

The Complete Guide to: KERBAL CONSTRUCTION TIME

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With some edits by: magico13

MOD BY: Magico13

ORIGINAL DEVELOPER: Ekku Zakku

Note: This is written with KCT version 1.0 in mind. Things may be different in the version you are using!

-Introduction

Hello, brave kerbonaut! You have just installed the fantabulastic Kerbal Construction Time mod, created by the glorious Ekku Zakku and taken over by our great leader: magico13.

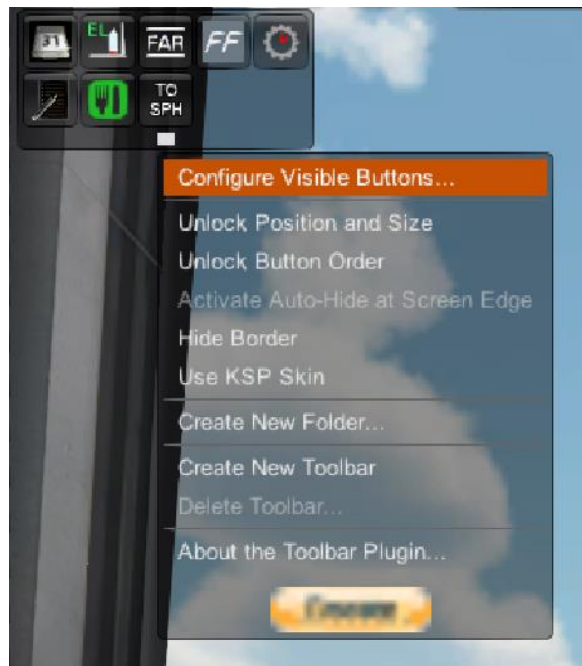
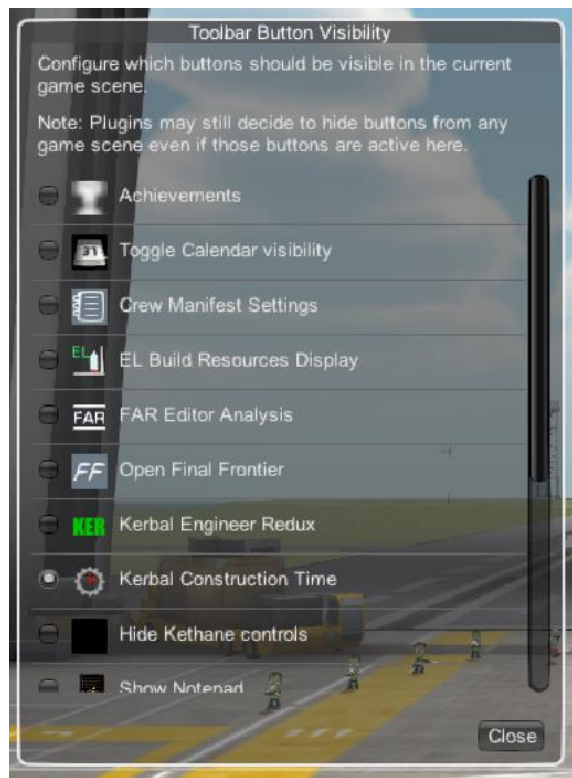
Ever wondered how the kerbal industries evolved to the point that their space center is able to pump out giant rockets every 30 seconds, especially when it seems that half of their engineering is based on struts? Don't want to plant a flag and artificially time-warp to simulate some degree of realism? Well, the answer has arrived! Kerbal Construction Time, or KCT, adds a rocket build timer, based on vessel cost, how familiar the engineers are with working with specific parts, and if you have parts in stock from a previous mission to calculate the time it would take to build that rocket!

So, in case your brain hasn't exploded from awesomeness (or G-force related to strapping 50 boosters to your rocket), you may be wondering: "But how do I work with it?" Worry not, for I, Guto8797, glorious paladin of goodwill, have written this guide to aid you in your quest to rocket building!

-Getting Started!

