Quantum fluctuations in science, space and society, from quarks to Hubble and Mars. Served up by Alan Boyle, msnbc.com science editor. E-mail Alan, or connect via Facebook or Twitter.

12 May 2011 4:05pm, EDT

Robot walks 40.5 miles non-stop

Cornell Ranger, a four-legged biped walked a non-stop ultra-marathon without re-charging or being touched by a human at Cornell University's indoor Barton Hall track.

By John Roach

A four-legged bipedal robot named Ranger, about as tall as a human adult truncated at the hips, has walked 40.5 miles on a single battery charge without stopping or any human hand-holding, smashing a world record, researchers reported this week.

The robot was built and programmed at Cornell University. It started walking around an indoor track on May 1 just after 2:00 p.m. ET and came to an abrupt stop May 2 at 9 p.m., after 30 hours, 49 minutes and 2 seconds. In that time, Ranger made 307.75 laps around the .13 mile track at an ambling pace of 1.3 mph.

The feat differs from the robot marathon in Japan earlier this year, in which the robots were repeatedly recharged. Ranger just kept going and going and going.

"Towards the end, we were getting kind of sick of it," Andy Ruina, a professor of mechanical and aerospace engineering who is leading the effort, told me today. He admitted to catching a few hours

of sleep on pole vault landing pads at one point.

The long walk bested the team's previous record set in July 2010, in which Ranger covered 14.3 miles. Prior to that, Boston Dynamic's Big Dog, a four-legged robot, had gone 12.8 miles without refueling.

Advanced stamina

The advance in Ranger's stamina comes from an improved controls algorithm, electronics and energy efficiency, the team said.

The 22-pound robot, outfitted with a red Cornell baseball cap for its walk, has six onboard computers and dozens of electrical and mechanical sensors. Motors extend the outer and inner ankles, and a third swings the legs. A fourth motor twists the inner legs for steering.

"A difference between (Ranger) and most robots is that it has rounded feed and not flat feet," Ruina said. "So most robots, almost all Japanese robots, they can stand upright ... This one can't do that. If you tried to stand it up, it would just tip over."

Ranger achieves balance by falling and catching itself with each step. In fact, the team had a side bet going about how Ranger would end up when its charge finally expired. Three members thought it would fall on its face, three thought it would fall on its back. "I bet standing up and I won," Ruina said.

All told, the robot requires 16 watts to run. When calculated on a scale called of transport (COT) that takes into account weight and speed, Ranger uses 0.28 joules per netwon-meter. For comparison, most robots have a COT of 1.5 or more. Humans walk with a COT of about 0.2. A Toyota Prius is about 0.08.

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Efficient walking

Ranger's energy efficiency stems from its original design. Ruina started building machines that could walk down gentle slopes without a motor at all then adding the power needed to allow it to walk along a flat surface. "In the end, it got much more sophisticated than that, but that was the starting philosophy."

Going forward, the team hopes to build a more human-like bipedal robot that has to contend with side-to-side balance and fore-and-aft balance. Such a robot, Ruina said, would help him achieve his overall goal of explaining how humans walk with the laws of physics.

"It should be that you can explain how people walk somehow in terms of Newton's laws. And what we see is that people somehow walk using very little energy so there should be some way of using Newton's laws to understand people as if they are a machine that uses very little energy," he said.

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John Roach is a contributing writer for msnbc.com. Connect with the Cosmic Log community by hitting the "like" button on the Cosmic Log Facebook pageor following msnbc.com's science editor, Alan Boyle, on Twitter (@boyle).

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TonyInDallas

How long before we can have walking technology on the Moon or Mars?

#1 - Thu May 12, 2011 5:18 PM EDT

REPLY

Pirate C

we already have robots "walking" on mars. But Bi-pedal locomotion isnt very practicle when confronted with low gravity like on the moon. It would really depend on balance. Its easier right now to just have rovers with wheels.

Ill probably see it im my lifetime though.

#2 - Thu May 12, 2011 5:59 PM EDT

REPLY

> ***TonyInDallas***
>
> Yes, I agree wheels are more efficient, but there are some terrains that walking would be able to cover that wheels cannot. Perhaps if Spirit could drop legs it could have walked itself out fo the sand trap.
>
> *#2.1 - Thu May 12, 2011 7:28 PM EDT*

REPLY

meatbot

I thought we (humans) were doomed. But seeing the video, no worries.
"Four-legged biped" is a contradiction in terms, and cannot not describe this robot or any robot. The only thing unclear is whether to

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call it quadrupedal or tripodal. The four legs are in a row, but the middle two move together. It walks more like a person on crutches would. At least it stopped gracefully when the battery ran out, like the pumps at Fukushima Daiichi.

#3 - Fri May 13, 2011 3:15 AM EDT REPLY

XDisk-3474938

Aside from the power consumption, what's the big deal. It's not a quadruped, it only has three legs. Plus if you pay attention, there's a guy following it controlling it with a remote control.

What's the big deal? a really efficient remote controlled toy robot?

X.

#4 - Sun May 15, 2011 9:55 AM EDT REPLY

TonyInDallas

I think it's called a "prototype".

#4.1 - Tue May 24, 2011 3:51 PM EDT

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