Space Shuttle Program
FLIGHT DATA FILE

JSC–48081–103

Hubble Space Telescope Deploy Checklist

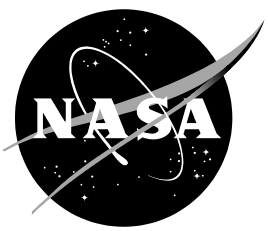
STS–103

Mission Operations Directorate
Operations Division

Final, Rev A
September 21, 1999

National Aeronautics and
Space Administration

Lyndon B. Johnson Space Center
Houston, Texas



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MISSION OPERATIONS DIRECTORATE

HUBBLE SPACE TELESCOPE
DEPLOY CHECKLIST
STS–103

FINAL, REVISION A
September 21, 1999

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Incorporates the following:			
482#:	HST DPY–57	HST DPY–60	HST DPY–63
	HST DPY–58	HST DPY–61	HST DPY–64
	HST DPY–59	HST DPY–62	HST DPY–65

AREAS OF TECHNICAL RESPONSIBILITY

Book Manager	DO5/T. Arnold	281–483–7431
RMS Procedures	DX2/L. Hammond	281–483–0348
Payload Operating Procedures	DO5/T. Arnold	281–483–7431
Separation Procedures	DM43/S. Walker	281–483–1665
Attitudes and Pointing	DO4/A. Lalich	281–483–7065

LIST OF EFFECTIVE PAGES

FINAL	07/20/99
REV A	09/21/99

* – Omit from flight book
Δ – Insert PDRS FS section 6 (OFF–NOMINAL HST DEPLOY OPS) behind tab

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CONTENTS PAGE

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GRAPPLE

HST GRAPPLE

Visually verify FSS in berthing posn

1. CAMR SETUP

A7 ✓PL BAY FLOODS MID (two) – OFF
FWD,AFT (four) – as reqd

✓Camr setup: P/TV15 HST RELEASE (PHOTO/TV FS, P/TV SCENES)

Use overlays as necessary

L10 VTR – ✓Adequate tape available

A7U CCTV – Install PDRS TARGET OVERLAY FOR CTVM
– RMS WRIST: zoom 34.0 HFOV
focus 5.0 ft

Maintain eyepoint ~18 inches when using grapple overlay

M 2. MNVR RMS TO PRE–GRAPPLE POSN

L10 ✓VTR PWR – ON
✓lt – on
CNTL sw – STBY,REC
✓REC lt – on

DAP: A10/AUTO(FREE)/VERN

* If Single Joint RMS, go to SJ HST GRAPPLE *
* (PDRS FS, OFF–NOMINAL HST DEPLOY OPS) *

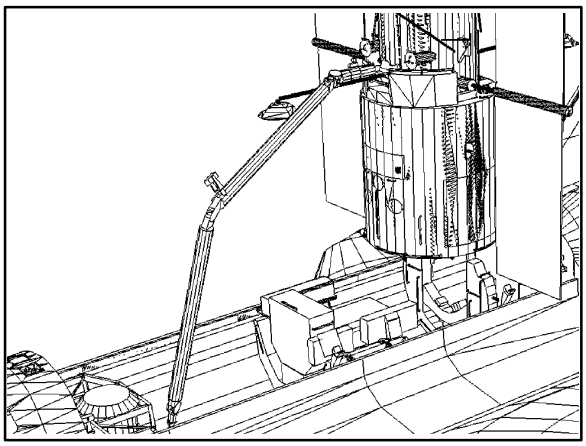
SM 94 PDRS CONTROL

✓PL ID (ITEM 3): 0
✓INIT ID (ITEM 24): 0

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

Mnvr to pre–grapple posn (+V2 wing/GF 1):

X	Y	Z	PITCH	YAW	ROLL	PL ID
–1024	–46	–755	0	0	1	0
SY	SP	EP	WP	WY	WR	
–29.3	+83.3	–79.7	–3.6	+29.3	+0.5	



HST Pregrapple

BRAKES – ON (tb–ON)

M 3. GRAPPLE
✓DAP: A10/AUTO(FREE)/VERN

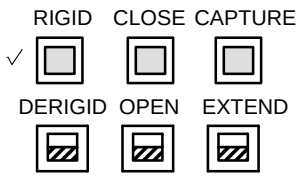
RHC/A8U RATE – VERN (RATE MIN tb–ON)
A8U BRAKES – OFF (tb–OFF)
MODE – END EFF, ENTER

Mnvr to grapple envelope

CAUTION
Monitor EE tb timing to prevent EE motor burnout

EE MODE – AUTO
RHC CAPTURE sw – depress (mom)

A8U



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

EE MODE – OFF
BRAKES – ON (tb–ON)

DAP: A10/AUTO/VERN(ALT)
SM 94 PDRS CONTROL
PL ID – ITEM 3 +1 EXEC
INIT ID – ITEM 24 +1 EXEC

L10 VTR CNTL sw – STBY
✓REC lt – off

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HST UMB DISCONNECT

1. CAMR SETUP

A7 ✓PL BAY FLOODS MID (two) – OFF
✓FWD,AFT (four) – as reqd
✓Camr setup: P/TV15 HST RELEASE (PHOTO/TV FS, P/TV SCENES)

☐ 2. PWR XFER PRECHECKS

SM 210 HST SYS

✓TLM COUNT – incr
✓EPS INT ESS BUS ABC – * * *
✓MAIN BUS A,B,C – INT,INT,OFF
L12UR ✓ESS BUS INT PWR – ON (tb–UP)
✓EXT PWR – ON (tb–gray)
✓cb SPACE TEL SW PWR – cl

UNBERTH

M 3. DEADFACE UMB

On MCC GO:
ESS/MN SW ENA – ON (tb–gray)
ESS BUS EXT PWR – OFF (tb–bp)
MN BUS EXT PWR – OFF (hold 2 sec, tb–bp)
✓IPCU RLY CLOSED tb – bp
✓MN BUS PWR ON tb – gray

SM 210 HST SYS

✓UMB SG V EXT MN BUS = 0
✓ESS BUS = 0
L12UR FHST SHUTTER – OP (tb–bp)
✓RSU SURV HTR PWR – OFF (tb–bp)
ESS/MN SW ENA – OFF (tb–bp)
✓SSM WK LTS – OFF
cb SPACE TEL SW PWR – op

SM 211 SSE CONTROL

✓DPC 1/2–11/12 VOLTS: 34.5 ± .7
✓AMPS: < 1.0

CRT PCU OFF – ITEM 4 EXEC (*)

