

ENAE 791 - Spring, 2008  
Mid-Term Exam

Posted 4/10/08  
Due 4/15/08 3:30 pm (class time)

Just to be sure everyone is on the same page, this is an **examination**. That means you can use notes, books, computers, whatever, but you cannot discuss it with each other or with anyone else. This must be your own, individual work. If you have any questions or need clarification, contact me via e-mail ([dakin@umd.edu](mailto:dakin@umd.edu)) and if it might be of general interest, I will also post the answer on the course web site (<http://spacecraft.ssl.umd.edu> and follow the academics link), so check the web site periodically during the exam period. Good luck!

1. To support extensive lunar exploration, a staging base has been constructed at the Earth-Moon L1 libration point. For the purposes of this question, assume that this is just a circular Earth orbit with a radius of 300,000 km. Your task is to calculate the details of a deorbit maneuver and atmospheric entry from this station. Your ideal entry condition is a flight path angle of  $-4^\circ$  at a defined entry interface altitude of 122 km.
  - a. Calculate the  $\Delta V$  to depart the circular orbit and enter Earth's atmosphere. What is the equivalent perigee altitude for the deorbit ellipse? (i.e., the perigee you would have if you did not encounter Earth's atmosphere or its surface.)
  - b. What is your velocity at entry interface?
  - c. What is the time interval from deorbit to entry interface?
  - d. Your deorbit burn is 1 m/sec lower than the calculated value in (a). What will your flight path angle and velocity be at entry interface on this trajectory?
  - e. What is the physical separation ( $\Delta$ angle around the Earth) between the nominal entry interface and the actual one specified in (d)?
  - f. On the incorrect trajectory specified in (d), you get measurement data to realize that you are on the wrong trajectory three hours prior to entry interface. What is your orbital position and velocity at this point?
  
2. There will be a question 2
  - a. This is part a
  - b. This is part b
  - c. This is part c
  
3. There will be a question 3
  - a. This is part a
  - b. This is part b
  - c. This is part c
  - d.