

High schoolers' satellite now orbiting Earth

Multiyear project by Virginia students is finished, launched

BY T. REES SHAPIRO
Washington Post

A blaze of flame erupted from NASA's Wallops Island facility on Virginia's Eastern Shore last month as a satellite developed by students from a Virginia high school launched into space aboard a Minotaur I rocket.

The rocket launch - visible across the Eastern Seaboard in the clear night sky - culminated seven years of work for more than 50 students from Thomas Jefferson High School for Science and Technology, in Fairfax County, Va. The satellite, TJCubeSat, was the first designed and built by high school students to be sent into space. The Minotaur I's payload included 29 satellites, which the company overseeing the launch said is the most ever carried into orbit by a single rocket.

"We were waiting for this day for so long," said Bobby Huddleston, a 2013 TJ graduate who was part of a group of alumni and students who watched the launch. "There was a sense of completion, that we had finished this project, and everyone high-fived and hugged."

The satellite, which completes an orbit around the Earth about every 100 minutes, is designed to receive messages the students send into space; it then rebroadcasts those messages using radio waves that can be heard around the globe via ham radio. The satellite's voice synthesizer interprets lines of text phonetically, meaning that, with slight tweaks in word structure, the messages can be "spoken" in any language.

Details about the satellite can be found at <http://bit.ly/19XxR2b>.

The satellite's location can be tracked at this site: www.2yo.com/?s=99902.

In a class of nanosatellites known for their distinctive cube shape, the TJCubeSat is about the size of a Pop-Tarts box, is small enough to fit in the palm of a hand and weighs about 2 pounds. The satellite travels at a speed of 4.5 miles per second and orbits the Earth from an altitude of about 30 miles.

The TJCubeSat project began in fall 2006, but it was hampered along the way by school budget cuts during the economic downturn. Once the satellite was completed, the launch date was delayed by the government shutdown, which temporarily closed NASA's Wallops Island launchpad.

The project started as an extracurricular club before becoming a systems engineering class. After school funding was curbed during the recession, satellite development became a research project for a select group of seniors. The program was initially funded with a \$30,000 donation from Orbital Sciences Corp., which collaborated with the school through the project's evolution. About 50 students have taken part in the program since its inception, said Adam Kemp, a teacher at TJ and the TJCubeSat project adviser.

REACH OUT

We value reader comments and suggestions. Contact John Bordsen, SciTech editor:

jbordsen@charlotteobserver.com; 704-358-5251; SciTech, P.O. Box 30308, Charlotte, NC 28230-0308

Online: charlotteobserver.com/scitech

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Bordsen



The art of science

Leigh Anne Carter's job? Drawing the birds of Mecklenburg County for an Audubon-sponsored atlas

BY AMBER VEVERKA
Correspondent

The golden-crowned kinglet leans over a sketched-twig perch, his bright eye peering out from the page at his creator, Leigh Anne Carter.

Carter, 27, is a scientific illustrator, a member of a storied profession whose practitioners - from famous naturalists such as John James Audubon to modern-day illustrators at the National Geographic Society - convey scientific data through the grace and power of art.

Carter's drawing of the kinglet, a spry little bird with distinctive striping on its head, is one of more than 300 species of birds Carter is capturing with pencil and paper for part of a ground-breaking scientific research project underway now in Mecklenburg County.

The project is the "Mecklenburg Breeding Bird Atlas," and it will tell researchers, for the first time, precisely which species of birds still make their homes in the county - and how Mecklenburg's rampant development may be affecting their populations. Some 125 species breed in the county, while others make it their temporary home. The collecting of data about the birds is being done in a scientifically repeatable way so that it will serve as a baseline for the future, to help birders and scientists document changes in a region where the human population is projected to jump by nearly 300,000 by 2030. The book also will include a section on the lost birds of Mecklenburg - species like the passenger pigeon, which once fluttered through downtown Charlotte.

Such atlases have been done at the state or regional level, but it's rare for a county to pull off such a feat, which relies on donated funds and dozens of volunteers - "citizen scientists" - to walk through neighborhoods, parks, and city streets over the course of three years, watching for nesting birds and recording what they see.

