B.

NUCLEAR NONPROLIFERATION
SUBCOMMITTEE REPORT

Science and Technology in the Office of Defense Nuclear Nonproliferation

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October 20, 2001

SUMMARY

Finding: The support the National Nuclear Security Administration (NNSA) provides to the science and technology (S&T) base at the DOE National Laboratories is a unique and valuable contribution to the interagency national security community

Recommendation: The NNSA Administrator should work to ensure that the importance of this S&T base is recognized in the Government and is included in the National Security Strategy and related directives.

Finding: The research and development (R&D) portfolio of the NN-20 Office of Research and Engineering has been inadequately funded since the mid-1990s. This has had deleterious effects on the S&T base at the laboratories in the areas of nonproliferation and counterterrorism. We believe part of the problem has been insufficient leadership at high levels of DOE administration and failure to think strategically about the relationship of S&T to the Department's nonproliferation and counterterrorism mission. A second important, but insufficiently recognized, contribution of the S&T base at the NNSA laboratories is the work for federal agencies (work for others).

Recommendation: NNSA should take ownership of its special role in achieving national security objectives. The vision of NNSA should be to become a 'go-to' agency on technical matters relevant to nonproliferation and counterterrorism. In that role, NNSA will be a strategic partner with the other U.S. government agencies.

Finding: The nuclear nonproliferation mission of NNSA is generally understood, but that is not the case for other mission areas, most of which are shared with multiple federal agencies. There are three existing NNSA/NN mandates that are in particular need of updating and strengthening: (i) the chemical-biological mandate, specifically NNSA/NN's role in chemical-biological nonproliferation, domestic preparedness and operations, (ii) NNSA/NN's relationship with the newly established White House Office of Homeland Security , and (iii) NNSA/NN's mandate to work with domestic law enforcement. Recent events make clear that counterterrorism needs to become part of the recognized mission of NNSA.

Recommendation: The existing body of legislation, executive orders, and interagency memoranda of understanding should be reviewed and supplemented by additional measures at the highest possible levels to clarify and strengthen the mission of NNSA and, derivatively, of NN. The name "Office of Defense Nuclear Nonproliferation," should be reconsidered as well.

Finding: The integration of technology and policy has received too low a priority in recent years in the internal culture of what is now the NNSA Office of Defense Nuclear Nonproliferation. This problem was identified prior to creation of NNSA in a report of an earlier advisory committee (see Appendix A), which made a series of recommendations concerning the integration of technology and policy in all NN Offices and at the highest levels of DOE, including, especially, the planning and allocation processes. This problem persists. The NNSA 2001 strategic plan and reorganization document provide the framework for integrating technology and policy within NNSA and NN. The strategic plan articulates the contributions that the NN science and technology

base can make to national security objectives, including nonproliferation and counterterrorism. However, an implementation plan does not yet exist for NN.

Recommendation: Prepare an integrated plan for implementation of the NNSA 2001 strategic plan with specific goals and priorities, planning and financial management structure, an accounting of personnel and skills required, review procedures, and management practices that will sustain creativity and innovation at the laboratory level. Also, implement the recommendations of the earlier NNAC 2000 report, which describes measures aimed at integrating technology and policy more effectively, strengthening communications to the interagency policy community, expanding the use of external merit reviews in program selection and reviews processes, and expanding interactions with end-users of NN products.

Finding: The May 2001 NNSA reorganization report calls for an augmentation of approximately 50 federal staff positions in NN to address additional mission needs and replace personnel who have been on extended rotational assignments to NNSA from national laboratories and support contractors.

Recommendation: A majority of these new positions should go to individuals with scientific or engineering training and experience. In the area of biological nonproliferation and counterterrorism there is a particularly urgent need for in-house leaders who have genuine bioscience expertise.

Finding: The responsibility of fissile material disposition was transferred to NNSA in its founding legislation and assigned to the NN-60 Office. Disposal of the excess weapons-usable materials world-wide will require a substantial increase in U.S. funding over an extended period of time as well as a strengthening of the management structure.

Recommendation: NNSA should seek a stronger national commitment, and itself develop a stronger management structure, to stem nuclear proliferation and combat the threat of nuclear terrorism worldwide.

Finding: The NNSA national laboratories, together with the other DOE laboratories, possess a broad S&T capability that should be fully applied to meeting the requirements of the Intelligence Community. However, structural issues exist within NNSA, DOE, and the intelligence community that limit the contributions, and in some instances, preclude contributions resident in DOE national laboratories.

