

# SpaceX Starship add-on

## v.250618

for Orbiter2016

### **RECOMMENDED ADD-ONS**

D3D9 Graphics Client

<https://www.orbiter-forum.com/resources/d3d9-for-orbiter-2016.5493/>

OrbiterSound

<http://orbiter.dansteph.com/forum/index.php?page=download>

The hi-res surface tiles for Gulf Coast area:

[https://mirror.orbiter-radio.co.uk/orbiter/assets/packages/Earth/EarthHi\\_10\\_07.zip](https://mirror.orbiter-radio.co.uk/orbiter/assets/packages/Earth/EarthHi_10_07.zip)

Boca Chica base and surface tiles:

<https://www.orbiter-forum.com/resources/boca-chica-base.778/>

Orbiter Forum Thread:

<https://www.orbiter-forum.com/threads/spacex-superheavy.39783/>

### **CFG FILE OPTIONS**

Payload attachment points, max.20, PayloadAttach0->PayloadAttach19, pos dir rot

TANKER = true (for tanker variant)

LANDINGGEAR = true (for landing gear)

ORIENTATION = 0 Heads-Up, 1 Roll+90, 2 Heads-Down, 3 Roll-90

(Launch autopilot orientation, vessel rolls to heads-up before stage sep.)

### **STARSHIP (UPPER STAGE) CONTROLS**

C = Toggle HUD Info display (LAUNCH/ORBITAL/REENTRY/LANDING/TANKER)

E = Set cockpit camera view

K = Open/Close Launch Control Panel

V = Start Launch Autopilot

N = Manual Jettison Booster

P = Open/Close payload bay

W = Tilt Payload Attachment Fitting ring (for payload jettison)

J = Jettison Payload

M = Forward Light On/Off

Ctrl+A = Aerofoil Mode Flight/Reentry

Alt+NumPad/ = Aerofoil Steering Enable/Disable

D = Nose RCS Enable/Disable

(enable Nose RCS for translation and balanced rotation)

B = Upper Stage Main Fuel Dump

Ctrl+K = Enter Upper Stage Landing Target

Alt+PageUp/PageDn = +/- AoA Wing Trim [Ctrl+PageUp/PageDn for fine adjust]

Alt+Delete = Set AoA Wing Trim 0%

Alt+M = Set Reference Planet: Earth/Mars

U = Reentry Attitude Autopilot On/Off

Controls attitude and throttle from reentry interface to landing. Use IMFD "Base Approach" or BaseApproachMFD to target reentry interface. See notes below.

F = Fly-by-Wire Reentry On/Off [Shift + Cursor Pad Arrows = Bank/AoA]

Set Bank and AoA during reentry, vessel rotates around airspeed vector.

Ctrl+J = Use Landing Reserve Fuel On/Off

Ctrl+N = Upper Stage engine selection (All/Vac/SL)

Ctrl+1/2/3 = Upper Stage Raptor SL selection (1,2 or 3 engines)

Ctrl+B = Skydive-and-Land Autopilot On/Off (from ~20km)

Ctrl+V = Retropulsion Landing Autopilot On/Off (from ~10km)

G = Deploy/Stow Landing Gear (if available)

### **TANKER FUNCTIONS** (Tanker variant only)

Ctrl+G = Select Target Propellant Tank for fuel transfer (enter tank index 0,1,2,etc.)

Ctrl+U = Start/Stop fuel transfer (200kg/s)

(on docking, tanker will automatically select docked vessel "default" propellant tank)

Internal Transfer

Alt+G = Payload Tank to Main Tank

Alt+U = Main Tank to Payload Tank

### **BOOSTER (LOWER STAGE) CONTROLS** (after jettison)

K = Enter Boostback/Landing Target name

M = Set Boostback mode (Boostback+Landing / Landing Only)

B = Start/Stop Boostback autopilot

P = Select Engines ( 33 / 13 / 3 )

J = Deploy/Stow Grid Fins

E = Set cockpit camera view

### **LZ1 LANDING PAD CONTROLS**

N = Toggle pad mesh invisible/visible

### **BC\_PAD TEST STAND CONTROLS**

K = Lights on/off

V = LOX vent on/off

P = Attach Vessel to Pad (Enter name)

