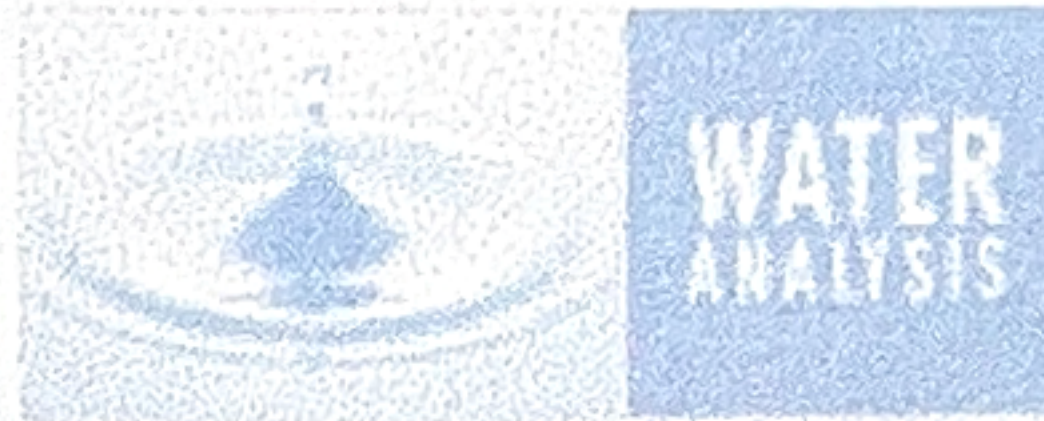


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CYRANOSE MAKES SENSE OF NASA TECHNOLOGY; SPACE RESEARCH PROPELS MEMS DEVELOPMENT

By Rosemary Clandos

Small Times West Coast Correspondent

PASADENA, Calif., June 4, 2001 – Unlike its namesake, the Cyranose may be the world's tiniest sniffer. And it can smell and identify almost anything – from chemicals to bad rice.

The electronic nose was originally used by the National Aeronautics and Space Administration to monitor hazardous gas on the International Space Station and space shuttle manned by John Glenn nearly a year and a half ago. Since then, the 1-inch-by 1-inch device has touched down in the commercial domain.

"It can revolutionize industry and the way we relate to smell," said Seb Nardecchia, vice president of operations at Cyrano Sciences, a Pasadena-based spin-off company from the Jet Propulsion Laboratory (JPL). "We're focusing on fire detection, diagnostics, waste treatment, leak detection, the environment – you can let your mind run away with (ideas) very quickly."

Cyrano Sciences licensed the technology from NASA, built a hand-held sensor and dubbed it the Cyranose 320. Undergoing further miniaturization with MEMS, the device is being used by businesses to control quality and identify product shipments.

The Cyranose 320 is just one of the many bits of technology that have spun out of JPL, where scientists are commercializing once space-specific micro machines. Traveling in deep space created the need to optimize size, weight and power and it has been a propellant for developing MEMS technology.

"At NASA, we're using the first sets of working devices on our space missions. Commercialization of what we do is driven by what looks good after we develop it for NASA," said Timothy Krabach, deputy program manager for the Center for Space Microelectronics Technology at JPL. California Institute of Technology manages JPL for NASA.

Apparently, the Cyranose 320 looks good to some chemical and petroleum companies that are paying about \$8,000 for the device to do the job of complicated chemical analysis systems that cost upwards of \$80,000. The device takes a minute



The Cyranose 320 is sniffing out potential unwanted ingredients in baby food, confections, baked goods, beverages and pet food.

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to sniff the contents of tankers, so drivers no longer have to wait about 45 minutes, said Seb Nardecchia, vice president of operations at Cyrano.

It is also being used in the food industry where buyers can identify, for example, premium quality rice grown in one state and poor quality rice from another state. The Cyrano 320 has a pump at top of the unit that draws vapors from the rice. The vapors are pulled over the top of the sensor chip and 32 polymers or plastic beads that are contained in the sensor act as tiny sponges and absorb the vapors. The swelling of the sponges are picked up as a measurement unit, and a pattern is created with the 32 beads. The pattern is compared to a database, which contains all the smells for which the device has been programmed. Then it tells the operator in plain English if the rice is from California or Oklahoma.

So far, the Cyrano 320 has been sniffing out potential unwanted ingredients at companies that produce baby food, confections, baked goods, beverages and pet food. Slated for clinical trials in June, the device can also detect odors generated by bacterium that cause upper respiratory infections and urinary tract infections.

And while MEMS devices can identify smells in the air, they also do a lot for planes in the air.

In 1999, JPL licensed a MEMS gyroscope to Hughes Space and Communications Company, which was recently sold and became Boeing Satellite Systems. The gyroscope can be used to detect rotations and monitor course headings on aircraft and in space applications. Smaller than a dime, the MEMS gyroscope operates like a tuning fork. It gives pilots an update of their turning motion rate and tells them when their aircraft moves as little as three degrees. It basically keeps them on course.

"It is unmatched in terms of size and performance values," said Krabach. "And it is much more accurate by a factor of 10 times better than other MEMS and it is 100 times smaller. Power consumption is also reduced by a factor of 10." The original project was funded by NASA and the Defense Advanced Research Project Agency.

Tim Stock, research and development program manager for the MEMS gyroscope at Boeing, said they are working to develop a device that can be used in several applications from missiles to virtual reality games. The completion date for the device depends on money and work force, he said. "If money were no object we could probably have it ready in a year. But we're doing it a nickel here and a nickel there."

To solve some of the packaging problems that face the microsystems industry, JPL is working with commercial outfits and trying to find solutions. Each new MEMS application requires customized packaging that will solve problems like size, humidity and corrosion from caustic fluids.

"In a couple cases, we're close," Krabach said. "Many people sympathize that we have a micro device that has to be put in macro packaging and many of the volume reductions are lost."

NASA's assistant chief technologist, Murray Hershbein, said that businesses could benefit from acquiring MEMS technology that has been developed for NASA. "If you look at some of the products already out there, the advantage is you get a lot of power in a very small device; you can get very tiny switches with precise manipulations and they can be produced en masse," Hershbein said.

While that may sound easy, it's not always the case. Some investors may think of MEMS technology as simple devices and not entire systems, Krabach said.

"In many cases, they need to deal with all the complexities that a system has; on a



micro level they have many more complexities," he said. "It is not a good strategy to make the device and then learn how the system works – that doesn't offer you the advantages of what the devices can do."

The solution, he said, entails a rigorous systems analysis. "You have to do the system engineering in the beginning of the design and then you have to get your arms around the full meaning of microsystem engineering."

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