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BLUEPRINT

Titan Arm: Bionic bicep gives you the strength of Hercules

By [Arion McNicoll](#) and [Stefanie Blendis](#), CNN

updated 11:41 AM EDT, Fri October 25, 2013 | Filed under: [Innovations](#)

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Exoskeleton gives you super strength

STORY HIGHLIGHTS

- University of Pennsylvania students develop upper-body exoskeleton
- The invention can lift 40 lbs and be used for physical rehabilitation
- The Titan Arm won the Cornell Cup for Innovation
- Inventor JD Albert described the device as "exciting"

(CNN) -- In the past, if you wanted to be able to lift more weight you would have to spend months bulking up at the gym. Now, with a new invention from a group of engineering students at the University of Pennsylvania, you can just strap on an external bicep and you are ready to go.

The bionic device, called the Titan Arm, is the brainchild of four mechanical engineering students who, in their final undergraduate year, built an upper-body exoskeleton that can be used in physical therapy and manual labor. The invention won its inventors \$10,000 in the [Cornell Cup for Innovation](#) and has recently been shortlisted for the [2013 Dyson award](#).

The Titan Arm straps directly to a user's right arm to help lift heavy objects that the user wouldn't normally be able to lift. Its inventors

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believe that it will be useful in aiding physical rehabilitation, both for people who have suffered upper body injuries and for those with pre-existing muscular-skeletal disorders.

The Titan Arm's inventors say the exoskeleton can also be used by people whose jobs require heavy lifting such as warehouse workers, removalists and couriers.

[Read: Bionic fashion, hot wearable tech](#)

"With the Titan Arm, we wanted to create something that could both augment a user's natural strength as well as help someone perform physical therapy in their own home," says Elizabeth Beattie, one of the Titan Arm's inventors. "We wanted to create something that was low-cost and easy for a user to put on and strap to themselves."

According to the United States Department of Labour, back

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updated 2:01 PM EST, Mon December 9, 2013



A baseball-sized shock absorbent camera that can be thrown into a disaster zone to assess risks posed to rescuers.

Save \$1000 with water-recycling shower

updated 2:51 PM EST, Mon November 11, 2013



Astronauts wash and drink from the same continuously recycled source for years. So why do we not do the same on Earth?

Bionic bicep gives Herculean strength

updated 5:46 AM EDT, Fri October 25, 2013



A new strap-on external bicep called the Titan Arm allows humans to lift very heavy objects by giving them instant super strength.

The origami kayak

updated 8:56 AM EDT, Fri October 11, 2013



See the origami kayak take shape in our 40-second time lapse video.

disorders are one of the leading causes of disability for people during their working years. The American National Institute for Occupational Safety and Health says that [back problems afflict over 600,000 employees each year](#) with a cost of around \$50 billion annually to the U.S. economy. The problem is significant in other countries: the World Health Organisation says that worldwide, 37% of lower back pain is due to [injuries sustained in the workplace](#).

Beattie says that addressing this problem while being attentive to user comfort was one of the primary motivating principles in designing the device: "We wanted something that was comfortable for the user, something that mimics the body's natural mobility and range, so we definitely went through a lot of testing in order to get to where the design is right now."

We want to use our engineering tool kits to better the quality of life of those around us

Elizabeth Beattie, co-inventor of the Titan Arm



The Titan Arm attaches to a user's right arm with a power motor at its elbow joint. The bionic limb can lift approximately 40 pounds of weight, augmenting a user's natural strength. The arm is predominantly made of aluminum and steel components, and is powered by a DC battery.

Read: [Meet the robot chef who "prints" cookies](#)

As well as helping lift weight, the arm can also be locked into any position with a ratchet brake to hold an object steady without any exertion from the user.

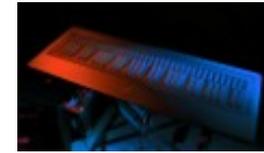
JD Albert, an engineer and co-founder of E-Ink, calls the Titan Arm "exciting," but adds: "I would caveat that with the fact that it's a very tough product to launch for a lot of reasons ... it needs to feel right (and) I think there's also some pretty significant safety concerns ... We are taking a piece of machinery and integrating it with a person and so naturally you need to make sure that there's no way to injure someone."

Still, Albert says that for young engineers, the Titan Arm represents

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Hans Zimmer plays piano of the future

updated 9:35 AM EDT, Fri September 27, 2013



The 'Seaboard keyboard' is a tech forward interpretation of the piano, that reimagines what a keyboard can do.

