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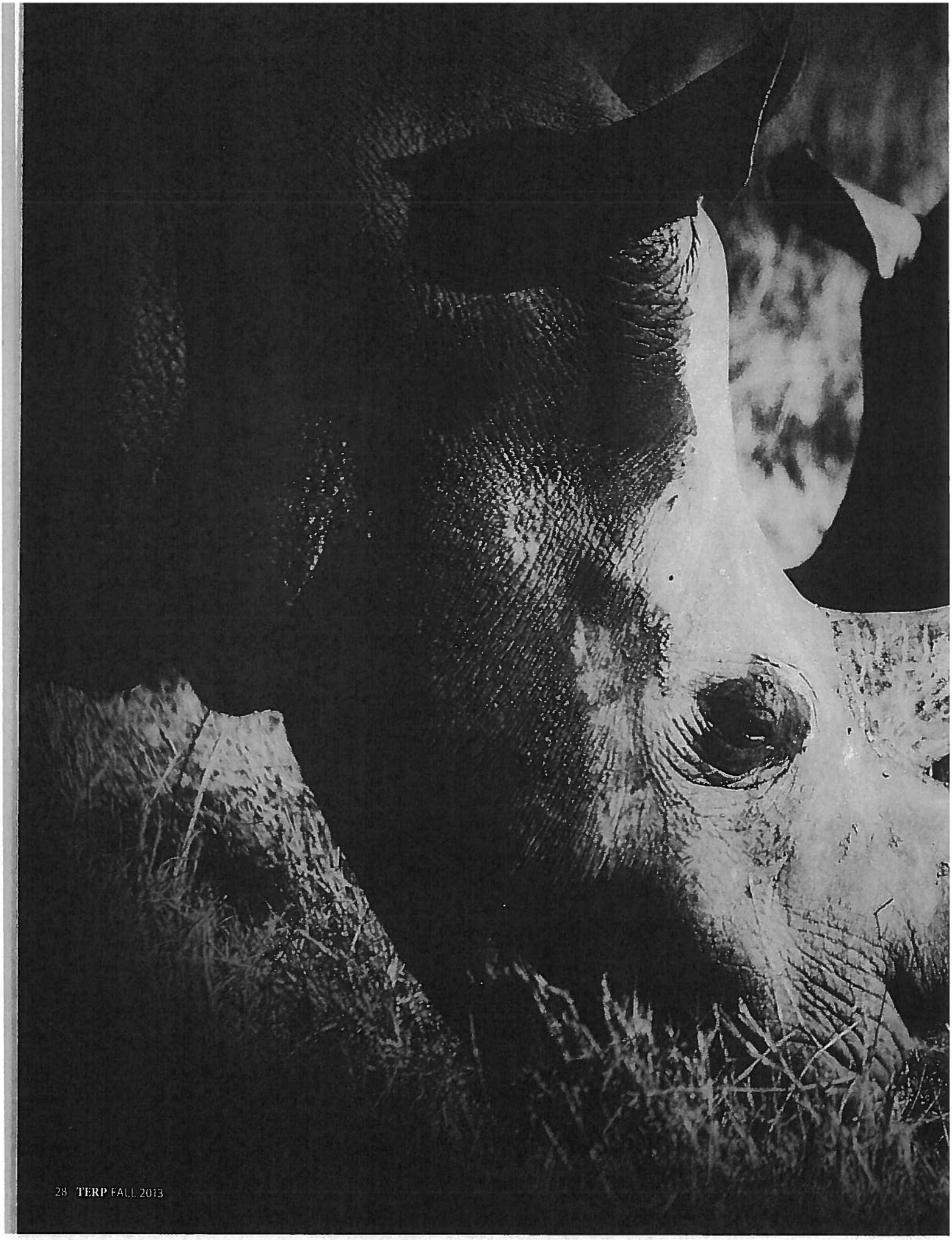
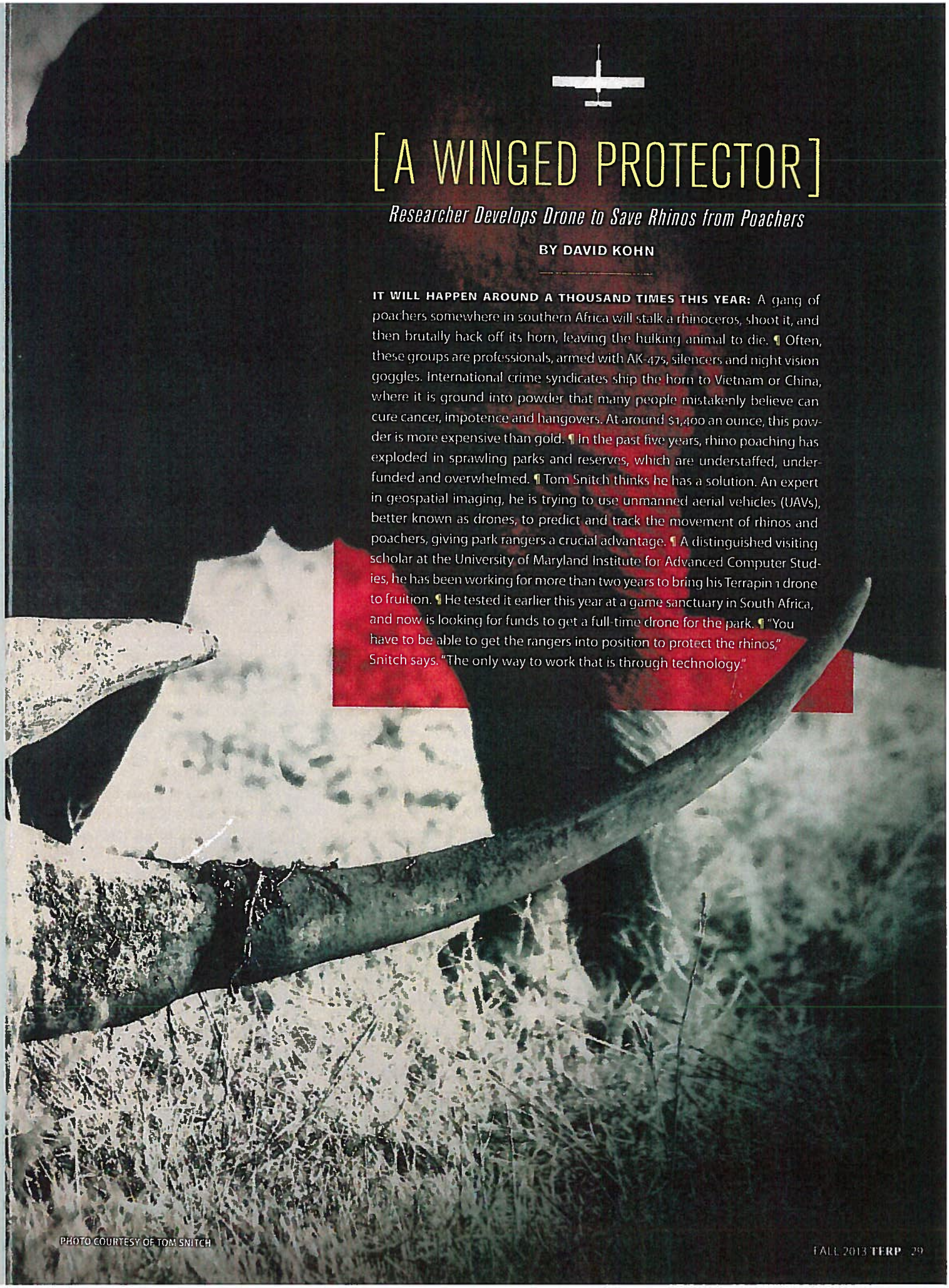
SHEPHERD IN THE SKY

