Balancing Scientific Openness and National Security Controls at the Nuclear Weapons Laboratories

Committee on Balancing Scientific Openness and National Security, National Academy of Sciences, National Academy of Engineering, and Institute of Medicine

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Balancing Scientific Openness and National Security

INTRODUCTION

There has been extensive discussion in recent months of the possible loss to the People's Republic of China of important nuclear-weapons-related information from certain national laboratories of the Department of Energy (DOE). This aroused concern about the leakage of weapons-related information through interactions of scientists employed by the laboratories with foreign nationals. As a result, moratoria on foreign visits and tighter controls governing interactions with foreigners have been proposed.

To provide an expedited examination of some of the issues surrounding such proposals and policies, in the hope of influencing the current debates as to how to proceed, the National Academies assembled a Committee on Balancing Scientific Openness and National Security. This committee has examined the roles of the national laboratories, the contribution of foreign interactions to the fulfillment of those roles, the risks and benefits of scientific openness[1] in this context, and the merits and liabilities of the specific policies being implemented or proposed with respect to contacts with foreign nationals. Of course, this broad agenda could not be covered in depth in the time available, but the committee did benefit from the prior involvement of its individual members in a wide variety of studies

[1] The committee reviewed and discussed the risks that scientific openness may entail, and recognizes them as serious. Brief discussions of the major risks appear at various places in the text, but the bulk of the report is devoted to presenting the benefits that properly managed scientific openness brings to the work of the DOE weapons laboratories.

and activities touching on these topics. The committee also had the benefit of a symposium held at the National Academy of Sciences on August 2–3, 1999, in which a diverse array of knowledgeable observers addressed the issues.[2] The committee's statement of task, brief biographies of its members, and the agenda for the symposium are attached as appendixes.

The committee reviewed unclassified portions of the reports dealing with the possible losses of weapons-related information from certain DOE national laboratories.[3] Although the committee has not reviewed the factual foundations for the allegations of espionage, it starts from the premise that protection of information that relates to the construction of nuclear weapons is of the highest importance to national security. One of DOE's most important responsibilities is to safeguard such information for the protection of the Nation and, indeed, of all mankind. Viewed in this light, it might appear simple and obvious that such information would best be protected by limiting access by foreign nationals to the laboratories at which the information is found and by isolating the scientists and engineers who work on such matters from contact with foreigners. Indeed, the initial proposed reaction to the alleged losses was along these lines. As will be seen, the committee believes that a less sweeping approach is required.

In response to the allegations of the loss of secrets to China, DOE has not sought to bar all foreign contact by laboratory personnel, but has sought to tighten significantly the policies governing interactions by laboratory staff with foreign nationals.[4] DOE has adopted organizational changes that are intended to give heightened prominence to security and counterintelligence,[5] revised the order governing access to the laboratories by foreign visitors, provided new guidance governing "exports" of unclassified information through communication with foreign nationals, and undertaken various actions to strengthen the protection of classified and sensitive information. (Documents related to the new and enhanced DOE security policies are listed in Appendix E.) The effects of these initiatives

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[2] The transcript of the presentations at the symposium can be found on the Internet at http://www.nationalacademies.org/oia/oiahome.nsf.

[3] For descriptions and assessments of various aspects of the risks of openness, see Select Committee on U.S. National Security and Military/Commercial Concerns with the People's Republic of China, House Report 105-851 (the "Cox Report") (Washington, D.C.: U.S. Government Printing Office, 1999); President's Foreign Intelligence Advisory Board, Special Investigative Panel, *Science at its Best, Security at its Worst: A Report on Security Problems at the U.S. Department of Energy* (the "Rudman Report") (Washington, D.C.: White House, 1999); U.S. Central Intelligence Agency Review Panel, *The Intelligence Community's Damage Assessment on the Implications of China's Acquisition of U.S. Nuclear Weapons Information on the Development of Future Chinese Weapons* (the "Jeremiah Report") (Langley, Va., U.S. Central Intelligence Agency, 1999).

[4] People who are admitted to the United States as permanent residents or U.S. citizens who are foreign-born are not (and should not be) considered foreign nationals for this purpose.

[5] Further changes subsequently arose from U.S. Public Law 106-65. *National Defense Authorization Act for Fiscal Year 2000.* 106th Cong., 1st session, 1999.

are still somewhat uncertain because the policies are evolving and the details of implementation are important. This report is intended to set out the committee's view of the conflicting objectives that must be balanced in the development and implementation of such policies.

Although there have now been several studies of possible recent espionage at DOE's laboratories, those of which the committee is aware do not identify scientific exchange with foreign nationals—either visitors or employees—as the source of losses of classified information. Although all possible channels of loss warrant attention, past experience suggests that overly strict action with respect to foreign nationals is neither necessary nor appropriate. Indeed, a response that focuses on foreign nationals may result in a misallocation of effort at best and a highly damaging reaction—without locating the true source of the espionage—at worst. Close and careful evaluation is required as policy is developed and as implementation proceeds.

FOREIGN INTERACTIONS AND THE WEAPONS LABORATORIES

This report focuses on the three so-called "weapons laboratories"—Los Alamos National Laboratory, Lawrence Livermore National Laboratory, and Sandia National Laboratory—because these laboratories are centrally involved in nuclear weapons programs and are the most directly and immediately affected by the various proposed policies.[6] These laboratories received some 6,398 foreign visitors or assignees (individuals who stay from 30 days to 2 years) in 1998, including approximately 1,824 visitors from sensitive countries (countries that are seen to present proliferation or national security risks). In addition, employees from the laboratories travel to foreign countries to engage in scientific meetings, including travel to sensitive countries, and interact with foreigners at foreign laboratories or at scientific conferences. In 1998, weapons laboratory personnel engaged in approximately 5,799 trips to foreign nations, including 1,814 trips to sensitive countries, on official business.[7]

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[6] Many of DOE's laboratories conduct only unclassified research that does not bear on the weapons program (i.e., Ames Laboratory, Fermi National Accelerator Laboratory, Lawrence Berkeley National Laboratory, National Renewable Energy Laboratory, Princeton Plasma Physics Laboratory, Stanford Linear Accelerator Center, and the Thomas Jefferson National Accelerator Laboratory). As a result, it appears that these laboratories will be largely exempted from some of the requirements that are being considered or imposed, although cleared individuals even at these laboratories may have new reporting requirements. (These laboratories may also be affected by the policies governing the "deemed export" of unclassified information through dialogue with foreign nationals, which is discussed subsequently.) Certain multipurpose laboratories (i.e., Argonne National Laboratory, Oak Ridge National Laboratory, and Brookhaven National Laboratory) do conduct some classified research and thus, like the weapons laboratories, they are and will be affected to some extent by tightened protections on classified information.

