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## Exoskeleton Technology's Impact on Policing

*by Milton McKinnon,  
Hermosa Beach  
Police Department*



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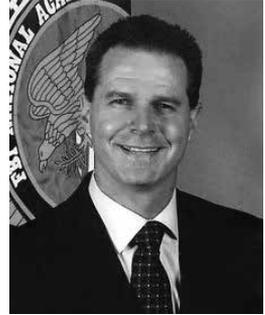
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# Exoskeleton Technology's Impact on Policing

By: Milton McKinnon, Hermosa Beach Police Department

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Officer Jones is in the locker room getting ready before his shift, just as he's done for the past seven years. He reaches down to grab his war bag and suddenly strains his shoulder. Jones ignores the pain, attends briefing and just an hour into his shift, he realizes the pain is getting worse. He reports the injury to his supervisor, who completes the Injured on Duty (IOD) paperwork. Jones is sent to the doctor, and then is put off from work until his scheduled MRI in a week or two. Two weeks later, the MRI results reveal a rotator cuff injury--likely a result of years of chronic wear. The injury is significant enough to require surgery. Now Jones is out of work for at least three more months, impacting staffing, budget, and Jones' morale.



This scenario plays out time and again across the country in all public safety organizations. Officers sustain significant knee injuries from stepping off curbs, back injuries from years of wearing gun belts, and other types of injuries when taking suspects into custody during altercations. What if there were ways to mitigate the number of injuries public safety employees sustain while on-duty? What if employees were given the tools to protect themselves from injuries and provide them with augmented strength? What if it were possible to mitigate an injured employee's restrictions so they were able to return or remain at work? In the near future, the impact of injuries in public safety could be lessened or even eliminated. As exoskeleton (ES) technology matures, it could be the answer to a chronic issue facing every officer in the field.

## Staffing, Costs & Impacts

While every law enforcement agency in the United States differs in budgets, culture, demography and political realities, one universal similarity is a lack of staffing. Staffing

*Captain Milton McKinnon has spent more than 25 years in law enforcement. He is currently the second-in-command at the Hermosa Beach Police Department where he runs day-to-day operations. He holds a Masters Degree in Leadership from USC, is a graduate of the FBI National Academy (Class 254), POST Command College (Class 60), LAPD's Leadership Program, the Delinquency Control Institute, and the Supervisory Leadership Institute. You can contact Captain McKinnon at [mmckinnon@hermosapolice.org](mailto:mmckinnon@hermosapolice.org).*

shortages resulting from retirements, resignations, terminations, vacations, and injuries impact how agencies effectively deliver service to their community. Forward thinking leaders can anticipate retirements and vacations and begin the necessary processes (e.g. hiring, personnel movement, etc.) to mitigate agency impact. Resignations are often a result of employees transferring to other agencies, but these activities are rarely announced by the departing employee and often occur expectantly. The areas over which management has little control are terminations and injuries sustained by on-duty employees. Nationwide, from 2009-2014, the average number of days employees miss from work as a result of an injury sustained while on-duty (IOD) is substantially higher than all other occupations (Figure 1.)



Figure 1. Bureau of Labor and Statistics; <https://www.bls.gov/iif/oshwc/foi/police-officers-2014.htm>

Public safety staffing issues related to on-duty injuries can be impacted by risk management and physical fitness programs. This requires a proactive approach by leadership and buy-in from staff. As noted in the IACP report on reducing injuries (International Association of Chiefs of Police [IACP], n.d., p. 10 & 13), “results showed that 63 percent of those who did not receive a safety lecture sustained an OSHA-reportable injury. In contrast, when a safety lecture was provided, the number of injuries decreased to 41 percent.” Also cited in the report, “... officers who did engage in fitness training were less likely to have an injury that was OSHA reportable when compared to those who did not, suggesting the value of fitness in reducing the severity of injuries sustained during the line of duty.” Many agencies have recognized the benefits of fitness programs and

have incorporated them into department culture and memorandums of understanding, often tied to increase of pay if members participate and/or perform at a certain level/ passes physical fitness tests.

