

## Ex-pat Takes Robots to the Moon

Dr Andrew Howard's fridge announces that he loves robots, which is just as well since he's helped create some of the most exciting robots on Earth – or off it for that matter.

Howard is a senior member of the technical staff at NASA's Jet Propulsion Laboratory (JPL) and Adjunct Professor at the University of Southern California (USC).

Although he joined JPL after the construction of the current generation of Mars rovers had finished, Howard has contributed to rovers planned for NASA's return to the Moon. He has also had a hand in numerous autonomous ground vehicles for Earth-based uses, and created open source software for robot designers.

Howard says it is much more difficult to design autonomous rovers for Earth. "Plants and vegetation are much more difficult to cope with than terrain," he says. "On Mars we worry if a hill is small enough to drive over or the soil is soft enough to bog the rover, or if a slope is too steep. All of these are relatively easy to assess with vision. On Earth we have the same problems, but things can be hidden as well."

One program saw a multi-tonne reconnaissance vehicle known as Crusher stop in front of a field of daisies because it was afraid that some danger may be hidden beneath. Earth-based rovers also have to deal with animals, nosy humans and water. One of Howard's biggest challenges is to ensure that none of his vehicles pose a hazard to pedestrians or cars.

"The challenge on Mars is extreme effi-

ciency," he says. "It's very expensive per kilogram landed on Mars. The hardware is also always years out of date because it takes so long to harden it against radiation."

Moon rovers have to overcome a less obvious problem. "It's very hard to dissipate heat without an atmosphere," Howard says. Consequently the projects he is working on must manage with very limited processing power.

"I can't remember ever not being a science and engineering geek," Howard says. His first robot was built from Lego at the age of 11 or younger. He began programming when he made his parents buy a computer at a similar age.

His wife, Deborah Dowling, recalls when they were undergraduates and she was miserable with 'flu. Howard offered to make her something to cheer her up and she suggested a duck, expecting a few yellow Lego bricks in a vaguely avian shape. "He came back with something that walked and quacked and flapped its wings," she says. "I was very impressed."

Despite this background Howard planned to be a theoretical physicist rather than an engineer. "I found physics more difficult and therefore more challenging." He was particularly keen on high-energy physics, but physics in Australia was in a particularly depressed state when he was finishing his undergraduate degree at the University of Melbourne, and Howard saw very good people unable to gain positions.

"So I returned to my first love," Howard says. He completed a PhD in robotic vision

at Melbourne, working on indoor robots and leading Melbourne's first Robocup team. This led Howard to USC, where he worked on multi-robot projects. "In one we had to deploy lots of robots to search for intruders in an empty building," he says.

In 2005 Howard joined JPL, where he was part of the Caltech team for the Urban Grand Challenge to create a vehicle that can drive in a typical urban environment. He also provided the vision for Big Dog, a four-legged robot intended for rough terrain, which achieved fame with the web release of a video of it recovering its footing after being kicked and slipping on icy roads.

Howard says that "it was easy going from physics to vision research. Physics remains an excellent grounding in the maths and practical aspects of robotic design. I quite often see people who are interested in robotics with strong computer programming backgrounds. However, I look for people with a maths background because I can teach them to program, but I can't teach programmers maths."

Although Howard is near the centre of some of the most advanced robotics work in the world he says there are plenty of opportunities for robotics engineers in Australia. "Australia is actually quite strong in robotics," he says. "Returning home is always an option."

Yet a position with NASA is hard to pass up. His wife says: "The 8-year-old Andrew wouldn't forgive the 38-year-old Andrew" if he missed the chance to work on a Moon rover or the next generation of missions to Mars, which are expected to collect samples to be returned to Earth.



# ISSUES

VOLUME 85  
DEC 2008

# Biofuels

Biofuels are one option in the race for fossil fuel replacements. Find out more about "peak oil", the food-versus-fuel debate and the difference between first- and second-generation biofuels. Read about Australian research such as the use of novel biofuel feedstocks like algae and some grass species, and the role of catalysts in producing efficient biofuels and making molecular fuels. See page 6 for subscription details or order your copy of this edition at [issues.com.au](http://issues.com.au)