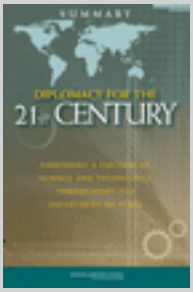

Summary: Diplomacy for the 21st Century: Embedding a Culture of Science and Technology Throughout the Department of State

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DIPLOMACY FOR THE 21ST CENTURY

EMBEDDING A CULTURE OF SCIENCE AND TECHNOLOGY THROUGHOUT THE DEPARTMENT OF STATE

Summary

Committee on Science and Technology Capabilities
at the Department of State

Development, Security, and Cooperation

Policy and Global Affairs

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Preface and Acknowledgments

ACKNOWLEDGMENT OF REVIEWERS

This report has been reviewed in draft form by individuals chosen for their diverse perspectives and technical expertise, in accordance with procedures approved by the National Academies' Report Review Committee. The purpose of this independent review is to provide candid and critical comments that will assist the institution in making its published report as sound as possible and to ensure that the report meets institutional standards for objectivity, evidence, and responsiveness to the study charge. The review comments and draft manuscript remain confidential to protect the integrity of the process.

We wish to thank the following individuals for their review of this report: Rita Colwell, University of Maryland; Nina Fedoroff, Pennsylvania State University; Cutberto Garza, Boston College; Mark Giordano, Georgetown University; Judith Kimble, University of Wisconsin at Madison; Venkatesh Narayanamurti, Harvard University; Thomas Quinn, National Institute of Allergy and Infectious Disease; Anthony Rock, Association of Science-Technology Centers; Vaughan Turekian, American Association for the Advancement of Science; and Ghebre Tzeghai, Proctor and Gamble Company.

Although the reviewers listed above have provided many constructive comments and suggestions, they were not asked to endorse the conclusions or recommendations, nor did they see the final draft of the report before its release. The review of this report was overseen by Enriqueta

Bond, Burroughs Wellcome Fund, and Robert Frosch, Harvard University. Appointed by the National Academies, they were responsible for making certain that an independent examination of this report was carried out in accordance with institutional procedures and that all review comments were carefully considered. Responsibility for the final content of this report rests entirely with the authoring committee and the institution.

Summary

The mission of the Department of State (department) is to shape and sustain a peaceful, prosperous, just, and democratic world and foster conditions for stability and progress for the benefit of the American people and people everywhere. The strategy calls for the department to become more efficient, accountable, and effective in a world in which rising powers, growing instability, and technological transformation create new threats but also opportunities.

This report recommends steps that the department should embrace in order to carry out its mission more effectively by taking full advantage of the unmatched science and technology (S&T) capabilities of the United States. These capabilities provide the department with many opportunities to promote a variety of the interests of the United States and its allies in a rapidly changing world wherein S&T are important drivers of economic development at home and abroad. S&T also play critical roles in preventing and responding to efforts of hostile governments and rogue organizations determined to disrupt international security of importance to the United States and its allies. Thus, the department should continuously update its capabilities to keep abreast of S&T developments at home and abroad and be prepared to anticipate and respond promptly to S&T-related challenges on many fronts.

THE CHANGING GLOBAL LANDSCAPE AND COMMON S&T INTERESTS

Advancements in S&T are heightening aspirations of societies throughout the world at an unprecedented pace while dramatically changing the way personal and business affairs are conducted. More than one-half of the world's population is now able simply to reach in their pockets to be informed, to be in touch, and to call for assistance when available. The biological and health revolution is providing the basis for extending human life, improving agricultural productivity, and protecting essential ecological resources. Geoscientists are leading global efforts to strengthen the resiliency of population centers and infrastructure that can withstand the shocks of tsunamis, earthquakes, and floods.

However, population growth and unrestrained industrialization are threatening valuable ecosystems, changing climate patterns, and redirecting ocean currents where fisheries have thrived. The same Internet that unites families and businesses also allows drug gangs and cyber criminals to prosper. Violent extremists effectively use the Internet and increasingly gain access to advanced destructive technologies.

Thus, international cooperation based on S&T is rapidly becoming a key dimension of foreign policies of a number of nations. The department is the critical focal point in the United States for addressing an ever-growing array of complex global challenges, drawing on contributions from many organizations in Washington and across the country. Such leadership by the department is essential as other like-minded governments also (a) adopt innovative approaches to promote economic growth, at times challenging the economic interests of the United States, (b) exercise restraint in reconfiguring the landscape created by nature, restraint that often depends on major U.S. commitments, (c) strengthen capabilities to prevent the spread of contagious diseases at home and across international borders, and (d) seek limitations on proliferation of weapons of mass destruction and other technology-driven threats to peace and security.

SCIENCE, TECHNOLOGY, AND U.S. FOREIGN POLICY

In recent years, the department has increasingly recognized the important role that S&T should play in development and implementation of U.S. foreign policy, and particularly the need to strengthen the S&T capabilities of its workforce. The department asked the National Academies (National Academy of Sciences, National Academy of Engineering, and National Academy of Medicine) to undertake an assessment and to make recommendations concerning the changing environment for the

conduct of diplomacy in the years ahead, with a focus on the role of S&T in the development and implementation of U.S. policies and programs.