Recommendation: NNSA should become a more effective technical arm of the Intelligence Community. The optimal structure to achieve this should be explored.

I. PREFACE

I.1. Charge

The charge to the NNSA Advisory Committee was "to review the current NNSA research and development portfolio and make strategic recommendations for strengthening NNSA leadership in science and technology." To accomplish the part of this review relating to the science and technology (S&T) base for NNSA's nonproliferation and counterterrorism support programs, the Nuclear Nonproliferation (NN) subcommittee of the NNSA Advisory Committee concentrated its attention on the programs and activities that fall under the aegis of the Office of Defense Nuclear Nonproliferation (NN-1). The subcommittee considered the NN S&T programs and associated personnel at the DOE National Laboratories administered by NNSA (Los Alamos, Sandia, and Livermore), specifically, the R&D portfolio of the NN-20 Office of Nonproliferation Research and Engineering, and the work on nonproliferation conducted by the NNSA laboratories with funding from sources other than NN-20.

The subcommittee began its work in June 2001 and presented interim findings and recommendations to the full advisory committee in August 2001. In its initial review, the subcommittee made use of two earlier reviews of the NN-20 R&D portfolio: the February 25, 2000, report of the formerly constituted DOE Nonproliferation and National Security Advisory Committee (NNAC), [1]and the June 8, 1996, report of an ad hoc review committee,[2] as well as information provided by NNSA headquarters and by the NNSA national laboratories.

The importance of the advisory committee's task was reinforced by the events of September 11, 2001. National security is at a crossroads. The cold war and the post-cold war era are over. We are in a new era marked by great uncertainty. A number of studies are underway inside and outside of Government concerning the relationship of homeland security to traditional national security. It is important that the contributions of science and technology to counterterrorism—and the limitations of science and technology as well—be fully recognized in such studies.

Since September 11, all elements of the U.S Government have been engaged in responding to the immediate consequences of the events of that tragic day and to the subsequent anthrax incidents. The new Office of Homeland Security is similarly consumed by the process of coordinating near-term responses to the terrorism threat. Congress is only beginning discussion and debate on legislation that will have a major impact on the way the U.S. Government will be organized to conduct counterterrorism. NNSA is already active and has completed an initial assessment of existing assets at the NNSA national laboratories that can be brought to bear on the counterterrorism problem.

The missions of nonproliferation and counterterrorism have much in common. There is a great synergy between the two areas at the science and technology level. The national

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[1] *DOE Research and Technology Against the Threat of Weapons of Mass Destruction: Review of the Department of Energy Office of Nonproliferation Research and Engineering (NN-20).* Department of Energy Nonproliferation and National Security Advisory Committee, February 25, 2000.

[2] *Report of the Comprehensive Research and Development Review Committee for the U.S. Department of Energy, Office of Nonproliferation and National Security,* Dr. Wolfgang K.H. Panofsky, Chair, June 8, 1996.

nonproliferation science and technology base has many assets that can be brought to bear in both areas.

I.2. State of the Health of the S&T Base for NNSA Nonproliferation and Counterterrorism Programs.

The collapse of the Soviet Union in the early 1990s led to an unparalleled new threat with respect to proliferation and counterterrorism. The responsibilities and budgets of the NN-1 Office grew rapidly in response to concerns that nuclear proliferation would be fueled by the leakage of fissile materials and human expertise from the territory of the former Soviet Union. Concerns about the proliferation of chemical and biological weapons soon followed when it became appreciated that these types of weapons could be developed by a much wider set of actors. NN-1 then took on certain responsibilities for such threats as well. In the mid-1990s, however, funding for NN-20 stagnated.

In sharp contrast to the funding pattern, concerns about the proliferation of weapons of mass destruction and how such weapons might be used by states or sub-state actors grew steadily. So too did U.S. efforts to prevent the loss of nuclear weapon materials and expertise from Russia. In addition, efforts continued throughout the period to strengthen the international nonproliferation regimes for all types of weapons of mass destruction. Unfortunately, this increased emphasis was not applied to R&D. In fact, R&D funding actually decreased when inflation is taken into account.

The underfunding of the NN-20 R&D Portfolio for more than a half-decade has had deleterious effects on the NN S&T base at all of the DOE national laboratories. In addition, opportunities have been lost to bring the full U.S. science and technology enterprise to the nonproliferation challenge.

