Space Shuttle Program
FLIGHT DATA FILE

Orbit Operations Checklist

Generic
Rev 1.0
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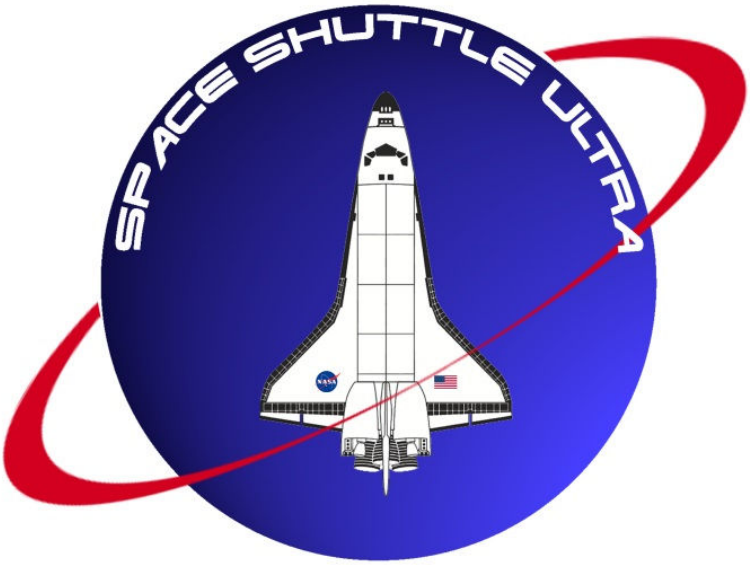

Space Shuttle Ultra 4.2
Orbiter 2010-2016

CONTENTS

*Full RMS OPS found in PDRS Checklist

LAMP TEST

SMOKE DETECTION

A	B
CABIN (R)	PAYLOAD (R)
L FLT DECK (R)	R FLT DECK (R)
AV BAY 1 (R)	AV BAY 1 (R)
AV BAY 2 (R)	AV BAY 2 (R)
AV BAY 3 (R)	AV BAY 3 (R)

(XDS 1)

C/W PANEL

O2 PRESS	H2 PRESS	FUEL CELL REAC (R)	FUEL CELL STACK TEMP	FUEL CELL PUMP
CABIN ATM (R)	O2 HEATER TEMP	MAIN BUS UNDERVOLT (R)	AC VOLTAGE	AC OVERLOAD
FREON LOOP	AV BAY/ CABIN AIR	IMU	FWD RCS (R)	RCS JET
H2O LOOP	RGA/ACCEL	AIR DATA (R)	LEFT RCS (R)	RIGHT RCS (R)
----- (R)	LEFT RHC (R)	RIGHT/AFT RHC (R)	LEFT OMS (R)	RIGHT OMS (R)
PAYLOAD WARNING (R)	GPC	FCS SATURATION (R)	OMS KIT	OMS TVC (R)
PAYLOAD CAUTION	PRIMARY C/W	FCS CHANNEL	MPS (R)	-----
BACKUP C/W ALARM (R)	APU TEMP	APU OVERSPEED	APU UNDERSPEED	HYD PRESS

(34V73A7A2)

<u>FORWARD STATION</u>

O6/O8	ANNUN LAMP TEST	– L, hold
	√78 lights	– illuminated:
O1	CAM lts	(25)
F2	MSTR ALARM	(1)
	Aerodynamic controls	(7)
	DRAG CHUTE	(2)
F3	NWS FAIL	(1)
	DRAG CHUTE	(1)
L1	FIRE SUPPR AV BAY	(3)
	SMOKE DETN	(10)
F6	LDG GEAR	(2)
	ABORT	(1)
	RCS CMD	(3)
	RANGE SAFE ARM	(1)
F7	SM ALERT	(1)
	C/W panel – partial	(20)

O6/O8	ANNUN LAMP TEST	– R, hold
	√61 lights – illuminated:	
F4	MSTR ALARM	(1)
	Aerodynamic controls	(7)
	DRAG CHUTE	(1)
F3	ANTISKID FAIL	(1)
	DRAG CHUTE	(2)
F8	LDG GEAR	(2)
F7	MN ENG STAT	(3)
	C/W panel – partial	(20)
C3	DAP PANEL	(24)