In response, this report concludes that prompt steps by the department's leadership are essential to increase comprehension throughout the department of the importance of S&T-related developments throughout the world and to incorporate this understanding into the nation's foreign policy for the 21st century. The department should accelerate its efforts to engrain within the Foreign Service an appreciation of the significance of the S&T advances taking place at home and abroad. It needs to support more fully our front-line diplomats with strong contingents of civil servants who are up-to-date on the technical dimensions of numerous issues on the department's agenda. Also, it should increase the cadre of Foreign Service Officers (FSOs) with technical backgrounds and provide increased training and education for all FSOs to prepare them for handling S&T-related issues, including assignments to positions that focus on S&T issues.

This report urges the adoption by the department of a broader whole-of-society approach in carrying out its responsibilities at home and abroad—extending beyond traditional interagency coordination and the narrow band of current external partners as it engages with these and other organizations in search of fresh ideas, additional S&T assets, and achievable aspirations. Foundations, universities, research centers, nongovernmental organizations, and private-sector companies are extending their international reach; and S&T engagement across geographic borders that has long-been pioneered by researchers now deserves greater recognition than ever before. The department needs to complement its focus on immediate-action in-boxes with greater attention to important global S&T trends that are increasingly recognized both internally and by others who are concerned of the consequences of neglect.

At the core of the ever-rising global interest in S&T are the prospects for new opportunities for nations to advance their economies and provide better livelihoods for their populations. In industrial and middle-income countries, innovative achievements often lead to improved economic competitiveness abroad. In less fortunate countries, locally produced goods and services that incorporate modern technologies frequently enhance the lives of some. The United States has opportunities to advance mutual interests through participation in both of these circumstances.

More broadly, the United States remains the leading nation in terms of military capabilities and economic prowess. But globalization has produced rising powers; and the United States is not able to establish global or regional security, political, or economic agendas unilaterally. Europe and Asia, in particular, have important S&T centers in a number of fields that rival or exceed U.S. capabilities. However, the U.S. capacity to use

its S&T capabilities to support peace and prosperity in other countries remain unrivalled in scale and impact.

Governments and populations of almost all countries respect the S&T capabilities of the United States. A record number of science, engineering, and medical students from throughout the world seek admission to U.S. universities, with more than 300,000 foreign students addressing science, technology, engineering, and mathematics (STEM) throughout the United States in 2014. A green card has long been a prized possession of many established and emerging scientists with roots in other countries. However, with the spread of S&T capabilities in many countries, a growing number of energetic and talented foreign students and young researchers at U.S. universities and research centers are returning home as suitable laboratories and other facilities increasingly offer opportunities.

The activities of multinational firms with headquarters or research affiliates in the United States have considerable influence on the effectiveness of U.S. foreign policy and particularly trade policy. In particular, private sector investments in S&T with important economic outcomes at home and abroad are expanding in some areas, such as energy development, pharmaceuticals, and advanced manufacturing.

S&T DEVELOPMENTS WITHIN THE DEPARTMENT SINCE 2000

In 1999, the National Research Council released a report titled *The Pervasive Role of Science, Technology, and Health in Foreign Policy: Imperatives for the Department of State,* which was also requested by the department. It has served as a timely starting point for consideration of future strategic directions—and related program initiatives—to achieve diplomatic goals, with particular attention to the S&T dimensions of these goals.

A principal recommendation of the 1999 report was to establish the position of Science and Technology Adviser to the Secretary of State (S&T Adviser). The recommendation was widely accepted and incorporated in legislation; and during the past 14 years, the activities of the newly established Office of the S&T Adviser (STAS) have complemented activities of a number of other units throughout the department, which have policy and implementation responsibilities for S&T-related issues. However, the potential of STAS is far from being realized, and this report proposes steps that would upgrade the role and activities of STAS.

Other important upgrades in the S&T capabilities and interests within the department in Washington have been triggered in part by recommendations of the 1999 report. The changes include:

1. The issuance by the Secretary of periodic directives concerning S&T components of important foreign policy issues.

2. Expansion of S&T capabilities of a number of bureaus and offices of the department through the hiring of additional technically skilled civil servants.
3. Encouragement of talented FSOs to assume S&T-related responsibilities that provide opportunities for them to broaden their skill sets.
4. Support for programs that place one-year and two-year technically trained Fellows in important positions in the department (e.g., American Association for the Advancement of Science Fellows and Jefferson Fellows).
5. Assignment of technical specialists from interested U.S. departments and agencies to U.S. embassies for periods of up to 90 days to carry out short-term assignments proposed by the embassies.
6. Expansion of public diplomacy efforts that capitalize on the S&T strengths of the United States.

The S&T Advisers have played particularly important roles with regard to recruitment and guidance of Fellows, support of public diplomacy efforts that emphasize the mutual benefits of cooperation in S&T, and encouragement of the United States Agency for International Development (USAID) and other agencies to develop innovative S&T programs abroad. Now the S&T Adviser needs increased authority and additional resources to play a more effective role in policy debates and in leading department-wide assessments of the intersections of S&T and foreign policy.

