating CLSW2 Power B](#)

COL CLSW 2 Act

'VTC 2 Master'

cmd Pwr B – On

Verify CLSW2 Pwr B Status – On
Verify CLSW2 Pwr B Current < 2.2 A
Verify CLSW2 Pwr A Current < 0.7 A

cmd CLSW2_Pwr_B_On_ACT
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify CLSW2_Pwr_B_Stat_ACT_PP – ON
Verify CLSW2_Pwr_B_Current_ACT_PP – < 2.2 A
Verify CLSW2_Pwr_A_Current_ACT_PP – < 0.7 A

5. [ACTIVATING MASS MEMORY UNIT](#)

5.1 [Activating MMU2 Power A](#)

Task: COL Final Act – Part 3: CDH: MMU 2

COL MMU 2 Act

'VTC 2 Master'

cmd MMU2 Pwr A – On

Verify MMU2 Pwr A Status – On
Verify MMU2 Pwr A Current < 1.58 A

cmd MMU2_Pwr_A_On_ACT
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify MMU2_Pwr_A_Stat_ACT_PP – ON
Verify MMU2_Pwr_A_Current_ACT_PP – <1.58 A

5.2 [Activating MMU2 Power B](#)

COL MMU 2 Act

'VTC 2 Master'

cmd MMU2 Pwr B – On

Verify MMU2 Pwr B Status – On
Verify MMU2 Pwr B Current < 0.12 A
Verify MMU2 Pwr A Current < 1.58 A

cmd MMU2_Pwr_B_On_ACT
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify MMU2_Pwr_B_Stat_ACT_PP – ON
Verify MMU2_Pwr_B_Current_ACT_PP – < 0.12 A
Verify MMU2_Pwr_A_Current_ACT_PP – <1.58 A

5.3 [Commanding MMU2 to Slave Mode](#)

'MMU 2 Boot as'

cmd MMU 2 Boot as – Slave

Wait up to 5 minutes for MMU2 Ready Status to be displayed.

Verify MMU2 Ready Status – Ready

cmd VTC_Boot_SPC_Cmd_SW
prm RT_Address – 27 (RT address of MMU2)
prm Mode – 9 (MMU_SLAVE)
prm Session Number – 1
data Onboard_Node – SYS_CCSDS_End_Point_VTCM

Verify MMU2_Ready_Stat_ACT_PP – READY

5.4 [Activating MMU1 Power A](#)

CDH: MMU 1

'VTC 2 Master'

cmd MMU1 Pwr A – On

Verify MMU1 Pwr A Status – On
Verify MMU1 Pwr A Current < 1.58 A

cmd MMU1_Pwr_A_On_ACT
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify MMU1_Pwr_A_Stat_ACT_PP – ON
Verify MMU1_Pwr_A_Current_ACT_PP – <1.58 A

5.5 [Activating MMU1 Power B](#)

COL MMU 1 Act

'VTC 2 Master'

cmd MMU1 Pwr B – On

Verify MMU1 Pwr B Status – On

Verify MMU1 Pwr B Current < 0.12 A

Verify MMU1 Pwr A Current < 1.58 A

cmd MMU1_Pwr_B_On_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify MMU1_Pwr_B_Stat_ACT_PP – ON

Verify MMU1_Pwr_B_Current_ACT_PP – < 0.12 A

Verify MMU1_Pwr_A_Current_ACT_PP – <1.58 A

5.6 [Commanding MMU1 to Master Mode](#)

COL MMU 1 Act

'MMU 1 Boot as'

cmd MMU 1 Boot as – Master-Default

Wait up to 5 minutes for MMU1 Ready Status to be displayed.

Verify MMU1 Ready Status – Ready

cmd VTC_Boot_SPC_Cmd_SW

prm RT_Address – 17 (RT address of MMU1)

prm Mode – 7 (MMU_MASTER_DEFAULT)

prm Session Number – 1

data Onboard_Node – SYS_CCSDS_End_Point_VTCM

Verify MMU1_Ready_Stat_ACT_PP – READY

6. [ACTIVATING MISSION MANAGEMENT COMPUTER](#)

NOTE

1. Steps 6.3 through 6.7 require AOS.
2. Expect DMS C&W messages.

6.1 [Inhibiting Redun Management for MMC](#)

Task: COL Final Activation - Part 3

COL Final Activation - Part 3

'Mission Management Computer'

√MMC Redun Management – Inh

6.2 [Enabling RT I/O for MMC](#)

COL Final Activation - Part 3: CB INT 2 RT Status

COL INT 2 RT Status

cmd 22 MMC RT Status – Enable **Execute** (Verify – Ena)

6.3 [Activating MMC Power A](#)

COL Final Act – Part 3: CDH: MMC

COL MMC Act

'MMC Pwr'

cmd MMC Pwr VTC 2 Master A – On

Verify MMC Pwr A Status – On

Verify MMC Pwr A Current < 1.19 A

cmd MMC_Pwr_A_On_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify MMC_Pwr_A_Stat_ACT_PP – ON

Verify MMC_Pwr_A_Current_ACT_PP – < 1.19 A

6.4 [Activating MMC Power B](#)

COL MMC Act

'MMC Pwr'

cmd MMC Pwr VTC 2 Master B – On

Verify MMC Pwr B Status – On

Verify MMC Pwr B Current < 0.12 A

Verify MMC Pwr A Current < 1.19 A

cmd MMC_Pwr_B_On_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify MMC_Pwr_B_Stat_ACT_PP – ON

Verify MMC_Pwr_B_Current_ACT_PP – < 0.12 A

Verify MMC_Pwr_A_Current_ACT_PP – < 1.19 A

6.5 [Initializing Command MMC S/W](#)

NOTE

During the MMC boot process, the configuration FLAPs MMC Cold Start and MMC Start-Up are executed automatically.

The MMC Cold Start FLAP:
 Starts monitorings of the MMC node
 Executes the MMC Startup FLAP

The MMC Start-Up FLAP:
 Resets the station mode compatibility variable and venting valve inhibit status
 Activates MMC hosted application software (COAP IDF task)
 Starts the SNCD CVT packet to the US MDM
 Starts the pre-emptive TIm packet for DMS data to Col-CC
 Starts the pre-emptive TIm packet for USM data to Col-CC

COL MMC Act

'MMC Boot as'

cmd MMC Boot as - MMC Default

Verify SPC2 Boot Report – 66048

Wait up to 5 minutes for MMC to boot before checking Ready Status.

Verify MMC Ready Status – Ready

Wait for “Go” to continue.

cmd VTC_Boot_SPC_Cmd_SW
prm RT_Address – 8 (RT address of SPC2)
prm Mode – 1(MMC_DEFAULT)
prm Session Number – 1 (TBC)
data Onboard_Node – SYS_CCSDS_End_Point_VTCM

Verify VTC_MASTER_SPC2_Boot_Report_SW_PP – 66048
 Verify MMC_Ready_Stat_ACT_PP – READY

COL-CC to give a “Go” to continue.

6.6 [Enabling RT FDIR for MMC](#)

COL Final Activation - Part 3: CB INT 2 RT Status

CB INT 2 RT Status

cmd 22 MMC RT FDIR Status – Enable FDIR **Execute** (Verify – Ena)

6.7 [Enabling MMC Redundancy Management](#)

Columbus Final Act - Part 3

COL Final Activation - Part 3

'Mission Management Computer'

cmd MMC Redun Management – Ena (Verify – Ena)

6.8 [Enabling CCSDS Checksum Validation on MMC \(Ground Only\)](#)

cmd DMS_CCSDS_Checksum_Ena_Cmd_SW

data ONBOARD_NODE –

SYS_CCSDS_End_Point_MMC_DMS_SERV

6.9 [Enabling CCSDS Checksum Validation on MMU \(Ground Only\)](#)

cmd DMS_CCSDS_Checksum_Ena_Cmd_SW

data ONBOARD_NODE –

SYS_CCSDS_End_Point_MMU_DMS_SERV

7. [ACTIVATING SPARE SPC AS DATA MANAGEMENT COMPUTER](#)

NOTE

1. Steps 7.1 through 7.5 require AOS.
2. Expect DMS C&W messages.
3. DMS redundancy for SPCs is lost.

7.1 [Activating Spare Power A](#)

Task: COL Final Act – Part 3: CDH: Spare

COL Spare Computer Act

'Spare Pwr'

cmd Spare Pwr VTC 2 Master A – On

Verify Spare Pwr A Status – On

Verify Spare Pwr A Current < 1.19 A

cmd Spare_Pwr_A_On_ACT

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify Spare_Pwr_A_Stat_VTC – ON

Verify Spare_Pwr_A_Current_VTC – < 1.19 A

7.2 [Activating Spare Power B](#)

COL Spare Computer Act

'Spare Pwr'

cmd Spare Pwr VTC 2 Master B – On

Verify Spare Pwr B Status – On
Verify Spare Pwr B Current < 0.12 A
Verify Spare Pwr A Current < 1.19 A

cmd Spare_Pwr_B_On_ACT
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify Spare_Pwr_B_Stat_VTC – ON
Verify Spare_Pwr_B_Current_VTC – < 0.12 A
Verify Spare_Pwr_A_Current_VTC – < 1.19 A

7.3 [Initializing Spare as DMC](#)

COL Spare Computer Act

'Boot Spare as'

cmd Boot Spare as DMC Default

Wait up to 5 minutes for Spare to boot as DMC before checking the SPC4 Boot Report

Verify SPC4 Boot Report – 4096

cmd VTC_Boot_SPC_Cmd_SW
prm RT_Address – 10
prm Mode – 0
prm Session_Number – 1
data Onboard_Node – SYS_CCSDS_End_Point_VTCM

Verify VTC_MASTER_SPC4_Boot_Report_SW_PP – 4096

7.4 [Configuring DMC as Bus Controller](#)

NOTE

All activation telemetry on PCS and ground displays will be invalid at the completion of step 7.4. These invalid parameters will be indicated by a cyan telemetry field.

COLUMBUS SINGLE VTC2 FINAL ACTIVATION

(ASSY MAL/1E/FIN/MULTI E)

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NOTE

During the DMC boot process, the configuration FLAPs 'DMC Cold Start' and 'DMC Start-Up' are executed automatically.

The DMC Cold Start FLAP:

- Starts several monitorings on the DMC node
- Starts the RT acquisition of active DMS equipment
- Initializes several DMS related S/W variables
- Executes the DMC Startup FLAP

The DMC Start-Up FLAP:

- Starts several monitorings of system measurements
- Starts the RT acquisition of active system equipment
- Initializes several S/W variables

CDH: VTC 2

COL VTC 2

'VTC 2 Modes'

cmd Select VTC 2 Mode – Vital To Nominal

Wait up to 15 minutes for DMC to boot up before checking Ready Status.

CDH

DMS Overview Act

'Spare'

Verify Ready Status – Ready

cmd VTC_Vital_To_Nom_Mode_Chg_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTCM

Verify SPARE_Ready_Stat_VTC – READY

7.5 [Enabling SPARE Monitoring \(Ground Only\)](#)

COL-CC

SPARE monitoring to be enabled by ground.

Wait for "Go" to continue.

cmd DMS_RT_Stop_RT_Acquisition_Cmd_SW
prm Remote_Terminal_ID –
MIL 1553B Bus RT Svstem Bus VTC2
data Onboard_Node –
SYS CCSDS End Point DMC DMS SERV

Verify VTC2_Sys_Bus_Ena_Stat_SW – DISABLED

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – SPARE_Pwr_A_Current_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify SPARE_Pwr_A_Current_VTC_MEF – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – SPARE_Pwr_B_Current_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify SPARE_Pwr_B_Current_VTC_MEF – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – SPARE_Pwr_A_Stat_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify SPARE_Pwr_A_Stat_VTC_MEF – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – SPARE_Pwr_B_Stat_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify SPARE_Pwr_B_Stat_VTC_MEF – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – SPARE_Temp_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify SPARE_Temp_VTC_MEF – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – SPARE_Sec_Voltage_Stat_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify SPARE_Sec_Voltage_Stat_VTC_MEF – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – SPARE_Ready_Stat_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify SPARE_Ready_Stat_VTC_MEF – ENABLED

COL-CC to give a “Go” to continue.

MCC-H

7.6 [Enabling C&W for the DMS and PDU1/2 Cautions \(Ground Only\)](#)

Enable the following events in the Primary and Backup C&C MDMs.

If ground unable to complete,

Perform [{2.101 CAUTION AND WARNING EVENT MANAGEMENT}](#), Step 2 (SODF: C&DH: NOMINAL) per Table 3, then:

Table 3. C&W Events for DMS and PDU1

Event	Text	Class
13570	'DMS I/O Unit (CMU1) Redundant Branch Failure – COL'	C
13572	'DMS I/O Unit (CMU2) Redundant Branch Failure – COL'	C
13574	'DMS I/O Unit (CMU3) Redundant Branch Failure – COL'	C
13576	'DMS I/O Unit (CMU4) Redundant Branch Failure – COL'	C
13579	'Power Distribution Unit (PDU1) Redun Controller Failure – COL'	C

7.7 [Enabling CCSDS Checksum Validation on DMC \(Ground Only\)](#)

```
cmd DMS_CCSDS_Checksum_Ena_Cmd_SW
data ONBOARD_NODE –
SYS_CCSDS_End_Point_DMC_DMS_SERV
```

COL-CC

7.8 [Swapping DMS Telemetry Packets \(Ground Only\)](#)

COL-CC to swap nominal DMS telemetry packets.

Wait for “Go” to continue.

<p><u>NOTE</u></p> <p>Packet swapping initiated from Col-CC: Disable VTC_Gnd_Tlm_Pkt_LOG1_VTC (1Hz) Disable VTC_Gnd_Tlm_Pkt_LOG2_VTC (1Hz) Disable VTC2_Gnd_Tlm_Pkt_PHY1_VTC (1Hz)</p>

COLUMBUS SINGLE VTC2 FINAL ACTIVATION

(ASSY MAL/1E/FIN/MULTI E)

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Perform [{2.2.41 VTC GROUND PACKET SWAPPING}](#) (ESA SODF: GROUND: NOMINAL), then:

NOTE

Automatically started TIm Packets:

MMC_Gnd_TIm_Pkt_DMS1_DMC (0.1 Hz)

MMC_Gnd_TIm_Pkt_USM3_DMC (0.1 Hz)

Packet swapping initiated from **Col-CC**:

Enable MMC_Gnd_TIm_Pkt_COAP_DMC (0.1Hz)

Enable MMC_Gnd_TIm_Pkt_DMS2_DMC (0.1Hz)

Enable MMC_Gnd_TIm_Pkt_EPDS1_DMC (0.1Hz)

Enable MMC_Gnd_TIm_Pkt_EPDS2_DMC (0.1Hz)

Enable MMC_Gnd_TIm_Pkt_TCS1_DMC (0.1Hz)

Enable MMC_Gnd_TIm_Pkt_TCS2_DMC (0.1Hz)

Enable MMC_Gnd_TIm_Pkt_ECLSS1_DMC (0.1Hz)

Enable MMC_Gnd_TIm_Pkt_ECLSS2_DMC (0.1Hz)

Enable MMC_Gnd_TIm_Pkt_USM1_DMC (0.1Hz)

Enable MMC_Gnd_TIm_Pkt_USM2_DMC (0.1Hz)

Enable MMC_Gnd_TIm_Pkt_Monitoring_Stat1_DMC (0.1Hz)

Enable MMC_Gnd_TIm_Pkt_Monitoring_Stat2_DMC (0.1Hz)

Enable MMC_Gnd_TIm_Pkt_FLAP_Variables1_DMC (0.1Hz)

Enable MMC_Gnd_TIm_Pkt_FLAP_Variables2_DMC (0.1Hz)

Enable MMU_Gnd_TIm_Pkt_LAPAP_DMC (0.1Hz)

Enable MMC_Gnd_TIm_Pkt_DMS_Off_Nominal_DMC (0.1 Hz)

Enable MMC_Gnd_TIm_Pkt_System_Activation_DMC (1 Hz)

Perform [{2.2.42 NOMINAL DMS PACKET SWAPPING}](#) (ESA SODF: GROUND: NOMINAL). then:

COL-CC to give "Go" to continue.

8. [ACTIVATING PORTABLE WORKSTATION](#)

NOTE

1. Steps 1 through 7 must be complete before PWS activation.

2. Ground can continue to step 9.

Perform [{PWS ACTIVATION}](#), all (SODF: ASSY OPS: ACTIVATION AND CHECKOUT), then:

9. [ENABLING PDU FOR NOMINAL SYSTEM SUPPORT](#)

NOTE

Steps 9.1 through 9.5 can only be verified by the **COL-CC**.

PCS

9.1 [Verify PDU Microcontrollers Status](#)

Task: COL Final Activation - Part 3: EPS

EPDS Overview

'PDU1'

Verify Redundant Controller Status – Off

Verify Nominal Controller Status – On

EPDS Overview

'PDU2'

Verify Nominal Controller Status – On

Verify Redundant Controller Status – Off

Verify PDU1_Nom_Redun_CPU_Stat_DMC – Nominal

Verify PDU2_Nom_Redun_CPU_Stat_DMC – Nominal

9.2 [Enabling Nominal System Bus Control for PDU1 Subsys Power Buses](#)

COL Final Activation - Part 3: COL EPDS Auto Cmd Sequences

COL EPDS Automated Command Sequences VTC2

√VTC2 Buffer Status – Empty

```

*****
*           If VTC2 Buffer – Full
*           |
*           | sel VTC2 Cancel 2 Step Command
*           |
*           | COL Cancel 2 - Stage Cmd VTC 2
*           |
*           |
*           | cmd Cancel 2 – Stage Cmd Execute (Verify
*           | – Empty)
*           |
*****

```

'PDU1'

'Subsys Pwr Bus Control Enable ACS'

Verify Status – Enabled

Record PCS ID: _____

cmd Start – Arm

pick PCS/C-X to VTC-Com2 (where X=PCS ID)

cmd Start – Set

√VTC2_Two_Stage_Buffer_Status_SW_PP – EMPTY

If VTC2_Two_Stage_Buffer_Status_SW_PP – FULL

cmd VTC_Cancel_Two_Stage_Cmd_Cmd_SW
data Onboard_Node SYS_CCSDS_End_Point_VTC2

 Verify VTC2_Two_Stage_Buffer_Status_SW_PP –
 EMPTY

cmd PDU1_Subsys_Pwr_Bus_Sys_Cntl_Ena_ACS (ARM)
data SW_CMD – VTC_Start_Terminate_ACS_Cmd_SW
data Action – 1 (START)
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify VTC2_Two_Stage_Buffer_Status_SW_PP – FULL

cmd VTC_Execute_2_Stage_Cmd_SW (EXEC)

Verify PDU1_ATU1_Pwr_Bus_Sys_Cntl_Stat_DMC – ENABLED
 Verify PDU1_CTCU1_Pwr_Bus_Sys_Cntl_Stat_DMC –
 ENABLED
 Verify PDU1_Rack_D1_Pwr_Bus_Sys_Cntl_Stat_DMC –
 ENABLED
 Verify PDU1_Fan_Pwr_Bus_Sys_Cntl_Stat_DMC – ENABLED
 Verify PDU1_PDU2_Redun_Pwr_Bus_Sys_Cntl_Stat_DMC –
 ENABLED
 Verify PDU1_Subsys_Pwr_Bus1_Sys_Cntl_Stat_DMC –
 ENABLED
 Verify PDU1_Subsys_Pwr_Bus2_Sys_Cntl_Stat_DMC –
 ENABLED
 Verify PDU1_Subsys_Pwr_Bus3_Sys_Cntl_Stat_DMC –
 ENABLED
 Verify PDU1_Subsys_Pwr_Bus4_Sys_Cntl_Stat_DMC –
 ENABLED
 Verify PDU1_Subsys_Pwr_Bus5_Sys_Cntl_Stat_DMC –
 ENABLED
 Verify PDU1_Subsys_Pwr_Bus6_Sys_Cntl_Stat_DMC –
 ENABLED
 Verify PDU1_Subsys_Pwr_Bus7_Sys_Cntl_Stat_DMC –
 ENABLED
 Verify PDU1_Subsys_Pwr_Bus8_Sys_Cntl_Stat_DMC –
 ENABLED
 Verify PDU1_Subsys_Pwr_Bus9_Sys_Cntl_Stat_DMC –
 ENABLED
 Verify PDU1_Subsys_Pwr_Bus10_Sys_Cntl_Stat_DMC –
 ENABLED
 Verify PDU1_SUP1_Pwr_Out1_SSPC1_Sys_Cntl_Stat_DMC –
 ENABLED

```

Verify PDU1_SUP1_Pwr_Out2_SSPC1_Sys_Cntl_Stat_DMC –
ENABLED
Verify PDU1_SUP1_Pwr_Out3_SSPC1_Sys_Cntl_Stat_DMC –
ENABLED
Verify PDU1_SUP2_Pwr_Out1_SSPC1_Sys_Cntl_Stat_DMC –
ENABLED
Verify PDU1_SUP2_Pwr_Out2_SSPC1_Sys_Cntl_Stat_DMC –
ENABLED
Verify PDU1_SUP2_Pwr_Out3_SSPC1_Sys_Cntl_Stat_DMC –
ENABLED
Verify PDU1_VDPU_Pwr_Bus_Sys_Cntl_Stat_DMC –
ENABLED
    
```

9.3 [Enabling Nominal System Bus Control for PDU2 Subsys Power Buses](#)

COL EPDS Automated Command Sequences VTC2

√VTC2 Buffer Status – Empty

```

*****
*           If VTC2 Buffer – Full
*           |
*           | sel VTC2 Cancel 2 Step Command
*           |
*           | COL Cancel 2 - Stage Cmd VTC 2
*           |
*           |
*           | cmd Cancel 2 – Stage Cmd Execute (Verify
*           | – Empty)
*           |
*           |
*****
    
```

'PDU2'

'Subsys Pwr Bus Control Enable ACS'

Verify Status – Enabled

Record PCS ID: _____

cmd Start – Arm

pick PCS/C-X to VTC-Com2 (where X=PCS ID)

cmd Start – Set

```

√VTC2_Two_Stage_Buffer_Status_SW_PP – EMPTY

If VTC2_Two_Stage_Buffer_Status_SW_PP – FULL
|
|
| cmd VTC_Cancel_Two_Stage_Cmd_Cmd_SW
| data Onboard_Node SYS_CCSDS_End_Point_VTC2
|
|
    
```

Verify VTC2_Two_Stage_Buffer_Status_SW_PP –
EMPTY

cmd PDU2_Subsys_Pwr_Bus_Sys_Cntl_Ena_ACS (ARM)

data SW_CMD – VTC_Start_Terminate_ACS_Cmd_SW

data Action – 1 (START)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify VTC2_Two_Stage_Buffer_Status_SW_PP – FULL

cmd VTC_Execute_2_Stage_Cmd_SW (EXEC)

Verify PDU2_ATU2_Pwr_Bus_Sys_Cntl_Stat_DMC – ENABLED

Verify PDU2_CTCU2_Pwr_Bus_Sys_Cntl_Stat_DMC –
ENABLED

Verify PDU2_Rack_D1_Pwr_Bus_Sys_Cntl_Stat_DMC –
ENABLED

Verify PDU2_Fan_Pwr_Bus_Sys_Cntl_Stat_DMC – ENABLED

Verify PDU2_PDU1_Redun_Pwr_Bus_Sys_Cntl_Stat_DMC –
ENABLED

Verify PDU2_Subsys_Pwr_Bus1_Sys_Cntl_Stat_DMC –
ENABLED

Verify PDU2_Subsys_Pwr_Bus2_Sys_Cntl_Stat_DMC –
ENABLED

Verify PDU2_Subsys_Pwr_Bus3_Sys_Cntl_Stat_DMC –
ENABLED

Verify PDU2_Subsys_Pwr_Bus4_Sys_Cntl_Stat_DMC –
ENABLED

Verify PDU2_Subsys_Pwr_Bus5_Sys_Cntl_Stat_DMC –
ENABLED

Verify PDU2_Subsys_Pwr_Bus6_Sys_Cntl_Stat_DMC –
ENABLED

Verify PDU2_Subsys_Pwr_Bus7_Sys_Cntl_Stat_DMC –
ENABLED

Verify PDU2_Subsys_Pwr_Bus8_Sys_Cntl_Stat_DMC –
ENABLED

Verify PDU2_Subsys_Pwr_Bus9_Sys_Cntl_Stat_DMC –
ENABLED

Verify PDU2_Subsys_Pwr_Bus10_Sys_Cntl_Stat_DMC –
ENABLED

Verify PDU2_SUP3_Pwr_Out1_SSPC1_Sys_Cntl_Stat_DMC –
ENABLED

Verify PDU2_SUP3_Pwr_Out2_SSPC1_Sys_Cntl_Stat_DMC –
ENABLED

Verify PDU2_SUP3_Pwr_Out3_SSPC1_Sys_Cntl_Stat_DMC –
ENABLED

Verify PDU2_SUP4_Pwr_Out1_SSPC1_Sys_Cntl_Stat_DMC –
ENABLED

Verify PDU2_SUP4_Pwr_Out2_SSPC1_Sys_Cntl_Stat_DMC –
ENABLED

Verify PDU2_SUP4_Pwr_Out3_SSPC1_Sys_Cntl_Stat_DMC – ENABLED
 Verify PDU2_VDPU_Pwr_Bus_Sys_Cntl_Stat_DMC – ENABLED

9.4 [Enabling Nominal System Bus Control for ECLSS Valves](#)

COL Final Activation - Part 3: COL ECLSS Auto Cmd Sequences

COL ECLSS Automated Command Sequences VTC2

√VTC2 Buffer Status – Empty

```
*****
*           If VTC2 Buffer – Full
*           |
*           | sel VTC2 Cancel 2 Step Command
*           |
*           | COL Cancel 2 - Stage Cmd VTC 2
*           |
*           |
*           | cmd Cancel 2 – Stage Cmd Execute (Verify
*           | – Empty)
*           |
*           |
*****
```

'ECLSS Valve System Control'

Verify Enable Status – Ena

Record PCS ID: _____

cmd Start – Arm

pick PCS/C-X to VTC-Com2 (where X=PCS ID)

cmd Start – Set

√VTC2_Two_Stage_Buffer_Status_SW_PP – EMPTY

```
If VTC2_Two_Stage_Buffer_Status_SW_PP – FULL
|
| cmd VTC_Cancel_Two_Stage_Cmd_Cmd_SW
| data Onboard_Node SYS_CCSDS_End_Point_VTC2
|
| Verify VTC2_Two_Stage_Buffer_Status_SW_PP –
| EMPTY
```

```
cmd ECLSS_Vlv_Sys_Cntl_Ena_ACS (ARM)
data SW_CMD – VTC_Start_Terminate_ACS_Cmd_SW
data Action – 1 (START)
data Onboard_Node – SYS_CCSDS_End_Point_VTC2
```

Verify VTC2_Two_Stage_Buffer_Status_SW_PP – FULL

cmd VTC_Execute_2_Stage_Cmd_SW (EXEC)

- Verify NLSOV1_Sys_Cntl_Stat_DMC – ENABLED
- Verify NLSOV2_Sys_Cntl_Stat_DMC – ENABLED
- Verify NLSOV3_Sys_Cntl_Stat_DMC – ENABLED
- Verify NLSOV4_Sys_Cntl_Stat_DMC – ENABLED
- Verify VADD_Vlv1_Sys_Cntl_Stat_DMC – ENABLED
- Verify VADD_Vlv2_Sys_Cntl_Stat_DMC – ENABLED
- Verify VEDD_Vlv1_Sys_Cntl_Stat_DMC – ENABLED
- Verify VEDD_Vlv2_Sys_Cntl_Stat_DMC – ENABLED
- Verify WLSOV_ISPR_A1_Sys_Cntl_Stat_DMC – ENABLED
- Verify WLSOV_ISPR_A2_Sys_Cntl_Stat_DMC – ENABLED
- Verify WLSOV_ISPR_A3_Sys_Cntl_Stat_DMC – ENABLED
- Verify WLSOV_ISPR_A4_Sys_Cntl_Stat_DMC – ENABLED
- Verify WLSOV_ISPR_F1_Sys_Cntl_Stat_DMC – ENABLED
- Verify WLSOV_ISPR_F2_Sys_Cntl_Stat_DMC – ENABLED
- Verify WLSOV_ISPR_F3_Sys_Cntl_Stat_DMC – ENABLED
- Verify WLSOV_ISPR_F4_Sys_Cntl_Stat_DMC – ENABLED
- Verify WLSOV_ISPR_O1_Sys_Cntl_Stat_DMC – ENABLED
- Verify WLSOV_ISPR_O2_Sys_Cntl_Stat_DMC – ENABLED

9.5 [Enabling Nominal System Bus Control for TCS Valves](#)

COL Final Activation - Part 3: COL TCS Auto Cmd Sequences:

COL TCS Automated Command Sequences VTC2

√VTC2 Buffer Status – Empty

```

*****
*           If VTC2 Buffer – Full
*           |
*           | sel VTC2 Cancel 2 Step Command
*           |
*           | COL Cancel 2 - Stage Cmd VTC 2
*           |
*           |
*           | cmd Cancel 2 – Stage Cmd Execute (Verify
*           | – Empty)
*           |
*****

```

'TCS Valve System Control Enable ACS'

Verify Status – Enabled

Record PCS ID: _____

COLUMBUS SINGLE VTC2 FINAL ACTIVATION

(ASSY MAL/1E/FIN/MULTI E)

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cmd Start – Arm

pick PCS/C-X to VTC-Com2 (where X=PCS ID)

cmd Start – Set

Wait for “Go” to continue.

√VTC2_Two_Stage_Buffer_Status_SW_PP – EMPTY

If VTC2_Two_Stage_Buffer_Status_SW_PP – FULL

cmd VTC_Cancel_Two_Stage_Cmd_Cmd_SW

data Onboard_Node SYS_CCSDS_End_Point_VTC2

Verify VTC2_Two_Stage_Buffer_Status_SW_PP –
EMPTY

cmd TCS_Vlv_Sys_Cntl_Ena_ACS (ARM)

data SW_CMD – VTC_Start_Terminate_ACS_Cmd_SW

data Action – 1 (START)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify VTC2_Two_Stage_Buffer_Status_SW_PP – FULL

cmd VTC_Execute_2_Stage_Cmd_SW (EXEC)

Verify WOOV1_Sys_Cntl_Stat_DMC – ENABLED

Verify WOOV2_Sys_Cntl_Stat_DMC – ENABLED

Verify WOOV3_Sys_Cntl_Stat_DMC – ENABLED

Verify WOOV4_Sys_Cntl_Stat_DMC – ENABLED

Verify WOOV5_Sys_Cntl_Stat_DMC – ENABLED

Verify WOOV6_Sys_Cntl_Stat_DMC – ENABLED

Verify WOOV7_Sys_Cntl_Stat_DMC – ENABLED

Verify WOOV8_Sys_Cntl_Stat_DMC – ENABLED

Verify WOOV9_Sys_Cntl_Stat_DMC – ENABLED

Verify WOOV10_Sys_Cntl_Stat_DMC – ENABLED

Verify WFSV_ISPR_A1_Sys_Cntl_Stat_DMC – ENABLED

Verify WFSV_ISPR_A2_Sys_Cntl_Stat_DMC – ENABLED

Verify WFSV_ISPR_A3_Sys_Cntl_Stat_DMC – ENABLED

Verify WFSV_ISPR_A4_Sys_Cntl_Stat_DMC – ENABLED

Verify WFSV_ISPR_F1_Sys_Cntl_Stat_DMC – ENABLED

Verify WFSV_ISPR_F2_Sys_Cntl_Stat_DMC – ENABLED

Verify WFSV_ISPR_F3_Sys_Cntl_Stat_DMC – ENABLED

Verify WFSV_ISPR_F4_Sys_Cntl_Stat_DMC – ENABLED

Verify WFSV_ISPR_O1_Sys_Cntl_Stat_DMC – ENABLED

Verify WFSV_ISPR_O2_Sys_Cntl_Stat_DMC – ENABLED

COL-CC to give a “Go” to continue.

PWS

9.6 [Activating PDU Outlet via DMC](#)

Activation Part 1

COL Activation Part 1

'PDU Outlet Activation'

'PDU1 CTCU1 Pwr Bus'

cmd Pwr On – **Execute** (OK)

Verify Pwr – ON

'PDU1 VDPU Pwr Bus'

cmd Pwr On – **Execute** (OK)

Verify Pwr – ON

'PDU1 Fan Pwr Bus'

cmd Pwr On – **Execute** (OK)

Verify Pwr – ON

'PDU2 CTCU2 Pwr Bus'

cmd Pwr On – **Execute** (OK)

Verify Pwr – ON

'PDU2 VDPU Pwr Bus'

cmd Pwr On – **Execute** (OK)

Verify Pwr – ON

'PDU2 Fan Pwr Bus'

cmd Pwr On – **Execute** (OK)

Verify Pwr – ON

cmd PDU1_CTCU1_Pwr_Bus_On_AP

data Onboard_Reception_Node –

SYS CCSDS End Point DMC DMS SERV

data Onboard_Execution_Node –

USM_SW_DMC_USS_Swop_Instance

Verify PDU1_CTCU1_Pwr_Bus_On_Off_Stat_DMC – ON

cmd PDU1_VDPU_Pwr_Bus_On_AP

data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV

data Onboard_Execution_Node –
USM SW DMC USS Swoop Instance

Verify PDU1_VDPU_Pwr_Bus_On_Off_Stat_DMC – ON

cmd PDU1_Fan_Pwr_Bus_On_AP

data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV

data Onboard_Execution_Node –
USM SW DMC USS Swoop Instance

Verify PDU1_Fan_Pwr_Bus_On_Off_Stat_DMC – ON

cmd PDU2_CTCU2_Pwr_Bus_On_AP

data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV

data Onboard_Execution_Node –
USM SW DMC USS Swoop Instance

Verify PDU2_CTCU2_Pwr_Bus_On_Off_Stat_DMC – ON

cmd PDU2_VDPU_Pwr_Bus_On_AP

data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV

data Onboard_Execution_Node –
USM SW DMC USS Swoop Instance

Verify PDU2_VDPU_Pwr_Bus_On_Off_Stat_DMC – ON

cmd PDU2_Fan_Pwr_Bus_On_AP

data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV

data Onboard_Execution_Node –
USM SW DMC USS Swoop Instance

Verify PDU2_Fan_Pwr_Bus_On_Off_Stat_DMC – ON

10. [ACTIVATING AND CONFIGURING HIGH RATE MULTIPLEXER](#)

NOTE

1. Fiber Optic Jumper installation must be complete before starting this step.
2. The HRM can route COL data to the USOS Ku Band system upon completion of this step. Downlink of this data stream to **COL-CC** will require configuration of the Ku-Band system.

COL-CC

10.1 [Swapping DMS Telemetry Packets \(Ground Only\)](#)

COL-CC to swap nominal DMS telemetry packets.

Wait for "Go" to continue.

<u>NOTE</u>
Packet swapping initiated from Col-CC: Enable MMC_Gnd_Tlm_Pkt_COMMS1_DMC (1Hz) Enable MMC_Gnd_Tlm_Pkt_HRM_Diagnostics_DMC (0.1Hz)
Perform {2.2.42 NOMINAL DMS PACKET SWAPPING} (ESA SODF: GROUND: NOMINAL). then:
COL-CC to give a "Go" to continue.

PWS

10.2 [Activating HRM](#)

Activation Part 1

COL Activation Part 1

'HRM Activation'

<u>NOTE</u>
The following command starts the FLAP 'HRM Activation', which: Switches ON both HRM Pwr converters Activates the nominal HRM-core, if the nominal HRM-core activation fails, the redundant HRM-core is automatically activated instead Starts RT acquisition & monitoring of HRM data Enables the HRM-MMU link (Master MMU)

cmd Activate – **Execute** (OK)

Wait up to one minute for verification

Verify Pwr A – ON

Verify Pwr B – ON

Verify Pwr A Current < 1.07 A

Verify Pwr B Current < 1.07 A

Verify Nom Core Stat – ON

Verify Nom Ready Stat – READY

cmd HRM_Activation_AP
data Onboard_Reception_Node – SYS CCSDS End Point DMC DMS SERV
data Onboard_Execution_Node – USM SW DMC USS Swop Instance
Verify HRM_Pwr_A_Stat_DMC – ON

```
Verify HRM_Pwr_B_Stat_DMC – ON
Verify HRM_Pwr_A_Current_DMC – < 1.07 A
Verify HRM_Pwr_B_Current_DMC – < 1.07 A
Verify HRM_Nom_Branch_Avail_Stat_SW – AVAIL
Verify HRM_Nom_Core_Stat_DMC – ON
Verify HRM_Nom_Ready_Stat_DMC – READY
Verify HRM_Nom_Sec_Voltage_Stat_DMC – OK
```

10.3 [Configuring HRM](#)

Activation Part 1

COL Activation Part 1

'HRM Configuration (with CDI)'

cmd Configure – **Execute** (OK)

Verify Serial Path TIm Input Selected – AUTO_SEL

Verify Output Datarate = 86 x 0.5 Mbps

```
cmd HRM_Configuration_with_CDI_AP
data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV
data Onboard_Execution_Node –
USM SW DMC USS Swoop Instance
prm Alloc_VCID_CDI – COMMON_ALLOC_VCID
prm Config_IF_CDI – CONFIG01_CONFIG_HRM
prm Execute_Setup_Flag – 1 (TRUE)
prm CMD_Delay – 0.1 [s]
prm Stop_Start_RT_Acq – 0 (FALSE)
prm Silent – 0 (RECEIVE MESSAGE)
```

```
Verify HRM_Serial_Path_TIm_Input_Selected_DMC –
AUTO_SEL
Verify HRM_LAN_Input_Selected_DMC – AUTO_SEL
Verify HRM_High_Speed_Output_Selected_DMC – BOTH_ON
Verify HRM_Output_Datarate_DMC = 86
Verify HRM_Config_Interface_CDI_SW – 278640513
Verify HRM_VCID_Allocation_CDI_SW – 278640531
```

After starting Ku band data flow **Col-CC** to coordinate with POIC the HRM and Ku-Band System configuration

Wait for “Go” to continue.

11. [ACTIVATING WATER PUMP ASSEMBLY CONDENSING HEAT EXCHANGER CONTROL LOOP](#)

11.1 [Starting WPA1 RT \(Ground Only\)](#)

```
cmd DMS_RT_Start_RT_Acquisition_CMD
```

prm REMOTE_TERMINAL_ID –
MIL 1553B Bus RT Svstem Bus WPA1
data Onboard_Node –
SYS CCSDS End Point DMC DMS SERV

Verify WPA1_Sys_Bus_Ena_Stat_SW – ENABLED

11.2 [Checking WPA1 Delta Pressure Valves](#)

TCS:

[TCS Functional Overview](#)

'Delta Pressure Sensor Blocks'

Verify DPSB 1 WPA1 DP1: > 18 kPa

Verify DPSB 3 WPA1 DP2: > 18 kPa

Verify WPA1_DPSB1_Plenum_DP1_DMC: > 18 kPa

Verify WPA1_DPSB3_Plenum_DP2_DMC: > 18 kPa

11.3 [Activating WPA Condensing Heat Exchanger Control Loop](#)

Activation Part 1

[COL Activation Part 1](#)

'WPA Final Activation (CHX Cntl Loop Activation)'

NOTE

The following command starts the FLAP 'WPA Final Activation' that:

Determines active WPA

Starts data acquisition from the WPA

Enables the plenum delta pressure control loop

Enables the CHX inlet temperature control loop

During the execution of the FLAP expect the following event message on the System Message Panel:

'FLAP WPA_Final_Activation_AP RT

MIL_1553B_Bus_RT_System_Bus_WPA1 on Node

USM_SW_DMC_USS_Swop_Instance already started when

Receiving a Start Cmd'

cmd Activate Execute (OK)

Verify WPA1 CHX Temp Cntl Loop Stat: ACTIVE

Verify WPA1 Plenum Delta Press Cntl Loop Stat: ACTIVE

Verify WMV3 MDV Pwr: ON

Verify WPA1 Accum Liq Qty1: 1 to 12 L

Verify WPA1 Accum Liq Qty2: 1 to 12 L

Activation Part 1: TCS:

[TCS Functional Overview](#)

'Delta Pressure Sensor Blocks'

Verify DPSB 1 WPA1 DP1: 40 to 44 kPa

Verify DPSB 3 WPA1 DP2: 40 to 44 kPa

cmd WPA_Final_Activation_AP

data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV

data Onboard_Execution_Node –
USM SW DMC USS Swop Instance

Verify WPA1_CHX_Temp_Cntl_Loop_Stat_DMC – ACTIVE

Verify WPA1_Plenum_Delta_Press_Cntl_Loop_Stat_DMC –
ACTIVE

Verify WMV3_MDV_Pwr_Stat_DMC – ON

Verify WPA1_Accum_Liq_Qty1_DMC = 1 to 12 L

Verify WPA1_Accum_Liq_Qty2_DMC = 1 to 12 L

Verify WPA1_DPSB1_Plenum_DP1_DMC = 40 to 44 kPa

Verify WPA1_DPSB3_Plenum_DP2_DMC = 40 to 44 kPa

Verify WPA_Active_Pump_SW – WPA 1

11.4 [Enabling FDIR for Water Loop Reconfiguration](#)

Activation Part 1: DMS: FDIR Configuration

DMS FDIR Configuration Commands

'Accumulator Overpressure FDIR'

cmd Enable – **Execute** (OK)

Verify Status – ENABLE

'WPA Switchover FDIR'

cmd Enable – **Execute** (OK)

Verify Status – ENABLE

'LTHX Overtemperature FDIR'

cmd Enable – **Execute** (OK)

Verify Status – ENABLE

cmd DMS_ACQ_Write_Dis_SW_Variable_Cmd_SW

prm Item_SID –
WPA Accum Overpressure FDIR Ena Stat SW
prm Value – \$ENABLED

data Onboard_Node –
SYS CCSDS End Point DMC DMS SERV

Verify WPA_Accum_Overpressure_FDIR_Ena_Stat_SW –
ENABLED

```

cmd DMS_ACQ_Write_Dis_SW_Variable_Cmd_SW
prm Item_SID – WPA_Recon_FDIR_Ena_Stat_SW
prm Value – $ENABLED
data Onboard_Node –
SYS CCSDS End Point DMC DMS SERV

Verify WPA_Recon_FDIR_Ena_Stat_SW – ENABLED

cmd DMS_ACQ_Write_Dis_SW_Variable_Cmd_SW
prm Item_SID – WPA_Enter_BSM_FDIR_Ena_Stat_SW
prm Value – $ENABLED
data Onboard_Node –
SYS CCSDS End Point DMC DMS SERV

Verify WPA_Enter_BSM_FDIR_Ena_Stat_SW – ENABLED
    
```

11.5 [Start LTHX Temperature Monitoring](#)

Menu Bar: DMS Monitoring: 5 - COMMS TCS Payload

'TCS'

Verify WTSB6 Low HX Temp1 – ≤7.6 DegC

Verify WTSB6 Low HX Temp2 – ≤7.6 DegC

'DMS Monitoring'

'Enable/Disable'

sel TCS

'Enable Monitoring WTSB'

cmd WTSB6 Low HX Temp1 – **Execute** (OK)

cmd WTSB6 Low HX Temp2 – **Execute** (OK)

sel Close

'TCS'

Verify the background color of measurements

WTSB6 Low HX Temp1: Green

WTSB6 Low HX Temp2: Green

```

Verify WTSB6_Low_HX_Temp1_DMC – ≤7.6 °C
Verify WTSB6_Low_HX_Temp2_DMC – ≤7.6 °C
    
```

```

cmd DMS_MONIT_Ena_Monitoring_Cmd_SW
prm MT_ID – DMC_Sys_Monitoring_Table_SW
prm EI_ID – WTSB6_Low_HX_Temp1_DMC
prm LIMIT_SET_ID – 0 (limit set 1)
data Onboard_Node –
SYS CCSDS End Point DMC DMS SERV

Verify WTSB6_Low_HX_Temp1_DMC_MS – NORMAL_1

cmd DMS_MONIT_Ena_Monitoring_Cmd_SW
prm MT_ID – DMC_Sys_Monitoring_Table_SW
prm EI_ID – WTSB6_Low_HX_Temp2_DMC
prm LIMIT_SET_ID – 0 (limit set 1)
data Onboard_Node –
SYS CCSDS End Point DMC DMS SERV

Verify WTSB6_Low_HX_Temp2_DMC_MS – NORMAL_1
    
```

12. [ACTIVATING SMOKE DETECTOR](#)

NOTE

Because of VTC1 unavailability, only Smoke Detector 2 will be activated.

COL-CC 12.1 [Swapping DMS Telemetry Packets \(Ground Only\)](#)
COL-CC to swap nominal DMS telemetry packets.

Wait for “Go” to continue.

NOTE

Packet swapping initiated from **Col-CC**:
 Enable VTC2_Gnd_Tlm_Pkt_PHY1_VTC (1Hz)

Perform [{2.2.41 VTC GROUND PACKET SWAPPING}](#) (ESA SODF: GROUND: NOMINAL). then:

COL-CC to give “Go” to continue.

PCS 12.2 [Powering Up Smoke Detector 2](#)
 COL: EPS: PDU2 120V Outlets
COL PDU2 120V Outlets VTC2
 'PDU 2'

cmd Outlet Num 24 – On (Verify – On)

```

cmd PDU2_SD2_Pwr_Bus_On_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC2
    
```


Verify PDU2_SD2_Pwr_Bus_On_Off_Stat_VTC_PP – ON

12.3 [Verifying Smoke Detector 2 Power Status](#)

COL: ECLSS: SD2

COL Cabin Smoke Detector 2

Verify Obscuration, % Contamination < 25

Verify Scatter, % Obscuration per Meter < 1

Verify Cabin_SD2_Obscuration_VTC_PP – < 25

Verify Cabin_SD2_Scatter_VTC_PP – <1

12.4 [Enabling Smoke Detector 2](#)

COL Cabin Smoke Detector 2

'Monitoring'

cmd Enable

Verify Status – Enabled

'Active BIT'

Verify Failure – blank

'Fire Status'

Verify Lens Status – Clean

Verify Out of Range – blank

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – Cabin_SD_2

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify Cabin_SD_2_EF – ENABLED

Verify VTC2_Cabin_SD_2_Stat_MVD – OK

12.5 [Enabling US C&W for Columbus Smoke Detector 2 \(Ground Only\)](#)

MCC-H

Enable the following events in the Primary and Backup C&C MDMs.

If ground unable to complete,

Perform [{2.101 CAUTION AND WARNING EVENT MANAGEMENT}](#), Step 2 (SODF: C&DH: NOMINAL)per Table 4, then

Table 4. C&W Events for COL Smoke Detector 2

Event	Text	Class
13501	'FIRE Smoke Detector 2 Cabin – COL'	E

13. [ACTIVATING CONDENSATE WATER SEPARATOR ASSEMBLY](#)

NOTE

Condensate Jumper must be installed prior to beginning this step.

PCS

13.1 [Opening Columbus Condensate Line Shut Off Valve](#)

COL: ECLSS: CLSOV

COL CLSOV VTC2

cmd Position – Open

Verify Position Ind – Open

cmd CLSOV_Vlv_Open_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify CLSOV_Vlv_Open_Stat_VTC_PP – OPEN

PWS

13.2 [Activating CWSA](#)

Activation Part 1: Activation Part 2: Activation Part 3

COL Activation Part 3

'CWSA1 Activation'

NOTE

The following command starts FLAP 'CWSA1 Activation' that:
 Checks the availability of the CWSA
 Powers on the CWSA
 Enables the monitoring of the CWSA parameters
 Enables the monitoring of the LCOS parameters

cmd Activate – **Execute** (OK)

Wait 20 seconds for telemetry stabilization.

Verify Pwr: ON

Verify Delta P Air: > 0.5 kPa

Verify Motor Speed: 4500 to 6800 rpm

Verify Input Current: < 0.50 A

```
cmd CWSA1_Activation_AP
data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV
data Onboard_Execution_Node –
USM SW DMC USS Swop Instance

Verify CWSA1_Pwr_Stat_DMC – ON
Verify CWSA1_Delta_P_Air_DMC – >0.5 kPa
Verify CWSA1_Motor_Speed_DMC – 4500-6800 rpm
Verify CWSA1_Input_Current_DMC – <0.5 A
```

13.3 [Enabling CWSA FDIR](#)

DMS: FDIR Configuration

DMS FDIR Configuration Commands

'CWSA Switchover FDIR'

cmd Enable – **Execute** (OK)

Verify Status – ENABLE

```
cmd DMS_ACQ_Write_Dis_SW_Variable_Cmd_SW
prm Item SID – CWSA_FDIR_Ena_Stat_SW
prm Value – $ENABLED
data Onboard_Node –
SYS CCSDS End Point DMC DMS SERV

Verify CWSA_FDIR_Ena_Stat_SW – ENABLED
```

14. [ACTIVATING CABIN FAN ASSEMBLY](#)

Activation Part 1: Activation Part 2: Activation Part 3

COL Activation Part 3

'CFA1 Activation (w/o monitoring)'

cmd Pwr_On – **Execute** (OK)

Verify Pwr: ON

Verify Delta P: > 0.25 kPa

Verify Fan Speed: 7500 to 8500 rpm

Verify Input Current: < 1.5A

```
cmd CFA1_Pwr_On_AP
data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV
data Onboard_Execution_Node – USM_SW_DMC_USS_Swop_Instance

Verify CFA1_Pwr_Stat_DMC – ON
Verify CFA1_Delta_P_DMC – >0.25 kPa
Verify CFA1_Fan_Speed_DMC – 7500-8500 rpm
```

Verify CFA1_Input_Current_DMC – <1.5 A

15. ACTIVATING CABIN TEMP CONTROL UNIT

15.1 Activating CTCU

Activation Part 1: Activation Part 2: Activation Part 3

COL Activation Part 3

'CTCU1 Activation'

NOTE

The following command starts the FLAP 'CTCU1 Activation' that:

- Checks that the other CTCU is not controlling the TCV
- Checks the availability of the CTCU
- Checks that at least one CFA is active
- Powers on the CTCU
- Enables monitoring of the CTCU parameters
- Activates the TCV
- Enables cabin temperature control

cmd Activate – **Execute** (OK)

NOTE

The cabin temperature may need time to stabilize to the nominal temperature range. If the cabin temperature is out of the expected values, continue with the procedure.

- Verify Pw: ON
- Verify Health Stat: OK
- Verify Cntl Loop Stat: ENABLED
- Verify TCV_Cntl Stat: ENABLED
- Verify Avg Cabin Temp: 18 to 27 deg C

cmd CTCU1_Activation_AP

data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV

data Onboard_Execution_Node –
USM SW DMC USS Swop Instance

- Verify CTCU1_Pwr_Stat_DMC – ON
- Verify CTCU1_Health_Stat_DMC – OK
- Verify CTCU1_Cntl_Loop_Stat_DMC – ENABLED
- Verify CTCU1_TCV_Cntl_Stat_DMC – ENABLED
- Verify CTCU1_Avg_Cabin_Temp_DMC – 18-27 °C

15.2 [Enabling FDIR for CTCU Reconfiguration](#)

DMS: FDIR Configuration

DMS FDIR Configuration Commands

'CTCU Switchover FDIR'

cmd Enable – **Execute** (OK)

Verify Status – ENABLE

cmd DMS_ACQ_Write_Dis_SW_Variable_Cmd_SW

prm Item SID – CTCU_FDIR_Ena_Stat_SW

prm Value – \$ENABLED

data Onboard_Node –

SYS CCSDS End Point DMC DMS SERV

Verify CTCU_FDIR_Ena_Stat_SW – ENABLED

16. [OPENING SAMPLE LINE SHUTOFF VALVE](#)

NOTE

1. The AR Sample Jumper must be installed prior to opening the Sample Line Shutoff Valve.
2. Pressure equalization of the Columbus Module must be performed before opening the Sample Line Shutoff Valves.

PCS

COL: ECLSS: Air Loop: SLSOV

COL SLSOV VTC2

cmd Position – Open

Verify Position – Open

cmd SLSOV_Vlv_Open_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify SLSOV_Vlv_Open_Stat_VTC_PP – OPEN

17. [ESTABLISHING INTERMODULE VENTILATION](#)

NOTE

1. IMV duct installation must be completed before starting this step.
2. NPRA Valve removal and IMV valve installation must be completed prior to this step.
3. Because of VTC1 unavailability the IRFA will not be activated. Air will flow from Columbus to Node 2 through the hatch.

17.1 [Activating Node 2 IMV Stbd Aft Valve](#)

Node 2: ECLSS: IMV Stbd Aft Vlv

sel RPCM N22A3B C RPC 02

cmd RPC Position – Close (Verify – Cl)

'Enable'

cmd Arm – (√Arm Status – Armed)

cmd Enable – (√State – Enabled)

17.2 [Opening Node 2 IMV Stbd Aft Valve](#)

'Open'

cmd Arm – (√Arm Status – Armed)

cmd Open

√Position – In Transit

Wait 25 seconds.

√Position – Open

17.3 [Activating Node 2 IMV Stbd Fwd Valve](#)

Node 2: ECLSS: IMV Stbd Fwd Vlv

sel RPCM N22A3B C RPC 06

cmd RPC Position – Close (Verify – Cl)

'Enable'

cmd Arm – (√Arm Status – Armed)

cmd Enable – (√State – Enabled)

17.4 [Opening Node 2 IMV Stbd Fwd Valve](#)

'Open'

cmd Arm – (√Arm Status – Armed)

cmd Open

√Position – In Transit

Wait 25 seconds.

√Position – Open

17.5 [Closing Columbus IMV Valves](#)

COL: ECLSS: Air Loop: ISSOV

COL IMV Valves VTC2

'IMV Return Shutoff Valve'

cmd Position – Close

Verify Position Ind – Closed

'IMV Supply Shutoff Valve'

cmd Position – Close

Verify Position Ind – Closed

cmd IRSOV_Vlv_Close_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify IRSOV_Vlv_Close_Stat_VTC_PP – CLOSED

cmd ISSOV_Vlv_Close_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify ISSOV_Vlv_Close_Stat_VTC_PP – CLOSED

17.6 [Opening Columbus IMV Valve](#)

COL: ECLSS: Air Loop: ISSOV

COL IMV Valves VTC2

'IMV Return Shutoff Valve'

cmd Position – Open

Verify Position Ind – Open

'IMV Supply Shutoff Valve'

cmd Position – Open

Verify Position Ind – Open

```

cmd ISSOV_Vlv_Open_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify ISSOV_Vlv_Open_Stat_VTC_PP – OPEN

cmd IRSOV_Vlv_Open_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify IRSOV_Vlv_Open_Stat_VTC_PP – OPEN
  
```

17.7 [Activating Columbus IMV Supply Fan](#)

COL: ECLSS: Air Loop: ISFA

COL IMV Fans

√VTC2 Buffer Status – Empty

```

*****
*           If VTC2 Buffer – Full
*           |
*           | sel VTC2 Cancel 2 Step Command
*           |
*           | COL Cancel 2 - Stage Cmd VTC 2
*           |
*           |
*           | cmd Cancel 2 – Stage Cmd Execute (Verify
*           | – Empty)
*           |
*****
  
```

'IMV Supply Fan Assembly (IMV Port Fwd Fan)'
 'Set Speed - VTC2 hardwire'

NOTE

The following ACS sets the IMV Supply Fan speed to 9960 rpm.

Record PCS ID: _____

cmd Start – Arm

pick PCS/C-X to VTC-Com2 (where X=PCS ID)

cmd Start – Set

'IMV Supply Fan Assembly'

cmd State – On

Verify dP: > 0.4 kPa

Verify Fan Speed: 9460 to 10460 rpm

Verify Fan Temp: < 60 degC

Verify ISFA Power: ON

√VTC2_Two_Stage_Buffer_Status_SW_PP – EMPTY

If VTC2_Two_Stage_Buffer_Status_SW_PP – FULL

cmd VTC_Cancel_Two_Stage_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify VTC2_Two_Stage_Buffer_Status_SW_PP –
EMPTY

cmd ISFA_SPEED_SET_ACS (ARM)

data SW_CMD – VTC_Start_Terminate_ACS_Cmd_SW

data Action – 1 (START)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify VTC2_Two_Stage_Buffer_Status_SW_PP – FULL

cmd VTC_Execute_2_Stage_Cmd_SW (EXEC)

cmd ISFA_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify ISFA_Delta_P_MVD – > 0.4 kPa

Verify ISFA_Fan_Speed_MVD – 9460 -10460 rpm

Verify ISFA_Fan_Temp_VTC – < 60 degC

Verify ISFA_Pwr_Stat_MVD – ON

17.8 [Enabling VTC Monitoring for ISFA Safing \(Ground Only\)](#)

COL-CC

COL-CC to enable ISFA monitoring

Wait for “Go” to continue.

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – ISFA_Fan_Temp_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify ISFA_Fan_Temp_VTC_MEF – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – ISFA_Delta_P_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify ISFA_Delta_P_VTC_MEF – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – ISFA_Fan_Speed_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify ISFA_Fan_Speed_VTC_MEF – ENABLED

COL-CC to give a “Go” to continue.

18. [ACTIVATING COLUMBUS CABIN FAN ASSEMBLY AND ENABLING FDIR FOR NOMINAL OPS](#)

PWS

18.1 [Configuring for CFA to Nominal Ops](#)

Activation Part 1: Activation Part 2: Activation Part 3

COL Activation Part 3

'Cabin Loop Final Activation'

'CFA1'

NOTE
The following command starts the FLAP 'CFA1 Activation' that: Checks the availability of the CFA Sets the Cabin Fan Speed to 9200 rpm Powers on the CFA Enables monitoring of the CFA parameters

cmd Activate – **Execute** (OK)

Verify Pwr: ON

Verify Delta P: 0.61 to 1.5 kPa

Verify Fan Speed: 8700 to 9700 rpm

Verify Input Current: < 1.5 A

ECLSS: AFS

ECLSS Air Flow Sensors

Verify Cab Air Massflow AFS2: 240 to 510 m3/h

cmd CFA1_Activation_AP
data Onboard_Reception_Node –
SYS_CCSDS_End_Point_DMC_DMS_SERV

data Onboard_Execution_Node –
 USM SW DMC USS Swop Instance

Verify CFA1_Pwr_Stat_DMC – ON
 Verify CFA1_Delta_P_DMC – 0.61 - 1.5 kPa
 Verify CFA1_Fan_Speed_DMC – 8700 - 9700 rpm
 Verify CFA1_Input_Current_DMC – <1.5 A
 Verify AFS2_Cab_Air_Massflow_MVD – 240 - 510 m3/h

18.2 [Enabling IMV Monitoring](#)

Main Panel: DMS Monitoring: 2 - ECLSS

DMS Monitoring 2 - ECLSS Commands

'DMS Monitoring'

sel Enable/Disable ECLSS

DMS Monitoring Enable / Disable Commands 2 - ECLSS

'Enable Monitoring'

cmd ISFA Delta P – **Execute** (OK)

cmd ISFA Input Current – **Execute** (OK)

Main Panel: DMS Monitoring: 2 - ECLSS

DMS Monitoring 2 - ECLSS

'System on DMC'

Verify the background color of measurements

ISFA Delta P: Green

ISFA Input Current: Green

cmd DMS_MONIT_Ena_Monitoring_Cmd_SW
prm MT_ID – DMC_Sys_Monnitoring_Table_SW
prm EI_ID – ISFA_Input_Current_DMC
prm LIMIT_SET_ID – 0 (limit set 1)

data Onboard_Node –
 SYS CCSDS End Point MMC DMS SERV

cmd DMS_MONIT_Ena_Monitoring_Cmd_SW
prm MT_ID – DMC_Sys_Monnitoring_Table_SW
prm EI_ID – ISFA_Delta_P_MVD
prm LIMIT_SET_ID – 0 (limit set 1)

data Onboard_Node –
 SYS CCSDS End Point MMC DMS SERV

Verify ISFA_Input_Current_DMC_MS – NORMAL_1

Verify ISFA_Delta_P_MVD_MS – NORMAL_1

18.3 [Enabling ISFA and CFA FDIR](#)

DMS: FDIR Configuration

DMS FDIR Configuration Commands

'ISFA FDIR'

cmd Enable – **Execute** (OK)

Verify Status – ENABLE

'CFA Switchover FDIR'

cmd Enable – **Execute** (OK)

Verify Status – ENABLE

cmd DMS_ACQ_Write_Dis_SW_Variable_Cmd_SW

prm Item SID – ISFA_FDIR_Ena_Stat_SW

prm Value – \$ENABLED

data Onboard_Node –

SYS CCSDS End Point DMC DMS SERV

Verify ISFA_FDIR_Ena_Stat_SW – ENABLED

cmd DMS_ACQ_Write_Dis_SW_Variable_Cmd_SW

prm Item SID – CFA_FDIR_Ena_Stat_SW

prm Value – \$ENABLE

data Onboard_Node –

SYS CCSDS End Point DMC DMS SERV

Verify CFA_FDIR_Ena_Stat_SW – ENABLED

PCS

18.4 [Activating VTC Monitoring for Air Flow Sensor 2](#)

COL: ECLSS: Atmos

COL Atmosphere

Verify Airflow Sensor 2 Massflow: > 240 m3/hr

cmd Airflow Sensor 2 Massflow Monitoring – Enable (Verify – Enabled)

Verify AFS2_Cab_Air_Massflow_VTC > 240 m3/hr

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – AFS2_Cab_Air_Massflow_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify AFS2_Cab_Air_Massflow_VTC_MEF – ENABLED

MCC-H

- 18.5 [Enabling C&W for the Previous Monitorings \(Ground Only\)](#)
 Enable the following events in the Primary and Backup C&C MDMs.

