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2.007 Design and Manufacturing I
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ME 2.007 SECTION 00

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1. REVIEW 1 - STRATEGY, DESIGN CHALLENGES, AND DESIGN CONCEPTS

On Monday February 23rd, we will have informal presentations covering the first three weeks of the course.

1.1. **Topics.** These presentations are expected to cover three things you have done in the first three weeks:

- (1) Your overall strategy for the competition
- (2) Key tasks or functions implied by these strategies
- (3) Preliminary design concepts to accomplish these tasks

A *design concept* is a means, within the kit materials, of accomplishing the tasks required. Don't worry about becoming "locked in" – this is a preliminary design and can be altered later as circumstances dictate.

1.2. **Format.** Presentation format is up to you, and I suggest some content below. You must be able to discuss (1-3) in the allotted time (see "Schedule" below). I would view this as a "pitch" meeting: you are trying to convince your peer group and myself that (1) your strategy is a good one, (2) you have identified the key tasks/functions that are design challenges, and (3) have some reasonable (and justified) concepts for attacking these challenges.

1.3. **Schedule.** Every student will get 10 minutes to present, with 5 minutes for presentation and 5 for questions/discussion. The 5 minutes for presenting is soft, but I will allow a *maximum* of 7 minutes for presentation so that *some* discussion occurs.

On February 23rd we will go by the following schedule:

1:30-2:10: *BC-KS* (Jamie, Emily, Vibin, & Dan)

2:20-2:50: *Boston* (Ben, Steve, & Toomas)

3:00-3:50: *McCormick* (Kam, Rachel, Jon, Arin, & Arielle)

(The peer groups will be mixed up for future presentation sessions so that no one group gets an implicit advantage by always presenting last.)

1.4. **Content.** The following is an outline of the content that will help address (1-3).

- Describing Your Strategy.* Outline what your robot will do. Which tasks (e.g. can crushing, bale stacking, plant stealing)? In what order? Can you write out a second-by-second schedule for your robot, including the first "autonomous" 10s?

- *Justifying Strategy.* You *must* justify your strategy using the scoring formula. Clearly identify the variable values (e.g. number of cans stored, feet plant moved, etc), parameter values (e.g. time to stack 1 bale at level 1, energy to stack 1 bale at level 2, etc.), constraint satisfaction (e.g. total energy less than 20 kJ), and describe any assumptions you have used. This does not need to be perfectly accurate at this point. In particular, how does the scoring formula and the problem constraints help you build *specifications* and *targets* for your key tasks?
- *Functional Decomposition.* Clearly describe five *functional requirements* of your design. For each one, describe how your design concepts address these functional requirements.
- *Benchmarking.* Many engineering problems are already elegantly solved. I would suggest looking to existing devices to generate some ideas for design concepts. There is a lot of available information on the internet, but I *highly* recommend “real-world” exploration. For example, organize a trip out to Home Depot or Lowe’s with your peer group to explore.
- *Sketches.* Sketch your design concepts in “engineering form.” For example, include multiple views, relevant dimensions (as symbols and as guesstimate values), contacts, forces and torques (i.e., draw out free-body diagrams). This is not to say your drawings should be perfectly drafted or need to be CAD drawings (but they can be, if you are very comfortable with CAD). Your sketches should still be initial, but should also illustrate your understanding of the decisions you will need to make and the analysis that will help you make them.
- *Analytical Models.* Briefly describe the calculations you have done (or will do) to justify and finalize your design. You do not need to go through all the gory details, just give your audience a “30,000-foot view” of the physics you are using (or will use) to inform your decisions.
- *Prototype.* One of the best things to do is to make a simple prototype, even if it is made out of paper and trash. Bring a simple physical prototype of at least one design concept. This can be made of simple materials and does *not* need to be functional. This could also be an existing object that you intend to mimic or modify in your design (excluding the simple car from the first lab).

1.5. **Brief Report.** Please prepare a brief report on (1-3) that you can hand out to your peer group and myself. Remember you are trying to “sell” your peer group and myself on your strategy and concepts you have chosen (the content described above is a good way of doing that). Why should you be allowed to work further on these concepts?

While there is no page requirement, I would guess about 2 pages of straight text, and 5-6 pages including (detailed) sketches. Being concise can help. The overall format is not important, so long as you present a convincing argument for your strategy and concepts. For example, you can photocopy pages from your lab notebook, as long as we can all follow the logic of your argument contained there.