The Complete-ish Guide to:
KERBAL CONSTRUCTION TIME

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MOD BY: Magico13

ORIGINAL DEVELOPER: Ekku Zakku

<u>Note:</u> This is written with KCT version 1.2 in mind. Things may be different in the version you are using!

<u>-Introduction</u>

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!

<u>-Getting Started!</u>

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. The very first thing that you'll encounter is a window telling you to do two things: Choose a Preset, and Spend Upgrades. You should do these two things, in that order.
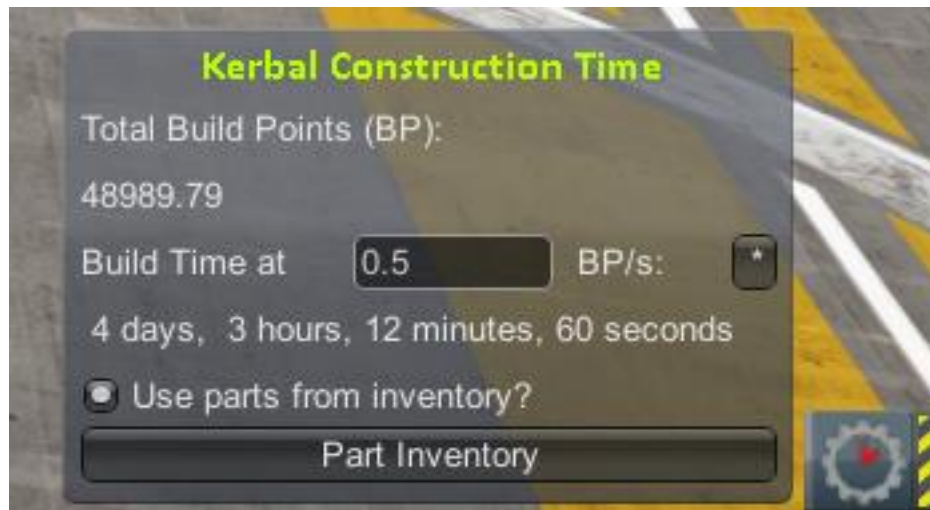

Presets are "Settings Packs" for KCT that define how KCT plays. If you're new, use the "default" Preset (it should be automatically selected). If you're playing with RP-0, then you should choose the RP-0 Preset. Presets are *extremely powerful*, and I highly encourage playing around with them once you get used to how KCT works. Several other Presets are included with the KCT download (Most are very simple examples, but UpFree and rlowtech are more fully featured). When you click the "Choose a Preset" button, you'll be greeted by the window below. Just click Save when you're done!

Assuming you selected a Preset that has starting Upgrade points (more on those later), you'll now have to assign those first points. Click the "Spend Upgrades" button, and then put all of your upgrade points into a single build rate in the building you will use most. For most people, this will result in a VAB build rate of 0.9 BP/s. You'll understand how this system works in detail later, but for now just know that rockets will build fast and planes will build slowly. If you want to build planes fast, put your points into the SPH and not into the VAB. When finished, it should look like this:

Ignore the Build List window that opens up when you press "Close" and open up the VAB or Space Plane Hangar. You should see a window like the one below, which is controlled by the "clock inside a gear" button.

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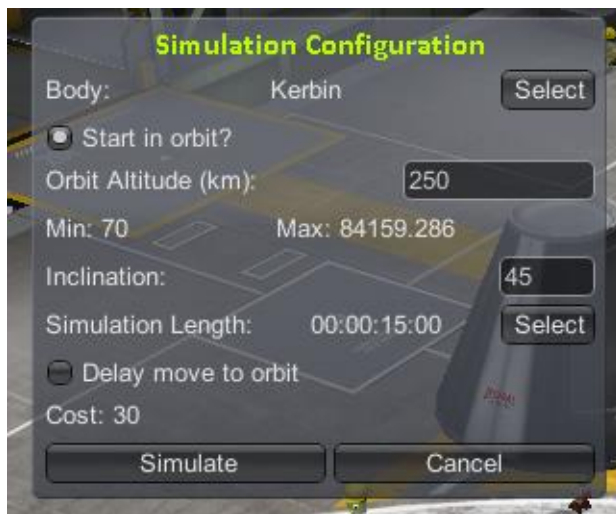
You can freely adjust the build rate to get an idea of the Build Time at different rates, but it doesn't actually change how long the ship will take to build. Pressing the "*" button will cycle through all of your available rates.

-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, and the body chosen to start around (mass, 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.

NOTE: Simulation times work slightly differently than they do in the above image. Instead of selecting a time, you now can enter a time in a colon-formatted manner, ie yy:dd:hh:mm:ss. For example, a 20 day, 4 hour, 30 minute simulation would be 00:20:4:30:00.

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"; "SPH"; "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. Here you can also see vessels that are ready to go and launch, scrap, edit, and rename them. Tech is like a build list but for tech nodes and KSC upgrades. 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! Once the vessel is finished, hit "Rollout"! (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 Rollout you have another short wait while the rocket is rolled onto the pad. Once that's complete, press Launch and 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!
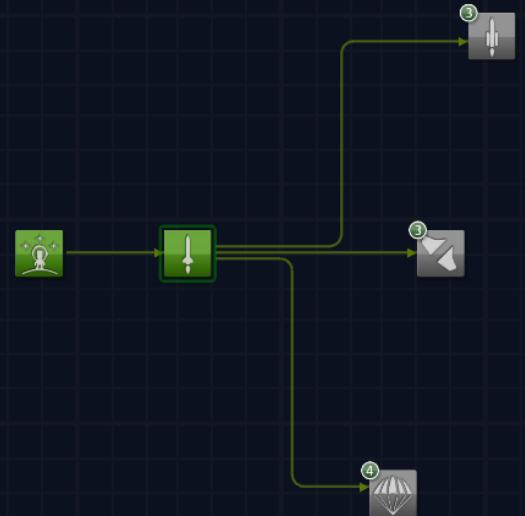

-Tech Node Unlocking

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, noes 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. The technology in the node won't be available until the time is up, but you can purchase additional nodes to unlock even before the pre-requisite nodes are completed

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!

