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### Politics & Policy

#### Why the Professor Went to Prison

By [Daniel Golden](#) on November 01, 2012

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**After lunch in his cell in the federal prison in Ashland, Ky.,** John Reece Roth noticed something unusual. Tiny red ants were swarming across his floor, feasting on candy bar scraps. Knowing that ants establish a trail to and from their food, Roth devised a trap: a Möbius strip with an on-ramp but no off-ramp. Ants carrying their prize home would climb onto the strip—a sheet of paper half twisted to have only one side and one edge—and be corralled. Fortunately for them, Roth couldn't test his contrivance properly because the Scotch tape needed to secure it is contraband at Ashland.

"I still have some inventing ability," says Roth, in a resonant voice that once filled lecture halls at the University of Tennessee in Knoxville. Round-faced and bespectacled, he exudes poise and self-assurance, even wearing prison khakis and sneakers and leaning on a four-footed cane. Roth, an emeritus professor of electrical engineering, taught and researched at Tennessee for nearly 30 years. A former scientist at NASA, he holds 11 patents and has testified before Congress on nuclear fusion.

He's also the only university professor or administrator ever prosecuted for violating the Arms Export Control Act (AECA). Convicted in federal district court in Knoxville in 2008 of using graduate students from China and Iran on U.S. Air Force research that was off-limits to foreigners, and taking a laptop with restricted files to China, he exhausted his appeals up to the Supreme Court, which declined last year to hear the case. He began serving a four-year prison sentence in January.

The AECA has been around for 36 years; that it's being used for the first time against a 75-year-old man epitomizes the growing tension between national security and academic freedom. American universities have long forged relationships with their counterparts abroad and attract hundreds of thousands of foreign graduate students and professors, especially in engineering and science. At the same time, universities are doing more defense-related research limited by the act to U.S. citizens and permanent residents. As China, Iran, and other

countries chase U.S. technological secrets, federal enforcement agencies see universities—and globe-trotting professors such as Roth—as a weak link. “The open environment of a university is an ideal place to find recruits, propose and nurture ideas, learn, and even steal research data,” the FBI said in a 2011 report. “It is unknown how the Chinese used the information they obtained from Roth, but because they invited him to visit China and he had a sensitive report e-mailed to him while there, it should be assumed they were interested in his research and planned to utilize it.”

From jail, Roth contends that true national security is rooted in tapping the world’s best minds, regardless of nationality. As he tells it, he’s a martyr for the open exchange of ideas. “I see this interpretation of the export control act and concern about homeland security as a deadly threat to free scholarly inquiry,” he says. “The problems I worked on in the plasma lab were not easy problems. They were hard problems. When anyone who does research refuses to hire Chinese or Iranian students, they’re cutting off their nose to spite their face.”

Roth has supporters. “I thought the whole thing was a waste of government money and time,” says Joseph Googe, former chairman of electrical engineering at the University of Tennessee, who hired Roth there. “The feds seemed to want to make a big case out of it.” Others are critical. “Roth was very industrious, a brilliant engineer, but his ego got in the way,” says A.J. Baker, an emeritus professor at Tennessee who consulted on the U.S. Air Force project and watched as Roth’s stubbornness helped shutter a cutting-edge research company with 25 employees. “He’s responsible for his own demise,” says Baker.

Roth’s high-handed approach to export controls also shattered the promising career of his former protégé and collaborator, Daniel Sherman. He cooperated with investigators and became a key witness against Roth, but also served a year in jail. “I don’t quite agree with him being as renowned as he thinks he is,” Sherman testified.

**Roth’s basement ranch house in suburban Knoxville, abutting a golf course fairway, displays silk screens and other mementos from his Asian trips. In the garage, a Buick (GM) LaCrosse proclaims his research specialty on its license plate: “Plasma.” Plasma—the glowing ionized gas found in lightning, TV sets, and fluorescent lamps—is also the name of his cat. With his owner in prison, Plasma lives with Roth’s wife of 40 years, Helen.**

The Roths, who have two children, are transplanted northerners. Helen, 70, comes from Cleveland. Roth grew up in Pennsylvania, where his father taught science education at a state college. A science fiction buff, Roth was president of the Rocket Research Society as an undergraduate at Massachusetts Institute of Technology before earning his doctorate at Cornell in 1963 and going to work at NASA. When NASA cut funding for his research area, Roth left for the University of Tennessee in 1978.

