Strengthening U.S-Russian Cooperation on Nuclear Nonproliferation

U.S Committee on Strengthening U.S. and Russian Cooperative Nuclear Nonproliferation, Development, National Research Council, Russian Committee on Strengthening U.S. and Russian Cooperative Nuclear Nonproliferation, Russian Academy of Sciences

ISBN: 0-309-55094-7, 104 pages, 8 1/2 x 11, (2005)

STRENGTHENING U.S.–RUSSIAN COOPERATION ON NUCLEAR NONPROLIFERATION

RECOMMENDATIONS FOR ACTION

U.S. Committee on Strengthening U.S. and Russian Cooperative Nuclear Nonproliferation

Development, Security, and Cooperation
Policy and Global Affairs

NATIONAL RESEARCH COUNCIL
OF THE NATIONAL ACADEMIES

Russian Committee on Strengthening U.S. and Russian Cooperative Nuclear Nonproliferation

RUSSIAN ACADEMY OF SCIENCES

THE NATIONAL ACADEMIES PRESS
Washington, D.C.
www.nap.edu

THE NATIONAL ACADEMIES PRESS 500 Fifth Street, N.W. Washington, DC 20001

NOTICE: The project that is the subject of this report was approved by the Governing Board of the National Research Council, whose members are drawn from the councils of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. The members of the committee responsible for the report were chosen for their special competences and with regard for appropriate balance.

This study was supported by Contract/Grant No. 6058 between the National Academy of Sciences and the Nuclear Threat Initiative. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the views of the organizations or agencies that provided support for the project.

International Standard Book Number 0-309-09669-3

Additional copies of this report are available from the National Academies Press, 500 Fifth Street, N.W., Lockbox 285, Washington, DC 20055; (800) 624-6242 or (202) 334-3313 (in the Washington metropolitan area); Internet, http://www.nap.edu.

Printed in the United States of America

THE NATIONAL ACADEMIES

Advisers to the Nation on Science, Engineering, and Medicine

The **National Academy of Sciences** is a private, nonprofit, self-perpetuating society of distinguished scholars engaged in scientific and engineering research, dedicated to the furtherance of science and technology and to their use for the general welfare. Upon the authority of the charter granted to it by the Congress in 1863, the Academy has a mandate that requires it to advise the federal government on scientific and technical matters. Dr. Ralph J. Cicerone is president of the National Academy of Sciences.

The **National Academy of Engineering** was established in 1964, under the charter of the National Academy of Sciences, as a parallel organization of outstanding engineers. It is autonomous in its administration and in the selection of its members, sharing with the National Academy of Sciences the responsibility for advising the federal government. The National Academy of Engineering also sponsors engineering programs aimed at meeting national needs, encourages education and research, and recognizes the superior achievements of engineers. Dr. Wm. A. Wulf is president of the National Academy of Engineering.

The **Institute of Medicine** was established in 1970 by the National Academy of Sciences to secure the services of eminent members of appropriate professions in the examination of policy matters pertaining to the health of the public. The Institute acts under the responsibility given to the National Academy of Sciences by its congressional charter to be an adviser to the federal government and, upon its own initiative, to identify issues of medical care, research, and education. Dr. Harvey V. Fineberg is president of the Institute of Medicine.

The **National Research Council** was organized by the National Academy of Sciences in 1916 to associate the broad community of science and technology with the Academy's purposes of furthering knowledge and advising the federal government. Functioning in accordance with general policies determined by the Academy, the Council has become the principal operating agency of both the National Academy of Sciences and the National Academy of Engineering in providing services to the government, the public, and the scientific and engineering communities. The Council is administered jointly by both Academies and the Institute of Medicine. Dr. Ralph J. Cicerone and Dr. Wm. A. Wulf are chair and vice chair, respectively, of the National Research Council.

www.national-academies.org

U.S. COMMITTEE ON STRENGTHENING U.S. AND RUSSIAN COOPERATIVE NUCLEAR NONPROLIFERATION

Rose Gottemoeller, Senior Associate, Carnegie Endowment for International Peace, *Chair*
Major General William F. Burns, Distinguished Fellow, U.S. Army War College
Orde Kittrie, Associate Professor, College of Law, Arizona State University
M. Teresa Olascoaga, Director, Cooperative International Programs Group, Sandia National Laboratories
Daniel Poneman, Principal, The Scowcroft Group
William H. Press, Senior Laboratory Fellow, Los Alamos National Laboratory

RUSSIAN COMMITTEE ON STRENGTHENING U.S. AND RUSSIAN COOPERATIVE NUCLEAR NONPROLIFERATION

Ashot Arakelovich Sarkisov, Director, Division of Applied Problems of Nuclear Power, Nuclear Safety Institute, RAS, *Chair*
Evgeny Nikolaevich Avrorin, Scientific Director, Zababkhin Russian Federal Nuclear Center
Valery Ivanovich Rachkov, Director, Nuclear Power Department, Federal Atomic Energy Agency of the Russian Federation
Vladimir I. Rybachenkov, Counselor, Ministry of Foreign Affairs of the Russian Federation
Emilia V. Sidorova, Attaché, Ministry of Foreign Affairs of the Russian Federation

Staff

Christopher A. Eldridge, Study Director, National Research Council
Rita S. Guenther, Senior Program Associate, National Research Council

Preface and Acknowledgments

In September 2003, the U.S. National Academies and Russian Academy of Sciences jointly organized a workshop on impediments to cooperation between the U.S. and Russia on nuclear nonproliferation. The product of that effort was a report entitled *Overcoming Impediments to U.S.-Russian Cooperation on Nuclear Nonproliferation: Report of a Joint Workshop*.[1] The present fast-track study builds upon that earlier collaboration by providing the consensus recommendations and conclusions of a joint U.S.-Russian committee about the most attractive path forward for cooperation between the two countries on nuclear nonproliferation. The National Research Council of the National Academies appointed the members of the U.S. committee, while the Russian Academy of Sciences appointed the members of the Russian committee. All members of the joint committee, U.S. and Russian, participated in this study as independent experts and the views expressed in this text do not necessarily reflect the views of the institutions with which they are affiliated.

To supplement the existing literature on cooperative nonproliferation programs and provide background material for the report, the joint committee commissioned several papers from Russian and U.S. experts. These papers appear as appendixes to the report. Although the report draws heavily on these appendixes, the views expressed in the appendixes are solely those of the authors of each appendix and do not necessarily reflect the views of the joint committee.

The statement of task for this project was as follows:

> In collaboration with the Russian Academy of Sciences, the National Academies will conduct a study on specific methods of overcoming impediments to cooperation between the United States and Russia on nuclear nonproliferation. This project will be a cooperative study performed by an NRC committee appointed by the NRC Chair and a Russian committee appointed by the Russian Academy of Sciences. The two committees will work to produce a joint consensus report which will provide in-depth assessments of problems and solutions while painting a picture of Russian and American experts' views on their governments' cooperative nuclear nonproliferation programs.

An international fast-track project such as this one places a premium on the ability of its participants to collaborate effectively across many miles, time zones, and cultural differences, and this project was extremely fortunate in that respect. We would like to express our sincere thanks and appreciation to the staff experts who made this report possible. They are Christopher Eldridge of the National Academy of Sciences' Committee on International Security and Arms Control, who directed the study and very ably guided the draft through the review process; Rita S. Guenther of The National Academies' Office for Central Europe and Eurasia, who provided substantive support and commanded the management details for the project; and Tatiana Povetnikova of the Institute for Nuclear Safety in Moscow, who handled logistical details in Russia, maintaining excellent communications with the members of the U.S. and Russian teams. Without their talents and attention, the high quality and fast pace of this study could not have been accomplished. In addition, Supernova Translations provided excellent translation and interpretation services for the project. The report text was skillfully edited in English by Michael Kent Hayes. Production of the Russian-language version of this report was coordinated by Nickolai Savinikh. None of this work would have been possible, however, without the generous financial support of the Nuclear Threat Initiative.

This report has been reviewed in draft form by individuals chosen for their diverse perspectives and technical expertise, in accordance with procedures approved by the NRC's Report Review Committee. The purpose of this independent review is to provide candid and critical comments that will assist the institution in making its published report as sound as possible and to ensure that the report meets institutional

[1]National Research Council, *Overcoming Impediments to U.S.-Russian Cooperation on Nuclear Nonproliferation: Report of a Joint Workshop* (Washington, D.C.: The National Academies Press, 2004).

standards for objectivity, evidence, and responsiveness to the study charge. The review comments and draft manuscript remain confidential to protect the integrity of the deliberative process.

We wish to thank the following individuals for their review of this report: John Ahearne, Sigma Xi, The Research Center; Victor Alessi, United States Industry Coalition; Omer Brown, Harmon, Wilmot, and Brown, L.L.P.; Cathleen Campbell, Civilian Research Development Corporation; Brian Finlay, The Henry L. Stimson Center; Alexander Flax, Consultant; Thomas Graham, Lawyers Alliance for World Security; David Holloway, Stanford University; Alexander Kaliadin, Institute of World Economy and International Relations; Victor Koltunov, Academy of Military Sciences; Richard Meserve, Carnegie Institution of Washington; Steven Pifer, Independent Consultant; Sergey Ruchkin, TENEX; Nikolai Khlebnikov, International Atomic Energy Agency; Ivan Safranchuk, Center for Defense Information, Moscow; Julian Steyn, Energy Resources International; and Larry Welch, Institute for Defense Analyses.

Although the reviewers listed above have provided many constructive comments and suggestions, they were not asked to endorse the conclusions or recommendations, nor did they see the final draft of the report before its release. The review of this report was overseen by R. Stephen Berry of the University of Chicago. Appointed by the National Research Council, he was responsible for making certain that an independent examination of this report was carried out in accordance with institutional procedures and that all review comments were carefully considered. Responsibility for the final content of this report rests entirely with the authoring committee and the National Research Council.

Rose Gottemoeller
Carnegie Endowment for International Peace
Chair, U.S. Committee

Ashot Arakelovich Sarkisov
Russian Academy of Sciences
Chair, Russian Committee

Contents

Summary

This study offers the consensus findings and recommendations of a joint committee established by the U.S. National Academies and the Russian Academy of Sciences to identify methods of strengthening the cooperative nuclear nonproliferation programs of the United States and Russia. The study builds upon a previous joint effort of the two academies, a 2003 workshop to examine impediments to U.S.-Russian cooperation on nuclear nonproliferation. This event resulted in a workshop report: *Overcoming Impediments to U.S. Russian Cooperation on Nuclear Nonproliferation: Report of a Joint Workshop*.[1]

Since 1992, the U.S. Departments of Defense, Energy, and State have worked with their counterparts in Russia and other states of the former Soviet Union to develop and implement a number of joint nuclear nonproliferation initiatives, many of them under the Cooperative Threat Reduction framework. This effort has significantly advanced the goals of the Nuclear Nonproliferation Treaty, particularly as it pertains to the reduction and elimination of nuclear weapons and materials stocks. These joint programs of the United States and the Russian Federation have enjoyed a number of important successes during the past several years. The high points of this cooperative effort have been the enhancement of security for nuclear storage facilities; the commercial blenddown and sale of surplus Russian enriched uranium as power plant fuel; and the elimination of nuclear weapons from Ukraine, Belarus, and Kazakhstan.

The goal of the present study is to provide recommendations for streamlining and accelerating these cooperative nuclear nonproliferation programs. Indeed, the work of the joint committee has focused heavily on examining the specific challenges that these programs face, developing practical approaches for making the programs more effective, and exploring the views of Russian and American experts on the programs. Although the charge to the joint committee could be interpreted narrowly to limit the study to the specific examination of programmatic issues, the members of the joint committee concluded that such an interpretation was not in keeping with the true intent of the task set before them. In addition to examining practical challenges, therefore, the joint committee considered a more fundamental issue that had become a central concern in the daily vagaries of cooperation: the nature of the bilateral relationship between the United States and Russia on nuclear nonproliferation.

The joint committee found that, in the course of 15 years of cooperation, the nonproliferation and threat reduction initiatives of the United States and Russia have matured in a way that suggests a potential for true partnership. This maturity has been hard won, with slow progress accumulated over time, often as Russian and U.S. agency leaders and project managers have worked out solutions in the course of implementation. It is formed, as many partnerships are, on the mutual confidence that results from having experienced project teams, time-tested working methods, more or less stable budgets, and predictable project plans. Although problems in the joint nonproliferation and threat reduction work remain, in many cases, significant progress in resolving these problems has been made.

