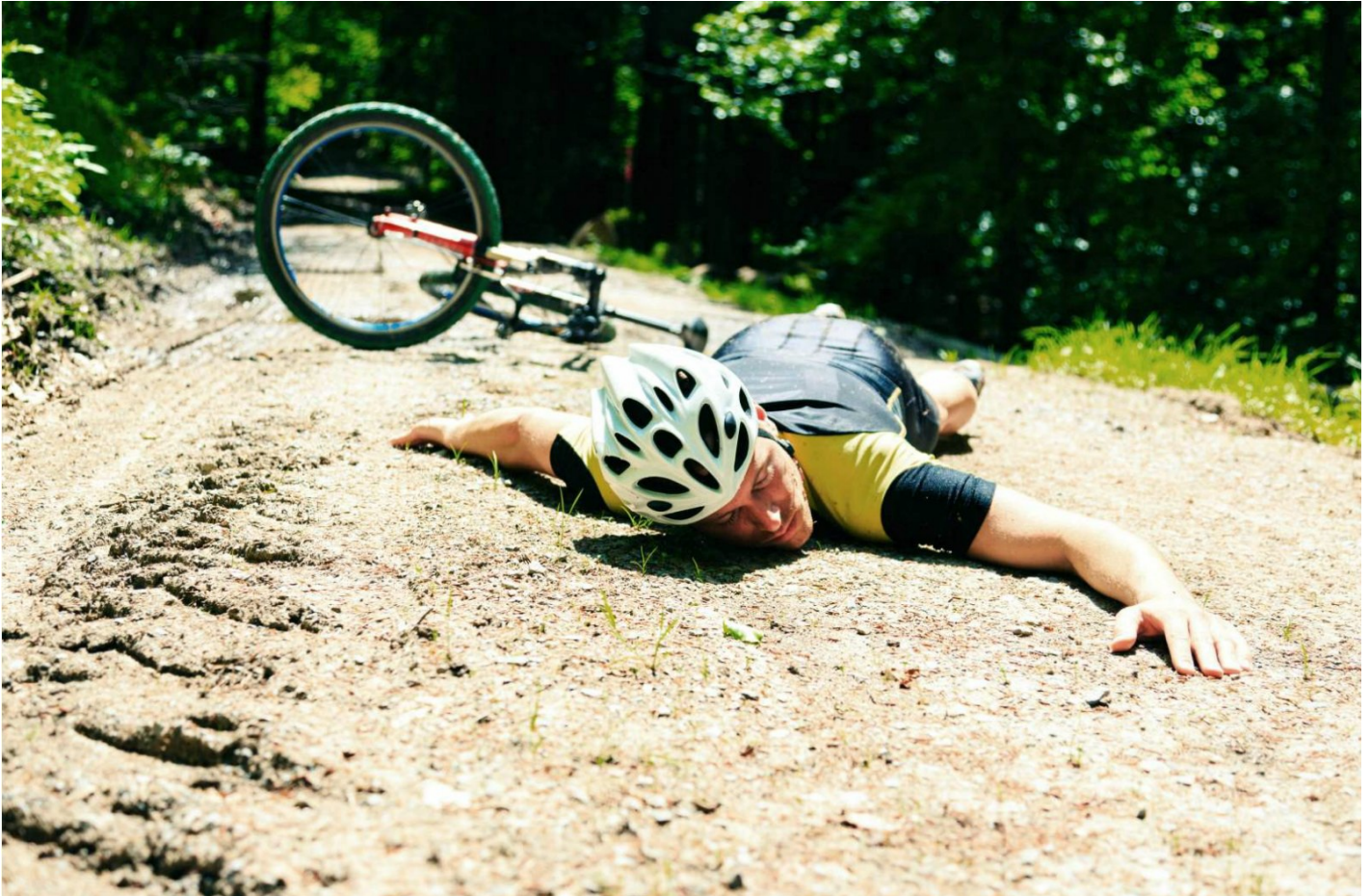


## Tiny Devices That Protect, Entertain And Simplify

Cornell Center for Technology Enterprise and Commercialization  
Cornell University



Have you ever heard of accident victims in isolated areas being quickly rescued?

In situations like these, people owe a debt of gratitude to researchers at Cornell University in Ithaca, N.Y. That's because they helped develop the tiny microelectromechanical motion sensors that play a critical role in locating victims and deploying assistance, or protecting data on hard drives that may be lost due to a hard jolt or a fall.

Microelectromechanical systems, or MEMS, technology isn't an easy concept to grasp. Fortunately, though, MEMS technology exists and it factors into many devices that we rely on every day. From lifesaving GPS assistance, to tilt-sensing game controllers and cell phones with gesture recognition, MEMS inertial sensors are the enabling component. The ability of such devices to detect motion and translate that motion into an electrical signal that ultimately protects a hard drive and the data it contains is attributable to MEMS technology. One thriving company called Kionix, Inc., located in Ithaca, N.Y., is taking that technology to new levels.

Kionix is recognized as a global leader in the design, engineering, and manufacture of high-performance, silicon-micromachined MEMS sensors. These tiny sensors are equipped to measure acceleration, rotation and free-fall. With the use of fabrication equipment standard to the semiconductor industry, the company constructs three-dimensional,

moving silicon structures on the scale of modern microelectronics.

