

Preliminary Design Review Assignment

ASEN 4018, Senior Projects I: Design Synthesis Fall 2005

1.0 Document Scope

This document specifies the required elements and deliverables for the Preliminary Design Review assignment.

2.0 Objectives

The Preliminary Design Review (PDR) marks the end of the preliminary design phase of a project. The goals of this phase are:

- Develop and assess design alternatives for each system or subsystem in your project
- Finalize design-to specifications for each system or subsystem in your project
- Assess design issues and associated risk
- Finalize project management plan, organization, schedule and cost estimates

Each of these is discussed in a subsection below.

2.1 Develop and Assess Design Alternatives

Your Project Definition Document (PDD) provides the top level basis from which all subsequent design decisions you make are ultimately derived. This process is referred to as “requirements flow-down.” Each of the individual “functional needs” defined in your PDD implies something about one or more of the systems or subsystems in your project. Your first job is to explore alternatives and pick the most feasible solutions fulfilling the objectives in your PDD.

Successful engineering design usually proceeds in the following steps:

1. Make (i.e. “brainstorm”) a list of alternative approaches for each functional need.
2. Define one or more performance metrics for the design (e.g. mass, stability, cost)
3. Define the design parameters that most directly determine the design (e.g. material selection, structural configuration, wing size and shape, engine power)
4. Perform analyses that quantify the performance metrics for a given design. Identify the driving design considerations.
5. Compare design alternatives using these performance metrics.

Note that this design stage heavily depends upon good analyses. The type of analysis that is needed varies from problem to problem. It can be as simple as a spreadsheet or as complicated as a numerical simulation. Your advisors are a good resource for determining the kind of analyses you should do for a given situation.

It is also worth noting that bad designs usually can be traced back to poor choices made at this stage without the benefit of good analyses.

2.2 Finalize Design-To Specifications

A basic measure of success at the PDR is whether you are ready to proceed to detailed design development for each system or subsystem in your project. Just as your PDD forms the initial condition for the phase leading up to PDR, your “design-to specifications” form the initial conditions for the detailed design phase leading up to CDR.

Design-to specifications define the requirements for each item that is to be designed. They should reflect the outcome of your assessment of design alternatives. Design-to specifications include items such as:

- Overall system architecture. Major components or subsystems should be identified (see WBS below) and their interdependence shown in a top level functional diagram. Additional top level diagrams should be developed, depending on the focus of the project. These could include a solid model of your project, software flow charts, system block diagrams, reference frame definitions, operation scenarios, etc.
- Outline of the the functional elements for your project, system by system, and subsystem by subsystem, usually in the form of a Work Breakdown Structure outline.
- Short itemization of the required performance parameters for each element (e.g. basic functional characteristics and configuration; allocated mass, size and power; interface constraints). These are the items to which individual engineers will design their respective systems.
- List of purchased components for each element, with sufficient information about each to include into the design.

2.3 Assess Design Issues and Risk

Now that the architecture has been defined, and individual elements described, the last step is to assess the remaining issues and risks expected in the design and implementation phases. All designs run into trouble upon detailed development. Types of risks often encountered include:

- Availability of a critical component or facility
- Error in an analysis during the preliminary design phase
- Inability to meet specified part mass, size and/or power constraints

You need to identify the most important risky elements in your design. If they are significant, you must develop backup plans. Backup plans can include:

- Alternative suppliers for critical components
- Conservative allocation of design-to specifications
- Project “Off-Ramps”

Off-Ramps are sometimes needed when a project attempts to reach a goal stated in the PDD, but has to fall back to a minimum goal due to problems encountered in the design. If off-ramps are defined for your project, you need to specify when this is done and what criteria will form the basis for the decision.

2.4 Finalize Project Management Plan

Your group is more like a small aerospace company than a large one, so a complex project management plan makes little sense. However, small companies are successful in part because they adapt some of the project management practices used by large companies. You should take this approach in developing your own project plan.

The elements required in this regard are:

- Organizational Responsibilities (including an organization chart)
- Work Breakdown Structure
- Schedule (detailed through CDR; preliminary through end of the project)
- Cost Estimates (by system and subsystem, with uncertainties as appropriate)
- Specialized Facilities and Resources

Use of external resources and facilities require a formal written letter of commitment. This must be coordinated with the course coordinator.

3.0 Deliverables

3.1 PDR Data Package

Each group must submit their PDR Data Package in the form of a Powerpoint presentation. This must be submitted to the Course Coordinator and to your faculty advisors. It may be submitted either by email or on a CD. The email or CD must be received by all the required recipients before the due date and time.

3.2 Due Date and Time

The due date and time is 5:00 PM, Monday, October 3, 2005.

3.3 No Changes to the Submittal

No changes will be allowed to your presentation materials after the due date and time. You will be presenting from the version of the data package that is submitted to the CC and your advisors.

No supplemental material may be distributed at the presentation.

Paper copies of your submitted data package will be provided to the PAB. Do not bring additional copies to the presentation.

3.4 Presentation Schedule and Format

Presentations will be scheduled during allotted class lecture and lab times beginning with lab time on Tuesday, October 4, 2005. All students are required to attend all presentations (see the Course Syllabus).

The order of presentations will be random. Each group will be allotted 50 minutes. This includes 25 minutes of presentation, followed by 25 minutes of discussion. *These time limits will be strictly enforced.*

Teams should expect questions from faculty, staff, and other students to clarify issues that arise during your presentations. Major discussions, however, are left for the 25 minute time at the conclusions of your presentation.

When a major issue is not resolved at the review, it is customary for the person that raises the issue to complete a "Recommendation for Action" (RFA) form. These will be provided at the review for use by the PAB and other students in the audience.

3.5 Presentation Content

The presentations must include the following major sections:

- Briefing Overview and Content. An index to the content of the presentation
- Objectives Overview. Review of top level objectives and functional needs.
- Development and Assessment of Design Alternatives (see section 2.1)
- Design-To Specifications (see section 2.2)
- Risk Assessment (see section 2.3)
- Project Plan (see section 2.4)

Each of these major sections must be clearly identified by name in the presentation.

4.0 Grading

You will receive a grade for this assignment according to Section 6.0 of the Course Syllabus (AES-SRP-001-2005).

In assigning grades, the PAB will consider the following relative weights to the required elements:

- Briefing Overview and Content (0%)
- Objectives Overview (10%)
- Development and Assessment of Design Alternatives (40%)
- Design-To Specifications (30%)
- Risk Assessment (10%)
- Project Plan (10%)

Note that the PAB will evaluate both the quality of the content and the quality of the presentation in determining your grade.