While the department has taken important steps in strengthening S&T capabilities in Washington, a "tale of two States" emerges when assessing activities at U.S. embassies abroad. Progress at the embassies in embracing S&T as a key component of diplomacy has lagged seriously behind. This report proposes steps to correct this weakness.

In recent years, several large program initiatives of U.S. Presidents and Secretaries of State have been based on S&T capabilities. For example, the department has led the interagency implementation of (a) the President's Emergency Plan for AIDS Relief (PEPFAR) with about $45 billion committed to this program during the past decade, and (b) global efforts to address climate change at the political, economic, environmental, and technical levels. The department has also strongly supported several other major initiatives, led by USAID, including (a) reducing infant mortality, (b) enhancing food security, (c) reducing malaria, (c) African education and energy initiatives, and (d) establishing the Global Development Lab.

A particularly significant initiative of the department was preparation in 2010 of the first *Quadrennial Diplomacy and Development Review* (QDDR), which identified major policy areas of interest to the department and

USAID. Many S&T-related activities are explicitly identified in the QDDR. The QDDR provides an important organizational and policy framework for the department, and it identifies many issues for which S&T is an important factor. Additional S&T-related initiatives are set forth in the *FY 2014-2017 Department of State and USAID Strategic Plan.* **What is missing, however, is the commitment by the department to provide adequate resources to reach the laudatory S&T goals that have been set forth in these documents.**

Of special relevance for this report has been the reorganization of important components of the department. Several functional bureaus and offices with S&T responsibilities were consolidated under the purview of the Undersecretary for Economic Growth, Energy, and Environment. These include the Bureau of Oceans and International Environmental and Scientific Affairs (OES), STAS, and a new Bureau of Energy Resources. Together with the previously existing Bureau of Economics and Business Affairs that includes offices for (a) telecommunications and information and (b) agriculture, the Undersecretary now has a formidable array of offices with responsibilities for various S&T-intensive policies and programs. Other undersecretaries also have responsibilities for S&T activities, and especially the Undersecretary for Arms Control and International Security.

THE GOAL, OBJECTIVES, AND ACTION-ORIENTED RECOMMENDATIONS

For several decades, and increasingly since 2000, the department has addressed S&T as an important appendage to the mainstream of foreign policy formulation and implementation. Now S&T responsibilities and skills are firmly embedded within a few components of the mainstream itself. Other units of the department are increasingly sensitive to the importance of including considerations of S&T-related opportunities to advance their programs. However, the department should incorporate S&T considerations into an even broader range of activities. From senior officials to desk officers and from ambassadors to junior embassy diplomats, understanding the potential of S&T can present new opportunities for international cooperation. At the same time, if misused, S&T can create new security risks.

The committee's view on the overarching goal of efforts to upgrade S&T capabilities within the department is set forth in the subtitle of this report: *Embedding a Culture of Science and Technology throughout the Department of State.*

Four complementary paths toward achieving this goal are suggested in the objectives articulated in the four substantive chapters of the report:

(a) Utilizing the department's S&T resources more effectively in responding to the dramatic changes in the global landscape that are determining the future of societies, states, and populations; (b) Engaging more fully the widely dispersed S&T capabilities of the United States, which are embodied in both government and nongovernment organizations, in a whole-of-society approach to foreign affairs; (c) Upgrading S&T capabilities of U.S. embassies that are on the front lines of diplomacy; and (d) Increasing the stature and capabilities of department officials responsible for S&T activities and providing challenging opportunities for highly qualified S&T Fellows from academia and industry and for deeply experienced S&T specialists from other agencies who are on short-term assignments to the department.

Twenty-seven action-oriented recommendations will contribute to achieving the four objectives discussed in the report. Nine of these recommendations that warrant priority attention by the leadership of the department are set forth below. All 27 recommendations are discussed in the full report, and they are consolidated in the final chapter. The priority recommendations were selected to highlight near-term actions that can help (a) achieve each of the four objectives, (b) engage the leadership of the department more fully in S&T activities, (c) upgrade the status of STAS as a critical node that together with OES can add cohesion to expanded roles of many components of the department and of external partners that should work together on S&T issues, and (d) strengthen department capabilities in Washington and abroad both to promote and support S&T engagement with other countries and to draw on the nation's broad range of S&T assets when appropriate.

The committee's findings that led to these recommendations are based primarily on (a) the personal knowledge and experience of the committee members, (b) presentations to the committee and its working groups by officials of many of the department's bureaus and by representatives of other interested organizations, (c) information concerning the international programs and activities of these and other organizations in response to requests for such information by committee members and staff, (d) reviews and analyses by the staff of authoritative reports of other organizations, and (e) responses to a survey of the activities of Environment, Science, Technology, and Health (ESTH) officers at a variety of posts. Also, staff analyses of relevant reports of experts and of databases of national and international organizations contributed to establishing the context for some key issues in this report."

Overall, however, the topic of this report covered a number of issues for which there are not well developed datasets or even significant reports; and the committee was well aware of the importance of rigor in considering anecdotal data in those cases wherein such data were an impor-

tant resource. For this reason, a great number of sources were consulted for both official and informal views, consistent themes were extensively validated and cross checked; and all positions taken relying on such data were expressed carefully.