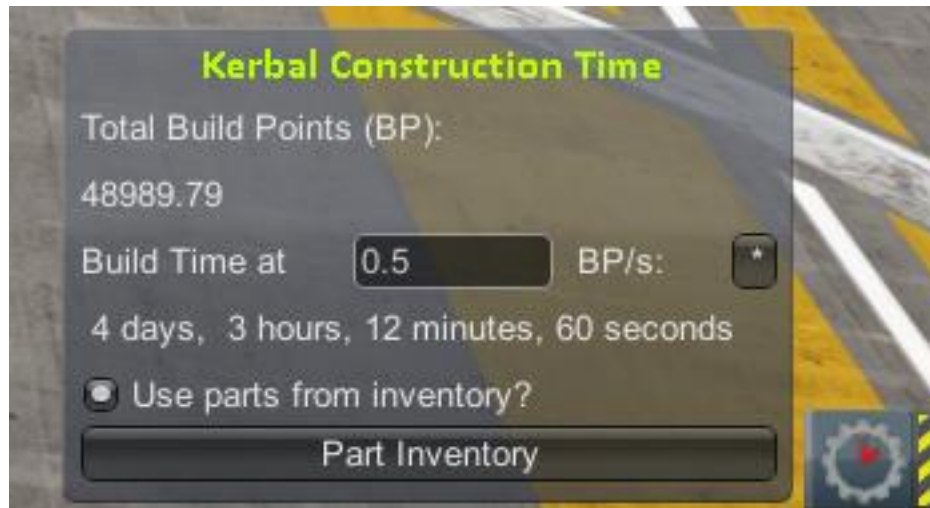
Let's assume you installed the mod correctly (simply merge the GameData folder with the one in the directory of your KSP installation, standard mod install) and do not suffer from serious debilitating mental instability. Start up the game and enter the VAB, or the SPB. You should now see a new icon floating around (in case you don't have Blizzy's toolbar mod). In case you do have the Toolbar mod, but can't see the icon, left click on the toolbar arrow, and click "configure visible icons".

Scroll down and you should find KCT's icon, select it.



(The arrow icon is bugged, it should be that white square)

Now close the icon menu, and select the KCT icon. GREAT! Now you should see something like this:



-Building the ~~death machine~~ rocket!

So, next step? BUILD THE (~~EXPLOSIVE CONTRAPTION~~) ROCKET!!! And remember kids, MOAR BOOSTERS! As you might notice the timer increases the more parts you add. Simple, big rockets take more time to build. There is also a button “Part Inventory”. Here you can see parts that have been recovered from recovered vessels or boosters that had enough parachutes. Parts in the part inventory don’t take as much time to build (about 1/10 of normal), just the time to fix them and attach them (probably with spit and buckloads of duct-tape).

This means spaceplanes just take some hours to refuel, while rockets take days to build! Also, the number of times you have used specific parts changes build times. If your engineers strapped some batteries a hundred times, they will have no problem doing it again, while if it is a new part, they will take more time reading the instructions manual! (After 4 launches a part takes about half the time to build, 16 = ¼, etc…)