“ *Inertial-sensor innovations developed by Kionix are used today in a wide range of applications including hard disk drive protection, computer and video gaming, personal navigation, sports diagnostics and health monitoring systems.* ”

### **From Laboratory Inventions to a Vision for a Company**

The work of Cornell University engineering professor Noel MacDonald, Ph.D., was especially significant in the development of MEMS technology. A leading researcher in the field of semiconductor fabrication, MacDonald pioneered the concept of using semiconductor manufacturing techniques, specifically reactive ion etching, to manufacture very small electromechanical devices in single crystal silicon wafers. Although prolific in the number of inventions he designed while at Cornell, MacDonald already had ample experience in commercializing his technologies and preferred to pursue teaching and academic research.

Many of MacDonald's inventions and designs did, however, land on the desk of licensing managers at Cornell's office of patents and licensing. Richard Cahoon, now director of the Cornell Center for Technology, Enterprise and Commercialization, was a manager at that time and recalls being intrigued by MacDonald's entire technology platform.

“His underlying invention involved the ability to do a certain kind of deep etching in single-crystal silicon. I realized this represented a fundamental breakthrough, and although a basic idea, it demonstrated a very powerful tool,” says Cahoon. “We were looking at methods and devices that would be useful and relatively inexpensive for sensing and actuating. I began to create a vision around the platform of this technology and considered the business possibilities that could jump off from this platform.”

Cahoon was willing to take the lead in creating a company and packaging its property portfolio to make it compelling enough to recruit investors, management and partners. Yet, he needed to find others with the background and the desire to start a company. He realized that this called for some innovative collaboration among knowledgeable colleagues.

What resulted was a “protoboard,” or a mix of business, technology, and not-for-profit people, and even some ambitious engineering students from MacDonald's lab. The group was united by their experience in the worlds of technology and business. Cahoon recalls how they all brought to the table some key solutions for laying the groundwork of what would eventually become Kionix.

Yet they still needed to identify the right CEO for the company, a born leader who would be energized by the challenge. Greg Galvin, Ph.D., fit the bill. After earning his doctorate in materials science, as well as an M.B.A. from Cornell University, Galvin served for more than five years as deputy director of the Cornell Nanofabrication Facility. He also worked as director of Corporate Research Relations at Cornell, an experience that undoubtedly served him well as president and CEO of Kionix.

Galvin took a sizeable risk in starting the company in 1993, according to Jeanette Shady, director of external communications for Kionix. Along with co-founder Timothy Davis, Ph.D., who now serves as executive vice president and chief technical officer, they initially funded the venture with a modest \$25,000 in personal financing and investments from family and friends. The two also faced the challenge of being located in upstate New York, a region relatively isolated from mainstream venture capital.

Until Kionix completed its first silicon wafer fabrication facility five years later, it continued to rely on Cornell's

infrastructure and rented use of the Cornell Nanofabrication Facility. It wasn't until late in 1998 that the company had its own fabrication facility, built from the ground up, located in the Cornell Business and Technology Park. In 2001 a new production facility was built to support Kionix's production requirements, which now stand at more than 40 million MEMS inertial sensors per year and are growing rapidly.

Galvin's appreciation of the Cornell Nanofabrication Facility and the seminal MEMS research pioneered by MacDonald still runs deep. He says it was one of the key ingredients of the overall collaborative effort that eventually yielded the birth of Kionix. "If it wasn't for MacDonald's background and the research capabilities available here at Cornell, the creation of Kionix probably would not have happened," says Galvin.

### **A Plethora of Intellectual Property**

As Kionix technologies took off, so too did the intellectual property coming out of Cornell University. The company secured its first license for its plasma micromachining technology in 1994, and the original license granted through Cornell was amended to allow for the incorporation of new discoveries into the company's portfolio. Scott Macfarlane, a senior licensing manager with the Cornell Center for Technology Enterprise and Commercialization, serves as liaison between Kionix and Cornell and says that more than 200 patents now protect Kionix products and manufacturing processes.

The industrious company has realized many successes since its founding, including acquisition by Calient Networks of San Jose, Calif., in 2000. Given Calient's focus on fiber-optic systems, the company was eager to acquire Kionix's optical business, specifically its MEMS micro-mirror array technology. Prior to the transaction, a new Kionix was spun off to investors to pursue inertial sensor and microfluidic business opportunities. As Galvin points out, in the end each company was able to focus on related, yet different, MEMS applications, and Kionix shareholders benefitted by the acquisition.

Almost 15 years ago when Galvin accepted the challenge of leading a new company, he couldn't possibly have predicted the technological explosion that would fuel the demand for MEMS products. By 2006, Kionix achieved annual sales of greater than \$10 million with a compounded annual growth rate in excess of 100 percent. Continued and rapid growth is expected over the next several years as advances in technology and demand for inertial sensors continues to rise.

Kionix now employs more than 100 people and remains a privately held company with shareholders that include both individuals and organizations. Having come a long way from the initial \$25,000 investment by friends and family, Kionix has to date raised more than \$70 million from both individuals and institutional investors. A close collaboration with the Ithaca based Cayuga Venture Fund has helped mitigate the difficulty of raising capital far from the traditional centers of venture investors.

Collaborations have played and will continue to play a significant role in the success of Kionix. Galvin places great importance on customer collaborations and the unparalleled customer service provided by his company. "The company's global sales team does more than insure sales success," he says. "Each operation is supported with a technical expert who can respond rapidly to questions and work in tandem on new applications." According to Galvin, this capability propelled Kionix to its leadership position in the markets it serves. As for the teamwork among researchers at Cornell that ultimately led to the creation of Kionix, they continue to spark new partnerships. Today, Kionix is involved in new collaborations with researchers at Cornell, and other related parties, in completely new areas of technology. Galvin is confident such relationships will lead to a new company and another great success.

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