MIDDECK (Verified by second crewmember)

O6/O8	ANNUN LAMP TEST	– L, hold
MO29J	√MIC KEY light	– illuminated
O6/O8	ANNUN LAMP TEST	– R, hold
	√5 lights – illuminated:	
MO52J	MSTR ALARM light	(1)
MO51F	RCRS CNTLR 1	(2)
	RCRS CNTLR 2	(2)

AFT STATION

A6U	ANNUN LAMP TEST	– L, hold
	√25 lights – illuminated:	
	DAP PANEL	(24)
A2	MIC KEY	(1)
A6U	ANNUN LAMP TEST	– R, hold
	√28 lights – illuminated:	
A7U	MSTR ALARM	(1)
	VID IN	(13)
	VID OUT	(8)
	CAMR CMD ALC	(3)
	CAMR CMD GAMMA	(3)

ON-ORBIT FCS CHECKOUT

NOTE
Only one APU used for FCS C/O.

1.FCS C/O PREP

C2	Set EVENT TIMER to 00:00, count UP	

2.APU PRESTART

R2	BLR N2 SPLY X	– ON
	√BLR PWR (three)	– ON
	√BLR CNTLR/HTR (three)	– B
	√APU FU TK VLV (three)	– CL
	√APU SPEED SEL (three)	– NORM
	√APU OPER (three)	– OFF
	HYD MN PUMP PRESS X	– LO
	APU CNTLR PWR X	– ON

3.APU START

R2	APU FU TK VLV X	– OP
	√APU/HYD RDY X tb	– gray
00:00	Start EVENT TIMER	
R2	APU OPER X	– START/RUN
HYD/APU	√HYD PRESS ind X	– LOW green
R2	√APU/HYD RDY X tb	– bp
	HYD MN PUMP PRESS X	– NORM
HYD/APU	√HYD PRESS ind X	– HI green

4.FCS CHECKOUT

C3	√FCS CH 1,2,3,4 – AUTO	
MDU1	SPI DSPLY	
CRT1 GNC	OPS 801 PRO (FCS/DED DIS C/O)	
	FCS C/OUT STRT, ITEM10 EXEC (*)	
	√FLT CTRLS MOVEMENT (EL,RDR,SPDBK) on CRT1 and MDU1 DSPLY's	
	FCS C/OUT STOP, ITEM11 EXEC (*)	

5.APU SHUTDOWN

When GO for APU SHUTDN:

R2	BLR N2 SPLY X	– OFF
	BLR PWR (three)	– OFF
	APU OPER X	– OFF
	APU FU TK VLV X	– CL
	√Shutdn (hyd press < 200)	
	APU CNTLR PWR X	– OFF

ON-ORBIT OMS BURN

1. OMS BURN PREP

If OPS 2:

CRT1	GNC	SPEC 20 PRO (DAP CONFIG)
		√DAP Config A1,B1
	GNC	OPS 201 PRO (UNIV PTG)
		CNCL – ITEM 21 EXEC
	GNC	OPS 202 PRO (ORBIT MNVR EXEC)
CRT2	GNC	SYS SUMM 2

If OPS 3:

CRT1	GNC	OPS 302 PRO (DEORB MNVR EXEC)
CRT3	BFS, GNC SYS SUMM 2	
	OMS/MPS	√OMS PRESS He TK L,R > 1500 psia

WARNING
If OMS PRESS not within limits,
do not execute on-orbit burn

2. LOAD TGT DATA

√Targets, OMS TARGETS
LOAD – ITEM 22 EXEC
TIMER – ITEM 23 EXEC

C3 DAP: If OPS 2, B/AUTO/VERN
If OPS 3, AUTO

CRT1 MNVR – ITEM 27 EXEC (*)

3. PERFORM OMS BURN

CRT1 √ENG SEL

C3 √DAP AUTO (PASS)/DISC

TIG-4 F6/F8 ADI RATE (two) – MED (1 deg/sec)
FLT CNTLR PWR (two) – ON

Perform **ON ORBIT OMS BURN** Cue Card

ON ORBIT OMS BURN

1.LOAD TGT DATA

CRT1 GNC OPS 202 PRO (ORBIT MNVR EXEC)

