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Attracting and Retaining Science and Engineering Talent in the Federal Government: A Workshop Summary

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February 2013
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IDA Document D-4740
Log: H 12-001536

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This work was conducted by the IDA Science and Technology Policy Institute under contract NSFOIA0408601/STPIAF, Task STPI-0400.00.AF (TP-20-1000), "Science and Technology Policy Institute Core Support Efforts: Recruitment and Retention of Federal Scientists and Engineers," for the Office of Science and Technology Policy. The views, opinions, and findings should not be construed as representing the official position of the National Science Foundation or the Office of Science and Technology Policy in the Executive Office of the President.

Acknowledgments

The Partnership for Public Service provided critical support in the design, execution, and post-mortem of this workshop. In particular, Tim McManus provided exceptional insight and guidance throughout this study.

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**Attracting and Retaining Science and
Engineering Talent in the Federal
Government: A Workshop Summary**

Bill Brykczynski
Pamela Ebert Flattau
Rashida Nek

Executive Summary

Introduction

This document summarizes a half-day workshop exploring the challenges and opportunities involved in recruiting, hiring, and retaining science and engineering professionals. Nearly 50 key staff members from 18 Federal agencies and representatives from the Office of Science and Technology Policy and the U.S. Office of Personnel Management attended the workshop, which was held on February 10, 2012, in Washington, DC.

Pre-Workshop Survey

The Partnership for Public Service (PPS) surveyed Federal hiring managers and human resources specialists about their experiences in recruiting and retaining scientists and engineers. Survey respondents identified “pay in comparison to the private sector” as the chief deterrent for top science and engineering professionals accepting a position in the Federal Government. Nearly 60 percent of the respondents also identified “limited opportunities for professional advancement.” The majority of these respondents identified “recruitment, relocation, and retention incentives” as a highly successful strategy for the recruitment of science and engineering professionals and for their retention. Survey respondents also identified “special pay rates” and “direct hiring authority” as effective for increasing the recruitment of top science and engineering talent, but “special pay rates” were seen as effective for retaining the top talent by only about one-third of survey respondents.

A final question in the PPS survey probed possible roles and strategies for the White House in helping agencies successfully recruit top science and engineering talent. Respondents noted that the White House could:

- Give special hiring authority and remove spending/retention and recruitment bonus limitations.
- Relax limits on the use of the science and technology pay system and Schedule B appointments (i.e., appointments to jobs where competitive hiring procedures are impractical).
- Use recruiters, not USAJOBS, to locate and find candidates.
- Encourage agencies to create a technical ladder for those interested in science and engineering.

- Support legislation to provide direct-hire authority for science and engineering positions at the prevailing market pay rate.
- Support a Federal market pay study for all science and engineering positions to support the increased pay caps.

Results for the Small Group Discussions

Workshop participants adjourned into five discussion groups: Recruiting, Retention, Career Advancement and Development, Total Compensation, and Classification and Job Expectations. At the conclusion of the small group discussions, participants created a master list of recommendations. The recommendations were evaluated in terms of their impact on recruiting and retaining science and engineering professionals and feasibility of being implemented. Two recommendations were judged to have a high impact and a high feasibility:

- Work to identify hard-to-fill positions in science, technology, engineering, and mathematics fields that are critical to the mission (i.e., mission critical occupations) of each agency.
- Establish an action-oriented network of human capital and science and engineering professionals to share concerns and explore recruitment and retention solutions.

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A. Introduction

In December 2011, the White House Office of Science and Technology Policy (OSTP) invited Federal Chief Human Capital Officers to encourage their agency staffs to attend a half-day workshop exploring the challenges and opportunities involved in the recruitment, hiring, and retention of science and engineering (S&E) professionals (see the appendix).

Nearly 50 key staff members from 18 Federal agencies joined representatives from OSTP and the U.S. Office of Personnel Management (OPM) at the *Workshop on Attracting and Retaining S&E Talent in the Federal Government* convened on February 10, 2012, in Washington, DC. This document provides a summary of the workshop, including the results of a pre-workshop survey and interviews exploring the experiences of Federal hiring managers and human resources (HR) specialists in recruiting and retaining scientists and engineers. An annotated bibliography is also provided.

B. Opening Remarks

In his welcoming statement, OSTP Deputy Director for Policy Thomas A. Kalil underscored the important role science and technology (S&T) play in President Obama's plan for building a highly skilled workforce as part of continuing the Nation's economic recovery. He urged workshop participants to explore new ideas for making the Federal Government a more competitive employer of world-class scientists and engineers as part of that strategy.

Sydney Smith-Heimbrock, Director of the OPM Leadership and Human Resource Development Solutions Center, described specific Federal efforts to close skill gaps in science, technology, engineering, and mathematics (STEM) among government workers. For example, the Federal Service Ambassadors program launched in 2011 encourages Federal STEM employees to engage in volunteer activities within their fields. She also mentioned that OPM would soon announce the Student Pathways program as a mechanism available to Federal agencies to create employment pathways between educational institutions and the government—including STEM employment opportunities.

Bill Brykczynski, Deputy Director, IDA Science and Technology Policy Institute (STPI), set the stage for subsequent workshop discussion by identifying several challenges in the recruitment and retention of top-quality scientists and engineers (S&Es) in government employment—themes that have periodically appeared in reports and analyses dating from the early 1990s. These challenges include the lack of relevant data describing the scope and quality of the Federal S&E workforce (National Research Council [NRC] 1990; Jackson 2003; Seng and Flattau 2009), as well as the need for (1) a

broader set of management strategies to facilitate the flow of top S&E talent into the Federal workforce and foster these workers' career advancement thereafter (National Academies 1997; Jackson 2003; Stine and Mathews 2009); (2) competitive employment and benefit incentives (NRC 1990; Stine and Brass 2009; Faulk 2012); and (3) coordination of government-wide and agency-specific statutory authorities that influence the growth and quality of the Federal S&E workforce (NRC 1990; Stine and Brass 2009).

C. Pre-Workshop Survey

At the request of OSTP, and under contract to STPI, the Partnership for Public Service (PPS) surveyed Federal hiring managers and HR specialists relative to their experiences in recruiting and retaining scientists and engineers. Table 1 presents the questions PPS posed.

At the workshop, PPS Vice President Tim McManus and his staff reported that a total of 76 individuals responded to the survey, chiefly representing various offices of the Department of Energy, the Department of Veterans Affairs, and the U.S. Nuclear Regulatory Commission. As Figure 1 illustrates, the majority of these respondents identified "recruitment, relocation, and retention incentives" as a highly successful strategy for the recruitment of S&Es (71% or 54 of the 76 respondents) and for their retention (56% or 43 of the 76 respondents). Survey respondents also identified "special pay rates" and "direct hiring authority" as effective for increasing the recruitment of top S&E talent (47% and 39%, respectively). However, "special pay rates" were seen as effective for *retaining* top S&E talent by only about one-third of survey respondents (26 of 76).