There are undoubtedly multiple reasons behind the stagnation of support for S&T in NN areas starting in the mid-1990s. We believe that part of the problem has been insufficient leadership at high levels of DOE administration and failure to think strategically about the relationship of science and technology to the Department's nonproliferation and counterterrorism missions.

The integration of technology and policy has received too low a priority in recent years in the internal culture of what is now the NNSA Office of Defense Nuclear Nonproliferation. The NNAC 2000 report cited earlier makes several recommendations concerning the integration of technology and policy in all NN Offices and at the highest levels of DOE, including, especially, the budget planning and allocation processes. [3]

The tragic and unexpected events of September 11 directly impact NNSA and the future of its Office of Defense Nuclear Nonproliferation. Further impacts can be expected. The weakness of our domestic security systems and our need for new intelligence assessment

[3] The recommendations from the NNAC 2000 report, *DOE Research and Technology Against the Threat of Weapons of Mass Destruction: Review of the Department of Energy Office of Nonproliferation Research and Engineering (NN-20),* are repeated in appendix A of this current report.

capabilities, were laid bare on September 11 in a way that no report could do. The events of that infamous day add enormous weight to the importance and urgency of the mandate NNSA/NN has to bring the S&T resources of the DOE laboratories—all DOE laboratories—to the nonproliferation, counterterrorism mission.

From the perspective of science and technology, work on nonproliferation will often have utility for counterterrorism, and vice versa. It would be a mistake to think of two distinct science and technology bases for these two missions; there is only one. It is both cost effective and technically advantageous to have research and engineering efforts for both applications managed in a coordinated way. It is also important to engage the relevant science and technology enterprise of the country. A key finding of the NNAC 2000 Report was that science and technology support for policy is a crucial contribution that NNSA brings to the interagency national security community. We strongly reaffirm that finding.

The initial NN-20 appropriation of $208.5M in FY02 fell below the $222.8M. funding level in FY01 However, later supplemental funding increased the total substantially to $286.5M, allowing major increases in the R&D for the NN-20 Proliferation Detection and Chemical and Biological Domestic Preparedness programs. The Administration's request for funding of $283.4M in FY03 will continue this much needed turn-around in NN-20 funding.

The products of investments in NN-20 R&D are usually absent from public view. However at the time this report is being completed, the Biological Aerosol Sentry and Information System (BASIS), a product of the NN-20 Chemical and Biological Domestic Preparedness program is in public use at Salt Lake City Winter Olympics monitoring the air at multiple sites continuously for biological pathogens. BASIS is but one example of the way in which S&T contributes to national security in tangible ways.

Biological weapons are only one part of the proliferation and terrorism threat. Science and technology have much to offer across the entire spectrum of threats. Both the potential and the limitations of S&T must be appreciated by the interagency policy community. The NN S&T base resident in the NNSA national laboratories and in the wider DOE national laboratories is an invaluable asset that needs to be engaged fully in coordination with the other sectors of the U.S. science and technology community.

II. Strategic Vision Regarding NNSA's Nonproliferation and Counterterrorism Programs.

NNSA and its constituent offices that deal with nonproliferation and counterterrorism need to think much more strategically than in the past, both internally and externally. The danger is that decisions will be made to allocate funding and other resources without adequate understanding of the contributions of science and technology to achievement of U.S. national security goals which cut across the nonproliferation and counterterrorism missions.

Recommendation:

NNSA should take ownership of its special role in achieving national nonproliferation and counterterrorism objectives. The vision of NNSA should be to become a 'go-to' agency on technical matters relevant to nonproliferation and counterterrorism. In that role, NNSA will be a strategic partner with the other U.S. government agencies.

III. Strengthening the Office of Defense Nuclear Nonproliferation (NN).

The nuclear nonproliferation mission of NNSA is generally understood, but this is not the case for other NN mission areas, which are shared with multiple federal agencies. There are three NNSA/NN mandates that are in particular need of strengthening: (i) the chem-bio mandate, specifically NNSA/NN's role in nonproliferation, domestic preparedness and operations, (ii) NN's relationship with the newly established Homeland Security Office, and (iii) the mandate to work with domestic law enforcement. Recent events make clear that counterterrorism needs to become part of the recognized mission of NNSA as well.

Recommendation

We recommend that the existing body of legislation, executive orders, and interagency memoranda of understanding be reviewed and supplemented by additional measures at the highest possible levels to clarify and strengthen the mission of the Office of Defense Nuclear Nonproliferation.[4] The name "Office of Defense Nuclear Nonproliferation," should be reconsidered as well.

