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Swarms of Satellites: Miniaturizing Space Exploration

📅 March 22, 2019

📍 cubesat Jekan

Thanga miniaturization robot satellite spacecraft SpaceTREx swarm University of Arizona

Swarms of small satellites and robots will revolutionize our exploration of the cosmos. That's the vision behind ongoing miniaturization efforts in the field of aerospace engineering. The popularization of cubesats has already made space more accessible. But more miniaturization, and also the ability to

coordinate this new generation of smaller machines, will allow us to explore space in ways that today we can't even imagine.

We spoke with Professor Jekan Thanga, who founded the Space and Terrestrial Robotic Exploration (SpaceTREx) Laboratory at University of Arizona. SpaceTREx focuses its efforts on advancing technologies related to miniaturization and low-gravity extreme environment exploration. The lab also applies these technologies to engineering challenges faced here on Earth. Professor Thanga shared his thoughts with us about aerospace engineering's future.

How did you come to head the SpaceTREx Laboratory, and what are the laboratory's focus areas?

I founded SpaceTREx in 2013 at Arizona State University. By 2015, we involved planetary scientists such as Professor Erik Asphaug and Professor Mark Robinson to collaborate with our team of engineers in developing new space technologies and mission concepts. In 2017, the laboratory moved to University of Arizona.

The laboratory exploits miniaturization in electronics, sensors, actuators, and power supplies to develop new small spacecraft like cubesats, or even smaller PicoSats and FemtoSats. The purpose of these small spacecraft is to advance science-focused space missions, technology demonstrations, and education. The lab has been concurrently developing enabling technologies for small satellites in the areas of guidance, navigation and control, propulsion, smart image processing, power, energy storage, and communications. Typically, these technologies advance exploration or demonstrate new technology or scientific concepts.

The laboratory also develops small robots for low-gravity extreme environment exploration – on asteroids and moons that have caves, canyons, cliffs, and lava tubes. A third focus area is applying these technologies to terrestrial engineering grand challenges related to clean water, energy, and security.

What do you think is an important but under-recognized way that cubesats and robots will help advance space exploration going forward?

I believe small spacecraft and small robots are just in the starting phases of revolutionizing space exploration! Thanks to their small size, low cost, and potential for mass-production, I believe we are going to see swarms and constellations applied to exploration and Earth observation. Large numbers of cubesats and small robots will perform whole new tasks not thought of before. They can provide richer data and multi-point observation not possible with a single, large, monolithic spacecraft. Thanks to this technology, we believe we will be better equipped to explore the far corners of our solar system, and also further beyond into our neighboring interstellar space.

What tips do you have for aspiring aerospace engineers interested in space exploration?

I would encourage aspiring aerospace engineers to learn more about the latest advances and, importantly, get involved where they can. The aerospace field is going through a golden age. Back when I was in middle school and high school, it was totally different. It felt like the field had reached rock bottom. I was perhaps one of a few students in a large high school who were deeply interested in space exploration. Despite facing enormous odds and not knowing anyone who entered the aerospace field, I kept on acting on my interest. I found ways to extend my interest in space not just in science and math classes, but also in English and the arts through projects.

I would encourage younger generations to go out and communicate and make connections with like-minded folks. Ways to do this include forming student clubs, building rockets or cubesats, participating in after-school activities, and joining space organizations. Don't worry about getting help and resources. There is such an enthusiastic community ready to support you. Other ways include applying for internships, supporting space camps, and getting involved in crowd-sourced activities. In addition, attending space conferences such as the International Astronautic Congress is a great way to meet the community and others who share a deep interest in aerospace.

I would say once you have had a chance to check out all the exciting activities going on, try to find something that you are really

interested in. Then focus your efforts in that specific area.

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