L12UL ✓PCU PWR CONTR A,B (two) – OFF

CRT ✓DPC 1/2–11/12: (no *)
✓1/2–11/12 VOLTS: 0.0 (after 30 sec)
✓AMPS: < 1.0

Notify MCC, Umb deadface complete

M 4. SET UP UMB DISCONNECT

A6U ✓PL RETEN LAT 1,2 – OFF
✓LOGIC PWR SYS 2(SYS 1) – OFF
✓PL SEL – 1
LOGIC PWR SYS 1(SYS 2) – ON

CRT MSB ON – ITEM 1 EXEC (A(B))

* If MSB ON – blank, continue *

✓MSB AMPS: < .03
✓MECH – blank
✓SEL (ITEMS 9–19) – (no *)
✓STAT (ITEMS 9–19) – blank
✓O/R DIS – (*)

* If any param not as expected, perform SSE SSR–1 *
* FMDM SWAP A → B(B→A) (PL SYS, SSE), then *
* repeat SET UP UMB DISCONNECT on alternate *
* side and continue using alternate side *

R13L PL BAY MECH PWR SYS 1(2) – ON

> WARNING
> Operation of two FSS mechanisms may result in HST collision with orbiter
>
> For any SM ALERT during FSS ops:
> A6U PL RETEN LAT 1,2 (both) – OFF
> R13 PL BAY MECH PWR SYS 1,2 (both) – OFF
> ✓MCC

M 5. DISCONNECT UMB

L10 ✓VTR PWR lt – on
Control sw – REC
✓REC lt – on

CRT UMB MN SEL – ITEM 17 EXEC (* MAT)

* If UMB MN STAT – *, *
* DESEL – ITEM 20 EXEC (ITEMS 9–19 – no *), *
* perform SSE SSR–1 FMDM SWAP A→B(B→A) *
* (PL SYS, SSE) *
* If UMB MN STAT – RDY, continue *

✓MSB AMPS: .03 to .10
✓MECH – steady A(B)
A6U ✓PL RETEN LAT 1 tb – LAT (A–side only)
1(2) – REL (tb–bp)
CRT ✓MECH – flashing A(B)
✓UMB MN STAT – RDY (wait 8 sec)

* If UMB MN STAT – MAT, *
* continue and expect (*) at end of travel *

✓UMB MN STAT – REL

* If UMB MN STAT – RDY or MAT after 20 sec, *
* PL RETEN LAT 1(2) – OFF, perform *
* 1.3a PRIMARY MOTOR FAILS TO DRIVE *
* MECHANISM (PL SYS, SSE) *

A6U ✓PL RETEN LAT 1(2) tb – REL (A–side only)
1(2) tb – OFF
CRT ✓MECH – steady A(B)
L12UR ✓MN BUS PWR ON tb – bp
✓ESS BUS INT PWR tb – bp

SM 210 HST SYS

✓UMB SG V INT MN BUS = 0
✓ESS BUS = 0
Notify MCC, UMB disconnected

HST UNBERTH

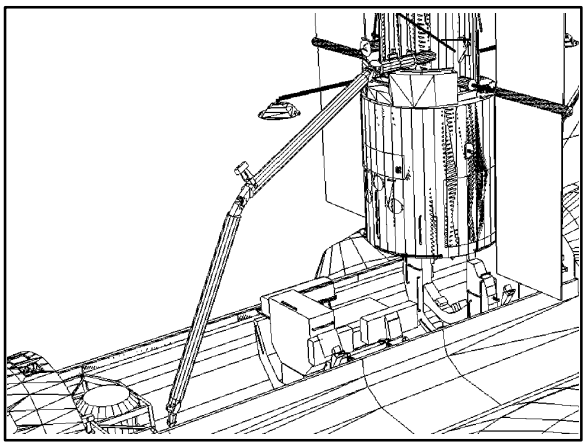
1. SETUP

A7 ✓PL BAY FLOODS MID (two) – OFF
✓FWD,AFT (four) – as reqd
✓Camr setup: P/TV15 HST RELEASE (PHOTO/TV FS, P/TV SCENES)

FSS BERTHED posn:

X	Y	Z	PITCH	YAW	ROLL	PL ID
–1149	0	–755	0	0	0	1
–1127	12	–497	0	0	0	2

SY	SP	EP	WP	WY	WR
–24.9	+70.3	–63.8	–6.5	+24.9	+0.5



FSS Berthed

2. PWR FSS CCTV

CAUTION
FSS CCTV limited to 2 hr continuous use

L12U ✓CCTV HTR PWR – ON (tb–gray)

SM 211 SSE CONTROL

CCTV ENA ON – ITEM 5 EXEC (*)
PWR ON – ITEM 7 EXEC (*)

* If CCTV ENA ON – (no *), retry ITEM 5: *
* If no joy, continue *
* If CCTV PWR ON – (no *), retry ITEM 7: *
* If no joy, attempt to display camr image *
* on monitor. If no image, ✓MCC *

A7U VID OUT pb – MON 1(2)
IN pb – PL1
ALC AVG pb – press
GAMMA NORM pb – press

M 3. OPEN BERTHING LATCH 3

Set up CCTV to monitor opening of Latch 3

L10 ✓VTR recording and timer
DAP: FREE

SM 211 SSE CONTROL

B LAT 3 SEL – ITEM 16 EXEC (* CL)

* If B LAT 3 STAT – * and visually observed closed, *
* | then BOT sw failure: *
* | DESEL – ITEM 20 EXEC (ITEMS 9–19 – no *), *
* | perform SSE SSR–1 FMDM SWAP A→B(B→A) *
* | (PL SYS, SSE) and complete steps 3–7 on alt side *
* If B LAT 3 STAT – RDY, continue *

✓MSB AMPS: .03 to .1
✓MECH – steady A(B)

A6U ✓PL RETEN LAT 1 tb – LAT (A–side only)
1(2) – REL (tb–bp)

CCTV Visually monitor latch operation

CRT ✓MECH – flashing A(B)
✓B LAT 3 STAT – RDY (wait 18 sec)

* If B LAT 3 STAT – CL, *
* continue and expect (*) *

✓B LAT 3 STAT – OP

* If B LAT 3 STAT – CL or RDY after 30 sec, *
A6U * PL RETEN LAT 1(2) OFF, perform *
* 1.3a PRIMARY MOTOR FAILS TO DRIVE *
* MECHANISM (PL SYS, SSE) *

✓PL RETEN LAT 1(2) tb – REL (A–side only)
1(2) tb – OFF

CRT ✓MECH – steady A(B)

M 4. OPEN BERTHING LATCH 1
Set up CCTV to monitor opening of Latch 1

L10 ✓VTR recording and timer

CRT B LAT 1 SEL – ITEM 14 EXEC (* CL)

* If B LAT 1 STAT – * and visually observed closed, *
* | then BOT sw failure: *
* | DESEL – ITEM 20 EXEC (ITEMS 9–19 – no *), *
* | perform SSE SSR–1 FMDM SWAP A→B(B→A) *
* | (PL SYS, SSE) and complete steps 4–7 on alt side *
* If B LAT 1 STAT – RDY, continue *