TV ROLL
If Posi Heads Up – ITEM 5 + 0 EXEC
If Posi Heads Dwn – ITEM 5 + 180 EXEC

Trim Load (*1 eng)
P – ITEM 6 = + 0.4 *(+ 0.4)
LY – ITEM 7 = - 5.7 *(+ 5.2)
RY – ITEM 8 = + 5.7 *(- 5.2)

2.PERFORM OMS BURN

CRT1 √ENG SEL

C3 √DAP AUTO (PASS)/DISC

TIG-4 F6/F8 ADI RATE (two) – MED (1 deg/sec)
FLT CNTLR PWR (two) – ON
√DAP – AUTO(PASS)/DISC
√GMBL TRIM

TIG-2 C3		SEL OMS ENG(s) – ARM PRESS (√P VLVs OP) If P VLV CL: Aff OMS ENG – OFF
TIG-00:15	CRT1	EXEC
00:00		TIG: start watch (√Pc, ΔVTOT, ENG VLVs)
CUTOFF +00:02	C3	OMS ENG(s) – OFF

Trim Residuals:

OMS2	TAIL ONLY CNTL	Orbit
VGO X < 0.2 fps VGO Y,Z < 2 fps	VGO X < 0.2 fps	All axes < 0.2 fps

F6/F8	FLT CNTLR PWR (two) – OFF
CRT	**IF OPS 2** DAP: B/INRTL/VERN CRT GNC OPS 201 PRO (√DAP)

RCS HOT FIRE TEST

> NOTE
> If RMS not cradled, verify RMS not in jet impingement zone

1.CONFIGURE FOR JET TEST

C3 DAP: A1/INRTL/VERN

2. PERFORM RCS JET TEST

Wait 3 sec between pulses
Monitor ADI rates to verify jet on or jet fail

C3 DAP TRANS: PULSE/PULSE/PULSE
DAP: A/FREE/PRI

F6/F8 ADI RATE – MED
FLT CNTLR PWR – ON

Perform following pulse sequence twice:

F5 THC: +X, 1 PULSE (fires jets R1A,L1A)
-X, 1 PULSE (fires jets F1F,F2F)
+Z, 1 PULSE (fires jets F1U,R1U,L1U)
+Y, 1 PULSE (fires jets F1L,L1L)
-Y, 1 PULSE (fires jets F2R,R1R)

Perform following pulse sequence twice:

THC: +Z, 1 PULSE (fires jets F2U,L2U,R2U)
-Z, 1 PULSE (fires jets F1D,F2D,L2D,R2D)
+Y, 1 PULSE (fires jets F1L,L2L)
-Y, 1 PULSE (fires jets F2R,R2R)

Perform following pulse sequence twice:

THC: +X, 1 PULSE (fires jets L3A,R3A)
-X, 1 PULSE (fires jet F3F)
-Z, 1 PULSE (fires jets F3D,F4D,L3D,R3D)
+Y, 1 PULSE (fires jets F3L,L3L)
-Y, 1 PULSE (fires jets F4R,R3R)

Perform following pulse sequence twice:

THC: +Z, 1 PULSE (fires jets F3U,L4U,R4U)
-Z, 1 PULSE (fires jets F3D,F4D,L4D,R4D)
+Y, 1 PULSE (fires jets F3L,L4L)
-Y, 1 PULSE (fires jets F4R,R4R)

C3 DAP: A/INRTL/VERN

F6/F8 FLT CTRL PWR – OFF

FREE DRIFT

AUTO MNVR TO ATTITUDE

C3 Change DAP A,B to A3,B3
DAP: B3/AUTO/VERN(ALT)

CRT1 GNC OPS 201 PRO (UNIV PTG)
TGT ID – ITEM 8 + 2 EXEC
BODY VECT – ITEM 14 + 5 EXEC

Load Body Vector P,Y,OM (per table below)

GRAVITY GRADIENT BODY VECTORS

		ATT ID	EXEC DATA			BODY RATES (±0.002)		
		ATT ID	P	Y	OM	R	P	Y
+XLV	PLBD NORTH	A	357.51	0.97	249.18	0.002	0.024	-0.062
	SOUTH	B	357.51	359.23	110.91	-0.002	0.024	0.062
-XLV	PLBD NORTH	C	177.51	0.77	69.09	0.002	-0.024	-0.062
	SOUTH	D	177.51	359.03	290.82	-0.002	-0.024	0.062