IV. Leadership of NNSA's Nonproliferation and Counterterrorism Programs.

The confirmation of Ambassador Linton Brooks as NNSA Deputy Administrator for Nuclear Nonproliferation (NN-1) was an important step forward. As the new Deputy Administrator for Nuclear Nonproliferation, he took office with two important pieces of work in place: (i) the "NNSA 2001 Strategic Plan," and (ii) NNSA "Report to Congress on the Plan for Organizing the National Nuclear Security Administration," May 2, 2001. The first of these documents describes the NN mission, goals, and strategies in accord with the founding legislation for NNSA. This builds on the historical legacy of stewardship of nonproliferation science and technology that reaches back to the Atomic Energy Agency era. The second document describes how NNSA will be administered and how the functions of the NN Office will be divided among five offices: (1) Nonproliferation Research and Engineering (NN-20), (2) International Nuclear Safety (NN-30), (3) Arms Control and Nonproliferation (NN-40), (4) International Material Protection and Emergency Cooperation (NN-50), and (5) Fissile Materials Disposition (NN-60).

[4] The letter sent to the NNSA Administrator on August 27, 2001, from the Chairman of the NNSA Advisory Committee, spoke to this same concern. The letter "strongly recommended that the new [national security] strategy [being drafted by the White House] give explicit mention to the importance of preserving America's science and technology base for dealing with the threats posed by the proliferation of weapons of mass destruction and NNSA's role as steward of this national asset."

There are a number of changes that need to be made before NNSA can fulfill its potential with respect to the NN mission. Most importantly, the NN science and technology base at the DOE national laboratories needs a champion, and that champion must be the Deputy Administrator for Nuclear Nonproliferation, backed by the full support of the Administrator of NNSA and the Secretary of Energy.

V. Planning for the S&T Base for Nonproliferation and Counterterrorism.

The NNSA 2001 strategic plan and reorganization document provide the framework for integrating technology and policy within NNSA and NN. The strategic plan articulates the contributions that the NN science and technology base can make to national security objectives, including nonproliferation and counterterrorism. However, an implementation plan does not yet exist for NN. Such a plan would assist NNSA in integrating its programmatic efforts and maximizing the synergy of its technical programs, provide prioritization of programs, sound allocation of resources, and maximize integration across programs.

Recommendation:

An integrated plan for implementation should be prepared with specific goals and priorities, planning and financial management structure, an accounting of personnel and skills required, review procedures, and management practices that will sustain creativity and innovation at the laboratory level.

VI. Staffing Issues Relating to NNSA Nonproliferation and Counterproliferation Programs.

VI.1. Staffing the Office of Nonproliferation at NNSA.

The May 2001 NNSA reorganization report calls for an augmentation of approximately 50 federal staff positions in NN to address additional mission needs and replace personnel who have been on extended rotational assignments to NNSA from national laboratories and support contractors.

Recommendations:

We recommend that a majority of these new positions go to individuals with scientific or engineering training and experience. This will ensure that NN has the in-house technical expertise needed for strategic leadership; successful integration of technology and policy; effective interaction with other parties of the interagency national security community; and the ability to facilitate the work of members of the S&T community at the national laboratories with end-users of NN products. In the area of biological nonproliferation and counterterrorism there is a particularly urgent need for in-house leaders who have genuine bioscience expertise.

VI.2. Recruitment at the Laboratories.

The events of September 11, 2001 and the subsequent anthrax threats have had a profound impact. The U.S. S&T community is eager to help. On September 20,2001, for instance, Bruce Alberts, William Wulf, and Kenneth Shine, the respective presidents of the National Academies of Science, Engineering, and Medicine, wrote President Bush saying, "As we enter a new war against terrorism-one that will demand a focus on the complex interplay between technological, sociological, and political issues, the National Academies stand ready to provide advice and counsel in any way that the nation desires." In his confirmation testimony on October 9,2001 John Marburger III, then director designate of the Office of Science and Technology Policy, said, "The struggle against terrorism has many fronts, and science and technology pervade them all." David Daniel, Dean of the College of Engineering at the University of Illinois at Urbana-Champaign, called his department heads together on the Friday of the week of September 11, 2001 to discuss how the faculty and students of the college could contribute to the counterterrorism challenge, as did leaders at other academic institutions. Expressions of support from the science and technology community came forward nationwide.

