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Conceiving babies in space poses many problems. One company is trying to solve them



—
DR EGBERT
EDELBRÖEK
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is the founder and CEO
of SpaceBorn United*

Everyone, it seems, is fixated on space exploration right now. NASA, in collaboration with the Canadian, Japanese and European space agencies, is working on the Gateway programme to build a human-tended space station in lunar orbit; and various billionaires are continuing with their plans to establish colonies on other planets and launch space tourism enterprises.

Assuming they're successful, these projects would represent the first, tentative steps humanity takes away from Earth and further out into space. But if surviving among the stars is the long-term aim of such endeavours, there's a hurdle that needs to be overcome in the short term: human reproduction. Making babies in space, whether by artificial means or naturally, is fraught with issues, most notably radiation and gravity.

SpaceBorn United, a company based in the Netherlands, is trying to address these issues. To that end it has developed a miniaturised IVF and embryo incubator, which is ready to be launched on a mission to assess humanity's ability to reproduce in space. SpaceBorn United's CEO Dr Egbert Edelbroek explains more...

WHAT IS SPACEBORN UNITED'S GOAL?

We intend to perform conception and early embryo development in space. If we want to have human settlements on Mars, for example, and if we want to make those settlements really independent, that requires solving the reproduction challenge. Nobody knows if the gravity level of Mars, which is much


less than the Earth's, will be sufficient for healthy embryo development.

Initially we were only focusing on learning about partial gravity effects. But we learned that there is another goal that we can contribute to: improving IVF on Earth. Doing IVF in space at different gravity levels will provide crucial insights that can increase the success of IVF treatments. This includes ground-based tests, which we're discussing with the European Space Agency (ESA), as they have facilities to simulate microgravity or partial gravity. We're excited that we can contribute to this.

AND WHAT POINT ARE YOU AT? HOW CLOSE ARE YOU TO ACHIEVING THIS GOAL?

We're interested in the development of artificial wombs as they might contribute to solving the reproduction challenge in space (currently these are being developed for premature babies rather than for use in space). A research team in Israel has succeeded in getting mouse embryos to grow outside of a natural womb for 11 days. The target we're aiming for is five days. [The legal limit on human embryo research in the UK is 14 days].

Of course, the first step is also using animal models, so mammalian gametes and embryos. But eventually we need to transition to working with human gametes. For the last five to six years, we've focused on this first stage of reproduction – and probably will for the next five to six years. This includes conception and early embryo development. But people are often interested in our longer-term mission to achieve childbirth in space. Our



Solutions to all of the other problems space exploration poses are meaningless if we can't find a way to reproduce safely in space

timelines were a little bit ambitious, though. We'll continue to focus on that first stage, but, eventually, of course, somebody needs to do childbirth in space – maybe we'll do it soon.

HOW DOES IVF IN SPACE ACTUALLY WORK?

We're using microfluidic technology to miniaturise and re-engineer existing embryo incubators. These were never designed to be small or low mass. But now we've made them into a CD-ROM-sized disc, full of micro channels. Different chambers hold sperm fluids and female eggs, and you can programme the complete conception process on that disc.

There's been a lot of progress in terms of hardware. Our first prototype is finished and ready to go into space. We're very proud of that.

ARE YOU WORKING WITH ASTRONAUTS ON NATURAL CONCEPTION, OR WILL THAT COME MUCH LATER?

We know that natural conception in space is not a good idea, ethically or medically. But there's this space tourism sector opening up and accelerating. That will be a magnet



“If we want to have human settlements on Mars, and make them really independent, that requires solving the reproduction challenge”

for couples that want crazy bragging rights, like “Hey, we have the very first baby conceived naturally in space.” But that’s not a good idea. We actually wrote a paper about this, in collaboration with Cranfield University, to boost awareness of the risks of natural sex in space. It went a little bit viral.

YOUR LAUNCH IS SCHEDULED FOR 2025. DO YOU THINK PLANS TO SEND HUMANS TO COLONISE MARS BY 2050 ARE REALISTIC?

I think there are so many reasons to leave Earth and expand humanity’s comfort zone. Exploration has given huge benefits to humanity. But there’s another reason [to leave Earth]. We’re not treating the planet nicely, which

has led to climate change, and there are potential problems with asteroids, artificial intelligence, even nuclear threats. So it would be a good idea to have a back-up plan.

But can we do it in 25 years... Who knows? Artificial intelligence seems capable of speeding up a lot of things, but, of course, it’s also about budgets. More and more private companies, including a lot of billionaires now, are taking part in the new space race so it’s further accelerating.

However, until recently space companies have focused on the engineering and hardware necessary to get people to space, not the reproductive part. The main reason for this is that it’s ethically complex

and sensitive. But it’s pretty pointless to spend all those billions of dollars, not to mention all that time and effort, on preparing settlements on Mars if you can’t overcome the reproductive challenge. There will be people living in space and possibly on Mars, so there is a life science part that has been happening in the margins. We’re adding to that.

LIKE THOSE RACING TO THE MOON OR MARS, ARE THESE BABY STEPS IN A DIFFERENT KIND OF SPACE RACE?

We have been approached by countries who want to put themselves on the map with some unique achievement in space. And it seems that being able to claim that their nation enabled the very first human baby to be conceived in space is attractive for them, in that regard. In the longer term, enabling the first childbirth in space is another very big step, of course.

Some other companies are working on space conception with frog eggs, fruit flies and sometimes small mammals, like mice or rats. But nobody else has the aim of doing this with human gametes and embryos.