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## **IN THIS ISSUE**

### **Health**

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### **Space**

Why NASA is launching the world's first wooden satellite

### **Innovations**

Our guide to 2023's smartest tech

# IS LIVING ON MARS A BILLIONAIRE'S FANTASY?

A base on the Red Planet might be filled with some annoying housemates, but that doesn't mean we can't aspire to setting up a permanent settlement there

by DR KELLY AND ZACH WEINERSMITH

Husband and wife team Kelly and Zach are the authors of *A City on Mars* (£25, Penguin).



On 18 November 2023, SpaceX launched one of the largest rockets ever constructed. Starship marks a step change for humanity's relationship with space – a reusable rocket so powerful that it could carry the mass of today's painstakingly built International Space Station in just two to three launches, and likely quite a bit cheaper. Dreams from the days of the Apollo programme, long squashed by the high cost of space access, are returning – and with them, arguments about the value of space to our species.

As with many experimental rockets, Starship failed to achieve all of its goals. Its first rocket stage exploded, and the second needed to self-destruct. Reactions are illustrative of the divide between space analysts and much of the media (and the public). To many, it was proof of failure. Those in the space-geek community generally viewed it as a success. Starship, a rocket the size of a skyscraper, soared 150km (over 90 miles) at high speed, gathering a trove of valuable data before malfunctioning. Not failure – progress with a bang.

## THEATRE OF HOPE

Space settlement researchers occasionally find themselves arguing about the value of space. For the most gung-ho space advocates, it's a theatre of all hope. It's a way to get rich from asteroid resources, to save the environment by offloading people and industry from an overburdened Earth, and a chance to create a second home for humanity that could survive the death of our planet. Others question

why we spend so much on space when we have so many problems on Earth. Some wonder darkly if space billionaires are cultivating a Martian redoubt as a kind of off-world bunker, in case our planet is ruined by climate change or war.

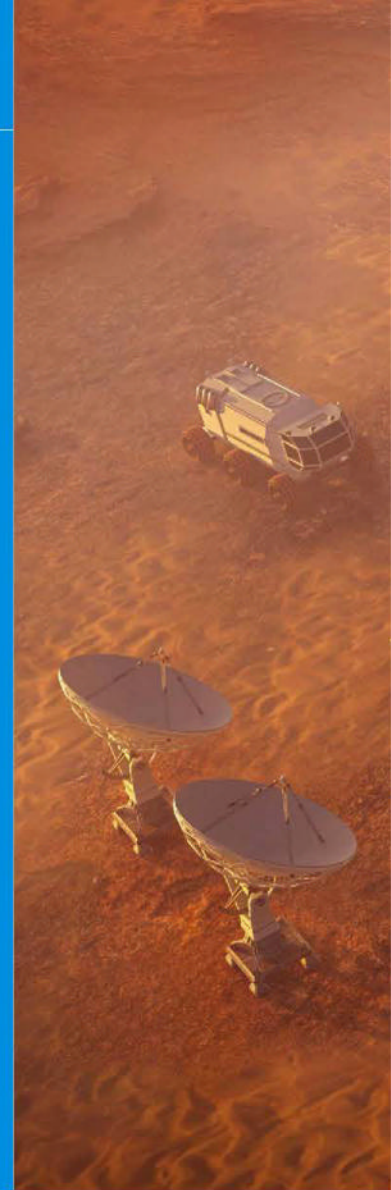
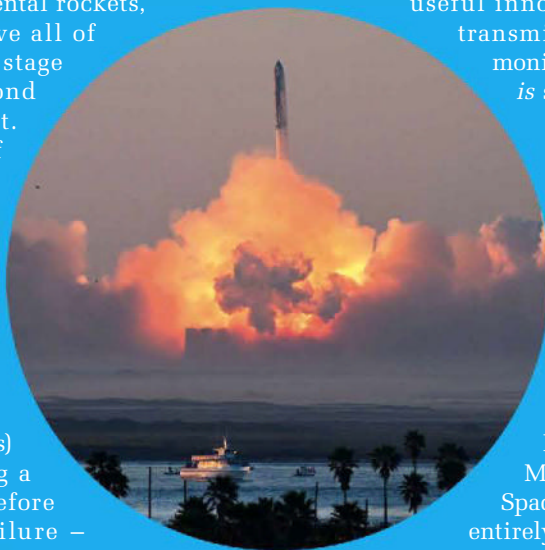
So how well do these arguments hold up?

Should we spend less up there and more down here? True, the space business is booming: estimates suggest it'll be worth over one trillion dollars within the next two decades. But this money isn't being thrown away on space fantasies. Most funds useful innovations: navigation, data transmission and environmental monitoring. So spending up there *is* spending for down here.

