# Lockheed Martin Collaborates With Penn State On Metamaterials Breakthrough

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NEWTOWN, Pa., Feb. 15, 2011 /PRNewswire/ -- Lockheed Martin (NYSE: LMT) has collaborated with The Pennsylvania State University to develop a breakthrough material that can significantly improve the performance of spacecraft antennas. The electromagnetic metamaterial is considered to be the first commercially viable product of its kind and is one of the first practical implementations of electromagnetic metamaterials that improves a real-world device.

Lockheed Martin's University Research Initiative (URI) Program funded the initiative, which produced a metamaterial used in a horn-shaped satellite antenna. Leveraging a partnership spanning several years, the latest Lockheed Martin-Penn State collaboration combined concepts envisioned by Dr. Erik Lier of Lockheed Martin Space Systems Company with Penn State's expertise. The collaborative effort was featured in a recent issue of *Nature Materials*, one of the world's most prestigious and highly cited science journals focused on all topics within the combined disciplines of materials science and engineering.

Metamaterials have properties not found in nature. Electromagnetic metamaterials, like the one developed by the Lockheed Martin-Penn State collaboration, are designed to interact with and control the way electromagnetic waves travel, enabling new devices with radically different and improved performance. Metamaterials can help make products smaller, which is important in space-based applications, and can also be less costly to manufacture.

"Many experts within government, industry and academia, have had doubts about electromagnetic metamaterials because they were perceived to have narrow bandwidth and high loss," said Lier. "The results we achieved in this collaborative effort challenged this paradigm, and I think we'll see customers benefitting from this technology in the near-term."

Prof. Doug Werner, director of the Penn State Computational Electromagnetics and Antennas Research Lab (PSU CEARL: http://cearl.ee.psu.edu/), led a team of students and scholars that developed the design optimization tools. They also successfully built and, along with Lockheed Martin, tested the first prototype antenna.

"We are extremely excited about the outcome of this collaboration, which represents a game change in the field of metamaterials," said Werner. "In particular, we have succeeded in designing metamaterials that considerably improve conventional horn antennas by more than an octave bandwidth with negligible loss, and advanced the state-of-the-art in the process."

"When our engineers collaborate with academia, we are able to leverage their inventions with our business and technical expertise to create innovative, affordable solutions that meet customer needs," said Jennifer Byrne, Lockheed Martin vice president for Technology Strategy and University Research. "Our collaboration with Penn State may well yield other breakthroughs in the promising field of metamaterials, and we may be able to explore other applications for this technology."

Headquartered in Bethesda, Md., Lockheed Martin is a global security company that employs about 132,000 people worldwide and is principally engaged in the research, design, development, manufacture, integration and sustainment of advanced technology systems, products and services. The Corporation's 2010 sales from continuing operations were $45.8 billion.

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