



Ship Shape: Designing New Ships

Engineers Use Computational Software to Design Safe, Smart, and Sound Vessels



Bethesda, MD (NAVSEA Carderock - Navy) -- Engineers use computers to help them design ships for the Navy. Using CAD and CFD (fluid dynamics) software, they can design ships that move efficiently. They run tests on computer models to determine fluid (air and water) flows and resistance and how well the ship will perform at sea.

"Ideally you want the ship to go through the water completely silently with as little wake as possible and as efficiently as possible." Susan Brewton, mechanical engineer

Framework

Middle School

Standards

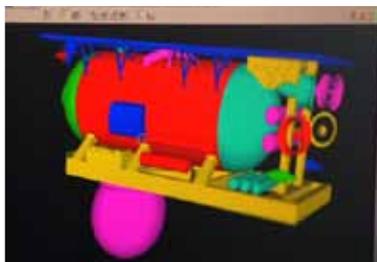
- NSES - B.ii.3 ➤ Unbalanced forces cause changes.
- STL - 2.R ➤ Requirements are placed on development of a system.
- STL - 8.F ➤ There is no perfect design.
- STL - 9.H ➤ Modeling, testing, and evaluating are done.

Content Illustrated

- Screen shots of computational fluid dynamics (CFD) analysis of ships.



Content



Physical Science

- The forces acting on a ship moving through water include turbulence and drag. Wind also applies force and acts on ships in the ocean.
- Water and air are both fluids.
- The measure of a resistance of a fluid is called viscosity. Viscosity affects drag.
- In order to move the ship, the force of the ship's thrust must be greater than the drag.

Technology

- Computer-aided design (CAD) helps engineers draw and manipulate 3-D models of ships.
- In the computer environment, the ship's design can be subjected to tests using the computational fluid dynamics (CFD) program. CFD uses the laws of physics to show the flow of air and water as they contact the surface of the ship.
- Types of Navy ships include cruisers, unmanned vessels, submarines, and aircraft carriers.

Engineering

- Purpose dictates design. When engineers design a ship they consider factors such as how far and how fast the ship needs to go, how quickly it needs to turn, how much weight it needs to carry, what it will do at its destination, and how much energy it uses.
- Designing a ship starts with an idea that is drawn on a computer using CAD software.
- A major challenge for ship designers is to minimize the resistance the ship encounters as it moves through the water.
- Designers study how fluids flow over a ship—the streamlines—and their effect on performance.

Guiding Questions

To think about as you watch:

- How are computers used in ship design? What are the necessary steps to make a computational model and test of a ship?

Suggested Activities

- Find out about streamlines around cars and buildings. What do they look like?

Keywords

computational fluid dynamics (CFD), computer-aided design (CAD), drag, resistance, streamlines, thrust, turbulence, viscosity, wake

- *Ship Shape* can be found online at www.ndep.us/Ship-Shape. Visit www.ndep.us/LabTV for a list of process skills modeled in webisodes.