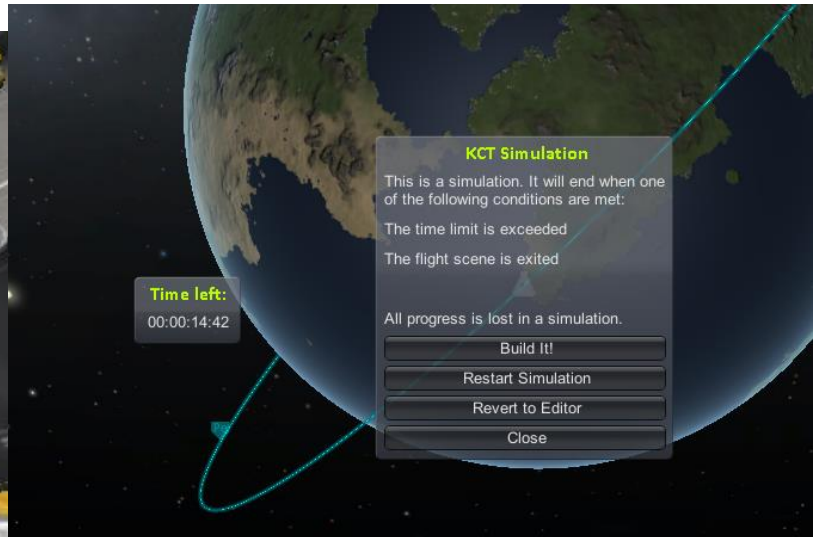
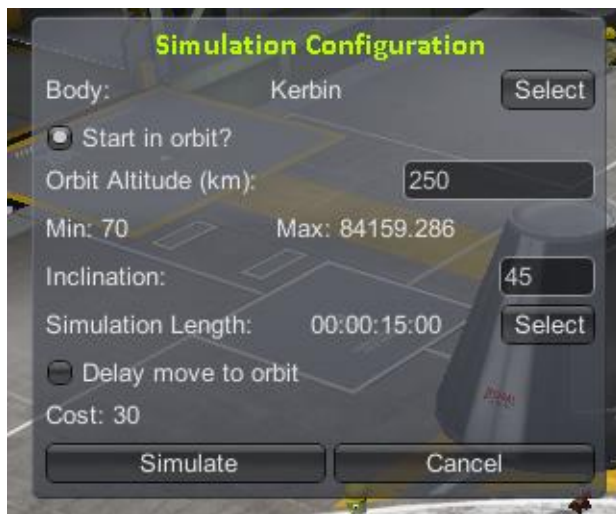
You can freely adjust the build rate to get an idea of the Build Time at different rates, but it doesn’t actually change how long the ship will take to build. Pressing the “*” button will cycle through all of your available rates.

-Launching it!/Crashing it in a fiery ball of fire and doom!

Now that you have your rocket ready, you have two options after pressing the Launch button: “Build” and “Simulate”. Simulate places you on the launch pad as a simulation, no waiting or building times, or can be done in orbit around any celestial body you have previously visited. It ends whenever the time limit is reached or the flight scene is exited, at which point the universe gets destroyed and the creators must load the universe from a backup (everything that happens in a simulation, stays in the simulation. Everything gets reset to before.)

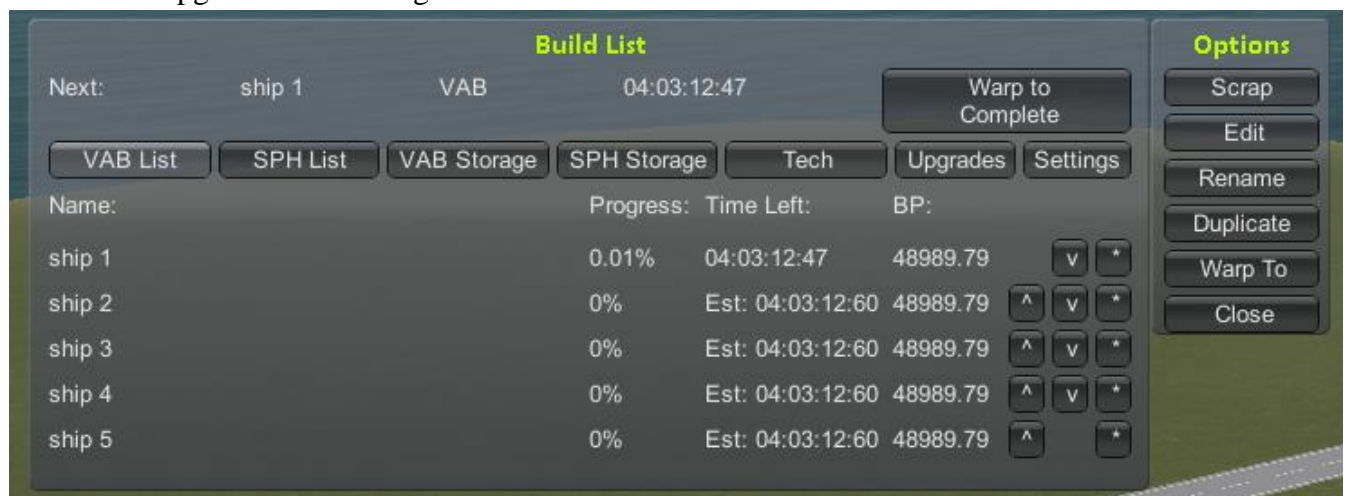
The simulation will end as soon as you exit the flight scene. If you began the simulation in orbit, and would like to restart the simulation, use the “Restart Simulation” button located on the KCT Window!

