2019 SeaPerch
Engineering Notebook Guide

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seaperch

DEPARTMENT OF THE NAVY
ONR
Science & Technology

Table of Contents

Top 2018 High School and Middle School Engineering Notebooks

The Engineering Notebook

Engineering Notebooks are used by engineers to:

- Document their ideas and steps taken to solve engineering problems and engineering design projects
- Provide a legal document that can be used as proof of invention for products they design

Engineering Notebooks are sometimes referred to as an Engineer's Notebook, Design Notebook, Laboratory Notebook, or Inventor's Notebooks. The purpose of the notebook is to carefully and systematically document design steps, procedures, and test results.

Included in such a notebook is important information on the following areas:

- Clearly articulated project or problem to be solved
- Project constraints and parameters
- Detailed design ideas
- Procedures to implement and test the designs
- Test results
- Recommendations for design modifications
- The design – test – modification cycle
- Proposed future steps

A very good resource for using an engineering notebook is the MIT Department of Mechanical Engineering, "Instructions for Using Your Laboratory Notebook"
http://web.mit.edu/me-ugoffice/communication/labnotebooks.pdf

SeaPerch Engineering Notebook Challenge

The SeaPerch Engineering Notebook is used to measure the team's ability to document the engineering design process used to design and modify their SeaPerch ROV to meet the pool challenges. The Engineering Notebook is not intended to document the construction of the standard SeaPerch ROV.

Teams competing in the SeaPerch Mission Challenge will submit their engineering notebook online as a Portable Document Format (PDF) file prior to the SeaPerch Challenge. The engineering notebooks will be judged by a panel of judges and the top teams from each division (middle school, high school, and open class).

Submission instructions, deadlines, and up to date engineering notebook challenge rules and rubrics will be posted online on the 2019 SeaPerch Challenge page.

FYI – Engineering, laboratory, or research notebooks are available online ranging in price from around $5 for a paperback research notebook to over $30 for a hardbound engineering notebook.

SeaPerch Engineering Notebook Challenge Rules

1. The SeaPerch ROV and engineering notebook must be solely a product of the students' own efforts, ideas, and designs. Teachers, mentors, and others may advise students, but may not create content for the notebook. For inclusion in the engineering notebook, graphics such as computer-aided design (CAD) or other types of drawings, photos, and sketches must be the work of the students that are part of the SeaPerch team.
2. Teams must submit an electronic copy (PDF file) of a physical **handwritten notebook.**
3. The notebook may consist of hand sketches, photos, computer-aided design (CAD) drawings, charts, and graphs. Photos, CAD drawings, and other computer generated entries should be taped to the notebook page and labeled. **Notes and other documentation must be handwritten.** Using a word processor, presentation software, or other software that uses a "handwritten font" is prohibited and will be cause for disqualification from the Engineering Notebook Challenge.
4. The Cover Page, Team Information Page, Table of Contents Page, and Reference Page may be digitally created (they do not have to be handwritten).
5. Faded text, faded graphics, small graphics that do not show detail, and handwriting that is too small to easily read will be causes for point reductions. Examples are provided in this guide. Thoroughly review the PDF file before submitting it.
6. Teams should not spent time rewriting their engineering notebook for submission. Content counts a lot more than neatness. The PDF version of the notebook needs to be clearly legible and needs to be a photo or scanned copied of the original notebook. See the example section of this guide.
7. The notebook should document the engineering design process and specific steps taken in designing and modifying the SeaPerch ROV to complete the SeaPerch Mission Challenge pool events.

SeaPerch Engineering Notebook Challenge Rules (cont'd)

8. The notebook is limited to 24 pages maximum in total length. Teams should select the relevant content from their original engineering notebook to create the PDF version of engineering notebook for the Engineering Notebook Challenge The maximum file size for the PDF file is 16MB. Files larger than 16MB will not be accepted.
9. The PDF file must be formatted as 8-1/2" X 11" portrait layout. Pages that have drawings or other graphics taking up the entire page may be in landscape layout.
10. Including multiple pages from the original notebook on a single page in the PDF file is not allowed. If a notebook is submitted with multiple pages on a single PDF page it will be disqualified, and given a score of zero. This will severely hurt your overall SeaPerch Mission Challenge score.
11. The Engineering Challenge Notebook score is used with the pool event scores to determine the overall SeaPerch Mission Challenge score.
12. The Cover page must follow the layout of the template provided on the 2019 SeaPerch Challenge Engineering Notebook page (http://seaperch.org/challenge_notebook). The cover page template is provided as a convenience, and its use is not mandatory, however the layout with required information at the top of the page is mandatory. The Cover Page information must match the information used when registering for the 2019 SeaPerch Challenge.

