

Technology transfer with UMD regional partner, national implications

ost technology transfers involve licensing NSA intellectual property to existing commercial companies. However, some transfers involve multistep agreements with academia that result in new start-ups. Such is the case with NSA's long-time partner—the University of Maryland, College Park (UMD). Located just 20 miles down the Route 295 corridor from Fort Meade, UMD is host to numerous NSA facilities including the Laboratory for Telecommunication Sciences and the Laboratory for Physical Sciences. But one little known fact is that NSA's Technology Transfer Office also partners with UMD's Office of Technology Commercialization (OTC), and this partnership has resulted in one particularly interesting technology start-up—FlexEl, LLC.

Powering devices on the cutting edge

With growing implementation of ultrasmall electronics and the revolution in ever-smaller form factors for computing and analytic applications, one significant bottleneck has been battery technology capable of meeting the required demands of such devices: How can power be provided when the source must be extremely small, lightweight, durable, reliable, inexpensive, safe, ideally rechargeable, and environmentally friendly? One promising solution has arisen out of the work of inventors at UMD, utilizing technology initially developed under contracts awarded by NSA and then licensed through OTC, in the form of an innovative electrochemical energy cell. This cell is designed to provide electrochemical power generation and capacitive storage in combination as a thin, flexible unit, capable of working in various applications.

This development culminated in recognition by UMD as their 2008 Invention of the Year in Physical Science, and in 2009, the start-up utilizing this technology, FlexEl, LLC, became the winner of UMD's Business Plan Competition. FlexEl was a member **FIGURE 1.** FlexEl's BatteryCloth is completely flexible and bendable.

> of UMD's Mtech Venture Accelerator, a selective program designed with rigorous goals and structure to promote business expertise and management for emerging companies and technological developments. Through this partnership, FlexEl was able to attract funding and support for further development and deployment of this technology. In 2010, the company was recognized as the Technology Transfer Company of the Year by the Maryland Incubator Company of the Year Awards Program.

FlexEl now focuses on continued refinement of this critical technology. In addressing some of the most pressing needs in battery capability, FlexEl is looking forward to what needs to be done to provide its product as a viable solution on the scale required, including improving capacity per unit area and ensuring manufacturability at volume. In preparing its technology for future use, FlexEl has developed three technologies tailored for different platform applications, currently in various stages of commercialization. Closest to market is a low-cost, high-capacity disposable thin film battery; next in line is a lower-capacity but rechargeable battery offering a longer lifetime; and furthest off (but perhaps with the most intriguing potential) is a battery capable of converting water from the environment into energy for activation and fueling of devices.

In addition to the battery technology that is at its foundation, FlexEl is also looking to make its mark through employing another technology based on an NSA invention—a radio frequency (RF) power harvesting circuit design. This technology provides the ability to capture and utilize energy in the form of ambient signals and transmissions from the environment. As the modern world is full of constantly radiated RF emissions, including those from cellular traffic and industrial, scientific, and medical (ISM) radio bands, developing this technology for use in the field would be a boon to reducing the physical power requirements of devices, as the operational life of electronics could be extended while significantly reducing their size. FlexEl is working as a licensing partner with UMD's OTC on improving the RF power harvesting circuit design and developing a first prototype in a joint venture between the state of Maryland and the Army as a proof of concept. Currently the device operates as a very

sensitive RF detector, with ultrasensitive applications moving toward energy harvesting as the company looks to expand and increase commercial viability of this nascent technology.

FlexEl and the future

Through the use and continued development of these technologies, built on the work of and in cooperation with NSA and UMD inventors, FlexEl has the ultimate goal of integrating them into an energy harvesting bloc capable of powering the next generation of ultrasmall electronics. The promise of FlexEl's goals is echoed by the approximately \$2–3 million in funding received from entities including the state of Maryland, the Department of Homeland Security, and various companies in the private sector.

FlexEl's story illustrates how technology transfer comes full circle: The contribution of FlexEl's products, intertwined with the innovation of NSA and the UMD OTC, offers a significant return on investment for all—beyond financial terms. FlexEl's CEO believes that, as this technology matures and comes to market, there will be a significant impact through its potential application in achieving NSA's ultimate goals of national defense and national security.

