The U.S. Embassy Science Fellows Program: Implementation and Impacts

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International cooperation in science and technology (S&T) plays an important role in driving scientific discovery, enhancing economic prosperity, and addressing broader foreign policy interests. One such program that infuses S&T into foreign policy is the U.S. Department of State’s (DoS) Embassy Science Fellows (ESF) program, which is designed to promote scientific personnel deployment in support of diplomacy. The aim of this paper is to utilize nearly two decades of data to assess the ESF program from a U.S. DoS perspective. We analyzed Fellows’ perceptions of their ESF experience, obtained through both quantitative and qualitative surveys, to identify both successful program elements and areas that might benefit from further improvements. Since 2001, the U.S. government has dispatched approximately 500 science and technology experts, spanning twenty-five federal agencies, most often from the U.S. Environmental Protection Agency, National Science Foundation, and U.S. Department of Agriculture (accounting for over 50% of ESF). Through 2001-2019, requests for ESFs Fellows were submitted by U.S. Embassies and Consulates in 142 countries. In response, the program was able to send experts to 116 countries, with deployments in China (N=51), Portugal

* Biographies available at the end.
(N=15), and the Philippines (N=14) leading. We found it encouraging that most Fellows reported favorable assessments of the program and its results and benefits to Fellows and hosts. They also reported that there was expanded international S&T cooperation and enhanced understanding of U.S. foreign policy goals. Also encouraging was the finding that home agencies benefitted following their employees’ ESF experience, as Fellows were better poised to advance the diverse, agency mission and priorities. The main sources of ESF dissatisfaction identified by Fellows were perceived isolation and insufficiently clear aims. Overall, this paper finds that the ESF program has been successful in terms of providing benefits to hosts, Fellows, and their employing agencies, and in expanding international S&T cooperation. We offer our perspective on opportunities for improvement and areas for further study and propose the ESF program as a model for other countries.

Introduction

Many major events of the modern era, such as the space race between the United States and Soviet Union and the ongoing efforts to respond to the COVID-19 pandemic and global climate change, required international collaboration in science and technology (S&T) to support national and global interests. Traditionally, scholars have defined a range of ways in which S&T intersects with foreign policy, informing science diplomacy (e.g., international response to global climate change and the COVID-19 pandemic), leveraging diplomacy to support and advance science (e.g., CERN), and strengthening evidence-based foreign policy decision-making. Scientific exchange has been a component of the American diplomatic toolkit since the late nineteenth century when zoologist Charles Wardell Stiles was dispatched to the U.S. Embassy in Berlin to overturn protectionist measures the local government had taken against the import of American pork. Scientific exchange was a key component of Senator James William Fulbright’s 1945 bill for “promotion of international good will through the exchange of students in the fields of education, culture, and science” which laid the groundwork for the Fulbright Scholar program. Over the last century, there has been a growing recognition of the important role of S&T in addressing urgent transnational challenges from space policy to emerging technology to wildlife conservation. In recognition of this shift, the U.S. Department of State (DoS), working with the White House Office of Science and Technology Policy (OSTP) and federal science agencies, has leveraged federal S&T capabilities to implement American foreign policy, advance U.S. foreign policy goals through diplomacy, and promote American global leadership. Here, we focus on the U.S. Embassy Science Fellows (ESF) program that launched in 2001, which provides American diplomatic posts with technical experts in support of mission strategic priorities.
Strengthening scientific capacity and promoting evidence-based, foreign policy decision-making at DoS were critical to meet foreign policy goals. In the late 20th century, several programs were launched to integrate S&T expertise and proficiency into DoS workforce, use S&T expertise and proficiency to support diplomatic objectives, and leverage diplomacy mechanisms to advance foreign policy objectives. DoS eventually began participating in the AAAS Science & Technology Policy Fellowships program, launched in 1973. The program now brings S&T experts into DoS, other executive branch agencies, Congress, and the judicial branch for one or two-year fellowships.