Before his fall, he was best-known for his book *Industrial Plasma Engineering*, which came out in 1995. It was followed by a second volume in 2001. Both were translated into Chinese, prompting a flood of lecture invitations and graduate student applications from China. Roth has made at least eight trips to the country since the late 1980s and was named an honorary professor at two universities there. “You know, in China, Dr. Roth have a very high prestigious reputation,” testified Xin Dai, his Chinese student on the U.S. Air Force project. “It is almost like a dream to me to come over here. I appreciate him very much.”

The University of Tennessee encouraged Roth and other professors to recruit abroad. Because many top American engineering students opt for industry jobs over graduate school, the foreigners strengthened Tennessee’s research. “The caliber of foreign students applying to my work was much better than the general run of U.S. students,” Roth says, adding that most of them intend to become U.S. citizens.

While he attracted talent, Roth also gained a reputation for taking credit for his students' innovations. In 1995, Mounir Laroussi, a former student who had become a research assistant professor working independently in Roth's lab, developed a method of using plasma to sterilize liquids. He says he asked the University of Tennessee to patent his invention, only to learn later that Roth, who outranked him, was also claiming the discovery. Laroussi complained to university officials, who referred the dispute to an arbitrator. Laroussi, now a professor at Old Dominion University, received a patent in 1999. Roth says he had "a great deal of documentation" of his contribution.

After the Laroussi flap, Roth inserted an unusual clause into his letter offering research positions to graduate students. "No matter what the outcome of your research," one letter obtained by *Bloomberg Businessweek* stipulated, "you should not expect to be considered an inventor of anything that results from activities that I originate or that you do under my general supervision." The provision simply codified what is typical practice in university labs, says Roth, adding that he was generous in citing students as co-authors on scientific articles.

**Daniel Sherman, 41, is six-foot-two with black hair and the high forehead of Civil War general William Tecumseh Sherman,** whom family lore claims as an ancestor. He grew up in a Tennessee shack with an alcoholic mother and a series of abusive stepfathers, and ran away as a teenager, according to court documents. His high school math teacher helped pay Sherman's freshman tuition at Tennessee, says Donny Palmgren, his former roommate, who's co-authoring a memoir with him. When Sherman entered graduate school, Roth became his adviser. A rare American in Roth's lab, Sherman found his Chinese counterparts unreliable, Palmgren says. Sherman and Roth "had argued for years about his inclusion of foreign students," Sherman testified.

With NASA funding, Roth, Sherman, and NASA scientist Stephen Wilkinson began exploring aerodynamic applications of plasma. In 1997, using a broken piece of glass with wires taped on it, Sherman demonstrated that an electrical device known as a plasma actuator could control the motion and direction of air. With proper adjusting of voltage and other design features, an actuator can enhance flight performance by ensuring that air flows smoothly over a wing. Roth graciously offered for Sherman to be the sole inventor, Palmgren says. Sherman declined, and the three researchers shared the patent.

The breakthrough impressed the U.S. Air Force. In April 2005 it awarded a \$749,751 contract to Atmospheric Glow Technologies, a Knoxville firm founded in 2000 by Sherman and two other University of Tennessee scientists to develop a model actuator to guide a drone.

The relationship between Roth and AGT was unusually guarded. Roth owned between 3 percent and 5 percent of AGT, and the company licensed his inventions from the university's research foundation. Nevertheless, the company didn't give him a management role, and, fearing that Roth might reveal its proprietary research in his articles or lectures, even banned him from the premises. Roth says he had no ambitions to run AGT and asked its executives himself not to tell him any trade secrets. Nevertheless, Roth complained to AGT and the foundation that they were lagging in commercializing his discoveries.

To placate him, and to be able to continue touting his name, AGT handed Roth and the university a \$73,000-a-year subcontract. A university official who reviewed the subcontract missed a potential stumbling block, the trial would reveal. As Roth had cautioned Sherman in October 2004, the project would be "subject to export controls."

