Documenting Your Design

ME 4054W
Spring 2012
Prof. David Y.H. Pui
Prof. Brad Bohlmann
## Important Due Dates

<table>
<thead>
<tr>
<th>Due Date</th>
<th>Deliverable</th>
</tr>
</thead>
<tbody>
<tr>
<td>February 9</td>
<td>Project Plan</td>
</tr>
<tr>
<td>March 1</td>
<td>Draft Problem Definition Chapter*</td>
</tr>
<tr>
<td>March 27</td>
<td>Draft Design Description Chapter*</td>
</tr>
<tr>
<td>April 17</td>
<td>Draft Design Evaluation*</td>
</tr>
<tr>
<td>April 26</td>
<td>Final Design Report*</td>
</tr>
</tbody>
</table>

* Design report deliverables include all supporting documents and appendices
What are Some Methods for Documenting Your Work?

• Emails, memos
• Drawings
• Design Notebooks
• Shared Documents
• Presentations
• Google site
• Final Report

If you don’t “write” it down no one will know what you’ve done
Examples of Google Site

Charge Reduction Units for Electrohydrodynamic Spraying

Sponsor: Nanocopoeia, Inc.
Sponsor Website: http://www.nanocopoeia.com/

Advisor 1 - Huijing Fu
Advisor 2 - Pat Ryan

Documents & Resources

Calendar

Directory

Tasks

Announcements & Discussion

Deliverables

Drafts

Final
Examples of Google Site

ME 4054W Biopsy

Team

Lung Biopsy Team

Sponsor: University of Minnesota's Medical Device Center

Advisors: James Kroczak; Greg Ruth

Meeting Times: Tuesday, 2:30p – 5:30p: STSS 312 ; Thursday, 2:30p – 3:45p: STSS 33

1) Wei Leong Cheong
   Email: cheong0323@umn.edu
   Cell: 612-636-8129

2) Ben Goulet

3) Eugene Sellin
   Email: sellin077@umn.edu
   Cell: 952.412.1406
Examples of Google Site

ME4054S12-CAPTURE

Documents and Resources

- Add file  Move to  Delete  Subscribe to changes

- Minutes for meeting with advisor
  Charlie Wright 1-26.pdf
  View  Download

Minutes from the meeting with advisor, Charlie Wright on 1/26/12. Discussed project objectives, design considerations, and other general information about the project. 175k  v. 1  Jan 29, 2012 9:12 AM  Jeremy Fien

- Minutes from meeting on 1-31.pdf
  View  Download

Minutes from 1/31/12. Some additional information about the project was provided by Charlie Wright. 83k  v. 1  Jan 31, 2012 4:19 PM  Jeremy Fien

Comments

89 days until Design Show

Edit sidebar
Examples of Google Site

Documents & Resources

- [027866293069586583.pdf](#)
- [Droplet Fission.pdf](#)
- [LC8 Rayleigh Instability.pdf](#)
- [Meeting Agendas](#)
- [Meeting Minutes](#)
- [Recent Findings - Must Read](#)
- [Research Documents](#)

**Meeting Agendas**

- [1_24_2012 agenda.docx](#)
- [1_31_2012 agenda.docx](#)

**Meeting Minutes**

- [18Jan Minutes.docx](#)
- [24Jan Minutes.docx](#)

**Recent Findings - Must Read**

- [Disintegration of Water Drops in an Electric Field.pdf](#)
Examples of Google Site

ME4054S12Conveyor

Tasks

<table>
<thead>
<tr>
<th>Description</th>
<th>Owner</th>
<th>Deliverable</th>
<th>Due Date</th>
<th>Progress</th>
<th>Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sign and Return NDA</td>
<td>Everyone, Individually</td>
<td>Signed Non-Disclosure Agreement to Tony</td>
<td>January 26, 2012</td>
<td>Done</td>
<td></td>
</tr>
<tr>
<td>Make Website</td>
<td>Micah Olson and Matt Crane</td>
<td>Website</td>
<td>January 26, 2012</td>
<td>Done</td>
<td></td>
</tr>
<tr>
<td>Project Team Roster</td>
<td>Everyone</td>
<td><a href="http://www.me.umn.edu/courses/me4054/assignments/roster.html">http://www.me.umn.edu/courses/me4054/assignments/roster.html</a></td>
<td>January 26, 2012</td>
<td>Upload Pictures to Documents and Resources</td>
<td></td>
</tr>
<tr>
<td>First Site Visit</td>
<td>Everyone</td>
<td><a href="http://www.me.umn.edu/courses/me4054/assignments/sitevisit.html">http://www.me.umn.edu/courses/me4054/assignments/sitevisit.html</a></td>
<td>February 14, 2012</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Problem Definition Chapter and Supporting Appendix</td>
<td>Everyone</td>
<td><a href="http://www.me.umn.edu/courses/me4054/assignments/designreport.html">http://www.me.umn.edu/courses/me4054/assignments/designreport.html</a></td>
<td>March 1, 2012</td>
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<td></td>
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<tr>
<td>Mid-Project Reviews</td>
<td>Everyone</td>
<td><a href="http://www.me.umn.edu/courses/me4054/assignments/midreview.html">http://www.me.umn.edu/courses/me4054/assignments/midreview.html</a></td>
<td>March 6, 2012</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Design Notebooks

