Uncertainty Principles: Photonics & Politics

The optics community responds to a changeable landscape in the U.S., the U.K., and beyond.

Stewart Wills

As 2016 drew to a close, the world looked back on a tumultuous political year. The United Kingdom's closely divided June "Brexit" vote to leave the European Union, followed in November by Donald J. Trump's election as U.S. president, pointed to seismic shifts in the language and norms of democratic engagement. And early signs suggest that 2017 could prove equally unpredictable, as electorates worldwide continue to register dissatisfaction about unequal sharing of the bounty of a globalized economy.

In short—as the Greek philosopher Heraclitus wrote two and one-half millennia ago—"nothing endures but change." With the near-term outlook so unstable, there's much to be said for waiting to see how events unfold before devising responses to the new political environment. Yet there's also much that the optics and photonics community can do—and is doing—to make the case for science during what's apt to be a long period of uncertainty. OPN talked with a few leaders in photonics and technology policy about the road ahead.

Murky view

As the world catches its breath after 2016's political turbulence, the immediate future looks murky at best.

In the United States, it's been eight years since the last change in presidential administration. That's a transition that even in the best case would take months to settle out. And in science and technology policy in particular, during the campaign season, the U.S. president-elect offered "few articulated policy positions, especially outside of the tax and trade area," according to a 9 November report by the Information Technology & Innovation Foundation (ITIF). Thus, since the election, industry observers have scrutinized the Trump transition team's activities, and particularly its announcements of staff picks and cabinet candidates, in the hope of finding some tea leaves to read.

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What signs there have been for science and tech have proved decidedly mixed. On the one hand, the transition team has included prominent voices that favor abolishing the White House Office of Science and Technology Policy (OSTP). And Trump's picks to head agencies such as the U.S. Environmental Protection Agency and the Department of Energy have raised fears of dim days ahead for U.S.-funded climate change research (and, possibly, the country's withdrawal from the 197-nation Paris climate agreement forged last April).

On the other hand, in mid-December, Trump added a number of high-profile technology leaders, including Tesla, SpaceX and Solar City entrepreneur Elon Musk, to his strategic team. That suggests a strong voice for tech in the president-elect's ear. Yet how these decisions—and the blizzard of others announced before Trump's inauguration on 20 January—might actually play out in the months to come remains very much an open question.

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In Europe, meanwhile, the Brexit vote's impact and the future shape and prospects of the European Union will also take months or years to fathom. The process of easing Great Britain out of the E.U. will likely not be complete until summer 2019, with much hard negotiation on the specific terms of withdrawal in the intervening months. And a number of other European countries themselves face the possibility of electoral upheaval in the near future. As many commentators have noted, the results of the Brexit referendum and the U.S. presidential race seem to have improved the chances that far-right, anti-establishment parties in France (which holds parliamentary elections in the spring) and Germany (with elections in the summer) might score similar surprise victories.

Globalism and trust

These events in Europe and the U.S., of course, have worldwide ramifications. The Trump campaign, for example, raised the prospect of using steep protective tariffs as leverage in trade negotiations with China, the world's second-largest single economy. In a larger sense, both the Brexit referendum and the U.S. election campaign included loud calls to renegotiate or scrap some high-profile multilateral trade agreements, and controversial stances on immigration that could jeopardize the movement of certain classes of individuals across borders. And that, in turn, has spurred concerns among some in the world of science, an inherently globalized enterprise.

"Most of us in science think of ourselves as citizens of the world," notes Sir Peter Knight, emeritus professor at Imperial College London and The Optical Society's 2004 president. "We've grown up in our scientific careers thinking that we contribute to a global effort, and this kind of fragmentation and growth of national compartmentalization threatens all that." One of the jobs of the photonics community in the new environment, he suggests, is to work to "dismantle those barricades, so that we're open to working with the best talent right around the world, and to engage on the big issues that everyone's concerned about."

Another, even bigger job, Knight says, could be building public trust in science at a time when the notion of expertise itself seems to be under threat. "We increasingly hear the statement, both in the United States and in Europe, that 'we've had enough of experts.' You hear it even from senior politicians." That, he notes, presents scientists with a significant challenge, because the notion of making decisions based on evidence "is in our genes; it's in our DNA."

Knight worries, in short, that "evidence-based policy is being replaced by policy-based evidence." To counter that, he says, the scientific community will need "to have the self-confidence to persuade the many, many people who have been quite frightened by the way the world has changed that science is not a threat to them, but an enabler to let them lead better lives."