[7] George Tegan, U.S. Department of Energy Foreign Travel System, telephone conversation with National Academy of Sciences staff, October 14, 1999.

The weapons laboratories engage in work in three principal areas: weapons-related research, open scientific research, and cooperative programs with other nations. Most of this work—perhaps 70 to 75 percent—is unclassified and the performance of all the work requires laboratory personnel to draw on contributions from the outside scientific world.[8] Indeed, because DOE's laboratories conduct only 1 to 2 percent of the world's research and development, the effectiveness of the laboratories depends substantially on the capacity to access and apply the 98 to 99 percent of the work that is performed elsewhere.[9]

The conduct of weapons-related research is a central mission of the three laboratories. The nature of the research, however, has changed significantly in recent years as a result of the end of the Cold War, the Comprehensive Test Ban Treaty,[10] the termination of the development of new physics packages (i.e., the nuclear components) for nuclear weapons, and the broadening responsibilities of the laboratories for nonproliferation programs. In the absence of testing, the United States has launched a science-based Stockpile Stewardship Program. The program relies centrally on the development and maintenance of the scientific skills and tools at the laboratories to assure the dependability and safety of nuclear weapons. Without undertaking the detonation with nuclear yield of weapons in tests, computer modeling and other tools are used to understand better the aging of materials and the complexities of weapons performance. Although much of this work is and must remain classified, weapons researchers must also maintain contact with related fields of open scientific research. Open communication in rapidly moving technical fields works to the advantage of the United States if it has the ability to exploit new ideas quickly regardless of the source of those ideas. For example, cutting-edge weapons-related research is heavily dependent on the broader, open research in materials, nuclear physics, computer science, hydrodynamics, lasers, and many other fields. Because of the international nature of science, this necessitates substantial international engagement by weapons scientists.

The laboratories also engage in open and broad-ranging scientific research in a wide variety of fields, both fundamental and applied. In the latter category, for example, the weapons laboratories contribute to the program of fusion energy research that is aimed at harnessing nuclear fusion as a commercially viable

[8] Secretary of Energy Advisory Board, Working Group on Foreign Visits and Assignments, *Report of the Secretary of Energy Advisory Board Working Group on Foreign Visits and Assignments* (Washington, D.C.: U.S. Department of Energy, 1999), 2.

[9] Ibid., 5. See also C. Holden, "Physics paper mills," *Science*, 285 (1999):2057.

[10] The United States declared a moratorium on nuclear testing in 1992 and signed the Comprehensive Test Ban Treaty in 1996. Although the U.S. Senate voted against ratification of the treaty on October 13, 1999, President Clinton has stated his intention to continue to adhere to the testing moratorium (White House, Office of the Press Secretary, "Statement by the President," October 13, 1999).

energy source.[11] This research is of great importance because fusion offers the possibility of a virtually inexhaustible fuel supply, in combination with favorable safety, waste management, and nonproliferation attributes, as well as freedom from the air pollution and climate change risks associated with fossil fuels. The research budgets of the Europeans and the Japanese in fusion energy exceed the U.S. budget and even the Russians have maintained a significant program. In light of the substantial programs that exist outside the United States, the case for meaningful engagement of the United States in international fusion activities is overwhelming.[12] The United States, as well as its international partners, gains by working to solve such common problems collectively.

The laboratories also carry out cooperative programs that serve U.S. national security interests. For example, the United States has embarked on a cooperative program with the Russians to upgrade the protection, control, and accounting of weapons-grade nuclear material in Russia.[13] This program is in the direct and immediate national security interest of the United States because of the risks that would arise if even a relatively small amount of the large and growing stocks of this material were to become available to a proliferant nation or a terrorist group.[14] The knowledge and skills necessary to carry out this program rest in the national laboratories and their involvement in the program is central to the program's success. Their participation, however, necessarily requires the laboratory staff to travel to sensitive countries and to engage in discussions with relevant counterparts in those countries, as well as to host visits by their counterparts.[15]

There are other aspects of international engagement by the laboratories that should also be taken into account. First, a spirit of reciprocity, transparency, and cooperation with scientists and technologists from sensitive countries is essential if the United States is to implement and verify nuclear arms reductions agreements that are in its national security interest. Some access, albeit carefully

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[11] The weapons laboratories engage in inertial confinement fusion in support of stockpile stewardship. This same approach is being explored as a possible source of electrical power.

[12] See Secretary of Energy Advisory Board, Task Force on Fusion Energy, *Realizing the Promise of Fusion Energy: Final Report of the Task Force on Fusion Energy* (Washington, D.C.: U.S. Department of Energy, 1999), 11–14; President's Committee of Advisors on Science and Technology, Panel on Energy Research and Development, *Report to the President on Federal Energy Research and Development for the Challenges of the Twenty-first Century* (Washington, D.C.: White House, 1997).

[13] Bilateral Commission, *Final Report of the U.S.–Russian Independent Scientific Commission on Disposition of Excess Weapons Plutonium* (Washington, D.C.: Office of Science and Technology Policy, 1997); Special Panel on Protection and Management of Plutonium, *Protection and Management of Plutonium*. LaGrange, Ill.: American Nuclear Society, 1995).

[14] National Academy of Sciences, Committee on International Security and Arms Control, *Management and Disposition of Excess Weapons Plutonium* (Washington, D.C.: National Academy Press, 1994).

[15] National Research Council, *Protecting Nuclear Weapons Materials in Russia* (Washington, D.C.: National Academy Press, 1999).

controlled access, to each other's weapons-related facilities is a necessary step in providing confidence in the arms control process. If the United States denies even controlled access to its weapons laboratories or staff, it should anticipate denial of U.S. access to facilities in sensitive countries. Such a step would constitute an unfortunate retreat in arms control.