Prompted by growing criticism of low scientific capacity at DoS when the role and importance of S&T in foreign policy was growing, U.S. Secretary of State Madeleine Albright asked the National Research Council (NRC) to offer advice for augmenting DoS S&T capabilities. This led to several important actions taken by DoS in the early 21st century to strengthen the DoS S&T leadership structure (e.g., establishing the Office of the Science and Technology Adviser to the Secretary (STAS) in 2000); enhancing the S&T literacy of the DoS workforce (through new recruitment, training, assignment and promotion policies–including the establishment of the Jefferson Science Fellowships); and broadening DoS partnerships with the U.S. S&T community (including through the establishment of the Professional Science and Engineering Society Fellows program). As scientific capacity increased at DoS, other S&T-focused programs emerged, including the U.S. Science Envoy program, Global Innovation through Science and Technology (GIST) Initiative, Asia-Pacific Economic Cooperation (APEC) Science Prize for Innovation, Research and Education (ASPIRE), and the U.S. Embassy Science Fellows (ESF) program. Better integration of S&T into U.S. foreign policy continues to offer opportunities for growth.

The ESF program, launched in 2001, deploys federal scientists from across the executive branch for short-term assignments at U.S. posts overseas, expanding international S&T collaboration. The program broadens U.S. scientific networks, projects American S&T leadership, cultivates partnerships between U.S. science and diplomacy practitioners, and increases U.S. access to foreign scientific materials, knowledge, and capabilities. Examples of how ESF Fellows help countries strengthen their S&T capacity include setting up science funding agencies; working with host country governments to evaluate scientific issues and implement recommendations (e.g., write a report while holding workshops on topics such as population-level cancer prevention, sewage treatment, or evidence-based high impact practices in STEM education); and performing hands-on research on topics ranging from fish population densities in threatened aquatic ecosystems to marine renewable energy opportunities, high-powered laser physics, biotechnology, and
crop production. While working overseas, ESF Fellows are on official duty and act as representatives of the U.S. government.

Given its recruitment with a narrow subset of federal employees from participating agencies, the ESF program is not widely known outside the U.S. government. In this paper, we explore ESF program performance in fulfilling the goals of host embassies and offices and addressing the professional and personal needs of its Fellows and their home agencies, both of which make substantial commitments to participate. In this paper, we explore the benefits of the program from a DoS perspective, utilizing data collected over the past decades to address the program’s impacts and document the perceptions of Fellows to identify strengths and opportunities for improvement of the program. We provide the first public evaluation of the ESF program using descriptive statistics, including information on deployment geography, language requirements, and scientific area of the proposal, as well as an evaluation of its success from the perspective of its alumni.

Methods

To analyze the results and benefits of the ESF program, we first performed a historical review of program data. Then, we conducted a survey of ESF Fellows using a survey instrument that collected both quantitative and qualitative data.

Historical Review

The DoS office responsible for the ESF program is the Office of Science and Technology Cooperation in the Bureau of Oceans and International Environmental and Scientific Affairs (OES/STC). This office maintains yearly logistical spreadsheets of requests submitted to OES/STC and Fellows deployed to Embassies and Consulates. We reviewed logistical data covering nearly the full duration of the program (2001-2019) and organized by geographical region, category of work performed, agency participation, and language requirement. These data were analyzed to describe the broad process of selection and summarize the proposals submitted, proposal fill rate, and project descriptive characteristics.

Survey

Our research design utilized a “mixed-methods” approach, blending quantitative and qualitative data analyses to permit a more complete and synergistic utilization of data. We created a survey instrument specifically for
this study. Surveys were emailed to 371 former Fellows (Fellows from 2001 to 2018 whose email address were not out-of-date) through the QualtricsXM online survey platform, and responses were anonymized by a third party. Survey questions explored how the Fellow’s ESF experience: (1) affected their understanding of and perceived contributions to U.S. foreign policy, (2) was perceived to impact the Embassy or Consulate in which they served, (3) was perceived to serve their home technical agency, and (4) helped them grow professionally. The survey consisted of both open-ended (qualitative) questions and closed ended (quantitative) questions using a Likert scale of one to five (Table 1), where one was “none” and five was “very significant.”

