

Orbital Test



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—Morgan Bailey, Rocket Lab, Auckland, New Zealand

It’s getting crowded up there. In yet another space race driven by privatization, startups are launching projects to get more satellites into Earth’s low orbit. Having more satellites closer to Earth can increase internet connectivity in underserved locations. It can also reduce the lag time of transferring data from above, which is a major appeal for industries such as financial trading that rely on having the fastest connections.

SpaceX launched 60 satellites in May, part of nearly 13,000 low-Earth-orbit satellites approved by the United States Federal Communications Commission (FCC). The satellites are part of the company’s plan to provide and sell high-speed internet to customers around the world. Amazon, meanwhile, is seeking permission from the FCC to launch 3,236 satellites for its own competing internet project. In June, Rocket Lab launched its seventh Electron rocket from New Zealand. The 17-meter (55.8-foot) Electron rocket carried small satellites for clients including the U.S. government’s Special Operations Command and the Melbourne Space Program.

Reduce, Reuse

Major challenges for project teams are twofold: Find ways to cut costs and make sure not to litter space with more junk, including via failed launches. In general, the increase in satellites risks clogging the Earth’s orbit with traffic and debris that, among other things, will alter the view of space for casual observers and astronomers alike.

For Rocket Lab, testing is critical to achieving its goals, says Morgan Bailey, head of communications, Rocket Lab, Auckland, New Zealand. Getting

the company’s first launch vehicle into orbit in January 2018 “followed years of research, development, testing and more testing—then some more testing,” she says. “Every individual thing must go right, or everything can go wrong.”

For instance, SpaceX lost contact with three satellites shortly after launch. “There is a lot of new technology here, and it’s possible that some of these satellites may not work and in fact a small possibility that all the satellites will not work,” SpaceX founder and CEO Elon Musk said at a news conference.

Looking for new ways to declutter, SpaceX plans to deorbit two functioning satellites. The company plans to test the satellites’ ability to drag down into the Earth’s atmosphere and disintegrate—a necessary feature that will ensure satellites disappear from space once they’re no longer needed.

Space Savers

Driving down costs is an even more pressing objective. While it once took millions of U.S. dol-



Rocket Lab’s first orbital launch in Mahia, New Zealand

PHOTO COURTESY OF ROCKET LAB

lars to launch anything into space, Mr. Musk has boldly told investors that his company aims to bring the cost per satellite down to US\$150. For Rocket Lab and others, rapid iteration is helping teams find new ways to cut costs.

Originally, Rocket Lab planned to use each Electron booster once. But during testing, the team realized recapturing the booster via helicopter could potentially prevent booster damage caused by returning to Earth and hitting the ground. Reusing boosters, Ms. Bailey says, will significantly decrease the cost per mission.

Two more ways Rocket Lab hopes to cut costs while increasing the number of satellites going up: Pack more satellites into each launch and conduct more frequent launches. The company has monthly launches planned for the remainder of the year and is building a second launch site in the U.S. state of Virginia to help reach the ultimate goal of weekly launches.

“To do that, we needed to design a launch vehicle that could be built and fly at an unprecedented rate,” Ms. Bailey says.

That need pushed Rocket Lab designers and engineers to incorporate 3D printing into the rocket’s structure and engines. The company’s Rutherford engines now have more 3D-printed components than any other rocket engine in the world, Ms. Bailey says, including combustion chamber, injectors, pumps and main propellant valves. Teams are able to print engine components in just 24 hours.

“Our fast turnaround and frequent launch is driving down the cost for small satellite companies to get to orbit,” she says. —*Ambreen Ali*



Shifting Sands

When Oppenheim Architecture was approached about a project to build the Ayla Oasis Golf Resorts Comfort Station in Aqaba, Jordan, the project sponsor wanted something iconic. But the team was “turned off” by the pursuit of that, principal Chad Oppenheim told *Architectural Digest*. “Instead, we focused on making a profoundly silent yet dramatic structure that integrates into the landscape.”

A more subtle but still dramatic design was no small feat. The project team designed a rolling wave shell for the outer portion of the building, which was built on-site first with flexible, thin-gauge steel ribbons and then a sprayed-concrete technique called shotcrete. In order to execute the design while still meeting the project plan of using local labor, the team had to allot time and resources for training local workers on how to pour shotcrete. The structure was then reinforced with bars and steel mesh before a final “blanket” mesh was laid on top and covered with additional shotcrete—for a raw look that organically fits the project’s surroundings.



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—Chad Oppenheim, Oppenheim Architecture, to *Architectural Digest*



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