

DEPARTMENT OF THE NAVY  
**SBIR/STTR TRANSITION PROGRAM**  
**SPOTLIGHT**

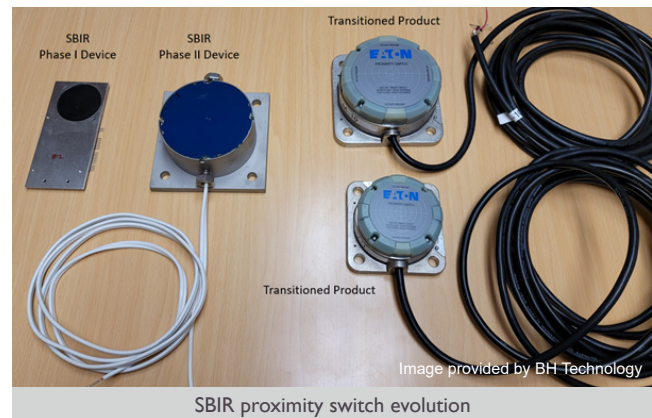
## BH Technology - Small Sensor has Big Impact

By Jennifer Reisch

While proximity sensors and switches have been around for decades, BH Technology has taken a fresh look at these commodity devices and, through the SBIR program and the company's patented technology, developed a new family of proximity sensors that are more capable, highly accurate, lower cost and better performing in harsh Naval environments. These proximity sensors will initially go on aircraft carrier weapons elevators, although they have many other possible applications throughout the Navy. Proximity sensors and switches are found in virtually every Navy platform. As well, these proximity devices can replace mechanical limit switches—eliminating mechanical wear and tear—while providing the same spatial awareness functionality in a matching form, fit and enhanced function package.

After successful SBIR research, development and qualification testing, proximity sensor production has been licensed to Eaton Corporation, which will be able to manufacture large quantities of the sensors and will be able to support the technology for the foreseeable future.

The Sensors group in Eaton's Industrial Controls Division has designed and manufactured sensors and limit switches to the requirements of a range of industrial customers and Navy shipboard applications for many decades. Resistance of electronic sensors in the Eaton portfolio to sources of electrical and electronic "noise" in an application environment is an important operating characteristic, and noise immunity requirements in many industrial environments fall in the range of three to 20 volts per meter. Some application environments in Eaton's target markets, including mining, mobile agricultural and construction vehicles,



and Navy shipboards require much higher levels of noise immunity, in some cases beyond 200 volts per meter. High noise immunity levels in this range are orders of magnitude more difficult to achieve technically than the lower requirements of industrial markets but remain a hard requirement for electronic sensors on these types of machinery, explained Tony Develice, engineering manager of Electronic Power Control and Input Devices at Eaton.

Partnering with BH Technology and using the company's unique high-noise immunity transducer technology allowed Eaton to leverage expertise in electronic sensor design and manufacturing to develop a new line of sensors for these difficult application requirements, including Navy shipboard use. The SBIR process and commercialization of the BH Technology design fostered a strong relationship and will lead to future uses of this and potentially other BH Technology innovations in other Eaton products, both within and outside of DoD applications, said Develice. Eaton sensor and limit switch products have been used on Navy ships for many years, but this was the Eaton Sensors group's first experience in a dedicated development project

involving PEO Carriers and with the SBIR process. Other groups from Eaton's Electrical Sector have long been involved, both in SBIR developments and in resultant commercial programs, within the Department of the Navy and across the DoD.

A proximity sensor literally detects something that is in the proximity of (or close to) the sensor, allowing for precise control of the position of one item relative to another. "You can imagine that if you have a weapons elevator that's carrying 10,000-pound bombs that are ready to go up to the flight deck for aircraft deployment, you want the floor of the elevator to exactly match the floor these bombs are being delivered to. You don't want the floor of the elevator stopping at a point where you've got a 6-inch drop to the flight deck. This is particularly true with bombs, but even with a human being, you don't want to step up or down when you get off an elevator. A proximity sensor is what allows you to stop the elevator exactly to match the floor," explained Dr. Aron Kain, senior vice president of engineering at BH Technology. "Equally as important, you need the proximity sensor to work even if there is a fire, or if bombs have exploded, under war conditions, under terrible EMI conditions, during jamming of radar. It absolutely has to work in the worst environment imaginable at the worst possible time."