✓MSB AMPS: .03 to .1
✓MECH – steady A(B)

A6U ✓PL RETEN LAT 1 tb – LAT (A–side only)
1(2) – REL (tb–bp)

CCTV Visually monitor latch operation

CRT ✓MECH – flashing A(B)
✓B LAT 1 STAT – RDY (wait 18 sec)

* If B LAT 1 STAT – CL, *
* continue and expect (*) *

✓B LAT 1 STAT – OP

* If B LAT 1 STAT – CL or RDY after 30 sec, *
A6U * PL RETEN LAT 1(2) – OFF, perform *
* 1.3a PRIMARY MOTOR FAILS TO DRIVE *
* MECHANISM (PL SYS, SSE) *

✓PL RETEN LAT 1(2) tb – REL (A–side only)
1(2) – OFF

CRT ✓MECH – steady A(B)

M 5. OPEN BERTHING LATCH 2
Set up CCTV to monitor opening of Latch 2 (include FSS Camr)

L10 ✓VTR recording and timer

CRT B LAT 2 SEL – ITEM 15 EXEC (* CL)

* If B LAT 2 STAT – * and visually observed closed, *
* then BOT sw failure: *
* DESEL – ITEM 20 EXEC (ITEMS 9–19 – no *), *
* perform SSE SSR–1 FMDM SWAP A→B(B→A) *
* (PL SYS, SSE) and complete steps 5–7 on alt side *
* If B LAT 2 STAT – RDY, continue *

✓MSB AMPS: .03 to .1
✓MECH – steady A(B)

A6U ✓PL RETEN LAT 1 tb – LAT (A–side only)
1(2) – REL (tb–bp)

CCTV Visually monitor latch operation

CRT ✓MECH – flashing A(B)
✓B LAT 2 STAT – RDY (wait 18 sec)

* If B LAT 2 STAT – CL, *
* continue and expect (*) *

✓B LAT 2 STAT – OP

* If B LAT 2 STAT – CL or RDY after 30 sec, *
A6U * PL RETEN LAT 1(2) – OFF, perform *
* 1.3a PRIMARY MOTOR FAILS TO DRIVE *
* MECHANISM (PL SYS, SSE) *

✓PL RETEN LAT 1(2) tb – REL (A–side only)
1(2) – OFF

CRT ✓MECH – steady A(B)

6. DESELECT BERTHING LATCHES
CRT DESEL – ITEM 20 EXEC
✓MSB AMPS: < 0.03

7. PWRDN FSS MECH SYSTEMS
MSB OFF – ITEM 2 EXEC (*)

A6U PL RETEN LAT 1,2 – OFF
LOGIC PWR SYS 1(SYS 2) – OFF
✓PL SEL – 1

R13L PL BAY MECH PWR SYS 1(2) – OFF

M 8. MNVR RMS TO FSS HOVER POSN
Set up CCTV to monitor HST motion to FSS Hover posn

L10 ✓VTR recording and timer

✓DAP: FREE

GNC 20 DAP CONFIG

Load DAPs A9 and B12
CNTL ACCEL – ITEM 28 +3 EXEC
– ITEM 48 +3 EXEC
✓DAP: no LO Z

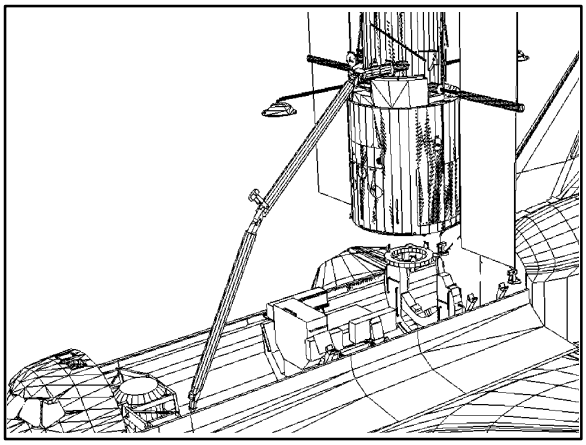
* If Single Joint RMS, go to SJ HST UNBERTH *
* (PDRS FS, OFF–NOMINAL HST DEPLOY OPS) *

RHC RATE – VERN(RATE MIN tb–ON)
A8U BRAKES – OFF (tb–OFF)
MODE – ORB LD, ENTER

Mnvr to FSS HOVER posn:

X	Y	Z	PITCH	YAW	ROLL	PL ID
–1149	0	–816	0	0	0	1
–1128	12	–557	0	0	0	2

SY	SP	EP	WP	WY	WR
–27.6	+63.4	–42.0	–21.3	+27.6	+0.5



FSS Hover

If using REL:

SM 94 PDRS CONTROL

Enter target position and attitude (ITEM 18–23)
CMD CHK – ITEM 25 (GOOD)
POR DISPLAY – ITEM 30 EXEC (REL)

When mnvr complete:

SM 94 PDRS CONTROL

POR DISPLAY – ITEM 30 EXEC (ORB)

BRAKES – ON (tb–ON)
– OFF (tb–OFF)

SM 94 PDRS CONTROL

PL ID – ITEM 3 +1 EXEC
INIT ID – ITEM 24 +1 EXEC

If attitude maintenance reqd,
DAP: A/AUTO/VERN(ALT)

9. UNPWR FSS CCTV

When FSS CCTV no longer reqd:

SM 211 SSE CONTROL

CCTV PWR OFF – ITEM 8 EXEC (*) (wait 15 sec)

* If CCTV PWR OFF, not (*), do not *
* perform CCTV ENA – OFF *

CCTV ENA OFF – ITEM 6 EXEC (*)

10. ACTIVATE KEEL CAMR

CAUTION
KEEL CCTV thermal constraints limit continuous operational use to 2–hr max

L10U ✓cb KEEL CAMR PWR – cl
✓HTR PWR – cl

KEEL CAMR PWR – ON
CONTR – ON

Record MET ____/____:____:____

A7U MON 1(2) – KEEL

M 11. MNVR RMS TO HST RELEASE POSN

L10 ✓VTR recording and timer

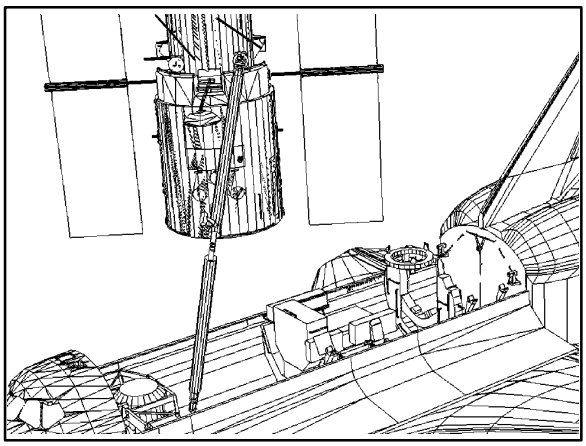
✓DAP: FREE

Load DAPS A9 and B12

RHC RATE – VERN(RATE MIN tb–ON)
A8U BRAKES – OFF (tb–OFF)
MODE – ORB LD, ENTER

Mnvr to RELEASE posn:

