

Roland Piquepaille's Technology Trends

How new technologies are modifying our way of life



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Robotic Nanotech Swarms on Mars... in 2034

NASA is testing a shape-shifting robot called "TETwalker" for tetrahedral walker, because it looks like a flexible pyramid. It has been tested in the lab and at the McMurdo station in Antarctica to test it under conditions more like those on Mars. Now, it is on the way to be -- really -- miniaturized by using micro- and nano-electro-mechanical systems. These robots will eventually join together to form "[autonomous nanotechnology swarms](#)" (ANTS). When it's done, in about thirty years, these nanotech swarms will "alter their shape to flow over rocky terrain or to create useful structures like communications antennae and solar sails." So in 2034, nanotechnology will land on Mars. Read more...

But in 2005, this is only the beginning of tests for this shape-shifting robot pyramid at NASA's Goddard Space Flight Center.

Like new and protective parents, engineers watched as the TETWalker robot successfully traveled across the floor at NASA's Goddard Space Flight Center in Greenbelt, Maryland. Robots of this type will eventually be miniaturized and joined together to form "autonomous nanotechnology swarms" (ANTS) that alter their shape to flow over rocky terrain or to create useful structures like communications antennae and solar sails.

Here are more details about the TETwalker.

The robot is called "TETwalker" for tetrahedral walker, because it resembles a tetrahedron (a pyramid with 3 sides and a base). In the prototype, electric motors are located at the corners of the pyramid called nodes.

The nodes are connected to struts which form the sides of the pyramid. The struts telescope like the legs of a camera tripod, and the motors expand and retract the struts. This allows the pyramid to move: changing the length of its sides alters the pyramid's center of gravity, causing it to topple over. The nodes also pivot, giving the robot great flexibility.

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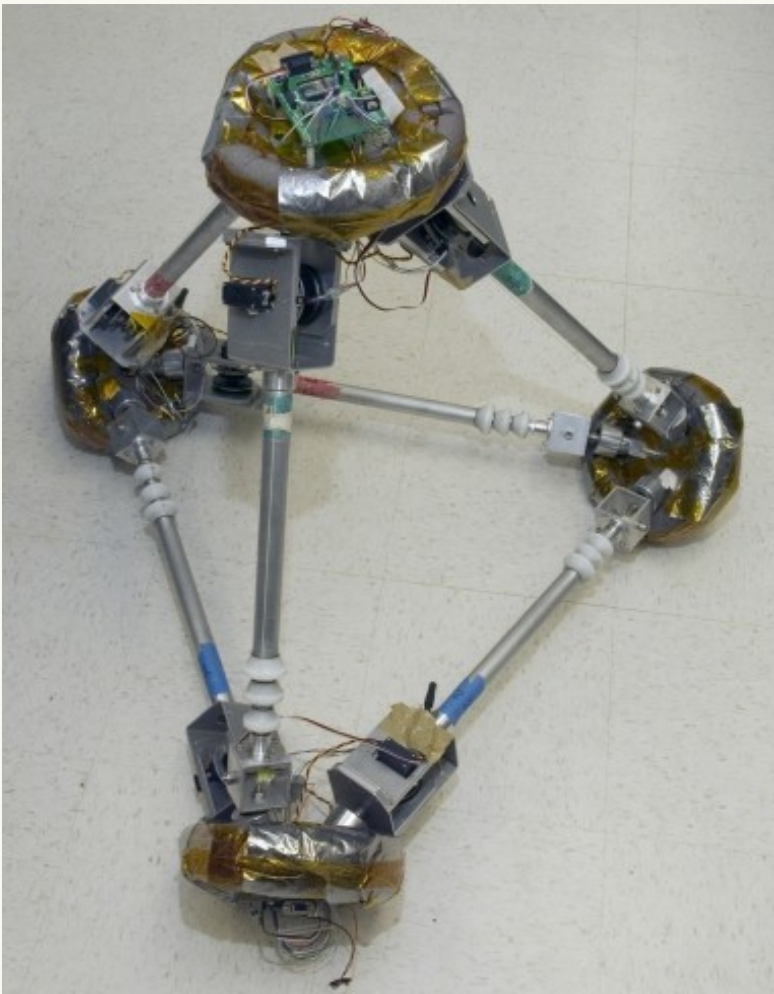
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Here is a TETwalker prototype walking on the floor of a NASA Goddard Space Flight Center lab (Credit: NASA). And here is [a link](#) to a larger version (1.3 MB). You'll find **other images** in this longer version of NASA's news release.

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Here is a TETwalker prototype being tested at the McMurdo station in Antarctica (Credit: NASA and the National Science Foundation). And here is [a link](#) to a larger version (245 KB).

But where is nanotechnology involved in this project?

The team anticipates TETwalkers can be made much smaller by replacing their motors with Micro- and Nano-Electro-Mechanical Systems. Replacement of the struts with metal tape or carbon nanotubes will not only reduce the size of the robots, it will also greatly increase the number that can be packed into a rocket because tape and nanotube struts are fully retractable, allowing

the pyramid to shrink to the point where all its nodes touch.

These miniature TETwalkers, when joined together in "swarms," will have great advantages over current systems. The swarm has abundant flexibility so it can change its shape to accomplish highly diverse goals. For example, while traveling through a planet's atmosphere, the swarm might flatten itself to form an aerodynamic shield.

Upon landing, it can shift its shape to form a snake-like swarm and slither away over difficult terrain. If it finds something interesting, it can grow an antenna and transmit data to Earth. Highly-collapsible material can also be strung between nodes for temperature control or to create a deployable solar sail.

Of course, there are many technological challenges to solve for this project to be successful. For more information about the project, please visit the [Autonomous NanoTechnology Swarm](#) website. Practically all pages have a graphical version (which look as poorly scanned images) and a cleaner text one.

In particular, take a look at [the technologies needed](#). Those of you interested by robotics will jump to the [Tetrahedral Walker](#) page while other will be more interested by [Carbon Nanotube Technology](#).

Finally, you can look at the [Timeline for Technological Development...](#) and dream about 2034.

Sources: NASA Goddard Space Flight Center news release, March 29, 2005; and various websites

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