The everlasting smartphone

updated 2:56 PM EDT, Thu September 19, 2013



What if you could build your own smartphone that would last you for the rest of your life?

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updated 4:49 AM EDT, Tue September 17, 2013



Why did the Victoria and Albert Museum in London acquire two models of the world's first 3D-printed gun?

Laser light could cut cyclist deaths

updated 6:09 AM EDT, Fri September 13, 2013



It looks like a regular bike light, but one day Emily Brooke's Blaze light could save your life.

Sober reality of Samsung smartwatch

updated 6:01 AM EDT, Tue September 10, 2013



After months of hype and speculation, the Samsung Galaxy Gear smart watch arrived this week with a bang... followed by a whimper.

an impressive achievement: "They've managed to combine a pretty wide variety of disciplines both dealing the mechanical side of things -- the design and the electrical -- and the software side of things as well."

Beattie says that the Titan Arm team intends to keep working on the exoskeleton with a view to one day bringing it to market: "The four of us definitely want to use our engineering tool kits to better the quality of life of those around us. I think that's one of the things that technology really has the power to do."

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updated 9:27 AM EDT, Wed August 21, 2013



Sound on Intution: sensors attach to your hands, feet and heart to produce music that responds to movement

Making gourmet meals out of maggots

updated 6:27 AM EDT, Thu August 15, 2013



In 2050, when nine billion people are living on Earth, will high-protein insects be a part of our staple diet?

Edible wrapping could wipe out waste

updated 9:01 AM EDT, Tue August 13, 2013



He's invented breathable food, flavor clouds and olfactory telephones. Now David Edwards is bringing edible food-packaging to the table.

Ski and surf combo could save your life

updated 6:31 AM EDT, Tue August 13, 2013



ASAP is a solar-powered life-saving machine that's cheaper, greener and more efficient than a traditional Jet Ski

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Guest · 2 months ago

Just like the Six Million Dollar Man was bogus. You can't lift more than your back can hold.

You have to have an entire Exoskeleton from top to bottom in order to support the load. They've done all this and are on their way to perfecting it.

I mean seriously CNN can't you just report the thing once it's done.

73 ^ | 5 v · Reply · Share ›



sumguy222 → Guest · 2 months ago

This is also where complete bionics break down, not just in the supporting bones and legs/back, but in the connection between metal and bone - it'd tear itself away from without significant reinforcement to the entire bone structure, you'd end up having to

16 ^ | v · Reply · Share ›



Blazing Machine Gun → sumguy222 · 2 months ago

It would cost about 6 million bucks to fix this. I saw it on a tv show.

9 ^ | v · Reply · Share ›

Bionic fashion: Hot, wearable tech

updated 6:57 AM EDT, Mon August 5, 2013



Transparent dresses, vacuum shoes, shark-proof wetsuits and more. We imagine a day in the life of a wearable technology user in the year 2015.

Smart streetlamps save energy

updated 1:23 PM EDT, Mon July 29, 2013



Europe spends \$13 billion annually on fueling street lights. With a new system called 'Twilight', streetlamps can sense the arrival of a person.

Table improves chances of survival

updated 5:19 AM EDT, Mon August 5, 2013



The earthquake-proof table can combat a ton of falling debris and provides reliable protection for people taking shelter during an earthquake

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HillCountryX → Guest · 2 months ago

Link me to that article about the Japanese exoskeleton please

9 ^ | 4 v · Reply · Share ›



javy150 → HillCountryX · 2 months ago

He said 'JAPANESE' exoskeleton; two completely different countries. Some

55 ^ | 5 v · Reply · Share ›



kerryberger → javy150 · 2 months ago

No, the Japanese have the lead on this technology javy150. We are

1 ^ | 1 v · Reply · Share ›



Blazing Machine Gun → kerryberger · 2 months ago

I don't like catchup. I prefer mustard. The light brown spicy kind.

^ | v · Reply · Share ›



HillCountryX → javy150 · 2 months ago

Corrected, Thank you, Sumātoarekku.

^ | v · Reply · Share ›



Tom → HillCountryX · 2 months ago

If your read the article it simply augments the users existing strength. So if s
40 lbs (which most might find difficult) then you could potentially curl up to 8
medical issues preventing heavy lifting it allows them to be able to curl a no
you wouldn't need an entire exoskeleton or anything.