X	Y	Z	PITCH	YAW	ROLL	PL ID
–878	+112	–853	0	305	0	1
SY	SP	EP	WP	WY	WR	
–53.4	+90.0	–68.5	–37.3	0.0	+8.5	



HST Release

BRAKES – ON (tb–ON)
– OFF (tb–OFF)

MODE – END EFF
JOINT – CRIT TEMP

L10 VTR CNTL sw – STBY
✓REC lt – off

12. DEACT KEEL CAMR

L10U KEEL CAMR CONTR – OFF (wait 15 sec)
PWR – OFF

M 13. MNVR ORBITER TO RELEASE ATT

GNC UNIV PTG

TRK OPTION:
✓TGT ID +5
RA ___ ___ ___.___ (per PAD)
DEC ___ ___ ___.___ (per PAD)
✓BODY VECTOR +5
P +1 8 0.0
Y +5 5.0
OM ___ ___ ___.___ (per PAD)

Init TRK – ITEM 19 EXEC (CUR – *)
DAP: A9/AUTO/VERN(ALT)

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RELEASE OPS

HST RELEASE PREP

NOTE
Prep procedures to be completed by release –:04:00

Install RMS–QUICK DEPLOY (Cue Card)

Install –Z COAS

1. CAMR SETUP

A7 ✓PL BAY FLOODS MID (two) – OFF
✓FWD,AFT (four) – as reqd

✓Camr Setup: P/TV15 HST RELEASE (PHOTO/TV FS, P/TV SCENES)

2. ACTIVATE KEEL CAMR

CAUTION
KEEL CCTV thermal constraints limit continuous operational use to 2–hr max

L10U ✓cb KEEL CAMR PWR – cl
✓HTR PWR – cl
KEEL CAMR PWR – ON
CONTR – ON

Record MET ____/____:____:____

A7U CCTV – KEEL (zoom as reqd)

3. TIMER SETUP

SM 2 TIME

F7,A4 Set CRT and EVENT TIMERS counting down to release MET per PAD (HST RMS RELEASE), 5–3

M 4. ADI SETUP

A6U ADI ATT – LVLH
ERR – MED
RATE – LO
SENSE: –Z

O14:E, O16:E ✓cb DDU AFT (two) – cl

5. KU RDR SETUP

A1U ✓KU CNTL – CMD
✓PWR – ON
MODE – RDR PASSIVE
RADAR OUTPUT – LO
sel – GPC
✓SIG STRENGTH sel – KU
SLEW RATE – as reqd

A2 DIGI–DIS sel – R/RDOT
✓X–PNTR SCALE – X1

SM ANTENNA

✓RDR RNG AUTO (ITEM 1) – (*)

6. UPDATE ORBITER WEIGHT
GNC, OPS 202 PRO

GNC ORBIT MNVR EXEC
Load WT per PAD
✓PEG 7 not all zero and TIG in future
LOAD – ITEM 22 EXEC

GNC, OPS 201 PRO

M 7. RMS SETUP

A8U ✓POS/ATT and JOINT ANGLES:

X	Y	Z	PITCH	YAW	ROLL	PL ID
–878	112	–853	0	305	0	1
SY	SP	EP	WP	WY	WR	
–53.4	+90.0	–68.5	–37.3	0.0	+8.5	

✓SAFING tb – gray
PARAM sel – JOINT ANGLE
JOINT – SP
B/U JOINT – SP

A7U ✓CCTV – RMS WRIST: zoom 34.0 HFOV
focus 5.0 ft

M 8. ENABLE RNDZ NAV
When target vector onboard,
GNC 33 REL NAV
RNDZ NAV ENA – ITEM 1 EXEC (*)

✓SV SEL (ITEM 4) – PROP
✓INH RNG (ITEM 18) – (*)
✓RDOT (ITEM 21) – (*)
✓Angles (ITEM 24) – (*)

RR – ITEM 13 EXEC (*)

☐ 9. VERIFY RF LINK AND PCS CONFIG
SM 210 HST SYS
✓PSP ENA ID: 1
✓RCVR 1(2) LOCK – *
✓TLM COUNT – incr
✓PCS MODE – DRFT
✓SNPT DIS – YES

☐ 10. TIGHTEN DEADBANDS

GNC 20 DAP CONFIG

Load DAP B9

–:17:00 If ALT:

A8U ✓BRAKES – OFF (tb–OFF)
DAP: B9/AUTO/ALT
Expect 12–min to dampen
arm motion and minimize orbiter rates

–:08:00 If VRCS:

If posn hold avail
✓BRAKES – OFF (tb–OFF)
DAP: B9/AUTO/VERN
Expect 3–min to dampen
arm motion and minimize orbiter rates

If posn hold not avail:
BRAKES – ON (tb–ON)
DAP: A9/AUTO/VERN
Continue, deadband collapse not reqd

Go to RELEASE (RMS AND HST SYSTEMS) or RELEASE AND SEP BURNS (ORBITER) as appropriate

RELEASE (RMS AND HST SYSTEMS)

M 1. RELEASE PREPS
Review RMS QUICK DEPLOY (Cue Card)

On MCC GO for Release:
L10 ✓VTR PWR lt – on
CNTL sw – REC
✓REC lt – on

☐ 2. HST SUNPOINT MACRO INIT
If RMS QUICK DPY, go to step 3

SM 210 HST SYS
✓RCVR 1(2) LOCK – *

–:01:30 PCS MODE SNPT – ITEM 6 +9 8(99) EXEC
✓MODE – DRFT
✓SNPT DIS – NO

* If PCS SNPT DIS still YES after 3 sec: *
* Reattempt ITEM 6 +9 8(99) EXEC *
* ✓SNPT DIS – NO *
* If no joy, attempt alt CDI cmd: *
* ITEM 6 +9 9(98) EXEC *
* ✓SNPT DIS – NO *
* If still no joy, abort deploy and ✓MCC *

Record Sunpoint macro start MET ____/____:____:____

M 3. RELEASE
If VRCS,
–:01:00 DAP: FREE

If ALT,
–:00:30 DAP: FREE

If Single Joint, go to SINGLE JOINT RELEASE

RHC/A8U RATE – VERN (RATE MIN tb–ON)
A8U MODE – END EFF, ENTER

CAUTION
Monitor EE tb timing to prevent EE motor burnout

Monitor Release using CCTVs

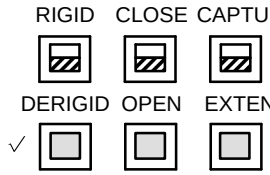
EE MODE – AUTO

–:00:00
RHC EE RELEASE sw – depress (mom)

