ENAE 791
Spring, 2004

Problem Set 1
Due March 11, 2004

You are controlling a lunar sample return spacecraft, approaching Earth at escape velocity. Your intent is for it to pass through Earth's atmosphere multiple times until you can place it in a circular low earth orbit to await retrieval. Assume the perigee altitude of each aerobraking pass is 100 km. You plan for four aerobraking passes, each of which reduces the spacecraft's *total energy* by the same amount. At the end of the fourth pass, the spacecraft will be in an elliptical orbit with an apogee of 500 km.

1) For each of the aerobraking passes, calculate the new apogee altitude.

2) What is the total time required from the first aerobraking pass until the spacecraft arrives at the final circular orbit?

3) What ΔV will be required to circularize the spacecraft's orbit after aerobraking is complete?

4) After the last aerobraking pass, and before you circularize at 500 km, you have a major systems failure and you realize you will have to do a direct atmospheric entry and landing. What ΔV will be required at apogee to enter the atmosphere at an altitude of 130 km with a flight path angle γ=-3°?