8 ^ | 1 v · Reply · Share ›



HillCountryX → Tom · 2 months ago

I didn't say you'd need one, I was just curious about the article Richa

^ | 1 v · Reply · Share ›



Think Twice → HillCountryX · 2 months ago

yes, link *please* remember, pics or it didn't happen

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Cyrus video leaves little to imagination



This woman does WHAT for a living?



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3D projector creates life-like holograms



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The top 10 tech 'fails' of 2013



Last chance to stream 'Titanic,' 'Top Gun' on Netflix



Blazing Machine Gun → Guest · 2 months ago

This bionic arm thing is great. They could call it the jack-a-matic and sell it on adult worldwide. I mean being metal it couldn't even grow hair on it's palm. Next they would all the guys going blind because of it..

2 ^ | v · Reply · Share ›



ScienceSoma → Guest · 2 months ago

A very popular Japanese exoskeleton is called the HAL created by Cyberdyne (yes, fans).

1 ^ | v · Reply · Share ›



Mike → Guest · 2 months ago

Your back can hold a lot more than your arms can lift generally. I can squat about 300 about 100 for a single rep. You wouldn't necessarily have to move the weight all the way to the floor. Making it so that it applies downwards rather than as a shearing motion from the side would be sufficient (I'm guessing something like a rucksack that presses down on the hip would be a not a great idea to move all the way to that 300lb for everyday use for me: there is a better way of lifting 300 10X4 a couple times a week and doing it once a minute for 40 hrs a week. 100lb a routine weight would be possible which would still be impressive. You'd be like terminator :)

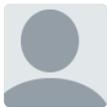
^ | v · Reply · Share ›



Bionic Bunny → Guest · 2 months ago

This system could bypass strain on one's back by implementing a belt much like la

^ | v · Reply · Share ›



Scud · 2 months ago

We are that much closer to the master chief.

22 ^ | v · Reply · Share ›



Robert Shaw · 2 months ago

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USA Today



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Bikini-Clad Jennifer Aniston Sizzles in the Sun

Hollyscoop



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It's up for the Dyson award. Is that Miles Bennett Dyson? Next step -- A Cyberdyne System

16 ^ | v · Reply · Share ›



Ambivalent Cynic → Robert Shaw · 2 months ago

Cyberdyne is a real-world Japanese company that is already producing full-body exo-skeleton. The current model is called the HAL.

Apparently nobody told them how 2001 or Terminator actually ended...

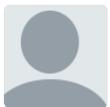
5 ^ | v · Reply · Share ›



Robert Shaw → Ambivalent Cynic · 2 months ago

Are you serious? Ha! That is hilarious! And a little scary? Get the Japanese Terminator, STAT!

1 ^ | v · Reply · Share ›



Tom McBride · 2 months ago

If you kids truly where on the cutting edge would simply use pressure sensors in the arm instead of a second controller. When the user raises their arm pressure is lower then arm goes up or down. A pressure pad sensor. At that point it wouldn't matter what you where holding, the arm can assist up or down load.

Sometimes I wish I had a lab and a million dollars, the world would be changed forever.

16 ^ | v · Reply · Share ›



Alden Bowen → Tom McBride · 2 months ago

You just hinted on the exact reason why they can't do what you described. They do have a million dollars. That is one of the major factors that ME capstone design projects have. Most students have a budget of only a couple thousand dollars at most. Figuring out how to do this for the amount of money given is one of the major accomplishments. Not that I'm a nuclear engineering student, but I have many many ME friends.

27 ^ | v · Reply · Share ›



Andrew Ulrich → Alden Bowen · 2 months ago

You should combine with your ME friends and make me a set of power arm

13 ^ | v · Reply · Share ›



Don → Alden Bowen · 2 months ago

A lab and a million dollars? Quick, someone call Jesse, we need to COOK!

1 ^ | v · Reply · Share ›



Welen Dowd → Tom McBride · 2 months ago

invest in CTLE hold it for a while, and cash out. You will be able to afford it!

^ | v · Reply · Share ›



Bill Myers · 2 months ago

Steve Austin. Astronaut. A man barely alive.

"Gentlemen. We can can rebuild him. We have the technology. We have the capability to r
first bionic man. Steve Austin will be that man. Better than he was before. Better. Stronger.
Da da da daaaah....