Required Content

The SeaPerch Engineering Notebook must include the following (in order listed):

1. Cover Page

   Notes:

   The Cover Page may be digitally created or handwritten.
   See SeaPerch Engineering Notebook Challenge Rule # 10 in previous section.

   The Cover page must include the following:

   a. School or club name
   b. City and State
   c. Team name
   d. ROV name
   e. Project title
   f. Photo of final ROV (the photo must not include the team or any other people)

2. Team Information Page (one page only)

   Notes:

   Do not include student or team bio or story. This information will be collected separately and will not be part of the Engineering Notebook Challenge.

   The Team Information page may be handwritten, typed, or digitally created*.*

   The Team Information page must include the following:

   a. Teacher, coach, mentor, or advisor name and email address
   b. First name (**list first name only**), grade level, and role(s) in project for each student.
      *If two or more students have the same first name, use an identifying letter following the first name (**do not use last names**).*
   c. Optional team picture

Required Content (cont'd)

3. Table of Contents Page
    a. The Table of Contents page may be handwritten, typed, or digitally created.
    b. The Table of Contents page must include descriptive titles and page numbers to each page following the Table of Contents..
4. Content (research, design, and testing documentation)
    a. Provide details of each step taken in the engineering design process.
        i. Use the SeaPerch Mission Challenge pool events as the project problem or one of the 2019 SeaPerch Challenge Citizen Science Challenges.
    b. Provide sketches, drawings, charts, and other graphics and written documentation describing solution and design concepts, design iterations, tests performed, and test results.
    c. Include engineering and scientific terms and concepts to demonstrate the team's understanding of the challenges of constructing and operating an underwater ROV.
    d. Provide a detailed breakdown and total cost associated with materials for the ROV modifications.
    e. All pages must be numbered and listed in the Table of Contents.
5. References
    a. The References page may be handwritten, typed, or digitally created.
    b. The Reference (Citation) page must follow the American Psychological Association (APA) style guide.
    c. In-text citation is allowed.

Cover Page Required Layout

School or club name: This must match the name used for registration (delete this comment)

City, State: _____

Team name: This must match the name used for registration (delete this comment)

ROV name: _____

Use this area to make your cover page exciting and showcase your ROV design.

You must include the following:

- Project Title
- Picture or sketch of your ROV

Optional content:

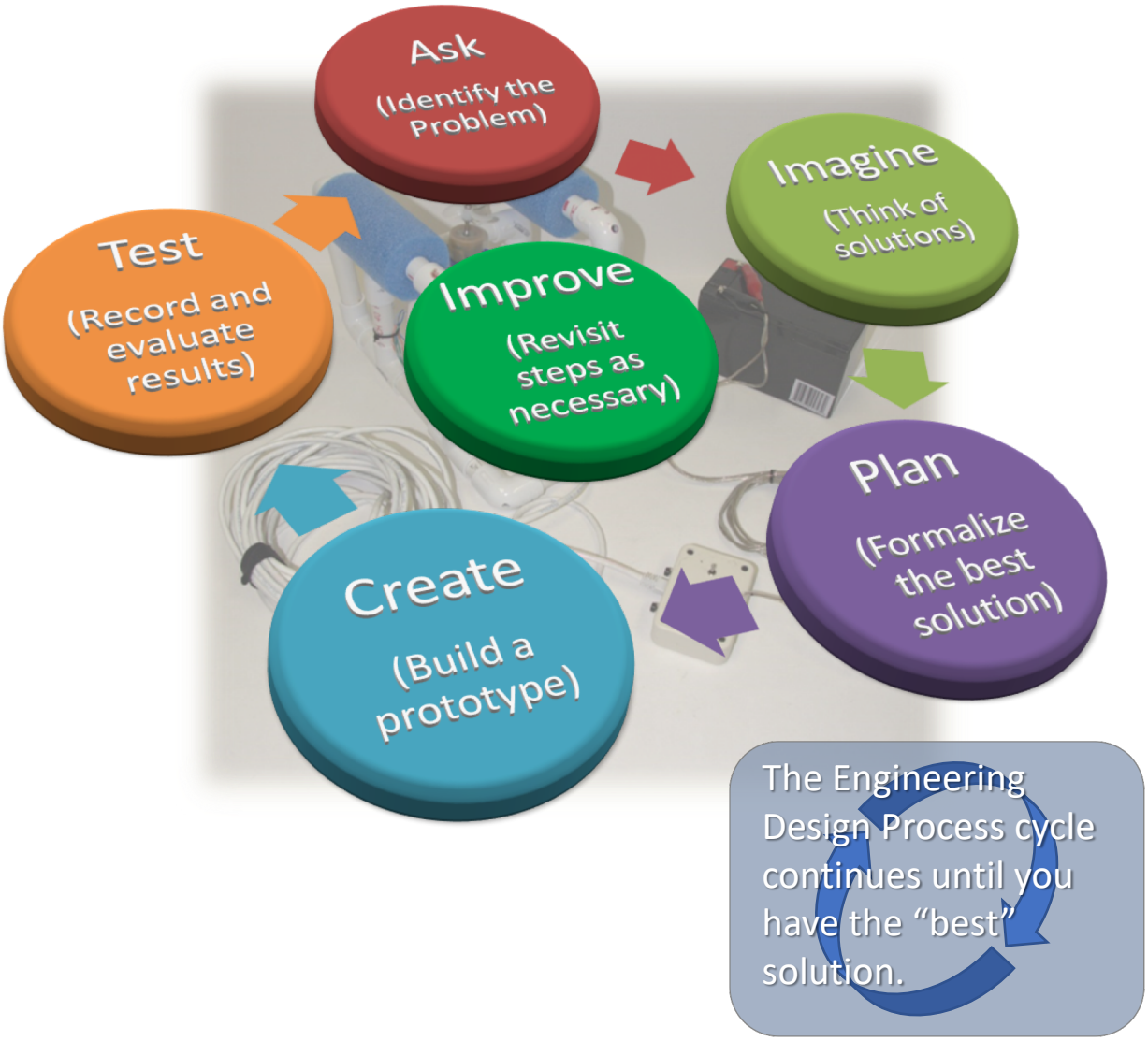
- Logo, artwork, etc.

