Written Testimony
Before the
Committee on Science and Technology
Subcommittee on Research and Science Education

by
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Chairman Lipinski, Ranking Member Ehlers and members of the Subcommittee, thank you for the opportunity to testify today on the evolving subject of the Science of Science and Innovation Policy.

The American Association for the Advancement of Science (AAAS) is the world's largest multidisciplinary scientific society and publisher of the journal *Science*. The association, which celebrated its 162nd birthday earlier this week, encompasses all fields of science, engineering, mathematics, biomedicine and their applications. For more than thirty-five years, AAAS has demonstrated its commitment to and involvement in science policy issues with projects and activities such as the annual AAAS Science and Technology Policy Forum, the Science and Technology Policy Fellows Program, more recently with our Leadership Seminar in S&T Policy, and – most directly relevant to this hearing – our joint project with the National Science Foundation on the Science of Science and Innovation Policy (SciSIP). We have served the academic science policy community by publishing the first *Guide to Graduate Education in Science, Engineering and Public Policy* (known as the *SEPP Guide*) in 1985 and maintaining it as an online resource to the present day.

Background
From one perspective the Science of Science and Innovation Policy is not entirely a new field. Since the 1950s – and probably earlier – economists, sociologists, political scientists and others interested in public policies for science and technology have sought ways of measuring the value of research investments. Research articles on topics such as measuring Return on Investment (ROI) from research and development (R&D), national innovation systems, and comparisons of state and international standings have been published for many years. Government tools such as the 1993 Government Performance and Results Act (GPRA) and the more recent Program Assessment Rating Tool (PART) as well as their programmatic forebears, have attempted to quantify the value of government investment in various programs, although they have found R&D programs more difficult to assess than others.

In the 1960s, the National Science Foundation (NSF) supported the development of research and graduate education programs in science and technology policy in a number of universities. During the 1970s, it created the R&D Assessment and R&D Incentives programs, which funded research on some aspects of S&T policy in universities and non-profit institutions. In addition to the SciSIP program, the Foundation currently funds

research in science policy and related areas through a number of programs, including the Science, Technology, and Society Program in the Directorate for Social, Behavioral, and Economic Sciences, and the Division of Science Resources Statistics, which has long provided data and analysis of importance to science policymaking.

The current Science of Science and Innovation Policy endeavor is unique, however, in its focus on drawing this research together into a systematic, coherent body of knowledge that can be brought to bear directly on national policy decisions. The National Science Foundation's SciSIP program is engaging the science policy community in research in theory, methods, models, and data development along four broad themes – workforce issues, innovation ecosystems, outcome measures, and data infrastructure. The program has an explicit mandate to couple advances in fundamental knowledge about processes of scientific discovery and technological innovation with issues of relevance to policymakers. As a field of research, the Science of Science and Innovation Policy has essentially been raised in relevance from a largely academic discourse to a field with a potential national impact.

Science and technology policy research can have and has had a positive effect on national policy decisions. R&D data analyzed and reported by NSF, as well as by AAAS, for example, has provided a roadmap for decades for policymakers such as the Members of this Committee as a guide for crafting the federal R&D portfolio.

As the NSF SciSIP program is still quite young and has been awarding grants for only a few years, we believe that it is premature to expect the results of that program's research to be incorporated into national policy decisions. Furthermore, the results of any science and technology policy research—whether within or outside SciSIP—must still run the gauntlet of the policy process.

In other words, simply because the research has been done, does not mean that it will be used. As helpful as the AAAS R&D budget analysis may be to its users, policymakers still make decisions based not only on research and analysis, but also on constituent needs, economic and political considerations, public opinion, and their own perspectives on national priorities. The same goes for studies that measure the effectiveness of federal programs. Politics is not a contaminant in the policymaking process. It is, after all, the essence of a democracy.

One way that policymakers can increase the likelihood that SciSIP research be used to inform the design of effective federal programs and the management of federal research investments is to conceptualize and design research that both advances knowledge in a discipline and answers specific questions relevant to policy. Some examples of such research topics are given in the NSF SciSIP program solicitation:

- examinations of the ways in which the contexts, structures and processes of science and engineering research are affected by policy decisions,

- the evaluation of the tangible and intangible returns from investments in science and from investments in research and development,

It should be pointed out that science and technology policy research is just as unpredictable as basic research in physics, chemistry, or life sciences, and decision makers must take into consideration the fact that some studies may yield unanticipated results and that some may serve long-term rather than short-term needs.   It is important to ensure that an effective SciSIP portfolio balances research that reflects short-term and long-term policy interests.

