

Reflections of an NSF Program Officer

In December 2015, I completed a four-year assignment as lead program officer (PO) for the US National Science Foundation's (NSF's) Secure and Trustworthy Cyberspace (SaTC) program.

NSF is the largest federal funder of academic computer science fundamental research in the US. Its review process—designed to avoid nonscientific bias and ensure that all proposals are considered strictly on the basis of their intellectual merit (scientific advances) and broader impact (the impact on society as a whole)—is widely emulated and considered the gold standard by peer agencies worldwide.

SaTC is both the largest funder of fundamental security and privacy research in the world and NSF's largest computer science research program. In 2002, Carl Landwehr (not coincidentally, one of the founders of *IEEE Security & Privacy*) started the NSF security and privacy research program; over the past 14 years, it has been led by Karl Levitt, Carl Landwehr for a second tour, and then me, with several dozen additional POs and administrative staff as part of the team.

In this column, I'll tell you what a PO does and why you might want to consider a similar assignment in your government at some stage in your career, regardless of what country you live in.

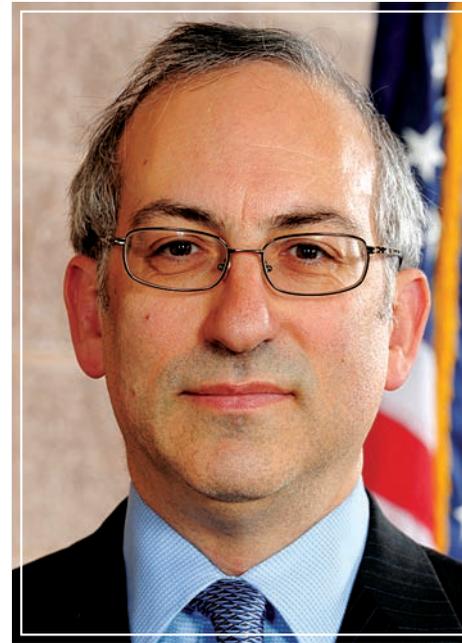
Why Be a PO?

POs can make a difference that's sometimes surprising to those on the outside. POs have the ability to create new targeted efforts. I'm proud of having started the New Collaborations program, which brings together social scientists and computer scientists to work on new research projects. This program, a joint effort of the NSF's Social, Behavioral & Economic Sciences Directorate and the Computer & Information Sciences & Engineering Directorate, dramatically expanded the level of interdisciplinary work and understanding of issues. During my four years, 39 projects

were funded under this umbrella, totaling about US\$10 million and uniting computer scientists and electrical engineers with psychologists, sociologists, anthropologists, criminologists, philosophers, and others.

POs can impact the community in a variety of other ways. For example, I aimed to increase the participation of women and underrepresented minorities in the research community. Neither I nor anyone else can solve this problem alone, but if each of us takes action toward this common goal, we can make progress. My approach was to actively seek out women and minorities to serve on SaTC's peer review panels, which make funding recommendations to POs. I encouraged other SaTC program officers to seek participation by these groups when selecting reviewers to serve on our panels. This helps NSF by ensuring a wide scope of opinions. But it also helps the panelists, who discuss proposals' strengths and weaknesses with their colleagues and learn what goes into making a successful proposal. In addition, new research ideas frequently grow out of the connections made at panels, so having more women and underrepresented groups at the panels improves the chances of their participation in new research ideas. Obtaining external funding is a key part of tenure decisions at many universities. By giving these individuals a jump start, I believe I helped indirectly in boosting the number of tenured women and minorities in the security and privacy field, which will in turn increase the number of women and minority students as they serve as mentors and role models. It's not a short-term solution to the problem but rather a long-term investment that I could make as PO.

Another area where I invested significant energy was in what I dubbed the Aspiring PI meetings. Researchers, or *principal investigators* (PIs), frequently don't know how to write winning proposals. The goal of the Aspiring PI meetings (one held in 2012 and a second



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in 2014) is to bring together those who have been unsuccessful at receiving SaTC funds to learn from POs and their peers what makes a good proposal. Thanks to generous offers from some successful PIs as well as hard work by Professor Rebecca Wright (Rutgers University), both the 2012 and 2014 workshops included paired proposals by the same researcher, which allowed participants to understand what turned an unsuccessful proposal into a winning one. Preliminary analysis indicates that researchers who attended an Aspiring PI meeting had a higher success rate than those who didn't.