1. The Secretary should continue to provide both leadership and guidance on S&T-related policies and programs for addressing priority global issues and advancing U.S. bilateral and multilateral interests. (Chapter 2)

One topic of increasing interest throughout the department is technological innovation and economic entrepreneurship. A concise statement as to the essential aspects of the U.S. approach and sources for additional information would be of value to many offices within the department and at embassies. Also, the hosting by the Secretary and undersecretaries of broad-ranging international conferences wherein S&T play a critical role can continue to be significant. The conferences on higher education in 2011 and on the oceans in 2014 attracted wide-spread attention within the department and throughout the world. Other topics of possible interest include the declining condition of the world's forests, preventing and fighting global pandemics, improving access to water resources, and responding to natural disasters.

2. The QDDR and other broad-ranging policy documents should underscore the importance of the department adopting a whole-of-society approach to diplomacy, which includes the capabilities and contributions of not only many government agencies but also nongovernmental entities that are deeply vested in S&T. (Chapter 3)

To the extent possible, widespread involvement of public and private sector organizations throughout the country can play important diplomatic roles in many areas involving S&T considerations such as Internet governance, foreign trade, global scientific research programs, and humanitarian assistance.

3. The department should carry out S&T-oriented foresight assessments. The Policy Planning Staff should have responsibility for this foresight effort with leadership provided by the S&T Adviser to the Secretary who would be double-hatted as a member of the Policy Planning Staff for such assessments. The Bureau of Intelligence and Research, the Bureau of Energy Resources, OES, and other interested bureaus should actively participate in such assessments. (Chapter 2)

The foresight program should be conducted by the department in collaboration with the intelligence community and other organizations. It should synthesize actionable conclusions of over-the-horizon S&T assessments and bring them to the attention of appropriate department officials. The program should not just identify challenges: advising on what to do is critical. Today, policy is too often reactive. We have the knowledge and competency to look out years ahead. We should take advantage of this capability.

4. The Secretary should establish a Science and Technology Advisory Board (STAB) of independent S&T experts of noted accomplishments and deep expertise to provide insights on S&T-laden non-defense issues that are or should be related to the department's foreign policy agenda. (Chapter 2)

The board would be most effective if it established and provided leadership for small groups of experts, with each group focusing for a limited period on a specific issue of interest to the department's leadership. Among the topics of possible interest are (a) the future of solar energy, including breakthroughs in thin-film receptors, (b) the search for better battery and other energy storage devices, (c) developments in robotics, with applications in manufacturing and in field activities, (d) affordable telemedicine in refugee camps, isolated communities, and remote locations, (e) advances in tropical medicine, (f) developments in synthetic biology and their potential for profit and harm, and (g) the international competition for high-tech talent. Of key importance is how such developments will impact on foreign policy.

5. The department should provide the S&T Adviser with organizational status equivalent to that of an Assistant Secretary. (Chapter 5)

Such elevated status would allow the S&T Adviser to support policy development and implementation related to S&T issues within the department. Also, with this enhanced status, the S&T Adviser would be better positioned to improve linkages between the department and external S&T-oriented organizations with global networks that can provide important perspectives on developments throughout the world.

6. The department should maintain S&T Counselors (currently called Science Counselors) at embassies where S&T issues are particularly important components of the bilateral relationship. Only highly-qualified individuals should be placed in these S&T Counselor posi-

tions. In most cases these will be outstanding Foreign Service Officers with extensive experience in S&T-related issues and other qualifications such as language fluency, regional expertise, and excellent diplomatic acumen. Some S&T Counselors might be drawn from the department's cadre of Civil Servants or exceptionally qualified outsiders. The department should also (a) ensure that S&T Counselors and other officers responsible for S&T activities at all embassies receive adequate training and preparation before assuming their duties, and (b) provide support for important efforts to initiate scientific collaboration by ensuring ready access by the embassies to available financial resources that could initiate or strengthen collaboration. (Chapter 4)

The department has relevant experience in all of these areas and should be able to quickly upgrade support of embassy staffs.

7. The department, while continuing to expand the use of new dialog mechanisms to reach large foreign audiences on U.S. values, interests, and policies (Facebook, Twitter, YouTube, and other emerging mechanisms), should increase efforts to better understand the composition, reactions, and influence of the audiences. (Chapter 4)

The department maintains about 1,000 official social media accounts around the world, representing hundreds of ambassadors, embassies, consulates, Washington bureaus, and the department as a whole. The department's flagship twitter account (@StateDept) recently broke the 1 million audience threshold, and the department's combined social media audience is over 40 million people world-wide. Given the extent and importance of the endeavor and the steady expansion of activities, assessments of the composition of audiences, their reactions, and their impacts are overdue.

8. While the most important factor in supporting S&T engagement should continue to be the advancement of science, engineering, and health capabilities in the United States and partner countries, the department, along with USAID, should give greater weight in determining allocation of funds for S&T engagement to the secondary impacts in the development and strengthening of civil society and good governance in partner countries. (Chapter 2)

Scientists, engineers, and medical specialists constitute large portions of the intellectual capital of most countries, often having considerable experience in managing important organizations. They are very significant

members of civil society, frequently serving as cabinet ministers and other leaders of governments. Scientists in positions of authority in a number of middle and low-income countries, in particular, are increasingly committed to internationally accepted principles of responsible science based on transparent, objective, and evidence-based decision making, which are important attributes of good public sector governance. However, funds explicitly designated to be used for strengthening democratic institutions should not be used to support S&T engagement activities since practice this could raise serious international concerns about the legitimacy of S&T engagement.