Among the features that differentiate the SciSIP program from similar, past efforts, is its focus on building a *community of practice* among researchers in the many disciplines engaged in the study of science and innovation policy and its conscious effort to build bridges between this community and the practitioners in the federal government. Previous programs to support science and technology policy research have always focused primarily on providing grants to individual principal-investigators.

AAAS has played an active role in building this community of practice. We organized a workshop of the grantees from SciSIP's first and second rounds (FY 2007 and 2008) of awards to further construct this community. The outcome of that workshop was a report, titled, *Toward a Community of Practice*.[*] Next month we will convene a second workshop to continue building a community of practice by connecting the researchers with potential users of their results in the federal policy community.

There are challenges to building this SciSIP community of practice. A sizable group of researchers working on current projects as well as a large body of literature already exists. To an important degree, these individuals and this literature reflect distinct disciplinary traditions that can inhibit a productive interdisciplinary dialogue. These disciplinary clusters may ask different questions, draw upon different theoretical frameworks, and employ different methodologies and analytical models even when they may address seemingly similar topics (e.g., diffusion of innovation). Sometimes it seems they even speak different languages.

At the same time, as these researchers speak to an audience of their peers—albeit within their disciplines—they often do not speak a language that policymakers understand or find useful. A concern expressed at the first AAAS SciSIP workshop was that policymakers would be confronted with a "Babel of tongues" which would lead them to ignore the experts and turn to other sources of information and advice.

Another challenge is the fact that not all SciSIP researchers have experience working at the interface between academic research and federal policymaking. Some lack an understanding of the user community and who the policymakers are, what information or datasets they might require, or what other information they might need to know in order to effectively address national policy priorities. This is not to imply that these researchers are not familiar with the organization of government or the legislative process. Rather, it has more to do with the subtleties and nuances of the "game" and having an insider's perspective on the complex

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[*] Albert H. Teich and Irwin Feller, *Toward a Community of Practice: Report on the AAAS-NSF Grantees Workshop*, March 24-25, 2009 (Washington, DC: American Association for the Advancement of Science, August 2009). Available online at http://www.aaas.org/spp/scisip/scisip_report.pdf.

policy questions that decision-makers face and the interplay of interests that often shapes the debate over science and innovation policy.

The AAAS project is an effort to build these necessary relationships and to help SciSIP researchers and policymakers speak each other's language and better understand each other's needs and expectations. The goal is not to build a grand over-arching theory of science and innovation policy, but to seek convergences among findings and a higher degree of understanding within the community about new perspectives and paradigms regarding science and innovation policy. It is to build a more interdisciplinary approach with an eye towards practical application by practitioners.

This community of practice is intended to assist individual researchers or teams of researchers by enlarging the set of variables and/or relationships that they consider in their work. It provides an opportunity to expose research findings to a wider set of critical perspectives and allows researchers to consider how their findings may relate to other disciplines and research findings in other areas.

As you know, the NSF initiative in the science of science and innovation policy stemmed from a sense that the body of science and innovation policy research does not seem to be very widely known or used among those who actually make policy in these areas. The AAAS SciSIP project is intended to facilitate interaction between relevant federal agency representatives and the growing community of SciSIP researchers, to help the agency representatives learn about emerging theories and models, and to connect research results with policy issues. At the same time, SciSIP researchers should be able to learn from the user community about their policy priorities and needs, which can help shape the direction of future projects.

While the SciSIP program and projects like the AAAS-NSF SciSIP workshop are an important step in building a community of knowledge and a strong foundation between research practitioners and policymakers, there is more that can be done.

Communication: As noted earlier, researchers addressing questions of science and innovation policy have tended to direct their work to colleagues, peers and others within their core discipline. This includes presentations at professional associations and conferences, and publishing in specialized journals (e.g., *Research Policy*, *Social Studies of Science*). This is quite understandable in view of the reward structure of academia and desire on the part of scholars in this field and others to gain recognition from their peers. Relatively few policymakers read such journals or attend academic conferences with any regularity. One could approach this problem in two ways: One approach would be to encourage policymakers to read these journals and/or attend more academic conferences. Given the constraints of time and energy they face, this seems unlikely to work. Alternatively, SciSIP researchers might seek, in addition to their regular publication outlets, opportunities to reach out to policymaking community either through themselves writing for those publications that policymakers do read or by cultivating opportunities to have their work reported in popular media.