Table 1

<table>
<thead>
<tr>
<th>Area Assessed</th>
<th>Questions Evaluating</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S. Foreign Policy</td>
<td>• Understanding embassy’s role in foreign policy</td>
</tr>
<tr>
<td></td>
<td>• Understanding how S&amp;T intersects with U.S. foreign policy</td>
</tr>
<tr>
<td></td>
<td>• Advancement of embassy’s engagement in a foreign country</td>
</tr>
<tr>
<td></td>
<td>• Advancement of the acceptance of U.S. scientific norms</td>
</tr>
<tr>
<td></td>
<td>• Advancement of U.S. international S&amp;T capabilities</td>
</tr>
<tr>
<td>Impact on Host Embassy</td>
<td>• Enhanced host country’s capacity to independently resolve S&amp;T issues (knowledge transfer)</td>
</tr>
<tr>
<td></td>
<td>• Helped resolve a real-world issue in my area of expertise</td>
</tr>
<tr>
<td></td>
<td>• Improved access to a host country’s scientific data, information, and facilities</td>
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<tr>
<td></td>
<td>• Improved the perception of the United States in the host country</td>
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<tr>
<td></td>
<td>• Strengthened host embassy’s intra-country networks</td>
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<tr>
<td>Advancement of Technical Agency</td>
<td>• Application of international best practices in my field to advance domestic mandate</td>
</tr>
<tr>
<td></td>
<td>• Application of new scientific skills on domestic projects</td>
</tr>
<tr>
<td></td>
<td>• Built international relationships that have advanced technical agency mission</td>
</tr>
<tr>
<td></td>
<td>• Understanding of international best practices in my field</td>
</tr>
<tr>
<td>Professional Development</td>
<td>• Expanded my international professional network</td>
</tr>
<tr>
<td></td>
<td>• Gained knowledge/skills in my area of expertise</td>
</tr>
<tr>
<td></td>
<td>• Increased ability to traverse cultural boundaries at the workplace</td>
</tr>
<tr>
<td></td>
<td>• Understanding of science or engineering systems used in another country</td>
</tr>
<tr>
<td></td>
<td>• Understanding of the international context of my field</td>
</tr>
</tbody>
</table>

Table 1. Items assessed quantitatively within each of the four areas in the survey administered to past ESF Fellows. Credit: Jacqueline McLaughlin.

Since the policy assessment area contained questions related to “understanding of” and “contributions to” U.S. foreign policy, this area was divided into two sub-groups, which were analyzed separately. Four open-ended questions were also included in each key area of assessment. These questions asked Fellows to comment on their perceptions and experiences and were analyzed using the framework described by Creswell.11 Briefly, responses were coded to form initial categories, which were then used to identify, clarify, and categorize broad themes for final analysis.12
Statistical analyses were conducted in IBM SPSS 26.0. All human subjects research conducted in this study was approved by the U.S. Department of State, Office of Legal Affairs, and the Office of Policy and Public Outreach (PPO) in OES. The Penn State Institutional Review Board also approved this study (ID 00017373).

Results

Historical Review

The ESF Process: The ESF program includes three phases through which diplomatic missions identify their needs, agencies identify potential Fellows, and Fellows and posts are matched. In phase one, OES/STC announces an official call for, and requests subsequent submission of, proposals from U.S. Embassies or Consulates. In preparing their proposals, Embassies and Consulates outline: (1) their diplomatic mission’s priorities; (2) the needs of the host government and/or non-government organization; (3) a description of how an ESF would assist in meeting these priorities; (4) the expertise required from the ESF, including language skills, the expected length of the project (30-90 days), and the ideal timing for the ESF to travel to the host country; and (5) logistical aspects, including costs, housing, and transport. Typically, the Fellow’s home agency pays salary, benefits, and travel, whereas the host diplomatic missions take care of housing, in-country travel, and logistics such as office space. Opportunities for the ESF to speak publicly with host country audiences about the project they are engaged in may also be outlined in the proposal. OES/STC then conducts outreach meetings with participating federal agencies to discuss participation opportunities. In phase two, an interested federal scientist or technology expert submits an application to be a Fellow, responding to up to three proposals. The application includes a statement of support for the applicant and project from the home agency. In phase three, Embassies and Consulates review and rank the Fellow applications, then work to secure their top applicants with OES/STC guidance. Prior to travelling overseas, each ESF must complete security training and meet medical requirements, such as vaccinations.

Proposals: From 2001 to 2018, 1,092 proposals were submitted to OES/STC, with an uptick beginning in 2016 (Figure 1). Of these, 485 (44.4%) were successfully matched. At the time of this study, 2019 data were not finalized, so only data through 2018 are presented here. In 2019, 121 proposals were submitted, and 60 (49.5%) applicants were successfully matched. Due to COVID-19 travel restrictions, however, only eight Fellows were able to complete their assignment in this cohort.
During the study years, Fellows originated from twenty-five participating federal agencies. Together, the top five agencies (U.S. Environmental Protection Agency, National Science Foundation, U.S. Department of Agriculture, National Institutes of Health, and National Oceanic and Atmospheric Administration) represented 358 of the 485 (73.8%) placed Fellows (Figure 2).

