Format for the Preliminary Design Review (PDR) Report

At an PDR you present your work leading to and including your best design concept. The PDR report is a detailed MS Word document that adheres to technical writing convention as presented on the course webpage.
The PDR occurs approximately at mid-semester in MECH4240 and includes, for both the presentation and the report:

- Management structure/cost budget/schedule and milestones.
- System engineer presents consideration of each of the 11 SE functions, including:
    - Documentation of the mission objective
    - A review of your feasible alternatives – perhaps shown as hand sketches. (*For those designing a subsystem within a system, the focus here will be on the subsystem rather than the system*).
    - Presentation of any or all of the following – logical arguments, engineering analyses, mock-ups, test results, risk analysis, cost analysis, functional analysis, house of quality, etc. - that argue for or against each feasible alternative, leading to a single recommended alternative.
    - Inclusion of enough design detail to complete and recommend a conceptual design – this will include undimensioned CAD drawings, an architecture proposed through the subsystem level and a first-cut at a bill of materials.
- Subsystems' design engineering effort to date on each subsystem (at the PDR details here may be limited).
- Summary of the objectives for the next review (e.g. Critical Design Review (CDR)).

You are to 1) make hardcopies of this report for the industrial sponsors and your instructor; also make an extra copy of the report to be delivered to Karen Clark in 201 Ross Hall immediately after your presentation, 2) load the report onto your webpage, 3) deliver to Dr. Beale your design diary for grading, 4) include your CODs + deliverables, clipped to your report. Hardcopying costs will be covered by the sponsor in most cases, so see Dr. Beale or the TA when ready to make hardcopy reports.

TITLE PAGE – Include a descriptive project title with "Preliminary Design Review" in the title, name of "corporation", members, semester, date, instructor, corporate sponsor.

SUMMARY or **ABSTRACT** (1 page of text, about 200 words)

TABLE OF CONTENTS (specify here the author for each section of the report for purposes of grading technical writing)

INTRODUCTION (by Project Manager)
Introduce the assignment, state and identify the design problem.

MAIN BODY
SYSTEMS ENGINEERING (by Systems Engineering team members)

1. Mission Objective – present a clear statement of the mission objective that all stakeholders have agreed upon and accepted.
2. Architectural Design Development – include:
    a. A review of your feasible alternatives – perhaps shown as hand sketches.
    b. Presentation of any or all of the following – logical arguments, analyses, mock-ups, test results, risk analysis, cost analysis, etc. - that argue for or against each feasible alternative, leading to a single recommended alternative.
    c. Inclusion of enough design detail to complete a conceptual design – this will include an architecture proposed through the subsystem level, which includes:
        i. *Undimensioned* CAD drawings - 3-D rendered CAD assembly drawings (Solid Edge) of design concept(s) – dimensions are not required yet, show the entire device, subassemblies and views of areas critical to understanding the concept.
        ii. Product hierarchy - A description of the subsystems and components, their interfaces,

their logical and physical layout appropriate for a conceptual design.

iii. First-cut Economic Analysis - Include a first-cut Bill of Materials, such as a parts list, part costs and total cost, and your cost to manufacture.

d. A course requirement is that each team demonstrate in either a, b or c:
   - Usage of modern engineering tools – e.g. commercial software such as FEA, Working Model and other simulation software, spreadsheets, data acquisition, CAD, etc.
   - Application of fundamental engineering analysis methods, based on simplified analytical models with calculations. Choose your calculation carefully, only do what is appropriate and necessary to your project. Discuss with your instructor what you plan on presenting here. Put calculations details in the appendix.