Do not include a team picture or other pictures that include people on the cover page.

5 points will be deducted if a team picture is included.

Delete this text box.

The Engineering Design Process



The Engineering Design Process is a repeating set of steps used to solve engineering problems and projects.

Throughout the design process previous steps are revisited to correct and improve the design.

(Some presentations of the Engineering Design Process may include additional main steps and may refer to the steps shown here using different terms. This is a simplified representation of the process.)

The Engineering Design Process (cont'd)

As part of the Engineering Design Process, engineers often do the following:

Ask:
- Define the problem or project
- Define the constraints, parameters, rules, etc.
- Research existing solutions

Imagine:
- Brainstorm and discuss possible solutions
- Document ideas
- Create conceptual design drawings

Plan:
- Create detailed design drawings
- Document fabrication steps and procedures
- Document test plans

Create:
- Create prototypes (models)

Test:
- Follow the test plans to test the prototypes.
- Document test results

Repeat previous steps to improve the design

Engineering Notebook Helpful Hints

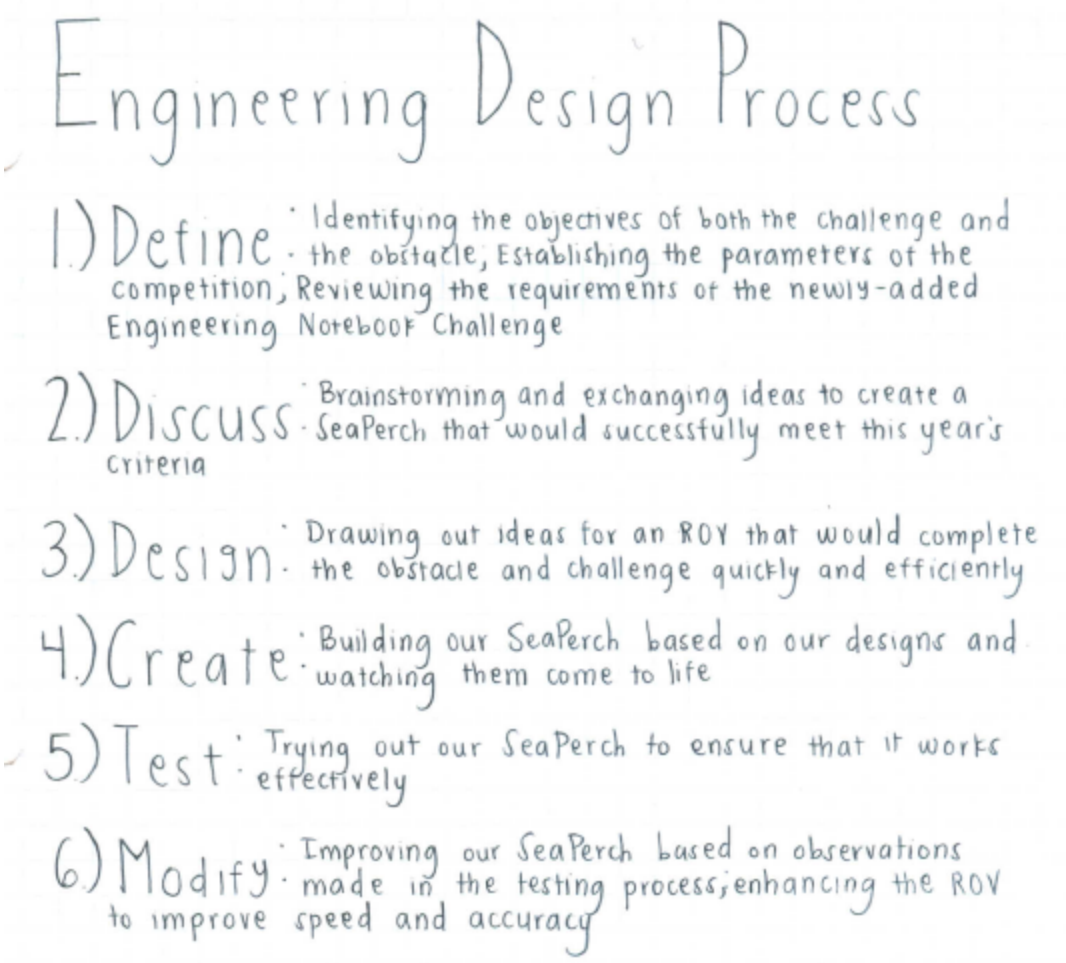
Helpful hints

1. Refer to the Engineering Notebook Challenge Rubric to assure you understand the requirements and scoring. See http://seaperch.org/challenge_notebook.
   a. Make sure to include all required elements for the Cover and Team Information pages.
   b. Make sure the Table of Contents and Reference pages are accurate.
2. Research the Engineering Design Process and apply it to the SeaPerch project. The engineering notebook should reflect that the engineering design process was followed.
3. Describe design iterations using ample text and graphics. Include pictures or drawing of the prototypes you built.
4. Use different types of graphics; pictures, hand sketches, CAD drawings, charts, etc.
5. Document test results using ample text and graphics.
6. Explain all graphics. Do not assume the reader or judge knows what you are trying to communicate. Clearly label relevant parts in drawings.
7. Use and define engineering and scientific terms in content of the notebook.

Engineering Notebook Helpful Hints (cont'd)

Helpful hints (continued)

8. Do not include the steps of building the standard SeaPerch ROV. You may want to document the steps in the working engineering notebook, but the SeaPerch engineering notebook that will be submitted for judging is used to document the engineering design process used in designing, planning, building, and testing the modifications to the ROV for competition.
9. Thoroughly review the entire PDF file before submitting it. Since the submitted notebook will be a scanned or photographed document that is converted to a PDF file it may be lighter than the original. The notebook will receive a reduction in points if the text and/or graphics are faded to light to easily read.
10. Make sure the PDF file is no more than 16MB. Notebooks over 16MB will not be accepted.
11. Provide a detailed breakdown and total costs associated with materials for the ROV modifications.
    a. Do not list the costs of tools.
    b. Do not list the cost of materials for the pool challenge parts or test fixtures.
    c. Provide the weight in grams of all 3D printed parts. 3D printed parts will be costed out at $0.05 per gram.



Engineering Design Process

1.) Define: Identifying the objectives of both the challenge and the obstacle, Establishing the parameters of the competition, Reviewing the requirements of the newly-added Engineering Notebook Challenge

2.) Discuss: Brainstorming and exchanging ideas to create a SeaPerch that would successfully meet this year's criteria

3.) Design: Drawing out ideas for an ROV that would complete the obstacle and challenge quickly and efficiently

4.) Create: Building our SeaPerch based on our designs and watching them come to life

