Lockheed Martin reveals first images from telescope as thick as a pen cap

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This concept view shows how a SPIDER instrument could be used in orbit on a spacecraft performing multiple missions. Currently, the size of optical payloads makes dual-payload spacecraft difficult and costly. A flat instrument like SPIDER could change all that. Credit: Lockheed Martin

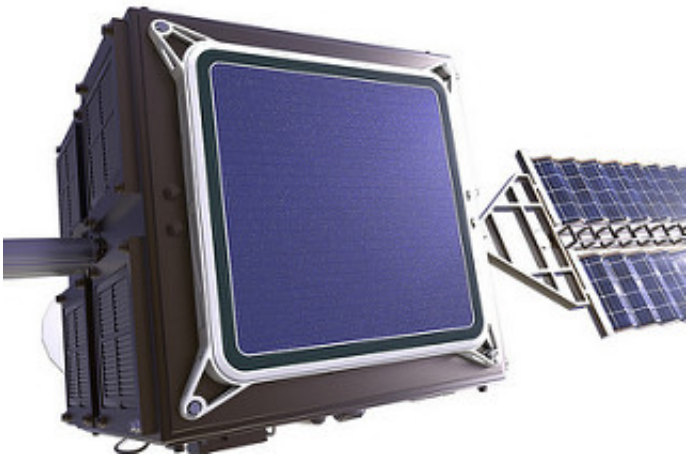
Lockheed Martin today revealed the first images from an experimental, ultra-thin optical instrument, showing it could be possible to shrink space telescopes to a sliver of the size of today's systems while maintaining

equivalent resolution.

Weighing 90 percent less than a typical telescope, the Segmented Planar Imaging Detector for Electro-Optical Reconnaissance (SPIDER) opens a path for extremely lightweight optical instruments, allowing for more hosted payloads or smaller spacecraft. More broadly, the sensor technology has applications for aircraft and other vehicles—anywhere that depends on small optical sensors. The future could see UAVs with imagers laid flat underneath their wings, and cars could have imaging sensors that are flush against their grills.

The SPIDER project has roots in research funded by the Defense Advanced Research Projects Agency (DARPA). Lockheed Martin independently completed this phase of research at its Advanced Technology Center (ATC).

"This is generation-after-next capability we're building from the ground up," said Scott Fouse, ATC vice president. "Our goal is to replicate the same performance of a space telescope in an instrument that is about an inch thick. That's never been done before. We're on our way to make space imaging a low-cost capability so our customers can see more, explore more and learn more."



