

16.82 Assignment 1: Introductory Trade Studies

Work in your groups

- Oral presentation of findings in class on 9/18 (2 members from each team)
- Written reports are due in class on 9/23 (individual progress report)

Feedback will be given between the oral presentation and the report deadline.

Objective: investigate various component options and identify key parameters and trades.

Each group should select (email us with your first and second choices on Friday) or will be assigned one of the following categories, each of which is anticipated to be a component of your final vehicle system.

- Communication: Communication devices and computers
- Sensing: Sensors and Cameras
- Vehicle: Batteries and Motors
- Control: Control algorithms

Each group should also consider other important trades from the full list of topics on pages 10 and 11 of the initial course announcement.

The assignment web page (<http://clohessy33.mit.edu/cdio/datasheets>) gives several options for each component including links to their product websites and datasheets. Your investigation should cover *every* option given in your section and *at least one more* from your own research. You should

1. Understand the specifications and identify critical parameters;
2. Investigate trades between parameters;
3. Discuss implications of your component choice on others.

Your results should be *quantitative* as far as possible. When meaningful, consider trade space plots of one parameter against another. You should also think “beyond” the datasheet: do you have all the information you need? What other issues might affect a choice of component for your project?

Group that chooses the control algorithms: in place of component options, you are provided with four different Simulink models, each of which represents a different control strategy for an example system $G(s) = \frac{1}{s^3}$. (This is not a model of the quad-rotor

but has some difficult features that the vehicle is anticipated to share, such as a slow response following from a large number of poles at the origin.) Each Simulink model also includes different options, chosen using the ‘Selector’ block. You should simulate step responses and analyze each controller and then compile quantitative and qualitative comparisons between the requirements and performance of each option. You should also investigate *at least one more* controller option of your own choosing. *Your findings should cover the same items 1-3 as above.*