9. The department should continue its efforts to increase its staff so that time available for training and professional development of both Foreign Service and Civil Service officers can increase from the current level of 5 to 7 percent of total available time (the float), with the goal of reaching as soon as possible 15 percent. (Chapter 5)

A larger float will provide more time for training, pre- and post-assignment briefings by and for U.S. S&T agencies, and professional development for all employees. Those with special S&T interests will be able to stay abreast of S&T advances along with opportunities for other officers interested in other specialties to also update their capabilities. To expand the knowledge base, the Foreign Service Institute should continue to broaden the scope and number of its classes and online offerings with significant S&T content to help achieve the goal of providing opportunities for continuing education for every employee of the department wherever located.

A CULTURAL SHIFT IN U.S. DIPLOMACY

In short, the entire workforce of the department should recognize that the breadth and pace of technological advancement throughout the world, along with the needs and aspirations of the global population, are increasing every day. In 2015, mobile phone subscribers will exceed 5 billion, with smartphone users surging to 2.4 billion and mobile–Internet use rivalling traditional cellular telephony. By 2030, the demand for food will increase by 35 percent over the demand in 2014 and for energy by 50 percent, with nearly one-half of the global population living in areas of severe water stress. In the near future, the Arctic region will be opened for new maritime routes and for resource exploration and exploitation of considerable economic and environmental significance. A series of dams is being planned to convert the Congo River basin into the world's largest hydrological water complex, with environmental consequences of enor-

mous proportions. The research and industrial communities need support by the department in investigating scientific challenges and investing resources in distant regions of the world, often with more difficult operating environments than in the past.

The related foreign policy considerations of S&T advances are driving diplomatic agendas throughout the world on a daily basis. The department needs to upgrade its S&T capabilities and related policies and programs accordingly. The recommendations set forth in this report, if supported by policy and budgetary commitments, should open new opportunities for the department to draw upon the expertise and ingenuity of the nation's S&T assets embedded in many institutions within and outside the government. S&T capabilities are the trump cards that are held by the United States, and we should not hesitate to use these capabilities when necessary to advance our nation's interests in a manner that in time will lead to peace and prosperity for the broader global community.

As reflected in the title to this report, a cultural change within the department is essential so that S&T competence will be considered equal in importance to language fluency and area expertise as a critical aspect of diplomacy that will be practiced throughout the world during the 21st century.

Findings, Conclusions, and Recommendations **(Chapter 6 of the Full Report)**

This chapter presents significant general findings and overarching conclusions that are presented in the previous chapters. Also, the committee responds in this chapter to the special interests of the department that were set forth in the request for this assessment of the science and technology (S&T) capabilities of the department. Then the chapter consolidates the 27 recommendations of the committee, including 9 that are of highest near-term priority.

GENERAL FINDINGS AND OVERARCHING CONCLUSIONS

Findings and conclusions of the assessment of the department's S&T capabilities are as follows:

1. Goals, livelihoods, and activities of many populations throughout the world are being transformed due in significant measure to:
   - Advances and diffusion of S&T capabilities that open new doors for nations to respond to the aspirations of their populations for improved security conditions, greater economic opportunities, and better social conditions.
   - Increased reliance of nations on S&T as a basis for economic development, but at times not giving adequate weight to side-effects of deployment of established or new technologies, including impacts that stretch across the borders of sovereign states;
   - Increased information technology and transportation connectivity

that enable individuals and organizations throughout the world to communicate and to have transactions more easily than ever before among themselves and with others who are nearby or at great distances; and
- Growing concerns over security and political confrontations now and in the future that could lead to deadly use of technologies with ever-increasing potency, which are becoming widely available.

2. U.S.-based S&T-oriented companies, universities, and other nongovernmental organizations are playing increasingly important roles in expanding U.S. interests abroad while at the same time often influencing S&T-driven international policies and programs of the U.S. government.

3. While the department's achievements in strengthening its S&T capabilities during the past 15 years are clearly evident within many bureaus and offices of the department in Washington, progress in strengthening S&T capabilities at U.S. embassies has lagged behind, and at some posts has declined. The department needs to (a) elevate the level of preparation for foreign service officers to assume S&T responsibilities within U.S. embassies, and (b) strengthen the role of science envoys, renamed as S&T envoys, who can develop new opportunities for the embassies to promote important S&T programs of interest to the U.S. government.

4. The S&T Adviser to the Secretary of State (S&T Adviser) has played a significant role in strengthening the internal S&T capabilities of the department and the department's external linkages with S&T leaders in the United States and abroad. The S&T Adviser's office (STAS), with a small staff, has been particularly important in (a) enlarging the number of S&T Fellows serving effectively on short-term assignments within the department, (b) underscoring the importance of innovation and economic entrepreneurship capabilities in a number of countries through public diplomacy efforts, and (c) improving internal department communications and coordination concerning the importance of S&T and readily available sources of expertise to address specific topics. However, the S&T Adviser should play a much broader role in the mainstream of foreign policy development and in the conception and promotion of major department initiatives with significant S&T content. Also, the S&T Adviser should be more active in providing advice to the leadership of the department as to implications of newly-emerging technologies and attendant opportunities for the department to maintain global leadership through effective use of the S&T assets of the country.

