For our future in space, China must aim further than the Moon

December 19 2013, by Martin Rees

Is China our only hope? Credit: Alexander F. Yuan/AP

A famous picture in the English edition of Newton's "Principia" shows cannon balls being fired from the top of a mountain. If they go fast enough, their trajectory curves downward no more steeply than the Earth curves away underneath it – they go into orbit. This picture is still the neatest way to explain orbital flight. Newton calculated that, for a cannon-ball to achieve an orbital trajectory, its speed must be 18000

miles per hour – far beyond what was then achievable.

Indeed, this speed wasn't achieved until 1957, when the Soviet Sputnik was launched. Four years later Yuri Gagarin was the first human to go into orbit. Eight years after that, Neil Armstrong made his "one small step". The Apollo programme was a heroic episode. And it was a long time ago – ancient history to today's young people.

Had the momentum of the 1960s been maintained over the next 40 years, there would be footprints on Mars by now. But after Apollo, the political impetus for manned spaceflight was lost.

The most crucial impediment to space flight stems from the intrinsic inefficiency of chemical fuel, and the consequent requirement to carry a weight of fuel far exceeding that of the payload. This is a generic constraint, based on fundamental chemistry. If a planet's gravity is strong enough to retain an atmosphere, at a temperature where water doesn't freeze, and metabolic reactions aren't too slow, the energy required to lift a molecule from it will require more than one molecule of chemical fuel.

Launchers will get cheaper when they can be designed to be more fully reusable. It will then be feasible to assemble, in orbit, even larger artifacts than the International Space Station. But so long as we are dependent on chemical fuels, interplanetary travel will remain a challenge.

To infinity and beyond? Probably not NASA. Credit: NASA

Nuclear power could be therefore be transformative. By allowing much higher in-course speeds, it would drastically cut the transit times to Mars or the asteroids. And it could transform manned spaceflight from high-precision to an almost unskilled operation. Driving a car would be a difficult enterprise if, as at present for space voyages, one had to program the entire journey beforehand, with minimal opportunities for steering on the way. If there were an abundance of fuel for mid-course corrections (and to brake and accelerate at will), then interplanetary navigation would be a doddle – indeed simpler than driving a car or ship, in that the destination is always in clear sight.

In the light of this, I would venture a confident forecast that during this century, all the planets, moons, and asteroids of the solar system will be

explored and mapped. The Hubble Telescope's successors, with huge gossamer-thin mirrors assembled under zero gravity, will further expand our vision of stars, galaxies and the wider cosmos.

But the role that humans will play in this is debatable. There's no denying that NASA's "Curiosity," now trundling across Martian craters, may miss startling discoveries that no human geologist could overlook. But robotic techniques are advancing fast, allowing ever more sophisticated unmanned probes. And the cost gap between manned and unmanned missions remains huge. The practical case for manned spaceflight gets ever weaker with each advance in robots and miniaturisation. Indeed, as a scientist I see little purpose in sending people into space at all.

But as a human being, I'm an enthusiast for manned missions. I hope some people now living will walk on Mars – as an adventure, and as a step towards the stars. They may be Chinese: China has the resources, the dirigiste government, and maybe the willingness to undertake an Apollo-style programme. And China would need to aim at Mars, not just at the Moon, if it wanted to assert its super-power status by a "space spectacular."

However, NASA's manned programme, ever since Apollo, has been impeded by public and political pressure into being too risk-averse. Unless motivated by pure prestige and bankrolled by superpowers, manned missions beyond the Moon will need perforce to be cut-price ventures, accepting high risks – perhaps even one-way tickets. Such missions would need to be privately funded. No Western governmental agency would expose civilians to such hazards.

Nonetheless, a century or two from now, there may be small groups of pioneers living independent from the Earth – on Mars or on asteroids. Whatever ethical constraints we impose here on the ground, we should surely wish these adventurers good luck in genetically modifying their

progeny to adapt to alien environments. This might be the first step towards divergence into a new species: the beginning of the post-human era.

And machines of human intelligence could spread still further. Whether the long-range future lies with organic post-humans or with intelligent machines is a matter for debate. Either way, dramatic cultural and technological evolution will continue not only here on Earth, but far beyond.

Source: The Conversation