MESA DAY COMPETITION
2022-23

Engineering Lab Book

LEVEL: Middle and High School (all grades)

SCOPE: Required **ONLY** for Cargo Glider, MESA Machine and Moon Base

OVERVIEW: The purpose of the Engineering Lab Book is for students to better understand the process an engineer goes through in the creation of a project. MESA projects are not designed to be completed in a single class period or day, but to be the result of thoughtful research, planning, analysis and evaluation. Keeping a lab book throughout the design process will help to keep a designer on track, using a logical progression of planning, in order to develop their project efficiently.

MATERIALS: **Electronic submissions will be required.** Teams should use an electronic portal/application such as Google Docs to keep and maintain a lab book. Access and permission to the lab book must then be given to MESA Day staff and judges OR lab book is submitted electronically (e.g., PDF file, WORD file) for review.

Please check with your local MESA center for the deadline and submission platform to submit your team's lab book for local and for regional events.

REQUIREMENTS:
Lab books are meant to clearly demonstrate and illustrate evidence of the application of the Engineering Design Process in the MESA project. One lab book per team should be submitted per required competition.

Engineering lab book must be properly labeled (names, school, center, grade level, etc.) and contain and cover the following sections, with each section tabbed/labeled:

1) **IDENTIFY THE PROBLEM** (at least 2 sentences for each question) *This is where you determine what goals you are working towards with your project.*
    a) What is the problem/challenge you are working on? What is the ultimate goal of the project? *Ex: What should the end result of your project be?*
    b) What are the limits/constraints? In other words, what rules do you have to be sure to follow? What are your guidelines? Ex: *Are there materials you aren't allowed to use? Is there a certain size limit you have to stay under?*
    c) How do you think you can solve the problem/challenge?

Tip: Read the competition rules thoroughly. As you read them, take notes in this portion of your lab book of important information.

2) EXPLORE

This is the research portion of your project. Before coming up with solutions you should understand the scope of your project, what others have already done, what has not yet been done (but should be), resources for information, materials, and ideas, and any other information that could help you create your project.

Include a real world example of project OR concept. Describe example (2 sentences). Find out what else has been done to solve your problem (research). Clearly list at least 3 sources (web pages, articles, books, etc.). Identify (cite) and describe each one (one sentence).

Tip: The goal is not to find what others have done in order to replicate their process; you are looking to familiarize yourself with the concepts related to your project in order for you to be able to come up with a unique solution.

3) DESIGN

This is the portion where you get to start being creative. Using your research and clearer understanding of your project scope, you will begin to craft multiple solutions in order to decide on which you think is the best, or perhaps even a combination of them all.

Brainstorm ideas (at least 3 ideas) and record them. Each idea should be represented by a sketch or drawing. These sketches and drawings should include notes about what the sketch means and how it would be executed. Select one idea and create a plan (at least 5 sentences) to build a prototype from. Generate a list of materials for your prototype.

4) CREATE

This is the portion where you get to start building. Once you have your materials, you will build your prototype based on the plan you created.

Using your plan, build your prototype; describe the building of prototype (at least five sentences). Include a picture of the actual project prototype.

Tip: The best way to describe how you built your prototype is to write the description as you are building. Notate where you had to deviate from your plan and why. Having this portion of your lab book will allow you to thoroughly analyze your work and easily find where you need improvements, not just of your project, but your building process as well. These notes should also help you in the building of your final project as well.

5) TRY IT OUT

This is the portion where you test your prototype and analyze your results in order to improve your design and process. This portion is typically continued until you have created a test result that fulfills your goal.

Test your idea/prototype. Attempt at least 3 trials/attempts of your test. Measure the results of your test (by project performance criteria). Provide evidence of the use and application of at least 2 appropriate mathematical concepts in your tests.

Tip: Take notes about each of your trials: setting up the test and anything you did differently during each time you set up, performing the test and anything that went differently during each trial, the results of each test and why you think each was different and what improvements need to be made.

6) **MAKE IT BETTER**

In this portion you review your test results and use them to come up with ways to improve your project to begin production on the final product. It is possible you will see major changes from your initial design, but it is also possible that it will still be similar.

Describe how you can make the project better and what modifications you will be making (at least 5 ways you can improve the project). Build and prepare a competition ready project. Include a picture.