Researcher Develops Drone to Save Rhinos from Poachers, pg. 28





[A WINGED PROTECTOR]

Researcher Develops Drone to Save Rhinos from Poachers

BY DAVID KOHN

IT WILL HAPPEN AROUND A THOUSAND TIMES THIS YEAR: A gang of poachers somewhere in southern Africa will stalk a rhinoceros, shoot it, and then brutally hack off its horn, leaving the hulking animal to die. ¶ Often, these groups are professionals, armed with AK-47s, silencers and night vision goggles. International crime syndicates ship the horn to Vietnam or China, where it is ground into powder that many people mistakenly believe can cure cancer, impotence and hangovers. At around $1,400 an ounce, this powder is more expensive than gold. ¶ In the past five years, rhino poaching has exploded in sprawling parks and reserves, which are understaffed, underfunded and overwhelmed. ¶ Tom Snitch thinks he has a solution. An expert in geospatial imaging, he is trying to use unmanned aerial vehicles (UAVs), better known as drones, to predict and track the movement of rhinos and poachers, giving park rangers a crucial advantage. ¶ A distinguished visiting scholar at the University of Maryland Institute for Advanced Computer Studies, he has been working for more than two years to bring his Terrapin 1 drone to fruition. ¶ He tested it earlier this year at a game sanctuary in South Africa, and now is looking for funds to get a full-time drone for the park. ¶ "You have to be able to get the rangers into position to protect the rhinos," Snitch says. "The only way to work that is through technology."