Do’s
• Add a page number and date
• Be clear—add notes for calculations and sketches
• Be neat and add contact info in case it’s lost

Don’ts
• Forget to label the picture—Use descriptions
• Explain why you chose that sketch
• Take Lecture notes in design notebook
• Erase
Design Notebooks

Do’s
- Dates
- Names & Titles
- Contact Information
- Reason for contact
- Conversation details

Don’ts
- Quote excessively
  - Ex: “Gary thinks…”
General Framework of the Final Design Report

Volume I

- Problem Definition
- Design Description
- Evaluation

Volume II
(Appendices)

- Supporting Information
  - Problem Definition
    - Supporting Docs
  - Design Description
    - Supporting Docs
  - Evaluation
    - Supporting Docs
Final Report Outline

Volume I.

1. Title Page
2. Executive Summary
3. Problem Definition (Assignment #2)
4. Design Description (Assignment #3)
5. Design Evaluation (Assignment #4)
6. References
Final Report Outline

Volume II.

1. Problem definition support documents
2. Design description support documents
3. Design evaluation support documents
The Final Report: The Basics

• **PURPOSE:**
  Enduring record of your project

• **GOAL:**
  To enable a follow-up group to completely understand and reconstruct your design

• **FORMAT:**
  Professional
  (Excellent material, excellent writing)

• **GUARANTEED READERS:**
  Your advisor and the course coordinator
Title Page Example

• Layout and font selection is not good:
  – Picture should not overlap title
  – Text in bottom half should:
    • not be italicized
    • be smaller
    • in a lighter color (e.g., white or yellow)

• Picture is a confusing

• Email addresses not needed
Title Page Example

- Good layout
- Font sizing is appropriate
- Picture does a good job of helping reader understand the context of the report
- Students should have “Team members:” header
- Student ID numbers should not be included
Title Page Example

• Good layout
• Font sizing and color are appropriate
  – B&W always works, although colors can make it visually appealing
  – A well done cover sets the tone, but doesn’t get the grade
• The picture of the proposed solution is an excellent choice
Executive Summary

• How you would describe the project to your CEO in 1-2 pages. Brevity and focus are critical.

• What would you tell the Dean of CSE?

• Be sure to include the most important results in addition to the project description. Be quantitative.

“The manufacturing cost (material, labor, and burden) of the concrete pump in production quantities of 1000 is $420.”
Contributions Pages

• Who did what?
• List everything you did as an individual (considered in grading)
• Hard copies should be signed by each team member (as shown)
Problem Definition Chapter

• Background
• Mission Statement
• Customer Needs
  – Identify key customers
  – VOC Method(s)
  – Customer Needs Chart
  – Explanation of Chart Entries
• Product Design Specification
  – Specification Chart
  – Explanation of Chart Entries

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<table>
<thead>
<tr>
<th>#</th>
<th>Need</th>
<th>Imp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Veneer press can handle large workpieces</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>Veneer press can melt hide glue</td>
<td>5</td>
</tr>
</tbody>
</table>

*Customer Needs Chart (excerpt)*

<table>
<thead>
<tr>
<th>Need #</th>
<th>Metric</th>
<th>Imp.</th>
<th>Unit</th>
<th>Marginal Value</th>
<th>Ideal Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Panel width</td>
<td>4</td>
<td>mm</td>
<td>300-635</td>
<td>150-720</td>
</tr>
<tr>
<td>1</td>
<td>Panel length</td>
<td>4</td>
<td>mm</td>
<td>900-1900</td>
<td>300-2000</td>
</tr>
</tbody>
</table>

*Product Design Specification (excerpt)*
Design Overview Chapter

- "Walk the reader through" your final design
- Refer to lots of figures
- Create context for following chapters

Sample annotated figure
Concept Generation & Selection Chapter

• Briefly review concept generation process
• Show key example concepts
• Present selection chart
• Explain selection rankings

Sample Concept

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Wt Factor</th>
<th>Clamp</th>
<th>Dead weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface flatness</td>
<td>25</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Loading time</td>
<td>15</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>...</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total score</td>
<td>100</td>
<td>470</td>
<td>465</td>
</tr>
<tr>
<td>Rank</td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Selection Chart (Excerpt)
Design Description Chapter

• Present models
• Show analyses (and their results)
• Document experiments & experimental prototyping
• Review testing of final product
• Compare final specifications to design goals
• Include:
  – Cost Analysis
  – Environmental Impact Assessment
  – Relevant regulations (UL, ANSI, etc.)

