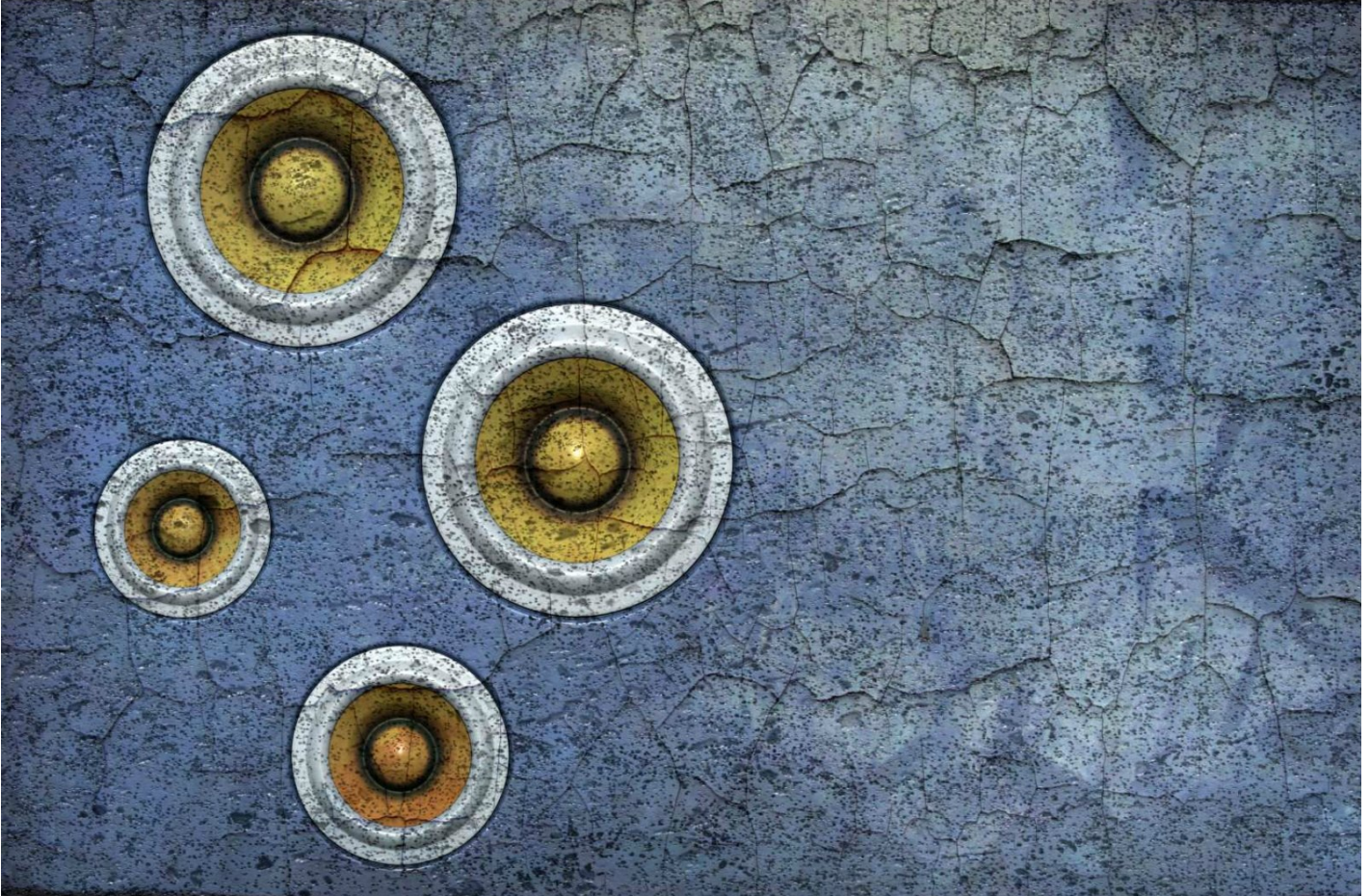


## Groundbreaking Technology "Sees" In Three Dimensions

Wayne State University



Acoustic holography technology, developed at Wayne State University, accurately visualizes sound as it flows through space and time, helping product design engineers “plug” leaks in products and machinery.

Imagine airplane designers being able to “see” where unwanted noise is coming from in a plane’s fuselage or engine. Or what if automotive engineers could “see” the rattling noise coming from a car door’s panel on a computer screen.

These marvels of technology may sound like science fiction, but they’re actually the invention and by-product of years of research by Sean Wu, Ph.D., distinguished professor of engineering at Wayne State University in Detroit.

Until now, noise diagnostics has been primarily a process of elimination.

“You might get lucky, you might not,” says Ravi Beniwal, senior applications engineer with SenSound, LLC, the company formed to commercialize the technology invented at Wayne State.

“Most of the time people just guesstimate where the noise is coming from, but our technology pinpoints exactly where noise is ‘leaking,’” Beniwal says.

