



Courtesy of Bell Labs-Lucent Technologies: Dave Pardee, Photographer

Alumnus Fellow Sets Standard

Next Generation Wireless to Use New Transmit Diversity Scheme

When the International Telecommunications Union (ITU) met last year, one of the standards adopted for the third generation (3G) standard for cellular wireless communications was in part developed by a former Bradley Fellow, R. Michael Buehrer (Ph.D., '96).

A Distinguished Member of the Technical Staff at Bell Labs — Lucent Technologies, Buehrer was on a two-person team that developed a transmit diversity method

for cellular communications. “It was pretty exciting,” Buehrer said. “Rob Soni and I were able to develop a concept, sit down and analyze it, simulate it to show that it works, take it to the product and standards people, and prove that it is useful.” Soni is also a Member of the Technical Staff who works in the wireless communications area.

“We spent the better part of a year pushing the idea through the global standards body,” Buehrer remarked. “The introduction to the politics of global stan-

dards was quite an education.” Without significant assistance from the Lucent standards team regarding politics and other aspects of the standards effort, their standard would not have gone through, he added.

While transmit diversity is not a new idea, only recently have researchers spent significant time analyzing it and proposing it for wireless standards. “In a wireless system, there is a good bit of signal fading — you can be on your cell phone and hear your call go out,” Buehrer explained. “When

transmit diversity is used, two signals are sent to your receiver simultaneously, so that if one fades, the other will not.”

The method Buehrer and Soni developed improved upon older methods by more judiciously using the two antennas at the base station. “The method that was being proposed originally was highly dependent on the error correction coding scheme used. Our new method was not,” he said.

When implemented, Buehrer’s concept will help maintain signal quality, which is even more critical in the coming third generation products than it has been in current devices. Broadband 3G devices are expected to deliver voice, video, and data, via wireless cellular networks, at rates up to 2 Mbits per second. Typical cell phones today employ rates of about 8 kbits per second.

Efficiently transmitting large amounts of data wirelessly is the next frontier in telecommunications, he said. “A couple of researchers have developed concepts that are going to open wide the possibilities,” he said. “We’ll have the technology. People actually will be able to have their telephone search the Internet and download recipes, or homework.”

A Corporate Researcher

A member of one of the last big, corporate research laboratories, Buehrer works with Bell Labs’ Wireless Signal Processing Group, in the Advanced Wireless Technology Lab in Whippany, New Jersey. He finds his time divided between applied and fundamental research in transmit diversity and intelligent antenna concepts and multiuser detection.

“We tend to move back and forth between projects,” he said. “Some of our research is limited to product specific tasks with a lim-

ited range of choices. Other projects are more open ended and open to the researcher’s interest.” He has developed a synergy between his applied and basic research projects. “I learn a lot on the applied projects and often use that experience to develop my own ideas of questions to pursue independently,” he said.

“What I love most about a job in research is that it all comes down to problem solving,” he commented. “You have a problem and a toolbox of ideas and concepts. You attack that problem with all you have and develop new tools. Basically, you decide what’s wrong, and you fix it.”

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— Michael Buehrer

He also enjoys being able to publish some of his work. “Many things are proprietary and cannot be released, but I’m able to publish enough to keep in touch with the academic research community and researchers at other companies.” At last year’s Annual Virginia Tech Symposium on Wireless Personal Communications, he presented papers on three different areas of his research.

The challenge in wireless research, he said, is “trying to get your arms around a whole problem. It is easy, when you are dealing with a whole cellular network, to focus on a small part. Trying to understand the rest of the picture, however, is the biggest challenge.”

Buehrer has recently joined the faculty of the New Jersey Institute of Technology as an adjunct professor. This semester, he is teaching a course in communications systems. “What I enjoy about teaching is that it gets me back to

the fundamentals, which helps my research. On the other hand, my research experience definitely helps with teaching my class,” he said.

A Leap to The Big Leagues

Buehrer said that he never imagined himself as a Ph.D. researcher at a first-rate research laboratory. “I might have hoped it, but I would not have believed it.” He earned his B.S. and M.S. degrees in EE at the University of Toledo, where he fell in love with communications. The best teacher he had as an undergraduate taught communications. “When you have a good teacher, it makes it that much more interesting,” he commented. “That class sparked my interest.”

He wanted to jump to a bigger school for his Ph.D. degree, with the hopes of then being able to jump to one of the bigger companies. It was a communications textbook written by Charles Bostian and Tim Pratt that first interested him in Virginia Tech. “I felt as though I knew Bostian and Pratt and some of the work at Tech through their textbook,” he said. When he was offered the Bradley Fellowship, he chose Virginia Tech over the University of Michigan.

“I was leaning toward Michigan, but when I saw how beautiful Blacksburg was, and I was awarded the Fellowship, I came to Tech and was able to participate in the excellent communications research there.” Buehrer did his dissertation under Brian Woerner on *The Application of Multiuser Detection to Cellular CDMA*.

“Being able to do good work at a well known school made all the difference,” he said. “The Bradley Fellowship played a large part in where I am today.”