If ground unable to complete,
 Perform [{2.101 CAUTION AND WARNING EVENT MANAGEMENT}](#), Step 2 (SODF: C&DH: NOMINAL)per Table 5, then:

Table 5. C&W Events for Cabin Air Flow

Event	Text	Class
13605	'Cabin Air Return Grid Clogging – COL'	C
13533	'Cabin Air Flow Sensor 2 Low – COL'	W

PCS

- 18.6 [Activating VTC Monitoring for TPS](#)

COL: ECLSS: Atmos

COL Atmosphere

Verify Air Press 1: 719 to 770 mmHg

cmd Air Press 1 Monitoring Status – Enable (Verify – Enabled)

Verify TPS1_Air_Press_VTC – 719 to 770 mmHg

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – TPS1_Air_Press_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify TPS1_Air_Press_VTC_MEF – ENABLED

MCC-H

- 18.7 [Enabling C&W for TPS \(Ground Only\)](#)
 Enable the following events in the Primary and Backup C&C MDMs.

If ground unable to complete,
 Perform [{2.101 CAUTION AND WARNING EVENT MANAGEMENT}](#), Step 2 (SODF: C&DH: NOMINAL)per Table 6, then:

Table 6. C&W Events for TPS1

Event	Text	Class
13526	'Total Pressure Sensor 1 Low – COL'	W

PCS

18.8 [Enabling Monitoring for PPOS and PPCS](#)

COL: ECLSS: Atmos

COL Atmosphere

Verify ppO2 Sensor 2: 124 to 188 mmHg

cmd ppO2 Sensor 2 Monitoring Status – Enable (Verify – Enabled)

Verify ppCO2 Sensor 2: < 10 mmHg

cmd ppCO2 Sensor 2 Monitoring Status – Enable (Verify – Enabled)

Verify PPOS2_Press_VTC – 124 to 188 mmHg

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – PPOS2_Press_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify PPOS2_Press_VTC_MEF – ENABLED

Verify PPCS2_Press_VTC < 10 mmHg

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – PPCS2_Press_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify PPCS2_Press_VTC_MEF – ENABLED

COL-CC

18.9 [Swapping DMS Telemetry Packets \(Ground Only\)](#)

COL-CC to swap nominal DMS telemetry packets.

Wait for “Go” to continue.

NOTE

Packet swapping initiated from **COL-CC**:
Disable VTC2_Gnd_Tlm_Pkt_PHY1_VTC (1Hz)

Perform [{2.2.41 VTC GROUND PACKET SWAPPING}](#) (ESA SODF: GROUND: NOMINAL). then:

COL-CC to give a “Go” to continue.

19. [DISABLING PPR FUNCTION](#)

PCS

19.1 [Closing PPRA Valves](#)

COL: ECLSS: Cabin Depress Assemblies: PPRA 1 Vlv

COL PPRA 1-2 VTC2

√PPRA1 Position – Closed

√PPRA2 Position – Closed

√PPRA1_Vlv_Close_Stat_VTC_PP – CLOSED

If PPRA1_Vlv_Close_Stat_VTC_PP – OPEN

cmd PPRA1_Vlv_Close_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify PPRA1_Vlv_Close_Stat_VTC_PP – CLOSED

√PPRA2_Vlv_Close_Stat_VTC_PP – CLOSED

If PPRA2_Vlv_Close_Stat_VTC_PP – OPEN

cmd PPRA2_Vlv_Close_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify PPRA2_Vlv_Close_Stat_VTC_PP – CLOSED

19.2 [Enabling VTC Monitoring of PPRAs](#)

COL PPRA 1-2 VTC2

cmd PPRA1 Close Status Monitoring – Enabled (Verify – Enabled)

cmd PPRA2 Close Status Monitoring – Enabled (Verify – Enabled)

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – PPRA1_Vlv_Close_Stat_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify PPRA1_Vlv_Close_Stat_Monitoring_Ena_VTC_PP – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – PPRA2_Vlv_Close_Stat_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify PPRA2_Vlv_Close_Stat_Monitoring_Ena_VTC_PP –
ENABLED

19.3 [Enabling VTC Monitoring of CDAs](#)

Cabin Depress Assemblies: CDA1

COL CDA 1-2 Valve Control VTC2

'CDA 1 Valve 1'

cmd Close Status Monitoring – Enable (Verify – Enabled)

'CDA 1 Valve 2'

cmd Close Status Monitoring – Enable (Verify – Enabled)

'CDA 2 Valve 1'

cmd Close Status Monitoring – Enable (Verify – Enabled)

'CDA 2 Valve 2'

cmd Close Status Monitoring – Enable (Verify – Enabled)

COL: ECLSS: Cabin Depress Assemblies: CDA3

COL CDA 3-4 Valve Control VTC2

'CDA 3 Valve 1'

cmd Close Status Monitoring – Enable (Verify – Enabled)

'CDA 3 Valve 2'

cmd Close Status Monitoring – Enable (Verify – Enabled)

'CDA 4 Valve 1'

cmd Close Status Monitoring – Enable (Verify – Enabled)

'CDA 4 Valve 2'

cmd Close Status Monitoring – Enable (Verify – Enabled)

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – CDA1_Vlv1_Close_Stat_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify CDA1_Vlv1_Close_Stat_Monitoring_Ena_VTC_PP –
ENABLED

COLUMBUS SINGLE VTC2 FINAL ACTIVATION

(ASSY MAL/1E/FIN/MULTI E)

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cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – CDA1_Vlv2_Close_Stat_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify CDA1_Vlv2_Close_Stat_Monitoring_Ena_VTC_PP –
ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – CDA2_Vlv1_Close_Stat_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify CDA2_Vlv1_Close_Stat_Monitoring_Ena_VTC_PP –
ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – CDA2_Vlv2_Close_Stat_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify CDA2_Vlv2_Close_Stat_Monitoring_Ena_VTC_PP –
ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – CDA3_Vlv1_Close_Stat_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify CDA3_Vlv1_Close_Stat_Monitoring_Ena_VTC_PP –
ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – CDA3_Vlv2_Close_Stat_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify CDA3_Vlv2_Close_Stat_Monitoring_Ena_VTC_PP –
ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – CDA4_Vlv1_Close_Stat_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify CDA4_Vlv1_Close_Stat_Monitoring_Ena_VTC_PP –
ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW

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prm Monitored_Item_ID – CDA4_Vlv2_Close_Stat_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify CDA4_Vlv2_Close_Stat_Monitoring_Ena_VTC_PP –
ENABLED

19.4 [Enabling VTC Monitoring of VAMRV](#)

NOTE

VEMR status telemetry is not available because of VTC1 unavailability, therefore monitoring cannot be activated

COL: ECLSS: Payload VV: VEDD

Columbus VADD VTC2

'Vacuum Manual Repressurization Valve'

cmd Close Monitoring – Enable (Verify Status – Enabled)

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – VAMRV_Vlv_Close_Stat_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify VAMRV_Vlv_Close_Stat_Monitoring_Ena_VTC_PP –
ENABLED

20. [ACTIVATING PLCU](#)

PWS

20.1 [Powering up PLCU](#)

Activation Part 1: Activation Part 2: Activation Part 3:
Activation Part 4:

COL Activation Part 4

'PLCU Activation (In Default Mode)'

NOTE

The following command starts the FLAP 'PLCU Act In Default Mode' that :

Checks that the SPC3 is not active

Switches SPC3 power A and power B on

Boot the PLCU in default mode

Enables the monitoring of the SPC3 ready status

cmd Activate – **Execute** (OK)

Verify Pwr A – On

Verify Pwr B – On

Verify Ready Stat – Ready

Verify Pwr A Current: < 1.19 A

Verify Pwr B Current: < 0.12 A
 Verify Sec Voltage Stat – OK

```

cmd PLCU_Act_In_Default_Mode_AP
data Onboard_Reception_Node –
    SYS CCSDS End Point DMC DMS SERV
data Onboard_Execution_Node –
    USM SW DMC USS Swop Instance

    Verify PLCU_Pwr_A_Stat_DMC – ON
    Verify PLCU_Pwr_A_Current_DMC – <1.19 A
    Verify PLCU_Sec_Voltage_Stat_DMC – OK
    Verify PLCU_Pwr_B_Stat_DMC – ON
    Verify PLCU_Pwr_B_Current_DMC – < 0.12 A
    Verify PLCU_Ready_Stat_DMC – READY
    
```

20.2 [Enabling CCSDS Checksum Validation on PLCU \(Ground Only\)](#)

```

cmd DMS_CCSDS_Checksum_Ena_Cmd_SW
data ONBOARD_NODE –
    SYS_CCSDS_End_Point_PLCU_DMS_SERV
    
```

21. [ACTIVATING XCMU](#)

Activation Part 1: Activation Part 2: Activation Part 3: Activation Part 4
 COL Activation Part 4

'XCMU Activation'

NOTE

The following command starts the FLAP 'XCMU Activation' that:
 Checks that the XCMU is available
 Checks that the redundant XCMU is off
 Switches XCMU nom power A and nom power B on
 Enables the monitoring of the nominal XCMU ready status

cmd Activate – **Execute** (OK)

Verify Nom Pwr A – On
 Verify Nom Pwr B – On
 Verify Nom Ready Stat – Ready
 Verify Nom Pwr A Current < 0.64 A
 Verify Nom Pwr B Current < 0.64 A
 Verify Nom Sec Voltage Stat – OK

```

cmd XCMU_Activation_AP
data Onboard_Reception_Node –
    SYS CCSDS End Point DMC DMS SERV
data Onboard_Execution_Node – USM_SW_DMC_USS_Swop_Instance
    
```

Verify XCMU_Nom_Pwr_A_Stat_DMC – ON
Verify XCMU_Nom_Pwr_A_Current_DMC – <0.64 A
Verify XCMU_Nom_Sec_Voltage_Stat_DMC – OK
Verify XCMU_Nom_Pwr_B_Stat_DMC – ON
Verify XCMU_Nom_Pwr_B_Current_DMC – <0.64 A
Verify XCMU_Nom_Ready_Stat_DMC – READY

22. ENABLING CABIN TEMPERATURE MONITORING

Main Panel: DMS Monitoring: 2 - ECLSS

DMS Monitoring 2 - ECLSS

'System on DMC'

Verify CTCU1 Cabin Temp1: 18 to 27 deg C
Verify CTCU1 Cabin Temp2: 18 to 27 deg C
Verify CTCU1 Cabin Temp3: 18 to 27 deg C
Verify HS1 Air Humidity: 20 to 73 %
Verify HS2 Air Humidity: 20 to 73 %

ECLSS: ECLSS Commands:

ECLSS Commands

'Monitoring Commands'

cmd CTCU Cabin Air Mon Ena – **Execute** (OK)

Main Panel: DMS Monitoring: 2 - ECLSS

DMS Monitoring 2 - ECLSS

'System on DMC'

Verify the background color of measurements

CTCU1 Cabin Temp1: Green
CTCU1 Cabin Temp2: Green
CTCU1 Cabin Temp3: Green
HS1 Air Humidity: Green
HS2 Air Humidity: Green

Verify CTCU1_Cabin_Temp1_DMC – 18 - 27 °C
Verify CTCU1_Cabin_Temp2_DMC – 18 - 27 °C
Verify CTCU1_Cabin_Temp3_DMC – 18 - 27 °C
Verify HS1_Air_Humidity_DMC – 20 - 73 %
Verify HS2_Air_Humidity_DMC – 20 - 73 %

cmd CTCU_Ena_Cabin_Air_Mon_AP
data Onboard_Reception_Node –
SYS_CCSDS_End_Point_DMC_DMS_SERV

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data Onboard_Execution_Node – USM_SW_DMC_USS_Swop_Instance

Verify CTCU1_Cabin_Temp1_DMC_MS – NORMAL_1

Verify CTCU1_Cabin_Temp2_DMC_MS – NORMAL_1

Verify CTCU1_Cabin_Temp3_DMC_MS – NORMAL_1

Verify HS1_Air_Humidity_DMC_MS – NORMAL_1

Verify HS2_Air_Humidity_DMC_MS – NORMAL_1

23. [ENABLE WPA TEMPERATURE & FDIR MONITORINGS](#)

Main Panel: DMS Monitoring: 5 – COMMS TCS Payload

DMS Monitoring 5 – COMMS TCS Payload

'System on DMC'

'TCS'

NOTE

The following parameters initiate a Water Pump Switchover if values are out of limits after monitorings are enabled:

WTSB2 Redun Plenum Temp3

WPA1 WTSB1 Plenum Temp1/2

WPA1 WTSB3 CHX Temp1/2

Verify WTSB2 Redun Plenum Temp3: > 14 deg C

Verify WTSB5 Moderate HX Temp1: < 16 deg C

Verify WTSB5 Moderate HX Temp2: < 16 deg C

Verify WTSB6 Low HX Temp1: < 7.7 deg C

Verify WTSB6 Low HX Temp2: < 7.7 deg C

'WPA1'

Verify WPA1 WTSB1 Plenum Temp1: 15 - 22 deg C

Verify WPA1 WTSB1 Plenum Temp2: 15 - 22 deg C

Verify WPA1 WTSB3 CHX Temp1: < 12 deg C

Verify WPA1 WTSB3 CHX Temp2: < 12 deg C

TCS: TCS Commands

TCS Commands

'Monitoring Command'

cmd WTSB Mon Ena – **Execute** (OK)

Main Panel: DMS Monitoring: 5 – COMMS TCS Payload

DMS Monitoring 5 – COMMS TCS Payload

'System on DMC'

'TCS'

Verify the background color of measurements

COLUMBUS SINGLE VTC2 FINAL ACTIVATION

(ASSY MAL/1E/FIN/MULTI E)

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WTSB1 Nom Plenum Temp3: Purple
WTSB2 Redun Plenum Temp3: Green
WTSB5 Moderate HX Temp1: Green
WTSB5 Moderate HX Temp2: Green
WTSB6 Low HX Temp1: Green
WTSB6 Low HX Temp2: Green

'WPA1'

Verify the background color of measurements

WPA1 WTSB1 Plenum Temp1: Green
WPA1 WTSB1 Plenum Temp2: Green
WPA1 WTSB3 CHX Temp1: Green
WPA1 WTSB3 CHX Temp2: Green

Verify WTSB2_Redun_Plenum_Temp3_MVD > 14 deg C
Verify WTSB5_Medium_HX_Temp2_DMC < 16 deg C
Verify WTSB5_Medium_HX_Temp1_DMC < 16 deg C
Verify WTSB6_Low_HX_Temp2_DMC < 7.7 deg C
Verify WTSB6_Low_HX_Temp1_DMC < 7.7 deg C
Verify WPA1_WTSB1_Plenum_Temp2_DMC – 15 - 22 deg C
Verify WPA1_WTSB1_Plenum_Temp1_DMC – 15 - 22 deg C
Verify WPA1_WTSB3_CHX_Temp2_DMC < 12 deg C
Verify WPA1_WTSB3_CHX_Temp1_DMC < 12 deg C

cmd WTSB_Monitoring_Ena_AP

data Onboard_Reception_Node –

SYS CCSDS End Point DMC DMS SERV

data Onboard_Execution_Node – USM_SW_DMC_USS_Swop_Instance

Verify WTSB1_Nom_Plenum_Temp3_MVD_MS – NOTNOM_1
Verify WTSB2_Redun_Plenum_Temp3_MVD_MS – NORMAL_1
Verify WTSB5_Medium_HX_Temp2_DMC_MS – NORMAL_1
Verify WTSB5_Medium_HX_Temp1_DMC_MS – NORMAL_1
Verify WTSB6_Low_HX_Temp2_DMC_MS – NORMAL_1
Verify WTSB6_Low_HX_Temp1_DMC_MS – NORMAL_1

Verify WPA1_WTSB1_Plenum_Temp2_DMC_MS – NORMAL_1
Verify WPA1_WTSB1_Plenum_Temp1_DMC_MS – NORMAL_1
Verify WPA1_WTSB3_CHX_Temp2_DMC_MS – NORMAL_1
Verify WPA1_WTSB3_CHX_Temp1_DMC_MS – NORMAL_1

24. [CONFIGURING HCU2 FOR NOMINAL OPS](#)

NOTE

HCU monitoring was enabled automatically as part of DMC boot process.

24.1 [Disabling Nominal Monitoring of HCU1](#)

Main Panel: DMS Monitoring: 2 - ECLSS

DMS Monitoring 2 - ECLSS

'DMS Monitoring'

'Enable/Disable'

sel Enable/Disable ECLSS

DMS Monitoring Enable/Disable 2

'Disable Monitoring'

cmd HCU1 Health Stat – **Execute** (OK)

DMS Monitoring 2 - ECLSS

'System on DMC'

Verify the background color of measurement

HCU1 Health Stat: White

```
cmd DMS_MONIT_Dis_Monitoring_Cmd_SW
prm MT_ID – DMC_Sys_Monitoring_Table_SW
prm EI_ID – HCU1_Health_Stat_DMC
data Onboard_Node –
SYS CCSDS End Point DMC DMS SERV
```

Verify HCU1_Health_Stat_DMC_MS – NOTMON_1

COL-CC

24.2 [Swapping DMS Telemetry Packets \(Ground Only\)](#)

COL-CC to swap vital DMS telemetry packet.

Wait for “Go” to continue.

NOTE

Packet swapping initiated from COL-CC:
Enable VTC_Gnd_Tlm_Pkt_LOG2_VTC (1Hz)

Perform [{2.2.41 VTC GROUND PACKET SWAPPING}](#) (ESA SODF: GROUND: NOMINAL)then:

COL-CC to give a “Go” to continue.

24.3 [Deactivating HCU1 Power Bus](#)

PCS COL: EPS: PDU 1 120V Outlets Subsys/Payloads
COL PDU1 120V Outlets VTC2
 'PDU1'

cmd Outlet Num 28 – Off (Verify – Off)

cmd PDU1_HCU1_Pwr_Bus_Off_VTC
data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify PDU1_HCU1_Pwr_Bus_On_Off_Stat_VTC_PP – OFF

24.4 [Enabling HCU2 Vital Monitoring \(Ground Only\)](#)

COL-CC **COL-CC** to enable vital system monitoring for the HCU2 primary current and CDA3, CDA4 heaters temperature telemetries.

Wait for “Go” to continue.

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – HCU2_Prim_Current_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify HCU2_Prim_Current_VTC_MEF – ENABLED

NOTE

Because of VTC1 unavailability only the CDA3 and CDA4 assemblies are available for Columbus cabin depressurization

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – HCU2_CDA3_Htr_Temp_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify HCU2_CDA3_Htr_Temp_Monitoring_Ena_VTC_PP – ENABLED

cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – HCU2_CDA4_Htr_Temp_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify HCU2_CDA4_Htr_Temp_Monitoring_Ena_VTC_PP – ENABLED

24.5 [Enable PDU2 HCU2 Power Bus Vital System Monitoring \(Ground Only\)](#)

COL-CC to enable the vital system monitoring for the PDU2-HCU2 power bus primary current and On/Off status telemetries.

Wait for "Go" to continue.

```
cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – PDU2_HCU2_Pwr_Bus_Current_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC2
```

Verify PDU2_HCU2_Pwr_Bus_Current_VTC_MEF – ENABLED

```
cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID –
PDU2_HCU2_Pwr_Bus_On_Off_Stat_VTC
prm Action – 1 (ENABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC2
```

Verify PDU2_HCU2_Pwr_Bus_On_Off_Stat_VTC_MEF – ENABLED

24.6 [Swapping DMS Telemetry Packets \(Ground Only\)](#)

COL-CC to swap vital DMS telemetry packet.

Wait for "Go" to continue.

NOTE

Packet swapping initiated from **COL-CC**:
Disable VTC_Gnd_Tlm_Pkt_LOG2_VTC (1Hz)

Perform [{2.2.41 VTC GROUND PACKET SWAPPING}](#) (ESA SODF: GROUND: NOMINAL). then:

COL-CC to give a "Go" to continue.

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4.701 SWITCHOVER VTC1 NOMINAL TO REDUNDANT

(C&DH/1E - ALL/FIN/MULTI E)

Page 1 of 12 pages

OBJECTIVE:

Reconfiguration of the Master VTC1 from the nominal to the redundant branch of VTC1.

NOTE

1. A failure, declared or suspicious, recommends switching VTC1 to redundant branch keeping its Master status. A Warm Start of the VTC1 will be performed since VTC2 is active and working as Slave.

NOTE

In case the nominal DMS does not provide the MVD parameters (Mirrored Vital Data) to Col-CC; VTC or Processed Parameters shall be checked instead of MVD parameters. For VTC Parameters ground TM packets from VTC have to be started.

PCS

1. CHECK STATUS OF VTC2

COL: CDH

DMS Overview Nom

Verify VTC2 – Slave

If VTC2 Nom – Ready

| Go to step 2.

Verify VTC2 Redun – Ready

Verify VTC2_Master_Slave_Mode_MVD – SLAVE

If VTC2_Nom_Ready_Stat_MVD – READY

| Go to step 2

Verify VTC2_Redun_Ready_Stat_MVD – READY

2. CHECK STATUS OF VTC1 REDUNDANT BRANCH

COL: CDH: VTC1

COL VTC1

'VTC1 Redundant'

Verify Ready Status – Not Rdy

Verify Redun Pwr A Status – Off

Verify Redun Pwr B Status – Off

Verify VTC1_Redun_Ready_Stat_MVD – NOT_RDY

Verify VTC1_Redun_Pwr_A_Stat_MVD – OFF

Verify VTC1_Redun_Pwr_B_Stat_MVD – OFF

4.701 SWITCHOVER VTC1 NOMINAL TO REDUNDANT

(C&DH/1E - ALL/FIN/MULTI E)

Page 2 of 12 pages

3. [RECONFIGURE REDUNDANCY MGT FOR VTC1](#)

CDH: Primary C&C: Recovery Retry: COL Module

'Master VTC Recovery to Redundant'

cmd Recovery Inhibit – Arm **Execute**
cmd Recovery Inhibit – Inhibit **Execute**

√Recovery Status – Inhibit

'Master VTC Recovery to VTC-2'

cmd Recovery Inhibit – Arm **Execute**
cmd Recovery Inhibit – Inhibit **Execute**

√Recovery Status – Inhibit

4. [SUPPRESS CAUTION & WARNING FOR VTC1](#)

C&W Summ

'Event Code Tools'

sel Suppress

input Event Code – 1 3 6 0 8
(**DMS MASTER VTC Recovery Step 1 Failure - COL**)

cmd Arm
cmd **Execute**

5. [DISABLE 1553B FDIR MANAGEMENT FOR VTC1](#)

CDH: Primary INT: CB INT: RT Status

'RT FDIR Status'

cmd 21 VTC 1 – Inhibit FDIR **Execute** (√ – Inh)

6. [DISABLE VITAL MONITORING FOR IRFA](#)

COL: ECLSS: Air Loop: IRFA (IMV Port Aft Fan)

'IMV Return Fan Assembly'

cmd Fan Speed Monitoring – Inh
cmd Fan dP Monitoring – Inh

4.701 SWITCHOVER VTC1 NOMINAL TO REDUNDANT

(C&DH/1E - ALL/FIN/MULTI E)

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Verify Speed Mon Ena – Inhibited

Verify dP Mon Ena – Inhibited

```
cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – IRFA_Fan_Speed_VTC
prm Action – 0 (DISABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1
```

```
cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – IRFA_Delta_P_VTC
prm Action – 0 (DISABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1
```

Verify IRFA_Fan_Speed_VTC_MEF – DISABLED

Verify IRFA_Delta_P_VTC_MEF – DISABLED

7. STOP RT ACQUISITION OF VTC1 ON SYSTEM BUS

PWS

DMS: DMC (SPC1)

DMC

If SW_to_HW_mapping – SPC1 or SPC4 (black on white background)

If coverage:

Call **Col-CC** to stop RT acquisition for VTC1 on the System Bus.
Wait for "Go" from **Col-CC** to continue with next step.

If no coverage:

Continue operation, VTC1 mirrored data on PWS displays will become invalid and a Nominal DMS Error Event will be raised on PWS System Message Panel:
DMS

USM_SW_DMC_USS_Swop_Instance Monitoring
Exception: VTC1_Sys_Bus_No_Resp_SW = ERROR.

Inform **Col-CC** during next coverage, to disable RT acquisition for VTC1 on the System Bus.

If USM_DMC_HW_To_SW_Mapping_SW_VS – VALID

```
cmd DMS_RT_Stop_RT_Acquisition_Cmd_SW
prm Remote_Terminal_ID –
MIL 1553B Bus RT Svstem Bus VTC1
data Onboard_Node –
SYS CCSDS End Point DMC DMS SERV
```

Verify VTC1_Sys_Bus_Ena_Stat_SW – DISABLED

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Give "Go" to **MCC-H** / Crew to continue, if they shall proceed.

8. DEACTIVATE VTC1 NOMINAL BRANCH

NOTE

When both power feeders to VTC1 are off the Caution '**DMS MASTER VTC Failure -COL**' with the Event Code 13606 will be shown on ground.

PCS

COL: CDH: VTC1

COL VTC1

'VTC1 Nominal'

If Nom. Pwr A Status – On

| **cmd** Nom. Pwr A – Off

If Nom. Pwr B Status – On

| **cmd** Nom. Pwr B – Off

Verify Nom Pwr A Status – Off

Verify Nom Pwr A Current < 0.19 A

Verify Nom Pwr B Status – Off

Verify Nom Pwr B Current < 0.19 A

Verify VTC1_Nom_Pwr_A_Stat_MVD – OFF

If VTC1_Nom_Pwr_B_Stat_MVD – ON

| **cmd** VTC1_Nom_Pwr_B_Off_VTC

| **data** SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

| **data** Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify VTC1_Nom_Pwr_A_Stat_MVD – OFF

Verify VTC1_Nom_Pwr_A_Current_MVD < 0.19 A

Verify VTC1_Nom_Pwr_B_Stat_MVD – OFF

Verify VTC1_Nom_Pwr_B_Current_MVD < 0.19 A

Verify VTC1_Nom_Ready_Stat_MVD – NOT_RDY

9. POWER ON VTC1 REDUNDANT BRANCH

9.1 POWER ON VTC1 REDUNDANT POWER A

COL: CDH: VTC1

COL VTC1

'VTC1 Redundant'

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cmd Redun Pwr A – On

Verify Redun Pwr A Status – On

Verify Redun Pwr A Current < 2.14 A

Verify Ready Status – Ready

Verify Temp < 48 degC

'VTC1 Modes'

Verify Idle Mode – Idle Mode

cmd VTC1_Redun_Pwr_A_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify VTC1_Redun_Pwr_A_Stat_MVD – ON

Verify VTC1_Redun_Pwr_A_Current_MVD < 2.14 A

Verify VTC1_Redun_Ready_Stat_MVD – READY

Verify VTC1_Redun_Temp_MVD < 48 degC

Verify VTC1_IDLE_CONFIG_MODE_SW_PP – IDLE

9.2 [POWER ON VTC1 REDUNDANT POWER B](#)

COL: CDH: VTC1

COL VTC1

'VTC1 Redundant'

cmd Redun Pwr B – On

Verify Redun Pwr B Status – On

Verify Redun Pwr A Current < 1.33 A

Verify Redun Pwr B Current < 1.08 A

Verify VTC1_Redun_Pwr_B_Stat_MVD – ON

Verify VTC1_Redun_Pwr_A_Current_MVD < 1.33 A

Verify VTC1_Redun_Pwr_B_Current_MVD < 1.08 A

10. [NOTIFY VTC1 – VTC2 IN SLAVE MODE](#)

COL: CDH: VTC2

COL VTC2

'VTC2 Modes'

Verify Master/Slave Mode – Slave

COL: CDH: VTC1

COL VTC1

'VTC1 Modes'

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cmd Notify VTC1 – VTC2 in Slave Mode

Verify VTC2_Master_Slave_Mode_MVD – SLAVE

cmd VTC_Notify_Mode_Cmd_SW

prm NEW_MODE – 0 (Slave)

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

11. [INITIALIZE VTC1 AS MASTER VTC](#)

NOTE

The current configuration of DMC shall be determined to ensure reconfiguration of the VTC into the correct DMS Mode (“Nominal” or “Vital”). If the DMC is Bus Controller (BC) on the System bus, the SW_to_HW_Mapping for the DMC shows SPC1 or SPC4 and the DMC Ready Status is “READY”, this means, the VTC has to be configured into DMS Mode “Nominal”, otherwise into DMS Mode “Vital”.

PWS

DMS: DMC (SPC1)

DMC

If SW_to_HW_mapping – SPC1 or SPC4 (black on white background)

PCS

COL: CDH: VTC1

COL VTC1

'VTC1 Initialization'

cmd Master-Nominal-Modified

'VTC1 Modes'

Verify DMS Mode – Nominal

Verify Master/Slave Mode – Master

Verify Idle Mode – Not Idle

If SW_to_HW_mapping – ? (purple background)

COL: CDH: VTC1

COL VTC1

'VTC1 Initialization'

cmd Master-Vital-Modified

'VTC1 Modes'

Verify DMS Mode – Vital

Verify Master/Slave Mode – Master

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~
| Verify Idle Mode – Not Idle

If USM_DMC_HW_To_SW_Mapping_SW_VS - VALID or TM packet with Validity status not available on ground

cmd VTC_Initialization_Cmd_SW
prm INIT_MODE – 1 (MASTER)
prm INIT_LIMIT_SET – 1 (MODIFIED)
prm INIT_APM_MODE – 0 (NOMINAL)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify VTC1_INT_DATA_APM_MODE_SW – NOMINAL
Verify VTC1_Master_Slave_Mode_MVD – MASTER
Verify VTC1_IDLE_CONFIG_MODE_SW_PP – NOT_IDLE

If USM_DMC_HW_To_SW_Mapping_SW_VS - NOT_VAL

cmd VTC_Initialization_Cmd_SW
prm INIT_MODE – 1 (MASTER)
prm INIT_LIMIT_SET – 1 (MODIFIED)
prm INIT_APM_MODE – 1 (Vital)
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify VTC1_INT_DATA_APM_MODE_SW – VITAL
Verify VTC1_INT_DATA_MASTER_SLAVE_MODE_SW – MASTER
Verify VTC1_IDLE_CONFIG_MODE_SW_PP – NOT_IDLE

12. [ENABLING VTC VITAL BUS FDIR](#)

COL: CDH: Vital Bus

COL Vital Bus

cmd Vital Bus Recon – Enable

Verify Vital Bus Recon – Enable

cmd VTC_Vital_Sys_Bus_Recon_Ena_Cmd_SW
prm BUS_ID – 0 (Vital)
prm RECONFIGURATION_ENABLE – 1 (Enable)
data Onboard_Node – SYS_CCSDS_End_Point_VTCM

Verify VTC_MASTER_Vital_Bus_Recon_Ena_SW_PP – ENABLE

13. [ENABLING VTC SYSTEM BUS FDIR](#)

If SW_to_HW_mapping – ? (purple background)

COL: CDH: DMS Overview Activation: System Bus

COL System Bus

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~
|
cmd System Bus Recon – Enable

Verify System Bus Recon – Enable

If USM_DMC_HW_To_SW_Mapping_SW_VS – NOT_VAL

cmd VTC_Vital_Sys_Bus_Recon_Ena_Cmd_SW

prm BUS_ID – 1 (System)

prm RECONFIGURATION_ENABLE – 1 (Enable)

data Onboard_Node – SYS_CCSDS_End_Point_VTCM

Verify VTC_MASTER_System_Bus_Recon_Ena_SW_PP –
ENABLE

14. [START RT ACQUISITION OF VTC1 ON SYSTEM BUS](#)

If VTC1 RT acquisition was stopped in step 7

Call **Col-CC** to start RT acquisition for VTC1 on the System Bus.

Wait for "Go" from **Col-CC** to continue with next step.

If VTC1 RT acquisition was stopped in step 7

cmd DMS_RT_Start_RT_Acquisition_Cmd_SW

prm Remote_Terminal_ID –

MIL 1553B Bus RT Svsystem Bus VTC1

data Onboard_Node –

SYS CCSDS End Point DMC DMS SERV

Verify VTC1_Sys_Bus_Ena_Stat_SW – ENABLED

Verify VTC1_Sys_Bus_No_Resp_SW – NO_ERROR

Give "Go" to **MCC-H** / Crew to continue.

15. [RE-ENABLE VTC1 TM PACKETS](#)

COL: CDH: VTC1: VTC 1 Packet Enable

COL VTC1 Packet Enable

cmd Log1 – Enable

cmd Log2 – Enable

cmd VTC_TIm_Pkt_Ena_Cmd_SW

prm Packet_ID – VTC_TIm_Pkt_LOG1_VTC

prm Action – 1 (Enable)

prm Checksum_Flag – 1 (Enable)

prm Dump_Pipe – 0 (TLM_P)

prm APID_Value – 1267

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

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```
cmd VTC_Tlm_Pkt_Ena_Cmd_SW
prm Packet_ID – VTC_Tlm_Pkt_LOG2_VTC
prm Action – 1 (Enable)
prm Checksum_Flag – 1 (Enable)
prm Dump_Pipe – 0 (TLM_P)
prm APID_Value – 1267
data Onboard_Node – SYS_CCSDS_End_Point_VTC1
```

Ground step only: Contact COMMS to stop TM packet "VTC1_Gnd_Tlm_Pkt_PHY2_VTC", which is automatically started at VTC initialization.

16. [RE-ENABLE 1553B FDIR MANAGEMENT FOR VTC1](#)

CDH: Primary INT: CB INT: RT Status

CB INT 1 RT Status

'RT FDIR Status'

cmd 21 VTC 1 – Enable FDIR **Execute** (√ – Ena)

17. [CONFIGURE REDUNDANCY MGT FOR VTC1](#)

CDH: Primary C&C: Recovery Retry: COL Module

COL Module Recovery

'Set VTC Master'

cmd VTC 1 – **Execute** (√ – VTC 1)

'Set VTC Branch'

cmd VTC Master Branch – Redundant **Execute** (√ – Redundant)

'Master VTC Recovery to VTC-2'

cmd Recovery Enable – Enable **Execute**

√Recovery Status – Enable

18. [ENABLE DMC RECONFIGURATION](#)

PWS

DMS: DMC (SPC1)

DMC

PCS

If SW_to_HW_mapping – SPC1 or SPC4 (black on white background)

COL: CDH: DMC

COL DMC Nom

'DMC FDIR'

cmd Ena DMC Recon

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~
|
Verify Recon – Enabled

```
If USM_DMC_HW_To_SW_Mapping_SW_VS - VALID
  cmd VTC_DMC_Recon_Ena_Cmd_SW
  prm Action – 1 (ENABLE)
  data Onboard_Node – SYS_CCSDS_End_Point_VTCM

Verify VTC_MASTER_DMC_Recon_Enable_SW_PP – ENABLE
```

19. START ACS IRFA_SPEED_SET

COL: ECLSS: Air Loop: IRFA (IMV Port Aft Fan)

COL IMV Fans

'IMV Return Fan Assembly'

If IRFA Power – Off >>

COL IMV Fans

√VTC1 Buffer Status – Empty

```
*****
* If VTC1 Buffer Status – Full
* | sel VTC1 Cancel 2 Stage Command
* |
* | Cancel 2 - Stage Cmd VTC 1
* |
* | cmd Cancel 2 – Stage Cmd Execute (Verify – Empty)
*
*****
```

NOTE

The following ACS sets the IMV Return Fan speed to 8800 rpm.

Record PCS ID:: _____

'Set Speed - VTC1 hardware'

cmd Start – Arm

pick - PCS/C-X to VTC-1 (as recorded)

cmd Start – Set

'IMV Return Fan Assembly'

cmd State – On

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Verify dP > 0.3 kPa

Verify Fan Speed – 8300 to 9300 rpm

If IRFA_Pwr_Stat_VTC – OFF >>

√VTC1_Two_Stage_Buffer_Status_SW_PP – EMPTY

If VTC1_Two_Stage_Buffer_Status_SW_PP – FULL

cmd VTC_Cancel_Two_Stage_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify VTC1_Two_Stage_Buffer_Status_SW_PP – EMPTY

cmd IRFA_SPEED_SET_ACS (ARM)

data SW_CMD – VTC_Start_Terminate_ACS_Cmd_SW

data Action – 1 (START)

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify VTC1_Two_Stage_Buffer_Status_SW_PP – FULL

execute VTC_Execute_2_Stage_Cmd_SW (EXEC)

Verify IRFA_Delta_P_VTC > 0.3 kPa

Verify IRFA_Fan_Speed_VTC – 8300 to 9300 rpm

20. [ENABLE VITAL MONITORING FOR IRFA](#)

COL: ECLSS: Air Loop: IRFA

COL IMV Fans

'IMV Return Fan Assembly'

cmd Fan Speed Monitoring – Ena

cmd Fan dP Monitoring – Ena

Verify Speed Mon Ena – Enabled

Verify dP Mon Ena – Enabled

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – IRFA_Fan_Speed_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – IRFA_Delta_P_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify IRFA_Fan_Speed_VTC_MEF – ENABLED

Verify IRFA_Delta_P_VTC_MEF – ENABLED

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OBJECTIVE:

Reconfiguration of the Slave VTC2 from the nominal to the redundant branch of VTC2.

NOTE

A failure, declared or suspicious, recommends switching VTC2 to redundant branch keeping its Slave status. A Warm Start of the VTC2 will be performed since the VTC1 is active and working as Master.

NOTE

In case the nominal DMS does not provide the MVD parameters (Mirrored Vital Data) to Col-CC; VTC or Processed Parameters shall be checked instead of MVD parameters. For VTC Parameters ground TM packets from VTC have to be started.

PCS

1. CHECK STATUS OF VTC1

COL: CDH

DMS Overview Nom

Verify VTC1 – Master

If VTC1 Nom – Ready
| Go to step 2.

Verify VTC1 Redun – Ready

Verify VTC1_Master_Slave_Mode_MVD – MASTER

If VTC1_Nom_Ready_Stat_MVD – READY
| Go to step 2.

Verify VTC1_Redun_Ready_Stat_MVD – READY

2. CHECK STATUS OF VTC2 REDUNDANT BRANCH

COL: CDH: VTC2

COL VTC2

'VTC2 Redundant'

Verify Ready Status – Not Rdy

Verify Redun Pwr A Status – OFF

Verify Redun Pwr B Status – OFF

Verify VTC2_Redun_Ready_Stat_MVD – NOT_RDY

Verify VTC2_Redun_Pwr_A_Stat_MVD – OFF

Verify VTC2_Redun_Pwr_B_Stat_MVD – OFF

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3. [RECONFIGURE REDUNDANCY MGT FOR VTC2](#)

CDH: Primary C&C: Recovery Retry: COL Module

'VTC Slave Recovery'

cmd Recovery Status – Inhibit **Execute**

√Recovery Status – Inhibit

4. [SUPPRESS CAUTION & WARNING FOR VTC2](#)

C&W Summ

'Event Code Tools'

sel Suppress

input Event Code – 1 3 6 1 0 (DMS SLAVE VTC Recovery Failure - COL)

cmd Arm

cmd **Execute**

5. [DISABLE 1553B FDIR MANAGEMENT FOR VTC2](#)

CDH: Backup INT: CB INT: RT Status

'RT FDIR Status'

cmd 21 VTC 2 – Inhibit FDIR **Execute** (√ – Inh)

6. [DISABLE VITAL MONITORING FOR ISFA](#)

COL: ECLSS: Air Loop: ISFA (IMV Port Fwd Fan)

'IMV Supply Fan Assembly'

cmd Fan Speed Monitoring – Inh

cmd Fan dP Monitoring – Inh

Verify Speed Mon Ena – Inhibited

Verify dP Mon Ena – Inhibited

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – ISFA_Fan_Speed_VTC

prm Action – 0 (DISABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

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```
cmd VTC_Monitoring_Ena_Cmd_SW
prm Monitored_Item_ID – ISFA_Delta_P_VTC
prm Action – 0 (DISABLE)
data Onboard_Node – SYS_CCSDS_End_Point_VTC2
```

```
Verify ISFA_Fan_Speed_VTC_MEF – DISABLED
Verify ISFA_Delta_P_VTC_MEF – DISABLED
```

7. STOP RT ACQUISITION OF VTC2 ON SYSTEM BUS

PWS

DMS: DMC
(SPC1)

DMC

If SW_to_HW_mapping – SPC1 or SPC4 (black on white background)

If coverage:

Call **Col-CC** to stop RT acquisition for VTC2 on the System Bus.
Wait for "Go" from **Col-CC** to continue with next step.

If no coverage:

Continue operation, VTC2 mirrored data on PWS displays will become invalid and a Nominal DMS Error Event will be raised on. PWS System Message Panel:
DMS USM_SW_DMC_USS_Swop_Instance
Monitoring Exception: VTC2_Sys_Bus_No_Resp_SW = ERROR.

Inform **Col-CC** during next coverage, to disable RT acquisition for VTC2 on the System Bus.

If USM_DMC_HW_To_SW_Mapping_SW_VS – VALID

```
cmd DMS_RT_Stop_RT_Acquisition_Cmd_SW
prm Remote_Terminal_ID –
MIL 1553B Bus RT Svstem Bus VTC2
data Onboard_Node –
SYS CCSDS End Point DMC DMS SERV
```

Verify VTC2_Sys_Bus_Ena_Stat_SW – DISABLED

Give "Go" to MCC-H / Crew to continue, if they shall proceed.

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8. [DEACTIVATE VTC2 NOMINAL BRANCH](#)

NOTE

When both power feeders to VTC2 are off the Caution 'DMS SLAVE VTC Failure -COL' with the Event Code 13607 will be shown on ground.

PCS

COL: CDH: VTC2

COL VTC2

'VTC2 Nominal'

If Nom. Pwr A Status – On

| **cmd** Nom. Pwr A – Off

If Nom. Pwr B Status – On

| **cmd** Nom. Pwr B – Off

Verify Nom Pwr A Status – Off

Verify Nom Pwr A Current < 0.19 A

Verify Nom Pwr B Status – Off

Verify Nom Pwr B Current < 0.19 A

If VTC2_Nom_Pwr_B_Stat_MVD – ON

| **cmd** VTC2_Nom_Pwr_B_Off_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify VTC2_Nom_Pwr_A_Stat_MVD – OFF

Verify VTC2_Nom_Pwr_A_Current_MVD < 0.19 A

Verify VTC2_Nom_Pwr_B_Stat_MVD – OFF

Verify VTC2_Nom_Pwr_B_Current_MVD < 0.19 A

Verify VTC2_Nom_Ready_Stat_MVD – NOT_RDY

9. [POWER ON VTC2 REDUNDANT BRANCH](#)

9.1 [Power On VTC2 Redundant Power A](#)

COL: CDH: VTC2

COL VTC2

'VTC2 Redundant'

cmd Redun Pwr A – On

Verify Redun Pwr A Status – On

Verify Redun Pwr A Current < 2.14 A

Verify Ready Status – Ready

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Verify Temp < 48 degC

'VTC2 Modes'

Verify Idle Mode – Idle Mode

cmd VTC2_Redun_Pwr_A_On_VTC

data SW_CMD – VTC_Disc_Out_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC1

Verify VTC2_Redun_Pwr_A_Stat_MVD – ON

Verify VTC2_Redun_Pwr_A_Current_MVD < 2.14 A

Verify VTC2_Redun_Ready_Stat_MVD – READY

Verify VTC2_Redun_Temp_MVD < 48 degC

Verify VTC2_IDLE_CONFIG_MODE_SW_PP – IDLE

9.2 [Power On VTC2 Redundant Power B](#)

COL: CDH: VTC2

COL VTC2

'VTC2 Redundant'

cmd Redun Pwr B – On

Verify Redun Pwr B Status – On

Verify Redun Pwr A Current < 1.33 A

Verify Redun Pwr B Current < 1.08 A

Verify VTC2_Redun_Pwr_B_Stat_MVD – ON

Verify VTC2_Redun_Pwr_A_Current_MVD < 1.33 A

Verify VTC2_Redun_Pwr_B_Current_MVD < 1.08 A

10. [INITIALIZE VTC2 AS SLAVE VTC](#)

COL: CDH: VTC2

COL VTC2

'VTC2 Initialization'

cmd Slave-Modified

'VTC2 Modes'

Verify Master/Slave Mode – Slave

Verify Idle Mode – Not Idle

cmd VTC_Initialization_Cmd_SW

prm INIT_MODE – 0 (SLAVE)

prm INIT_LIMIT_SET – 1 (MODIFIED)

prm INIT_APM_MODE – 2 (N/A)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

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Verify VTC2_Master_Slave_Mode_MVD – SLAVE
Verify VTC2_IDLE_CONFIG_MODE_SW_PP – NOT_IDLE

11. START RT ACQUISITION OF VTC2 ON SYSTEM BUS

If VTC2 RT acquisition was stopped in step 7

Call **Col-CC** to start RT acquisition for VTC2 on the System Bus.
Wait for "Go" from **Col-CC** to continue with next step.

If VTC2 RT acquisition was stopped in step 7

cmd DMS_RT_Start_RT_Acquisition_Cmd_SW
prm Remote_Terminal_ID –
MIL 1553B Bus RT Svstem Bus VTC2
data Onboard_Node –
SYS CCSDS End Point DMC DMS SERV

Verify VTC2_Sys_Bus_Ena_Stat_SW – ENABLED
Verify VTC2_Sys_Bus_No_Resp_SW – NO_ERROR

Give "Go" to **MCC-H** / Crew to continue.

12. RE-ENABLE VTC2 TM PACKETS

COL: CDH: VTC 2: VTC 2 Packet Enable

COL VTC 2 Packet Enable

cmd Phy4 – Enable

cmd Phy5 – Enable

cmd VTC_Tlm_Pkt_Ena_Cmd_SW
prm Packet_ID – VTC2_Tlm_Pkt_PHY4_VTC
prm Action – 1 (Enable)
prm Checksum_Flag – 1 (Enable)
prm Dump_Pipe – 0 (TLM_P)
prm APID_Value – 1268
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

cmd VTC_Tlm_Pkt_Ena_Cmd_SW
prm Packet_ID – VTC2_Tlm_Pkt_PHY5_VTC
prm Action – 1 (Enable)
prm Checksum_Flag – 1 (Enable)
prm Dump_Pipe – 0 (TLM_P)
prm APID_Value – 1268
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

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Ground step only: Contact COMMS to stop TM packet "VTC2_Gnd_Tlm_Pkt_PHY2_VTC", which is automatically started at VTC initialization.

13. RE-ENABLE 1553B FDIR MANAGEMENT FOR VTC2

CDH: Backup INT: CB INT: RT Status

'RT FDIR Status'

cmd 21 VTC 2 – Enable FDIR Execute (√ – Ena)

14. START ACS ISFA_SPEED_SET

COL: ECLSS: Air Loop: ISFA

(IMV Port Fwd Fan)

'IMV Supply Fan Assembly'

If ISFA Power – Off >>

√VTC2 Buffer Status – Empty

```
*****
*          If VTC2 Buffer Status – Full
*          |
*          |   sel VTC2 Cancel 2 Stage Command
*          |
*          |   
*          |
*          |   cmd Cancel 2 - Stage Cmd Execute (Verify – Empty)
*          |
*          |
*****
```

NOTE

The following ACS sets the IMV Supply Fan speed to 9960 rpm.

Record PCS ID: _____

'Set Speed – VTC2 hardwire'

cmd Start – Arm

pick – PCS/C-X to VTC-2 (as recorded)

cmd Start – Set

'IMV Supply Fan Assembly'

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cmd State – On

Verify dP > 0.4 kPa

Verify Fan Speed – 9460 to 10460 rpm

If ISFA_Pwr_Stat_VTC – OFF >>

√VTC2_Two_Stage_Buffer_Status_SW_PP – EMPTY

If VTC2_Two_Stage_Buffer_Status_SW_PP – FULL

cmd VTC_Cancel_Two_Stage_Cmd_Cmd_SW

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify VTC2_Two_Stage_Buffer_Status_SW_PP – EMPTY

cmd ISFA_SPEED_SET_ACS (ARM)

data SW_CMD – VTC_Start_Terminate_ACS_Cmd_SW

data Action – 1 (START)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify VTC2_Two_Stage_Buffer_Status_SW_PP – FULL

execute VTC_Execute_2_Stage_Cmd_SW (EXEC)

Verify ISFA_Delta_P_VTC > 0.4 kPa

Verify ISFA_Fan_Speed_VTC – 9460 to 10460 rpm

15. [ENABLE VITAL MONITORING FOR ISFA](#)

COL: ECLSS: Air Loop: ISFA

COL IMV Fans

'IMV Supply Fan Assembly'

cmd Fan Speed Monitoring – Ena

cmd Fan dP Monitoring – Ena

Verify Speed Mon Ena – Enabled

Verify dP Mon Ena – Enabled

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – ISFA_Fan_Speed_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

cmd VTC_Monitoring_Ena_Cmd_SW

prm Monitored_Item_ID – ISFA_Delta_P_VTC

prm Action – 1 (ENABLE)

data Onboard_Node – SYS_CCSDS_End_Point_VTC2

Verify ISFA_Fan_Speed_VTC_MEF – ENABLED
Verify ISFA_Delta_P_VTC_MEF – ENABLED

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4.120 SWITCHOVER CMU 1 (2,3,4) NOMINAL TO REDUNDANT (VITAL DMS)

(ASSY MAL/1E/FIN/MULTI E)

Page 1 of 3 pages

OBJECTIVE:

This procedure performs a manual switchover from nominal to redundant CMU [X] in DMS VITAL mode.

<u>NOTE</u>	
1. DMS has to be in VITAL mode.	
2. The following CMUs need to be active for the switchover:	
CMU to be switched	Required CMUs
CMU 1	CMU 2 + CMU 4
CMU 2	CMU 1 + CMU 3
CMU 3	CMU 4 + CMU 2
CMU 4	CMU 3 + CMU 1
3. Both VTCs have to be active.	
4. CMU [X], where X = 1, 2, 3 or 4, depending which CMU shall be switched.	

PCS

1. VERIFY MASTER VTC IS IN VITAL MODE

COL: CDH

DMS Overview Nom

If VTC1 - Master

| Verify VTC1 DMS Mode - Vital

If VTC2 - Master

| Verify VTC2 DMS Mode - Vital

<u>NOTE</u>	
- The 'Onboard_Node' of the '..._ACT' commands in step 3 have to be the onboard node of the VTC which is Master.	
- Use the variable [Z] defined below to derive the correct onboard node (Standard configuration: [Z] = VTC1).	

If VTC1_INT_DATA_MASTER_SLAVE_MODE_SW - MASTER

| Verify VTC1_INT_DATA_APM_MODE_SW - VITAL

| [Z] = VTC1

If VTC2_INT_DATA_MASTER_SLAVE_MODE_SW - MASTER

| Verify VTC2_INT_DATA_APM_MODE_SW - VITAL

| [Z] = VTC2

4.120 SWITCHOVER CMU 1 (2,3,4) NOMINAL TO REDUNDANT (VITAL DMS)

(ASSY MAL/1E/FIN/MULTI E)

Page 2 of 3 pages

2. VERIFY CMU [X] REDUNDANT BRANCH IS OFF

COL: CDH: DMS Overview Activation: CMU [X]

COL CMU [X] Act

'CMU [X] Redundant'

Verify Ready Status – Not Rdy

√CMU [X] Redun Pwr A Status – Off

√CMU [X] Redun Pwr B Status – Off

Verify CMU[X]_Redun_Ready_Stat_ACT – NOT_RDY

√CMU[X]_Redun_Pwr_A_Stat_ACT – OFF

√CMU[X]_Redun_Pwr_B_Stat_VTC – OFF

3. SWITCHOVER NOMINAL TO REDUNDANT CMU [X]

COL: CDH: DMS Overview Activation: CMU [X]

COL CMU [X] Act

'CMU [X] Nominal'

If CMU [X] Nom Pwr A Status – On

cmd CMU [X] Nom Pwr A – Off Execute

√CMU [X] Nom Pwr A Status – Off

If CMU [X] Nom Pwr B Status – On

 If Master/Slave Mode VTC 1 – Master

cmd CMU [X] Nom Pwr VTC 1 Master: B – Off Execute

 Else If Master/Slave Mode VTC 2 – Master

cmd CMU [X] Nom Pwr VTC 2 Master: B – Off Execute

√CMU [X] Nom Pwr B Status – Off

Verify CMU [X] Nom Pwr A Current < 0.19 A

Verify CMU [X] Nom Pwr B Current < 0.19 A

Verify Ready Status – Not Rdy

'CMU [X] Redundant'

If Master/Slave Mode VTC 1 – Master

cmd CMU [X] Redun Pwr VTC 1 Master: A – On Execute

Else If Master/Slave Mode VTC 2 – Master

~

4.120 SWITCHOVER CMU 1 (2,3,4) NOMINAL TO REDUNDANT (VITAL DMS)

(ASSY MAL/1E/FIN/MULTI E)

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┌
└ **cmd** CMU [X] Redun Pwr VTC 2 Master: A – On **Execute**

√CMU [X] Redun Pwr A Status – On
Verify CMU [X] Redun Pwr A Current < 1.35 A

cmd CMU [X] Redun Pwr B – On **Execute**

√CMU [X] Redun Pwr B Status – On
Verify Ready Status – Ready
Verify CMU [X] Redun Pwr A Current < 0.75 A
Verify CMU [X] Redun Pwr B Current < 0.75 A

If CMU[X]_Nom_Pwr_A_Stat_VTC – ON

┌
└ **cmd** CMU[X]_Nom_Pwr_A_Off_VTC
data End_Item – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC1

√CMU[X]_Nom_Pwr_A_Stat_VTC – OFF

If CMU[X]_Nom_Pwr_B_Stat_ACT – ON

┌
└ **cmd** CMU[X]_Nom_Pwr_B_Off_ACT
data End_Item – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_[Z]

√CMU[X]_Nom_Pwr_B_Stat_ACT – OFF
Verify CMU[X]_Nom_Pwr_A_Current_VTC < 0.19 A
Verify CMU[X]_Nom_Pwr_B_Current_ACT < 0.19 A
Verify CMU[X]_Nom_Ready_Stat_ACT – NOT_RDY

cmd CMU[X]_Redun_Pwr_A_On_ACT
data End_Item – VTC_Disc_Out_Cmd_Cmd_SW
cmd Onboard_Node – SYS_CCSDS_End_Point_[Z]

√CMU[X]_Nom_Pwr_A_Stat_ACT – on
Verify CMU[X]_Nom_Pwr_A_Current_ACT < 1.35 A

cmd CMU[X]_Redun_Pwr_B_On_VTC
data End_Item – VTC_Disc_Out_Cmd_Cmd_SW
data Onboard_Node – SYS_CCSDS_End_Point_VTC2

√CMU[X]_Redun_Pwr_B_Stat_VTC – ON
Verify CMU[X]_Redun_Ready_Stat_ACT – READY
Verify CMU[X]_Redun_Pwr_A_Current_ACT < 0.75 A
Verify CMU[X]_Redun_Pwr_B_Current_VTC < 0.75 A

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2.101 TCS LOOP WPA1 TO WPA2 SWITCHOVER - AUTO

(ASSY MAL/1E/FIN/MULTI E)

Page 1 of 9 pages

OBJECTIVE:

This procedure is used to perform a switchover from the nominal water loop (WPA1, WOOV1, WMV1/3, WTSB1, DPSB1.1, DPSB3.1) to the redundant water loop (WPA2, WOOV2, WMV2/4, WTSB2, DPSB2.1, DPSB3.2). It includes also preparation of both the accumulators for the switchover.

PRECONDITIONS:

1. No active cooling is supplied to the ISPR
2. WFSV configured to Open position where no ISPRs are installed
3. All power outlets required for water loop 2 operation are switched on

These conditions will be checked in step 1.2. and 1.3.

REFERENCED PROCEDURES:

2.104 PASSIVE WPA ACCUMULATOR RE-PRESSURIZATION/DE-PRESSURIZATION

1. [DETERMINATION OF WATER LOOP STATUS FOR SWITCHOVER](#)

NOTE

For switchover the payloads have to be inactive (No active cooling). The switchover should not take more than 20 minutes because of cooling requirements for equipment on cold plates.

NOTE

Continuously S-Band AOS during this operation required

PWS

1.1 [Determination of Active Pump and Redundancy Status](#)

TCS:

[TCS Functional Overview](#)

'Water Pump Assemblies'

Verify Active WPA – WPA1

Verify Redun WPA – AVAIL

Verify WPA_Active_Pump_SW – WPA1

Verify WPA_Redun_Stat_SW – AVAIL

1.2 [Check Power Source for WPA2](#)

EPDS: PSU2: 120V Subsys

[PDU2 120V Subsys](#)

'PDU2 Outlets 17'

Verify Pwr – ON

EPDS: PDU2 28V Subsys

[PDU2 28V Subsys](#)

'PDU2 Outlets 31'

Verify Pwr – ON

2.101 TCS LOOP WPA1 TO WPA2 SWITCHOVER - AUTO

(ASSY MAL/1E/FIN/MULTI E)

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'PDU2 Outlets 33'

Verify Pwr – ON

'PDU2 Outlets 34'

Verify Pwr – ON

'PDU2 Outlets 37'

Verify Pwr – ON

EPDS: PDU1 28V Subsys

PDU1 28V Subsys

'PDU1 Outlets 33'

Verify Pwr – ON

'PDU1 Outlets 34'

Verify Pwr – ON

Verify PDU2_Rack_D1_Pwr_Bus_On_Off_Stat_DMC – ON

Verify PDU2_Subsys_Pwr_Bus6_On_Off_Stat_DMC – ON

Verify PDU2_Subsys_Pwr_Bus7_On_Off_Stat_DMC – ON

Verify PDU2_Subsys_Pwr_Bus8_On_Off_Stat_DMC – ON

Verify PDU2_Subsys_Pwr_Bus9_On_Off_Stat_DMC – ON

Verify PDU1_Subsys_Pwr_Bus7_On_Off_Stat_DMC – ON

Verify PDU1_Subsys_Pwr_Bus8_On_Off_Stat_DMC – ON

1.3

Verify Cooling Status for ISPRs

NOTE

The WFSV configuration has to be checked against the current on-orbit configuration of the payloads for the specific increment. WFSV have to be in OPEN position where no ISPR are connected or the ISPR has no water cooling I/F. WFSV have to be CLOSED where ISPR are connected to the water loop.

