

Eagle Harbor Tech Case Study



“Our mission has always been to deliver solutions that exceed our customer expectations.”

- Ken Miller, head research scientist at EHT

Creating New Energy Solutions with PCB123

Founded in 2006, [Eagle Harbor Technologies \(EHT\)](#) built a stellar reputation by delivering innovative, high quality pulsed power solutions to organizations such as the Department of Energy (DoE), National Aeronautics and Space Administration (NASA), and the United States Navy. From its new headquarters in downtown Seattle, WA, EHT now offers a full suite of pulsed power products to commercial and research markets. These organizations depend on high voltage nanosecond pulse generation, advanced plasma sources, and fusion energy technologies.

“Our mission had always been to deliver solutions that exceed customer expectations,” said Ken Miller, head research scientist at EHT. “Today, we bring that philosophy to commercial products.”

The Mission

“Our main business involves creating customized pulsed power supplies,” said Miller.

EHT products provide [unprecedented pulse control](#) and generate high voltage square wave pulses over a wide frequency. Uses include magnet control for fusion experiments, generation of high power microwaves in defense applications, and in biomedical for sterilization. This broad range of uses across multiple industries put EHT’s reliable, innovative products in high demand.

The Differentiator

Success in the energy industry is about exploring and pushing boundaries, and Eagle Harbor is a key partner in new initiatives. Researchers continuously stretch the limits of possibility when it comes to the future of nuclear fusion energy. “The primary obstacle to progress was the need for longer pulse generation. Future machines would require it and no one had developed a reliable, cost-effective answer,” said Miller, “until we solved the problem.”

Arming itself with such a competitive advantage was no small feat for Miller and his team. “To generate sufficient pulse duration within [parameters](#), our products use specialized boards that just aren’t all that easy to design or build,” said Miller.

The Beginning

“PCB123 provided a low barrier to entry for scientists who were not necessarily electrical engineers.”

- Ken Miller, head research scientist at EHT

When EHT first transitioned into commercial products, the operation was lean and relied on expertise from outside the organization. “We are physicists, not PCB designers,” said Miller. “We needed a design tool that was cost-effective and easy to use.”

PCB123® made it possible for skilled professionals to design PCBs with complex, geometric layouts. Of critical importance, PCB123 is easy to use—enabling Miller and his team to quickly become proficient with it. “PCB123 provided a low barrier to entry for scientists who were not necessarily electrical engineers,” said Miller.

EHT chose Sunstone to prototype and manufacture and never looked back. “They have been our choice for our first product development and we continue to use them,” said Miller.



The Better Fit

“A few years ago we did an analysis of competitor’s software to see if any could meet our requirements for speed and geometry,” said Miller. “It was clear that Sunstone was *the* choice.”

With products operating at up to 20,000 volts, failure literally is not an option. “It would be more dramatic than just melting. Let’s leave it at that,” said Miller.

Sunstone could support designs with complex layouts, including the critical geometric aspects of them. “We precisely dictate the layout to ensure functionality,” said Miller. “This is because of the stray inductance and capacitance, and of course the high voltage.”

“Especially when you consider our requirements, Sunstone design tools are remarkably easy to use,” said Miller.

Collaboration, Iteration, Improvement

By effectively setting the table for continuous improvement, Miller and his team have confidence that Sunstone can support production from design through manufacturing.

“When Sunstone technicians first saw one of our designs, they told us they had never seen anything close to their complexity,” said Miller.

This began an enduring collaboration unique for both organizations. Open dialogue



about designs, prototypes, and production runs are all part of an average day’s work at Sunstone. Working with a customer to iterate and optimize the PCB123 software represented uncharted territory.

“We often take their software to the edge of its abilities,” said Miller.

Challenges come in many varieties and are often about the tiniest detail—setting hold offs for individual holes or having individual polygons with stand-offs different from the net with which they are associated. “The goal is always to make the process better the next time,” said Miller.

By effectively setting the table for continuous improvement, Miller and his team have confidence that Sunstone can support production from design through manufacturing.

“We are always challenging them, always on a timeline,” said Miller. When that occurs, Sunstone upgrades PCB123 to support more complex designs. “They work with us to resolve issues and add features when necessary,” said Miller.

“Eagle Harbor (EHT) provides innovative solutions for pulsed power applications. EHT has delivered on R&D contracts for DOE, NASA and DOD. Our products rely on innovative PCB designs that must withstand operation at voltages up to 40 kilovolts (kV), while minimizing stray inductance and capacitance. To achieve these design goals, EHT designs with circular, ring-like layouts and complex curved copper shapes.

When our designs started stressing PCB123, the engineering team at Sunstone quickly started working with us by adding additional review steps to catch potential problems. Meanwhile, they analyzed PCB123, implementing new features that allow us to more easily design our particular PCBs.

-Ken Miller Head Research Scientist Eagle Harbor Technologies

A Lasting Partnership

Sunstone works closely with EHT to design, prototype, and manufacture the boards it needs to break new ground in the fusion energy arena.

PCB123 certainly serves as the foundation for the durable partnership between Sunstone and EHT, but there is more to the relationship than software. “Sunstone produces quality boards and they do it very quickly,” said Miller.

“It is one thing to find a software package capable of supporting such complex and precise design requirements,” said Miller. “Sunstone can also prototype and manufacture our boards on a timeline that meets our production requirements.”

Complexity, collaboration, and commitment. Sunstone works closely with EHT to design, prototype, and manufacture the boards it needs to break new ground in the fusion energy arena.

“Sunstone has proven over and over to be the right partner for us,” said Miller.