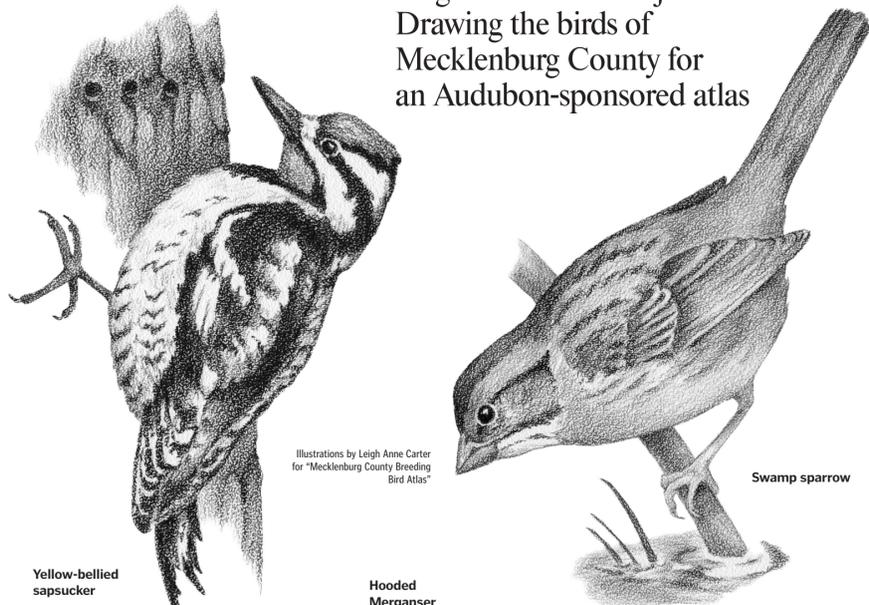
"These animals represent the health of [the] overall habitat," said Donald Serif, "Breeding Bird Atlas" coordinator and conservation biologist for Mecklenburg Park & Recreation. "If you lose the bird, you lose hundreds of other species."

Both the data and Carter's drawings tell a story of loss and survival. There's the barn owl, an elegant, ghostly species which once nested throughout the county but which is now reduced to a single bird. And then there's the great blue heron, which disappeared from Mecklenburg County for more than 50 years - but now has rebounded so successfully that local scientists no longer worry about watching for its nests.

After the data-gathering is complete next year, the end result of the bird atlas will be a searchable database and a published book, with Carter's illustrations enlivening every page.

"I was searching for a while to figure out what my calling is, and with art and the natural world - it emerged," Carter said. "I can't ask for anything more fun. It's the best!"

That's not to say science illustration is a field thick with jobs. "You



Yellow-bellied sapsucker

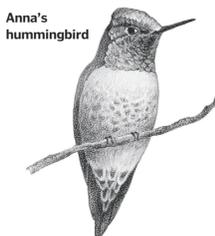
Hooded Merganser duck

Swamp sparrow

Illustrations by Leigh Anne Carter for "Mecklenburg County Breeding Bird Atlas"



Acadian flycatcher



Anna's hummingbird

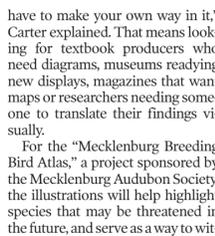
is done well adds a tremendous amount to any publication on plants or animals," said Serif. The atlas also will include photographs, but unlike photos, illustrations can "emphasize information with close-ups and detail," Carter said, and provide a "lively portrait" showing the most typical examples of a species' markings or form.

Carter, a Charlotte native, began a fascination with drawing and the natural world at a young age. Originally, she thought she might become a veterinarian, an ambition quashed after she sat in to observe a surgery on a cat - and quickly fled the room.

After undergraduate work in art and writing at UNC Wilmington, she studied science illustration at California State University at Monterey Bay. Then she embarked on a series of projects and internships around the country, leaving in her wake a trove of science art: watercolors of Appalachian salamanders, brochures for wildlife groups, a series of intricate flea beetle drawings for a Smithsonian scientist's research and more.

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Anna's hummingbird

have to make your own way in it," Carter explained. That means looking for textbook producers who need diagrams, museums readying new displays, magazines that want maps or researchers needing someone to translate their findings visually.

For the "Mecklenburg Breeding Bird Atlas," a project sponsored by the Mecklenburg Audubon Society, the illustrations will help highlight species that may be threatened in the future, and serve as a way to witness nature "through someone else's eyes," said Jill Palmer, president of Mecklenburg Audubon Society. "You talk to a lot of birders... (and they say) photos are good to document, but those exact field marks, you can't always get from a photo. You need a good drawing."

of the Guild of Natural Science Illustrators, a national trade group, says digital tools are important to science illustration, but anyone in the field is going to need traditional skills first.