2.101 TCS LOOP WPA1 TO WPA2 SWITCHOVER - AUTO

(ASSY MAL/1E/FIN/MULTI E)

Page 3 of 9 pages

Table 1. ISPR Location Identifiers

Location	Identifier [Y]	ISPR Installed	Water Cooling I/F
COL1A1	A1	ER	Yes
COL1A2	A2	BioLab	Yes
COL1A3	A3	EPM	Yes
COL1A4	A4	HRF 2	Yes
COL1F1	F1	EDR	Yes
COL1F2	F2	MSG	Yes
COL1F3	F3	MARES	No
COL1F4	F4	HRF 1	Yes
COL1O1	O1	FSL	Yes
COL1O2	O2	ETC	No

TCS: Plenum

TCS Plenum

'WFSV'

Where ISPR Installed and ISPR interfaces to water cooling

Verify ISPR [Y] Posn – CLOSED

Else

Verify ISPR [Y] Posn – OPEN

Verify WFSV_ISPR_A1_Close_Stat_DMC – CLOSED
 Verify WFSV_ISPR_A2_Close_Stat_DMC – CLOSED
 Verify WFSV_ISPR_A3_Close_Stat_DMC – CLOSED
 Verify WFSV_ISPR_A4_Close_Stat_DMC – CLOSED
 Verify WFSV_ISPR_F1_Close_Stat_DMC – CLOSED
 Verify WFSV_ISPR_F2_Close_Stat_DMC – CLOSED
 Verify WFSV_ISPR_F3_Open_Stat_DMC – OPEN
 Verify WFSV_ISPR_F4_Close_Stat_DMC – CLOSED
 Verify WFSV_ISPR_O1_Close_Stat_DMC – CLOSED
 Verify WFSV_ISPR_O2_Open_Stat_DMC – OPEN

2. [PERFORM WPA2 ACCUMULATOR REPRESSURAZATION](#)
 Perform [{2.104 PASSIVE WPA ACCUMULATOR RE-PRESSURIZATION/DE-PRESSURIZATION}](#), step 1 (ESA SODF: TCS)

3. [ACTIVATION OF AUTOMATIC SWITCHOVER FROM WPA1 TO WPA2](#)

NOTE

The following FLAP Performs:

- a switchover from the nominal to the redundant water loop:
- Powers WPA2
- Disables WPA1 monitoring
- Stops WPA1 pump operations
- Opens WOOV2
- Closes WOOV1
- Switch from WMV1/3 to WMV 2/4
- Starts WPA2 pump operations
- Activates Control loops of WPA2
- Sets new Accumulator quantity limits
- Enables WPA2 monitoring

Time of FLAP 12 min. The water flow will be established by WPA2 after the first 60 seconds!

3.1 [Start auto switchover with FLAP](#)

TCS: TCS Commands

TCS Commands

'WPA Commands'

cmd WPA Nom Switch Over **Execute** (OK)

TCS: WPA 2

TCS WPA 2

'WPA2 Electronics'

Verify Pwr – ON

cmd WPA_Nom_Switch_Over_AP

data Onboard_Reception_Node –
SYS CCSDS End Point DMC DMS SERV

data Onboard_Execution_Node –
USM SW DMC USS Swop Instance

Verify WPA2_Pwr_Stat_DMC – ON

3.2 [Verify Switchover Operations](#)

TCS

TCS Functional Overview

'Water Pump Assemblies'

'WPA1'

Verify Pump Running – OFF

'WOOV2'

Verify Posn – OPEN

2.101 TCS LOOP WPA1 TO WPA2 SWITCHOVER - AUTO

(ASSY MAL/1E/FIN/MULTI E)

Page 5 of 9 pages

'WOOV1'

Verify Posn – CLOSED

'WMV2 Pwr'

Verify MDV – ON

'WMV4 Pwr'

Verify MDV – ON

'WMV1 Pwr'

Verify MDV – OFF

'WMV3 Pwr'

Verify MDV – OFF

'WPA2'

Verify Pump Running – ON

'Delta Pressure Sensor Blocks'

'DPSB2'

Verify WPA2 DP1 – 40 - 44 kPa

'DPSB3'

Verify WPA2 DP2 – 40 - 44 kPa

'Water Pump Assemblies'

Verify Active WPA – WPA2

Verify WPA1_Pump_Running_Stat_DMC – OFF

Verify WOOV2_Open_Stat_DMC – OPEN

Verify WOOV1_Close_Stat_DMC – CLOSED

Verify WMV2_MDV_Pwr_Stat_DMC – ON

Verify WMV4_MDV_Pwr_Stat_DMC – ON

Verify WMV1_MDV_Pwr_Stat_DMC – OFF

Verify WMV3_MDV_Pwr_Stat_DMC – OFF

Verify WPA2_Pump_Running_Stat_DMC – ON

Verify WPA2_DPSB2_Plenum_DP1_DMC – 40 - 44 kPa

Verify WPA2_DPSB3_Plenum_DP2_DMC – 40 - 44 kPa

Verify WPA_Active_Pump_SW – WPA2

3.3

Verify Start of WPA2 Pump Operation

TCS: WPA2: WPA2 Commands

WPA 2 Commands

'Cntl Loop Stat'

2.101 TCS LOOP WPA1 TO WPA2 SWITCHOVER - AUTO

(ASSY MAL/1E/FIN/MULTI E)

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NOTE

CHX Control loop active after 30 seconds of Pump start.

Verify CHX Temp – ACTIVE
Verify Plenum Delta Press – ACTIVE
Verify Plenum Temp – ACTIVE

Verify WPA2_Plenum_Temp_Cntl_Loop_Stat_DMC – ACTIVE
Verify WPA2_Plenum_Delta_Press_Cntl_Loop_Stat_DMC – ACTIVE
Verify WPA2_CHX_Temp_Cntl_Loop_Stat_DMC – ACTIVE

G-3.3.1 Note New Lower Limits for WPA2 Accumulator Quantity 1&2

Read WPA2_Accum_Liq_Qty1_DMC – _____ Liters

Calculate new LL:

QL1 = Qty1 - 2.0Liter QL1 = _____ Liters

Read WPA2_Accum_Liq_Qty2_DMC – _____ Liters

Calculate new LL:

QL2 = Qty2 - 2.0 Liter QL2 = _____ Liters

cmd DMS_MONIT_Read_Analog_Limit_Cmd_SW
prm MT_ID – DMC_Sys_Monitoring_Table_SW
prm EI_ID – WPA2_Accum_Liq_Qty1_DMC
prm LIMIT_SET_ID – 0 (first limit set)

data Onboard_Node –
SYS CCSDS End Point DMC DMS SERV

Command Response:

Verify Out: SOFT_LOW_LIMIT_VALUE, Real: – QL1 +- 0.2

cmd DMS_MONIT_Read_Analog_Limit_Cmd_SW
prm MT_ID – DMC_Sys_Monitoring_Table_SW
prm EI_ID – WPA2_Accum_Liq_Qty2_DMC
prm LIMIT_SET_ID – 0 (first limit set)

data Onboard_Node –
SYS CCSDS End Point DMC DMS SERV

Command Response:

Verify Out: SOFT_LOW_LIMIT_VALUE, Real: QL2 +- 0.2

G-3.3.2 Verify Enabling of WPA2 Monitoring

2.101 TCS LOOP WPA1 TO WPA2 SWITCHOVER - AUTO

(ASSY MAL/1E/FIN/MULTI E)

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Verify WPA2_Accum_Liq_Qty1_DMC_MS – NORMAL_1
Verify WPA2_Accum_Liq_Qty2_DMC_MS – NORMAL_1
Verify WPA2_Massflow_DMC_MS – NORMAL_1
Verify WPA2_Pump_DP_DMC_MS – NORMAL_1
Verify WPA2_Water_Flow_DMC_MS – NORMAL_1
Verify WPA2_Input_Current_DMC_MS – NORMAL_1
Verify WPA2_EU_Sec_Voltage_Plus5V_DMC_MS –
NORMAL 1
Verify WPA2_EU_Sec_Voltage_Plus15V_DMC_MS –
NORMAL 1
Verify WPA2_EU_Sec_Voltage_Plus28V_DMC_MS –
NORMAL 1
Verify WPA2_EU_Sec_Voltage_Minus15V_DMC_MS –
NORMAL 1
Verify WPA2_DPSB2_Plenum_DP1_DMC_MS – NORMAL_1
Verify WPA2_DPSB3_Plenum_DP2_DMC_MS – NORMAL_1
Verify WPA2_WD_Stat_DMC_MS – NORMAL_1
Verify WPA2_Accum_Pressure1_DMC_MS – NORMAL_1
Verify WPA2_Accum_Pressure2_DMC_MS – NORMAL_1
Verify WPA2_WTSB2_Plenum_Temp1_DMC_MS –
NORMAL 1
Verify WPA2_WTSB2_Plenum_Temp2_DMC_MS –
NORMAL 1
Verify WPA2_WTSB4_CHX_Temp1_DMC_MS – NORMAL_1
Verify WPA2_WTSB4_CHX_Temp2_DMC_MS – NORMAL_1

G-3.3.3 Enable Monitoring for Accumulator Pressure MVD Measurements

Verify WPA2_Accum_Abs_Press1_MVD – 165-195 kPa
Verify WPA2_Accum_Abs_Press2_MVD – 165-195 kPa

cmd DMS_MONIT_Ena_Monitoring_Cmd_SW
prm MT_ID DMC_Sys_Monitoring_Table_SW
prm EI_ID WPA2_Accum_Abs_Press1_MVD
prm Limit_Set_ID 0 (First Limit Set)

data Onboard_Node
SYS CCSDS End Point DMC DMS SERV

cmd DMS_MONIT_Ena_Monitoring_Cmd_SW
prm MT_ID DMC_Sys_Monitoring_Table_SW
prm EI_ID WPA2_Accum_Abs_Press2_MVD
prm Limit_Set_ID 0 (First Limit Set)

2.101 TCS LOOP WPA1 TO WPA2 SWITCHOVER - AUTO

(ASSY MAL/1E/FIN/MULTI E)

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data Onboard_Node

SYS CCSDS End Point DMC DMS SERV

Verify WPA2_Accum_Abs_Press1_MVD_MS – NORMAL_1

Verify WPA2_Accum_Abs_Press2_MVD_MS – NORMAL_1

G-3.3.4. Verify Disabling of WPA1 Monitoring

Verify WPA1_Massflow_DMC_MS – NOTMON_1

Verify WPA1_Pump_DP_DMC_MS – NOTMON_1

Verify WPA1_Water_Flow_DMC_MS – NOTMON_1

Verify WPA1_Input_Current_DMC_MS – NOTMON_1

Verify WPA1_EU_Sec_Voltage_Plus5V_DMC_MS –
NOTMON 1

Verify WPA1_EU_Sec_Voltage_Plus15V_DMC_MS –
NOTMON 1

Verify WPA1_EU_Sec_Voltage_Plus28V_DMC_MS –
NOTMON 1

Verify WPA1_EU_Sec_Voltage_Minus15V_DMC_MS –
NOTMON 1

Verify WPA1_DPSB1_Plenum_DP1_DMC_MS – NOTMON_1

Verify WPA1_DPSB3_Plenum_DP2_DMC_MS – NOTMON_1

Verify WPA1_WD_Stat_DMC_MS – NOTMON_1

Verify WPA1_WTSB1_Plenum_Temp1_DMC_MS –
NOTMON 1

Verify WPA1_WTSB1_Plenum_Temp2_DMC_MS –
NOTMON 1

Verify WPA1_WTSB3_CHX_Temp1_DMC_MS – NOTMON_1

Verify WPA1_WTSB3_CHX_Temp2_DMC_MS – NOTMON_1

Verify WPA1_Accum_Abs_Press1_MVD_MS – NOTMON_1

Verify WPA1_Accum_Abs_Press2_MVD_MS – NOTMON_1

Verify WPA1_Accum_Pressure1_DMC_MS – NOTMON_1

Verify WPA1_Accum_Pressure2_DMC_MS – NOTMON_1

G-3.3.5 Check WPA1 Quantity Levels for Check Valve Failure

NOTE

FLAP has 10 minutes Wait time to monitor Narrow band monitoring of WPA1 Qty levels

Verify WPA1_Accum_Liq_Qty1_DMC – stable (+-0.02 L)

Verify WPA1_Accum_Liq_Qty2_DMC – stable (+-0.02 L)

Verify WPA1_Accum_Liq_Qty1_DMC_MS – NOTMON_1

Verify WPA1_Accum_Liq_Qty2_DMC_MS – NOTMON_1

3.4 [Verify WPA1 Power Status](#)

NOTE

FLAP has 10 minutes Wait time to monitor Narrow band monitoring of WPA1 Qty levels.

TCS: WPA1

TCS WPA 1

'WPA Electronics'

Verify Pwr – OFF

Verify WPA1_Pwr_Stat_DMC – OFF

4. [DEPRESS OF WPA1 ACCUMULATOR](#)
Perform [{2.104 PASSIVE WPA ACCUMULATOR RE-PRESSURIZATION/DE-PRESSURIZATION}](#), Step 2 (ESA SODF: TCS).

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1.601 TCS FLUID SAMPLING

(ASSY MAL/1E/FIN/MULTI E)

Page 1 of 8 pages

OBJECTIVE:

Installation of a standard ITCS Sampling Adapter to sample TCS fluid from the MT loop and to analyze the sampled fluid.

START_IMS

LOCATION:

TBD

DURATION:

TBD

CREW:

One

PARTS:

None

MATERIALS:

Rubber Gloves

Eye Protection

Dry Wipes

Ziplock Bags

Return Ziplock Bag Assembly (P/N SEG46118278-701)

TOOLS REQUIRED:

Coolant Quality Monitoring Kit (CQMK) (P/N SEG46118247-301)

REFERENCED PROCEDURE(S):

3.1.602 ADJUSTMENT OF TCS FLUID SAMPLING ADAPTER METERING VALVE

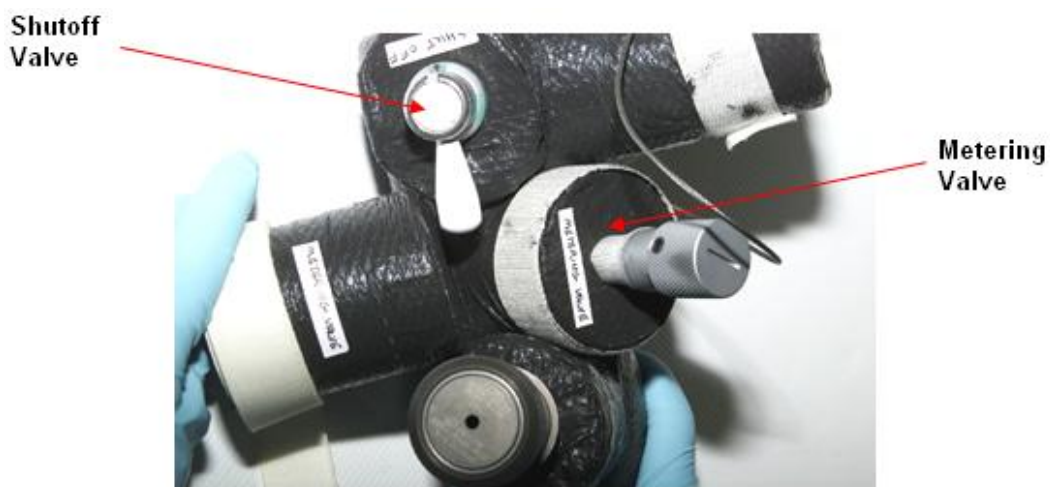


Figure 1. TCS Fluid Sampling Adapter (Typical Configuration)

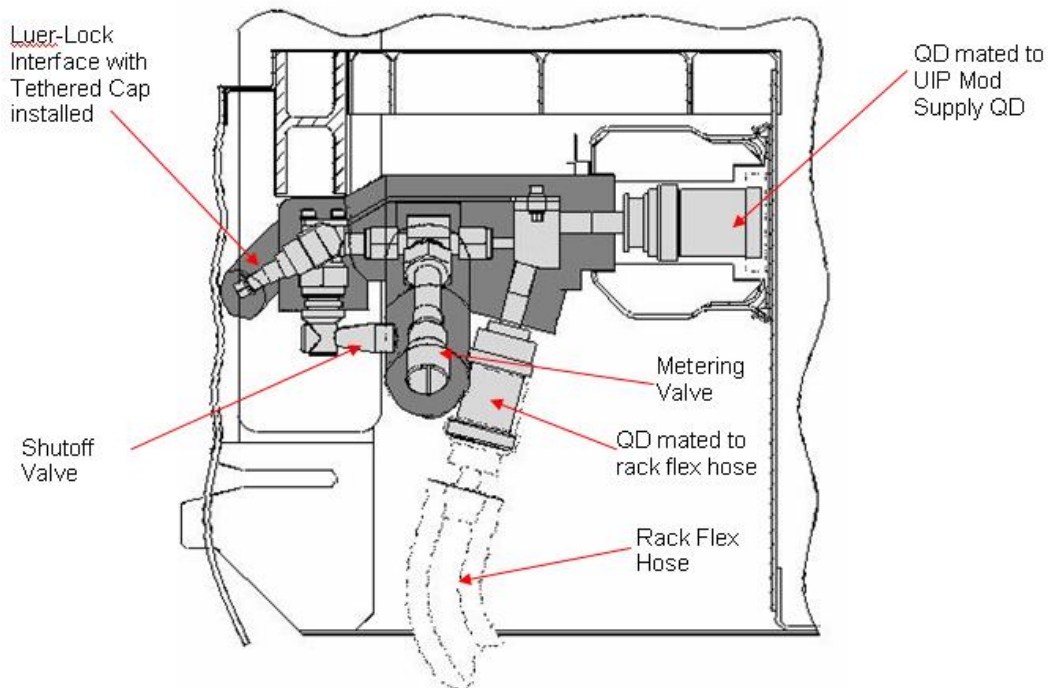


Figure 2. TCS Sampling Adapter (Installed) (Tool highlighted light gray, insulation highlighted dark gray)

This figure will show a photograph of the UIP MT Mod Supply QD with rack flex hose connected.

Photograph is presently not available.

Figure 3. UIP MT Mod Supply

This figure will show a photograph of the TCS fluid sampling adapter mated to the UIP MT Mod Supply QD and the rack flex hose.

Photograph is presently not available.

Figure 4. TCS Sampling Adapter mated to UIP and Rack Flex Hose

1. SAFING

NOTE

Always check with COL-CC that all Columbus systems are configured as required to allow for H/W installation for fluid sampling as well as for performance of fluid sampling.

1.1 ✓COL-CC - GO for TCS fluid sampling

2. ACCESSING**NOTE**

1. TCS grade water has a TBD pH level. Wear gloves and eye protection when handling containers, connecting or disconnecting QDs. Failure to comply could result in skin/eye irritation to crew.
2. Rubber gloves must be worn to preclude contamination of the sample.

- 2.1 Disconnect the rack water coolant flex hose from the UIP MT Mod Supply QD.
Check for fluid, dry as necessary.
Refer to Figure 3.
- 2.2 Mate sampling adapter inlet QD to the UIP MT Mod Supply QD.
Refer to Figure 4.
- 2.3 Check connection for leakage.
If leaking connection.
| Notify COL-CC.
- 2.4 Mate sampling adapter outlet QD to the rack water coolant flex hose.
Refer to Figure 4.
- 2.5 Check connection for leakage.
If leaking connection.
| Notify COL-CC.
- 2.6 Don rubber gloves, eye protection.
- 2.7 Remove insulation covering Luer-Lock interface, shutoff valve.
- 2.8 Luer-Lock tethered cap ←|→ Luer-Lock interface.

CAUTION

Luer-Lock fitting on all sample bags needs to be inspected for proper attachment prior to use. The fitting on one bag failed on 7A resulting in the loss of the sample. Refer to Figure 5 for an example of good and bad attachment.

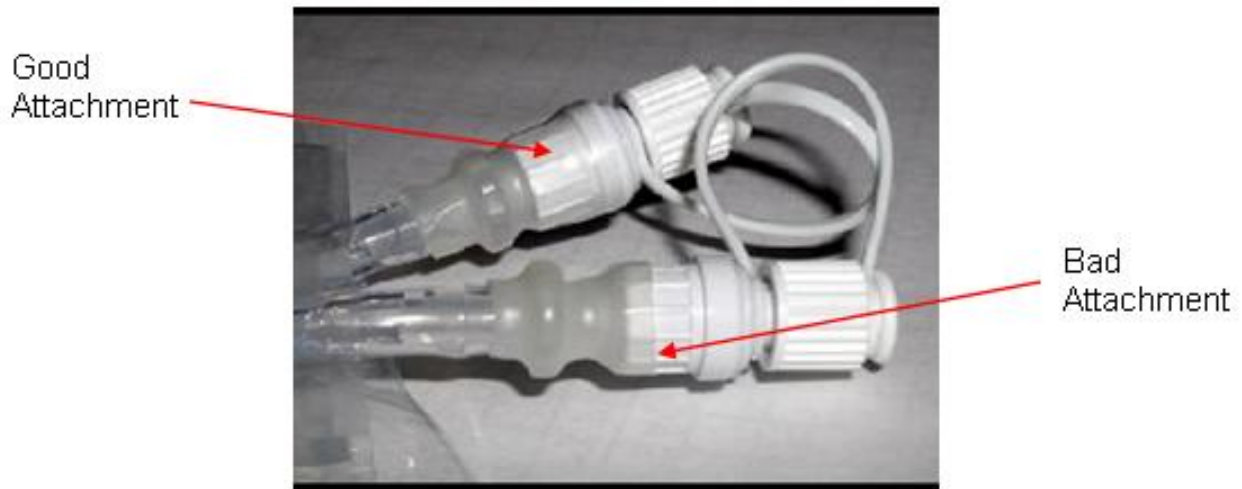


Figure 5. Properly and Improperly Attached Fittings.

3. FLUSHING

- 3.1 Inspect sample bag, then:
TCS Sample Port Flush Bag →|← Luer-Lock interface.

CAUTION

Overfilling flush or sample bag will result in failure of bag to contain coolant.

NOTE

Flow rate of coolant into sample bag should take approximately 1 minute to fill.

If coolant flow rate is too great or too small, refer to [{3.1.602 ADJUSTMENT OF TCS FLUID SAMPLING ADAPTER METERING VALVE}](#), all (SODF: ISS IFM: LAB: PREVENTIVE/TCS), then:

- 3.2 Slowly open shutoff valve to establish coolant flow into bag.
- 3.3 When bag has been filled with coolant, close coolant shutoff valve.
- 3.4 TCS Sample Port Flush Bag ←|→ Luer-Lock interface.
Temporarily stow bag.
Bag can be discarded if no Return to Ground samples will be taken.

NOTE

1. Ensure proper checkout is being performed for sample type taken.
For Return to Ground sample, perform steps 10 to 14.
For Ammonia sample, perform steps 15 to 22.
For pH sample, perform steps 23 to 30.
2. Label sample bags with time, date, rack, and which loop sample was taken from.
3. Coolant has been known to leak out the ends of both the Ammonia and pH Sample Bags during the fill process. Different methods can be tried to avoid this, such as doubling back the end of the bag and putting under the alligator clip or rolling up the end of the bag.

4. CHECKOUT FOR RETURN TO GROUND SAMPLE

- 4.1 Inspect sample bag, then:
Thermal Control System Sample Bag →|← Luer-Lock interface.

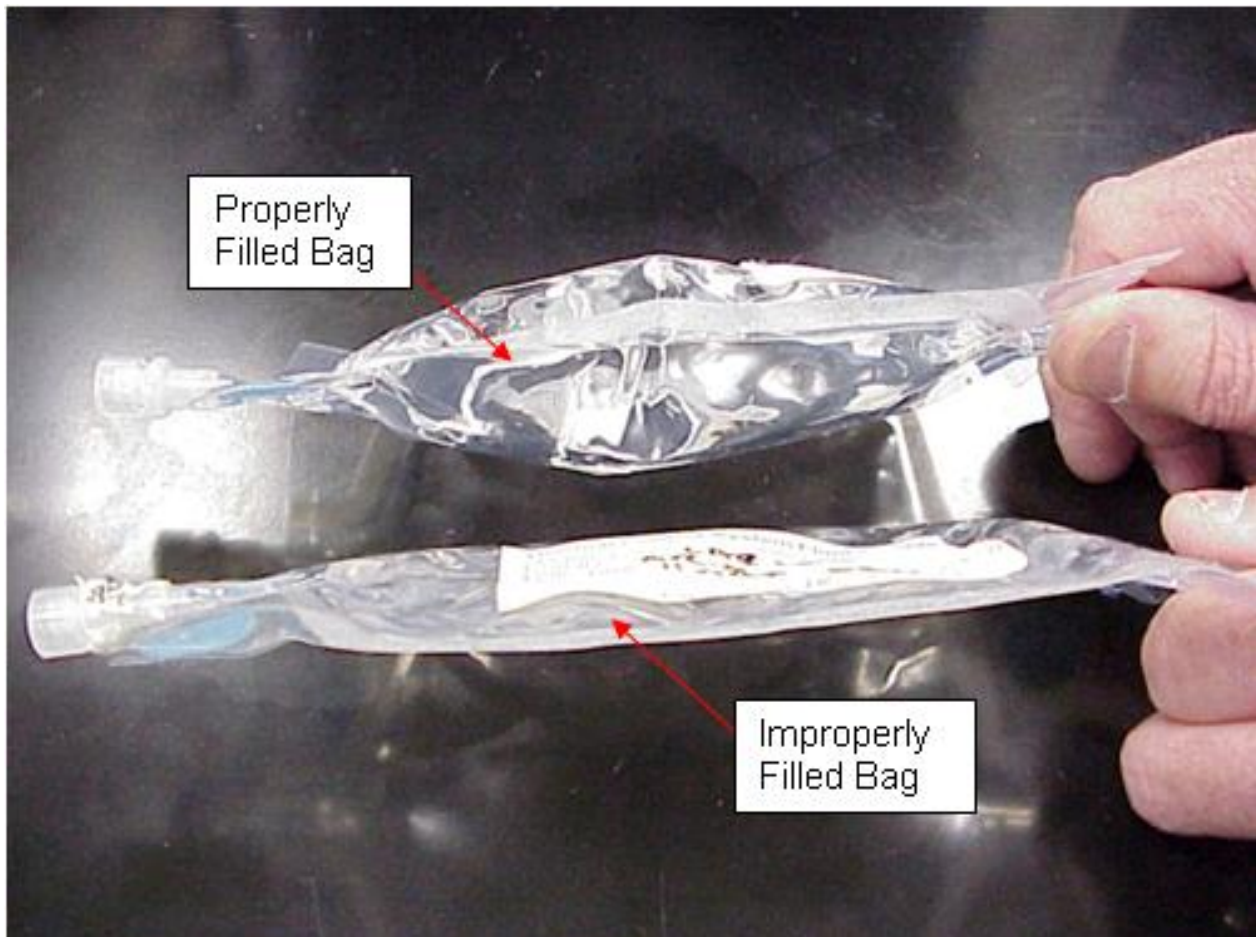


Figure 6. Properly and Improperly Filled Bags (properly filled bag contains the full 150 mL; improperly filled bag contains only 50 mL).

- 4.2 Slowly open shutoff valve to establish coolant flow into bag.
- 4.3 When bag has been filled with coolant, close coolant shutoff valve.

~
| Refer to Figure 6.

4.4 Thermal Control System Sample Bag ←|→ Luer-Lock interface.

4.5 Label sample bags.

Package Thermal Control System Sample Bag and TCS Sample Port Flush Bag in individual Ziplock Bags and then place in the Return Ziplock Bag Assembly (P/N SEG46118278-701) for return to ground.

5. CHECKOUT FOR AMMONIA TEST SAMPLE

5.1 Inspect sample bag, then:

TCS Coolant Test Strip: Ammonia Bag →|← Luer-Lock interface.

5.2 Pinch end of Test Strip Bag between fingers, slowly open shutoff valve to establish coolant flow into bag.

NOTE

For best results, Test Strip should remain in contact with fluid for 30 seconds and air dry for 30 seconds. Removal from Test Strip Bag begins drying time. If Test Strip is exposed to air or fluid for more than 60 seconds, test must be reformed.

5.4 When Test Strip Bag has been filled with coolant, close coolant shutoff valve.

5.5 TCS Coolant Test Strip: Ammonia Bag ←|→ Luer-Lock interface.

5.6 After Test Strip has been exposed to fluid for 30 seconds, pinch end of Test Strip Bag between fingers, remove Fluid Retaining Clip, remove Test Strip from Bag, reinstall Fluid Retaining Clip on Bag. Removal from Test Strip Bag begins drying time.

5.7 After air drying for 30 seconds, compare Test Strip with ammonia color chart in IATC Coolant Quality Monitoring Kit.

5.8 Record results, notify **COL-CC** upon completion of procedure.

5.9 If no Return to Ground sample was taken, discard Test Strip Bag, Test Strip.
If Return to Ground sample was taken, package Ammonia Test Strip Bag in individual Ziplock Bags and then place in the Return Ziplock Bag Assembly (P/N SEG46118278-701) for return to ground.

6. CHECKOUT FOR PH TEST SAMPLE

6.1 Inspect sample bag, then:

TCS Coolant Test Strip: pH Bag →|← Luer-Lock interface.

6.2 Pinch end of Test Strip Bag between fingers, slowly open shutoff valve to establish coolant flow into bag.

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NOTE

For best results, Test Strip should remain in contact with fluid for 30 seconds and air dry for 30 seconds. Removal from Test Strip Bag begins drying time. If Test Strip is exposed to air or fluid for more than 60 seconds, test must be reperformed.

- 6.3 When Test Strip Bag has been filled with coolant, close coolant shutoff valve.
- 6.4 TCS Coolant Test Strip: pH Bag ←|→ Luer-Lock interface.
- 6.5 After Test Strip has been exposed to fluid for 30 seconds, pinch end of Test Strip Bag between fingers, remove Fluid Retaining Clip, remove Test Strip from Bag, reinstall Fluid Retaining Clip on Bag. Removal from Test Strip Bag begins drying time.
- 6.6 After air drying for 30 seconds, compare Test Strip with pH color chart in IATC Coolant Quality Monitoring Kit.
- 6.7 Record results, notify **COL-CC** upon completion of procedure.
- 6.8 If no Return to Ground sample was taken, discard pH Test Strip Bag, Test Strip.
If Return to Ground sample was taken, package pH Sample Bag in individual Ziplock Bags and then place in the Return Ziplock Bag Assembly (P/N SEG46118278-701) for return to ground.

7. CLOSEOUT

NOTE

Always check for FOD around work area within 3' radius to reduce risk of crew injury by FOD hazard.

- 7.1 Demate sampling adapter from the rack water coolant flex hose. Check for fluid, dry as necessary.
- 7.2 Disconnect sampling adapter from the UIP MT Mod Supply QD. Check for fluid, dry as necessary.
- 7.3 Connect the rack water coolant flex hose to the UIP MT Mod Supply QD.
- 7.4 Check connection for leakage.
If leaking connection
| Notify **COL-CC**
- 7.5 Luer-Lock tethered cap →|← Luer-Lock interface.
- 7.6 Reinstall insulation covering Luer-Lock Interface, shutoff valve
- 7.7 Temporary stow fluid sampling adapter.

8. POST MAINTENANCE

- 8.1 Notify **COL-CC** of task completion, report test results, problems and anomalies.
- 8.2 Update IMS.
Stow Coolant Quality Monitoring Kit, materials.

MALFUNCTION

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CRIB SHEETS NODE 2 PREP FOR COLUMBUS VESTIBULE OUTFITTING

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Failure	Workaround	Cause	Impact
STEP 1 – COLUMBUS LAPTOP SETUP			
TBD			If unable to set up laptop, ground will be in charge of all commanding for activation.
STEP 2 – LAN MATE PREP			
TBD			
STEP 3 – INSTALL AND ACTIVATE PORTABLE FAN (if required)			
STEP 4 – POWER DOWN EQUIPMENT ON DDCU N2D4B AND N2D1B			
Step 4.1: MTL SFCA CLC - Ena	Continue with procedure	Software failure	Step 13.3 affected in { NODE 2 RECOVERY } (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
Step 4.2: PPA Inlet Pressure < 166 kPa	1) Perform TBD Node2 ITCS Repress procedure. 2) Continue with procedure. Pump can operate at pressure as low as 124 kPa	Back pressure on accumulator	None, PPA able to operate about 193 kPa
Step 4.2: PPA Inlet Pressure > 193 kPa	1) Perform TBD Node 2 ITCS Depress, then perform TBD Node 2 ITCS Repress procedure. 2) Continue with procedure. Pump can operate at pressure as high as 690 kPa		Steps 13.1 and 13.2 affected in { NODE 2 RECOVERY } (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
Step 4.X: MTL NIA State - Ena	Continue with procedure	Software failure	Steps 13.1 and 13.2 affected in { NODE 2 RECOVERY } (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
Step 4.3: RPCM_N21B4B_B RT FDIR Status - Ena	Suppress C&W and continue with procedure	Software problem	Will receive nuisance Caution and Warning

CRIB SHEETS NODE 2 PREP FOR COLUMBUS VESTIBULE OUTFITTING
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Failure	Workaround	Cause	Impact
Step 4.3: RPCM_N21B4B_B RT Status - Ena	Suppress C&W and continue with procedure	Software problem	Will receive nuisance Caution and Warning
Step 4.4: RPCM_N21B4B_A RT FDIR Status - Ena	Suppress C&W and continue with procedure	Software problem	Will receive nuisance Caution and Warning
Steps 4.5 and 4.6: DDCU N2DXB RT FDIR Status - Ena	Suppress C&W and continue with procedure	Software problem	Will receive nuisance Caution and Warning
STEP 5 – POWER DOWN DDCU N2D4B			
Step 5.1: DDCU N2D4B Share Ratio, % > 0	Continue with procedure, crew must monitor DDCU output voltage during Power cable W5013 mate, steps 5.2 thru 5.4 {COLUMBUS VESTIBULE OUTFITTING} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)		Lack of proper number of safety inhibits in place. Do we really need 2 safety inhibits ? Consider MBSU workaround. Step 3 affected in {NODE 2 RECOVERY} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
Step 5.2 (1 of 2 indications): MBSU 4 RBI 10 Position – CI or MBSU 4 RBI 10 Voltage is not in the range of –5 to 5 V	Continue with procedure	Sensor failure	None
Step 5.2 (2 of 2 indications): MBSU 4 RBI 10 Position – CI and MBSU 4 RBI 10 Voltage is not in the range of –5 to 5 V	Continue with procedure, crew must monitor DDCU output voltage during Power cable W5013 mate, steps 5.2 thru 5.4 {COLUMBUS VESTIBULE OUTFITTING} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)	MBSU RBI failure	Lack of proper number of safety inhibits in place. Step 3 affected in {NODE 2 RECOVERY} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
Step 5.2: DDCU N2D4B Integration Counter is incrementing	Continue with procedure, crew must monitor DDCU output voltage during Power cable W5013 mate, steps 5.2 thru 5.4 {COLUMBUS VESTIBULE OUTFITTING} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)	MBSU RBI failure	Lack of proper number of safety inhibits in place. Step 3 affected in {NODE 2 RECOVERY} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)

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Failure	Workaround	Cause	Impact
STEP 6 – POWER DOWN DDCU N2D1B			
Step 6.1: DDCU N2D1B Output Voltage > 12.8V	1) Check downstream RPCM loads 2) Continue with procedure, crew must monitor DDCU output voltage during Power cable W5013 mate, steps 5.2 thru 5.4 {COLUMBUS VESTIBULE OUTFITTING} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)	1) DDCU N2D1B failed on. 2) DDCU N2D1B may be off but DDCU N2D4B is failed on. 3) If there are downstream loads, then Converter failure. If no downstream loads then sensor failure.	Lack of proper number of safety inhibits in place. Do we really need 2 safety inhibits ? Consider MBSU workaround. Step 4 affected in {NODE 2 RECOVERY} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
Step 6.2 (1 of 2 indications): MBSU 1 RBI 11 Position – CI or MBSU 1 RBI 11 Voltage is not in the range of –5 to 5 V	Continue with procedure	Sensor failure	None
Step 6.2 (2 of 2 indications): MBSU 1 RBI 11 Position – CI and MBSU 1 RBI 11 Voltage is not in the range of –5 to 5 V	Continue with procedure, crew must monitor DDCU output voltage during Power cable W5013 mate, steps 5.2 thru 5.4 {COLUMBUS VESTIBULE OUTFITTING} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)	MBSU RBI failure	Lack of proper number of safety inhibits in place. Step 4 affected in {NODE 2 RECOVERY} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
Step 6.2: DDCU N2D1B Integration Counter is incrementing	Continue with procedure, crew must monitor DDCU output voltage during Power cable W5013 mate, steps 5.2 thru 5.4 {COLUMBUS VESTIBULE OUTFITTING} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)	MBSU RBI failure	Lack of proper number of safety inhibits in place. Step 4 affected in {NODE 2 RECOVERY} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)

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Failure	Workaround	Cause	Impact
STEP 7 – DEACTIVATE ECLSS EQUIPMENT FOR PORT DDCU POWERDOWNS			
Step 7.1 (1 of 2 indications): Node 2 Fwd Stbd IMV Fan – On or Node 2 Fwd Stbd IMV Fan Speed is NOT 7164 ± 3 RPM	Continue with procedure, TBD MAL prior to {NODE 2 RECOVERY} (SODF: ASSY OPS: ACTIVATION & CHECKOUT) procedure?	Sensor Failure	None, Step 7.9 affected in {NODE 2 RECOVERY} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
Step 7.1 (2 of 2 indications): Node 2 Fwd Stbd IMV Fan – On and Node 2 Fwd Stbd IMV Fan Speed is NOT 7164 ± 3 RPM	Continue with procedure	Fan controller failure	Will receive C&W, associated RPC opened in Step 8.1. Step 7.9 affected in {NODE 2 RECOVERY} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
Step 7.2: Node 2 IMV Fwd Port Vlv – Enabled	Continue with procedure	Command not working, C&C software issue or loss of comm with MDM	None, this valve will unpowered in Step 8.2
Step 7.3: Node 2 IMV Fwd Stbd Vlv – Enabled	Continue with procedure	Command not working, C&C software issue or loss of comm with MDM	None, this valve will unpowered in Step 8.3
Step 7.4: Node 2 IMV Aft Port Vlv – Enabled	Continue with procedure	Command not working, C&C software issue or loss of comm with MDM	None, this valve will unpowered in Step 8.4
Step 7.5: Node 2 IMV Aft Stbd Vlv – Enabled	Continue with procedure	Command not working, C&C software issue or loss of comm with MDM	None, this valve will unpowered in Step 8.5
Step 7.6 (1 of 2 indications): CCAA State – EIB On or CCAA Command Status is not Stop Complete	Continue with procedure	Software failure	None, Step 7 affected in {NODE 2 RECOVERY} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)

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Failure	Workaround	Cause	Impact
Step 7.6 (2 of 2 indications): CCAA State – EIB On and CCAA Command Status is not Stop Complete	TBD, continue with procedure	TBD	CCAA is powered down in Step 8.6. Step 7 affected in {NODE 2 RECOVERY} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
Step 7.6 (1 of 2 indications): Node 2 CCAA Water Separator Speed ≠ 4964 RPM or Node 2 CCAA Fan Speed ≠ 2000 RPM	Continue with procedure	Sensor failure	None, Step 7 affected in {NODE 2 RECOVERY} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
Step 7.6 (2 of 2 indications): Node 2 CCAA Water Separator Speed ≠ 4964 RPM and Node 2 CCAA Fan Speed ≠ 2000 RPM	TBD, continue with procedure	TBD	CCAA is powered down in Step 8.6. Step 7 affected in {NODE 2 RECOVERY} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
Step 7.7: Node 2 Smoke Detector 1 Monitoring – Ena	Power off Smoke Detector 1 Node 2: ECLSS: SD1 <u>Node 2 Smoke Detector 1</u> sel N21A4A C RPC 06 <u>RPCM N21A4A C 06</u> cmd RPC Position - Open (√RPC Position - Open)	Control of SD failure	None, there will be no air monitoring so there could be indications given, such as C&W, about false fires.
Step 7.8: Node 2 Smoke Detector 2 Monitoring – Ena	Continue with procedure	Control of SD failure	None, deactivated when open RPC in the second part of the step (7.8).
Step 7.8: RPCM N22A3B C RPC 01 Position - CI	Continue with procedure	RPC position failure	None, Step 7.2 affected in {NODE 2 RECOVERY} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)

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Failure	Workaround	Cause	Impact
STEP 8 – POWERDOWN ECLSS EQUIPMENT FOR PORT DDCU POWERDOWNS			
Step 8.1: RPCM N22A3B A RPC 11 Position - CI	Continue with procedure	RPC failed	None, fan turned off in Step 7.1
Step 8.2: RPCM N22A3B C RPC 05 Position – CI	Continue with procedure	RPC failed	None, Fwd Port IMV valve disabled in Step 7.2
Step 8.3: RPCM N22A3B C RPC 03 Position – CI	Continue with procedure	RPC failed	None, Fwd Stbd IMV valve disabled in Step 7.3
Step 8.4: RPCM N22A3B C RPC 04 Position - CI	Continue with procedure	RPC failed	None, Aft Port IMV valve disabled in Step 7.4
Step 8.5: RPCM N22A3B C RPC 07 Position - CI	Continue with procedure	RPC failed	None, Aft Stbd IMV valve disabled in Step 7.5
Step 8.6: RPCM N22A3B C RPC 13 Position - CI	Continue with procedure	RPC failed	None, CCAA deactivated in Step 7.6
Step 8.6: RPCM N22A3B C RPC 14 Position - CI	Continue with procedure	RPC failed	None, CCAA deactivated in Step 7.6
Step 8.6: RPCM N22A3B C RPC 15 Position - CI	Continue with procedure	RPC failed	None, CCAA deactivated in Step 7.6
Step 8.6: RPCM N22A3B C RPC 17 Position - CI	Continue with procedure	RPC failed	None, CCAA deactivated in Step 7.6
STEP 9 – CONFIGURE TCS EQUIPMENT FOR PORT DDCU POWERDOWNS			
Step 9.1: LTL NIA State - Ena	Continue with procedure		
Step 9.2: Auto Thermal Load Shed - Ena	Continue with procedure. Expect LTL Thermal Load cautions upon LTL loop shutdown. Check current LTL load shed table against loads powered off in {NODE 2 PREP} (SODF: ASSY OPS: ACTIVATION & CHECKOUT). Repower additional loads after performing {NODE 2 RECOVERY} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)	Software failure	Check current load shed table to determine impacts to recovery. Expect TBD Load Shed Table.

CRIB SHEETS NODE 2 PREP FOR COLUMBUS VESTIBULE OUTFITTING
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Failure	Workaround	Cause	Impact
Step 9.3: IATCS Status – not Idle	1) Resend the shutdown command 2) Check telemetry at Node 2: TCS: LTL Software and Node 2: TCS: IATCS Details and report to MCC-H 3) Check with MCC-H	1) Command failure 2) Software failure 3) Controller failure	None, Step 8 affected in { NODE 2 RECOVERY } (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
Step 9.3: Shutdown Power Request – blank	Continue with procedure, only used to trigger LTL Thermal Load Shed	Software/Sensor Failure	None
Step 9.3: TWMV Software LTL CLC – Ena or Regen TWMV Software LTL CLC – Ena or SFCA Software Mod Vlv CLC – Ena	Continue with procedure	Software Failure	None
Step 9.3: PPA Software LTL – Started	1) Resend Shutdown commands 2) Turn off the power to the PPA Node 2: TCS: LTL PPA Node 2: TCS: LTL PPA Commands: RPCM N22A3A B RPC 17 RPCM N22A3A B RPC 17 √Open Cmd - Ena cmd RPC Position – Open Verify RPC Position – Op	1) Software Error 2) Pump is still running	None, DDCU power removed from the RPCM in Steps 12 and 13.
Step 9.3: PPA Pump Speed is > 54 rpm	Continue with procedure. Expect LTL Shutdown Failure caution.	Sensor Failure	None, DDCU power removed from the RPCM in Steps 12 and 13.
Steps 9.4: PPA N2-2 RT FDIR Status - Ena	Suppress C&W and continue with procedure	Software problem	Will receive nuisance C&W
Steps 9.4: PPA N2-2 RT Status - Ena	Suppress C&W and continue with procedure	Software problem	Will receive nuisance C&W

CRIB SHEETS NODE 2 PREP FOR COLUMBUS VESTIBULE OUTFITTING
 (ASSY MAL/1E/FIN/MULTI E)

Failure	Workaround	Cause	Impact
STEP 10 – CONFIGURE NODE 2-2 MDM FOR POWERDOWN			
Step 10.1: MDM N2-2 RT FDIR Status - Ena	Continue with procedure		Expect bus swapping and receiving multiple nuisance C&W
Step 10.2: MDM N2-2 RT Status – Ena	Continue with procedure		Inhibit Primary INT MDM Auto Transition to Diagnostics. Will receive nuisance C&W
Step 10.3: RPCM N22A3A B RPC 02 and/or 04 Position - CI	Continue with procedure	RPC failed	None, Power will be removed in Steps 12 and 13
Step 10.4: RPCM N22A3A B RPC 01 Position - CI	Continue with procedure	RPC failed	None, Power will be removed in Steps 12 and 13; will receive nuisance C&W
STEP 11 – CONFIGURE NODE 2 EPS FOR PORT DDCU POWERDOWNS			
Step 11.2: UOP 3 NOD2PD4 - CI	Continue with procedure	RPC failed closed	None, Power will be removed in Steps 12 and 13

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Failure	Workaround	Cause	Impact
Step 11.3: RPCM_N22A3A_B RT Status – Ena	Continue with procedure	Software failure	Will receive nuisance C&W; power removed from RPCMs in Steps 12 and 13
Step 11.3 – 11.5: RPCM_N22A3A_X RT FDIR Status – Ena	Continue with procedure	Software failure	Will receive nuisance C&W
Step 11.6: DDCU N2PXA RT FDIR Status – Ena	Continue with procedure	Software failure	Will receive nuisance C&W
STEP 12 – POWERDOWN DDCU N2P2A			
Step 12.1: DDCU N2P2A Share Ratio, % > 0	Continue with procedure, crew must monitor DDCU output voltage during Power cable W5012 mate, steps 5.5 thru 5.7 {COLUMBUS VESTIBULE OUTFITTING} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)		Lack of proper number of safety inhibits in place. Do we really need 2 safety inhibits ? Consider MBSU workaround. Step 1 affected in {NODE 2 RECOVERY} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
Step 12.2 (1 of 2 indications): MBSU 2 RBI 3 Position – Cl or MBSU 2 RBI 3 Voltage is not in the range of –5 to 5 V	Continue with procedure	Sensor failure	None
Step 12.2 (2 of 2 indications): MBSU 2 RBI 3 Position – Cl and MBSU 2 RBI 3 Voltage is not in the range of –5 to 5 V	Continue with procedure, crew must monitor DDCU output voltage during Power cable W5012 mate, steps 5.5 thru 5.7 {COLUMBUS VESTIBULE OUTFITTING} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)	MBSU RBI failure	Lack of proper number of safety inhibits in place. Step 1 affected in {NODE 2 RECOVERY} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)

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Failure	Workaround	Cause	Impact
Step 12.2: DDCU N2P2A Integration Counter is incrementing	Continue with procedure, crew must monitor DDCU output voltage during Power cable W5012 mate, steps 5.5 thru 5.7 {COLUMBUS VESTIBULE OUTFITTING} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)	MBSU RBI failure	Lack of proper number of safety inhibits in place. Step 1 affected in {NODE 2 RECOVERY} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
STEP 13 – POWERDOWN DDCU N2P3A			
Step 13.1: DDCU N2P3A Output Voltage > 12.8 V	1) Check downstream RPCM loads 2) Continue with procedure, crew must monitor DDCU output voltage during Power cable W5012 mate, steps 5.5 thru 5.7 {COLUMBUS VESTIBULE OUTFITTING} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)	1) DDCU N2P3A failed on. 2) DDCU N2P3A may be off but DDCU N2P2A is failed on. 3) If there are downstream loads, then Converter failure. If no downstream loads then sensor failure.	Lack of proper number of safety inhibits in place. Do we really need 2 safety inhibits ? Consider MBSU workaround. Step 2 affected in {NODE 2 RECOVERY} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
Step 13.2 (1 of 2 indications): MBSU 3 RBI 3 Position – CI or MBSU 3 RBI 3 Voltage is not in the range of –5 to 5 V	Continue with procedure	Sensor failure	None
Step 13.2 (2 of 2 indications): MBSU 3 RBI 3 Position – CI and MBSU 3 RBI 3 Voltage is not in the range of –5 to 5 V	Continue with procedure, crew must monitor DDCU output voltage during Power cable W5012 mate, steps 5.5 thru 5.7 {COLUMBUS VESTIBULE OUTFITTING} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)	MBSU RBI failure	Lack of proper number of safety inhibits in place. Step 2 affected in {NODE 2 RECOVERY} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)

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Failure	Workaround	Cause	Impact
Step 13.2: DDCU N2P3A Integration Counter is incrementing	Continue with procedure, crew must monitor DDCU output voltage during Power cable W5012 mate, steps 5.5 thru 5.7 {COLUMBUS VESTIBULE OUTFITTING} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)	MBSU RBI failure	Lack of proper number of safety inhibits in place. Step 2 affected in {NODE 2 RECOVERY} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
STEP 14 – 1553 BUS SAFING STEPS			
Step 14.1: BC Comm Fail – Enable	Continue with procedure		Will receive nuisance C&W
Step 14.2: Auto Channel Switch Status – Enable (Any)	If some channels on B and can't get to A, then move all channels to B		None, receive nuisance C&W. Step 7 affected in {COLUMBUS VESTIBULE OUTFITTING} (SODF: ASSY OPS: ACTIVATION & CHECKOUT) - Steps will need to be performed in the following order: 7.7, 7.8, 7.3-7.6 (for Channel A), and 7.1-7.2 Expected FDAs for mating on active channel?

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CRIB SHEETS NODE 2 RECOVERY
 (ASSY MAL/1E/FIN/MULTI E)

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Failure	Workaround	Cause	Impact
STEP 1 – POWER UP DDCU N2P2A			
Step 1.1: DDCU N2P2A Integration Counter is not Incrementing	Continue with procedure	DDCU failure	Loss of DDCU redundancy. Perform appropriate DDCU malfunction procedure when time is available.
Step 1.1 (2 of 2 indications): MBSU 2 RBI 3 Position – Open and DDCU N2P2A Input Voltage < 119.2 V	Continue with procedure	RBI Failed to Close	Loss of DDCU redundancy. Perform appropriate MBSU malfunction procedures when time is available.
Step 1.1 (2 of 2 indications): MBSU 2 RBI 3 Position – Closed and DDCU N2P2A Input Voltage < 119.2 V	Continue with procedure	Isolate Cause. Compare DDCU Input Voltage to RBI Output Voltage. 1) If values agree to within +/- 6 V then RBI is not passing power. 2) If values do not agree then sensor failure.	1) Loss of DDCU redundancy. Perform appropriate MBSU malfunction procedures when time is available. 2) None
Step 1.1 (2 of 2 indications): MBSU 2 RBI 3 Position – Closed and DDCU N2P2A Input Voltage > 168.8 V	Continue with procedure	Isolate Cause. Compare DDCU Input Voltage to RBI Output Voltage. 1) If values agree to within +/- 6 V then primary system problem. 2) If values do not agree then sensor failure.	1) Loss of DDCU redundancy. Perform appropriate malfunction procedures when time is available. 2) None
Step 1.1 (2 of 2 indications): MBSU 2 RBI 3 Position – Open and DDCU N2P2A Input Voltage in nominal range	Continue with procedure	RBI Cmded State Failure	None
Step 1.2 (1 of 2 indications): DDCU N2P2A Input Current ≠ -4 to 4A Or DDCU N2P2A Output Current ≠ -4 to 4A	Continue with procedure	All downstream DDCU loads should be initially off and current values should be within 0 +/- 4 A. Values outside this range indicate sensor failure.	None

CRIB SHEETS NODE 2 RECOVERY
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Failure	Workaround	Cause	Impact
Step 1.2: DDCU N2P2A Output Voltage < 123 or > 126 V	Continue with procedure	Isolate cause. Check downstream voltages at loads. 1) If voltages agree with DDCU voltage, then DDCU Failure 2) Otherwise, sensor failure	1) Loss of DDCU redundancy. Perform appropriate DDCU malfunction procedures when time is available. 2) None
Step 1.2 (1 of 3 indications): Converter Temp > 43.8°C or Power Supply Temp > 49.5°C or Baseplate Temp > 40.3°C	Continue with procedure	Sensor Failure	None
Step 1.2 (2 of 3 indications or 3 of 3 indications): Converter Temp > 43.8°C and/or Power Supply Temp > 49.5°C and/or Baseplate Temp > 40.3°C	Continue with procedure Refer to Flight Rule B9-602	DDCU Thermal problem	Loss of DDCU redundancy. Perform appropriate DDCU malfunction procedures when time is available.
STEP 2 – POWER UP DDCU N2P3A			
Step 2.1: DDCU N2P3A Integration Counter is not Incrementing	Continue with procedure	DDCU failure	Loss of DDCU redundancy. Perform appropriate DDCU malfunction procedure when time is available.
Step 2.1 (2 of 2 indications): MBSU 3 RBI 3 Position – Open and DDCU N2P3A Input Voltage < 119.2 V	Continue with procedure	RBI Failed to Close	Loss of DDCU redundancy. Perform appropriate MBSU malfunction procedures when time is available.
Step 2.1 (2 of 2 indications): MBSU 3 RBI 3 Position – Closed and DDCU N2P3A Input Voltage < 119.2 V	Continue with procedure	Isolate Cause. Compare DDCU Input Voltage to RBI Output Voltage. 1) If values agree to within +/- 6 V then RBI is not passing power.	1) Loss of DDCU redundancy. Perform appropriate MBSU malfunction procedures when time is available.

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Failure	Workaround	Cause	Impact
		2) If values do not agree then sensor failure.	2) None
Step 2.1 (2 of 2 indications): MBSU 3 RBI 3 Position – Closed and DDCU N2P3A Input Voltage > 168.8 V	Continue with procedure	Isolate Cause. Compare DDCU Input Voltage to RBI Output Voltage. 1) If values agree to within +/- 6 V then primary system problem. 2) If values do not agree then sensor failure.	1) Loss of DDCU redundancy. Perform appropriate malfunction procedures when time is available. 2) None
Step 2.1 (2 of 2 indications): MBSU 3 RBI 3 Position – Open and DDCU N2P3A Input Voltage in nominal range	Continue with procedure	RBI Cmded State Failure	None
Step 2.2 (1 of 2 indications): DDCU N2P3A Input Current ≠ -4 to 4A Or DDCU N2P3A Output Current ≠ -4 to 4A	Continue with procedure	All downstream DDCU loads should be initially off and current values should be within 0 +/- 4 A. Values outside this range indicate sensor failure.	None
Step 2.2: DDCU N2P3A Output Voltage < 123 or > 126 V	Continue with procedure	Isolate cause. Check downstream voltages at loads. 1) If voltages agree with DDCU voltage, then DDCU Failure 2) Otherwise, sensor failure	1) Loss of DDCU redundancy. Perform appropriate DDCU malfunction procedures when time is available. 2) None
Step 2.2 (1 of 3 indications): Converter Temp > 43.8°C or Power Supply Temp > 49.5°C or Baseplate Temp > 40.3°C	Continue with procedure	Sensor Failure	None

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Failure	Workaround	Cause	Impact
Step 2.2 (2 of 3 indications or 3 of 3 indications): Converter Temp > 43.8°C and/or Power Supply Temp > 49.5°C and/or Baseplate Temp > 40.3°C	Continue with procedure Refer to Flight Rule B9-602	DDCU Thermal problem	Loss of DDCU redundancy. Perform appropriate DDCU malfunction procedures when time is available.
STEP 3 – POWER UP DDCU N2D4B			
Step 3.1: DDCU N2D4B Integration Counter is not Incrementing	Continue with procedure	DDCU failure	Loss of DDCU redundancy. Perform appropriate DDCU malfunction procedure when time is available.
Step 3.1 (2 of 2 indications): MBSU 4 RBI 10 Position – Open and DDCU N2D4B Input Voltage < 119.2 V	Continue with procedure	RBI Failed to Close	Loss of DDCU redundancy. Perform appropriate MBSU malfunction procedures when time is available.
Step 3.1 (2 of 2 indications): MBSU 4 RBI 10 Position – Closed and DDCU N2D4B Input Voltage < 119.2 V	Continue with procedure	Isolate Cause. Compare DDCU Input Voltage to RBI Output Voltage. 1) If values agree to within +/- 6 V then RBI is not passing power. 2) If values do not agree then sensor failure.	1) Loss of DDCU redundancy. Perform appropriate MBSU malfunction procedures when time is available. 2) None
Step 3.1 (2 of 2 indications): MBSU 4 RBI 10 Position – Closed and DDCU N2D4B Input Voltage > 168.8 V	Continue with procedure	Isolate Cause. Compare DDCU Input Voltage to RBI Output Voltage. 1) If values agree to within +/- 6 V then primary system problem. 2) If values do not agree then sensor failure.	1) Loss of DDCU redundancy. Perform appropriate malfunction procedures when time is available. 2) None
Step 3.1 (2 of 2 indications): MBSU 4 RBI 10 Position – Open and DDCU N2D4B Input Voltage in nominal range	Continue with procedure	RBI Cmded State Failure	None

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Failure	Workaround	Cause	Impact
Step 3.2 (1 of 2 indications): DDCU N2D4B Input Current \neq -4 to 4A Or DDCU N2D4B Output Current \neq -4 to 4A	Continue with procedure	All downstream DDCU loads should be initially off and current values should be within 0 +/- 4 A. Values outside this range indicate sensor failure.	None
Step 3.2: DDCU N2D4B Output Voltage < 123 or > 126 V	Continue with procedure	Isolate cause. Check downstream voltages at loads. 1) If voltages agree with DDCU voltage, then DDCU Failure 2) Otherwise, sensor failure	1) Loss of DDCU redundancy. Perform appropriate DDCU malfunction procedures when time is available. 2) None
Step 3.2 (1 of 3 indications): Converter Temp > 43.8°C or Power Supply Temp > 49.5°C or Baseplate Temp > 40.3°C	Continue with procedure	Sensor Failure	None
Step 3.2 (2 of 3 indications or 3 of 3 indications): Converter Temp > 43.8°C and/or Power Supply Temp > 49.5°C and/or Baseplate Temp > 40.3°C	Continue with procedure Refer to Flight Rule B9-602	DDCU Thermal problem	Loss of DDCU redundancy. Perform appropriate DDCU malfunction procedures when time is available.
STEP 4 – POWER UP DDCU N2D1B			
Step 4.1: DDCU N2D1B Integration Counter is not Incrementing	Continue with procedure	DDCU failure	Loss of DDCU redundancy. Perform appropriate DDCU malfunction procedure when time is available.

