

Drop the word "exoskeleton" into conversation, and you typically conjure up images from *Aliens,* or *Iron Man* foiling whoever it is he's supposed to foil with augmented power. Fanciful as that may seem, exoskeletons are finding their way into everyday manufacturing.

EksoVest won't give users superstrength, but it does help take some of the strain out of the day

But they're not being used to perform "feats of strength." Reality is more mundane—and much more repetitive.

According to Ford, overhead assembly line workers lift their arms above their heads up to 4,600 times per day. Over a year, that's about one million times. Can you say "repetitive stress injury"? If you're an assembly line worker, you probably can. "My job entails working over my head, so when I get home my back, neck, and shoulders usually hurt," says Paul Collins, an assembly line worker at Ford's Michigan Assembly Plant.

That kind of pain-and potential injuries that come with it-is something auto makers are seeking to alleviate by employing exoskeletal devices. Along with Ford, Audi and GM see benefits for their workers and lower healthcare costs for their bottom line.

Ford is "farther ahead than anyone else" in the US in testing wearable exoskeletal devices, according to Marty Smets, Ford's Technical Expert for Human Systems & Virtual Manufacturing. In early November, the company concluded a three-month trial of an upper-body device called the EksoVest in conjunction with the United Auto Workers. Prototypes were evaluated at Ford's Michigan Assembly and Flatrock plants that produce the Focus and C-Max, and Mustang and Continental, respectively.

Developed by California-based Ekso Bionics, which pioneered another exoskeleton called the Human Universal Load Carrier (HULC) for Lockheed Martin, EksoVest is a lightweight vest that elevates and supports a worker's arms while performing



FURTHER READING

This magic exoskeleton for industrial workers is the future—we know, we wore one

overhead tasks. Made of materials including carbon fiber mesh, it can be fitted to workers ranging from 5 feet to 6-feet 4-inches tall, and provides adjustable lift assistance of five pounds to 15 pounds per arm.

Staying power, not super-strength

EksoVest is an unpowered device that leverages mechanical advantage to assist raising a wearer's arms. A non-disclosure agreement means Smets wouldn't elaborate on the details, but recent developments in exoskeleton technology suggest the EksoVest could possibly be actuated by a pneumatic, spring, or lever system.

Whatever means is used, the emphasis is on assisting repetitive arm-lift rather than force output, Smets affirms.

"It's not about giving someone super-human strength. It's about endurance. If you were curling a 20 pound dumbbell yesterday, now you're curling a ten pound dumbbell. If you make the same number of reps, you're less fatigued. If you have to go back tomorrow and do the same repetitive dumbbell curling, you won't require as much rest before returning to full functionality."

Full functionality isn't impacted by EksoVest's emphasis on overhead lift assist. Overhead line workers reported free all-around mobility and no difficulty performing the subassembly tasks they do at table-height. A "horse collar" or pillow that supports the EksoVest's user's neck further reduces neck strain from looking up.

"We're still refining the vest with Ekso-Bionics and the UAW," Smets reports. "Our operators have more experience of the Ekso Vest than anyone else on the planet right now. They're close to 900 hours of continuous usage."

Exoskeletal devices are the latest in a number of technologies Ford has employed to reduce the physical toll on its workers. The company asserts that between 2005 and 2016, it saw an 83 percent decrease in the number of incidents that resulted in days away, work restrictions, or job transfers-to an all-time low of 1.55 incidents per 100 full-time North American employees.

The cost of each EksoVest prototype is currently \$6,000, a tab picked up for the trial by the UAW. While that's not cheap, Ford anticipates significant savings from a lower frequency of shoulderrelated injuries and increased worker productivity. The company expects to make an acquisition decision on EksoVest "in the near future."

Gimme a hand

While Ford is looking to exoskeletons to reduce shoulder and neck fatigue, General Motors is seeking to diminish hand fatigue. GM has partnered with a Swedish firm called Bioservo to capitalize on grasp-assist technology, which the automaker co-researched with NASA.

The partnership will further develop a robotic glove that uses leading-edge sensors, actuators, and tendons that are comparable to the nerves, muscles, and tendons in a human hand. The glove will be capable of augmenting operation of hand-tools designed for humans, increasing operator efficiency while reducing fatigue in hand muscles. GM says that research shows fatigue can occur within a few minutes of continuously gripping a tool.



Manufacturing plant tests of the externally powered "Roboglove" have yet to be announced, and specific applications for it are not yet defined, but it follows the pattern for repetitive stress reduction.

In Europe, the emphasis has been on relieving the stress of standing.

In 2015, Audi began evaluating a device called the "Chairless Chair," a carbon fiber exoskeleton which straps to the back of each of a worker's legs and supports the buttocks and thighs. Developed with Swiss start-up firm Noonee, the Chairless Chair allows users to walk around freely but have instant support once they get into a bending, squatting, or crouching position—in effect, sitting.

Its aim is to reduce stress on the joints and muscles of workers required to stand for long periods of time, and like EksoVest, the Chairless Chair is non-powered. Testing was undertaken at Audi's Neckarsulm and Ingolstadt plants on the A4 and A6 assembly lines. Though Noonee announced that it had started production of the Chairless Chair in April 2017, Audi has not formally confirmed it will acquire the devices.

Ford's Marty Smets is more optimistic that EksoVest will see widespread use on the company's assembly lines. "The trial was a complete success," he said. "The operators all reported a reduction in musculoskeletal discomfort at the end of the day. They all said they'd continue using it daily if given the choice."

Listing image by Ford

READER COMMENTS 48



← PREVIOUS STORY

NEXT STORY \rightarrow

Related Stories

Sponsored Stories

Powered by Outbrain





Healthy Eater? Try This Greatist



The Cast Of "Star Trek **Recently Reunited And We** Could Hardly Recognize Them DailyFores



Forget Your 401k If You Own A Home (Do This Instead) The Bette



The Link Between Vitamin D and RA Health Central



Strange Link Between Eggs and Diabetes Scares The Insulin Companies. (Watch)

Today on Ars

Now Enrolling: Equinox Research Study for Painful

Fo ox Stud

Periods Due to Endometriosis

RSS FEEDS VIEW MOBILE SITE VISIT ARS TECHNICA UK ABOUT US

CONTACT US STAFF **ADVERTISE WITH US** REPRINTS



CONDÉ NAST

Use of this Site constitutes acceptance of our **User Agreement** (effective California Privacy Rights. The material on this site may not be reproduc Ars Technica Addendum (effective 5/17/2012). View our Affiliate Link Policy. Your e used, except with the prior written permission of Condé Nast.