5. The department's diplomatic efforts are driven in large measure by immediate issues confronting the department in Washington and at U.S. embassies. A broader foresight perspective, with particular attention to S&T-related developments, could effectively complement the intense near-term focus of the department and provide the basis for addressing authoritative S&T-related predictions of future trends by many credible organizations through foreign policy initiatives.

6. For many years, department officials have been committed to supporting interagency approaches in addressing issues that cut across the responsibilities of many other departments and agencies. Also, the department has engaged a limited number of nongovernmental entities to expand the reach of U.S. organizations with experience and capabilities directly related to program interests of the government. Greater attention should now be given to adopting whole-of-society approaches in addressing broad-ranging issues, and particularly S&T issues, at both the policy and program levels.

7. Opportunities for effectively utilizing U.S. S&T strengths in public diplomacy activities are much more extensive than have been recognized by the department and deserve greater emphasis in highlighting the contributions of responsible use of S&T as a driver of development and economic prosperity while at the same time as a protector of human health and the environment.

8. In order for the department to reach the laudatory goals set forth in this report, a commitment by the department of a modest increase in the level of resources devoted to intensifying and expanding S&T-related efforts in selected areas is essential.

RESPONSES TO SPECIAL INTERESTS OF THE DEPARTMENT

In the request for this report, the department identified the issues set forth below in bold type as being of particular interest. The committee's views on the issues follow.

1. Providing incentives for Foreign Service Officers to follow career tracks that include assignments devoted in large measure to international S&T engagement. An important incentive is the challenge of and personal rewards from carrying out on a daily basis interesting and important S&T responsibilities that are being given increased attention within many bureaus and offices of the department and the embassies. There are unique opportunities within the Bureau of Oceans and Inter-

national Environmental and Scientific Affairs (OES), in particular, for mid-level officials to have their own portfolios of issues and to serve as lead U.S. delegates to international gatherings. Also, for the near-term, the committee recommends an additional department award presented annually for outstanding S&T-related contributions by an embassy official to achievement of foreign policy goals or program success. In addition, appropriate recognition should be given to S&T competence and achievements in performance appraisals and promotion considerations. In the longer term, professional satisfaction from serving in the midst of an ever-increasing dimension of foreign affairs should continue to grow.

2. Reaping benefits from scientific exchange programs. The interagency process has greatly helped in the sharing of findings from government-supported exchanges. However, most S&T cross-border exchanges are now carried out without direct involvement of the department. Articulation and implementation of a whole-of-society approach by the department, as advocated in this report, should help raise the stature of exchanges in general and encourage department officials to pay more attention to exchanges not addressed in the interagency process in their areas of interest and responsibility. Also, as S&T literacy continues to grow throughout the department, more department officials will be sensitive to the impacts of S&T cooperation that involves partnerships with centers of S&T prowess throughout the United States.

3. Incorporating S&T principles into programs designed to foster democracy and economic advancement. The department and the U.S. government more broadly should recognize S&T professional societies and networks that command widespread international recognition as important components of civil society. As such, they can become important platforms for promoting transparency, critical review of policy-relevant assertions, and objective decision making based on available evidence. These strengths of the scientific approach, which is accepted globally as an important component of economic advancement, have the potential for similar acceptance in the building of strong civil societies. A specific recommendation concerning this issue is set forth below as a priority recommendation of the committee.

4. Leveraging the science community to strengthen relations between countries and to increase the role of S&T expertise in policy decisions of future governments throughout the world. People-to-people programs supported by the department have been important components of the national effort to build bridges with countries that have been relatively closed to outsiders. S&T participants in these programs, from both

the United States and cooperating countries, have played significant roles in encouraging the governments of isolated countries to give weight to S&T as a driver of economic development and an important aspect of responsible decision making. The extensive international S&T networks can also help ensure that governments appreciate the role of S&T in economic success and the importance of international cooperation to this end. This report highlights common interests in technological innovation as an example of shared interests among many countries on all continents, and the contributions of the S&T Advisers in sharing U.S. experience in this regard.

THE GOAL, OBJECTIVES, AND ACTION-ORIENTED RECOMMENDATIONS

The committee's view on the overarching goal of efforts to upgrade S&T capabilities within the department is encompassed in the subtitle of this report: *Embedding a Culture of Science and Technology throughout the Department of State.*

Four objectives to achieve this goal are set forth in the themes of the four substantive chapters of the report: Chapter 2: Utilizing the nation's S&T resources more effectively in responding to the dramatic changes in the global landscape that are determining the future of societies, states, and populations. Chapter 3: Engaging more fully the widely dispersed S&T capabilities of the United States, which are embodied in both government and nongovernment organizations, in a whole-of-society approach to foreign affairs. Chapter 4: Upgrading S&T capabilities of U.S. embassies that are on the front lines of diplomacy. Chapter 5: Increasing the stature and capabilities of department officials responsible for S&T activities and providing challenging opportunities for Fellows and officials from other departments and agencies on short-term assignments within the department and at the U.S. embassies.

