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ATTACK OF THE DRONES

Assistant Professor Adam Scott Wandt and his team of graduate students up the ante on cybersecurity

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Imagine a wallet-sized flying machine hacking into terrorists' networks without endangering the lives of U.S. soldiers. Assistant Professor Adam Scott Wandt did, three years ago. "But until last semester, I didn't have enough students interested in creating a unique drone configuration with custom software that intelligence agencies could use," says Wandt, Assistant Professor of Public Policy at John Jay College.

Enter his drone dream team: Digital Forensics and Cybersecurity graduate students Matthew Alilionis, Frederick Chan, and Alexa Zinder. These self-admitted gadget geeks tackled the shortcomings of current unmanned aerial systems used in the government's lawful collection of data. During the

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BY MICHELE MEYER

(left to right) Frederick Chan, Matthew Alilionis, professor Adam Scott Wandt, and Alexa Zinder

course, the team learned about the security, interception, and forensics of private communications—wifi, cellular, and network based. "They wrote a lot of new code and patched it all together in a computer array the size of a cigarette pack," says Wandt. "Then they attached the computer to a custom-built drone programed to remotely deploy and operate the entire system."

Wandt believes students learn best by doing hands-on research, and his students agree. "It's not like literature or ancient history, which you can teach out of a textbook," says Alilionis. "Cybersecurity changes on a weekly basis."

This trio's assignment: take cutting-edge technology to a new level to protect our nation. "If we can save American lives with

$1,000 to $2,000 in hardware, it's so worth it," says Wandt.

The first concern: power. Most drones are battery-juiced and can fly only 30 minutes, tops, says Chan. Solved: Attached solar-panels allow the devices to travel greater distances, if continuously powered by sunlight. The second concern: destination. Drones need to know where to go, without nearby humans at the controls. Solved: Students programmed coordinates to specify the exact flight path and landing site. Third: secrecy. Drones need to fly undetected. The students' current drone is the size of a microwave, but their goal is to shrink it to the size of a Rubik's cube, Wandt says.

Last May John Jay hosted a training for the New York Office

of the FBI in our forensics lab. After Wandt gave a lecture, three student groups presented their work, including the drone team. "Of three student presentations, this one got immediate attention. They told us they see great potential," says Wandt. Who can blame them? The team's project could save American lives, but while the race is on for using the technology for security purposes, others are attempting to use it for harm. Last August, two drones armed with explosives were allegedly sent to assassinate Venezuelan president Nicolás Maduro at an outdoor rally. They failed, but the attempt garnered worldwide attention. "The technology could be used against us, for terrible motives," Wandt says. "We're fully aware that we're not the only people thinking of this."

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In fact, the risks have been known for more than a decade. In 2003, Dennis M. Gormley, then a senior consultant at the James Martin Center for Nonproliferation Studies in Monterey, California, warned of drone attacks in the *Nonproliferation Review*.

Unmanned aerial vehicles can also be used to cause airplane crashes and to violate Fourth Amendment rights against

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unreasonable and unlawful searches. Those are among the reasons drones are banned near airports and throughout New York City, and why law enforcement immediately disables drones flying within no-fly areas.

To heed the law, Wandt and his students set up and then hacked their own network with hot spot/wireless capability. They also flew their drone indoors, with lab-generated signals. "We need to build it to know what it's capable of, and how it can be exploited," says Zinder. "If we don't, someone else will."

Wandt's "Interception and Forensics of Private Information" students are up to the task, thanks to already impressive credentials. Project leader Alilionis, M.S., has worked in law enforcement for 12 years. "The threats of drones and terrorism are hot topics where I work." In high school, he built computers from scratch, but he'd never assembled a drone. So he combed the internet for open-source software. "That was the most difficult part, and the most exciting," he says. "It's like building a remote-control race car. I modeled it after other drones I'd seen online. I tried to get similar parts, which was another challenge." Unable to find a 3-D printer up to the task of producing top-flight parts, Alilionis had to order them online. "On a student budget, I didn't have much money to play with." Onboard the drone is a small Raspberry Pi 3 computer. It can hack into networks. "These devices need to be in close proximity to the source to function," says Wandt. "The drone provides a safe way to get the equipment into place without the need to send a person to physcially position it."

Chan is a retired IT systems analyst obsessed with robotics. He's invented facial- and voice-recognition drones and robots that dance to Michael Jackson's *Smooth Criminal*. Yet Chan realizes he's barely tapped the potential of "IoTs"—that's short-hand for "Internet of Things," the sensors and software

Wandt and his students preparing for flight

that enable self-driving cars and voice- and touch-activated icemakers on refrigerators. Not long from now, Chan expects that all supermarkets will ring up purchases as shoppers exit stores, without even having to check out.

Meanwhile, Zinder, M.A., a junior systems administrator, coordinates all the FBI projects and student communications. "I've always been interested in how things work," she says. "But luckily for my parents, I never took apart anything." Chan's and Zinder's performance has been so impressive that the school has hired them as adjunct professors. "All three students are go-getters," says Wandt. And, though the course has ended, "this has become a priority in their lives. It's an excellent example of what John Jay students can do, and it has allowed them to shine for prospective employers."

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The students feel that Wandt is a shining example of what the College can offer. "He does everything he can to help you develop and explore your interests," Zinder says. "It's amazing to have a teacher this invested in his students way beyond the classroom." Adds Alilionis, "Adam is very personable and likes the same stuff we do. We feed off each other."

The future of drones seems limitless. Soon, every Amazon package will be delivered by a drone. "It's only a matter of time before we have daily exposure to them," Wandt says. But secret drones may be the most valuable. "Maybe someday local police departments will use them," Wandt continues, "and eventually a small drone could drop from another drone flying overhead. It's almost like a scene in *Star Wars*. In fact, it probably is." **JM**