



Tech Science: Out on the Nano Frontier

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The garage tinkers of yesterday -- who brought the world technology like [Apple](#) Macintosh and Hewlett-Packard computers -- could make do with oscilloscopes and soldering irons. Today's cutting-edge tech, like nanoscale technology, requires somewhat more-sophisticated equipment.

"Molecular-scale technology is replacing conventional-scale technology as everything is squeezed into ever smaller dimensions," Lawrence Goldberg, senior engineering advisor, directorate for engineering at the [National Science Foundation](#), told NewsFactor.

According to Goldberg, the development of nanotechnology is so critical to the future of computing that the National Science Foundation has awarded US\$70 million to 13 universities throughout the nation to open their labs and equipment to small and large businesses and individuals, allowing qualified inventors and researchers unprecedented access to the country's most advanced and sensitive research equipment.

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Small, Small World

Among the latest in microtechnology developments seemingly headed for consumer use are super fast nanocapacitors and nanoscale memory cells.

For example, a carbon nanotube-based electrochemical double-layer capacitor, composed of a hexagonal network of carbon atoms rolled to form a seamless cylinder, is currently under development by Georgia Tech Research Institute (GTRI) researcher Jud Ready. The supercapacitor promises to provide more power,

increased energy density and longer energy life than traditional batteries and conventional electrical capacitors. The project is sponsored by the U.S. Army Space and Missile Defense Command.

An MIT research team, headed by professors Vladimir Bulovic of electrical engineering and computer science, and Mounji Bawendi of chemistry, invented a new nanoscale memory cell. The technology combines organic chemistry and quantum dot technology, and uses self-assembly to manufacture a persistent, nanosized memory cell in an inexpensive, organic production system.

Possible applications include the next generation of flash memory used in personal computers, digital cameras, and numerous other consumer products. Earlier, MIT's Mark Baldo, assistant professor of electrical engineering and computer science, exploited the properties of a newly developed organic molecule, an important step in the development of the futuristic bio-computers that will integrate organic and non-organic materials in super-fast microprocessors designed to function more like the human brain.

Hot Stuff

"New processors are consuming more power, circuit densities are getting higher and there is pressure to reduce the size of devices. Unless there is a breakthrough in low-power systems, conventional fan-driven cooling will no longer be enough." said Raghav Mahalingam, a research engineer in Georgia Tech's School of Mechanical Engineering.

A new cooling technology, "SynJets," synthetic jets that resemble tiny, flexible stereo speakers that fit in devices that formerly could not accommodate conventional cooling fans, was developed and patented by Professor Ari Glezer and coworkers at the [Georgia Institute of Technology's](#) School of Mechanical Engineering.

The rights to manufacture were recently licensed to Atlanta-based company Innovative Fluidics. The company has produced several prototype SynJets and expects to have commercial products available within one to two years.

"The top three candidates for the first commercial application of SynJets are CPU cooling, GPU (graphics cards) cooling, and server memory cooling," John Goldman, commercialization catalyst at Georgia Tech told Newsfactor.

The jets move 70 percent less air than conventional fans of comparable size but they produce turbulent air flow, encouraging efficient mixing of ambient air and breaking up thermal boundary layers. The jets are flexible and can be shaped to fit any configuration and can be precisely directed at areas requiring cooling.

"You get a much higher heat transfer coefficient with synthetic jets, so you do away with the major cooling bottleneck seen in conventional systems," Mahalingam said.