Thus, the notion of a true Russian-U.S. partnership on nonproliferation and threat reduction is not new; it is part of a natural progression. Because of the frequency with which questions about the fundamental nature of the U.S.-Russian bilateral relationship on nuclear nonproliferation came to the surface during the discussions of and research on specific program problems and solutions, the members of the joint committee conducting this study decided that it was time to consider this progression more fully. In particular, they recognized that the potential exists for U.S. cooperation with Russia to shift farther away from an assistance relationship—which was the necessary result of the economic crisis that struck after the demise of the Soviet Union—and toward partnership.

[1]National Research Council, *Overcoming Impediments to U.S.-Russian Cooperation on Nuclear Nonproliferation: Report of a Joint Workshop* (Washington, D.C.: The National Academies Press, 2004).

For this reason, the joint committee decided that future cooperation should be considered in two aspects. First, can the two countries implement existing programs in the former Soviet Union as full partners, working in the most efficient and effective way possible? Second, can they expand their cooperation to include joint efforts to solve proliferation problems in other countries and regions of the world? Exploration of the potential for a cooperative relationship that progresses to a fuller partnership was seen as an important goal for this study.

Despite the many accomplishments of U.S. and Russian cooperative threat reduction efforts to date, impediments to joint work have limited progress in the past and threaten to do so in the future. Some of these problems are the result of restrictive practices that flowed from the U.S. reaction to the attacks on the United States on September 11, 2001, and subsequent initiatives to combat international terrorism. Others are residual constraints not yet eliminated from the Cold War era. Still others involve legal issues, such as taxation and liability, managerial and organizational problems, project financing, and weaknesses in U.S.-Russian scientific and technical cooperation. Many of these challenges originate in legitimate concerns about national security matters in both countries and different perspectives on current international issues. Indeed, political leaders in Moscow and Washington often have very different objectives based on their own national interests as well as their own political doctrines and outlooks.

Many thorough and serious studies have reported on the continuing impediments to cooperation and the necessity of overcoming them to speed up joint work on securing fissile materials (such as uranium-235 and plutonium-239) and other critical tasks.[2] Recognizing this very real problem, the U.S.-Russian committee responsible for this study sought answers that would be practical and that could be pursued either in Moscow or in Washington, wherever they would be most relevant. The fact that they are offered as consensus U.S. and Russian recommendations makes them unique and, it is hoped, powerful in both capitals. This report's emphasis on solutions, however, in no way downplays the very real challenges that continue to obstruct the joint cooperation.

This report responds to these challenges in three ways. First, it provides an in-depth exploration of methods of overcoming impediments to existing cooperation. Second, it examines the potential for expanded cooperation based on a fuller concept of partnership. Third, it offers specific conclusions and recommendations that can be used to achieve the first two goals. The report records the consensus of the Russian and the American committee members on concrete and well-defined steps toward improving cooperation that will have utility and relevance in both countries.

This executive summary provides a synopsis of the report and identifies the key recommendations from each of the report's main sections. Additional recommendations are presented in the full text of the report. Finally, it should be noted that members of the joint committee relied primarily on two mechanisms for gathering the information on which this report is based: commissioned papers by U.S. and Russian experts and meetings of joint committee members with small groups of experts in Moscow and Washington in January and February 2005.[3]

POLITICAL ISSUES

To accomplish the vision of full partnership described above, the joint committee agreed on a two-tiered approach: first, a short-term commission should examine past progress and determine a joint strategy for future cooperation; second, a joint group made up of agency representatives from the governments of both countries should supervise cooperative efforts for the indefinite future.

As a first and fundamental step, the joint committee recommends that the presidents of the Russian Federation and the United States establish a Joint High-Level Commission with the responsibility of preparing a strategy for current and future U.S.-Russian cooperation to combat nuclear proliferation.

This High-Level Commission could be organized in several ways. For example, its membership could include current and former government officials as well as eminent nongovernment experts, or it could be made up of government officials supported by an advisory group of nongovernment experts. In any case, the joint committee believes that experts from outside the government should participate in the commission's work. The rationale for this approach is linked to the joint committee's view that the cooperation is progressing to a new stage—fuller partnership—that has both positive potential and a number of continuing pitfalls that must be countered. The definition and description of a strategy for this new stage will require a brainstorming approach that might not be possible under the constraints of a purely governmental body or with only one type of expert—e.g., individuals from the scientific community—in the room. The main emphasis should be on developing new ideas and directions for the cooperation. For this reason, the joint committee concluded that the premium for the organization of the group should be placed on bringing a variety of viewpoints and backgrounds to the table. Thus, despite the difficulties of organizing a mixed governmental-nongovernmen-

[2]See, for example, the study by Matthew Bunn and Anthony Wier, *Securing the Bomb 2005: The New Global Imperatives*. Online. Available at http://bcsia.ksg.harvard.edu/publication.cfm?program=CORE&ctype=media_feature&item_id=398&ln=releases&gma=49. Accessed May 6, 2005.

[3]The list of meetings is provided in Appendix E.

tal body with members from both the United States and Russia, the joint committee believes that the effort in this case is justified. It is the only way in which, in the view of the joint committee, the result envisioned can be achieved: a fundamentally new strategy that would effectively continue and complete existing work in the Russian Federation and develop practical, imaginative steps toward cooperation on nonproliferation initiatives in new countries and regions.

To develop new ideas for cooperation or methods to streamline the joint work, the commission might appoint special working groups that would investigate specific issues. This report also offers recommendations on issues that might benefit from the attention of such working groups. It is anticipated that, once the commission has completed the process of designing a strategy for the short-term and long-term future of U.S.-Russian cooperative nonproliferation programs, it would be disbanded. An appropriate tenure would be approximately two years.

The partnership that this commission will facilitate is grounded in the fact that Russia and the United States, the leading powers possessing both nuclear weapons and stockpiles of fissile material, bear special responsibility for protecting and preventing them from falling into the hands of international terrorists or states attempting to acquire nuclear weapons clandestinely.

The challenges involved in implementing the programs designed to pursue nonproliferation and threat reduction goals are considerable, however. Although President George W. Bush of the United States and President Vladimir Putin of Russia have clearly stated their concerns about the threat and their support for the joint cooperation, they have many other concerns, both domestic and international. Thus, these two individuals cannot always be available to focus on the programs, nor can lower-level leaders in the departments and ministries of either government.

The joint committee therefore welcomed the Senior Interagency Group that was established by Presidents Bush and Putin at the Bratislava Summit. Chaired by the Secretary of Energy and the Director of the Russian Atomic Energy Agency, the group will be responsible for overseeing the implementation of U.S.-Russian cooperative efforts on nuclear security.[4] Presumably, this means that the group will have the authority to resolve issues that arise in the existing cooperation, with the possibility of raising them to the presidential level as needed.

In the joint committee's view, the Senior Interagency Group is the necessary second tier of the proposed two-tiered approach. It is a wholly governmental entity formed at a high level and focused on ensuring the efficient implementation of cooperative efforts on nonproliferation. The joint committee envisions that the Senior Interagency Group will have effective communication channels to the Joint High-Level Commission as the commission makes its recommendations on strategy. The Senior Interagency Group, along with other governmental entities, will have the responsibility for translating those recommendations into policy.

The joint committee recommends that the Senior Interagency Group also be empowered to create working groups to address specific issues that arise in the implementation process. The present study describes several such issues that the joint committee believes would benefit from detailed and careful discussions by working groups.

Financing issues are among the key challenges for bilateral nuclear nonproliferation programs. One potential source of additional resources for nonproliferation is the nuclear energy industry in both the United States and Russia. It is in the interest of nuclear energy providers to promote nuclear security and nonproliferation because it will both increase the security of their facilities and bolster public confidence in the safety and security of nuclear power plants. Where it is possible to align economic incentives and national security objectives, the results are self-sustaining efforts of greater durability than programs that rely on political and bureaucratic processes that are less infused with the commercial self-interest of the parties.

LEGAL OBSTACLES AND OPPORTUNITIES

U.S.-Russian nuclear nonproliferation cooperation is built on a framework of government-to-government agreements and national laws. Although much of this framework serves joint efforts well, disagreements over legal issues have in some cases significantly impeded cooperation on nonproliferation efforts. The United States and Russia must together overcome these legal impediments. Doing so would not only facilitate the more rapid implementation of current cooperative nonproliferation programs but would also establish an improved framework for future U.S.-Russian work in this arena.

One of the most persistent and challenging impediments to U.S.-Russian cooperation on nuclear nonproliferation is the disagreement between the two governments about liability protection. The governments of the United States and Russia disagree about the level of liability protection that should be afforded agents and contractors of the U.S. government who are working on projects involving nuclear technology in Russia. The U.S.-Russian impasse over liability protection has had a significant negative effect on cooperation on nonproliferation. Solving this problem should be a very high priority. **The joint committee recommends that the governments of the United States and Russia, as a long-term and comprehensive solution to the liability issue, adopt and ratify the Convention on Supplementary Compensation for Nuclear Damage.**

[4]Joint Statement by President Bush and President Putin on Nuclear Security Cooperation, Bratislava. Online. Available at http://www.whitehouse.gov/news/releases/2005/02/20050224-8.html. Accessed April 26, 2005,

Taxation issues also continue to hinder cooperation on nuclear nonproliferation. These problems stem from the fact that the U.S. government is unwilling to have its contributions to bilateral nonproliferation efforts taxed by the Russian government. Exemptions must therefore be provided for contractors and grantees who receive U.S. funding for work performed in Russia. However, there are often problems with providing and implementing these exemptions. **The joint committee recommends that the Russian government take steps to reduce or remove these impediments, such as improving the mechanism for the value-added tax exemption, amending the Russian tax code to exempt gratuitous assistance from the excise tax, and addressing and resolving issues of exemption from the payment of regional and local taxes.**

Access to sensitive facilities has also been a long-standing challenge to cooperation on nonproliferation. The United States seeks access to Russian locations at which U.S.-funded work is taking place to ensure that U.S. assistance is spent on the intended purposes. For the Russian government, however, access requests can raise national security concerns. U.S. requests for access to Russian facilities can most easily be accommodated by Russian nuclear and military agencies if the requests are for access that is as nonintrusive as possible; the purpose of the visit is as narrowly tailored as possible, consistent with the goals of the visit; and the visits include only personnel who have been cleared in advance to participate. **The joint committee recommends that the U.S. government require U.S. agencies and contractors to define their requests for access so that they are as clear and as narrowly tailored as possible, link their access requests to the achievement of specific goals, and make use of mechanisms such as preset master lists of visitors whenever possible. They should also coordinate their visits to the maximum extent possible, to minimize the administrative burden for Russian facilities.**

A lack of reciprocal access has been a particular concern for the Russian Federation. The United States has long emphasized that it is seeking access to Russian facilities only to ensure that its assistance funds are being used for intended purposes and that reciprocal visits to U.S. facilities are therefore not relevant. If, however, the United States and Russia are engaged as partners to address proliferation problems around the world, then they will need to work closely together to develop improved counterproliferation technologies and procedures and exchange best practices. Visits by Russian experts to U.S. sites would facilitate this collaboration, would enable those experts to see how various techniques have been implemented at individual U.S. facilities, and would provide opportunities for joint research. **The joint committee recommends that the governments of the United States and Russia collaborate actively to identify the practical steps that would be required to implement President George W. Bush's recent call for more reciprocal access.**

PROGRAM ORGANIZATION AND MANAGEMENT

What began more than a decade ago as a political commitment by the governments of the United States and the former Soviet Union to cooperate on nuclear nonproliferation has resulted in tangible improvements in nuclear safety and security across the former Soviet Union, particularly Russia. The translation of that early political commitment into successful programmatic cooperation was the task of a complex mix of ministries, departments, agencies, national laboratories, institutes, and contractors. The resulting years of joint cooperation have yielded a wealth of experience for Russian and American experts tasked with bringing projects to successful completion. Use of these experts' valuable insights and knowledge to strengthen current efforts in the short term and to inform the evolving strategic partnership in the long term is crucial to overcoming impediments to Russian-American cooperation.

Many of the current U.S.-Russian nuclear nonproliferation programs have specific strategic plans that drive implementation; however, few of these strategic plans are actually *joint* U.S. and Russian plans that reflect jointly developed program objectives and priorities. One approach to facilitating greater participation and partnership is the development of programmatic strategic master plans, each based on a systems approach similar to that used by Russia in its development of the Strategic Master Plan for Complex Disposition of Nuclear Submarines.[5] **The joint committee recommends the development of joint U.S.-Russian program-level strategic master plans under the authority of the implementing agencies or ministries.** The inclusion of Russian experts in the strategic planning activities of the programs is critical to their becoming full partners in the entire process of program organization and management, from the initial development to project implementation and evaluation, and to maximizing the long-term sustainability of nonproliferation goals.

