

Project Timing and Requirements

As you know, this semester your design project consists of a competition where you need to design and build a vehicle to connect to an existing launch mechanism. The vehicle that travels the **longest distance** wins. Your design must travel in a **controlled** and **repeatable** fashion. You will work in teams and are expected to use your course notes as resources. *Your work is expected to be at the collegiate level, e.g. just taping a nail onto a skateboard will not result in a passing grade!*

TIMING

We will begin working on the designs when student teams are established. Work will continue on the designs throughout the rest of the semester.

| Date | Project Related In-Class Activities | *Project* Assignments Due |
|-------------------------------|---|--|
| Tuesday 22 OC | <ul style="list-style-type: none"> • Project Introduction • Establish Teams | |
| Tuesday 29 OC | | <ul style="list-style-type: none"> • Individual designs and descriptions <i>Paper submission</i> • Team Info <i>D2L submission</i> <i>1 per team</i> |
| Tuesday 12 NO | | <ul style="list-style-type: none"> • Technical Design Report <i>D2L submission and</i> <i>paper submission</i> <i>1 per team</i> |
| Tuesday 03 DE | <ul style="list-style-type: none"> • COMPETITION! | |
| Tuesday 10 DE 600-800pm | <ul style="list-style-type: none"> • PowerPoint presentations | <ul style="list-style-type: none"> • PowerPoint file <i>D2L submission</i> <i>1 per team</i> • List of tasks completed by each team member <i>Paper submission</i> <i>1 per team</i> • Teammate and self-evaluations <i>Paper submission –</i> <i>completed during</i> <i>presentations</i> |

Project Timing and Requirements

DESIGN CONSTRAINTS & SPECS

- Vehicle must connect to the existing launcher via a nut at the end of the launcher's 250" tow rope. The vehicle must travel under the launcher, through an opening that is 20" wide and 9.5" high. The races will take place on the main first floor hallway outside the machine shop and robotics labs.
- Each vehicle must weigh a minimum of 3 lb. Weigh-ins will occur prior to racing, and any vehicle that does not meet this minimum will not be allowed to race. This will affect your grade in a negative way.
- The connection between the car and the rope must not allow any upward force on the car. For example, hooks and slanted nails are not allowed.
- Energy from the launcher will be developed through the dropping action of a 10-lb weight, dropped 41.5". The only energy your car gets will come from the falling weight, hence batteries for servo motors, etc., may NOT be used.
- Much thought must be placed on getting cars to pull straight. Many cars fail by hitting the machine. Focus on mechanical steering techniques.

DESIGN PROJECT – Grading Rubric

The following grading rubric will be used to evaluate your design project:

- 5% Team Info (group submission: D2L)
- 10% Individual Design Sketches and Description (paper submission)
- 45% Technical Design Report (group submission: paper & D2L)
- 10% Car Performance During Competition
- 25% Group PowerPoint Presentation (group submission: D2L)
- 5% Teammate and Self Evaluations (individual submission: paper)

TEAM INFORMATION (5% of project grade)

Try to form teams of 4 remembering that scheduling is key for a successful team. Then each Team Captain will submit to D2L the following information:

- The **names** of the members of your team, listed alphabetically by last name. Identify the **team captain** parenthetically next to their name.
- The contact **email & phone number** of each team member. You may include additional email addresses, but please make sure to include each team member's student Kennesaw email address.
- A **photo** of each teammate, and the **team name**

The Team Captain will also email this document to all teammates to ensure the information is correct.

Project Timing and Requirements

INDIVIDUAL DESIGN SKETCHES & DESCRIPTION (10% of project grade)

Each student will submit their individual designs. They should be **sketched** in pencil on green engineering computation paper and submitted during class. Include enough sketches so that I can easily see the concept that you are proposing. Include relevant dimensions. You also need to include a **written paragraph** describing your design. This must be typed and stapled to your design. The method by which your car will connect and then disconnect from the launch mechanism must be clearly described, as well as whatever mechanical technique you will be using to ensure that your vehicle is pulled straight.

You will need a **high-quality digital scan** of your individual sketch for both the Technical Design Report, and your PPT. Hence, make a scan of your individual design **before** you turn it in. Note that photographs of your individual design are not allowed in either your Design Report or your PPT – so you must get that high-quality scan prior to turning it in.