When OPEN tb – gray, slowly mnvr arm clear of GF

When clear of GF pin:
RATE – COARSE (RATE MIN tb–OFF)
Translate RMS to right in END EFF MODE to Y = –130

A8U



CRITICAL TIMES (28–sec total):
DERIGID tb – gray (5–sec max), then

OPEN tb – gray (3–sec max), then

EXTEND tb – gray (20–sec max)

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

If RMS QUICK DEPLOY, go to step 4

* If HST not released by timer init +4:15, *
* disable HST Sunpoint macro: *
* *
* SM 210 HST SYS *
* PCS SNPT DIS – ITEM 7 +9 9 EXEC (YES) *
* GNC 20 DAP CONFIG *
* LOAD DAPs A9 and B12 *
* DAP: A/AUTO/VERN(ALT) *

M 4. SEP 1 BURN
✓SEP 1 initiated

M 5. HST TO SUNPOINT
SM 210 HST SYS
✓RCVR 1(2) LOCK – *

* If RMS QUICK DEPLOY, activate hardware Sunpoint: *
* PCS MODE SUNPOINT – ITEM 6 +9 6 EXEC *
* – ITEM 6 +9 7 EXEC *
* Expect 'PDI DECOM FAIL' msg, >> *

+:03:30 ✓PCS MODE – SNPT
+:03:52 ✓SNPT DIS – YES

* If PCS MODE not SNPT, *
* ✓MCC *

SINGLE JOINT RELEASE

M 1. RELEASE

```
                * If backup pwr reqd:                *
A7U             *    BRAKES    – ON (tb–ON)         *
                *    RMS PWR   – B/U                *
                *    B/U PL REL – ON (10 sec)       *
                *               – OFF               *
                *    Alternate joints until arm clear: *
                *       Drive B/U SP+               *
                *       Drive B/U WP–               *
                *       SY+ when clear of GF pin    *
                *       Go to step 2                *

A8U             MODE – best available
RHC             RATE – as reqd (VERN within 10 ft of structure)
A8U             EE MODE – MAN
                   MAN CONTR – DERIGID (hold until DERIGID tb–gray) (5–sec
                     max)
–:00:00
RHC/A8U            RELEASE sw – depress (hold until OPEN tb–gray) (3–sec max)

                Mnvr arm clear of GF pin (SP+ first, then WP–)
                SY+ when clear of GF pin
                Monitor release using CCTVs

A8U             EE MAN CONTR – DERIGID (hold until EXTEND tb–gray) (20–sec
                  max)
                MODE     – OFF
                BRAKES   – ON (tb–ON)
                MODE     – not DIRECT
                JOINT    – CRIT TEMP
               ✓CCTV     – AUTO IRIS

                Record Release MET ____/____:____:____

                * If HST not released by timer init +4:15,  *
                *  disable HST Sunpoint macro:              *
                *                                           *
                *    SM 210 HST SYS                         *
                *    PCS SNPT DIS – ITEM 7 +9 9 EXEC (YES)  *
                *    GNC 20 DAP CONFIG                      *
                *    LOAD DAPs A9 and B12                   *
                *    DAP: A/AUTO/VERN(ALT)                  *
```

M 2. SEP 1 BURN
✓SEP 1 initiated

☐ 3. HST TO SUNPOINT
SM 210 HST SYS

```
               ✓RCVR 1(2) LOCK – *
+:03:30        ✓PCS MODE       – SNPT
+:03:52           ✓SNPT DIS – YES

                * If PCS MODE not SNPT, *
                *  ✓MCC                 *
```

RELEASE AND SEP BURNS (ORBITER)

M 1. RELEASE

–:03:00 ✓Orbiter in release attitude:

GNC UNIV PTG

TRK OPTION:

✓TGT ID +5

RA ___ ___ ___.___ (per PAD)

DEC ___ ___ ___.___ (per PAD)

✓BODY VECTOR +5

P +1 8 0.0

Y +5 5.0

OM ___ ___ ___.___ (per PAD)

✓DAP: B9/AUTO/VERN(ALT)

✓ATT ERR < 2.0 deg

✓RATES < .1 deg/sec

A6U ADI ATT – REF

ATT REF pb – push

✓ADI: 0,0,0

✓SENSE: –Z

GNC 25 RM ORBIT

SW RM INH – ITEM 16 EXEC (*)

AFT FLT CNTLR PWR – ON

SW RM INH – ITEM 16 EXEC (no *)

GNC 33 REL NAV

ORB TO TGT – ITEM 10 EXEC

If VRCS,

–:01:00 DAP: FREE

If ALT,

–:00:30 DAP: FREE

GNC 20 DAP CONFIG

Change DAP A,B to A7,B7

DAP TRANS: PULSE/PULSE/PULSE, LO Z

DAP: A7/FREE/PRI

–:00:00 ✓RELEASE initiated

Record Release MET ____/____:____:____ (release)

* If HST not released by timer init +4:15, *
* disable HST Sunpoint macro: *
* *
* SM 210 HST SYS *
* PCS SNPT DIS – ITEM 7 +9 9 EXEC (YES) *
* GNC 20 DAP CONFIG *
* LOAD DAPs A9 and B12 *
* DAP: A/AUTO/VERN(ALT) *

M 2. SEP 1 BURN

When RMS clears HST:

ASAP — AFT THC: –X(dn) 10 pulses (1.0 fps)

Record MET: ___/___:___:___ (burn init)

AFT FLT CNTLR PWR – OFF

Report TIG to MCC

When center of HST in bottom half of Keel Camr
(REF BALL PITCH ~65 deg):
DAP: INRTL

When pitch rate nulled,
DAP: VERN(ALT)

A6U — ADI ATT – LVLH

☐ 3. HST TO SUNPOINT

+:03:30 — ✓HST Sunpoint mode initiated

M 4. MNVR TO TARGET TRACK ATT

GNC UNIV PTG

TRK OPTION:

TGT ID	+1
BODY VECTOR	+3
✓P	+90.0
✓Y	+0.0

OM +180.0 ___ ___ ___.___ (per PAD)

SEP 1
+:05:00 — Init TRK – ITEM 19 EXEC (CUR – *)
DAP: A7/AUTO/VERN(ALT)

