WORLD WAR II - *Submarine Simulation*

LESSON PLAN

Objective:
Given the variables of battery power, number of engines, and motor horsepower, the student will construct a submarine designed to cross the Atlantic during World War II. The goal is to cross safely without being sunk by a German submarine.

Course / Grade Level:
Middle school general science (Grades 6-8)

Pre-Activities:
- Study the unit on electricity.
- Study unit on fluids in motion.

Activity Procedure:
1. Listen to the audio explanation and/ or read the information section for the *Submarine Simulation* activity in the *Time Engineers* game. Use the *Submarine Simulation* interface transparency to explain to the students the goal of the activity and each of the parameters they can set.
2. Allow students time to play with the *Submarine Simulation* activity. Make copies of the *Recording Sheet* (found on the next page) for the students. Have them add the following headings:

   MEGAWATT HOURS, # OF ENGINES, MOTOR HP, # OF TORPEDOES, MILES TRAVELED, COMMENTS

   As the students do the activity, have them keep track of each trial using the recording sheet. If they were unsuccessful, have them modify their settings, record, and try more crossings until they were successful in reaching Great Britain.

Discussion / Questions:
- What is the impact of raising the megawatt-hours for the batteries?
- Do you think one or two engines are the best for submarine design? Explain
- What are the pros and cons of selecting a 500-horsepower engine?
- What are the optimum settings to successfully reach your destination?

Extensions:
- Read and report on the book Blind Man's Bluff by Sherry Sontag. It is about submarine espionage in the 20^{th} century during the Cold War and how submarine design evolved with increased challenges.
- Make a cartesian diver out of an eyedropper of a 2 liter plastic pop bottle. How does the rise and fall of the eyedropper compare to actions of a submarine.

TIME ENGINEERS™

Recording Sheet