CRT1 TRK – ITEM 19 EXEC (CUR-*)
√ERR TOT, ITEM 23 – (*)

ESTABLISH FREE DRIFT

F6,F8 √Att mnvr complete
ADI ATT – LVLH

If VERN jets available:
C3 DAP: A3/AUTO/VERN
DAP: FREE

If VERN jets not available:
C3 DAP: A3/AUTO/ALT

Wait 30 sec

When -0.01 < Roll Rate < 0.01, then:

C3 DAP: FREE
Rcd MET ____/____ ____:____ ____:____

F6,F8 ADI ATT – as reqd

Reconfig to FLIGHT PLAN DAP
DAP: INRTL

PRCS PTC

MNVR TO PTC ATTITUDE

NOTE
If crew sleep, use Tail-only control for all DAPs

C3 DAP: A1/AUTO/ALT

CRT1 GNC OPS 201 PRO (UNIV PTG)
TGT ID – ITEM 8 + 4 EXEC
BODY VECT – ITEM 14 + 5 EXEC
P – ITEM 15 + 2 7 0 EXEC
Y – ITEM 16 + 0 EXEC
OM – ITEM 17 + 2 7 0 EXEC
TRK – ITEM 19 EXEC (CUR-*)

INITIATE PTC ROTATION

CRT1 GNC SPEC 20 PRO (DAP CONFIG)
Change DAP A to A2

GNC OPS 201 PRO (UNIV PTG)
BODY VECT – ITEM 14 +1 EXEC
ROT – ITEM 20 EXEC (CUR-*)

TERMINATE PTC ROTATION

GNC OPS 201 PRO (UNIV PTG)
CNCL – ITEM 21 EXEC

Reconfig to FLIGHT PLAN DAP

VRCS PTC

MNVR TO PTC ATTITUDE

C3 DAP: A1/AUTO/VERN

CRT GNC OPS 201 PRO (UNIV PTG)
TGT ID – ITEM 8 + 4 EXEC
BODY VECT – ITEM 14 + 5 EXEC
P – ITEM 15 + 2 7 0 EXEC
Y – ITEM 16 + 0 EXEC
OM – ITEM 17 + 2 7 0 EXEC
TRK – ITEM 19 EXEC (CUR-*)

INITIATE PTC ROTATION

When in attitude:

CRT1 GNC OPS 201 PRO (UNIV PTG)
BODY VECT – ITEM 14 +1 EXEC
ROT – ITEM 20 EXEC (CUR-*)

When rates have stabilized (~60 sec):

GNC SPEC 20 PRO (DAP CONFIG)
Change DAP A to A2

TERMINATE PTC ROTATION

GNC SPEC 20 PRO (DAP CONFIG)
Change DAP A to A1

When rates have stabilized (~60 sec):

CRT1 GNC OPS 201 PRO (UNIV PTG)
CNCL – ITEM 21 EXEC

When rates have damped:

Reconfig to FLIGHT PLAN DAP

ON ORBIT +X RCS BURN

1. LOAD TGT DATA AND MNVR TO BURN ATT

C3		DAP: A/AUTO/ALT (B/ALT as rqd)
CRT1	GNC	OPS 201 PRO (UNIV PTG) CNCL – ITEM 21 EXEC
	GNC	OPS 202 PRO (ORBIT MNVR EXEC) √RCS SEL, ITEM 4 – (*)
CRT2	GNC	SYS SUMM If onboard computed burn:
CRT1		Enter or verify TGT DATA LOAD – ITEM 22 EXEC TIMER – ITEM 23 EXEC √BURN DATA MNVR – ITEM 27 EXEC (*)

2. BURN EXEC

TIG-3:00 F6(F8)	ADI ERR – MED ADI RATE – HI ADI ATT – INRTL √ADI ATT, then: ATT – REF REF pb – push
F6(F8)	FLT CNTLR PWR – ON
C3	DAP TRANS: NORM/PULSE/PULSE
TIG-0:30	DAP: A1/INRTL/PRI
TIG	If VGO Z is neg ⟶ Z,X,Y seq; Otherwise ⟶ X,Y,Z seq THC Trim VGOs < 0.2 fps