Twenty-seven action-oriented recommendations that will contribute to achieving these objectives are then set forth in the report. Nine of these recommendations are considered to deserve priority attention by the leadership of the department, and they are singled out for inclusion in the Summary (indicated by ***). These priority recommendations were selected to highlight near-term actions that can be prompt steps toward (a) achieving each of the four objectives, (b) engaging the leadership of the department more fully in S&T activities, (c) upgrading the status of STAS as a critical node that together with the Bureau of Oceans and International Environmental and Scientific Affairs (OES) adds cohesion to expanded roles of many components of the department to work together and with external partners on S&T issues, and (d) strengthening depart-

ment capabilities in Washington and abroad both to promote and support S&T engagement with other countries and to draw on the nation's broad range of S&T assets for achieving U.S. diplomatic objectives.

A Rapidly Changing World

****Recommendation 2-1*

The Secretary should continue to provide both leadership and guidance on S&T-related policies and programs for addressing priority global issues and advancing U.S. bilateral and multilateral interests.

****Recommendation 2-2*

The department should carry out S&T-oriented foresight assessments. The Policy Planning Staff should have responsibility for this foresight effort with leadership provided by the S&T Adviser to the Secretary who would be double-hatted as a member of the Policy Planning Staff for such assessments. The Bureau of Intelligence and Research, the Bureau of Energy Resources, OES, and other interested bureaus should actively participate in such assessments.

****Recommendation 2-3*

The Secretary should establish a Science and Technology Advisory Board (STAB) of independent S&T experts of noted accomplishments and deep expertise to provide insights on S&T-laden non-defense issues that are or should be related to the department's foreign policy agenda.

****Recommendation 2-4*

While the most important factor in supporting S&T engagement should continue to be the advancement of science, engineering, and health capabilities in the United States and partner countries, the department, along with USAID, should give greater weight in determining allocation of funds for S&T engagement to the secondary impacts in the development and strengthening of civil society and good governance in partner countries.

Recommendation 2-5

STAS, in continuing consultations with participants in various inter-

national S&T networks, should give priority to seeking opportunities for leveraging the outreach capabilities of existing and proposed global and regional networks in addressing S&T issues of interest to the department.

A Whole-of-Society Approach in Incorporating Science and Technology into 21st Century Diplomacy

Recommendation 3-1

U.S. embassies should consult with American scientists, engineers, and health specialists residing in their countries, when appropriate, regarding research, development, and other programs that are relevant to ongoing or proposed engagement activities of interest to the embassies. Also, such in-country specialists are important in identifying opportunities for initiating new programs of mutual interest. At the same time, the embassies should also be alert to possible contributions from other in-country specialists who are not affiliated with U.S. government activities.

Recommendation 3-2

The department, in cooperation with the Department of Commerce, the Office of the Trade Representative, and U.S. industry, should continue to encourage governments of trade partners to adopt comprehensive approaches to development and use of technologies, including protection of their own and foreign intellectual property.

Recommendation 3-3

The department should encourage USAID to initiate external reviews of its S&T programs every 3 to 5 years given the many overlapping goals of USAID and the department that often involve nongovernment entities. The 2006 report prepared by the National Academies titled "The Fundamental Role of Science and Technology in International Development: An Imperative for the Agency for International Development" provides a good starting point for the next review.

Recommendation 3-4

The leadership of the department, in concert with senior Department of Defense officials, should continue to give emphasis to the importance of collaboration between the two departments at many

levels. Opportunities for joint planning, program development activities, and readiness for future contingencies should receive particular attention, perhaps in preparation of the Quadrennial Defense Review and the Quadrennial Diplomacy and Development Review.

Recommendation 3-5

The department should ensure that U.S. delegations to meetings of international organizations include essential experts from other government departments and agencies. Other agencies that have important expertise and interest concerning the topic of a meeting usually cover the travel costs of their specialists. However, when priorities of the department and other agencies do not align, the delegations may be lacking technical expertise for addressing specific agenda items.

Recommendation 3-6

The S&T Adviser to the Secretary, in consultation with the White House Office of Science and Technology Policy, should stay abreast of the activities of S&T-oriented committees and panels established by components of the Executive Office of the President and should help ensure that the department is appropriately represented when current and future international dimensions of research and development activities are discussed.

****Recommendation 3-7*

The QDDR and other broad-ranging policy documents should underscore the importance of the department adopting a whole-of-society approach to diplomacy, which includes the capabilities and contributions of not only many government agencies but also nongovernmental entities that are deeply vested in S&T.

Recommendation 3-8

OES, STAS, the Bureau of Educational and Cultural Affairs, and other interested bureaus should jointly organize annual conferences for representatives of interested universities, professional societies, foundations, nongovernmental organizations, companies, and other private sector organizations to meet with relevant department officials in assessing past and future opportunities for partnerships and other arrangements that will enhance mutual interests in the development and carrying out of international non-defense S&T-oriented pro-

grams. The meetings should be primarily for information exchange, and they should not be construed as policy formulation meetings.