Second, the weapons laboratories must attract and retain first-rate scientific and engineering talent. One of the biggest challenges in the science-based Stockpile Stewardship Program is the maintenance of a cadre of talented scientists and technologists to deal with the potential changes in the demands on the nation's nuclear-weapons-related skills in an unpredictable world. The laboratories have recruited and continue to recruit such personnel by providing them the opportunity to engage in open scientific work that is related to the maintenance of capabilities in classified weapons work. The ability to attract and maintain such talent will be compromised if the open work is overly constrained; a life "behind the fence" is unattractive, and less productive, for most of the front-rank researchers that the laboratories need to employ.

Finally, openness serves not only scientific advance, but also policy formation in the national security sphere. Secrecy can make it difficult for policy makers of all countries and the publics to whom they are accountable to know what they need to know in order to make sensible judgments on important public matters bearing on national security. For example, open international discussion of the usability of reactor-grade plutonium in nuclear weapons has been essential to effective policy-making on the management of plutonium for both military and civilian use worldwide. There is a fundamental tension between secrecy and openness in such matters. The basic point remains, however, that there are costs in extending the scope of secrecy too extensively.

STRIKING A BALANCE

The committee concludes that there are many aspects of the work at the laboratories that benefit from or even demand the opportunity for foreign interactions. Thus, the establishment of a sensible policy should be guided by a net assessment of the risks and benefits that such interactions allow.

The committee has not had access collectively to the classified assessments and thus cannot offer an independent judgment of the magnitude of the risks presented through interactions by laboratory personnel with foreign nationals. It is certainly plausible that foreign nations might seek to exploit visits to the laboratories or contacts with laboratory personnel as a means of obtaining classified information. Indeed, this is an information age and protections against espionage must remain an important element of U.S. national security in the years ahead. The apparent absence of any significant losses of classified information in the recent past either by weapons-lab personnel traveling abroad or through espionage by foreign visitors suggests, however, that the existing procedures governing such foreign interactions, although needing to be reexamined, have been generally adequate. Of course, continued vigilance is needed to assure adequate protection of weapons-related information.

In striking a balance, it must also be recognized, as explained above, that significant curtailment of foreign interactions by laboratory staff will impose substantial costs. The committee concludes that U.S. national security will not be served by severely restricting international interactions at the laboratories in an effort to hide secrets more carefully. Rather, national security can be better assured by a system that seeks to avoid losses, but that also enhances the capacity to advance knowledge in relevant fields and to achieve the other benefits of openness through international contacts by laboratory personnel. In short, a balanced policy should not only allow, but also facilitate the opportunity for foreign dialogue in appropriate areas.

If viewed properly, the protection of weapons-related secrets and the need for openness are not necessarily in conflict. Rather, they should be viewed as two aspects of a proper national security strategy. The weapons-related matters of espionage interest primarily relate to the detailed designs and the technological know-how that enable the fabrication of items of importance to national security. The sphere of information of principal concern to national security does not overlap with the areas in which the maintenance of openness is essential; hence, a proper policy can and should accommodate both tight secrecy in some areas and openness in others. Key to a proper balance is a clear and precise definition of the information that is to be sequestered and education of laboratory staff so as to assure that it is knowledgeable of the boundaries surrounding that information.[16]

The need for such an approach is a common element of the modern technological world in other contexts. For example, microelectronics companies perceive it is in their interest to share information, through full involvement in open scientific dialogue, in connection with research on the properties of materials, while simultaneously maintaining tight secrecy with regard to the design and means of fabrication of a particular microelectronic device. Similarly, biotechnology companies may encourage their technical staff to publish in the open scientific literature about scientific advances, while maintaining tight secrecy about particular products that are under development. It is now common practice in the industrial world to leverage technical capability by stimulating and participating in the scientific contributions of the general scientific community, while exercising strict control over the specific integrative and "know-how" capability. This same model applies to the work of the weapons laboratories.

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[16] See National Academy of Sciences, National Academy of Engineering, and Institute of Medicine, *Scientific Communication and National Security* (Washington, D.C.: National Academy Press, 1982); National Research Council, *A Review of the Department of Energy Classification: Policy and Practice* (Washington, D.C.: National Academy Press, 1994).

SUGGESTIONS FOR POLICY

The committee draws a number of conclusions for the implementation of policy.

1. Maintain balance. Policy governing international dialogue by laboratory staff should seek to encourage international engagement in some areas, while tightly controlling it in others. It is through the encouragement of both aspects of policy that U.S. national security will be best advanced. Indeed, there is a very real danger that misdirected security crackdowns could have widely pernicious effects by inhibiting international interactions that serve U.S. national security interests, as well as research and development in general.

Overly strict constraints on foreign interactions could affect not only foreign visitors and international meetings at the weapons laboratories, but also visits and meetings taking place at other U.S. institutions where weapons-lab personnel and visitors from sensitive countries might come into contact. Moreover, constraints on international meetings in this country or on travel abroad could affect not only the full-time employees of the weapons labs, but also a much wider array of security-cleared consultants and advisors to the laboratories and the various branches of government. Of course, some constraints already exist and have for years. The danger that concerns this committee is the possibility that the mechanisms to constrain interactions may be strengthened in ways that could cause significant damage in exchange for small benefits.[17]

2. Educate staff. Security procedures should be clear, easy to follow, and serve an understandable purpose. The key ingredient is the development of an awareness and appreciation throughout the laboratory staff of the nature of the threats and of the methods that should be used to prevent espionage. Education and training are essential. Top-level scientific and program management should develop a definition of the boundaries of acceptable interactions with foreign experts and should assure understanding of those boundaries by the technical personnel. Prescriptive rules are not an effective substitute for informed personal vigilance.

[17] DOE has recently published a proposed rule concerning the use of polygraph examinations of certain DOE and contractor employees for national security purposes (U.S. Department of Energy, Polygraph Examination Regulation, 64 Fed. Reg. 45,061, August 18, 1999). The committee is aware of concerns that the expanded use of polygraph tests could adversely affect national security by making it more difficult for the weapons laboratories to attract and retain skilled personnel. The committee did not examine this issue in detail because it extends beyond its charge. The committee urges careful consideration of the proposed rule, however, to assure that the chilling effect of the expanded use of polygraphs does not outweigh any security benefit that the testing might bring.