Survey respondents identified "pay in comparison to the private sector" as the chief deterrent for top S&Es accepting a position in the Federal Government (82% or 62 of the 76 respondents). Nearly 60% of the respondents also identified "limited opportunities for professional advancement" (45 of the 76 respondents). Figure 2 summarizes those results.

When S&Es leave Federal service, they largely take up employment in the private sector, according to the 76 survey respondents (Figure 3).

Table 1. Pre-workshop Survey Questions

What are the critical issues your agency/subcomponent faces in recruiting top S&E talent?

What are the effective strategies or practices that your agency/subcomponent uses to recruit scientists and engineers? Please briefly describe.

Based on your experience and insights, what do you believe are the greatest deterrents keeping top scientists and engineers from accepting a position in Federal Government?

What, if any, strategies or approaches have worked well for your agency to increase the recruitment of top S&E talent? [Check all that apply]

Can you share any insights about why these approaches have been successful?

Please select true or false for the statements below:

- Our agency/subcomponent attracts top science and engineering talent.
- Our agency/subcomponent hires top science and engineering talent.
- Our agency/subcomponent retains top science and engineering talent.

What are the critical issues your agency/subcomponent faces in retaining its S&E workforce today?

What are the effective strategies or practices that your agency/subcomponent uses to retain scientists and engineers? Please briefly describe.

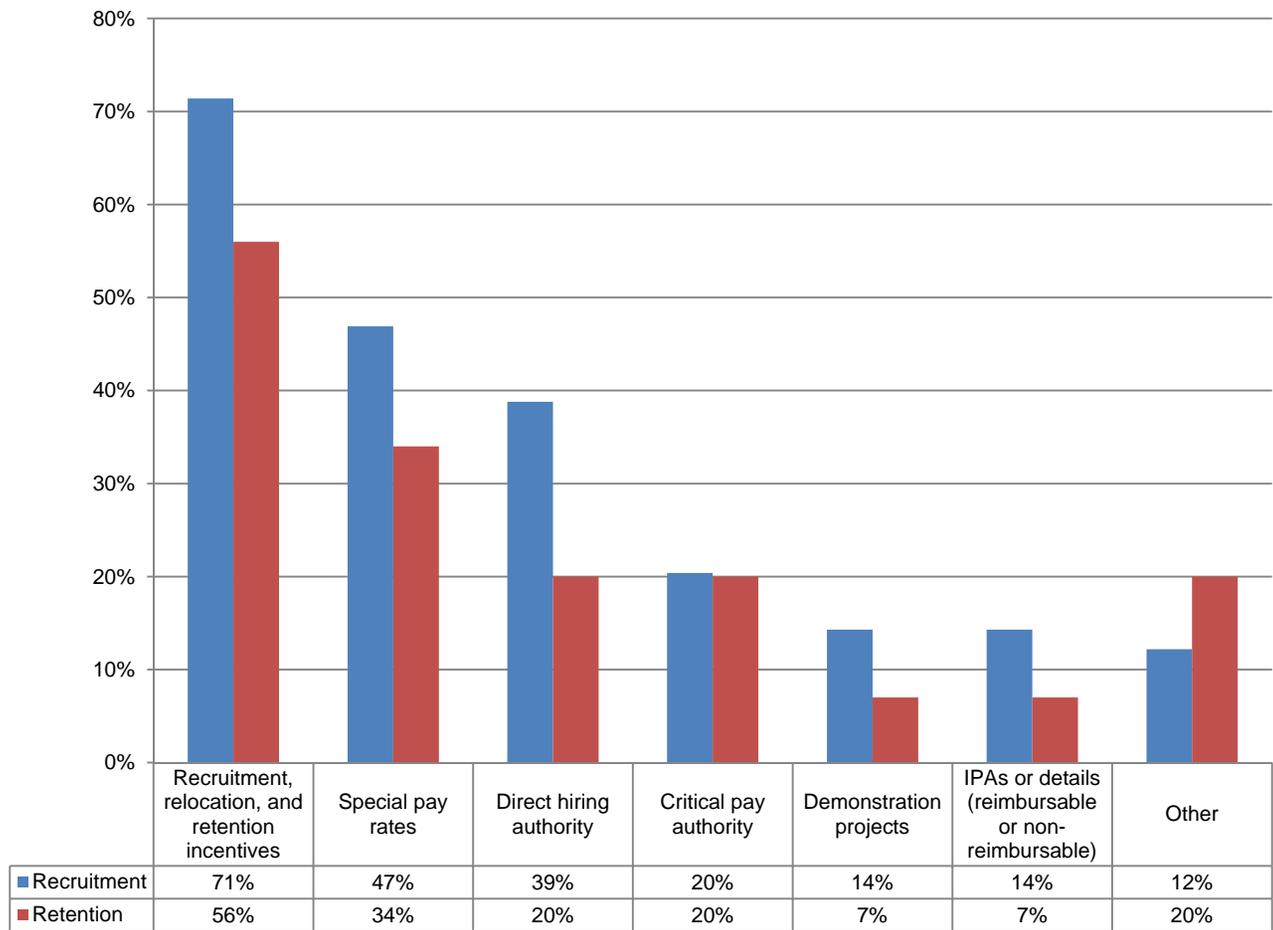
What, if any, strategies or approaches have worked well for your agency to increase the retention of S&E talent? [Check all that apply]

Can you share any insights about why these approaches have been successful?

When S&E talent departs your agency/subcomponent, where does the departing talent go?

Besides recruitment and retention of S&E talent, what other personnel issues related to S&E hinder your ability to achieve your agency's mission? Please describe below.

Based on your experience and insights, what can the White House do to help agencies successfully recruit and retain top S&E talent?



Note: IPAs = Personnel on temporary assignment through the Intergovernmental Personnel Act Mobility Program.

Figure 1. Successful Recruiting and Retention Approaches:
What, if any, strategies or approaches have worked well for your agency to increase the recruitment/retention of top S&E talent?