**Figure 1**

![Figure 1. ESF proposals submitted to OES/STC (light blue) annually and corresponding “matched” ESFs (dark blue). Credit: Jacqueline McLaughlin, Sean Hogan, and Kevin Manuel.](image)

**Figure 2**

![Figure 2. U.S. Government agency participation in the ESF program, showing total number of ESFs who served abroad from 2001 to 2018.](image)

From 2001 to 2018, American diplomatic missions in 142 countries requested ESF Fellows and those in 116 countries received them (Figure 3). The top sources of proposals were from U.S. diplomatic missions in China (N=103), Philippines (N=44), and Croatia (N=31) and the top locations for Fellow deployments were China (N=51), Portugal (N=15), and the Philippines (N=14). Generally, proposals generated by missions in Europe and Asia were matched with U.S. federal scientists at a higher rate than those generated by missions in Africa, particularly non-Anglophone parts of the continent (Figure 4). Proposals from Australia, New Zealand, and the Caribbean region were also matched at relatively low rates. Language requirements and host country GDP (defined here as the top 25% per-capita GDP based on the 2019 data of The International Monetary Fund’s World Economic Outlook Database, year 2019, and excluding the Chinese territories of Hong Kong and Macau) were found to have a statistically insignificant effect on the rate at which proposals were matched (Fisher’s exact tests; N = 640, P > 0.1 in both cases).

Figure 3

Figure 3. Numbers of proposals submitted (size of circle) submitted and matched (color) from 2001 to 2018, by country. Map copyrighted OpenStreetMap contributors. Credit: Sean Hogan, Kevin Manuel, and Jacqueline McLaughlin.
Proposals were classified into nine categories and a subset (2011-2018) was identified for trend analysis (Figure 5). A significant difference in the number of proposals between the categories was observed (ANOVA; F1,70 = 14.48, p < 0.001) and a significant increase in the annual number of proposals is evident (N=72, Pearson correlation coefficient = 0.414, P < 0.001). However, the increase was not equal across all categories. The greatest increase in proposals over this period occurred in the categories of Natural Resources (slope=2.27, indicating a roughly doubling of requests over this period), Biosphere (slope=1.82), Medicine (slope=1.52), and Computing (slope=1.30). Computing, Biosphere, and Medicine experienced the highest average annual growth rate, all greater than 50%, as compared to an average annual growth rate of 13.8% for proposals overall. The increase was statistically significant for some categories (linear regression with N=8 in all cases; Biosphere: two-tailed P = 0.004; Energy: P = 0.034; Medicine: P = 0.007; Natural resources: P = 0.028), only marginally significant for Computing (P = 0.071), and not significant for Agriculture (p=0.74), Earth Systems (P = 0.349), Public Policy (P = 0.132), or Science and Innovation (P= 0.163). The Biosphere and Computing categories had the two lowest matching rates, 29.0% and 21.7%, respectively, during this period (Table 2), but overall matching rate was not significantly correlated with overall number of proposals (Spearman's nonparametric correlation. N = 9, P > 0.25), suggesting that the magnitude of demand was not the cause for low matching rates. Instead, the
relatively low matching rate is attributed to an insufficient number of applicants for proposals in these categories. In contrast, Agriculture, Public Policy, and Science and Innovation, categories showing little growth in proposal number, were matched with U.S. federal scientists at the highest rates (over 45% in all three cases, compared to a mean of 36.6% for other categories; Table 2). Indeed, the rate of growth in proposals over time (slope, Table 2) was significantly negatively correlated with matching rate (Spearman’s nonparametric correlation. N = 9, rho = -0.683, P = 0.042), suggesting a possible mismatch between the proposed projects and the scientists/experts available to participate or science agency priorities. As the overall number of proposals experienced year-on-year growth during this time period, the relative composition of proposal categories remained much the same.