The current support described above will have a beneficial impact on recruiting at the DOE National Laboratories. The members of the NN subcommittee met with young members of the science and technology base during meetings in August 2001 at LLNL, LANL, and SNL. We were pleased to learn how many of these young scientists and engineers reported that they found the opportunity to apply their technical expertise to nonproliferation problems an important factor in their choice of a national laboratory career. The opportunity to work on the counterterrorism challenge will have an even a stronger attraction given that events of September 11, 2001 touched every American.

VII. NNSA Programs for Nonproliferation and Counterterrorism.

VII.1. Funding for Nonproliferation and Counterterrorism Programs

The position of NNSA/NN at critical times in the budget cycle must be strengthened and efforts are needed to ensure greater interactions between NNSA and end-users of NN technology. A government-wide understanding of the full scope of the NN mission will broaden support for the NN-20 R&D portfolio and the science and technology that underlies it. The NN S&T base will wither if it fails to receive the funds necessary to do meaningful work on the scale of the threats facing the nation. The new security environment confronting us heightens the importance of the NN portfolio and the need for improved planning and prioritization.

VII.2. NNSA and Fissile Material Disposition.

The world inventory of weapons-useable materials, both in assembled weapons and in fissile material stockpiles, is enormous. The responsibility for fissile material disposition was transferred to NNSA in its founding legislation and assigned to the NN-60 Office. The reduction and control of this inventory must be an overriding national objective and NN within NNSA must take a leadership role.

Disposing of the excess weapons-usable materials in a reasonable time is essential to U.S. nonproliferation goals. It will require a substantial increase in U.S. funding, as well as strengthening of the management structure.

Recommendation:

We recommend a substantial increase funding for fissile materials disposition programs.

VII.3. NNSA Support to the Intelligence Community.

The NNSA laboratories, together with the other DOE laboratories, possess a broad scientific and technical capability that should be fully applied to meeting the requirements of the Intelligence Community, including the national objectives of nonproliferation and counterterrorism. These capabilities range from the advice of an individual scientist to the development and deployment of complex systems. However, structural issues exist within NNSA, DOE, and the intelligence community that limit the contributions, and in some instances, preclude contributions resident in the DOE laboratories.

Currently, the DOE is authorized and directed to: (1) overtly collect information with respect to foreign energy matters, (2) produce and disseminate foreign intelligence necessary for the Secretary of Energy's responsibilities, (3) formulate intelligence collection and analysis requirements where the special expert capability of the department can contribute, (4) provide expert technical, analytical and research capability to other agencies within the Intelligence Community.

Recommendation:

This broad authorization needs to be matched with an appropriate administrative structure to maximize the contribution of the science and technology base at the NNSA and other DOE laboratories to the Intelligence Community. NNSA should become a more effective technical arm of the Intelligence Community. The optimal structure to achieve this needs to be explored.

APPENDIX A

The following are the recommendations specified in the executive summary of *DOE Research and Technology Against the Threat of Weapons of Mass Destruction: Review of the Department of Energy Office of Nonproliferation Research and Engineering (NN-20),* Department Energy Nonproliferation and National Security Advisory Committee, February 25, 2000 (also referred to as the "NNAC 2000 Report.")

Recommendation 1: Cooperative interactions between the technology and policy offices of NN should become a regular feature of the annual budget and planning process.

At an appropriate time in the budget cycle, NN policy offices should formally cite their nonproliferation technology needs to NN-20 and NN-20 should respond with its plans to address those needs. At other time of the budget year and in a more informal manner, NN-20 together with representatives from the DOE national laboratories should provide NN policy offices with information about new opportunities emerging from technological advances. The policy offices should in turn present their technology implementation plans and practices.

Recommendation 2: NN should assume the responsibility for communicating to the interagency policy community two categories of technical information: (i) the basic capabilities and limitations of today's technologies that support U.S. nonproliferation, arms control, and security objectives, and (ii) the mid- and long-term prospects for improved technologies relevant to the NN mission. This information, which we shall refer to as the Annual Nonproliferation Technology Assessment, should be made widely available within government in the form of a classified annual report or an equivalent communiqué.

Given its history and unique combination of technology and policy expertise, NN has an affirmative responsibility to keep the wider governmental community apprised of the potential—and the limitations—for technology to address national needs. No other unit of the U.S. Government is capable of doing so.

