

# Prosthetics in Track

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**Abstract**—The cheetah flex prosthetic designed for leg amputees allows for the ability of running to be regained. Using carbon fiber, a “j” shaped strap on prosthetic has been designed to allow for high speeds to be reached. This leads to controversy wondering if it is easier to run with these lightweight high performance prosthetics than normal legs.

## I. INTRODUCTION

For lower body amputees running or walking again used to be a very unrealistic thought. The loss of a limb used to limit abilities because the only thought was to place a piece of wood or a hook in its place. But as technology advanced, that unrealistic thought became a reality. Now for some amputees, they are even able to run in the Olympics against able-bodied people. For one man in particular, Oscar Pistorius, the dream of running in the Olympics even with out legs became a reality in 2012 in London. He used a prosthetic that most sports players with the loss of limbs use. This device is called the Flex-Foot Cheetah blade. The Flex-Foot Cheetah blade is a prosthetic custom designed prosthetic designed specifically for sports activities.

## II. METHODS

Van Phillips, an amputee himself, designed the cheetah prosthetic. He mimicked the form a cheetah has while mid stride, assuming it would maximize the speed that the prosthetic could provide and withstand. This prosthetic is designed specifically for high intense activities. Phillips used thousands of carbon fibers heated together to form a strong bond. He shaped these fibers into a “j” form. Where there are high stress points, along the top and bottom, more carbon fiber is bonded here. Where there are low stress points, in the bend, less carbon fiber is used so that it can compress and spring back. Then using a lamination connector the device is connected to the rest of the leg. When in use, the “j” shaped curve compresses and then returns back to its original state propelling the amputee forward and releasing the stored energy.



## III. RESULTS

Upon looking at the effectiveness of this prosthetic, the comfort, degree of movement, weight, and speeds reached must be looked at. Users say that the prosthetic is as comfortable as any other external prosthetic device. The external socket application also allows for a good degree of movement that makes running fast feel normal. The lightweight of the carbon fiber makes it easy to pick up each leg and run. When looking at the numbers the Flex-Foot blade can return about 90% of the energy stored in it.

## IV. DISCUSSION

There is a major controversy over allowing the Flex-Foot in the Olympics. People believe that the ultra lightweight and spring provided from the “j” shape give amputees a clear advantage over able-bodied runners.

Once again looking at the numbers, it is experimentally proven that 25% more energy is required to use a prosthetic over a human leg. Also the muscles in the calf and ankles allow for a return of nearly 250% of the energy stored in it. When comparing this to the 90% energy return of the Flex-Foot it is clear that muscles prevail over the curve of the carbon fiber. So even though these prosthetics allow for people to participate in intense activities, they do not give them an advantage over able-bodied athletes.

As advances in technology are made, springs have been implemented on devices like the Flex-Fit in order to mimic the muscles in the calf. These advances may eventually lead to an advantage of prosthetics over human legs.

## REFERENCES

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