Figure 5

Figure 5. ESF requests submitted by U.S. missions, 2011-2018, by category. Dotted trend lines show growth over time. One proposal from 2012 could not be assigned. Credit: Sean Hogan, Jacqueline McLaughlin, Kevin Manuel, and Gad Perry.
Table 2

<table>
<thead>
<tr>
<th>Category</th>
<th>Proposals</th>
<th>Fill Rate</th>
<th>Slope</th>
<th>Average Annual Growth Rate</th>
<th>Average Percent of Total +/- One Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Resources</td>
<td>112</td>
<td>43.8%</td>
<td>2.27*</td>
<td>21.5%</td>
<td>16.9 ± 3.9</td>
</tr>
<tr>
<td>Biosphere</td>
<td>41</td>
<td>29.3%</td>
<td>1.82*</td>
<td>65.6%</td>
<td>5.3 ± 3.5</td>
</tr>
<tr>
<td>Medicine</td>
<td>38</td>
<td>42.1%</td>
<td>1.52*</td>
<td>63.6%</td>
<td>5.3 ± 3.4</td>
</tr>
<tr>
<td>Computing</td>
<td>23</td>
<td>21.7%</td>
<td>1.30</td>
<td>82.9%</td>
<td>2.8 ± 3.3</td>
</tr>
<tr>
<td>Public Policy</td>
<td>143</td>
<td>45.5%</td>
<td>1.08</td>
<td>11.0%</td>
<td>23.9 ± 6.9</td>
</tr>
<tr>
<td>Energy</td>
<td>64</td>
<td>35.9%</td>
<td>1.06*</td>
<td>25.7%</td>
<td>10.1 ± 2.8</td>
</tr>
<tr>
<td>Earth Systems</td>
<td>105</td>
<td>46.7%</td>
<td>0.92</td>
<td>19.4%</td>
<td>17.5 ± 6.6</td>
</tr>
<tr>
<td>Science and Innovation</td>
<td>83</td>
<td>54.2%</td>
<td>0.88</td>
<td>20.6%</td>
<td>13.4 ± 3.9</td>
</tr>
<tr>
<td>Agriculture</td>
<td>30</td>
<td>50.0%</td>
<td>0.14</td>
<td>50.0%</td>
<td>4.9 ± 2.9</td>
</tr>
</tbody>
</table>

Table 2. Number of ESF proposals and fill rate by proposal category, arranged by the value of b in a linear regression of number of proposals per year (slope, Figure 5). Starred values are significant at the α = 0.05 level. Credit: Jacqueline McLaughlin and Gad Perry.

ESF Survey

Quantitative Analyses. Overall response rate to our survey was 45%, with 166 former Fellows completing the survey in full. An additional thirty respondents completed only part of the survey, and therefore, were not included in the following analyses. Respondents represented nineteen out of the twenty-five participating agencies, including three of the top four agencies sending ESFs abroad.

Past ESFs report high levels of positivity about their experience and its impacts. Over 90% felt it allowed them to improve their understanding of and advance U.S. foreign policy by enhancing engagement with the host country, expanding the acceptance of U.S. scientific norms, and improving U.S. international S&T capabilities (Figure 6 A1, A2) while enhancing their personal professional development and making them more competent in their field of expertise (Figure 6 D). Over 85% felt they provided knowledge transfer that enhanced the host country’s capacity to independently resolve S&T issues, and almost 80% reported
that their mission benefitted from the activities of their home agency (Figure 6 B, C). Few respondents chose “disagree” or “strongly disagree” on any of the questions. Overall, former Fellows believed that their ESF missions helped resolve real-world issues, improved U.S. standing in and access to the host country’s scientific community, improved the perception of the U.S. in the host country, strengthened the host country’s scientific capabilities, helped them personally, and benefitted their home agency.

**Figure 6**

![Figure 6](image)

*Figure 6. Average Likert ratings by former ESF Fellows (N=166) in each area of assessment. Positive responses (green and blue) are to the right of the line representing a “neutral” reply and negative responses are to its left. Credit: Jacqueline Mclaughlin and Kevin Manuel.*

**Qualitative Analyses.** Responses (N=132) from the optional open-ended questions (Figure 7) were congruent with those from quantitative questions. Over ten percent of respondents felt that they gained specific knowledge in policy development and implementation; better understood the working dynamics of an embassy and how science influences foreign policy and vice versa, informed future programs or practices; advanced international collaborations; and transferred scientific or technical knowledge to host country colleagues. A small number of negative responses was also recorded, primarily regarding lack of support and feelings of isolation while in the host country.
Figure 7. Percentage of respondents (N = 132) who reported, in open-ended questions, that they came to understand a U.S. foreign policy theme area (light blue), contributed to the advancement of a theme area (dark blue), or had negative experiences (red). Most column descriptors are self-explanatory, but “Interlocutor” is used to denote their role as a spokesperson for the U.S. government and “the STATE advantage” reflects the prestige and importance of representing DoS. Credit: Jacqueline McLaughlin and Kevin Manuel.

