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Commerce, Justice, Science, and Related Agencies Subcommittee

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Good morning, Chairman Wolf and Ranking Member Fattah. My name is Elizabeth Rogan, CEO of the Optical Society (OSA). I appreciate the opportunity to comment on the Fiscal Year 2014 budgets for the National Science Foundation (NSF) and National Institute of Standards and Technology (NIST), both of which are vital to the future economic growth of our nation. I would like to thank you and the subcommittee members for your stewardship in providing sustained investments in these two critical agencies especially during these tough economic times.

Mr. Chairman, OSA supports the Fiscal Year 2012 budget levels for NSF and NIST. During that year, NSF received a total of $7 billion while NIST received $750 million.

Uniting more than 180,000 professionals from 175 countries, the Optical Society, known as OSA, brings together the global optics community through our programs and initiatives. Since 1916 OSA has worked to advance the common interests of the field of optics and photonics, providing educational resources to the scientists, engineers and business leaders who work in the field by promoting the science of light and the advanced technologies made possible by optics and photonics. OSA publications, events, technical groups and programs foster optics knowledge and scientific collaboration among all those with an interest in this dynamic field.

Optics and photonics are highly specialized fields of physics and engineering known as the "science of light," which makes possible everything from life-saving medical imaging devices and solar energy to high-speed Internet connections, computer chips and LEDs, to laser cutting for manufacturing. In short, optics and photonics are essential to solving problems, enabling innovation, facilitating economic growth and improving lives.

Mr. Chairman, this past summer the National Academy of Sciences released a landmark report discussing the current state of optical sciences and goals for the future – *Optics & Photonics: Essential Technologies for Our Nation*. The NAS study identifies the technological and economic opportunities the science has enabled, assesses trends in market needs, gives examples of where progress in photonics innovation has translated into economic benefits, and makes

recommendations for future research and policies that are intended to advance the optics and photonics discipline. The report states that "the promise of optics and photonics can be realized if the US acts now to cultivate this versatile scientific field."

One of the key recommendations of the report is to engage US industry, government and academia in the design and oversight of R&D and related programs that include federal as well as industry funding.

OSA and other professional scientific societies are working to move the recommendations of the report forward, including its ultimate goal of the establishment of a National Photonics Initiative or NPI. We are collaborating with a number of industry partners and have reached out to the relevant federal agencies to pinpoint any barriers to competitiveness and identify ways the private sector, academia, and government can work together to overcome them. We look forward to working with the committee in the future as the NPI takes shape.

NIST and NSF are two agencies critical to strengthening the optics and photonics industry. Both make significant investments in the field and we're already seeing the benefits of these programs:

1. NIST is the lead agency for the National Network for Manufacturing Innovation (NNMI), which seeks to create an effective manufacturing research infrastructure for U.S. industry and academia to solve industry-relevant problems. Last year, a special "pilot institute" was created on additive manufacturing, which brought together 85 companies, 13 research universities, nine community colleges and 18 non-profit and professional associations. Additive manufacturing, or "3-D printing," is a technique that, rather than removing a material to create a basic commodity, builds products from scratch one microscopic layer at a time. This results in less waste of materials while promising a new era of customized, fast-turnaround manufacturing design, ideal for a sophisticated, nationally-based workforce. These advanced printers, enabled by optics, can create objects ranging from prosthetic limbs and functional human tissue to jet engine parts.

   The Administration has announced that an additional three manufacturing institutes will be funded this year. It is our hope that they will consider the importance of optics and photonics as they move forward with these institutes.

2. NIST researchers are also working on improving the safety of the nation's drinking water. The EPA has recently introduced stricter water treatment rules for controlling microbes that are resistant to the current chlorine-based disinfection practices. EPA has called for treating water with ultraviolet light to inactivate microbes that survive chlorine disinfection. The NIST Optical Radiation Group is working on research that aims to create guidelines for standards such as how powerful ultraviolet light needs to be to eliminate these microbes.

3. NIST researchers are working toward making fiber optic communications more efficient, resulting in the transmission of more data with a much lower error rate. This past year, NIST researchers in collaboration with Stanford University developed and tested a device that offers the promise of doubling data transmission rates and enabling commercial systems that can better safeguard the transfer of sensitive information. NIST researchers have also made progress toward an optimal single-photon detector system, which is an extremely important research goal, not only in fiber-based telecommunications, but in numerous other fields from quantum information science and data-encryption to medical imaging, light detection, DNA sequencing, astrophysics, and materials science.

4. An NSF-funded researcher at the University of Nebraska-Lincoln is working on a polymer solar cell to increase energy conversion efficiency. The goal is to ensure that almost any surface, including walls, windows, even computer bags and clothing, will have the ability to tap into power of the sun. If successful, this could lead to replacing large, expensive solar panels atop buildings and poles and bring the promise of solar technology to millions of Americans in a more practical and affordable way. The grant includes an educational component; the researcher is preparing a workshop about solar engineering and the possibility of engineering as a career for Nebraska's high school students.

5. Researchers at MIT have developed a 3-D "light switch" using an optogenetics technique that manipulates neurons with light. Optogenetics uses light-detecting proteins to sensitize select brain cells to a particular color of light. By illuminating precise areas of the brain, scientists can selectively activate or deactivate the individual neurons that have been sensitized. The 3-D tool developed at MIT with NSF funding enables unprecedented precision to activate a single kind of neuron at a precise location with a single beam of light. This type of precision tool could one day help treat Parkinson's disease and epilepsy and enable mapping of the circuitry of the brain. Biomedical optics research like this has the potential to change the lives of many Americans and the federal government is poised to advance these technologies through programs such as the recently established Fattah Neuroscience Initiative. I'd like to acknowledge and thank Ranking Member Fattah for his leadership with this initiative, which promotes research and discovery across brain cognition, development, disease and injury.

These programs are just a few examples of how federal investments in science – and optics and photonics in particular – are resulting in real-life improvements for ordinary citizens. Science and engineering research, whether conducted in the private sector, at a university or within a federal agency or laboratory, requires long-term predictability and a sustained, coordinated effort to produce positive results. I urge the committee to keep this in mind during the FY 2014 budget process and beyond.

No matter how strong our research programs may be, we must also ensure we continue to educate and train the next generation of innovators and manufacturers. As I travel throughout the US and meet with our corporate members, I continually hear the importance of a well-trained workforce in Science, Technology, Engineering and Math (STEM) fields. Many of our members can't fill the technical positions that their businesses have available, such as highly-skilled shop floor technicians who support manufacturers. NSF understands the importance of getting students interested in STEM fields and the urgency of equipping our young people with the skills needed for the jobs of today and tomorrow. NSF grants are funding projects like those of Dr. Carl Wieman, a Nobel Laureate and OSA member, for the "PhET Interactive Simulations" at the University of Colorado Boulder. The project provides free, interactive, research-based simulations of physics concepts for elementary through university students as well as tools for science educators from all across the country. Already, more than 90 million such simulations have been run, enhancing classroom curriculum and providing students with a powerful tool for experimentation and fun, interactive learning.

Mr. Chairman, these are certainly difficult economic times. We know that you and members of this subcommittee have long supported and understood the importance of long-term investments in R&D funding, and hope you will continue to make investments in science and technology a national priority.

Once again, we greatly appreciate this committee's leadership and look forward to working with you as you move forward with the Fiscal Year 2014 budget process.