What Does a PO Do?

A PO's time is split in many ways; the specifics depend on the program and government agency. My time was roughly split between the "proposal machine" and everything else.

The proposal machine is what most researchers encounter when they write proposals. An NSF PO's job includes

- writing solicitations (requests for proposals) that spell out topics of interest, timelines, requirements, and so on, which involves working with peers throughout NSF, other government agencies, and sometimes industry partners;
- receiving proposals from the research community and working with administrative staff to ensure that proposals comply with requirements;
- reading and organizing proposals into groups requiring common reviewer expertise (which we call *binning*);
- finding peer reviewers appropriate for each group and finding dates when they can meet to discuss proposals;
- moderating peer review panels, which are somewhat similar to program committee meetings, in which panelists

discuss proposals' strengths and weaknesses and make their recommendations to NSF;

- meeting with other program officers and NSF management to discuss the research funding portfolio and use the peer review panel recommendations to select proposals to be funded;
- working with researchers to clarify questions from the peer review process, obtain missing information (for instance, Institutional Review Board approvals), adjust budgets, and so on; and
- obtaining management approval for awards and processing paperwork to make awards.

The "everything else" part of the job includes a wide range of topics. The largest fraction of this category is talking to researchers; in an average year, I had discussions with approximately 200 researchers on future research ideas and updates to existing awards.

Other items that fall into this category include the following:

- Coordinating with other US government agencies: Identify areas of emerging interest, potential joint funding, research results that might be useful to operational needs, and so on.
- Responding to congressional inquiries: These might include information about specific awards or requests for testimony.
- Developing strategies: Over the past few years, interagency teams (including NSF POs) have developed the National Privacy Research Strategy and the Federal Cybersecurity Strategy, both of which will affect government research funding for the next decade.
- Organizing workshops: In a typical year, SaTC organizes three or four workshops to elicit potential research topics, which might encourage researchers to explore

a new area. In some cases, these workshops are driven by PO interest; in others, researchers who suggest important topics.

- Organizing biannual PI meetings: With more than 1,000 PIs covering a vast span of topics, the SaTC community doesn't meet as a whole at typical research conferences like the IEEE Symposium on Security and Privacy. The purpose of the PI meeting is to bring together the full breadth of the community, create new connections, and help PIs see potential areas for future research.
- International collaborations: Cybersecurity and privacy aren't US-only topics. During my tenure at NSF, we set up new international collaborations with Israel, the Netherlands, and Brazil. Each of these will bring new visions and expertise to the community.
- Industry collaborations: Joining academic and industry research teams facilitates multiple perspectives and provides additional funding and new opportunities for rapid technology transition. During my time at NSF, I co-lead the efforts for joint programs with the Semiconductor Research Corporation and Intel.
- Private foundation collaborations: NSF focuses on the technical aspects of the security and privacy fields. I had the opportunity to work with POs at private foundations to jointly fund research that crossed the boundary between technical and policy issues. Such joint funding can allow more progress than either organization can achieve alone.

Why Should You Consider a Job Like This?

As the description outlines, POs are involved in a wide range of activities, which will depend to some extent on the program's needs and the POs' interests.

I was motivated to apply for the PO position by a colleague, Sami Saydjari, who served as a DARPA program manager (a similar role to mine at NSF). Saydjari pointed out that the research community's success depends on having knowledgeable program managers who can provide leadership to the community and service to their country in solving difficult problems and advancing science. I've found that many NSF POs (including myself) were motivated by the patriotic desire to help their country.

But there are many other reasons. For one, POs can shape the direction of their field for a decade or more to come. By identifying new and emerging research areas, POs can direct additional research funding, which will in turn influence what students work on and subsequently the types of jobs they take and companies they start. In addition, POs have the opportunity to not only learn about the latest and greatest ideas long before they become public but also help shape the expression of those ideas, often through conversations with individual investigators, the peer review process, and award oversight, including annual reports and site visits. As a scientist, this was always exciting for me.

What Makes a Good Program Officer?

Understanding the research world in one's field is essential to being a PO, as is an interest in serving the research community. POs must have broad interests in their field and a strong desire to help others achieve their research vision. While my research areas are voting systems and software assurance, I also participated in assessing proposals relating to systems, networking, usability, hardware,

authentication, biometrics, education, and social sciences.

