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When are we moving to Mars?

With wars raging and environmental collapse on the horizon, the idea of escaping to start again on another planet is gaining appeal. Both NASA and the Chinese are working on lunar bases. But how soon before the rest of us can take to the stars? And what about the planet we'd leave behind?

The idea of a mass human migration to space, the Moon or other planets is exciting, but... well, a little overzealous. As the authors of *A City on Mars* say: "An Earth with climate change and nuclear war and zombies and werewolves is still a better place than Mars."

To find out why, we spoke to one of its authors, Dr Kelly Weinersmith, who, after years of research into space settlements, gave us the low-down on how long it's *really* likely to be before humans can move beyond Earth.

WHY MIGHT IT NOT BE THE RIGHT TIME TO MOVE TO MARS?

There's so much that we don't know yet. In particular, settlements require that people can have babies and we don't have anywhere near enough science to know if that's going

to be safe for the mothers or for the babies.

When you move out to a place like Mars where you only have 40 per cent of Earth's gravity and you're completely exposed to space radiation, everything gets harder. We've done a lot of research on the International Space Station (ISS), which has been within the protection of the magnetosphere that surrounds Earth and shuttles space radiation to the poles. Most of that radiation hasn't hit our astronauts, so we don't understand what it does to human bodies.

There's also a lack of clarity about what you're allowed to do with the resources in space. In 1967, the UN passed the Outer Space Treaty, which says that no one is allowed to claim sovereignty. The US interpretation of this is that you

can extract and sell resources from space without claiming sovereignty. But not all nations agree with this.

We've figured out how to solve problems like this in Antarctica and the deep seabed, so this could unfold peacefully. I would like to see more clarity in international law to figure out who's allowed to do what before things heat up too much.

WHAT OTHER ASPECTS OF DAY-TO-DAY LIFE DO WE NEED TO FIGURE OUT?

Closed-loop systems are going to be critical. They're already an important part of life on the ISS – astronauts regularly complain about what a pain in the rear it is just to maintain the bathroom.

Also, carbon dioxide (CO₂) levels on the ISS are higher than they are on Earth because it's difficult and expensive to



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Mars-bound astronauts prepare for the psychological demands of the three-year mission <https://bit.ly/3YywANZ>



maintain low carbon dioxide and high oxygen levels. We don't really have the complicated equations that we're going to need to understand, for example, how many wheat plants we'd need to absorb the carbon dioxide for a group of people.

There's some power research that we need to do, too: solar panels will be great, but we're going to need portable nuclear reactors to provide a sufficient amount of power. We have some research on those reactors, but they haven't been tested in space yet, which is a great case for going back to the Moon first.

WHAT ARE THE MOST VIABLE CURRENT OPTIONS FOR A SPACE SETTLEMENT?

I think Mars is probably the best place for us to settle in space, as it has most of what humans need. For example, it has a lot of fairly

accessible water, as well as the minerals and nutrients that we need to grow plants.

But Mars is pretty far away, so you can only fly to it every two years, when Mars is in the right position to be close enough to Earth. It also takes six months to get there, so if something goes wrong, you're on your own. This makes the Moon a very valuable place to learn things and test equipment before going all the way to Mars.

There's another argument that rotating space settlements are the future ideal – like a bicycle tyre spinning in space, generating something like Earth's gravity. But technologically they're far more complicated to create and are going to be very expensive.

DO WE HAVE GOOD REASON TO WANT TO SETTLE SPACE?

Shouldn't we be spending the

money on solving the climate crisis?

Jeff Bezos argues that we need to go to space to save Earth. The idea is, if we take a bunch of people off Earth, we can relieve some of the population pressure.

I don't find that argument very convincing. We put something like 200,000 new people on Earth every day. So even just to tread water, we would need to move 200,000 people from Earth into space habitats that we don't even know how to make yet. I just don't think any of these solutions are going to come fast enough.

That said, there does seem to be this conflict where people think there's a trade-off between money that goes into space and money that goes into environmental problems. But exploring the Solar System helps us understand Earth better, including ozone depletion and climate change. Additionally, a lot of the space budget goes into satellites, which give us information about weather and climate change models.

DO YOU THINK PEOPLE WILL BE DISAPPOINTED TO HEAR YOUR VERDICT ON SPACE SETTLEMENTS?

I know they're disappointed because they've reached out to tell me that. But I also think that, even on an Earth that was ravaged by nuclear war and had been hit by an asteroid, there would probably still be places on the planet where you could go outside and not die immediately. On Mars, you can't even go outside and, say, feel the wind on your skin without dying.

I think if you really want to settle Mars, you need a plan for keeping Earth alive, one that allows us to continue to advance technologically so that we *can* support settlements on Mars. We have to be realistic to move forward with this goal.

by **DR KELLY WEINERSMITH**

*Kelly and Zach Weinersmith are the authors of *A City on Mars*, winner of the 2024 Royal Society Trivedi Science Book Prize and a Hugo Award (2023, Particular Books).*