Simulations cost funds dependent on the time limit chosen, the total cost of the vessel (less if it costs less than \$25k, more if it costs more than \$25k), and the body chosen to start around (distance, presence of an atmosphere, and if it’s a moon all affect the cost).



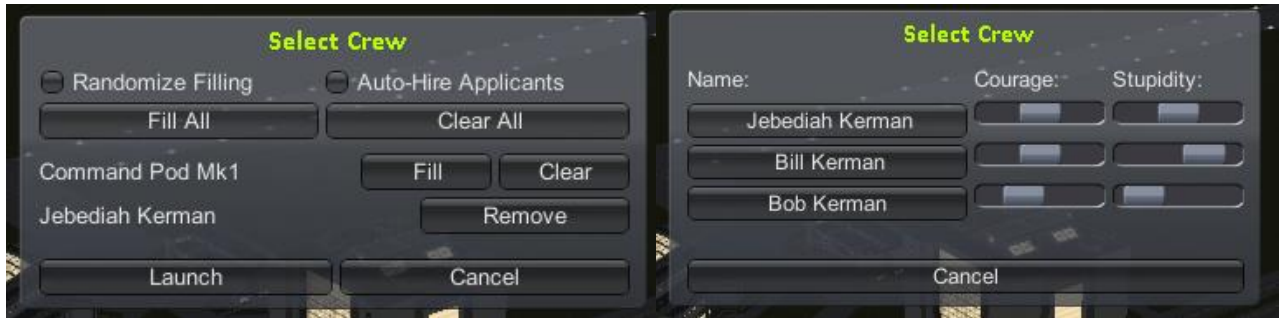
If you are satisfied with the simulation's results, or just bored to death, click "Build". Good! Your basic cognitive functions are still operational! Now either design a new rocket, or leave the VAB/SPH.

In the Space Center you can click the KCT icon and this will show you the Build List menu. From here you have several sections: "VAB List"; "SPH List"; "VAB Storage"; "SPH Storage"; "Tech"; "Upgrades"; and "Settings". On the build lists you can see the vessels that are currently being built, change their build order, cancel, edit, and rename them. Any times listed with "EST:" are estimated times at the fastest rate owned. On the storages, you can see ready to go vessels and launch, scrap, edit, and rename them. Tech is like a build list but for tech nodes. Upgrades and Settings will be covered later.



You will also notice a "currently building timer", and you can warp to completion! This means you can warp time to the moment your rocket is finished! Now go to the storage window, hit launch! (Or scrap or edit, in case you realized you made a mistake). If you hit scrap, the parts are added to the part inventory and you're refunded the cost of the vessel (if you do this while it is still building; only a percentage of the parts are added to your inventory.) You can optionally edit any vessels that are in progress or are complete. Editing will cause you to lose some time, but often far less than if you had to rebuild the entire vessel.

After pressing Launch you should see the crew selection window. The way the mod works, selecting the crew in the VAB or SPH does nothing, you must select it with this window. When everything is set, hit launch!



You shall now see the familiar face of either the runway, or the launch pad. Now launch (a.k.a crash) the rocket in a pretty much standard way. I hope you enjoy the mod, and that it does not hold any secrets to you from now on!