Support of Science and Technology Policies, Programs, and Outreach by U.S. Embassies

****Recommendation 4-1*

The department should maintain S&T Counselors (currently called Science Counselors) at embassies where S&T issues are particularly important components of the bilateral relationship. Only highly-qualified individuals should be placed in these S&T Counselor positions. In most cases these will be outstanding Foreign Service Officers with extensive experience in S&T-related issues and other qualifications such as language fluency, regional expertise, and excellent diplomatic acumen. Some S&T Counselors might be drawn from the department's cadre of Civil Servants, or exceptionally qualified outsiders. The department should also (a) ensure that S&T Counselors and other officers responsible for S&T activities at all embassies receive adequate training and preparation before assuming their duties, and (b) provide support for important efforts to initiate scientific collaboration by ensuring ready access by the embassies to available financial resources that could initiate or strengthen collaboration.

Recommendation 4-2

To stimulate S&T awareness throughout the embassies, the department should establish a prestigious annual award for leadership by an embassy official who has made the most outstanding contribution during the year in enhancing science, technology, and innovation-related impacts in areas of priority interest to the department.

Recommendation 4-3

The department should continue to encourage short-term assignments of government specialists from other agencies to serve at embassies that request the support of specialists from other agencies. However, the department, in consultation with the requesting embassies and the interested agencies, should give greater attention to the lengths of assignments that are appropriate.

Recommendation 4-4

The number of Science Envoys (renamed S&T Envoys) should continue to increase.

Recommendation 4-5

The department should establish a program that supports short-term visits to interested countries by American scientists and engineers in their early careers who have already received national recognition for their innovative S&T achievements (the Early-Career Innovators).

****Recommendation 4-6*

The department, while continuing to expand the use of new dialog mechanisms to reach large foreign audiences on U.S. values, interests, and policies (Facebook, Twitter, YouTube, and other emerging mechanisms), should increase efforts to better understand the composition, reactions, and influence of the audiences.

Recommendation 4-7

OES, together with the regional bureaus, should assess whether the regional Hubs should remain in place as an important component of the department's overseas presence or whether other approaches would be more cost-effective in addressing regional S&T issues in the years ahead.

Enhancing Organizational and Personnel Capabilities

****Recommendation 5-1*

The department should provide the S&T Adviser with organizational status equivalent to that of an Assistant Secretary.

Recommendation 5-2

STAS should have (a) an increase in staff positions, and (b) access to support funds.

****Recommendation 5-3*

The department should continue its efforts to increase its staff so that time available for training and professional development of

both Foreign Service and Civil Service officers can increase from the current level of 5 to 7 percent of total available time (the float), with the goal of reaching as soon as possible 15 percent.

Recommendation 5-4

The department should (a) evaluate the adequacy of the number of AAAS fellows in its workforce and increase the number if warranted, while broadening their opportunities for career appointments; (b) encourage Presidential Management Fellows with Science, Technology, Engineering, and Mathematics (STEM) backgrounds, interests in foreign affairs, and hiring preferences in competitions for civil service positions to seek permanent employment opportunities at the department; and (c) create new pathways for Jefferson Fellows to continue to respond to the department's needs for their S&T skills after they complete their commitments of permanent assignments in Washington of one academic year.

Recommendation 5-5

The department should formally request a change in the Office of Personnel Management's Civil Service Qualification Standards throughout the Foreign Affairs series that will recognize that STEM degrees are appropriate in satisfying education requirement for positions in this series.

Recommendation 5-6

Beginning with the recruitment of new FSOs and Civil Servants, the department should take advantage of the many opportunities to help them appreciate the integral role of S&T in the development and implementation of foreign policy and international programs of growing importance.

Recommendation 5-7

The Foreign Service Institute should continue its expansion of educational and training offerings through online courses—including both courses in preparation for specific assignments and broader overview offerings for more general educational and professional advancement.

In closing, all the bits and pieces of more effective S&T underpinnings of diplomacy and of greater recognition of the value of facilitating S&T

engagement between U.S. and foreign institutions should be in place if the recommendations in this report are adopted. Enhancing the S&T capabilities of the department will require some, but not many resources. The return on a modest investment will be substantial. However, greater cohesion of the organizational and policy frameworks of the department will be needed to ensure that appropriate personnel recruitment, resource allocation, and foreign policy and program adjustments take place. Important steps have been taken in this regard, and more steps based on this report may soon be on the table. But only through collaborative efforts between the department and other key elements of the U.S. S&T enterprise will the full S&T potential of the nation be reflected in foreign affairs.

In about 5 years, another independent assessment of the role of S&T in foreign affairs should be undertaken as to the progress in moving toward greater security and prosperity through pathfinding efforts based on S&T. Because international organizations are giving increased attention to documenting the role of S&T in global development and international affairs, by the time of the next report there should be a stronger basis of well-organized data on which to assess department S&T policies. In carrying out the next assessment, special attention should be given to whether the S&T Adviser has been empowered to play a more important role in providing authoritative and timely S&T counsel for the leaders of the department. Also, the diffusion of S&T literacy throughout the department, including the embassies, should be a primary concern of the assessment. Progress in both of the areas will be a good indicator as to the extent that personal S&T literacy has joined language fluency and area expertise as cornerstones of the diplomatic culture for the 21st century.