The technology, licensed to SenSound in 2004, is making waves because of the innovative way it “sees” the origin of noise in cars, boats, airplanes and other machines and products. The benefits are significant because the technology helps engineers design quieter products and achieve better noise-related quality control.

“There’s a lot of need for this technology in industry,” says Beniwal, “because we can help engineers make everything quieter.”

### **Inventing the “Sound Camera”**

Manmohan Moondra, senior product development engineer with SenSound, knows firsthand the excitement behind developing a groundbreaking sound analysis system. In 2002, when he was a research assistant at Wayne State, he worked on some of the software with Professor Wu and also validated the software between 2002 and 2004.

“We developed software that uses a microphone array sound camera to ‘photograph’ sound and convert the analog signals from the microphones to digital pictures of sound,” says Moondra. “The really exciting part is when we connect the software to the computer and can see the images of what the microphones pick up.”

Before the development of this technology, sound diagnostics with acoustic holography was limited to a two-dimensional plane, but SenSound has taken it a step further by showing sound in three dimensions. More than \$800,000 in grants from the National Science Foundation, along with additional financial support from the Ford Motor Co., DaimlerChrysler Challenge Fund, Cadillac Products Automotive Co. and L&L Products, contributed to the development of Wayne State University Technologies licensed by SenSound.

### **From Discovery to Start-up**

The next step for Professor Wu and Wayne State was to find the right partners for establishing a startup company.

Judy Johncox, director of venture development at Wayne State University, says once the sound diagnostics technology was developed at the university, the next question was whether it would be sustainable for a startup company.

“We brought together Gary Kendra, a lawyer with Kendra Law Firm in Detroit whose practice area focuses on technology and commercialization and Sergio Mazza, who had approached the university as a private investor,” says Johncox. “Their synergy and common goals were apparent from the beginning. It took about three months to complete the licensing agreement in December 2003.”

“The result was SenSound, the first company that uses 3-D holography to take measurements in the field, and then trace the noise to a source,” says Moondra.

SenSound has had a strong showing since it was launched in 2004 with more than \$800,000 in revenue in 2005. The company already has 10 employees, many of whom are graduates of Wayne State.

“This company is exceptional in many ways,” says Johncox. “With startup companies, it usually takes two to three years to have a revenue stream, but they went from sales to revenue in the first year.”

Kendra points out SenSound’s strong leadership from the CEO has helped the company succeed.

“Sergio has a strong international presence, which has helped us make a lot of headway,” he notes.

### **Infinite Applications**

When Beniwal, who designs the diagnostic tests for SenSound, makes presentations to potential customers, the

common reaction when shown how the technology works is, “Wow!”

“People are not used to seeing sound in diagnostic tests,” says Beniwal. “When they see what we can do, it usually amazes them.”

The sound detectives look for unwanted sound in numerous locations. To locate noise in an airplane, Moondra and Beniwal took sound measurements while flying at 30,000 feet. Next, they brought the 3-D sound photos back to their computers, and then crunched the numbers based on the new diagnostics technology.

“On a model of the plane, you can ‘see’ the entire sound field inside the fuselage,” says Moondra. “The beauty of this technology is that when airplane designers have this information, they can make intelligent decisions about where to place various components, like where to put insulation or install seats on the plane.”

In another example, Beniwal tested several variations and operating conditions of a car’s noisy door panel. The motor that operated the window was quiet, and the door was quiet, but when put together, they produced noise. By creating a model of the sound field, SenSound shows the customer where the unwanted sound is streaming in.

“Noise is interesting,” says Beniwal. “You can put several silent components together and build a noisy system. There’s also the combination of vibration and sound which are interrelated, but even though all sound is produced by vibrations, not all vibrations can produce sound. Our value is saving companies time and money by getting to the root of the problem faster. If you can hear the noise above the background, we can visualize and detect it,” says Beniwal.

There is no end in sight for applications of SenSound services and products.

“The capabilities for industry and consumer products are just tremendous,” says Johncox.

## **New Horizons**

Consumers and employees will soon benefit from SenSound’s innovative problem-solving technology as the company moves forward and targets workplace environments and consumer products.

“*“The possibilities for SenSound’s technology are endless,” says Kendra, who points out the next great horizon of regulatory activity is noise control.*”

“Noise is going to become an even bigger social and aesthetic issue in the future,” Kendra says. “For example, Europe has started to become very aggressive about noise. If you’re going to send equipment like snow blowers or lawn movers to Europe, you need to know how to respond to controlling and reducing noise.”

Kendra recognizes that educating the marketplace about the value of manufacturing noise-free products in a work environment with less noise, is part of the company’s challenge in the future.

Kendra expects SenSound’s patented technology of noise diagnostics will continue indefinitely to make great strides in unraveling the mysteries of unwanted sound.

“We can identify unwanted sound wherever it affects quality control,” he says. “Our approach is more scientific, more mathematic, and more accurate. The trade-off is a quicker turnaround of identifying problems for designers, and better products in the long run.”

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