



TAKING TO THE SKIES TO REPLENISH THE EARTH

A team of NJIT and Rutgers-Newark students is devising a rocket-shaped fertilizer capsule that can reforest remote areas stripped of vegetation.

Few landscapes speak more hauntingly of environmental distress than barren expanses stripped of trees. Felled for farming, fuel and export, their depletion leaves the land prey to topsoil erosion and moisture loss. In the most extreme cases, they become virtual deserts.

Chrystoff Camacho '17, an engineering technology major from Brooklyn, would like to reforest the world's denuded acres in a hail of rejuvenating missiles. His biodegradable capsules, containing packets of seeds and mineral-rich soil, would be dropped by planes and drones, perforating the flat, dry ground where they land so it retains water to nurture the seedlings.

dealistic fantasy? Not according to the judges at the regional CleanTech University Prize (UP) competition held at Rutgers University earlier this year, where his Aerial Reforestation Capsule (ARC) captured second place. That finish sent him on to the CleanTech UP National Competition in Denver, where he went up against older, more experienced competitors from MIT and Stanford University.

The contests, sponsored by the U.S. Department of Energy (DOE), are designed to “inspire the next generation of clean energy entrepreneurs and innovators.” David Friedman, the agency’s acting assistant secretary for energy efficiency and renewable energy, describes the regional competitions as “a lot like the hit show *Shark Tank*—students pitch to a panel of experts, explaining why their idea is feasible and how it can make a positive impact.” The top three teams from each win a spot at nationals.

The DOE views reforestation as integral to renewable energy policy because trees function as carbon sinks that take in heat-trapping gases, emitted by fossil fuel combustion and other sources, to power their growth. They can also be used as biomass.

TECHNOLOGY BY NATURE

Early on in college, Camacho focused his entrepreneurial aspirations on military applications such as technology to deliver supplies, but a trip to his native Guyana then opened his eyes to a growing problem: widespread decimation caused by



Meet the team:
Alec Ratyosyan '17;
Kira Antoine '17;
Abbas Taiyebi '17; and
Chrystoff Camacho '17.

PHOTO: CHRISTINA GROVETTO

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logging. That got him thinking – and researching rates of tree loss around the world.

“My first idea was about developing some way to make the land in need of rehabilitation more productive. Land stripped of trees becomes dry and flat and can’t hold water, so I was thinking about making conical imprints that would create mini-basins for trees or crops that would be planted by hand,” Camacho recounts. “But that got me thinking about ways to do this by air, using velocity to make the imprint, because doing it by hand is so time-consuming. And then I had the idea of including the seeds and soil.”

“It’s true that the ARC does look a lot like a missile,” he laughs.

Camacho’s start-up, ParaTrees: Technology by Nature, received a National Science Foundation I-Corps grant for \$3,000 to further develop the prototype and to seek out advice and customers through regional business accelerators. It has also caught the attention of tech entrepreneurs, prompting a \$30,000 infusion from an angel investor to develop a drone

platform and business structure.

“The value of the I-Corps grant goes well beyond the funding – it allows us to pair up young entrepreneurs with mentors and advisers who will help them take a cool idea and identify potential customers with real concerns,” said Michael Ehrlich, an associate professor of management in NJIT’s Martin Tuchman School of Management who administers NJIT’s I-Corps site along with Judith Sheft, associate vice president for technology and enterprise development. Camacho has worked with Nancy Jackson, a professor of chemistry and environmental science, and William Marshall, assistant vice president for government affairs and a director of NJIT’s New Jersey Innovation Institute, responsible for its defense and homeland security innovation lab.

A TEAM EFFORT

Over the course of this year, he has assembled a five-person team from NJIT and Rutgers-Newark to speed development of a working prototype while also scoping out

potential markets and additional investors. Team members – three engineers from NJIT and two business majors from Rutgers – each bring a different skill to the enterprise.

Matthew Mann ’17, a mechanical engineer from Mount Olive, has been tinkering with the capsules’ design, varying their weight to optimize velocity, as he projects their path and impact in different geographical locations. They will range in size from 5.5 inches to less than an inch, depending on where and how they are dropped. The larger capsules will be deployed by airplane and the smaller by drone.

“We’re looking at penetrating two different types of soils, including clay silts and grainier turf with debris,” he notes. Having purchased an octocopter drone at the end of the summer to test it, the team is making modifications to perfect precision planting. Abbas Taiyebi ’17, biology major from Edison, is working in the lab on the growth medium, including soil mixes.

The Rutgers team members

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bring business and marketing skills.

Alec Ratyosyan, a senior at Rutgers-Newark from Tenaflly who is majoring in marketing and has worked in product sales, said he joined the team because he shares Camacho's view on the urgency of the problem.

"The technology's appeal is pretty simple and straightforward—it's meant to solve a crisis. Forests play a crucial role in the water cycle, in ecosystems and, more generally, in life on Earth. We need to preserve them as the population expands," he notes. "And from a sales standpoint, it's important to be able to get behind

the product you're promoting. I do think the ARC would provide value for a range of customers, from lumber companies, to conservation groups, to government agencies."

Kira Antoine, a Rutgers junior majoring in psychology, heads up corporate responsibility and social impact.

"I come from the tech side of things and business was foreign to me at first. I realized that if I were serious, I couldn't do this by myself. And when it comes to engineering applications, it's important to have multiple minds," says Camacho, adding that he is also now thinking

about community development and land stewardship as part of what he calls a "post-care" phase after the plants reach maturity.

"There is a lack of education in land management and the idea is to get people locally to start thinking about sustainability, while also boosting seasonal employment."

While they prepare the ARC for a first major pilot test next year, they continue to bring it before

outside technology organizations for input. Earlier this year, the team entered a contest put on by the New York City Regional Innovation Node (NYCRIN), a cleantech accelerator in Manhattan. They also joined the Brooklyn-based Urban Future Lab, where they took a 12-week course on business development. Their initial elevator pitch was attended by a range of businesses from Shell to renewable energy companies. They've since received inquiries from prospective companies in the U.S. and South America looking to rehabilitate land, and are applying for additional large grants to continue developing the prototype.

"I'm learning a lot about what it takes to run a business, to talk about it articulately to investors and potential partners and to be a more effective team leader," Camacho says. "These are the skills you need to maneuver in the business world."

The team is currently operating out of a studio two blocks from NJIT's Enterprise Development Center, in the basement of a house they're sharing.

"Sharing a space fosters team spirit in an organic way and is helping us develop professional habits of focus and hard work," Ratyosyan says, adding, "We don't even have cable!" ■

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PHOTO: CHRISTINA CROVETTO



Chrystoff Camacho '17 and Abbas Taiyebi '17 test their octocopter drone.