**Task 9: Preliminary Design Review**

The Preliminary Design Review (PDR) is a refinement of the information presented in your Conceptual Design Review that consists of the following components:

1. Project description
2. Use case
3. System-level requirements
4. Functional architecture
5. Cyberphysical architecture
6. Subsystem descriptions
7. Current system status
8. Project management

Component descriptions

1. Project description. This is a **refined** project description consisting of user needs and your proposed method of meeting them. It focuses on end results, not the details of the technology.
2. Use case. Give a brief refined use case coupled with a **graphical representation** of the system in its **use case/mission environment**. For example, if you are creating an Explosive Ordnance Disposal (EOD) robot, the figure should show not only the robot, but the likely bomb site, the area to be traversed to reach that site, and the user interacting with the robot. Use this graphical representation to give the audience a clear idea of how your system will be used.
3. System-level requirements
4. These should be divided into two categories: **mandatory and desirable**. Each of the mandatory and desirable categories should be divided into two further categories: functional and non-functional.
5. Use some numbering scheme for your requirements for consistency and ease of tracking their fulfillment as you progress throughout the year.
6. Where possible, associate a quantitative technical performance measure with a requirement.
7. Identify any requirements changes since the CoDR with justification for the changes.
8. Functional architecture
   1. This is a block diagram showing your system’s **major functions and the flow** (information, energy, material) between them down to one level below the one presented in the CoDR.
   2. Don’t use generic subsystem names. The subsystems should be as specific to your system as possible. So, for example, instead of Sensing, Planning, Acting, for a planetary rover you might have Rock Detection, Path Planning, Rock Abrading, Sample Storing.
9. Cyberphysical architecture
10. This is a block diagram showing your system’s **major cyberphysical (hardware and software) components and the flow** (information, energy, material) between them.
11. The cyberphysical elements detailed here (hardware & software) are a particular realization of your functional architecture, so the two block diagrams should be strongly parallel. In particular, there should be a strong match between the subsystems in both.
12. If the information flow requires additional detail not possible to fit into the main cyberphysical architecture block diagram, you should include a software architecture block diagram.
13. Subsystem descriptions. Concisely describe and, if appropriate, depict each major subsystem.
14. Current system status. Describe and depict what you have developed so far. Use videos or simulations for moving parts.
15. Project management
16. Work Breakdown Structure. Present a **summary** of the three-level Work Breakdown Structure you developed in the Systems Engineering class. Save the WBS details for the Critical Design Review document due at the end of the semester.
17. Schedule
    1. Fall granularity should be weekly; spring granularity should be biweekly (every two weeks).
    2. Answer these key questions: What are the major system development milestones in the remaining schedule? Are you behind, ahead of, or on schedule?
18. High-level test plan
    1. Present your test plan as a set of capability milestones for the three (3) remaining Progress Reviews (PR) in the fall semester (PR 3, 4, and 5-6, since 5-6 are the fall validation experiment and its encore) and for roughly the ends of each of the four (4) months (Jan-Apr) in the spring semester. Indicate how these capabilities will be tested.
    2. Fall and spring validation experiments. These are the final two (2) Progress Reviews in each semester, to be presented in lab demonstrations lasting no more than 30 minutes per team. Describe them with somewhat greater detail than the other capability milestones, including these essential elements:
       1. The test conditions: location, needed equipment, size and nature of operating area, etc.
       2. A list of steps your system will be put through written in a sufficiently clear way for someone with no knowledge of your project to be able to test the robot.
       3. A set of quantitative performance metrics that your system will be measured against during the validation experiment. Typically, these metrics will be written into the list of steps in the previous item.
19. Budget. Answer these key questions:
    1. What is your total budget?
    2. What are the big-ticket items that comprise the majority of your budget?
    3. How much/what percentage have you spent to date?
20. Risk management
21. Apply techniques learned in the Systems Engineering class to evaluate risk from the technical, cost, schedule, and overall project/program standpoints and identify mitigation strategies.
22. For your major risks, present the following information:
    * 1. Name of risk
      2. Associated requirements
      3. Description of risk
      4. Risk type (cost, schedule, technical, project)
      5. What would cause the risk to be realized and what is the likelihood?
      6. What are the consequences if the risk is realized?
      7. Risk reduction plan
23. Action planned
24. Success metrics/expected outcome
25. Comments

You will also be graded on your delivery (item 9 in the rubric below). Practice as a team ahead of time; include the practice of smooth handoffs from one speaker to another. Adhere to the length limit, speak clearly and without stumbling, face the audience, and be prepared to answer questions crisply and coherently.

The table below gives the grading rubric for this assignment.

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| **Preliminary Design Review Element** | **Weight** |
| 1. Project description | 0.5 |
| 2. Use case | 1 |
| 3. System-level requirements | 1.5 |
| 4. Functional architecture | 1 |
| 5. Cyberphysical architecture | 1 |
| 6. Subsystem descriptions | 2.5 |
| 7. Current system status | 2.5 |
| 8a. Project management: Work Breakdown Structure | 1 |
| 8b. Project management: Schedule | 0.8 |
| 8c. Project management: High-level test plan | 2 |
| 8d. Project management: Budget | 0.7 |
| 8e. Project management: Risk management | 1.5 |
| 9a. Length | 1 |
| 9b. Intelligibility, flow, demeanor, audience connection | 2 |
| 9c. Handling of Q & A | 1 |
| **Total:** | 20 |