The new sensors will replace technology that is over 30 years old with a form, fit, and enhanced function one-for-one replacement. "So literally you can take our sensors and replace the old

technology with better performance devices, and not sacrifice time and effort and even save on the cost of the device," said Kain. The sensors can be used in new Navy vessel design as well as to replace existing sensors. "There are areas of the ship that are extremely difficult to access that also require an awareness of where items are in relationship to each other. In these cases, reliability is as important as the measurement of proximity. The sensor needs to last 30 years without maintenance, without calibration, without cleaning. Set it and forget it for 30 years.

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**Dr. Aron Kain, senior vice president of engineering at BH Technology**

"Successfully navigating and graduating from the SBIR program to transition to the fleet is not for the faint of heart. To get from a successful phase II to the potential of having the fleet acquire the SBIR product, you have two hurdles: one is the transition from a research project to a manufacturable device and then two, qualification testing

of the device to make sure it can go on a ship. There can be any number of product iterations required while testing. If you haven't done it right, the expense of iterations is on the small business, unless an acquisition program picks up the cost of qualification testing and associated iterations. The SBIR program is not designed for qual testing. We were fortunate in the way that we did our design that we had first pass qualification testing success, so the expense to BH Technology was at a bare minimum," said Kain.

"The next hurdle after qual for the small business is, who's going to manufacture this in the expected

quantities that the Navy anticipates? Certainly not us; otherwise all we'd be doing is building these sensors, and would not be able to use our sensor technology in the many other application areas we have and would like to explore. Fortunately, during the Phase II effort, anticipating the volume of devices that would be needed and could be expected, we teamed with Eaton Corp. and licensed the device manufacturing and sales to them. This frees us up to further integrate the technology into other areas that may benefit the Navy. We already see the payoff in this approach as we are currently doing a Rapid Innovation Fund project for netted proximity sensors as well as another SBIR Phase II for a planar conductivity, temperature, and depth sensor for PEO submarines, all based on our patented technology.

“There is a tremendous amount of embedded goodwill and good technology and proper programmatic for rolling something out from a concept on a blackboard all the way to getting it out to the actual fleet on a ship. The SBIR program allowed us to develop the technology beyond where it was to satisfy a particular Navy need; transition the device to the fleet, and now explore new opportunities based on what was developed,” Kain explained.

BH Technology's proximity sensor technology has many other applications beyond the weapons elevators. “For example, a crane derrick on a ship moves and rotates. You want to make sure it doesn't hit a part of the ship, and doesn't interfere with something else, so you could put a sensor on there. You really want to know that the hatch of a submarine is closed before going under the water. Someone might even want to put a proximity sensor on the front of a washing machine that does heavy loads of laundry on a ship because you want to be sure that door is closed and not flooding the compartment of the ship with soap suds. The potential applicability of this is staggering,” said Kain. “The technology goes well beyond proximity sensing. Using



the same core technology, we have developed pressure, temperature, force, torque, flow, and displacement sensors, both linear and rotational, all tracing their origins back to the original SBIR effort. The technology is such that it can easily be customized. If there is an application that needs a change in form and fit, it can be readily accommodated.”

The proximity sensor is an enabling component. “Not only will the sensor get the elevator to stop in the right place, but being a smart technology, it allows you to better control the elevator; it allows the elevator to do other things than simply stop at a floor. You can now, for example, control the speed of the elevator; you can look at built-in testing and maintenance. The sensor can allow the elevator itself to be smart and tell you ‘I might have a problem here,’ or ‘You should look at this and change this out.’ There is great value-added potential,” described Kain.

BH Technology develops disruptive technology sensors and sensor systems across a wide range of applications and industries for government and commercial clients. Advanced accurate, cost effective, highly reliable and robust sensors and sensor systems allow customers to advance and enhance current product lines and new emerging markets. For more information, visit the company's website at <https://www.bhsensors.com/>.