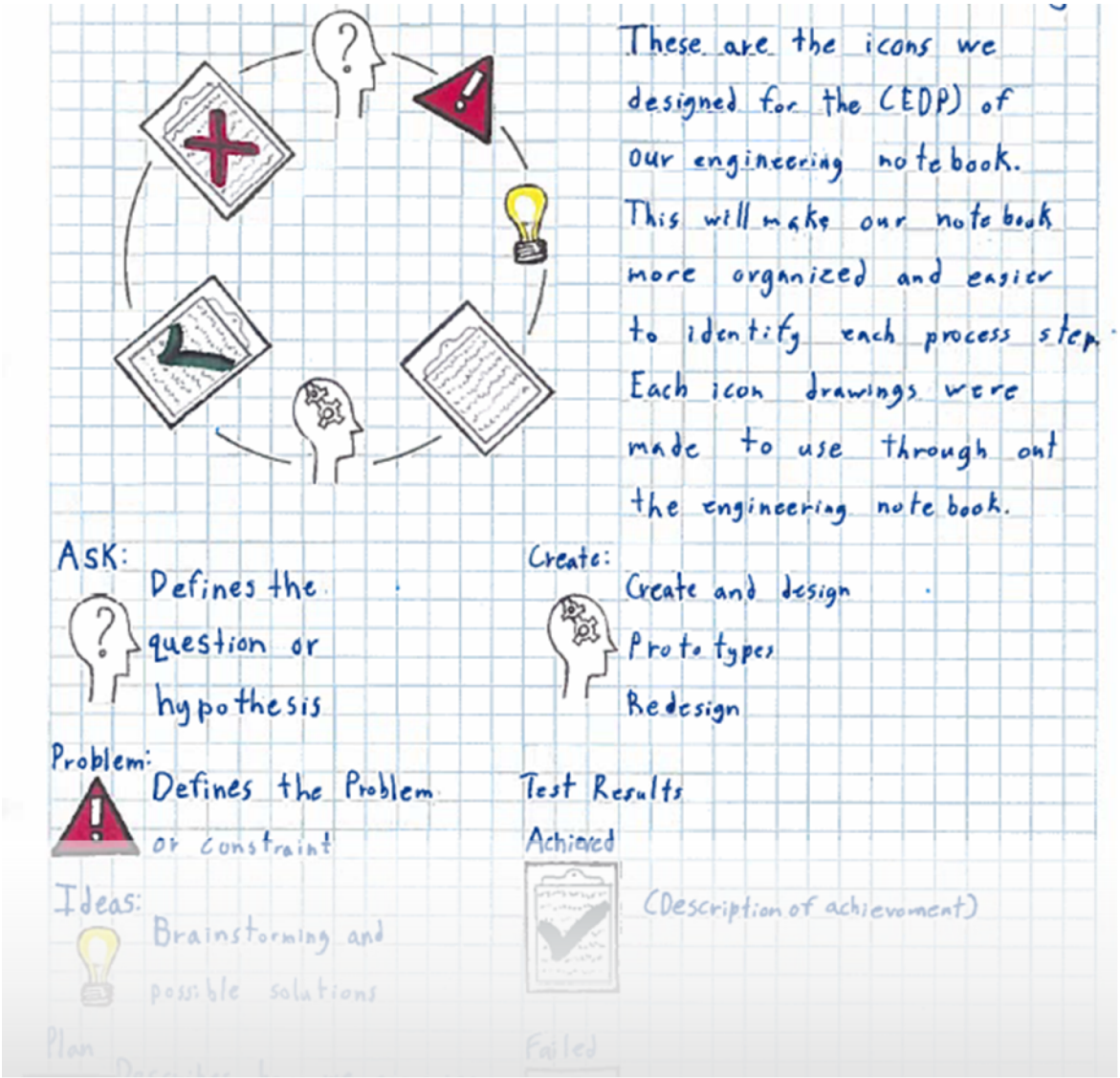
5.) Test: Trying out our SeaPerch to ensure that it works effectively

6.) Modify: Improving our SeaPerch based on observations made in the testing process; enhancing the ROV to improve speed and accuracy

