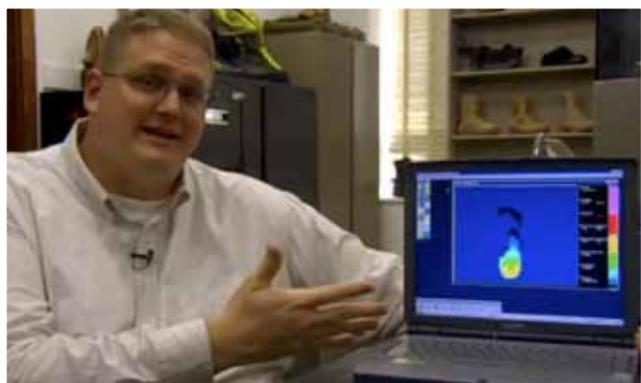




Foot Soldier Designing Modular Boots for the Military



Natick, MA (Army Research Lab) -- Engineers design and test versatile footwear for soldiers so they'll be comfortable and protected from the environment. The featured biomechanical engineer was challenged to make one modular boot that can do the job of four different boots. The new boot is more efficient, lighter, and less expensive.

"When your feet hurt, everything else is miserable. Biomechanics is taking the principles of engineering and applying them to the human body or human movement." **Micheal Holthe, footwear engineer**

Framework	Standards
Middle School	<ul style="list-style-type: none"> NSES - C.i.1 ➤ Form and function are related. STL - 2.R ➤ Requirements are placed on development. STL - 4.D ➤ Technology affects safety and comfort. STL - 10.G ➤ Invention and innovation play a role. STL - 19.H ➤ Manufacturing changes the form of materials.

Content Illustrated

- Animation showing form and function of feet.



Content



Life Science

- There are 26 bones and more than 100 muscles, ligaments, and tendons in the foot. It also has 33 separate joints.
- The foot is the only part of the body that repeatedly contacts the ground.

Technology

- Different materials are used to make boots, including leather, rubber, cloth, flame-resistant Nomex, nylon, and polyurethane.
- Modular boots have different components that interchange for different climates. They can be worn in temperatures from 120 degrees down to -60 degrees.

Engineering

- Biomechanics takes the principles of engineering and applies them to the human body.
- Boots need to be comfortable, resist abuse, be protective, and support the load and speed of a soldier's walk. Biomechanical engineers consider how fast soldiers need to move, how much weight they carry, and the environmental conditions such as desert, jungle, and snow). Boots are designed for hot, cold, wet, and dry weather.
- An engineering goal is to make boots that perform well and are comfortable so that soldiers don't have to think about their feet. A colorized digital display of "footprints" helps engineers figure out how to eliminate pressure points.

Math

- Foot and leg injuries in the military have been reduced by 30 percent using new boot soles.

Guiding Questions

- What factors are important to consider in designing footwear?

Suggested Activities

To think about as you watch:

- Have students calculate the pressure under their feet when standing and when tip-toeing.

Keywords

biomechanics,
bones, cloth, leather,
ligament, metatarsal,
modular, muscles,
Nomex, polyurethane,
rubber, tendon,
temperate

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