Stanford eCorner

Explaining Agile Aerospace

William Marshall, *Planet Labs*

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William Marshall, co-founder and CEO of Planet Labs, describes how the startup began building Earth-imaging satellites many times smaller than the aerospace industry traditionally produces. Marshall, a former NASA scientist, also explains how rapid iteration helped Planet Labs cut down production time and costs for its "dove" satellites.

Transcript

So we started this in our garage as Silicon Valley start-ups are want to do. But I think we were the first space start-up to do that. We literally built our first satellite in our garage and that wasn't the only lesson we learned from Silicon Valley. We took an approach of rapid iteration, we call it agile aerospace. I'll tell you a little bit more about that in a minute. We try to just take things out into the field and test them; we would take our satellites out. We'd fire them in planes over our ground stations to check they work, have the radio tests along across the Valley from here to basically the Lick Observatory, we would send somebody up there and try and to do a link and make sure everything worked. So we took this sort of more hands-on and testing approach, which is quite different from the aerospace sector which takes a very hardcore analytical approach to finding problems and risks to the satellite design. So we started in our garage and that was just over three years ago, 3.5 years ago, and we -- actually the founders of our company we all met at the United Nations at a conference that was looking at how to use satellites to help humanity? How can we bring them to help people in developing countries, help stop disasters, things like that? And so this in many ways has been the uniting theme throughout our careers so we've known each other for about 15 years before starting this company and so we were long-term friends and cared about this overarching mission. So what was standing in our way? The first thing that was standing in our way was that satellites look like this.

You see these people, they're rather big the satellites, either that or the people are very small. So these satellites weigh about six tons, this is a Landsat satellite. It was launched last year by NASA. This is what a traditional Earth imaging satellite looks like. So it weighs six tons. It's 4x4x6 meters. It cost $855 million. It was launched on a single rocket. And satellites like this have done a tremendous service in helping us to understand the planet so far. And this is -- this sort of satellite has given us reliable data over the last 40 years.

But if you want to put up 150 satellites, this model doesn't really work, because well at least not unless you have a gigantic budget. But that doesn't really represent the forefront of satellite technology at least small satellite technology which really was represented prior to us at least by these folks at Surrey Satellites, who are actually from the U.K. and these are some of their satellites that they build, a rapid eye is the constellation of satellites that they built here shown and these satellites are about 100 kilograms and commensurately less money, only say $30 million or $40 million. But even that for us was that not going to work. We needed to put up 150 of these guys and even by that standard it was going to be billions of dollars and not something we could get venture capital funded let alone try and start out of our own pockets, which is what we wanted to do. So what we did was make satellites much smaller and this is actually one of our satellites under construction by one of our engineers to give you a bit of sense of scale. So our satellites -- this is actually one of them, what it looks like. One of the dominant features you can see is actually, we have an artist in residence who paints all of our satellites and this is actually the top side of the solar array, so you can't see the main solar array obviously that has to have the solar cells on it, but the artist gets to paint the other parts, which is kind of cool. But what's inside that? So we've miniaturized a massive amount of technology into this little volume. These satellites are 10x10x30 centimeters.

They use what's called the CubeSat form factor, which actually Stanford engineers were involved with pioneering in the late 90s. It's basically a standard form factor of size of a satellite. And launch providers got used to this form factor to give -- which enabled us to get more access to space basically. But inside that is first and foremost the largest telescope we could possibly fit into that volume. So to the front two thirds of the satellite is essentially the telescope, which is the optics that you need to get reasonable resolution imagery of the ground from 400 or 500 kilometers up, which is where we are orbiting.