In spite of the successes of training and safety programs, though, law enforcement organizations forecast that between 10%-15% of sworn officers will be unavailable for service as a result of IOD (and to a small degree, vacations). Some agencies have substantially higher rates of unavailable officers when only taking into account IOD (Dolan, 2014). While IOD staffing issues are impactful to all organizations, larger agencies can often times more easily absorb the impact to staffing. Of the 18,000 agencies in the United States, most have less than 15 fulltime officers, (Stephens & Matarese, 2013) and the impact of losing two or more employees can be devastating to these small organizations. IOD statistics have remained static for many years despite efforts to mitigate injuries through training and (Wills, 2012) and physical fitness incentives (Line, 2015). One way to alter this equation, however, is already here.

Exoskeleton (ES) technology augments an individual's strength, with the added benefit of reducing repetitive motion fatigue. An exoskeleton allows users to lift and move more weight, perform physical tasks for longer periods without fatigue, and facilitates the movement of injured or damaged limbs. Using ES in law enforcement can impact IOD injuries before they occur, and may allow injured officers to return to work more quickly than they otherwise would. Using ES, police agencies may experience less turnover, fewer missed days, and better levels of performance from every member of staff. Before we don our ES equipment, however, it is important to understand the advantages ES offer, and the issues that will be necessary to address before they are a part of our everyday life.

## **Exoskeleton Technology**

A powered exoskeleton is a wearable mobile machine that provides users with increased strength and endurance ("Powered exoskeleton," n.d.). For many years, the intent and push for ES technology was primarily military and industry centric. The military's interest in the technology was to enhance the abilities of soldiers during combat. Since 2001, the war on terrorism has resulted in more than 40,000 American soldiers and civilians sustaining significant injuries (Goldberg, 2014) including, severed spinal cords, shattered limbs, amputations, partial and full body paralysis. These injuries, combined with the approximate 12,500 American spinal cord injuries occurring per year, ("Spinal Cord Injury Facts & Statistics," n.d.) resulting in partial or full body paralysis have created a localized need for ES technology. Several ES manufactures have made significant advancements that now allow people with spinal cord injuries to walk, an activity that was impossible just a few years ago (Maldarelli, 2016).

Private industry's interest in ES is to increase the manufacturing process by providing workers with augmented and sustained strength (Marinov, 2016). Today, the medical field is now heavily involved in the production and implementation of ES technology related to injuries and birth defects that cause limitations in a person's mobility and quality of life (Eisinger, 2015). With continued investment and advancements in ES technology by the military, medical field and private industry, it is not beyond the realm

of possibilities that ES technology will someday be incorporated into a wearable suit no thicker than the clothes/uniforms we wear today (Davis, 2016). This clothing would absorb the impact of a projectile (e.g. bullet, bat, punch), provide support in weak areas (e.g. back, knees, neck) and augment the strength of the wearer (Woodford, 2016). It would lessen the frequency of injuries officers sustain during the course of their career, while simultaneously allowing those who are injured to return to duty sooner as the impact of their injury would be mitigated through the augmentation of the ES suit. Although ES may seem like something from science fiction, once ES becomes commonplace by officers and the public, the increased strength they facilitate, while also reducing the chance of injury, should overcome concerns of cost and “militarization.”

## **Normalization of ES**

While the concept and use of exoskeletons may be foreign to most of us, the reduced cost of ES has allowed the technology to slowly make its way into mainstream society. As technology improves and costs decrease, a person using ES in public will be no more unusual than a person using a wheelchair or a walker. The normalization and acceptance of ES in society and its inevitable use by the criminal element will result in law enforcement incorporating ES into everyday police work. As noted in the Rand/Police Executive Research Foundation (PERF) 2015 Report of the Law Enforcement Futuring Workshop, “...in many cases, criminals currently make more effective use of technology than law enforcement. Because of this, and the rapid rate of advancement of technology, they concluded that doing nothing to improve the effectiveness of law enforcement use of technology would inevitably lead to an undesirable future in which criminals have the upper hand and public support for law enforcement agencies is eroded.” (Silberglitt et al., 2015, p. 45).

## **Increased Strength**

In his 2009, article about Raytheon’s XOS exoskeleton which was, “capable of lifting over 200 pounds without the operator breaking a sweat” Kessel, A. (2009) proved that the use of exoskeletons can significantly increase a user’s strength. Increased strength would benefit an officer at the scene of an overturned vehicle; for example, the ability to quickly open a stuck door could save the vehicle’s occupants. It can also provide pre-emptive policing in that subjects contemplating resisting arrest may have second thoughts if they know they cannot “outmuscle” an officer.