The importance and high degree of visibility of the U.S.-Russian cooperation on nuclear nonproliferation to the respective governments and the need to balance nonproliferation objectives with other national security objectives, such as homeland security, often translate into a perceived need by central agencies and ministries to closely control all details of program implementation. Such tight central control, however, has several negative ramifications. These include inefficiencies in implementation because of the additional layers of agency or ministry review and approval of technical decisions; limited creativity in technical problem solving and a growing sense of risk aversion; the need for government program managers to accompany all delegations on travel; and the diversion of agency or ministry resources from core missions, such as strategic program direction and coordination with other stakeholders.

[5]A summary of this plan appears in Appendix H of the full report.

The joint committee recommends that the relevant U.S. and Russian government agencies and implementers work together to establish and maintain a clear division of responsibility between those managing the program (central control) and those implementing the program (local control) while working together to achieve the objectives of U.S.-Russian cooperation. Furthermore, the joint committee recommends that, to the extent possible, federal authorities in both countries give primary problem-solving responsibility for projects to program managers and implementers and reward them for the good results that they produce by being creative and taking responsible risks. By more clearly delineating the responsibilities of the central and local levels of program organization and management, managers and implementers will have more effective guidance and support to mutually reinforce program objectives, which will work toward achieving the overall goals of the partnership.

Finally, as the previous report observed, there is a need for improved interactions at all levels, from individual project teams to the international community. At the highest level, within the international community, nuclear proliferation is clearly a widely shared concern. Although its implementation requires improvement, the nuclear nonproliferation regime has had a history of some success. The pivotal role played by the International Atomic Energy Agency (IAEA) continues to be critical. Once the United States and Russia have defined a joint strategic vision for the current and the future stages of the cooperation, it would be beneficial to explore the role that IAEA can best play in supporting the achievement of that vision. The role of the G-8 partnership is another key element to be integrated. In each case, a range of potential actions, such as meetings, workshops, and bilateral or multilateral initiatives, can be identified and implemented.

SCIENTIFIC AND TECHNICAL COOPERATION

There are a number of reasons why the United States and Russia (preceded by the Soviet Union) have found it useful to collaborate on science and technology and why it is important that they continue and expand that cooperation. First, each of the two countries has a significant pool of scientific and technical expertise on which to draw, as well as extensive research and development infrastructures that were established during their years of Cold War rivalry. Second, the personal and institutional relationships that are built in the course of scientific and technical cooperation help to strengthen the overall ties between the two nations and create a firm foundation for cooperative efforts at reducing the proliferation threat. Third, as their relationship matures into a partnership, the collaboration between the United States and Russia on science and technology can contribute substantially to their joint efforts to promote nonproliferation goals around the world.

Both Russian and American scientists articulate an interest and willingness to tackle hard technical issues that might genuinely advance the cause of nonproliferation, not only in a bilateral context but also internationally, if they could do so genuinely as scientists seeking innovative new technologies in an atmosphere of partnership with their peers. It is important that future programs be structured to take advantage of this talent pool before it becomes irretrievably lost to nonproliferation efforts. Specifically, this can be done by providing an appropriate degree of flexibility and autonomy regarding technical decisions to the participants from both countries in both the project definition and the project execution phases. **The joint committee recommends that agency leaders and project planners actively seek opportunities to incorporate appropriate scientific flexibility for participants from both countries in future projects so that scientific expertise can be used as effectively as possible and so that such projects can be made more attractive to the best scientific talent in each country.**

From the Russian perspective, there is a growing need for a new formally recognized science and technology relationship. During discussions in Moscow, Russian experts whom the joint committee consulted argued that it would be desirable to sign a new, high-level framework agreement on collaboration in science and technology. The framework agreement could cover issues generic to all areas of collaboration, including intellectual property and liability for damage. The Russian experts noted that a new high-level government-to-government agreement on science and technology would be difficult to pursue, because the process of building consensus for such an agreement, let alone negotiating it, can be very lengthy. They argued, however, that ongoing cooperative efforts could be allowed to continue during the negotiations, as could new efforts that are ripe to proceed.

Russian experts also suggested that science and technology collaboration in the field of nuclear nonproliferation might especially benefit from such an agreement, because it is a sensitive subject with certain constraints on both sides. **Given this clearly expressed Russian perspective, the joint committee recommends a U.S.-Russian review of currently operative agreements and an assessment of the nature and the scope of any new agreements that might be needed.**

A number of potential avenues for mutually beneficial cooperation on science and technology exist. Some of them offer not only an opportunity for the two nations to collaborate on science and technology but also a chance for the United States and Russia to use their relationship to further their joint nonproliferation goals beyond the borders of the United States and the former Soviet Union. Two of the most pertinent of these are the development of nuclear energy technology and cooperation against the threat of radiological terrorism. **The joint committee therefore recommends the establishment of a joint technical working group on risk assessment and mitigation relating to nuclear energy**

projects in non-nuclear-weapons states under the charter of the Joint High-Level Commission described earlier. The joint committee also recommends the establishment, under the same charter, of a bilateral scientific and technical working group on combating radiological terrorism.

CONCLUSION

Cooperative efforts are at a turning point. No longer should or can the Russian Federation be solely the recipient of assistance. It is now able, politically and economically, as well as militarily, to take its place as a true partner of the United States in the effort to contain the proliferation of nuclear weapons in the world.

It is therefore time for the two sides to forge a full partnership in this regard. To accomplish this, a two-pronged program is required. First, the remaining impediments to existing and contemplated programs of cooperation must be removed or, at the least, their effects must be diminished. Second, a long-term approach to the establishment of a true partnership is required to reduce and eliminate the threat of the further proliferation of nuclear devices, the material needed to construct them, and their delivery systems. As the nations with the world's largest stockpiles of nuclear weapons and fissile material, the United States and Russia have not only an opportunity but also an obligation to strengthen their cooperative nuclear nonproliferation programs and make them as effective as possible.

Introduction: From Assistance to Partnership

The U.S. National Academies and the Russian Academy of Sciences cooperated in 2003 to convene a workshop to examine impediments to U.S.-Russian cooperation on nuclear nonproliferation. This event resulted in a workshop report: *Overcoming Impediments to U.S. Russian Cooperation on Nuclear Nonproliferation: Report of a Joint Workshop*.[1] The present study, performed by a joint committee established by the two academies,[2] builds upon the previous effort and provides specific recommendations that represent the consensus of American and Russian committees both to eliminate current impediments and to chart a future course for even closer cooperation.

Since 1992, the U.S. Departments of Defense, Energy, and State have worked with their counterparts in Russia and other states of the former Soviet Union to develop and implement a number of joint nuclear nonproliferation initiatives, many of them under the Cooperative Threat Reduction (CTR) framework.[3] This effort has significantly advanced the goals of the Nuclear Nonproliferation Treaty, particularly as it pertains to the reduction and elimination of nuclear weapons and nuclear materials stocks. These joint programs of the United States and the Russian Federation have enjoyed a number of important successes during the past several years. The high points of this cooperative effort have been the enhancement of security for nuclear storage facilities[4]; the commercial blenddown and sale of surplus Russian enriched uranium as power plant fuel; and the elimination of nuclear weapons from Ukraine, Belarus, and Kazakhstan.

This study acknowledges the important achievements to date. However, it also identifies a number of sometimes interrelated challenges to future cooperative efforts. Impediments to joint work have limited progress in the past and threaten to do so in the future. Some of these problems are the result of restrictive practices that flowed from the U.S. reaction to the attacks on the United States on September 11, 2001, and subsequent initiatives to combat international terrorism. Others are residual constraints not yet eliminated from the Cold War era. Still others involve legal issues, such as taxation and liability, managerial and organizational problems, project financing, and weaknesses in U.S.-Russian scientific and technical cooperation. Many of these challenges originate in legitimate concerns about national security matters in both countries and differences in perspectives on current international issues.

Many thorough and serious studies have reported on the continuing impediments to cooperation and the necessity of overcoming them to speed up joint work on securing fissile materials (such as uranium-235 and plutonium-239) and other critical tasks.[5] Recognizing this very real problem, the joint U.S.-Russian committee responsible for this study sought answers that would be practical and that could be pursued either in Moscow or in Washington, wherever they would be most relevant. The fact that they are offered as consensus U.S. and Russian recommendations makes them unique and, it is hoped, powerful in both capitals. This report's emphasis on solutions, however, in no way downplays the very real challenges that continue to obstruct the joint cooperation.

---

[1]National Research Council, *Overcoming Impediments to U.S.-Russian Cooperation on Nuclear Nonproliferation: Report of a Joint Workshop* (Washington, D.C.: The National Academies Press, 2004).

[2]Biographical information about the committee members may be found in Appendix B.

[3]Historical background on the CTR program is provided in a paper by Susan Koch, Cooperative Threat Reduction Negotiations: Lessons Learned (Appendix C).

[4]Nikolai Nikitovich Yurasov, The Experience of Cooperation in Accounting, Control and Physical Protection of Nuclear Materials Between the Ministry of Defense of Russia and the Department of Energy of the United States (Appendix D).

[5]See, for example, the study by Matthew Bunn and Anthony Wier, *Securing the Bomb 2005: The New Global Imperatives*. Online. Available at http://bcsia.ksg.harvard.edu/publication.cfm?program=CORE&ctype=media_feature&item_id=398&ln=releases&gma=49. Accessed May 6, 2005.

This report responds to these challenges in three ways. First, it provides an in-depth exploration of methods of overcoming impediments to existing cooperation in greater depth. Second, it examines the potential for expanded cooperation, based on a fuller concept of partnership. Third, it offers specific conclusions and recommendations that can be used to achieve the first two goals. The report records the consensus of Russian and American committee members on concrete and well-defined steps that can be taken to improve cooperative efforts that will have utility and relevance in both countries. The participants, in rendering this joint report, offer these recommendations to their governments, to nongovernmental organizations involved in the cooperation, and to the broader community of nonproliferation experts in the hope that they will be tools that can be used to strengthen cooperation on nuclear nonproliferation.

Members of the joint committee relied primarily on two mechanisms to gather the information on which this report is based: commissioned papers by U.S. and Russian experts, which appear as appendixes to this report, and meetings of joint committee members with small groups of experts in Moscow and Washington in January and February 2005. The experts who participated in those meetings are listed in Appendix E. To encourage candor, the joint committee promised participants in the meetings that their comments would not be attributed to them.

Political Challenges to Cooperation on Nonproliferation

Many political challenges confront cooperation on nonproliferation. These political challenges are defined as issues that occur in the context of the overall bilateral relationship and that are also governed by it. For example, as the leaders of the United States and Russia reach consensus on the critical nature of the proliferation threat, they also establish priorities both for their own national policies and for bilateral cooperation to address the threat. Political leaders can deal with these challenges to cooperation on nonproliferation that emerge as political issues through a variety of actions whether they are taken by the U.S. and Russian presidents, government agency leaders, or lower-level decision makers.

Political solutions, however, often emerge because hard work has succeeded in the legal or management realm. The political leadership can then endorse what has been accomplished, cementing it as an authoritative step forward to improve cooperation. In other situations, political leaders refer a matter to legal experts or program managers to work out a solution for their later endorsement. In any case, a close relationship exists between political issues and legal or management activities. Thus, although this study is divided into sections on political issues, legal issues, management and organizational challenges, and scientific and technical cooperation, a great deal of interplay exists among these areas.

The goal of the present study is to provide recommendations for streamlining and accelerating these cooperative nuclear nonproliferation programs. Indeed, the work of the joint committee focused heavily on examining the specific challenges that these programs face, developing practical approaches for making the programs more effective, and exploring the views of Russian and American experts on the programs. Although the charge to the joint committee could be interpreted narrowly to limit the study to a specific examination of programmatic issues, the members of the joint committee concluded that such an interpretation was not in keeping with the true intent of the task set before them. In addition to examining practical challenges, therefore, the joint committee considered a more fundamental issue that had become a central concern in the daily vagaries of cooperation: the nature of the bilateral relationship between the United States and Russia on nuclear nonproliferation.