3. Streamline procedures. Good science is compatible with good security if there is intelligent line management both at the labs and in Washington, which applies effective tools for security in a sensible fashion. It is important in this context to put in place procedures that establish needed security protections, while minimizing interference with work. For example, the DOE policy governing foreign visitors requires that the identities of certain visitors be checked with various intelligence services so as to enable an informed decision as to whether or how to allow visits to occur.[18] Such a system should be implemented so that these so-called "indices checks" can be performed without undue delay. (The committee understands that the relevant DOE office aspires to a 10-day turnaround for such checks, but that the delays have been far longer in recent months.) Efforts should be made to assure that security procedures serve their purpose, but do not become bottlenecks. If the procedures sweep too widely or are too cumbersome, the achievement of compliance will be compromised.

4. Focus efforts. DOE should focus its efforts governing tightened security for information. The greatest attention should obviously be provided to the protection of classified information by appropriate physical and cybersecurity measures, and by personnel procedures and training. In response to the recent reports, DOE has revised its policies governing disclosures of "sensitive but unclassified" subjects, such as controls on exports of technical data through communication with foreign nationals (see Appendix E). Although the concrete effects of the revised guidance are not yet fully apparent, the directives in this area are creating significant ambiguity and can intrude on communications that are far distant from DOE's security mission. As a result, the policy will have a detrimental effect on communications that serve U.S. national security interests. Instead of creating new control regimes, DOE should rely on the control systems that are already in place across the government—such as the controls on classified information and on export of certain technical data. The protection of truly important information is likely to be more effective if DOE devotes attention to the information of central importance—if it builds high fences around narrow areas—rather than by allowing the effort to be diffused and diluted by encompassing unclassified information of marginal (or non-existent) significance to national security.

Physical security requirements should also be tailored to the level of risk presented by the specific location at which the work is performed. As DOE has recognized, its university-like laboratories (e.g., Fermi National Accelerator Laboratory) conduct no classified research and, as a result, should not be subject to requirements relating to military security. Even at the weapons laboratories, heightened levels of protection should be directed at those areas in which classi-

[18] U.S. Department of Energy, Unclassified Foreign Visits and Assignments, DOE N 142.1, July 13, 1999, paragraph 4.d.

fied work is conducted, with more limited security elsewhere. In short, there should be a graded regime that follows the basic principle that the level of security should be tailored to the magnitude of the risks.

5. Beware of prejudice against foreigners. Over the past half-century foreign-born individuals have contributed broadly and profoundly to national security through their work at the national laboratories. During World War II, the foreign-born contributors to U.S. war efforts included many giants of science—Enrico Fermi, Eugene Wigner, Leo Szilard, Edward Teller, Hans Bethe, John Von Neumann, Stanislaw Ulam, and others. Many of the current employees of the laboratories are foreign-born and some are foreign nationals, including individuals from sensitive countries. These persons are making very significant contributions to the laboratories' work.[19]

To the committee's knowledge, no such employees have ever been identified as the source of losses of classified information in recent decades.[20] Efforts to prevent losses of important weapons-related information cannot fairly be directed at individuals of any particular national or ethnic background. The most notorious recent spies—for example, Aldrich Ames and the Walker family—were native-born U.S. citizens. Under the circumstances, there can be no justification for focusing counterintelligence and security efforts on those individuals who happen to be foreign nationals or who are of any particular national or ethnic background.

Moreover, such a focus not only would be unfair, but also would be counterproductive. Approximately 52 percent of all doctoral students in the U.S. science and engineering programs are non-U.S. citizens, with many from China and India (both identified as sensitive countries).[21] To limit access to the laboratories by such researchers or to engage in practices that are less than fully welcoming of

[19] See Secretary of Energy Advisory Board, Working Group on Foreign Visits and Assignments, *Report of the Secretary of Energy Advisory Board Working Group on Foreign Visits and Assignments* (Washington, D.C.: U.S. Department of Energy, 1999); Alvin Trivelpiece, Director, Oak Ridge National Laboratory Presentation to the Committee on Balancing Scientific Openness and National Security, August 3, 1999. See also S. G. Levin and P. E. Stephan, "Are the foreign born a source of strength for U.S. science?" *Science* 285 (1999):1213.

[20] Klaus Fuchs, a German national and spy for the Soviet Union who was present at Los Alamos during World War II as part of the British scientific delegation, is the only foreign national of whom the committee is aware who was employed at a weapons laboratory and was connected with espionage activities. The individual identified in the press as the possible source of recent losses at Los Alamos of classified information to the People's Republic of China is a U.S. citizen.

[21] This estimate is based on questionnaire responses by those doctorate recipients who indicated citizenship. Foreign students, for this purpose, includes both those with temporary visas and permanent resident status. National Research Council, *Summary Report 1996: Doctorate Recipients from United States Universities.* (Washington, D.C.: National Academy Press, 1998). See also National Science Foundation, *Science and Engineering Degrees, by Race/Ethnicity of Recipients: 1989–96.* (Arlington, Va.: National Science Foundation, 1999).

them would deprive the laboratories of a major source of scientific and technical talent, with adverse consequences both for the laboratories and for U.S. national security.

CONCLUSION

We live in an age in which information is of central importance to U.S. national security; the United States has know-how and capabilities related to weapons that must be safeguarded carefully. We should expect that espionage aimed at obtaining this information will be attempted. But this does not mean that we should terminate all channels of international information flow through which weapons-related information might arguably leak. The world is awash in scientific discoveries and technological innovations. If the United States is to remain the world's technological leader, it must remain deeply engaged in international dialogue, despite the possibility of the illicit loss of information. Furthermore, international cooperation and communication related to nuclear arms control, nuclear nonproliferation, and the protection of nuclear materials bring substantial direct benefits to U.S. national security. As a result, the objective of U.S. policy should be to assure that the gains from international networking always offset the losses. In the case of the national laboratories, this is best assured by a policy of informed protection of truly important information, while preserving openness in other areas.