3. POST BURN RECONFIG

F6(F8)		FLT CNTLR PWR – OFF
C3		DAP: A/AUTO/ALT (B/AUTO/ALT as reqd) DAP TRANS: PULSE/PULSE/PULSE
CRT1	GNC	OPS 201 PRO (UNIV PTG)
		When in attitude:
C3		DAP: A/AUTO/VERN(ALT

ON ORBIT MULTI-AXIS RCS BURN

1. EXECUTE MULTI-AXIS BURN

C3		DAP: B1/AUTO/VERN(PRI)
CRT1	GNC	OPS 202 PRO (ORBIT MNVR EXEC)
CRT2	GNC	SYS SUMM
CRT1		Enter or verify TGT DATA LOAD – ITEM 22 EXEC TIMER – ITEM 23 EXEC √BURN DATA

> NOTE
> Ignore computed attitude, perform burn in current attitude

TIG-3:00 F6(F8)		FLT CTRL PWR – ON
C3		DAP TRANS: as reqd
TIG-0:30		DAP: A1/AUTO/PRI (B1/AUTO/PRI)
TIG		If VGO Z neg: Z,X,Y THC sequence If VGO Z not neg: X,Y,Z THC sequence THC: Trim VGOs < 0.2 fps

2. POST BURN RECONFIG

F6(F8)		FLT CTRL PWR – OFF
	GNC	OPS 201 PRO (UNIV PTG)
C3		DAP: A/AUTO/ VERN

SEP MANEUVER

1. SET UP AFT STATION

A6U
√SENSE -Z
DAP: A1/INRTL/PRI
DAP TRANS: as reqd
FLT CNTLR PWR – ON

2. OBTAIN VISUAL CONTACT THRU OVHD WINDOW

A6U
DAP ROT: as reqd
RHC: as reqd

When adequate visual contact obtained,
DAP ROT: DISC/DISC/DISC

3. NULL CLOSING RATE

THC: +Z (out)
As reqd to null closing rate

4. PERFORM RR ACQ (if desired)

A1U

KU MODE	– RDR PASSIVE
KU RADAR OUTPUT	– LO
KU sel	– AUTO TRK
KU CNTL	– PNL

Slew antenna to target
KU SEARCH – SEARCH (tb-gray)

If no lock-on within 1 min,
repeat SEARCH as convenient

5. OBTAIN ~1 FPS OPENING RATE

A6U
DAP TRANS:NORM/NORM/NORM

If Norm Z sep desired:
DAP: no LO Z
THC: +Z (out) for 3 sec
If LO Z sep desired (MCC call):
DAP: LO Z
THC: +Z (out) for 25 sec

6. PERFORM OUT-OF-PLANE MNVR

CRT GNC OPS 201 PRO (UNIV PTG)
CNCL – ITEM 21 EXEC

GNC OPS 202 PRO (ORBIT MNVR EXEC)
GNC ORBIT MNVR EXEC
RCS SEL – ITEM 4 EXEC (*)

If time critical,
Set TIG to current time +2.00

If not time critical,
Set TIG to current time +22.00

TGT PEG 7 ΔVx – ITEM 19 +0 EXEC
ΔVy – ITEM 20 +2 EXEC
ΔVz – ITEM 21 +0 EXEC
LOAD – ITEM 22 EXEC
TIMER – ITEM 23 EXEC

√VGO Z ≥ 0; if VGO Z < 0

TGT PEG 7 ΔVy – ITEM 20 -2 EXEC
LOAD – ITEM 22 EXEC
TIMER – ITEM 23 EXEC
√VGO Z ≥ 0

Do NOT MNVR to BURN ATT

A6U √DAP: no LO Z
At TIG, deflect THC to null VGOs

7. PERFORM FINAL SEP

CRT GNC OPS 202 PRO (ORBIT MNVR EXEC)
√RCS SEL – ITEM 4 (*)