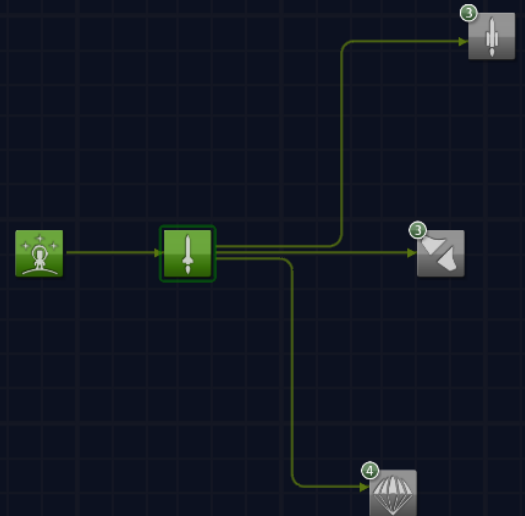
-Tech Node Unlocking

By default, tech nodes require time to unlock. The Kerbal engineers need time to process all that new science and figure out how to put together the new parts. Progress isn't immediate people! You'll be alerted that an upgrade point has been added (next section) and that the node will unlock in X days. Without any upgrades, nodes will take 1 day (24 hour days assumed. Multiply by 4 for Kerbin days) per 2 science that they are worth. Every upgrade doubles the rate, so one upgrade will cause it to be 1 day per 4 science, two will make it 1 per 8, 3 is 1 per 16, 4 is 1 per 32, etc. So the first tech node costs 5 science and at a rate of 1 day per 2 science, it takes 2.5 days to unlock (or 10 Kerbin days). Putting that single upgrade in will cause it to take 1 day per 4 science, or 1.25 days (5 science / 4science per day = 1.25 days). Make sense? Good.

You may notice that it appears as if the node is unlocked and further nodes can be unlocked as well. This is partially true. Closing the R&D screen and reopening it will have all currently researching nodes appear locked. Unlocking them again will inform you that it is already being researched, will refund your science and will temporarily unlock the node! That way you can unlock later nodes at any point, if you've got the science for them.

All tech researches at the same rate and at the same time, unlike with ships where it's first come-first served. You can view the progress of any currently researching tech in the "Tech" tab of the Space Center window. You can even warp to tech completion if you want!

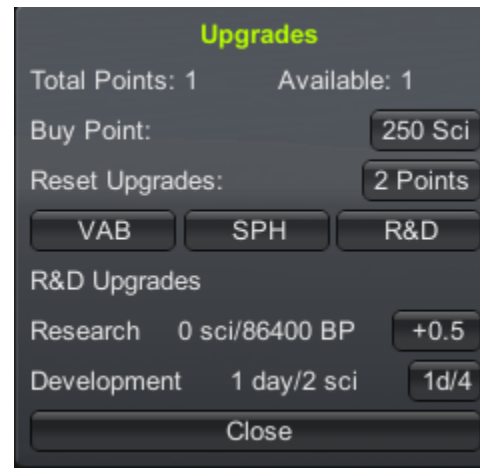
[KCT] Upgrade Point Added!
[KCT] Node will unlock in 2.5 days.



-Upgrading Your Space Center

Build times too slow? Want to be able to build multiple ships at once? Tech taking forever? Think your engineers are getting some hands on experience that deserves science? Well, you've come to the right place! Opening up the "Upgrades" window from the Space Center KCT GUI will let you fix all of these!

In this window you can spend upgrade points to unlock additional build rates or improve the ones you have, or spend them to make tech unlock faster or earn science from building ships! Each button press consumes one upgrade point, with the total earned and the number available listed at the top. The VAB and the Spaceplane Hangar each have their own independent build rates which must be upgraded independently. To speed up your primary build rate, simply press the +0.05 button! Now Rate 1 goes from 0.1 BP/s (build points per second) to 0.15 BP/s. To unlock a second build rate, upgrade Rate 2 from 0 BP/s to 0.1 BP/s. Now ships in the second slot of the build list will be built at 0.1 BP/s. Rate 3 becomes visible after purchasing Rate 2, but can't be upgraded yet. Why is this? Well, secondary rates cannot be faster than the rate before them, obviously! So Rate 3 must be slower than Rate 2, which must be slower than Rate 1! So why isn't it available? Because each upgrade of Rate 3 increases it by 0.15 BP/s. Upgrading Rate 2 to 0.2 BP/s makes Rate 3 upgradable. This continues on for (essentially) forever. The mathematical formula for rate increases is $(0.05 \text{ BP/s}) \times (\text{Rate Number})$, as secondary rates are not as useful as one really really fast rate (consider a single rate of 2 compared to two rates of 1. Two ships will take the same total time to build. One ship will be take half the time though!)



