

Chapter 8



Power Systems

Chapter 8: Power Systems

Stories From Real Life: The *Hunley* and Nuclear Subs

Chapter Outline

1. **Introduction**
2. **Energy, Power, and Efficiency**
 - 2.1. Energy
 - 2.2. Power
 - 2.3. Efficiency
3. **Vehicle Power Choices: What's Realistic?**
 - 3.1. Criteria for Evaluating Power Systems
 - 3.2. Electrical Power—A Logical Choice
4. **An Introduction to Electricity and Electric Circuits**
 - 4.1. Charge
 - 4.2. Current
 - 4.3. Voltage
 - 4.4. Resistance and Ohm's Law
 - 4.5. Insulators, Conductors, and Semiconductors
 - 4.6. Circuits
 - 4.7. Schematic Diagrams
 - 4.8. Open Circuits and Short Circuits
 - 4.9. Ground
 - 4.10. Power in Electric Circuits
 - 4.11. AC and DC Electricity
 - 4.12. Series and Parallel Configurations
5. **How Much Electricity Does My Vehicle Need?**
 - 5.1. Power for Propulsion
 - 5.2. Other High-Power Systems
 - 5.3. A Sample Power Budget
6. **Electric Power Sources for Small Vehicles**
 - 6.1. AC Power
 - 6.2. AC Power Safety
 - 6.3. An Introduction to Batteries
 - 6.4. Battery Safety
 - 6.5. Battery Performance Characteristics
 - 6.6. Series and Parallel Battery Combinations
 - 6.7. Contemporary Battery Choices
7. **Transmission and Distribution of Electrical Power**
 - 7.1. Wires, Cables, and Connectors
 - 7.2. Fuses
 - 7.3. The Power Switch
 - 7.4. Transmitting Electrical Power over a Tether
 - 7.5. Accommodating Multiple Voltages
 - 7.6. Power Distribution Systems: Three Actual Examples
8. **Steps in Circuit Design and Construction**
 - 8.1. Step 1: Circuit Design
 - 8.2. Step 2: Circuit Prototyping
 - 8.3. Step 3: Robust Circuit Construction
9. **Chapter Summary**

Figure 8.1.cover: *Battery Powered Robots*

This team has their power system figured out and is ready to launch. There's the robot (on the left of the photo), the power source (the battery on the right), and the power delivery mechanism (the tether in the middle).

Image courtesy of Randall Fox

Chapter Learning Outcomes

- Estimate the total amount of energy (in joules and watt-hours) and the maximum instantaneous power (in watts) that your vehicle will require to complete its mission.
- Explain why batteries are a good power source for small underwater vehicles, and select an appropriate battery (or combination of batteries) to supply the energy and power requirements of your vehicle.
- Describe options for placing batteries (on board the vehicle or on the surface), and explain how you would distribute electrical power from those batteries to the parts of your vehicle that need it.
- Describe the important roles of fuses and voltage regulators in power distribution systems.