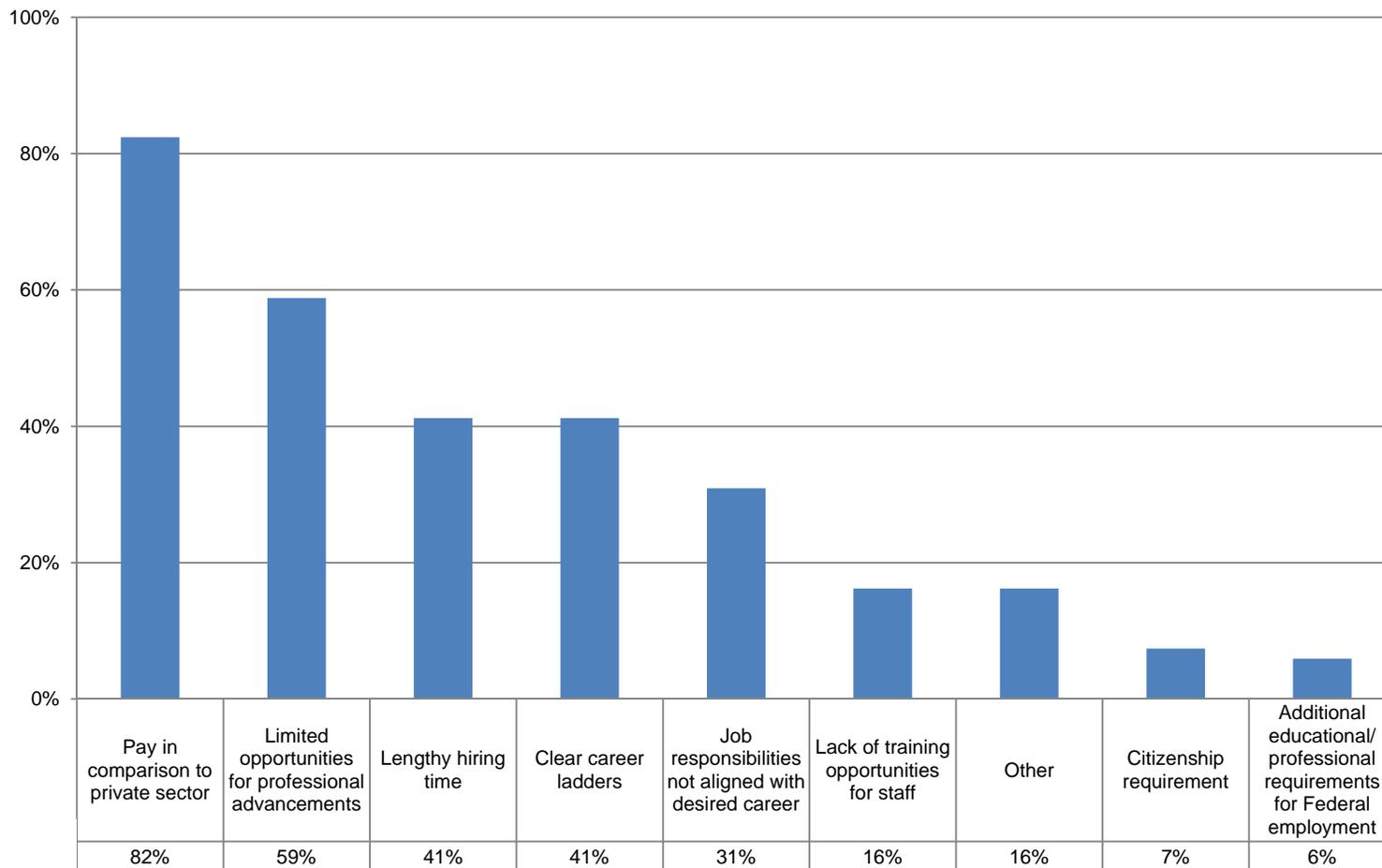
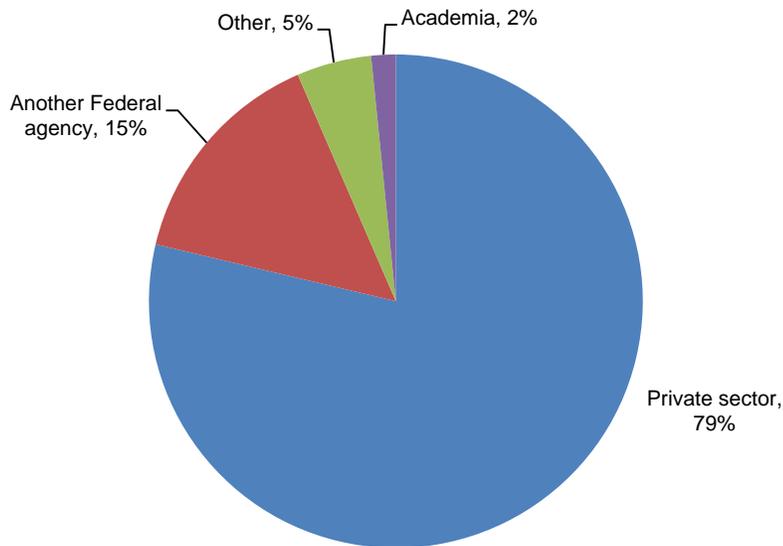


Figure 2. Deterrents for Recruiting Top S&E Talent:
Based on your experience and insights, what do you believe are the greatest deterrents keeping top scientists and engineers from accepting a position in Federal Government?



**Figure 3. Post-Federal Employment of S&E Talent:
When S&E talent departs your agency/subcomponent,
where does the departing talent go?**

A final question in the survey probed possible roles and strategies for the White House in helping agencies successfully recruit top S&E talent. Respondents noted that the White House could:

- Give special hiring authority and remove spending/retention and recruitment bonus limitations.
- Relax limits on the use of the S&T pay system and Schedule B appointments (i.e., appointments to jobs where competitive hiring procedures are impractical).
- Use recruiters, not USAJOBS, to locate and find candidates.
- Encourage agencies to create a technical ladder for those interested in S&E. Currently, the management ladder is the primary way for employees to be paid at the General Schedule (GS) GS-14 and GS-15 levels.
- Support legislation to provide direct-hire authority for S&E positions at the prevailing market pay rate.
- Support a Federal market pay study for all S&E positions to support the increased pay caps.

PPS also conducted a series of interviews with representatives of Federal research laboratories regarding their experiences in recruiting and retaining scientists and engineers.

D. Small Group Discussions

Workshop participants adjourned into five discussion groups and were asked to summarize the results of those discussions in a plenary session. Highlights of these discussions follow.

1. Recruiting

Workshop attendees participating in this discussion agreed that “direct hiring authority” has proved to be an effective hiring tool. Less effective are current government efforts to “brand” Federal S&T jobs for purposes of attracting talent. Furthermore, the “devolution” of human resource practices has led to the perception that recruitment is a “compliance” process rather than a workforce problem-solving one. Finally, attendees pointed out that world-class S&Es are often concerned about the professional restrictions imposed by government employment.