Note that you should NEVER – **EVER!** – take a photo of something and then put it in a professional report (or PPT). That being said, you can use your camera to create **pseudo-scans**. There are a lot of apps that do this. I like Office Lens because it is good, and it is free. (The Notes app on iOS devices also works.) In Office Lens, set it to “document” and then create the scan using your phone or tablet camera. You then need to apply a filter to the photo to make it look like a scan. I most often use the black and white document filter, but that depends on whether I need/want color.

TECHNICAL DESIGN REPORT (45% of project grade)

Each group will submit one technical design report. Your report will be typed, double line spaced, 12 font Arial font, justified alignment – and housed in a report cover. Pages must be numbered. This should be very professional, and as such it will be something that you can show potential employers as you look for co-ops or paid internships. The Team Captain will also submit a complete digital copy via D2L.

- **Title page**
Identify the team name, each team member’s name, the team captain and date. List member names alphabetically.
- **Table of Contents** (5 points: title page + TOC)

Project Timing and Requirements

- **Introduction (10 points)**
Describe the problem and summarize the needs of the design in terms of the corresponding goals that are sought in an optimal design solution.
- **Alternative Solutions Developed**
As you know, each team member was tasked to develop an individual design solution. They should be shown and described here. Use the high-quality scans and written description from the previous assignment. Photographs of individual designs will not be accepted.
- **Design Matrix**
Include the design matrix that was used to develop your final design solution. Each alternative design (a minimum of one per team member, plus likely a hybrid or two developed by the team) needs to be evaluated on weighed selection criteria. These criteria need to be weighed between 0-1, with each design scoring between 0-10 on each criterion.
Describe why each criteria weight was assigned, and why each alternative was scored as it was. The results of your design matrix should be discussed and justified in detail. Be certain that all of the decisions that your team made in developing and selecting your final solution are stated explicitly.
- **Final Design Solution (50 points: alternative, matrix + final)**
The final design solution should be described in sufficient detail such that the reader will be able to recognize both its strengths and its weaknesses. Sketches and CAD drawings (optional, unless you are in a Graphics Learning Community) should be included. As with the individual sketches, make sure that you describe how your vehicles will connect and then disconnect from the launcher. Also complete a free body diagram (FBD) of the final design. You do not need to complete an equilibrium (statics) analysis to solve for unknown forces.
- **Bill of Materials (BOM) (10 points)**
Include a table that lists the parts needed, quantity, cost of each, where to buy, part number or other descriptor, shipping costs, and the total cost at the bottom. To be clear, this should actually be a table format. Set the cost of 3-D printed parts to zero. Some stores will donate parts for educational endeavors such as this, up to a certain value, such as \$50. Ask the manager on duty, showing them your design and student IDs (and asking very nicely!)

Project Timing and Requirements

- **Fabrication and Assembly Instructions** (10 points)
Include instructions so that a machine shop technician can understand how to make your device from the parts listed in the BOM. You should include sketches, as needed, to help with the instructions.
- **Conclusions** (10 points)
Comment upon whether the final solution satisfies the original design goals that were sought. Do not blindly defend your design: instead, be honest in your evaluation and conclusions.
- **Bibliography** (5 points: *Bibliography + Meeting Attendance*)
Following standard style guidelines, list all references and other resources (e.g. people) used in the development of the design and the report. Note that at the minimum, these Project Requirements should be included. And whatever source you used for the FBD.
- **Meeting Attendance**
Keep a log of each meeting. The days, times, and list of persons in attendance.

TECHNICAL DESIGN REPORT – Grading Rubric

The following grading rubric will be used for the technical design report:

| | |
|-----|---|
| 5% | Title / TOC |
| 10% | Introduction |
| 50% | Alt Soln / Design Matrix / Final Design |
| 10% | BOM |
| 10% | Fabrication & Assembly |
| 10% | Conclusions |
| 5% | Bibliography |

CAR PERFORMANCE DURING COMPETITION (10% of project grade)

During the competition, each team will be allowed to launch their vehicle three times. Each launch will be worth 10 points, for a total of 30 points possible. Grades on D2L will be shown as a percent. Points will be earned using the following rubric:

- +5 points** Earned if the vehicle can be launched. Meaning that it has met the minimum weight of 3 pounds and is structurally sound.
- +3 points** Earned if the vehicle makes it through the launcher's escape hatch

Project Timing and Requirements

- +1 point** Earned if the vehicle proceeds 10 feet past the launcher
- +1 point** Earned if the vehicle proceeds at least 20 feet past the launcher

POWERPOINT PRESENTATION (25% of project grade)

During our last class meeting you will give a presentation. It will be 3 minutes minimum and 5 minutes max, with a couple of minutes afterwards for Q&A. Below you can find required content – including point distribution - and hints.

