Creating What Nature Cannot Provide

Richard Ziolkowski needs materials that don't exist in nature for micro-antennas, so he creates them himself

Professor Richard Ziolkowski

Professor Richard Ziolkowski of the electrical and computer engineering department was at the seminal 1999 DARPA workshop on metamaterials and has been at the leading edge of metamaterials research ever since, particularly in the area of electrically small antennas. In 2006, he and Nader Engheta, of the University of Pennsylvania, wrote a best-selling book on the subject, Metamaterials: Physics and Engineering Explorations.

Ziolkowski has been working on a DARPA-funded project with Boeing to create an extremely small, low-loss unit cell that is only 1/75th of a wavelength at 400 MHz. Boeing has already built a 100 MHz antenna based on his design, which is currently being tested by the National Institute of Standards and Technology.

"We're exploring whether or not some of the metamaterial-inspired antennas we've developed could move into the millimeter and terahertz range to be used for power harvesting," Ziolkowski said. "We'd also like to move up in frequency eventually into the solar range and create a highly efficient solar energy convertor."

"We have demonstrated that we can make efficient, electrically small antennas," Ziolkowski said. "Now we've made predictions that we also can potentially create those electrically small antennas with a wide frequency bandwidth." That would break through a barrier that's existed since the 1880s when Heinrich Hertz transmitted his first radio signals, and would shrink communications systems to sizes that seemed unimaginable only a few years ago.