2. Retention

Participants in this discussion group identified inadequate standards for professional development and advancement as a significant barrier for retaining top-quality S&Es. The inability to continue to participate in professional activities within their communities is seen as a disincentive. Lower compensation and inadequate IT and technology resources compared to that of the private sector also emerged as issues behind the loss of S&E talent from the Federal workforce.

3. Career Advancement and Development

Discussants participating in this group identified the limited opportunities for professional development as a problem for retaining skilled S&E staff. However, they also pointed out that the absence of a clear path for advancement works against retaining these workers. The group identified the Development Career Map as an example of a report that laid out the path to a senior position. The potential role for a mentorship program was also discussed. It is important to recognize that some S&Es are interested in advancing along a management/administration career path, while others prefer to advance as professional research or technical staff.

4. Total Compensation

This discussion group emphasized the importance of standardizing hiring levels across fields of S&E, pointing out that some agencies recruit S&Es at lower GS levels than other agencies. Participants suggested a study on market pay would be useful, but with attention to differences across S&E fields—a topic of special importance in current efforts to recruit early career S&E talent. Participants noted that agency heads must be held accountable to avoid favoritism and other forms of compensation abuses.

5. Classification and Job Expectations

Workshop attendees participating in this discussion emphasized the need to convey clearly what the work of new hires will be, particularly the extent to which their work might involve administrative tasks to a greater degree than they might expect. Discussants agreed that greater attention is needed on S&E job classifications as job experience for the same S&E field will vary across the government. This group also discussed the need for more attention to S&T leadership training and development, especially with the goal in mind of creating better managers of talented S&Es.

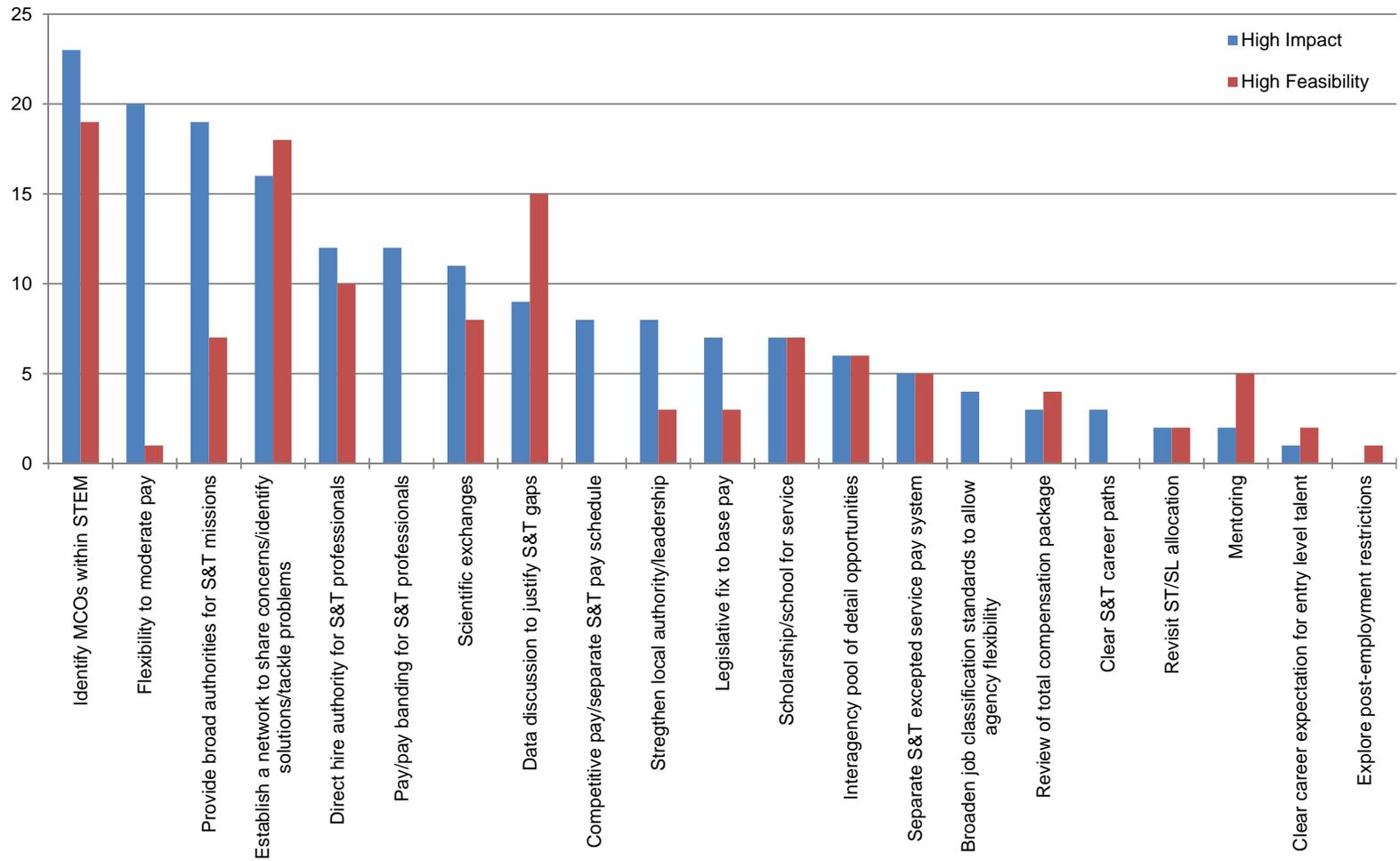
E. Plenary Session

At the conclusion of the small group discussions, participants began the process of synthesizing the discussions by creating a master list of recommendations. The group identified 21 action-oriented recommendations (some of which are identified in the preceding paragraphs). Workshop attendees were then invited to “vote” on each recommendation relative to two criteria: *impact* and *feasibility*. Figure 4 lists the 21 recommendations ranked on the basis of probable impact, with the ranking of probable feasibility also arrayed.

For example, participants agreed that giving agencies “flexibility to moderate pay” would have high *impact*, but that the rule changes needed to implement the recommendation made it of low *feasibility*.

The top four high-*impact* recommendations emerging from the workshop, together with a parenthetical notation regarding their perceived *feasibility*, are as follows:

1. Work to identify hard-to-fill positions in STEM fields that are critical to the mission (i.e., mission critical occupations or MCOs) of each agency (high *feasibility*)
2. Provide agency directors/laboratory heads with the flexibility to moderate pay for S&Es, especially within a pay band (low *feasibility*)
3. Extend broad hiring and pay authorities currently used by some agencies to recruit physicians, lawyers, or cyber-security specialists to include STEM professionals (moderate *feasibility*)
4. Establish an action-oriented network of human capital and S&E professionals to share concerns and explore recruitment and retention solutions (high *feasibility*)



Note: MCO = mission critical operation; ST/SL = Science or Technical/Senior Level positions in the Senior Executive Service.

