Space robots: Coming soon to a planet near you

February 1 2013, by Gordon Roesler

NASA's RASSOR will be able to climb hills and, more importantly, extract water, ice and fuel from lunar soil. Credit: NASA

Earlier this week, NASA announced the development of a mining robot called RASSOR: the Regolith Advanced Surface Systems Operations Robot. RASSOR has been designed to assist in extracting water, ice and fuel from soil on the moon – all essential resources for future human habitation.

And the reality is, if we want to achieve our dreams of exploring the solar system, robots will be the means.

With the exception of a few select missions, human space flight is in a prolonged hiatus. It has languished in low-Earth orbit over the past four decades and is likely to continue languishing for many more.

The International Space Station, or ISS (take a guided tour) continues in its orbit 400 kilometres up. And China will soon visit the moon. But for more distant destinations, we've realised that radiation and bone loss would harm space travellers for life.

There are as yet no cures to the adverse physical effects of space travel, so humans remain bound to Earth, and possibly the moon, for now. Instead, we will use robots for the heavy lifting.

As our space minions, robots are expanding humanity's understanding of the solar system without endangering life and limb.

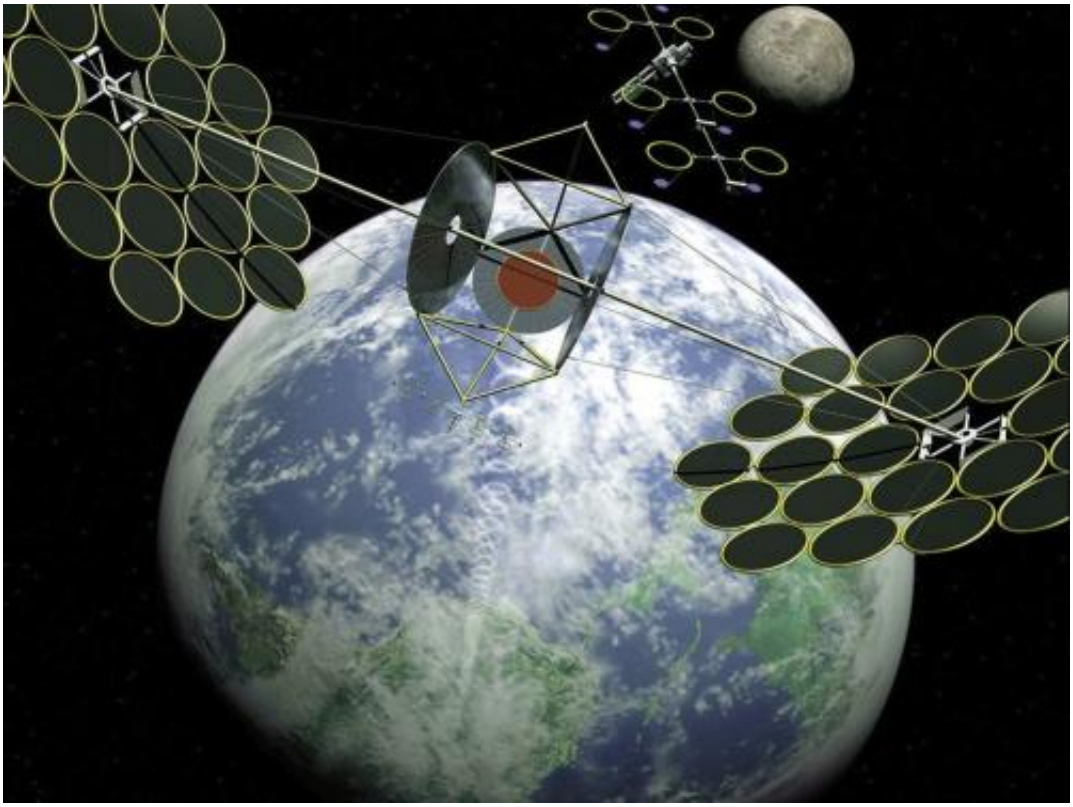
A robot just showed there is water ice on Mercury. Robots have taught us that Saturn's moons are a wild collection of oddities. And if you haven't heard about Curiosity – officially the Mars Science Laboratory – and its exploits, you must live on another planet.

Satellite maintenance

Exploration is not the only application for space robots. Closer to home, there's a strong economic case for using robots to refuel satellites, such as those that will support the National Broadband Network. Satellites use fuel because the moon pulls them out of position, so refuelling makes these very expensive spacecraft last longer.

Some possible refuelling techniques are being tested at the ISS as you read this. Two companies – the experienced Canadian space firm MacDonald, Dettwiler and Associates, and the new startup Vivisat – are already trying to establish markets and methods to extend satellite

lifetime.



Space-based solar power has been on the cards for many years. Credit: NASA

It may also be valuable to be able to inspect a satellite to make sure it is in good condition. Here's a video made by one satellite flying around another with no humans at the controls.

These are pretty fantastic accomplishments. And they represent technology that will support some even more audacious space businesses.

Off-Earth mining

There has been much in the media lately about a company called

Planetary Resources and their plan to mine asteroids—and now there's a second company, Deep Space Industries, getting into the game.

Just as automation and robotics have transformed the mining industry on Earth, so they will inevitably play a central role in any future off-Earth mining expeditions, where hostile environments will prohibit the use of human labour.

In support of this idea, the Australian Centre for Space Engineering Research at UNSW is hosting a forum in February. It will bring innovators together with mining experts and university roboticists, to help robot mining take shape, and ultimately succeed.

Space structures

Further out is the idea of using robots to build huge structures in space. These structures could be large telescopes, antennas, fuel depots for longer space trips, and just about anything that is just too large to pack into the nose of a single rocket and go.

Some materials – such as ceramics, iron or hydrogen – might even come from the moon. Some of my colleagues at UNSW are working on methods to mine and process the lunar dust and to use the extracted minerals to create building materials. And, as mentioned above, there's NASA's newly announced RASSOR, which will be ready for testing in 2014.

The process, called "in-situ resource utilisation", is an important one, and it relies on the fact that transporting materials to the moon from Earth is prohibitively expensive. If you are going to build on the moon, you need to get your materials there.

How important is building large space structures? Well, would you be

interested in a new supply for humanity's growing demand for energy, without greenhouse gas emissions and without nuclear waste? Space solar power is a completely clean and feasible approach, but the structures are huge. We need robots to build them.

Exciting territory

Space robotics is in its infancy, and Australia can get into the game. Australian universities have tremendous accomplishments in robotics, such as automated farming systems and helping to mine the Pilbara. By establishing collaborations with space agencies and laboratories around the world, Australian roboticists will be able to make meaningful contributions to space businesses as well as to those on Earth.

There is another reason to enter this field: Australian students want to "do space". We know this anecdotally, and we see an intense demand for space engineering degrees.

An Australian space robotics capability will motivate our best and brightest, and give them relevant opportunities here once they have their degrees. They will join one of the most exciting areas of technology, and add that innovation and expertise to the Australian economy.

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