PHOTO COURTESY OF TOM SNITCH

A SPIKE IN DEMAND

About 85 percent of the world's 24,000 rhinos live in South Africa. According to the South African government, 668 were killed there last year, up from 13 in 2007. Kirsty Brebner, who oversees rhino protection for the Endangered Wildlife Trust, a South African conservation group, says between 800 and 900 will die this year. (Getting comprehensive numbers for other African countries is difficult, because many parks and governments don't keep a careful count.) She calls the rate of killing "absolutely unprecedented."

There are two species in Africa: white rhinos, which have two horns, and black rhinos, which have one. About 19,000 of the former survive, and 5,000 of the latter—down from a total of 100,000 a century ago. Although neither species is in immediate danger of extinction, experts say poaching could sharply reduce their population.

The horns have no medicinal value; they consist largely of keratin, the same material as human fingernails. But in Vietnam and China, the growing middle class has been gripped by a kind of mania for rhino horn, driving demand and prices higher and higher. Lured by the prospect of enormous profits—a single horn can be worth several hundred thousand dollars—poachers have become increasingly aggressive and sophisticated. They hire ex-paramilitary soldiers and use high-powered weapons and helicopters. Sometimes they recruit corrupt veterinarians to tranquilize the animals beforehand, reducing noise during the kill.

Craig Sholley, an official at the African Wildlife Foundation, says parks and reserves lack the rangers, vehicles and equipment to stop poachers: "We haven't been able to keep up."

A KINSHIP WITH A CONTINENT

A burly, gregarious man with a drooping mustache and salt-and-pepper hair, Snitch, 58, fell for Africa a decade ago, when he and his wife starting coming for annual trips. They mostly hike and photograph animals, including rhinos, water buffalo and elephants. He especially loves the savannahs and steppes of southern Africa. Though not religious in the traditional sense, he feels spiritual about the terrain and its creatures.

"The horizon is 25 miles away, in all directions. You get this amazing feeling of what the planet must have been like 100,000 years ago," he says. "You can go to a watering hole, and you are part of a different world. It makes you feel small, but in a good way. I'd hate for these animals to be gone."

After years of hearing about the explosion in rhino killings from his ranger and warden friends, he decided to do something.

His background is not that of a typical conservationist. He has a master's in Japanese and a doctorate in international economics, and he did postdoc work in nuclear physics and reactor design at Los Alamos and Oak Ridge national laboratories. In the 1980s he worked for the Reagan administration as an arms negotiator and learned the value of satellite monitoring—both the Soviets and Americans relied on images from space to check on each other.

He then became a consultant on defense issues, working in several Asian countries—he is fluent in Japanese and Chinese, knows some Thai and speaks passable Swahili. Over the past year, he has been helping a U.S. engineering company coordinate with Japanese officials to clean up Fukushima, the nuclear plant decimated by the 2011 earthquake and tsunami.

As he sees it, all of his jobs have one thing in common: "I solve problems. I fix things. I'm basically a mechanic."

FROM IRAQ TO SOUTH AFRICA

A decade ago, Snitch met then-university president Dan Mote, who encouraged him to get involved with the university. In 2006, Snitch joined the board of visitors of the College of Computer, Mathematical, and Natural Sciences, and began working on projects there.

