

# Optics and photonics research priorities, grand challenges presented in new report

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A new report from the National Research Council identifies research priorities and grand challenges to fill gaps in optics and photonics, a field that has the potential to advance the economy of the United States and provide visionary directions for future technology applications. The report recommends that the federal government develop a "National Photonics Initiative" to bring together academia, industry, and government to steer federal research and development funding and activities.

"Much is unknown when pursuing basic [optical science](#) and its transition to engineering and ultimately to products, but the rewards can be great," said Alan Willner, professor of electrical engineering at the University of Southern California and co-chair of the committee that wrote the report. "There are a number of opportunities that could change our daily lives."

"People do not think of [Google](#) as an optics company, but a typical Google data center has more than a million lasers in it," said Paul McManamon, technology director of the Ladar and Optical Communication Institute at the University of Dayton and committee co-chair. "The Internet example is only one case where work in optics and photonics may be a small part of the money invested in research, but is a critical enabler for high-tech businesses and jobs."

The committee named five [grand challenges](#) facing the nation that can be addressed with advances in optics and photonics technology. The first

is to keep up the pace of technological achievement established in previous decades. Others include improved [military surveillance](#) and [missile defense](#), achieving cost parity for solar power versus fossil fuel across the country's electrical grid, reaching seamless integration of photonics and electronics at the chip level, and developing optical sources and imaging tools to support increased resolution in manufacturing.

Eight particular areas of technological application are discussed in separate chapters: communications, information processing, and data storage; defense and national security; energy; health and medicine; advanced manufacturing; advanced photonic measurements and applications; strategic materials for optics; and displays. Each chapter reviews progress that has occurred since the 1998 National Research Council report *Harnessing Light: Optical Science and Engineering for the 21st Century*, as well as the technological opportunities that have risen from recent advances in optical science and engineering. The report recommends actions for the development and maintenance of global leadership in photonics-driven industries, including both near-term and long-range goals, likely participants, and responsible agents of change.

A National Photonics Initiative will help manage the breadth of rapidly expanding applications of photonics technologies, the report says, allowing both government and industry to form coherent strategies for technology development and deployment. The recommended initiative should also spearhead a collaborative effort to improve the collection and reporting of research, development, and economic data on this sector.

"The impact of optics and photonics on U.S. technology leadership is substantial; this is a critical reason to support a National Photonics Initiative," said McManamon. "Optics and photonics facilitates many

technology areas and is therefore critical to U.S. high-tech competitiveness. A National Photonics Initiative will ensure that we make full use of these technologies."

Provided by National Academy of Sciences

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