

Be a Submarine Engineer

Name: _____

Submarines are almost impossible to locate when they are submerged, making them an effective form of transportation for the armed forces. Subs are stealthy because their engines operate quietly and efficiently. The U.S.S. *Jimmy Carter* can circle the earth several times without surfacing or refueling, yet it can pass directly under a ship without being detected.

Submarines like the U.S.S. *Jimmy Carter* are powered by nuclear generators. These generators create steam. The *kinetic energy* (energy of movement) of the steam spins the submarine's *turbine* (a machine that has a rotor and is driven by the pressure or momentum of a moving fluid, such as steam). The turbine then creates electricity to power the navigational, life support, and propulsion systems.

Follow the steps in this experiment to re-create a working steam turbine:

- 1** Hold a pinwheel (representing the submarine's turbine) horizontally under a trickle of water (representing the steam). Adjust the water flow until the pinwheel starts to spin. The water's kinetic energy is being converted into mechanical energy.
- 2** Read "Steps of the Scientific Method" at right and conduct an experiment to engineer a "turbine" that spins faster. Record your research on a separate sheet of paper.

Steps of the Scientific Method

- 1** Base your experiment on an observation.
- 2** State your purpose.
- 3** Do background research to find out what is already known about your topic.
- 4** State your hypothesis (an educated guess about what the results will be).
- 5** Come up with a detailed procedure.
- 6** Carry out your experiment and collect data.
- 7** Record your results.
- 8** Draw a conclusion from your results. Was your hypothesis correct?

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Beneath the Surface

Navy SEALs are Special Operations Forces trained to scuba dive into battles. Soon these troops will have *mini subs* to make the travel safer. The lithium ion battery-powered ASDS

(Advanced SEAL Delivery System) can transport 16 SEALs from attack submarines to shoreline combat zones. It weighs about 55 tons and is 65 feet long.

Visit www.seal.navy.mil/seal/news/062703.asp to learn more.