

**TIDEE**

Transferable Integrated Design Engineering Education



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## **UNIT 4: Multi-week Engineering Design Project**

### **Session 3: Interfacing of Individual Components**

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### **Session 3: Interfacing of Individual Components**

#### **Announcements and Objectives for the Day (10 minutes)**

- a. Develop a broader understanding of limitations when designing in paper
- b. Create a repository of ideas by identifying multiple solutions for each component
- c. Upgrade three refined conceptual designs, which provides a better basis from which to select one design for further development
- d. Gather enough new information so that the team can refine the problem definition and timeline to become more relative and pertinent

#### **Develop Individual Components (50 minutes)**

It is too easy to choose a linear path, lock into an “ideal” design, and then exert all of your team’s energy into developing that idea. Often this approach creates dead ends! When that happens, teams don’t quickly recognize the futility of continuing the process. They reason that they have invested too much time already and that there must be a quick fix to the problem. They have difficulty dropping the idea and switching to a new approach, partly because they don’t have any viable options. Consequently they lose valuable time, which doesn’t get them any closer to the solution. As deadlines approach they become desperate!

What to do? Here’s a better idea. Broaden your base of ideas from the beginning! Work on developing multiple conceptual designs and then choose to focus on one when you have a better handle on the issues and what is possible.

The approach for this activity is to broaden your base by designing individual components for all of your conceptual designs. The information gathered may be useful to help you select your conceptual design after building a repertoire of ideas or to modify the design by using ideas developed for your other conceptual designs.

#### **Upgrade Conceptual Designs (15 minutes)**

#### **Refine Design Criteria and Timeline (12 minutes)**

#### **Reflectors Report (Outlined in previous activity)**

## Session Overview

This session is concerned with developing conceptual designs. Initially, it may seem like a lot of additional work, but developing three conceptual designs upfront can provide handsome dividends in the end. The multiple concepts developed by designing the interfacing required between different designs helps to broaden the knowledge base - much like doing reverse engineering on several of the competitors' products. The selection of the final design to develop into a prototype is postponed until the fourth session.

Individual components are developed for each of the preliminary conceptual designs. Armed with this information, your team will be directed through an activity to ask how the component designs affects the conceptual design; make changes to the conceptual designs; and update the criteria and timelines. If teams have fallen behind in a workable schedule, then the teams are instructed to develop a recovery plan. The reflector reports how the changes affected the team activities and performance, which, in turn, provides an opportunity for each team to publicly explain their process.

## Activity: Develop Individual Components

**Objective:** Develop individual parts of each conceptual design to create a broader inventory of ideas to use in the final design

### Tasks

1. Review the three conceptual designs that your team has identified as possible solutions to the design contest.
2. Discuss and come to a consensus about how each conceptual design might be divided into subsystems. Record the subsystems in your journal.
3. Choose a common subsystem to begin analyzing, like attaching a non-powered wheel to a frame.
4. Identify differences that would result for each conceptual design. For example, one design might be to attach the wheel between two parallel frame members, wheels on either end of a long axle, and on for a third possibility, the wheels are connected directly to the frame.
5. Brainstorm to develop possible solutions for each configuration.
6. Think of problems or issues that need to be overcome for your solutions.
7. Record all information with sketches in your team journal.
8. Choose another subsystem and repeat steps 5 through 8. When completed, you will have developed a repository of ideas that can be used later.
9. Prepare a progress report that includes some sketches of the work in progress.

### Deliverables

- Team reporter prepared to briefly discuss work in progress for conceptual design and development of individual subsystems
- Team reflector prepared to give a brief report that describes how the team is developing as a unit and how the team is encompassing the diversity of backgrounds and experiences to provide input to creative solutions.

### Criteria for Success

- The design is effectively broken into components that can be solved separately.
- Teams display a lot of synergy.
- Insights by the reflector are becoming “richer” and more meaningful.
- Report helps other teams generate new ideas.

### Resources

- Previous work on project.
- Forty-minutes of time.

## Activity: Upgrade Conceptual Designs

**Objective:** To review component development and upgrade the conceptual designs

### Tasks

1. Review the previous criteria and check for omission.
2. Combine or remove extraneous items.
3. Check and update weighting scale to reflect appropriate ranking for the selection and construction of the design.
4. Check timeline tasks to insure all required tasks are identified.
5. Review the progress vs. schedule and prepare a recovery plan if necessary.
6. Reporters prepared to give short report on changes that were needed.
7. Team helps reflector report on how the changes will affect team activities and performance.

### Deliverables

- Reporter prepares a summary of team's changes.
- Reflector describes how the changes will affect team activities and performance.

### Criteria for Success

- Team produces a schedule that is more in line with real progress and required future tasks.
- Team members begin to understand the iterative nature of a design process.
- Team members become more sensitive the effects that detailed planning has on the project.

### Resources

- Previous criteria, weighting factors and timelines.
- Ten minutes of team activity

## Activity: Refine Design Criteria and Timeline

**Objective:** To review work previously done and update the design criteria and timeline.

### Tasks

1. Review the previous criteria and check for omission.
2. Combine or remove extraneous items.
3. Check and update weighting scale to reflect appropriate ranking for the selection and construction of the design.
4. Check timeline tasks to insure all required tasks are identified.
5. Review the progress vs. schedule and prepare a recovery plan if necessary.
6. Reporters prepared to give short report on changes that were needed.
7. Team helps reflector report on how the changes will affect team activities and performance.

### Deliverables

- Reporter prepares a summary of team's changes.
- Reflector describes how the changes will affect team activities and performance.

### Criteria for Success

- Team produces a schedule that is more in line with real progress and required future tasks.
- Team members begin to understand the iterative nature of a design process.
- Team members become more sensitive the effects that detailed planning has on the project.

### Resources

- Previous criteria, weighting factors and timelines.
- Ten minutes of team activity