If ΔVY (block 6) +2:
TV ROLL – ITEM 5 +2 7 0 EXEC

If ΔVY (block 6) -2:
TV ROLL – ITEM 5 +0 9 0 EXEC

Set TIG to TIG from step 6 +15:00

TGT PEG 7 ΔVx – ITEM 19 +3 EXEC
ΔVy – ITEM 20 +0 EXEC
ΔVz – ITEM 21 +0 EXEC
LOAD – ITEM 22 EXEC
TIMER – ITEM 23 EXEC

A6U DAP: B1/AUTO/PRI

At TIG-8:00, MNVR – ITEM 27 EXEC (*)

At TIG, deflect THC to null VGOs

FLT CNTLR PWR – OFF

8. MNVR TO MINIMUM DRAG ATTITUDE (-ZLV/-XVV)

A6U DAP: A/AUTO/VERN

CRT GNC OPS 201 PRO (UNIV PTG)
√TGT ID: 2
BODY VECT: 3
OM: 0
START TRK – ITEM 19 EXEC (CUR-*)

RMS ON-ORBIT INITIALIZATION

1.RMS SHOULDER BRACE RELEASE

NOTE
Expect MA, C/W REACH LIM lt – on (SP, EP), C/W SINGULAR lt – on (EP) SM ALERT

A8L	RMS SEL	– PORT
	√SAFING tb	– gray
	SHLDR BRACE REL	– PORT (hold2 sec following tb-gray)
	RMS SEL	– OFF

2. CONFIGURE POWER

R13L	PL BAY MECH PWR SYS (two)	– ON

7. PORT MPM DEPLOY

A8L	PORT RMS	– DPY (tb-DPY) (68 sec max)
	PORT RMS	– OFF

8. STBD MPM DEPLOY

A8L If Starboard MPM installed:

CAUTION
Ku-Band Antenna must be deployed prior to STBD MPM deploy to prevent antenna/OBSS contact

A8L	STBD RMS	– DPY (tb-DPY) (68 sec max)
	STBD RMS	– OFF

9. RECONFIGURE POWER

R13L	PL BAY MECH PWR SYS (two)	– OFF

RMS PWRUP

1. PLB LTS, CCTV ACT

A7U PL BAY FLOOD (six) – as reqd

Perform ACTIVATION,OPERATIONS(TV Cue Card) for desired camrs
Perform ILLUMINATOR OPS (TV Cue Card) as reqd

√Physical integrity of arm, EE, blankets

√PORT RMS HTR (two) – AUTO

2. RMS SEL (IDLE MODE)

A8U √MODE – not DIRECT

NOTE
If RMS cradled, expect MA, C/W REACH LIM lt – on (SP, EP), SINGULAR lt – on (EP)

A8L RMS SEL – PORT (MA, SM ALERT)
√SAFING tb – gray

	X	Y	Z	PITCH	YAW	ROLL	PL ID
√	-1282	-108	-445	0	0	0	0
	SY	SP	EP	WP	WY	WR	
√	0.0	0.0	0.0	0.0	0.0	0.0	

R13L PL BAY MECH PWR SYS (two) – ON

3. PORT MPM DEPLOY

If MPM stowed:
PORT RMS – DPY (tb-DPY) (68 sec max)
PORT RMS – OFF

A6U DAP: VERN(FREE)

A8L PORT RMS RETEN LAT – REL (tb-REL) (18 sec max)
PORT RMS RETEN LAT – OFF

4.. RECONFIGURE POWER

R13L PL BAY MECH PWR SYS (two) – OFF

5. ARM UNCRADLE

CAUTION
Arm temperatures must be within limits (no alarms) prior to uncradling

A8U
RATE – as reqd (VERN within 10 ft)
PARAM – JOINT ANGLE
BRAKES – √OFF (tb-OFF)
MODE – SINGLE, ENTER

SINGLE DR to PRE-CRADLE position (within 1°):

	SY	SP	EP	WP	WY	WR
Cradle	0.0	0.0	0.0	0.0	0.0	0.0
1: WP +				+5.0		
2: EP +			+1.0			
3: SP +		+25.0				
4: EP –			-25.0			
Pre-cradle	0.0	+25.0	-25.0	+5.0	0.0	0.0

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

BRAKES – ON (tb-ON)
DAP: as reqd

RMS PWRDWN

A8L RMS PWR – OFF

F6 FLT CTRL PWR – ON

ORBIT OPS CHECKLIST

STS ALL

BACK COVER