



Evolution of Martian Trajectories

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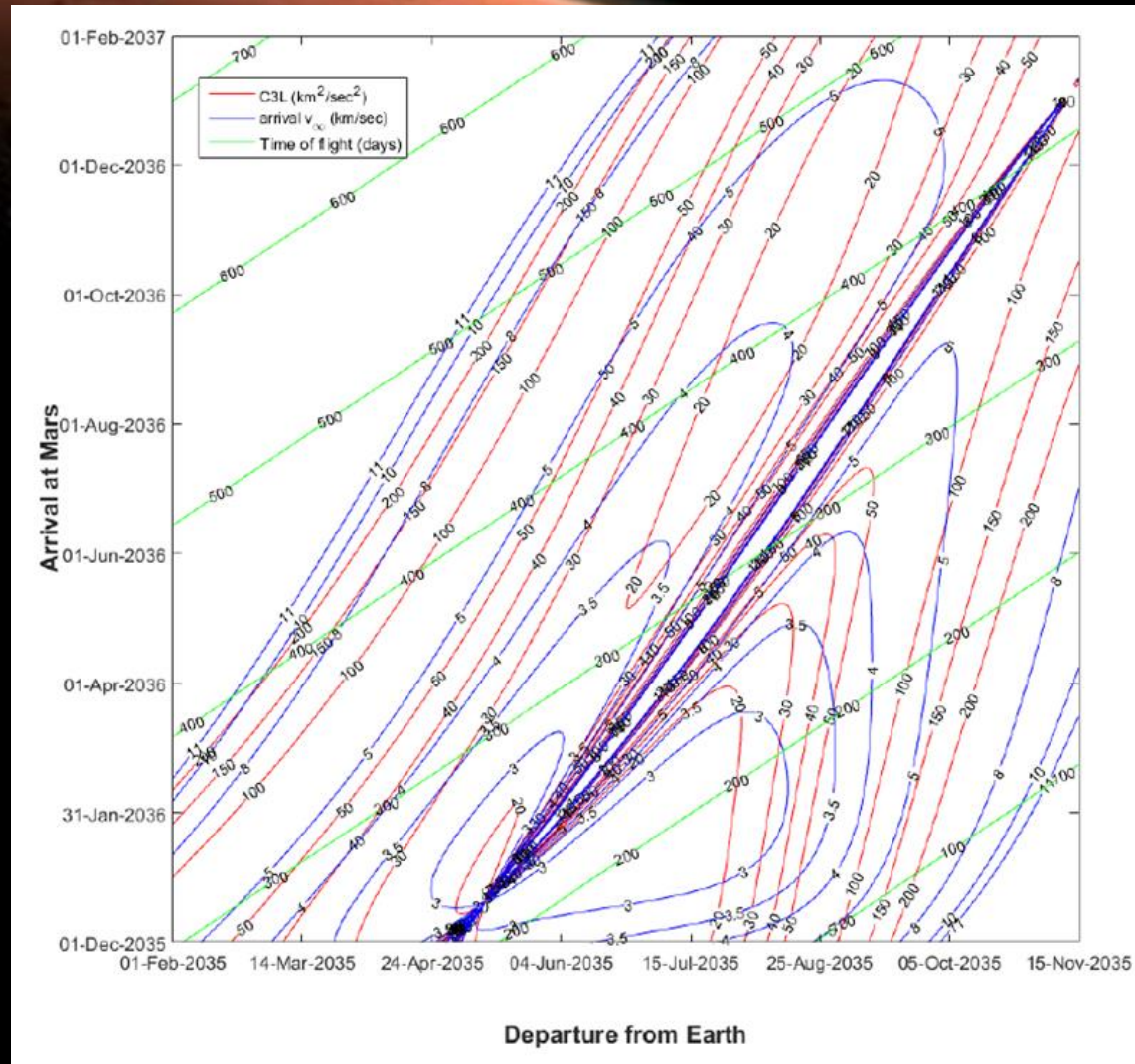
Intro to Orbital Elements

- a = semimajor axis
- e = eccentricity
- i = inclination
- Ω = longitude of the ascending node
- ω = degree of periapsis
- v = true anomaly



When determining an orbit...

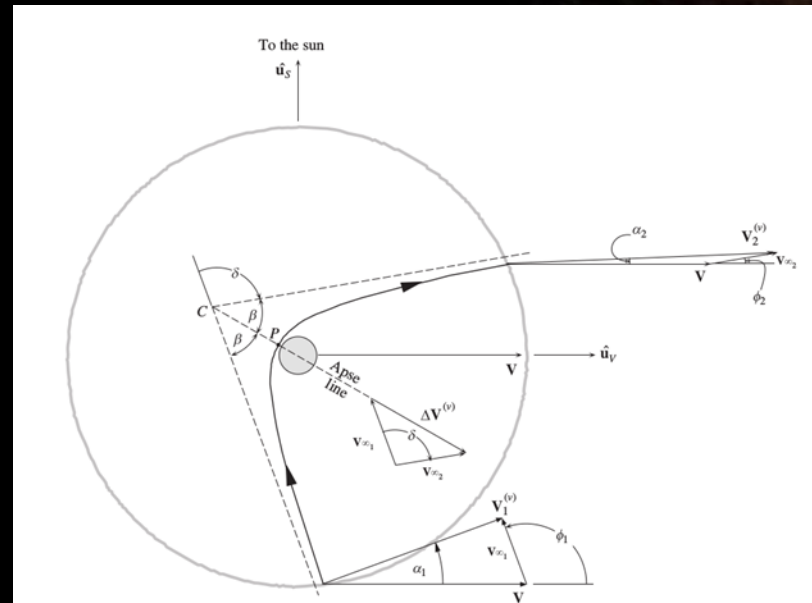
There are a lot of things you have to consider



A porkchop plot is shows many of these

What we have done so far...

- Flybys (Mariner 4,6,7) – hyperbolic trajectories
- Orbiters (Starting with Mariner 9) – circular or elliptical orbits
 - Aerobraking (Starting with MGS) – changes orbit without using fuel



What's Coming Next...

- Solar Sails and Ion Propulsion
 - These technologies will change the way we calculate orbits
 - Minimize fuel use
 - Decrease travel time

We will have to change the way we treat maneuvers

Sources

- “Destination Mars” by Rod Pyle
- “Fundamentals of Astrodynamics” by Bate, Mueller, White
- “The Case for Mars” by Robert Zubrin
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- <http://help.agi.com/stk/index.htm#training/tq-hohmann.htm>
- https://www.jpl.nasa.gov/news/fact_sheets/mariner.pdf
- <https://www.space.com/2439-tricky-task-aerobraking-mars.html>
- <https://github.com/poliastro/poliastro/wiki/Patched-conics-computations>
- https://en.wikipedia.org/wiki/Mariner_4
- https://en.wikipedia.org/wiki/Mariner_9



Questions?