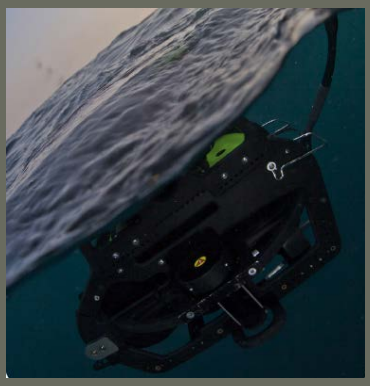
Navy SBIR/STTR Success



Opportunistic Energy Harvesting for Submarine Wireless Sensors

This technology gives machines a "voice" to communicate how close they are to a failure condition. Maintenance is only performed when it is needed, as opposed to being performed on an aggressive schedule.

Condition-based maintenance performed on information received from self-powered wireless sensors installed on UUVs is one goal of the Department of Defense.

Topic Number: N093-190

SBIR Investment:
$545,321

Phase III Revenue:
$20,000,000

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About the Technology:

Energy harvesters work by capturing wasted energy from a machine's normal operation. The harvested energy is typically used to power devices such as wireless sensors. In many applications these sensors generate key information related to the health or condition of their host asset. The health and condition information can then be used to support data-driven and targeted maintenance activities. This self-contained harvester-powered sensor approach is essential to enabling the DoD's Condition-Based Maintenance Plus (CBM+) initiatives because high value data can be procured at a low lifecycle cost. CBM+ is allowing the DoD to move away from an overly conservative preventative maintenance schedules to an optimized on-demand maintenance model. After winning several SBIR awards to evolve its energy harvester technologies, KCF then embarked on a Phase I and II project with NAVSEA to harvest from the ambient electromagnetic environment that exists on submarines. The harvester developed under this SBIR project used a specialized magneto-electric transducer.

Naval Benefit

Ubiquitous application of wired sensor systems is limited by installation cost and complexity, faults, and maintenance of the wires for supplying power and communication. A routine task like adding a new wire route could cost over $1 million just to get the plans drawn. Sustaining the wire route throughout the life of the submarine is also costly each time you add a wire. Batteries present a competitive alternative, but they must be replaced on a regular basis before failure to ensure continuous sensor monitoring, and that drives labor and material cost. The magneto-electric harvester proved to be applicable to certain locations in the submarine. To more broadly address the need for sensors throughout the submarine, the SBIR work was refocused on reducing the power consumption of the sensor components. By optimizing the wireless sensor electronics, the project resulted in hardware that requires a very low power budget and enables a long 8-year battery life. This key technology advancement enables battery replacements to be aligned with submarine depot maintenance cycles.

Transition

Although implementation on submarines with the goal of continuous machine monitoring has a lengthy transition path, KCF continues to supply its condition monitoring product line to the commercial marketplace, while furthering its development on subs. The success of KCF's SmartDiagnostics® commercial product line is in-part built around the ability to send large amounts of data using an extremely low power budget, which was furthered under this SBIR topic. This equates to enabling continuous monitoring of machines and low sensor lifecycle cost through minimizing battery replacements. Machines in commercial industry typically fail unexpectedly and over short time periods, which is why continuous monitoring is essential to practically enabling Condition-Based Maintenance.

KCF's suite of commercial products can be found on large industrial fans/air handling units, water pumps, mud pumps, paper plants, and within industries like natural gas, food processing, steel, and chemical plants. The objective always remains the same, and that is to optimize maintenance practices. The power generation industry is a natural fit for Condition-Based Maintenance and self-powered sensors, since failure of any of the large, moving parts results in costly downtime.

KCF Technologies, Inc.

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