PRODUCT DESIGN & DEVELOPMENT

Taking The Load Off Soldiers

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Soldier crawling wearing vest, body armor and blue sensor pads.

Next generation body armor optimally distributes the load that soldiers carry.

Madison, NJ– Wearing body armor for protection against bullets and shrapnel has been a double-edged sword for soldiers. While the armor provides an indispensable defense, its weight and placement on the body exposes the wearer to neck, shoulder and back discomfort and possibly years of lingering pain.

The problem is not just the armor, but also the heavy equipment that soldiers routinely wear for hours and days at a time that can weigh more than 60 lbs – including rifles, ammunition, grenades, radios, medical kits, backpacks, water and other supplies.

To alleviate discomfort and reduce the fatigue that reduces the soldier's tactical effectiveness, a new generation of body armor systems is being developed. A body mapping pressure system by Sensor Products Inc. called Tactilus is enabling a highly-skilled team of designers and engineers to develop new vests and carriage systems that optimally distribute the load that soldiers carry. The project is being directed by KDH Defense Systems of Johnstown, PA through a contract with the U.S. Air Force.

EDGE Product Development of Newtown, PA is using human factors engineering, design and prototyping to adapt the armor systems to the needs of the soldiers.

Dr. Evan Goldman (l) and John Ficker of EDGE (r) adjust mockup of vest and body armor for testing sensor system.

Soldier and rifle with vest and body armor being tested by sensor software.

"To enable soldiers to perform their duties with more comfort and less fatigue, we are designing body armor systems that eliminate 'hot spots' of excessive pressure during typical activities," says Daniel Massam, director of industrial design.

Dr. Evan Goldman, a professor of gross anatomy and physiology at Philadelphia University, is using the sensor technology to test the body armor on the soldiers.

"The pressure mapping sensor system shows us any pressure points that develop, not just when soldiers stand in place but also when they perform ballistic motions – such as jumping, running quickly, turning, crouching or crawling on their bellies," says Dr. Goldman.

"By viewing images and statistics from sensors located beneath their vests, we can see how these pressure points move with the body in real time as they perform their maneuvers."

When a soldier complains that they feel pressure in a certain area, the pressure points change on the computer screen and pinpoint where the vest and armor need to be redesigned to improve the pressure distribution. Besides increasing comfort, the team says the new body armor will significantly increase the soldier's flexibility and maneuverability, which has enormous strategic advantages in the field.

Pushed to their creative limits, participants in the project are breaking new ground. Jason Blume, an engineer at Sensor Products, discovered new uses for their Tactilus electronic sensor system when he suggested the sensors could work in a new configuration to fit the size and shape of the vest and carriage.

"The challenge for us in sensor technology was to modify our sensors and software to conform to the dimensions of a vest, while providing full three -dimensional pressure distribution visibility of the chest, back and neck," says Blume.

Previously Sensor Product's systems had supported square or rectangular designs, such as mattresses for ergonomic testing. While they were optimistic, there were questions about whether the sensors' electronic lines could be cut and reconfigured to the vest. Three separate sensor pads needed to be used for the chest, back and waist, and clear color-coded body images and precise statistics had to be produced without signal interference.

Sensor Products split up the sensing points; rows of sensors were distributed into two connecting L patterns, with one L inverted to face the other to provide coverage for the neck, shoulders and trunk. A third sensor pad was configured to wrap around the soldier's waist. The software was broken up into multiple pieces for full system functionality. The sensors were then melded into the vest to serve as a guide for future prototypes.

Jeffrey Payne, Project Manager of KDH Defense Systems, says the project is on track to meet its goals.

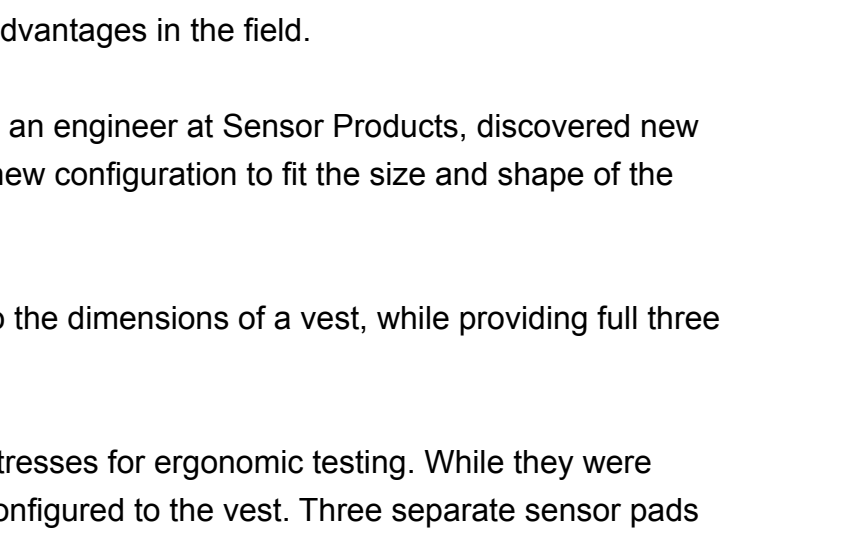
"Armor designs today are over the body and wrap like a jacket, making the vest and armor wrap around the wearer so tightly that it becomes load bearing," says Jeffrey Payne, Project Manager of KDH Defense Systems.

"We are looking to apply human factors engineering in order to create a better more efficient unit. Our results have been very encouraging. We are on track to reach our goals."

Dr. Goldman attests that the armor being created has technological advantages.

"While one of the armor prototypes excelled in some of our design goals, we could tell through the full-body sensors that it limited the wearer's range of motion. Thanks to the sensor technology, the superb new armor we are creating has tremendous measurable enhancements compared to current military armors."

For more information visit **www.sensorprod.com**



Soldier running in a field tested wtih sensor system.