

EE/CpE 423 ENGINEERING DESIGN
WRITTEN AND ORAL PRESENTATION REQUIREMENTS
THE FINAL DESIGN REPORT
Fall 2004

A. Written and Oral Presentation Requirements

Each group in the senior design project is required to make the following written presentations.

- the project proposal-first semester
- the final design report –first semester
- the interim progress report-second semester
- the final report-second semester

The oral presentations required for each group are the:

- oral/slide presentations-first semester
- poster presentation/prototype demonstration-second semester

The following sections describe the format recommended for the final design report in the senior design project. Generally industrial firms use particularized formats for their design reports that they have found to be efficient, useful and successful. The format required here for the senior design project represents good industrial practice.

B. Final Design Report-First Semester

General

Each group must submit a written final design report to the group's faculty technical advisor and provide a hard copy to the course coordinator. This hard copy must be graded and signed by the group faculty advisor. The final design report must also be published on the group's senior design web site.

The final design report contains the detailed technical design for the project that the group intends to implement in the second semester. The engineering and technical information presented in this report is of such quality and thoroughness that:

- it completely specifies the design to be implemented including numerical values of all major system parameters to be used in the design. Typical parameters, for example, include power requirements and consumption, size and weight of the units, frequency of operation, bandwidths, data and error rates, A/D rates, number of lines of code to

be implemented, response times, throughput, system block diagrams, critical circuit diagrams and flow charts, software package requirements, computer requirements, memory requirements, access times, security issues, and performance curves and tables expected to be achieved as a function of pertinent conditions of system operation.

- it specifies all critical parts required and their sources of acquisition
- it is sufficient to enable another competent group with the same technical interests and skills to implement the prototype from the information contained in the design report.

Finally the report provides assurances based on the engineering studies completed and the judgment of the group submitting the design report that in the group's technical opinion the proposed prototype when designed and implemented in accordance with the engineering plan contained therein will

- meet the project's technical goals.
- meet the project's functional requirements.
- satisfy all specified design and risk constraints.
- be completed within the proposed budget.
- be completed within the proposed schedule.

In an industrial context, the project proposal is usually written and submitted at the proposing company's own expense. The customer may select one, more than one, or none of the proposals submitted to go on to the next stage of the acquisition process. In many cases this next stage is the final design report.

The final design report presented by the industrial firm contains the best technical design and winnable approach that the proposing company can offer. This is done with the major goal and incentive of winning the competition to be the funded provider of the eventual prototype.

C. Final Design Report Format

The written format requirements for the final design report are very similar to those required for the project proposal. The report is composed of a number of sections and are arranged in the following order:

- Title Page
- Table of Contents

Section:

I. Abstract

II. Project Final Design Plan

III. Summary

IV. References

V. Appendices

D. Detailed Requirements of the Final Design Report

The contents of the final design report are as follows:

- **Title Page**

The title page should include the following information in order:

Project Title

Group number

Date submitted to the faculty advisor

Faculty Technical Advisor(s), printed names and signatures

Sponsoring Client

Group members' printed names, and signatures

Stevens Pledge

The title page is not given a page number or a section heading

- **Table of Contents**

The table of contents is started on a separate page(s) and in the form usually found in textbooks. It is placed immediately after the title page. The table of contents lists the various section headings, section numbers and sub-sections contained in the report starting with the Abstract and concluding with all Appendices, List of Figures and the List of Tables in that order. Page numbers showing the page number in the report where a section or sub section can be found must be included in the table of contents opposite the particular section heading.

The title Table of Contents appears at the top of the page and is centered. The first page of the table of contents is designated page number i and is placed at the bottom of the page and is centered on the page. Successive page numbers of the table of contents after page number i are labeled ii, iii etc as needed.

I. Abstract

The abstract provides a short but informative overview of the entire project. It

- defines the general project area being addressed,
- states the specific technical problems and issues being addressed in the project,
- outlines the specific technical design selected for the project and the functionality and results to be expected at the conclusion of the project.

The abstract for the final design report is generally similar to that provided in the project proposal that has been previously submitted by the group. However with the benefit of the additional design work and research that has been expended in the design stage, this abstract should be able to be refined such that it is more specific, informative and focused than the abstract used in the project proposal. The average length of the abstract is approximately 200 words in length but can vary depending on the scope of the project.

The abstract is labeled section I of the report and begins on a separate page immediately after the Table of Contents page(s). The abstract page is numbered page 1. Clearly thereafter, page numbers are paginated in sequence except for the Appendices. numbers. Sections after the abstract follow contiguously.

I-1. Acknowledgement

An acknowledgement of any meaningful and long-term support (technical advice, equipment, lab space, financial assistance etc) provided by an industrial firm or other organization (sponsor or client) to the group shall be included in this section of the design report

II. Project Final Design Plan

II-1 Introduction

This section describes the general technical problem area of the project, and can be based on the information provided in the Introduction section of the Project Proposal. However due to the effort expended since the proposal was submitted, additional pertinent, relevant and updated material should be included.

In addition to providing background information, this section discusses, in general terms, the parameters that the group intends to engineer into their design. These include:

- new or improved technical features that the design will provide in the prototype.
- new or upgraded operating conditions that the project will sustain; technical problem areas that are addressed and improved; additional users or skill sets that will be accommodated- thereby broadening the applicability and usefulness of the final product; reduced risk factors that will be achieved
- key parameters of the final product that are improved; increased efficiencies achieved; reduced power required etc compared to previous designs and implementations.