Team Ring Masters 2017

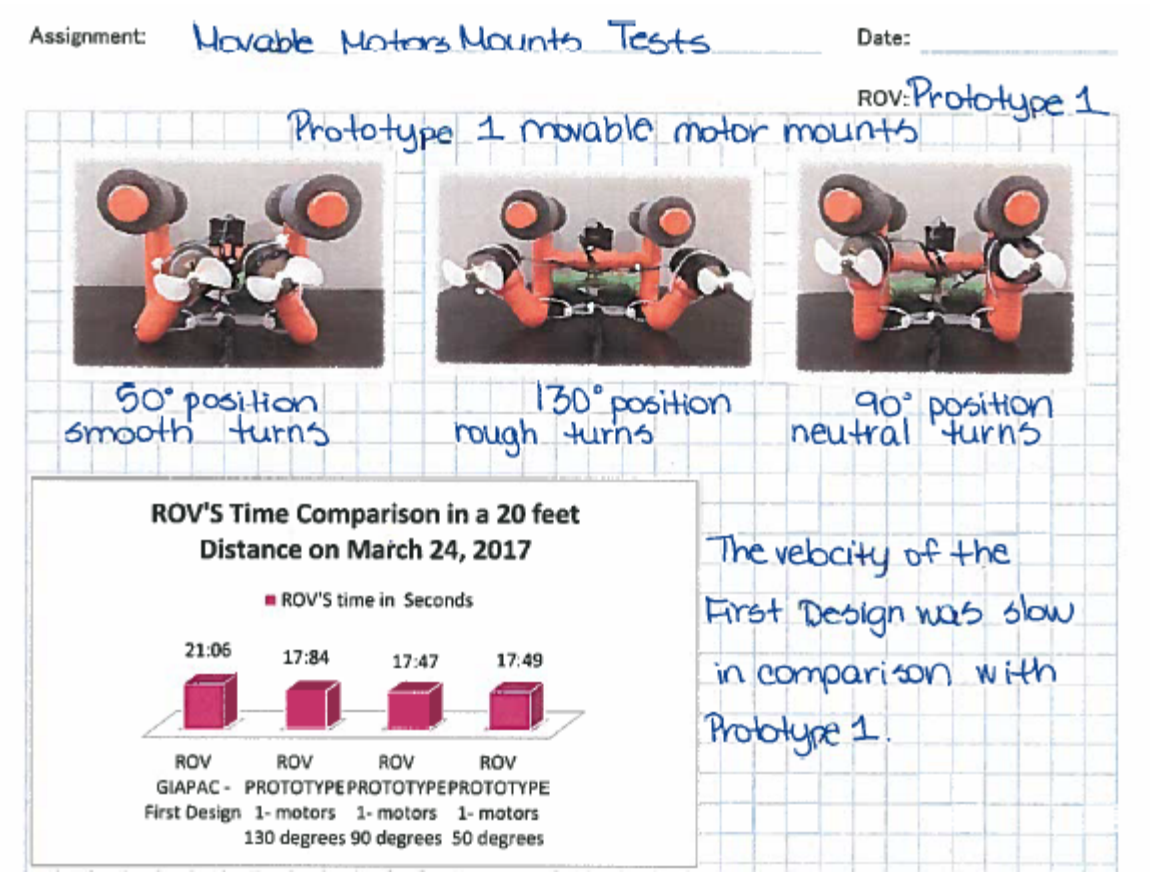
A very good example of summarizing how the Engineering Design Process (EDP) was applied to their project. Simply restating the EDP would not be as valuable.