Action amid uncertainty

The global sweep and rapid changes of today's politics, and of public attitudes, make prediction and planning a hazardous affair. "Previous models are broken, and when

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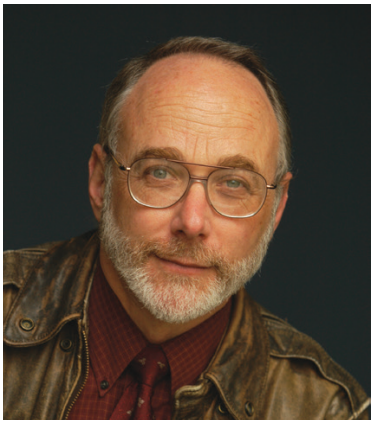
that happens, forecasting becomes substantially more difficult," notes John Lincoln, chief executive of the U.K. Photonics Leadership Group. "People are much more inclined to see what reality actually brings."

Yet, while a wait-and-see attitude will suit many aspects of day-to-day business, Knight's comments suggest a very clear call to current action for the photonics community: To engage directly in politics and with the public, and make the case for science's long-term benefits amid the near-term political flux. Thomas Baer of Stanford University, who served as 2009 OSA President and led the steering group of the National Photonics Initiative (NPI) from 2013 to 2015, agrees that scientists need to step up and actively help to shape the debate. "Now is not a time to push away from the table," he says.



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Indeed, while press attention has largely focused on the disruptive effects of recent U.S. political shifts, those same shifts may also bring new opportunities. Matthew Weed, the chair of OSA's Public Policy Committee and a member of the NPI steering committee, notes that the election has placed control of both the executive and legislative branches in the hands of one party. That, he suggests, could eliminate some of the well-publicized political stalemate that has characterized executive-legislative relations in the past several years.

"The U.S. government is intended to effect change starting with Congress—that's where most of the things that matter to the U.S. scientific community take place," says Weed. "So I think the primary difference will be a strong revitalization of congressional engagement. It will be more difficult to get sweeping initiatives through, but we will get longer-lasting, more dependable programs," he says, owing to Congress's authority over budgets, program authorizations and appropriations. We may, observes Weed, be "moving back toward a legislative environment in which we can take a much longer view."

Yet that same opportunity comes with a caveat, notes Weed: the party now controlling both Congress and the White House has long articulated a policy of limited government, which implies pressure on domestic spending—including, perhaps, spending for science. And, once again, he suggests the results will largely depend on how well the scientific community responds. The challenge, he says, will be "making a business case" to congressional representatives—"just like we do in industry"—as to how investments in science can lead, through technology transfer and commercialization, to economic gains and an improved quality of life.

Building on success

Fortunately, in making that case to both the executive and legislative branches, the optics and photonics community can build on a strong recent foundation of success.

"The Public Policy Committee at OSA has worked very constructively with both Democrats and Republicans," observes Thomas Baer. "We have a track record of really being able to work across the aisle, and come up with common themes that are important to both political parties." One recent example was a successful effort to add language promoting photonics in the reauthorization of the technology- and education-focused, bipartisan American Innovation and Competitiveness Act, passed by both houses of the U.S. Congress in mid-December.

Also notable have been some of the recent fruits of NPI's efforts. Established in 2013 by a coalition of OSA, SPIE, the IEEE Photonics Society, the Laser Institute of America, and the APS Division of Laser Science, NPI grew out of a recommendation in a landmark 2012 report from the U.S. National Research Council, *Optics and Photonics: Essential Technologies for Our Nation*. That report—authored by a committee co-chaired by 2016 OSA President Alan Willner and OSA Fellow Paul McManamon—suggested, among other steps, creation of "an integrated initiative in photonics" that would bring together stakeholders in industry, academia and government to drive a coherent R&D agenda for U.S. photonics.

Since its establishment, NPI has emerged as an important source of information and advocacy to keep photonics on policymakers' radar screens. And the initiative has logged some significant recent successes. One was its role in laying the groundwork, through a strong

information and engagement program, for AIM Photonics, the US$600 million public-private partnership, announced in July 2015, that grew out of the Obama administration's National Network for Manufacturing Innovation program.

NPI also actively promoted the importance of photonics, and brought industry funding partners into the mix, for the administration's Brain Research through Advancing Innovating Neurotechnologies (BRAIN) initiative. And, in mid-2016, it crafted and unveiled a whitepaper and technology roadmap on the importance of photonic technologies, such as sensing and image-guided therapies, for early detection and intervention in cancer, as an input to the administration's much-publicized "Cancer Moonshot" effort.

The new 21st Century Cures Act, signed into law in December 2016 amid broad bipartisan support, includes funding of US$1.8 billion for the Moonshot and nearly US$1.6 billion for the BRAIN initiative. That funding ensures that these two Obama administration initiatives will have a life past 20 January 2017. And while it was only one among many stakeholders working to promote passage of the Cures Act, NPI's advocacy arguably helped to carve out a meaningful role for photonics in the research that the legislation will fund.

