

# The DEKA Arm

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**Veterans sacrifice their lives in the battlefield for the well being of our country. As a result, they suffer catastrophic injuries that may lead to an amputated limb. Losing a limb can be a very difficult reality to deal with, especially an upper extremity which is responsible for so many everyday functions. Individuals who could do everything for themselves would need additional assistance to carry out daily tasks.**

## I. INTRODUCTION

As of July of 2011, there were 1286 major limb amputations for Operation Enduring Freedom and Operation Iraqi Freedom treated in all U.S military facilities [1]. The US Department of Veteran Affairs (VA), has many resources available for amputated veterans in terms of receiving a prosthetic arm. However, many veterans reject or abandon their prosthesis because the discomfort that it implies is not worth the small amount of assistance provided [2]. In order to give veterans a better chance at finding a prosthetic that they liked, the Department of Veteran Affairs has partnered with the Defense Advanced Research Projects Agency (DARPA) and DEKA Integrated Solutions to optimize the function of an advanced prosthetic arm system that will enable greater independence and function [1].

## II. METHODS

The DEKA arm is a very advanced prosthetic arm that can be controlled in two ways. Most users take advantage of a noninvasive system that uses foot controls, which are inertial measurement units (IMU) worn on the shoes [3]. The user commands motion of the prosthesis by applying pressure to the sensors on different areas of the foot [4]. The picture below shows the IMU (left) and how it is worn on laces (right) [4].



The second method to control the DEKA arm is through an optional surgical procedure called Targeted Reinnervation, where residual nerves on the amputated limb are implanted in pectoral muscles. When the user thinks about moving their arm, the signals travel down the nerves now connected to the chest. When the chest muscle contracts, the electrodes send signals to the prosthetic arm, moving the arm [3].

Also, the DEKA arm is the first prosthetic arm that allows the wrist and fingers to adjust in six different preprogrammed grips, allowing the patient to carry out several every day functions, such as picking up a grape, holding a tube of toothpaste, and using a power tool [3]. These different grip

patterns provide both precision and power grasps [4].

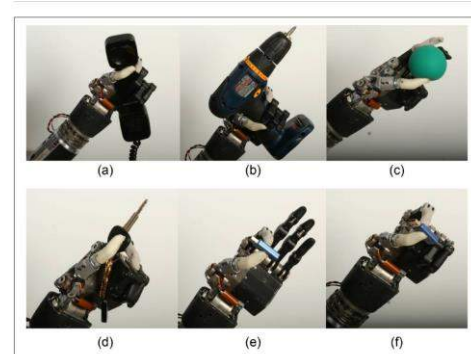


Figure 2. Six grips of the DEKA Arm (Gen 2 Hand): (a) power, (b) tool, (c) chuck, (d) lateral pinch, (e) fine pinch open, and (f) fine pinch closed.

## III. RESULTS

One study done in 2013, measured the desirability of the DEKA arm in comparison to other prosthesis. The study utilized data from 24 upper-limb amputees fit with a Gen 2 DEKA Arm and 13 fit with a Gen 3 DEKA Arm. The Gen 2 participants included 8 radial configuration (RC) amputees, 7 humeral configuration (HC) amputees, and 9 shoulder configuration (SC) amputees. The Gen 3 participants included 4 RC, 5 HC, and 4 SC. At the end of the trial, the participants were asked if they would like to receive a DEKA arm. 79% of Gen 2 and 85% of Gen 3 reported that they wanted to receive or might want to receive a DEKA arm [5].

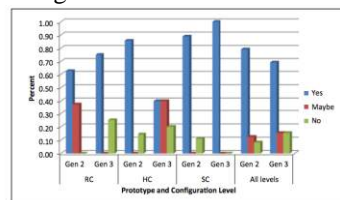


Figure 4. Desire to receive a DEKA Arm in future.

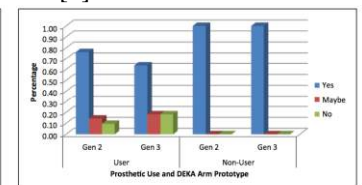


Figure 5. Comparison of prosthetic users' and nonusers' desire to receive a DEKA Arm.

Also, 95% of Gen 2 and 91% of Gen 3 prior prosthesis users reported that they were able to preform new activities that that they were unable to preform with their own prosthesis [5].

## IV. DISCUSSION

Many of the people who have tried the DEKA arm, both clinical trial participants and veterans, have been overall pleased with the product. Many explained that they wanted the DEKA Arm because of increased overall function, saying things like, "(it) will make everyday activities better" and "the functionality far surpasses anything that I've had so far" [5]. The DEKA arm was approved by the FDA in 2014, which means that anyone with the appropriate financial resources can purchase their own. This new device has the ability to improve many lives and with further research and new technology this product will be ideal for anyone who is in need of an arm.

## References

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