

Burn Time Calc MFD 2.x



Burn Time MFD Version 2.x short description

What can this MFD do?

In simple words: It helps you to get your deltaV right. This can be done in multiple ways and in different situations.

The simplest situation is if you change your dV “now”. But the MFD can also change your dV on apoapsis, periapsis and on the right moment if you will intercept the ISS. For doing this right, the MFD will calculate your mass, including fuel mass, taken under consideration the flow rate of your fuel. Also docked vessel will be taken into account.

In the following, I will describe how to do this.

Change dV “now”

This is very easy: Press MFD-Button dV. Enter the dV into the input box and press BRN.

Change dV on a given countdown

Because it takes time to accelerate, the countdown refers to the point on which you have already accelerated the half dV of your manoeuvre. To do this, press dT, enter the time. Then press dV and enter your dV. After that, press ARM and the countdown will be start.

Change dV on Apoapsis / Periapsis

Press MD until “Time to Periapsis / Apoapsis” is shown in the display. Then enter your dV and press ARM.

Circularize orbit on Apoapsis / Periapsis

If you wish that your orbit will be a circle (useful for entering orbit from a interplanetary trip), do the steps like in “Change dV on Apoapsis / Periapsis”. Instead entering dV, press CIR. Then start the prograde (for Periapsis) / retrograde (Apoapsis) autopilot of Orbiter. The rest will be done automatically.

Get dV to zero on ISS incoming from a interplanetary trip

Because this is only a bit more complicated, I will describe this by a short tutorial. But no panic, everyone can do this.

Before doing this tutorial, make sure you have installed the latest TransX version from www.orbithangar.com. Currently this is: TransX 2015.05.25 Nelder-Mead, but if there is a later version, then use it.

Start Orbiter, and from the Orbiter Luanchpad, select the scenario ISSIntercept under BurnTimeCalcMFD, and press Launch Orbiter. You are inbound to earth aiming to do a direct intercept of the ISS.

1. You should be in glass cockpit mode, with the Earth in front of you, and both MFD's powered off.
2. Press “H” 2 times, until HUD-Mode is “DOCK”. You will see NOSECONE and a large X, indicating that the nosecone is closed.
3. Press K to open the nosecone and watch the HUD start to flash.
4. Press F1, hold down right-mouse, and move the mouse around to watch the nose open.
5. When the nosecone is fully open, press F1 again.

6. Power on the two MFD's (press PWR on each one).
7. On the left MFD, press SEL and select COM/NAV.
8. Press Ctrl-I to bring up the Object Info window, and select Vessel and ISS from the drop-down menus.
9. Note the transponder (XPDR) frequency. It should be 131.30 MHz.
10. CAREFULLY: click on the Object Info window so it is selected, and with your mouse still in the window, press Alt-F4 to dismiss it. (Note: don't do this when the main Orbiter screen is selected, or you will exit the scenario!).
11. On the COM/NAV MFD, make sure the NAV1 line is highlighted in yellow. If not, press SL- until it is highlighted.
12. Use >>, >, <, and << to adjust the NAV1 frequency to the ISS transponder: 131.30 MHz.
13. Press the RETRGRD button to activate the Retrograde Autopilot. The vessel should move to the left (i.e. Earth slides off the right of your screen).
14. On your left MFD, hit SEL and open TransX. (You did make sure you had the latest version installed, as I said above, right?)
15. Press ADJ (select target changes to Ships), then ++ and enter "iss"
16. We are now going to set up a manoeuvre to arrive at the ISS. To start this, press VW, noting it says manoeuvre mode is off, and then press ++ to switch manoeuvre on.
17. We want to time a burn for the encounter date & time (Enc. MJD), of approximately the negative encounter velocity (Enc. V) to arrive at the ISS with approximately the same velocity. Because the plane is not identical, we need to also adjust the plane and outward velocity to get a really close approach. (The details of fine tuning TransX are not important for this tutorial, but you are encouraged to watch videos and delve deeper into TransX adjustments if you wish to do these adjustments yourself.)
18. Press VAR 4 times to bring up the Man. Date. Hit ENT, and enter the Enc. MJD shown by TransX: 51997.7650.
19. Press -VR to select Prograde vel.. Hit ENT, and enter -4461. Note that this is close to the Enc. V, and we will adjust for the remainder in the other two axes.
20. Press VAR 2 times to bring up Outward Vel. Hit ENT, and enter -214.9.
21. Press VAR to bring up Ch. Plane vel. Hit ENT, and enter 160.8.
22. This completes the set-up of the burn. You should now see a predicted closest approach of around 100m, and a relative velocity of around 3m/s, at date 51997.7729.
23. Press VW, and you will see the target screen for the TransX burn, with a countdown of 3500s seconds or more to the burn.
24. On the other MFD, press SEL (once or twice, depending on which page has BurnTimeMFD) and open the BurnTimeMFD. Check you have version v2.8 or higher on the top of the MFD.
25. Press GET, and magically you will see the TransX data be imported into the Burn Time Calculator, labelled and highlighted in yellow at the top of the MFD. The autoburn is also armed and counting down. This is a big burn – roughly 244 seconds, as you can see from the Autoburn Armed line, so the difference between the TransX Burn Time (the “instantaneous burn” point) and the Time to Ignition (the real burn point taking into account the engine thrust) is noticeably different.
26. Just to show you something – try pressing ARM, to disarm the countdown. You see now that the target data goes grey and is just a manual target now. This is because you have suspended the count, so if you restarted it, it would no longer reflect the countdown from TransX. The same would happen if you change DV or DT – it becomes a manual burn again. Go ahead and press GET again to re-acquire the burn details from TransX and pick up the countdown again.

