Some Guidelines for the ENAE 791 Final Project
May 5, 2020

Hi, folks. Somewhat late, I wanted to clarify what I'm looking for in the final projects for ENAE 791. Just to start, let's acknowledge the obvious - there aren't going to be any more problem sets, and the grading will be based on the first two homework and the final report. (Actually, I plan to take all of the trials and tribulations of this term into account in the grading, so I don't think any of you need to worry too much about your grades - as long as you make an honest effort to use the material from the course in your term project, you should be happy with the outcome.)

Here are some of the things I plan to look for in reviewing your final projects. This is not to say that you must have all of these elements present in your project, these are just some examples of what I believe you should be able to accomplish using the material of the course. You should feel free to hit as many of these elements as you reasonably can, and don't worry if some of them don't get done. (This is especially true for anyone doing a solo project.) I do want to see some content in both launch vehicle and entry vehicle design, through.

- Launch vehicle design
    - Parametric vehicle trades (e.g., payload mass, number of stages, types of propellant)
    - Optimization (preferably based on cost, but could be on mass)
    - Expendable vs. reusable
    - Vehicle detailed design based on mass estimating relations
    - CAD images
    - Trajectory simulation*
- Entry vehicle design
    - Selection of size, mass, ballistic coefficient, and L/D
    - Calculation of entry velocity
    - Trajectory simulation
        - Trade study on entry flight path angle
        - Maximum g load on entry
    - Maximum cross-range calculation
    - CAD images
    - Heating rate*
    - Heat shield analysis*
- (For those on the original project with teams) Cislunar design
    - Trade studies on staging sites (do you stop/refuel/transfer payloads in LEO, low lunar orbit, somewhere in between…)
    - Launch vehicle requirements (do you drop off payload in low Earth orbit, send it directly to lunar orbit, all the way to the lunar surface?)
    - Trade studies on propellant choice, transfer vehicle sizing
    - Trade studies on reusability vs, expendable systems
    - CAD images
- Systems integration
    - Cost spreading of nonrecurring costs using beta function
    - Learning curve effects on multiple vehicles/flights
    - Overall cost summation (year-by-year and total)
    - Calculation of cost/flight and cost/kg of payload
    - Calculation of system resiliency

The final project should be documented either via a slide presentation (e.g., Powerpoint) or as a document (e.g., Word/LaTeX) - whichever is easier for you to do. It is due on the last day of

finals week (Wednesday, May 20). Feel free to contact me at dakin@umd.edu if you have any questions or need help.

* ”reach goal” - something briefly covered in lectures, but might be tough to actually accomplish since we didn’t cover it in depth. Try if you want to, but think of it like “extra credit”