KSC building upgrades work almost identically, so you can probably figure them out pretty easily. Build rates for KSC buildings are based on the sum of the VAB and SPH rates, rather than a separate rate.
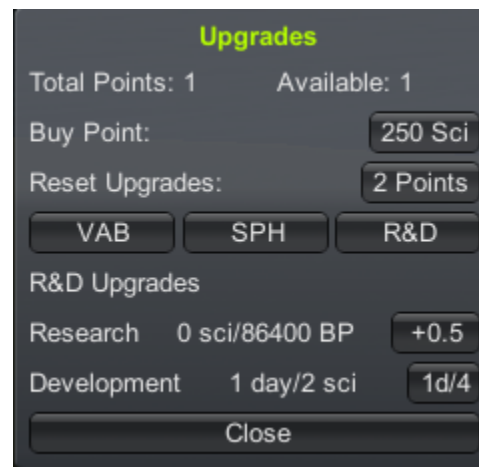
[KCT] Upgrade Point Added!

[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 BP/s)*(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 $(2^{(upgrades+1)})$ 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" buttons let 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! The cost for resetting increases each time you use it, so you shouldn't rely on it.

-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. This is heavily tied to the rollout time as well. In fact, with the default Preset you can

choose what percentage of time should be spent BEFORE launch on rollout, vs AFTER launch on reconditioning. Additionally, with Kerbal Konstructs every launch site has their own Rollout/Reconditioning queues!

- 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.

- Recovering Vessels Directly To Storage
People bugged me about this enough times that I added it in. First, a warning: KSP really doesn't like turning a Vessel into a ShipConstruct/craft file, and as such this code frequently doesn't work. As a result, KCT makes a quicksave called KCT_backup.sfs before the code runs, just in case things get seriously messed up.

To recover a craft directly into storage, just land the craft on Kerbin and open up the main KCT window (the Build List). Then, open either the VAB or SPH tab and click the big "Recover Active Vessel" button. The vessel will be recovered and will show up in the appropriate vessel storage as "recovering". Once the time is up (less time the closer you are to KSC) you can launch it as normal.

I HIGHLY suggest editing the vessel (through the * button) to refuel it and fix any broken parts. Additionally, planes will be oriented pointing straight up, but clicking on the root part once will fix that.

Like I mentioned, this code has issues. See this GitHub issue discussing known sources of problems, and this tutorial to see how to add Modules to reset upon recovery (such as parachutes).

- Interactions with Other Mods
StageRecovery: When using the StageRecovery addon, any recovered stages have their parts added to the Part Inventory (with a small exception). 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)

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".

Kerbal Konstructs: Every launch site has its own rollout and reconditioning queue, so you can launch a bunch of things at once from different sites, or have a rescue mission sitting on a separate pad just in case your launch goes awry.

KSCSwitcher: Every KSC has its own Build Lists and Upgrades, except for Tech related items (which are shared globally). So one KSC might focus on building rockets, while another can focus on airplanes, and they'll each have their own build queues. The part tracker/inventory, tech nodes, KSC upgrades, and upgrade points spent on Research or Development are all shared.

Test Flight: In simulations you can disable the chance of random part failure completely.

RemoteTech: Work In Progress. During simulations you can disable connection requirements.

- 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 length of time of the simulation. The longer the simulation, the more it costs. The second is the mass of the selected body's Parent (if Mun is selected, the Parent is Kerbin. If Laythe, then Jool. If Eeloo, then the Parent is still Eeloo) The bigger the mass, the higher the cost. The third is whether the Body has an atmosphere. If so, then the simulation costs 1.1 times the normal cost. If the Body is a moon, the simulation cost is 1.1 times the cost, stacking with the atmosphere modifier. The final parameter is vessel cost. Vessels that cost less than 50,000 funds cost less to simulate and vessels that cost more than 50,000 funds cost more to simulate.

Starting simulations on Kerbin (from the Launchpad/Runway) costs much less than starting them in orbit, but typically in orbit you need smaller, cheaper craft.

-Settings and Presets

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.

Here you can change a few global settings on the right, which affect all saves, while anything in the center only affects the current save. All of the center options are defined by a Preset. Changing any of them away from their standard values switches the save to the Custom Preset. Presets can be fairly complex, and they're subject to a non-trivial amount of change, so you should consult the wiki on GitHub for the latest information, here: https://github.com/magico13/KCT/wiki/Presets:-An-Overview

A very brief summary of the Presets system is that it makes it very simple for players to try out new ways of playing with KCT without worrying about messing up other saves, while also making it easy for other mod authors to tweak KCT to work with their mods (RP-0 does this. Extraplanetary Launchpads could do this to make the build times line up). There is a metric butt ton of config options, especially within the Formulas section, that can completely redefine how KCT works. If you create an awesome Preset, share it on the forum thread and we'll add it to the library!

-Conclusions

This guide can't hope to cover every aspect of KCT, and in fact, it's likely missed entire sections of the mod. As such, if you have any further questions don't hesitate to [ask on the forums](). Hopefully this guide has at the very least helped you to get started with KCT, and I sincerely hope you enjoy using the mod!