SCIENCE & DIPLOMACY

A quarterly publication from the AAAS Center for Science Diplomacy

Fahmida N. Chowdhury, "Engineers Outside the Box: Pathways to Global Impact," *Science & Diplomacy*, Vol. 7, No. 1 (March 2018). http://www.sciencediplomacy.org/perspective/2018/engineers-outside-box

Engineers Outside the Box: Pathways to Global Impact

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Over my long academic and government career, I have noticed that the term *science and engineering diplomacy* is little known, used, discussed, or understood in the engineering community. This includes the content presented at the numerous technical and engineering conferences I've attended—conferences that are international not only because participants come from all over the world but because collaborations themselves often span researchers from multiple countries. I dare say that some amount of science and engineering diplomacy does take place in these collaborations. Yet the broader policy-level implications of this cooperative work are seldom documented, and the path from successful scientific or engineering relationships to enhanced government-level interactions remains unclear.

Indeed, I have never encountered any science and technology (S&T) policy discussions at any of my engineering-related conferences, nor have I heard "engineers as ambassadors" or similar ideas mentioned—except perhaps in small

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informal chats over coffee, or between friends. While exceptions exist in other contexts, such as the engineering diplomacy course launched at the University of Southern California in 2016,[1] often even engineers working on technology development for humanitarian applications tend to remain on the "technology" side—not venturing into policy—despite the clear policy relevance of their work. To achieve greater societal impact, I therefore invite more engineers to step outside the box—out of their comfort zones—to embrace diplomacy as an essential component of the engineering-career spectrum.

I ventured out of my comfort zone when I applied for and was awarded an Embassy Science Fellowship (in 2012) from the National Science Foundation (NSF). The program, run by the U.S. Department of State, allows for short tours (8-12 weeks) at overseas US embassies by scientists and engineers from fifteen U.S. government departments and agencies, during which fellows pursue specific projects.[2] In 2013, I was stationed for two months at the U.S. embassy in Dhaka, Bangladesh, the country of my birth. My project was to study Bangladesh's S&T landscape and to make informed recommendations to the embassy, State Department, and NSF regarding fields and subfields ripe for collaboration between the U.S. and Bangladeshi S&T communities. In a sense, I was serving as a science envoy to Bangladesh for those two months. I conducted site visits to various universities and laboratories, reviewed literature, and brought together various stakeholders—i.e., government officials, academics, private-sector and NGO leaders, and scientists—from across the science and engineering community. The experience was edifying and enjoyable, and from it I produced an internal report recommending four major technical areas for bilateral activity:

1. Renewable and sustainable energy and environment;
2. Biotechnology, including bioinformatics and drug research and development;
3. Software, information technology and communications;
4. Education, training and capacity building in the above three sectors.

Yet, I never discussed my experience or the potential role of engineers in advancing international relations/collaborations at any of the subsequent engineering conferences that I attended. There was no scope, and non-technical topics are not expected. This is the norm.

Last year, I decided to try to break that norm. I submitted an abstract for a paper titled "Science Diplomacy: A Path for Scientists and Engineers to Make Global Societal Impacts" to the International Symposium on Technology and Society,[3] coordinated by the Institute of Electrical and Electronics Engineers (IEEE).[4] Held in Sydney, Australia, the conference brought together electrical engineers, computer scientists and engineers, and professionals in other related disciplines from many different countries. Despite the emphasis on society in the conference title, I knew

science diplomacy would make for atypical material and hoped the reviewers would be intrigued and accept my paper. I was indeed shocked when the general chair of the conference emailed me with an offer to give a keynote on the topic.

After several weeks of preparation, I gave my keynote to a packed audience. I made clear that "science diplomacy" automatically includes engineering, much as the NSF includes engineering. I highlighted how governments around the world, from Australia to the United Kingdom to the European Union, appreciated the role of science diplomacy as a tool in foreign policy. I mentioned how mechanisms such as[5] the AAAS Science and Technology Policy Fellowships, the National Academies of Sciences' Jefferson Science Fellowships, the IEEE-USA Congressional Fellowships, and the IEEE Engineering & Diplomacy Fellowships channel technical expertise into the government, while exposing the Fellows to the world of policymaking. My favorite moment, though, was when I received loud applause after reading a quote from an article by Norman Neureiter, former science advisor at the State Department,[6] attributed to John Sununu, a PhD mechanical engineer who served as governor of New Hampshire and White House chief of staff under the first President Bush: "If the problem solvers of the world don't participate in making public policy, then policies will be developed by those who don't know how to solve problems."

After the talk, the Q&A session lasted well beyond the allotted time, indicating a high level of curiosity and interest about this topic among the attendees. Even though the concept may have been relatively unfamiliar for the engineering community, it appeared to resonate on some level. Further, it showed me that engineers could be encouraged to apply their natural problem-solving abilities to bigger societal problems. I sensed that the talk might be more than timely—it might even be overdue.

