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Stanford and NASA Launch Tiny IoT Satellites Into Earth's Orbit



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Gadgets associated with the Internet of Things (IoT) get used everywhere from manufacturing plants to people's homes.

But what about outer space? In June 2019, a partnership between Stanford University and NASA resulted in dozens of miniature satellites getting launched into orbit. The results of this project could forever change how researchers explore space, as well as the technology they use to do it.

How Could These IoT Satellites Facilitate Research?

NASA calls these centimeter-scale satellites sprites or ChipSats. The team sent more than 100 of them into orbit in the spring of 2019, and received the first signals back from them the next day. Those communications demonstrate the satellites can work together, and that's essential if they eventually operate in a swarm.

Researchers believe this successful deployment means it'll soon be possible to forge ahead with space exploration in different, more cost-efficient ways than before. They built these sprites for \$100 each.

One of the outstanding things about this use of IoT technology is that the satellites can get into a part of Earth's atmosphere called the mesosphere. It's too low for traditional satellites to reach but too high for access by balloons or airplanes.

So, assuming this project proceeds as expected, it could provide researchers with more insights about a part of the atmosphere that's not as well-known as others.

The things scientists learn about the Earth and its climate through these minuscule satellites could also carry over to support other work related to space exploration or nature.

For example, Zac Manchester, one of the Stanford researchers and an assistant professor at the university, envisions a time not long from now when the ChipSats might contain specialized electronics for particular missions, investigate weather patterns or gather data about wildlife migrations. Moreover, these IoT satellites could send communications and data-collection tools to other planets, such as Mars.

Postage Stamp-Sized Gadgets Used as Part of a Larger Program

Each of these satellites is a circuit board that measures 3.5 x 3.5 centimeters — approximately the size of a postage stamp. Depending on a project's needs, the ChipSats

can contain sensors, communication equipment and computing components. The satellite that houses and deploys the sensors is called a CubeSat.

This recent launch of the IoT satellites was part of the CubeSat Launch Initiative (CSLI). It's a NASA project involving research nanosatellites. NASA has so far selected 167 CSLI missions, with a total of 39 states set to participate.

Each nanosatellite conforms to the specific measurements of 10 x 10 x 11 centimeters per unit. A complete satellite contains up to 12 units, and each unit weighs under three pounds.

For the IoT ChipSats mission, the CubeSat satellite had two compartments and three units. One unit held the computing necessities to run the spacecraft, process data and communicate with other ChipSats. The other two held and deployed the little satellites, respectively.

A Kickstarter Origin Story

Back in 2009 when studying at Stanford, Manchester got inspired to try and create a satellite in a device that was cheaper and easier to build than a CubeSat. A couple of years later, he put his project — called KickSat — onto Kickstarter, where 315 backers contributed about \$75,000 to the cause.

Then, in 2014, Manchester sent the first of his tiny, economical satellites into orbit. Unfortunately, though, an engineering issue made the satellites reenter the Earth's atmosphere too early, destroying them before deployment.

The team persevered and redesigned the sprites for this most recent mission, naming the improved versions Kick-Sat-2. They put 105 of them into a CubeSat satellite and sent it to the International Space Station on Nov. 17, 2018, to await the go-ahead for launch.

The approval finally came months later on March 18, 2019, when a 60-foot dish on the Stanford grounds sent the deployment commands.

After that, Manchester and his team tracked the satellites until March 21, when the disposable satellites came back into the Earth's atmosphere and burned up. Manchester hopes his work will eventually allow anyone to send satellites into space, perhaps as easily as hobbyists can fly drones today.

Additionally, NASA is investigating how to use the IoT in other ways. The organization [set up an IoT lab](#) at Johnson Space Center, and work is underway to find out which IoT technology is most applicable to NASA's work, and how to keep the gadgets secure.

The recently completed first phase of using the IoT facility involved studying 20 connected devices and the data collected from them.

Tiny, but Mighty

The work with the IoT satellites known as sprites or ChipSats proves how small technologies could spur future space exploration advancements. People will have to wait and see what exciting things they will help humankind learn and accomplish, but the developments are promising.

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