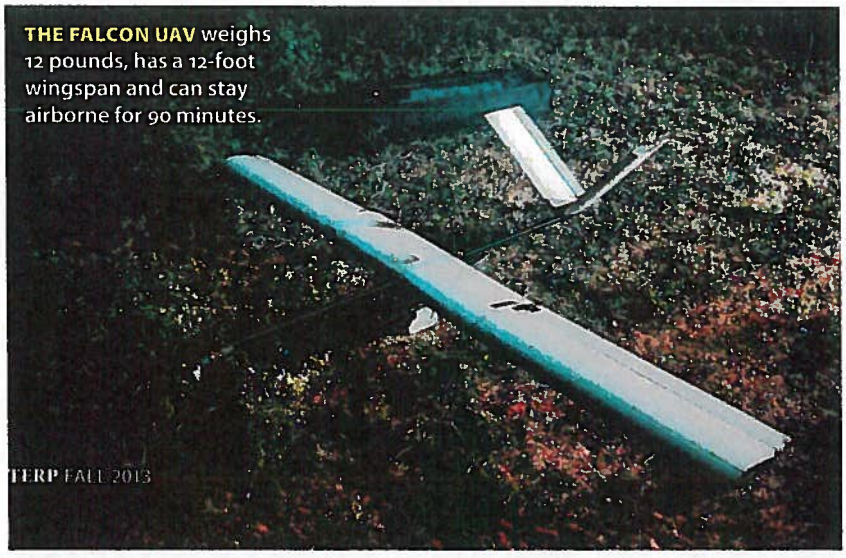
Three years ago, he linked up with Maryland computer science Professor V.S. Subrahmanian, who was working on computer models to predict clandestine human behavior, such as where insurgents will put roadside bombs in Afghanistan or hide weapons caches in Baghdad.

They talked about how this approach could also be adapted to protect rhinos. "Human behavior has patterns," Snitch says. "Animal behavior has patterns. You just need the right data."

But unraveling how poachers and rhinos move was only part of their idea. They wanted to use prediction models to run drones that would send real-time video of rhinos to rangers patrolling on the ground. When poachers threatened, the rangers would know right away.

This strategy has a significant advantage over the current one, which relies on ground-based patrols. In large parks, and even in small ones, there's no way for rangers to keep track of so many rhinos. The software and the drones wouldn't solve this problem, but—in theory at least—they would allow officials to see much more.

Subrahmanian says the key is distilling a limited number of variables into an algorithm that narrows down when



THE FALCON UAV weighs 12 pounds, has a 12-foot wingspan and can stay airborne for 90 minutes.

PHOTOS FROM LEFT: FRANK POPE/ SAVE THE ELEPHANTS; JOHN T. CONSOLI

IN DEMAND, UNDER ATTACK

Thousands of years ago, rhinos lived throughout Africa, Asia and even Europe. Today, though, the animals exist only in southern Africa, India and Java and Sumatra. As many as 850,000 rhinos roamed the planet a century ago, but today there are only about 29,000 in the wild, mostly in South Africa. Poaching has decimated their numbers in the past decade, with 668 animals killed in South Africa alone.

HABITAT Grasslands, savannahs, shrub lands and tropical forests

SIZE 4–10 feet long, 6 feet tall

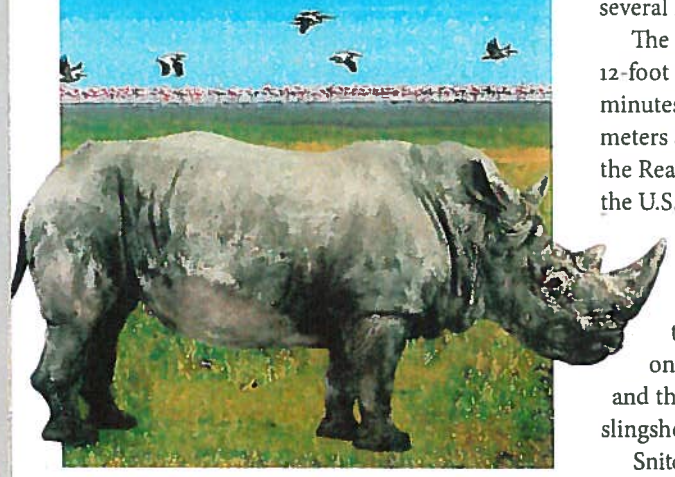
WEIGHT 1,500–6,000 pounds. Despite their size, rhinos can run up to 30 mph.

HABITS Sleeping, resting in the shade or wallowing in bodies of water. They tend to eat and drink at night.

HORNS Can reach a length of four feet. Some sanctuaries have tried removing rhinos' horns to dissuade poachers. This procedure does not hurt the rhino, which can survive without the horn. However, the horn is so valuable that poachers often kill the "hornless" rhinos for the leftover stump.

ODD FACTS A group of rhinos is called a "crash." They have three toes, and although they are called pachyderms, are more closely related to horses than elephants.

Sources: World Wildlife Foundation, Save the Rhino, *Savingrhinos.org*, International Union for Conservation of Nature



A GROUP OF four Park vehicles, as seen at night by the drone's infrared camera. The white dot to the right of the vehicles is a ranger. The image was taken during a test. A vehicle's heat "signature" depends on whether the engine is running. For example, if a car sits all night in the cold, it would probably not have a signature by dawn.

and where the drones should look: past rhino locations, as well as specs on the weather, terrain and season.

