

# Design Document (Educator Guide)

Students will be using this design document to meet the following objectives as outlined in the *Project Lead the Way: Introduction to Engineering Design* course outline. As part of the design process students will:

- Utilize research tools and resources (such as the internet; media centers; market research; professional journals; printed, electronic and multimedia resources; etc.) to gather and interpret information to develop an effective design brief.
- Define and justify a design problem, and express the concerns, needs, and desires of the primary stakeholders.
- Present and Justify design specifications, and clearly explain the criteria and constraints associated with a successful design solution.
- Write a design brief to communicate the problem, problem constraints, and solution criteria.
- Generate and document multiple ideas or solution paths to a problem through brainstorming.
- Clearly justify and validate a selected solution path.

## TEACHER DIRECTIONS

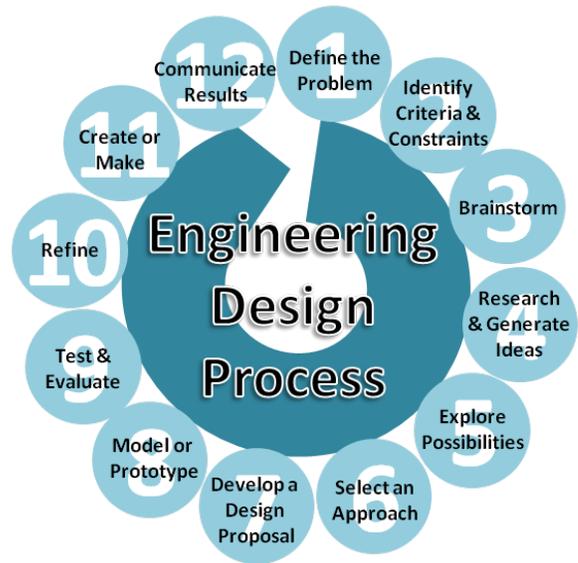
- > Before watching the video, hand out the Design Document Student Template.
- > Go over the engineering design process with your students and answer any questions they may have. Focus on the first six steps of the process.
- > Play the first segment of the Spark 101 Video, *Fruit Fly Surveillance*, directing students to listen for answers to parts A and B.
- > Have your students work in groups of three to complete the activity.
- > Part C directs students to use the provided K-W-L Template to do their brainstorming and research. Students will either need to have access to internet in a computer lab or in the classroom, or will need to complete the research as homework.
- > Direct students to complete parts C, D, and E with their groups.
- > Watch the second segment of the Spark 101 video, *Fruit Fly Surveillance*.
- > Direct students to complete part F and discuss with their groups.
- > Discuss with the class how their designs compared to the NASA engineering design.
- > Discuss with class how they feel steps 7-12 of the design process may have been implemented by NASA engineers and what importance they may have had in the process.

## STUDENT DIRECTIONS

- > Watch the first segment of the Spark 101 video, *Fruit Fly Surveillance*.
- > In your own words, define the problem described by Dr. Som. Who is the design being built for? What are their concerns, needs, and desires for the design?
- > Identify criteria and constraints that Dr. Som shared during the video that need to be considered in your design? What design specifications did he share?
- > Use the K-W-L Template to brainstorm and to research and generate Ideas. Brainstorm what you already know, and what you want to know about the research topics given. Think about what kind of information will help you come up with a design. Then do the Research to find the answers to your questions.
- > Explore your possibilities. Brainstorm with your group to generate three different design ideas. How does each idea meet the criteria and constraints?
- > Select an approach that will work best. Which of your ideas best met the constraints and makes the most sense for the project? Clearly explain your selection and why you feel it is the best design solution.
- > Watch the second segment of the Spark 101 video, *Fruit Fly Surveillance*.
- > How does your design compare with the design NASA scientists developed?

# Design Document (Student Template)

When doing any engineering design, it is important to follow an engineering design process. While the steps of this process may vary a little depending on the type of engineering you are designing for, the same basic ideas hold true for any engineering design. We will be using the process outlined to the right but will focusing on the first six steps of the process for this activity. After learning about the problem to be solved and the criteria and constraints given you will be asked to come up with a design and then compare your design with the one developed by NASA engineers to help with research on the International Space Station.



## Directions

Watch the first segment of the Spark 101 video, *Fruit Fly Surveillance*, to complete parts A and B.

- A. In your own words, **Define the Problem (step 1)** described by Dr. Som. Who is the design being built for? What are their concerns, needs, and desires for the design?
  
- B. **Identify Criteria and Constraints (step 2)** that Dr. Som shared during the video that need to be considered in your design? What design specifications did he share?
  
- C. Use the K-W-L Template to **Brainstorm (step 3)** and to **Research and Generate Ideas (step 4)**. Brainstorm what you already know, and what you want to know about the research topics given. Think about what kind of information will help you come up with a design. Then do the Research to find the answers to your questions.

**D. Explore Your Possibilities (step 5).** Brainstorm with your group to generate three different design ideas. How does each idea meet the criteria and constraints? If you need more space, use a separate paper and attach.

	Describe and/or Sketch	How are the criteria & constraints met?
Design Idea 1		
Design Idea 2		
Design Idea 3		

**E. Select an Approach (step 6)** that will work best. Which of your ideas best met the constraints and makes the most sense for the project? Clearly explain your selection and why you feel it is the best design solution.

Watch the second segment of the Spark 101 video, *Fruit Fly Surveillance*.

**F.** How does your design compare with the design NASA scientists developed?