

# New space savers: Small satellites

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Suddenly, everyone from the U.S. government, commercial satellite companies, universities and even high school students needs to have a small satellite.

And that is fueling another boom, in Southern California and across the West, in companies dedicated to giving the satellites a ride to space.

By one estimate, 210 satellites weighing less than 110 pounds will be launched this year, to do such things as map the Earth, expand broadband access and track packages on shipping vessels. That's up from just 25 launches in 2010. The number is expected to double again in five years.

In the last six months, at least half a dozen new launch vehicle firms aimed at the small satellite market have cropped up, said Marco Caceres, senior space analyst for Teal Group, an aerospace and defense analysis company.

The ever-growing list includes Firefly Space Systems in Cedar Park, Texas; Rocket Lab in Los Angeles and Richard Branson's Virgin Galactic, best known for its space tourism endeavors.

In a quiet industrial park near Long Beach Airport where warplanes were once built around the clock, Virgin Galactic is making a satellite-launching rocket that will drop from the wing of a 747.

"There is strong confidence in the aerospace community that [small](#)

[satellites](#) are the way to go," said Kevin Sagis, chief engineer for LauncherOne. "It's an exciting time."

The hopes of the upstarts are bolstered by news that companies such as SpaceX outside Los Angeles and OneWeb in Arlington, Va., are planning to launch constellations of hundreds or even thousands of satellites that would provide low-cost internet access, especially to more remote areas of the world.

Last year, SpaceX opened an office in Seattle where engineers will build smaller satellites for launch. Around the same time, Branson announced an investment in the OneWeb venture.

"Just those two companies alone can create a whole new market," Caceres said. "And I think that's what launch companies are looking for."

Traditional satellite manufacturing has long been based in Southern California. Hughes Electronics Corp. built satellites at its El Segundo facility outside LA for years before its space and communications businesses were acquired in 2000 by aerospace giant Boeing Co. Boeing still manufactures satellites in El Segundo.

Swarms of satellites are not a new idea. Huge satellite constellations were proposed back in the 1990s as a way to provide telecommunications services around the globe. But entrepreneurs badly underestimated the steep cost of building and blasting hundreds of satellites into orbit, and the proposed services were undercut by cheaper ground-based cellular services.

Plans for the ambitious Teledesic satellite constellation collapsed in the early 2000s. The network, which was to provide high-speed internet service, was founded by cellphone pioneer Craig McCaw and garnered

some investment from Microsoft co-founder Bill Gates, but couldn't raise enough money to cover its high costs.

In 1999, satellite communications company Iridium filed for Chapter 11 bankruptcy protection after it signed up fewer than 50,000 customers for its global telephone service. The company later reorganized and its network of 66 satellites still provides services.

Industry players say this time will be different. They point to the greater diversity in satellite usage now as insurance against the bust of any one particular industry.

Planet Labs, for example, says it operates the largest fleet of Earth observation satellites. Data from the San Francisco company's nanosatellites can be used to monitor farmland and track carbon emissions.

Demand for mobile connectivity is also greater than it ever was in the 1990s, even in previously unconnected places such as airplanes.

And new technology has driven down the cost of developing and launching a satellite, aided in part by miniaturization; smaller satellites weigh less, and thus are cheaper to launch.

Tom Stroup, president of the Satellite Industry Association, said it's not likely that all the satellite constellations that have been announced will be launched. But he expects at least one, if not more, of the proposed projects in each sector - imaging, broadband, communication services - to succeed.

"We live in a different world than we did in the 1990s," he said.

Another plus for this round of satellite projects is that they're more

likely to be backed by the companies' own money, said Caceres of Teal Group.

"They're not totally reliant on investors like they were in the 1990s," he said. "So there's a good chance that many of these companies will be able to put these thousands of satellites into orbit, and if they do, they need launch vehicles."

Currently, small satellites can hitch a ride by going "piggyback" on a rocket purchased by a larger company and squeezing in where there's space. But aspiring launch providers say this method can restrict the launch time and location, as well as the orbit where the satellite will be placed.

That's where companies like Virgin Galactic think they can succeed.

The company announced its LauncherOne project in 2012 after it saw the potential in the small-satellite market. Virgin Galactic plans to eventually produce 24 rockets or more each year in its 150,000-square-foot facility, which borders the Long Beach Airport and is near the former Boeing C-17 plant, which closed in November.

Virgin Galactic is looking to produce rockets quickly and at low cost. On average, the company said it will cost \$10 million to launch a 440-pound [satellite](#) to a 500-kilometer sun-synchronous orbit, the most commonly requested orbit. That compares with SpaceX's starting price of \$62 million for its Falcon 9 rocket, or Rocket Lab's \$5 million charge for a 330-pound payload.

The company has invested in machines that speed the rocket production line. One of them creates new parts through 3-D printing, while simultaneously shaving off any extra material that could make a part even a hair's width too big.

Even the launch system was designed with costs in mind.

The 65-foot-long rocket will be secured under the left wing of a modified commercial 747-400 jetliner dubbed Cosmic Girl. After the plane climbs to about 35,000 feet, it will release LauncherOne to deliver the payload into orbit.

LauncherOne's first test flight is scheduled for next year. The plane will take off from Mojave and launch the rocket off the California coast near Santa Barbara.

The company has already started to fill its launch manifest. Its biggest customer is OneWeb, which has purchased flights for 39 satellites. Last year, Virgin Galactic won a \$4.7 million NASA contract to carry more than a dozen small satellites into orbit. Firefly Space Systems and Rocket Lab won similar contracts.

Stratolaunch Systems, a project backed by Microsoft co-founder Paul Allen and his company Vulcan Aerospace, also hopes to launch satellites from midair. It is building a rocket-carrying aircraft in Mojave that, when completed, will have the largest wingspan of any plane ever built.

Caceres said he doesn't expect all of the start-up launch companies to survive. "Many of them will fold," he said. "As long as you have someone wealthy and you're not relying on attracting private investors, you have a much better chance."

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