Figure 4. Recommendations Ranked According to Impact

Workshop participants considered the extension of direct-hiring authority across the Federal Government to be a moderately *feasible* recommendation having moderate *impact* on the recruitment and retention of S&Es in the Federal workforce.

Table 2 summarizes the main issues discussed in the small groups and the recommendations proposed to address them.

Table 2. Summary of Small Group Discussion Topics and Recommendations

Discussion Topic	Main themes and issues	Recommendations
Recruitment	Limited direct hiring authority for STEM positions	Allow direct hiring authority for STEM positions across all government agencies
	Branding for S&T jobs is not done well by the public sector, making them less competitive with the private sector	1. Create a competitive pay structure that is separate from any existing pay structure 2. Increase the supply of S&Es by reaching students through scholarship programs
	Top-tier scientists worry about conflicts of interest terms when entering or leaving government	
	Devolution of the HR community	
Retention	Inadequate standards for technology, professional development, and continued education	Implement opportunities for scientific exchanges, professional development, and continued education using real support for these programs, rather than pulling from current budgets
	Allowing for scientific exchanges	
	Opportunities for promotion: the difference between scientists and managers	Give agencies local authority to promote people based on scientific ability
	Compensation and benefits	
Advancement and Development	Limited opportunity for development, innovation, and educational experiences	Creating an inter-agency rotational program for scientists to work on similar projects that allows them to focus on one big issue—a “One Stop Shopping Center”—where the best ideas float to the top
	No clear advancement path	Develop a focused community of practice that includes mentorship, sharing and solving problems, innovation, and planning ahead. Using this inter-agency network, scientists can identify a problem and work on this problem with others in the field.
	Define administrative management and technical management	Identify a specific career track (i.e., Science and Technology Career Maps) that keeps people in their field and out of administrative management

Continued on the next page

Table 2—continued

Discussion Topic	Main themes and issues	Recommendations
Total Compensation	Recognizing variation in S&T fields	<ol style="list-style-type: none"> 1. In OPM's annual survey, ask employees why they came to the Federal workforce, why they might consider leaving, and what their plans are for the future. 2. Revise legislation to adjust base pay and relieve pay compression
	Study on market pay	<ol style="list-style-type: none"> 1. Conduct a market pay study that is field and skill specific and takes into account years of experience and education level 2. Look at why people are leaving, how many and at what grade level, and what would provide incentive for them to stay
	Inherent inflexibility of offering compensation packages	Grant agency heads flexibility to modulate pay based on their needs
Classifications and Job Expectations	Clear expectations of S&E jobs	Avoid the mismatch of job expectations and job realities
	How to classify S&E jobs	Conduct a government-wide campaign on job structuring/classification to lure students in and retain them with various opportunities to make a difference with identifiable impact
	S&T leadership development	Look at career paths for people we want to stay in the government but who should not be managers

During the plenary session, participants discussed solutions and recommendations and ranked them according to their potential impact and feasibility. Table 3 lists these solutions and recommendations, four of which were considered to be both highly *feasible* and high *impact*.

F. Wrap-up and Next Steps

Arun Seraphin, OSTP's Assistant Director for Defense Programs, concluded the workshop by thanking participants for their contributions. He noted that the next steps would be to generate the evidence that would inform many of the issues and concerns raised and, working with the Office of Personnel Management and Office of Management and Budget, to identify solutions. He further noted that in the course of systematically exploring the dual topics of recruitment and retention, mechanisms not available today to Federal Human Capital Officers might emerge to enhance their important role in building and sustaining a vibrant and world-class Federal S&E workforce.

Table 3. List of Overall Plenary Solutions and Recommendations, in Order of Impact

Identify MCOs within STEM

Flexibility to moderate pay

Provide broad authorities for S&T missions

Establish a network to share concerns/identify solutions/tackle problems

Direct hire authority for S&T professionals

Pay/pay banding for S&T professionals

Scientific exchanges

Data discussion to justify S&T gaps

Competitive pay/separate S&T pay schedule

Strengthen local authority/leadership

Legislative fix to base pay

Scholarship/school for service

Interagency pool of detail opportunities

Separate S&T excepted service pay system

Broaden job classification standards to allow agency flexibility

Review of total compensation package

Clear S&T career paths

Revisit Science or Technical/Senior Level positions in Senior Executive

Service allocation

Mentoring

Clear career expectation for entry level talent

Explore post-employment restrictions

Note: Bold text indicates solutions/recommendations ranked as both high impact and high feasibility.

Appendix.

Supporting Materials

This appendix reproduces a memorandum from OSTP Deputy Director for Policy Tom Kalil inviting Chief Human Capital Officers to the workshop and an OSTP announcement that includes the workshop objective and agenda. Table A-1 provides a list of the attendees.

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF SCIENCE AND TECHNOLOGY POLICY
WASHINGTON, D.C. 20502

December 29, 2011

MEMORANDUM FOR CHIEF HUMAN CAPITAL OFFICERS

FROM: TOM KALIL
DEPUTY DIRECTOR FOR POLICY

SUBJECT: RECRUITING, HIRING & RETAINING FEDERAL SCIENCE &
ENGINEERING TALENT

The White House Office of Science & Technology Policy (OSTP) recognizes that the Federal government must become a more competitive employer for our Nation's top scientists and engineers. To make informed changes to policy and practice, the Administration must understand which barriers prevent the Federal government from hiring and recruiting world-class scientists and engineers.

You are invited to attend a half-day workshop we are hosting on the morning of February 10, 2012. The purpose of the workshop is to gain a better understanding of the challenges and successes that agencies have in recruiting and retaining science and engineering (S&E) professionals. We also expect that the workshop will help us identify potential policy changes that will help you recruit and retain S&E talent.

I have asked the Science and Technology Policy Institute (STPI), OSTP's Federally Funded Research and Development Center, to help us identify and propose concrete programmatic and policy solutions to the challenges the Federal government faces in recruiting, hiring and retaining scientists and engineers. STPI has retained the Partnership for Public Service (the Partnership) assist in this effort.

To do this, STPI and the Partnership will gather and confirm root causes to the problem through interviews with Federal S&E subject matter experts (SMEs) and a survey of the S&E community. Their findings will serve as the basis for the February workshop focused on developing realistic next steps for OSTP and the Federal S&E community.

Please join our initial efforts by sharing this link <http://tinyurl.com/73a2zzm> to a brief survey with both your organization's leading S&E SMEs and also your own S&E recruiters or human capital strategists. The survey will be open until January 17, 2012. Please also register for the workshop at <http://pps.convio.net/site/Calendar?id=100244&view=Detail> and encourage appropriate staff within your agency to attend this important event. Contact Erin Creasy (ecreasy@ourpublicservice.org) with any questions about the survey or registration.