APPENDIX A

Statement of Task

In response to the joint statement of the three Presidents of the National Academies, the Office of International Affairs will appoint a Committee on Balancing Scientific Openness and National Security. The Committee will organize a symposium to address consequences of current and proposed restrictions on international contacts by the U.S. Department of Energy's national laboratories and explore methods of best serving national security through positive new scientific advances facilitated by international communication among scientists, through scientific contacts to further non-proliferation, and through careful protection of crucial classified information from foreign espionage. The symposium will examine:

- the role of the U.S. Department of Energy's national laboratories in national security and the contributions by foreign laboratories and scientists,
- the proposals for amending security policies of the weapons laboratories in regard to contact with foreign laboratories and scientists, and
- the risks and benefits of scientific openness in this context.

The Committee's report will review current policies and proposals designed to enhance security at the weapons laboratories, primarily those related to restrictions on foreign contacts by U.S. Department of Energy scientists. The letter report will make recommendations to the U.S. government regarding methods of best serving national security both through positive new scientific advances facilitated by international communication among scientists and through careful protection of crucial classified information from foreign espionage.

APPENDIX B

Committee and Staff Biographies

COMMITTEE

RICHARD A. MESERVE (Chair) is a partner in the law firm of Covington and Burling. He holds a law degree from Harvard Law School and a Ph.D. in applied physics from Stanford University. Earlier in his career he served as clerk for Supreme Court Justice Harry Blackmun and as legal counsel and senior policy analyst in the White House Office of Science and Technology Policy. Dr. Meserve has served as chair or vice-chair of a number of National Research Council committees, including the Board on Energy and Environmental Systems, the Committee on Declassification of Information for the Department of Energy Environmental Remediation and Related Programs, and the Panel on Cooperation with the USSR on Reactor Safety. He was also chair of the Committee of Dual-Use Technologies, Export Control, and Materials Protection, Control, and Accountability and the Committee on Upgrading Russian Capabilities to Secure Plutonium and Highly Enriched Uranium. Dr. Meserve resigned from the committee after his appointment as Chairman of the Nuclear Regulatory Commission in October 1999.

JOHN P. McTAGUE (Chair) is former vice president for technical affairs of the Ford Motor Company. He is a member of the Secretary of Energy Advisory Board. He also serves as Co-chair of the U.S. Department of Energy's Laboratory Operations Board. Dr. McTague was formerly vice president for research at Ford Motor Company. Prior to joining Ford, Dr. McTague served as Deputy Director of the Office of Science and Technology Policy and as Acting Science Advisor to the President, in the Executive Office of the President. He was also an adjunct professor of chemistry at Columbia University. Dr. McTague was elected Alfred P. Sloan Research fellow, a NATO senior fellow, a John Simon Guggenheim Memorial fellow, and a member of the President's Council of Advisors on Science and Technology (PCAST). He received his undergraduate degree from Georgetown University and his doctorate from Brown University. Dr. McTague is a member of the National Academy of Engineering.

RUTH M. DAVIS is President and Chief Executive Officer of the Pymatuning Group, Inc., which specializes in industrial modernization strategies and technology development. She is currently the Chairman of the Aerospace Corporation and serves on the Boards of BTG, Inc., Ceridian Corporation, Consolidated Edison Company of New York, Institute for Defense Analyses, SSDS, Inc., and Varian Semiconductor Equipment Associates, Inc. She has also served as a member of the Board of Regents of the National Library of Medicine from 1989 to 1992 and as Chairman of that Board from 1991 to 1992. Dr. Davis was Assistant Secretary of Energy for Resource Applications (1979–1981) and Deputy Under Secretary of Defense for Research and Advanced Technology (1977–1979). She obtained both her Ph.D. and M.A. degrees from the University of Maryland. Dr. Davis is a member of the National Academy of Engineering.

JOHN H. (JACK) GIBBONS served as Assistant to the President for Science and Technology and Director, Office of Science and Technology Policy, from February 1993 to April 15, 1998. In that position he co-chaired the President's Committee of Advisors on Science and Technology and was a member of the Domestic Policy Council, the National Economic Council, the National Security Council, and the National Science and Technology Council, which coordinates science and technology policy and budgets across the federal government. He received a bachelor's degree in mathematics and chemistry from Randolph-Macon College in 1949 and a doctorate in physics from Duke University in 1954. He currently serves on the Board of Directors of the World Resources Institute, the Board of Governors of the New York Academy of Sciences, and on the boards of several high-tech companies. He is a member of the University of Virginia Visiting Committee to the Shannon Center for Advanced Studies and is a member of the National Advisory Committee of the National Renewable Energy Laboratory (DOE). During 1998 through 1999, Dr. Gibbons was the Karl T. Compton Lecturer at the Massachusetts Institute of Technology. He is president-elect of Sigma Xi, The Scientific Research Society, and is a senior fellow at the National Academy of Engineering. Dr. Gibbons is a member of the National Academy of Engineering.

JOHN P. HOLDREN is the Teresa and John Heinz Professor of Environmental Policy and Director of the Program in Science, Technology and Public

Policy at the John F. Kennedy School of Government, and Professor of Environmental Science and Public Policy in the Department of Earth and Planetary Sciences, at Harvard University. He is currently the Chairman of the Committee on International Security and Arms Control (CISAC) and he chaired CISAC's panel that assessed reactor options for the disposition of excess plutonium. Dr. Holdren is also a member of the President's Committee of Advisors on Science and Technology (PCAST). In connection with PCAST, Dr. Holdren has chaired studies for the White House on protection of nuclear bomb materials (1995), the U.S. fusion-energy research and development program (1995), U.S. energy research and development strategy for the challenges of the 21st century (1997), and international cooperation on energy-technology innovation (1999). From 1996 to the present he has co-chaired with Evegeny Velikhov the U.S.–Russian Independent Scientific Commission on Plutonium Disposition (reporting to Presidents Clinton and Yeltsin). Dr. Holdren is a member of the National Academy of Sciences.