11 ^ | v · Reply · Share ›



Bibliophilist → Bill Myers · 2 months ago

Did you hear about the Six Million Dollar Man? He met a fifty dollar woman...

9 ^ | v · Reply · Share ›



TJSlipperman → Bill Myers · 2 months ago

Seems the idea of the Six Million Dollar Man becoming a reality really isn't too far of

4 ^ | v · Reply · Share ›



Quadg → TJSlipperman · 2 months ago

the 6 million dollar man is a myth, inflation means at least 60 million..

1 ^ | v · Reply · Share ›



ellid → Quadg · 2 months ago

I hear they tried to reboot it as the Six BILLION Dollar Man.

2 ^ | v · Reply · Share ›



Benjamin · 2 months ago

All while I was reading this article and seeing all the parts about how this was designed for construction workers, I was thinking about how many comic book villains used this sort of better hope these teens don't get their funding cut and swear revenge, or we may have a li and Bane's running around smashing stuff.

10 ^ | v · Reply · Share ›



jjxtra · 2 months ago

Cool device, but strength of Hercules? "The bionic limb can lift approximately 40 pounds of

10 ^ | v · Reply · Share ›



Dave Mittner → jjxtra · 2 months ago

Well, he's really let himself go over the past few hundred years...

41 ^ | v · Reply · Share ›



SFC Mike → jjxtra · 2 months ago

Which is nothing except to a girl or an out of shape ME student.

6 ^ | v · Reply · Share ›



codifex → SFC Mike · 2 months ago

I'll bet Hawking is watching this development with interest.

4 ^ | v · Reply · Share ›



drowlord101 → jjxtra · 2 months ago

It adds 40lbs of capability to your existing strength. If you want Herculean strength, lbs of a Greek Hero's power.

3 ^ | v · Reply · Share ›



Joe the Juggler · 2 months ago

CNN: It's "biceps" not "bicep".

More of that professional writing!

7 ^ | v · Reply · Share ›



anthony king · 2 months ago

I'm thinking of getting metal legs. It's a risky procedure, but it'll be worth it.

5 ^ | v · Reply · Share ›



thespicymeatball · 2 months ago

You really think any company is gonna spend millions on these things when they can just hire illegal immigrants to do all the heavy lifting? In a perfect world yes, but we don't live in that world.

5 ^ | v · Reply · Share ›



Dave Mittner → thespicymeatball · 2 months ago

It's unlikely to be cost effective for construction workers for some time, but imagine other emergency workers. Might be nice there.

9 ^ | v · Reply · Share ›



Black Light Shoots → thespicymeatball · 2 months ago

Which is why Elysium reached out to them lol. Oh that perfect world.

1 ^ | v · Reply · Share ›



Johnny550 · 2 months ago

I might consider this; I could knock out 50 democrats in one punch!!

10 ^ | 2 v · Reply · Share ›



CriticalThinking77 → Johnny550 · 2 months ago

You must live a sad, sad life.

4 ^ | 1 v · Reply · Share ›



bob rivers · 2 months ago

"You will all become one with the Borg..."

- Locutus, Stardate 6431.2

4 ^ | v · Reply · Share ›

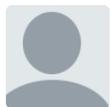


Thisis Notme · 2 months ago



When will they make a Jaeger?

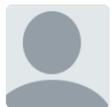
4 ^ | v · Reply · Share ›



Free_Radical · 2 months ago

I think I'll hit the gym anyways.

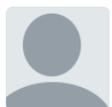
4 ^ | v · Reply · Share ›



Tachomanx · 2 months ago

Power Armor! Come on, you all want one!

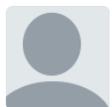
4 ^ | v · Reply · Share ›



masseffect · 2 months ago

Master Chief and the Spartans :D

4 ^ | v · Reply · Share ›



Quadg · 2 months ago

reminds me of fall out, with exoskeletons running about containing skeletons, because the
is dead...

is that a person wearing a suit or a suit wearing a person?

3 ^ | v · Reply · Share ›

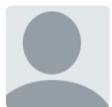


PeriSoft → Quadg · 2 months ago

"is that a person wearing a suit or a suit wearing a person?"

I used to ask myself that question when I saw my boss.

^ | v · Reply · Share ›



thegreaterfool · 2 months ago

Elysium can happen. Just kid lol.

3 ^ | v · Reply · Share ›

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