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Failure	Workaround	Cause	Impact
Step 4.1 (2 of 2 indications): MBSU 1 RBI 11 Position – Open and DDCU N2D1B Input Voltage < 119.2 V	Continue with procedure	RBI Failed to Close	Loss of DDCU redundancy. Perform appropriate MBSU malfunction procedures when time is available.
Step 4.1 (2 of 2 indications): MBSU 1 RBI 11 Position – Closed and DDCU N2D1B Input Voltage < 119.2 V	Continue with procedure	Isolate Cause. Compare DDCU Input Voltage to RBI Output Voltage. 1) If values agree to within +/- 6 V then RBI is not passing power. 2) If values do not agree then sensor failure.	1) Loss of DDCU redundancy. Perform appropriate MBSU malfunction procedures when time is available. 2) None
Step 4.1 (2 of 2 indications): MBSU 1 RBI 11 Position – Closed and DDCU N2D1B Input Voltage > 168.8 V	Continue with procedure	Isolate Cause. Compare DDCU Input Voltage to RBI Output Voltage. 1) If values agree to within +/- 6 V then primary system problem. 2) If values do not agree then sensor failure.	1) Loss of DDCU redundancy. Perform appropriate malfunction procedures when time is available. 2) None
Step 4.1 (2 of 2 indications): MBSU 1 RBI 11 Position – Open and DDCU N2D1B Input Voltage in nominal range	Continue with procedure	RBI Cmded State Failure	None
Step 4.2 (1 of 2 indications): DDCU N2D1B Input Current ≠ -4 to 4A Or DDCU N2D1B Output Current ≠ -4 to 4A	Continue with procedure	All downstream DDCU loads should be initially off and current values should be within 0 +/- 4 A. Values outside this range indicate sensor failure.	None

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Failure	Workaround	Cause	Impact
Step 4.2: DDCU N2D1B Output Voltage < 123 or > 126 V	Continue with procedure	Isolate cause. Check downstream voltages at loads. 1) If voltages agree with DDCU voltage, then DDCU Failure 2) Otherwise, sensor failure	1) Loss of DDCU redundancy. Perform appropriate DDCU malfunction procedures when time is available. 2) None
Step 4.2 (1 of 3 indications): Converter Temp > 43.8°C or Power Supply Temp > 49.5°C or Baseplate Temp > 40.3°C	Continue with procedure	Sensor Failure	None
Step 4.2 (2 of 3 indications or 3 of 3 indications): Converter Temp > 43.8°C and/or Power Supply Temp > 49.5°C and/or Baseplate Temp > 40.3°C	Continue with procedure Refer to Flight Rule B9-602	DDCU Thermal problem	Loss of DDCU redundancy. Perform appropriate DDCU malfunction procedures when time is available.
STEP 5 – ENABLE RT FDIR AND RT I/O FOR PORT AND DECK DDCUS			
Step 5.1-5.4: DDCU & RPCM RT FDIR Status – Inh (Any of them)	Continue with procedure	Software error	None
Step 5.3: RPCM N21B4B_B RT Status - Inh	TBD, MDM problem?	RPCM connection to bus or MDM Software failure	None, can manually move MTL SFCA valve after DDCU power up to control temp.

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Failure	Workaround	Cause	Impact
Step 5.4: RPCM N22A3A_B RT Status - Inh	TBD, MDM problem?	RPCM connection to bus or MDM Software failure	Loss of power redundancy to VTC. Steps 1, 2.1, 2.2, 2.4, and 4.1 affected in {COLUMBUS BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
STEP 6 – ACTIVATE AND CHECKOUT N2-2 MDM			
Step 6.1 (1 of 2 indications): Primary Int MDM Frame Count not Incrementing or Primary Int MDM Processing State not Operational	Continue with procedure	Software error	None
Step 6.1 (2 of 2 indications): Primary Int MDM Frame Count not Incrementing and Primary Int MDM Processing State not Operational	ODIN recovers backup INT MDM	Primary INT MDM failure	None

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Failure	Workaround	Cause	Impact
Step 6.3: RPCM N22A3A_B RPC 01 Position – Op	Skip to step 7 of procedure	Command was not read by the C&C MDM or loss of comm w/INT MDM or RPC failure	None, only N2-1 MDM needed for activation. Loss of commands and telemetry from N2-2 MDM, refer to TBD. Skip steps 1.2, 2.1, 2.4, and 4.1 in {COLUMBUS BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT) Will have impact on LTL loop, may have to manually activate LTL pump, have crew manipulate valves, little operating insight, and no auto temp control.
Step 6.4: MDM N2-2 RT Status - Inh	Skip to step 7 of procedure	N2-2 MDM Input/Output failure	None, only N2-1 MDM needed for activation. Loss of commands and telemetry from N2-2 MDM, refer to TBD. Skip steps 1.2, 2.1, 2.4, and 4.1 in {COLUMBUS BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT) Will have impact on LTL loop, may have to manually activate LTL pump, have crew manipulate valves, little operating insight, and no auto temp control.

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Failure	Workaround	Cause	Impact
Step 6.5 (1 of 2 indications): N2-2 MDM Frame Count not Incrementing or N2-2 MDM Processing State – not Operational	Continue with procedure	Software error	None
Step 6.5 (2 of 2 indications): N2-2 MDM Frame Count not Incrementing and N2-2 MDM Processing State – not Operational	1) Reboot/cycle RPCM N22A3A_B RPC 01 by re-performing Step 6.3 2) Continue and skip to step 7 of the procedure	1) RPC failure 2) Loss of comm w/ MDM or processing failure	None, only N2-1 MDM needed for activation. Loss of commands and telemetry from N2-2 MDM, refer to TBD. Skip steps 1.2, 2.1, 2.4, and 4.1 in {COLUMBUS BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY OPS, ACTIVATION & CHECKOUT) Will have impact on LTL loop, may have to manually activate LTL pump, have crew manipulate valves, little operating insight, and no auto temp control.
Step 6.6: RPCM N22A3A_B RPC 02 Position – Op	Continue with procedure	RPC failure	Loss of power to ARS valves
Step 6.6: RPCM N22A3A_B RPC 04 Position – Op	Continue with procedure	RPC failure	Loss of power to the C&W panel lamps
Step 6.7: MDM N2-2 RT FDIR Status - Inh	Continue with procedure	Software error	None

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Failure	Workaround	Cause	Impact
STEP 7 – RECOVER ECLSS EQUIPMENT AFTER PORT DDCU POWERUP			
Step 7.1: Node 2 Smoke Detector 1, Obscuration, % Contamination is not less than 25 or/and Node 2 Smoke Detector 1, Scatter, % Obscuration per meter is not less than 1	1) Check for smoke in the cabin, report status to MCC-H 2) Power Cycle the Smoke Detector Node 2: ECLSS: SD1 Node 2 Smoke Detector 1 sel N21A4A C RPC 06 RPCM N21A4A C 06 cmd RPC Position - Open (√RPC Position - Open) Then: Node 2: ECLSS: SD1 Node 2 Smoke Detector 1 sel N21A4A C RPC 06 RPCM N21A4A C 06 cmd RPC Position - Close (√RPC Position - Closed) 3) Open RPC 6, continue with procedure and R&R at another time	1) Smoke in Cabin 2) Smoke Detector laser is working incorrectly or lens is dirty (TBD procedure) 3) Smoke Detector 1 Failure	1) TBD 2) Loss of redundancy until SD is serviced 3) Loss of redundancy until R&R
Step 7.1 (1 of 3 indications): Node 2 Smoke Detector 1 Active BIT Failure is not blank or Node 2 Smoke Detector 1 Passive BIT Lens Status is not Clean or Node 2 Smoke Detector 1 Passive BIT Failure is not blank	Continue with procedure	Sensor failure	None

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Failure	Workaround	Cause	Impact
<p>Step 7.1 (3 of 3 indications): Node 2 Smoke Detector 1 Active BIT Failure is not blank and Node 2 Smoke Detector 1 Passive BIT Lens Status is not Clean and Node 2 Smoke Detector 1 Passive BIT Failure is not blank</p>	<p>1) Check for smoke in the cabin, report status to MCC-H 2) Power Cycle the Smoke Detector Node 2: ECLSS: SD1 Node 2 Smoke Detector 1 sel N21A4A C RPC 06 RPCM N21A4A C 06 cmd RPC Position - Open (√RPC Position - Open) Then: Node 2: ECLSS: SD1 Node 2 Smoke Detector 1 sel N21A4A C RPC 06 RPCM N21A4A C 06 cmd RPC Position - Close (√RPC Position - Closed) 3) Continue with procedure and change out at another time</p>	<p>1) Smoke in Cabin 2) Smoke Detector laser is working incorrectly or lens is dirty (TBD procedure) 3) Smoke Detector 1 Failure</p>	<p>1) TBD 2) Loss of redundancy until SD is serviced 3) Loss of redundancy until R&R</p>
<p>Step 7.2: Node 2 Smoke Detector 2 RPCM N22A3B C RPC 01 Position – Op</p>	<p>1) Power Cycle RPC Node 2: ECLSS: SD2 Node 2 Smoke Detector 2 sel N22A3B C RPC 01 RPCM N22A3B C 01 cmd RPC Position - Open (√RPC Position - Open) Then: Node 2: ECLSS: SD2 Node 2 Smoke Detector 2 sel N22A3B C RPC 01 RPCM N22A3B C 01 cmd RPC Position - Close (√RPC Position - Closed) 2) Change out RPC</p>	<p>1) Power trip 2) RPC failure</p>	<p>1) None 2) Loss of redundancy until R&R performed</p>

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Failure	Workaround	Cause	Impact
Step 7.2 : Node 2 Smoke Detector 2, Obscuration, % Contamination is not less than 25 or/and Node 2 Smoke Detector 2, Scatter, % Obscuration per meter is not less than 1	1) Check for smoke in the cabin, report status to MCC-H 2) Power Cycle the Smoke Detector Node 2: ECLSS: SD2 <u>Node 2 Smoke Detector 2</u> sel N22A3B C RPC 01 <u>RPCM N22A3B C 01</u> cmd RPC Position - Open (√RPC Position - Open) Then: Node 2: ECLSS: SD2 <u>Node 2 Smoke Detector 2</u> sel N22A3B C RPC 01 <u>RPCM N22A3B C 01</u> cmd RPC Position - Close (√RPC Position - Closed) 3) Open RPC 1, continue with procedure and R&R at another time	1) Smoke in Cabin 2) Smoke Detector laser is working incorrectly or lens is dirty (TBD procedure) 3) Smoke Detector 2 Failure	1) TBD 2) Loss of redundancy until SD is serviced 3) Loss of redundancy until R&R
Step 7.2 (1 of 3 indications): Node 2 Smoke Detector 2 Active BIT Failure is not blank or Node 2 Smoke Detector 2 Passive BIT Lens Status is not Clean or Node 2 Smoke Detector 2 Passive BIT Failure is not blank	Continue with procedure	Sensor failure	None

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Failure	Workaround	Cause	Impact
<p>Step 7.2 (3 of 3 indications): Node 2 Smoke Detector 2 Active BIT Failure is not blank and Node 2 Smoke Detector 2 Passive BIT Lens Status is not Clean and Node 2 Smoke Detector 2 Passive BIT Failure is not blank</p>	<p>1) Check for smoke in the cabin, report status to MCC-H 2) Power Cycle the Smoke Detector Node 2: ECLSS: SD2 Node 2 Smoke Detector 2 sel N22A3B C RPC 01 RPCM N22A3B C 01 cmd RPC Position - Open (√RPC Position - Open) Then: Node 2: ECLSS: SD2 Node 2 Smoke Detector 2 sel N22A3B C RPC 01 RPCM N22A3B C 01 cmd RPC Position - Close (√RPC Position - Closed) 3) Continue with procedure and change out at another time</p>	<p>1) Smoke in Cabin 2) Smoke Detector laser is working incorrectly or lens is dirty (TBD procedure) 3) Smoke Detector 2 Failure</p>	<p>1) TBD 2) Loss of redundancy until SD is serviced 3) Loss of redundancy until R&R</p>
<p>Step 7.3: Unable to activate and Checkout Node 2 CCAA with {1.513 NODE 2 CCAA ACTIVATION} Steps TBD (SODF: ECLSS: ACTIVATION AND CHECKOUT: THC)</p>	TBD	TBD	TBD
<p>Step 7.4: RPCM N22A3B C RPC 8, 9, 10, and 11 Position – Open (Any of the 4)</p>	TBD, continue with procedure	RPC failure	
<p>Step 7.4 (1 of 2 indications): Node 2 HX FCV Position Op - <blank> or Node 2 HX FCV Position Cl - √</p>	Continue with procedure	Sensor failure	None
<p>Step 7.4 (2 of 2 indications): Node 2 HX FCV Position Op - <blank> and Node 2 HX FCV Position Cl - √</p>	TBD	Valve Failure	Loss of HX valve - TBD
<p>Step 7.4 (1 of 2 indications): Node 2 Bypass FCV Position Op - √ or Node 2 Bypass FCV Position Cl - <blank></p>	Continue with procedure	Sensor failure	None

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Failure	Workaround	Cause	Impact
Step 7.4 (2 of 2 indications): Node 2 Bypass FCV Position Op - √ and Node 2 Bypass FCV Position Cl - <blank>	TBD	Valve Failure	Loss of bypass valve - TBD
Step 7.5 – 7.8: RPCM N22A3B C RPC XX Position – Op	TBD, continue with procedure	RPC failure	Loss of power to valve and degraded intermodule ventilation
Step 7.5 – 7.8 (1 of 3 indication): Node 2 IMV XX Valve Arm Status – Disarmed or Node 2 IMV XX Valve State – Inhibited or Node 2 IMV XX Valve Position is ‘not Open’	Continue with procedure	Sensor failure	None
Step 7.5 – 7.8 (3 of 3 indication): Node 2 IMV XX Valve Arm Status – Disarmed and Node 2 IMV XX Valve State – Inhibited and Node 2 IMV XX Valve Position is ‘not Open’	TBD	Valve Failure	Degraded intermodule ventilation
Step 7.9: RPCM N22A3B RPC 11 Position - Op	TBD, continue with procedure	RPC failure	Loss of ventilation (active flow)
Step 7.9: Node 2 IMV Fan State is not ‘In Transit’	Continue with procedure	TBD (Software error?)	None
Step 7.9 (1 of 2 indications): Node 2 IMV Fan State – Off or Node 2 IMV Fan Speed is < 7462 or > 9500 rpm	Continue with procedure	Sensor failure	None
Step 7.9 (2 of 2 indications): Node 2 IMV Fan State – Off and Node 2 IMV Fan Speed is < 7462 or > 9500 rpm	TBD, continue with procedure	RPC failure	Loss of ventilation (active flow)

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Failure	Workaround	Cause	Impact
Step 7.10: Unable to perform {2.301 MCA AUTO SEQUENCE LIST CHANGE}, select Lab, Node 1, Airlock, and Node 2 for MCA Sampling (SODF: ECLSS: NOMINAL: ARS)	Continue with procedure	TBD	Automatic air sampling unavailable. Step 16 affected in {COLUMBUS FINAL ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
STEP 8 – ACTIVATE AND CHECKOUT NODE 2 LOW TEMPERATURE LOOP			
Step 8.1: Node 2 RPCM N22A3A A RPC 16 Position – Op (SFCA Flow Control Valve) or Node 2 RPCM N22A3A B RPC 03 Position – Op (Three Way Valve REG HX) or Node 2 RPCM N22A3A B RPC 16 Position – Op (Three Way Valve CTB)	Change out RPC	RPC failure	LTL loop temperature cannot be controlled. Node2 DDCUs cannot remain powered without cooling
Step 8.1: Node 2 RPCM N22A3A A RPC 01 Position – Op (SFCA Shutoff Valve)	1) Start LTL loop with TBD Manual Startup procedure. 2) Change out RPC	RPC failure	LTL loop cannot be started automatically. Manual startup will leave loop without failure or leak detection response.
Step 8.1: Node 2 RPCM N22A3A A RPC 02 Position – Op (NIA Vent Valve) or Node 2 RPCM N22A3A A RPC 15 Position – Op (NIA Isolation Valve)	Continue with procedure	RPC failure	LTL loop pressure cannot be changed

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Failure	Workaround	Cause	Impact
Step 8.1: Node 2 RPCM N22A3A B RPC 17 Position – Op (LTL PPA)	<ol style="list-style-type: none"> 1) Run TBD RPCM MAL (RPCM Close Failure) 2) Go to Sngl PDU Ops 3) Powerdown RPCM loads 4) R&R RPCM after activation complete 	RPC failure	LTL loop cannot be started. Node2 DDCUs cannot remain powered without cooling Step 3 affected in {COLUMBUS FINAL ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
Step 8.2: PPA N2-2 RT Status - Inh	TBD		LTL loop cannot be started. Node2 DDCUs cannot remain powered without cooling. Step 3 affected in {COLUMBUS FINAL ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
Step 8.3: Node 2 LTL TWMV Software did not start or Node 2 LTL TWMV Temp Setpt is not 17.3 deg C or Node 2 LTL Regen TWMV Software did not start or Node 2 LTL Regen TWMV Temp Setpt is not 20.1 deg C	<ol style="list-style-type: none"> 1) Resend command 2) Check MCC- for possible valve reconfigurations performed manually 	Software error	LTL loop temperature cannot be controlled. Node2 DDCUs cannot remain powered without cooling
Step 8.3: Node 2 LTL PPA pump inlet pressure is < 124	Perform TBD Node2 ITCS Repress procedure		LTL loop cannot be started. Node2 DDCUs cannot remain powered without cooling

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Failure	Workaround	Cause	Impact
Step 8.3: Node 2 LTL PPA pump inlet pressure is > 193 kPa	1) Perform TBD Node 2 ITCS Depress, then perform TBD Node 2 ITCS Repress procedure. 2) Continue with procedure. Pump can operate at pressure as high as 690 kPa		
Step 8.3: Node 2 LTL IATCS Status is not - 'Oper' or Node 2 LTL IATCS Activation - 'In Prog'	1) If Status is 'Idle', resend Startup commands 2) Continue with procedure if pump speed is nominal 3) Check MCC-H	Software error	LTL loop cannot be started. Node2 DDCUs cannot remain powered without cooling
Step 8.3: TWMV Software LTL CLC - Inh or SFCA Software Mod Vlv CLC - Inh or PPA Software LTL - 'not Started'	1) Ground command, continue with procedure 2) Crew may need to manipulate valves	1) Software error 2) Valve misconfigured	None
Step 8.3: Node 2 PPA pump speed is < 12075 or > 14575 rpm	Check MCC-H, Run TBD MAL	Hardware or sensor failure	LTL loop cannot be started. Node2 DDCUs cannot remain powered without cooling, what are acceptable characteristics?
Step 8.4: PPA N2-2 RT FDIR Status - Inh	Continue with procedure	Software error	None
Step 8.5: LTL Parameters are out of configuration (any of them)	Check with MCC-H, continue with procedure	Possible Sensor Failure	None?
Step 8.6: Node 2 LTL NIA State - Inh	Verify pressure and continue with procedure, monitor accumulator quantities	Software error	FDIR no longer valid
Step 8.6: Node 2 LTL Leak Rcvry - Inh	1) Send command to enable failure recovery Node 2: TCS: LTL Software <u>Node2 LTL Software Commands</u> 'LTL IATCS' 'Leak Recovery' cmd Auto Shutdown Enable – Ena √ Auto Shutdown - Ena 2) Continue with procedure, monitor accumulator quantities	Software error	FDIR no longer valid

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Failure	Workaround	Cause	Impact
Step 8.7: Node 2 LTL Failure Recovery - Inh	1) Send command to enable failure recovery Node 2: TCS: LTL Software <u>Node2 LTL Software Commands</u> 'Failure Recovery' cmd Fail Rcvy Enable – Ena √Fail Rcvy - Ena 2) Continue with procedure	Software error	None, monitor system more closely
Step 8.7: Node 2 LTL SFCA Overpress Protection Status - Inh	1) Send command to enable SFCA Overpress Protection Status Node 2: TCS: LTL Software <u>Node2 LTL Software Commands</u> 'SFCA Overpress Protection' cmd SFCA Overpress Protection Enable – Ena √ SFCA Overpress Protection - Ena 2) Continue with procedure	Software error	None, monitor system more closely
Step 8.8: RPCM N22B2A A RPC 01 Position - CI	Continue with procedure	RPC failure	None
STEP 9 – COMPLETE NODE LTL ACTIVATION			
Step 9.1: Unable to set LTL TWMV to 4.5 deg C	Ground reconfig or crew reconfigure valve manually, continue with procedure	Software error	None, temperature in module slightly warmer/diminished cooling
Step 9.2: Unable to set LTL Regen TWMV to 17.3 deg C	Check with MCC-H for crew actions to reconfigure valve manually, continue with procedure	Software error	None, temperature in module slightly warmer/diminished cooling
STEP 10 – VERIFY ACTIVE COOLING FOR PORT AND OVHD DDCUS			
1 of 3 indications: Converter Temp > 43.8°C or Power Supply Temp > 49.5°C or Baseplate Temp > 40.3°C	Continue with procedure	Sensor Failure	None

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Failure	Workaround	Cause	Impact
2 of 3 indications or 3 of 3 indications: Converter Temp > 43.8°C and/or Power Supply Temp > 49.5°C and/or Baseplate Temp > 40.3°C	Refer to Flight Rule B9-602 Thermal load shed??	Failure of cooling	If there really is a cooling issue, multiple DDCUs will be impacted and we will lose half of Node 2 and one string in Columbus.
STEP 11 – COMPLETE CONFIGURATION OF RPCMS			
Unable to perform {5.420 RPCM POWER ON RESET} for RPCMs XXXX, (SODF: GND SYS: EPS: CORRECTIVE: SECONDARY POWER SYSTEM)	Continue with procedure		
STEP 12 – ACTIVATE REMAINING NODE 2 CHANNEL 2/3 EQUIPMENT			
Step 12.1: RPCM N22A3A A RPC 01 Close Command - Inh	Continue with procedure; R&R RPCM after activation	Software error	Loss of ABC-4; Step 20 affected in {COLUMBUS FINAL ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
Step 12.1: RPCM N22A3A A RPC 01 Position - Op	Continue with procedure; R&R RPCM after activation	RPC failure	Loss of ABC-4; Step 20 affected in {COLUMBUS FINAL ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
Step 12.2: RPCM N22A3A A RPC 02 Close Command - Inh	Continue with procedure; R&R RPCM after activation	Software error	Loss of ATU2; Step 20 affected in {COLUMBUS FINAL ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
Step 12.2: RPCM N22A3A A RPC 02 Position - Op	Continue with procedure; R&R RPCM after activation	RPC failure	Loss of ATU2; Step 20 affected in {COLUMBUS FINAL ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)

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Failure	Workaround	Cause	Impact
Step 12.4: UOP 2 NOD2S6 - Op	Continue with procedure	UOP failure	Loss of UOP, perform TBD procedure after activation
Step 12.4: UOP 3 NOD2PD4 - Op	Continue with procedure	UOP failure	Loss of UOP, perform TBD procedure after activation
STEP 13 – ACTIVATE REMAINING NODE 2 CHANNEL 1/4 EQUIPMENT			
Step 13.1: RPCM N21B4B_B RPC 02 Close Command – Inh	Continue with procedure	Software error	None, valve should already be in correct position
Step 13.1: RPCM N21B4B_B RPC 02 Position – Op	Continue with procedure	RPC failure	None, valve should already be in correct position
Step 13.1: RPCM N21B4B_B RPC 15 Close Command – Inh	Continue with procedure	Software error	None, valve should already be in correct position
Step 13.1: RPCM N21B4B_B RPC 15 Position – Op	Continue with procedure	RPC failure	None, valve should already be in correct position
Step 13.1: RPCM N21B4B_B RPC 16 Close Command – Inh	Continue with procedure, may require manual adjustment	Software error	None
Step 13.1: RPCM N21B4B_B RPC 16 Position – Op	Continue with procedure, may require manual adjustment	RPC failure	None
Step 13.2: Node 2 MTL NIA State - Inh	Continue with procedure	Software error	Loss of automatic MTL closed loop pressure control and no auto repress capability. Should be at a good pressure config.
Step 13.3: Node 2 MTL SFCA CLC - Inh	MCC-H can send direct valve commands if necessary. Continue with procedure.	Software error	No immediate impacts, but affects MTL cooling in the long term.

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Failure	Workaround	Cause	Impact
STEP 15 – SWITCH 1553 BUSES TO CHANNEL A AND ENABLE CH SWITCHING			
Step 15.1 – 15.4: Channel Selected – B (CB INT-1, CB INT-2, LB_CHECS_APM, or LB_PL_APM)	Continue with procedure, but do not enable Auto Channel Switch Status for that particular bus	Bus or Software failure	Loss of redundancy
Step 15.1 – 15.4: Auto Channel Switch Status – Inh (CB INT-1, CB INT-2, LB_CHECS_APM, or LB_PL_APM)	Continue with procedure	Bus or Software failure	None, loss of auto switching
Step 15.5: BC Comm Fail – Inh	Continue with procedure	Software error	None

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Failure	Workaround	Cause	Impact
STEP 1 – OPENING NODE 2 STARBOARD HATCH			
Node 2 STBD hatch will not open properly	<ol style="list-style-type: none"> 1) Check for DP/DT 2) Cycle latch handle 3) Remove MPEV, perform {1.2.508 HATCH MPEV R&R}, steps 1-4, (SODF:IFM: COMMON: CORRECTIVE: S&M) and look for FOD in Mechanism using Inspection Mirror 	FOD in mechanism	Unable to ingress the vestibule; therefore, unable to power HCU's from Node 2 DDCUs
Node 2 STBD hatch sticks during opening	<ol style="list-style-type: none"> 1) Perform {1.2.504 HATCH ROLLER ASSEMBLY R&R}, all steps, (SODF: IFM: COMMON: CORRECTIVE: S&M) 2) Panel removal {X.X.XXX NODE 2 CLOSEOUT PANEL LOCATIONS} (SODF:IFM) 	<ol style="list-style-type: none"> 1) FOD in mechanism or roller problem 2) Panel Interference 	Unable to ingress the vestibule; therefore, unable to power HCU's from Node 2 DDCUs
STEP 2 – REMOVING CBM CENTER DISK COVER			
{1.105 CBM CENTER DISK COVER REMOVAL}			
{1.105} – Step 1			
Any of the pull rings (two each turnbuckle) can not be removed from the turnbuckles	<ol style="list-style-type: none"> 1) Use pliers to loosen pull rings and remove them from turnbuckles 2) If unable to remove pull rings, proceed to workaround for Step 2. 	Damaged pull rings (out of spec, etc.)	None
{1.105} – Step 2			
Turnbuckles can not be loosened	Remove Standoff Bracket Bar Open End Wrench 3/4" Open End Wrench 5/8"	Unable to remove pull rings or damaged turnbuckles.	None

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Failure	Workaround	Cause	Impact
{1.105} – Step 4			
PIP pins are unable to be removed from the Clevis brackets	1) Use pliers to loosen PIP pins and remove from Clevis brackets 2) Remove Clevis Bracket, P-Clamp and Ground wire, non-captive fasteners, washers and shims. Ratchet, 1/4" Drive 2" Extension, 1/4" Drive 3/16" Hex Head, 1/4" Drive 5/16" Hex Head, 1/4" Drive Phillips Head Screwdriver	1) Interference with PIP pins 2) PIP pin stuck	None, center disk cover may be partially in way of work area
{1.105} – Step 5			
Unable to push the pulleys into the base of the Clevis brackets to release the restraints	1) Loosen turnbuckles 2) Remove Clevis Bracket, P-Clamp and Ground wire, non-captive fasteners, washers and shims. Ratchet, 1/4" Drive 2" Extension, 1/4" Drive 3/16" Hex Head, 1/4" Drive 5/16" Hex Head, 1/4" Drive Phillips Head Screwdriver	1) Turnbuckles were not loosened enough 2) Interference with restraints	None
Unable to slide pulleys out of Clevis bracket	1) Loosen turnbuckles 2) Remove Clevis Bracket, P-Clamp and Ground wire, non-captive fasteners, washers and shims. Ratchet, 1/4" Drive 2" Extension, 1/4" Drive 3/16" Hex Head, 1/4" Drive 5/16" Hex Head, 1/4" Drive Phillips Head Screwdriver	1) Turnbuckles were not loosened enough 2) Interference with pulleys	None
{1.105} – Step 6			
Unable to remove Standoff Bar PIP pins from restraint location on Standoff Bracket	1) Use pliers to loosen Standoff Bar PIP pins and remove from Standoff Bracket 2) Remove Standoff Bracket (non-captive fasteners and washers) Open End Wrench 3/4" Open End Wrench 5/8"	Interference with PIP pins or PIP pin stuck	None

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Failure	Workaround	Cause	Impact
{1.105} – Step 7			
Unable to remove Standoff Bar from Standoff Bracket	1) Check for FOD 2) Remove Standoff Bracket Bar Open End Wrench 3/4” Open End Wrench 5/8”	1) FOD in mechanism 2) Damaged Standoff Bar or Bracket	1) None 2) None
STEP 3 – REMOVING COLUMBUS PCBM THERMAL BLANKET			
Step 3.2: Unable to disengage any of the ground fasteners necessary for MLI removal	On MCC-H Go , cut grounding wires using Wire Cutters	Fasteners damaged or have interference	None
STEP 4 – INSTALLING ACBM TO PCBM GROUND STRAPS			
{1.102 ACBM TO PCBM GROUND STRAP INSTALLATION}			
{1.102} – Step 4			
Unable to tighten fasteners for securing the grounding strap to mounting brackets	1) Inspect fasteners on grounding strap 2) Inspect mounting brackets for FOD	1) Fasteners are unclean 2) FOD in mounting brackets	None, Loss of one grounding strap. CBM guide pins have been deemed as sufficient for grounding.
STEP 5 – INSTALLING COLUMBUS POWER JUMPERS			
Step 5.2: Unable to remove protective caps from Node 2 (J99) and COL (J02) bulkheads	Use connector pliers to remove caps	Caps incorrectly placed on bulkhead or interference	Loss of Power String 1, Perform {SINGLE PDU2 BERTHED SURVIVAL MODE ACTIVATION} and {SINGLE PDU2 FINAL ACTIVATION} (SODF: ASSY OPS: CONTINGENCY)
Step 5.3: Unable to remove protective caps from POWER FEEDER APM1 jumper (W5013)	Use connector pliers to remove caps	Caps incorrectly connected to jumper or interference	Loss of Power String 1, Perform {SINGLE PDU2 BERTHED SURVIVAL MODE ACTIVATION} and {SINGLE PDU2 FINAL ACTIVATION} (SODF: ASSY OPS: CONTINGENCY)

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Failure	Workaround	Cause	Impact
<p>Step 5.4: Unable to install POWER FEEDER APM1 jumper (W5013) P99 to J99 on the Node 2 side or Unable to install POWER FEEDER APM1 jumper (W5013) P02 to J02 on the COL side</p>	<p>1) Inspect connectors for FOD</p> <p>2) Make sure that the key on the connector is clocked correctly when trying to mate it.</p> <p>3) Inspect connectors for bent pins. If there is a bent pin, possibly straighten pin On MCC-H Go. If not successful, recap any exposed connectors</p>	<p>1) FOD in jumper/bulkhead interface</p> <p>2) Mating with key clocked incorrectly</p> <p>3) Bent pin on jumper</p>	<p>Loss of Power String 1, Perform {SINGLE PDU2 BERTHED SURVIVAL MODE ACTIVATION} and {SINGLE PDU2 FINAL ACTIVATION} (SODF: ASSY OPS: CONTINGENCY)</p>
<p>Step 5.5: Unable to remove protective caps from Node 2 (J98) and COL (J01) bulkheads</p>	<p>Use connector pliers to remove caps</p>	<p>Caps incorrectly placed on bulkhead or interference</p>	<p>Loss of Power String 2, Perform {SINGLE PDU1 BERTHED SURVIVAL MODE ACTIVATION} and {SINGLE PDU1 FINAL ACTIVATION} (SODF: ASSY OPS: CONTINGENCY)</p>
<p>Step 5.6: Unable to remove protective caps from POWER FEEDER APM2 jumper (W5012)</p>	<p>Use connector pliers to remove caps</p>	<p>Caps incorrectly connected to jumper or interference</p>	<p>Loss of Power String 2, Perform {SINGLE PDU1 BERTHED SURVIVAL MODE ACTIVATION} and {SINGLE PDU1 FINAL ACTIVATION} (SODF: ASSY OPS: CONTINGENCY)</p>
<p>Step 5.7: Unable to install POWER FEEDER APM2 jumper (W5012) P98 to J98 on the Node 2 side or Unable to install POWER FEEDER APM2 jumper (W5012) P01 to J01 on the COL side</p>	<p>1) Inspect connectors for FOD</p> <p>2) Make sure that the key on the connector is clocked correctly when trying to mate it.</p> <p>3) Inspect connectors for bent pins. If there is a bent pin, possibly straighten pin On MCC-H Go. If not successful, recap any exposed connectors</p>	<p>1) FOD in jumper/bulkhead interface</p> <p>2) Mating with key clocked incorrectly</p> <p>3) Bent pin on jumper</p>	<p>Loss of Power String 2, Perform {SINGLE PDU1 BERTHED SURVIVAL MODE ACTIVATION} and {SINGLE PDU1 FINAL ACTIVATION} (SODF: ASSY OPS: CONTINGENCY)</p>

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Failure	Workaround	Cause	Impact
STEP 6 – INSTALLING HARDWIRED INSTRUMENTATION JUMPERS			
<p>Step 6.1: Unable to remove protective caps from Node 2 and COL bulkheads</p> <ul style="list-style-type: none"> - For W5010 <ul style="list-style-type: none"> ▪ NOD 2 bulkhead J95 ▪ COL bulkhead J05 - For W5003 <ul style="list-style-type: none"> ▪ NOD 2 bulkhead J78 ▪ COL bulkhead J06 - For W5006 <ul style="list-style-type: none"> ▪ NOD 2 bulkhead J91 ▪ COL bulkhead J04 - For W5007 <ul style="list-style-type: none"> ▪ NOD 2 bulkhead J82 ▪ COL bulkhead J12 	<p>Use connector pliers to remove caps</p>	<p>Caps incorrectly placed on bulkhead or interference</p>	<p>Loss of some command and telemetry, refer to {COLUMBUS ELECTRICAL BUS LOSS MATRIX} (SODF: ASSY OPS: MALFUNCTION) Steps affected in {COLUMBUS BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT) For W5010 – 2.1, 2.4, and 4.1 For W5003 – 2.2, 2.3, and 4.3 For W5006 – 2.1 and 2.2 For W5007 – 2.3, 2.4, 4.1, 4.3, 4.5, and 4.6</p>

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Failure	Workaround	Cause	Impact
<p>Step 6.2: Unable to remove protective caps from COL HARDWIRED INSTRUMENTATION jumpers (W5010, W5003, W5006, and W5007)</p>	<p>Use connector pliers to remove caps</p>	<p>Caps incorrectly connected to jumper or interference</p>	<p>Loss of some command and telemetry, refer to {COLUMBUS ELECTRICAL BUS LOSS MATRIX} (SODF: ASSY OPS: MALFUNCTION) Steps affected in {COLUMBUS BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT) For W5010 – 2.1, 2.4, and 4.1 For W5003 – 2.2, 2.3, and 4.3 For W5006 – 2.1 and 2.2 For W5007 – 2.3, 2.4, 4.1, 4.3, 4.5, and 4.6</p>

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Failure	Workaround	Cause	Impact
<p>Step 6.3: Unable to install COL HARDWIRED INSTRUMENTATION jumper (W5010, W5003, W5006, and W5007) on the Node 2 or COL side</p>	<p>1) Inspect connectors for FOD</p> <p>2) Make sure that the key on the connector is clocked correctly when trying to mate it</p> <p>3) Inspect connectors for bent pins. If there is a bent pin, possibly straighten pin On MCC-H Go. If not successful, recap any exposed connectors</p>	<p>1) FOD in jumper/bulkhead interface</p> <p>2) Mating with key clocked incorrectly</p> <p>3) Bent pin on jumper</p>	<p>Loss of some command and telemetry, refer to {COLUMBUS ELECTRICAL BUS LOSS MATRIX} (SODF: ASSY OPS: MALFUNCTION) Steps affected in {COLUMBUS BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT) For W5010 – 2.1, 2.4, and 4.1 For W5003 – 2.2, 2.3, and 4.3 For W5006 – 2.1 and 2.2 For W5007 – 2.3, 2.4, 4.1, 4.3, 4.5, and 4.6</p>
STEP 7 – INSTALLING 1553 DATA JUMPERS			
<p>Step 7.1: Unable to remove terminators from Node 2 (J93) and COL (J07) connection interfaces</p>	<p>Use connector pliers to remove terminators</p>	<p>Caps incorrectly placed on feedthroughs or interference</p>	<p>Loss of redundancy, refer to {COLUMBUS ELECTRICAL BUS LOSS MATRIX} (SODF: ASSY OPS: MALFUNCTION)</p>
<p>Step 7.1: Unable to remove protective caps from 1553B, LB-B Jumper Assembly (W5002)</p>	<p>Use connector pliers to remove caps</p>	<p>Caps incorrectly connected to jumper or interference</p>	<p>Loss of redundancy, refer to {COLUMBUS ELECTRICAL BUS LOSS MATRIX} (SODF: ASSY OPS: MALFUNCTION)</p>

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Failure	Workaround	Cause	Impact
Step 7.2: Unable to install 1553B LB-B Jumper (W5002) P07 to J07 on the COL side or Unable to install 1553 B LB-B Jumper (W5002) P93 to J93 on the Node 2 side	1) Inspect connectors for FOD 2) Make sure that the key on the connector is clocked correctly when trying to mate it 3) Inspect connectors for bent pins. If there is a bent pin, possibly straighten pin On MCC-H Go. If not successful, recap any exposed connectors	1) FOD in jumper/bulkhead interface 2) Mating with key clocked incorrectly 3) Bent pin on jumper	Loss of redundancy, refer to { COLUMBUS ELECTRICAL BUS LOSS MATRIX } (SODF: ASSY OPS: MALFUNCTION)
Step 7.3: CB INT-1 Channel Selected - A	Leave Channel switch – Ena		None, when bus disconnected will switch automatically to B
Step 7.3: CB INT-1 Auto Channel Switch Status - Ena	Continue with procedure		None
Step 7.4: CB INT-2 Channel Selected - A	Leave Channel switch – Ena		None, when bus disconnected will switch automatically to B
Step 7.4: CB INT-2 Auto Channel Switch Status - Ena	Continue with procedure		None
Step 7.5: LB CHECS APM Channel Selected - A	Leave Channel switch – Ena		None, when bus disconnected will switch automatically to B
Step 7.5: LB CHECS APM Auto Channel Switch Status - Ena	Continue with procedure		None
Step 7.6: LB PL APM Channel Selected - A	Leave Channel switch – Ena		None, when bus disconnected will switch automatically to B
Step 7.6: LB PL APM Auto Channel Switch Status - Ena	Continue with procedure		None

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Failure	Workaround	Cause	Impact
Step 7.7: Unable to remove terminators from Node 2 (J81) and COL (J08) connection interfaces	Use connector pliers to remove terminators	Caps incorrectly placed on feedthroughs or interference	Loss of redundancy, refer to {COLUMBUS ELECTRICAL BUS LOSS MATRIX} (SODF: ASSY OPS: MALFUNCTION)
Step 7.7: Unable to remove protective caps from 1553B, LB-A Jumper (W5001)	Use connector pliers to remove caps	Caps incorrectly connected to jumper or interference	Loss of redundancy, refer to {COLUMBUS ELECTRICAL BUS LOSS MATRIX} (SODF: ASSY OPS: MALFUNCTION)
Step 7.8: Unable to install 1553 B LB-A Jumper (W5001) P08 to J08 on the COL side or Unable to install 1553 B LB-A Jumper (W5001) P81 to J81 on the Node 2 side	1) Inspect connectors for FOD 2) Make sure that the key on the connector is clocked correctly when trying to mate it. 3) Inspect connectors for bent pins. If there is a bent pin, possibly straighten pin On MCC-H Go. If not successful, recap any exposed connectors	1) FOD in jumper/bulkhead interface 2) Mating with key clocked incorrectly 3) Bent pin on jumper	Loss of redundancy, refer to {COLUMBUS ELECTRICAL BUS LOSS MATRIX} (SODF: ASSY OPS: MALFUNCTION)
STEP 8 – REMOVING CBM CONTROLLER PANEL ASSMBLIES			
{1.101 CBM CONTROLLER PANEL ASSEMBLY REMOVAL - GENERIC}			
{1.101} – Step 4.2			
Unable to disconnect any of the 9 power/data cable connectors from CPA	1) Use connector pliers to remove the stuck connector 2) On MCC-H Go , use Wire Cutters to cut power/data cable to remove CPA	1) FOD in connector 2) Damaged or out of spec connector	None
{1.101} – Step 4.4			
Unable to unfasten CPA ground strap fastener	On MCC-H Go , use Wire Cutters to cut ground strap to remove CPA	FOD in fastener	None, some interference in the vestibule working area

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Failure	Workaround	Cause	Impact
{1.101} – Step 4.7			
Unable to unfasten any of the CPA fasteners (five per CPA)	1) Use Breaker Bar, 3/8" Drive 2) On MCC-H Go , remove bolt using Impact Driver, 7/16" Impact Socket, 3/8" Drive 3) On MCC-H Go , remove bolt using Screw Extractor Kit {X.X.XXX SCREW EXTRACTOR SET USAGE} (SODF: IFM: A.2.4)	Interference with fastener fit or damaged/ out of spec fastener	None, restricted access to IMV Ducts, impacts time duration of Steps 11 and 12
STEP 9 – INSTALLING ITCS JUMPERS			
Step 9: TCS Jumper Inspection - if any TCS line leaking fluid at QD	Disconnect QD and cap jumper, check MCC-H		
Step 9.1: Unable to remove QD Caps from Node 2 and/or COL Bulkheads	Use connector pliers to remove caps	Caps incorrectly placed on bulkhead or interference	Degraded cooling. One loop is sufficient for initial Columbus module ops. Step 3.11 affected in {COLUMBUS FINAL ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT) - Close WOOV7 - Open WOOV6 - Open WOOV8
Step 9.1: Unable to remove QD Plugs from LTCS Supply Jumper	Use connector pliers to remove caps	Caps incorrectly connected to jumper or interference	Degraded cooling. One loop is sufficient for initial Columbus module ops. Step 3.11 affected in {COLUMBUS FINAL ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT) - Close WOOV7 - Open WOOV6 - Open WOOV8

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Failure	Workaround	Cause	Impact
<p>Step 9.1: Unable to install LTCS Supply Jumper on the Node 2 (or COL) side</p>	<p>1) Inspect connectors for FOD 2) Check that jumper is keyed correctly If not successful, recap any exposed connectors</p>	<p>1) FOD in mechanism 2) Mating with key clocked incorrectly</p>	<p>Degraded cooling. One loop is sufficient for initial Columbus module ops. Step 3.11 affected in {COLUMBUS FINAL ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT) - Close WOOV7 - Open WOOV6 - Open WOOV8</p>
<p>Step 9.2: Unable to remove QD Caps from Node 2 and/or COL Bulkheads</p>	<p>Use connector pliers to remove caps</p>	<p>Caps incorrectly placed on bulkhead or interference</p>	<p>Degraded cooling. One loop is sufficient for initial Columbus module ops. Step 3.11 affected in {COLUMBUS FINAL ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT) - Close WOOV7 - Open WOOV6 - Open WOOV8</p>
<p>Step 9.2: Unable to remove QD Plugs from LTCS Return Jumper</p>	<p>Use connector pliers to remove caps</p>	<p>Caps incorrectly connected to jumper or interference</p>	<p>Degraded cooling. One loop is sufficient for initial Columbus module ops. Step 3.11 affected in {COLUMBUS FINAL ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT) - Close WOOV7 - Open WOOV6 - Open WOOV8</p>

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Failure	Workaround	Cause	Impact
<p>Step 9.2: Unable to install LTCS Return Jumper on the Node 2 (or COL) side</p>	<p>1) Inspect connectors for FOD 2) Check that jumper is keyed correctly If not successful, recap any exposed connectors</p>	<p>1) FOD in mechanism 2) Mating with key clocked incorrectly</p>	<p>Degraded cooling. One loop is sufficient for initial Columbus module ops. Step 3.11 affected in {COLUMBUS FINAL ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT) - Close WOOV7 - Open WOOV6 - Open WOOV8</p>
<p>Step 9.4: Unable to remove QD Caps from Node 2 and/or COL Bulkheads</p>	<p>Use connector pliers to remove caps</p>	<p>Caps incorrectly placed on bulkhead or interference</p>	<p>Degraded cooling. One loop is sufficient for initial Columbus module ops. Step 3.11 affected in {COLUMBUS FINAL ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT) - Close WOOV5 - Open WOOV3 - Open WOOV4</p>
<p>Step 9.4: Unable to remove QD Plugs from MTCS Supply Jumper</p>	<p>Use connector pliers to remove caps</p>	<p>Caps incorrectly connected to jumper or interference</p>	<p>Degraded cooling. One loop is sufficient for initial Columbus module ops. Step 3.11 affected in {COLUMBUS FINAL ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT) - Close WOOV5 - Open WOOV3 - Open WOOV4</p>

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Failure	Workaround	Cause	Impact
<p>Step 9.4: Unable to install MTCS Supply Jumper on the Node 2 (or COL) side</p>	<p>1) Inspect connectors for FOD 2) Check that jumper is keyed correctly If not successful, recap any exposed connectors</p>	<p>1) FOD in mechanism 2) Mating with key clocked incorrectly</p>	<p>Degraded cooling. One loop is sufficient for initial Columbus module ops. Step 3.11 affected in {COLUMBUS FINAL ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT) - Close WOOV5 - Open WOOV3 - Open WOOV4</p>
<p>Step 9.5: Unable to remove QD Caps from Node 2 and/or COL Bulkheads</p>	<p>Use connector pliers to remove caps</p>	<p>Caps incorrectly placed on bulkhead or interference</p>	<p>Degraded cooling. One loop is sufficient for initial Columbus module ops. Step 3.11 affected in {COLUMBUS FINAL ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT) - Close WOOV5 - Open WOOV3 - Open WOOV4</p>
<p>Step 9.5: Unable to remove QD Plugs from MTCS Return Jumper</p>	<p>Use connector pliers to remove caps</p>	<p>Caps incorrectly connected to jumper or interference</p>	<p>Degraded cooling. One loop is sufficient for initial Columbus module ops. Step 3.11 affected in {COLUMBUS FINAL ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT) - Close WOOV5 - Open WOOV3 - Open WOOV4</p>

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Failure	Workaround	Cause	Impact
<p>Step 9.5: Unable to install MTCS Return Jumper on the Node 2 (or COL) side</p>	<p>1) Inspect connectors for FOD 2) Check that jumper is keyed correctly If not successful, recap any exposed connectors</p>	<p>1) FOD in mechanism 2) Mating with key clocked incorrectly</p>	<p>Degraded cooling. One loop is sufficient for initial Columbus module ops. Step 3.11 affected in {COLUMBUS FINAL ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT) - Close WOOV5 - Open WOOV3 - Open WOOV4</p>
STEP 10 – INSTALLING CONDENSATE JUMPER			
<p>Step 10.1: Unable to loosen/remove Node 2 and COL feedthrough caps with FFTD</p>	<p>1) Inspect for FOD/interference 2) On MCC-H Go, increase torque value of FFTD</p>	<p>1) FOD/interference with cap 2) Tool incorrectly calibrated</p>	<p>Loss of condensate collection. Water separator cannot be activated therefore CHX water inlet temp must be maintained above dew point or fans must be off. Step 13 affected in {COLUMBUS FINAL ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)</p>
<p>Step 10.2: Unable to loosen/remove caps from Waste Water Jumper</p>	<p>Use connector pliers to remove cap</p>	<p>Cap incorrectly connected to jumper or interference</p>	<p>Loss of condensate collection. Water separator cannot be activated therefore CHX water inlet temp must be maintained above dew point or fans must be off. Step 13 affected in {COLUMBUS FINAL ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)</p>

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Failure	Workaround	Cause	Impact
Step 10.3: Unable to install jumper onto Node 2 (A01)or COL (A01) feedthrough	1) Inspect for FOD 2) Inspect threads on jumper and feedthrough for damage, then report to MCC-H . If not possible to install, re-cap exposed ends of jumper and feedthrough	1) FOD in mechanism 2) Threading problem	Loss of condensate collection. Water separator cannot be activated therefore CHX water inlet temp must be maintained above dew point or fans must be off. Step 13 affected in { COLUMBUS FINAL ACTIVATION } (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
Step 10.3: Unable to torque Gamah fittings to their desired in-lbs	1) Verify Gamah tool size 2) Change to a different torque wrench 3) Use crow's foot with torque wrench and combination wrench (two wrench method)	1) Using wrong size Gamah tool 2) 1 st Torque driver was bad 3) Gamah tool problem	Loss of condensate collection. Water separator cannot be activated therefore CHX water inlet temp must be maintained above dew point or fans must be off. Step 13 affected in { COLUMBUS FINAL ACTIVATION } (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
STEP 11 - INSTALLING IMV RETURN DUCT			
Step 11.1: Unable to cycle Node 2 IMV Valve	Manually actuate the valve		
Step 11.2 and 11.3: Unable to loosen V-Band Clamp	Check for FOD around the interface areas	FOD in mechanism	None, Degraded intermodule ventilation. May need to place PFA at hatch.
Step 11.2: Unable to remove IMV Cap for NOD2 STBD (A11) IMV Flange	1) Check for FOD around the interface areas 2) Cycle IMV Valve to Open and then back to Close.	FOD in mechanism	None, Degraded intermodule ventilation. May need to place PFA at hatch.

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Failure	Workaround	Cause	Impact
Step 11.3: Unable to remove IMV Flange Saver from COL (A11) IMV Flange	Check for FOD around the interface areas	FOD in mechanism	None, Degraded intermodule ventilation. May need to place PFA at hatch.
Step 11.4: Unable to install the IMV Return Duct	Check for FOD around the interface areas and vestibule volume area	FOD obstructing interface	None, Degraded intermodule ventilation. May need to place PFA at hatch.
Step 11.5: Unable to secure IMV Return Duct to Node 2 IMV Flange with V-band clamp	Check for FOD around the interface areas and vestibule volume area	FOD obstructing interface	None, Reduced intermodule ventilation, due to loss of sealing
Step 11.5: Unable to tighten V-band clamp to 35 in-lbs	1) Use a different torque wrench 2) Tighten clamp as snug as possible	1) Problems with the 1 st torque wrench 2) V-band Clamp not manufactured to specs	None, Reduced intermodule ventilation, due to loss of sealing
Step 11.6: Unable to secure IMV Return Duct to COL IMV Flange with V-band clamp	Check for FOD around the interface areas	FOD obstructing interface	None, Reduced intermodule ventilation, due to loss of sealing
Step 11.6: Unable to tighten V-band clamp to 35 in-lbs	1) Use a different torque wrench 2) Tighten clamp as snug as possible	1) Problems with the 1 st torque wrench 2) V-band Clamp not manufactured to specs	None
STEP 12 – INSTALLING IMV SUPPLY DUCT			
Step 12.1 and 12.2: Unable to loosen V-Band Clamp	Check for FOD around the interface areas	FOD in mechanism	None, Degraded intermodule ventilation. May need to place PFA at hatch.
Step 12.1: Unable to remove IMV Cap from Node Starboard (A04) IMV Flange	1) Check for FOD around the interface areas 2) Cycle IMV Valve to Open and then back to Close.	FOD in mechanism	None, Degraded intermodule ventilation. May need to place PFA at hatch.
Step 12.2: Unable to remove IMV Flange Saver from COLUMBUS (A04) IMV Flange	Check for FOD around the interface areas	FOD in mechanism	None, Degraded intermodule ventilation. May need to place PFA at hatch.

