

► Wilcoxon Research, Inc. Advances in Vector Sensor Technology

About the technology

Developing of a highly sensitivity, ultra-low noise, acoustic particle velocity sensor in a small package has been a desire of the Navy, and a formidable technical challenge, for many years. An acoustic particle velocity sensor, or “Vector”

sensor, provides a marked advantage over traditional hydrophones because it provides the amplitude and the direction, in three dimensions, from which the detected acoustic signal originated.

When combined in arrays, the Vector sensors greatly improve the accuracy and efficiency of the detection system.

To create a highly sensitive transducer using piezoelectric materials, a great deal of charge or voltage must be generated when the material is strained. In addition, for the sensor to maintain its low “self-noise”, it must be interfaced to downstream signal processing using very low noise electronics. Wilcoxon Research, Inc. met the first challenge by utilizing a new, highly efficient^{1,2}, piezoelectric material (PMN-PT), that exhibited extremely high piezoelectric properties when compared to existing PZT ceramic materials. To further enhance the sensors performance, a novel method to mechanically amplify the strain³ induced into the crystal was devised. Finally an extremely low noise amplifier was designed to interface specifically to the new piezoelectric

material to allow the entire system to meet the Navy’s ultra-low noise requirements.

Military and commercial significance

The Navy’s detection systems are continuously looking for more accurate and efficient methods to detect and identify acoustic targets. A vector sensor allows the location and range of a target to be determined in a more accurate manner when compared to a traditional omni-directional hydrophone. A vector sensor could be used to replace hydrophones in existing and future line and towed arrays. They could also be used in Homeland Security applications where advanced notice and location of unwanted sea-going vessels could be crucial to the security of a harbor or port.

Applications

- Line Arrays
- Towed Arrays
- Directional Hydrophones
- Advanced Sonar
- Port Perimeter Security
- Oil Exploration
- Geophysical Research



About the company

For more than 40 years, Wilcoxon Research, Inc. has been manufacturing a wide range of vibration sensors that are used worldwide in a variety of industrial, process control, military, and test & measurement applications. Wilcoxon Research, Inc. also provides the latest in Bluetooth Wireless systems for the process control market. In addition to providing a core product line, Wilcoxon Research, Inc. has a Wilcoxon Research Labs group that focuses on state of the art basic and applied research topics for a variety of Military and Government agencies.

Contact

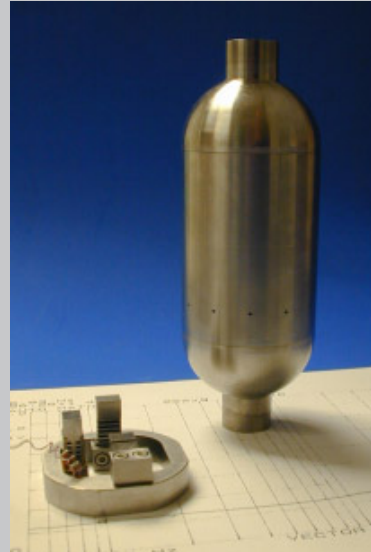
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■ Wilcoxon Vector Sensor core and canister

fyi Wilcoxon Research
was awarded a Phase III
Vector Sensor contract for
minaturization of the Vector
Sensor.

■ **SBIR Investment: \$250K**

■ **Project Revenue: \$700K**

1. Park, S. and T.R. Shrout. "Ultrahigh Strain and Piezoelectric Behavior in Relaxor Based Ferroelectric Single Crystals." J. Appl. Phys. Vol. 82, No. 4, 15 August 1997, pp. 1804-1811
2. Yamashita, Y. et al. "Recent Applications of Relaxor Materials." Ferroelectrics, Vol. 219, 1998, pp. 29-36.
3. K. Deng et al. "Method of Strain Amplification for Piezoelectric Transducers." Patent Pending.