Militaries developing Iron Man-style exoskeleton suits to give troops ‘superhuman strength’ or increase their endurance

Some of the missions the soldiers perform can take weeks, away from in difficult terrain like deserts and mountains which requires maintaining an incredibly high level of physical fitness. Around the world, armies are recognizing the importance of maximizing the effectiveness of Soldiers physically, perceptually, and cognitively.

Militaries are trying to augment physical performance, through Exoskeletons designed to increase the physical strength of the Soldier or increase their endurance. Today’s exoskeletons allow soldiers to carry 17 times more weight than normal and march with significantly less strain on the body. With an XOS 2 suit, for example, a solider can carry 400 pounds but feel the weight of only 23.5.

US army is testing a futuristic exoskeleton that gives soldiers superhuman abilities. The exoskeleton uses artificial intelligence to provide additional power and mobility to soldiers, and allows them to carry heavier loads. US Army chiefs are also developing an Iron Man-style suit to give troops ‘superhuman strength’. When made, the Tactical Assault Light Operator Suit (TALOS) is set to be bulletproof and give the wearer enhanced strength. Fortis could prove particularly useful in urban combat, because it enhances soldier mobility,

power and speed, according to the engineers.

The exoskeleton systems are more important in an era when the U.S. Army believes its units may have to operate on future battlefields cut off from regular sources of supply. As a result, soldiers can stand carrying heavy weapons longer—think shoulder-fired Stinger anti-aircraft missiles and other heavy weapons. Soldiers could also traverse difficult, hilly terrain in places like Afghanistan and Korea with less exertion.

Russian armed forces may soon be fitted with exoskeleton suits every inch of which is bulletproof. The gear consists of heavy body armor and a futuristic helmet that entirely covers the head. Apparently, the helmet's visor doubles as a screen, which will display tactical information and satellite data to soldiers in real time. The suit weighs almost 100 pounds. To compensate for the limited mobility, Russian scientists added in a powerpack that carries most of its weight and supporting the legs and back. However they require large power and even huge battery packs and wearable solar panels don't sustain them for more than a few hours. Therefore, the Russian suit won't be able to carry its own weight for long, experts say.

The U.S. Army is also developing soft exosuits using soft robotics. The Department of Veterans Affairs is also seeking research into soft robotics for exoskeletons to aid wounded veteran. Soft robotics differ from traditional counterparts in some important ways: Soft robots have little or no hard internal structures. Instead they use a combination of muscularity and deformation to grasp things and move about. Rather than using motors, cables or gears, soft robots are often animated by pressurized air or liquids.

US Army’s Future Soldier

Lockheed Martin has developed new exoskeleton that lessens leg strain and makes it easier for soldiers to carry heavy loads without becoming exhausted. According to Army Technology, a study by the University of Michigan Human Neuromechanics Laboratory found that people equipped with the Fortis leg exoskeleton carrying a 40-pound load at a 15-degree angle experienced significantly less leg strain.

The knee stress release device (KRSD) was designed to boost leg capacity when lifting or dragging heavy objects, or walking on inclines. The frame fits round the soldier’s legs, and is attached to a belt worn around the waist. The belt connects to flexible hip sensors, which tell a computer where the soldier is in space, as well as the speed and direction of the movements. Weighing 27 pounds, the exoskeleton generates synchronized movements at the motorized knees that physically aid the wearer. Lockheed Martin claims the system improves work rates by “2 to 27 times”, and that it requires a minimum of training to use.

The U.S. Army is also developing a “third arm” device that can be attached to a soldier’s protective vest to hold a weapon. The purpose of the device is to redirect all of the weight of a weapon to the soldier’s body and lessen the weight on the soldier’s arms, freeing up his or her hands for other tasks. The prototype of the third arm weighs less than four pounds thanks to the use of carbon fiber composites. “We’re looking at a new way for the Soldier to interface with the weapon,” said Zac Wingard, a mechanical engineer for the Army Research Laboratory’s Weapons and Materials Research Directorate.

As the Army Research Laboratory explained, some soldiers are

weighed down by combat gear heavier than 110 pounds. Those heavy loads may worsen as high energy weapons are developed for future warfare. The third arm could also allow soldiers to use future weapons with more recoil. Additionally, researchers plan to examine the device's potential applications for various fighting techniques, like shoot-on-the-move, close-quarters combat, or even shooting around corners with augmented reality displays.

MAXFAS exoskeleton improves soldiers' aim

Dan Baechle, a mechanical engineer at the US Army Research Laboratory (ARL), has developing the MAXFAS exoskeleton made of light metal and carbon composites and stabilizes the shooter's arm by correcting errors and helping to increase proficiency. The engineer has modified the therapeutic robotic exoskeletal arm used at the University of Delaware to train stroke victims to move their arms properly.

In tests, subjects wore a laboratory version of the MAXFAS unit that consisted of a cable-driven arm with the motors mounted behind the wearer. The arm is attached to the wearer using carbon composite braces that are equipped with sensors that detect a tremor when taking aim and then signals the motors to adjust the cables and correct it, but does not affect voluntary movements. According to Bachele, when in use, the MAXFAS unit provided feedback that reduced the tremor, which remained reduced after the unit was removed.