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Failure	Workaround	Cause	Impact
Step 12.3: Unable to install the IMV Supply Duct	Check for FOD around the interface areas and vestibule volume area	FOD obstructing interface	None, Degraded intermodule ventilation. May need to place PFA at hatch.
Step 12.4: Unable to secure IMV Supply Duct to Node 2 IMV Flange with V-band clamp	Check for FOD around the interface areas and vestibule volume area	FOD obstructing interface	None, Reduced intermodule ventilation, due to loss of sealing
Step 12.4: Unable to tighten V-band clamp to 35 in-lbs	1) Use a different torque wrench 2) Tighten clamp as snug as possible	1) Problems with the 1 st torque wrench 2) V-band Clamp not manufactured to specs	None, Reduced intermodule ventilation, due to loss of sealing
Step 12.5: Unable to secure IMV Supply Duct to COLUMBUS IMV Flange with V-band clamp	Check for FOD around the interface areas	FOD obstructing interface	None, Reduced intermodule ventilation, due to loss of sealing
Step 12.5: Unable to tighten V-band clamp to 35 in-lbs	1) Use a different torque wrench 2) Tighten clamp as snug as possible	1) Problems with the 1 st torque wrench 2) V-band Clamp not manufactured to specs	None
STEP 13 – INSTALLING FIBER OPTIC JUMPERS			
Step 13.1: Unable to remove protective caps from Node 2 (J83) and COL (J10) feedthroughs	Use connector pliers to remove caps	Caps incorrectly placed on feedthroughs or interference	Loss of ATU and Downlink redundancy, no impact to activation
Step 13.2: Unable to remove protective caps from Fiber Optic 1 (W5009) Jumper	Use connector pliers to remove caps	Caps incorrectly connected to jumper or interference	Loss of ATU and Downlink redundancy, no impact to activation
Step 13.3: Unable to install the Fiber Optic 1 (W5009) Jumper to J83 (NOD2) or J10 (COL)	1) Inspect for FOD 2) Make sure that the key on the connector is clocked correctly when trying to mate it. If not successful, recap any exposed connectors	1) FOD in jumper/bulkhead interface 2) Mating with key clocked incorrectly	Loss of ATU and Downlink redundancy, no impact to activation

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Failure	Workaround	Cause	Impact
Step 13.4: Unable to remove protective caps from Node 2 (J90) and COL (J11) feedthroughs	Use connector pliers to remove caps	Caps incorrectly placed on feedthroughs or interference	Loss of ATU and Downlink redundancy, no impact to activation
Step 13.5: Unable to remove protective caps from Fiber Optic 2 (W5004) Jumper	Use connector pliers to remove caps	Caps incorrectly connected to jumper or interference	Loss of ATU and Downlink redundancy, no impact to activation
Step 13.3: Unable to install the Fiber Optic 2 (W5004) Jumper on J90 (NOD2) or J11 (COL)	1) Inspect for FOD 2) Make sure that the key on the connector is clocked correctly when trying to mate it. If not successful, recap any exposed connectors	1) FOD in jumper/bulkhead interface 2) Mating with key clocked incorrectly	Loss of ATU and Downlink redundancy, no impact to activation
STEP 14 – INSTALLING AR SAMPLE JUMPER			
Step 14.1: Unable to remove protective caps from Node 2 and COL feedthroughs	Use connector pliers to remove caps	Caps incorrectly placed on feedthroughs or interference	Loss of ability to perform air sampling
Step 14.1: Unable to remove protective caps from AR Sample Jumper Assembly (683-13870-72)	Use connector pliers to remove caps	Caps incorrectly connected to jumper or interference	Loss of ability to perform air sampling Step 16 affected in {COLUMBUS FINAL ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
Step 14.1: Unable to get COL (or Node 2) Feedthrough Locking Key to engage on QD housing	1) Inspect for FOD 2) Make sure that the key on the connector is clocked correctly when trying to mate it. If not successful, recap any exposed connectors	1) FOD in jumper/bulkhead interface 2) Mating with key clocked incorrectly	Loss of ability to perform air sampling Step 16 affected in {COLUMBUS FINAL ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)

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Failure	Workaround	Cause	Impact
STEP 15 – INSTALLING ETHERNET JUMPER (LAN)			
Step 15.1: Unable to remove protective caps from NOD2 (J77) and COL (J03) feedthroughs	Use connector pliers to remove caps	Caps incorrectly placed on feedthroughs or interference	If not successful, no impacts to activation. Loss of Lan connectivity
Step 15.2: Unable to remove protective caps from LAN2 Ethernet (W5015) Jumper	Use connector pliers to remove caps	Caps incorrectly connected to jumper or interference	If not successful, no impacts to activation. Loss of Lan connectivity
Step 15.3: Unable to install the LAN2 Ethernet Jumper on J77 (NOD2) or J03 (COL)	1) Inspect connectors for FOD 2) Make sure that the key on the connector is clocked correctly when trying to mate it. If not successful, recap any exposed connectors	1) FOD in jumper/bulkhead interface 2) Mating with key clocked incorrectly	If not successful, no impacts to activation. Loss of Lan connectivity
STEP 16 – INSTALLING IVA ANTENNA ASSEMBLY			
Step 16.1: Unable to remove protective caps from NOD2 (J79) and COL (J09) feedthroughs	Use connector pliers to remove caps	Caps incorrectly placed on feedthroughs or interference	If not successful, no impacts to activation. Loss of wireless antenna
Step 16.2: Unable to remove protective caps from IVA Antenna Assembly (W5005) Jumper	Use connector pliers to remove caps	Caps incorrectly connected to jumper or interference	If not successful, no impacts to activation. Loss of wireless antenna
Step 16.3: Unable to install the IVA Antenna Assembly Jumper on J79 (NOD2) or J09 (COL)	1) Inspect connectors for FOD 2) Make sure that the key on the connector is clocked correctly when trying to mate it. If not successful, recap any exposed connectors	1) FOD in jumper/bulkhead interface 2) Mating with key clocked incorrectly	If not successful, no impacts to activation. Loss of wireless antenna
STEP 17 – INSTALLING NITROGEN JUMPER			
Step 17.1: Unable to close N2 Supply Valve	TBD	TBD	TBD

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Failure	Workaround	Cause	Impact
Step 17.1: Unable to open A/L PCA N2 Intro Valve	TBD	TBD	TBD
Step 17.1: Unable to close A/L PCA N2 Intro Valve	TBD	TBD	TBD
Step 17.2: Unable to open closeout panel NOD2SO_24	TBD	TBD	TBD
Step 17.2: Unable to demate Low Press QD behind closeout panel NOD2SO_24	TBD	TBD	TBD
Step 17.4: Unable to loosen Node 2 feedthrough cap with FFTD	1) Inspect for FOD/interference 2) On MCC-H Go , increase torque value of FFTD	1) FOD/interference with cap 2) Tool incorrectly calibrated	TBD
Step 17.5/17.12: Unable to loosen/remove cap from Node 2 side of jumper by hand	Use connector pliers to remove cap	Cap incorrectly connected to jumper or interference	TBD
Step 17.15: Unable to install jumper onto Node 2 feedthrough hand tight	Inspect for FOD If not successful, recap any exposed ends of the jumper	1) FOD in mechanism 2) Threading problem	TBD
Step 17.19	See workarounds from steps 17.4-17.15		
Step 17.21: Unable to torque Gamah fittings to their desired in-lbs	1) Verify Gamah tool size 2) Change to a different torque wrench 3) Use crow's foot with torque wrench and combination wrench (two wrench method)	1) Using wrong size Gamah tool 2) 1 st Torque driver was bad 3) Gamah tool problem	TBD

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Columbus Vestibule Outfitting Jumper-Pin Impact Matrix

Jumper			
Pin	Pin Function	Description	Steps effected for nominal activation
Hardwired Instrumentation ML-R (W5006)			
53	MON+	PDU1 Input Current	Tlm in Steps 2.1 and 2.2 in {COLUMBUS BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
65	MON-	PDU1 Input Current	Tlm in Steps 2.1 and 2.2 in {COLUMBUS BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
76	MON+	VTC2 R_Power_B_Current	None
64	MON-	VTC2 R_Power_B_Current	None
63	MON+	VTC1 R_Power_B_Current	None
52	MON-	VTC1 R_Power_B_Current	None
Hardwired Instrumentation HO-R (W5010)			
53	CMD	PDU1 N_POWER_ON	Step 2.1 in {COLUMBUS BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
65	RTN	PDU1 N_POWER_ON	Step 2.1 in {COLUMBUS BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
76	CMD	PDU2 R_POWER_ON	Step 2.4 in {COLUMBUS BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
64	RTN	PDU2 R_POWER_ON	Step 2.4 in {COLUMBUS BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
63	CMD	for ISS Ops and APM use: PDU1 CDA1,2 ENABLE/DISABLE for NOD2 Internal Use: PDU1 VALVE CONTROL ENABLE/DISABLE	TBD
52	RTN	for ISS Ops and APM use: PDU1 CDA1,2 ENABLE/DISABLE for NOD2 Internal Use: PDU1 VALVE CONTROL ENABLE/DISABLE	TBD
41	CMD	VTC1 N_POWER_A_ON	Step 4.1 in {COLUMBUS BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
30	RTN	VTC1 N_POWER_A_ON	Step 4.1 in {COLUMBUS BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)

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42	CMD	VTC1 N_POWER_A_OFF	None
54	RTN	VTC1 N_POWER_A_OFF	None
66	CMD	VTC2 R_POWER_B_ON	None
77	RTN	VTC2 R_POWER_B_ON	None
88	CMD	VTC2 R_POWER_B_OFF	None
99	RTN	VTC2 R_POWER_B_OFF	None
87	CMD	PDU1 N_POWER_OFF	None
75	RTN	PDU1 N_POWER_OFF	None
20	CMD	PDU2 R_POWER_OFF	None
31	RTN	PDU2 R_POWER_OFF	None
110	MON	PDU1 N_POWER_STATUS	TIm in Step 2.1 in {COLUMBUS BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
118	RTN	PDU1 N_POWER_STATUS	TIm in Step 2.1 in {COLUMBUS BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
109	MON	PDU1_ACTIVATION_OUTLET STATUS 1	TBD
98	RTN	PDU1_ACTIVATION_OUTLET STATUS 1	TBD
86	MON	PDU2 R_POWER_STATUS	TIm in Step 2.4 in {COLUMBUS BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
74	RTN	PDU2 R_POWER_STATUS	TIm in Step 2.4 in {COLUMBUS BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
62	MON	PDU2_ACTIVATION_OUTLET STATUS 2	TBD
51	RTN	PDU2_ACTIVATION_OUTLET STATUS 2	TBD
40	MON	VTC1 N_POWER_A_STATUS	TIm in Step 4.1 in {COLUMBUS BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
29	RTN	VTC1 N_POWER_A_STATUS	TIm in Step 4.1 in {COLUMBUS BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
19	MON	VTC2 R_POWER_B_STATUS	None
11	RTN	VTC2 R_POWER_B_STATUS	None
Hardwired Instrumentation HO-N (W5003)			
53	CMD	PDU1 R_POWER_ON	Step 2.2 in {COLUMBUS BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
65	RTN	PDU1 R_POWER_ON	Step 2.2 in {COLUMBUS BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)

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76	CMD	PDU2 N_POWER_ON	Step 2.3 in {COLUMBUS BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
64	RTN	PDU2 N_POWER_ON	Step 2.3 in {COLUMBUS BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
63	CMD	for ISS Ops and APM use: PDU2 CDA3,4 ENABLE/DISABLE for NOD2 Internal Use: PDU2 VALVE CONTROL ENABLE/DISABLE	TBD
52	RTN	for ISS Ops and APM use: PDU2 CDA3,4 ENABLE/DISABLE for NOD2 Internal Use: PDU2 VALVE CONTROL ENABLE/DISABLE	TBD
41	CMD	VTC1 R_POWER_B_ON	None
30	RTN	VTC1 R_POWER_B_ON	None
42	CMD	VTC1 R_POWER_B_OFF	None
54	RTN	VTC1 R_POWER_B_OFF	None
66	CMD	VTC2 N_POWER_A_ON	Step 4.3 in {COLUMBUS BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
77	RTN	VTC2 N_POWER_A_ON	Step 4.3 in {COLUMBUS BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
88	CMD	VTC2 N_POWER_A_OFF	None
99	RTN	VTC2 N_POWER_A_OFF	None
87	CMD	PDU1 R_POWER_OFF	None
75	RTN	PDU1 R_POWER_OFF	None
20	CMD	PDU2 N_POWER_OFF	None
31	RTN	PDU2 N_POWER_OFF	None
110	MON	PDU1 R_POWER_STATUS	TIm in Step 2.2 in {COLUMBUS BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
118	RTN	PDU1 R_POWER_STATUS	TIm in Step 2.2 in {COLUMBUS BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
109	MON	PDU1_ACTIVATION_OUTLET STATUS 2	TBD
98	RTN	PDU1_ACTIVATION_OUTLET STATUS 2	TBD
86	MON	PDU2 N_POWER_STATUS	TIm in Step 2.3 in {COLUMBUS BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)

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74	RTN	PDU2 N_POWER_STATUS	Tlm in Step 2.3 in {COLUMBUS BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
62	MON	PDU2_ACTIVATION_OUTLET STATUS 1	TBD
51	RTN	PDU2_ACTIVATION_OUTLET STATUS 1	TBD
40	MON	VTC1 R_POWER_B_STATUS	None
29	RTN	VTC1 R_POWER_B_STATUS	None
19	MON	VTC2 N_POWER_A_STATUS	Tlm in Step 4.3 in {COLUMBUS BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
11	RTN	VTC2 N_POWER_A_STATUS	Tlm in Step 4.3 in {COLUMBUS BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
Hardwired Instrumentation ML-N (W5007)			
53	MON+	PDU2 INPUT_CURRENT	Tlm in Steps 2.3 and 2.4 in {COLUMBUS BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
65	MON-	PDU2 INPUT_CURRENT	Tlm in Steps 2.3 and 2.4 in {COLUMBUS BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
76	MON+	VTC2 N_Power_A_Current	Tlm in Steps 4.3 and 4.6 in {COLUMBUS BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
75	MON-	VTC2 N_Power_A_Current	Tlm in Steps 4.3 and 4.6 in {COLUMBUS BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
63	MON+	VTC1 N_Power_A_Current	Tlm in Steps 4.1 and 4.5 in {COLUMBUS BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
52	MON-	VTC1 N_Power_A_Current	Tlm in Steps 4.1 and 4.5 in {COLUMBUS BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY OPS: ACTIVATION & CHECKOUT)
1553B, LB-B (W5002)			
53	SGN	SSMB C&C BUS 1B/CB INT 1B HI	Steps 7.3 and 7.4 in {COLUMBUS VESTIBULE OUTFITTING} (SODF: ASSY OPS: ASSEMBLY)

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65	SGN	SSMB C&C BUS 1B/CB INT 1B LO	Steps 7.3 and 7.4 in {COLUMBUS VESTIBULE OUTFITTING} (SODF: ASSY OPS: ASSEMBLY)
43	SGN	SSMB C&C BUS 2B/CB INT 2B HI	Steps 7.3 and 7.4 in {COLUMBUS VESTIBULE OUTFITTING} (SODF: ASSY OPS: ASSEMBLY)
55	SGN	SSMB C&C BUS 2B/CB INT 2B LO	Steps 7.3 and 7.4 in {COLUMBUS VESTIBULE OUTFITTING} (SODF: ASSY OPS: ASSEMBLY)
89	SGN	CHECS - APM B HI	Step 7.5 in {COLUMBUS VESTIBULE OUTFITTING} (SODF: ASSY OPS: ASSEMBLY)
100	SGN	CHECS - APM B LO	Step 7.5 in {COLUMBUS VESTIBULE OUTFITTING} (SODF: ASSY OPS: ASSEMBLY)
109	SGN	CB P/L - APM B HI	Step 7.6 in {COLUMBUS VESTIBULE OUTFITTING} (SODF: ASSY OPS: ASSEMBLY)
98	SGN	CB P/L - APM B LO	Step 7.6 in {COLUMBUS VESTIBULE OUTFITTING} (SODF: ASSY OPS: ASSEMBLY)
86	SGN	APM P/L BUS B HI	Pin not connected in J07 (COL end of jumper)
74	SGN	APM P/L BUS B LO	Pin not connected in J07 (COL end of jumper)
51	SGN	APM PWS DATA - Redundant Tx HI	TBD
39	SGN	APM PWS DATA - Redundant Tx LO	TBD
19	SGN	APM PWS DATA - Redundant Rx HI	TBD
29	SGN	APM PWS DATA - Redundant Rx LO	TBD
1553B, LB-A (W5001)			
53	SGN	SSMB C&C BUS 1A/CB INT 1A HI	None
65	SGN	SSMB C&C BUS 1A/CB INT 1A LO	None
43	SGN	SSMB C&C BUS 2A/CB INT 2A HI	None
55	SGN	SSMB C&C BUS 2A/CB INT 2A LO	None
89	SGN	CHECS - APM A HI	None
100	SGN	CHECS - APM A LO	None
109	SGN	CB P/L - APM A HI	None
98	SGN	CB P/L - APM A LO	None
86	SGN	APM P/L BUS A HI	Pin not connected in J08 (COL end of jumper)
74	SGN	APM P/L BUS A LO	Pin not connected in J08 (COL end of jumper)
51	SGN	APM PWS DATA - Nominal Tx HI	TBD
39	SGN	APM PWS DATA - Nominal Tx LO	TBD
19	SGN	APM PWS DATA - Nominal Rx HI	TBD
29	SGN	APM PWS DATA - Nominal Rx LO	TBD
FIBER OPTIC 1 (FO1) (W5009)			
r	SGN	APM Downlink Data via TDRSS-N	None
q	SGN	APM Downlink Data via JEM-N	None
p	SGN	Spare	None

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n	SGN	Video/Status 1A (ISS to APM)	None
m	SGN	Video/Status 2A (APM to ISS)	None
k	SGN	Sync/Control 1	None
h	SGN	Audio In Bus A (COL Module ATU2)	None
g	SGN	Audio In Bus A (COL Module ATU1)	None
f	SGN	Audio Out Bus A (COL Module ATU2)	None
e	SGN	Audio Out Bus A (COL Module ATU1)	None
d	SGN	APM ISPR A1 - IN	None
c	SGN	APM ISPR A1 - OUT	None
b	SGN	APM ISPR A2 - IN	None
a	SGN	APM ISPR A2 - OUT	None
Z	SGN	APM ISPR A3 - IN	None
Y	SGN	APM ISPR A3 - OUT	None
X	SGN	APM ISPR A4 - IN	None
W	SGN	APM ISPR A4 - OUT	None
V	SGN	APM ISPR O1 - IN	None
U	SGN	APM ISPR O1 - OUT	None
FIBER OPTIC 2 (FO2) (W5004)			
r	SGN	APM Downlink Data via TDRSS-R	None
q	SGN	APM Downlink Data via JEM-R	None
p	SGN	Spare	None
n	SGN	Video/Status 1B (ISS to APM)	None
m	SGN	Video/Status 2B (APM to ISS)	None
k	SGN	Sync/Control 2	None
h	SGN	Audio In Bus B (COL Module ATU2)	None
g	SGN	Audio In Bus B (COL Module ATU1)	None
f	SGN	Audio Out Bus B (COL Module ATU2)	None
e	SGN	Audio Out Bus B (COL Module ATU1)	None
d	SGN	APM ISPR F4 - IN	None
c	SGN	APM ISPR F4 - OUT	None
b	SGN	APM ISPR O2 - IN	None
a	SGN	APM ISPR O2 - OUT	None
Z	SGN	APM ISPR F1 - IN	None
Y	SGN	APM ISPR F1 - OUT	None
X	SGN	APM ISPR F2 - IN	None
W	SGN	APM ISPR F2 - OUT	None
V	SGN	APM ISPR F3 - IN	None
U	SGN	APM ISPR F3 - OUT	None
LAN2 Ethernet (W5015)			
21	SGN	PEHG-2 to APM (Hi)	None
15	SGN	PEHG-2 to APM (Lo)	None
20	SGN	PEHG-2 from APM (Hi)	None
19	SGN	PEHG-2 from APM (Lo)	None
7	SGN	OPS LAN to APM (Hi)	None
6	SGN	OPS LAN to APM (Lo)	None
5	SGN	OPS LAN from APM (Hi)	None
4	SGN	OPS LAN from APM (Lo)	None

CRIB SHEETS COLUMBUS BERTHED SURVIVAL MODE ACTIVATION
 (ASSY MAL/1E/FIN/MULTI E)

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Failure	Workaround	Cause	Impact
STEP 1 - VERIFYING NODE MDMS ARE NOMINAL			
Step 1.1 (case 1): Frame Count - not incrementing (N2-1)	Continue activation by activating VTC2 via VTC1: <ul style="list-style-type: none"> • Verify N2-2 MDM • Activate PDU1 MB1 Nominal Main Auxiliary Converter • Do not activate PDU1 MB1 Redundant Main Auxiliary Converter, and PDU2 MB2 Nominal Main Auxiliary Converter • Activate PDU2 MB2 Redundant Main Auxiliary Converter • Enable communication with C&C MDM • Activate VTC1 nominal power A • Enable VTC1 Physical Gnd TIm packet • Configure VTC1 to MASTER • Start VTC1 Logical TIm Packet 1 + 2 • Activate PDU1 and PDU2 outlets to VTC2 (VTC command to PDU) • Activate VTC2 nominal power B and expect the following current values: <ul style="list-style-type: none"> - VTC2 Nom Pwr A Current < 0.19 A - VTC2 Nom Pwr B Current < 2.14 A • Enable telemetry packet physical 1 on VTC2 • Activate VTC1 nominal power B • Verify VTC1 and VTC2 nominal ready status is Ready • Configure VTC2 to Slave • Activate PDU1 Redun_Aux_Conv and PDU2_Nom_Aux_Conv via VTC Hardwired Commands (establish PDU internal redundancy) • When verifying microcontroller status during the activation of the PDUs cross strapped power bus, expect the PDU2 nominal controller to be Off and the redundant controller to be On 	N2-1 MDM failure	Loss of hardwired commands and telemetry from N2-1 MDM, refer to {COLUMBUS POWER BUS LOSS MATRIX} (SODF: ASSY OPS: REF DATA) to identify affected equipment. Additional loss of power redundancy on VTC2 (power A unavailable).

CRIB SHEETS COLUMBUS BERTHED SURVIVAL MODE ACTIVATION

(ASSY MAL/1E/FIN/MULTI E)

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Failure	Workaround	Cause	Impact
<p>Step 1.1 (case 2): Processing State - not Operational (N2-1)</p>	<p>Continue activation by activating VTC2 via VTC1:</p> <ul style="list-style-type: none"> • Verify N2-2 MDM • Activate PDU1 MB1 Nominal Main Auxiliary Converter • Do not activate PDU1 MB1 Redundant Main Auxiliary Converter, and PDU2 MB2 Nominal Main Auxiliary Converter • Activate PDU2 MB2 Redundant Main Auxiliary Converter • Enable communication with C&C MDM • Activate VTC1 nominal power A • Enable VTC1 Physical Gnd TIm packet • Configure VTC1 to MASTER • Start VTC1 Logical TIm Packet 1 + 2 • Activate PDU1 and PDU2 outlets to VTC2 (VTC command to PDU) • Activate VTC2 nominal power B and expect the following current values: <ul style="list-style-type: none"> - VTC2 Nom Pwr A Current < 0.19 A - VTC2 Nom Pwr B Current < 2.14 A • Enable telemetry packet physical 1 on VTC2 • Activate VTC1 nominal power B • Verify VTC1 and VTC2 nominal ready status is Ready • Configure VTC2 to Slave • Activate PDU1 Redun_Aux_Conv and PDU2_Nom_Aux_Conv via VTC Hardwired Commands (establish PDU internal redundancy) • When verifying microcontroller status during the activation of the PDUs cross strapped power bus, expect the PDU2 nominal controller to be Off and the redundant controller to be On 	<p>N2-1 MDM anomaly</p>	<p>Loss of hardwired commands and telemetry from N2-1 MDM, refer to {COLUMBUS POWER BUS LOSS MATRIX} (SODF: ASSY OPS: REF DATA) to identify affected equipment. Additional loss of power redundancy on VTC2 (power A unavailable).</p>

CRIB SHEETS COLUMBUS BERTHED SURVIVAL MODE ACTIVATION
 (ASSY MAL/1E/FIN/MULTI E)

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Failure	Workaround	Cause	Impact
<p>Step 1.2 (case 1): Frame Count - not incrementing (N2-2)</p>	<p>Continue activation by activating VTC1 via VTC2:</p> <ul style="list-style-type: none"> • Do not activate PDU1 MB1 Nominal Main Auxiliary Converter • Activate PDU1 MB1 Redundant Main Auxiliary Converter and PDU2 MB2 Nominal Main Auxiliary Converter • Do not activate PDU2 MB2 Redundant Main Auxiliary Converter • Enable communication with C&C MDM • Do not activate VTC1 nominal power A • Activate VTC2 nominal power A, but skip the verification of the nominal ready status for both VTC1 and VTC2 • Enable VTC2 Physical Gnd Tlm packet • Configure VTC2 to MASTER • Start VTC2 Logical Tlm Packet 1 + 2 • Activate PDU1 and PDU2 outlets to VTC1 (VTC command to PDU) • Activate VTC1 nominal power B and expect the following current values: <ul style="list-style-type: none"> - VTC2 Nom Pwr A Current < 0.19 A - VTC2 Nom Pwr B Current < 2.14 A • Verify that VTC1 and VTC2 nominal ready status is Ready • Enable telemetry packet physical 1 on VTC1 • Activate VTC2 nominal power B • Configure VTC1 to Slave • Activate PDU1 Nom_Aux_Conv and PDU2_Redun_Aux_Conv via VTC Hardwired Commands (establish PDU internal redundancy) • When verifying microcontroller status during the activation of the PDUs cross strapped power bus, expect the PDU1 nominal controller to be Off and the redundant controller to be On 	<p>N2-2 MDM failure</p>	<p>Loss of hardwired commands and telemetry from N2-2 MDM, refer to {COLUMBUS POWER BUS LOSS MATRIX} (SODF: ASSY OPS: REF DATA) to identify affected equipment. Additional loss of power redundancy on VTC1 (power A unavailable).</p>

CRIB SHEETS COLUMBUS BERTHED SURVIVAL MODE ACTIVATION
 (ASSY MAL/1E/FIN/MULTI E)

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Failure	Workaround	Cause	Impact
	<ul style="list-style-type: none"> After reaching the BSM configure VTC1 as MASTER and VTC2 as SLAVE 		
<p>Step 1.2 (case 2): Processing State - not Operational (N2-2)</p>	<p>Continue activation by activating VTC1 via VTC2:</p> <ul style="list-style-type: none"> Do not activate PDU1 MB1 Nominal Main Auxiliary Converter Activate PDU1 MB1 Redundant Main Auxiliary Converter and PDU2 MB2 Nominal Main Auxiliary Converter Do not activate PDU2 MB2 Redundant Main Auxiliary Converter Enable communication with C&C MDM Do not activate VTC1 nominal power A Activate VTC2 nominal power A, but skip the verification of the nominal ready status for both VTC1 and VTC2 Enable VTC2 Physical Gnd Tlm packet Configure VTC2 to MASTER Start VTC2 Logical Tlm Packet 1 + 2 Activate PDU1 and PDU2 outlets to VTC1 (VTC command to PDU) Activate VTC1 nominal power B and expect the following current values: <ul style="list-style-type: none"> VTC2 Nom Pwr A Current < 0.19 A VTC2 Nom Pwr B Current < 2.14 A Verify that VTC1 and VTC2 nominal ready status is Ready Enable telemetry packet physical 1 on VTC1 Activate VTC2 nominal power B Configure VTC1 to Slave Activate PDU1 Nom_Aux_Conv and PDU2_Redun_Aux_Conv via VTC Hardwired Commands (establish PDU internal redundancy) 	<p>N2-2 MDM anomaly</p>	<p>Loss of hardwired commands and telemetry from N2-2 MDM, refer to {COLUMBUS POWER BUS LOSS MATRIX} (SODF: ASSY OPS: REF DATA) to identify affected equipment. Additional loss of power redundancy on VTC1 (power A unavailable).</p>

CRIB SHEETS COLUMBUS BERTHED SURVIVAL MODE ACTIVATION

(ASSY MAL/1E/FIN/MULTI E)

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Failure	Workaround	Cause	Impact
	<ul style="list-style-type: none"> When verifying microcontroller status during the activation of the PDUs cross strapped power bus, expect the PDU1 nominal controller to be Off and the redundant controller to be On After reaching the BSM configure VTC1 as MASTER and VTC2 as SLAVE 		
STEP 2 - ACTIVATING PDU			
Steps 2.1 thru 2.4 (case 1): Any PDU Pwr Status - Off	Perform the necessary actions as per {PDU PWR STATUS FAILURE INDICATIONS} (SODF: ASSY MAL: MALFUNCTION)	---	---
Steps 2.1 thru 2.4 (case 2): Any PDU VTC Pwr Bus Status - Off	Perform the necessary actions as per {PDU PWR STATUS FAILURE INDICATIONS} (SODF: ASSY MAL: MALFUNCTION)	---	---
Steps 2.1 thru 2.4 (case 3): Any PDU Main Input Current = 0 (Related PDU Status indicates ON)	Continue activation (Additional insight into failure mode will be available when activating and initializing VTC1 and VTC2)	Hardline ML-N(R) cable (W5006 & W5007) not connected or sensor failure	Loss of insight, refer to {COLUMBUS POWER BUS LOSS MATRIX} (SODF: ASSY OPS: REF DATA) to identify affected equipment.

CRIB SHEETS COLUMBUS BERTHED SURVIVAL MODE ACTIVATION
 (ASSY MAL/1E/FIN/MULTI E)

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Failure	Workaround	Cause	Impact
Step 2.1: PDU1 Main Input Current ≥ 5.0 A	1) If confirmed sensor failure then continue with activating the PDU1 MB1 redundant main auxiliary converter and expect the same signature. 2) If unable to confirm sensor failure, power off PDU controller and continue activation	1) Sensor failure 2) Possible controller short	1) Loss insight for PDU1 MB1 main and redundant power controllers. Note: Each PDU has only one current sensor. 2) Loss of nominal PDU controller.
Step 2.2: PDU1 Main Input Current ≥ 5.0 A	1) Power off redundant PDU controller 2) Recover from complete PDU1 failure: <ul style="list-style-type: none"> • Power off nominal PDU1 controller • Complete Berthed Survival Mode activation according to {SINGLE PDU2 COLUMBUS BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY MAL: CONTINGENCY) procedure • Perform Columbus final activation as per {SINGLE PDU2 COLUMBUS FINAL ACTIVATION} (SODF: ASSY MAL: CONTINGENCY) 	1) Possible controller short 2) PDU short	1) Loss of redundant PDU controller 2) Loss of PDU, refer to {COLUMBUS POWER BUS LOSS MATRIX} (SODF: ASSY OPS: REF DATA) to identify affected equipment.

CRIB SHEETS COLUMBUS BERTHED SURVIVAL MODE ACTIVATION
 (ASSY MAL/1E/FIN/MULTI E)

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Failure	Workaround	Cause	Impact
Step 2.3: PDU2 Main Input Current ≥ 5.0 A	1) If confirmed sensor failure then continue with activating the PDU2 MB1 redundant main auxiliary converter and expect the same signature. 2) If unable to confirm sensor failure power off PDU controller and continue activation	1) Sensor failure 2) Possible controller short	1) Loss of insight for PDU1 MB1 main and redundant power controllers. Note: Each PDU has only one current sensor. 2) Loss of nominal PDU controller.
Steps 2.4: PDU2 Main Input Current ≥ 5.0 A	1) Power off PDU2 redundant controller 2) Recover from complete PDU2 failure: <ul style="list-style-type: none"> • Power off nominal PDU2 controller • Complete Berthed Survival Mode activation according to {SINGLE PDU1 COLUMBUS BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY MAL: CONTINGENCY) procedure • Perform Columbus final activation as per {SINGLE PDU1 COLUMBUS FINAL ACTIVATION} (SODF: ASSY MAL: CONTINGENCY) 	1) Possible controller short 2) PDU short	1) Loss of redundant PDU controller. 2) Loss of PDU, refer to {COLUMBUS POWER BUS LOSS MATRIX} (SODF: ASSY OPS: REF DATA) to identify affected equipment.

CRIB SHEETS COLUMBUS BERTHED SURVIVAL MODE ACTIVATION
 (ASSY MAL/1E/FIN/MULTI E)

Failure	Workaround	Cause	Impact
STEP 3 - ENABLING COMMUNICATION WITH C&C MDM			
Step 3.1: Master VTC Recovery Step 1 - Ena or Master VTC Recovery Step 2 - Ena or Slave VTC Recovery - Ena	<ul style="list-style-type: none"> • Activate VTC1 nominal power A and enable telemetry packet physical 1 on VTC1 • Activate VTC2 nominal power A • Enable RT I/O with VTC1 and VTC2 • Enable telemetry packet physical 1 on VTC2 • Activate VTC1 nominal power B • Activate VTC2 nominal power B • Continue activation with configuration of Master and Slave VTC 	Software error	Activate VTC before I/O is enabled and therefore will not see VTC telemetry during the bootup process.
Step 3.2: 21 VTC 1 RT Status - Inh	1) Swap 1553 channels 2) Recover from loss of VTC1: <ul style="list-style-type: none"> • Consider safing VTC1 as necessary • Complete Berthed Survival Mode activation according to {COLUMBUS SINGLE VTC2 BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY MAL: CONTINGENCY) procedure • Perform Columbus final activation as per {COLUMBUS SINGLE VTC2 FINAL ACTIVATION} (SODF: ASSY MAL: CONTINGENCY) procedure 	1) Channel failure 2) I/O hardware, software error	1) None. 2) Loss of VTC1, loss of nominal power B and redundant power A feed to VTC2. Loss of all hardwired tlm and cmd connected to VTC1 (refer to TBD Table ECD May 2006).

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Failure	Workaround	Cause	Impact
Step 3.3: 21 VTC 2 RT Status - Inh	1) Swap 1553 channels. 2) Recover from loss of VTC2: <ul style="list-style-type: none"> • Consider safing VTC2 as necessary • Complete Berthed Survival Mode activation according to {COLUMBUS SINGLE VTC1 BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY MAL: CONTINGENCY) procedure Perform Columbus final activation as per {COLUMBUS SINGLE VTC1 FINAL ACTIVATION} (SODF: ASSY MAL: CONTINGENCY)	1) Channel failure 2) I/O hardware, software error	1) None 2) Loss of VTC2, loss of nominal power B and redundant power A feed to VTC1. Loss of all hardwired tlm and cmd connected to VTC2 (refer to TBD Table ECD May 2006).
STEP 4 – ACTIVATING AND INITIALIZING VTC1 AND VTC2			
Step 4.1 (case 1) VTC1 Nom Pwr A Status – Off	Check VTC1 Nom Pwr A Current: <ol style="list-style-type: none"> 1) If current value is < 0.19 A: <ul style="list-style-type: none"> • Activate VTC2 nominal power A • Enable telemetry packet physical 1 on VTC2 • Activate VTC1 nominal power B and verify the VTC1 and VTC2 nominal ready status is “Ready” • Enable telemetry packet physical 1 on VTC1 • Activate VTC2 nominal power B • Continue activation with configuration of Master and Slave VTC 2) If current value is ≤ 2.14 A: <ul style="list-style-type: none"> • Continue activation 	1) VTC1 nominal power A converter or MDM card problem 2) Power status sensor failure or N2-2 MDM component failure	1) Loss of redundant power A feeder to nominal VTC 1 branch (VTC1 Nom Power B will be commanded on by VTC2). 2) Loss of insight Note: Idle response is sufficient to perform initialization as slave or master.

CRIB SHEETS COLUMBUS BERTHED SURVIVAL MODE ACTIVATION
 (ASSY MAL/1E/FIN/MULTI E)

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Failure	Workaround	Cause	Impact
Step 4.1 (case 2): VTC1 Nom Pwr A Current > 2.14 A	<ul style="list-style-type: none"> • Deactivate VTC1 nominal power A and activate VTC2 nominal power A • Enable telemetry packet physical 1 on VTC2 • Activate VTC1 nominal power B and verify the VTC1 and VTC2 nominal ready status is "Ready" • Enable telemetry packet physical 1 on VTC1 • Activate VTC2 nominal power B • Continue activation with configuration of Master and Slave VTC 	VTC1 sensor failure, VTC nominal converter or branch failure (potential short) or MDM output driver failure.	Loss of redundant power A feeder to nominal VTC1 branch (VTC1 Nom Pwr B will be commanded on by VTC2). Note: Idle response is sufficient to perform initialization as slave or master.
Step 4.1 (case 3): VTC1 Idle Config Mode – not "Idle Mode"	<ol style="list-style-type: none"> 1) Swap 1553 channel on CB INT-1 2) Power cycle VTC1: Verify VTC1 Idle Config Mode - Idle Mode Continue activation 3) Recover from VTC1 nominal branch failure: <ul style="list-style-type: none"> • Activate VTC2 nominal power A • Enable telemetry packet physical 1 on VTC2 • Activate VTC1 nominal power B • Reconfigure VTC1 to its redundant branch performing the necessary actions from the {4.701(4.704) SWITCHOVER VTC1(2) NOMINAL TO REDUNDANT} (SODF: ASSY MAL: CONTINGENCY) procedure • Verify the VTC1 and VTC2 nominal ready status is "Ready" • Enable telemetry packet physical 1 on 	<ol style="list-style-type: none"> 1) RT problem between C&C MDM and VTC1 (potentially connector problem) 2) Transient VTC1 problem 3) VTC1 nominal branch failure 	<ol style="list-style-type: none"> 1) Loss of CB INT-1 redundancy. Crew may remate connector later. 2) None. 3) Loss of VTC1 (Master) internal redundancy.

CRIB SHEETS COLUMBUS BERTHED SURVIVAL MODE ACTIVATION
 (ASSY MAL/1E/FIN/MULTI E)

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Failure	Workaround	Cause	Impact
	VTC1 <ul style="list-style-type: none"> • Activate VTC2 nominal power B • Continue activation with configuration of Master and Slave VTC • When enabling the C&W for VTC redundancy management, enable only the "Master VTC Recovery Step 2" and the "Slave VTC Recovery" 		
	4) Recover from loss of VTC1: <ul style="list-style-type: none"> • Consider safing VTC1 as necessary • Complete Berthed Survival Mode activation according to {COLUMBUS SINGLE VTC2 BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY MAL: CONTINGENCY) procedure • Perform Columbus final activation as per {COLUMBUS SINGLE VTC2 FINAL ACTIVATION} (SODF: ASSY MAL: CONTINGENCY) procedure 	4) VTC failure	4) Loss of VTC1. Loss of all hardwired tlm and cmd connected to VTC1 (refer to TBD Table ECD May 2006).
Step 4.2: Pre-emptive packets from VTC1 not received by COL-CC	<ul style="list-style-type: none"> • Activate VTC2 nominal power A • Enable telemetry packet physical 1 on VTC2 1) If VTC2 pre-emptive packets are received by COL-CC : <ul style="list-style-type: none"> • Reconfigure VTC1 to its redundant branch performing the necessary actions from the {4.701(4.704) SWITCHOVER VTC1(2) NOMINAL TO REDUNDANT} (SODF: ASSY MAL: CONTINGENCY) procedure • Enable telemetry packet physical 1 on VTC1 • Activate VTC2 nominal power B • Continue activation with configuration of Master and Slave VTC 	1) Error on VTC1 nominal branch	1) Loss of VTC1 (Master) internal redundancy.

CRIB SHEETS COLUMBUS BERTHED SURVIVAL MODE ACTIVATION

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Failure	Workaround	Cause	Impact
	<ul style="list-style-type: none"> • When enabling the C&W for VTC redundancy management, enable only the “Master VTC Recovery Step 2” and the “Slave VTC Recovery” <p>2) If neither VTC1 nor VTC2 pre-emptive packets are received by COL-CC:</p> <ul style="list-style-type: none"> • complete the Berthed Survival Mode activation using the processed parameters • Continue activation by activating the VTC1 nominal power B 		
<p>Step 4.3 (case 1): VTC2 Nom Pwr A Status – Off</p>	<p>Check VTC2 Nom Pwr A Current:</p> <p>1) If current value is < 0.19 A:</p> <ul style="list-style-type: none"> • Activate VTC2 nominal power B and verify the VTC1 and VTC2 nominal ready status is “Ready” • Enable telemetry packet physical 1 on VTC2 • Activate VTC1 nominal power B • Continue activation with configuration of Master and Slave VTC <p>2) If current value is \leq 2.14 A:</p> <ul style="list-style-type: none"> • Continue activation 	<p>1) VTC2 nominal power A converter or MDM card problem</p> <p>2) Power status sensor failure or N2-2 MDM component failure</p>	<p>1) Loss of redundant power A feeder to nominal VTC2 branch (VTC2 Nom Power B will be commanded on by VTC1).</p> <p>2) Loss of insight</p> <p>Note: Idle response is sufficient to perform initialization as slave or master.</p>

CRIB SHEETS COLUMBUS BERTHED SURVIVAL MODE ACTIVATION
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Failure	Workaround	Cause	Impact
Step 4.3 (case 2): VTC2 Nom Pwr A Current > 2.14 A	<ul style="list-style-type: none"> • Deactivate VTC2 nominal power A • Activate VTC2 nominal power B • Enable telemetry packet physical 1 on VTC2 • Activate VTC1 nominal power B and verify the VTC1 and VTC2 nominal ready status is "Ready" • Continue activation with configuration of Master and Slave VTC 	VTC2 sensor failure, VTC nominal converter or branch failure (potential short) or MDM output driver failure	Loss of redundant power A feeder to nominal VTC2 branch (VTC2 Nom Pwr B will be commanded on by VTC1).
Step 4.3 (case 3): VTC2 Idle Config Mode – not "Idle Mode"	<ol style="list-style-type: none"> 1) Swap 1553 channel on CB INT-2 2) Power cycle VTC2 Verify VTC2 Idle Config Mode - Idle Mode Continue activation. 3) Recover VTC2 nominal branch failure: <ul style="list-style-type: none"> • Reconfigure VTC2 to its redundant branch performing the necessary actions from the {4.701(4.704) SWITCHOVER VTC1(2) NOMINAL TO REDUNDANT} (SODF: ASSY MAL: CONTINGENCY) procedure • Verify the VTC1 and VTC2 nominal ready status is "Ready" • Enable telemetry packet physical 1 on VTC2 • Activate VTC1 nominal power B • Continue activation with configuration of Master and Slave VTC • When enabling the C&W for VTC redundancy management, enable only the "Master VTC Recovery Step 1" and the "Master VTC Recovery Step 2" 	<ol style="list-style-type: none"> 1) RT problem between C&C MDM and VTC2 (potentially connector problem) 2) Transient VTC2 problem 3) VTC2 nominal branch failure 	<ol style="list-style-type: none"> 1) Loss of CB INT-2 redundancy. Crew may remate connector later 2) None. 3) Loss of VTC2 (Slave) internal redundancy.

CRIB SHEETS COLUMBUS BERTHED SURVIVAL MODE ACTIVATION
 (ASSY MAL/1E/FIN/MULTI E)

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Failure	Workaround	Cause	Impact
	4) Recover the VTC2 unavailability: <ul style="list-style-type: none"> • Consider safing VTC2 as necessary • Complete Berthed Survival Mode activation according to {COLUMBUS SINGLE VTC1 BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY MAL: CONTINGENCY) procedure • Perform Columbus final activation as per {COLUMBUS SINGLE VTC1 FINAL ACTIVATION} (SODF: ASSY MAL: CONTINGENCY) procedure 	4) VTC2 failure	4) Loss of VTC2. Loss of all hardwired tlm and cmd connected to VTC2 (refer to TBD Table ECD May 2006).
Step 4.3 (case 4): VTC1 Nom Ready Status – Not Ready	1) Power cycle VTC1 Verify VTC1 Nom Ready Status –Ready Continue activation 2) Recover VTC1 nominal branch failure: <ul style="list-style-type: none"> • Reconfigure VTC1 to its redundant branch performing the necessary actions from the {4.701(4.704) SWITCHOVER VTC1(2) NOMINAL TO REDUNDANT} (SODF: ASSY MAL: CONTINGENCY) procedure • Verify the VTC1 and VTC2 nominal ready status is “Ready” • Enable telemetry packet physical 1 on VTC1 • Enable telemetry packet physical 1 on VTC2 • Activate VTC2 nominal power B • Continue activation with configuration of Master and Slave VTC • When enabling the C&W for VTC redundancy management, enable only the “Master VTC Recovery Step 2” and the “Slave VTC Recovery” 	1) Transient VTC1 problem 2) VTC1 nominal branch failure	1) None. 2) Loss of VTC1 (Master) internal redundancy.

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Failure	Workaround	Cause	Impact
Step 4.3 (case 5): VTC2 Nom Ready Status – Not Ready	<ol style="list-style-type: none"> 1) Power cycle VTC2 Verify VTC2 Idle Config Mode - Idle Mode Verify VTC2 Ready Status – Ready Continue activation 2) Recover VTC2 nominal branch failure: <ul style="list-style-type: none"> • Reconfigure VTC2 to its redundant branch performing the necessary actions from the {4.701(4.704) SWITCHOVER VTC1(2) NOMINAL TO REDUNDANT} (SODF: ASSY MAL: CONTINGENCY) procedure • Verify the VTC1 and VTC2 nominal ready status is “Ready” • Enable telemetry packet physical 1 on VTC2 • Activate VTC1 nominal power B • Continue activation with configuration of Master and Slave VTC • When enabling the C&W for VTC redundancy management, enable only the “Master VTC Recovery Step 1” and the “Master VTC Recovery Step 2” 3) Recover the VTC2 unavailability: <ul style="list-style-type: none"> • Consider safing VTC2 as necessary • Complete Berthed Survival Mode activation according to {COLUMBUS SINGLE VTC1 BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY MAL: CONTINGENCY) procedure • Perform Columbus final activation as per {COLUMBUS SINGLE VTC1 FINAL ACTIVATION} (SODF: ASSY MAL: CONTINGENCY) procedure 	<ol style="list-style-type: none"> 1) Transient VTC2 problem 2) VTC2 nominal branch failure 3) VTC2 failure 	<ol style="list-style-type: none"> 1) None. 2) Loss of VTC2 (Slave) internal redundancy. 3) Loss of VTC2. Loss of all hardwired tlm and cmd connected to VTC2 (refer to TBD Table ECD May 2006).

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Failure	Workaround	Cause	Impact
Step 4.4: VTC2 pre-emptive packets not received by COL-CC	<ul style="list-style-type: none"> • Reconfigure VTC2 to its redundant branch performing the necessary actions from the {4.701(4.704) SWITCHOVER VTC1(2) NOMINAL TO REDUNDANT} (SODF: ASSY MAL: CONTINGENCY) procedure • Activate VTC1 nominal power B • Continue activation with configuration of Master and Slave VTC • When enabling the C&W for VTC redundancy management, enable only the "Master VTC Recovery Step 1" and the "Master VTC Recovery Step 2" 	VTC2 nominal branch failure	Loss of VTC2 (Slave) internal redundancy.
Steps 4.5 (case 1): VTC1 Nom Pwr B Status – not On	Check VTC1 Nom Power B Current: 1) If current value is < 0.19 A: <ul style="list-style-type: none"> • Continue activation 2) If current value is < 1.08 A: <ul style="list-style-type: none"> • continue activation 	1) VTC1 power feed problem 2) Sensor problem	1) Loss of VTC1 power feed redundancy. 2) Loss of insight.
Steps 4.5 (case 2): VTC1 Nom Pwr A Current > 1.33 A	1) Recover nominal converter failure: <ul style="list-style-type: none"> • Switch power A feeder off • Verify power B current is < 2.14 A • Continue activation by activating the VTC2 nominal power B 2) Recover nominal branch failure: <ul style="list-style-type: none"> • Reconfigure VTC1 to its redundant branch performing the necessary actions from the {4.701(4.704) SWITCHOVER VTC1(2) NOMINAL TO REDUNDANT} (SODF: ASSY MAL: CONTINGENCY) procedure • Continue activation by activating the 	1) VTC1 nominal converter short or sensor failure 2) VTC1 nominal branch error	1) Loss of VTC1 power feed redundancy. 2) Loss of VTC1 (Master) internal redundancy

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 (ASSY MAL/1E/FIN/MULTI E)

Failure	Workaround	Cause	Impact
	VTC2 nominal power B <ul style="list-style-type: none"> When enabling the C&W for VTC redundancy management, enable only the "Master VTC Recovery Step 2" and the "Slave VTC Recovery" 		
Steps 4.5 (case 3): VTC1 Nom Pwr B Current > 1.08 A	1) Recover nominal converter failure: <ul style="list-style-type: none"> Switch power B feeder off Verify power A current is < 2.14 A Continue activation by activating the VTC2 nominal power B 2) Recover nominal branch failure: <ul style="list-style-type: none"> Reconfigure VTC1 to its redundant branch performing the necessary actions from the {4.701(4.704) SWITCHOVER VTC1(2) NOMINAL TO REDUNDANT} (SODF: ASSY MAL: CONTINGENCY) procedure Continue activation by activating the VTC2 nominal power B When enabling the C&W for VTC redundancy management, enable only the "Master VTC Recovery Step 2" and the "Slave VTC Recovery" 	1) VTC1 nominal converter short or sensor failure 2) VTC1 nominal branch error	1) Loss of VTC1 power feed redundancy 2) loss of VTC1 (Master) internal redundancy

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Failure	Workaround	Cause	Impact
Steps 4.5 and 4.6 (case 4): VTC1(2) Nom Temp > 48.6 °C	<ul style="list-style-type: none"> • Reconfigure VTC1 to its redundant branch performing the necessary actions from the {4.701(4.704) SWITCHOVER VTC1(2) NOMINAL TO REDUNDANT} (SODF: ASSY MAL: CONTINGENCY) procedure • Continue activation by activating the VTC2 nominal power B • When enabling the C&W for VTC redundancy management, enable only the “Master VTC Recovery Step 2” and the “Slave VTC Recovery” 	VTC1 nominal branch high temperature or sensor failure	Loss of VTC1 (Master) internal redundancy.
Steps 4.6 (case 1): VTC2 Nom Pwr B Status – not On	Check VTC2 Nom Power B Current: 1) If current value is < 0.19 A: <ul style="list-style-type: none"> • Continue activation 2) If current value is < 1.08 A: <ul style="list-style-type: none"> • continue activation 	1) VTC2 power feed problem 2) Sensor problem	1) Loss of VTC2 power feed redundancy. 2) Loss of insight.
Steps 4.6 (case 2): VTC2 Nom Pwr A Current > 1.33 A	1) Recover nominal converter failure: <ul style="list-style-type: none"> • Switch power A feeder off • Verify power B current is < 2.14 A • Continue activation with configuration of Master and Slave VTC 2) Recover nominal branch failure: <ul style="list-style-type: none"> • Reconfigure VTC2 to its redundant branch performing the necessary actions from the {4.701(4.704) SWITCHOVER VTC1(2) NOMINAL TO REDUNDANT} (SODF: ASSY MAL: CONTINGENCY) procedure • When enabling the C&W for VTC 	1) VTC2 nominal converter short or sensor failure 2) VTC2 nominal branch error	1) Loss of VTC2 power feed redundancy. 2) Loss of VTC2 (Slave) internal redundancy

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Failure	Workaround	Cause	Impact
	redundancy management, enable only the "Master VTC Recovery Step 1" and the "Master VTC Recovery Step 2"		
Steps 4..6 (case 3): VTC2 Nom Pwr B Current > 1.08 A	1) Recover nominal converter failure: <ul style="list-style-type: none"> • Switch power A feeder off • Verify power B current is < 2.14 A • Continue activation with configuration of Master and Slave VTC 2) Recover nominal branch failure: <ul style="list-style-type: none"> • Reconfigure VTC2 to its redundant branch performing the necessary actions from the {4.701(4.704) SWITCHOVER VTC1(2) NOMINAL TO REDUNDANT} (SODF: ASSY MAL: CONTINGENCY) procedure • Continue activation with configuration of Master and Slave VTC • When enabling the C&W for VTC redundancy management, enable only the "Master VTC Recovery Step 1" and the "Master VTC Recovery Step 2" 	1) VTC2 nominal converter short or sensor failure 2) VTC2 nominal branch error	1) Loss of VTC2 power feed redundancy 2) Loss of VTC2 (Slave) internal redundancy
Steps 4.6 (case 4): VTC2 Nom Temp > 48.6 °C	<ul style="list-style-type: none"> • Reconfigure VTC2 to its redundant branch performing the necessary actions from the {4.701(4.704) SWITCHOVER VTC1(2) NOMINAL TO REDUNDANT} (SODF: ASSY MAL: CONTINGENCY) procedure • Continue activation with configuration of Master and Slave VTC • When enabling the C&W for VTC redundancy management, enable only the "Master VTC Recovery Step 1" and the "Master VTC Recovery Step 2" 	VTC2 nominal branch high temperature or sensor failure	2) Loss of VTC2 (Slave) internal redundancy

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Failure	Workaround	Cause	Impact
STEP 5 – CONFIGURING VTC1 TO MASTER AND VTC2 TO SLAVE			
Step 5.1: VTC2 Mode – not Slave or VTC2 Idle Config Mode – not Not Idle	1) Power cycle VTC2 Verify VTC2 Mode – Slave Verify VTC2 Idle Config Mode – Not Idle Continue activation 2) Recover from nominal branch failure: <ul style="list-style-type: none"> • Reconfigure VTC2 to its redundant branch performing the necessary actions from the {4.701(4.704) SWITCHOVER VTC1(2) NOMINAL TO REDUNDANT} (SODF: ASSY MAL: CONTINGENCY) procedure • Continue activation enabling the physical telemetry packets 4 and 5 • When enabling the C&W for VTC redundancy management, enable only the “Master VTC Recovery Step 1” and the “Master VTC Recovery Step 2” 3) Recover from the loss of VTC2: <ul style="list-style-type: none"> • Consider safing VTC2 as necessary • Complete Berthed Survival Mode activation according to {COLUMBUS SINGLE VTC1 BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY MAL: CONTINGENCY) procedure • Perform Columbus final activation as per {COLUMBUS SINGLE VTC1 FINAL ACTIVATION} (SODF: ASSY MAL: CONTINGENCY) procedure 	1) VTC2 transient problem 2) VTC2 nominal branch failure 3) VTC2 failure	1) None. 2) Loss of VTC2 (Slave) internal redundancy 3) Loss of VTC2. Loss of all hardwired tlm and cmd connected to VTC2 (refer to TBD Table ECD May 2006).
Step 5.2: No verification method	Continue activation. Note: These packets only increase the sample rate of caution and warning events from the VTC to the C&C MDM.		

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Failure	Workaround	Cause	Impact
	(From three packets to five packets per second.)		
Step 5.3: Unverifiable until step 5.4	Cannot activate VTC1 as master if this command is not executed.		
Step 5.4: VTC1 Mode - not Master or VTC1 DMS Mode – not Vital or VTC1 Idle Config Mode – not Not Idle	1) Reattempt the command to notify VTC1 that VTC2 is in Slave mode and the command to initialize VTC1 in Master mode 2) Power cycle VTC1 Verify VTC1 Mode – Master Verify VTC1 DMS Mode - Vital Verify VTC1 Idle Config Mode – Not Idle Continue activation 3) Recover from nominal branch failure: <ul style="list-style-type: none"> • Reconfigure VTC1 to its redundant branch performing the necessary actions from the {4.701(4.704) SWITCHOVER VTC1(2) NOMINAL TO REDUNDANT} (SODF: ASSY MAL: CONTINGENCY) procedure • Continue activation enabling the logical telemetry packets 1 and 2 • When enabling the C&W for VTC redundancy management, enable only the “Master VTC Recovery Step 2” and the “Slave VTC Recovery” 4) Recover from loss the of VTC1: <ul style="list-style-type: none"> • Consider safing VTC1 as necessary • Complete Berthed Survival Mode activation according to {COLUMBUS SINGLE VTC2 BERTHED SURVIVAL MODE ACTIVATION} (SODF: ASSY 	1) VTC1 transient failure or loss of the Notify Mode command. 2) VTC1 transient problem 3) VTC1 nominal branch failure 4) VTC1 failure	1) None. 2) None. 3) Loss of VTC1 (Master) internal redundancy 4) Loss of VTC1. Loss of all hardwired tlm and cmd connected to VTC1 (refer to TBD Table ECD May 2006).

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Failure	Workaround	Cause	Impact
	MAL: CONTINGENCY) procedure <ul style="list-style-type: none"> Perform Columbus final activation as per {COLUMBUS SINGLE VTC2 FINAL ACTIVATION} (SODF: ASSY MAL: CONTINGENCY) procedure 		
Step 5.5: Master VTC telemetry is not provided to the C&C MDM for S-band downlink	1) Start downlink of the pre-emptive packet that "mirrors" CVT telemetry, then continue activation swapping telemetry packets as needed for the remainder of the procedure execution 2) Stop activation until resolved		1) Crew unable to see select Columbus data on PCS
Steps 5.6: VTC1 Master pre-emptive packets not received by COL-CC	If pre-emptive packets are not received by COL-CC , continue activation to Berthed Survival Mode with processed parameters	Error with onboard CDH system or ground processing	COL-CC unable to see pre-emptive packets.
Step 5.7: Vital Bus Recon – Inhibited	Continue activation	Software error	Loss of automated vital bus 1553 channel swapping.
Step 5.8: System Bus Recon – Inhibited	Continue activation	Software error	Loss of automated systems bus 1553 channel swapping.
Step 5.9: 21 VTC 1 RT FDIR Status – Inh	Continue activation	Software error	Loss of automated 1553 channel switching for VTC1.
Step 5.10: 21 VTC 2 RT FDIR Status – Inh	Continue activation	Software error	Loss of automated 1553 channel switching for VTC2.

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Failure	Workaround	Cause	Impact
Step 5.11: Master VTC Recovery Step 1 – Inh or Master VTC Recovery Step 2 – Inh or Slave VTC Recovery – Inh	Continue activation	Software error	Loss of automated VTC recovery capability.
Step 5.12: MCC-H to generically manage			
STEP 6 – ACTIVATING PDU CROSS STRAPPED POWER BUS			
Step 6.1 (case 1): PDU1 Nom Cntl – Off and PDU1 Redun Cntl – On	Continue activation	Watchdog mechanism detected nominal controller failure and swapped controllers	Loss of PDU1 internal redundancy.
Step 6.1 (case 2): PDU2 Nom Cntl – Off and PDU2 Redun Cntl – On	Continue activation	Watchdog mechanism detected nominal controller failure and swapped controllers	Loss of PDU2 internal redundancy.
Step 6.2: VTC1 Buffer – not Empty	Response is captured in procedure. Continue activation	VTC1 buffer full.	None.

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Failure	Workaround	Cause	Impact
Step 6.3: PDU SSPC Aux Converter(s) fail to activate (ground verification)	1) COL-CC to send manual commands to activate the specific SSPC Aux supply 2) Continue activation	1) Transient PDU failure or ACS unsuccessful 2) PDU SSPC Aux converter failure	1) None. 2) Loss of 120V outlet power connected to the failed converter. Redundant equipment can be powered from alternate PDU. Refer to {COLUMBUS POWER BUS LOSS MATRIX} (SODF: ASSY OPS: REF DATA).
Step 6.4: PDU 1/2 Redun Pwr Bus Status – Off	Continue activation	PDU outlet failure	PDU1 to PDU2 valve driver cross strap (redundant) power loss.
Step 6.5: PDU 2/1 Redun Pwr Bus Status – Off	Continue activation	PDU outlet failure	PDU2 to PDU1 valve driver cross strap (redundant) power loss.
Step 6.6: PDU 1 Cross Strapped Conv Status – Off	Continue activation	PDU auxiliary converter failure	PDU2 to PDU1 valve driver cross strap (redundant) power loss.
Step 6.7: PDU 2 Cross Strapped Conv Status – Off	Continue activation	PDU auxiliary converter failure	PDU1 to PDU2 valve driver cross strap (redundant) power

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Failure	Workaround	Cause	Impact
			loss.
Step 6.8: PDUx Outlet 21 – Off (1 of 2 indications)	Continue activation	Internal PDU failure	Lighting within module reduced to half capacity.
STEP 7 – ACTIVATING HEATER CONTROL UNIT			
Step 7.1 (case 1): PDU1 HCU1 Pwr Bus Status – Off	Check PDU1 HCU1 Input Current: 1) If input current value is in the nominal range then continue activation 2) If input current value is zero then continue activation	1) Sensor failure 2) HCU1 or PDU1 outlet failure	1) Loss of insight. 2) Redundant heater control loss.
Step 7.1 (case 2): PDU1 HCU1 Input Current > 10 A	Deactivate PDU outlet to HCU1 and continue activation	Possible short or HCU1 failure	Redundant heater string lost
Step 7.2 (case 1): PDU2 HCU2 Pwr Bus Status – Off	Check PDU2 HCU2 Input Current: 1) If input current value is in the nominal range then continue activation 2) If input current value is zero continue activation	1) Sensor failure 2) HCU2 or PDU2 outlet failure	1) Loss of insight. 2) Redundant heater control loss.
Step 7.2 (case 2): PDU2 HCU2 Input Current > 10 A	Deactivate PDU outlet to HCU2 and continue activation	Possible short or HCU2 failure	Redundant heater string lost
Step 7.2 (case 3): Any HCU heater control loop status not enabled. (ground only verifications)	Continue activation	HCU software or heater hardware failure	Loss of heater chain redundancy

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Failure	Workaround	Cause	Impact
STEP 1 - ACTIVATING PDU OUTLET			
Steps 1.1 thru 1.4: PDU Subsys Pwr Bus Posn X – Off	Continue activation	PDU outlet failure	Loss of power outlet. Redundant equipment can be powered from alternate PDU. Refer to {COLUMBUS POWER BUS LOSS MATRIX} (SODF: ASSY OPS: REF DATA)
Steps 1.5: Rack D1 Pwr Bus – Off	Activate on alternate equip. Do not enable FDIR for WPA, CWSA and CTCU. Continue activation	PDU1 outlet failure	Loss of power outlet. WPA1, CWSA1 and TCV1 power lost (CTCU1 function lost). Refer to {PDU 120V ELECTRICAL BUS LOSS MATRIX} (SODF: ASSY OPS: REF DATA)
Steps 1.6: Rack D1 Pwr Bus – Off	Do not enable FDIR for WPA, CWSA and CTCU. Continue activation	PDU2 outlet failure	Loss of power outlet. WPA2, CWSA2 and TCV2 power lost (CTCU2 function lost). Refer to {PDU 120V ELECTRICAL BUS LOSS MATRIX} (SODF: ASSY OPS: REF DATA)
Step 1.7 (case 1): WPA1_Accum_Abs_Press1_VTC not 165 – 195 kPa or WPA1_Accum_Abs_Press2_VTC not 165 – 195 kPa (1 of 2 indications)	Continue activation	Sensor failure	Loss of redundant monitoring of accumulator pressure
Step 1.7 (case 2): WPA1_Accum_Abs_Press1_VTC not 165 – 195 kPa and WPA1_Accum_Abs_Press2_VTC not 165 – 195 kPa (2 of 2 indications)	If both sensors are above 195 kPa continue activation If the Accumulator pressure is between 120 kPa and 165 kPa continue activation. Consider skipping of enabling FDIR for water loop reconfiguration if the accumulator pressure is close to the FDIR	Launch pressure was above 195 kPa. Accumulator nitrogen charge has leaked out.	None. Expected pressure below 210 kPa to avoid FDIR trigger (N2 supply valve closure at 210 kPa and BSM at 280 kPa) Loss of WPA FDIR for Accum Overpress, WPA Switchover and LTHX Overtemp until the accumulators have been

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Failure	Workaround	Cause	Impact
	<p>reconfiguration limit of 120 kPa.</p> <p>If Accumulator pressure is between 95 and 120 kPa skip enabling FDIR for water loop reconfiguration until WPA Accumulator is pressurized. Continue activation</p> <p>If Accumulator pressure is below 95 kPa. Perform the procedure {COLUMBUS NITROGEN JUMPER INSTALL AND PURGE}, steps 1 through 4, 6 (SODF: ASSY OPS: ASSEMBLY) and the procedure {COLUMBUS WPA ACCUMULATOR SETUP}, (SODF: ASSY OPS: ACTIVATION & CHECKOUT). Continue activation</p>	<p>Accumulator nitrogen charge has leaked out.</p> <p>Accumulator nitrogen charge has leaked out.</p>	<p>pressurized</p> <p>Loss of WPA FDIR for Accum Overpress, WPA Switchover and LTHX Overtemp until the accumulators have been pressurized</p> <p>Pressurization of the WPA Accumulator has to be performed without purging the Columbus Nitrogen Line.</p> <p>Note: At low pressures, the cabin pressure will be used to verify accumulator pressures. The accumulator pressure sensors have a worst-case error of 15 kPa.</p>
<p>Step 1.7 (case 3): WPA2_Accum_Abs_Press1_VTC not 165 – 195 kPa or WPA2_Accum_Abs_Press2_VTC not 165 – 195 kPa (1 of 2 indications)</p>	<p>Continue activation</p>	<p>Sensor failure</p>	<p>Loss of redundant monitoring of accumulator pressure</p>

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Failure	Workaround	Cause	Impact
Step 1.7 (case 4): WPA2_Accum_Abs_Press1_VTC not 165 – 195 kPa and WPA2_Accum_Abs_Press2_VTC not 165 – 195 kPa (2 of 2 indications)	Continue activation	Launch pressure is out of nominal range or nitrogen charge leak.	No impact to activation
Step 1.7 (case 5): WPA1_Accum_Abs_Press1_VTC not 165 – 195 kPa and WPA2_Accum_Abs_Press2_VTC not 165 – 195 kPa (2 of 2 indications)	Continue activation	VTC1 Card Failure	Loss of redundant pressure monitoring Refer to {COLUMBUS DATA BUS LOSS MATRIX} (SODF: ASSY OPS: REF DATA)
Step 1.7 (case 6): WPA1_Accum_Abs_Press2_VTC not 165 – 195 kPa and WPA2_Accum_Abs_Press1_VTC not 165 – 195 kPa (2 of 2 indications)	Continue activation	VTC2 Card Failure	Loss of redundant pressure monitoring. Refer to {COLUMBUS DATA BUS LOSS MATRIX} (SODF: ASSY OPS: REF DATA)
Step 1.8: MCC-H to generically manage			
Step 1.9 (case 1): TPS1 Air Pressure not 719-783 mmHg or TPS2 Air Pressure not 719-783 mmHg or TPS3 Air Pressure not 719-783 mmHg or TPS4 Air Pressure not 719-783 mmHg (1 of 4 indications)	Continue activation	TPS failure	Loss of redundant pressure monitoring
Step 1.9 (case 2): TPS1 Air Pressure not 719-783 mmHg and TPS2 Air Pressure not 719-783 mmHg	Continue activation	VTC2 Card Failure	Loss of redundant pressure C&W monitoring. Refer to {COLUMBUS DATA BUS LOSS MATRIX} (SODF: ASSY OPS: REF DATA)

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Failure	Workaround	Cause	Impact
Step 1.9 (case 3): TPS3 Air Pressure not 719-783 mmHg and TPS4 Air Pressure not 719-783 mmHg	Continue activation	VTC1 Card Failure	Loss of redundant pressure C&W monitoring. Refer to {COLUMBUS DATA BUS LOSS MATRIX} (SODF: ASSY OPS: REF DATA)
Step 1.9 (case 4): TPS1 Air Pressure not 719-783 mmHg and TPS2 Air Pressure not 719-783 mmHg and TPS3 Air Pressure not 719-783 mmHg and TPS4 Air Pressure not 719-783 mmHg (4 of 4 indications)	Expected to be observed during vestibule leak check.	Potential cabin leak.	
STEP 2 - ACTIVATING CMU 1-4			
Steps 2.1 (case 1): CMU x Nom Pwr A Status – Off	1) Check CMU x Nom Pwr A Current < 0.19 A Continue activation 2) Check CMU x Nom Pwr A Current < 1.35 A Continue activation	1) Internal CMU x failure 2) Sensor failure	1) Loss of redundant power A feed to CMUx Nominal branch. Next CMU Ready status will not be available until power B applied to this CMU later during activation. 2) Loss of insight (specified measurement)
Step 2.1 (case 2): CMU x Nom Pwr A Current \geq 1.35	Power off CMUx Nom Pwr A. Continue activation	CMUx nominal power feed A short, internal nominal CMUx failure, or sensor failure	Loss of redundant power A feed to CMUx nominal branch. Next CMU Ready Status will not be available until redundant power applied to this CMU later during activation.