“Well that’s great, but that only explains build rates, not the R&D tab!” you say. Well calm down, I’m getting there! The R&D tab has two upgradable options, “Research” and “Development”. We’ll start with **Development**, since we have actually talked about it already. This is the rate at which tech nodes unlock. Each upgrade makes the nodes take **HALF THE TIME** of the previous one. So if a node will take 10 days to unlock, upgrading this once will make it take 5 days. The formula is 1 day per $(2^{(\text{upgrades}+1)})$ science. **Research** represents your engineers’ hands on learning. Each upgrade causes you to earn more science per ship built. Initially you don’t earn any. The first upgrade causes you to earn 0.5 science per 86400 Build Points of ship you complete. This is equivalent to one Earth day at a rate of 1 BP/s, so you can think of it (naively) as x science per day while things are being built. More Build Points being completed each day means more science earned per day, though. Science is awarded when ships are finished. Each upgrade increases the rate by 0.5 science.

“What about the other buttons?” - you. Wow, you are needy. The “Buy Point” button lets you purchase upgrades for an increasing number of science or funds. Each time you purchase an upgrade, the cost doubles, up to a maximum of 512 science or 1,024,000 funds. The “Reset Upgrades” button costs two upgrade points to activate. It will reset how you’ve SPENT your upgrade points, but keep the Total Points the same. So if you’ve just finished the tech tree and put everything into Development up until now, but wish you could take them out and put them into the SPH build rates, then all you have to do is have two unspent points and click the button. BOOM! Now you can spend them all how you want them! The reason it costs two points is so you can’t do it all the time. You have to plan ahead a bit!

-Launchpad Reconditioning

After blasting the surface of the Launchpad with the fire of your BOOSTA’s it’s gonna need a bit of patching up. This is what LaunchPad Reconditioning is. By default, reconditioning is worth 86400 Build Points per 25 tons of the vessel at launch. The 86400 BP is multiplied by the Overall Multiplier in the Time Settings and the tonnage can be changed in the Time Settings. While reconditioning is active, no new launches can occur from the Launchpad (you don’t want to totally break the thing, do ya?). Conveniently the Launchpad can be reconditioned while other ships are being built and is progressed at a rate equal to the sum of all the VAB Build Rates. If you’ve got one rate, it’s exactly that one. If you’ve got two rates (say, 1 BP/s and 0.5BP/s) then it’s the combination of the two (1.5 BP/s). If you’ve got 12 rates, it’s all of those bad boys tossed into one big pile of reconditioning goodness.

- Rocket Build Point Modifiers

- Part costs define the base of the Build Point calculation;
- Use of recovered parts reduces build time;
- Engineer expertise with specific parts (building the same parts lots of time makes engineers build them faster!)

The formula for the total number of build points is: $BP = 2000 * OverallMultiplier * TotalEffectiveCost$. The TotalEffectiveCost is the sum of every part's EffectiveCost which is determined to be:
 $EffectiveCost = PartCost / (InventoryEffect + (BuildEffect * TimesUsed + 1))$. If the part isn't in the inventory, InventoryEffect is 0.

-NOTE: Adding parachutes to stages, in such an amount that guarantees their touch down speed is less than 10m/s (the parachutes don't need to be deployed, just present, but deploying them is advised) recovers them, adding them to the part inventory. This works with RealChutes parachutes or stock ones.

- Interactions with Other Mods

StageRecovery: When using the StageRecovery addon, KCT will delegate all dropped stage recovery operations to SR, meaning SR and KCT are in complete agreement about whether a stage is recovered. StageRecovery and KCT also have additional interactions where if a stage is recovered with a Speed Percent between 0 and 100%, there is a chance (100-Speed Percent) per part that the part will be too damaged to be added to the inventory and used in future build. Example: A stage lands with a 77% Speed Percentage. There is a 23% chance, per part, that the part will be scrapped and not added to the inventory. If any parts are "scrapped" then a message will be given through the stock toolbar explaining which parts were scrapped (assuming the All Messages setting is enabled)

DebRefund: When using DebRefund, KCT can only delegate funds recovery to it, and there may be disagreements as to whether a particular stage is recovered because each mod must perform its own checks with its own requirements. It is strongly encouraged that if you aren't going to use KCT's built in stage recovery that you use the StageRecovery addon so that no confusion occurs.

