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Science, Technology, and Global Reengagement

In a world in which global concerns are becoming more prominent and the role of science and technology more critical, U.S. leaders must pay more attention to the interplay of these two domains.

The new administration should move quickly to give science and technology (S&T) a prominent role in foreign policy. Historic shifts are under way in S&T capabilities around the globe. Those shifts create unprecedented opportunities for discovery and innovation, for responding to common challenges, and for U.S. leadership. Yet rather than being poised to lead the way, the United States is in a weak position.

The new administration will probably reformulate U.S. global policies, giving a higher priority to international engagement instead of unilateralism. International links in S&T can play a central role in this global reengagement. But to realize this potential, S&T issues related to foreign policy can no longer just be at the table. They must be in the lead.

A number of studies during the past few decades have stressed the importance of U.S.-international partnerships in S&T. But follow-up actions have been modest at best. Why haven't past recommendations had a significant impact? What can the incoming administration do to achieve better success, leveraging global trends and U.S. S&T capabilities to more fully advance common interests?

To be meaningful, S&T policy changes must reflect power and process in the government. S&T interests must be able to define policies at the highest levels. They must be able to influence budgets, spur action throughout the federal government, and work with partners, both international and domestic.

Science, technology, and diplomacy intertwined at high levels throughout the second half of the 20th century. President Kennedy launched the first bilateral science agreement with Japan after World War II, and it led to one of the nation's strongest international partnerships. President Nixon promoted building scientific links with China as he began normalizing relations, and Chinese universities have become a leading source of graduate students in U.S. science and engineering programs. President Clinton leveraged decades of

scientific ties with the former Soviet Union to assist in the safer disposition of hundreds of tons of weapons-grade nuclear material. Today, there are many more possibilities for win-win collaboration.

Asia's investment in R&D is on the verge of surpassing that of North America. China has exceeded Japan in its national S&T investment and now trails only the United States. The World Technology Evaluation Center recently assessed research in China in fields such as nanotechnology, catalysis, and the brain-computer interface. In each case, China is doing research that is defining the state-of-the-art and is developing facilities second to none.

In South Korea, the government elevated the S&T minister to deputy prime minister. Economies from India to Indonesia have devised policies to advance S&T. India has passed South Korea in total R&D expenditures while launching a massive program to expand higher education. Indonesia held its first National Innovation Summit in the summer of 2006. Singapore continues to advance as the world-class biotech hub in Asia while Malaysia continues to be the information technology leader. Vietnam is a hot spot for new ventures.

In 2007, the 22 nations of the Arab League announced a 10-year plan to increase support for scientific research 12-fold, to an average of 2.5% of GDP. Egypt's President Hosni Mubarak has declared 2007-2017 as Egypt's "Decade of Science," and Qatar—despite a population of less than 1 million—has pledged a $1.5 billion annual allocation to science. In Saudi Arabia, the King Abdullah University of Science and Technology is being launched in 2009, with an initial endowment of $10 billion. Private sources are also moving to play a major role. Sheikh Mohammed bin Rashid al Maktoum of the United Arab Emirates has created a pan-Arab educational foundation with an endowment of $10 billion.

In the African Union, nations developed a consolidated S&T action plan with the theme "Science, Technology and Scientific Research and Climate Change" for the 2007 Summit of Heads of State. In Latin America, Brazil continues to expand its investment in S&T and its global leadership in biomass renewable energy. The presidents of Chile and Argentina have launched programs to promote development of their S&T capabilities.

Accompanying this increased capability around the globe is the heightened recognition that humanity now faces many common challenges that can be addressed most effectively if nations pool and leverage their assets. In the battle against infectious diseases, the need to work closely with nations such as Indonesia and Vietnam is critical in dealing with avian influenza. In the search for new medications, cooperation can expand exploration of tropical organisms, which are the source of 25% of Western pharmaceuticals. The United States could learn much from Europe and Japan about using energy more efficiently, and many countries are eager to find ways to capture and sequester carbon. Penrose Albright, the first assistant secretary for S&T in the Department of Homeland Security, has observed that "international cooperation in S&T must underpin any U.S. counterterrorism strategy. … the needed talent (and understanding of the threat) exists in the broader international community."

Helping countries prepare for natural disasters can be enhanced through global monitoring and the expertise of other nations, such as Japan's capabilities in earthquake mitigation. To improve the food supply and nutrition, cooperation will speed genome projects to decode the DNA of food staples from wheat to rice to kiwis. With emerging fields such as nanotechnology and biotechnology, cooperation would help prepare international policies from the outset rather than having to harmonize a maze of national regulations. As National Science Foundation (NSF) director Arden Bement has observed, "International cooperation in science is not a luxury. It is a necessity."