The Annual Nonproliferation Technology Assessment would primarily serve members of interagency groups engaged in developing options for nonproliferation policies and in preparatory work for arms control planning and negotiations and in supporting domestic counterterrorism objectives. However, the Assessment would also strengthen communications among DOE national laboratories and DOE headquarters and provide discipline among proponents of particular technologies by recognizing both the promise and limitations of a given approach.

Recommendation 3: The Advisory Committee recommends that the activities of the DOE Nuclear Transfer and Supplier Policy Division (NN-43) in promulgating lists of unclassified but export-controlled items be subject to review by representatives from the scientific community within NN. In case of conflict, the assistance of the NN Science Advisor should either settle the matter or refer it to higher authority in DOE.

The implementation of export controls on information (knowledge) is an area in great need of help from the technical community. NN has the responsibility, exercised through the NN-43 office, to publish lists of "sensitive unclassified technical information" and export-controlled information.

The breadth of the scientific and engineering work sponsored by NN-20 does not permit a common set of project selection and review procedures to be applied uniformly across its entire R&D portfolio.

Nevertheless, there are principles that can be applied across the portfolio and serve as guidelines to strengthen the selection and review processes and to ensure high quality. Such principles would serve as a unifying influence for choosing appropriate project selection and review procedures for each area of the NN-20 R&D portfolio.

Recommendation 4: NN-20 should expand its use of external merit reviews in project selection decisions and subsequent progress reviews, including it wherever feasible in managing its R&D portfolio.

Merit review is defined by two principal criteria: (1) scientific and technical quality, and (2) potential contribution to nonproliferation and national security goals. The extent to which merit review can be incorporated varies by program area. The chemical and biological nonproliferation program area of NN-20 has made commendable use of merit review for final project selection and some other program areas use it as well but in less explicit ways. For activities that are primarily applied, especially those serving highly classified applications, project selection and review procedures may need to be less open and inclusive, but they should always include individuals from outside of NN-20 and outside of the DOE laboratory community. Where special circumstances make this impractical, the reasons should be documented.

Recommendation 5: The transparency and documentation of the project selection and review processes for the NN-20 R&D portfolio need to be enhanced.

The NN-20 office should ensure that its selection and review procedures are well publicized and well documented. Regular procedures will ensure that the broader science and technology community is informed about the NN-20 program and its purpose and standards.

Recommendation 6: A clear balance needs to be established between the reviews that NN-20 program management conducts to fulfill its responsibilities and what is best done at the laboratory level.

DOE headquarters and the DOE national laboratories can and should have separate domains of accountability. Recommendations 4-5 above are intended as guidelines for all reviews and procedures, not as additional layers of review and management.

DOE headquarters should focus its attention on initial project selection, end-user needs, integration of technology and policy, and interagency education. Headquarters should rely

more on the science and engineering review processes at the laboratories than it currently does for making judgments about the technical progress of projects once they are underway, provided these reviews are done in a manner that is clearly articulated and include technical experts from outside the laboratory. For multi-laboratory projects or when significant technical or budgetary problems arise in previously approved projects at a single laboratory, a combination of headquarters and laboratory reviews would be appropriate. Annual reviews of all projects by NN-20 should continue; redundant reviews should be avoided.

Recommendation 7: Existing practices for NN-20 interactions with end-users need to be given greater visibility and articulation within NN and also in the wider interagency community.

Areas already exist where NN-20 has excellent communications with end-users and representatives from the end-user community are involved in review of programs and technical progress. By expanding and codifying practices within NN-20 that are most effective, relationships with end-users will become more fruitful. This is especially true when NN-20's work is closely tied to end-user needs. There can be unexpected benefits as well. Brainstorming with potential end-uses can sometimes lead to innovative ideas for new technologies.

Recommendation 8: To maximize the prospects for successful transfer of new technologies, communications with potential end-users should be opened as early as possible and proceed through all the phases of the work for which NN-20 has responsibility.

Discussions should be technical, but with the policy implications and costs spelled out with due regard given to the end-user's ability to make commitments to a technology in the development stage. It is important in the earliest phases of concept formulation that a prospective end-user be made aware of technological and scientific advances potentially available from an NN-20 project and the uncertainties in those assessments be communicated as well. The Annual Nonproliferation Technology Assessment recommended above will help, but direct communications between NN-20 and end-users are needed as well.