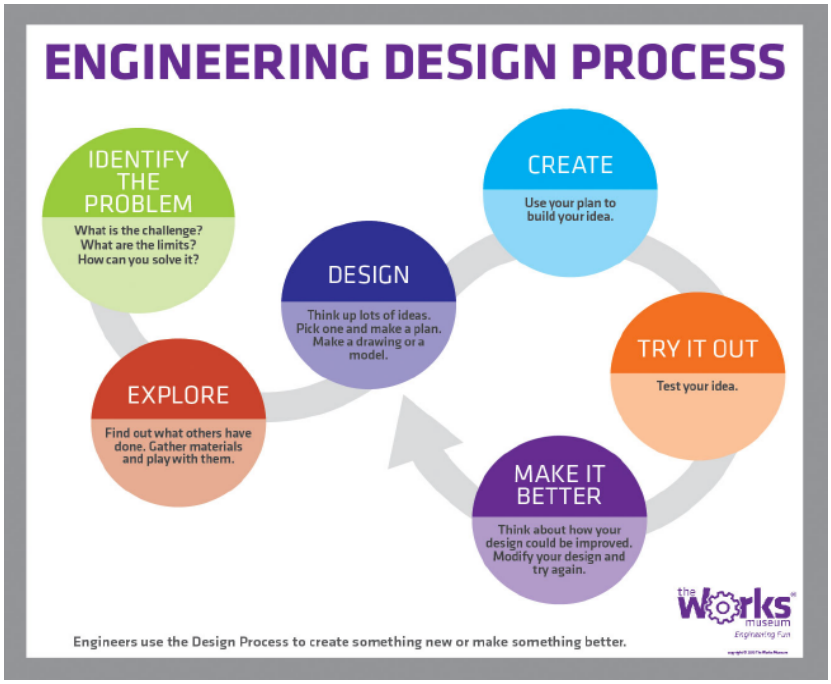
Tip: Test out the modifications on your prototype or build a new prototype if necessary. Did your modifications work? If so, you are ready to build a competition ready project. If not, what additional modifications do you need to make to do so? Analyze your design process and show understanding of your successes and failures.

SCORING:

A deduction of 50% of the total project score will be assessed for a missing lab book and will make the team ineligible to place in both ribbon and medal categories. A missing lab book is one that is not submitted and received through the required methods OR scores lower than **15 points** on the scoring rubric (subsequent page).

A deduction of 20% of the total project score will be assessed for an incomplete lab book (An incomplete lab book scores between **15 and 19 points** on the scoring rubric).

LAB BOOK SCORE	DEDUCTION (from total Team/Project Score)
below 15 points (< 15)	50%
15 - 19 points (≥ 15 and ≤ 19)	20%
20 - 25 points	No deduction



MESA DAY 2022-23

Lab book Requirement Rubric

Project/Contest:_____ Level (circle one): Middle School High School

Team Member Names:_____School:_____

	Criteria	Excellent *(no stated items missing)* (4 pts.)	Good *(one stated item missing)* (3 pts.)	Fair *(two stated items missing)* (2 pts.)	Poor *(three or more stated items missing)* (1 pt)	Missing *(Criteria is completely missing)* (0 pts)
A	Is the lab book properly labeled? *(Names, Grades, School, Center)*	2 pts – All stated items included	2 pts – All stated items included	2 pts – All stated items included	1 pt – One or two stated items missing	0 pts – Stated items completely missing
1	Identify the Need *At least 2 sentences.State what is the challenge being worked on? What are the limits/constraints? How do you think you can solve it?*	3 pts – All stated items included	3 pts – All stated items included	2 pts – one stated item missing	1 pt – Two or more stated items missing	0 pts – Stated items completely missing
2	Explore *Conducting research (one real world example, description, list 3 cited/referenced sources), gathering materials, try using materials*					
3	Design *Brainstorming ideas (at least 3 iterations) each represented by a picture, sketch or drawing. Creating a plan for selected idea (at least 5 sentences). A list of materials for the prototype.*					
4	Create *Building a prototype. Describing the building of the prototype (at least 5 sentences). Include a final picture of the project.*					
5	Try it Out *Testing idea/prototype. Attempting at least 3 trials/attempts. Measuring each trial result (by specific performance criteria like distance traveled, time, etc.). Providing evidence of the use and application of at least 2 appropriate mathematical concepts in the tests.*					
6	Make Better *Evaluate results. List at least five ways project can be improved*					
	SUB TOTALS					

Rubric Total *(25 points possible)*:_____ Does Lab book have deductions? **NO** (score is 20 points or higher) **YES** (assess below)

Is score **≥ 15 and ≤ 19**? **NO** **YES** *(-20% of total performance score)* Is score lower than **< 15**? **NO** **YES** *(-50% of total performance score)*