5. RADAR ACQUISITION

✓Range ≥ 100 ft

GNC 33 REL NAV

KU ANT ENA – ITEM 2 EXEC (*)
GNC I/O RESET

A1U — ✓KU RADAR OUTPUT – LO
✓sel – GPC
✓MODE – RDR PASSIVE
✓PWR – ON
CNTL – PNL

A2 — ✓DIGI–DIS SEL – R/RDOT

* If no lock within 2 min: *
A1U — * KU sel – AUTO TRACK *
* SLEW ELEV – as seen in COAS *
* AZ – as seen in COAS *
* ✓EL, AZ angles < 30 deg *
* KU SEARCH – SEARCH (tb–gray) *
* Repeat slew and search as reqd *
* If acquisition not successful, ✓MCC *

6. RR NAVIGATION

A1U ✓KU TRACK tb – gray

GNC 33 REL NAV

✓RR (ITEM 13) – (*)

* If RATIO > 1.0, *
* ✓MCC *

AUTO RNG – ITEM 17 EXEC (*)
RDOT – ITEM 20 EXEC (*)
Angles – ITEM 23 EXEC (*)

When SV UPDATE POS < 0.03 and MARK ACPT > 9,
SV SEL – ITEM 4 EXEC (FLTR)

When R > 400 ft,

A1U KU RDR OUTPUT – HI

M 7. SEP 2 BURN

F6 ✓ADI ATT – LVLH

If SEP 1 was posigrade:

When orbiter on HST –Rbar (Fwd ADI Pitch = 0 deg):

F7 Fwd FLT CNTLR PWR – ON
DAP: A/AUTO/PRI
DAP TRANS: NORM/PULSE/PULSE, LO Z
Fwd THC: –X(out) 10 sec (2.5 fps)

If SEP 1 was retrograde:

When orbiter on HST + Rbar (Fwd ADI Pitch = 0 deg):

Fwd FLT CNTLR PWR – ON
DAP: A/AUTO/PRI
✓DAP TRANS: PULSE/PULSE/PULSE, LO Z
Fwd THC: –X(out) 10 pulses (1.0 fps)

Record MET: ___/___:___:___ (burn init)
Fwd FLT CNTLR PWR – OFF
DAP: A/AUTO/VERN(ALT)
DAP TRANS: PULSE/PULSE/PULSE

Report TIG to MCC

8. P/TV DEACTIVATION

Perform P/TV15 HST RELEASE, DEACTIVATION (PHOTO/TV FS, P/TV SCENES)

9. CONFIG KU FOR COMM

When RANGE > 5000 FT:

GNC 33 REL NAV

INH RNG – ITEM 18 EXEC (*)
RDOT – ITEM 21 EXEC (*)
Angles – ITEM 24 EXEC (*)
KU ANT ENA – ITEM 2 EXEC (no *)

A1U

KU MODE – COMM
✓SEL – GPC
CNTL – CMD

A2

DIGI–DIS SEL – EL/AZ

DAP: No LO Z

Go to FLIGHT PLAN

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BACKAWAY DEPLOY

NOTE
STOCC will cmd LGA switch. Expect
'S62 PDI DECOM FAIL'

1. CAMR SETUP
✓PL BAY FLOODS MID (two) – OFF
✓FWD,AFT (four) – as reqd

✓Camr setup: P/TV15 HST RELEASE (PHOTO/TV FS, P/TV SCENES)

2. VERIFY RMS CLEARANCE
✓RMS clear of payload envelope

3. DAP/TIMER SETUP
GNC 20 DAP CONFIG
✓DAP A,B set to A10,B10

SM 2 TIME
F7,A4 Set CRT and EVENT TIMERS counting down to release
MET per PAD (HST BACKAWAY DEPLOY)

4. MNVR TO BACKAWAY DPY ATT
GNC UNIV PTG
TRK OPTION:
✓TGT ID +5
RA ___ ___ ___.___ (per PAD)
DEC ___ ___ ___.___ (per PAD)
✓BODY VECTOR +5
P +1 7 5.0
Y 0.0
OM ___ ___ ___.___ (per PAD)

DAP: A10/AUTO/VERN (ALT,LO Z)
Init TRK – ITEM 19 EXEC (CUR – *)

5. ADI SETUP
A6U ADI ATT – LVLH
ERR – MED
RATE – LO
SENSE: –Z

CONT OPS

O14:E, O16:E ✓cb DDU AFT (two) – cl

6. KU RDR SETUP
A1U ✓KU CNTL – CMD
✓PWR – ON
MODE – RDR PASSIVE
RADAR OUTPUT – LO
sel – GPC
✓SIG STRENGTH sel – KU
SLEW RATE – as reqd

A2 DIGI–DIS sel – R/RDOT
✓X–PNTR SCALE – X1

SM ANTENNA
✓RDR RNG AUTO (ITEM 1) – (*)

7. UPDATE ORBITER WEIGHT
GNC, OPS 202 PRO

GNC ORBIT MNVR EXEC
Load WT per PAD
✓PEG 7 not all zero and TIG in future
LOAD – ITEM 22 EXEC

GNC, OPS 201 PRO

8. ENABLE RNDZ NAV
When target vector onboard:
GNC 33 REL NAV
RNDZ NAV ENA – ITEM 1 EXEC (*)

✓SV SEL (ITEM 4) – PROP
✓INH RNG (ITEM 18) – (*)
✓RDOT (ITEM 21) – (*)
✓Angles (ITEM 24) – (*)

RR – ITEM 13 EXEC (*)

9. VERIFY RF LINK
SM 210 HST SYS
✓PSP ENA ID: 1
✓RCVR 1(2) LOCK – *
✓TLM COUNT – incr

10. FSS MSB PWR ON

WARNING
Operation of two FSS mechanisms may result in HST collision with orbiter

For any SM ALERT during FSS ops:
A6U PL RETEN LAT 1,2 (both) – OFF
R13 PL BAY MECH PWR SYS 1,2 (both) – OFF
✓MCC

A6U ✓PL RETEN LAT 1,2 – OFF
✓LOGIC PWR SYS 2(SYS 1) – OFF
✓PL SEL – 1
LOGIC PWR SYS 1(SYS 2) – ON

SM 211 SSE CONTROL
MSB ON – ITEM 1 EXEC (A(B))
✓MSB AMPS < .03
✓MECH – blank
✓SEL (ITEMS 9–19) – no *
✓STAT (ITEMS 9–19) – blank
✓O/R DIS – *

* If any param not as expected, ✓MCC *

R13L PL BAY MECH PWR SYS 1(2) – ON

11. HST ROTATION

CCTV Monitor HST position during rotation
DAP: FREE
CRT ROTATOR SEL – ITEM 12 EXEC (* RDY)
✓MSB AMPS: .03 to .10
A6U PL RETEN LAT 1(2) – LAT (tb–bp)

Mnvr to reqd posn:

POSN	DURATION (MM:SS)	ROTATION DIRECTION	POSN IND REF
30° CCW from berthing	02:05	CCW	HST 150°

CRT ✓MECH flashing A(B)
✓ROTATOR STAT – RDY

* If ROTATOR STAT – ccw and visually verified not at *
* EOT, then EOT sw failed. *
* Perform SSR–1 PWR LOSS RECOVERY (PL SYS, SSE) *