There should be greater opportunity for the wider U.S. scientific and technical community to contribute to the success of the NN-20 portfolio. This can be done through open competition administered by DOE Headquarters and through partnerships chosen and managed by the DOE national laboratories.

The DOE national laboratories have a strong history of interaction with the larger scientific and technical community. Participation of non-DOE personnel in NN-20 projects has been successful. The participation of appropriate institutions outside of the DOE national laboratories draws into the NN-20 portfolio the expertise of the broader U.S. scientific and technical enterprise.

Recommendation 9: Program areas of the NN-20 portfolio that are chosen for open competition should be ones in which high expertise already exists in the academic sector and/or the industrial sector.

The NN-20 budget is too small to fund development of expertise in nonproliferation or verification technologies where it does not already exist. Furthermore, it would be wasteful to duplicate expertise that already exists at the DOE national laboratories. For academic competitors the work will need [to] be restricted to the unclassified level or special arrangements made.

Areas that come to mind as candidates for open competition include seismic verification technologies for very low yield underground nuclear tests and chemical and biological agent detection and identification technologies. Other possible areas might be specialized electronic chip development and certain radio-frequency technologies. Many parts of the NN-20 R&D program are unsuitable for competition that reaches beyond the DOE national laboratories.

Recommendation 10: NN-20 should document more systematically funding that goes directly to institutions outside of the DOE system as well as funding that goes to the DOE national laboratories and then goes out to consultants, subcontractors and collaborators.

Partnerships in the form of consultantships, subcontracting, sabbatical visits, etc., involving academic researchers and subcontracting with industry for development and manufacture are all mechanisms with which the DOE national laboratories have much experience. These are clear evidence that the DOE national laboratories reach out to the broader science and technology community when the needed expertise is not available in-house. The recommended documentation will give greater visibility and clarity to existing practices.

The DOE national laboratories were created as partners to the U.S. Government under contracts documenting that partnership, not as contractors in the ordinary sense. Their continued existence requires that they remain centers of excellence and responsive to national needs.

Recommendation 11: NN-20 headquarters and administrators at the DOE laboratory complex who manage funds received from NN-20 should work together to identify metrics that will serve as objective indicators of the quality of the work performed and the impact of that work on nonproliferation and national security goals. Records of quality and impact should be kept and reported on a regular basis.

The diversity of the NN-20 portfolio means that no single set of metrics will be suitable for all areas. Metrics used to evaluate the quality of NN-20 projects and program management should be chosen in a manner matched to the activity being evaluated.

The Committee does not wish to suggest specific metrics. There are too many possibilities worth considering. For work at the basic scientific level, publications, invited talks, and research funds received on a competitive basis—the norm in the academic community—can be used for evaluation, but this is suitable for only a small part of the NN-20 R&D portfolio. For

applied research and development activities, metrics that correspond to success in moving projects toward nonproliferation and national security objectives in cost effective ways (and for terminating them when initial expectations prove unjustified!) and for interacting effectively with end-users are needed. Prizes for research and technology achievements, testimonials from end-users of NN-20 technologies, and citations of locations and exercises at which NN-20 technology have been used are possibilities.

Indicators of the quality of individuals funded by NN-20 should be included as well, whether or not the indicators refer directly to NN-20 activities. For example, the selection of an NN-20 supported scientist or engineer for service on an interagency group, receipt of an award from a Laboratory Directed Research and Development (LDRD) competition, patents granted, and the like should all be used.

Most DOE national laboratories have one or more external advisory committees. Reports from such committees usually review performance and can be useful sources of information on the quality of personnel, programs, and projects.

Classified work is intrinsically more difficult to evaluate because the peer group is often small, but a good faith effort needs to be made in each case.

The DOE national laboratories collectively constitute a major sector of the nation's science and technology enterprise along with the academic and industrial sectors. The health of the DOE sector is important to all the other sectors.

Each of the sectors of the national science and technology enterprise has unique capabilities and there are areas of complementing, and in some cases intersecting, expertise—a healthy situation. Each sector contributes to the vigor and quality of the overall national enterprise, and each contributes to national security and the well being of the country.

Recommendation 12: Within the constraints imposed by the need to protect classified information, greater efforts should be made to increase professional contacts and interactions between scientists and engineers engaged in NN-20 projects at the DOE national laboratories and members of the larger national scientific and engineering community.