Turgid processes

Although the science community often feels that the importance of these international issues should compel action, action does not necessarily follow. Take the example of the U.S. government's initiative to address emerging infectious diseases.

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In response to a growing array of these scourges, the United States in the mid-1990s launched an initiative to better address them where they arise. But the budget of the Centers for Disease Control and Prevention (CDC) allocated to addressing global emerging infections was only about $5.6 million. (By contrast, Dustin Hoffman received a reported $8 million for his role in the movie Outbreak, which dealt with the danger of an epidemic.)

Through the National Science and Technology Council (NSTC), a U.S. government strategy on emerging diseases was developed. But this was only a first step. At an initial meeting at the Office of Management and Budget (OMB), a young OMB budget examiner initially dismissed the issue, saying he "did not hear infectious disease was a problem." When it was noted that an emerging disease program would also address vulnerabilities in U.S. domestic and global health infrastructure that made the nation more vulnerable to bioterrorism, a senior OMB official called that argument alarmist and irresponsible. When emerging diseases was suggested as a topic for policy discussions at the Asia Pacific Economic Forum (APEC), the U.S. ambassador to APEC said in a White House meeting, "I just don't get this infectious disease issue." This attitude retarded development of a dialogue on the disease problem. Meanwhile, congressional staff declared that they were interested in the subject but wanted to wait for the administration to define the next steps.

Momentum shifted into higher gear after a concerted effort on several fronts. The director of the CDC made the issue a top priority, and other agencies echoed the need for greater action. A presidential decision directive (comparable to an executive order) was issued, top officials at the National Security Council (NSC) took an interest in actively addressing emerging diseases as a national security issue, and ultimately the president held a White House meeting on the matter. Once the president has become engaged, no room is big enough to contain all the people who have suddenly discovered the importance of an issue.

Budget support was ultimately increased at several agencies, with CDC reaching $168 million for this effort by 2000. This strategy laid the foundation for the government's post 9-11 response to countering bioterrorism. Post 9-11, the issue also became a central topic at the APEC forum as well as in the global community.

However, it should not take half a decade of bureaucratic tussling—and a national disaster—to put in place sensible S&T-based policy. S&T needs to be in a leadership role. It is essential to define policy in a way that ensures resources and incentives are in place to spur government agencies and nongovernmental partners into action.

Yet trends have been moving in the opposite direction. At the State Department, despite the establishment in 2000 of the post of science advisor to the secretary of state, little has been done to reverse decades of decay in S&T priorities. Career incentives have not yet been reestablished since the elimination in the mid-1990s of career tracks in oceans, environment, and science and the downgrading of science counselor positions at U.S. embassies around the world. Science at State is borne on the shoulders of temporary science fellows.

The U.S. Agency for International Development (USAID) eliminated its Research and Development Bureau in 1993 and subsequently cancelled other S&T budget items, including a successful international fellowship program, which had more than 3,200 African professionals earning graduate degrees at U.S. universities. In 2003-2004, while the U.S. National Academy of Sciences (NAS) was studying and validating the value of S&T to U.S. international development priorities, USAID eliminated more of its S&T functions. The once active USAID Science Fellows program has all but disappeared.

The White House also stepped back. In 2001, the White House eliminated the management position dedicated to international S&T issues in the Office of Science and Technology Policy (OSTP) as well as the NSTC's committee on international science, engineering, and technology—which had launched the emerging infectious diseases initiative described above.

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Turnaround formula

In order to make a difference, policies must establish authority, provide resources, and align incentives. This is the leadership package that enables action. The measures should include leadership from the top, defining a position from which things can get done, influencing budgets, and incorporating incentives so that the bureaucracy wants to execute the policy. Here are some specific proposals.

Leadership. The greatest need is for clear leadership from the president. Anything less will result in muddled progress at best. A variety of agencies can respond to varying incentives, but their mixed interests have often resulted in a stalemate, handicapping both S&T and foreign policy. The best time to exert this leadership is in the first 100 days of a new administration. As policies are being redirected, agencies will look to the new president for guidance. A clear form of guidance would be an executive order on S&T in global affairs.