We all look forward to working with you on fresh and practical solutions to the challenges we face in S&E talent management.



EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF SCIENCE AND TECHNOLOGY POLICY
WASHINGTON, D.C. 20502



ATTRACTING AND RETAINING SCIENCE AND ENGINEERING TALENT IN THE FEDERAL GOVERNMENT

LOGISTICS

Date: Friday, February 10, 2012
Time: 8:30 a.m. to 12:00 p.m.
Location: Partnership for Public Service Conference Facilities
1100 New York Avenue NW, Suite 200E, Washington, DC 20005

OBJECTIVE

The objective of this workshop is to gain a better understanding of the challenges and successes that agencies have in attracting and retaining science and engineering (S&E) professionals. The workshop will help us identify potential policy changes that will help you attract and retain S&E talent.

AGENDA

8:30 a.m.	Welcome & Introductions	Tim McManus Vice President Partnership for Public Service Tom Kalil Deputy Director for Policy Office of Science and Technology Policy Sydney Heimbrock Deputy Associate Director for Employee Services U.S. Office of Personnel Management
8:45 a.m.	Summary of the Challenges	Bill Brykczynski Deputy Director Science and Technology Policy Institute
9:00 a.m.	Small Group Discussions: Assumptions & Solutions	Tim McManus and Partnership facilitators
10:00 a.m.	Break	
10:10 a.m.	Highlights and Reactions from Small Group Discussions	Tim McManus
11:15 a.m.	Recommended Government-Wide Solutions	Tim McManus
11:45 a.m.	Wrap Up and Next Steps	Arun Seraphin Assistant Director, Defense Programs Office of Science and Technology Policy
12:00 p.m.	Adjourn	

Last updated: February 7, 2012

Table A-1. List of Attendees

First Name	Last Name	Employer	Title	Government Agency	Email
Carmen	Andujar	Office of Personnel Management	Recruitment Policy and Outreach Manager	Office of Personnel Management	carmen.andujar@opm.gov
Colleen	Barros	National Institutes of Health	Deputy Director for Management, CFO	National Institutes of Health	gallen@mail.nih.gov
Andrea	Bright	Office of Personnel Management	Acting Deputy Associate Director for Recruitment and Hiring	Office of Personnel Management	andrea.bright@opm.gov
Dustin	Brown	Office of Management and Budget	Deputy Associate Director for Performance and Personnel Management	Office of Management and Budget	dbrown@omb.eop.gov
Bill	Bryczynski	IDA Science and Technology Policy Institute	Deputy Director		bryk@ida.org
Jeri	Buchholz	National Aeronautics and Space Administration	Chief Human Capital Officer	National Aeronautics and Space Administration	jeri.l.buchholz@nasa.gov
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Lisa	Frehill				lfrehill@etcmd.com
Teresa	Fryberger	National Aeronautics and Space Administration	Associate Chief Scientist	National Aeronautics and Space Administration	
Harry	Furukawa	National Oceanic and Atmospheric Administration	Director of Workforce Planning and Development	National Oceanic and Atmospheric Administration	harry.furukawa@noaa.gov

First Name	Last Name	Employer	Title	Government Agency	Email
Bob	Garrett	Department of Defense		Department of Defense	
Charles	Gay	National Aeronautics and Space Administration	Deputy Associate Administrator	National Aeronautics and Space Administration	
Jesse	Goodman	Food and Drug Administration	Chief Scientist and Deputy Commissioner	Department of Health and Human Services	jesse.goodman@fda.hhs.gov
Nayanee	Gupta	Institute for Defense Analyses	Research Staff		ngupta@ida.org
Adriana	Hamilton	Department of Veterans Affairs	HR Consultant	Department of Veterans Affairs	adriana.hamilton@va.gov
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First Name	Last Name	Employer	Title	Government Agency	Email
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Annotated Bibliography

Faulk, Justin. 2012. “Comparing Benefits and Total Compensation in the Federal Government and the Private Sector.” Congressional Budget Office.

Using data from the Current Population Survey and the Bureau of Labor Statistics, this report compares the total compensation and benefits of the Federal Government to the private sector. The comparison accounted for educational level and compared only those workers in the Federal and private sectors that had similar attributes. For instance, only data private sector workers in larger firms were used in this analysis because the work performed is similar to that performed by Federal employees.

- The analysis found that benefits for Federal workers were 48% higher than in the private sector. Federal workers receive more non-wage benefits such as paid leave, medical insurance, and defined-benefits pension plans, which are less available in the private sector. Benefit costs in the private sector are mostly from higher contributions to medical and dental insurance. Private sector workers receive fewer hours of paid leave, but provide additional benefit categories such as transportation and continuing education benefits, which were not accounted for in this study.
- Benefits for those with a high school degree or less were 70% higher for Federal workers as compared to similar workers in the private sector. Similarly, the differences in Bachelor’s level and Master’s level workers were 46% and 36%, respectively, compared to similar workers in the private sector. The costs of benefits for those with professional degrees and PhDs were comparable to those of workers with advanced degrees in the private sector.
- When comparing total compensation overall, Federal workers received 16% more compensation as compared to workers in the private sector. For Federal workers with a high school diploma or less, total compensation was 32% higher as compared to the private sector. For those with a bachelor’s degree and Master’s degree, compensation was 15% and 18% higher, respectively, than in the private sector. For those with a professional degree or PhD, compensation was 18% less than as compared to workers in the private sector.

Jackson, Shirley Ann. 2003. “Envisioning a 21st Century Science and Engineering Workforce for the United States: Tasks for University, Industry, and Government.” Washington DC: The National Academies Press.

This paper, presented to the Government-University-Industry Research Roundtable (GUIRR), focused on the current science and engineering workforce and what actions need to be taken to strengthening this specific workforce. Jackson notes that Federal and private sector science and engineering workforce are intertwined due to

the Government's heavy reliance on private sector for much of its R&D and explores the role of the Federal Government in workforce planning around science and engineering talent.

Among the problems facing the science and engineering workforce, Jackson highlights the following as top risks to ensuring an adequate U.S. S&E workforce:

- The Federal S&E workforce is shrinking: Over 45% of all Federal scientists and engineers are 45 years of age or older. Federal agencies have not hired scientist and engineers in significant numbers in recent years. With this growing workforce, the nation risks losing essential technological expertise to retirement.
- The ability to recruit talent from abroad may be limited in the future: In the wake of September 11, there is legislative pressure to restrict immigration in the U.S.
- Comparable opportunities are luring foreign students home: Nations, such as South Korea and China, are providing more opportunities for their students and graduates at home.
- There is little room to increase "stay rates" of foreign scientists much further: The overall rate between 1994 and 1999 was 63%.
- The gaps between skill sets required for jobs do not match those gained through degree programs.
- There is a lack of reliable data to serve as a platform for public policy: Primarily, there is no reliable data on what happens to individuals with H-1B visas.