Export controls occupy a middle ground on the secrecy scale between basic research, open to any nationality, and classified work, which requires a security clearance. Before a foreign national can participate in export-controlled research, the university must first obtain a license from the government. The State, Commerce, and

Energy departments each have different sets of export controls. State's regulations apply to military research, such as the Air Force project. Sharing information with foreigners in the U.S., as Roth did, is considered exporting by the State Department, which typically denies licenses for students from about 25 countries, including China and Iran.

The federal government depends on universities to disclose violations, and once they do, it usually lets them off with a warning. But faculty members say the line between basic and export-controlled research is blurry. Regulations exempt fundamental research that's ordinarily publishable or in the public domain—an exception Roth contends covered his work. “The fact that it is possible to do your due diligence and still run afoul of export controls is something a lot of us in the field are concerned about,” says Carl Lon Enloe, a physics professor at the U.S. Air Force Academy. “It's personally a little bit scary.”

The University of Notre Dame's Center for Flow Physics and Control avoids trouble by a simple expedient: rejecting foreigners from prohibited countries. U.S. citizens make up 80 percent of graduate students at the center, where six of eight projects are export-controlled, says director Thomas Corke. He turns down applicants from the Middle East because obtaining approval for them or segregating them to basic research is “just too difficult,” he says.

Roth preferred to use foreigners—and he didn't always tell the government about them. In April 2005, discussing a proposal for another Air Force contract, he advised Sherman in an e-mail to omit reference to a Chinese scientist's participation.

The use of plasma actuators for aerodynamics was arguably in the public domain. At least a half-dozen countries were researching actuators; the Russians had put one on a glider. Arms traffic regulations don't specify actuators as a controlled item. Still, the Air Force restricted AGT's contract because it was part of a weapons program. The goal was to improve the combat ability of drones by replacing cumbersome mechanical flaps with lighter actuators.

**Xin admired Roth from afar. Born in central China, he** earned his bachelor's and master's degrees from Hunan University of Science and Technology, where he encountered Roth's work. “Anybody interested in plasma engineering know Dr. Roth,” he would later testify. He applied to study for his doctorate under Roth, and joined the lab in 2002.

Roth liked Xin, and insisted on using him on the Air Force project over Sherman's objections. Sherman was reluctant to confront his mentor Roth, and later admitted he deliberately ignored indications that the research should have been restricted to Americans. To allay Sherman's fear that Xin would spirit AGT's trade secrets to China, Sherman and Roth compromised. While Xin would conduct basic research in Roth's lab, a U.S. graduate student, Truman Bonds, would handle more sensitive tasks such as wind tunnel testing at AGT and withhold that data from Xin.

This arrangement soon proved impractical. In July 2005, with the approval of both Sherman and Roth, Bonds and Xin began sharing reports. The following May, Roth proposed replacing Xin, who was about to earn his doctorate and leave the lab, with an Iranian, Sirous Nourgostar, a graduate student with a background in plasma aerodynamics. Taken aback, Sherman and AGT refused. Only a month earlier, President Mahmoud Ahmadinejad had announced that Iran had enriched uranium, prompting a diplomatic crisis.

Roth complained to Robin Witherspoon, who oversaw export-control compliance for the university. He said AGT was telling him how to run his lab and argued that a Chinese national had been working on the project for a year, so an Iranian shouldn't be a problem. Witherspoon soon realized that the project was export-controlled. She warned Roth, who was about to leave for a two-week lecture tour in China, not to take

sensitive files there or talk about the project.

While Roth headed to China, the university disclosed these concerns to AGT, the FBI, customs, and the State Department. When Roth returned, federal customs agents met him at the airport in Detroit. They photocopied documents in his briefcase and luggage, including one of Xin's weekly reports about the project and an agenda indicating Roth had lectured in China on using plasma to control aircraft.

Roth then flew to Knoxville, where FBI agents with a search warrant seized his laptop and a thumb drive containing another report by Xin. While there was no evidence that Roth opened that file in China, just bringing it there violated export controls. They also found a draft of a paper on plasma aerodynamics that Roth had been working on. Because Roth's own e-mail wasn't functioning in China, Roth asked Xin to send him the manuscript via a Chinese professor's e-mail address. In other words, Roth had arranged for Xin to send a sensitive document to a Chinese scientist.