The Russian and American experts interviewed for this study agreed that the nonproliferation and threat reduction initiatives of the United States and Russia have matured in a way that suggests the potential for true partnership. This maturity has been hard won, with slow progress accumulated over time, often as Russian and U.S. agency leaders and project managers have worked out solutions in the course of implementation. For example, the problem of facility access plagued the programs from their inception, with the Americans seeking a means to ensure that U.S. taxpayer funds were properly spent and with the Russians concerned about a foreign presence at their most sensitive sites. Although this problem has not been entirely resolved, as will be discussed further below, the careful efforts of joint working groups that have drawn on the actual experience that has been gained on the ground have created an effective set of solutions for most access issues.[1]

Therefore, the call for partnership is not merely rhetorical. It has a solid foundation that has been built up slowly and with effort throughout the years of U.S.-Russian cooperation. It is formed, as many partnerships are, on the mutual confidence that grows out of experienced project teams, time-tested working methods, more or less stable budgets, and predictable project plans. Although problems remain in the joint nonproliferation and threat reduction work, in many cases, significant progress has been made in resolving them.

The commitment of the leadership of both countries has also been an important factor. President George W. Bush

[1]This notion of a set of solutions ("solution set") to problems that have been encountered in the relationship was first discussed during the joint U.S.-Russian workshop to examine impediments to cooperation. See *Overcoming Impediments to U.S.-Russian Cooperation on Nuclear Nonproliferation*, pp. 118-119.

and President Vladimir Putin have worked well together since their first meeting in 2001, and both have confirmed their commitment to cooperate on nuclear security issues.[2] On her visit to Moscow in April 2005, Secretary of State Condoleezza Rice further emphasized the potential to work together on proliferation problems: "We see Russia as a strategic partner moving forward. We see Russia as a strategic partner in the war on terrorism. We see Russia as a strategic partner in stopping the spread of weapons of mass destruction."[3]

Once again, this commitment of the leadership is not always consistent, which creates political problems for the joint work, an issue that will also be discussed further below. However, the interest of the presidents, combined with the slow accumulation of successes in the implementation of nonproliferation and threat reduction initiatives, has meant that the cooperation on nonproliferation has been among the most active spheres of the U.S.-Russian endeavor over the past decade.

In this sense, threat reduction and nonproliferation have led the way along a continuum that grew out of the Cold War disarmament relationship. Indeed, the first task of the threat reduction programs was to eliminate Soviet-era weapons platforms under the Strategic Arms Reduction Treaty (START). As the programs evolved, they focused more and more on a critical new security threat to both Russia and the United States: the potential that nuclear weapons or materials would fall into the hands of terrorists. The challenges that this threat poses have forced the programs themselves to change and to become more complex, which in turn have created new impediments and difficulties for their implementers. The process of overcoming these new problems has, in turn, built up the foundation for partnership.

Thus, the notion of a true Russian-U.S. partnership on nonproliferation and threat reduction is not new; it is part of a natural progression. The joint committee conducting this study decided that it was time to consider this progression more fully. In particular, they recognized that the potential exists for U.S. cooperation with Russia to shift away from an assistance relationship—which was the necessary result of the economic crisis that struck after the demise of the Soviet Union—and toward partnership.

For this reason, the joint committee decided that future cooperation should be considered in two aspects. First, can the two countries implement existing programs in the former Soviet Union as full partners, working in the most efficient and effective way possible? Second, can they expand their cooperation to include joint efforts to solve proliferation problems in other countries and regions of the world? Exploration of the potential for a cooperative relationship that progresses to a fuller partnership was seen as an important goal for this study.

To accomplish this vision of full partnership, the joint committee agreed on a two-tiered approach: first, the establishment of a short-term commission to examine past progress and determine a joint strategy for future cooperation; second, the establishment of a joint group made up of agency representatives from both governments to supervise cooperative efforts for the indefinite future.

As a first and fundamental step, the joint committee recommends that the presidents of the Russian Federation and the United States establish a Joint High-Level Commission with the responsibility of preparing a strategy for current and future U.S.-Russian cooperation to combat nuclear proliferation.

This Joint High-Level Commission could be organized in several ways. For example, its membership could include current and former government officials as well as eminent nongovernment experts, or it could be made up of government officials supported by an advisory group of nongovernment experts. Another alternative is that it could be made up of former senior officials, including retired members of the U.S. Congress and the executive branch, operating under the aegis of a U.S. government agency.[4] Or its membership could be drawn primarily from the scientific community, drawing on scientists at the national laboratories in the United States and Russia as well as those at the universities of both countries. Each of these approaches has merit, and others of merit could be devised.

The joint committee believes that experts from outside the government should participate in the commission's work, either as members of the commission itself or as part of an advisory body to the commission. The rationale for this approach is linked to the joint committee's view that the cooperation is progressing to a new stage—fuller partnership—that has both positive potential and a number of continuing pitfalls that must be countered. The definition and description of a strategy for this new stage will require a brainstorming approach that might not be possible under the constraints of a purely governmental body or with only one type of expert—e.g., from the scientific community—in the room. The main emphasis should be on developing new ideas and

[2]Joint Statement by President Bush and President Putin on Nuclear Security Cooperation, Bratislava. Online. Available at http://www.whitehouse.gov/news/releases/2005/02/20050224-8.html. Accessed April 26, 2005.

[3]Interview with Aleksey Venediktov of Ekho Moskvy Radio, Secretary Condoleeza Rice, Moscow, Russia, April 20, 2005. Online. Available at http://www.state.gov/secretary/rm/2005/44968.htm. Accessed April 26, 2005.

[4]This was the model of the Baker-Cutler Commission, which was formed under the Secretary of Energy's Advisory Board in the U.S. Department of Energy. See Howard Baker and Lloyd Cutler, *A Report Card on the Department of Energy's Nonproliferation Programs with Russia*. Online. Available at http://www.eisenhowerinstitute.org/programs/globalpartnerships/safeguarding/threatreduction/BakerCutlerReport.pdf. Accessed May 13, 2005.

directions for the cooperation. For this reason, the joint committee concluded that the premium for the organization of the group should be placed on bringing a variety of viewpoints and backgrounds to the table, drawing not only on the best scientific talent available but also on the experience with nonproliferation and the creative, flexible approaches to nonproliferation that experts from nongovernmental organizations can bring. Therefore, individuals from both within and outside government with relevant political, program management, legal, scientific, and technical expertise should be involved in the commission's activities.

Despite the difficulties of organizing a mixed government-nongovernment group with members from both the United States and Russia, the joint committee believes that the effort in this case is justified. It is the only way in which, in the view of the joint committee, the result envisioned can be achieved: a fundamentally new strategy that would effectively continue and complete existing work in the Russian Federation, and develop practical, imaginative steps to cooperate on nonproliferation initiatives in new countries and regions. Areas of cooperation might include, for example, the repatriation of spent nuclear fuel, the development of nuclear energy technology that minimizes proliferation risks, and strengthening of the implementation of the Treaty on the Nonproliferation of Nuclear Weapons (NPT).

To develop new ideas for cooperation or methods to streamline the joint work, the commission might appoint special working groups that would investigate specific issues. The topics examined by these working groups might include cooperation on resolving regional nonproliferation issues, coordination among the multilateral international organizations dealing with the challenges of nonproliferation, and collaboration and information sharing to reduce the threat posed by subnational groups that want to build and detonate crude nuclear explosives. Additional recommendations on issues that might benefit from the attention of such working groups are offered elsewhere in this report.

It is anticipated that, once it has completed the process of designing a strategy for the short-term and long-term future of U.S.-Russian cooperative nonproliferation programs, the commission would be disbanded. An appropriate tenure would be approximately two years. The joint committee believes that this limited tenure for the Joint High-Level Commission is vital both to ensure that the strategy exercise remains rapid fire and results oriented and to preclude any competition with the regular policy-making process. Indeed, because its membership would comprise a mixture of individuals from governmental and nongovernmental bodies, the commission would not be a policy-making body. Its status as an entity appointed by the presidents of Russia and the United States would ensure that its results will be highly visible, but the two governments would then determine how the strategy would evolve into policy.

The partnership that this commission will facilitate is grounded in the fact that Russia and the United States, the leading powers possessing both nuclear weapons and stockpiles of fissile material, bear special responsibility for protecting and preventing them from falling into the hands of international terrorists or states attempting to acquire nuclear weapons clandestinely. At the Bratislava Summit in February 2005, President Bush and President Putin stated that "The United States and Russia will enhance cooperation to counter one of the gravest threats our two countries face, nuclear terrorism. . . . Building on our earlier work, we announce today our intention to expand and deepen cooperation on nuclear security with the goal of enhancing the security of nuclear facilities in our two countries and, together with our friends and allies, around the globe."[5] Thus, U.S.-Russian cooperation on nuclear nonproliferation and counterterrorism is in the service not only of both countries but also of the world community as a whole.

Even though Russia and the United States agree on these goals, they do not agree on every issue of bilateral or international importance. Indeed, political leaders in Moscow and Washington often have very different objectives based on their national interests as well as their political doctrines and outlooks. Historically, different social systems sharply separated the United States and the Soviet Union during the Cold War years, creating a hostile environment and many constraints on cooperation. Even during that period, however, the two superpowers began to work together to control and reduce their nuclear arsenals through the Intermediate-Range Nuclear Forces Treaty (INF), the Strategic Arms Limitation Talks (SALT), and the Strategic Arms Reduction Treaty (START). Such negotiations went forward without linkage to broader disagreements because they were considered to be equally in the national security interests of the Soviet Union and United States.[6]

Since the end of the Cold War, the necessity of minimizing the impact of disagreements in other areas of the bilateral relationship on nonproliferation and threat reduction cooperation has generally held firm. Moscow and Washington each see their national security interests reflected in the fight against nuclear proliferation and terrorism. As one eminent Russian expert has said, "Disagreements between the United States and Russia on a number of issues must not undermine the foundations of our cooperation, since we agree on the most important thing: U.S.-Russian collaboration on nuclear disarmament and nonproliferation is essential for the strengthening of strategic stability and security

[5]Joint Statement by President Bush and President Putin on Nuclear Security Cooperation, February 24, 2005. Online. Available at http://www.whitehouse.gov/news/releases/2005/02/print/20050224-8.html. Accessed February 25, 2005.

[6]A number of sources provide further information on the relationship between the United States and Russia. See, for example, Committee on International Security and Arms Control, National Academy of Sciences, *The Future of U.S. Nuclear Weapons Policy* (Washington, D.C.: National Academy Press, 1997).

and is in the best interest of both countries and the entire global community."[7]

This overall political environment governs cooperation between the United States and Russia on nonproliferation and threat reduction matters, granting it some stability. As a result of this more or less stable environment, nonproliferation program managers in both countries have been able to steadily accumulate valuable experience and develop mutual confidence. According to one experienced Russian manager, these two factors are in fact the most important to program success: reliable high-level leadership support and mutual confidence stemming from long-standing, consistent working relationships.

The challenges in implementing the programs designed to pursue nonproliferation and threat reduction goals are considerable, however. Different national interests, political doctrines, and leadership outlooks create many opportunities for disagreement and controversy. Different perceptions of the threat have been a problem in the past; another has been uneven recognition of the importance of the programs. These problems have translated in turn into different levels of commitment to the programs between the two capitals and sometimes even among agencies within each of the two governments.

The episodic nature of leadership commitments is another challenge. Presidents Bush and Putin, as clearly as they have stated their concerns about the threat and their support for the joint cooperation, have many other concerns, both domestic and international. They cannot always be available to focus on the programs, and the same is true for lower-level leaders in the government departments and ministries.

The joint committee therefore welcomed the Senior Interagency Group that was established by Presidents Bush and Putin at the Bratislava Summit. Chaired by the Secretary of Energy and the Director of the Russian Atomic Energy Agency, the group will be responsible for overseeing implementation of cooperative efforts on nuclear security.[8] Presumably, this means that the group will have the authority to resolve issues that arise in the existing cooperation, with the possibility of raising them to the presidential level as needed.

In the joint committee's view, the Senior Interagency Group is the necessary second tier of the proposed two-tiered approach. It is a wholly governmental entity formed at a high level and focused on ensuring efficient implementation of cooperation on nonproliferation. The joint committee envisions that the Senior Interagency Group will have effective channels of communication to the High-Level Commission as the commission makes its recommendations on strategy. The Senior Interagency Group, along with other governmental entities, would naturally have the responsibility for translating those recommendations into policy.

The joint committee recommends that the Senior Interagency Group also be empowered to create working groups to address specific issues that arise in the implementation process. The present study describes several such issues that the joint committee believes would benefit from detailed and careful discussions by the working groups.

Another major challenge has been to maintain consistency in working relationships as government reorganizations and transitions have occurred in both capitals. Managers in both Moscow and Washington noted the difficulty of maintaining the pace of work on joint projects in the light of uncertain organizational status or changing personnel. A change in senior personnel sometimes results in a decision-making vacuum for a time.