Education and Training: This "clustering" of a narrow core discipline has not only worked its way into the presentation of information, but in the education and training of students studying science and innovation policy that only encourages self-organization of a research area. Although the AAAS SciSIP program may help in encouraging the development of a more interdisciplinary curriculum, it isn't the central goal of the project.

As the committee has noted, there are about 25 U.S. universities that offer graduate education in science, engineering and public policy. There is no central organization for these programs and do not share a common curriculum or even a common nomenclature. The AAAS *Guide to Graduate Education in Science, Engineering, and Public Policy* mentioned earlier lists programs such as Science Policy; Technology Policy; Science and Technology Policy; Science, Technology, and Public Policy; and Engineering and Public Policy. In addition, many programs in Science and Technology Studies (STS) include a policy component, and some programs in public administration and public policy provide for a science and technology concentration. Furthermore, these graduate programs can be administered within different academic departments: Schools of Engineering, Public Administration, International Affairs, etc. Some programs allow for students to take coursework outside the traditional curriculum in other tangential fields (e.g., law), while other schools do not.

Many of the graduates of these programs have gone on to very successful careers. Nevertheless, it might be useful to have people from the policy community – the potential users - involved in reviewing the curricula of these programs as well as engaging in teaching as adjuncts or guest lecturers. This is obviously easier for universities in the Washington, DC, area to do than for those in other regions and some institutions in this area do it regularly to good effect. But it is worth the effort and expense for all.

Fellowships: Another potential mechanism for promoting cross-fertilization of ideas and greater understanding of the policymaking community's needs, is to create a Fellowship program for SciSIP researchers to work in government for one year, similar to the AAAS Science and Engineering Policy Fellowship that allows scientists an opportunity to work at a federal agency or in a congressional office or committee. Intergovernmental Personnel Act appointments could also be used for this purpose. Providing science and policy researchers and/or graduate students an opportunity to work in a policy office of the federal government would allow them an opportunity to learn first-hand the language, needs, and priorities of an agency, department, or congressional committee.

Conclusion.

I would like to thank the Members of the Subcommittee for holding this hearing and for their interest in the SciSIP program and the area of science and innovation policy research. I look forward to working with your staff as we prepare for the next AAAS workshop. Like our workshops, this hearing is an opportunity for the science policy community to hear from you, as policymakers, what research questions you believe SciSIP researchers should be addressing. I look forward to the Q&A as an opportunity to exchange ideas on that subject

Appendix

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Al Teich is Director of Science & Policy Programs at AAAS, a position he has held since 1990. He is responsible for the Association's activities in science and technology policy and serves as a key spokesperson on science policy issues. Science and Policy Programs, which includes activities in ethics, law, science and religion, and human rights, as well as science policy, has a staff of 40 and a annual budget exceeding $13 million. He also serves as director of the AAAS Archives.

Teich received his bachelor's degree in physics and his PhD in political science, both from M.I.T. Prior to joining the AAAS staff in 1980, he held positions at George Washington University, the State University of New York, and Syracuse University. Al is the author of numerous articles and editor of several books, including *Technology and the Future*, the most widely used college textbook on technology and society, the twelfth edition of which will be published in 2011 by Cengage Learning.

He is a Fellow of AAAS and the recipient of the 2004 Award for Scientific Achievement in Science Policy from the Washington Academy of Sciences. He is a member of the editorial advisory boards to the journals, *Science Communication*; *Science, Technology, and Human Values*; *Review of Policy Research;* and *Renewable Resources* and has been a consultant to government agencies, national laboratories, industrial firms, and international organizations.   He is past president of the Washington Academy of Sciences; former chair of the Board of Governors of the U.S.-Israel Binational Science Foundation, where he remains a member of the executive committee; a member of the Technical Advisory Committee of the Maine Space Grant Consortium; the Norwegian Research and Technology Forum in the United States; the Advisory Board of the University of Virginia's Department of Science, Technology and Society; the Program Committee for the 5th EuroScience Open Forum (to be held in Dublin, Ireland, in 2012) and the Council of Advisors for Research and Innovation Strategy of the National University of Singapore.

Teich speaks frequently before audiences in the U.S., as well as Europe and Asia. He has appeared on National Public Radio, CNN, C-SPAN, as well as various other electronic media and has been quoted in numerous print media, including *The New York Times*, *The Washington Post*, *National Journal, The Chronicle of Higher Education,* and *CQ Weekly Report.*