Explaining that they were interested in the controversy that had arisen over his research before he left for China, the agents interrogated Roth in a corner of the airport lobby for two hours. Roth repeatedly denied that Bonds, the American student, had shared data with Xin, FBI agent Kevin Gounaud testified.

In later FBI interviews, Roth pontificated with the freedom normally accorded a professor with tenure, but not looked so kindly upon by FBI agents, or, later, jurors. He argued that discriminating against foreign students was prohibited by university policy, and that "would essentially trump" export controls. He also proclaimed that Iran didn't deserve its "bad guy status." Both pronouncements would haunt him at trial. In a letter to Tennessee's faculty, he denounced the FBI's "outrageous fishing expedition," the "federal intervention and snooping," and "this Orwellian gulag we have created in the name of national security."

Tightening the noose, the FBI equipped Xin with a recording device and sent him to talk with Roth. The gambit failed. When Xin confided that he was worried about testifying before a grand jury, Roth encouraged him to tell the truth.



Clay Owen/Knoxville News Sentinel Indicted on 17 counts, Roth refused to plea-bargain. "I won't go to my deathbed having admitted that I betrayed my country" **To avoid multiple charges, Sherman agreed to plead** guilty to one count of conspiring to violate export controls. He supplied e-mails and journal entries and testified against Roth. Despite his cooperation, he was sentenced to 14 months

in prison and served one year. His career and personal life disintegrated. He was barred from working on federal contracts and his relationship with a longtime personal partner broke up. He filed for bankruptcy in 2011, citing income of \$1,200 a month and debts of almost \$400,000, mainly student loans.

AGT sought bankruptcy protection in March 2008 and pleaded guilty that August to 10 counts of export-control violations. The University of Tennessee wasn't prosecuted. It didn't know of or condone Roth's actions and disclosed them to the government once they came to light, says Assistant U.S. Attorney Will Mackie. "I was surprised the university didn't even get its hand slapped," says former AGT Chief Executive Officer Thomas Reddoch.

Indicted on 17 counts in May 2008, Roth refused to plea-bargain. "He told me, 'I won't go to my deathbed having admitted that I betrayed my country,'" says his lawyer, Thomas Dundon. Even facing ruin, Roth fretted about his foreign students. Before Nourgostar was to testify for the prosecution, Roth phoned to assure him that the defense would not raise any issues affecting his visa. "He was extremely honest, one of the greatest mentors I ever had," Nourgostar says. Hours after being convicted on all counts, Roth called again, expressing regret that he could no longer be Nourgostar's adviser.

Rather than protesting Roth's fate, higher education has been tightening up. Representatives of more than 75 universities have attended Department of Justice and FBI presentations about the case. The University of Arizona in October began requiring participants in export-controlled projects to pass an online training course that includes discussion of Roth.

The University of Tennessee beefed up contract review and export-control training, says Gregory Reed, associate vice chancellor for research. After benefiting for decades from Roth's prestige and research grants, the university shielded itself from legal liability this past April by shredding his office library: 200 cubic feet of books, laboratory notes, and scientific articles, including 300 by Roth himself. "That was his career being shredded," says William Dunne, associate dean for research and technology at the college of engineering, who disposed of Roth's collection at the behest of university lawyers.

While distancing itself from Roth, the university continues to cultivate China. It agreed in May to open an institute on campus to teach Chinese language and culture. A Chinese government subsidiary will provide \$150,000 in startup funds and recruit and pay instructors.

Even a low-security prison like Ashland is no place for the aged and infirm. Roth, who had a triple bypass about 25 years ago and suffers from osteoarthritis, can barely walk. Hard of hearing, he wears an aid or lip-reads. He had planned to spend retirement fixing antique radios he'd bought on summer vacations in Maine, and tackling the third volume of his book. "It will never be written now," he says.

Stoically, he makes the best of his plight. He praises prison staff as "competent and caring," boasts about the myriad citations on Google ([GOOG](#)) Scholar for his publications, and remains hopeful that he will be vindicated. "Sometimes stubborn people are right," he says. At least he no longer has to contend with red ants; other inmates blocked them by sealing a crack with petroleum jelly.

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