ASEN 6008 – Interplanetary Mission Design

Lab 3: Non-Hohmann Transfers to Mars

Answer Sheet

Due: February 15, 2017

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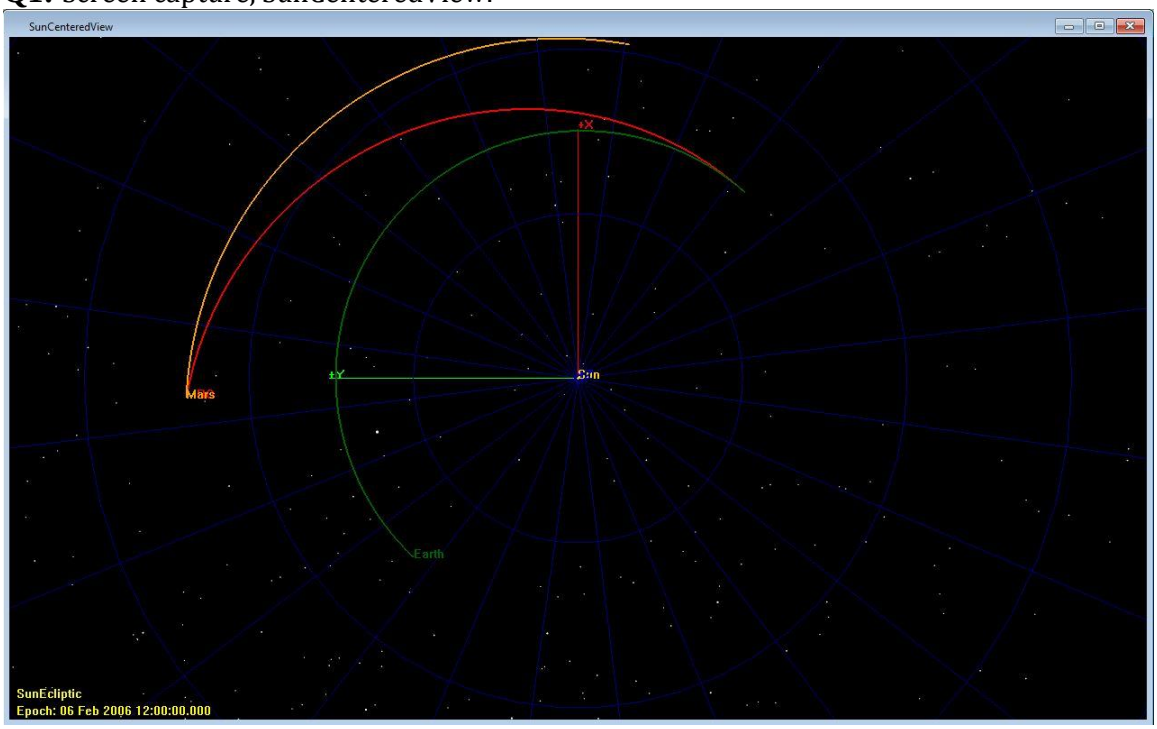
Q1: Screen capture, SunCenteredView.



Q2: How is this transfer different from a Hohmann Transfer?

1. The change in true anomaly on the transfer orbit between departure and arrival is less than 180 degrees.
2. MRO does not arrive at Mars at apoapsis of the transfer orbit.
3. The time of flight is less than that of a Hohmann transfer from Earth to Mars.

Q3: What happens if you keep these values 0?
The Newton-Raphson algorithm in DC1 would not converge because it would continually add fractions of zero to the solution, never changing it.

Q4A. Why did the initial targeting attempt fail to converge?
The perturbation value in the "Vary" commands was too small, so the solver couldn't test sufficiently small changes to delta-V.

Q4B. What can you do drive the solution to convergence?
Change the perturbation from 1e-5 to 1e-8.

