

Assignment 1: Design Report on Rocket Project

Whether engineers are designing products or processes, the end results of their work are usually not delivered in physical form. Instead, the results are communicated in a design report. Design reports can be very detailed and will usually include not only final results but also extensive accounts of the design process—the development and testing of the idea, along with the data that informed design decisions. The primary audience for a design report is the client, the person or firm who hired the engineer to deliver the desired product or process. Copies of design reports also go to project team members and managers for their records. Design reports must clearly **present the design and provide evidence for the quality of the design.**

Your first assignment is a report on the first design project, the soda bottle rocket. This design report will be in the form of a short memorandum report and is to be individually written. (At the end of the semester, you will collaboratively write a formal report on the second design project.)

Objectives

By doing this assignment, you will learn and practice how to:

- Address the competing and/or overlapping needs of different readers
- Support claims with appropriate evidence and reasoning—in this case, parametric design practices and test data as the basis for design decisions
- Apply technical writing skills to present information effectively and ethically, including summary, description, narration, and visual representation of data
- Produce effective writing within a short time period
- Work effectively as a team member on a long-term, complex project
- Generate multiple engineering design solutions using convergent design processes
- Evaluate and benchmark a design
- Optimize an artifact using parametric design

Due Dates and Copies

This assignment will be due **in class** on the following dates, depending on your section:

- Thursday lab sections (2, 4, 6): Tues, 10/4 and Wed, 10/5**
- Monday lab sections (1, 3, 5): Tues, 10/9 and Wed, 10/10**

Please turn in **three copies** of your design report. You will also be asked to submit an electronic copy.

Components of the Design Report

Below is a list of sections that the design report should have and brief overviews of the content of each. More specific guidelines and strategies for writing the report will be covered in class.

The components of the design report are intended to meet the needs of different readers. Some readers will carefully read the entire report from beginning to end. Some will also scrutinize the material in the appendices. Most readers will skim the document, looking for the information they are interested in and skipping the parts they don't need. Some readers read only the beginning and ending and look at the graphics. To approximate this variety of reading approaches, the writing faculty will read the body of the report excluding the Appendices; one of the engineering faculty will read only the Executive Summary and the Conclusions and will look at the figures and tables; and another of the engineering faculty will read the entire report and the Appendices.

Some readers read the entire report. Others read the executive summary and the conclusions and look at the graphics.
Still others read the entire report and check the appendices.

An effective report meets all of these needs.

- **Executive summary**

The executive summary is written for a reader who is unlikely to read the body of the report. This is a concise “stand-alone” explanation of the purpose of the project, the approach that was used, and relevant performance results (final distance, overall improvement, and/or accuracy of prediction based on optimization). No product specifications should be given. Refer to relevant figures and tables in the text so they can be found with ease.

- **Introduction**

The introduction provides context and information about navigating the report to a reader who is either going to read the entire document or wants to be able to skip around. Explain the general background of the project and specify what the report contains.

- **Definition of the Design Problem**

Explain, in your own words, the problem that was assigned to you, including the project goals, parameters, and constraints. **Do not copy directly from lab handouts.**

- **Technical Description of Final Design**

Describe your final design in detail, including materials, key attributes, and functioning. Focus on the physical object; do not explain the design process or rationale here. Provide the results of your rocket's final launch, including distance, trajectory, and characteristics of the rocket's flight, and note the launch conditions. Include and refer to at least one figure of the rocket and a figure showing the parametric model of the fin. Figures can be computer-generated or hand-drawn, but must be neat and done to scale. Label the parts and show dimensions. Additional illustrations or alternative views may be included if desired.

- **Parametric Design Process**

Discuss how the rocket's physical attributes were optimized through the parametric design process. Identify the initial design instance(s) that you considered and discuss any information that informed your choice of fin parameter. Your discussion should distinguish between design decisions that were not under your control (including constraints as well as assumptions made for the purpose of simplifying the design problem) and those that were the focus of your optimization. Describe the test matrix and procedures you developed to optimize the parameters. Summarize the key data that informed your design decisions in appropriate graphic form and refer to the data in your discussion. Remember that some readers will look principally to these graphic representations of your data and may not read the accompanying text. Also, for the benefit of those readers who want more detail, you need to refer to any additional relevant information that you have included in the Appendices (see below).

- **Conclusions**

Summarize your optimization of the soda bottle rocket. Give a **quantitative** evaluation of its performance versus your expectations, and state your conclusions about the quality of the design and why it did or did not succeed. This, like the executive summary, must make sense by itself for those readers who are not reading the body of the report. Refer, again, to relevant figures and tables in the text.

- **Appendices**

The main body of the report must give all the information needed for the reader to see what the final design is and how the team arrived at it. The appendices contain details that are not essential for understanding the report but would allow the reader, if so inclined, to verify that the statements in the main body of the report are accurate. You should include early sketches and diagrams of the rocket, test matrices you developed for each parameter, "raw" test results, and results of calculations using the rocket equations. All appendices must be referred to within the report.

Format and Style

This report should be:

- no more than three pages of text, single-spaced, not including graphics or appendices
- standard memorandum format

In addition, please follow these format guidelines:

- Leave 1-inch margins all around the text.
- Use 12-point Times New Roman font for body text.
- Emphasize headings and subheadings with Arial or Arial Bold.
- Double-space between sections and paragraphs. **Do not indent paragraphs.**
- Show pagination at the bottom of each page.
- Number figures consecutively (Figure 1, Figure 2, etc.). Include a descriptive caption **below** each figure. Graphs, diagrams, and illustrations are all considered figures. Be

sure that all figures are clearly legible. Use black and white patterns or gray scale instead of color.

- Number tables separately from figures (Table 1, Table 2, etc.). Include a brief title **above** each table.
- Key figures and tables should be referred to within the body of the report. Place figures and tables after the paragraph in which you refer to them; do not wrap the text around them.
- Organize different kinds of material into separate appendices and label them with capital letters (Appendix A, Appendix B, etc.) and an identifying title.

The style should be formal; avoid casual, imprecise, or slang expressions (for example, do not say “we thought up a bunch of ideas”). Avoid using the first person (“I” or “we”). You may refer to “the team” to attribute actions where necessary to avoid awkwardness (phrases like “it was decided that”) or ambiguity (cases where it is important to identify a team design decision versus a specification or condition beyond your control).

Sharing of Content and Text

This report is to be individually submitted. The project on which the report is based is collaborative, so it is reasonable that team members’ reports will be similar. The following components of the report may be shared and/or reproduced among team members:

- Design ideas, decisions, and conclusions
- Testing data
- Figures and their captions, including rocket diagrams and graphic representations of data

The following components of the report may be discussed by team members but must be **individually written** and distinguishable among team members:

- Executive summary and introduction
- Verbal explanations of the design problem and design process
- Verbal description of the design
- Verbal discussion of conclusions

In other words, although the content of your report will be similar to that of your team members’ reports, **the text should be different** and should clearly be your individual work. If any report appears to be a copied or reworded version of another team members’ report, each writer will receive half of the credit.

General Grading Criteria

The report will be evaluated primarily on the thoroughness of your description and explanation, the degree to which you demonstrate that you are developing an understanding of effective design thinking, and the degree to which your report reflects awareness of the various readers of the report. Your team’s level of collaboration will be evaluated through your team wiki. You will receive a more detailed checklist of grading criteria before the assignment is due.