Professional contacts and interactions are essential to maintaining vibrant scientific and technical work. They can be achieved, for example, by means of seminars, conferences, and exchanges of scientists and engineers. Maintaining contact with the outside national scientific and engineering communities will become all the more important as NN-20 moves with NN into the new DOE National Nuclear Security Administration.

There are, of course, areas where security needs preclude any outside interactions, but this requirement should not drive a restrictive policy that is applied to all areas. For example in the chemical and biological disciplines, the unclassified community outside of DOE has vast resources and knowledge that cannot be duplicated by DOE. DOE scientists and engineers must remain connected to this larger community.

The DOE national laboratories comprise a diverse group of scientists and engineers who understand the signatures of the proliferation of weapons of mass destruction, the technologies that can be marshaled to exploit these signatures, and the requirements of the end-users in the national security community. This unique combination of expertise exists only in the classified environment of the D0E national laboratories. We refer to it as the nonproliferation and national security technology base (NN Tech Base).

DOE laboratory administrators, scientists, and engineers have long expressed concern that the NN Tech Base was endangered, but little or no attention has been paid to these concerns. The one-third reduction in the DOE national laboratories' authority to "tax" programs to fund LDRD budgets in the current fiscal year [FY2000] will further diminish the NN Tech Base.

The NN Tech Base in the DOE laboratory complex is shrinking due to recurrent under-funding. Current trends need to be reversed.

The Advisory Committee recognizes that no single agency or office can be the sole guarantor of the NN Tech Base. However, the Office of Nonproliferation Research and Engineering (NN-20) has long been a key shareholder through its support of the development of technology linked to its nonproliferation and national security objectives. The Office must remain a strong supporter.

Recommendation 13: DOE should seek increased funding for NN-20 for the support of advanced concepts research on nonproliferation and national security technologies in future years. This might be done in steps starting at a level of 5% of the NN-20 R&D budget and growing to 10% or more over time.

An NN-20 budget line named "advanced concepts" has been lost in recent years as DOE was required to take on new nonproliferation technology initiatives but was not given corresponding increases in budget. Restoration of advanced concepts funding should be a high priority.

The need for a stable level of funding for advanced concepts is easily understood. Such funding allows scientists and engineers of the NN Tech Base the opportunity to spend a small fraction of their time conceiving and exploring new ideas that may offer fundamentally new and more capable nonproliferation and national security technologies than those currently available or under development—in other words, the opportunity to be creative in an applied context. Funding for advanced concepts is important in its own right, and it will also help attract the best and the brightest of new generations of scientists and engineers to the NN Tech Base.

A portion of the NN-20 R&D portfolio must continue to be flexible and go to the DOE national laboratories in support of high-quality, creative research on future nonproliferation and national security technologies.

Advanced concepts research need not necessarily have a definite end-user, but the scientists and engineers involved should be motivated by possible applications for their work. Indeed, it

would be counterproductive to national security to require that all work on nonproliferation and national security technologies be driven by the immediate needs of users. Focusing exclusively on immediate needs, as has happened at some federal laboratories, inevitably turns innovative programs, such as those in the NN-20 portfolio that can occasionally make revolutionary advances, into an evolutionary programs [sic] that ultimately become stagnant and produce little of real value.

As a general rule, NN-20 does not carry the development of technologies into the manufacturing stage.

The prime exception occurs for satellite-based sensors that are designed to detect nuclear explosions in the atmosphere or in space. Nuclear Detonation Detection System (NDS) packages are deployed in secondary payloads on ballistic missile infrared early warning Defense Support Program (DSP) satellites and on satellites of the Global Positioning System (GPS).

Recommendation 14: DOE/NN should conduct a study assessing the desirability of DOE continuing to be the manufacturer of operational satellite-based Nuclear Detonation Detection System (NDS) packages. The study should involve participation of all stakeholders.

The key question to examine in the study is whether it might be better to follow an alternative model for the manufacturing stage, a model more in line of what NN-20 does in the rest of its R&D portfolio. Namely, NN-20 would carry the development of new-generation NDS packages through the prototype development and testing stages, and then turn the drawings and specifications over to an industrial manufacturer selected on a competitive basis. DOE scientists and engineers would remain involved as consultants to resolve problems that arise in manufacture and help with liaison to the Air Force Project Office that has responsibility for the GPS.

The question should be decided on the basis of what is best for the country and makes the best use of expertise in the DOE national laboratories. It may be that there is no industrial interest or insufficient industrial expertise in the specialized areas involved in manufacturing the NDS packages to change the way that manufacturing is done now.