Mind-Controlled Exoskeletons

Russian scientists and engineers are working on a technology that is straight out of science fiction: bionic exoskeleton

suits controlled by the human brain, according to Zvezda television channel. There are several means of operating robotic suits, including via a muscle interface. Teaching them to understand brain commands is a real challenge though.

“We believe that a neuro-interface connecting the human brain with an exo-suit is the most efficient means of controlling it. The problem is that we need to teach the computer to understand brain-transmitted commands and this is exactly what we are now working on,” Alexander Kulish, department head at the United Instrument Corporation said in conclusion.

Chinese Exoskeletons for difficult environments

A robotic exoskeleton which can help disabled people to walk again will begin production this year, its Chinese developer announced Friday, Feb. 26, the Xinhua News Agency reported.

The report said that since 2010, the Center for Robotics at University of Electronic Science and Technology of China based in Chengdu has been developing the robotic exoskeleton, which is a wearable robot that can be held on one’s waist and legs to help with walking and movement.

The 202 Institute of China Ordnance Industry Group at a June 2015 presentation, showed exoskeleton upgrades, including a larger battery pack on the back, strengthened legs and more powerful, hip mounted hydraulic/pneumatic pumps to power leg movement. The exoskeleton can allow the user to carry over 100 pounds, with enough charge to walk 20 kilometers at a speed of

4.5 km per hour.

202nd sees its exoskeletons eventually being used by frontline infantry in difficult environments like mountainous terrain to easily carry a 100 pound pack of supply and ammunition. Other photos showed that the exoskeleton had enough flexibility to allow lateral ground movement including crawling in the mud while under enemy fire.

Wyss Institute developing wearable exosuits

Army researchers have evaluated prototype devices developed for the Defense Advanced Research Projects Agency at Maryland's Aberdeen Proving Ground. The prototype was developed by researchers from Harvard University's Wyss Institute under DARPA Warrior Web program.

The lightweight Soft Exosuit is designed to overcome the challenges of traditional heavier exoskeleton systems, such as power-hungry battery packs and rigid components that can interfere with natural joint movement. The exosuit is made of soft, functional textiles interwoven into a piece of smart clothing that is pulled on like a pair of pants. It mimics the actions of leg muscles and tendons when a user walks and provides periodic assistance at the joints.

It is intended to be worn comfortably under clothing and could enable soldiers to walk longer distances, keep fatigue at bay,

and minimize the risk of injury when carrying heavy loads. Alternative versions of the suit could eventually assist those with limited mobility as well

Instead of shielding the wearer, its purpose is to propel them forward and conserve their energy, explains Conor Walsh, lead researcher from Harvard's Wyss Institute for Biologically Inspired Engineering. "We are intrigued by this challenge because we are so inspired by how our muscles and nervous systems work," Walsh explains. Using a system of battery-powered sensors, motors, gears, cables and pulleys sandwiched between the fabric layers, the suit senses the wearer's motion and responds to assist. So far, tests have shown energy savings of seven per cent, and in 2017 Walsh will share the final prototype "with more efficient actuators, sensors and cables," he says

A series of webbing straps contain a microprocessor and a network of strain sensors– continuously monitoring various data signals, including the suit tension, the position of the wearer (e.g., walking, running, crouched), and more. Batteries and motors are mounted at the waist and cables transmit forces to the joints.

"The suit mimics the action of leg muscles and tendons so a Soldier's muscles expend less energy," said Dr. Ignacio Galiana, a robotics engineer working on the project. Galiana said the team looked to nature for inspiration in developing cables and pulleys that interact with small motors to provide carefully timed assistance without restricting movement.

Inspired by a deep understanding of the biomechanics of human walking, the Soft Exosuit technology is spawning the development of entirely new forms of functional textiles, flexible power systems, soft sensors, and control strategies that enable intuitive and seamless human-machine interaction.

DARPA had awarded the Wyss Institute for Biologically Inspired Engineering at Harvard University a $2.9 million contract to further develop the Soft Exosuit under Warrior Web program, which seeks to develop technologies to mitigate musculoskeletal injuries among military Service members while improving performance.

Super-Releaser is developing an orthotic exoskeleton called the Neucuff

Super-Releaser is developing an orthotic exoskeleton called the Neucuff that could drastically reduce the cost of orthotics. The Neucuff is an entirely soft robotic elbow orthosis that can fit a wide variety of bodies without any customization. It is aimed at allowing people with cerebral palsy to move their arms with enough strength and fidelity to take control of tasks like self feeding and dressing that might otherwise require live-in care.

“Soft robotics offers an avenue to apply force evenly across the body with an exoskeleton that is as gentle as it is strong. Being conformal by nature means a single design can fit a wide range of people just like any athletic brace,” according to Super-Releaser’s website.

These orthotics could mean considerable savings for wounded warriors returning from combat after a disabling injury. It could also help make exoskeletons more comfortable to wear, especially when bearing a heavy load.

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