

Rafts, Boats, Ships, OH My!



How can additive manufacturing be used to design boats that can carry weight?

Suggested Equipment Skill Level

Novice User

Equipment Skills

3D
Design

Naval Architect

Career & Skillset Connections

- Creativity and Innovation
- Problem Solving
- Mathematical Skills

Project Guiding Themes

- Engineering design process
- Designing in 3D modeling software
- Designing a prototype that meets multiple constraints

Suggested Software & Materials

-3D Modeling Software

TinkerCAD, OnShape, Autodesk Fusion 360, Autodesk Inventor, Solidworks

- Weight (washers, pennies, weights, etc.)
- Plastic tub with water for testing

Aligned VDOE CTE Course(s) and Competencies

Technical Drawing and Design

36-Weeks



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3D Printing-Novice Skill Level

How can additive manufacturing be used to design boats that can carry weight?

Project Problem & Career Prompt

You are interviewing for a Naval Architect job at the Coast Guard to work on their next Search and Rescue vessel design. As part of the interview process, your task is to design and 3D print a vessel that will hold a designated amount of weight.

Project Background & Resources

Use pictures or sample materials (from around the classroom) and have students make predictions on whether they will float or not. Discuss how some materials float because of their design of the structure and some float because of their material composition.

[Why Don't Big Ships Sink?](#)

<https://www.youtube.com/watch?v=Yyvyj41njbs>

Investigative Questions

If I throw a penny into a fountain to make a wish, why does it float?

What makes one float and not the other even though they are both made of metal?

How does a cargo ship float carrying heavy weight?

Project Criteria

-Boat must contain an area to put weight to test.

-Boat must fit within teacher designated size constraints (2x2, or 3x4, etc.)

Project Constraints

-Boat must contain at least one 3D printed part.

Suggested Pacing

*Work through the Engineering Design Process. Begin with a day of research and brainstorming after teams understand the project

-1-2 days of Modeling. Use 3D modeling software of your choice.

-Printing projects (will take multiple days depending on number of students and 3D printers.

-1 day Testing. Have students test boats in a tub of water with weight that you determine (washers, pennies, weights, etc.)

-1 day Review and discuss. Students communicate (visual or writing, presentation) what they learned from the activity.

Did their boat float or not? How much weight did it hold?

Compare designs- what could cause boats to hold more weight? How would you/your team redesign your boat?

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3D Printing

Career & Skill Set Connections



Naval Architect

Naval Architects are responsible for the design, construction and repair of marine vessels. From sailboats to naval aircraft carriers, a naval architect also conducts research and development of new designs.

Essential Skills

- *Leadership
- *Problem-Solving Skills
- *Risk Analysis
- *Engineering
- *Oral and Written Communication Skills



Academic Pathway

High School Diploma
and
Community College/Certification
or
Bachelor's degree
or
Master's degree



Aligned VDOE CTE Course(s) and Competencies

Technical Drawing & Design

Workplace Readiness Skills & Work-Based Learning Opportunities

Examine All Aspects of an Industry

Introducing the Design Process

Apply the engineering design process, including prototyping and modeling.

Analyze design solutions.

Refine design solutions.

Producing Technical Drawings

Create solutions, using CAD.

Producing Prototypes

Produce a prototype, using a 3D printer.

All resources and content can be adjusted at teacher discretion.



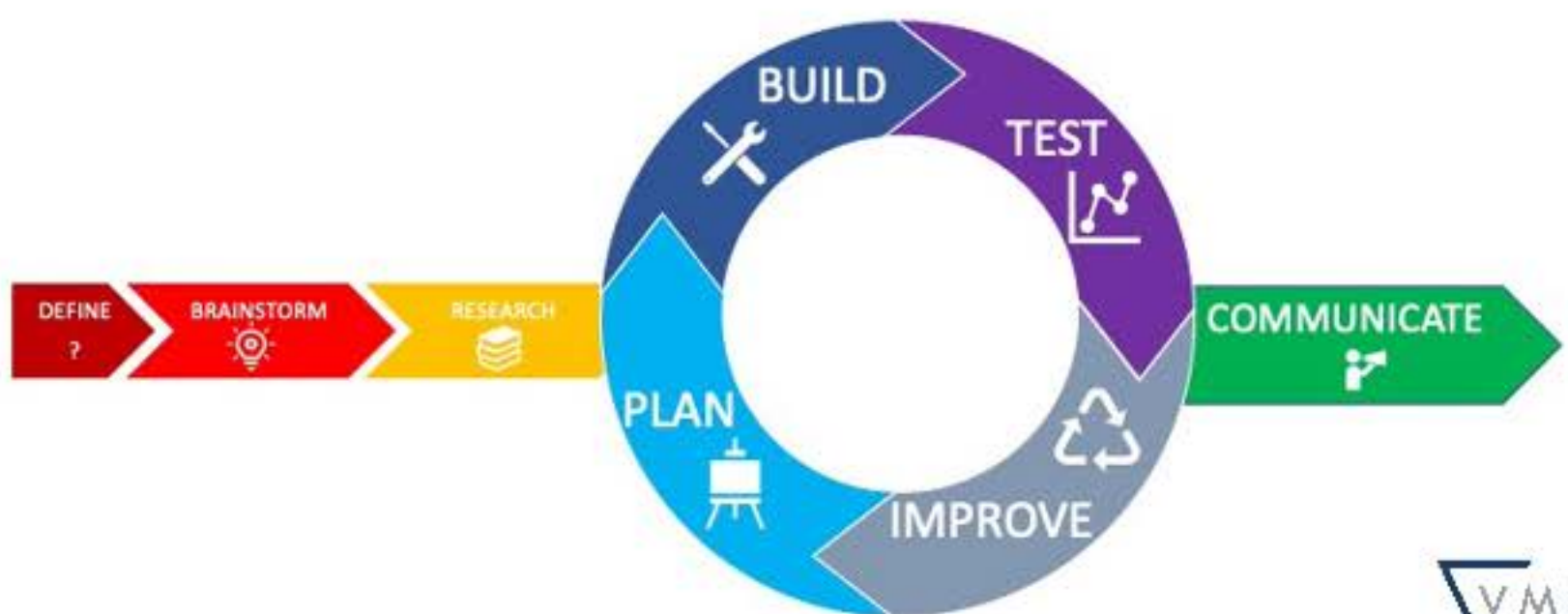
Project Management Plan

**Team
Member
Roles**

**Team
Goals
&
Timelines**

**Team
Member
Tasking**

Sketches & Design Planning



Notes

Notes