Engineering Notebook Examples (cont'd)



Team GIAPAC.101 2017

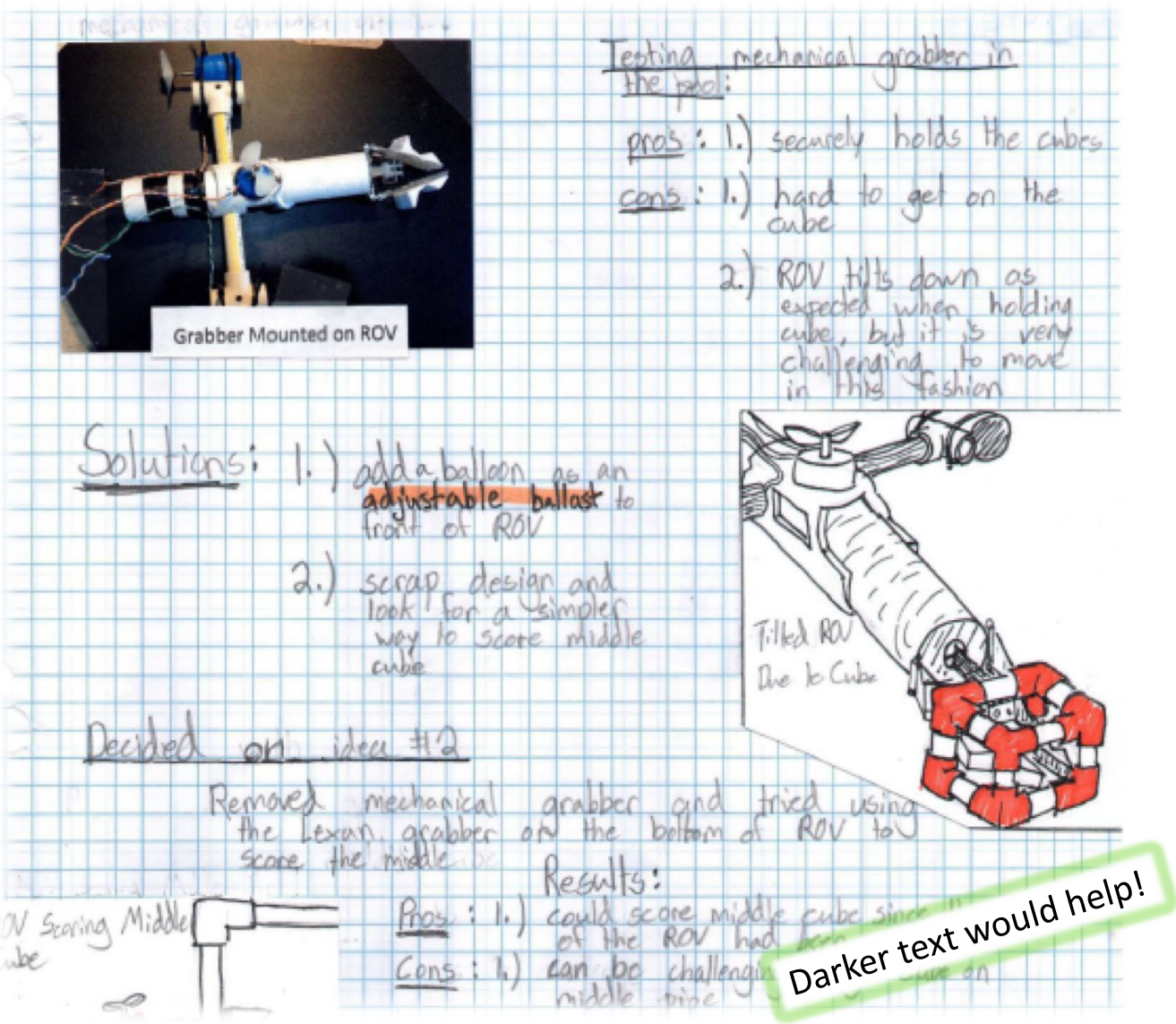
This team designed icons that they used throughout their notebook to provide visual indicators of the steps of the Engineering Design Process.



