Purpose

“A design review is a retrospective study of the design up to that point in time. It provides a systematic method for identifying problems with the design, aids in determining possible courses of action, and initiates action to correct the problem areas.”\(^1\) Design reviews are a critical part of every design process. They help avoid “group think” and identify problems in the concept or analysis. Design reviews should occur at multiple stages throughout the design process; otherwise, if left to the end of the project, changes, errors, or new brilliant ideas will be expensive and difficult to implement. Typically, design reviews occur at each major stage of the design—before the design team can move into the next phase: project specifications and metrics defined, strategy selected, concept and modules selected, detailed design finished and ready for initial fabrication, and possibly more depending on the scope of the project.

The Preliminary Design Review (PDR) presents the top-level design process and establishes a viable concept. It gives an overview of how the design concept was developed; an understanding of the requirements; what problems or concerns need to be overcome; what resources are needed; and the cost and schedule for the project. The PDR addresses overall preliminary design information and technical program risks associated with each system and reviews technical, cost and schedule impacts. At the conclusion and acceptance of each design review the overall risk level of the project should be reduced when compared to the previous step.

This is not an arbitrarily imposed assignment. Design reviews are so important that many companies hire private consulting firms to conduct reviews on critical projects to ensure objectivity. Design reviews are required for all federally funded projects – e.g. any project funded by the Department of Defense (DOD). According to DOD requirements, the preliminary review is used “...to ensure that a system is ready to proceed into detailed design and can meet stated performance requirements within cost (program budget), schedule (program schedule), risk, and other system constraints.”\(^2\)

Objectives

- Define your solution strategy and concept. Explain how your design meets the objectives.
- Provide context: a concise re-introduction to your design problem, including the primary motivation for the project, the key technical challenges, and any existing full/partial solutions (prior art).
- Provide the most up-to-date versions of your overall goal statement and stakeholder objectives, as well as the relative importance and rationale behind each objective.

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• Provide the most up-to-date versions of all system-level project requirements, with the validation methodology and rationale for each one explained in detail.
• Summarize both the concept generation and selection process for your proposed solution.
• Clearly describe the overall system-level design of your proposed solution, including any initial CAD models.
• Clearly describe the mode of operation of your proposed solution, including interactions with all key stakeholders.
• Describe the following aspects of each subsystem of your proposed solution in detail:
  o Requirements, both system-level and subsystem-level.
  o Overall design, including all key components (both purchased and team-manufactured).
  o Primary design driver(s) and associated analysis.
  o FMEA and Risk Analysis, with associated mitigation strategies.
  o Potential outstanding concerns and issues.
• Present an updated management strategy for completing your proposed solution, including:
  o Descriptions of roles/responsibilities assumed for this portion of the project and proposed for the next.
  o A complete budget and bill of materials, with all funding sources described.
  o An updated WBS and project timeline.

Written Proposal
Throughout the report, do not just make assertions—rather, back up the assertions with evidence. Use first order mathematical and physics estimates as well as references from journal articles, books, or other sources that are well respected.

Title Page^3 [1 page maximum]
• First line: “ME 481 2020 Spring – Preliminary Design Review"
• Second line: Your own descriptive title/team name
• Logo (project, team, or sponsor)
• Names of all team members and their team role titles
• Final line: “Instructor: A Zachary Trimble" 

Executive Summary [1 page maximum]
The Executive Summary should give the reader all the important information and findings of the document without having to read any further. Summarize both the project and the contents of the report. In other words, you must capture the reader’s interest; summarize the purpose, importance and impact of the project; and inform the reader what they can expect to learn about the project from this particular report. Because of its content and location this section is the most widely read section of the document. For that reason, the section should be well written and carefully proofread. First impressions matter. Incorporate into the executive summary the project mission statement in italics. The mission statement should be a smooth part of your executive

^3 Should be paginated with “i, ii, iii, iv,...”
summary and not an after-thought or add on. For the preliminary design review it is particularly important to convey that you have clearly thought through every aspect of your entire project and to leave your reader with the confidence that you will be able to satisfy your stakeholders' demands.

**Table of Contents**

- List of Figures and Tables (should show page numbers)
- Acronyms and Abbreviations

**Technical Report Body** [40 pages maximum]

Address the report objectives. Below is a skeletal suggested outline (i.e. you should add project appropriate sub-sections), but you have freedom to address the objectives in whatever way is best for your project.

1. **Introduction**
   Review your problem including the motivation, purpose, importance, and impact in the context of economic, social, ethical, sustainable, etc. consideration. Introduce your solution.

2. **Technical Overview**
   This section should include a detailed description of strategies and concepts—the focus should be on the selected strategy and concept, but where necessary when defending your decisions or expounding on the benefits of your design you will need to describe other concepts and strategies that you considered and your selection analysis to prove you selected the best design and thought of all the alternatives. Discussion of all design considerations (cost, weight, function, performance, schedule, risk, etc. – use budgets). Summarize all engineering analyses—the details are provided in appendices. Description of any bench level experiments that were used to verify your models and analysis. Discussion of original contributions. Discussion of performance budgets and risks. Make sure to make effective use of graphics.