Should be the longest chapter

\[ \Delta U = Q_{in} + Q_{heat} - Q_{out} - Q_{loss} \]
Conclusions & Recommendations

Chapter

• Summarize important results
• Assess your final design (strengths & limitations)
• Where should product go from here?
• Reflect on design process
Figures

- Number each figure
- Add a descriptive caption
- Ensure plot axes are readable
- Ensure graphics are clear

Figure 9.13. Candidate worst-stressed points at junction of beam with frame.
Figures

Guidelines

• Caption below all figures
• Use callouts to highlight important features
• Use detail/section views when needed
• Refer to figure within text
• Make sure figures are clear and easy to understand
• Reference in appendices
Equations

\( F_{mag} = \frac{\chi m B}{\mu_0} \frac{dB}{dz} \) \hspace{1cm} (1)

...produces must be proportional in magnitude of the angular velocity. In equation form, it looks like the following:

\[ T_{damper} = B \omega \]

Guidelines

- Define all variables and include units (as necessary)
- Number equations
- Reference the equation number
References

• List articles, books, data sheets, URLs, etc. used in your project
• Citing by author name suggested

Reference example

Appendices

- CAD drawings
- Supporting detailed calculations
- Raw experimental data
- Concepts (from concept generation)
- Bill of Materials
- Catalog pages, data sheets (highlight important data)
- Other important information that doesn't flow well in body of the report

**Appendix A**
Detailed drawings of concrete pump piece parts

Auger . . . . . . . . . . . . . A.1
Body . . . . . . . . . . . . . A.2
Handle . . . . . . . . . . . . A.3

*Label and name every appendix*
Project Flyer

• Used to “advertise” your project
• Include:
  – Project Name
  – Sponsor (if applicable)
  – Advisor
  – Team Member Names
  – 100-200 Word Description
  – Graphic
• Please include course number and semester
• Portrait orientation; B&W
• Hand out at the Design Show!

Sample Flyer
Additional Project Flyer Examples

**Nanoparticle Extraction Probe**
Spring 2005
Sponsor: University of Minnesota
Advisor: Prof. Uwe Kortshagen

Christine Becker
Matt Kelly
Evan Leingang
Elijah Thimsen

The goal of the project is to design a probe that can sample particles from different spatial locations in a flow-through plasma reactor. The particles need to be extracted in such a way that their properties in the reactor at a given spatial location can be inferred. Deliverables for the semester include a write-up of the probe design, specifications for probe operation, and directions for operation. The extraction probe design has several integrated areas: the sampling probe itself, the movement of the probe inside the reactor, the particle deposition region, the pumps and measurement devices, and the attachments that connect all the components together. The middle figure below indicates the layout of the design.

**MRI Head-Movement Measuring Device**

**TEAM MEMBERS**
John Bengtson
Ryan Charlton
Myles Lukoskie
Paul Quam
Nick Valley

**ADVISORS**
Tonya White
Al Fox

**SEMESTER**
Spring 2005

We are a mechanical engineering senior design team at the University of Minnesota. Our objective was to design and construct a device which was capable of measuring head movement in real-time for MRI purposes. This mechanism was to be connected to a feedback system which could alert an MRI patient and administrator of head motion. The need for such a device is driven by the unwanted lost money and time resulting from blurred MRI images generated by excessive head motion.

The functional prototype that we constructed was designed for use in a mock scanner at the University of Minnesota’s Center for Magnetic Resonance Research (CMRR), but it has the ability to be adapted for future use in an actual MRI scanner. This prototype can be used to train patients and help the MRI administrator evaluate whether a patient is able to withstand the actual MRI procedure without significant head motion.

The final design of our measurement device utilizes a vision system to track a unique feature attached to a patient’s head. Our prototype is capable of tracking sub-millimeter head movement and providing valuable feedback to both the MRI patient and administrator.
Tips on Preparing the Final Report

• Develop a detailed, comprehensive outline *now!*
• Appoint an editor to set styles, collect sections, etc.
• Assign writing tasks
  – Be sure *all* team members contribute
    (Individual contributions must be cited on the "Contributions" page)
• Create deadlines
  – Rough draft
  – Final copy
Tips on Preparing the Final Report

• Plan to have other team members read your draft sections (find grammatical errors)

• Don’t forget:
  – Cost analysis
  – Design for Environment
  – Regulatory analysis
Tips on Organization

• Outline *first*!
• Make your most important points *first*!
• Define terms upon first usage (or in a glossary)
• Begin each chapter with a "roadmap" which describes the content of each of the following sections (1 paragraph)
• Begin each section with a "roadmap" of what's included in that section (1 paragraph)
Style Suggestions

• Use lots of short, simple sentences
• Use lots of short, simple paragraphs
• Avoid "It" & "There" as subjects
• Use proper citation technique
Recommended Additional Information

• Re-read the web pages on the Final Report (Assignments link)
• *Elements of Style*, Strunk & White
Samples of Final Reports

• You can reference some final reports at the course website under “Report Archives”. Two that were considered to be well written are:
  – Spring 2009: “Biosensor”
  – Spring 2009: “Shock”

• I suggest you go to the website in the next day or two and confirm that you are able to view the documents.