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Failure	Workaround	Cause	Impact
Step 2.1 (case 3): CMUx Ready Status – Not Rdy	<ol style="list-style-type: none"> 1) Power cycle CMUx Verify Ready Status – Ready Continue with activation 2) Complete activation of power A converters of remaining CMUs and then switchover to redundant CMUx branch using the Vital system 	<ol style="list-style-type: none"> 1) Transient CMUx problem 2) CMUx nominal branch failure 	<ol style="list-style-type: none"> 1) None 2) Loss of CMUx internal redundancy
Step 2.2 (case 1): CMU x Nom Pwr B Status – Off	<ol style="list-style-type: none"> 1) Check CMUx Nom Pwr B Current < 0.19 A - continue activation 2) Check CMUx Nom Pwr B Current < 0.75 A - continue activation 	<ol style="list-style-type: none"> 1) CMU converter B failure 2) Sensor failure 	<ol style="list-style-type: none"> 1) Loss of redundant power B feed to CMUx nominal branch 2) Loss of insight (specified measurement)
Step 2.2 (case 2): CMU x Nom Pwr A (B) Current ≥ 0.75 A	<ol style="list-style-type: none"> 1) Power off CMU controller that is ≥ 0.75 A and verify the other power feed is < 1.35 A 2) Switchover to redundant CMUx branch using the Vital system 	<ol style="list-style-type: none"> 1) CMUx nominal power feed A (B) short 2) CMUx nominal branch failure 	<ol style="list-style-type: none"> 1) Loss of redundant power A (B) feed to CMUx nominal branch. 2) Loss of CMUx internal redundancy.
Step 2: A single CMU fails to power on	Activation may continue but will hold until procedures/ workaround is determined.	Entire CMU box fails	
STEP 3 - ACTIVATING WATER LOOP			
Step 3.1 (case 1): MTL Isol Vlv Position – not Open	Leave the MTL Byp Vlv in Bypass and continue activation (including temperature monitoring)	Failed MTL isolation valve	Loss of MTL heat exchanger cooling for Columbus loop. Adequate cooling still available with LTL IFHX for 1E COL config.
Step 3.1 (case 2): MTL Byp Vlv Position – not Flothru	Continue activation (including temperature monitoring)	Failed MTL bypass valve	Loss of MTL heat exchanger cooling for Columbus loop. Adequate cooling still available with LTL IFHX for 1E COL config.

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Failure	Workaround	Cause	Impact
Step 3.1 (case 3): LTL Isol Vlv Position – not Open	Leave the LTL Byp Vlv in Bypass and continue activation (including temperature monitoring)	Failed LTL isolation valve	Loss of LTL heat exchanger cooling for Columbus loop. Adequate cooling still available with MTL IFHX for 1E COL config.
Step 3.1 (case 4): LTL Byp Vlv Position – not Flothru	Continue activation (including temperature monitoring)	Failed LTL bypass valve	Loss of LTL heat exchanger cooling for Columbus loop. Adequate cooling still available with MTL IFHX for 1E COL config.
Step 3.2 (case 1): WOOV1 Posn – not Open	<ul style="list-style-type: none"> • Open WOOV2 in order to avoid a closed volume in the water loop. • Perform {WOOV STATUS NOT OPEN} (SODF: ASSY MAL: MALFUNCTION): If valve open, close WOOV2 and continue activation If valve indeterminate or closed, perform {SINGLE PDU2 COLUMBUS FINAL ACTIVATION} (SODF: ASSY MAL: CONTINGENCY) to activate water loop with WPA2. Resume nominal activation with activation of CLSW and do not enable FDIR for Water Loop Reconfiguration. Post-ingress visually verify position of WOOV1 and close if necessary. Consider keeping WPA1 electronics active to monitor accumulator status. On time may be limited due to thermal concerns. 	Refer to Mal conclusion blocks	<p>Switch to WPA 2 and WOOV2. WPA 1 unavailable. Loop performance potentially affected if the WOOV1 position is not fully closed when using WPA2 and WOOV2.</p> <p>[QUESTION: Is it ok to operate with WOOV1 indeterminate (potentially open) with WPA2 running... potential for water transfer and loop/performance degradation? Worst case(WOOV1 fully open)? FDIR for WPA2 leak? Do we need to evaluate any loop performance after pump activation before continuing (monitor capability)? Analysis by engineering ongoing]</p> <p>To avoid closed volumes in the water loop, the steps within the single PDU2 Final Activation procedure must be swapped. Open first WMV2 and then close WMV1. And open first WMV4 and then close WMV3. WPA1 and WOOV1 are unavailable.</p>

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Failure	Workaround	Cause	Impact
<p>Step 3.2 (case 2): WOOV2 Posn – not Closed</p>	<p>Perform {WOOV STATUS NOT CLOSED} (SODF: ASSY MAL: MALFUNCTION): If valve closed, continue activation If valve indeterminate, continue activation and do not enable FDIR for Water Loop Reconfiguration. Post-ingress visually verify position of WOOV2 and close it if necessary. Consider keeping WPA2 electronics active to monitor accumulator status. On time may be limited due to thermal concerns. If valve open, perform {SINGLE PDU2 COLUMBUS FINAL ACTIVATION} (SODF: ASSY MAL: CONTINGENCY), to activate water loop with WPA2. Continue Final Activation with activation of CLSW and do not enable FDIR for Water Loop Reconfiguration.</p>	<p>Refer to Mal conclusion blocks</p>	<p>None May have degraded loop performance [(Same question as above for indeterminate valve)]</p> <p>Loss of pump redundancy</p>
<p>Step 3.2 (case 3): WOOV3 (4) Posn – not Open</p>	<p>Perform {WOOV STATUS NOT OPEN} (SODF: ASSY MAL: MALFUNCTION): If valve open, continue activation If valve indeterminate, continue activation, do not close WOOV5 so that water will flow past MTL IFHX and continue to LTL IFHX. After crew ingress verify WOOV positions. Open WOOV3(4) if necessary and close WOOV5. If valve closed, continue activation, do not close WOOV5. Do not enable Temperature Monitoring for</p>	<p>Refer to Mal conclusion blocks</p>	<p>None MT IFHX cooling limited. Cooling primarily provided by LT IFHX.</p> <p>Loss of cooling capability from the MT IFHX. Cooling only provided</p>

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Failure	Workaround	Cause	Impact
	<p>WTSB 5. Send manual commands for the remainder of the items to be enabled in the FLAP during WPA Temperature Monitoring.</p>		<p>by LT IFHX.</p>
<p>Step 3.2 (case 4): WOOV5 Posn – not Open</p>	<p>Perform {WOOV STATUS NOT OPEN} (SODF: ASSY MAL: MALFUNCTION): If valve open, continue activation. If valve indeterminate, continue activation. Post-ingress visually verify position of WOOV5 and close if necessary. If valve closed, continue activation and do not send additional command to close WOOV5 prior to WPA activation.</p>	<p>Refer to Mal conclusion blocks</p>	<p>None MT IFHX cooling limited depending on actual position of WOOV5. Cooling remains with the use of the LT IFHX. None, WOOV5 nominally closed later in procedure For MTHX isolation WOOV5 has to be reconfigured manually</p>
<p>Step 3.2 (case 5): WOOV6 (8) Posn – not Open</p>	<p>Perform {WOOV STATUS NOT OPEN} (SODF: ASSY MAL: MALFUNCTION): If valve open, continue activation If valve indeterminate, continue activation, do not close WOOV7 so that water will flow past LTL IFHX. After crew ingress verify WOOV positions. Open WOOV6(8) if necessary and close WOOV7. If valve closed, continue activation, do not close WOOV7. Do not enable Temperature Monitoring for WTSB 6. Send manual commands for the remainder of the items to be enabled in the FLAP during WPA Temperature Monitoring.</p>	<p>Refer to Mal conclusion blocks</p>	<p>None LT IFHX cooling limited. Cooling primarily provided by MT IFHX. Loss of cooling capability from the LT IFHX. Cooling only provided by MT IFHX.</p>

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Failure	Workaround	Cause	Impact
Step 3.2 (case 6): WOOV7 Posn – not Open	Perform {WOOV STATUS NOT OPEN} (SODF: ASSY MAL: MALFUNCTION): If valve open, continue activation. If valve indeterminate, continue activation. Post-ingress visually verify position of WOOV7 and close if necessary. If valve closed, continue activation do not send additional command to close WOOV7 prior to WPA activation.	Refer to Mal conclusion blocks	None LT IFHX cooling limited depending on actual position of WOOV7. Cooling remains with the use of the MT IFHX None, WOOV7 nominally closed later in procedure. For LTHX isolation WOOV7 has to be reconfigured manually.
Step 3.2 (case 7): WOOV9 Posn – not Open	Perform {WOOV STATUS NOT OPEN} (SODF: ASSY MAL: MALFUNCTION): If valve open, continue activation If valve indeterminate, then open WOOV10 and then activate CWSA1 and 2. Do not activate Cabin Temperature Control Loop during activation of CTCU. Post-ingress visually verify position of WOOVs. If necessary open WOOV9 and close WOOV10. Deactivate CWSA2 and activate Cabin Temperature Control Loop. If valve closed, then open WOOV10 and then activate CWSA2.	Refer to Mal conclusion blocks	None Must open WOOV10 in order to allow water flow fully through CHXFA Core 2., may lead to degraded cabin temperature control Change of dryout strategy Note: Consider raising water loop setpoint for CHX inlet temperature control if cabin gets too cold.
Step 3.2 (case 8): WOOV10 Posn – not Closed	Perform {WOOV STATUS NOT OPEN} (SODF: ASSY MAL: MALFUNCTION): If valve closed, continue activation. If valve indeterminate, then continue activation and then activate CWSA1 and 2. Do not activate Cabin Temperature	Refer to Mal conclusion blocks	None WOOV 9 must remain open in order to allow water to flow fully through the CHXFA Core 1. may lead to degraded cabin temperature control

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Failure	Workaround	Cause	Impact
	Control Loop during activation of CTCU. Post-ingress visually verify position of WOOV10 and close if necessary. Deactivate CWSA2 and activate Cabin Temperature Control Loop. If valve open, then close WOOV9. Activate CWSA2.		Change of dryout strategy. Note: Consider raising water loop setpoint for CHX inlet temperature control if cabin gets too cold.
Steps 3.3 or 3.5 or 3.7 or 3.9: WMVx SOV Pwr – Off	1) Verify WMVx SOV position is either open or closed. Continue activation. 2) • Activate redundant WMV power supply and verify WMVx SOV power status is on. • Continue activation	1) Power sensor failure 2) Power feed failure	1) Loss of insight to SOV power status. Note: Any valve position status (open or closed) indicates the WMV SOV is powered on. 2) Loss of redundant power feed
Step 3.3 or 3.7: WMVx SOV1 Posn – not Open and/or WMVx SOV2 Posn – not Open (X = 1 or 3)	1) Command open WMVx SOVx 2) • If both SOVs are closed, perform appropriate steps of { SINGLE PDU2 COLUMBUS FINAL ACTIVATION } (SODF: ASSY MAL: CONTINGENCY) to activate the water loop with WPA2. Do not enable FDIR for Water Loop Reconfiguration. Continue activation with activation of the CLSW. • If only one SOV is open, one valve in transit or both are in transit the COL-CC to overstroke	1) Transient SOV movement 2) WMVx failure	1) None 2) Loss of WMV 1 and/or WMV3 SOV portions. Use the alternate water pump and mixing valves. Note: The two SOVs within a WMV are mechanically linked to one another.

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Failure	Workaround	Cause	Impact
	<p>the modulating section of the WMV. (The overstroke function provides the ability to shut off the WMV by closing the modulating valve section.)</p> <p>Perform appropriate steps of {SINGLE PDU2 COLUMBUS FINAL ACTIVATION} (SODF: ASSY MAL: CONTINGENCY) to activate the water loop with WPA2. Do not enable FDIR for Water Loop Reconfiguration. Continue activation with activation of the CLSW.</p>		
<p>Steps 3.4 or 3.8: WMVx SOV Pwr – On (X = 1 or 3)</p>	<p>1) Determine whether WMVx SOV position indicates an unpowered state. If the indication shows unpowered, then power on the SOV section, reverify position status and unpower the WMV SOV section. Continue activation.</p> <p>2) Perform appropriate steps of {SINGLE PDU2 COLUMBUS FINAL ACTIVATION} (SODF: ASSY MAL: CONTINGENCY) to activate the water loop with WPA2. Do not enable FDIR for Water Loop Reconfiguration. Continue activation with activation of the CLSW.</p>	<p>1) I/O or sensor failure</p> <p>2) WMVx failure</p>	<p>1) WMVx SOV not powered but the power status incorrectly indicates on</p> <p>2) Unable to remove power from WMV 1 and/or WMV3 shut-off portions. Use the alternate water pump and mixing valves.</p> <p>Note: Consider overstroking the modulating valve section to close the WMV to provide fault tolerance for inadvertent opening of failed valve.</p>

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Failure	Workaround	Cause	Impact
<p>Step 3.5 or 3.9: WMVx SOV1 Posn – Open and/or WMVx SOV2 Posn – Open (X = 2 or 4)</p>	<p>1) Command close WMVx SOVx 2) COL-CC to overstroke the modulating section of the WMV. (The overstroke function provides the ability to shut off the WMV by closing the modulating valve section.) Do not enable FDIR for Water Loop Reconfiguration. Continue activation with activation of the CLSW.</p>	<p>1) Transient SOV movement 2) WMVx failure</p>	<p>1) None 2) WMV 2 and/or WMV4 SOV portions are failed open. Note: If both SOVs fail open, must operate with WMV2 and WMV4. Note: The two SOVs within a WMV are mechanically linked to one another.</p>
<p>Steps 3.6 or 3.10: WMVx SOV Pwr – On (X = 2 or 4)</p>	<p>1) Determine whether WMVx SOV position indicates an unpowered state. If the indication shows unpowered, then power on the SOV section, reverify position status and unpower the WMV SOV section. Continue activation. 2) Do not enable FDIR for Water Loop Reconfiguration. Continue activation with activation of the CLSW.</p>	<p>1) I/O failure 2) WMVx failure</p>	<p>1) WMVx SOV not powered but the power status incorrectly indicates on 2) Unable to remove power from WMV2 and/or WMV4 shut-off portions. Note: Consider overstroking the modulating valve section to close the WMV to provide fault tolerance for inadvertent opening of failed valve.</p>

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Failure	Workaround	Cause	Impact
Step 3.11 (case 1): WOOV5 Posn – Open	Continue activation (including temperature monitoring). Crew can manually close the WOOV after module ingress.	WOOV5 failure	MT IFHX cooling reduced because bypass leg is open. Adequate cooling still available with LTL IFHX for 1E COL config.
Step 3.11 (case 2): WOOV7 Posn – Open	Continue activation (including temperature monitoring). Crew can manually close the WOOV after module ingress.	WOOV7 failure	LT IFHX cooling reduced because bypass leg is open. Adequate cooling still available with MTL IFHX for 1E COL config.
Step 3.12: WMV1 MDV Pwr – Off	<ol style="list-style-type: none"> 1) Activate redundant WMV power supply and verify WMV1 MDV power status is on. Continue activation. 2) Perform appropriate steps of {SINGLE PDU2 COLUMBUS FINAL ACTIVATION} (SODF: ASSY MAL: CONTINGENCY) to activate the water loop with WPA2. Do not enable FDIR for Water Loop Reconfiguration. Continue activation with activation of the CLSW. 	<ol style="list-style-type: none"> 1) Power feed failure 2) WMV1 MDV failure 	<ol style="list-style-type: none"> 1) Loss of redundant power feed, full functionality remains. 2) Loss of water loop redundancy

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Failure	Workaround	Cause	Impact
Step 3.13: WPA1 Pwr – Off	1) Continue to attempt nominal starting up WPA1. If startup is nominal, continue with activation. 2) If WPA1 does not start up then command off WMV1 MDV and perform appropriate steps of {SINGLE PDU2 COLUMBUS FINAL ACTIVATION} (SODF: ASSY MAL: CONTINGENCY) to activate the water loop with WPA2. Do not enable FDIR for Water Loop Reconfiguration. Continue activation with activation of the CLSW.	1) I/O or sensor failure 2) Water pump failure	1) Loss of insight 2) Loss of water loop redundancy
Step 3.14 (case 1): Three of the four indications are nominal	Continue activation. If plenum delta pressure sensor failed, do not enable monitoring for the failed sensor. Caution and warning events may still be enabled.	Sensor failure	Loss of insight. Note: DPSB sensors used in the WPA control loop are not available for crew or ground monitoring until the DMC is activated.
Step 3.14 (case 2): All four measurements indicate water pump is off.	Command off WPA1 and WMV1 MDV. Then perform appropriate steps of {SINGLE PDU2 COLUMBUS FINAL ACTIVATION} (SODF: ASSY MAL: CONTINGENCY) to activate the water loop with WPA2. Do not enable FDIR for Water Loop Reconfiguration. Continue activation with activation of the CLSW..	Total water pump failure	Loss of WPA1. Operate with WPA2.

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Failure	Workaround	Cause	Impact
<p>Step 3.14 (case 3): Mass Flow < 230 kg/h and Nom Plenum dP < 18 kPa and Redun Plenum dP < 18 kPa (3 of 3 indications)</p>	<p>1) Command off WPA1 and WMV1 MDV. Then perform appropriate steps of {SINGLE PDU2 COLUMBUS FINAL ACTIVATION} (SODF: ASSY MAL: CONTINGENCY) to activate the water loop with WPA2. Do not enable FDIR for Water Loop Reconfiguration. Continue activation with activation of the CLSW. 2) Consider operations with degraded flow.</p>	<p>1) Water blockage in the active water pump or pump degradation. 2) Water loop blockage</p>	<p>1) Loss of water loop redundancy Note: At this stage there is no active control of the water pump speed. Pump will be provided a constant/set current. 2) Reduced cooling capability or total loss of cooling capability</p>
<p>Step 3.15: DPSB1 Nom Plenum dP Mon Status – Inhibited or DPSB2 Red Plenum dP Mon Status – Inhibited</p>	<p>Continue activation</p>	<p>Software failure</p>	<p>Loss of redundant monitoring of pump delta pressure. Note: With two sensors monitored, both will be required to be out of range in order for safing to initiate Berthed Survival Mode. If only a single sensor is monitored then safing will initiate Berthed Survival Mode with an out of range indication on this sensor. At 18 kPa maintained for two minutes safing will initiate Berthed Survival Mode.</p>

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Failure	Workaround	Cause	Impact
Step 3.16 (case 1): WTSB1 Nom Plenum Temp $\geq 24\text{ }^{\circ}\text{C}$ or WTSB2 Redun Plenum Temp $\geq 24\text{ }^{\circ}\text{C}$ (1 of 2 indications)	Continue activation and do not enable VTC monitoring and caution and warning for this sensor.	WTSB sensor failure	Loss of temperature monitoring redundancy for water loop Note: These are the only temperature sensors which are available at this point during activation. At 26.9 deg C a warning event will initiate and will transition to Support Mode. At 38 deg C safing will initiate Berthed Survival Mode.
Step 3.16 (case 2): WTSB1 Nom Plenum Temp: If temp between 24 and 40 $^{\circ}\text{C}$ and WTSB2 Redun Plenum Temp: : If temp between 24 and 40 $^{\circ}\text{C}$ (2 of 2 indications)	Continue activation and do not enable WTSB monitoring and caution and warning.	Water loop elevated temperature	Must monitor loop until within limits and C&W enabled
Step 3.16 (case 3): WTSB1 Nom Plenum Temp $\geq 40\text{ }^{\circ}\text{C}$ and WTSB2 Redun Plenum Temp $\geq 40\text{ }^{\circ}\text{C}$ (2 of 2 indications)	Perform manual switchover to WPA2 using the Vital system. Continue with the activation of the CLSW.	Pump control problem or modulating valve problem	Loss of water loop redundancy Note: WTSB sensors used in the MDV control loop are not available for crew or ground monitoring until the DMC is activated.

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Failure	Workaround	Cause	Impact
Step 3.17: WTSB1 Nom Plenum Temp 3 Monitor Status – Inhibited or WTSB2 Redun Plenum Temp 3 Monitor Status – Inhibited	Continue activation	Software failure	Loss of redundant monitoring of loop temperature Note: With two sensors monitored, both will be required to be out of range in order for safing to initiate Berthed Survival Mode. If only a single sensor is monitored then safing will initiate Berthed Survival Mode with an out of range indication on this sensor. At 26.9 deg C a warning event will initiate and will transition to Support Mode. At 38 deg C safing will initiate Berthed Survival Mode.
Step 3.18: MCC-H to generically manage			
Step 3.19: PDUx ATUx Pwr Bus Pwr – Off	1) Continue activation by attempting to configure ATU. 2) If unable to configure ATU then, continue activation without ATU.	1) Sensor failure 2) PDU outlet or ATU failure	1) Loss of insight 2) Loss of redundant ATU
STEP 4 - ACTIVATING NETWORK CLSW			
Step 4.1 (case 1): CLSW1 Pwr A Status – Off	Check CLSW1 Pwr A current 1) If current is < 0.1 A then continue activation 2) If current is < 2.5 A then continue activation	1) Internal CLSW1 failure 2) Sensor failure	1) Loss of redundant power feeder A to CLSW1. Expect CLSW1 Pwr B current to > 2.2 A. 2) Loss of insight
Step 4.1 (case 2): CLSW1 Pwr A Current \geq 2.5 A	Command off CLSW1 Pwr A feed and continue activation verify CLSW1 Ready Status after Pwr B is on.	Possible converter failure or short	Loss of redundant power feed to CLSW1. Note: If the short is downstream of converters, expect Pwr B to be affected.

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Failure	Workaround	Cause	Impact
Step 4.1 (case 3): CLSW1 Pwr A Ready Status – Not Rdy	1)Power cycle CLSW1 and continue activation 2)Continue to activate CLSW1 Pwr B and verify CLSW1 Ready Status after Pwr B is on.	1) Transient CLSW1 problem 2) CLSW1 Pwr A failure	1) None 2) Loss of CLSW1 power feeder A
Step 4.2 (case 1): CLSW1 Pwr B Status – Off	Check CLSW1 Pwr B current 1) If current is < 0.1 A then continue activation 2) If current is < 2.2 A then continue activation	1) Internal CLSW1 converter failure 2) Sensor failure	1) Loss of redundant power feeder B to CLSW1. 2) Loss of insight
Step 4.2 (case 2): CLSW1 Pwr B Current \geq 2.2 A	1) Power off CLSW1 Pwr B and continue activation 2) Power off CLSW1 Pwr A and continue activation	1) CLSW1 power feed B failure 2) CLSW1 internal failure	1) Loss of CLSW1 redundant power feed 2) Loss of CLSW1
Step 4.2 (case 3): CLSW1 Pwr A Current \geq 0.7 A	1) Power off CLSW1 Pwr A and verify CLSW1 Pwr B current < 2.6 A. Continue activation 2) Power off CLSW1 Pwr B And continue activation	1) CLSW1 power feed A failure 2) CLSW1 internal failure	1) Loss of CLSW1 redundant power feeder A 2) Loss of CLSW1
Step 4.3 (case 1): CLSW2 Pwr A Status – Off	Check CLSW2 Pwr A current 1) If current is < 0.1 A then continue activation 2) If current is < 2.5 A then continue activation	1) Internal CLSW2 failure 2) Sensor failure	1) Loss of redundant power feeder A to CLSW2. Expect CLSW2 Pwr B current to > 2.2 A. 2) Loss of insight
Step 4.3 (case 2): CLSW2 Pwr A Current \geq 2.5 A	Command off CLSW2 Pwr A feed and continue activation verify CLSW2 Ready Status after Pwr B is on.	Possible converter failure or short	Loss of redundant power feed to CLSW2. Note: If the short is downstream of converters, expect Pwr B to be affected.

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Failure	Workaround	Cause	Impact
Step 4.3 (case 3): CLSW2 Pwr A Ready Status – Not Rdy	1)Power cycle CLSW2 and continue activation 2)Continue to activate CLSW2 Pwr B and verify CLSW2 Ready Status after Pwr B is on.	1) Transient CLSW2 problem 2) CLSW2 Pwr A failure	1) None 2) Loss of CLSW2 power feeder A
Step 4.4 (case 1): CLSW2 Pwr B Status – Off	Check CLSW2 Pwr B current 1) If current is < 0.1 A then continue activation 2) If current is < 2.2 A then continue activation	1) Internal CLSW2 converter failure 2) Sensor failure	1) Loss of redundant power feeder B to CLSW2. 2) Loss of insight
Step 4.4 (case 2): CLSW2 Pwr B Current ≥ 2.2 A	1) Power off CLSW2 Pwr B and continue activation 2) Power off CLSW2 Pwr A and continue activation	2) CLSW2 power feed B failure 2) CLSW2 internal failure	1) Loss of CLSW2 redundant power feed 2) Loss of CLSW2
Step 4.4 (case 3): CLSW2 Pwr A Current ≥ 0.7 A	1) Power off CLSW2 Pwr A and verify CLSW2 Pwr B current < 2.6 A. Continue activation 2) Power off CLSW2 Pwr B And continue activation	1) CLSW2 power feed A failure 2) CLSW2 internal failure	1) Loss of CLSW2 redundant power feeder A 2) Loss of CLSW2
STEP 5 - ACTIVATING MASS MEMORY UNIT			
Step 5.1 (case 1): MMU2 Pwr A Status – Off	Check MMU2 Pwr A current 1) If current is < 0.07 A then continue activation 2) If current is < 1.58 A then continue activation	1) Internal MMU failure 2) Sensor failure	1) Loss of redundant power feeder A to MMU2. Expect MMU2 Pwr B current to be > 0.12 A. 2) Loss of insight
Step 5.1(case 2): MMU2 Pwr A Current ≥ 1.58 A	Command off MMU2 Pwr A feed and continue activation verify MMU2 Ready Status after Pwr B is on.	Possible converter failure or short	Loss of redundant power feed to MMU2. Note: If the short is downstream of converters, expect Pwr B to be affected.

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Failure	Workaround	Cause	Impact
Step 5.2 (case 1): MMU2 Pwr B Status – Off	Check MMU2 Pwr B current 1) If current is < 0.07 A then continue activation 2) If current is < 1.87 A then continue activation	1) Internal MMU2 converter failure 2) Sensor failure	1) Loss of redundant power feeder B to MMU2. 2) Loss of insight
Step 5.2 (case 2): MMU2 Pwr B Current ≥ 0.12 A	1) Power off MMU2 Pwr B and verify Pwr A current < 1.58 A. Continue activation 2) Power off MMU2 Pwr A and continue activation with MMU1 activation.	1) MMU2 power feed B failure 2) MMU2 internal failure	1) Loss of MMU2 redundant power feed 2) Loss of MMU2
Step 5.2 (case 3): MMU2 Pwr A Current ≥ 1.58 A	1) Power off MMU2 Pwr A and verify Pwr B current < 1.87 A. Continue activation 2) Power off MMU2 Pwr B and continue activation with MMU1 activation.	1) MMU2 power feed B failure 2) MMU2 internal failure	1) Loss of MMU2 redundant power feed 2) Loss of MMU2
Step 5.3: MMU2 Ready Status – Not Rdy	1)Power cycle MMU2 and command MMU2 to boot as Slave. Wait for up to 5 minutes for ready-status. Verify MMU2 Ready Status - Ready 2)Power off MMU2 and continue activation.	1) Transient failure 2) MMU2 failure	1) None 2) Loss of redundant MMU2
Step 5.4 (case 1): MMU1 Pwr A Status – Off	Check MMU1 Pwr A current 1) If current is < 0.07 A then continue activation 2) If current is < 1.58 A then continue activation	1) Internal MMU failure 2) Sensor failure	1) Loss of redundant power feeder A to MMU1. Expect MMU2 Pwr B current to be > 0.12 A. 2) Loss of insight

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Failure	Workaround	Cause	Impact
Step 5.4 (case 2): MMU1 Pwr A Current ≥ 1.58 A	Command off MMU1 Pwr A feed and continue activation verify MMU1 Ready Status after Pwr B is on.	Possible converter failure or short	Loss of redundant power feed to MMU1. Note: If the short is downstream of converters, expect Pwr B to be affected.
Step 5.5 (case 1): MMU1 Pwr B Status – Off	Check MMU1 Pwr B current 1) If current is < 0.07 A then continue activation 2) If current is < 1.87 A then continue activation	1) Internal MMU1 converter failure 2) Sensor failure	1) Loss of redundant power feeder B to MMU1. 2) Loss of insight
Step 5.5 (case 2): MMU1 Pwr B Current ≥ 0.12 A	1) Power off MMU1 Pwr B and verify MMU1 Pwr A current < 1.58 A. Continue activation. 2) Power off MMU1. Reset MMU2 and reboot MMU2 as master. Wait for up to 5 minutes for Ready Status. Continue activation with MMC.	1) Possible converter failure or short 2) Internal MMU1 failure	1) Loss of redundant power feed to MMU1 2) Loss of MMU redundancy
Step 5.5 (case 3): MMU1 Pwr A Current ≥ 1.58 A	1) Command off MMU1 Pwr A feed and verify Pwr B current < 1.87 A. Continue activation 2) Power off MMU1. Reset MMU2 and reboot MMU2 as master. Wait for up to 5 minutes for Ready Status. Continue activation with MMC.	1) Possible converter failure or short 2) Internal MMU1 failure	1) Loss of redundant power feeder A to MMU1 2) Loss of MMU redundancy

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Failure	Workaround	Cause	Impact
Step 5.6: MMU1 Ready Status – Not Rdy	1)Power cycle MMU1 and reboot MMU1 as master. Wait for up to 5 minutes for Ready Status. Continue activation. 2)Power off MMU1. Reset MMU2 and reboot MMU2 as master. Wait for up to 5 minutes for Ready Status. Continue activation with MMC	1) Transient failure 2) MMU1 failure	1) None 2) Loss of primary MMU1, failover to redundant (Slave) MMU2
STEP 6 - ACTIVATING MISSION MANAGEMENT COMPUTER			
Step 6.1: MMC Redun Management – Ena	Continue activation and enable I/O after the MMC has been initialized.	Software error	MMC telemetry not received until after RT I/O has been enabled. Note: If I/O and RM are enabled then recovery would immediately initiate.
Step 6.2: 22 MMC RT Status – Inh	1) Continue activation. Verify MMC telemetry received after initialization. 2) Activate MMC with Spare (SPC4) Continue activation with DMC and do not enable MMC Redundancy Management	1) C&C software error. 2) I/O error	1) None 2) Loss of SPC redundancy (boot MMC on Spare)
Step 6.3 (case 1): MMC Pwr A Status – Off	Check MMC Pwr A current 1) If current is < 0.07 A then continue activation 2) If current is < 1.19 A then continue activation	1) Internal MMC failure 2) Sensor failure	1) Loss of redundant power feeder A to MMC. Expect MMC Pwr B current to be > 0.12 A. 2) Loss of insight
Step 6.3 (case 2): MMC Pwr A Current ≥ 1.19 A	Command off MMC Pwr A feed and continue activation.	Possible converter failure or short	Loss of redundant power feed to MMC. Note: If the short is downstream of converters, expect Pwr B to be affected.

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Failure	Workaround	Cause	Impact
Step 6.4 (case 1): MMC Pwr B Status – Off	Check MMC Pwr B current 1) If current is < 0.07 A then continue activation 2) If current is < 1.39 A then continue activation	1) Internal MMC converter failure 2) Sensor failure	1) Loss of redundant power feeder B to MMC. 2) Loss of insight
Step 6.4 (case 2): MMC Pwr B Current ≥ 0.12 A	1) Power off MMC Pwr B and verify MMC Pwr A current < 1.19 A. Continue activation. 2) Power off MMC. activate MMC with Spare (SPC4) Continue activation with DMC and do not enable MMC Redundancy Management.	1) Possible converter failure or short 2) Internal MMC failure	1) Loss of redundant power feed to MMC 2) Loss of MMC redundancy
Step 6.4 (case 3): MMC Pwr A Current ≥ 1.19 A	1) Power off MMC Pwr A and verify Pwr B current < 1.39 A. Continue activation 2) Power off MMC Pwr B and activate MMC with Spare (SPC4) Continue activation with DMC and do not enable MMC Redundancy Management.	1) Possible short or controller failure 2) MMC failure	1) Loss of MMC redundant power feed 2) Loss of SPC redundancy
Step 6.5 (case 1): SPC2 Boot Report – not 66048 or MMC Ready Status – Not Rdy	1) Power cycle MMC and reboot. 2) Power off MMC and activate MMC with Spare (SPC4) Continue activation with DMC and do not enable MMC Redundancy Management.	1) Transient failure 2) MMC failure	1) None 2) Loss of SPC redundancy, Spare SPC configured to MMC Note: These two parameters are CVT parameters via the VTC.
Step 6.5 (case 2): Pre-emptive packets not received by COL-CC	1) COL-CC to start pre-emptive packets manually 2) Swap CB INT channel 3) COL-CC to send test command to MMC and receive response via pre-emptive packet. [And then do	1) FLAP error 2) Channel error 3) ?????	1) No impact to activation 2) Loss of CB INT channel redundancy 3) ?????

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Failure	Workaround	Cause	Impact
	what?] 4) Activate DMC and verify CVT and pre-emptive packets. 5) Power off MMC and activate MMC with Spare (SPC4) Continue activation with DMC and do not enable MMC Redundancy Management.	4) ?????? 5) MMC failure	4) ??? 5) Loss of SPC redundancy Note: MCC-H GC can determine whether Columbus packets are received in the DL FEP.
Step 6.6: 22 MMC RT FDIR Status – Inh	Continue activation	Software error	No automated 1553 channel switching for MMC.
Step 6.7: MMC Redun Management – Inh	Continue activation	Software error	Loss of automatic switching of CB INT buses. Note: MMC FDIR will only function after activation of the DMC.
STEP 7 - ACTIVATING DATA MANAGEMENT COMPUTER			
Step 7.1 (case 1): DMC Pwr A Status – Off	Check DMC Pwr A current 1) If current is < 0.07 A then continue activation 2) If current is < 1.19 A then continue activation	1) Internal DMC failure 2) Sensor failure	1) Loss of redundant power feeder A to DMC. Expect DMC Pwr B current to be > 0.12 A. 2) Loss of insight
Step 7.1 (case 2): DMC Pwr A current ≥ 1.19 A	Command off DMC Pwr A feed and continue activation.	Possible converter failure or short	Loss of redundant power feed to DMC. Note: If the short is downstream of converters, expect Pwr B to be affected.
Step 7.2 (case 1): DMC Pwr B Status – Off	Check DMC Pwr B current 1) If current is < 0.07 A then continue activation 2) If current is < 1.39 A then continue activation	1) Internal DMC converter failure 2) Sensor failure	1) Loss of redundant power feeder B to DMC. 2) Loss of insight
Step 7.2 (case 2): DMC Pwr A Current ≥ 1.19 A	1) Power off DMC Pwr A and verify Pwr B current < 1.39 A. Continue	2) Possible short or controller failure	1) Loss of DMC redundant power feed

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Failure	Workaround	Cause	Impact
	activation 2) Power off DMC and activate DMC with Spare (SPC4) Continue activation by enabling caution and warning for DMS and PDU equipment.	2) DMC failure	2) Loss of SPC redundancy
Step 7.2 (case 3): DMC Pwr B Current ≥ 0.12 A	1) Power off DMC Pwr B and verify MMC Pwr A current < 1.19 A. Continue activation. 2) Power off DMC and activate DMC with Spare (SPC4) Continue activation by enabling caution and warning for DMS and PDU equipment..	1) Possible converter failure or short 2) Internal DMC failure	1) Loss of redundant power feed to DMC 2) Loss of DMC redundancy
Step 7.3: SPC1 Boot Report – not 4096	1) Power cycle DMC and reboot. Continue activation. 2) Power off DMC and activate DMC with Spare (SPC4) Continue activation by enabling caution and warning for DMS and PDU equipment.	1) Transient failure 2) DMC failure	1) None 2) Loss of SPC redundancy, Spare SPC configured to DMC
Step 7.4: DMC Ready Status – Not Rdy	1) Power cycle DMC and reboot. Continue activation. 2) Power off DMC and activate DMC with Spare (SPC4) Continue activation by enabling caution and warning for DMS and PDU equipment.	1) Transient failure 2) DMC failure	1) None 2) Loss of SPC redundancy
Step 7.5: Any DMC xxx VTC Monitoring - DISABLED or Any SPARE xxx VTC Monitoring - DISABLED (ground verification)	Continue activation	Software error	Loss of automatic recovery by the VTC of a DMC failure

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Failure	Workaround	Cause	Impact
Step 7.6: Enable DMC FDIR Status - Inhibited	Continue activation	Software error	Loss of VTC automatic FDIR of the DMC
Step 7.7: MCC-H to generically manage			
Step 7.8: Pre-emptive packets not received by COL-CC	Continue activation. ????????		
STEP 8 - ACTIVATING PORTABLE WORKSTATION			
Workarounds not included in crib sheet			
STEP 9 - ENABLING PDU FOR NOMINAL SYSTEM SUPPORT			
Step 9.1: PDU1 Subsys pwr bus cntl not enabled (ground verification)	<ol style="list-style-type: none"> 1) COL-CC uplink individual VTC commands to enable bus items 2) If not successful continue activation and use VTC commands. 	<ol style="list-style-type: none"> 1) Software error during ACS execution 2) Internal PDU failure 	<ol style="list-style-type: none"> 1) None 2) Loss of DMC control to PDU 1 subsys pwr bus. VTC still able to control subsys buses. PWS and FLAPs commanding to PDU1 subsys buses will not work.
Step 9.2: PDU2 Subsys pwr bus cntl not enabled (ground verification)	<ol style="list-style-type: none"> 1) COL-CC uplink individual commands to enable bus items 2) If not successful continue activation and use VTC commands. 	<ol style="list-style-type: none"> 1) Software error during ACS execution 2) Internal PDU failure 	<ol style="list-style-type: none"> 1) None 2) Loss of DMC control to PDU 1 subsys pwr bus. VTC still able to control subsys buses. PWS and FLAPs commanding to PDU1 subsys buses will not work.
Step 9.3: ECLSS valve system cntl not enabled (ground verification)	<ol style="list-style-type: none"> 1) COL-CC uplink individual commands to enable ECLSS valves 2) If not successful continue activation 	<ol style="list-style-type: none"> 1) Software error 2) Internal PDU failure 	<ol style="list-style-type: none"> 1) None 2) Loss of DMC control to ECLSS valves. VTC still able to control ECLSS valves. PWS and FLAPs commanding to PDU1 ECLSS valves will not work.

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Failure	Workaround	Cause	Impact
<p>Step 9.4: TCS valve system cntl not enabled (ground verification)</p>	<p>1) COL-CC uplink individual commands to enable TCS valve</p> <p>2a) If not successful for WOOV 3 through WOOV 8, continue activation.</p> <p>2b) If not successful for WOOV 1 or WOOV 2 skip the "WPA Switchover FDIR - Enable" command, continue activation.</p> <p>2c) If not successful for WOOV 9 or WOOV 10 skip "Enabling CWSA FDIR", continue activation.</p>	<p>1) Software error</p> <p>2a) Internal PDU failure</p> <p>2b) Internal PDU failure</p> <p>2c) Internal PDU failure</p>	<p>1) None</p> <p>2a) Loss of DMC control to TCS valves. VTC still able to control TCS valves. PWS and FLAPs commanding to PDU1 TCS valves will not work.</p> <p>2b) Loss of DMC control to WPA valves. VTC still able to control WPA valves. Loss of automated WPA redundancy management</p> <p>2c) Loss of DMC control to CWSA valves in the CHX. VTC still able to control CWSA valves in the CHX. Loss of the ability to switch water flow through CWSA1 and CWSA2. Only manual CWSA switchover possible using VTC commands for WOOV operations.</p>
<p>Step 9.5 (case 1): PDU1 CTCU1 Pwr Bus Pwr – Off</p>	<p>1) Send individual DMC commands (including enabling monitoring)</p> <p>2) If not successful send individual VTC commands (including enabling monitoring)</p> <p>3) If not successful:</p> <ul style="list-style-type: none"> • Activate CTCU2 rather than CTCU1 perform appropriate steps in {SINGLE PDU2 COLUMBUS FINAL ACTIVATION}, (SODF: ASSY MAL: CONTINGENCY). •Continue activation with the remainder of step 9.5. 	<p>1) Software error during FLAP execution</p> <p>2) Software error VTC</p> <p>3)Internal PDU failure</p>	<p>1) None</p> <p>2) Loss DMC capability to command CTCU1 power bus.</p> <p>3) Loss of CTCU1 and of the automatic CTCU reconfiguration</p>

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Failure	Workaround	Cause	Impact
Step 9.5 (case 2): PDU1 VDPUs Pwr Bus Pwr – Off	Continue activation with the remainder of step 9.5.	Internal PDU failure or software error during FLAP execution	Loss of redundant power feed to VDPUs
Step 9.5 (case 3): PDU1 Fan Pwr Bus Pwr – Off	<ol style="list-style-type: none"> 1) Send individual DMC commands (including enabling monitoring) 2) If not successful send individual VTC commands (including enabling monitoring) 3) Continue activation with step 9.5. Where appropriate activate alternate equipment using the {SINGLE PDU2 COLUMBUS FINAL ACTIVATION} (SODF: ASSY MAL: CONTINGENCY) procedure. <ul style="list-style-type: none"> • Activate CFA2 • Activate ISFA Do not enable the CFA2 FDIR 	<ol style="list-style-type: none"> 1) Software error during FLAP execution 2) Software error VTC 3) Internal PDU failure 	<ol style="list-style-type: none"> 1) None 2) Loss DMC capability to command PDU1 fan power bus. 3) Loss of CFA1 and IRFA. Loss of cabin air loop automatic reconfiguration capability
Step 9.5 (case 4): PDU2 CTCU2 Pwr Bus Pwr – Off	<ol style="list-style-type: none"> 1) Send individual DMC commands (including enabling monitoring) 2) If not successful send individual VTC commands (including enabling monitoring) 3) Continue activation with the remainder of step 9.5. Do not enable FDIR for CTCU Reconfiguration 	<ol style="list-style-type: none"> 1) Software error during FLAP execution 2) Software error VTC 3) Internal PDU failure 	<ol style="list-style-type: none"> 1) None 2) Loss DMC capability to command CTCU2 power bus. 3) Loss of CTCU2 and automatic CTCU reconfiguration capability

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Failure	Workaround	Cause	Impact
Step 9.5 (case 5): PDU2 VDPU Pwr Bus Pwr – Off	Continue activation with the remainder of step 9.5.	Internal PDU failure or software error during FLAP execution	Loss of redundant power feed to VDPU
Step 9.5 (case 6): PDU2 Fan Pwr Bus Pwr – Off	<ol style="list-style-type: none"> 1) Send individual DMC commands (including enabling monitoring) 2) If not successful send individual VTC commands (including enabling monitoring) 3) Continue activation. Where appropriate activate alternate equipment using the {SINGLE PDU1 COLUMBUS FINAL ACTIVATION} (SODF: ASSY MAL: CONTINGENCY) procedure. <ul style="list-style-type: none"> • Activate CFA1 and increase fan speed • Activate IRFA Do not enable CFA Switchover FDIR. 	<ol style="list-style-type: none"> 1) Software error during FLAP execution 2) Software error VTC 3) Internal PDU failure 	<ol style="list-style-type: none"> 1) None 2) Loss DMC capability to command PDU2 fan power bus. 3) Loss of CFA2 and ISFA. Reduced IMV airflow
STEP 10 - ACTIVATING AND CONFIGURING HIGH RATE MULTIPLEXER			
Step 10.1: Cannot enable pre-emptive packets.	Continue activation	Error with onboard CDH system or ground processing	
Step 10.2 (case 1): Pwr A - Off or Pwr B - Off (1 of 2 indications)	Check Pwr A or B current <ol style="list-style-type: none"> 1) If current is < 0.03 A and the alternate converter current is < 2.09 A then continue activation 2) If current is < 1.07 A then continue activation 	<ol style="list-style-type: none"> 1) Internal HRM failure 2) Sensor failure 	<ol style="list-style-type: none"> 1) Loss of redundant power feed. 2) Loss of insight

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Failure	Workaround	Cause	Impact
Step 10.2 (case 2): Either Pwr A or B current ≥ 1.07	Power off converter with overcurrent and verify that the current on the other converter is <2.09 A and continue	Possible short in converter	Loss of power converter redundancy.
Step 10.2 (case 3): Both Pwr A and B current is ≥ 1.07	<ol style="list-style-type: none"> 1) • Deactivate HRM <ul style="list-style-type: none"> • Power on only power converters A and B • Check Pwr A and B currents. If Pwr A current < 0.3 A and Pwr B current < 0.3 A then activate the redundant core of the HRM. Continue activation. 2) Power off converters. Continue activation 	<ol style="list-style-type: none"> 1) HRM nominal core failure 2) HRM failed or possible short downstream of converters. 	<ol style="list-style-type: none"> 1) Loss of HRM core redundancy 2) Loss of HRM.
Step 10.2 (case 4): Nom Core Stat – OFF or Nom Ready Stat – NOT_RDY	Check redun core status: <ol style="list-style-type: none"> 1) Redun Ready Stat – READY Redun Core Stat – ON Continue activation 2) Redun Ready Stat – NOT_RDY or Redun Core Stat – OFF Continue activation 	<ol style="list-style-type: none"> 1) HRM nominal core failure 2) HRM Failure 	<ol style="list-style-type: none"> 1) Loss of HRM redundancy 2) Loss of HRM <p>Note: The FLAP will activate the redundant core if either the nominal Core Stat is OFF or the nominal Ready Stat is not RDY.</p>
Step 10.3: Serial Path Tlm Input Selected – not AUTO_SEL or Output Datarate – not “86 x 0.5 Mbps”	Attempt to configure HRM with alternate CDI. Continue activation	Software error or wrong CDI (configuration data item) or telemetry failure	HRM is unavailable until configuration is resolved. Possible loss of Columbus Ku data. HRM configuration different as expected or loss of insight

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Failure	Workaround	Cause	Impact
STEP 11 - ACTIVATING WATER PUMP ASSEMBLY CONDENSING HEAT EXCHANGER CONTROL LOOP			
Step 11.1 (case 1): WPA1 CHX Temp Cntl Loop Stat – Not Act or WPA1 Plenum Delta Press Cntl Loop Stat – Not Act or WMV3 MDV Pwr – Off (1 of 3 indications)	Perform water loop switchover and continue final activation by starting the LTHX Temperature Monitoring. Do not enable FDIR for Water Loop Reconfiguration.	WPA internal failure	Loss of redundancy.
Step 11.1 (case 2): WPA1 Accum Liq Qty1 – out of range or WPA1 Accum Liq Qty2 – out of range (1 of 2 indications)	Continue activation	Telemetry or sensor failure	Loss of insight Note: With two sensors monitored, both will be required to be out of range in order for FDIR and safing to initiate Berthed Survival Mode. If only a single sensor is monitored then FDIR and safing will initiate Berthed Survival Mode with an out of range indication on this sensor. Note: Monitoring of the WPA accumulator sensors is not active during this stage. Once FDIR is enabled a two liter drop will result in a warning event and safing will shut off WPA and initiate Berthed Survival Mode.
Step 11.1 (case 3): WPA1 Accum Liq Qty1 – out of range and WPA1 Accum Liq Qty2 – out of range (2 of 2 indications)	1) Check the water quantity on the other water pump. If quantity is equally low then go to Berthed Survival Mode and attempt water leakage detection and isolation. 2) If the water quantity in the other accumulator for WPA2 has increased then swap to WPA2.	1) Major water loop leakage 2) Water transfer due to check valve failure.	1) Loss of water loop. 2) Loss of redundancy.

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Failure	Workaround	Cause	Impact
Step 11.2: Accumulator Overpressure FDIR – Disabled or WPA Switchover FDIR – Disabled or LTHX Overtemperature – Disabled	Continue activation	Software error	Loss of the water loop automatic reconfiguration capability
Step 11.3 (case 1): WTSB6 Low HX Temp1 > 7.6°C or WTSB6 Low HX Temp2 > 7.6°C (1 of 2 indications)	Continue activation	Sensor failure	Loss of redundancy
Step 11.3 (case 2): WTSB6 Low HX Temp1 > 7.6°C and WTSB6 Low HX Temp2 > 7.6°C (2 of 2 indications)	Continue activation. Do not enable WTSB6 monitoring.	LT IFHX failure or elevated ETCS ammonia temperature,	Reduced heat rejection capability. Determine whether sufficient heat rejection capability is available to continue activation.
Step 11.3 (case 3): WTSB6 Low HX Temp1 not Green or/and WTSB6 Low HX Temp2 not Green	Continue activation.	Software error	Loss of monitoring and caution & warning. Note: On PWS, green indicates that the DMS is monitoring these temperatures and they are within nominal range.
STEP 12 - ACTIVATING SMOKE DETECTOR			
Step 12.1: Unable to adjust pre-emptive packet rate.	If pre-emptive packet rate does not change, continue activation	Error with onboard CDH system or ground processing	
Step 12.2: Outlet No. 24 SD1 Pwr Bus – Off	Check obscuration and scatter: 1) If obscuration and scatter are within nominal range, then continue activation by enabling SD1. 2) If obscuration and scatter read default/off values, then continue activation but do not enable monitoring or C&W for SD1.	1) PDU sensor failure 2) PDU outlet failure	1) Loss of PDU insight for SD1 power 2) Loss of redundant smoke detector

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Failure	Workaround	Cause	Impact
Step 12.3: Obscuration – out of range and/or Scatter – out of range	Do not enable monitoring and C&W for SD1 and continue activation by powering on SD2. After the cabin fan is activated then recheck obscuration and scatter to determine whether or not airflow is able to clear contamination	SD1 failure or contamination of SD1	Loss of redundant smoke detector Note: Impossible to detect smoke event at this point during activation (no cabin air circulation).
Step 12.4: Status – Inhibited or Failure – X or Lens Status – Dirty or Out of Range – X	Continue activation by powering on SD2. If required inhibit SD1 monitoring. Do not enable C&W for SD1 C&W.	SD algorithm failure, dirty lens, hardware anomaly.	Loss of redundant smoke detector
Step 12.5: Outlet No. 24 SD2 Pwr Bus – Off	Check obscuration and scatter: 1) If obscuration and scatter are within nominal range, then continue activation. 2) If obscuration and scatter read default/off values, then continue activation but do not enable monitoring or C&W for SD2.	1) PDU sensor failure 2) PDU outlet failure	1) Loss of PDU insight for SD1 power 2) Loss of redundant smoke detector.
Step 12.6: Obscuration – out of range and / or Scatter – out of range	Do not enable monitoring and C&W for SD2 and continue activation.. After the cabin fan is activated then recheck obscuration and scatter to determine whether or not airflow is able to clear contamination	SD failure or contamination of SD2	Loss of redundant smoke detector
Step 12.7: Status – Inhibited or Failure – X or Lens Status – Dirty or Out of Range – X	Continue activation. If required inhibit SD2 monitoring. Do not enable C&W for SD2 C&W.	SD algorithm failure, dirty lens, hardware anomaly.	Loss of redundant smoke detector

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Failure	Workaround	Cause	Impact
Step 12.8: MCC-H to generically manage	Continue activation		Loss of Columbus C&W for smoke detection.
STEP 13 - ACTIVATING CONDENSATE WATER SEPARATOR ASSEMBLY			
Step 13.1: Position Ind – "Closed" or "In Transit"	<ol style="list-style-type: none"> 1) Command close and then open the CLSOV 2) Will not activate CWSA and adjust setpoint to prevent condensation on the CHX cores. Continue activation with cabin fan activation. As soon as practical rotate rack D1 to manually open the valve. Then configure CWSA and CHX inlet temp to nominal config. 	<ol style="list-style-type: none"> 1) CLSOV temporarily stuck 2) CLSOV failure 	<ol style="list-style-type: none"> 1) None 2) Loss of condensate removal. Normal CWSA activation may occur after valve is manually opened. Loss of automatic valve FDIR response for isolation.
Step 13.2 (case 1): Pwr – Off	<p>Check motor speed and dP:</p> <ol style="list-style-type: none"> 1) If motor speed and dP are within range, continue activation. 2) If motor speed and dP are consistent with an off fan then swap to redundant CWSA and CHX core and adjust WOOVs as required. Continue activation but do not enable CWSA FDIR. 	<ol style="list-style-type: none"> 1) Sensor failure 2) CWSA1 failure 	<ol style="list-style-type: none"> 1) Loss of CWSA1 telemetry 2) Loss of redundant CWSA and not able to dry out the active CHX core unless condensate collection is discontinued for a period of time.
Step 13.2 (case 2): Two of three sensors are out of range. (dP, speed and current)	Swap to to redundant CWSA and CHX core and continue activation but do not enable CWSA FDIR.	CWSA1 failure or blockage of the CWSA check valve	Loss of redundant CWSA and unable to dry out the active CHX core unless condensate collection is discontinued for a period of time.
Step 13.2 (case 3): One of three sensors are out of range. (dP, speed and current)	Continue activation	Sensor failure	Loss of CWSA1 telemetry
Step 13.3: CWSA Switchover FDIR not enabled	Continue activation	Software error	Loss of automated CWSA redundancy management.

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Failure	Workaround	Cause	Impact
STEP 14 - ACTIVATING CABIN FAN ASSEMBLY			
Step 14 (case 1): Pwr – Off	Check fan speed and dP: 1) If fan speed and dP are within range, then continue activation. 2) If fan speed and dP are consistent with an off fan then swap to the redundant CFA and continue activation and do not enable CFA Switchover FDIR.	1) Sensor failure 2) CFA1 failure	1) Loss of CFA1 telemetry. 2) Loss of redundant CFA.
Step 14 (case 2): Two of three sensors are out of range. (dP, speed and current)	Swap to the redundant CFA and continue activation and do not enable CFA Switchover FDIR.	CFA1 failure or blockage	Loss of CFA
Step 14 (case 3): One of three sensors are out of range. (dP, speed and current)	Continue activation	Sensor failure	Loss of CFA1 telemetry.
STEP 15 - ACTIVATING CABIN TEMP CONTROL UNIT			
Step 15.1 (case 1): Pwr – Off	Check the remainder of the step.. 1) If indications other than temperature are nominal then continue activation. 2) If indications other than temperature are off nominal then swap to redundant CTCU and continue activation. Do not enable FDIR for CTCU Reconfiguration.	1) Sensor failure 2) CTCU1 failure	1) Loss of CTCU1 telemetry 2) Loss of CTCU redundancy. CTCU1 is unavailable.
Step 15.1 (case 2): Cntl Loop Stat – Disabled or TCV Cntl Stat – Disabled or Health Stat – not OK	Swap to redundant CTCU and continue activation. Do not enable FDIR for CTCU Reconfiguration	CTCU1 failure	Loss of CTCU redundancy. CTCU1 is unavailable.
Step 15.1 (case 3): Avg Cabin Temp out of range	Continue activation	Initial conditions are not as expected	Temperature potentially uncomfortable for crew

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Failure	Workaround	Cause	Impact
			Note: FDIR not enabled at this point. Once fully enabled the CTCUs will swap when the temperature outside of the nominal range.
Step 15.2: CTCU Switchover FDIR - Disabled	Continue activation	Software error	Loss of automated CTCU redundancy management. Note: The cabin temperature monitoring required by CTCU FDIR is not enabled at this point.
STEP 16 - OPENING SAMPLE LINE SHUTOFF VALVE			
Step 16.1: Position Ind – Closed	1) Command close and then open the SLSOV 2) Continue activation. When time permits, rotate the D1 rack and manually open SLSOV. Evaluate when to include Columbus in the USOS MCA sequence.	1) SLSOV temporarily stuck 2) SLSOV failed closed	1) None 2) Automatic air sampling of Columbus is not available until SLSOV can be manually opened.
STEP 17 - ESTABLISHING INTERMODULE VENTILATION			
Step 17.1, 17.2, 17.3, 17.4, or 17.5: If the valve cannot be opened by command	Manually open valve and continue activation.		Crew will be reminded that they are required to manipulate the valves in the event of an emergency.
Step 17.6 and 17.7 (case 1): Two of three sensors are out of range. (dP, fan speed and current)	Deactivate affected fan. If ISFA then activate second CFA, increase fan speed and continue activation. Do not enable ISFA VTC monitoring and CFA FDIR. If IRFA then continue activation. Do not enable IRFA VTC monitoring.	ISFA or IRFA failure or blockage	Loss of ISFA or IRFA Note: Current can only be observed by COL-CC . The FDIR will only shut off the fan.

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Failure	Workaround	Cause	Impact
Step 17.6 and 17.7 (case 2): One of three sensors are out of range. (dP, speed and current)	Continue activation	Sensor failure	Loss of insight for ISFA or IRFA Note: Current can only be observed by COL-CC .
Step 17.8: Any ISFA "xxx" VTC Monitoring – Disabled or Any IRFA "xxx" VTC Monitoring – Disabled	Continue activation	Software error	Loss of automated shutdown of ISFA and IRFA as failure management
STEP 18 - ACTIVATING COLUMBUS ECLSS FDIR FOR NOMINAL OPS			
Step 18.1: Fan Speed does not increase to 9200 rpm (± 500 rpm)	Continue activation	Software or controller error	Degraded intramodule air circulation. Fan speed is sufficient for smoke detection.
Step 18.2: Any ISFA xxx – not Green or Any IRFA xxx – not Green	Continue activation	Software error	Loss of IMV fan caution generation
Step 18.3 (case 1): IRFA FDIR – DISABLED or ISFA FDIR – DISABLED	Continue activation	Software error	Loss of IMV fan caution generation
Step 18.3 (case 2): CFA Switchover FDIR – DISABLED	Continue activation	Software error	Loss of CFA automated switchover as failure management
Step 18.4: Air Flow 1 Monitoring Status – Inhibited and/or Air Flow 2 Monitoring Status – Inhibited	Continue activation	Software error	Loss of cabin air flow C&W.
Step 18.5: MCC-H to generically manage	Continue activation		
Step 18.6: Air Press 1 Monitoring Status – Inhibited and/or Air Press 3 Monitoring Status – Inhibited	Continue activation	Software error	Loss of C&W annunciation for air pressure out of range conditions
Step 18.7: MCC-H to generically manage	Continue activation		

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Failure	Workaround	Cause	Impact
Step 18.8 (case 1): ppO2 Sensor 1 – out of range and/or ppO2 Sensor 2 – out of range	Continue activation and do not enable monitoring of the PPO2 sensor that is out of range.	Software error	None
Step 18.8 (case 2) ppO2 Sensor 1 Monitoring – Inhibited and/or ppO2 Sensor 2 Monitoring – Inhibited	Continue activation	Software error	Loss of C&W annunciation for O2 partial pressure out of range conditions
Step 18.8 (case 3): ppCO2 Sensor 1 – out of range and/or ppCO2 Sensor 2 – out of range	Continue activation and do not enable monitoring of the PPCO2 sensor that is out of range.	Software error	None
Step 18.8 (case 4) ppCO2 Sensor 1 Monitoring – Inhibited and/or ppCO2 Sensor 2 Monitoring – Inhibited	Continue activation	Software error	Loss of C&W annunciation for CO2 partial pressure out of range conditions
Step 18.9: Unable to adjust pre-emptive packet rate.	If pre-emptive packet rate does not change, continue activation	Error with onboard CDH system or ground processing	
STEP 19 - DISABLING PPR FUNCTION			
Step 19.1: PPRA x Position Close Ind – "open" or "in transit"	Continue activation and after module ingress manually close the PPRA valve	Failed PPRA valve or position indication	Loss of second barrier against vacuum
Step 19.2: PPRA x Close Status Monitoring – Inhibited	Continue activation	Software error	Loss of PPRA monitoring
Step 19.3: Any "CDA x Valve y" Close Status Monitoring – Inhibited	Continue activation	Software error	Loss of CDA monitoring
Step 19.4: VEMRV Close Monitoring – Inhibited and/or VAMRV Close Monitoring – Inhibited	Continue activation	Software error	Loss of VEMRV or VAMRV monitoring

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Failure	Workaround	Cause	Impact
STEP 20 - ACTIVATING PLCU			
Step 20.1: Unable to adjust pre-emptive packet rate.	If pre-emptive packet rate does not change, continue activation	Error with onboard CDH system or ground processing	
Step 20.2 (case 1): PLCU Pwr A – Off	Check PLCU Pwr A current 1) If current is < 0.07 A then continue activation 2) If current is < 1.19 A then continue activation	1) Internal PLCU failure 2) Sensor failure	1) Loss of redundant power feeder A to PLCU. Expect PLCU Pwr B current to be > 0.12 A. 2) Loss of insight
Step 20.2 (case 2): PLCU Pwr B – Off	Check PLCU Pwr B current 1) If current is < 0.07 A then continue activation 2) If current is < 1.39 A then continue activation	1) Internal PLCU converter failure 2) Sensor failure	1) Loss of redundant power feeder B to PLCU. 2) Loss of insight
Step 20.2 (case 3): PLCU Ready Stat – Not Rdy	1) Power cycle PLCU and reboot. Continue activation. 2) Power off PLCU and activate PLCU with Spare (SPC4) Continue .	1) Transient failure 2) PLCU failure	1) None 2) Loss of SPC redundancy
Step 20.2 (case 4): PLCU Pwr A Current ≥ 1.19	1) Power off PLCU Pwr A and verify Pwr B current < 1.39 A. Continue activation 2) Power off PLCU and activate PLCU with Spare (SPC4)	3) Possible short or controller failure 2) PLCU failure	1) Loss of PLCU redundant power feed 2) Loss of SPC redundancy
Step 20.2 (case 5): PLCU Pwr B Current ≥ 0.12	1) If PLCU Power B current < 1.39A and PLCU Power A Current < 0.07A, then continue activation 2) If PLCU Power A Current between 0.71A and 1.19A, then deactivate Pwr B feed and continue activation	1) PLCU automatically swapped to B power feed. 2) Problem with power B feed	1) Loss of PLCU redundant power feeder A. 2) Loss or PLCU redundant power feeder B.