### **BC\_TOWER LAUNCH TOWER CONTROLS**

J = Engage/Disengage QDA Claw

G = Engage/Disengage QDA

B = Enable/Disable Catch Sequence (deletes any currently "caught" vessel)

P = Enter Catch Target Name (useful for multiple launches, otherwise can leave on AUTO)

K = Lights on/off

V = LOX vent on/off

N = Attach Vessel to Pad (Enter name)

1 / 2 = Lower / Raise / Pause Catch Arms

3 / 4 = Open / Close / Pause Catch Arms

5 / 6 / 7 = Slew Right / Left / Centre Catch Arms

8 / 9 = +/- Transport Attached Vessel Along Arms

**NOTE:** You can place the caught booster stage on to the pad by moving it into position (within 2m), and releasing it (open arms [3] ).

### **LAUNCH CONTROL PANEL**

Press [K] to toggle the Launch Control Panel On/Off.

Attach any existing vessel as payload, by entering name and click on "Attach".

Enter target orbit parameter and click on "Enter". Inclination must be greater than launch latitude.

Enter positive inclination for launch to ascending-node azimuth, negative inclination for descending node.

1<sup>st</sup> Stage Apogee at MECO is automatically calculated from target orbit perigee, but can be overridden.

Enter name of 1<sup>st</sup> Stage boostback-and-landing target (can be base or landed vessel).

Enable/disable 1<sup>st</sup> Stageboostback-and-landing autopilot.

Toggle 1<sup>st</sup> Stage autopilot mode: "boostback-and-landing" or "landing only".

Enter name of Starship reentry and landing target.

Enter Tanker Fuel Payload.

Enter max. acceleration limiter for ascent autopilot.

Activate T-10 Launch Autopilot for launch to target orbit or set Liftoff time UTC.

### **DE-ORBIT FOR RE-ENTRY**

Use IMFD"Base Approach" or BaseApproachMFD to perform de-orbit burn for reentry.

Re-entry interface parameters:

	Earth(LEO)	Mars(Hyperbolic)
Altitude (Alt.)	120km	90km
Re-entry Angle (ReA)	1.5°	9.8°
Anterior Angle (Ant)	45°	40°

### **LANDING**

Earth "Skydive and Land" requires ~30T fuel (use reserve tank)

Mars "Retropulsion Landing" requires ~65T fuel (payload requires additional fuel)

### **DOCKING**

Starship and Tanker have a Docking Port defined, centrally located on top (heads-up) of the vessel. This enables Starship and tanker to dock "back-to-back" - see "Tanker Docking and Transfer test" scenario. Use DockingMFD to perform docking.

### **MULTIPLE STARSHIPS/TANKERS IN THE SAME SCENARIO**

Due to my limited coding ability, each Starship vessel (not the Booster) requires its own .cfg and associated .dll .

Copy and rename .cfg and .dll (edit new .cfg to point to new .dll)

See "Double launch" scenarios for example.

### **VEHICLE DATA**

#### **Booster stage**

Dry Mass	180000kg
Propellant Mass	3400000kg
Thrust	2250000N per engine (x33)
ISP	3490(Vac) 3200(SL) Ns/kg
RCS Thrust	3600N per engine
RCS ISP	1000 Ns/kg

#### **Upper Stage**

Dry Mass	120000kg
Main Propellant Mass	1470000kg
Landing Reserve Propellant Mass	30000kg
Thrust	2450000N per engine (x3 Vac + x3 SL)
ISP (VAC Raptor)	3680 (Vac) 3100 (SL) Ns/kg
ISP (SL Raptor)	3490 (Vac) 3200 (SL) Ns/kg
RCS Thrust	3600N per engine
RCS ISP	1000 Ns/kg

Tanker max.fuel payload                      200000kg

Starship Propellant Tank Index

Upper Stage Main	0
Upper Stage Reserve	1
Booster Stage Main	2

Tanker Propellant Tank Index

Upper Stage Main	0
Upper Stage Reserve	1
Payload Propellant	2
Booster Stage Main	3

Booster Propellant Tank Index

Main	0
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