Thus, the joint committee recommends that agency leaders in Washington and Moscow make provisions to strengthen existing mechanisms such that, when reorganizations and transitions occur, decision-making authority remains effective and evident throughout the process and institutional memory is preserved. Such provisions might include granting transitional authority, amending implementing agreements, or bolstering existing avenues of communication. Agency leaders could ease the transition process by ensuring the explicit handover of responsibilities from one team to another. The handover period should be short, and managers should have mechanisms that they can use to alert their leaderships to persistent delays.

A related issue is the general problem of the uneven commitments among agencies of each government to specific programs. As agencies become responsible for the implementation of cooperative measures, agency personnel become committed to the projects and enthusiastic about the mission. In effect, they become "stakeholders" in the joint cooperation. Other offices in the same agency or in different agencies of the government might not share their interest or enthusiasm. From the perspective of different responsibilities or from a perceived need for bureaucratic self-defense, they might set up roadblocks or barriers to the implementation of the joint programs. The extent to which this occurs varies widely, however, depending on the staff, programs, and agencies involved.

An example of this stakeholder phenomenon was evident in the early years of the CTR program in the U.S. Department of Defense. In the early 1990s, the Secretary of Defense was authorized to use funds that were not being used in other Pentagon programs to fund new CTR projects in the former Soviet Union. The funds would, in effect, be "reprogrammed" to CTR, with the result that stakeholders from the CTR program collided with stakeholders from other Pentagon offices who saw their programs being placed at risk. This problem was resolved only when the CTR program received its own appropriation in the U.S. federal budget. Then Secretary of Defense William Perry, with the support of

[7]Lev D. Ryabev, On Some Issues of Global Security and Nonproliferation of Nuclear Weapons (Appendix F).

[8]Joint Statement by President Bush and President Putin on Nuclear Security Cooperation, op. cit.

President Bill Clinton and Senators Sam Nunn and Richard Lugar on Capitol Hill, played an important role in brokering this solution. At about the same time, the introduction of the "lab-to-lab" program gave U.S. and Russian nuclear experts stakes in the U.S. Department of Energy's Materials Protection, Control, and Accounting (MPC&A) program and created vital internal constituencies in both countries that helped drive significant progress in that program for many years.

More recently, a new stakeholder issue involving the security and protection of nuclear facilities has come to the fore. Events such as the September 11, 2001, terrorist attacks and the terrorist attack on the school in Beslan, Russia, have engendered a strong focus on preventing unauthorized personnel from accessing sensitive facilities in the United States and Russian Federation. Often, such moves have extended to keeping Russians out of U.S. facilities and Americans out of Russian facilities, even when such visits would contribute to cooperative efforts to protect nuclear materials. In both countries, the agencies responsible for security would typically prefer to deny access to foreigners rather than to facilitate cooperation to protect nuclear assets. President Bush addressed this issue during his press conference on December 20, 2004: "We've got work to do to secure nuclear materials. I look forward to working with the Russians to continue to expand cooperation. I think one of the things we need to do is to give the Russians equal access to our sites, our nuclear storage sites to see what works and what doesn't work, to build confidence between our two governments."

A strong presidential statement of this kind in support of a new policy direction regarding access or any other issue in cooperation on nonproliferation can be important to changing the perspective of agency decision makers.[9] **The joint committee therefore recommends that the presidents of the United States and Russia take every opportunity to reaffirm the top priority that they accord to cooperation on nonproliferation and be willing to address how that top priority might supersede or take precedence over existing policy.** Although the stakeholder community for cooperation on nonproliferation will never be universal across all agencies in Moscow or Washington, the effectiveness of resistance from nonstakeholders can be limited by unequivocal direction from above. The focus must be on ensuring that the statement of presidential priority be clear, that its transmission through lower-level leaders be unambiguous, and that senior officials be empowered to enforce that presidential priority.

Another major challenge is the way in which policy, legal, or procedural vacuums or gaps in the two countries continue to place barriers in the way of program implementation. The problem of access to sensitive sites has been a long-standing one, and it will be discussed further below as a matter requiring legal attention. Although the joint committee argues here for clear presidential leadership to overcome such obstacles, it must also be stressed that competent program managers in both Russia and the United States can and will do much work to address these problems.

Both U.S. and Russian managers stated during interviews and discussions that significant progress had been achieved in addressing access issues through steady, attentive work at their level. The venues for doing so, such as the working group on access for the MPC&A program, were designed to derive maximum benefit from the experience of day-to-day implementers on both sides. Therefore, although vacuums remain in certain areas, they have been addressed considerably by the joint efforts of responsible program managers. This phenomenon was noted in the earlier joint workshop report on overcoming barriers and impediments to cooperation, but its effect has strengthened considerably in the period since that report was completed.[10]

The final challenge to be considered in the political arena is the full character of partnership. If the Russian Federation and the United States are to become full partners in the cooperation, then they should share responsibilities in a minimum of three areas: setting priorities, program management, and financing of the programs. In discussions with Russian participants in the cooperation, it became clear that they agreed with the first two responsibilities and expressed a belief that joint, parity-based participation in program funding will have to be achieved as the state of the Russian economy improves.

In some sense, this approach is natural: even though the Russian economy has improved markedly in recent years, Russia has an enormous burden of infrastructure modernization, of which the nuclear complex is only a part. In another sense, however, it poses a difficulty for expanding the cooperation beyond the assistance relationship that has existed in the past. If the United States is providing resources for the bulk of the effort, then it is inevitable that it will retain more responsibility for priority setting and management as well as the financing aspect.

The joint committee recommends that the Senior Interagency Group charter a working group, drawing on the experience of program implementers in Russia and the United States, to characterize the contributions of each country so that they are better understood on a mutual basis. This working group should be temporary and should focus on this particular task. It may be that the financing issue is in part presentational and that Moscow simply needs to express its contribution in terms that are more easily calibrated with those of the United States and other donors. Russia already provides the second largest con-

[9]President Bush's remarks may be found online at http://www.whitehouse.gov/news/releases/2004/12/20041220-3.html. Accessed March 3, 2005. Of course, laws and regulations must sometimes be changed, a point that will be discussed further below.

[10]See *Overcoming Impediments to U.S.-Russian Cooperation on Nuclear Nonproliferation*.

tribution to the Global Partnership[11] budget, after that of the United States. If that contribution is clearly advertised and described, then it will certainly convey Russia's commitment to the financing of nonproliferation projects. Moreover, Russia makes many in-kind contributions to the cooperation, such as providing labor for construction projects. With some analysis, such contributions would provide a clearer sense of Russia's full financial effort in the nonproliferation and threat reduction arena. Indeed, the development of a stronger mutual perception of partnership in the U.S.-Russian relationship may benefit significantly from a clearer elucidation of the contributions that the Russian government already makes, in part because the data that result will make it possible for U.S. and Russian program staff members to work together on setting annual goals that increase Russian contributions of all types as the partnership between the two nations progresses.[12]

Overall, greater mutual transparency about the financing of projects will be an important aspect of a more robust partnership. The United States does publish its overall budget numbers openly, but details about how the budget is then allocated are sometimes less clear. Russian project participants have often complained, for example, that more funds are spent in the United States than on work on the ground in Russia. They understand that the programs necessitate substantial support activity in the United States, and they agree that the funds should be spent where they will have the greatest effect, because the goal of the programs is to assist Russia, not simply to expend funds there. Nevertheless, there is resistance to the notion that a significant proportion of the money that is supposed to be spent helping Russia should be spent in the United States instead. These complaints have at times led to action by the U.S. Congress to ensure that a higher proportion of the U.S. funds are spent in Russia.[13] Detailed disclosures and explanations of how project funds are spent will help ease these tensions.

Financing is not the only issue that makes for true partnership, however. For Russia and the United States to truly achieve that status, their experts should share responsibility for conceiving, designing, implementing, evaluating, and sustaining the cooperative nonproliferation programs.[14] Such an approach would require the United States to be willing to embrace more of a joint approach with Russia than it has in the past. For its part, Russia not only would need to put more of its own resources into the effort but also would need to commit to sustaining high levels of security over time. If the United States and Russia can take these steps, then they will be able to move beyond their current cooperation in the Russian Federation to become co-leaders of a global effort to fight nuclear proliferation.

One potential source of additional resources for nonproliferation is the nuclear energy industry in both the United States and Russia. It is in the interest of nuclear energy providers to promote nuclear security and nonproliferation because it will both increase the security of their facilities and bolster public confidence in the safety and security of nuclear power plants. Improving security at nuclear power plants is a global challenge, because a terrorist attack on such a facility anywhere in the world would have widespread repercussions. Where it is possible to align economic incentives and national security objectives, the results are self-sustaining efforts of greater durability than programs that rely on political and bureaucratic processes that are less infused with the commercial self-interest of the parties.

Partnerships work best when the interests—whether they be economic or political—are truly mutual, as was the case in the useful precedent of the Highly Enriched Uranium (HEU) Purchase Agreement. In that partnership the shared interests in tapping the energy potential of former warhead material and reducing nuclear dangers have resulted in a robust degree of cooperation. This effort has generated billions of dollars while converting the uranium in the warheads of more than 10,000 weapons into nuclear fuel that is now used to generate 10 percent of the electricity in the United States. Under this program, the HEU from 10,000 more warheads will be blended down and converted to low-enriched uranium fuel for electrical power generation between now and 2013.

This section has featured challenges to U.S.-Russian cooperation that political actors can address. Many of the recommendations in this section have therefore focused on the political actors and have especially called on the U.S. and Russian presidents to take certain steps. In subsequent sections on legal issues, management and organizational challenges, and scientific and technical cooperation, the study turns to challenges that the players in those arenas can address. Once again, however, there is a close relationship between political issues and legal or management solutions.

[11]The full name is the Global Partnership Against the Spread of Weapons and Materials of Mass Destruction. The Global Partnership plans to spend $2 billion per year through 2012 to address problems of the proliferation of weapons of mass destruction, in the first instance, in Russia. Originally a G-8 initiative that was established in 2002, the Partnership has since expanded beyond the G-8 countries to include countries ranging from Norway and Switzerland to Australia, New Zealand. and South Korea. For more information on the Global Partnership, see the Strengthening the Global Partnership home page at www.sgpproject.org. Accessed March 21, 2005.

[12]Some progress has been made in this regard. For example, according to U.S. government experts, the Russian government's claim that it contributed $13 million to the activities of the Arctic Military Environmental Cooperation (AMEC) Program has been substantiated. See U.S. Government Accountability Office, *Russian Nuclear Submarines: U.S. Participation in the Arctic Military Environmental Cooperation Program Needs Better Justification*, GAO-04-924, September 2004, p. 8, for more information. This is the sort of positive experience that could be replicated in other programs.

[13]For example, after a report by the General Accounting Office in 1998, the Initiatives for Proliferation Prevention (IPP) program was authorized by the U.S. Congress to spend no more than 45 percent of its funds in the United States.

[14]Electronic mail from Matthew Bunn, Harvard University, February 28, 2005.

Legal Obstacles and Opportunities

U.S.-Russian cooperation on nuclear nonproliferation is built on a framework of government-to-government agreements and national laws. Although much of this framework serves the joint efforts well, disagreements over legal issues have in some cases significantly impeded cooperation on nonproliferation. The United States and Russia must together overcome these legal impediments. Doing so not only would facilitate the more rapid implementation of current cooperative nonproliferation programs but would also establish an improved framework for future U.S.-Russian work in this arena.

BACKGROUND

The legal structure under which the U.S.-Russian cooperation on nonproliferation takes place has been developed over the past decade and a half, and it continues to evolve today. The foremost government-to-government agreement is the Agreement between the Russian Federation and the United States of America concerning the Safe and Secure Transportation, Storage, and Destruction of Weapons and the Prevention of Weapons Proliferation, commonly known as the Cooperative Threat Reduction (CTR) Umbrella Agreement. It entered into force in 1992 and was extended in June 1999 with provisional application for an additional seven years. The CTR agreement expires in 2006.

A number of specific implementing agreements have been put into place under the umbrella of the CTR Agreement. Each implementing agreement is specific to the particular program that it governs. However, not all U.S.-Russian cooperation on nuclear nonproliferation takes place under bilateral agreements such as the CTR Agreement. Some important programs are governed by multilateral agreements. For example, the International Science and Technology Center (ISTC) in Moscow, an intergovernmental organization that helps scientists make the transition to non-nuclear-weapons-related work, was established in 1992 by agreement between the European Union, Japan, the Russian Federation, and the United States. Armenia, Belarus, Canada, Georgia, Kazakhstan, the Kyrgyz Republic, Norway, South Korea, and Tajikistan have subsequently joined the ISTC.