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Failure	Workaround	Cause	Impact
Step 20.2: PLCU Activation Sec Voltage Stat – not OK	Continue activation	Sensor failure	Loss of insight.
STEP 21 - ACTIVATING XCMU			
Step 21.1(case1): XCMU Nom Pwr A – Off	1) Check XCMU Nom Pwr A current is below 0.19 A and continue activation. 2) Check XCMU Nom Pwr A current below 0.64 A and continue activation	1) Internal XCMU converter failure 2) Sensor failure	1) Loss of redundant power A feed to XCMU nominal branch 2) Loss of insight
Step 21.1 (case2): XCMU Nom Pwr B – Off	1) Check XCMU Nom Pwr B current is below 0.19 A and continue activation. 2) Check XCMU Nom Pwr B current below 0.64 A and continue activation	1) Internal XCMU converter failure 2) Sensor failure	1) Loss of redundant power B feed to XCMU nominal branch 2) Loss of insight
Step 21.1 (case 3): XCMU Nom Ready Stat – Not Rdy	1) Wait 90 seconds and verify that the redundant core was activated nominally. Continue activation. Note: XCMU Activation FLAP would have automatically activated the redundant core. 2) Continue activation	1) XCMU nominal branch failure. 2) Total XCMU failure	Loss of XCMU redundancy
Step 21.1 (case 4): XCMU Nom Pwr A or B current ≥ 0.64	Power off converter with overcurrent: 1) Verify that the current on the other converter is < 1.13 A and continue activation. 2) If the current on the other converter is ≥ 1.13 A then switchover XCMU to redundant branch and continue activation	1) XCMU power feed short 2) XCMU nominal branch failure	1) Loss of redundant power feed to XCMU Nominal controller 2) Loss of XCMU redundancy
Step 21.1 (case 5): XCMU Nom Sec Voltage Stat – not OK	Continue activation	Sensor failure	Loss of insight

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Failure	Workaround	Cause	Impact
STEP 22 - ENABLING CABIN TEMPERATURE MONITORING			
Step 22 (case 1): Any single temperature or humidity measurement out of range	Continue activation by using FLAP	Sensor failure	Expect out-of-limit messages on SMP but automatic reconfiguration will not be triggered
Step 22 (case 2): CTCU1 Cabin Temp1 - not in range and CTCU1 Cabin Temp2 - not in range and CTCU1 Cabin Temp3 - not in range	Continue activation with manual commanding and do not enable CTCU monitoring	Extreme initial conditions	Temperature potentially uncomfortable for crew Avoid automatic CTCU reconfiguration until temperature reaches nominal range Note: CTCU FDIR already enabled as per previous step.
Step 22 (case 3): HS1 Air Humidity – not in range and HS2 Air Humidity – not in range	Continue activation with manual commanding and do not enable humidity sensor monitoring	Extreme initial conditions	Out-of-limit messages on SMP about humidity will not be triggered
STEP 23 - ENABLING WPA TEMPERATURE MONITORING			
Step 23 (case 1): Any single measurement out of range	Continue activation without using FLAP and use activation with manual commanding for those sensors within nominal range.		Loss of monitoring for sensor(s) out of range.
Step 23 (case 2): Any single measurement is not Green.	Continue activation	Software error	Loss of monitoring
Step 23 (case 3): Background color of WTSB1 Nom Plenum Temp3 - White and of WTSB2 Redun Plenum Temp3 - White	Continue activation	Software error	Automatic swap of the water pumps will not occur but if the temperatures increase enough then VTC will shut off the water pump and initiate Berthed Survival Mode
Step 23 (case 4): Background color of WPA1 WTSB1 Plenum Temp1 - White and	Continue activation	Software error	Automatic swap of the water pumps will not occur but if the temperatures increase enough then VTC will shut off the water

CRIB SHEETS COLUMBUS FINAL ACTIVATION
 (ASSY MAL/1E/FIN/MULTI E)

Failure	Workaround	Cause	Impact
of WPA1 WTSB1 Plenum Temp2 - White			pump and initiate Berthed Survival Mode.
Step 23 (case 5): Background color of WPA1 WTSB3 CHX Temp1 - White and of WPA1 WTSB3 CHX Temp2 - White	Continue activation	Software error	Automatic swap of the water pumps will not occur.
STEP 24 - CONFIGURING HCU FOR NOMINAL OPS			
Step 24.1: HCU2 Health Stat – not White	Continue activation.	Software error	Expect suppressed caution when deactivating the HCU2 power bus
Step 24.2: Pre-emptive packets not received by COL-CC	Continue activation.		
Step 24.3: Outlet No. 28 Posn – On	Use HCU2: power off HCU1 and re-enable HCU2 Health Stat. HCU1 Health Stat can be disabled and the PDU1 Outlet No. 28 can be powered off.	HCU or PDU outlet failure	Cannot power off HCU 2, will power off HCU 1 to minimize heater loads
Step 24.4 or 24.5. (ground steps) Any Monitoring item – not ENABLED	Continue activation.	Software error	CDA heater high temperature safing is lost in one of the two branch (one branch is two valve assemblies). That branch cannot be used for depress.
Step 24.6: Pre-emptive packets not disabled by COL-CC			

474

SYS

PDU Pwr Status - Off

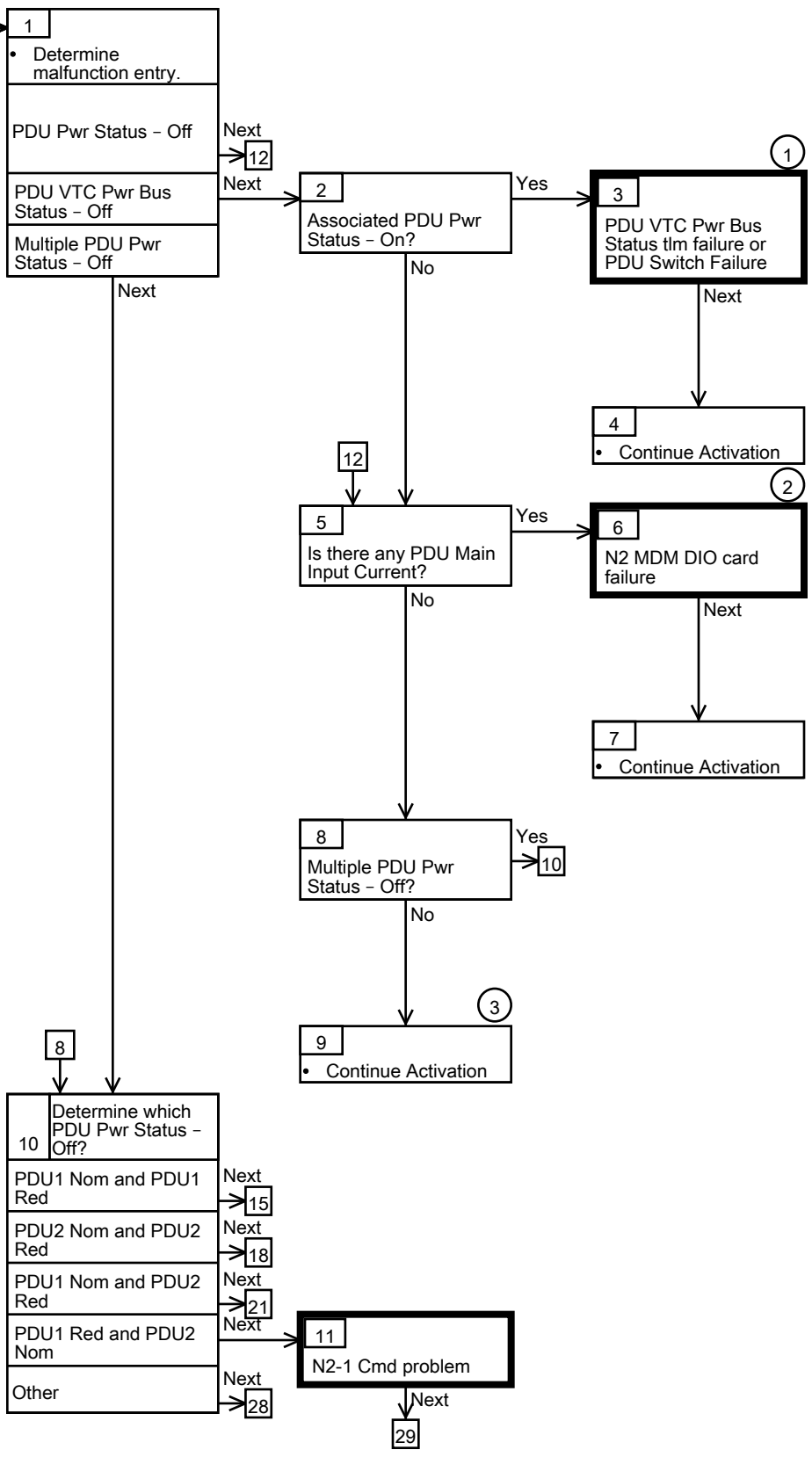
PDU VTC Pwr Bus Status - Off

Multiple PDU Pwr Status - Off

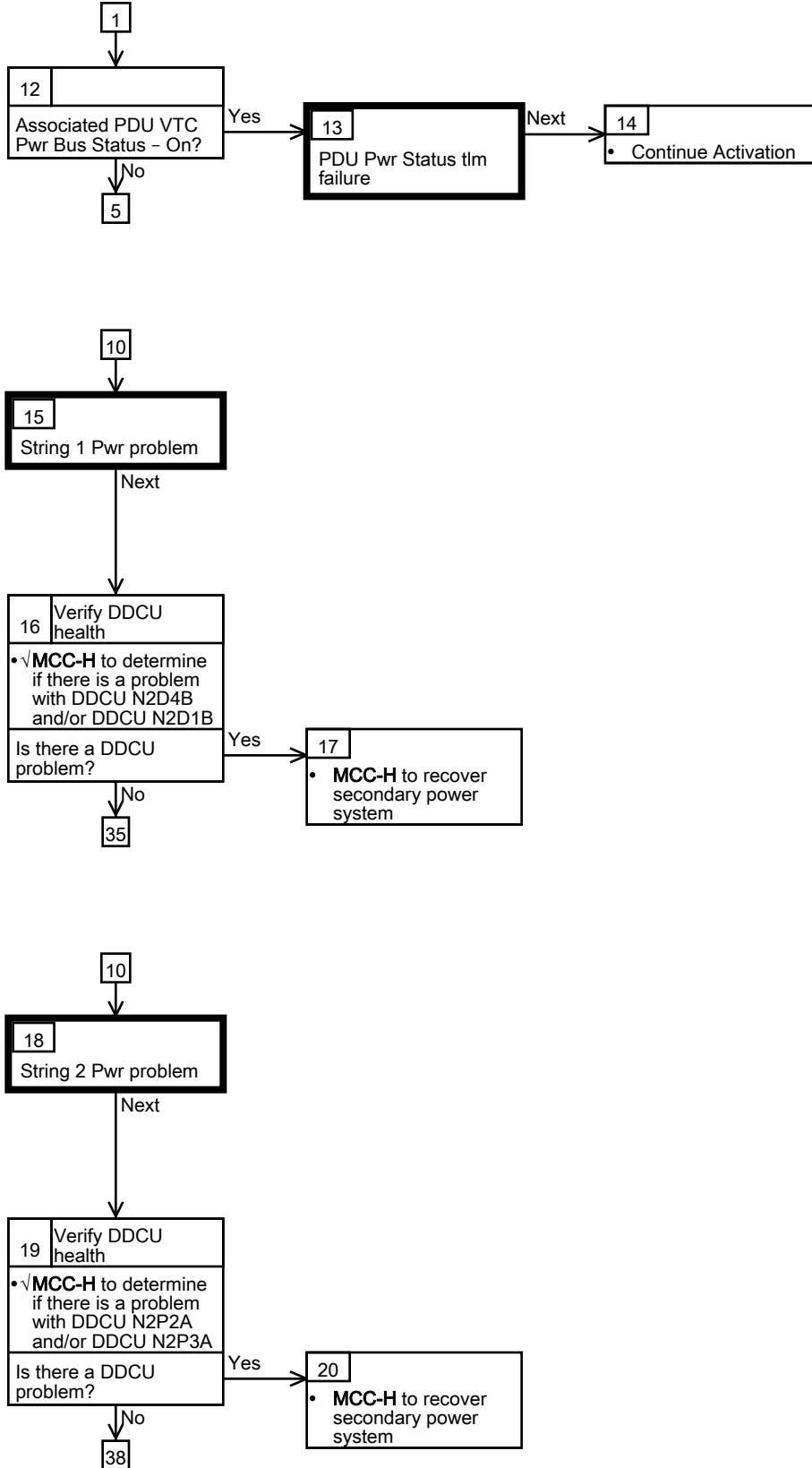
Nominal Config:
 DDCU N2D1B - ON
 N2D4B - ON
 N2P2A - ON
 N2P3A - ON
 NODE 2-1 MDM PROCESSING STATE - OPERATIONAL
 NODE 2-2 MDM PROCESSING STATE - OPERATIONAL

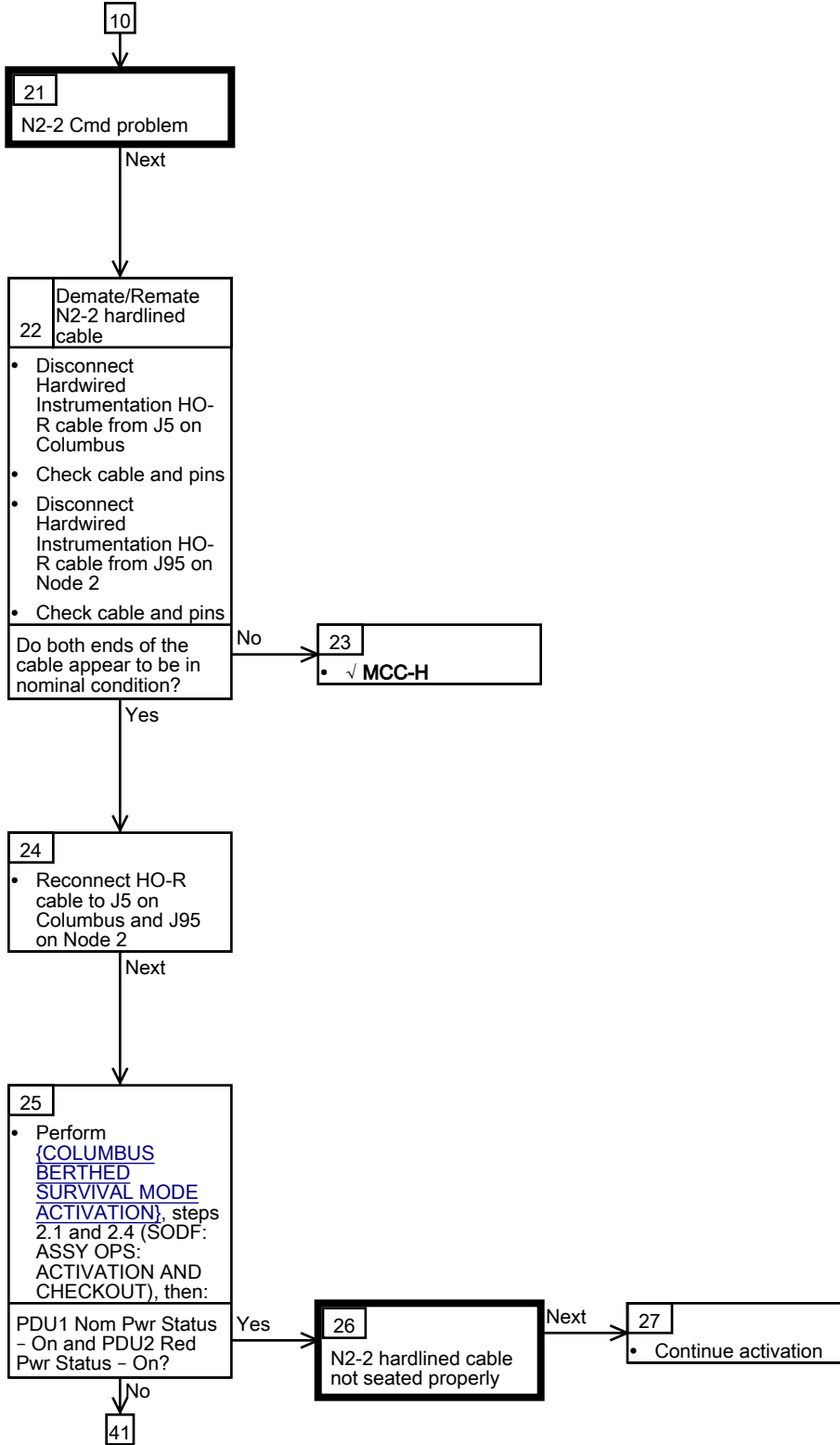
PDU PWR STATUS FAILURE INDICATIONS

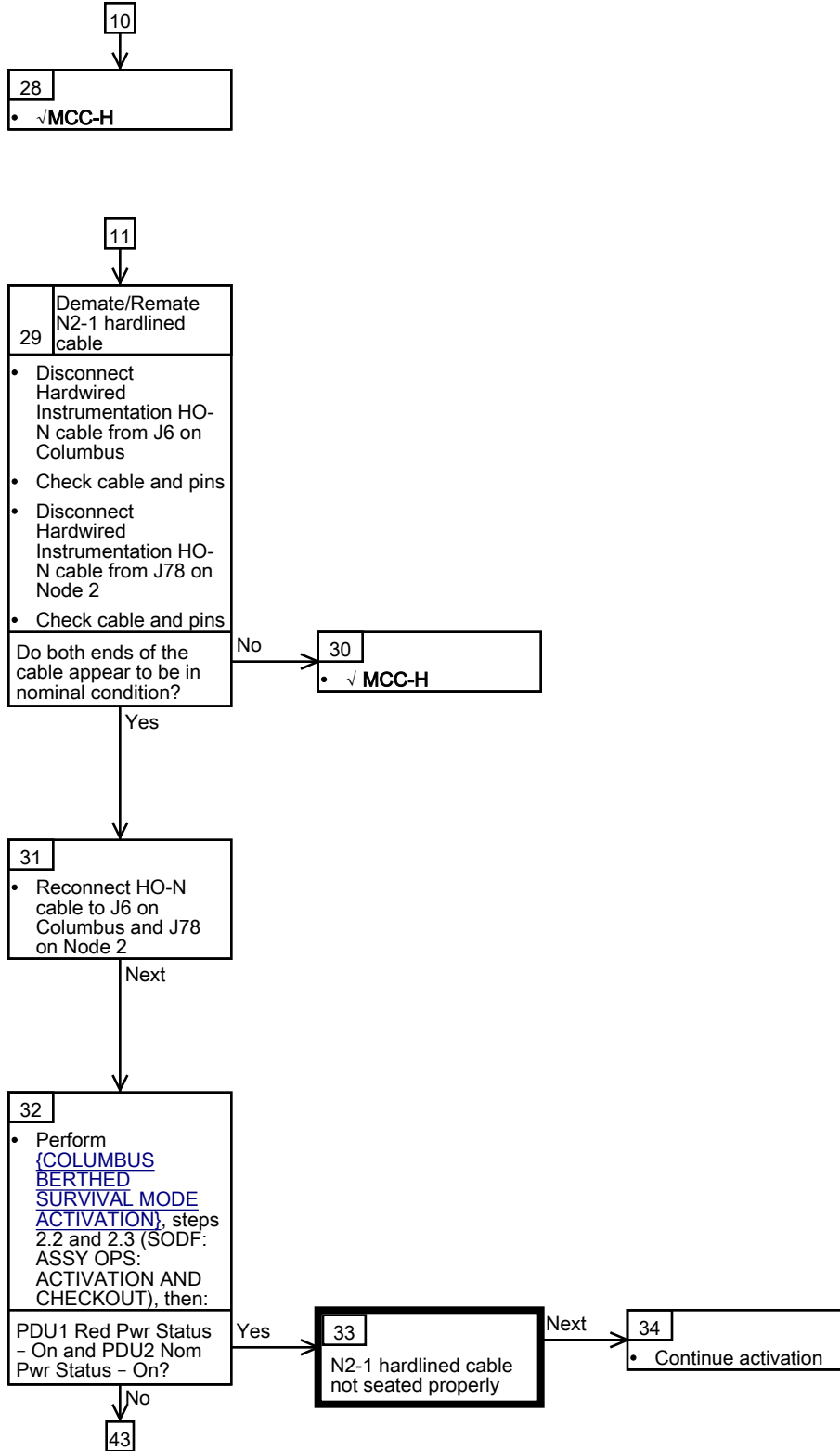
(ASSY MAL/1E/FIN/MULTI E) Page 1 of 8 pages



- ① Failure can be determine when VTC is powered on. Successful power up of VTC will confirm a tim failure.
- ② N2-1 DIO4: • PDU1 Redun Pwr Status • PDU1 VTC2 Pwr A Bus Status • PDU2 Nom Pwr Status • PDU2 VTC2 Pwr B Bus Status N2-2 DIO4: • PDU 1 Nom Pwr Status • PDU1 VTC1 Pwr A Bus Status • PDU2 Redun Pwr Status • PDU2 VTC1 Pwr B Bus Status
- ③ Loss of a single controller is an internal PDU redundancy loss. Full PDU capability still exists.







16

35

Demate/Remate Power Feeder (APM1, 1B/4B) cable

Columbus: EPS

- sel PDU1 Nom Conv1

COL PDU 1-2 Converter Summary

- cmd PDU1 Redun Conv1 – Conv Off
- √ PDU1 Nom Conv 1 Status – Off
- √ PDU1 Nom Conv 2 Status – Off
- Perform [\(NODE2 PREP FOR COLUMBUS VESTIBULE OUTFITTING\)](#), steps 4.3-4.6, 5, 6 (SODF: ASSY OPS: ACTIVATION AND CHECKOUT), then:
- Disconnect Power Feeder (APM1, 1B/4B) cable from J2 on Columbus
- Check cable and pins
- Disconnect Power Feeder (APM1, 1B/4B) cable from J99 on Node 2
- Check cable and pins

Do both ends of the cable appear to be in nominal condition?

No → 36

- √ MCC-H

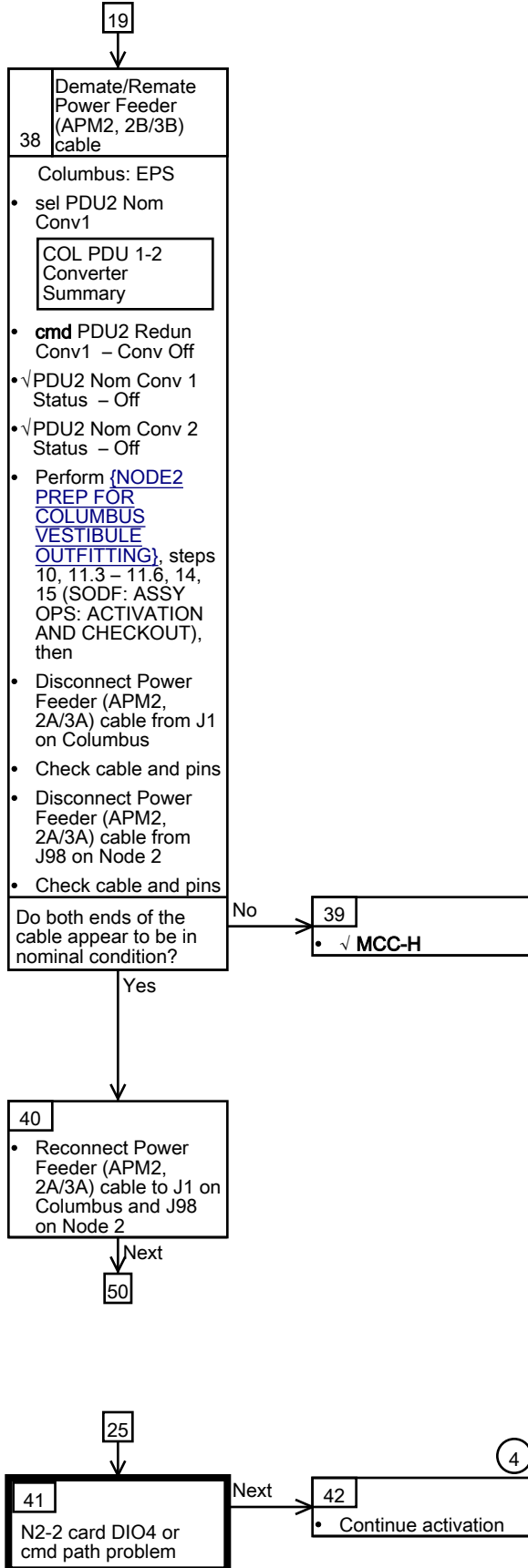
Yes ↓

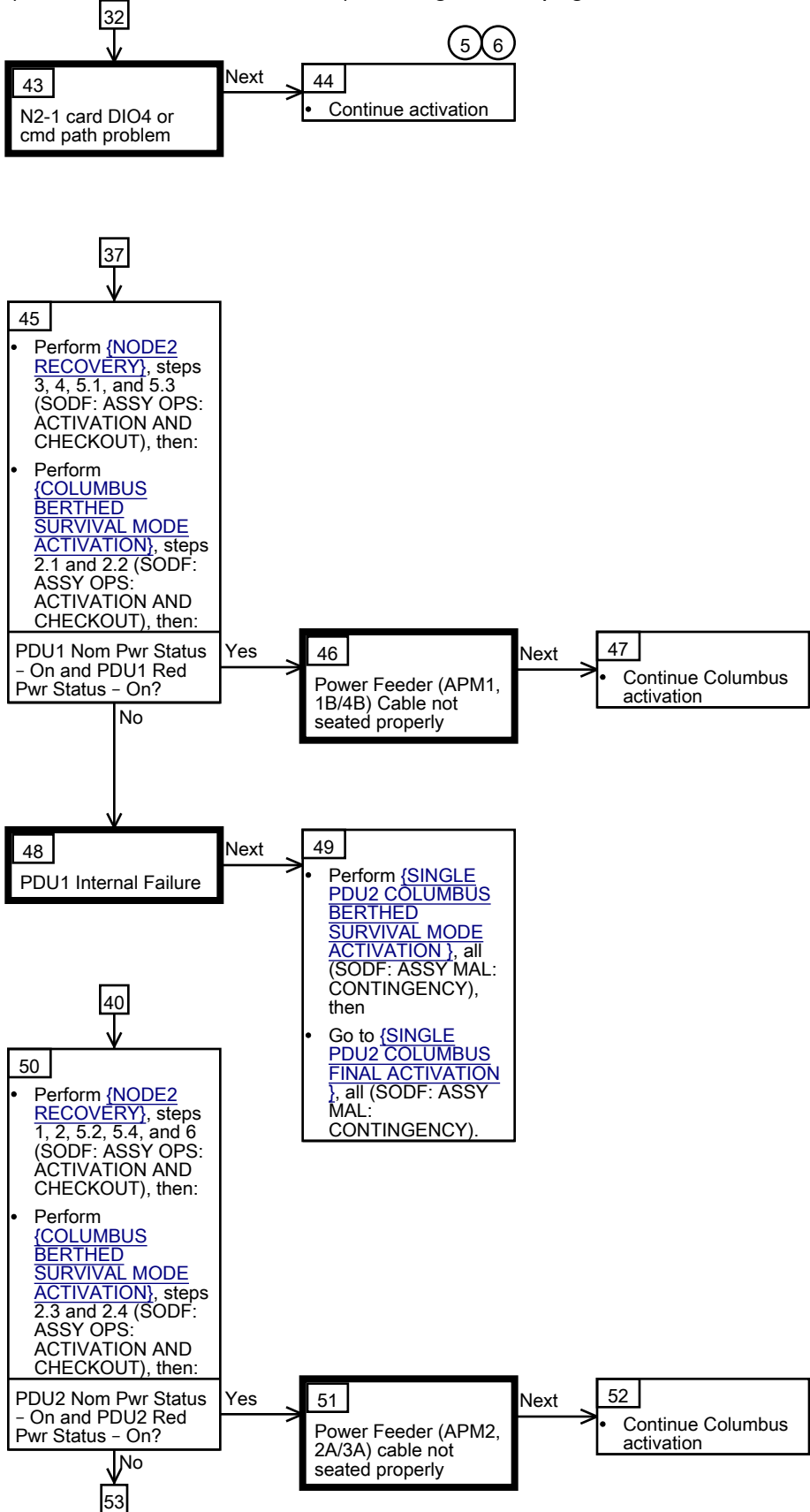
37

- Reconnect Power Feeder (APM1, 1B/4B) cable to J2 on Columbus and J99 on Node 2

Next ↓
45

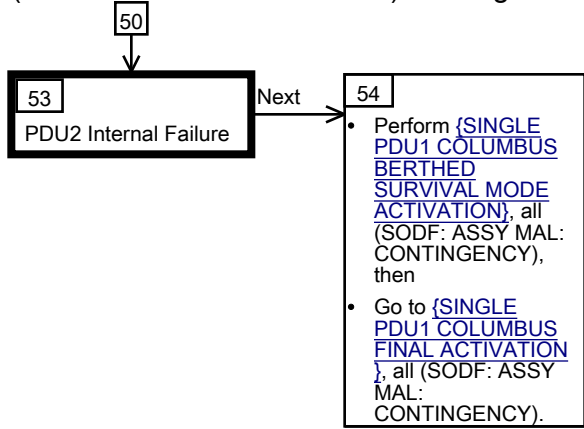
④
 Cmd in Step 4.1 to power on VTC1 Nom Pwr A is via the N2-2 hardlined cable. This cmd is to be attempted as a troubleshooting step, but is not expected to work. Activation can continue with only VTC1 Nom Pwr B available.





5
 Cmd in Step 4.3 to power on VTC2 Nom Pwr A is via the N2-1 hardlined cable. This cmd is to be attempted as a troubleshooting step, but is not expected to work. Activation can continue with only VTC2 Nom Pwr B available.

6
 Step 4.6 must be performed prior to Step 4.5.



SYS

WOOV Status not open

Nominal Config:
 COL Final Acitvation - Part 2: TCS

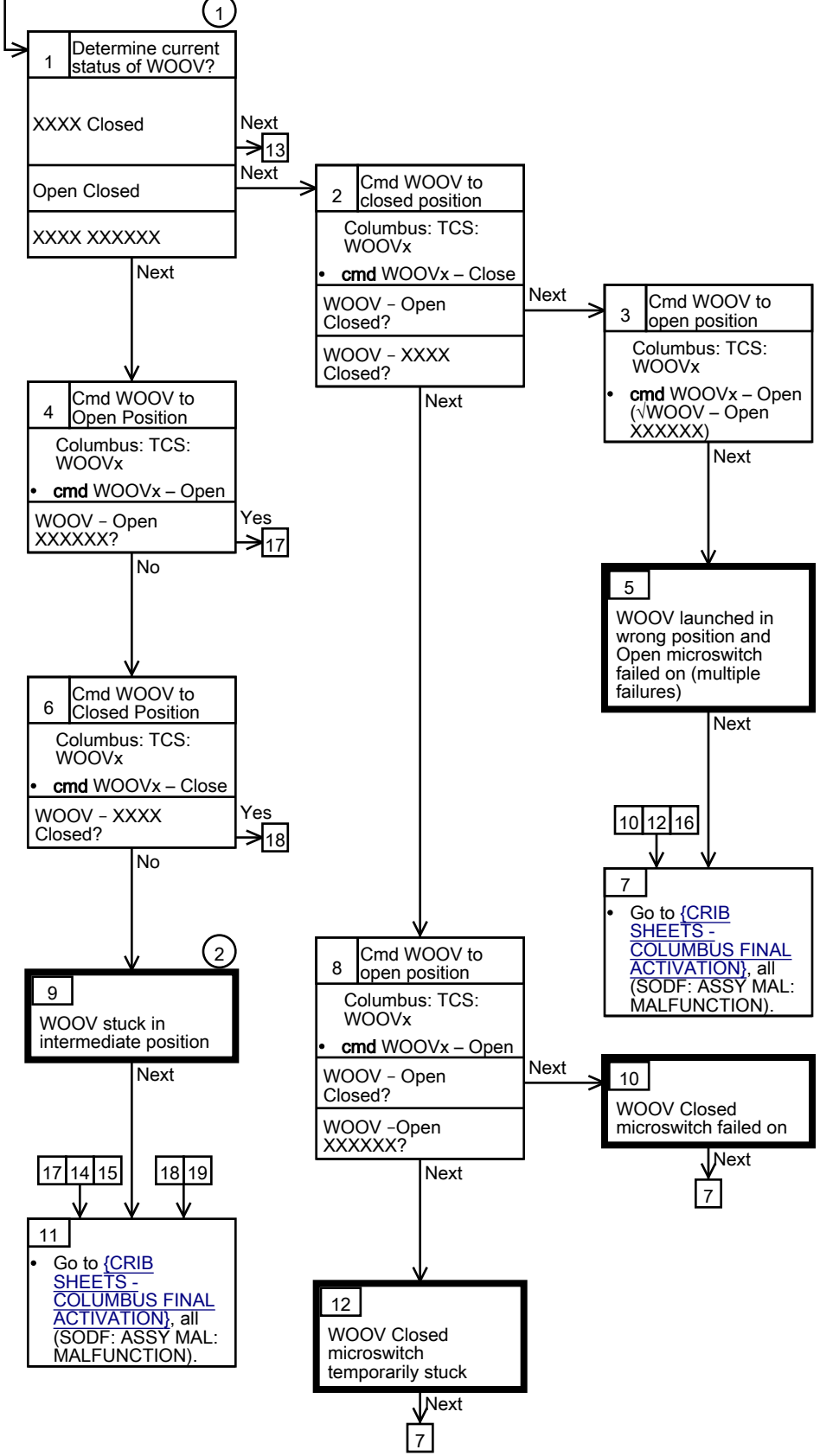
WPA 1 - Off
 WPA 2 - Off

COL Final Acitvation - Part 2

WOOV1 Posn - Open XXXXXX
 WOOV3 Posn - Open XXXXXX
 WOOV4 Posn - Open XXXXXX
 WOOV5 Posn - Open XXXXXX
 WOOV6 Posn - Open XXXXXX
 WOOV7 Posn - Open XXXXXX
 WOOV8 Posn - Open XXXXXX
 WOOV9 Posn - Open XXXXXX

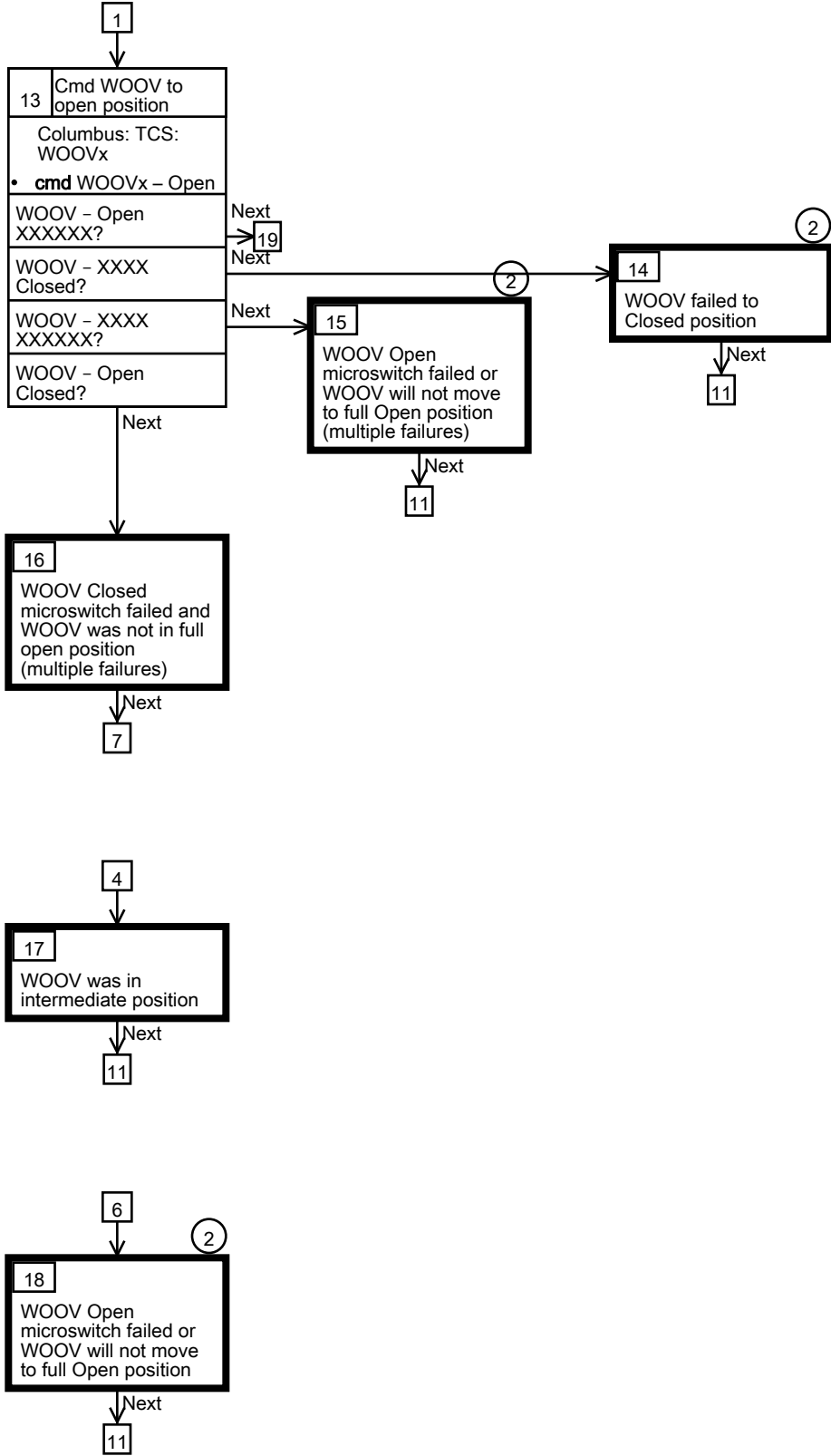
WOOV STATUS NOT OPEN
 (ASSY MAL/1E/FIN)

Page 1 of 3 pages

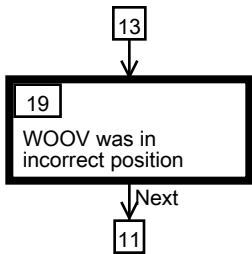


① WOOV has microswitches that indicate when the valve has traveled to the full open or full close position.

② WOOV position can be visually verified and manually set after module ingress, refer to {4.105 COL WATER ON / OFF VALVE MANUAL OVERRIDE}; (ESA SODF: TCS: CORRECTIVE). Location of WOOVs are: WOOV1 - OF3, WOOV2 - OF2, WOOV3 - OF1, WOOV4 - PFM, WOOV5 - PFM, WOOV6 - PAM, WOOV7 - PAM, WOOV8 - PAM, WOOV9 - PDC, WOOV10 - PDC



② WOOV position can be visually verified and manually set after module ingress, refer to {4.105 COL WATER ON / OFF VALVE MANUAL OVERRIDE} (ESA SODF: TCS: CORRECTIVE). Location of WOOVs are: WOOV1 - OF3, WOOV2 - OF2, WOOV3 - OF1, WOOV4 - PFM, WOOV5 - PFM, WOOV6 - PAM, WOOV7 - PAM, WOOV8 - PAM, WOOV9 - PDC, WOOV10 - PDC



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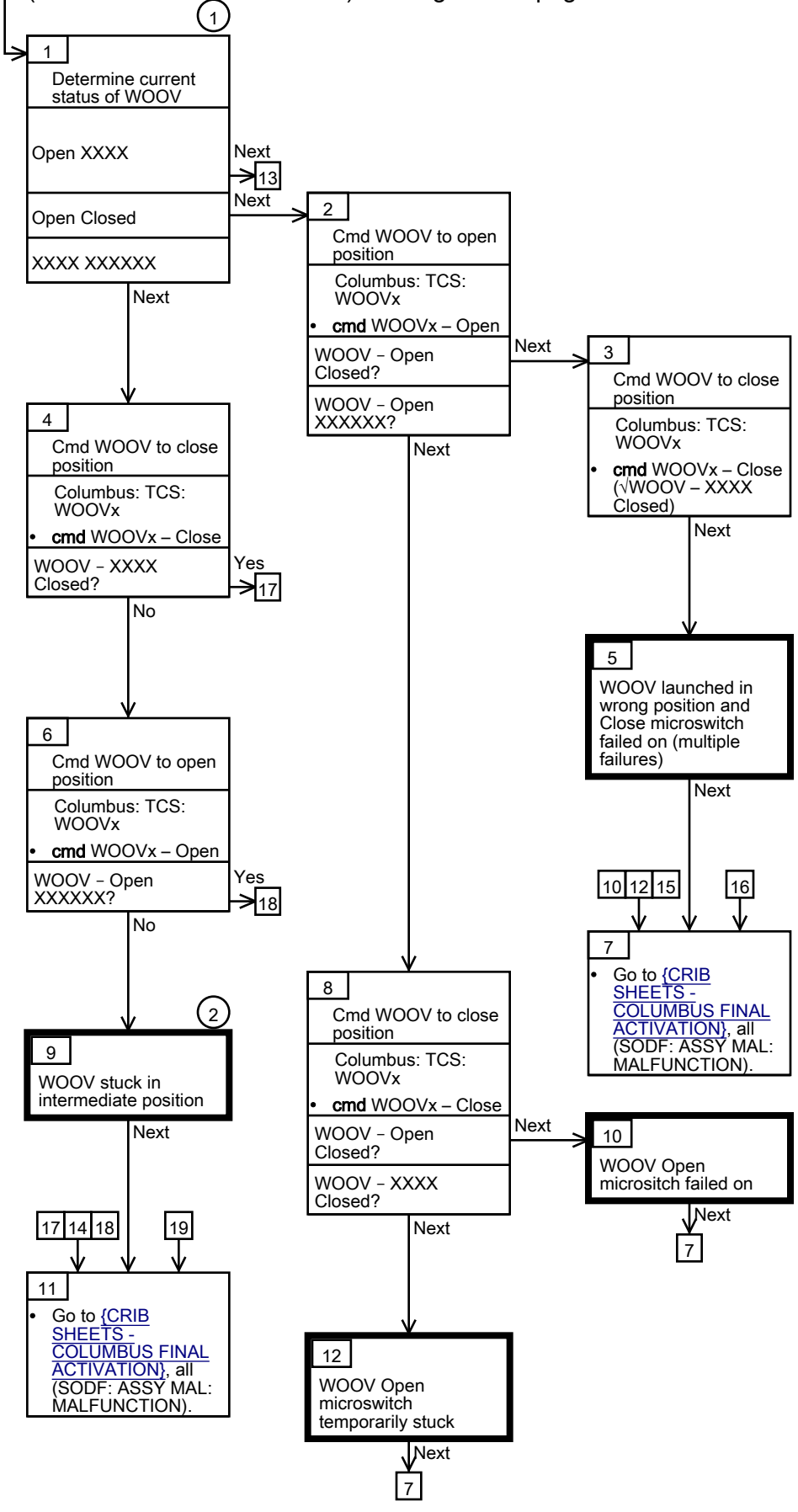
SYS

WOOV Status not close

Nominal Config:
 COL Final Activation - Part 2: TCS
 WPA 1 - Off
 WPA 2 - Off
 COL Final Activation - Part 2
 WOOV2 Posn XXXX Closed
 WOOV10 Posn XXXX Closed

WOOV STATUS NOT CLOSED

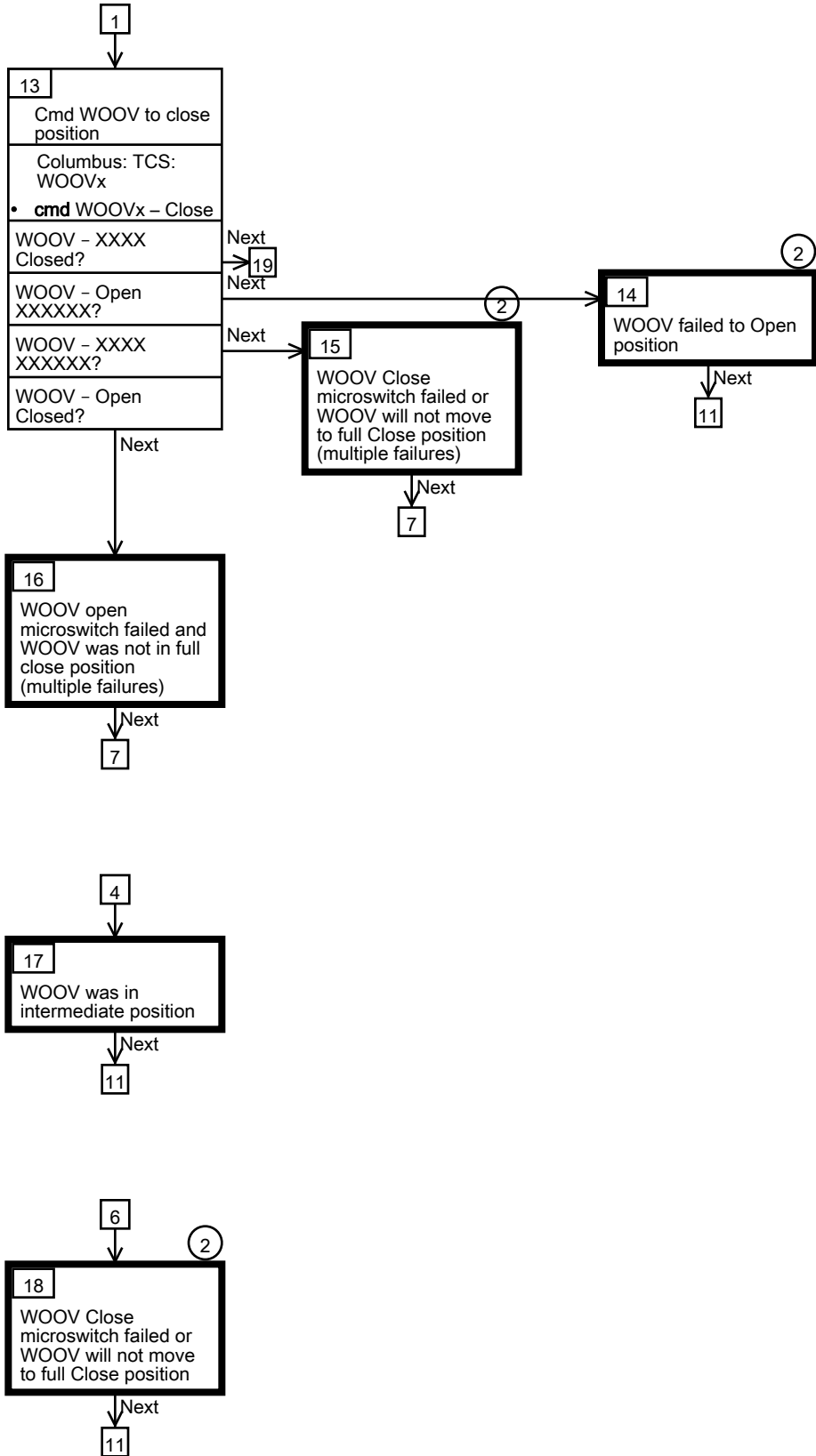
(ASSY MAL/1E/FIN/MULTI E) Page 1 of 3 pages



① WOOV has microswitches that indicate when the valve has traveled to the full open or full close position.

② WOOV position can be visually verified and manually set after module ingress, refer to {4.105 COL WATER ON / OFF VALVE MANUAL OVERRIDE}; (ESA SODF: TCS: CORRECTIVE). Location of WOOVs are: WOOV1 - OF3, WOOV2 - OF2, WOOV3 - OF1, WOOV4 - PFM, WOOV5 - PFM, WOOV6 - PAM, WOOV7 - PAM, WOOV8 - PAM, WOOV9 - PDC, WOOV10 - PDC

WOOV STATUS NOT CLOSED

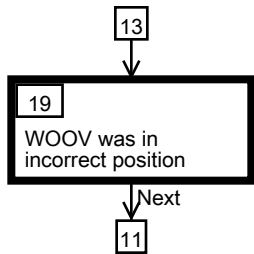


②
 WOOV position can be visually verified and manually set after module ingress, refer to {4.105 COL WATER ON / OFF VALVE MANUAL OVERRIDE} (ESA SODF: TCS: CORRECTIVE). Location of WOOVs are: WOOV1 - OF3, WOOV2 - OF2, WOOV3 - OF1, WOOV4 - PFM, WOOV5 - PFM, WOOV6 - PAM, WOOV7 - PAM, WOOV8 - PAM, WOOV9 - PDC, WOOV10 - PDC

SYS

WOOV STATUS NOT CLOSED

(ASSY MAL/1E/FIN/MULTI E) Page 3 of 3 pages



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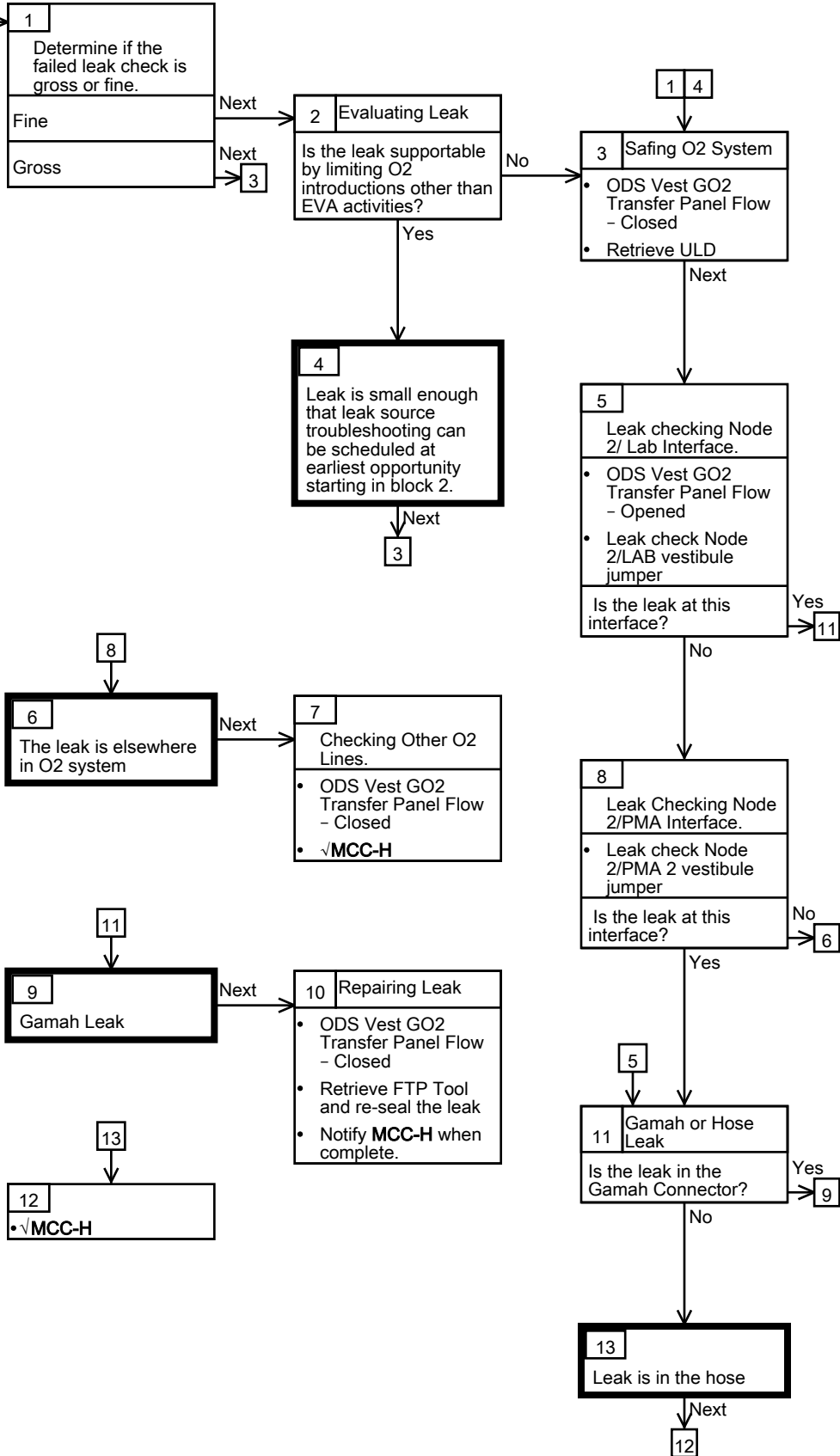
ECLSS

**CAUTION
ALARM**

Node 2 O2
System has
failed it's
leak check.