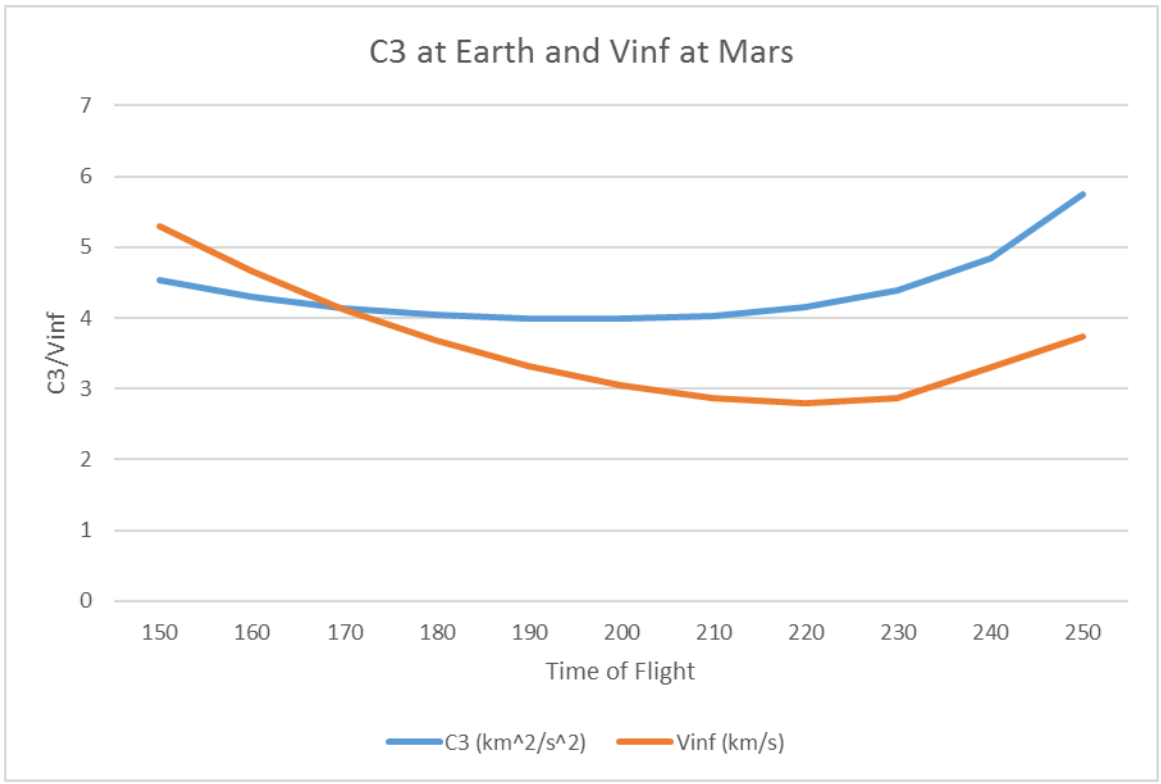
Q5. ΔV_X __2.737__ ΔV_Y ___2.781_____ ΔV_Z ____1.039__

Q6A. C_3 at Earth ____16.3067 km^2/s^2_____

Q6B. V_∞ at Mars _____3.67965 km/s_____

Q7. Plot: C_3 at the Earth

Plot: V_∞ at Mars



Results Table

Transfer Duration	C_3 at Earth (km^2/s^2)	V_∞ at Mars (km/s)
150	4.526085324	5.299683706
160	4.299165933	4.661531842
170	4.140370653	4.124697746
180	4.03821528	3.68000404
190	3.987187342	3.323127893
200	3.982938331	3.051646928
210	4.033400344	2.87230588
220	4.157042044	2.799104556
230	4.394361729	2.85937193
240	4.84014621	3.295858755
250	5.739225786	3.732345581

Q8. What do you think is the best arrival date and trip duration for this mission and why?
The best trip duration is 200 days, based on the low C3 and low Vinf values this will be the most fuel efficient.

Q9. Is this an efficient way of solving for the mission design parameters? How could we speed up the convergence process?
No. This takes far, far, too long for preliminary mission design.