

**PRESS RELEASE**

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## **Multibeam Patent Enables High Accuracy in Multi-Column E-Beam Writing, Processing, and Inspection**

Innovative use of “Hadamard” patterns enhances both wafer alignment and beam placement accuracy in four key multi-column e-beam applications

**SANTA CLARA, CA - November 14, 2017 - Multibeam Corporation** today announced a major addition to its e-beam patent portfolio that advances wafer alignment and pattern overlay accuracy for multi-column e-beam writing. The patent underscores the company's leadership in multi-column e-beam technology and significantly enhances e-beam placement accuracy in four key applications: wafer patterning, electron-assisted etch/deposition, integrated defect inspection, and device-embedded security.

### **Multibeam Patent # 9,595,419**

The patent announced today describes a unique alignment target comprised of an array of “Hadamard” patterns – specifically chosen to have high e-beam image contrast, balanced x-y edge information, and excellent orthogonality with respect to neighboring Hadamard patterns. Location of one Hadamard pattern within an array of patterns enables accurate registration on a "near miss" basis since the offset from a central target is known.

While the primary advantage of the Hadamard targets is superior wafer alignment and layer-to-layer pattern registration, resulting in higher device yields, there are other benefits:

- Target size and complexity can be scaled to die area and performance requirements.
- Targets can be used to monitor e-beam deflection, resolution, and other parameters.
- Higher-order Hadamard targets can also be used for more sensitive beam diagnostics.

This new patent supports complementary e-beam lithography (CEBL) and direct electron writing (DEW) by speeding wafer alignment and improving overlay accuracy. Similar improvements apply to electron-assisted etch and deposition at precise locations defined by a design layout database. In e-beam inspection (EBI), Hadamard targets can be used for the centering of care areas for scanning.

### **About Hadamard Patterns**

Hadamard patterns, named after Jacques Salomon Hadamard (1865 - 1963), derive from a generalized class of Fourier transforms that perform orthogonal, symmetric, involutive, and linear operations on real numbers. Hadamard was a French mathematician whose legacy encompasses major advances in number theory, complex function theory, differential geometry and partial differential equations.

## **About Multibeam**

Multibeam Corporation is a leading electron-beam technology innovator in wafer fab equipment. The company's proprietary miniature e-beam column array is currently being used to build lithography systems for the U.S government. In addition to these systems that enable low-volume, high-mix production of microchips, the company aims to apply its e-beam platform to serve other key applications such as embedding chip-specific security information to reinforce device security and enhancing etch/deposition accuracy in advanced-node fabrication. Based in Santa Clara, California, Multibeam is led by Dr. David K. Lam, the founder and first CEO of Lam Research. Widely recognized as a major contributor to the growth of the semiconductor industry, Dr. Lam was inducted into the Silicon Valley Engineering Hall of Fame in 2013.

For more information, visit [www.multibeamcorp.com](http://www.multibeamcorp.com).