BEST START

Partner Company Profile

MAXWELL LABS

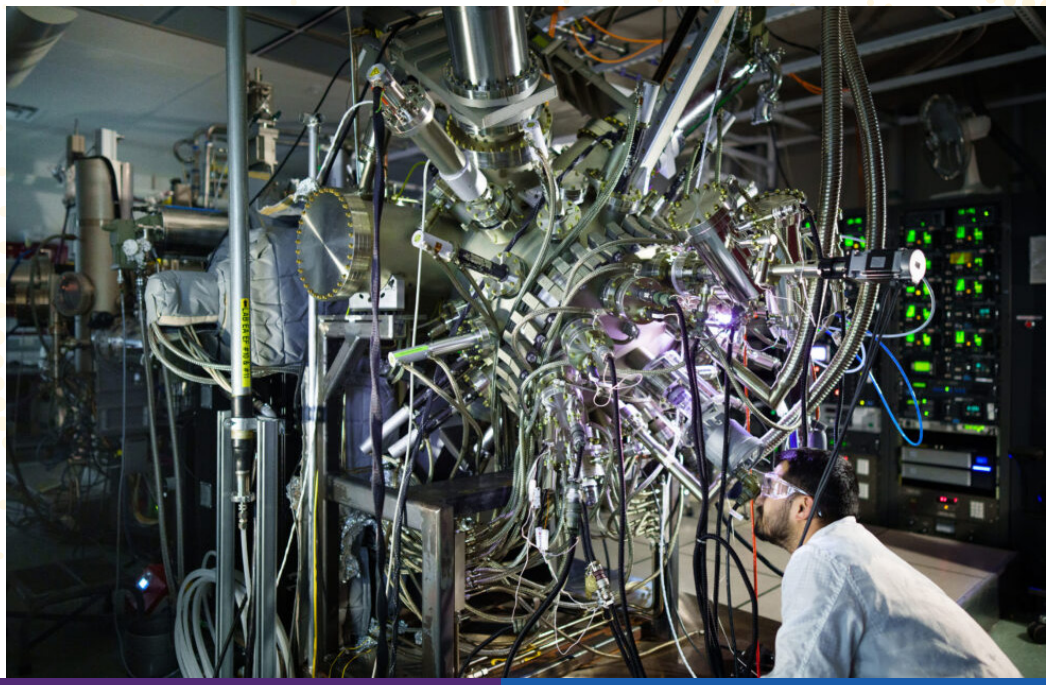
Advanced Cooling for High-Performance Computing

With modern artificial intelligence (AI) and high-performance computing (HPC) systems pushing the boundaries of processing power and generating intense heat, current cooling techniques are creating bottlenecks in processing speed and power efficiency. Traditional air and liquid cooling technologies struggle to keep up with the intense heat generated by modern processors, particularly at microscopic hotspots where heat is most concentrated on chips. This bottleneck limits advancements in defense applications where rugged, high-power computing is essential.

Optical Cooling: A Breakthrough for the Warfighter

Maxwell Labs' chip-scale optical cooling system leverages cutting-edge advances in nanophotonics and materials science to dissipate heat. Unlike conventional methods, this solid-state technology uses light to directly target and remove heat from processor hotspots, converting thermal energy into usable light and even recovering waste heat for improved power efficiency. This innovation enables dramatic increases in computing performance, such as higher clock speeds, greater bandwidth, and enhanced reliability. For the warfighter, this means next-generation computing architectures that are faster, more energy-efficient, and capable of operating in extreme conditions, increasing processing power for battlefield analytics, autonomous systems, and real-time decision-making.

The cooling technology uses an inverse design algorithm to create nanophotonic structures that deliver targeted, high-density laser cooling directly to hotspots deep within CPUs and GPUs. This this approach enables precise and rapid heat management far beyond the limits of conventional air or liquid cooling. A laser-cooled photonic cold plate penetrates the chip's active regions, removing heat at the source and overcoming thermal challenges, resulting in clock speeds in the hundreds of GHz in silicon, double the power efficiency, and no moving parts or working fluids.



Revolutionizing Data Center Cooling with Advanced Laser Technology for Greater Efficiency and Performance Photo: Maxwell Labs

MAXWELL LABS

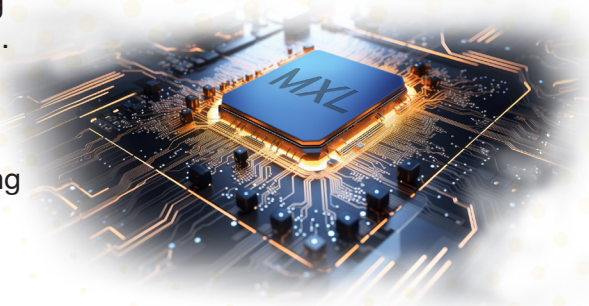
Solving DoD's Toughest Power and Cooling Challenges

Maxwell Labs' photonic cooling technology directly supports the DoD's top priorities in advanced power generation, next-gen energy conversion, and AI-driven optimization. By reducing energy waste and processor temperatures, the technology enables:

- Higher-performance computing for autonomous systems and real-time simulation
- Lower thermal signatures in field-deployed hardware
- Extended hardware lifespans through reduced heat stress

The technology delivers critical capabilities across multiple defense applications. For cybersecurity, it enables hardware-level workload monitoring independent of software, providing intrinsic processing behavior analysis for real-time threat detection. In modeling and simulation, the system supports complex multi-physics battlefield scenarios in real-time, significantly improving accuracy in missile guidance systems and ballistics modeling for enhanced strategic planning. Autonomous systems and ISR platforms benefit from faster decision cycles and improved sensor data processing, enabling rapid situational awareness in contested environments with reduced human intervention. Additionally, the technology's efficient thermal management reduces detectable signatures from computing systems while maintaining processing performance, offering dual advantages of stealth and computational power.

The research also contributes to broader advancements in energy-efficient computing architectures and thermal management solutions relevant to defense needs. This approach provides a practical solution to the growing thermal limitations in military computing systems without requiring fundamental changes to existing hardware designs.



About Maxwell Labs

Maxwell Labs was founded by Jacob Balma, Alejandro Rodriguez, and Mike Karpe, and is supported by a team of industrial and academic leaders in supercomputing, nanoscale heat transport, and photonic engineering. Based in St. Paul, Minnesota, Maxwell Labs is currently collaborating with Sandia National Labs and the University of New Mexico to refine its prototype, which will be demonstrated through BEST START. They are launching an early-access program to engage users from various industries.

Maxwell Labs | https://mxllabs.com | info@mxllabs.com

About BEST START

BEST START provides the crucial support businesses need to bring their visionary technologies to life. Whether refining smart grid technologies, enhancing green energy applications, or creating efficient solutions for power generation, BEST START partners with Minnesota companies to move technology forward. BEST START is a collaboration of three organizations—DEVCOM Army Research Laboratory, the University of St. Thomas in Minnesota, and ETC, a nonprofit defense solutions provider.

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