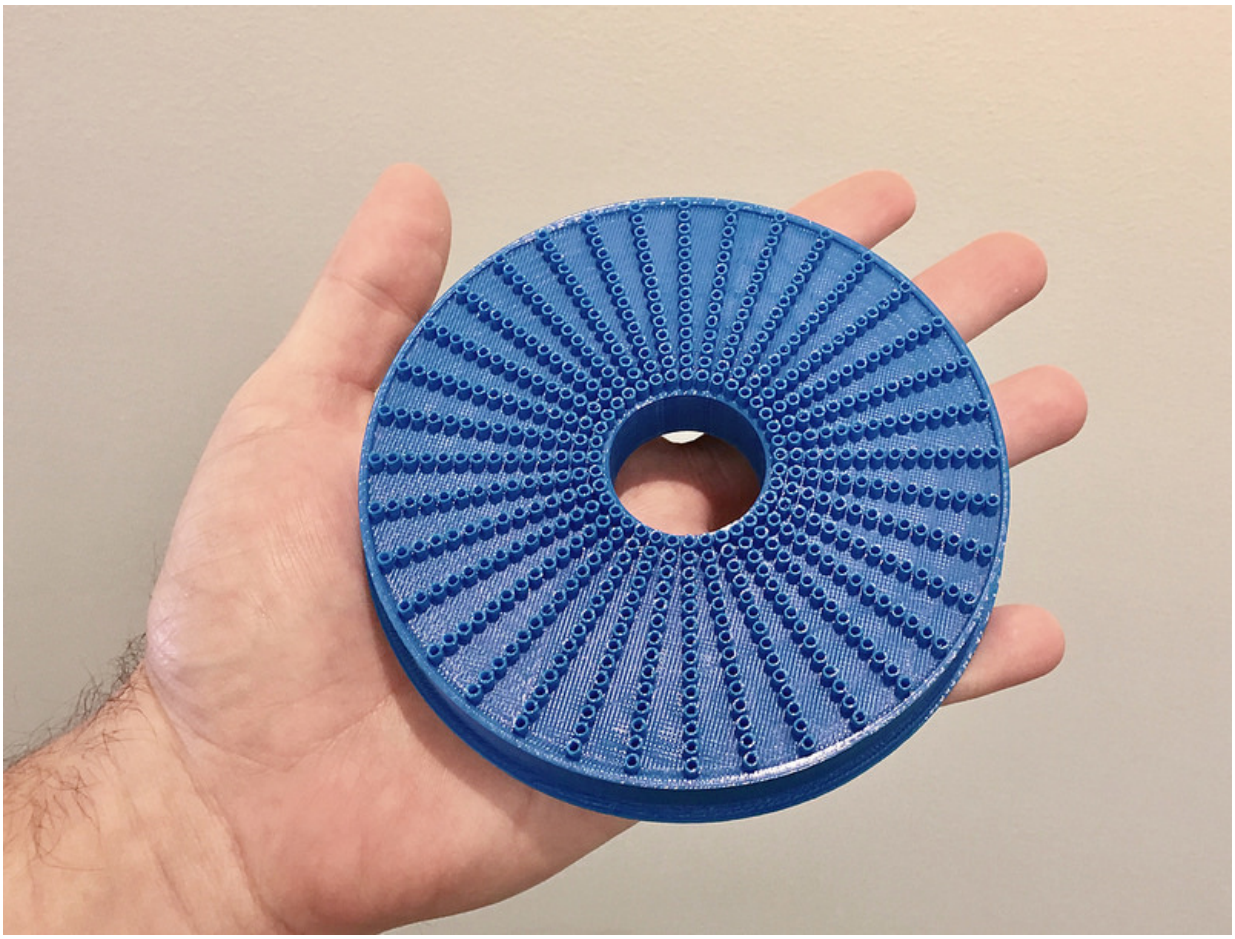
This close-up concept view shows how a SPIDER instrument could be hosted on a spacecraft performing multiple missions. Currently, the size of optical payloads makes dual-payload spacecraft difficult and costly. A flat instrument like SPIDER could change all that. Credit: Lockheed Martin

The system uses tiny lenses to feed optical data divided and recombined in a photonic integrated circuit (PIC), which was originally designed for telecommunications at the University of California, Davis. Using these chips in a different way, Lockheed Martin researchers unlocked new potential for ultra-thin telescopes using a technique called interferometric imaging.

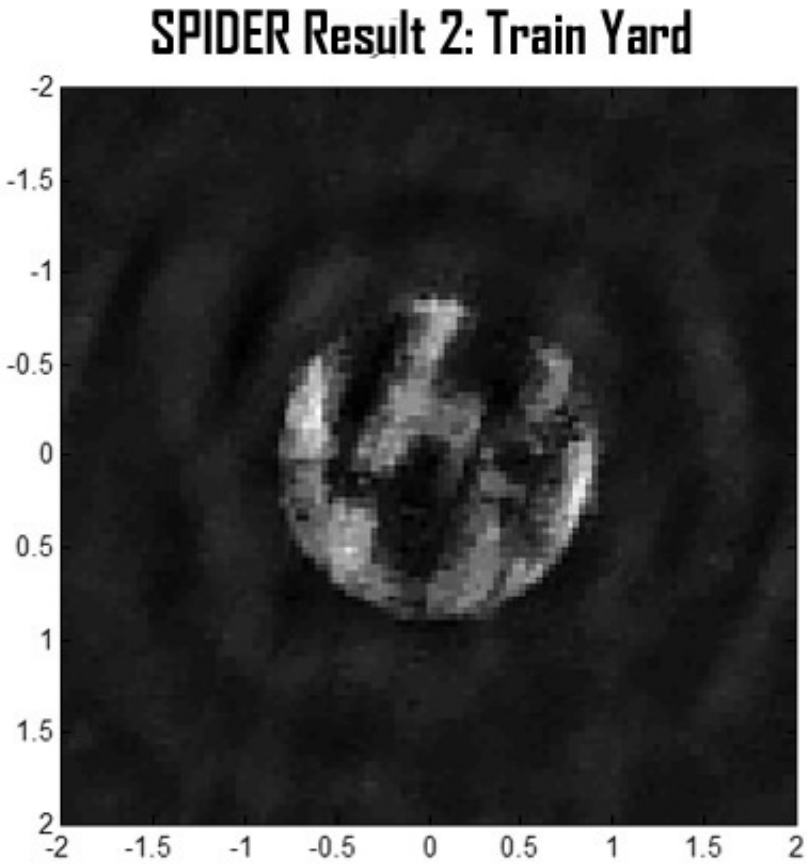
The tests involved a PIC aligned to a series of 30 lenses, each smaller than a millimeter across. An optical system simulated the distance from space to the ground, where scenes were illuminated and rotated. The first image included a standard bar test pattern, and the second image showed the overhead view of a complex rail yard.

