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**LIGHTEN
THE LOAD**

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LIGHTEN THE LOAD

Carrying the load

Military forces are groups of people who train to be prepared for warfare. Since before recorded human history, when a military force is called upon, they fight for their country, queen or king, or leader. Ground troops such as soldiers and marines have always had to carry weapons, protection, and food and water into battle. This is called a soldier's fighting load. It is carried or worn on the torso, head, thighs, feet, arms, and hands. Records show that the current fighting load is about the same as it was in 1,000 BCE. The current fighting load is 20 to 35 kilograms (44 to 77 pounds).

In addition to their fighting load, ground troops carry extra materials as they march to an area of battle. This is called an approach load, and may include clothes, water, food, and sleeping bags. The approach load brings the total weight carried to about 45 kilograms (99 pounds).



In the past, shields used for protection were often made of wood or animal hide.





Marines run across a stream during training.



Soldiers run uphill in loose and uneven sand.

Do you walk the same speed all the time? When you walk quickly, your body uses more energy than if you are walking slowly. Imagine how much harder it is to walk up a steep hill or through loose sand. Would you feel in control if you were running down a hill with a heavy pack on your back?

The type of ground surface, or terrain, adds to the impact of carrying a load. Moving over loose surfaces like sand and snow or through rough terrain such as overgrown or swampy areas requires more energy resources. Adding a load makes it worse.

What are the problems?

Why does it matter? What problems are caused by carrying a heavy load? A heavy load makes a service member move more slowly. That means everyone must slow down. A heavy backpack makes a person lean forward. The load and the lean make it harder to stop quickly. Leaning forward also makes it harder to see what's around you and slows down your reaction time.

When carrying a heavy load, humans need more oxygen. The excess weight also makes it harder to breathe in. This makes physical activity harder. You get tired.

Heavy loads can lead to other physical problems, such as bone and muscle injuries. Lower back and leg injuries are the most frequent types of injuries among people who regularly carry heavy loads. Carrying heavy loads can also cause nerve damage.

Some of these injuries heal quickly. Some may cause longer-term problems. These long-term effects can last for months and take soldiers out of the field. Injuries caused by carrying heavy loads accounted for about one-third of medical evacuations from the battlefields in Iraq and Afghanistan.

▼ Injured service members receive support in the field.

▼ A tired soldier may slow down an entire group.





Laptops and radios are used for communicating and tracking targets.



Smaller and better-fitting body armor may lighten a marine's load.

How would you solve these problems?

Can we make lighter equipment?

Research shows that soldiers shouldn't carry loads that are more than 30% to 45% of their body weight. For an 80-kilogram (176-pound) soldier, 40% of their body weight is a 32-kilogram (70-pound) load. With all the technology improvements throughout history, how has a soldier's load changed?

The weight of some parts of the load has gone down. Uniforms, boots, and body armor are lighter than they used to be. For example, heavy wool and cotton uniform fabric has been replaced by lighter cotton-synthetic blends. Pockets, snaps, and connectors to hold patches have been removed from recently designed uniform shirts. This reduces weight and also limits how much water (and weight) the shirt holds when it gets wet.

But new technology also means a soldier has more to carry. The soldiers of the past didn't have to carry night vision goggles, laptops, and GPS devices.

Body armor replaced carried shields decades ago. And body armor weight has gone down since World War II. It comes in a lot more sizes than in the past, too. People have distinct body sizes and shapes. Older body armor might have been too long or too wide for a particular soldier. Providing a range of sizes can reduce weight and mobility issues for some soldiers.



- ▶ Backpacks and other equipment pouches shift around when a person moves.



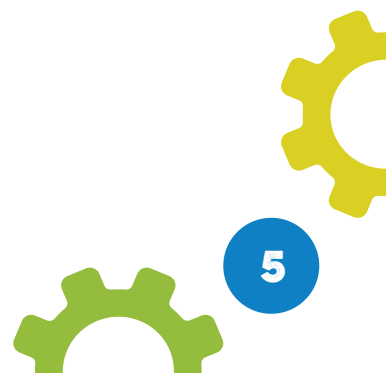
- ▶ The pulleys (in the green frame) on a new backpack design isolate the wearer from the motion of the load.

Can we make it seem like the equipment is lighter?

Engineers are improving the backpacks soldiers carry. Backpacks are tightly secured to a person's body by straps that go over the shoulders. The weight of the load moves up and down and shifts around when a person walks or runs.

A new backpack design uses suspended-load technology. The backpack has a frame with pulleys. The load hangs on the pulleys. It barely moves as a soldier walks. The weight doesn't disappear, but it seems like the load floats on the shoulder straps.

Tests of this backpack design show that it reduces the weight a soldier feels on their back. This results in less stress on the soldier's back. That may lead to fewer injuries.



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How can we deal with injuries?

Injuries still happen. The US Army has begun to assign physical therapists to serve in war zones. If a soldier can get ongoing therapy, they do not have to leave the area. They don't have to be replaced by someone else. The military uses other types of treatment for injured service members. They use yoga, meditation, and acupuncture to help with pain management.

Fitness level is important. It affects the number of injuries that happen when carrying heavy loads, especially for longer distances. Low aerobic fitness is a risk factor for injury. If soldiers do more march training carrying loads, that can reduce this risk factor. Training soldiers to change how they walk when carrying a load can also decrease injuries. Taking slightly wider steps is best when you have a heavy pack on your back.

Can you think of other ways to lighten a load and reduce injuries?

▼ A group of crewmen start a new training course.



▼ A soldier trains with a full fighting load.

