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2.007 Design and Manufacturing I
Spring 2009

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Milestone 3

Develop Concept and Finalize Car Design

Schedule for: week of 16 - 20 February.

Deliverable: 3-5 pages in your lab notebook before next week's lab

Week's Activities

It's important at this point to look ahead to a **major milestone**. Looking at the schedule, you can see that in the week before spring break, the weekly milestone says, "Demonstrate MCM." In other words, before spring break the schedule is for you to demonstrate your Most Critical Module (MCM) on your car. Specifically, you should be able to drive out of the Starting Box and perform, within the next 60 seconds, the functions assigned to your MCM as called for by your strategy.

Then after vacation, you will complete and integrate your other modules, and refine your design as appropriate.

Looking now at the weeks between now and spring break, you see the stages of concept development, MCM design, MCM fabrication (two weeks), and MCM demonstration.

What is a Most Critical Module? A "module" in the sense it is being used here is a major subsystem of your over-all design; i. e. the total system could be partitioned into a set of modules, like the car (platform) itself, a bale mover and stacker, and a plant puller. A module is a part of the system that you should be able to build and test separately from other modules. The "most critical" module is then that module which you think is most challenging or most difficult or most important to your strategy. Accordingly it should be completed first to reduce risk.

1. Concept Selection

If a "strategy" describes what you want to do, the "concept" begins to detail how you will realize the strategy. Next week you will do the related design design; this week you are to select your concept.

Selecting concepts is part of the creative side of design, so be sure to give your imagination/ideas free rein. Brainstorm with your peer group or other people, look at previous year's machines, play with kit materials on the table, etc, etc to get three different concepts. I suggest you focus on what you think will be your MCM, but don't forget about where the other modules will go and what they will need in terms of resources, etc. For instance, if you choose to crush cans, your three concepts might be to crush end-on-end, to crush sideways, or to hammer into submission.

Develop these concepts so that you are convinced they are feasible, and then compare them in some systematic fashion. As always, it is easier and more accurate to make relative judgments, so make one of the concepts the reference concept and compare the others to it.

It's often useful to do creative work iteratively, so you might want to make a preliminary down-selection to two concepts from three, refine them, then make a final selection. Feasibility is key. You need to demonstrate that you have the energy, time, materials, actuators, etc to realize your concept.

2. Car (Platform) Final Design

Last week you were asked to a preliminary design for your final car; this week the task is to finalize the design. In particular, as your concept emerges and is finalized, you will want to draw the implication for your car design. For an example, if you came up with a fairly substantial bale lifter which you were going to mount on the front of your rear wheel drive car, you might want to think carefully about the impact of the center of mass of this design on drivability. As a second example, if you are planning to position a release arm $\pm 1/4$ inch to get cans into the storage slot by moving the car, you will want to think carefully about car design factors that enable precise positioning. (Or experiment with your simple car with an arm of some sort stuck out in front.)

As you've had two lectures on CAD by now, use CAD to the extent possible to document your design.

Milestone 2 Specific Deliverables

As for last week, turn in your lab notebook to the collection box at your section's designated time, with the comments of your peers written down in them. You are entitled to correct/fix/change any issues or problems your peers may have discovered or noticed, so add these into your notebook. Changes like this reflect your learning from your peers. Remember the primary purpose of the peer review is to avoid problems so you do not get into the position of finding problems way downstream when they are likely much harder to fix.

1. Concept Summary

Summarize your selected concept for implementation of your strategy and summarize the process of how you came to this decision. Show what aspects of feasibility you have considered. If you modified your strategy in any particular way, i.e. you realized your scoring estimate was too high when you did your strategy and/or your time line need to be modified, make these changes.

2. Final Car Design

In your lab notebook, provide your car design specifications in a table. Then provide the necessary drawings and manufacturing process drawings as well. The design should be "complete." This means that someone reasonably skilled in 2.007 practices, e.g. Dan Frey, one of the lab guys, one of your fellow students, or even perhaps me, could manufacture your design from the documentation in your notebook without having to ask you a stack of questions.

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