   2.1. **Context**
      Review your objectives and requirements in sufficient detail to understand and motivate your strategies and concepts and design decisions.

   2.2. **Proposed Solution**
      No mystery stories explain your solution immediately and how it addresses the objectives (expound on the concept of operations and systems architecture diagrams). Provide the primary performance budgets and metrics and analysis.

   2.3. **Concept selection**
      Explain why your solution is better than other alternatives and your selection and decision making process.

3. **Project Management/Proposed Approach**
   What are your time and money constraints/needs and what are the general tasks and risks. What are the key milestones that must be reached for your project (i.e. not just class milestones)?

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4 Should be paginated with “1,2, 3, …”
3.1. Organizational Structure
Concisely remind the reader of your team’s structure in the context proving you can be successful. Pay attention to any changes and explain.

3.2. Work Breakdown Structure (WBS)
Provide a understanding of your upcoming tasks and their success criteria.

3.3. Project Timeline/Schedule
Update your milestone timeline and what it means to achieve each milestone. Update your time budget. I.e. are you on schedule? Provide a schedule to achieve the aforementioned tasks and identify the critical path.

3.4. Budget
Provide an appropriate level of detail budget on both prototype and development costs of your project.

3.5. Potential Challenges/Risks
Identify your current risk hierarchy and provide a risk tracking structure.

4. Conclusion
• It is important to provide a real conclusion. This is a design review. It should be accompanied with an authorization to proceed. So provide a conclusion. Have you met all the necessary gates to pass the review?

5. References (Does not count against page limit)

Appendices (Does not count against page limit)

1. List of Requirements
Provide the full list of all your requirements both basic and derived in table format with a useful tracability/tracking methodology

2. Schedule
Provide your full Gantt chart.

3. Competing Concepts
Provide descriptions of the competing concepts you considered. As described in class, just enough to understand.

4. Full Calculations
Provide detailed derivations, calculations, experiment descriptions, and results, etc.

Formatting Information
• Use “Century Gothic” single-spaced 12-point font for all body text. Headings may be larger if desired.
• Use 0.5 in. margins on all pages.
• Number all pages after the Table of Contents in the lower right footer of each page. Use roman numerals for the pre-content.
• Figures and tables must be centered in the middle of the page (i.e., no text-wrapping) and have a unique number and caption.

Evaluation
All items are graded on a 10-point scale (see the RIP Website).

<table>
<thead>
<tr>
<th>Objective/Element</th>
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<tr>
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<td>Introduction/Overview</td>
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<td>Requirements</td>
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<td>Strategy</td>
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<td>Concept</td>
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Oral Presentation

**Audience:** Your stakeholders and the ME 481 course

**Format:** Review (Questions as necessary during)

**Location:** Holmes Hall 309

**Date:** 10 & 12 March

**Time:** 60 minutes (encompassing both presentation and questions/feedback)

**Attendance:** All students must attend all presentations. You are expected to be an active peer reviewer and ask meaningful questions and provide meaningful feedback.

**Dress Code:** Business professional (Hawaiian)

**Evaluation:** Based on the presentation evaluation criteria posted to the course website.

- **If Your Project Has Sponsor(s):** You **must** also invite your sponsor(s) to your oral presentation and make every effort to schedule your presentation so that they can attend. If your sponsor(s) are unable to attend, it is your responsibility to arrange for a teleconference or video recording.
- All slides (except Title Slide) must show the slide number and the total number of slides in the main presentation **(not including Backup Slides)** e.g. 14/37
- The name of the presenter should be on the first slide of a contiguous set of slides that the student is presenting. The student's initials should be on each other section.
- The presentation should cover all the information in the technical report.

Submission Information

- **Deliverables: Due at 1500 on Friday, 13 March**
  - Hard copy of your report “bound” with something more than a staple
  - Digital copy of your report
    - File naming convention: “me481_2020s_pdrReport_abbreviatedTeamName.doc”
  - Digital copy of your slides
    - File naming convention: “me481_2020s_pdrPresentation_abbreviatedTeamName.ppt”

- **Submission:**
  - Hard copy of your report put in collection box in ME office (Holmes Hall 302)
  - Both electronic deliverables must be submitted as attachments to a single email written by the project manager, addressed to the instructor, and having the subject line “[ME481 2020s] - [Team name] – Preliminary Design Review”

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<th>Time/Task Management</th>
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<td>Quality, Conciseness, Effectiveness</td>
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• The report must be in **Word** format (**.dox** or **.docx**) format, and the oral presentation slides must be in **PowerPoint** (**.ppt** or **.pptx**) format.

• **If Your Project Has Sponsor(s):** A second email written by the project manager, addressed to the sponsor(s) and cc’d to the instructor, and having the subject line “UH Senior Design Project – Preliminary Design Review Documents” must be sent with the deliverables attached. All deliverables sent to sponsor(s) must be in Adobe PDF (**.pdf**) format.