This experience reinforced my belief that it is important for engineers to expand their traditional roles and encompass some activities not typically thought of as part of "what we do." Indeed, among the nuances of the concept of science diplomacy is that it not only advances scientific and technical collaboration transnationally, but also builds more effective partnerships across borders. Some of these partnerships already exist through the projects in which many of us are engaged for our daily scientific/engineering work. Even in these partnerships without an explicit diplomatic component, positive societal impacts can emerge beyond the immediate scope of a specific project, in turn possibly helping minimize or remove barriers to further scientific or developmental cooperation among nations. One individual to eloquently outline the need for a greater role for engineers in mitigating global challenges was the late educator and engineer George Bugliarello. In an editorial for the National Academy of Engineering, he offered historical examples on

matters such as the geopolitical impacts of opening the Suez and Panama Canals, as well as observations on how advances in telecommunications has changed the functioning of diplomacy.[7]

To maximize potential benefits to society, engineers could pursue short-term opportunities to explore policy or diplomacy, as I did when I served as an Embassy Science Fellow. The resulting experiences may even lead to unforeseen career changes for participants. I am, of course, not the first person to make such a case. Others have put forth compelling arguments to the same effect,[8] and engineers are among those in the S&T community to branch out into other careers, including science diplomacy.[9] Yet today, only a small number of fellowships are available to facilitate a direct pathway to diplomacy work for the engineering community. We need to create more opportunities for policy-interested engineers to make optimal use of their expertise for greater societal benefit.

In practice, engineers could boost the diplomatic enterprise in a multitude of ways. These include helping translate various countries' S&T policies into implementation, advancing humanitarian applications for engineering, and creating technologies for sustainable development. On the last item, one annual event, the IEEE Global Humanitarian Technology Conference,[10] offers a venue, and discussions have centered on the role of engineers in helping fulfill the UN's Sustainable Development Goals (SDGs).[11]

The leap from participating in technology-related activities to higher-level policy engagement may not be as large as it may appear, if we are willing to make the effort. To paraphrase from a recent UNESCO report,[12] science has value beyond obviously scientific issues, and science should be integral to policy discussions; indeed, science and engineering can be a game changer in dealing with global challenges and meeting the Sustainable Development Goals. A willingness to explore opportunities in government or diplomacy is essential for engineers to fully realize their potential contributions to society. In local contexts, models for such a path are cropping up, such as the USC course mentioned earlier. The goal now is to create increased awareness of science and engineering diplomacy and to transform that awareness into tangible actions.

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Endnotes

1. See Daniel Druhora, "Students Turn to Engineering Diplomacy to Solve 21st Century Grand Challenges," USC Viterbi School of Engineering, February 6, 2017, https://viterbischool.usc.edu/news/2017/02/training-21st-century-diplomacy/.
2. U.S. Department of State, "Embassy Science Fellows Program," https://www.state.gov/e/oes/stc/sciencefellows/.
3. IEEE International Symposium on Technology and Society: *From Good Ideas to Practical Solutions*, August 9–11, 2017, Sydney, Australia, http://technologyandsociety.org/istas2017/.
4. See the IEEE website, https://www.ieee.org/index.html.
5. See these websites, https://www.aaas.org/program/science-technology-policy-fellowships, http://sites.nationalacademies.org/pga/Jefferson/index.htm, https://ieeeusa.org/advocacy/government-fellowships/congressional-fellow..., https://ieeeusa.org/advocacy/government-fellowships/engineering-and-dipl....
6. Norman P. Neureiter, "Engineering and American Diplomacy," *The Bridge* 34, no. 2 (Summer 2004): 5–10, https://www.nae.edu/File.aspx?id=7306&v=e9c0a3a0.
7. George Bugliarello, "Engineering, Foreign Policy, and Global Challenges," National Academy of Engineering, posted December 3, 2008, https://www.nae.edu/19582/Bridge/SystemsChallengesonaGlobalScale/Enginee....
8. Najmedin Meshkati, "Engineering Diplomacy," *Science & Diplomacy*, June 2012, http://www.sciencediplomacy.org/perspective/2012/engineering-diplomacy.
9. A remarkable example is Tom Wang, director of the AAAS Center for Science Diplomacy, who holds a PhD in chemistry from MIT.
10. See http://sites.ieee.org/ghtc/.
11. One example was highlighted recently by Alex Crump, a civil engineer in the United Kingdom, in his paper "What Can We Do to Help Achieve the UN's Sustainable Development Goals?" Institution of Civil Engineers, updated June 26, 2017, https://www.ice.org.uk/news-and-insight/the-infrastructure-blog/june-201....
12. "A Summary Report to the Secretary-General of the United Nations," UNESCO, September 2016, https://en.unesco.org/un-sab/content/documents.