Even if every penny spent by governments on space were wasted, that cost would still be dwarfed by spending elsewhere. NASA – the best-funded space agency – receives under half a per cent of the total US budget.

Nor are space billionaires spending huge sums on Martian cities. Though Elon Musk talks of settling Mars, SpaceX's rockets are used almost entirely for satellites local to Earth. What about space resources? Will

mining asteroids lift us all out of poverty, or at least make somebody unfathomably wealthy? We're sceptical. Space resources certainly have value, but accessing a lot of currently valuable stuff is unlikely to eliminate poverty. Consider aluminium: once so precious that it was used to cap the Washington Monument, today we use it to wrap leftover lasagne. Our lives have certainly been enriched by aluminium, but it hasn't made us all richer. As such, we should be wary of any



**ABOVE** Mars is the most likely planet for human settlement, but we're still a long way from solving the problems that would arise

**LEFT** SpaceX's Starship blasts off on its test launch on 18 November 2023. The mission ended in explosions, but wasn't necessarily a failure

ALAMY, GETTY IMAGES



narrative that promises a specific dollar return for, say, mining asteroids or the Moon.

In any case, we can't gather these resources yet – nor likely for a long time. Asteroids aren't closely packed lumps of solid platinum. Many are loosely held-together agglomerations of rock and stone, spread thinly across space. Just reaching an asteroid will take months, and extracting valuable material will be incredibly difficult.

#### WEALTH OF IDEAS

Bear in mind when considering any scheme to gather and exploit extraterrestrial resources that, despite common misconceptions, most wealth doesn't come from stuff. According to the World Bank, non-renewable resources (such as those you would extract from asteroids) make up only about 2.5 per cent of Earth's wealth. The rest comes from ideas and technology – from us.

Many space advocates say that's missing the point: why focus on the value of minerals on Earth? The value proposition is in building infrastructure in space, allowing outbound migrants to enjoy exciting lives while easing the burden on Earth's biosphere.

That may become plausible one day, but the numbers are daunting. In 2022, Earth gained 80

**"REJECTING UNLIKELY SPACE FANTASIES DOESN'T MEAN WE ALSO HAVE TO REJECT SPACE EXPLORATION OR PROGRESS"**

million people. So, just to tread water, we'd need to move 220,000 volunteers per day. For context, today's ISS has a crew of six. Starship, filled to capacity, could take around 100 humans per launch. Perhaps we can scale to these numbers eventually – but not in time to halt climate change.

Consider the most likely destination for those space settlers: Mars. The journey there, which takes about six months, can be launched only every two years. Light takes about three minutes to cover that distance, rendering live chat impossible. The atmosphere on Mars is only about one per cent the thickness of Earth's, and largely carbon dioxide. →

Lunar mining is unlikely to generate vast wealth on Earth, but could yield resources for other space missions



→ With that thin atmosphere, plus the lack of a strong magnetosphere, anyone on the Martian surface will be exposed to high levels of space radiation. Serious plans for habitation involve living beneath Martian dirt, which is nasty stuff: sharp dust and fines that are likely bad for both equipment and lungs, mixed with hormone-disrupting chemicals. And all whipped up by periodic dust storms that can engulf the entire planet.

#### BIOLOGY LESSONS

Many questions about biology linger, too. Can we have babies on Mars, with these problems and only 40 per cent of Earth's gravity? Can those babies grow up to have their own children? The science of animal reproduction in space is rudimentary, so little can be said for sure. Nor do we know how to construct the enormous sealed ecosystems probably required to create and recycle food, water and air.

Getting these sorts of data would be the work of decades if they were well-funded projects starting immediately – and neither governments nor space billionaires appear to be shelling out such funds.

This returns us to our earlier question: are billionaires planning to use Mars as a distant sanctuary? We suspect not. Almost nothing you could do to Earth would make it as inhospitable as Mars. Nuclear war would still leave a functioning biosphere, as would runaway climate change. Even the asteroid that wiped out the dinosaurs spared humankind's ancestors. If billionaires believe this is a good escape plan, they're even more foolish than they sound on social media.

But rejecting unlikely space fantasies doesn't mean we also have to reject space exploration or progress. Whether an en-masse space migration is possible or even desirable, space exploration will remain a source of economic growth, useful information and beautiful truths. There may not be a space economy beyond providing data about Earth, but those benefits are real and growing.

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## COULD A PILL REALLY HELP US LOSE WEIGHT?

Cutting-edge weight-loss treatments might be around the corner. But can they end obesity?