"We want to plan a flight path for the drone so that the number of unprotected animals is as small as possible," he says.

FINDING THE PERFECT VEHICLE

As he worked with Subrahmanian, Snitch hunted for the right drone. He spent months learning about the hundreds on the market. Conservationists and game parks don't generally have large budgets, so the vehicle would have to be relatively inexpensive. The harsh, dusty climate of southern Africa wears down machines; spare parts are hard to get, and repair people are often far away, so the drone would also need to be sturdy and easy to fix.

Eventually, he came across a model that fit his specifications: the Falcon, made by a small company in Colorado. He convinced company owner Chris Miser to lend him several machines for testing.

The Falcon weighs 12 pounds, has a 12-foot wingspan, can stay airborne for 90 minutes, and typically hovers 200 to 300 meters above the ground. Compared with the Reaper, a 7,000-pound vehicle used by the U.S. military, it's a toy. But the Falcon costs $21,000, camera included, far less than the Reaper's $17 million price tag. Snitch sends the vehicle airborne by attaching one end of a bungee cord to a tree and the other end to the fuselage, then slingshotting the machine aloft.

Snitch contacted parks, reserves and environmental groups to gauge interest in his idea. He found none. Most parks are on government land, and Snitch says officials were wary of having a "foreign" drone—even a small, cheap one—flying over their territory. In addition, he says, many officials were suspicious of technology in general.

Finally, with the help of the Endangered Wildlife Trust, he convinced a private sanctuary, Olifants Nature Reserve, to allow him to test the drone.

Home to rhinos, elephants, water buffalo and giraffe, Olifants is mostly open savannah. It has more rangers than most parks in Africa and covers a relatively small area—about 38 square miles. It hasn't lost any rhinos this year, but even so, officials there worry about poachers: It abuts 7,500-square-mile Kruger National Park, where hundreds of rhinos have been poached annually.

SEARCHING FOR RHINOS

In June, Snitch flew to Africa with two drones and three questions: Would Terrapin 1 work in the dusty conditions of the African bush? Could its infrared camera see animals and people at night? And could the software predict where the rhinos would be?

In the months before the tests, officials sent Snitch data about rhino movement, poaching attacks and weather; once there, he talked more with the rangers, who knew the park and its animals, and added new details to the software. He sometimes had to translate their perspective before putting it into the computer model: "You'd ask,

PHOTO PROVIDED BY SHUTTERSTOCK; VIDEO STILL COURTESY OF FALCON UAV

'Where was this last incident?' and they'd say, 'It was a half day from the big rock.' So you'd have to figure out which rock it was, and which direction they'd mean."

Then came the field tests: 11 flights, including five at night. On the first night test, the drone found rhinos. "We see the rhinos going toward the fence, and then we see a car on the other side of the fence. It stops, and some guys get out," Snitch recalls. The group didn't pursue the rhinos, but the incident illustrated the system's potential.

Terrapin 1 wasn't perfect: Miser says the vehicle had trouble detecting animals hidden by brush and trees. And Brebner of the Endangered Wildlife Trust notes that even if they do work, drones won't shut down poaching on their own. They won't eliminate the shortage of rangers and equipment, endemic corruption and rising demand for horn—all key drivers of the epidemic.

"I think they will be useful," she says. "But I'm afraid there is no cure-all. This is just a tool."

Other groups are also experimenting with drones. In December, the World Wildlife Fund received a $5 million grant from Google to pursue a range of anti-poaching technologies, including drones. In June, the group tested a drone in Nepal, which is home to endangered rhinos, tigers and elephants. Earlier this year, Kruger Park tested a small drone made by a South African company. Park spokesman Isaac Phaala says the drone had some of the same difficulties as the Falcon, such as tracking animals and humans in areas with trees and bush.

Despite the glitches, Snitch thinks the technology will only get better. Eventually, he says, multiple drones could be used to create an "aerial curtain," providing surveillance over thousands of square miles of territory and protecting not only rhinos, but also elephants and other endangered animals. He has been talking to a range of conservation groups and foundations about using drones elsewhere, and is trying to secure funds for a full-time drone for Olifants.

"You get a few smart people who are enthusiastic," he says, "and you'd be amazed at what you can do." **TERP**