ME 482 Fall 2021
Final Report

I. Submission Deadlines

Submission

• Submit your final report in pdf format via email. Use subject line “ME482 F21 - [Project Title] - Final Report”
• The final report is due no later than 8:00 AM on Monday, December 13, 2021

II. Rubric

<table>
<thead>
<tr>
<th>Item</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>0.05</td>
</tr>
<tr>
<td>Executive Summary</td>
<td>0.05</td>
</tr>
<tr>
<td>Purpose, Importance, Impact</td>
<td>0.1</td>
</tr>
<tr>
<td>Problem Definition (objectives, requirements, success criteria, governing or limiting physics).</td>
<td>0.1</td>
</tr>
<tr>
<td>Design</td>
<td></td>
</tr>
<tr>
<td>Concepting (concepts, concept of operations, system architecture, global models etc.)</td>
<td>0.05</td>
</tr>
<tr>
<td>Systems (subsystems, interfaces, global budgets and models, etc.)</td>
<td>0.05</td>
</tr>
<tr>
<td>Technical Details</td>
<td>0.1</td>
</tr>
<tr>
<td>Implementation</td>
<td></td>
</tr>
<tr>
<td>Manufacturing</td>
<td>0.1</td>
</tr>
<tr>
<td>Component testing and verification (model validation)</td>
<td>0.15</td>
</tr>
<tr>
<td>System testing</td>
<td>0.15</td>
</tr>
<tr>
<td>Conclusions</td>
<td></td>
</tr>
<tr>
<td>Context, critique, and recommendations</td>
<td>0.05</td>
</tr>
<tr>
<td>Appendices</td>
<td>0.1</td>
</tr>
<tr>
<td>Overall</td>
<td></td>
</tr>
<tr>
<td>Style, formatting, compliance, conciseness, effectiveness, grammar, etc.</td>
<td>0.05</td>
</tr>
</tbody>
</table>

We have been working on this for a year, so I expect you to be able to demonstrate the tools and “vocabulary” we have been working on all year. You should be able to polish off your CDR as a starting point.
III. Key Goals

- Provide a complete, concise overview of every aspect of your design project.
- Convince your audience that you found an effective solution to your design problem, given the constraints on your team.
- Provide an honest critique of your design and project management, as well as how both might be improved in the future.
- For the technical report, include every piece of information that would be required to completely recreate your design decisions and prototype.
- Demonstrate that you can produce high-quality technical documentation.
- Each student should independently reflect on the experience: design process, team process, existing solution/prototype etc. Close your feedback loop. Determine how you would do anything better or different next time. (This part is graded individually for each student and is part of the individual contribution multiplier.)

IV. Guidelines

Technical Report (Word Document, 50 content pages maximum, in addition include Title Page, Executive Summary, References, and Appendices)

The goal of this document is to provide a thorough but concise review of your entire project. The main body of this report is meant to be a distillation of the final results of each milestone/aspect of the project, while the appendices are meant to be an exhaustive reference documenting your design and all of the analysis used to create it.

General Formatting Guidelines

- Use 12pt Times font.
- Number all pages after the Table of Contents in the lower right footer of each page.
- All references must be cited in the order they are used in the text using numerical listings (e.g., [1], [2-4]).
- All references must have full citations in the references section, linked to their numerical citations.
- Figures and tables must be centered in the middle of the page (i.e., no text-wrapping) and have a unique number and caption, also with numerical citations. No single figure should be larger than 1/2 page or be split across multiple pages.
- This is your opportunity to demonstrate you have learned something about design, and design communication. I.e. Although I am providing an outline below (so your report meets the ABET requirements) you are responsible to use the appropriate “vocabulary: e.g. concept of operations” in the appropriate places.

Outline

1. Title Page (1 full page)
   Include only the following:
   1. An initial title line with the text “ME482 F21 - Final Report”.
   2. A second title line with your own descriptive title for your project.
   3. A project/team/sponsor logo.
4. The full names of all team members, with team role titles.

2. Executive Summary (1 page maximum)

3. Acknowledgements (1 page maximum, centered on its own page)
   Use this section to thank your sponsor(s) at a minimum, as well as anyone else you wish to acknowledge for contributing to your project.

