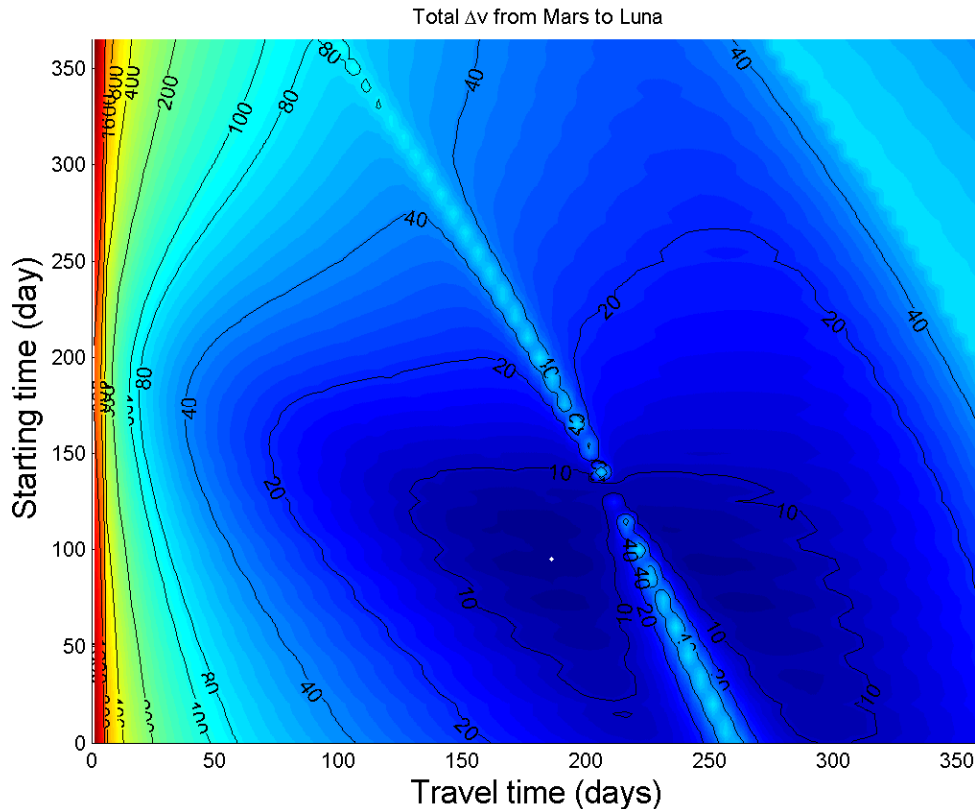


Reading porkchop plots

Here is my attempt at a "how to use a porkchop plot" tutorial:



You are at planet X and want to go to planet Y. You select the right plot. This plot will tell you how much energy you are going to need if you want to go from X to Y at a certain time and arrive at another time.

The colors denote the total amount of delta V needed for that particular combination of start and end time: red means a *lot* of delta V, while dark blue is a small amount. If your spaceship can produce a certain amount of delta V, then you can make the trip in the regions that require less. If you are a real cheapskate you will try to use one of the bluest regions (where a little white dot denotes the cheapest possible trip in the year). If you have resources to spend (hurray for your Oversight expense account!) you can deviate from this. However, if the required delta V is too large for your ship you will end up stranded: either you cannot catch up with the destination, or you cannot match speed with it and will just go past.

Now you find today's date on the vertical axis (I just used "days since 1 Jan 10 AF" here, but imagine it labeled with a nice almanac). If you want to start today, go right from this point. The horizontal axis denotes how many days the trip will last. The leftmost part denotes super-fast trips taking just a few days. They require enormous energy and go nearly in a straight line from X

to Y. Most likely your ship is only rated for a certain delta V, so you can't make these trips. Continue right until you reach the contour corresponding to your delta V rating (say 400 km/s for a standard transport). This point is the fastest trip you can make to your destination that your ship has fuel and power enough to do. If you continue to the right you will likely find slightly longer trips that take less fuel, up to a point. Beyond that lies less useful orbits: slow trips that take more fuel (and sometimes a really slow trip that happens to be cheaper because the destination lines up nicely with your approach).

However, sometimes it is smart to wait until later to launch. Especially for very weak ships like an old scum barge with plasma rocket there might not even be a feasible trip today. But if you wait for a while the planets will move and new trajectories become possible. If you go upwards in the diagram you can find regions of launch date/trip length that are feasible. Even if you have a pretty powerful rocket it is sometimes smart to wait a bit for a good alignment making the trip shorter.

Had this been a real interactive program you would have seen nice graphs of the suggested trajectory, navigation hazard information, slingshot possibilities etc. Generally the thin brighter green/cyan lines (sometimes looking like isolated points) represent trajectories that go pretty close to the sun. The diagrams could of course be extended arbitrarily far into the future, these just show trips starting within 10 AF that last less than 1 year (and doesn't round the sun more than once; back in the early days of space travel people often traded speed for fuel efficiency by taking very roundabout trajectories). For travel in the outer system pretty hefty drives are required for trips shorter than one year - if you can egocast it is usually the best alternative.

In practice this is the kind of stuff your navigation AI solves, with no need to think too deeply about delta V or any plots (unless you happen to be professional/old-fashioned about it, like a sea captain who likes to know how to navigate by stars besides GPS). You just tell the AI where you want to go and it gives you a series of likely options and their price-tags/risks. Some bickering later, and your course is set.

Further links

See the excellent Atomic Rocket site for an introduction to delta V, orbits and mission planning:
<http://www.projectrho.com/rocket/rocket3b.html>

For a taste of how one could do this interactively, check out
<http://astrojava.com/ballistic-trajectory-planner>

It is a somewhat temperamental program that has many options I have little or no clue about, but at least one can double-click at a point in the porkchop and then switch to the selected trajectory tab to see how the orbit looks.

JAQARsoftware.com has downloadable software that appears to be able to analyze and produce trajectory calculations:

<http://www.jaqarsoftware.com/JAQRastro.html>
<http://www.jaqarsoftware.com/swingby.html>