In addition to identifying problems and risks, Jackson also identifies priorities to address S&E workforce concerns. The list of priorities includes:

- Linking policy to need: Jackson suggests establishing a more targeted student aid program to address specific national needs, such as S&E, loan forgiveness, and S&E specific programs modeled after the Pell grants.
- Improve management practices, especially in government laboratories, to attract and retain S&E workers: To accomplish this, Jackson recommends designing and implementing systems that include practices such as competitive incentives, peer evaluations, and pay and promotions based on performance, not years of service.
 - Additionally, Jackson recommends flexibility in hiring, allowing directors to autonomously hire personnel, and flexibility in work schedules. Jackson also encourages agency scientists and engineers to design work to be interesting and challenging to compete with private sector pay.
- Gather better data to inform policy-making and provide information for more effective funding investment.

- Induce talented scientists to enter and remain in research by a campaign to renew interest in public service careers.
- Keep funding at appropriate levels: Federal agencies' share of total R&D funds declined from 40% to below 30% during the 1990s.

National Academies. 1997. "Preparing for the 21st Century: Science and Engineering Research in a Changing World." Washington, DC: The National Academies Press.

This paper highlights restrictions on pay and professional advancement as barriers to the Federal Government recruiting and retaining highly qualified scientist and engineers. While the Federal Employee Pay Comparability Act of 1990 gave agencies the authority to ease these restrictions, the act has not been fully implemented. Possible solutions in the paper include affording agencies more flexibility in compensating employees and establishing a Senior Research and Development Service, modeled after the Senior Executive Service. Additionally, the paper also explores disincentives that prevent exceptional scientists and engineers from serving in top positions, such as unreasonable post-government employment restrictions and inappropriate conflict-of-interest prohibitions.

National Research Council (NRC). 1990. "Recruitment, Retention, and Utilization of Federal Scientists and Engineers." Committee on Scientists and Engineers in the Federal Government, Office of Scientific and Engineering Personnel. Washington, DC: National Academies Press.

This report to the Carnegie Commission on Science, Technology, and Government documents the findings and recommendations of the Committee on Scientists and Engineers in the Federal Government ("the Committee") on "what is known about the ability of federal agencies to recruit, retain and utilize scientists and engineers effectively." It also includes five commissioned papers on specific aspects of the barriers or opportunities within Federal S&E workforce management, and shares the agenda, participants, and proceedings of a workshop held Feb. 23, 1990, on this topic.

The Committee's key findings are grouped in three major areas:

1. Availability and Relevance of Data
2. Management Practices
3. Presidential Appointments

Availability and Relevance of Data:

- The quality and consistency of data on the S&E workforce by occupation classifications and also by individuals' qualifications is a concern. Some agencies, including Naval Research Lab (NRL), Department of Defense (DOD) and Public Health Service (PHS) took data collection and analysis into their own hands in order to understand their organization's workforce through individual agency data systems.
- S&E managers do not agree on "what constitutes accurate measures of the quality of that workforce." Having proxies for that information is essential to getting a firm grasp on the state of the workforce. OPM and MSPB co-sponsored work on this issue in 1989 through the Conference on Workforce Quality Assessment and OPM began to survey S&E professionals in 1990.

Management Practices:

- The perceptions about the ineffectiveness, and limitations, of Federal hiring persist as a hindrance to agencies' management of the recruiting process despite the centralized efforts of OPM and the individual work of various agencies.
- OPM's initiatives included: (1) Delegation of Examining and Hiring Procedures, (2) Special Salary Rates, (3) Federal Pay Reform Act of 1990, and (4) Other recruitment initiatives to automate hiring and bring Federal Employment information to college populations.
- Agency's initiatives included: (1) Cooperative programs, (2) increased on-campus recruiting and (3) restructuring entry-level job classifications.
- The Committee also acknowledged that S&E work "can be completed under a variety of scenarios, including the traditional setting within an agency, demonstration projects, Federal laboratories and managed-and-operated (M&O) facilities." Demonstration projects show that dual career ladders for technical experts and broad pay bands can help agencies.
- Utilization of S&E talent also varies across agencies. While "the federal government clearly needs technically knowledgeable people who can interact with contractors and manage R&D contracts...several federal scientists and engineers felt that they were required to spend an inordinate amount of time on contract matters" (p. 25).
- Recruitment initiatives for underrepresented groups could allow the government to ward off future S&E shortages.
- "Government policies that limit the hiring of foreign nationals may have adverse effects on the ability of federal agencies to perform S&E work." (p. 27)

Presidential Appointments:

- It is critical to the missions of government to have Presidential Appointee positions in S&E fields filled in a timely manner with knowledgeable and supportive leadership to carry out policy.

Three of the six lingering issues identified by the Committee for additional analysis have direct linkages to the goals of the current STPI project. They are explored on pages 29–32 of the report:

1. “What can be done to enhance federal recruitment of scientists and engineers, especially women and minorities at the entry level, and retention of all scientists and engineers at the midcareer level? What institutional decision-making processes should be altered and in what way? Should the relationship between OPM and the individual agencies be different for scientists and engineers than it is for other federal personnel?” (p. 29)
2. “What steps must be taken to heighten the awareness within agencies of the mechanisms established by OPM to alleviate many of the problems they encounter in recruiting and retaining scientists and engineers?” (p. 30)
3. “Are there too few scientists and engineers in the federal government? Or are there too few highly qualified federal scientists and engineers?” (p. 31)

Seng, Jocelyn M., and Pamela Ebert Flattau. 2009. “Assessment of the DoD Laboratory Civilian Science and Engineering Workforce.” IDA Paper P-4469. Alexandria VA: Institute for Defense Analyses.

This report to the Director of Defense Research and Engineering assessed the composition of the current Science and Engineering workforce at the Department of Defense Laboratories, including identification of workforce trends and projection of future workforce sizes, compositions, and trends. Using data from the Defense Manpower Data Center (DMDC), trends were analyzed from 1988 to 2003 in 5-year time increments. The analysis was supplemented with lab director interviews to understand the role of “Lab Demo.”