## **Leadership Considerations**

Aside from budget concern when purchasing ES products, there are three areas leaders must factor into their decision-making as they consider a move to ES technology.

- **Repetitive Strain Reduction.** A repetitive strain injury is an “injury to the musculoskeletal and nervous systems that may be caused by repetitive tasks, forceful exertions, vibrations, mechanical compression, or sustained or awkward positions (Wikipedia, Repetitive Strain Injury, n.d.). Officers carry a significant amount of additional weight (bullet resistant vests and police duty

belts). This excess weight combined with repetitive tasks (entering/exiting police vehicle, searching suspect vehicles, long durations of standing,) impact the number of injuries to officers (NCBI, 2009). Exoskeletons would benefit these officers by off-loading the additional weight and are uniquely designed to minimize muscle and body strain/fatigue related to repetitive motion.

- **Protection.** An officer wearing an exoskeleton suit would have less of their body exposed to the elements and impacts. This would include impacts related to auto accidents, projectiles, and impact weapons. As a benefit, ES has the capacity to reduce the number of injuries officers sustain in the course of their career. Injuries to officers as a result of using force against criminals, in addition to repetitive motion injuries sustained over the course of a career, can result in officers being absent from work for a year or more. Sometimes officers are forced to retire as a result of IOD injuries. Research into 18 police departments in the United States determined there were a total of 59,380 hours missed by injured officers in one year (International Association of Chiefs of Police [IACP], n.d., p. 7). The cost of paying the injured officer and backfilling vacancies for the 18 agencies during the year was \$3,028,380. This figure does not include medical costs. The average cost per department is \$168,243. There are over 17,930 law enforcement agencies in the United States (“U.S. State and Local Law Enforcement Agency Census 2008,” 2008). If one assigned the average cost to all departments across the nation, the total cost for injured officers equates to more than \$3 billion.
- **Current Concerns.** Before any agency jumps onto the ES technology bandwagon, there are several obvious issues that currently hamper exoskeleton’s integration into law enforcement:
  - Currently the cost of one exoskeleton for paraplegics exceeds \$50,000 and can operate only for a few hours before needing to be recharged.
  - ES technology is new; society is not accustomed to seeing it and would likely consider it to be offensive and potentially appearing as Police Militarization (“Militarization of the Police,” n.d.).
  - Current ES technology is bulky and requires a significant power supply. The technology is not yet mature enough to seamlessly function in a law enforcement environment.
  - Consideration should be made of ES acquisition by the criminal element.

Although current ES technology may not be ready and functional for police officers, the good news is the cost of manufacturing exoskeletons has and continues to decrease. Battery size requirements in ES suits is shrinking as a result of better ES and battery technology. ES mobility, functionality, ergonomics, and usability are increasing as a result of competition in the industry, consumer demand and cutting edge research by the military.

## What will the Future Be For ES Technology?

As exoskeleton technology advances, we will begin seeing its integration into daily life, and ultimately it will enhance prosthetic devices used by amputees and likely integrate or replace splints and braces. Integration in private industry as well as other and in public safety is inevitable. History has shown that law enforcement deploys better and more powerful technology and tools as the availability of those items become more readily accessible to the criminal element. The level of damage, injury and death can become significantly higher if a criminal bent on destruction were to use an exoskeleton in the course of criminal activity. As an example, prior to the North Hollywood shootout in 1997, most police departments did not have high-powered rifles. The suspect in this incident used high-powered rifles against the police. Subsequently, most police departments now carry high-powered rifles in their vehicles. For those reasons, the government may want to have oversight regarding the production and sale of exoskeleton technology. This might include regulations that “throttle back” the abilities of consumer or non-law enforcement suits.

The primary push for ES technology and its further refinement will not occur for the purpose of law enforcement use. It will be driven by the needs of military, industry and the medical field’s response to help injured and disabled people. Law enforcement will ultimately integrate the technology in an attempt to mitigate officer injuries or simply to keep up with the equipment available to criminals. In any event, it is coming and law enforcement professionals and society need to prepare.

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