The lenses and PIC comprise one section of a full instrument to be assembled in the next project phase. The team plans to increase the resolution and field of view in future phases.

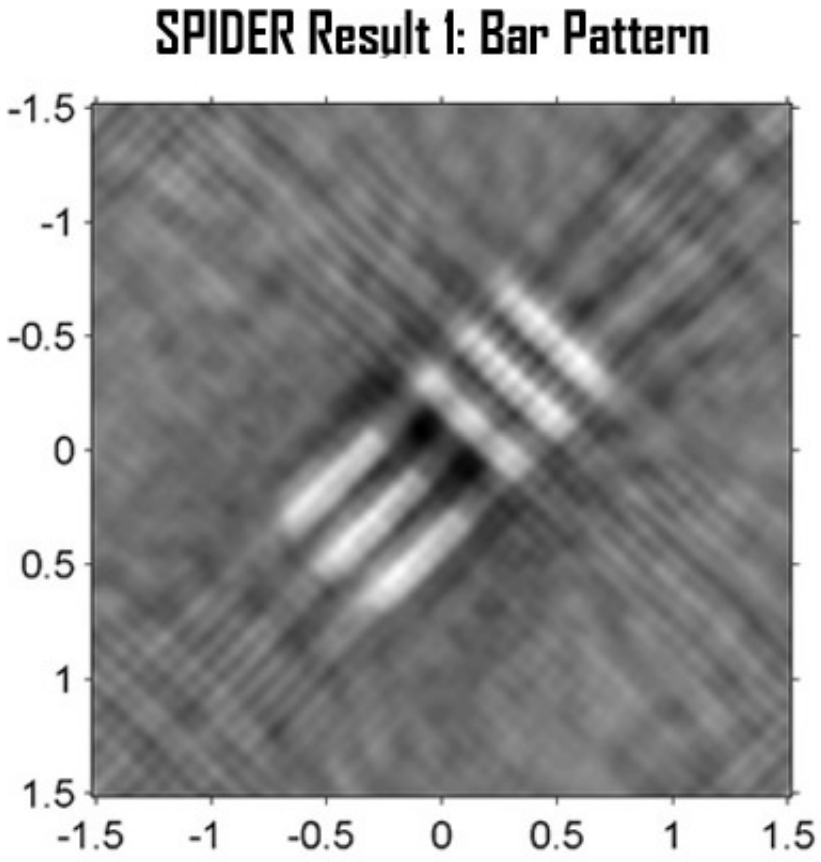
The initial findings from this project were presented today at the Pacific Rim Conference on Lasers and Electro-Optics (CLEO-Pacific Rim) in Singapore.



A close-up view of the next phase concept for SPIDER, which would align rows of tiny lenses and its photonic integrated circuits around a circular instrument, still retaining a size around an inch thick. Credit: Lockheed Martin



SPIDER's second test used a complex overhead view of a rail yard, result shown here (in millimeters). The team continues to increase the system's resolution from these first, baseline images. Credit: Lockheed Martin



SPIDER's first test used a standard bar pattern used to test optical instruments, result shown here (in millimeters). The team continues to increase the system's resolution from these first, baseline images. Credit: Lockheed Martin

Provided by Lockheed Martin

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