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# New Company Takes Important First Step Toward Building Field-Ready Chemical and Biological Agent Sensor

Up-and-coming firm MEMS Precision Technology, Inc. has built a real-time, portable sensor with the potential to detect airborne chemical and biological (CB) warfare agents and protect first responders and the military. Construction of the sensor was a major milestone on the road to producing a working model that first responders can use to detect toxic chemicals and dangerous micro-organisms in the field.

The new sensor was developed using micro-electromechanical systems (MEMS), a technology that enables the construction of tiny and inexpensive devices that combine electrical and mechanical components. The surface of the MEMS device was treated so that CB sensing materials would adhere to the device.

Designed to detect a CB warfare agent where and when it is released, the sensor warns first responders early enough for them to respond in an effective and timely way. The engineers and scientists at MEMS Precision Technology also plan on adding value to the sensor by giving it the ability to communicate clinical and epidemiological data so that first responders can coordinate the response with hospitals and health care personnel. These critical data will assist first responders in rapidly assessing the situation, determining the best personal protection procedure to initiate, and arranging for victims to be transported to a hospital in the event of a CB agent attack.

## Providing Protection

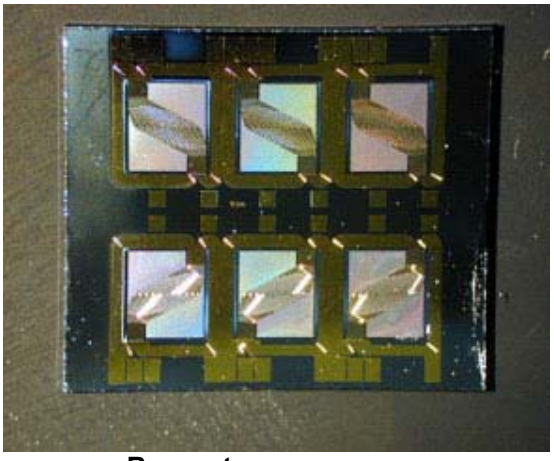
Protecting people is at the heart of the new sensors and the reason MEMS Precision Technologies was founded in 2002. “After the anthrax letter attacks that followed what happened at the World Trade Center in New York, we thought, ‘We can do something about this. We can apply our experience to helping protect people from the risk of a [CB] agent release,’” explains Dr. John Dunfield, president of MEMS Precision Technology.

Although a relative newcomer to the defence research and development (R&D) industry, MEMS Precision Technology employs a team of scientists and engineers with years of experience in developing and producing MEMS devices. The company also has investigators with molecular biology and biochemistry backgrounds on its core team to better leverage the capabilities of MEMS to develop CB warfare agent detection and identification systems, one of the most intense research activities in defence R&D. Shortly after the company was officially launched, CRTI invited MEMS Precision Technology to provide research that would improve the ability to prevent, survey, and alert against chemical, biological, radiological, and nuclear (CBRN) events.

## Detection Based on Recognition

Joined by the Suffield research centre for biological detection at Defence Research and Development Canada, the enterprising new company constructed a micro-fabricated resonator array that vibrates at a specific frequency in the presence of specific

CB agents. The sensing material used on the surface of the resonator includes antibodies, nucleic acid probes, and imprinted polymers. These materials “recognize” or bind to complementary materials in the CB agent, resulting in a specific and identifiable change to the resonator’s frequency. “The sensor is very precise,” says Dr. Dunfield. “It is able to detect very small masses of chemical agents and very small particles of biological agents.”



**Resonator sensor array**

The technology also boasts the potential for low costs and low power consumption. The electronic components in the sensors typically operate at very low power. Detection does not depend on reagents, such as precipitants, solvents, or oxidizers, or on “labelling” the recognition elements with indicators, such as fluorescence, colour, or radioactivity, to transform their signal when CB agents are present. Coating the sensor’s surface with the recognition materials enables it to provide enough of a signal to be measurable when specific target agents are present. This accuracy and precision of the sensor avoid the need for expensive hardware, such as lasers, light sources, optical detectors, and lenses.

## The Road to Readiness

By the project’s end the team had moved development of an accurate, small, light, and energy-efficient sensor quite far along the road to a field-ready product. “We’ve made great progress,” reports Dr. Dunfield. “We built the device and we built test electronics.” The next step is to test and evaluate the resonator sensors for stability and mass coating sensitivity before fine-tuning the design. Refining the signal processing algorithms will also improve the sensor’s sensitivity and precision, as well as reduce false alarm rates.

**Electronics device designed to generate an oscillating signal**

Dr. Dunfield and his colleagues at MEMS Precision Technology are encouraged by their success in building the MEMS device and are ready for the long road to field readiness stretching ahead of them. “We are intent on moving the device along, though we still have a ways to go,” he admits. “We’re looking for more funding to take it further so that we can bring first responders the protection they need in facing down chemical and biological agent terrorist threats.”