Here’s why Rocket Lab changed its mind on reusable launch

Enlarge / Rocket Lab CEO Peter Beck speaks during the opening of the new Rocket Lab factory on October 12, 2018, in Auckland, New Zealand.

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On Tuesday, the US-based company Rocket Lab announced that it had begun to explore the possibility of reusing its smallsat launch vehicle, Electron. This represented a change of heart for the company, whose chief executive, Peter Beck, had previously dismissed the possibility of re-using the Electron booster.

To understand what led to this decision, Ars spoke with Beck at length on Wednesday. During the interview, we also discussed SpaceX’s recent announcement that it was entering the smallsat launch market with dedicated rideshare missions on its Falcon 9 rocket. Because the whole interview may be of interest to space aficionados, we’re sharing all of it.

Ars Technica: *So, after all this time, how did you come to this decision to embrace rocket reusability?*

Peter Beck: There’s nothing like actually flying and gathering data. The Electron vehicle is really heavily instrumented on every flight, with thousands of channels of data. We’re a conservative bunch, and we like to make sure we have lots of margins. We’ve been able to understand what sort of structural

margins we have during ascent, and the performance of the vehicle. And in parallel to that, we've been ramping up at a hugely aggressive rate. We built a new factory, and we're continuing to expand and hire at a crazy rate. We're seeing the production delivery times get smaller, and a stage is rolling out of the factory every 30 days now. But really, we're just nowhere close to keeping up with the demand from our customers. We need to ramp production even more aggressively.

At the end of last year I started to really look into the possibility of recovery, and the team looked at the data. We formed a recovery team and started hiring early this year, and they've been working on it ever since then. And every flight we've been instrumenting more and more and understanding more and more. In parallel with that, we've been building computational fluid dynamic models and structural analysis models and really validating those models with our data to understand what's going on. As we understood the problem better and better, we got to the point where we were able to propose solutions that we felt were really quite feasible. At that point, we committed to the project and started upgrades. You'll see on Flight 10 a few obvious changes on the first stage of Electron, and we felt this was a good opportunity to talk about it given that the jig will be up soon with people starting to notice stuff. We'd be busted pretty quick.

[embedded content]
Rocket Lab's plan for Electron reuse.
Explain how going for reuse is better than just trying to continue to scale production of the Electron rocket.

We're trying to do both. Scaling production is not a trivial thing. We need to quadruple production over the next couple of years. You can take any product on this planet—a chair or a consumer product—and say I want a 4x production of that product. And that's no trivial thing to do. When you have a supply chain as they have in the aerospace industry, which is

really quite fragile, and you're not just asking yourself to scale four times—you're asking your suppliers to scale four times. Take the engine, for example: even if we wanted to double engine production and order a bunch more printers, those printers are six- or 12-month lead time. Really, we need to be all in. We're crazy expanding our factories and hiring. But this is an additional step we need to take to increase launch opportunities.

Did the inspiration for this recovery method come from Armadillo, which tried something similar, or some other company?

The idea of mid-air capture has a long history, right back to the Corona missions in the 1950s and 1960s. That's not new. And it's funny, if you look at the helicopter capture, most people think that's the hardest thing to do. But that's really not hard at all. That's the bit I'm least worried about being successful. It's getting it through the atmosphere and down to a sensible speed that is really where the challenge lies. That's where a lot of the innovation is going to come from in this program. We have some very unique aerodynamic decelerators that we'll be employing to control the reentry but also to scrub the velocity.

When you say "aerodynamic decelerators," does that look like a fin or what?

Yeah, I guess that's kind of the magic of what we're trying to do. That's something that we've been a little bit less public on, some of the techniques we're developing for that.

Enlarge / ELaNa19 mission liftoff of Electron rocket.
Trevor Mahlmann

And when do you hope to start trying this out in practice? Is there a target for the first recovery?

Yeah, so the next flight on the pad here is an important one [Flight 8, due to launch later this month]. We have some critical flight instrumentation on that. Flight 10 is a block upgrade, with some visible changes to the booster. Really, after flight 10, there will be new things we're trying on every flight. But look, this is a very, very difficult thing to do, and I'm reluctant to define a flight number that we're going to do a full recovery on. It's a very methodical and iterative approach we're taking here.

How many times do you hope to reuse a booster?

If we could reuse it once we've effectively doubled production. Once would be wonderful. Anything more would be really fantastic.

Did you take inspiration from SpaceX's success with reusing rockets over the last 2.5 years? Did that maybe push you over the line from, "It would be nice to do this," to "Hey, we could actually do this"?

There's no argument that SpaceX has reset the industry standard. What they've done has reset everybody's expectations about what a 21st-century launch vehicle should look like. We always felt that recovery was not achievable on a small launch vehicle because, to do it propulsively, you end up actually building a large launch vehicle because you need so much propellant. Things don't scale very well. That's why we used to say publicly we didn't see a path toward reusability. But we're taking a very different approach here, one that was required to mesh what we have with a small launch vehicle.

Business must be pretty good if you need all these Electrons.

We've brought something to the market that was sorely needed, and we think we've hit the sweet spot for payloads. It's enough that you can rideshare a few CubeSats, but it's really spectacularly ideal for a dedicated smallsat launch. A 150kg or 200kg spacecraft—the Electron really suits it well. Launch has always been constrained, but we're helping to ease the problem.

What do you think about the competition? SpaceX is entering the smallsat launch market. There are dozens of companies trying to build vehicles like Electron.

Ultimately, I think an increase in launch opportunities is good for everybody. It stimulates more opportunities, and it enables people to get on orbit more often. The limitation for SpaceX, obviously, is that they're flying once a year to one particular orbit. Generally, the kind of customer that's

flying on Electron is not looking to rideshare—they're looking for a dedicated service and all of the massive advantages that gives you. So, you know, from Rocket Lab's perspective, we don't see any challenge or impact to our business. It's a very different customer that will fly on us versus a Falcon 9. But what I would say is there are quite a lot of launch vehicles in the 1,000kg payload range that are under development at the moment, and I think that's going to be a real challenge for those guys. Basically their model is rideshare, and when you're going head-to-head with an established player like SpaceX, you know, that has proven flight credibility and opportunities, that will be a real challenge.

How much does having a big head start, like you do, help in this kind of environment?

I lost count, personally, at 114 small-launch vehicle companies. I was told this morning that it was announced at this conference that there are now 130. I think actually flying and delivering payloads with high accuracy—it's a long way away from someone who is looking to get to their first flight. What we found is that it took the same amount of time, capital, and energy to get to first flight that it did to get to flying once a month. I think flying is everything, and then flying regularly is even more. A customer just has to decide if they're going to risk flying on a vehicle that has yet to be developed and proven and risk losing a time slot on a vehicle that is already operational.

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