Team GIAPAC.101 2017

A good example for the following reasons:

- The graphics are large enough and high enough resolution.
- Graphics are labels.
- A chart is used for test results.
- Neat and clear.



Team Gulf Coat Contenders 2017

A good example for the following reasons:

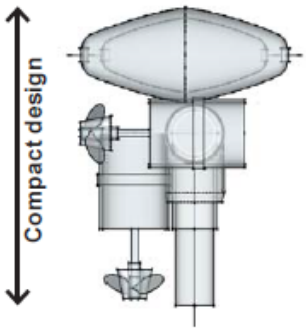
- Multiple types of graphics are used.
- Graphics are labels.
- The team highlighted scientific and engineering terms throughout the notebook.

Engineering Notebook Examples (cont'd)

H-7.1 prototype.

H-7.2 prototype.

H-8 Prototype.

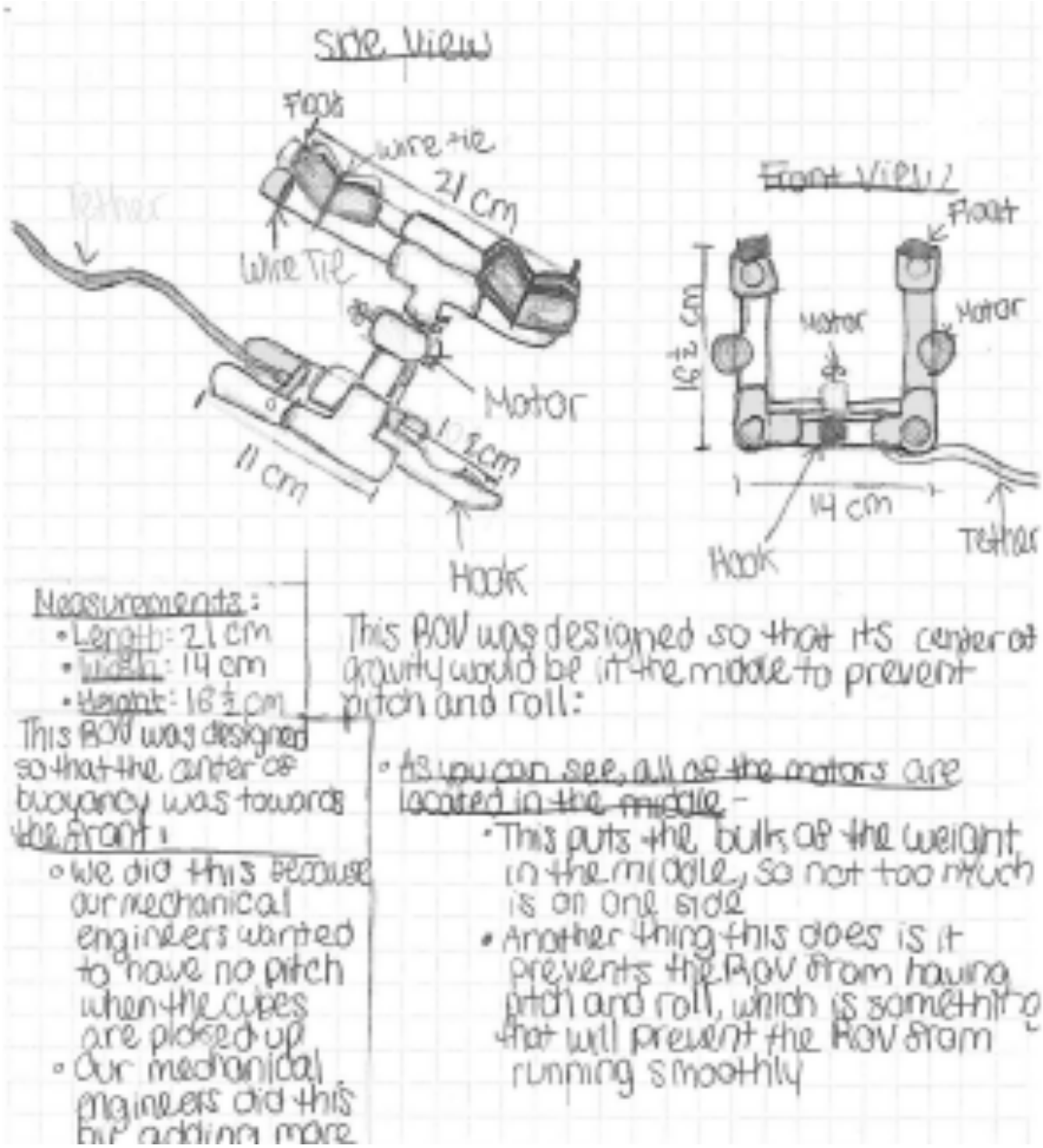


Team Hetwilers Halibut 2017

A good example for the following reasons:

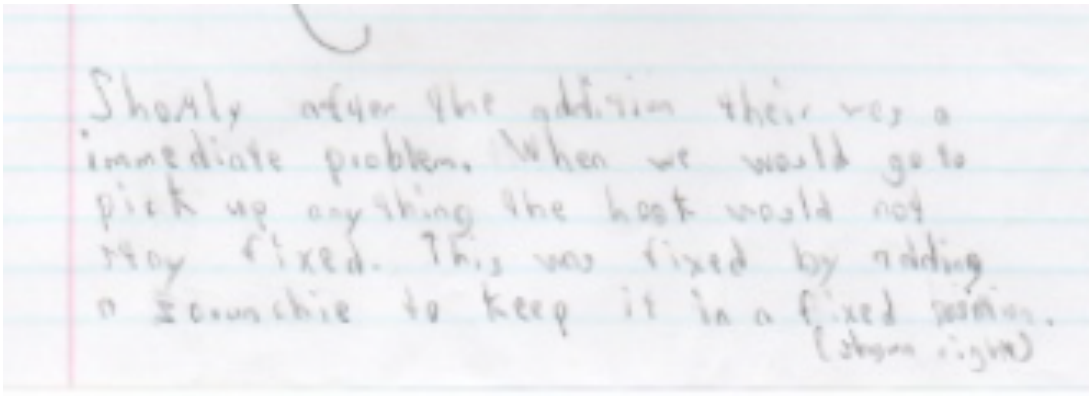
- Multiple types of graphics are used throughout the notebook.