But, as my friend Bob Blakley from Citigroup observed, the most important quality isn't research credentials but rather "good taste" in identifying which of the myriad research ideas are worth exploring,

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which are likely to be dead ends, and which are likely to lead to new insights. No individual PO has all the answers, but synthesizing input from peer review panels and the PO team maximizes the useful research from each dollar invested.

There are always a million projects going on, so being able to juggle many tasks is necessary, and something I (almost) always enjoyed.

Lessons Learned

Being an NSF program officer is hard work but immensely rewarding. In hindsight, I wish I had put more energy up front into starting new programs, because by the time I recognized some of the areas I wanted to pursue, my time was running short. Outside collaborations with other countries and private industry were productive and resulted in good research but, in my case, were more tactical than strategic, based more on who approached the program rather than a grand vision.

Tools available to NSF POs are rudimentary and aren't generally standardized, with each PO having his or her own. I wish I had invested the time to learn more about what was available and create my own tools before I became absorbed in managing the SaTC program; this

would have reduced the workload and freed more time for the scientific portion of the job.

Carl Landwehr told me that POs' most important job is identifying their replacement, as officers have a four-year time limit. I underestimated the difficulty of this task, and as a result, my position is still open as I write this column and is being filled on an interim basis by a PO from another program. Although the job is tremendously exciting and important, it's hard to find people with the

requisite interests and experience who can put their careers on hold for several years to come to Washington, DC. This can be difficult for academics—who make up the majority of POs—if they have their own research programs with graduate students. Although it's possible to continue mentoring students, it's a particularly challenging effort given the workload. Some institutions are more supportive of allowing their staff to do a rotation in government; others give up long-standing (or even tenured) positions to serve at NSF, which is a significant sacrifice. Although none of these potential setbacks were a problem for me, they add to the difficulty of hiring POs.

What about Other Agencies and Countries?

The experience I've described here was one program in one government agency. (Even experiences within an agency can vary; see another viewpoint at www.cccb.org/2011/08/24/first-person-life-as-a-nsf-program-director.) I've spoken with peers in other US and foreign government agencies and have learned that, although the specifics vary, the broad motivations and goals are similar. In some agencies and countries, POs are

“permanent” (that is, government employees with no time limits), whereas at some agencies like NSF and DARPA, much of the staff are “rotators” (on loan from an institution for a limited time period). In some countries, the POs are scientists but not specialists in the area they administer or are administrators rather than scientists; this can lead to difficulties as they’re completely dependent on the outside experts they solicit rather than their own expertise and are thus less able to provide an unbiased vision of the future. As a result, they tend to be somewhat more reactive than proactive. Attending technical conferences to learn the about latest and greatest is a key part of the job and can help increase POs’ breadth and depth of knowledge if they don’t have a technical background in the field. Based on my experience, having technical experts as POs is a major advantage of NSF’s model compared to many others.

Regardless of which model is used, a term of service in a funding agency is a worthwhile contribution to a career as a researcher.

Serving as an NSF PO can be fun but also scary. For example, in my last month as PO, I was seated next to the Brazilian Minister of Science, Technology and Innovation at the opening plenary of a workshop. While he was reading his opening speech welcoming attendees on behalf of Brazil’s government, I realized that I was expected to do the same on behalf the US—but without any prepared remarks! The ability to make off-the-cuff serious remarks that won’t cause an international incident is a small but important part of the role.

It takes a village to build and run a successful research program like SaTC. I’d like to thank the many PIs who shared their ideas with me and with my colleagues, gave their time to serve on peer review panels, and wrote innumerable white papers and proposals. Over four years, I touched close to 5,000 proposals and was consistently impressed by the energy and enthusiasm of the researchers who submitted proposals to the SaTC program.

I worked with a diverse team of technical and administrative experts

who made my term both pleasant and successful: Nina Amla, Carl Anderson, Vijay Atluri, Chris Clifton, Sol Greenspan, Angelos Keromytis, Dongwon Lee, Wenjing Lou, Peter Muhlberger, Anita Nikolich, Victor Piotrowski, Andrew Pollington, Cassandra Queen, Deborah Shands, Richard Sheehy, Ralph Wachter, Sam Weber, and Heng Xu—as well as the researchers in the community.

Please thank these people when you see them. If you’ve worked on security or privacy research, built a product based on research findings, or used a product that’s grown out of research, these people had a hand in making it possible.

And if you’re interested in spending a term as a PO at NSF, I would be happy to help you make the right connections! ■

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