Decisionmaking. If S&T are to be seriously integrated into global affairs, the OSTP director must a member of the NSC as well as the National Economic Council (NEC). No serious international work can be done without integration into the NSC. The NSC and NEC directors currently sit on each others' councils, and both are on the NSTC.

Execution. Recent history has shown that S&T policy concerns have trouble attracting timely attention and action. The remedy is for the executive order to create a new White House position: deputy assistant to the president for science, technology, and global affairs. The seniority of this position matters. Proximity to the president is power, and a person who can deal with the crosscutting issues that involve the OSTP, NSC, and NEC can make a critical difference. Scientists are often content to have a seat at the table because they believe that their expertise will win respect. But in the rapid-fire environment of high-level policymaking, passive advice is often ignored. The S&T perspective should not merely be at the table, it should take the lead in framing the discussion and influencing decisions.

Budget. To act, agencies need resources, and securing resources for international S&T activities has been difficult. When I was the head of international issues at OSTP, numerous agency representatives noted that this issue could be a "third rail," because it was perceived that the atmosphere was hostile in Congress. Foreign partners are not a strong political constituency.

International S&T cooperation is greatest in cases in which national interests are deemed most vital: national defense and health. The Department of Defense and the National Institutes of Health have extensive international efforts designed to tap expertise wherever it is found. Why other agencies have less interest in pursuing this global strategy is a mystery. Further, when budget instability in Congress affects major international commitments such as the U.S. commitment to the International Thermonuclear Experimental Reactor, the negative consequences affect the nation's ability to secure partnerships in other arenas.

The executive order should direct the deputy assistant to the president and the OMB to review international S&T initiatives in the context of annual agency budget proposals. Without such a direct link, budgetary influence is much more ephemeral. Here, Japan's cabinet-level Council on Science and Technology might provide a model. This council, sitting in the prime minister's office, plays a formal role in the annual budget process, which enables it to provide meaningful support for priorities and more effective coordination of all S&T programs.

Strategy. The executive order should call for a strategy for S&T in global affairs. Part of the challenge in gaining support for international S&T is that it is not clear to many how much it benefits our national goals or advances technical knowledge. Such a strategy could validate the broad value of international engagement in S&T. It would clarify action and accountability by directing S&T agencies to define ways of supporting their missions and U.S. global priorities simultaneously. It would also mean directing foreign policy agencies to decide how to integrate S&T into their global policy missions and direct all agencies to articulate factors that would fit into agency-by-agency goals and performance plans.

This S&T strategy can also provide a framework for col-

laborating with nongovernmental organizations. Nongovernmental organizations such as the NAS, American Association for the Advancement of Science, and the Civilian Research and Development Foundation have extensive global networks and on-the-ground expertise. They can also work in situations where the government finds it difficult to do so, such as in our relations with Libya, Iran, and Cuba.

Define incentives for action. To act, agencies need incentives. Budget is one. The congressionally mandated Government Performance and Results Act (GPRA) is another. GPRA requires all agencies to develop regular strategic plans, performance plans, and performance assessments. This system has been effective in driving and clarifying performance in federal agencies and should thus reflect the policies of S&T in global engagement. Incorporating strategic and performance criteria such as the effective leveraging of international assets and expertise would help to reshape this aspect of bureaucratic culture.

Get the best ideas from the bottom up. Scientists often dislike the word strategy because it seems to imply a top-down ordering of events. Many are suspicious of policy as an intrusion rather than an enabler. Just as the United States has achieved the highest quality science using a bottom-up process of idea generation, so too can bottom-up partnerships provide excellent opportunities for global leveraging, global resources, and global impacts. The executive order should direct agencies to establish bottom-up leveraged international partnership programs.

An example is the relatively new Program for International Research and Education at NSF, which leverages capabilities globally and is extremely popular with U.S. research institutions. Projects address a diversity of research challenges, including imaging the African superplume seismic geostructure, analyzing geohazards, providing cleaner water through nanotechnology, developing better ways of interpreting meaning in languages, and advancing frontier fields such as angstrom-scale technologies, electron chemistry, and microfluidics.

Strengthen science in foreign policy. Here more muscle is needed. The executive order should establish the position of under secretary for environment, science, technology, and health in the State Department. This person would also function as science advisor to the Secretary of State, which would give the science advisor the authority, staff, and resources to shape and follow-through on policy initiatives. Currently, the Bureau of Oceans and International Environmental and Scientific Affairs (OES) in the State Department is handicapped by being a secondary priority of the undersecretary of democracy for global affairs. Although the science advisor has access to the Secretary of State, the position has few staff or resources and no direct influence over the OES Bureau. The advisor's decisionmaking authority needs to be enhanced and resources aligned.