3. Requirements - List requirements that are derived and those that have originated from the sponsor or other stakeholders. Place these in outline form, the first outline level is the system level, followed by the subsystem level requirements, and component requirements if any at this time. Consider also requirements that are based upon economic, environmental, sustainability, manufacturability, ethical, health and safety, social, and political factors.
4. Concept of Operations (ConOps) – Describe how the system will operate.
5. Validate and Verify – Formulate a brief, preliminary test plan, to be performed in Phase D to test the system to show that each measurable system requirement is met (this is System Verification). Present brief, preliminary test plan that will demonstrate that the system will function according to the ConOps and satisfy the mission objective (this is System Validation).
6. Interfaces and ICD – List the mechanical, electrical, thermal and operational boundaries at this point in time, if any. (Much of this detail will not be determined until after the PDR).
7. Mission Environment – Describe the mission environment and its effect, if any, on the design.
8. Technical Resource Budget Tracking – identify and estimate resource budgets if relevant and necessary - such as mass, volume, power, battery, fuel, memory, etc.
9. Risk Management – The systems engineer will be able to identify risks to safety, performance and program. Perform Failure Mode Analysis if called for.
10. Configuration Management and Documentation. Update the webpage and baseline the PDR documents. Summarize how the configuration is managed.

SUBSYSTEMS DESIGN ENGINEERING - effort to date on the subsystems design using the engineering design process (at the PDR details may be limited so some subsystems do not need to be presented).

PROJECT MANAGEMENT – Show project management structure (show how tasks are assigned on the basis of multifunctional areas), schedule of milestones and reviews, estimated projected costs, tasks and plans for next review. Summary of proposed deliverables for the next review.

CONCLUSIONS

Restate the primary information.

APPENDIX AND REFERENCES

- Pages from catalogs and technical description for parts and components to be purchased.
- Information from suppliers, price quotes.
- Reference citations, e.g. textbooks, technical articles, etc.
- Details of calculations described in report.

Attach (clip) all your CODs plus deliverables to the Report!

PDR Power Point Presentation

Like the PDR Report above, the presentation has the introduction, a main body and a conclusion. Use an outline structure, hit the key points, make significant use of computer graphics, such as digital photos, x-y plots, animations, Excel spreadsheet and graphing, Power Point graphical features, other software (e.g. FEA, Working Model) and, of course, your imported CAD drawings. Give your instructor a "dry run" at least 2 days before the presentation to Dr. Beale or your Technical Advisor. It is a course requirement that each student must present at either the midterm and/or final presentation. Consider contacting your sponsor a week before the presentation to tell them about your proposed concept in order to get their "blessing".

PDR Presentation Grading Considerations by Instructor:

- Adherence to aforementioned format from the report, but of course with much less detail.
- Technical Writing – use course webpage guidelines for technical writing on slides.
- Presentation Skills – everyone must present at either the PDR or CDR course presentation to assess oral communication skills. (remember the grade sheet your instructor will be using is linked on the course webpage).
- Graphics – effectiveness of plots and CAD.
- Time Limitations – did you stay within the time constraints. Presentations should be no more than 30 minutes, optimally 20 minutes. The remaining time should be left for questions from the sponsor.
- Overall demonstration of professional and ethical behavior.

Format for Final PowerPoint Presentation and Final Report

This is a presentation of a complete design, in preparation for working prototype construction. Your grade will be significantly based on passing the following "litmus test":

- A complete parts list, sufficient to purchase all components

- A complete set of dimensioned part and assembly drawings, of sufficient details so that team of machinists, technicians, and engineers could build the device from the drawing set.

Following the presentation, each group must fill out purchase orders and order parts.
Presentation/Final Report formats are same format as midterm, but updated and including:
Include 3-view orthographic projections, fully dimensioned, of all parts that must be manufactured. Drawing must adhere to the format in [3]. Drawings must be approved by the designer, drawer, and instructor.
Include assembly drawings, schematics of hydraulic, pneumatic and electrical systems if needed.
Complete parts list.
Update and refine 3-D solid models, engineering analyses, economic analyses.
Answer any concerns of industrial sponsor from midterm.
Gantt Chart showing construction schedule [5].

References:

[1] MECH 4240-50 Class Web page: http://www.eng.auburn.edu/users/bealedg/MECH4240-50/
[2] Introduction to Communication: http://www.eng.auburn.edu/users/bealedg/MECH4240-50/#Q13
[3] Machine Drawing Format http://www.eng.auburn.edu/users/bealedg/MECH4240-50/#Q15
[4] Online Ethics Center for Engineering and Science: http://onlineethics.org/eng/cases.html
[5] Gant Chart online: http://www.ganttchart.com/