TweakScale: Parts that have had their sizes tweaked will have their Build Point value adjusted accordingly. Different sized parts are tracked differently for both the "times used" and the part inventory. In the inventory parts at their default scale are listed by just their name but parts with tweaked size are listed "name,size", for instance a 50% sized Sepratron may be listed "Sepratron I,0.5" while the normal one is just "Sepratron I".

RealChute: When using KCT's booster recovery both Stock parachutes and RealChute parachutes are supported for calculating the terminal velocity of the craft. Note: when using RealChute parachutes on a craft all Stock chutes are ignored, unless the RealChute ModuleManager configs are in place since then they're treated as RealChutes. If RealChute is installed but one stock chutes are on a craft, KCT will properly detect which parachute module to use.

- Simulation Notes

Simulations can be performed in orbit around any celestial body (planet/moon) you have visited OUTSIDE of a simulation. They must start above the atmosphere and can have any inclination.

- No Saving;
- Time limit;

To restart a simulation in orbit, you must use the KCT “Restart Simulation” button.

You can end a simulation by going to the tracking station or space center, the results of the simulation will not be saved, meaning any killed kerbals are suddenly alive again and any science performed is lost!

The cost of the simulation is defined by several parameters. The first is the distance the selected Body (or its Parent if the Body is a moon) is from Kerbin (comparing Semi-Major Axis). The further the distance, the higher the cost. The second is whether the Body and its Parent (if a moon) have an atmosphere. If the Parent has an atmosphere (or the Body if the Parent is the Sun) then the simulation costs 1.25 the normal cost. If the Body is a moon, the simulation cost is 1.25 that of the Parent body (and an additional 1.5 times if the Body has an atmosphere). The third parameter is the length of time for the simulation, where 15 minutes is a 1x multiplier, but infinite time is 13x. The final parameter is vessel cost. Vessels that cost less than 25,000 funds cost less to simulate and vessels that cost more than 25000 funds cost more to simulate.

There are two special cases for simulations: Starting on Kerbin and starting around the Sun. Around the Sun the cost is $10000 * \text{Time Multiplier} * \text{Vessel Cost Modifier}$. On Kerbin the cost is $100 * \text{Time Modifier} * \text{Vessel Cost Modifier}$.

-Settings, aka The Cheat Menu

From the Space Center, open the Build List by clicking the KCT icon. You should see a button titled “Settings” toward the right of the window, below “Warp to Complete”. Clicking this will bring up the Settings menu. These settings correspond to the settings in the Config files with the exception of the Game specific settings which are saved to the persistence file. An overview of each setting is presented below. Press the “Save” button to finalize your choices, or the “Cancel” button to cancel any changes. At the present time, there is no way to revert to the default settings other than setting them manually back to default or deleting the Config files.



Game Specific Settings:

Enabled for this save?: Enable or disable the mod for a particular save game.

Number of Upgrade Points: (Sandbox only) Change the number of upgrades available.

Build Times: Enable or disable build times for vessels. Disabling leaves the mod running in a “simulation only” mode where simulations can still be performed without build times.

Instant Tech Unlock: If enabled, tech nodes don’t take time to unlock.

Override Body Tracker: If overridden, all celestial bodies are available for simulations even if they haven’t been visited.

Funds Recovery Mod: The percentage of funds recovered from dropped stages. (Not used if StageRecovery or DebRefund are installed)

Free Simulations: Simulations don’t cost funds to start (note: you must still have enough funds to pay for the vessel, but they won’t be spent)

Reconditioning: Enable or disable LaunchPad reconditioning.

Global Settings:

Max TimeWarp: Changes the maximum speed for timewarp. A preview of the amount is given.

