



SBIR/STTR SUCCESS

# EXPERT MICROSYSTEMS

Since 1995, Expert Microsystems has made a place for itself in the niche market of prognostics and health management for critical equipment. In the aerospace and power generation realm, this translated to precise techniques for monitoring the sensors of engines, power plants, and other infrastructure using specialized software. The company's patented SureSense® system provided the means to monitor automatically a complex system such as a power plant, from a remote location. The plant data is accessed using a distributed SCADA – Supervisory Control and Data Acquisition – system that is essentially a communications and control network that can open and close valves, operate pumps, and give other commands. The thought process then turned to the SCADA systems themselves – instead of monitoring just the plant equipment, why not monitor the control systems and ensure they are also of optimal health?

#### PHASE III SUCCESS

Over \$6.58 million in related revenues

#### AGENCIES

DHS, DOE, NASA, USAF

#### SNAPSHOT

Expert Microsystems SureSense® software has been deployed across federal agencies as well as the commercial marketplace in the electric power generation, aerospace, cyber security, electronic and industrial process control industries.

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7932 Country Trail Dr. Suite 1  
Orangevale, CA 95662

[www.expmicrosys.com](http://www.expmicrosys.com)

With this in mind, Expert Microsystems embarked on an SBIR project with the Department of Homeland Security (DHS) to apply these same proven principles to intrusion detection with the goal of making the control infrastructure – which can be vulnerable to threats – more secure. During the Phase II portion of the project, Expert Microsystems demonstrated the feasibility of this new defense by actually hacking into a SCADA system at the Idaho National Laboratory (INL) and demonstrating the ability to identify the attack even while the conventional intrusion detection systems – commonly used today – did not. The INL-provided SCADA system provided an opportunity for testing where no real damage to public infrastructure could be caused by the testing.

“In doing this project, we added a whole set of new and useful capabilities to our core technologies for prognostics and health management,” explains Randy Bickford, Founder and President of Expert Microsystems. “Our original goal was to apply our PHM techniques to the problem of intrusion detection in control systems, and we successfully proved that this core technology has an extended applicability across a wide range of other computing platforms as well.”

The work the Sacramento-based company did in 2006 with DHS is continuing to come to fruition – in early 2014, Expert Microsystems was awarded a U.S. patent for its

asset surveillance methods, which were based off of the same technology developed under the SBIR sponsorship. This patent, in combination with twelve related patents for the company's core PHM technology, demonstrate a long history of successful innovation.

The path of success led Expert Microsystems to the commercial marketplace. The company chose to pursue opportunities in the computer networking and server industry. This entailed applying the same techniques of PHM to a computer server and monitoring both hardware and software within a network infrastructure. This is especially important for financial or security institutions which engage in high-end transactions. Whether a threat might compromise the server hardware or software, detection of the problem is critical to prevent a server crash. Ultimately, this technology was licensed to one of the largest software manufacturers in the world, and they have been successful in applying the technology to database and transaction servers. Here, the technology has several advantages over existing products including fewer false positives, the ability to analyze very large data sets and variables from multiple sources, and the ability to monitor cyber networks automatically in multiple and differing environments.

In addition to licensing the technology, Expert Microsystems won a follow-on Phase II contract with the Department of Energy (DOE), and most notably, a Phase III designated procurement contract with NASA. Using its SureSense® software package, Expert Microsystems demonstrated the ability to accurately detect and diagnose sensor faults and identify anomalous system operating states in a wide variety of power plant and spacecraft equipment. The SureSense® package is also being embedded in other computer programs and control systems for providing real-time data analytics.



Today, Expert Microsystems is combining its SureSense® product line with a newer and complimentary product that they are developing for the Electric Power Research Institute (EPRI) and DOE. This Fleet-wide PHM Suite combines the output from SureSense® with other plant information, such as results from inspections or maintenance actions, to further refine the diagnosis based on the instrument data processed through SureSense®.

New applications are broad and Expert Microsystems is actively seeking licensing opportunities with a global player in the power generation space. There is also interest on the part of DHS to monitor first responders and from the Department of Defense to monitor soldiers. While their core technology is essentially a “doctor” for machines, this same prognostic principle can apply to the health of individuals. New uniforms are currently being constructed for firefighters that sense the wearer’s vital signs. The sensors have a wireless link to a local station – either on the truck or an office – and the interest is in knowing which person is healthy and which is in distress? If a firefighter is down, vital signs information can be monitored in real-time and medical personnel can be alerted automatically with precise diagnostic information about the firefighter’s condition.

Contrary to what people may conclude, this software does not and will not replace the human expert. In fact, it is quite the opposite. Rather than have the doctor seek out and analyze data to find the abnormal condition, the software does the early work - it finds the problem, and synthesizes the data to an initial diagnosis. What it does not do is decide the necessary course of action and treatment. The goal is to enable the human expert to implement the most effective response at the earliest possible time.

“Letting problems accumulate in both machines and humans has the same detrimental effect on the overall health of the unit,” says Bickford. “So whether we are dealing with equipment, or the “human” machines of the heart and other vital organs, longevity through continued prognostics and maintenance is what we are seeking.”