Another example of such an arrangement is the HEU Purchase Agreement mentioned in the previous section. The United States and Russia negotiated a government-to-government agreement for the United States to purchase 500 metric tons of HEU from Russia. Pursuant to that agreement a contract was negotiated between the U.S. Enrichment Corporation (USEC) and Technabsexport (TENEX) to establish the commercial terms for the transaction. Although the implementation has at times been fraught with uncertainty, the agreement and contract continue to operate to this day.

The U.S. Civilian Research and Development Foundation (CRDF) provides another example of possible legal arrangements. CRDF is a not-for-profit organization that also concentrates on helping scientists make the transition away from nuclear weapons-related work. It receives funding for its projects from various U.S. and Russian governmental agencies, as well as from some nongovernmental sources, such as the MacArthur Foundation. CRDF is registered as a not-for-profit foundation in the Russian Federation and operates subject to Russian laws on technical and humanitarian assistance. CRDF maintains an enabling agreement with the Russian Ministry of Science and Education and certifies its projects and programs through the Technical Assistance Commission. CRDF is also included on the Russian government's official list of foreign organizations whose grant payments are exempt from taxation.

The legal framework for U.S.-Russian cooperation on nonproliferation includes not only the agreements mentioned above but also key national laws and regulations. For example, Russian laws and regulations that govern access to sensitive facilities may affect some cooperative programs. U.S. contracting regulations may also affect some programs.

Successful reconciliation of the two countries' national legal and regulatory requirements is sometimes necessary before work can proceed on particular projects or types of

projects. U.S. law, for example, can require U.S. government access to Russian facilities to confirm that equipment and materials paid for by the United States are being used for the purposes intended. Russian laws and regulations may restrict such access. Therefore, to move forward in the cooperation, a detailed understanding and some adaptation of laws and regulations on each side may be necessary. In some cases, it may be necessary to add or amend laws or regulations to enable the cooperation to go forward in ways that are consistent with the laws of both countries.

Law, including legally binding agreements and domestic legal reforms, has proven to be a powerful tool for the overall advancement of U.S.-Russian cooperation on nuclear nonproliferation. Examples include the Cooperative Threat Reduction Agreement and the HEU Purchase Agreement. At the same time, disputes over certain legal issues have been major stumbling blocks to cooperation in particular areas. This section suggests ways of making progress on several legal issues of particular importance to cooperation between the United States and Russia in the nuclear nonproliferation arena. During the course of consultations with Russian and American government and nongovernment experts, the joint committee was able to identify mutually beneficial paths forward on several key issues. Interested readers may find useful background information in Appendix G, which contains a particularly extensive set of Russian recommendations on legal issues.

LEGAL ISSUES HINDERING COOPERATION

Liability

The governments of the United States and Russia disagree about the level of liability protection that should be afforded agents and contractors of the U.S. government who are working on projects involving nuclear technology in Russia. The U.S.-Russian impasse over liability protection has had a significant negative effect on cooperation on nonproliferation. Solving this problem should be a very high priority. **The joint committee recommends that the governments of the United States and Russia, as a long-term and comprehensive solution to the liability issue, adopt and ratify the Convention on Supplementary Compensation for Nuclear Damage (CSC).**[1] The ratification of CSC by the United States and Russia would result in all third-party claims for nuclear damage resulting from a nuclear incident being channeled exclusively to the operator responsible for the nuclear incident and being resolved exclusively through the legal system of the country where the nuclear incident occurred. CSC ratification by Russia and the United States would also have the benefit of prompting ratification by other states, thereby facilitating future joint efforts to solve nonproliferation problems in other countries and regions of the world.

Until this solution is achieved, government-to-government agreements on liability will be necessary to provide a framework within which cooperation on nuclear nonproliferation can proceed. Because of this necessity, **the joint committee recommends that the Russian Duma ratify both the CTR umbrella and the ISTC umbrella agreements.**[2] This would be an initial, practical step toward a long-term and comprehensive resolution of the liability issue. The continuing limbo serves neither country's interest in continuing vital cooperation on nonproliferation.

Russia's accession, in March 2005, to the 1963 Vienna Convention on Civil Liability for Nuclear Damage[3] was just such an important initial step forward. **The joint committee recommends that the Russian government, in implementing the 1963 Vienna Convention, adopt a comprehensive domestic nuclear liability law that is consistent with CSC and that covers both civilian and defense nuclear sites (which the Price-Anderson Act in the United States does).**

Taxation

Taxation issues continue to hinder cooperation on nonproliferation. These problems stem from the fact that the U.S. government is unwilling to have its contributions to bilateral nonproliferation efforts taxed by the Russian government. Exemptions must therefore be provided for contractors and grantees who receive U.S. funding for work performed in Russia. However, there are often problems with the provision and implementation of these exemptions. **The joint committee recommends that the governments of the United States and Russia conclude negotiation and adoption of the umbrella bilateral agreement entitled the Protocol Between the Government of Russia and the U.S. Government on the Implementation of Taxes, Dues, and Duty Exemptions in Connection with Gratuitous Assistance Rendered to the Russian Federation by the U.S. Government,** which the two governments have in recent years negotiated almost to conclusion.

In addition, the joint committee recommends that the Russian government modify its tax system along the following lines to facilitate cooperation on nonproliferation:

1. The amount of time that it takes to complete the bureaucratic procedure of assigning projects and programs the status of gratuitous technical aid should be reduced. Improvements in this area could be made either by changes to the Russian tax code or by government decree. For example,

[1]See http://www.iaea.org/Publications/Documents/Infcircs/1998/infcirc567.shtml online. Accessed April 30, 2005.

[2]More information about the CTR agreement is available online at http://www.defenselink.mil/pubs/ctr/; more information about ISTC is available online at http://www.istc.ru. Accessed May 8, 2005.

[3]See http://www.iaea.org/Publications/Documents/Conventions/liability.html online. Accessed April 30, 2005.

Russian law should be changed to clarify that any taxes paid while applications are pending will be refunded after the exemption is confirmed.

Confirmation of the tax-exempt status of a project or program is often delayed because of confusion about the documentation that must be submitted to the Commission on International Humanitarian and Technical Assistance (CIHTA). Although a list of forms and documents to be submitted to CIHTA has been published, confusion still exists about various unwritten requirements. A complete list of all the formatting and other requirements regarding documentation should be published.

2. The mechanism for exemption from the value-added tax (VAT) should be improved:

- The VAT exemption law needs to be amended so that it includes organizations implementing nonproliferation programs as well as donors and beneficiaries. Most of the nonproliferation work in Russia that is funded by the U.S. government is done through implementing organizations, either contractors or grantees; a statutory reference to implementing organizations would help clarify their eligibility for exemption from paying taxes on their U.S. government-funded work.
- The current insistence by CIHTA that certificates providing an exemption from the payment of VAT be issued on a transaction-by-transaction basis causes great difficulties. The mechanism for VAT exemptions should be changed to facilitate exemptions from the payment of VAT for small transactions and recurrent transactions (such as the monthly phone and electricity bills).
- Russian vendors currently have insufficient incentive to honor VAT exemption certificates, especially in light of the burdensome nature of the reporting procedure for vendors who accept such certificates. The VAT exemption law should be changed to provide vendors with sufficient incentives to honor VAT exemption certificates, including by simplifying the VAT exemption reporting procedures.
- The VAT exemption law needs to be changed so that there is an effective system for VAT reimbursement in cases in which transactions that are exempt from the payment of VAT are in fact taxed, including the inclusion of a statutory time frame within which such reimbursements must take place.

3. The Russian tax code should be amended to exempt gratuitous assistance from the excise tax.

4. Both sides should work together to address and resolve issues of exemption for regional and local taxes.

Access

The United States seeks access to Russian locations at which U.S.-funded work is taking place to ensure that U.S. assistance is spent on the intended purposes. This includes needs assessment before work begins, assessment after completion of the work, and periodic assessments thereafter to ensure that the U.S.-funded material and equipment continue to be used properly and effectively. For the Russian government, however, access requests can raise national security concerns.

A lack of reciprocal access has been a particular concern for the Russian Federation. The United States has long emphasized that it is seeking access only to ensure that its assistance funds are being used for their intended purposes and that reciprocal visits to U.S. facilities are therefore not relevant. If the United States and Russia are engaged as partners to address proliferation problems around the world, however, then they will need to work closely together to develop improved counterproliferation technologies and procedures and exchange best practices. Visits by Russian experts to U.S. sites would facilitate this collaboration, enabling those experts to see how various techniques have been implemented at individual U.S. facilities and providing opportunities for joint research. In support of such visits, President Bush stated the following in a press conference on December 20, 2004: "I think one of the things we need to do is to give the Russians equal access to our sites, our nuclear storage sites to see what works and what doesn't work, to build confidence between our two governments."[4] **The joint committee recommends that the governments of the United States and Russia collaborate actively to identify the practical steps that would be required to implement President Bush's recent call for more reciprocal access.**

U.S. requests for access to Russian facilities can be most easily accommodated by Russian nuclear and military agencies if the request is for access that is as nonintrusive as possible; the purpose for the visit is as narrowly tailored as possible, consistent with the goals of the visit; and the visits include only personnel who have been cleared in advance to participate. Preagreed master lists of visitors (such as those used for U.S. and Russian monitors under the Plutonium Production Reactor Agreement and HEU Purchase Agreement) that are updated annually, kept to a reasonable length, and used to supplement, not replace, existing procedures for individuals not on the lists have helped smooth access for certain agreements, especially when there is a degree of reciprocity in such visits. **The joint committee recommends that the U.S. government require U.S. agencies and contractors to define their requests for access so that they are as clear as possible and so that the purpose of the visit is defined as narrowly as possible, link their access requests to the achievement of specific goals, and make use of mechanisms such as the use of preagreed master lists of visitors whenever possible. They should also coordinate their visits to the maximum extent possible, to minimize the administrative burden for Russian facili-**

[4]See http://www.whitehouse.gov/news/releases/2004/12/20041220-3.html online. Accessed March 21, 2005.

ties. Further clarification on the levels or types of access needed (represented in Russian by the distinction between *dostup* and *dopusk*)[5] may mitigate concerns in both countries.

At the same time, the Russian government's ability to grant necessary access in a timely manner needs to be facilitated by a streamlining of Russian regulations and procedures, which, for example, currently require up to 45 days for the processing of paperwork.

One potentially powerful new tool for mitigating access disputes is the joint development and deployment of remote monitoring and verification technologies and systems that could satisfy both U.S. and Russian needs. The Office of National Infrastructure and Sustainability in the U.S. Department of Energy, for example, works cooperatively with Russian agencies to install MPC&A Operations Monitoring systems in sensitive facilities. This involves the installation of video cameras and other sensors at key points in a nuclear facility so that site managers and government officials can monitor MPC&A activities. This project has installed monitoring systems at five sites in Russia, and three more are being designed and installed. Such technologies may be adaptable to meet some of the U.S. government's need for data on how U.S. tax dollars are spent in Russia.[6] **The joint committee recommends that the governments of the United States and Russia increase their joint work on remote monitoring and verification technologies and systems for this purpose.**

Access disputes might also be mitigated by negotiation of a bilateral framework agreement on access issues. The United States and Russia should consider whether negotiation of such an agreement would be productive.

Visas

Delays and other difficulties with respect to visa issuance by both the United States and Russia—a problem of long standing—remains a significant hurdle to U.S.-Russian cooperation on nuclear nonproliferation. **The joint committee recommends that the governments of the United States and Russia provide multiple-entry visas to program participants who regularly need to visit on program business.**

[5]Both of these words are translated into English as "access," but they are not synonyms in Russian. *Dopusk* refers to permission to gain access to a specific item or piece of information; *dostup* has a broader meaning, akin to an individual's "need to know" in American security parlance but relating mainly to the possibility of visiting a specific facility. This distinction is important and has been the source of confusion when Russian officials fear that their American counterparts are asking for broader access than is actually the case.

[6]Sources: Office of National Infrastructure and Sustainability website, online at http://www.nnsa.doe.gov/na-20/onis.shtml, and the Nuclear Threat Initiative's web page on the Materials Protection, Control, and Accounting program, online at http://www.nti.org/e_research/cnwm/securing/mpca.asp. Accessed April 28, 2005.