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Alan Willner, who took over as chair of the NPI steering committee in 2015, sees similar opportunities going forward. "We've spent the last several years trying to get people to know what photonics is, and we've been fairly successful," he says. "Now there's going to be a new group of people to educate." And, adds Willner, "I think we have a great story, because optics and photonics enables almost everything."

One important area in which to emphasize that enabling role could be the push to rebuild aging U.S. infrastructure. That push emerged as a major theme of both the Democratic and Republican candidates during the campaign season, and is likely to be an "out of the gate" legislative priority for the next Congress. Willner observes that a variety of technologies—ranging from optical sensors to monitor large structures such as bridges and dams, to high-performance computers for modeling, to autonomous vehicles to realize the future vision of "smart cities" that's likely to inform any long-term infrastructure plan—all represent areas where photonics can stake out a place in upcoming federal programs. "There's no question," he says, "that optics and photonics will play a role in that."

Reflecting on NPI's record since its 2013 founding, Thomas Baer sums it up this way: "Over the last three or four years, working with NPI, I've surprised even myself with how optimistic I've become on our ability to influence the government."

Looking beyond borders

In the wake of the Brexit decision, says John Lincoln, photonics in the U.K. faces a similar mandate to make its case to government. "In a climate of uncertainty," he notes, "all of us are beholden to provide as many facts as we can, and as much evidence as we can, to clearly substantiate the impact of photonic technology." His organization has thus redoubled its efforts to provide data on the size and impact of the U.K. business—and to get that information in front of the right members of Parliament.

Peter Knight, who serves as science advisor to the U.K. government, has been involved with similar work on the contribution of photonics to the country's GDP. "We discovered that photonics contributes more to the GDP than pharmaceuticals," he says. "Nobody knew that." And that kind of information, he suggests, can send a powerful message when it finds its way into government circles. "We need to provide government officials this kind of evidence to enable them to make wise decisions," says Knight. "If they don't know about how photonics contributes to employment and wealth, they will neglect us—and we'll throw away a wonderful opportunity."

As much as attention has focused—perhaps understandably—on the political realignments in the U.S. and U.K., however, Thomas Baer suggests that science may have a still more pressing role to play in bridging gaps worldwide. "As countries like the U.K. and the U.S. are tending to look inward more and more," he says, "the scientific community can provide a framework for international cooperation that transcends these nationalistic trends."

A new vehicle for advancing those cross-border ties is the International Photonics Advocacy Congress (IPAC). This OSA initiative, which is set to launch in the coming months and which Baer himself is leading, will leverage the society's broad global member network to build coalitions of industry, government and academia, as well as other scientific societies and stakeholders. Those coalitions will advocate for funding and support for optics and photonics among international policymakers, on targeted issues of multinational importance.

On that head, IPAC's first focus will be on photonics in environmental monitoring and measurement technology—an area that, Baer notes, "very naturally transcends national boundaries." As with the NPI effort, IPAC will focus on engaging stakeholders and developing technology roadmaps and other support that can help guide international funding agencies and decision makers.

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Individual steps

Quite apart from the advocacy and activities of partnerships such as NPI and IPAC, the leaders OPN spoke with also stressed the importance of individual actions. Admittedly, exhortations for photonic professionals to engage directly with their elected representatives are standard fare—and such engagement seldom ends up as a high priority for time-pressed scientists and engineers. But the unusual nature of the ongoing political realignments worldwide suggests a particular urgency for that kind of outreach today.

"Volunteering to come and see your congresspeople is critical, now more than ever," says Alan Willner. "Showing that you actually care goes a long way."

Thomas Baer adds that OSA, through its public-policy activities, offers a number of avenues to facilitate such grassroots political involvement, such as visits to members of Congress in Washington, D.C., and the opportunity to invite congresspersons to visit facilities and labs. "The tools are there," says Baer. "It's up to the individual members to take the initiative to engage. And it makes all the difference in the world."

In the long run, though, some of the most important engagement opportunities for photonic scientists may be with other citizens—who, after all, are the ultimate decision makers in democratic societies. "More than ever, I think it's useful if people are proud of what they do, and talk with people about photonics technology and what a big difference we make," says the U.K. Photonics Leadership Group's John Lincoln. "That's the practical end of the world that really moves things forward. And that's how we can bury the political differences that have emerged in recent times." OPN

Stewart Wills is the editor and content director of *Optics & Photonics News*.

References and Resources

- The Information Technology and Innovation Foundation, https://itif.org (technology policy papers and roadmaps for the new administration).
- The National Photonics Initiative, www.lightourfuture.org (whitepapers to guide government priorities; tips on organizing congressional visits).
- The OSA Public Policy Office, www.osa.org/publicpolicy (policy updates, information about individual and group advocacy, and OSA position statements on a range of issues).
- The U.K. Photonics Leadership Group, https://photonicsuk.org (information on size and impact of U.K. photonics industry).