

# Space Shuttle: Launch Sequence

## Countdown

- ? For a Shuttle to successfully reach orbit hundreds of individual events have to take place in the correct order and at the correct time. The schedule that organizes these events is known as a countdown.
- ? A typical countdown may begin up to 2 days before the actual launch, but the most critical phase of a Shuttle countdown is the two hour period before the launch and the 45 to 60 minutes after the launch.
- ? A Shuttle countdown can be halted at any time before the Solid Rocket Boosters are ignited.
- ? All Shuttle countdowns include certain essential elements, but details may vary depending on the nature of the mission being flown.
- ? Time before launch is referred to by the prefix T-, so T-0:30:00 means 30 minutes before launch. Time after launch is referred to by the prefix T+.

## A typical Space Shuttle countdown

<b>T-5:00:00</b>	Final countdown begins
<b>T-4:30:00</b>	Liquid oxygen pumped into External Tank liquid oxygen tank
<b>T-2:50:00</b>	Liquid hydrogen pumped into External Tank liquid hydrogen tank
<b>T-1:50:00</b>	Crew enter orbiter
<b>T-1:30:00</b>	Communications check with launch control
<b>T-1:25:00</b>	Communications check with mission control
<b>T-1:10:00</b>	Crew access hatch is closed and secured by ground crew
<b>T-1:05:00</b>	Crew carry out orbiter cabin leak check
<b>T-0:30:00</b>	Ground crew retires to secure area
<b>T-0:25:00</b>	Commander and pilot carry out voice communications check with mission control and receive updated abort data
<b>T-0:20:00</b>	Ten minute countdown hold to allow any behind schedule activities to be completed
<b>T-0:16:00</b>	Main propulsion system pressurized
<b>T-0:09:00</b>	Second ten minute countdown hold to allow any behind schedule activities to be completed
<b>T-0:07:00</b>	Crew access arm retracts
<b>T-0:06:00</b>	Orbiter's hydraulic system powered-up
<b>T-0:04:30</b>	Orbiter switches to internal power
<b>T-0:03:45</b>	Orbiter aero surfaces tested
<b>T-0:03:00</b>	Orbiter main engines gimbal to launch positions
<b>T-0:02:55</b>	External tank oxygen vents close – liquid oxygen tank begins pressurization for launch
<b>T-0:01:57</b>	External tank hydrogen vents close – liquid hydrogen tank begins pressurization for launch
<b>T-0:00:25</b>	Countdown management switches to orbiter computers
<b>T-0:00:03.46</b>	First Space Shuttle Main Engine (SSME) ignites
<b>T-0:00:03.34</b>	Second SSME ignites
<b>T-0:00:03.22</b>	Third SSME ignites
<b>T-0:00:00</b>	Solid Rocket Booster ignition timer starts
<b>T + 0:00:02.64</b>	Solid Rocket Boosters ignite
<b>T + 0:00:03</b>	Liftoff
<b>T + 0:00:060</b>	Launch tower cleared
<b>T + 0:00:11</b>	Begin 120° roll into 'heads down' attitude
<b>T + 0:00:44</b>	At speed of Mach 1, SSMEs reduce thrust to 65%
<b>T + 0:01:06</b>	SSMEs increase thrust to 100%
<b>T + 0:02:00</b>	Solid Rocket Boosters burn-out
<b>T + 0:02:07</b>	Solid Rocket Booster separation
<b>T + 0:04:20</b>	Last point at which a return to launch site abort is possible
<b>T + 0:08:28</b>	SSMEs reduce thrust to 65%
<b>T + 0:08:38</b>	SSMEs shut down
<b>T + 0:08:54</b>	External Tank separation
<b>T + 0:10:39</b>	Orbital Maneuvering System (OMS) burn to raise orbit
<b>T + 0:12:24</b>	OMS burn ends
<b>T + 0:12:30</b>	Auxiliary power unit shut down
<b>T + 0:45:58</b>	Second OMS burn
<b>T + 0:46:34</b>	Second OMS burn ends