MICHAEL M. MAY is the Co-Director of Stanford University's Center for International Security and Cooperation and Professor (Research) of Engineering-Economic Systems and Operations Research at Stanford. He is currently Director Emeritus of the Lawrence Livermore National Laboratory of which he was the Director from 1965 to 1971. Professor May was technical advisor to the Threshold Test Ban Treaty negotiating team, a member of the U.S. delegation to the Strategic Arms Limitation Talks, and has been a member of the Defense Science Board, the General Advisory Committee to the Atomic Energy Commission, the Secretary of Energy Advisory Board, the RAND Corporation Board of Trustees, and the Committee on International Security and Arms Control of the National Academy of Sciences. He is a member of the Council on Foreign Relations and the Pacific Council on International Policy, and a Fellow of the American Physical Society and the American Association for the Advancement of Science.

WOLFGANG (PIEF) PANOFSKY is Professor and Director Emeritus at the Linear Accelerator Center at Stanford University (SLAC). He served as Director of SLAC during the period from 1961 to 1984. He is a current member of the Committee on International Security and Arms Control (CISAC) and chaired CISAC's study on plutonium disposition. He was a member of the President's Science Advisory Committee under Presidents Eisenhower and Kennedy and the General Advisory Committee on Arms Control to the President under President Carter. He has also served on the National Research Council (NRC) Committee to Provide Interim Oversight of the U.S. Department of Energy (DOE) Nuclear Weapons Complex, the DOE Panel on Nuclear Warhead Dismantlement and Special Nuclear Materials Controls, and the NRC Committee on Declassification of Information for DOE's Environmental Remediation and Related Programs. Dr. Panofsky is a member of the National Academy of Sciences.

STAFF

JOHN P. BORIGHT is the Executive Director of the Office of International Affairs of the National Academy of Sciences. From 1994 to 1995, he served as Deputy to the Associate Director for National Security and International Affairs in the Executive Office of the President at the Office of Science and Technology Policy. From 1989 to 1995, he also served as U.S. Delegate to the OECD Committee on Science and Technology Policy. During the period from 1989 to 1994 he served as Deputy Assistant Secretary for Science and Technology Affairs at the Department of State overseeing U.S. science and technology agreements with other countries, international space policy and program matters, and the science officer system at U.S. Embassies. During the period 1987 to 1989 Dr. Boright served as Director of the Division of International Programs at the National Science Foundation, where he developed international cooperative arrangements and U.S. access to science and engineering in other countries, particularly with Japan, other Asian countries, and the former Soviet Union and Eastern Europe. Prior to 1987 he served for 10 years at the Department of State, including a 4-year tour (1982–1986) as Counselor for Scientific and Technological Affairs at the U.S. Embassy in Paris. Dr. Boright's earlier professional experience includes work at the Goddard Space Flight Center, the U.S. Arms Control and Disarmament Agency, and the U.S. Mission to International Atomic Energy Agency in Vienna, Austria. Dr. Boright currently serves as U.S. Board member for the Science and Technology Center, Ukraine. He has received numerous awards for outstanding service. He is a member of Phi Beta Kappa and received a B.A. and Ph.D. in physics from Cornell University.

JO L. HUSBANDS is the Director of the Committee on International Security and Arms Control. From 1986 to 1991 she was Director of the Academy's Project on Democratization and a Senior Research Associate for its Committee on International Conflict and Cooperation. Before joining the NAS, from 1982 to 1986 Dr. Husbands was Deputy Director of the Committee for National Security, a Washington, D.C.-based non-governmental organization. She holds a Ph.D. in Political Science from the University of Minnesota and a Master's degree in International Public Policy (International Economics) from the Johns Hopkins University School of Advanced International Studies. Dr. Husbands has published widely on the topics of arms control, arms transfers, weapons proliferation, and international negotiations. She is a member of the board of the Arms Control Association, the editorial boards of International Studies Quarterly and International Politics, and a member of the International Institute for Strategic Studies.

WENDY D. WHITE is Director of the Division for International Organizations and Academy Cooperation (IOAC) at the National Research Council. Her office evaluates the directions of international science and technology and advances U.S. participation in international organizations and programs. IOAC provides a forum to discuss matters of common concern to all scientists, such as education, public understanding of science, the availability of and access to scientific information, new patterns of scientific communication, and the freedom to conduct science. Since joining the National Research Council in 1979, she has worked in more than 40 countries in Europe, Asia, Latin America, and Africa. She has degrees in French and History (Macalester College), a Master's degree in library science (University of Minnesota), and a post-graduate certificate in publishing (George Washington University).

TAMAE MAEDA WONG is a Program Manager in the Division for International Organizations and Academy Cooperation (IOAC) at the National Research Council. She manages the U.S. National Committee system that addresses international issues of interest to U.S. researchers such as collaboration of young investigators, free circulation of scientists, building communications and technology resources, and fostering science in the developing world. Dr. Wong has been with the National Research Council since 1993 addressing issues in chemical sciences, environmental technologies and management, international collaboration of young researchers, laboratory safety, and careers for science and engineering students. Prior to joining the Academies, she has conducted research in surface science at Brookhaven National Laboratories and Georgetown University. She holds Ph.D. and M.S. degrees in materials science and engineering from the University of Pennsylvania and a B.A. in physics from Bryn Mawr College. She has served on the editorial advisory board of the *Chemical and Engineering News* and was the editor for *Women in Science* magazine.

GEOFFREY S. FRENCH is a Research Associate for the National Academy of Sciences' Committee on International Security and Arms Control. He supports the committee in its dialogues with similar groups of scientists and former government officials in Russia, China, and India. He also supports the committee's ad hoc panels that advise the government in technical or policy issues. He has worked with the Academy since 1994, primarily in health policy, and has contributed to several studies for the Institute of Medicine. His undergraduate degree is in history and anthropology, and he completed his Master's degree in national security studies at Georgetown University.

MELISSA GOODWIN has worked in the Office of International Affairs of the National Research Council since 1997, beginning as an intern and returning as a program assistant after completing a legislative internship with the Irish Parliament. She has an M.A. in Irish Studies from the Catholic University of America and a B.A. in history from the University of Texas, Permian Basin.

KAI-HENRIK BARTH is a Ph.D. candidate in history of science and technology at the University of Minnesota. In his research he examines the role of scientists in nuclear arms control negotiations. His M.S. in experimental high-energy physics with a minor in history of science is from the University of Hamburg, Germany. Formerly, he was a research physicist at the German Electron Synchrotron Laboratory. Kai-Henrik is currently supporting the Committee on International Security and Arms Control as an intern.

