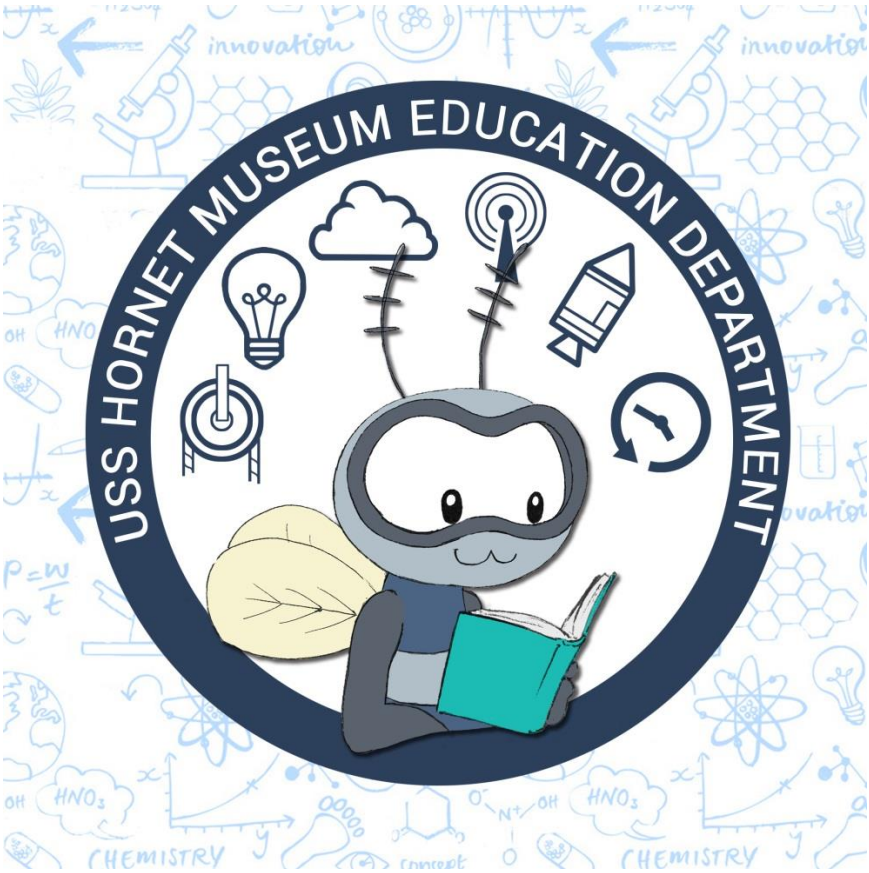


Tower Building

Physics and Technology aboard the *USS Hornet*

(AD May 2018)

From the USS Hornet Museum Education Department

Alissa Doyle 2018

Alissa.Doyle@uss-hornet.org

About This Document

The Island structure of an aircraft carrier houses many essential areas key to the ship's overall functionality, all the while towering eight decks above the Flight Deck. This program allows students elementary age through high school to test their engineering skills, work collaboratively, and explore the elements required to control and stabilize a vital technological section of an aircraft carrier.

Alissa Doyle, Lead Education Instructor

USS Hornet Museum Education Department

PO Box 460, Alameda CA 94501

uss-hornet.org

✉ *edu@uss-hornet.org*

f *facebook.com/USSHornetMuseumEDU*

Table of Contents

Goals

In this program, students will:

- Work collaboratively to build a structurally-sound tower
- Engage in the engineering process as they come up with an idea, execute it, and test its viability

Objectives

In this program, students will:

- Understand the functions of the Island
- Understand the physics involved in keeping the ship balanced

Big Questions…and Answers

How do engineers solve a problem?

They come up with an idea, they create their idea, and then test it to determine its viability. This process is repeated indefinitely as they refine and perfect their idea.

How can we observe various physics principles at work in the Island?

Since the weight of the Island is offset, an aircraft carrier relies heavily on other sections of the ship to compensate for that huge amount of weight. Ballast is used to offset the weight of the Island as well as the additional weight of the angled deck support sponsor.

Program Overview

<u>Program Timeline- 40 minutes</u>

Brief overview of the *Hornet*'s Island structure, including Navigation and the Bridge- 15 minutes

Activity Introduction- less than 5 minutes

Design planning and building in small teams- 15-20 minutes

In this program, students will engineer a structurally sound creation. They will engage in the design process as they first plan their structure on paper, build it out of index cards, and refine as they go.

