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Arogyaswami J. Paulraj, Key Enabler of Wireless Broadband, to Receive 2011 IEEE Alexander Graham Bell Medal

Development of Multiple Antenna System for Wireless Communications Helped Bring the Power of the Internet to Mobile Devices

10 August 2011 - Arogyaswami J. Paulraj, an engineer whose development of multiple input-multiple output (MIMO) antenna technology for wireless communications has been a key enabler of the "Mobile Internet" and next-generation wireless standards such as 4G, is being honored by IEEE with the 2011 IEEE Alexander Graham Bell Medal. IEEE is the world's largest technical professional association.

The medal, sponsored by Alcatel-Lucent Bell Labs, recognizes Paulraj for pioneering contributions to the application of multi-antenna technology to wireless communication systems. The medal will be presented on 20 August 2011 at the IEEE Honors Ceremony in San Francisco, Calif.

Paulraj's development of MIMO technology has revolutionized local area and mobile wireless communications, enabling high-speed access to multimedia services. The success of MIMO is its ability to provide both higher data rates and wider coverage areas. MIMO technology involves using multiple antennas at both the transmit station and the receive station. Efficiency is increased because parallel streams of data can be sent between the multiple antennas within the same channel. MIMO is a key component of wireless standards such as LTE, WiMAX and other 3G and WiFi systems.

Paulraj first developed the idea of MIMO in 1992 while at Stanford University. Using the spatial multiplexing concept that exploits MIMO antennas, he demonstrated that spectral efficiency could be improved by transmitting independent data streams from each antenna and then exploiting the distinct spatial signatures of each stream at the receive antennas to separate them. This led to the increased throughput and higher spectrum efficiency.

Paulraj was issued a patent for the MIMO concept in 1994, but he faced skepticism from industry and funding sources, and practical application of the technology was not seen until the early 2000s. Among the obstacles, digital transmission was needed to fully exploit the potential of MIMO, but the U.S. wireless industry was still predominantly analog at the time. However, Paulraj persisted and held annual workshops at Stanford on the technology that eventually helped interest in MIMO and spatial multiplexing take hold.

Paulraj founded Iospan Wireless Inc. in 1998 to form the first company to incorporate MIMO technology in a commercial system. The system developed by Paulraj at Iospan helped erase lingering skepticism about the practicality of MIMO. The lessons learned at Iospan gave the wireless industry the confidence to incorporate MIMO into emerging wireless standards, and the technology developed at Iospan such as spatial multiplexing, orthogonal frequency-division multiple access and opportunistic scheduling, can be seen in today's 4G systems. Intel Corp. acquired part of Iospan in 2003 to help launch its own push into WiMAX, further establishing the importance of Paulraj's MIMO concept. Paulraj co-founded Beceem Communications in 2003 and the company became a leader in WiMAX chipsets. Beceem was acquired by Broadcom Corp. in 2010.

An IEEE Fellow, Paulraj is also a member of the U.S. National Academy of Engineering and several other scientific / engineering academies. His awards include the IEEE Signal Processing Society Technical Achievement Award and Padma Bhushan from the president of India, one of the country's highest civilian awards. Paulraj received his bachelor's degree in electrical engineering from the Naval College of Engineering, Lonavala, India, and his doctorate in electrical engineering from the Indian Institute of Technology, New Delhi. Paulraj is a Professor Emeritus at Stanford University, Calif., and is also a Senior Advisor to Broadcom Corp., Irvine, Calif.

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