A major intent of this section is to demonstrate that the project being developed is useful and has long term value to the engineering community and society.

II-2 Design Requirements

This section discusses in technical and concrete terms the objectives, specifications and functionality that the group intends to engineer into their prototype. The section contains the following information:

- design objectives-State the specific technical problems being addressed in the project, and the objectives and the degree to which these technical problems will be reduced and improved by the prototype planned to be implemented.
- functional requirements- State each of the upgraded or new functions and features that the prototype will provide and perform. For example, the prototype provides increased availability and dissemination of network information with increased security; or the unit provides increased flexibility for a communication system by introducing and using certain diversity techniques etc.
- system parameters. Numerical values of high level system parameters that will be provided in the design and which describe the increased functionality, that is being built into the overall system are provided in this section.
- design constraints-State the limitations on the design that the group recognized and considered in designing the system. These are constraints that the group recognized a-priori or imposed on the design for various reasons such as time available, manpower restrictions, cost/performance limitations etc. These constraints are recognized before the prototype is built and their expected effects on system performance are stated in this section.

II-3 System Design

This section of the report is at the heart of the System Design Report. It describes in explicit numerical and engineering detail:

- the specific design approach selected to be implemented in the prototype
- all critical components that may be required in the implementation and their sources of acquisition
- all test procedures required to measure and evaluate system performance provided by the prototype
- all anticipated major design risks and risk management procedures to be taken to control the effects of these risks

During the design stage of the senior design project each group considers and investigates various design approaches that might be applicable to implementing the prototype while simultaneously meeting the performance requirements and goals. The final design approach selected from these possible approaches is detailed in this section of the report.

The final design selected is the one that best meets all the requirements of the project. **This is the design that the group intends to implement, test and demonstrate throughout the second semester of their senior design project.**

The final design is discussed, detailed, and presented, and includes block and circuit diagrams, flow diagrams etc. Pertinent and critical parameter values are numerically specified. The expected performance of this design is evaluated and compared in terms of the technical goals and requirements specified for the project.

In addition, the technical reasons used to select this design over the other possible approaches are presented. That is, why is the selected design better than the other designs that were considered? This can be accomplished by presenting the results of mathematical/engineering analyses, or by presenting simulation results that compare the performances provided by each approach. The results of this comparison of the different design approaches' performances should logically demonstrate that the design approach selected is in fact the best approach to take to implement the senior design prototype.

The comparison of the performances of the different design approaches must also include a comparison of the risks associated with implementing each of the possible designs. The risks associated with the selected final design approach must be carefully and clearly stated in this section along with the steps and procedures built into the design to control and manage these risks. In this risk comparison, financial budget considerations and manpower requirements should also be evaluated and compared.

Finally a description of any specialized testing procedures, instruments and equipments (for example laptops, computers, robots, cell phones etc) that are required to support, evaluate, or test system performance must be clearly stated.

II-3A Parts List

As part of the senior design requirements a complete parts list for the project prototype implementation must be submitted to the group's technical advisor and course coordinator in a document separate from the the final design report. The complete parts list is a direct result of the design approach selected and documented in this design report. Critical components and their sources of supply and cost must also be identified in the final design report **and** in the separate parts list document.

II-4 Financial Budget

This section includes a detailed financial analysis and estimate of the cost of the project. The financial estimate provided in the project proposal forms a basis of the information presented here. However, because of the work and knowledge gained about the project in this design stage, these original costs estimates should be able to be refined, and made more thorough, solid, detailed, and accurate. Labor costs, materials and parts costs, specialized test equipment, documentation and travel costs should be accurately evaluated separately and added up to arrive at a final and accurate financial cost figure. These figures should be presented clearly. If various design approaches were investigated as part of the design, financial budgets for each approach must be provided and comparisons made between each of them.

II-5 Project Schedule

A schedule for the final design implementation phase that will take place in the second semester will be provided using Gantt charts. The charts will show the schedule for each member of the group and their tasks. This section will also clearly discuss each member's responsibility and role in the development stage.

III. Summary

This section clearly summarizes in approximately 200-300 words the following items:

- the basic final design to be implemented as a prototype in the second semester
- the specific performance goals and functionality that the prototype will provide
- a clear statement that the project that will be implemented is worthy of development and will meet the expected performance

IV. References

Textbooks, reports websites, and other documents used in the body of the final design report to support the design conclusions, decisions and recommendations should be recorded in this section. References should be completely specified so that a reader can locate the references effectively. The format for the reference section is readily available in the engineering textbooks used at Stevens and elsewhere.

V. Appendices

As in the project proposal, the Appendix section is usually used to provide detailed information that is pertinent to the report but is somewhat less necessary to place in the main body of the report. This information is placed in a separate section at the end of the report. Examples of such information are detailed analyses, and lengthy mathematical proofs.

Page numbers for the appendices need not be keyed to the pagination of the preceding sections. Thus the pages for Appendix A are numbered A-1, A-2 etc. The pages for Appendix B are numbered B-1, B-2 etc. This procedure decouples the page numbering sequence in the body of the report from that used in the Appendices and thereby simplifies the addition or deletion of appendix material at any time in the documentation and production process.