WENDY BLANPIED is currently working on the Committee on Balancing Scientific Openness and National Security as a project assistant. Previously, she worked in Venezuela as an English teacher and as an editorial assistant for the Venezuelan American Chamber of Commerce. After graduating from the University of Maryland, she supported the French Embassy as an intern. She received her B.A. in French language and literature and European history in 1997.

APPENDIX C

Statement on Scientific Openness and National Security*

from Bruce Alberts, President, National Academy of Sciences
Wm. A. Wulf, President, National Academy of Engineering
Kenneth I. Shine, President, Institute of Medicine
and the Council of the National Academy of Sciences

May 21, 1999

We are deeply concerned about the consequences of potentially inappropriate restrictions on the program for foreign visitors at the Department of Energy's national laboratories. Such restrictions could harm our U.S. national interests by impeding scientific progress, weaken the nation's role as a key player in the international scientific community, and endanger international cooperative activities that bolster our national security and well-being by addressing such issues as nuclear safety and environmental cleanup. At the same time, we clearly recognize the importance of protecting U.S. national security interests from foreign espionage aimed at U.S. national laboratories. To contribute to the implementation of policies that maintain our scientific leadership while protecting national security, the National Academies will initiate a fast-track study with a workshop in July to examine these issues and make recommendations to the U.S. government.

A 1995 report from the Academies' National Research Council, *A Review of*

*For more information visit **www.nationalacademies.org/oia.**

the Department of Energy Classification Policy and Practice, urged DOE to adopt the following principle: "Construct high fences around narrow areas." That is, it recommended that the department maintain very stringent security around sharply defined and narrowly circumscribed areas, but reduce or eliminate classification around areas of lesser sensitivity. The report endorsed the view that scientific openness in unclassified areas is key to the health of the scientific enterprise.

New restrictions on interactions with foreign scientists would be damaging in ways we cannot fully anticipate. They would almost certainly lead to reciprocal restrictions on U.S. scientists' access to foreign laboratories, thereby greatly reducing our knowledge of and potential influence on other nations' activities. An unnecessarily restrictive environment also generates hostility and is likely to exaggerate concern about the intentions of others.

DOE national laboratories necessarily engage not only in classified military work but also in basic scientific research and educational programs, as well as technology transfer activities that stimulate scientific innovations and important new applications of technology. Many of the foreign scientists who visit U.S. national laboratories come by invitation because they bring new knowledge and expertise. Bringing a range of scientific expertise into these settings — from the United States and abroad — is essential for maintaining the intellectual vitality and quality of these laboratories and for sustaining their capacity to attract and retain promising young talent.

Several studies of the National Academies also have articulated the importance, for U.S. and international security, of increasing degrees of openness and transparency in certain programs. Openness reinforces confidence and helps to promote the security systems that are necessary for controlling chemical, nuclear, and biological weapons. The 1997 National Academy of Sciences report *Controlling Dangerous Pathogens* emphasizes that appropriately structured U.S.-Russian scientific cooperation, featuring direct lab-to-lab contact and broad transparency, would increase the certainty that chemical-weapons work is not continued in Russia. It also would help avoid the "brain drain" of specialists from Russia to undesirable places. Likewise, the 1999 National Research Council report *Protecting Nuclear Weapons Material in Russia* concludes that "continued DOE involvement in strengthening material protection, control, and accountability in Russia should be a high-priority national security imperative for the United States for at least a decade."

In the post-Cold War era, the scientific and engineering communities in this country have increasingly been called upon to play important diplomatic roles in establishing international partnerships. They have facilitated important progress in such areas as counter-proliferation, demilitarization, and weapons reduction, environmental cleanup, nuclear safety, and counter-terrorism, while helping to divert foreign military manpower toward civilian goals. These interactions, which are fostered by openness and by free communication among scientists, clearly are in the nation's best interests.

In conclusion, national security is served both through positive new scientific advances facilitated by international communication among scientists and through careful protection of crucial classified information from foreign espionage. The Academies' upcoming study will examine how best to achieve both of these objectives, which are essential to the general well-being of our citizens.

APPENDIX D

Symposium Agenda

MONDAY, AUGUST 2, 1999

9:00 **WELCOMING REMARKS**
E. William Colglazier
Executive Officer, National Research Council

9:15 **RISKS AND BENEFITS OF INTERNATIONAL SCIENTIFIC COLLABORATION FOR NATIONAL SECURITY**
Richard Meserve
Partner, Covington & Burling
Chair, Committee on National Security and Scientific Openness

9:45 **THE NATIONAL LABORATORIES TODAY: NEW CHALLENGES AND NEW OPPORTUNITIES**
Robert Galvin
Chairman of Executive Committee, Motorola, Inc.

11:00 **PANEL 1: BASIC SCIENTIFIC RESEARCH AT THE LABS**
Moderator: Michael May
James F. Jackson
Former Deputy Director, Los Alamos National Laboratory

Burton Richter
Director, Stanford Linear Accelerator Center

Gilbert G. Weigand
Deputy Assistant Secretary for Strategic Computing and Simulation
U.S. Department of Energy

1:30 **PANEL 2: RESEARCH AND PROGRAMS RELATED TO NATIONAL SECURITY**
Moderator: John P. Holdren

Rose Gottemoeller
Assistant Secretary, Nonproliferation and National Security
U.S. Department of Energy

Roy Schwitters
Professor of Physics, University of Texas

3:30 **PANEL 3: THE CURRENT CHALLENGE—ENSURING SECURITY AT THE DOE LABORATORIES**
Moderator: John McTague

William Fenzel
Assistant Director, Energy Audits
U.S. General Accounting Office

Ernest J. Moniz
Under Secretary
U.S. Department of Energy

Harlan Watson
Staff Director of the House Energy and Environment Science Subcommittee
House Science Committee

5:00 **ADJOURN**

TUESDAY, AUGUST 3, 1999

9:00 **PANEL 4: POLICY OPTIONS—MAXIMIZING SECURITY BY BALANCING SECRECY AND OPENNESS**
Moderator: Richard Meserve

William Happer
Professor, Princeton University

Alvin Trivelpiece
Director, Oak Ridge National Laboratory
President, Lockheed Martin Energy Research Corp.