Of those who mentioned benefits to the host embassy (N=128), close to half believed their ESF Fellowship helped to forge new relationships (48.6%) or expanded the breadth of the U.S. mission (47.2%). Just over 30% believed that they had enhanced overall international S&T cooperation and created new knowledge, and about a quarter felt they helped enhance mission community outreach (23.2%). Of ESFs who perceived that the experience benefited their home agency (N=129), at least a quarter listed development of research collaborations (37.3%), enhancement of scientific knowledge (29.6%), or increased employee competence and skills (26.1%). Similarly, at least one quarter of respondents who listed professional development benefits (N =123) included increased networks and relationships (29.6%), broadened international perspectives (26.8%), or increased scientific and technical knowledge (24.6%). Almost one quarter (23.9%) reported elevated
professional satisfaction and a sense of personal fulfilment. A small number of respondents (around 2%) identified poorly communicated project goals as a cause for dissatisfaction; logistical issues, lack of material support, or adverse changes in home agency policy or host embassy priorities in the year or more between project approval and completion were also mentioned.

Discussion

Our study joins a small number of formal, publicly available evaluations of science policy and science diplomacy efforts.\textsuperscript{5,6,13,14,15} We report on the process and scope of the Fellowship program and show that Fellows overwhelmingly felt that their experience was beneficial to the diplomatic goals of the U.S., to the host countries, to their home agencies, and for them personally. These are highly encouraging findings. In a few cases, they also highlighted challenges that could be addressed to improve the program for future program years.

Proposal number and the matching rate increased intermittently over time, particularly from 2015 to when the global COVID-19 pandemic began. This too is encouraging, as different government agencies that participate in the program are responsible for a diversity of tasks and goals. Moreover, those agencies are not necessarily entrusted with supporting the diplomatic mission of the DoS and thus might not feel compelled to participate. Of the nine categories analyzed, proposals seeking ESFs with expertise in the categories of Natural resources, Biosphere, and Medicine showed the greatest increased demand, with Biosphere, Medicine, and Computing each displaying average year on year growth exceeding 50%. Overall matching rates did not reach 60% in any of the categories, and those for Biosphere and Medicine were particularly low. Likely, this indicates ongoing interest in topics such as pollution, climate change, human health, and disease, and we believe these trends are likely to continue. Over time, we also anticipate that changes in agency leadership and priorities will impact relative support for the ESF program in various ways. For example, as agency missions change, availability of Fellows in areas of global demand may increase or decrease.

Matching rates were generally highest for missions located in Europe and in English-speaking countries in other regions; although Australia and New Zealand, which are also English-speaking countries, have advanced internal S&T resources, and enjoy strong diplomatic relations with the U.S., both had low matching rates for reasons that are unclear. However, the data do not indicate that countries requiring non-English proficiency or countries with lower GDP per capita would have lower matching rates. The causes underlying regional matching-rate disparities
merit additional future study, especially in light of low matching rates in much of Africa, where the expertise offered by the ESF program may be most needed and impactful. Reasons why some missions submit many more proposals than others are not always clear and also merits additional study.

The statistically significant negative correlation we found between matching rate and the rate of growth in proposals over time suggests that there is more interest from U.S. Embassies and Consulates than available scientific and technical experts. The U.S. science funding agencies set U.S. S&T goals and this finding suggests the need to better align the ESF program with science agency goals and objectives.

Again, the combined quantitative and qualitative data from the survey paint a clear and very positive picture: former Fellows self-report that the ESF program has strong merit with positive results for the Fellows themselves. This high-level buy-in from a large density alumni pool could be a useful recruitment tool for future cohorts. It could also help explain, in conjunction with reported support of the missions of their home agencies, why the program continues to enjoy participation from so many other federal agencies, though additional research in this area is warranted. Nonetheless, some areas for improvement present themselves in the responses.

Areas for Program Improvement

We have identified two primary areas where improvements may be possible.

