16.346 Astrodynamics
Fall 2008

Exercises 09

Mars Reconnaissance Orbiter

The NASA Mars Reconnaissance Orbiter Mission was launched from Cape Canaveral on August 12, 2005 and is expected to arrive at Mars on March 10, 2006.

1. Find the launch and arrival times in Julian days.

2. Find the flight time in days and the transfer angle in degrees.

3. Determine the position and velocity of the earth at the time of launch and Mars at the time of arrival. The two position vectors determine the transfer orbital plane.

4. Find the inclination angle of the orbital plane of the spacecraft in degrees.

Note: Do **not** assume coplanar orbits for the planets. **Use the Gaussian value of μ.**

5. Find the longitude of the ascending node Ω in degrees.

6. Determine the parameter p of the optimum single-impulse transfer orbit from earth to Mars.

7. With this value of p, calculate the semimajor axis a, the angular momentum vector **h** and the eccentricity vector **e** of the MRO orbit.

8. Use the Lagrange time equation with the optimum value of a, calculated in Part 7, to determine the transfer time for the optimum single-impulse orbit.

9. How does this calculated time-of-flight compare with that of the NASA MRO mission?

View from Trajectory North Pole
(30 day tick marks)