PARLIAMENTARY ACTION: APPROPRIATIONS AND RATIFICATIONS

Authority to Waive Certification Requirements

The U.S. government's ability to provide nonproliferation assistance to Russia has at times been severely complicated by legislative requirements stipulating that the president must certify that Russia has met standards that, in some cases, have little connection to the assistance in question.[7] If the president is unable to give such certification, funding for vital nonproliferation programs may be threatened or cut off for reasons that are unrelated to the merits of the programs.[8] Even when such cuts are avoided, the uncertainty caused by this process can be very disruptive to cooperative nonproliferation programs.[9] Nonproliferation assistance serves the interests of the United States as well as the interests of Russia, and the U.S. president should have maximal flexibility to continue progress in addressing the existential threat of nuclear terrorism. **The joint committee recommends that the U.S. Congress either repeal such certification requirements or provide the president with permanent waiver authority.**

Funding Flexibility

Just as some certification requirements can weaken the financial stability of CTR and other nonproliferation pro-

[7]The Cooperative Threat Reduction Act of 1993 provides that any assistance provided under the act may not be provided for any year unless the president certifies to the U.S. Congress that the proposed recipient state is complying with certain requirements for that year, including, for example, that it is "committed to . . . observing internationally recognized human rights." See Section 1203(d) of the Cooperative Threat Reduction Act of 1993 (22 U.S.C. 5952(d)). Similar certification requirements are also contained in Section 211(b) of the Soviet Nuclear Threat Reduction Act of 1991 (22 U.S.C. 2551 note) and Section 502 of the Freedom for Russia and Emerging Eurasian Democracies and Open Markets Support Act of 1992 (22 U.S.C. 5852).

[8]Indeed, this has occurred in the past. For example, nonproliferation assistance to Belarus has been impeded by a presidential inability to certify that the government of Belarus is "observing internationally recognized human rights." In 2002, an inability to certify Russia's compliance on chemical and biological weapons issues threatened the ability of the U.S. government to proceed with CTR programs in the area of nuclear nonproliferation. The issue was resolved only when the U.S. Congress passed and the U.S. president signed first one and then another law granting the president temporary authority to waive congressionally mandated certification requirements for CTR programs. In addition, cooperation between Russia and the United States on space exploration has often been hindered when the president was unable to certify, according to the Iran Nonproliferation Act, that Russia was not sharing nuclear technology with Iran.

[9]The following proposal to address this issue is being considered: S. 313, the Nunn-Lugar Cooperative Threat Reduction Act of 2005, which was introduced by Senator Lugar on February 8, 2005, would repeal the certification requirements at 22 U.S.C. 5952(d) and 22 U.S.C. 2551 note and render the certification requirement at 22 U.S.C. 5852 inapplicable to any CTR program.

grams, existing legal requirements and limitations restrict the speed and flexibility with which CTR funds can be distributed in response to urgent, unanticipated challenges. "Notwithstanding" language can be helpful in addressing these impediments. Funds appropriated by the U.S. Congress to the Nonproliferation and Disarmament Fund (NDF), for example, can be expended notwithstanding any other provision of law. The flexibility that this language affords has made it possible for funds from NDF to be used quickly and effectively. In light of the unpredictability of developments in the nuclear nonproliferation arena, **the joint committee recommends that the U.S. Congress consider the use of such "notwithstanding" language with respect to additional nonproliferation accounts, including Cooperative Threat Reduction programs.**

LAW AS TOOL FOR ADDRESSING SPECIFIC JOINT CHALLENGES

Combating Radiological Terrorism

Radiological terrorism—the use of "dirty bombs"—has the potential to cause casualties and effect severe dislocation and massive economic damage through the use of relatively simple devices.[10] One of the most significant recent developments in combating radiological terrorism is the approval by the IAEA Board of Governors in 2003 of an updated Code of Conduct on the Safety and Security of Radioactive Resources (the Code). The Code is not legally binding. However, the IAEA General Conference has urged each state to write to the director general of IAEA that it fully supports and endorses the agency's efforts to enhance the safety and security of radioactive sources, is working toward following the guidance contained in the Code, and encourages other countries to do the same. Both Russia and the United States have made such written commitments.

The joint committee recommends that the governments of the United States and Russia exchange information, including "best practices," regarding domestic legal regimes relating to radiological terrorism and implementation of the Code. Improving applicable laws and regulations in the area of inventory control and physical protection of radioactive substances can help reduce the threat of radiological terrorism. Legal reforms should seek to increase the difficulty of illegal acquisition of radioactive substances by elevating the level of physical protection of radiological substances and enhancing the licensing and record-keeping procedures for the dangerous radioactive substances whose use is permitted.

The United States recently became a party to the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.[11] Russia signed the agreement but has not yet ratified it. **The joint committee recommends that the Russian government become a party to this agreement and pass appropriate implementing and other related legislation.**

The Russian Federal Atomic Energy Agency (Rosatom) and the U.S. Department of Energy signed an interagency agreement on cooperation against radiological terrorism threats in 2004. Nevertheless, cooperation between the United States and Russia against radiological terrorism threats could potentially also be enhanced by an appropriate government-to-government agreement reflecting new developments in this arena, especially if significant science and technology interactions are to develop, as discussed below in the section on scientific and technical cooperation. **The joint committee recommends that the governments of the United States and Russia enter into negotiation of an agreement that will facilitate science and technology cooperation between the two countries against the threats of radiological terrorism.**

Spent Fuel Management

Cooperation between the United States and Russia on the management of spent nuclear fuel could also make a significant contribution to nonproliferation efforts. Russian authorities are interested in selling spent fuel management services internationally, whereby other countries pay a fee for Russia to store their spent fuel. To support this effort, the Russian Duma passed legislation explicitly authorizing Russia to take back spent fuel containing plutonium from reactors in third countries. This program supports nonproliferation goals by making it impossible for those countries to reprocess their spent fuel to extract plutonium and important uranium isotopes. This is the approach reflected in the agreement, signed in February 2005 by the Russian and Iranian governments, for Russia to provide Iran with fresh fuel and then take back the spent fuel.[12]

The United States is in a strong position to stimulate such agreements, because the United States supplied much of the spent nuclear fuel in the world as fresh fuel. The U.S. Atomic Energy Act of 1954[13] stipulates, however, that this nuclear

[10]A radiological dispersal device (RDD) is not a nuclear explosive, i.e., it does not generate a "nuclear yield" via an explosive chain reaction. The successful detonation of a nuclear explosive, even one that is crude by today's standards, could cause catastrophic destruction and loss of life. An RDD, by contrast, is a weapon that is designed to disperse radioactive material into the environment, and many types of radioactive material might be used. Although RDDs certainly have the capacity to cause damage to public health and local economies, the number of fatalities and the amount of destruction associated with the use of an RDD would be significantly less than those that would result from the use of a nuclear explosive.

[11]For more information, see http://www.iaea.org/Publications/Documents/Conventions/jointconv.html online. Accessed May 8, 2005.

[12]The IAEA website is a useful resource for tracking the evolving situation with regard to Iran. See http://www.iaea.org/NewsCenter/Focus/IaeaIran/index.shtml online. Accessed May 8, 2005.

[13]As amended.

fuel cannot be retransferred unless an agreement for peaceful nuclear cooperation, known as a "123 Agreement" (because it is described in Section 123 of the Atomic Energy Act), is in place. Attempts to establish such an arrangement between the United States and Russia so that Russia could "take back" spent fuel of U.S. origin have been stymied to date because of U.S. concerns about Russian cooperation with Iran. Entering into negotiations for such a scheme, on the basis of the understanding that it could be completed only in the context of a satisfactory solution to the Iranian nuclear proliferation threat, could reinforce diplomatic efforts to confront that threat effectively. **The joint committee recommends that the governments of the United States and Russia enter into negotiation of a joint spent fuel repatriation agreement in support of multilateral diplomatic efforts to resolve the Iranian proliferation threat.**

The Global Nonproliferation Regime

By working together, the United States and Russia, as the world's preeminent nuclear powers, can make an enormous contribution to strengthening the global legal regime for preventing nuclear proliferation. The NPT, which entered into force in 1970, has made and will continue to make a tremendous contribution to nonproliferation efforts. Recent experience, however, has demonstrated that implementation of the regime suffers from certain weaknesses. The NPT, and the nuclear nonproliferation regime that is founded upon it, is facing new tests and challenges, the most prominent of which are states that proliferate nuclear weapons or the technology to build those weapons and the potential threat of nuclear terrorism. These threats, and the recent revelations regarding the existence of an international network that for several years has been engaged in the illicit trade of nuclear materials and technologies, have revealed the fragility of the nuclear nonproliferation regime and the critical relationship between nuclear weapons proliferation and nuclear terrorism.

Today, the world faces a "crisis of compliance" because of North Korea's announced withdrawal from the NPT, revelations that Libya was engaged in programs for the development of weapons of mass destruction, the undeclared nuclear experiments in South Korea, and the possibility of a clandestine nuclear weapons program in Iran. These challenges to the NPT regime reflect weaknesses in implementation of the treaty. These weaknesses include the possible mischaracterization of Article IV of the treaty as a justification for the use of nuclear power development to disguise undeclared nuclear weapons development activities and the lack of clarity on the consequences of withdrawal from the NPT.

The joint committee recommends that the governments of the United States and Russia work together to strengthen the nuclear nonproliferation regime and the NPT that is at its foundation, giving joint consideration to how such weaknesses in the implementation of the NPT regime could most effectively be addressed. This could be an issue for discussion by the Joint High-Level Commission. As a first step, it is critical that the meaning of the treaty be clarified to ensure that Article IV cannot be successfully invoked to justify a program aimed at the development of a nuclear weapon capability under the cover of a putative peaceful nuclear energy program.

The NPT legal regime can be supplemented without amendment of the treaty itself. Current and future opportunities for strengthening the NPT regime include continuing support for the G-8 Global Partnership Against the Spread of Weapons and Materials of Mass Destruction; facilitating compliance with the United Nations Security Council's Resolution 1540; bolstering the Guiding Principles of the Nuclear Suppliers Group so that it is more difficult to transfer sensitive technologies to countries that do not currently possess them; and revising nuclear materials protection, control, and accounting regulations and practices as appropriate.

The United States and Russia should explore how advances in the legal regime may be able to reflect or incorporate recent technological advances and approaches. These include developments in remote monitoring techniques, methods for detecting undeclared nuclear activities, the development of low-enriched uranium fuel for use in reactors that now use highly enriched uranium fuel, and the return of used or spent highly enriched uranium fuel.

Both the United States and Russia are parties to the Convention on the Physical Protection of Nuclear Material (CPPNM), which requires certain physical protection measures during international transport of civilian nuclear material. The joint committee urges the United States and Russia to continue to support amendment of the CPPNM to expand its scope to include the physical protection of nuclear material during domestic use, storage, and transport.[14]

The joint committee also applauds the April 2005 passage of the International Convention on the Suppression of Acts of Nuclear Terrorism.[15]

NEED FOR IMPROVED LAWYER-TO-LAWYER DIALOGUE

Dialogue Between U.S. and Russian Legal Experts

The joint committee recommends fuller and more direct dialogue and information sharing between U.S. and Russian legal experts, perhaps under the aegis of the Joint High-Level Commission, including scholars and

[14]See http://www.unodc.org/unodc/terrorism_convention_nuclear_material.html and http://www.iaea.org/Publications/Documents/Conventions/cppn.html online. Accessed April 30, 2005.

[15]See http://www.iaea.org/Publications/Documents/Conventions/unga040405_csant.pdf online. Accessed May 8, 2005.

other nongovernment experts, as appropriate. Resolution of U.S.-Russian disputes over legal issues such as liability could be greatly facilitated by a fuller and more direct dialogue between U.S. and Russian legal experts. Impasses are prolonged by the current state of affairs, in which lawyers for both sides operate with insufficient understanding of each other's legal requirements, and complicated legal issues are too often negotiated in the absence of lawyers by policy makers who have only a limited grasp of the legal issues.

Such dialogue would also be useful in the area of security culture. U.S. and Russian lawyers and other experts could share "best practices" on the legal and regulatory frameworks, incentives, disincentives, and enforcement efforts necessary to foster disciplined, well-trained, and responsible custodians and protective forces and fully utilized and well-maintained security systems.

Lawyer-to-lawyer dialogue could facilitate both a more complete, nuanced, and contextual understanding of each side's legal requirements and the development of creative solutions. Once progress in addressing the existing legal problems has been made, attention could profitably be given to, for example, those legal mechanisms—perhaps borrowed from best practices in other arenas—that could actively improve rather than merely unstop cooperation. Lawyer-to-lawyer dialogue should involve face-to-face meetings, but once the dialogue is established, it can be usefully supplemented with communication through the use of technologies such as videoconferencing and Web links.