Improving Fellow satisfaction. Fellows make substantial commitments to participate in the ESF program, so their satisfaction is particularly important. A few Fellows listed isolation, lack of clarity about or changes in project goals, and lack of sufficient support as their primary concerns. A sense of isolation was the most common reason for dissatisfaction cited by Fellows. To some extent, this is not surprising, because similar feelings have long been reported in students studying abroad\textsuperscript{16} and expatriate workers.\textsuperscript{17} While Fellows are usually enthusiastically welcomed by their host mission’s community, they are nonetheless thrust into a foreign environment with which they may have limited familiarity. Even if no language requirement was listed, the local population, including local organizations the Fellow is embedded within, might not primarily be English speaking. Such feelings might be alleviated by managing Fellow expectations via pre-departure training programs, including panels with former Fellows who can describe their experiences and coping strategies. In addition, we recommend
that DoS provide missions with information on best practices for hosting Fellows, which, we understand, DoS has started early in 2021. In addition, recent experience with technologies such as tele- or videoconferencing could enable better and more collaborative pre-departure project development and consultation with the home agency as the work progresses. DoS might also enable better post-trip follow-ups and ongoing consultations after the Fellow returns to the United States.

Another reason for fellow dissatisfaction was project goals that were either not clearly communicated or that shifted over time. The temporal gap between the application and matching process and Fellow deployment can result in a project that, at completion, is of lower priority to the diplomatic mission, host government, or home agency than it was at submission, or in a more subtle shift in goals that is not well communicated to the Fellow. Addressing these issues would require additional review of proposals by DoS, mission, and host government to assess the clarity of proposal goals and clarify any shifts between submission of a proposal and arrival of a Fellow.

Improving alignment with S&T agency priorities. The gap between the demand expressed in the growing number of proposals from diplomatic missions and supply of Fellows is shown by a consistent matching-rate of about 50%. Given this gap, additional discussion analysis with the home agencies could help evaluate whether there is a way to improve ESF program goals and to maximize the benefit of the program on the agency. Additional outreach and analysis are needed to determine why some federal agencies regularly participate in the ESF program while others do not. Additionally, concerns about ESF project relevance become even more important given the time delay mentioned above. Ultimately, the ESF program is a tool of the U.S. Government to help meet S&T agencies’ international goals and there may be no need for expansion. One action that might allay some concerns is to better publicize our findings that highlight that home agencies benefit from sending their employees on ESF Fellowships. However, these findings are based on self-reporting by Fellows, not on input from their home agencies. We therefore recommend that a follow-up survey be conducted among current and potential home agencies to document concerns, understanding of ESF benefits, and explore ways to better align the program with their needs. To decrease the processing delay, DoS could reach out to both agencies and missions to highlight priority topics and offer an expedited process for projects where agencies have experts available on short notice. This could allow DoS to identify posts in priority countries interested in submitting a targeted proposal. A similar process has occurred in the past in an ad-hoc manner, but a more systematic approach could yield better results. In addition, availability of experts could be expanded by inclusion of current and former Fellows in science fellowships who have experience working in DoS, such as the JSF and AAAS programs. Finally, Fellows work within
the context of U.S. Missions abroad. Those involved help establish the planned work, choose the Fellow, and provide logistical support. A future examination of the benefits and challenges for participating embassies and consulates might also provide instructive insights to strengthen the ESF program.

Conclusion

This work provides a descriptive statistical overview of the U.S. DoS ESF program from 2001 to 2018 and of survey results from former Fellows. The ESF program supports three important components: providing scientific support for the diplomatic mission (science for diplomacy), enabling diplomatic efforts to enrich the scientific endeavor (diplomacy for science), and encouraging the inclusion of scientific insights and expertise in diplomatic activities (science in diplomacy). The ESF program is a flexible and adaptable foreign policy tool with overwhelmingly positive feedback from former Fellows. Further studies should include broader stakeholder analysis of the impacts of the program, including surveys of host embassies, host country governments/NGOs, and home agencies of the ESF scientists. Building on feedback from diplomatic missions about their needs, science interagency partners, and administration goals, DoS is well positioned to wield the ESF program as a nimble foreign policy tool to inject S&T knowledge into foreign policy, build international S&T cooperation and networks, and utilize S&T to promote American global leadership. Finally, we hope this study will encourage other countries to adopt the ESF model and thereby expand the global reach of science diplomacy. SD
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Endnotes