NODE 2 O2 SYSTEM LEAK TROUBLESHOOTING

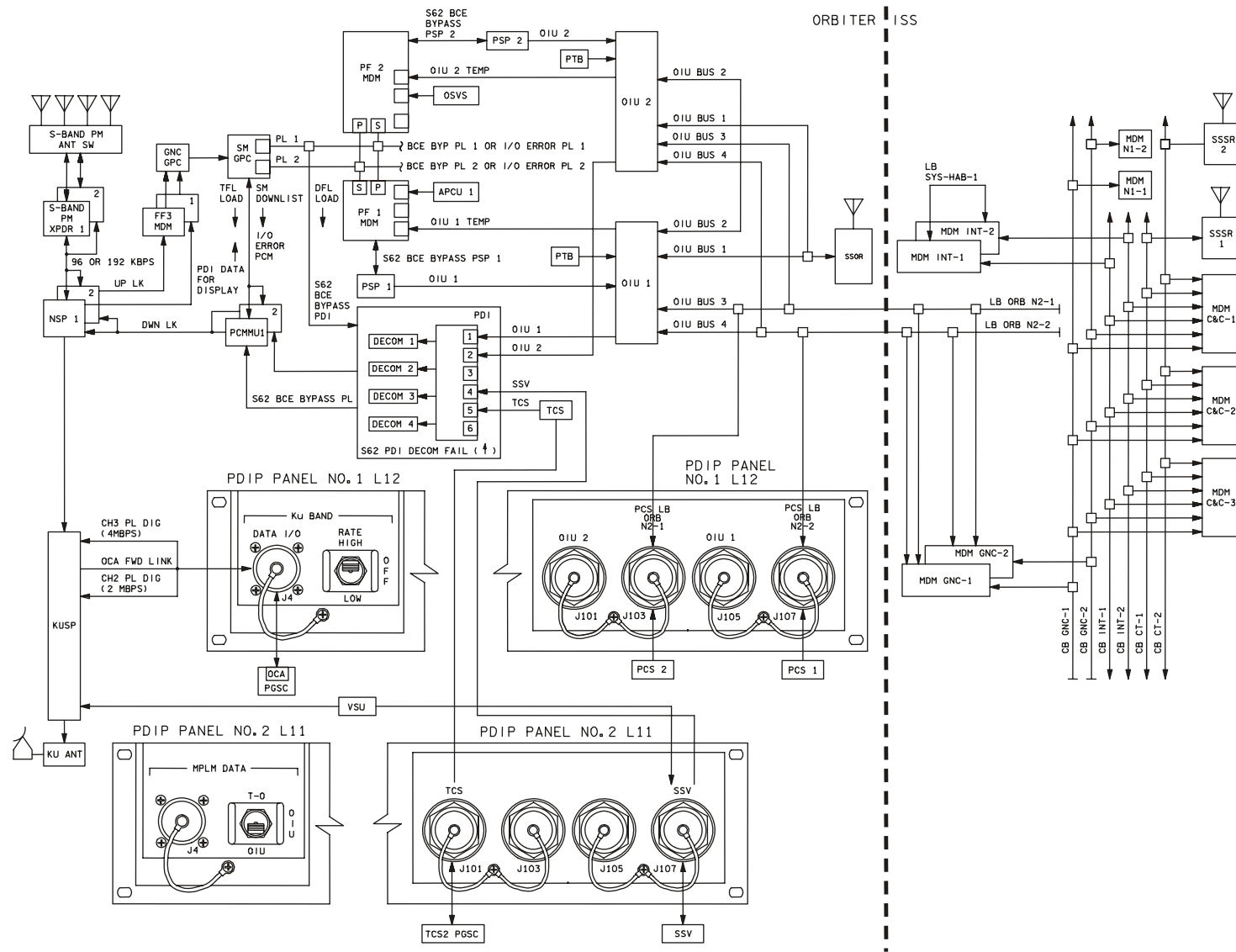
(ASSY MAL/1E/FIN/MULTI E) Page 1 of 1 page



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COMM MALFUNCTION POINTS (ASSY OPS/1E/FIN/MULTI E)

493



4850202_112, SCH 2

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COMM

SM ALERT

S62 PDI DECOM FAIL

(ASSY MAL/1E/FIN/MULTI E) Page 1 of 5 pages

1
S62 PDI DECOM FAIL

{S212 OIU AD 1 NOLK/LOSS OF ISS OR SSOR TELEMETRY} (SODF: ASSY MAL: MALFUNCTION: COMM)

{2.4g S62 PDI DECOM FAIL} (FDF: MAL: COMM)

Nominal Config:
(A1L)

PL DATA INTLVR PWR - ON

(R1)

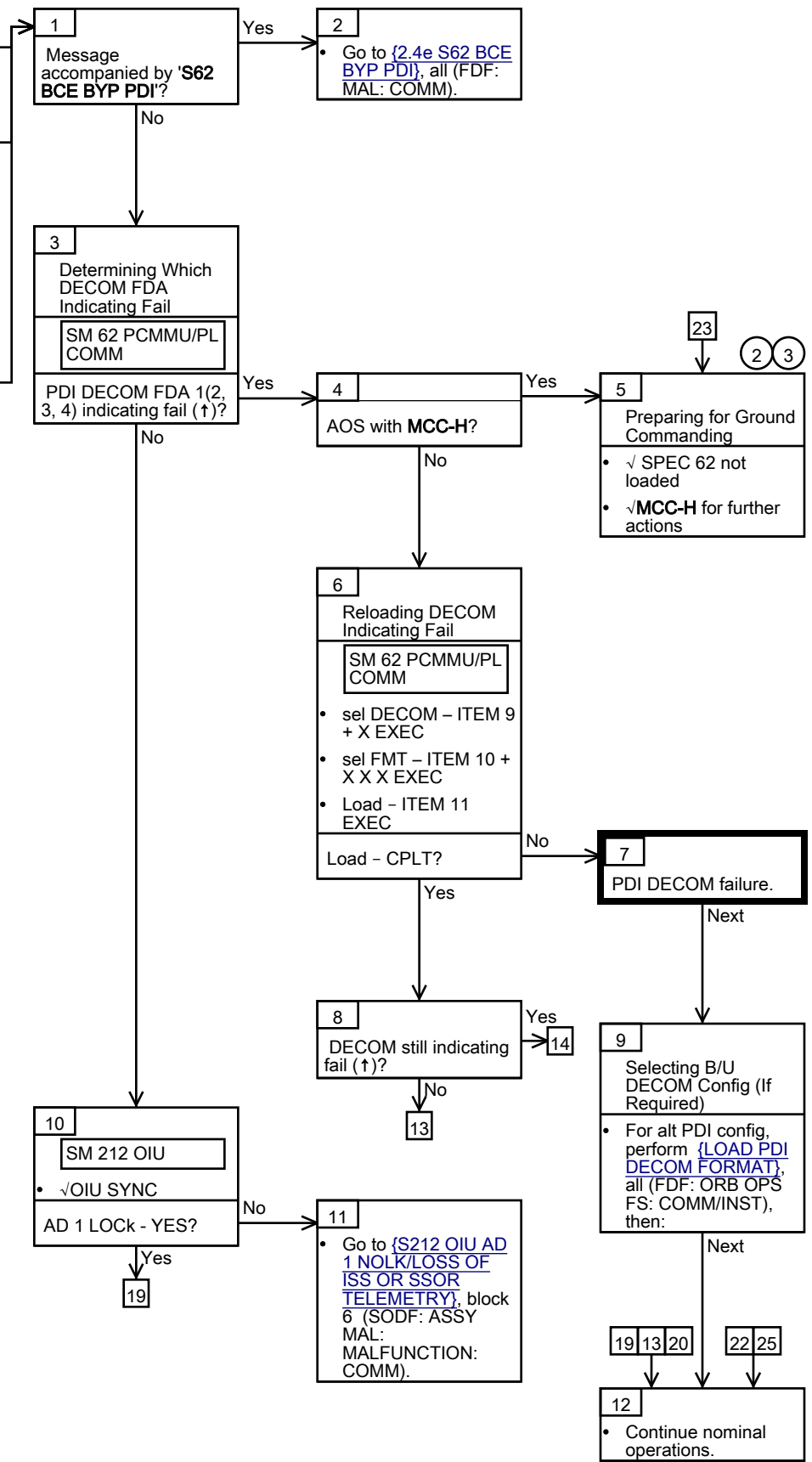
PL CAB - MNA(MNB)

PL AUX - ON

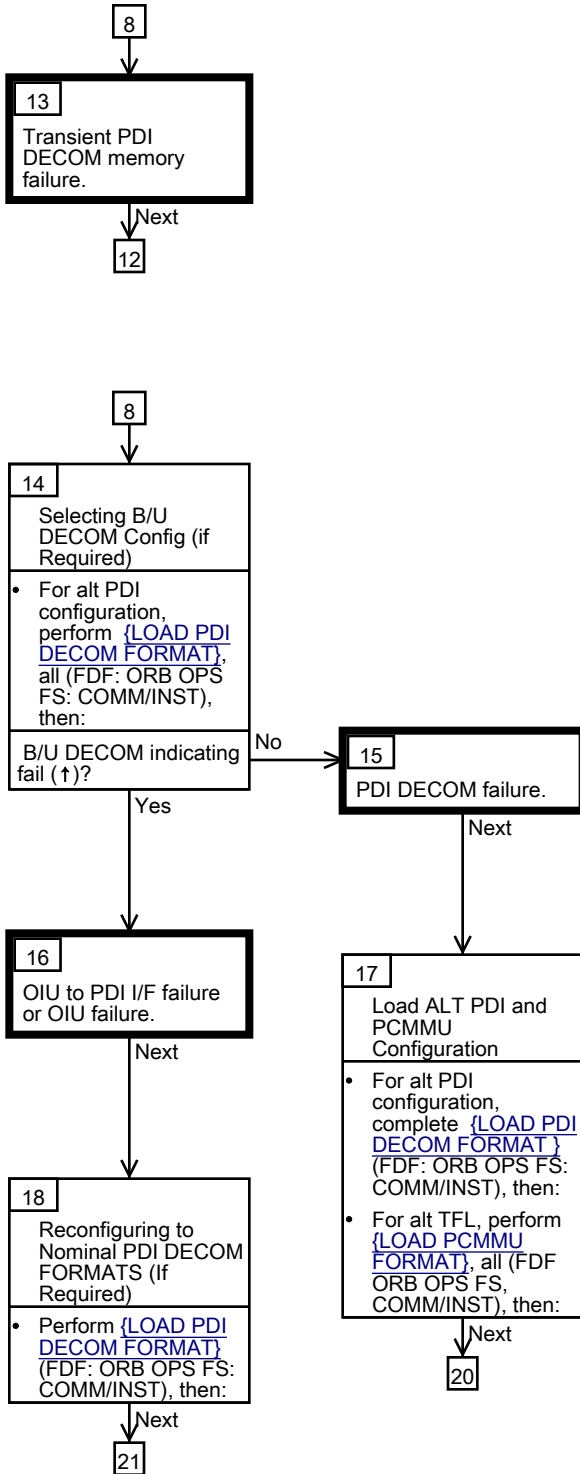
(SSP1)

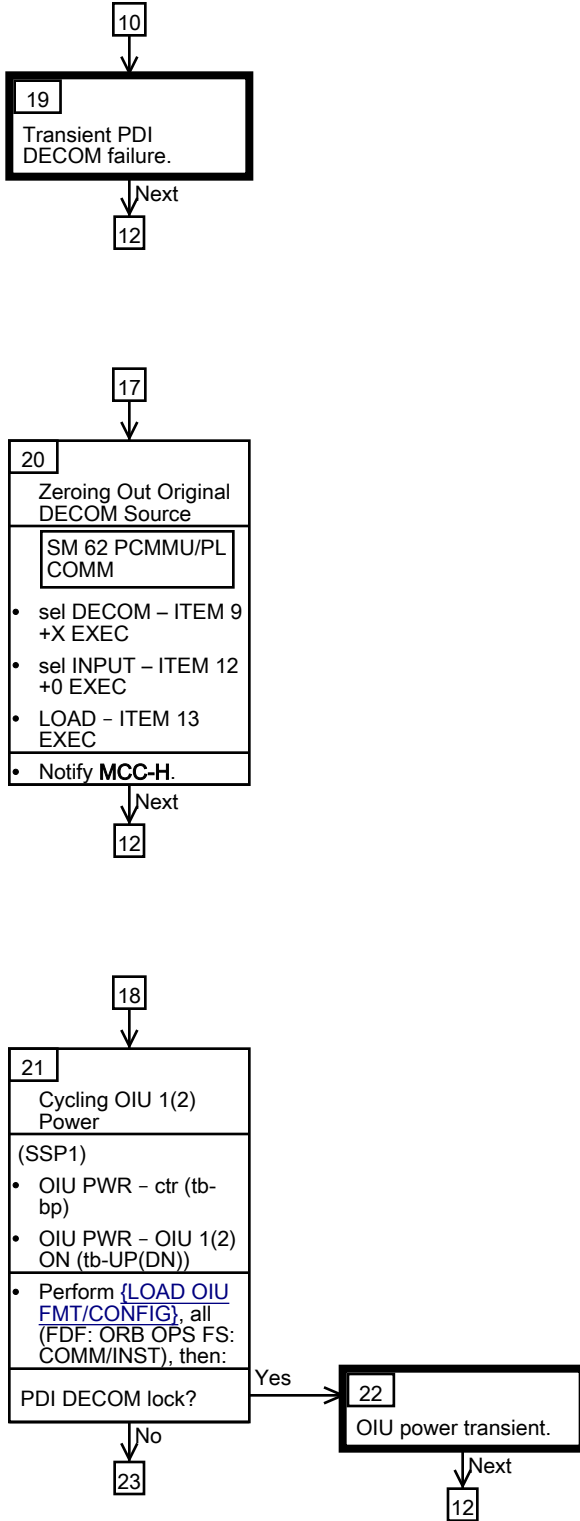
OIU PWR - OIU 1(2) ON

tb-UP(DN)



- 1 TCS and SSV not addressed in MAL; FDA not nominally enabled.
- 2 For ground commanding of PL COMM system, SPEC 62 must not be loaded.
- 3 MCC-H can perform all PL COMM reconfig, except OIU PWR cycle and swap steps.

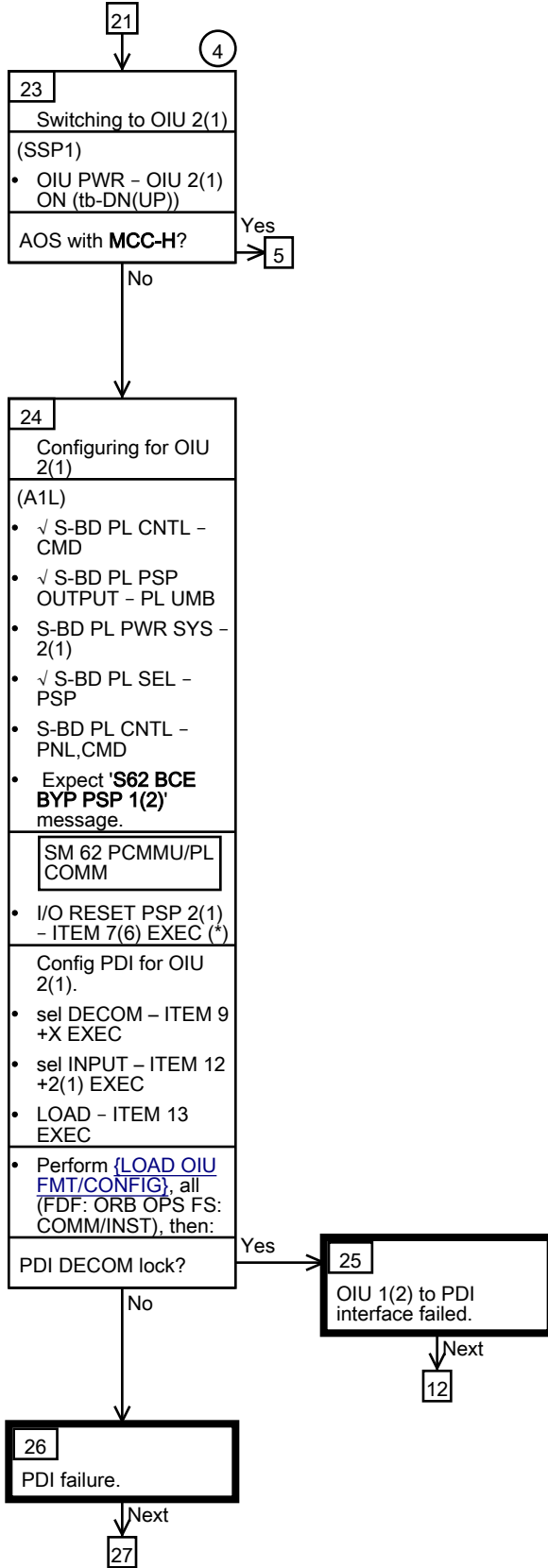




S62 PDI DECOM FAIL

(ASSY MAL/1E/FIN/MULTI E)

④
Alternate (OIU 1) requires PSP 1.



COMM

S62 PDI DECOM FAIL

(ASSY MAL/1E/FIN/MULTI E)

Page 5 of 5 pages

26



27

- √MCC-H for possible PDI replacement

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COMM

OIU FAIL TO COMMAND
(ASSY MAL/1E/FIN/MULTI E)

①

Power cycle will place OIU in Format 255. OIU Station TLM will be lost until OIU CMD is recovered. OIU H&S TLM will also be lost if PDI is not configured for OIU FMT 255.

No Response to OIU Configuration or Routed Commands

Nominal Config: (A1L)

S-BD PL CNTL - CMD

S-BD PL PWR SYS - 1

S-BD PL PWR SEL - PSP

S-BD PL PSP OUTPUT - PL UMB

(SSP1)

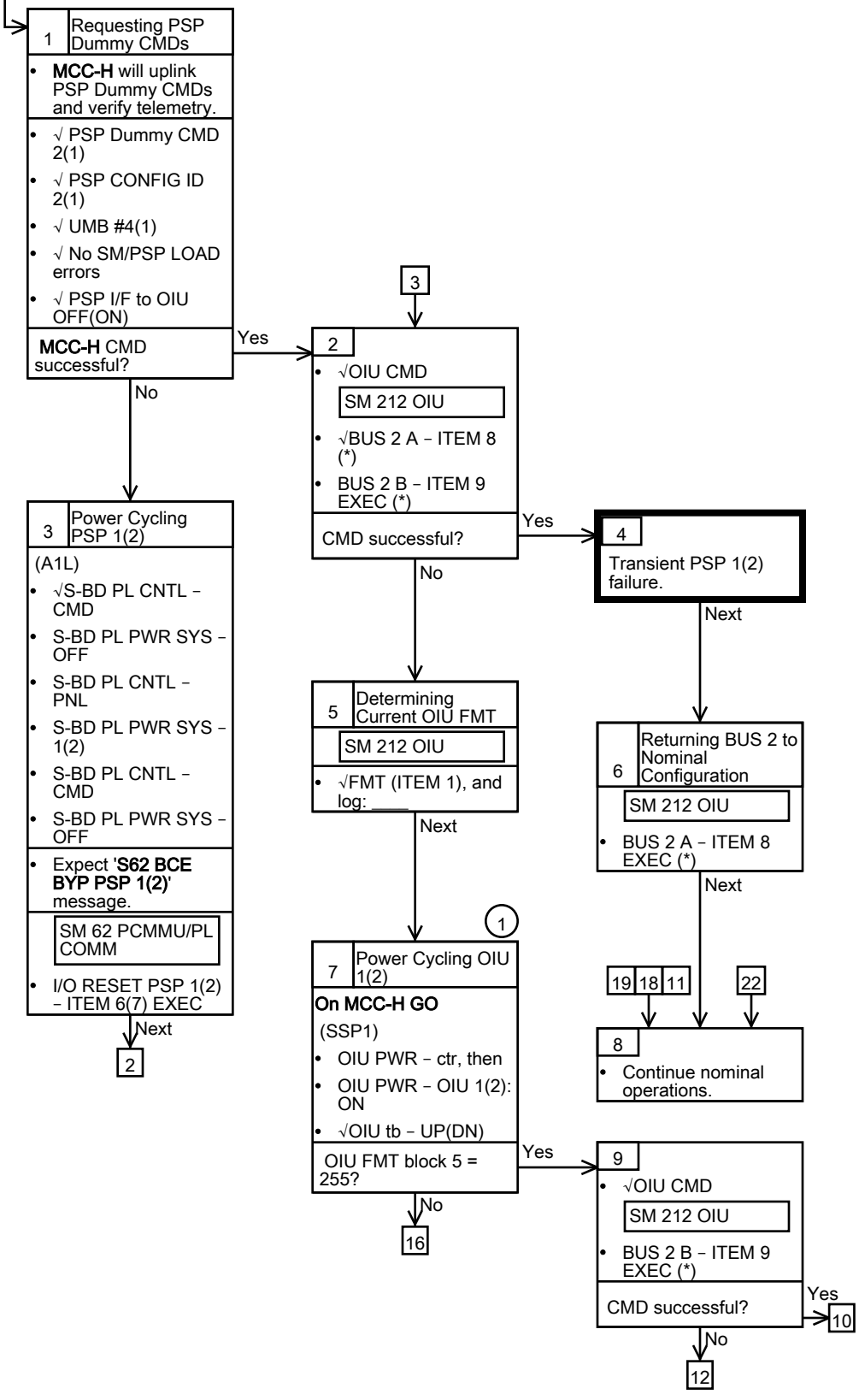
OIU PWR - OIU 1(2) ON

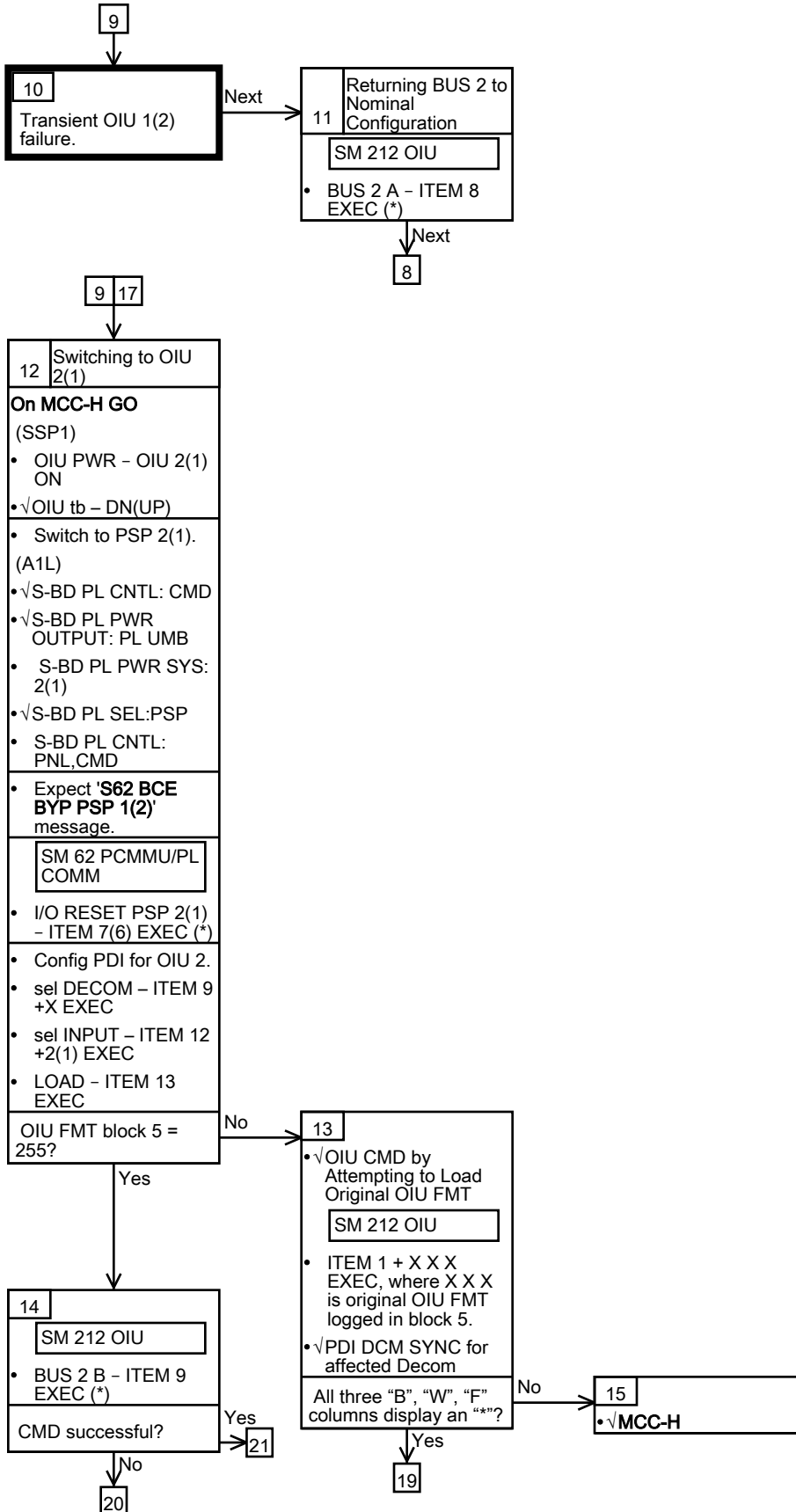
tb OIU - UP(DN)

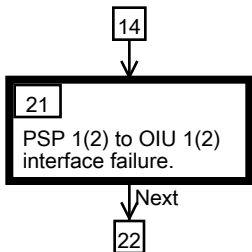
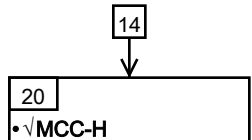
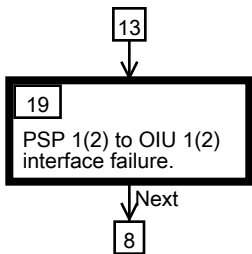
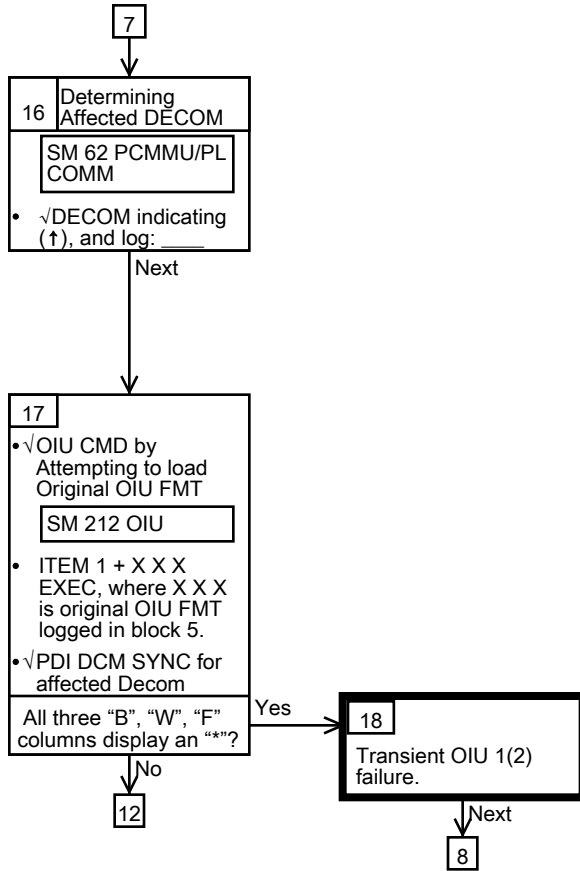
(R1)

PL CAB - MNA(MNB)

PL AUX - ON

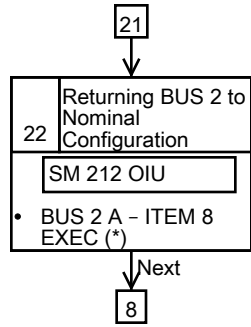






OIU FAIL TO COMMAND

(ASSY MAL/1E/FIN/MULTI E)



ASSY OPS

OIU TEMP HIGH MALFUNCTION

(ASSY MAL/1E/FIN/MULTI E) Page 1 of 2 pages

SM 212 OIU TEMP

OIU message:
OIU TEMP > 212

Nominal Config:
(R1)

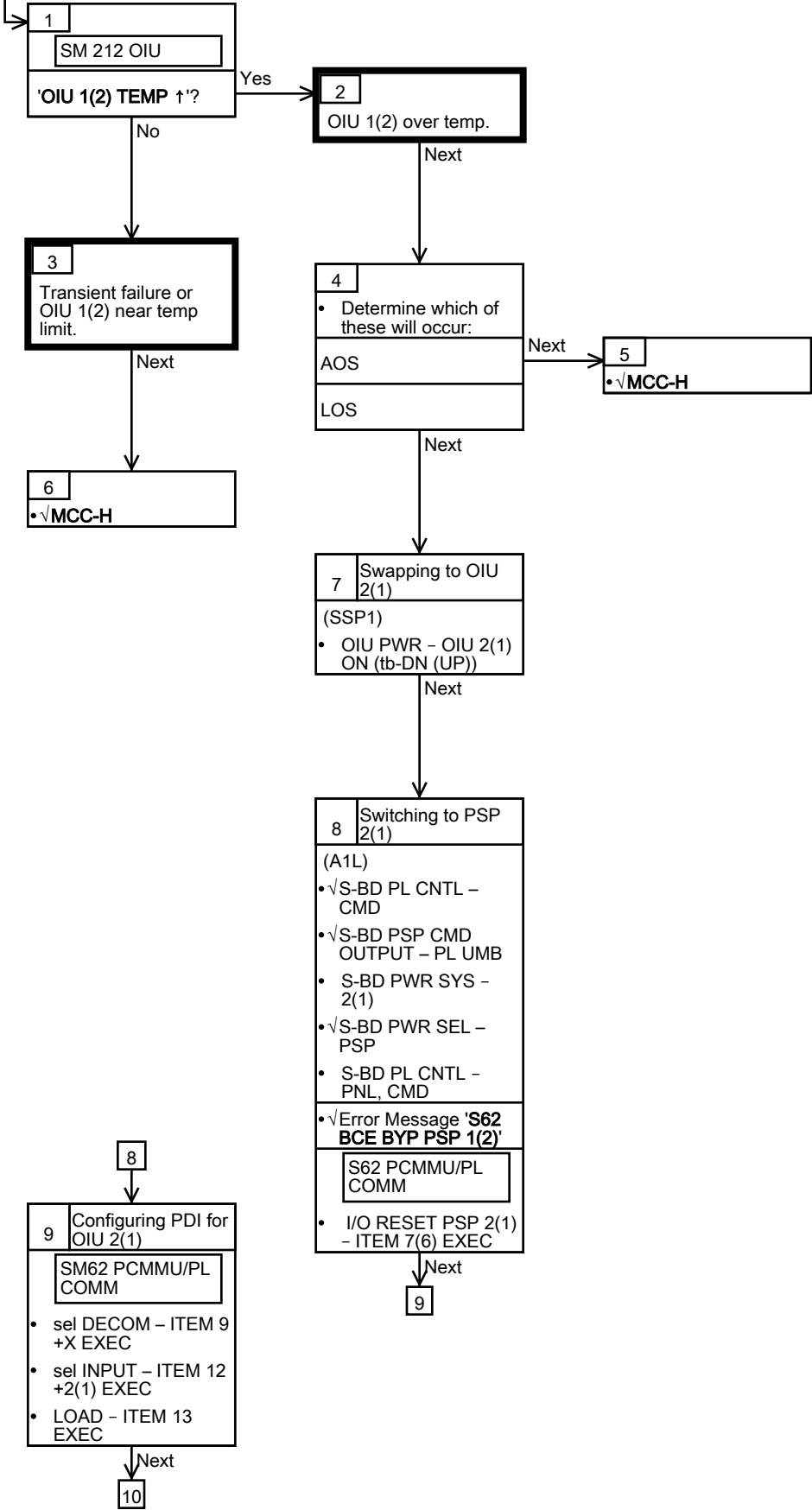
PL CAB - MNA(MNB)

PL AUX - ON

(SSP 1)

OIU PWR - OIU 1(2) ON

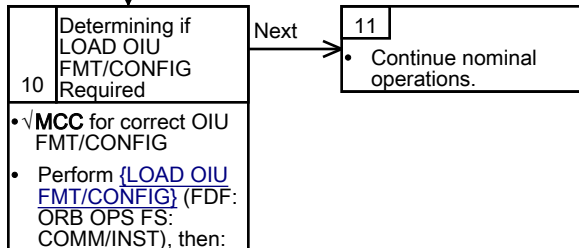
tb OIU - UP(DN)



OIU TEMP HIGH MALFUNCTION

(ASSY MAL/1E/FIN/MULTI E) Page 2 of 2 pages

9



COMM

SM ALERT

S212 OIU
AD1 NOLK

Loss of Data
On SPEC
205 During
Undocking

MCC-H
Reports
Loss of ISS
Data To
Ground Via
OIU

{S62 PDI
DECOM
FAIL} block
7 (SODF:
ASSY MAL:
MALFUNCT
ION:
COMM)

Nominal Config:
(R1)

PL CAB -
MNB(MNA)

PL AUX - ON
(SSP1)

OIU PWR - OIU
1(2) ON

tb OIU -
UP(DN)

For ISS:

If AFD PCS
manifested,
then one PCS
connected to
GNC-1(2)
MDM

[SM 212 OIU]

OIU FMT: 009

For SSOR:

(R14)

cb MNA UHF
EVA - cl

cb MNC UHF
EVA - cl

(O6)

EVA STRING:
1(2)

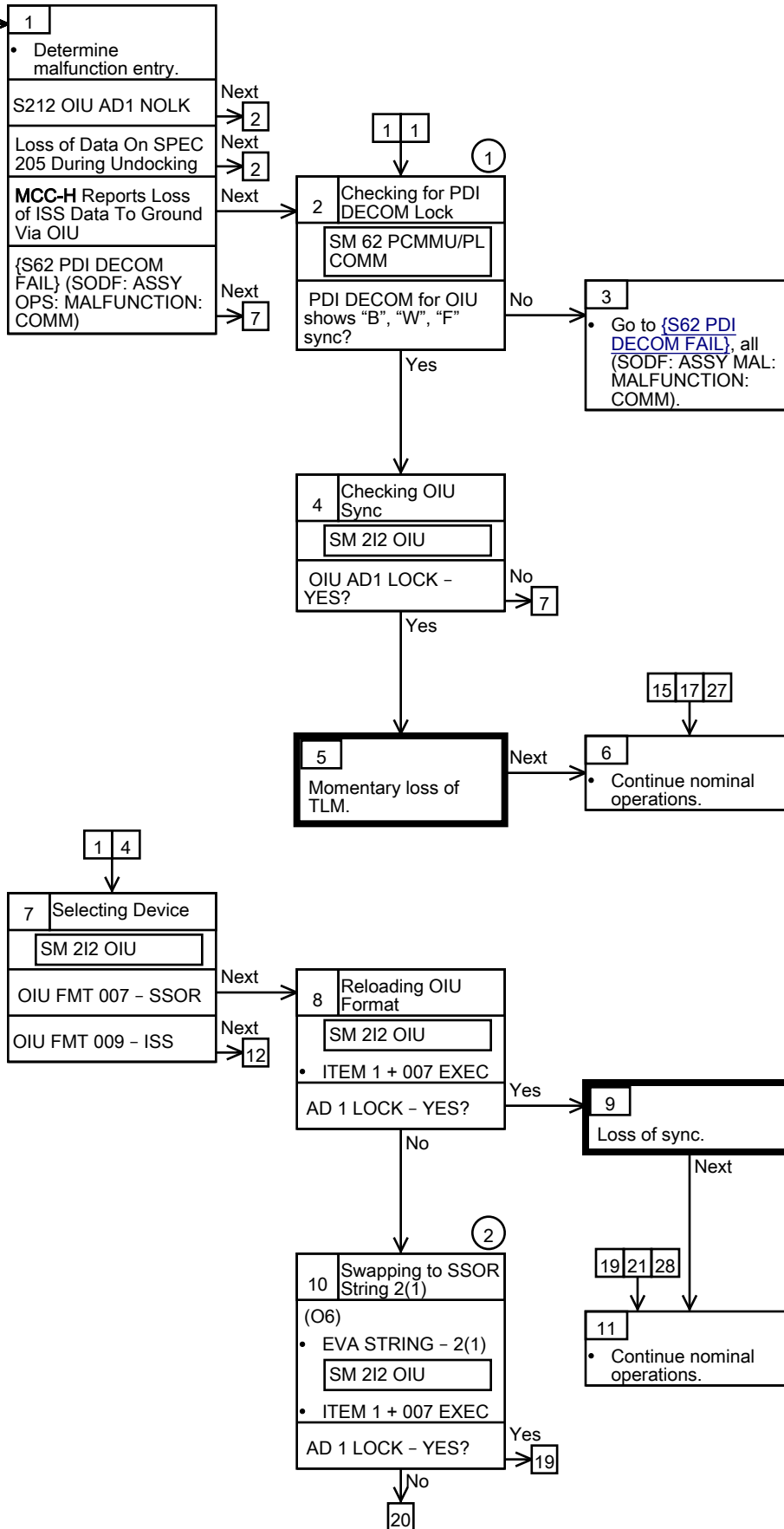
UHF MODE -
EVA

[SM 212 OIU]

OIU FMT - 007

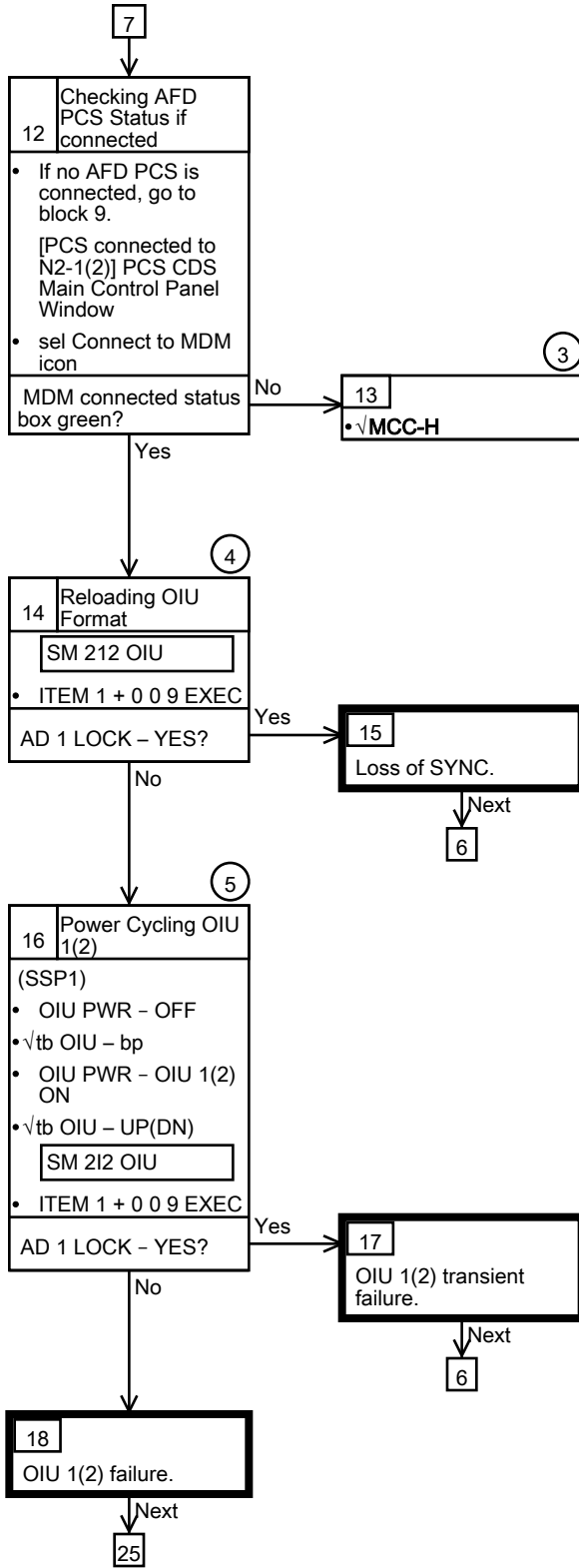
S212 OIU AD 1 NOLK/LOSS OF ISS OR SSOR TELEMETRY

(ASSY MAL/1E/FIN/MULTI E) Page 1 of 5 pages



① OIU to PDI problems would announce a 'S62 PDI DECOM FAIL' message if FDA enabled.

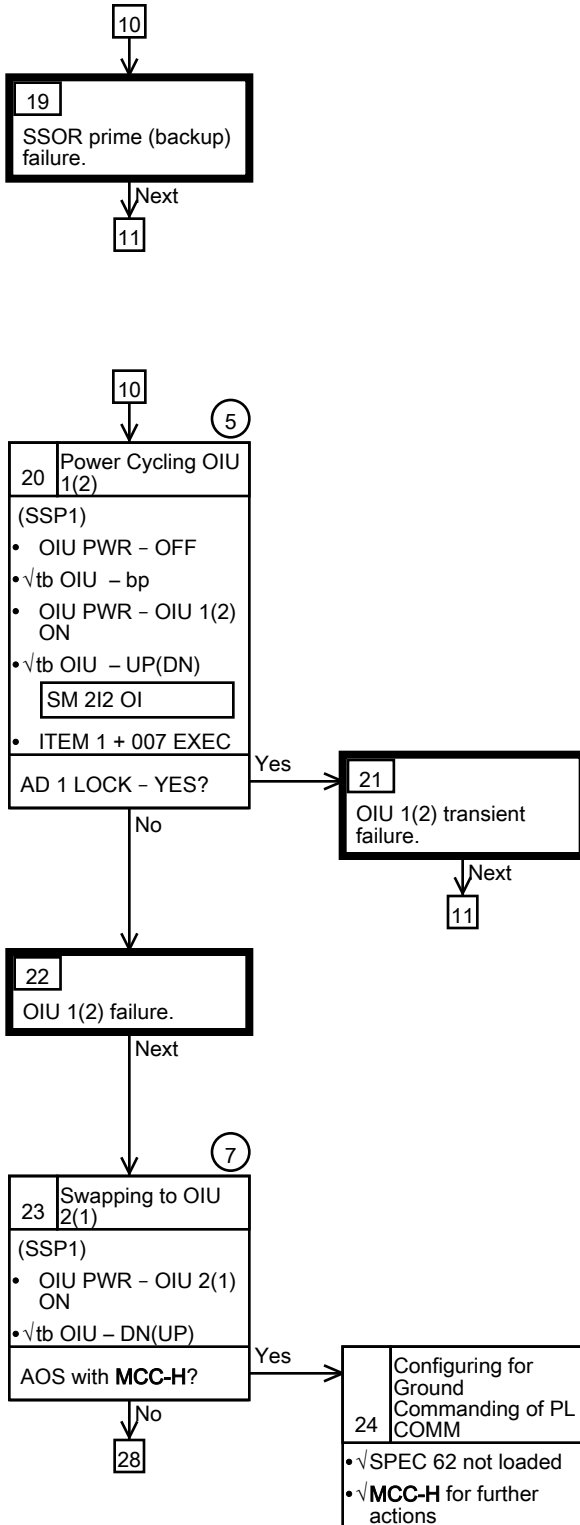
② Reloading the OIU format forces a resync with the SSOR.



3
If AFD PCS connected, then MCC-H will likely direct STS or ISS crew to reconnect the AFD PCS after MCC-H has completed any required reconfigurations.

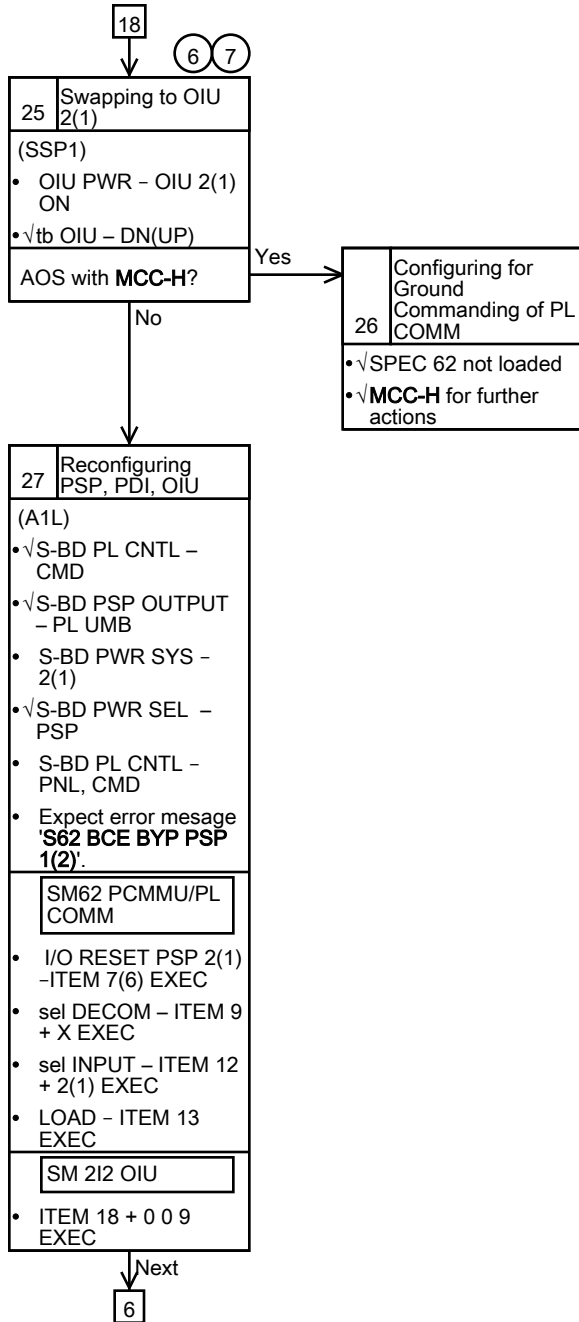
4
Reloading the OIU format forces a resync with the GNC MDM or SSOR.

5
OIU active device mapping occurs with format load.



5 OIU active device mapping occurs with format load.

7 OIU powerup config on OIU BUS 3 is RT on ch A.



6 Malfunction restores operational capability; additional troubleshooting to determine BIA failure may be performed later.

7 OIU powerup config on OIU BUS 3 is RT on ch A.

23



28	Reconfiguring PSP, PDI, OIU
(A1L)	
<ul style="list-style-type: none">•√S-BD PL CNTL - CMD•√S-BD PSP OUTPUT - PL UMB• S-BD PWR SYS - 2(1)•√S-BD PWR SEL - PSP• S-BD PL CNTL - PNL, CMD• Expect error message 'S62 BCE BYP PSP 1(2)'	
SM62 PCMMU/PL COMM	
<ul style="list-style-type: none">• I/O RESET PSP 2(1) -ITEM 7(6) EXEC• sel DECOM - ITEM 9 + X EXEC• sel INPUT - ITEM 12 + 2(1) EXEC• LOAD - ITEM 13 EXEC	
SM 2I2 OIU	
<ul style="list-style-type: none">• ITEM 1 + 0 0 7 EXEC	

Next

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PL/DPS RECONFIGURATION

(ASSY MAL/1E/FIN/MULTI E)

Page 1 of 3 pages

Procedure	Secure Action	Recovery Action	Info
{ PL 1(2) MDM I/O ERROR; PL 1(2) MDM OUTPUT } (FDF: ORB PKT: DPS)	N/A	N/A	A
{ 5.3c I/O ERROR PL 1(2); MDM OUTPUT PL 1(2) } (FDF: MAL: DPS)	N/A*	N/A	A
{ PASS SM GPC FAIL } (FDF: ORB PKT: DPS)	N/A	D	B
{ GNC RECOVERY VIA G2FD } (FDF: ORB PKT: DPS)	N/A	C,D	B
{ 5.1a CS SPLIT } (FDF: MAL: DPS)	N/A	C,D,E **	B
{ 5.3g BCE BYP PL1(2) } (FDF: MAL: DPS)	N/A*	N/A	A
{ GPC FRP-4 PASS RECOVERY AFTER BFS ENGAGE (ASCENT/ORBIT/ENTRY) } (FDF: MAL: DPS)	N/A*	C,D	B
{ GPC FRP-7 DPS RECONFIG FOR LOSS OF AV BAY COOLING } (FDF: MAL: DPS)	N/A*	C,D	B
{ DPS SSR-3 GNC REASSIGNMENT } (FDF: MAL: DPS)	N/A*	N/A	B
{ DPS SSR-4 SM REASSIGNMENT } (FDF: MAL: DPS)	N/A	C,D	B
{ ECLSS SSR-10 H2O PUMP OPS VIA GPC } (FDF: MAL: ECLSS)	N/A	C,D,E **	B
{ YERO PROCEDURES } (FDF: ORB OPS: DPS)	N/A	C,D	B

*Note: Procedure does not call out PL/DPS RECONFIG, Secure

**Note: Procedure does not call out PL/DPS RECONFIG, Recovery

ACTION A

If 'I/O ERROR PL1' message

Loss of ground and orbiter MCDS command interface to ISS via PSP 1/OIU 1.

For additional impacts, refer to [{ORBITER MDM LOSS IMPACTS}](#) (SODF: ASSY MAL: MALFUNCTION: CRITICAL EQUIPMENT).

If failure at IOP XMTR/RCVR at SM GPC

If PL2 interface with SM GPC failed

√**MCC-H** for SM GPC reassignment

PF1 interface can be recovered by port moding PL 1/2 buses.

If 'I/O ERROR PL2' message

Loss of ground and orbiter MCDS command interface to ISS via PSP 2/OIU 2.

For additional impacts, refer to [{ORBITER MDM LOSS IMPACTS}](#) (SODF: ASSY MAL: MALFUNCTION: CRITICAL EQUIPMENT).

If failure at IOP XMTR/RCVR at SM GPC

If PL1 interface with SM GPC failed

√**MCC-H** for SM GPC reassignment

PF2 interface can be recovered by port moding PL 1/2 buses.

ACTION B

If SM GPC affected

Note PL/ISS commanding via SM GPC (ground and orbiter MCDS) not possible until SM machine is restored and PL 1(2) MDM I/F is restored.

If GNC GPC affected

Ground commanding not possible until GNC machine is restored.

ACTION C

If PSP I/O reset not previously performed

SM 62 PCMMU/PL COMM

I/O RESET PSP 1(2) - ITEM 6(7) EXEC

Notify **MCC-H** when complete.

ACTION D

Reload Perform [{PDI DECOM FORMAT}](#) (FDF: ORB OPS FS: COMM/INST),
then:

As required, reenable PDI DECOM FDA.

Resume SPEC 62.

ACTION E

Reload PCMMU TFLs, load Perform [{PCMMU FORMAT}](#) (FDF: ORB OPS FS:
COMM/INST).

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ORBITER ELECTRICAL BUS LOSS MATRIX
(ASSY MAL/1E/FIN/MULTI E)

Table 2. Orbiter Electrical Bus Loss Matrix (PRLA)

ORBITER ELECTRICAL BUSES→	MNA DA1		CNTL BUS*						MNB DA2	
	FPC1	PNL A6&A14							FPC2	PNL A6&A14
	AC1		AB1	AB2	BC1	BC2	CA1	CA2	AC2	
PRLA-PAYLOAD RETENTION LATCHES										
PRLA PL 1, 2, & 3- Latch 1/Sys A, 2/A, 3/A, 4/A, 5/A DC Logic Pwr		X								
PRLA PL 1, 2, & 3- Latch 1/Sys A, 2/A, 3/A, 4/A, 5/A Cntl Bus			XC							
PRLA PL 1, 2, & 3- Latch 1/Sys A, 2/A, 3/A, 4/A, 5/A AC Mech Pwr	X									
PRLA PL 1, 2, & 3- Latch 1/Sys B, 2/B, 3/B, 4/B, 5/B DC Logic Pwr										X
PRLA PL 1, 2, & 3- Latch 1/Sys B, 2/B, 3/B, 4/B, 5/B Cntl Bus					XC					
PRLA PL 1, 2, & 3- Latch 1/Sys B, 2/B, 3/B, 4/B, 5/B AC Mech Pwr									X	
Logic Pwr Sys 1		X								
Logic Pwr Sys 2										X
PL Bay Mech Pwr Sys 1	X		XRC	XRC			XRC	XRC		
PL Bay Mech Pwr Sys 2					XRC	XRC			X	

X = Total loss of operational power
P = Loss of primary power source
R = Loss of redundant power source
(R) = Requires action to use redundant source
XC = Total loss of CNTL power
XPC = Loss of primary CNTL power
XRC = Loss of redundant CNTL power
*- CNTL bus name identifies power source (ex: CNTL BC1 is powered by MNB & MNC through RPCs and by MNA through cb and fuse)

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Table 3. Payload Retention Usage

Payload	Latch	PL SEL	Latch Use	Latch Location
Columbus	1	1	LATCH / RELEASE	LATCH 1
	2	1	LATCH / RELEASE	LATCH 2
	3	1	LATCH / RELEASE	LATCH 3
	4	1	LATCH / RELEASE	LATCH 4
	5	1	LATCH / RELEASE	KEEL LATCH 2

ORBITER MDM LOSS IMPACTS

(ASSY MAL/IE/FIN/MULTI E)

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FF1	Uplink through NSP 1 (secondary)
FF3	Uplink through NSP 2 (primary)
PF1	ISS Primary command path (via PSP 1 - UMB 1/OIU 1) APCU 1 telemetry OIU 1 telemetry (PDI TELEMETRY 1) input DIH ODS X2/PMA2 X1 connector mate telemetry - <u>1 4</u> input DIH ODS X1/PMA2 X2 connector mate telemetry - <u>1 5</u>
PF2	ISS Redundant command path (via PSP 2 - UMB 1/OIU 2) APCU 2 telemetry OIU 2 telemetry (PDI TELEMETRY 2) input DIH ODS X1/PMA2 X2 connector mate telemetry - <u>0 8</u> input DIH ODS X2/PMA2 X1 connector mate telemetry - <u>0 9</u>
OF1	PCMMU 1 - mode select telemetry PCMMU 1 / 2 - ON/OFF power telemetry PCMMU 1 / 2 - RPC A telemetry PL AUX A - RPC ON/OFF telemetry MID MCA 1 OP STATUS (1, 2, 3, 4) telemetry MID MCA 3 OP STATUS (1, 2, 3, 4) telemetry PL BAY MECH PWR SYS 1, 2 telemetry PL RETEN LOGIC PWR SYS 1, 2 telemetry
OF2	PSP 1 / 2 - bit and frame sync PCMMU 2 - mode select telemetry PCMMU 2 RPC B telemetry PL AUX B - RPC ON/OFF telemetry MID MCA 1 OP STATUS (5, 6) telemetry MID MCA 3 OP STATUS (5, 6, 7, 8) telemetry PRLA PL SEL 1 / SYSTEM B: PRLA Latch (1, 2, 3, 4, 5) R-F-L, LAT, REL telemetry
OF3	Orbiter Comm system telemetry (refer to OI MDM/DSC Failure Impacts) PL PRI MNC, MNB, FC3 - ON/OFF telemetry PCMMU 1 RPC B telemetry
OF4	Ku-Band - RADAR mode and output power S-Band, Ku-Band - PNL/CMD switch position PSP, GCIL - ON/OFF telemetry ORBITER Comm system telemetry (refer to OI MDM/DSC Failure Impacts) CAB PL (MNA, MNB), PL AUX - ON/OFF telemetry

ORBITER MDM LOSS IMPACTS

(ASSY MAL/IE/FIN/MULTI E)

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OA1	ODS X4/PMA X3 connector mate telemetry PMA 2/3 GRP 1 passive hooks (1, 3, 5, 7, 9, 11) Close telemetry
DSC OA1	ODS X4/PMA X3 connector mate telemetry PMA 2/3 GRP 1 passive hooks (1, 3, 5, 7, 9, 11) Close telemetry
OA2	AFT PL MNB PWR ON telemetry AFT PL MNB amps ODS X3/PMA X4 connector mate telemetry PMA 2/3 GRP 2 passive hooks (2, 4, 6, 8, 10, 12) Close telemetry
DSC OA2	ODS X3/PMA X4 connector mate telemetry PMA 2/3 GRP 2 passive hooks (2, 4, 6, 8, 10, 12) Close telemetry
OA3	AFT PL MNC PWR ON telemetry AFT PL MNC amps PRLA PL SEL 1 / SYSTEM A: PRLA Latch (1, 2, 3, 4, 5) R-F-L, LAT, REL telemetry

COLUMBUS ELECTRICAL BUS LOSS MATRIX - 120V

(ASSY MAL/1E/FIN/MULTI E)

Table 1. PDU 120V Electrical Bus Loss Matrix

PDU 120V ELECTRICAL BUSES (Outlets)	BSSPC1			BSSPC2		BSSPC3			BSSPC4			BSSPC5			BSSPC6			BSSPC7			BSSPC8		BSSPC9		
	15	16	28	2	21	6	7	24	4	5	10	8	9	20	1	22	13	14	17	3	23	11	12	18	
OUTLETS																									
SUP1 Outlet 1																									
SUP1 Outlet 2																									
SUP1 Outlet 3																									
SUP2 Outlet 1																									
SUP2 Outlet 2	1X																								
SUP2 Outlet 3		1X																							
SUP3 Outlet 1																									
SUP3 Outlet 2																									
SUP3 Outlet 3																									
SUP4 Outlet 1																									
SUP4 Outlet 2	2X																								
SUP4 Outlet 3		2X																							
HCUs																									
HCU1				1X																					
HCU2				2X																					
ISPRs																									
A1						2A											1M								
A2				1M			2A																		
A3												2A										1M			
A4										1M															
F1						1A																			
F2				2M			1A																		
F3													1A												
F4										2M				1A											
O1											1M	2A													
O2											2M	1A													
PPSB																									
D1-RACK																									
WPA1																									
CWSA1																									
TCV1																									

1, 2 = PDU ID M = Loss of main power R = Loss of redundant power
 X = Total loss of power A = Loss of auxiliary power

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COLUMBUS ELECTRICAL BUS LOSS MATRIX - 120V

(ASSY MAL/1E/FIN/MULTI E)

Continuation of Table 1. PDU 120V Electrical Bus Loss Matrix

PDU 120V ELECTRICAL BUSES (Outlets)	BSSPC1			BSSPC2		BSSPC3			BSSPC4			BSSPC5			BSSPC6			BSSPC7			BSSPC8		BSSPC9		
	15	16	28	2	21	6	7	24	4	5	10	8	9	20	1	22	13	14	17	3	23	11	12	18	
D1-RACK																									
WPA2																									
CWSA2																									
TCV2																									
ECLSS EQUIPMENT																									
CFA1																									
CFA2																									
IRFA																									
ISFA																									
SMOKE DETECTORS																									
SD1																									
SD2																									
C&T EQUIPMENT																									
ATU1																									
ATU2																									
XPEGH																									
VDPU																									
LIGHTS																									
ELUPS																									
MLU1																									
MLU2																									
MLU3																									
MLU4																									
MLU5																									
MLU6																									
MLU7																									
MLU8																									
PDU1																									
PDU2																									

1, 2 = PDU ID M = Loss of main power R = Loss of redundant power
 X = Total loss of power A = Loss of auxiliary power

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COLUMBUS ELECTRICAL BUS LOSS MATRIX - 28V

(ASSY MAL/1E/FIN/1E/MULTI E)

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Table 1. PDU 28V Electrical Bus Loss Matrix.

PDU 28V ELECTRICAL BUSES (Outlets)	CONV1	CONV2	CONV3	CONV4	CONV5 → BCEP1			CONV6	CONV7	CONV8	CONV9 → BCEP2		
	38	32	35	36	29	31	33	39	40	30	34	37	41
Sub Sys Pwr Bus		2	3	4		6	7		5	1	8	9	10
DMS													
VTC1	1RA							2RB					
VTC2	2RA							1RB					
DMC				1RA						2RB			
MMC				1RA/2RB									
PLCU		1RB	2RA										
SPC SPARE			1RB/2RA										
CMU1		1RB								2RA			
CMU2				2RA					1RB				
CMU3									2RA	1RB			
CMU4			1RB							2RA			
XCMU		1RB		2RA									
MMU1		2RA							1RB				
MMU2		1RA							2RB				
CLSW1			1RA						2RB				
CLSW2			2RA							1RB			
C&T													
VMN1										1X			
VMN2		2X											
HRM									1RA/2RB				
VCR1				1X									
VCR2		2X											

1, 2 = PDU ID M = Loss of main power R = Loss of redundant power
 X = Total loss of power A = Loss of A power string B = Loss of B power string

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COLUMBUS ELECTRICAL BUS LOSS MATRIX - 28V

(ASSY MAL/1E/FIN/1E/MULTI E)

Continuation of Table 1. PDU 28V Electrical Bus Loss Matrix.

PDU 28V ELECTRICAL BUSES (Outlets) Sub Sys Pwr Bus	CONV1	CONV2	CONV3	CONV4	CONV5 → BCEP1			CONV6	CONV7	CONV8	CONV9 → BCEP2		
	38	32	35	36	29	31	33	39	40	30	34	37	41
ECLSS		2	3	4		6	7		5	1	8	9	10
AFS1											1X		
AFS2												2X	
PPOS1							1X						
PPOS2						2X							
PPCS1											1X		
PPCS2							2X						
CTCU1					1X								
CTCU2					2X								
TPS1						1X							
TPS2							1X						
TPS3												2X	
TPS4											2X		
RVAPS						1X							
VAPS1												2X	
VAPS2							1X						
VAPS3										2X			
RVEPS													2X
VEPS1											2X		
VEPS2												1X	
VEPS3											1X		
VEPS4				2X									
HS1									1X				
HS2										2X			
LCOS1											1X		
LCOS2							2X						
CHX-FA DPS1											1X		
CHX-FA DPS2												2X	
CFA1 DPS													1X
CFA2 DPS							2X						
IRFA DPS													1X
ISFA DPS											2X		
CWSA1 DP Water							1X						
CWSA1 DP Air													1X
CWSA2 DP Water									2X				
CWSA2 DP Air							2X						

1, 2 = PDU ID M = Loss of main power R = Loss of redundant power
 X = Total loss of power A = Loss of A power string B = Loss of B power string

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COLUMBUS ELECTRICAL BUS LOSS MATRIX - 28V

(ASSY MAL/1E/FIN/1E/MULTI E)

Continuation of Table 1. PDU 28V Electrical Bus Loss Matrix.

PDU 28V ELECTRICAL BUSES (Outlets)	CONV1	CONV2	CONV3	CONV4	CONV5 → BCEP1			CONV6	CONV7	CONV8	CONV9 → BCEP2		
	38	32	35	36	29	31	33	39	40	30	34	37	41
Sub Sys Pwr Bus		2	3	4		6	7		5	1	8	9	10
TCS													
WMV1						2RB (redun)						1RA (nom)	
WMV2											1RB/2RA		
WMV3												2RB (redun)	1RA (nom)
WMV4							1RB/2RA						
DPSB1.1 (WPA1 DP1)							1X						
DPSB1.2 (Nom DP /VTC1)						1X							
DPSB2.1 (WPA2 DP1)						2X							
DPSB2.2 (Redun DP /VTC2)							2X						
DPSB3.1 (WPA1 DP2)												1X	
DPSB3.2 (WPA2 DP2)												2X	

1, 2 = PDU ID M = Loss of main power R = Loss of redundant power
 X = Total loss of power A = Loss of A power string B = Loss of B power string

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COLUMBUS ELECTRICAL BUS LOSS MATRIX - VALVES

(ASSY MAL/1E/FIN/MULTI E)

Table 1. PDU 1 Valve Nomenclature (Power provided by PDU1 main and redundant buses)

VST board	STEPPER TYPE / TCS		BRUSH TYPE / ECLS	
	DRIVER	VALVE NAME	DRIVER	VALVE NAME
1	1	WFSV A2	1	VEDD V1
	2	WOOV 6	2	WLSOV A2
2			3	NLSOV 1
			4	NLSOV 3
3	3	WFSV A3	5	PPRA1
	4	WOOV 8	6	VADD V1
4	5	WFSV A1	7	WLSOV A3
	6	WOOV 9	8	SLSOV
5	7	WFSV A4	9	CDA1 V1
	8	WOOV 1	10	CDA2 V2
6	9	WOOV 7	11	WLSOV A1
	10	WFSV O1	12	ISSOV
7	11	Not connected	13	CLSOV
	12		14	WLSOV A4
			15	CDA2 V1
			16	CDA1 V2
			17	WLSOV O1
			18	Not connected
			19	
			20	

Table 2. PDU 2 Valve Nomenclature (Power provided by PDU2 main and redundant buses)

VST board	STEPPER TYPE / TCS		BRUSH TYPE / ECLS	
	DRIVER	VALVE NAME	DRIVER	VALVE NAME
1	1	WFSV F2	1	VEDD V2
	2	WOOV 3	2	WLSOV F2
2			3	NLSOV 2
			4	NLSOV 4
3	3	WFSV F3	5	PPRA2
	4	WOOV 5	6	VADD V2
4	5	WFSV F1	7	WLSOV F3
	6	WOOV 10	8	Not connected
5	7	WFSV F4	9	CDA3 V1
	8	WOOV 2	10	CDA4 V2
6	9	WOOV 4	11	WLSOV F1
	10	WFSV O2	12	IRSOV
7	11	Not connected	13	Not connected
	12		14	WLSOV F4
			15	CDA4 V1
			16	CDA3 V2
			17	WLSOV O2
			18	Not connected
			19	
			20	

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