CCTV ✓Rotator posn visually

* If HST not in posn in expected time + 5 min or *
* no movement observed: *
A6U * PL RETEN LAT 1(2) – OFF, then perform *
* 1.3a PRIMARY MOTOR FAILS TO DRIVE *
* MECHANISM (PL SYS, SSE) *

PL RETEN LAT 1(2) – OFF
CRT ✓MECH – blank
After 4 min,
DAP: A10/AUTO/VERN(ALT,LO Z)

* For any observed uncontrolled SA motion: *
* SM 210 HST SYS *
* SADE OFF – ITEM 20 +9 9 EXEC (OFF) *
* Notify MCC *

12. PWR FSS CCTV

CAUTION
FSS CCTV limited to 2 hr continuous use

L12U ✓CCTV HTR PWR – ON (tb–gray)
CRT CCTV ENA ON – ITEM 5 EXEC (*)
PWR ON – ITEM 7 EXEC (*)

* If CCTV ENA ON – (no *), retry ITEM 5: *
* If no joy, continue *
* If CCTV PWR ON – (no *), retry ITEM 7: *
* If no joy, attempt to display camr image *
* on monitor. If no image, ✓MCC *

VID OUT pb – MON 1(2)
IN pb – PL1
ALC AVG pb – press
GAMMA NORM pb – press

13. UMB DISCONNECT
Perform HST UMB DISCONNECT steps 2,3,4,5 (UNBERTH), 2–2

M 14. HST SUNPOINT MACRO INIT
On MCC GO for release:

SM 210 HST SYS
✓RCVR 1(2) LOCK – *

–:01:30 PCS MODE SNPT – ITEM 6 +9 8(99) EXEC
✓MODE – DRFT
✓SNPT DIS – NO

* If PCS SNPT DIS still YES after 3 sec: *
* Reattempt ITEM 6 +9 8(99) EXEC *
* ✓SNPT DIS – NO *
* If no joy, attempt alt CDI cmd: *
* ITEM 6 +9 9(98) EXEC *
* ✓SNPT DIS – NO *
* If still no joy, abort deploy and ✓MCC *

Record Sunpoint macro start MET ____/____:____:____

–01:00 15. OPEN BERTHING LATCHES

NOTE
Perform SEP 1 BURN ASAP once LATCH 2 open and verified clear

L10 ✓VTR recording and Timer

GNC 33 REL NAV
ORB TO TGT – ITEM 10 EXEC

GNC UNIV PTG
✓ATT ERR < 5.0 deg
✓RATES < .1 deg/sec

DAP: FREE

GNC 20 DAP CONFIG
Change DAP A,B to A7,B7

SM 211 SSE CONTROL
B LAT 3 SEL – ITEM 16 EXEC (* CL)

A6U PL RETEN LAT 1(2) – REL

CRT ✓B LAT 3 STAT – RDY (wait 18 sec)
✓3 STAT – OP

A6U PL RETEN LAT 1(2) – OFF

CRT B LAT 1 SEL – ITEM 14 EXEC (* CL)

A6U PL RETEN LAT 1(2) – REL

CRT ✓B LAT 1 STAT – RDY (wait 18 sec)
✓1 STAT – OP

A6U PL RETEN LAT 1(2) – OFF

CRT B LAT 2 SEL – ITEM 15 EXEC (* CL)

A6U PL RETEN LAT 1(2) – REL

CRT ✓B LAT 2 STAT – RDY (wait 18 sec)
✓2 STAT – OP

A6U PL RETEN LAT 1(2) – OFF

CCTV Visually verify LATCHES open and umbilical clear

* If any B LAT fails to open, disable HST sunpointing mnvr capability prior to 5 min timer expiration:
SM 210 HST SYS
PCS SNPT DIS – ITEM 7 +9 9 EXEC (YES)

16. SEP 1 BURN

A6U ✓SENSE: –Z

✓DAP: A7/FREE/VERN(PRI)
DAP TRANS: PULSE/PULSE/PULSE, LO Z

GNC 25 RM ORBIT
SW RM INH – ITEM 16 EXEC (*)
AFT FLT CNTLR PWR – ON
SW RM INH – ITEM 16 EXEC (no *)

ASAP AFT THC: +Z (out) 1 pulse (0.1 fps),
DAP: A7/INRTL/VERN(PRI)
AFT THC +Z (out) 5 pulses (0.5 fps)

Record MET: ___/___:___:___

AFT FLT CNTLR PWR – OFF

M 17. HST TO SUNPOINT

SM 210 HST SYS
✓RCVR 1(2) LOCK – *
+:03:30 ✓PCS MODE – SNPT
+:03:52 ✓SNPT DIS – YES

18. RADAR ACQUISITION
✓Range ≥ 100 ft

GNC 33 REL NAV
KU ANT ENA – ITEM 2 EXEC (*)
GNC I/O RESET

A1U ✓KU RADAR OUTPUT – LO
✓sel – GPC
✓MODE – RDR PASSIVE
✓PWR – ON
CNTL – PNL

A2 ✓DIGI–DIS SEL – R/RDOT

* If no lock within 2 min: *
A16 * KU sel – AUTO TRACK *
* SLEW ELEV – as seen in COAS *
* AZ – as seen in COAS *
* ✓EL, AZ angles < 30 deg *
* KU SEARCH – SEARCH (tb–gray) *
* Repeat slew and search as reqd *
* If acquisition not successful, ✓MCC *

19. RR NAVIGATION

A1U ✓KU TRACK tb – gray

GNC 33 REL NAV

✓RR (ITEM 13) – (*)

* If RATIO > 1.0, *
* ✓MCC *

AUTO RNG – ITEM 17 EXEC (*)
RDOT – ITEM 20 EXEC (*)
Angles – ITEM 23 EXEC (*)

When SV UPDATE POS < 0.03 and MARK ACPT > 9,
SV SEL – ITEM 4 EXEC (FLTR)

When R > 400 ft,
A1U KU RDR OUTPUT – HI

20. MNVR TO SEP 2 ATT

GNC UNIV PTG

TRK OPTION:

TGT ID	+2
BODY VECTOR	+5
P	+270.0
Y	+0.0
OM	+0.0

Init TRK – ITEM 19 EXEC (CUR – *)

RELEASE
+:10:30 DAP: A7/AUTO/VERN(ALT)

✓ERR TOT – ITEM 23 EXEC (*)

21. SEP 2 BURN (retrograde)
DAP TRANS: PULSE/PULSE/PULSE, LO Z

A6U ✓SENSE: –Z
AFT FLT CNTLR PWR – ON
DAP: A/AUTO/PRI

+:30:30 AFT THC: –X (dn) 10 pulses (1.0 fps)