"Most contemporary scientific illustrators use digital technology to one degree or another. Almost all of them admit that mastery of traditional approaches to drawing and painting is critical to developing a digital style that is aesthetically pleasing," said Rawlins, a professor of art at Arcadia University in Pennsylvania. "Many illustrators begin their renderings with sketches, and depending on the setting - for example, an archaeological dig or a perch high in the rainforest canopy - a pencil and pad of paper are generally the best materials to use."

The main thing, Rawlins said, is that science illustration strives for clarity along with aesthetic quality: "When the illustrator appreciates the value of an aesthetic approach, (he or she) can often convince the scientists that this is the way to go, thus preserving a certain classical look," he says.

Carter, who recently began work on bird drawing No. 205 - a blue-winged teal - said she's hopeful that good illustrations will draw in people who don't think they're interested in science. "You're trying to show the public (science) might not be that difficult to understand if you look at it in a different way," she said. "And hopefully drawings and paintings will get people who aren't interested in being outside interested in it."

For herself, Carter finds that a months-long focus on drawing birds has her noticing all the creatures perching and flying around her.

"Every time I'm drawing something, I fall a little bit in love with it," Carter said, "and after 205 birds, I'm not tired of them."

Science Briefs

>> Neanderthals' home use? Like modern humans'

Scientists have found that Neanderthals organized their living spaces in ways that would be familiar to modern humans, a discovery that once again shows similarities between these two close cousins.

The findings, published in the latest edition of the Canadian Journal of Archaeology, indicate that Neanderthals butchered animals, made tools and gathered round the fire in different parts of their shelters.

"There has been this idea that Neanderthals did not have an organized use of space, something that has always been attributed to humans," said Julien Riel-Salvatore, assistant professor of anthropology at the University of Colorado Denver and lead author of the study. "But we found that Neanderthals did not just throw their stuff everywhere but in fact were organized and purposeful when it came to domestic space."

— UCDENVER.EDU

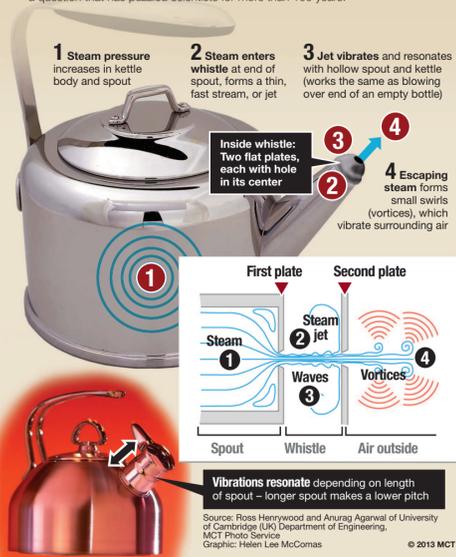
>> Loofahs could help save energy, lessen waste

Loofahs, best known for their use in exfoliating skin to soft, radiant perfection, have emerged as a new potential tool to advance sustainability efforts on two fronts at the same time: energy and waste. The study that describes the pairing of loofahs with bacteria to create a power-generating microbial fuel cell (MFC) appears in the journal Environmental Science & Technology.

Some bacteria have the ability to convert waste into electric power, but current MFC devices can be expensive and complicated to make: The pores in the cells' electrodes are often too small for bacteria to spread out in. Researchers have turned to plant materials as a low-cost alternative, but pore size has still been an issue. Loofahs, which come from the fully ripened fruit of loofah plants, have very

Where a kettle gets its whistle

Researchers have finally worked out how a whistling kettle makes its shrieking noise - a question that has puzzled scientists for more than 100 years.



large pores, yet are still inexpensive.

When the scientists put nitrogen-enriched carbon nanoparticles on loofahs and loaded them with bacteria, the resulting MFC performed better than traditional MFCs. The research team was led by Shungui Zhou of China's Guangdong Institute of Environmental Science & Technology.

>> TV documentary sparks physics-engineering paper

When Virginia Tech engineering professor James Hanna and Jamal Guven, of nuclear sciences institute of the National Autonomous University of Mexico, were visiting a colleague in France, they spent one rainy day watching TV - and stumbled across a

documentary about whirling dervishes, members of the mystic Sufi order of Islam who spin at a fixed speed in their floor-length skirts. Intrigued, Hanna thought about rotating flexible structures; the two physicists thought about conical symmetry: shapes that can be defined as a series of straight lines emanating from a single point.

The trio pooled their ideas and co-wrote "Whirling Skirts and Rotating Cones," a paper published last month in New Journal of Physics that widens the understanding of the dynamics of flexible objects and of pattern formation in rotating systems. The work may also "shed some light on the previously known instabilities of turbine disks and hard disks," Hanna said.