Force Stop Timewarp on Complete?: Always stops timewarp when a ship finishes if enabled.

Recovery Messages: Show messages when a stage is recovered successfully (not used if StageRecovery or DebRefund are installed)

All Messages: Disable to prevent any messages in the stock toolbar from appearing (recovery, vessel completion, or StageRecovery related part destruction)

Override Launch Button: Disabling this causes the Launch button in the editor to be disabled and you must launch/simulate from the KCT Editor Window (similar to how the Pre-Releases worked)

Enable Debugging: When enabled, KCT will output far more information to the debug log. Enable this before filing a bug report!

Auto Check For Updates: If enabled, KCT will check for updates once per KSP session and display an alert in the build list if there is one. Clicking the “Check” button will force a check, no matter what the current settings are (in case you want to manually check).

Check Only for this KSP Version?: If yes, KCT will only check for updates made for the KSP version that the current KCT version is designed for. If no, KCT will check for the absolute latest version.

The current version and the latest version gathered from the updater are displayed at the bottom. If an update hasn't been checked for, or the check failed, no latest version will be displayed.

Global Time Settings:

Overall Multiplier: This number is multiplied into the total build time. Setting it to 2 doubles build times, 0.5 halves them.

Build Effect: Changes the effect that repeated builds have on time. Set to 0 to disable.

Inventory Effect: Changes the effect that inventory parts have on time. Set to 0 to disable.

LaunchPad Reconditioning: Change the amount of time needed to recondition the Launchpad. By default it is 86400 BP per 25 tons. Setting to 86400 BP per 100 tons would reduce the BP value to one quarter the default.

Default Settings:

All of these are used to set the default values of the Game Specific Settings in new saves. If, for instance, you never want tech nodes to take time to unlock, you can set the default for Instant Tech Unlock to True and new saves will automatically not have tech node unlock times.

CFG file options:

KCT_Config.txt (located at KerbalConstructionTime folder)

SandboxEnabled = True //If set to "False" then KCT will by default only work in career mode saves.

MaxTimeWarp = 7 //The maximum timewarp index to use when warping to complete.

SandboxUpgrades = 45 //The default number of upgrades that Sandbox games will have.

EnableAllBodies = False //Setting to True allows you to simulate in orbit around every available planetary body

ForceStopWarp = False //Setting to True will cause warp to always stop whenever a ship completes.

DisableRecoveryMessages = False //Setting to True will disable successful recovery messages

DisableAllMessages = False //Setting to True will disable all KCT messages in the Stock Toolbar

CheckForUpdates = True //The default of this is based on your selection for sending progress data to Squad. If True then KCT will automatically check for updates once per session

VersionSpecific = False //Setting to True will only check for updates for the KSP version that the version of KCT is designed for

RecoveryModifierDefault = 0.75 //Setting this between 0 and 1 will change the default value for the amount of funds you receive from dropped stages (the RecoveryModifier)

NoCostSimulationsDefault = False //Setting to True will cause simulations to not cost funds by default

InstantTechUnlockDefault = False //Setting to True will cause tech nodes to unlock instantly by default
DisableBuildTimeDefault = False //Setting to True will cause Build Times to be disabled by default
EnableAllBodiesDefault = False //Setting to True will allow all bodies to be simulated around by default
ReconditioningDefault = True //Setting to False will disable reconditioning by default
Debug = False //Setting to True will enable KCT's debug messages in the debug log
OverrideLaunchButton = True //Setting to False will cause KCT to use the Pre-Release version of building/simulating

KCT_TimeSettings.txt (located at KerbalConstructionTime folder)

OverallMultiplier = 1 //The total time is multiplied by this number, so if you want build times to be twice as long, set this to 2. If you want them to be half as long, set it to 0.5

BuildEffect = 1 //This number defines how much using parts over and over affects the build time. Disable by setting to 0.

InventoryEffect = 100 //Defines how much the inventory affects build time. Disable by setting to 0.

ReconditioningEffect = 3456 //Defines how many build points per ton reconditioning is worth (before OverallMultiplier)