27. At this point, press T twice to go to 100x time acceleration, and carefully watch the Time To Ignition countdown on the BurnTimeMFD display. As you approach 500 seconds, press R to go back to 10x, and then press it again to go to 1x.
28. Press H to switch to Orbit HUD, and press RETRGRD to engage the retrograde autopilot. This is to give us a rough alignment to the burn (as most of the thrust will be retrograde to slow down to drop into orbit around Earth).
29. Once the ship has stopped rotating, press H twice to get back to Docking HUD, and press RETRGRD again to disengage the autopilot.
30. On TransX, press VW twice to get back to Manoeuvre view, and press VAR twice to bring up Auto-Center. Press ++ to engage auto-center mode, which will keep us aligned with the desired burn vector. Press VW to return to Target view, and watch the green x align with the center of the target. (You can hit KILL ROT to help out the autopilot if it is having trouble centering the target: if you do this, de-select it once the x has stopped moving, and allow the TransX auto-center to resume alignment).
31. At this point, you can use 10x acceleration (press T to increase, then R to return to 1x) to count down to T-20 seconds to the burn, and at that point, drop to 1x acceleration for the final countdown to the burn. If the ship becomes twitchy or unstable under time acceleration, then immediately drop to 1x acceleration again and let it settle down, or use KILL ROT autopilot if necessary.
32. As you get closer to the burn (e.g. 90 seconds to ignition), you will see the docking HUD come alive with the distance to ISS (D[ISS]) and the relative closing velocity (-V[ISS], indicating you ready for the retrograde burn).
33. When the burn starts, the BurnTimeMFD will show "Autoburn Engaged" in red, with a countdown to the end of the burn. This is a long burn, so be patient, and enjoy the view of the Earth on the left side. You will see the distance and relative velocity dropping as the burn proceeds, with TransX holding alignment, and BurnTimeMFD controlling the thrust. You may use 10x acceleration if you wish, but come back to 1x acceleration for the last 20 seconds of the burn at least.
34. As the burn completes, you will see ISS slide alongside from the right, and hover just above the BurnTimeMFD window, at a distance of around 540m, and a relative velocity of around -10.7m/s (i.e. pulling away from the ISS). (Power off the right MFD to see the ISS). The accuracy of this burn is amazing, given how long a burn it was, and how fast we were traveling in relative velocity terms. Tap the Keypad+ button a few times to null out the relative velocity to under 1 m/s.
35. We need to switch off the TransX auto-center now, and complete the manoeuvre. Press VW twice to select Manoeuvre mode. We should still be on Auto-Center, but if not, press VAR until Auto-Center comes up, and then press ++ to disable Auto-Center. Then press -VR to bring up Manoeuvre mode, and press ++ to switch it off.
36. You may proceed to dock now, but that's outside of the scope of this tutorial.

Let's recap what we just did: we set up and executed a burn using TransX and BaseSyncMFD, passing the burn data automatically across the two MFD's. The result was an entry back into a circular Earth orbit, right alongside the ISS. Cool, hey?

Have fun!

Brought to you for free by the BaseSyncMFD Developers!