



Chinese Military Sponsors Exoskeleton Competition

OE Watch Commentary: In October, the PLA's Army Equipment Department [陆军装备部] held a competition for exoskeleton designs. The accompanying article explains that the competition showcased recent advances in loadbearing and maneuverability for a number of different designs. A group of 29 teams fielded 50 prototype exoskeletons submitted to the competition. The exoskeletons were put through a series of tests, including light maneuvering, marching carrying heavy loads, handling materials, and reloading artillery.

Exoskeletons are wearable frameworks meant to aid in lifting heavy objects or carrying equipment. The article explains that the strain of these tasks can lead to long-term medical problems. There are numerous military and civilian applications for exoskeletons. As noted in the article, Russia has fielded "K-2" exoskeletons for mine clearing work in Syria. The US and Canada have also shown a number of models. In 2010 for example, Lockheed Martin displayed a Human Universal Load Carrier (HULC) intended for a number of applications, including artillery. The article further notes that exoskeletons potentially offer a breakthrough in mobility in complex terrain, or behind enemy lines, where opportunities for fuel resupply are limited.

While not identified in the article, photos circulating in Chinese language forums indicate that Chinese armaments giant Norinco has an exoskeleton program. Norinco's Northwest Institute of Electrical and Mechanical Engineering (202 Research Institute), established an exoskeleton research program in April 2013. The research institute apparently completed the digital design, modeling and physical prototyping of the exoskeleton in two years and it entered environmental testing in 2015. A number of civilian universities appear to be involved related work with civilian applications. Walking assistance exoskeletons for the elderly in particular seems to be an area of interest, due to China's ballooning elderly population.

For the moment, the application of these exoskeletons will remain limited. Unpowered exoskeletons have already been used for some physically demanding tasks in manufacturing, but these systems are still limited by the operator. To allow more demanding tasks or further reduce strain on the operator, powered systems are necessary. A key hurdle has been the energy density of battery power—the amount of energy a given weight battery can put out. While the specifics vary depending on the battery application, it appears that energy density has roughly doubled every decade. Combined with the development of lighter and stronger structural materials and better drive systems (such as electric motors or hydraulics), more powerful exoskeletons are on the horizon. **End OE Watch Commentary (Wood)**



DARPA Exoskeleton.
Source: DARPA via Wikimedia, https://commons.wikimedia.org/wiki/File:DARPA_Exoskeleton.tiff, Public domain

“The competition... tested light-duty mobility, weight-bearing marching, material handling, and other areas, fully demonstrating that exoskeletons have a strong prospect for use on a future battlefield.”

Source: “有了这款单兵外骨骼，我军炮弹装填手就不用这么辛苦了 (With this Exoskeleton, Reloading Artillery Shells Does Not Have to Be So Hard),” *Ordnance Industry Science & Technology* 《兵工科技》, 30 October 2019. Post on Wechat - <https://mp.weixin.qq.com/>

As we all know, reloading artillery is tiring work. This is especially true for large-caliber howitzers, whose shells often weigh tens of kilograms, and repeated movement of reloading artillery is exhausting, and many people suffer from deteriorative back problems starting at a young age, impacting the effectiveness of artillery operations.

So, how to reduce this burden? From October 23 to 27, the Army Equipment Department organized the “Super Warrior - 2019” Individual Soldier Exoskeleton System Challenge. At the challenge, they presented an exoskeleton system specially developed for artillery reloaders. The loaders, wearing mechanical power-assisted exoskeletons, were transformed into “Hercules” effortlessly lifting 155mm shells weighing between forty and fifty kilograms.

Exoskeletons are able to achieve these marvelous effects mainly through external power and mechanical power-assist systems, helping address some of the limitations of individual soldiers such as insufficient strength, limited mobility, etc. In combat situations such as operations behind enemy lines, mountain warfare, on border patrols, or rescue and disaster relief, mobile platforms generally cannot reach mission areas or their fuel supplies are insufficient to operate for very long. Exoskeletons could enhance mobility while carrying heavy loads or adaptability to complex terrain while reducing the physical fatigue of long-term marching.

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Many people believe exoskeletons remain in the realm of science fiction, but this view has been disproved, and with the advance of technology, the exoskeleton has become practical. Russia has released videos of soldiers on the Syrian battlefield employing K-2 exoskeletons for mine clearance operations, and several U.S. exoskeleton systems have been put into use on the battlefield in the Middle East.

China, of course, is not backward, and this “Super-Power Warrior - 2019” competition demonstrates that China’s exoskeleton systems have also gradually moved towards practicality. In addition to reloading, the competition also tested light-duty mobility, weight-bearing marching, material handling, and other areas, fully demonstrating that exoskeletons have a strong prospect for use on future battlefields.