Record MET: ___/___:___:___ (burn init)

AFT FLT CNTLR PWR – OFF
DAP: A/AUTO/VERN(ALT)

Report TIG to MCC

When HST no longer in CCTV FOV:
L10 VTR CNTL sw – STBY,UNTHRD
PW – OFF
✓PWR lt – off

22. INITIATE TGT TRACK
GNC UNIV PTG
TRK OPTION:
TGT ID +1
BODY VECTOR +3
OM +0.0

✓DAP: A7/AUTO/VERN(ALT)
Init TRK – ITEM 19 EXEC (CUR – *)

23. CONFIG KU FOR COMM
When RANGE > 5000 ft:
GNC 33 REL NAV
INH RNG – ITEM 18 EXEC (*)
RDOT – ITEM 21 EXEC (*)
Angles – ITEM 24 EXEC (*)
KU ANT ENA – ITEM 2 EXEC (no *)

A1U KU MODE – COMM
✓sel – GPC
CNTL – CMD

A2 DIGI–DIS SEL – EL/AZ
DAP: No LO Z

24. DESELECT BERTHING LATCHES
SM 211 SSE CONTROL
DESELECT – ITEM 20 EXEC
✓MSB AMPS: < 0.03

25. PWRDN FSS MECH SYSTEMS
MSB OFF – ITEM 2 EXEC (*)

A6U ✓PL RETEN LAT 1,2 – OFF
LOGIC PWR SYS 1(SYS 2) – OFF
✓PL SEL – 1
R13L PL BAY MECH PWR SYS 1(2) – OFF

26. UNPWR FSS CCTV
SM 211 SSE CONTROL
CCTV PWR OFF – ITEM 8 EXEC (*) (wait 15 sec)

* If CCTV PWR OFF, not (*), do not *
* perform CCTV ENA – OFF *

CCTV ENA OFF – ITEM 6 EXEC (*)

Go to FLIGHT PLAN

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RMS QUICK DEPLOY

[M] = MANDATORY items: Must be successfully completed for deploy
[ ] = Items which enhance mission capabilities: Attempt and press

TAB	PROCEDURE
GRAPPLE	**HST GRAPPLE** [M] MNVR RMS TO PRE–GRAPPLE POSN [M] GRAPPLE
UNBERTH	**HST UMB DISCONNECT** [ ] PWR XFER PRECHECKS [M] DEADFACE UMB [M] SET UP UMB DISCONNECT [M] DISCONNECT UMB **HST UNBERTH** [M] OPEN BERTHING LATCH 3 [M] OPEN BERTHING LATCH 1 [M] OPEN BERTHING LATCH 2 [M] MNVR RMS TO FSS HOVER POSN [M] MNVR RMS TO HST RELEASE POSN [M] MNVR ORBITER TO RELEASE ATT

TAB	PROCEDURE
RELEASE OPS	**HST RELEASE PREP** [M] ADI SETUP KU RDR SETUP UPDATE ORBITER WEIGHT [M] RMS SETUP [M] ENABLE RNDZ NAV [ ] VERIFY RF LINK AND PCS CONFIG [ ] TIGHTEN DEADBANDS **Go to RELEASE (RMS & HST SYSTEMS) or RELEASE AND SEP BURNS (ORBITER) as appropriate** **RELEASE (RMS & HST SYSTEMS)** [M] RELEASE PREPS [ ] HST SUNPOINT MACRO INIT [M] RELEASE or **SINGLE JOINT RELEASE** [M] SEP 1 BURN [M] HST TO SUNPOINT **RELEASE AND SEP BURNS (ORBITER)** [M] RELEASE [M] SEP 1 BURN [ ] HST TO SUNPOINT [M] TARGET TRACK ATT RADAR ACQUISITION RR NAVIGATION [M] SEP 2 BURN CONFIG KU FOR COMM

HST PADS

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HST RMS RELEASE PAD
RELEASE ORBIT ☐☐☐
RETROGRADE/POSIGRADE

WINDOW OPEN MET = ☐ / ☐☐ : ☐☐ : ☐☐

WINDOW CLOSE MET = ☐ / ☐☐ : ☐☐ : ☐☐
(NLT SS–10 MIN)

ORBITER WEIGHT = ☐☐☐☐☐☐ (3–3)

RELEASE ATT RA = ☐☐☐ . ☐☐☐ (2–10,3–8)
DEC = ☐☐☐ . ☐☐☐
OMICRON = ☐☐☐ . ☐☐☐
TGT TRK OMICRON = ☐☐☐ . ☐☐☐ (3–9)

HST RMS RELEASE PAD
RELEASE ORBIT ☐☐☐
RETROGRADE/POSIGRADE

WINDOW OPEN MET = ☐ / ☐☐ : ☐☐ : ☐☐

WINDOW CLOSE MET = ☐ / ☐☐ : ☐☐ : ☐☐
(NLT SS–10 MIN)

ORBITER WEIGHT = ☐☐☐☐☐☐ (3–3)

RELEASE ATT RA = ☐☐☐ . ☐☐☐ (2–10,3–8)
DEC = ☐☐☐ . ☐☐☐
OMICRON = ☐☐☐ . ☐☐☐
TGT TRK OMICRON = ☐☐☐ . ☐☐☐ (3–9)

HST BACKAWAY DEPLOY PAD
DEPLOY ORBIT ☐☐☐

WINDOW OPEN MET = ☐/☐☐:☐☐:☐☐

WINDOW CLOSE MET = ☐/☐☐:☐☐:☐☐
(NLT SS–10 MIN)

RELEASE ATT RA = ☐☐☐.☐☐☐ (4–2)
DEC = ☐☐☐.☐☐☐
OMICRON = ☐☐☐.☐☐☐

ORBITER WEIGHT = ☐☐☐☐☐☐ (4–3)

HST BACKAWAY DEPLOY PAD
DEPLOY ORBIT ☐☐☐

WINDOW OPEN MET = ☐/☐☐:☐☐:☐☐

WINDOW CLOSE MET = ☐/☐☐:☐☐:☐☐
(NLT SS–10 MIN)

RELEASE ATT RA = ☐☐☐.☐☐☐ (4–2)
DEC = ☐☐☐.☐☐☐
OMICRON = ☐☐☐.☐☐☐

ORBITER WEIGHT = ☐☐☐☐☐☐ (4–3)

OFF–NOMINAL RMS OPS

Insert section 6 of PDRS FS
(OFF–NOMINAL HST DEPLOY OPS) after tab

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Space Shuttle Program
FLIGHT DATA FILE

JSC–48081–103
FINAL, REV A

HST DEPLOY CHECKLIST

STS 103

Flight Cover (trim bottom to expose tabs)