R. James Woolsey, Jr.
Shea and Gardner
Former Director of Central Intelligence

11:00 **PUBLIC COMMENT AND DISCUSSION WITH THE PANEL**

12:00 **CLOSING REMARKS**

12:15 **ADJOURN**

Appendix E

U.S. Department of Energy Security Policies: Relevant Documents

The following documents describe or make recommendations for security policy at the U.S. Department of Energy (DOE). This list was designed to be concise rather than comprehensive. These documents provide an overview of policy and recommendations as well as context, but should not be considered a complete review of relevant literature.

LEGISLATION

U.S. Public Law 106-65. *National Defense Authorization Act for Fiscal Year 2000*. 106th Cong., 1st session, 1999.

This public law establishes the National Nuclear Security Administration within DOE. It also implements several recommendations from the Select Committee on National Security and Military Commercial Concerns with the People's Republic of China.

U.S. Congress. House. Intelligence Authorization Act for Fiscal Year 2000. 106th Cong., 1st session, 1999. HR.1555.

This bill contributed to the debate regarding the reorganization of DOE by outlining the organization and responsibilities of the Agency for Nuclear Stewardship.

DOE POLICY DOCUMENTS

Lawrence Livermore National Laboratories. Policy on hosting a foreign visitor (UCRL-MI-133770), May 13, 1999.

> This document describes the requirements for compliance with the laboratory's policy regarding export controls and foreign travel and protection of technical data.

Richardson, W., Secretary of Energy. Memorandum to heads of departmental elements and contractor organizations on unclassified foreign visits and assignments, July 14, 1999.

> These directives formalize the changes to DOE policy and procedures, provide additional clarification, and extend their applicability to other facilities. This document specifically exempts facilities that do not perform classified work and are therefore not subject to the requirements of DOE N 142.1.

Richardson, W., Secretary of Energy. Memorandum to heads of departmental elements and contractor organizations on DOE export control guidelines, July 28, 1999.

> This memorandum describes DOE policy on reviews for Export Controlled Information—a category of information defined as unclassified technical information whose export is subject to export control and whose unrestricted public dissemination could help proliferants or potential adversaries of the United States.

U.S. Department of Energy. List of sensitive subjects, July 1999.

> This is a list of areas of technical subject matter or technologies containing sensitive information. The list identifies subjects related to the development and production of weapons of mass destruction (nuclear, chemical, and biological) and their delivery systems (including missiles), conventional weapons, and other technologies deemed significant to the national security of the United States.

U.S. Department of Energy. Policy on unclassified foreign visits and assignments (DOE P 142.1), July 13, 1999.

> This policy outlines the responsibilities of those hosting a foreign visitor and the steps required, such as obtaining approval, checking the visitor's background, and protecting sensitive information.

U.S. Department of Energy. Notice on unclassified foreign visits and assignments (DOE N 142.1), July 13, 1999.

> This document supplements DOE Policy P 142.1 by defining terms and describing the requirements for background and indices checks for all unclassified

foreign visits and assignments at DOE field and contractor site (including DOE laboratories), among other security measures.

DOE NEWS RELEASES AND UPDATES

U.S. Department of Energy. Richardson unveils security reform package. News bulletin R-99-111, May 11, 1999.

This news release describes the Office of Security and Emergency Operations and the Office of Foreign Visits and Assignments Policy and their responsibilities. Supporting documents include: the DOE security reform package, the status of DOE counterintelligence measures and counterintelligence plan implementation, and further enhancements to DOE cybersecurity.

REPORTS ON AND RECOMMENDATIONS FOR SECURITY AT DOE LABORATORIES

President's Foreign Intelligence Advisory Board, Special Investigative Panel. 1999. Science at its Best, Security at its Worst: A Report on Security Problems at the U.S. Department of Energy (the "Rudman Report"). Washington, D.C.: White House.

This report is an analysis of the structural and managerial problems in DOE security and counterintelligence operations that makes recommendations for reform in policy and organization.

Secretary of Energy Advisory Board, Openness Advisory Panel. 1997. Responsible Openness: An Imperative for the Department of Energy. Washington, D.C.: U.S. Department of Energy.

This report examined the status and strategic direction for DOE's classification and declassification policies and programs, as well as other aspects of its efforts to enhance openness.

Secretary of Energy Advisory Board, Working Group on Foreign Visits and Assignments. 1999. Report of the Secretary of Energy Advisory Board Working Group on Foreign Visits and Assignments. Washington, D.C.: U.S. Department of Energy.

This report reviewed the policies and practices related to foreign visitors and assignees at DOE's laboratories and assessed the balance between security and science.

U.S. Central Intelligence Agency Review Panel. 1999. The Intelligence Community's Damage Assessment on the Implications of China's Acquisition of U.S. Nuclear Weapons Information on the Development of Future Chinese Weapons (the "Jeremiah Report"). Langley, Va.: U.S. Central Intelligence Agency.

This panel examined the extent to which the People's Republic of China was able to obtain classified information and the contribution this made to China's nuclear program.

U.S. Congress. House. Select Committee on U.S. National Security and Military/Commercial Concerns with the People's Republic of China. A Report of the Select Committee on U.S. National Security and Military/Commercial Concerns with the People's Republic of China (the "Cox Report"). 105th Cong., 2nd session, 1998. H.Report 105-851.

This report describes lapses in security policy and export control that the People's Republic of China could have used to improve its nuclear weapons program. Please note that the committee reviewed the unclassified version of the Cox Report as released in 1999.

U.S. General Accounting Office. 1997. DOE Needs to Improve Controls over Foreign Visitors to Weapons Laboratories. Washington, D.C.: U.S. Government Printing Office.

U.S. General Accounting Office. 1998. DOE Needs to Improve Controls over Foreign Visitors to its Weapons Laboratories. Washington, D.C.: U.S. Government Printing Office.

U.S. General Accounting Office. 1998. Problems in DOE's Foreign Visitor Program Persist. Washington, D.C.: U.S. Government Printing Office.

These reports describe the DOE security policies in regard to foreign visitors and assignees and the extent to which the DOE laboratories enforce them.