



They're buying an elevator to heaven; SPACE ELEVATOR NASA hopes to get its space elevator off the ground by offering a cash incentive. Working on a shoestring in Scarborough, a local team has its eyes on the prize. By Scott Simmie SPACE ELEVATOR

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Jack Jr." still has some growing up to do.

For the moment, he's just a skeleton of half-inch copper tubing, soldered into an unusual looking frame. Across the room, electronic entrails are starting to take shape.

But a team of bright aerospace and engineering types has big plans for little Jack. They'll be tinkering and upgrading and head scratching until it evolves into "Jack Sr." - - a device capable of climbing up a taut ribbon of material. It's a high-tech, space-age variation on a children's tale.

"Jack is the climbing part. And, of course, Jack climbs the beamstock," laughs Daniel Fudge, a 28-year-old engineer whose real job is with MDA Space Missions, the folks who ensure that the Canadarm does its thing on the space shuttle. And yes, he means "beam" stock.

He's talking about the building blocks of a space elevator, a remotely powered device that could climb an ultra-thin but ultra-strong ribbon of material that extends far out in space. Such an elevator could shuttle people, and even cargo, to orbit and back (and potentially beyond) at a fraction of the cost of conventional launches.

Providing, of course, one ever gets built. Though a wild concept, there's a fair bit of science suggesting it's at least theoretically possible - but not until tremendous engineering challenges are overcome.

To that end, NASA is looking outside the box to see what smart thinkers and even garage-tinkerers can come up with. It's offering major cash prizes, in competitions called Centennial Challenges, for the teams that can advance either of the two core technologies required for such an elevator.

The Tether Challenge hopes to advance the ribbon end of things by getting teams to produce super-strong tethers.

The second core technology is something that can climb. That's why for months now, Fudge and a small team calling itself Punkworks Design have been spending their Saturdays in a rented industrial space in Scarborough, just across the street from a wood lot and just down the road from Mac's Lobsters. They come here on their own time, buy supplies with their own money, and are working toward a common goal competing in NASA's "Beam Power Challenge" this fall.

Basically, they have to make Jack climb 50 metres up a taut ribbon while carrying a payload. Jack has to climb at least one metre per second. If Jack does that and does it well, Punkworks might just take home the top prize of \$150,000 (U.S.).

That might not be so hard if you could put batteries or some other power source on board Jack. But here's the catch. The power has to be beamed from a transmitter on the ground to a receiver on the climber. And, of course, the farther Jack and its competitors climb, the farther they are from that power beam.

According to NASA's website, this challenge "is designed to promote the development of new power distribution technologies. These technologies can be applied to many aspects of space exploration... (and) may also support the development of far-term space infrastructure concepts such as space elevators and solar power satellites."

Some teams plan to use solar power, firing a powerful spotlight at an array of solar panels on their climber. In 2005, the competition's first year, all entrants had to use solar, relying on a supplied 10,000-watt light source. No one went high or fast enough to win, but the **University of British Columbia** "Snowstar" team did well enough to be recognized as favourite for the 2006 competition.

This time around, the rules have been modified to allow for other power sources, including high-power lasers. But unlike last year, when the spotlight was supplied, teams must now supply both the climber and their own beaming power supply.

Though it won't reveal many details, the Punkworks team plans to use a souped-up version of an energy source found in most homes: microwaves. That explains why the carcasses of several microwave ovens are scattered around the Punkworks space - including one with a hole cut in its door.

They're smart guys who know what they're doing, they're also facing the challenge of doing rocket science on a budget considerably lower than NASA's.

"We don't have the money to pay for a \$300 titanium screw that goes on the shuttle," says Allen Atamer, one of the driving forces behind Punkworks Design. "We have Canadian Tire."

By the time contest day rolls around, the team says it will beam about 12 kilowatts of focused microwave energy at Jack. It's enough power that the team will have permits and special safety procedures in place to ensure that bystanders aren't inadvertently nuked.

It's also way more than you'd need to warm a cup of coffee.

"That's roughly 10 times the power of a commercial microwave," says Atamer, grinning. "If it was focused, you'd probably vaporize the coffee."

Jack's payload will have a special receiver called a rectenna that will grab that microwave energy and transform it into something a little more useful. Erwin Lin, currently doing his Ph.D. in chemistry at York University, shows off a small rectenna that's sitting in front of the hole in that oven door. They've been testing, very cautiously, its ability to grab what spits through that hole.

"This would receive the microwaves and convert it to DC power," he says. In turn, that power will get electric motors rolling and - bingo - Jack should climb the beamstock.

For NASA, the Centennial Challenges program is a way of reaching a brainy world far beyond its walls, where virtually

anyone with an idea and some skills can strut their scientific stuff. And, unlike offering grants or funding proposals, the use of a prize as an incentive doesn't cost NASA a dime until someone produces results.

The agency had been kicking around the prizes idea for years but finally made a commitment in 2004 in a blueprint for where the agency is heading, and how it's going to get there.

"In addition to tapping creative thinking within the NASA organization, NASA will need to leverage the ideas and expertise resident in the Nation's universities and industry..." said the Vision for Space Exploration document. "As in the barnstorming days of early aviation, NASA plans to establish prizes for specific accomplishments that advance solar system exploration and other NASA goals."

And so you have a team of smart guys (and one girl) - one of 20 teams around the world - trying to solve a very tricky engineering problem.

"It mirrors what happened in the aviation industry in the early 20th century," says Atamer. "It's a bit like Charles Lindbergh and the Orteig Prize (which spurred his non-stop flight from New York to Paris). "But this has very specific engineering challenges that push the limits."

"We have a lot of people all around the world, every corner, who are interested in space," says Fudge of Punkworks. "So why not spread it out there, tap into all the resources, and get people from all over the globe looking at the same problem from a million different angles? Hopefully, someone will come up with that one little idea where if you were a single organization, you might miss it."

The team at Punkworks Design - whose name, incidentally, is a comedic play on the secretive Lockheed "Skunkworks" team that developed several cutting-edge aircraft for the U.S. military - hopes Jack will climb (and climb fast) at the competition this fall. In the event Jack wins one of the three cash prizes in October, team members will split the proceeds according to how much time and/or money each has already invested.

But you get the sense, as they solder copper and drill aluminium and scribble formulas, that they're doing this for more than the prospect of the cash.

"I'm eager to get a hands-on application of all the theory I've learned in school," says Sara Clark, a 20-year-old team member who's just finishing her third year in aerospace engineering at the U of T.

It's a common sentiment in this high-tech, low-budget variation of TV's Monster Garage.

"Believe me, money's not the number one motivating factor," says Atamer. "It's the development of space technologies."

The competition is on Oct. 20 in New Mexico. Go, Jack, go.

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