

# Robot's space debut 'giant leap for tinmankind'

November 1 2010, By MARCIA DUNN , AP Aerospace Writer

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This July 28, 2009 picture provided by NASA shows two Robonaut 2 robots in Houston. Robonaut 2 is hitching a one-way ride to the International Space Station on the final flight of the space shuttle Discovery scheduled for Wednesday, Nov. 3, 2010. NASA hopes one day they will assist flesh-and-bone astronauts in orbit. (AP Photo/NASA, Robert Markowitz)

Space is about to get its first humanoid from planet Earth. Robonaut 2 - affectionately known as R2 - is hitching a one-way ride to the International Space Station this week aboard the final flight of space shuttle Discovery.

It's the first [humanoid robot](#) ever bound for space, a \$2.5 million mechanical and electrical marvel that NASA hopes one day will assist flesh-and-bone astronauts in orbit.

Imagine, its creators say, a future where [Robonaut](#) could take over space station cleaning duties; spend hours outside in the extreme heat and cold, patiently holding tools for spacewalking astronauts; and handle emergencies like toxic leaks or fires.

Why, Robonaut's descendants could even scout out asteroids, Mars and other worlds in the decades ahead, paving the way for humans.

The adventure begins Wednesday afternoon, with the planned final launch of Discovery and Robonaut's six human crewmates. Mission managers gave the green light Monday for the new launch date; shuttle gas leaks had to be repaired before the countdown could begin and forced a two-day delay.

"While it might be just a single step for this robot, it's really a giant leap forward for tinmankind," said Rob Ambrose, acting chief of Johnson Space Center's automation, robotics and simulation division in Houston.

For now, R2 - a collaboration between NASA and General Motors - exists only from the waist up. It measures 3 feet 4 inches tall and weighs 330 pounds. Each arm is 2 feet 8 inches long.

Legs are still in the works. But, oh, what an upper body: perfectly toned arms and hands with palms, a robotic rarity, along with broad shoulders and a washboard stomach. Arnold Schwarzenegger, Hollywood's cyborg Terminator, would be proud.

Watch Robonaut lifting a 20-pound dumbbell, and "you can kind of feel the burn," Ambrose said, showing a video at a recent news conference.

Unlike people who tend to cheat, "this robot will really do what the physical trainers tell you to do, which is to do the bicep curls nice and slow," he said.

Made of aluminum and nickel-plated carbon fiber, the torso and arms are padded to protect Robonaut and the astronauts, all the way down to the five fingers on each hand. No metal, bony-looking fingers for this robot.

R2's eyes are where they should be: in its gold-colored head. Four visible light cameras are located behind the robot's visor, and an infrared camera is in its mouth for depth perception.

But its brain is in its tummy; engineers had nowhere else to put the computerized gray matter.

A backpack holds a power system for plugging R2 into the space station. On an asteroid or Mars, the backpack would contain batteries.

The joints are filled with springs for give, and more than 350 electrical sensors are scattered throughout, allowing R2 to sense even a feather with its fingertips.

NASA began working on its first dexterous robot - the landlubbing Robonaut 1 - in 1997. Lacking money, the project ceased in 2006. General Motors stepped in with the intention of improving car manufacturing and better protecting workers. Early this year, the much speedier R2 was unveiled.

NASA made room for the robot on one of its last few shuttle flights. It is Discovery's 39th mission and the next-to-last shuttle flight for NASA, although an additional trip may be added next year.

R2 is boxed up and stowed away for launch. Its identical twin - identical on the outside, anyway - is at Kennedy Space Center, posing for pictures and awaiting liftoff.

"I'm not even a little nervous; NERVES OF ALUMINUM!!!" R2 said last week in a Twitter update under AstroRobonaut. (OK, so a NASA public relations woman and Robonaut team member are serving as ghost tweeters.)

The robot will remain tucked away at the space station until late December - a nice Christmas present for the station's six inhabitants, Ambrose figures.

While the space station already has Canadian and Japanese robotic arms - resembling cranes - human operators are needed. Once given orders, R2 can carry out preprogrammed tasks by itself.

First will come a series of tests to see how Robonaut operates in weightlessness atop a fixed pedestal.

Legs will be needed before Robonaut can tackle indoor chores like wiping handrails or vacuuming air filters. NASA hopes to send up legs in late 2011, followed a year later by torso and computer enhancements enabling the robot to venture out on spacewalks.

The objective is to help astronauts, not replace them, NASA stresses. Humans have been living continuously on the space station for 10 years - the actual record-setting anniversary is Tuesday - and the wish is for 10 more.

The beauty of Robonaut, officials say, is it's strong yet safe and trustworthy enough to work right next to humans. Think good Autobots rather than evil Decepticons from "Transformers." It's also serenely mute, more WALL-E than R2-D2 of "Star Wars" fame.

Discovery's astronaut-physician, Michael Barratt, would have loved to pawn off toilet cleaning while living at the space station last year. As

appealing as Robonaut is, he cautions "it will be a long time" before the robot can do a job as quickly and efficiently as a space station human.

Robonaut's strength, Barratt said, will be emergencies.

"Going into a toxic atmosphere to throw a switch or close a valve," he explained.

And, in a final salute, going down with the ship.

R2 will be on board when the space station stops operating sometime after 2020 and NASA sends it hurtling toward a grave in the Pacific.

**More information:** NASA: <http://robonaut.jsc.nasa.gov/default.asp>  
Twitter: <http://twitter.com/AstroRobonaut>  
GM: <http://www.gm.com/vehicles/innovation>

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Citation: Robot's space debut 'giant leap for tinmankind' (2010, November 1) retrieved 18 April 2024 from <https://phys.org/news/2010-11-robot-space-debut-giant-tinmankind.html>

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