- **Title Slide & Outline Slides & Car (10 points)**
Include the team name and individual team member names, listed alphabetically. Then include an outline slide. As was demonstrated in class, use grayed out text with black text to step your audience through the PPT progress. Bring your car to the presentation.
- **Individual Designs (10 points)**
Briefly describe, using both words and sketches, alternative designs that were considered. Here is where you need to include the high-quality scans of the individual designs. Photographs of individual designs are not acceptable.
- **Design Matrix (10 points)**
Show your design matrix. What were the criteria used for assessing the designs? How were the criteria weighed?
- **Final Design (10 points)**
Highlight the key features that made this design a winner.
- **Bill of Materials & Actual Cost (10 points)**
How did your actual costs compare to the anticipated costs?
- **Construction Process (10 points)**
Show photos and/or video of the construction process.
- **Testing (10 points)**
Show photos and/or video of your testing. What was learned during testing? Were any changes made?
- **Race Day Results (10 points)**
How did your car perform? How did this compare to other vehicles? Show videos and/or pictures.

Project Timing and Requirements

- **Reflection** (20 points)

This is a woulda/coulda/shoulda analysis. If you knew a month ago what you know now, what changes would you make to your car, your team interactions, and/or your process? Looking at the point distribution of the PPT, you'll see that this reflection should be well thought out.

Presentation Hints:

1. I expect that each member of your team will speak, and that you will be *practiced and professional*, but you do not have to dress up. Did I say "practiced", yea well I'm saying it again: **practiced!**
2. I suggest that you use the *KSU PPT template*. It can be found on our D2L site.
3. As was stated in the Individual Design section, either use scans or pseudo-scans with a document filter, but never include photographs of written work in a PPT. It looks extremely unprofessional.
4. Make sure your font is large enough to read in the back of the class – no smaller than 20 points is a good rule of thumb. Avoid too many words on a slide and then reading it aloud like a book. You will *not be allowed notes or a script* to read during your presentation. You should already know well what you want to say, and these props are unprofessional.
5. Make sure that you print out your **task list** (who did what) and have it signed by every team member. You'll give that to me as you go up to give your presentation. See below.
6. **Submit your PPT via D2L.** I suggest that you try to embed your videos in the PPT, but also include them in the submission folder.
7. You will be completing **peer reviews** of both yourself and each of your teammates. See below.

List of Tasks & Final Meeting Attendance

Just prior to your PPT presentation, you will submit to the professor a **typed list** of what each team member did to contribute to the report, vehicle, race and PPT. These task lists need to be **signed** by each team member. Additionally, you will need an **updated meeting attendance list**. This should repeat the information in the design matrix, and also include attendances for the construction of the vehicle, race, and writing of the PPT.

Project Timing and Requirements

TeamMate and Self Evaluations

At the end of the semester, you will have the opportunity to evaluate how much time each member – including yourself – devoted to the success of your team, and their effectiveness towards this goal.

Team Captain Responsibilities

Each team must elect a captain. The responsibilities of the Captain include:

1. Submit the team's contact info to D2L. Also email this info to your teammates to ensure that contact info is correct.
2. Take meeting attendance, which will be attached to the Design Report, and again attached to the List of Tasks.
3. Communicate with the team about meetings, etc.
4. Communicate with professor on behalf of the team.
5. Submit the team's Technical Design Report via D2L.
6. Submit the team's PPT via D2L.

Relevant Clichés

Two clichés are particularly relevant to our design project:

20% of the people do 80% of the work. This is true way too much of the time, and it will not fly in this class! I will encourage participation from each team member by requiring meeting attendances to be included in the report, requiring a list of who-did-what prior to the PPT presentation, and most especially by having all teammates evaluate each other.

KISS = Keep It Simple, Stupid! When choosing between alternative designs, it is almost always best to choose the simpler alternative. But that being said, don't forget that this is a collegiate-level design experience, requiring a collegiate-level amount of work and attention to detail.