Suggested Materials:

-graph paper

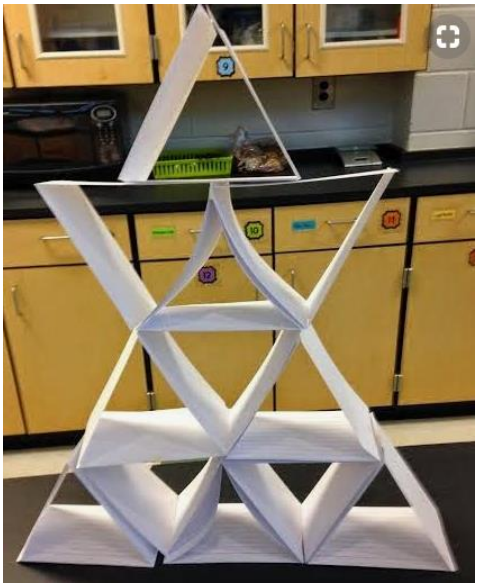
-pens or pencils

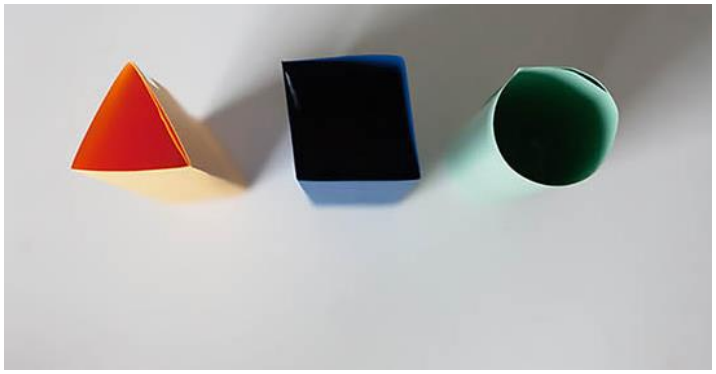
-index cards

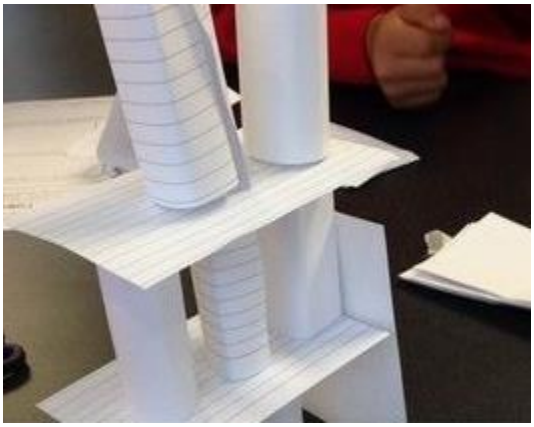
-yard stick- for instructor for measuring final towers if desired

Divide students into teams of 3 to 5. Encourage them to first design their tower on paper, then build it, and refine it as they go. Comparing their initial drawing to their final tower design allows them to work like real engineers, who constantly refine and redesign their creations.

This activity can be as limited or as open as the instructor desires. Height restrictions can be imposed, weights can be added, additional materials can be provided, a fan can be introduced, or students can be forced to work on a slanted or unstable surface.







USS Hornet Reference Material

Flight Deck (Island Structure)

- *What is the Island structures purpose?* This structure serves as the ships control center. It houses both the Flag and Navigation Bridges' primary flight control, Radar platform boiler uptakes, stacks, both the Admiral and Captains Sea Cabins and the signal bridges.

- *How does the Ship compensate the weight of the island being offset?* Ballast is used to offset the weight of the Island structure as well as the additional weight of the angled deck support sponsor.

Suggested Questions

- *How many different antennas do you see? What do you think each does?*
- *How do you think weather affected the Island's functionality?*
- *How do you think being under attack affected the Island's functionality?*
- *How do you think the crew in the Island communicated information to the rest of the ship?*

Next Generation Science Standards

Grade Level	Standards
3-5	*Engineering Design:* 3-5-ETS1-1 Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost. 3-5-ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem. 3-5-ETS1-3 Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.
3	*Motion and Stability: Forces and Interactions:* 3-PS2-1Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces

	on the motion of an object.
6-8	*Forces and Interactions:* MS-PS2-2. Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.
8	*Motion and Stability: Forces and Interactions* MS-PS2-2. Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.

Appendix: Class Materials, Reference Items


12
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BEWARE-JET BLAST
PROPS-ROTOR BLADES
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Links and Credits

Docent Scott Zirger has created a wiki for the ship containing a wealth of information:
https://en.wikipedia.org/wiki/User:Szirger/Books/USS_Hornet_Reference_Material

This program was created in conjunction with a grant from the Office of Naval Research, and expands upon ideas found in the following lesson:
http://www.ussnautilus.org/education/pdf/stemlessons/Engineering%20Design%20Tower%20Building.pdf