— VTNVNEWS.VT.EDU

In the news

This watchman would roll

If operational, robot could work for \$6.25 an hour

BY JOHN MARKOFF
New York Times

The night watchman of the future is 5 feet tall, weighs 300 pounds, looks a lot like R2-D2 and will cost just \$6.25 an hour.

Knightscope, a company based in Sunnyvale, Calif., has developed a mobile robot, known as the K5 Autonomous Data Machine, as a safety and security tool for corporations, schools and neighborhoods.

"We founded Knightscope after what happened at Sandy Hook," said William Santana Li, a co-founder of the company. "You are never going to have an armed officer in every school."

The minimum wage in the United States is \$7.25, costing in substantially under that cost, Knightscope's robot watchman service raises questions about whether artificial intelligence and robotics technologies are beginning to assault the workforce.

The K5 is the work of Li, a former Ford Motor Co. executive, and Stacy Dean Stephens, a former police officer in Texas. They gained some attention in June for their failed attempt to manufacture a high-tech police cruiser at Carbon Motors Corp. in Indiana.

The co-founders have chosen to position K5 not as a job killer, but as a system that will upgrade the role of security guard, even if fewer humans are employed.



KNIGHTSCOPE

Knightscope's K5 Autonomous Data Machine: The mobile robot is being developed as a safety and security tool for corporations, schools and neighborhoods.

"We want to give the humans the ability to do the strategic work," Li said in a recent telephone interview, describing a highly skilled analyst who might control a herd of security robots.

The robot is still very much a work

in progress. The system will have a video camera, thermal imaging sensors, a laser range finder, radar, air-quality sensors and a microphone. It will also have a limited amount of autonomy, such as the ability to follow a preplanned route. It will not, at least for now, include advanced features such as facial recognition, which is still being perfected.

Li envisions a world of K5 security bots patrolling schools and communities, in what would amount to a 21st-century version of a neighborhood watch. The all-seeing mobile robots will eventually be wirelessly connected to a centralized data server, where they will have access to "big data," making it possible to recognize faces, license plates and other suspicious anomalies.

Li said he believed he could circumvent privacy-rights objections by making the data produced by his robots available to anyone in a community with access to the Internet.

"As much as people worry about Big Brother, this is as much about putting the technology in the hands of the public to look back," he said. "Society and industry can work together on this issue."

This is essentially a reprise of the debate over Google's Street View system, which has drawn opposition from privacy advocates. But while Google's cars captured still images infrequently, a pervasive video and audio portal that autonomously patrolled a neighborhood would in effect be a real-time Street View system.

Science Blog

Psychologist explores dark corners of his field

BY SAM BOYKIN
Correspondent

After receiving his doctorate in psychology from York University in Toronto, Romeo Vitelli spent 15 years as a staff psychologist in Millbrook Correctional Centre, a maximum-security prison in Ontario.

In 2003, he "successfully escaped" to go into practice full time. Vitelli is also a disaster-management volunteer with the Red Cross.

His blog, Providentia (www.drvitelli.blogspot.com), is Vitelli's "biased look at psychology in the world." Find Vitelli via Twitter at @rvitelli

Q. What was it like working at Millbrook Correctional Centre?
As a maximum-security facility, we got the cases that couldn't be handled anywhere else in the province. This included sex offenders and people who needed special protection because of problems with mental illness or who couldn't be held safely anywhere else.

It was a strange place at times, but I got exposure to a range of psychiatric problems.

Q. What psychology issues do you blog about most often on Providentia?

It's basically my chance to say what I want in my own personal corner of the Internet.

Along with interesting news items that tend not to get much play in the regular news sites, I also talk about interesting new research studies, most of which rarely get any coverage (topics range from assisted suicide to the health risks of loneliness to demonic possession).

I also have a fascination with bizarre episodes from history that most people have no idea about, such as the 1949 demonic possession case in St. Louis that inspired the movie "The Exorcist."

Q. What would you most like to convey to readers about your blog?

With Providentia, I am trying to provide a resource for people to consult about mental issues, including mental illness, suicide, recent research and history.

Q. After practicing psychology for 25 years, what kind of insight into human behavior do you bring to your blog?

Many people tend to be invisible in our society since others prefer not to acknowledge their existence. I try to deal with that, to some extent. I also focus on how people with mental illness are treated in developing nations, including cases where they have been accused of being witches or possessed by demons.

Some incidents can be horrific, but it is important to call attention to them when possible.

samboykin4@gmail.com

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