With undersecretary rank, the position would be comparable to the undersecretary for S&T at the Department of Homeland Security, undersecretary for science at the Department of Energy, and the undersecretary for oceans and atmosphere at the Department of Commerce. The science advisor would continue to participate in the broad range of S&T-intensive issues in the State Department's foreign policy portfolio, including arms control, counterterrorism, and export controls.

Create a catalytic Global Priorities S&T Fund. Modest budgets can catalyze a lot of activity, but the State Department, despite its central role in foreign affairs, has highly limited resources. If the science advisor has no budget to even organize workshops, other agencies with S&T capabilities, international partners, and nongovernmental organizations will not come to the table. A dedicated Global Priorities S&T Fund is needed. It would also support grants to encourage international cooperative activities that advance U.S. foreign policy priorities.

Create a development S&T fund. At USAID, the executive order should establish a separate fund to support S&T global aid priorities. The NAS report on USAID documented the longstanding and counterproductive tension between the need for immediate crisis management and

the desire for longer-term capacity building, with the former typically winning out over the latter for resources. A dedicated fund would mitigate the bureaucratic stalemate that has historically weakened long-term goal-setting.

The congressional role

Past studies fail to highlight the critical role played by Congress in S&T policy. Its leadership and support are essential. Members of Congress have often complained that international engagement in S&T is a handout rather than an activity of mutual benefit to the United States and other countries. This clearly deters agency actions. There are three ways to start the process of improving support from Congress: Create a congressional caucus on S&T in global affairs, develop congressional resolutions expressing support, and pass legislation to define global engagement as one tool in effectively fulfilling agency missions and serving the public.

Creating a congressional S&T caucus would help organize congressional support, identify appropriate congressional leaders, provide a forum for education and information exchange, and enable more effective policy guidance. Such congressional caucuses have long existed for national defense, health care, the environment, and S&T for competitiveness.

As an example, in 1997, the Senate S&T caucus provided active dialogue and support for doubling the NSF research budget. On the House side, Reps. Rush Holt (D-NJ) and Judy Biggert (R-IL) formed a similar congressional R&D caucus. These two caucuses have also been active in supporting the annual S&T congressional visits day, during which professional and academic organizations flock to Capitol Hill to present briefings on the need for sustained investments.

To promote science and math education, Reps. Vern Ehlers (R-MI) and Mark Udall (D-CO) launched a bipartisan education caucus for members of Congress, and Sens. Norm Coleman (R-MN) and Richard Durbin (D-IL) established a similar science and math education caucus in the Senate.

To express support, proclamations such as congressional resolutions and senses of the Congress could be a first step. These do not have the force of law, but provide the federal bureaucracy with confirmation that members of Congress back a policy priority. These proclamations can also be done quickly. In a bureaucracy that is often gun-shy when it comes to international S&T, signs of support from Congress would strike a positive chord.

For example, in 2004, both the House and the Senate passed resolutions that encouraged the government and public to observe the World Year of Physics and to engage in educational and research activities to strengthen awareness of the field and advance its knowledge base. The Senate and House resolutions on the International Polar Year of 2007 similarly called for certain agencies to give priority to promoting this event and directed NSF to report on how they would do so.

Legislation would make clear that federal agency missions include leveraging international partnerships in S&T. This would give positive momentum to agencies, make the priority unambiguous, and provide a stronger basis for long-term commitment should future administrations wobble. Agency reauthorization bills provide one such opportunity to confirm this priority. The House Committee on Science and Technology held two hearings in 2008 on the international dimensions of S&T opportunities, which could be important step in this direction.

For decades, U.S. policy toward the dual faces of S&T in international affairs has hobbled along. The growth of global capabilities in S&T and the rise of common global challenges increase the handicap stemming from this weak engagement. Policies to advance S&T have come to the forefront in all regions of the world, and the rise of capabilities in all continents has broadly expanded the sources of discovery and innovation. The world is advancing, but U.S. policies are standing still.

Only with leadership at the highest level, combined with appropriate resources and incentives down to the operational level, can the United States gain full advantage from these underused national and international assets. The new administration has an historic chance to leverage global opportunities in S&T. This could strengthen U.S. global leadership, more effectively meet pressing challenges, and enhance the speed of discovery and innovation. The challenge to the next administration is to see the world as it is changing and to lead.

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