4. Table of Contents, List of Figures, List of Tables, and Acronyms
   Aside from listing the key section/subsection headings below and their associated starting pages, also include a list of figures, list of tables, and acronyms.

5. Introduction
   Describe the primary motivation for your project; the purpose, importance, and impact. Include details of the technical context, business context, and scope of your project. Note that this should be similar to the text from your Critical Design Review, but should be edited to fix any issues from that deliverable.

6. Problem Definition
   Define the overall goal for your project, the justified objectives, system level requirements, success criteria (edited based on new information if necessary), and constraints. Don’t forget to include mention that your solution was also required to be executable within the constraints of the time/funds/resources of your team and the class. Include the governing and/or limiting physics, which is a good way to justify your problem definition.

7. Design
   a. Concept Development
      Discuss your concept from the perspective of strategies, big picture, its ability to meet the objectives. Include other concepts considered only from the perspective of defending your choices.
   b. Final Design Overview
      Discuss the details of your final design (as edited during this semester). Include an overall assembly view with subsystems labeled and/or color coded for clarity. Describe all key features and subsystems, referencing your figure. Also include a photograph of your actual prototype. Create a detailed description of the mode of operation, making sure to include exactly what your end user(s) will experience as they set up and/or use your proposed solution. Provide technical design details and engineering analysis and models of all your systems, subsystems, and components. In the report body, focus on an overview of the analysis and present the results; full calculations should be included in the appendices (and direct your reader to refer to them when appropriate). For any software created as part of your prototype, display a flowchart of the logic of your code and refer the reader to your full source code in the appendices.

8. Implementation
   Document all details associated with the manufacturing process. Document all component, subsystem, and system testing. Frame all tests in the context of the predictive models and physics. Include details on the associated project requirement(s), the test protocol (with equipment used), the results, and the implications for your project. Present data in appropriate formats (e.g., tables, graphs, etc.).

9. Conclusions
   Did you meet all of your project requirements? Linking back to your validation results, describe your overall success in meeting the stakeholder objectives and overall project goal. Were your chosen project requirements truly valid in quantifying the success in meeting the goal and
objectives? If not, what might be changed? Were your expectations (or those of your sponsor) too ambitious? What project requirements, if any, should have been included and validated but were not due to limitations in time and/or resources? How successful was your project management strategy, and what did you learn from the experience? If you did not meet one or more project requirements even after design revisions, direct the reader to the “Conclusions” section below. Leave the reader with a suggested list of actions that could help your proposed solution better meet the overall project goal, stakeholder objectives, and project requirements. What would you have done to improve your design and/or validation process if you had more time and/or resources? Could another student team pick up where you left off? How should your sponsor(s) apply your findings most effectively?

Tell the reader what to think as the last part of the conclusion. Highlight your ability to meet your objectives.

10. References (start on a fresh page)
   As always, all references must be cited in the order they are used in the body text. Include citations for all figures as well. Use the American Society of Mechanical Engineers (ASME) citation format unless your project is better served by IEEE or similar.

11. Appendices (start each on a fresh page)
   a. A complete Bill of Materials, with a final budget total clearly emphasized at the bottom. Include links/citations for exactly where someone can obtain each item to reproduce the system. Don't forget to include all shipping and handling costs.
   b. [If applicable] Engineering drawings for all components that must be custom manufactured for your prototype.
   c. [If applicable] Electrical diagrams
   d. [If Applicable] Complete, thoroughly commented and cited source code that you wrote for execution within your prototype. Full URLs and author(s) for any borrowed source code must be included in the commented introduction to your code not in the normal references section.
   e. Manufacturing plans/details for components that you manufactured yourself. E.g. for 3D printed parts, state the 3D printer settings and build orientation used. For composite parts, materials, binders, ratios, etc.
   f. Assembly plans and/or users manuals for your complete prototype.
   g. Complete details of all engineering analyses you performed, including governing equations and/or model setup (or model source code), explanations of any variables and values used, and results. Be sure to properly cite all information from external references.
   h. Individual Reflections: (1 page per person max). Each team member should provide reflections on the process and the prototype. What would you do the same and what would you do different. Close your design feedback loop.