The findings were grouped in three major areas:

Workforce Quality:

- The DOD labs civilian workforce is similar to the general U.S. S&E workforce with the exception that the DOD lab workforce is not flat, lacking in workers between the ages of 35–45 owing to a hiring freeze in the 1990s.
- Not much is known in terms of the quality of the S&E workforce, and to address this, IDA made the following recommendations.
 - Collect additional data to support a S&E workforce quality assessment

- Compile workforce metrics, such as number of patents, publications, citations, and invited talks and presentations.

Workforce Projections:

- The number of computer science, mathematics, and physics baccalaureates remains low, due to rising uncertainty in employment in the sciences and engineering as well as shifting student career preferences, and so DOD may have difficulty in seeking and hiring qualified workers from these fields.
- To address this, IDA recommended the following:
 - DOD should implement a workforce model to strengthen strategic planning.
 - DOD should revisit the adequacy of their workforce development strategies based upon three possible workforce scenarios:
 - Downsizing:
 - Maintaining current workforce
 - Increasing the S&E workforce

Workforce Management:

- A new wave of retirement in the DOD labs will begin in the next 5–10 years, and current and new hires will dominate the S&E workforce. Lab directors indicated in interviews that Lab Demo would allow the flexibility needed to make personnel decisions based on current market conditions and need.
- IDA recommended that Lab Demo be incorporated into the redesign of the DOD Personnel Management System.

Stine, Deborah, and Christine Matthews. 2009. “The U.S. Science and Technology Workforce.” Congressional Research Service. June 30.

This Congressional Research Service (CRS) report provides an overview of the current S&T workforce as well as policy discussions around this workforce. According to data from the National Science Foundation, the majority of scientists and engineers work in the business/industry sector (69.4%) with only 11.8% working in government. The report highlights three key issues that policy makers tend to focus on: demographics trends and the future of S&T talent pool, the current S&T workforce and changing workforce needs, and the influence of foreign S&T students and workers on the U.S. S&T workforce. In regard to foreign S&T students and workers, policy discussions focus on immigration policy, primarily increasing the ability for foreign STEM students to more easily obtain permanent admission and increasing the number of H-1B visas to recruit more talent from abroad. Views on immigration and the S&T workforce diverge, with some individuals citing the over-reliance on H-1B visa workers to fill high-tech positions has weakened opportunities for the U.S. workforce.

Stine, Deborah, and Clinton Brass. 2009. "Hiring and Pay Authorities for Federal Scientific and Technical (S&T) Personnel." Congressional Research Service.

This report provides an illustrative overview of statutory authorities relating to the hiring and pay rates of Federal S&T personnel. Key factors that have contributed to S&T workforce concerns include:

- Demand for S&T workers in the broader labor market
- Competitive salaries
- The report cites that pay disparity may exist at higher degree levels (i.e., doctorate or professional degrees).
- U.S. citizenship requirement
- Aging of the Federal S&T workforce
 - Older individuals represent almost 60% of all Federal scientists and engineers
 - Between 2003 and 2005, the number of Federal scientists and engineers between 35–39 years of age decreased by 12.9% while those between 40–44 years of age increased by 5.4%.

The report also notes that the Federal civil service has become increasingly fragmented, leading to fragmentation of data for Federal S&T personnel. This fragmentation is due to increased complexities in the hiring and pay of the S&T workforce.

The Civil Service Reform Act of 1978 (CSRA) and other laws, including the Federal Employees Pay Comparability Act of 1990 (FEPCA), provided statutory authorities related to the S&T workforce. While these authorities allow more agency flexibility, the government faces the challenge of finding the balance between flexibility and preventing abuse of the flexibility by holding agencies accountable. The report discusses executive branch–wide authorities and agency-specific statutory authorities.

Executive branch–wide authorities include:

- Appointment of high-level scientific and professional (ST) personnel
 - The Senior Professional Performance Act of 2008 established a new pay system for scientific or professional employees.
- Demonstration projects
 - These projects are a result of new statutory authority to pilot new management techniques. Only four of the 178 initiatives proposed were implemented. Demonstration projects are currently being implemented at the U.S. Navy, NIST, DOC, and DOD.
- Intergovernmental mobility

- Critical pay authority
- Recruitment, relocation and retention incentives
- Special pay rates
- Direct hire authority

Agency-specific statutory authorities that provided agencies with flexibility proliferate in the 1990s. The report highlights NASA's critical pay authority and DARPA's statutory authority, which provided flexibilities similar to critical pay and direct hire authorities and served as the foundation for similar authorities at DHS and HHS.

REPORT DOCUMENTATION PAGE

*Form Approved
OMB No. 0704-0188*

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1. REPORT DATE (DD-MM-YYYY) XX-02-2013	2. REPORT TYPE Final	3. DATES COVERED (From - To) Dec 2011 - Aug 2012
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4. TITLE AND SUBTITLE Attracting and Retaining Science and Engineering Talent in the Federal Government: A Workshop Summary	5a. CONTRACT NUMBER NSFOIA0408601/STPIAF
	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S) Brykczynski, Bill Flattau, Pamela Ebert Nek, Rashida	5d. PROJECT NUMBER
	5e. TASK NUMBER STPI-0400.00.AF (TP-20-1000)
	5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Science and Technology Policy Institute 1899 Pennsylvania Avenue, NW, Suite 520 Washington, DC 20006-3602	8. PERFORMING ORGANIZATION REPORT NUMBER IDA Document D-4740
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9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) Office of Science and Technology Policy Eisenhower Executive Office Building (Suite 492) 1650 Pennsylvania Avenue Washington, DC 20504	10. SPONSOR/MONITOR'S ACRONYM(S) OSTP
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited. (4 March 2013)

13. SUPPLEMENTARY NOTES

14. ABSTRACT
In December 2011, the White House Office of Science and Technology Policy (OSTP) invited Federal Chief Human Capital Officers to encourage their agency staffs to attend a half-day workshop exploring the challenges and opportunities involved in the recruitment, hiring, and retention of science and engineering (S&E) professionals. Nearly 50 key staff members from 18 Federal agencies joined representatives from OSTP and the U.S. Office of Personnel Management at the Workshop on Attracting and Retaining S&E Talent in the Federal Government convened on February 10, 2012, in Washington, DC. This document provides a summary of the workshop, including the results of a pre-workshop survey and interviews exploring the experiences of Federal hiring managers and human resource (HR) specialists in recruiting and retaining scientists and engineers. An annotated bibliography is also provided.

15. SUBJECT TERMS
federal workforce; federal scientists and engineers; recruitment; retention; professional development

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report	18. NUMBER OF PAGES 33	19a. NAME OF RESPONSIBLE PERSON Seraphin, Arun A.
a. REPORT Unclassified	b. ABSTRACT Unclassified	c. THIS PAGE Unclassified			19b. TELEPHONE NUMBER (Include area code) 202-456-4444

