



The third prototype of Red Rover, the Moon explorer built by X Prize team Astrobotic.

SPACE

Moon shots stuck on Earth

Some Google Lunar X Prize contenders book launches for 2015 — but many say that is a stretch.

BY NICOLA JONES

The Google Lunar X Prize is dangling new carrots in front of the 18 private teams that are trying to put a lander on the Moon by the end of 2015. On 19 February, the prize organization announced that five teams — two US groups, one Indian, one German and one Japanese — will compete for US\$6 million in ‘milestone prizes’. To win the cash, prototype landers will have to demonstrate by September 2014 that they can soft-land on the Moon, move more than 500 metres once there and beam back video from the surface.

The tests will be taking place on Earth. And that is where many think that the landers will remain two years from now. Although the milestone prizes offer further financial encouragement — and catnip for the media — the goal of reaching the Moon still seems very far away. Some team members and outside observers have doubts that the \$20-million main prize, which aims to stimulate the private market for getting to the Moon, will be won at all.

Jonathan McDowell, a space historian and astronomer at the Harvard-Smithsonian Center

for Astrophysics in Cambridge, Massachusetts, says that the technological hurdles are too high and the financial incentives too low. “The Google Lunar X Prize is one of the least promising things I’ve seen come out of the private space industry,” he says. “In two years, I just don’t see it from any of these teams.”

The X Prize Foundation, based in Culver City, California, will probably have to extend the 2015 deadline, says Wolfgang Demisch, a retired aerospace consultant in New York who has served on the US National Science Foundation’s Next Generation Launch Technology panel. But Alex Hall, senior director for the Lunar X Prize, says that the organization is not contemplating any such extension.

The rules and deadlines have already been adjusted since the prize was first announced in 2007. The original deadline of 2012 was extended to 2015 in November 2009. And in September 2013 — when it was clear that China was going to put its rover, Jade Rabbit (or Yutu), on the Moon — organizers withdrew a provision that would have reduced the prize money if a government-sponsored mission beat the X Prize teams to the punch (see go.nature.com/ftdob8).

Part of the problem has been convincing investors to put up cash. When the \$10-million Ansari X Prize for achieving repeatable space-flight with a manned craft was won in 2004 by Scaled Composites of Mojave, California, it was easy to see a financial motivation beyond the prize itself. The sponsors of the winning team founded Virgin Galactic, based in Las Cruces, New Mexico, which has been taking deposits for space-tourist tickets costing \$250,000 since 2005.

To clarify the business outlook, this time, the X Prize Foundation commissioned a study by UK consultancy London Economics. The study concluded that by 2025 there would be a \$1.9-billion lunar market for everything from hauling payloads to hardware development. Payload delivery is a big part of the plan for Astrobotic, a spin-out company from Carnegie Mellon University in Pittsburgh, Pennsylvania, and one of the teams competing for the milestone prizes. “Think of us as a FedEx to the Moon,” says the company’s chief executive, John Thornton. It already has a handful of payload contracts — for example, to deliver human ashes to the Moon for Celestis, a company that does ‘memorial spaceflights’. Astrobotic plans to charge \$1.2 million per kilogram for a soft-landing delivery, and less for a non-controlled drop.

But most teams are hoping for bigger customers — in particular, NASA. And the agency is indicating its interest: in 2010, it handed out six contracts (including four to X Prize teams) worth up to \$30 million over five years to collect data on everything from lander test-flight results to the properties of lunar soil. Then, last month, NASA announced a programme that will offer free technical expertise, equipment and facilities to companies developing lunar landers. The only academic X Prize team, Lunar Lion of Pennsylvania State University in University Park, says that it is using the competition to gain an introduction to the world of NASA mission contracts. But McDowell points out that money from NASA “is very dependent on whims of Congress”.

The X Prize competitors expect to be able to complete their first Moon mission for tens of millions of dollars. That would be cheap compared to past NASA missions, such as the Mars Pathfinder mission that put a small rover on the red planet in 1997 for \$265 million. But even with the lower price tags, none of the 18 teams has reported raising sufficient funds. Only four teams — Astrobotic, Lunar Lion, Moon Express and Barcelona Moon — have booked launches for 2015 (see go.nature.com/ftdob8). And only Astrobotic has reported testing a full prototype lander. A few of these teams confessed to *Nature* that the 2015 prize deadline will be tight. “It’s not impossible,” says Lunar Lion team leader Michael Paul. “Feasible is a different word.”

Most intend to continue with their business plans, with or without the X Prize. “We’ll still be going after the Moon,” says Thornton. “No matter what.” ■

Back to the Moon, Commercially

The recent *News* article (“Moon shots stuck on Earth”, *Nature*, vol. 506, p. 278, doi:10.1038/506278a, 20 February 2014) on the Google Lunar X Prize teams offers an overly pessimistic view of private companies reaching the lunar surface and capturing the \$20M first prize. While the article claims that “none of the 18 teams has reported raising sufficient funds,” *Moon Express Inc.* has succeeded in all of its financing rounds, built a payroll of 40 people, secured a launch contract, and developed a sustainable business plan.

The business plan for *Moon Express* is multi-faceted with income from both government and private sources. Its goals include exploitation of lunar resources using autonomous and/or remotely operated robotic spacecraft. The economics of such activity are viable with known resources on the Moon. Furthermore, commercial landers can reach new locations including the lunar poles where water ice has been detected. Understanding the nature and accessibility of such ice is of vital interest to future explorers and scientists as water is the most useful resource on the Moon and for developing cis-lunar space. Water can sustain astronauts, be converted into rocket fuel, and provide protection from space radiation.

Moon Express began flight-testing prototype landers in 2010 and last year successfully completed a series of tests of its control software with the Mighty Eagle lander at NASA Marshall Space Flight Center. *Moon Express* plans its first technology demonstration flight next year followed by continuing commercial missions that will feature science with instruments funded by international commercial and public sectors. One such mission will probe lunar fire-fountain deposits that are of interest to both scientists and miners. Subsequent missions will deliver surface astronomical and geological instruments, rovers, and sample return vehicles.

Reaching the Moon, commercially, is much closer than implied. The technical hurdles have been mostly solved, and significant numbers of private investors/entrepreneurs have emerged to begin the next step in exploration of the Solar System.

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