- Graphics are labels, although it would have been helpful to label the drawing on the right.
- Shows the design iterations (different prototypes).

Engineering Notebook Examples (cont'd)

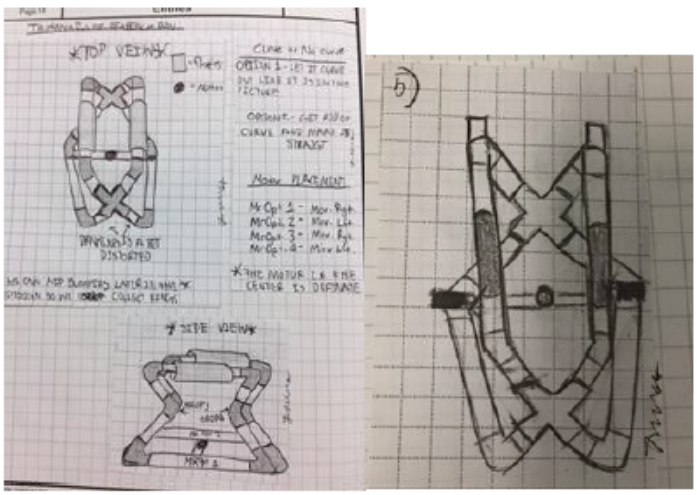


Team HMS SeaBots 2017

This team had very good sketches and drawings throughout their notebook, and did a great job presenting their design iterations. However, it would be helpful on this page to spread out the text to make it more easily readable.



Make sure the text is dark and legible.



(Sketches of a design idea)

If you tape drawings or printed pages on a notebook page, make sure they are large enough that the reader can see the details and read the text.

Notes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