

# **New power sources needed for soldier of the future**

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The U.S. Army should investigate alternative power sources, such as fuel cells and small engines, to create longer-lasting, lighter, cheaper, and more reliable sources of energy for the equipment soldiers will use in the future, says a new report from the National Academies' National Research Council. In addition, the Army should step up its efforts to develop and acquire technologies that are more energy-efficient, said the committee that wrote the report.

"The Army should immediately conduct a comprehensive analysis of power sources for future dismounted soldiers, looking beyond today's standard military batteries," said Patrick Flynn, committee chair and retired vice president for research, Cummins Engine Company Inc., Columbus, Ind. "Many commercial energy sources exist, but they are developed for a consumer market, not the military. The Army must determine and select the energy sources that are most relevant to its needs."

The Army will equip its future warriors through a program called "Land Warrior," which, in addition to weaponry, includes high-tech electronics that significantly increase soldiers' awareness of the combat environment, such as helmets with visual displays, chemical and biological sensors, radios, and portable computers. But these devices are not energy-efficient and will need new power sources to operate efficiently. The development, testing, and evaluation of these new energy sources will be carried out under a program known as Future Force Warrior.

The committee evaluated and prioritized options for supplying energy to various low- and high-power applications on the battlefield. In addition to disposable and rechargeable batteries, the committee considered fuel cells, small engines, and hybrid energy systems such as those combining a battery with a fuel cell, or a small engine with a battery. Existing military batteries can provide enough power for computer displays, radios, sensors, and electronics for a 12-hour mission, but longer missions will require other technologies to efficiently power operations lasting up to 72 hours. These include improved low-power electronics, sophisticated power-management software, and "smart" hybrid energy systems that automatically adjust to the soldier's operating environment on the battlefield.

Some of the applications requiring a higher level of power -- an average of 100 watts -- include portable battery rechargers; laser target designator devices used to guide a rocket, missile, or bomb to its target; and individual cooling systems for protective garments. For these applications, the committee concluded that hybrid systems operating on common military fuels would be needed.

Other devices designed to enhance soldiers' performance on the battlefield use even more power, requiring between 1 and 5 kilowatts. For example, the "exoskeleton," which consists of a pair of mechanical metal leg braces and a backpack-like frame, literally takes the load off a soldier's back, allowing him or her to carry large or heavy packs without losing agility. To power such energy-intensive equipment, the Army should consider use of lightweight engine generators, the report says.

Among all possible energy sources, hybrid systems provide the most versatile solutions for meeting the diverse needs of the Future Force Warrior, the committee said. The key advantage of hybrid systems is their ability to provide power over varying levels of energy use, by combining two power sources.

"Products historically have evolved to become more portable, mobile, and wearable," Flynn said. "By integrating components and minimizing the energy they consume, tomorrow's military equipment will help soldiers operate in various conditions, extend the range and duration of their operations, and minimize their vulnerability."

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