Program Organization and Management

What began more than a decade ago as a political commitment by the governments of the United States and the former Soviet Union to cooperation on nuclear material-related issues has resulted in tangible improvement in nuclear safety and security across the former Soviet Union, particularly Russia. Translation of that early political commitment into successful programmatic cooperation was the task of a complex mix of ministries, departments, agencies, national laboratories, institutes, and contractors. The resulting years of joint cooperation have yielded a wealth of experience to Russian and American experts tasked with bringing projects to successful completion. Use of these experts' valuable insights and knowledge to strengthen current efforts in the short term and to inform the evolving strategic partnership in the long term is crucial to overcoming impediments to Russian-American cooperation.

All organizations struggle with the challenges of making bureaucracies work effectively and efficiently, and cooperative nonproliferation programs are certainly not exempt from this problem. Indeed, despite considerable efforts in both the United States and Russia, bureaucratic and programmatic impediments to cooperation still remain. Overcoming these impediments will require a commitment by Russian and American experts to strengthen their working relationships with full partnership as the guiding principle. In both the short term and the long term, this principle can serve as an important foundation when addressing difficult problems of joint organization and management of programs that focus on cooperation on nonproliferation. The following section proposes specific recommendations for overcoming programmatic impediments and facilitating future cooperation in the continuing and evolving partnership between the United States and Russia.[1]

STRENGTHENING THE CURRENT AND FUTURE PARTNERSHIP: CONCRETE APPROACHES TO OVERCOMING ORGANIZATIONAL AND MANAGERIAL IMPEDIMENTS

Improving the Joint Development and Implementation of Programs

Many of the current U.S.-Russian nuclear nonproliferation programs have specific strategic plans that drive their implementation; however, few of these strategic plans are actually *joint* U.S.-Russian plans that reflect jointly developed program objectives and priorities. In some cases, programmatic plans are developed solely by the U.S. side and are not negotiated or discussed with Russian experts before or during implementation. This often means that Russian experts do not participate fully in the decision making regarding prioritization, equipment purchases, or training elements; nor are they aware of all long-term costs. In other cases, programmatic plans are developed jointly to various degrees, but even in the best of cases, the priorities are primarily set by the U.S. side.

One approach to facilitating greater participation and partnership is the development of programmatic "strategic master plans," each based on a systems approach similar to that used by Russia in its development of the Strategic Master Plan for Complex Disposition of Nuclear Submarines, a summary of which appears in Appendix H.[2] These programmatic master plans will complement and flow down from the joint

[1]This study draws a distinction between program organization and program management. "Program organization" refers to the actions taken to define the objectives, goals, and priorities of the overall cooperative effort, including individual programs, and the supporting structure of projects and tasks used to achieve those objectives. "Program management" refers to the technical and political actions taken to implement projects and tasks to achieve the objectives, including the oversight necessary to measure success and to ensure effectiveness.

[2]This Strategic Master Plan does not have a registration number, but it was put into effect through Rosatom Director's Decree No. 257, dated December 1, 2004, approved by the NDEP Operating Committee on November 5, 2004, and concurred with by the Donor State Assembly on December 6, 2004.

strategy to be developed by the High-Level Commission proposed earlier. The program-level strategic master plans would then be used to bridge the gap between overall program goals and project definition and implementation. In the joint committee's view, increasing Russian participation in project definition and planning is vital to both the short-term and the long-term successes of these programs.

The joint committee recommends the development of joint U.S.-Russian program-level strategic master plans under the authority of the implementing agencies or ministries. The inclusion of Russian experts in the strategic planning stages of the programs is critical to their becoming full partners in the entire process of program organization and management, from the initial development through project implementation and evaluation and to maximizing the long-term sustainability of nonproliferation goals.[3]

The jointly developed strategic master plans could provide the following:

- Clearly articulated program objectives, goals, strategies, and priorities that are clearly derived from the U.S.-Russian nuclear nonproliferation strategy to be developed by the High-Level Commission;
- Meaningful and achievable metrics that can be used to determine how successfully specific objectives and goals are being met;
- Program effectiveness evaluations based on the metrics mentioned above;
- Strategies for greater implementation effectiveness, with full recognition and leveraging of the various roles that can best be played by national laboratories and institutes, nongovernmental organizations, and industry;
- Detailed estimates of the life cycle costs for implementation, together with identification of the available and promised funding from all sources;
- Analysis and description of current and future U.S. and Russian funding commitments, with recommendations for funding that are in keeping with the goal of a stronger partnership between the United States and Russia, to clearly reflect any in-kind contributions;
- Review of the legal and regulatory basis, at both the governmental and the programmatic levels, required for efficient implementation, including the sharing of sensitive information and data when it is required; and
- Sustainability plans, including training programs, to ensure the availability of trained personnel to develop and sustain a robust nonproliferation culture. In addition to physical security and materials accounting, training should be provided for individuals in program management, systems engineering, cost accounting, and other supporting disciplines.

Project plans are most effectively developed by small technical teams composed of U.S. and Russian experts who are responsible for identifying and describing the project parameters. The technical group could generate a project plan that includes the following elements:[4]

- Clarification of the task, that is, identification of the overall goals of the project and determination of whether funding, relevant contractual frameworks, and other relevant structures are in place;
- Assessment of local, bilateral, bureaucratic, legal, organizational, political, and other potential hurdles that are peculiar to the specific circumstances of the project;
- Joint selection of the technology appropriate to the application and the operating conditions or, at a minimum, evaluation of the relevance of the technology chosen for the project and examination of the local and national political and economic implications of its installation and use;
- Clarification of the legal, regulatory, licensing, and approval procedures that will be required to complete the project;
- Determination of the staff resources and training that will be required and identification and building of relationships with key organizations and individuals in Russia; and
- Clarification of the assumptions, goals, and linkages required for implementation of the program.

As Russian and U.S. experts tasked with implementing joint nonproliferation programs work toward full partnership, the inclusion of both groups of experts from the earliest stages of program design and development, through implementation and sustainability, will strengthen the programs' short- and long-term effectiveness.

Improving the Balance Between Central and Local Control

The importance and high degree of visibility of the U.S.-Russian cooperation on nuclear nonproliferation to the respective governments and the need to balance nonproliferation objectives with other national security objectives, such as homeland security, often translate into a perceived need by central agencies and ministries to closely control all details of program implementation. Such tight central control, however, has several negative ramifications. These include inefficiencies in implementation because of the additional layers of agency or ministry review and approval of technical decisions; limited creativity in technical problem solving and a growing sense of risk aversion; the need for government program managers to accompany all delegations on travel; and the diversion of agency or ministry resources

[3]M. S. Elleman and W. D. Smith, Overcoming Impediments to Cooperation Between the United States and Russia: Improving Communication During Project Definition (Appendix I).

[4]M. S. Elleman and W. D. Smith, Overcoming Impediments to Cooperation Between the United States and Russia: Elements of Successful Project Preparation (Appendix J).

from core missions, such as strategic program direction and coordination with other stakeholders.

The joint committee recommends that relevant U.S. and Russian government agencies and implementers work together to establish and maintain a clear division of responsibility between those managing the program (central control) and those implementing the program (local control) while working together to achieve the objectives of U.S.-Russian cooperation. Furthermore, the joint committee recommends that, to the extent possible, federal authorities in both countries give primary problem-solving responsibility for projects to program managers and implementers and reward them for the good results that they produce by being creative and taking responsible risks. By more clearly delineating the responsibilities of the central and local levels of program organization and management, managers and implementers will have more effective guidance and support to mutually reinforce program objectives, which will work toward achieving the overall goals of the partnership.

In the joint committee's view, it is the role of the central agency or ministry to ensure that

- Necessary agency-to-ministry and agency-to-agency (or ministry-to-ministry) agreements are in place to enable work under the partnership consistent with the *shared* U.S.-Russian vision and strategies and with those of other affected agencies or ministries within the United States or Russia;
- Each program or project advances the *shared* vision, strategies, and priorities defined in the U.S.-Russian Nuclear Nonproliferation Strategy and is implemented in accordance with the associated government- or program-level agreements;
- All programs are effectively coordinated and integrated to implement U.S.-Russian strategies to achieve their *shared* objectives;
- An agency's programs are effectively coordinated with the programs of other agencies (or ministries);
- The roles and responsibilities of agency and ministry managers and staff and those of the implementing organizations (laboratories, institutes, and contractors) are clearly and appropriately defined and executed;
- The implementing organizations (not individual staff) are selected and held accountable for meeting all the program management commitments (cost, performance, and schedule) to the agency or ministry and the associated implementation authority and responsibility are clearly established;
- Mechanisms are in place to protect and share sensitive information and data when such activities are required to achieve programmatic objectives;
- Personnel training requirements are identified and programs are put in place to ensure common implementation of best practices and lessons learned;
- Bureaucratic obstacles are removed or minimized; and
- Each agency's or ministry's fulfillment of commitments is monitored and reported; best practices and opportunities for improvements are noted and communicated.

In the joint committee's view, it is the responsibility of those charged with local implementation to ensure that

- Program management accept responsibility for assigning the appropriate individuals to lead or participate in joint U.S.-Russian project teams, based on their capability and availability, and holds its staff accountable for meeting all program management and implementation commitments;
- Jointly established project goals and expectations are defined;
- Personnel are assigned on a long-term basis, with a minimum number of changes during the lifetime of a project;
- Personnel have the necessary infrastructure, e.g., training, financial systems, and foreign travel support, available to more effectively meet all of their implementation responsibilities;
- The management process is transparent, with project information easily available to both Russian and U.S. project teams; and
- Coordination and teaming with other implementing organizations are effective.

Improving the Balance Between Managerial Flexibility and Structural Consistency

Another factor essential to removing impediments to U.S.-Russian cooperation, as noted in the previous report, is the need for balance between managerial flexibility and the structural consistency that is necessary for institutional stability.[5] This becomes less of an issue if the recommendations discussed in this report are implemented. Joint strategic objectives should lead to better-defined goals and priorities. The availability of better-defined goals and priorities, together with clearly defined and respected roles and responsibilities and an understanding and acceptance of each partner's national constraints or requirements, should result in a program of cooperation that demonstrates consistent and defensible decisions and actions across all of its component programs and projects.

One example of the need for greater balance between managerial flexibility and structural consistency is the current process of contracting. At present, a great deal of time, effort, and resources is spent on administering small contracts between Russian and American facilities, agencies, contractors, and others. If teams working on particular sites are given greater flexibility and discretion in the drafting of contracts and task orders—including flexibility on their size,

[5]See also NRC, *Overcoming Impediments to U.S.-Russian Cooperation on Nuclear Nonproliferation*, p. 32.

scope and scale—both American and Russian experts would be more free to pursue serious substantive work. The issue of better balance between central and local control and the issue of better balance between managerial flexibility and structural consistency are closely coupled.

The joint committee recommends that U.S. and Russian program managers work toward achieving a more effective balance between managerial flexibility and structural consistency by considering and adopting the relevant ideas proposed in this section—for example, development of joint strategic master plans, implementation of appropriate roles and responsibilities, and rewarding creativity and risk taking that produce good results—to improve the balance between central and local control. By balancing these two aspects of project organization and management, U.S. and Russian experts will be able to allocate more time to substantive cooperation, gain mutual trust, and more fully maximize their resources.

Structural disincentives greatly exacerbate inefficiencies in joint cooperation. If flexibility on the managerial level is increased wherever possible and the level of support offered to staff who demonstrate initiative in effectively and quickly solving problems is also increased, then program implementation will be less constrained by bureaucratic and procedural problems.

Improving the Consistency of Personnel on Project Teams

Better balance between flexibility and structure (as well as between central and local control) should also address an ever-growing problem that is in part because of the long period of time required to successfully accomplish U.S.-Russian nuclear nonproliferation objectives and specific program goals. This problem is one best described as absorption of limited staff both at the governmental levels and at the implementing institute levels, which results in significant personnel turnover.

The joint committee recommends that U.S. and Russian agency leaders and program managers create greater incentives to retain and support quality personnel who will remain committed to joint cooperation. When a personnel change is anticipated, preemptive steps should be taken to reduce the disruption to cooperation. The problem of turnover cannot be avoided, but it can be better managed. One approach is to communicate to all affected parties as early as possible that a change in personnel is anticipated and to begin a transition with the replacement if at all possible. One factor that strongly contributes to turnover is the burnout that results from long work hours, frequent and lengthy travel, and the resulting impacts on health and family life. The right balance in control, together with effective delegation of responsibility and authority, should decrease the number of meetings and trips that each individual must take and the detailed oversight that must be provided. Another measure that could alleviate this work burden is the proactive planning for and training of successors, whether they are project team members or government program managers. This last point is particularly important if it is considered more strategically. There is an immediate need to begin identifying and training future program leaders. This can be done through workshops, assignment of student interns, and other activities specifically targeted toward creating sustainable leadership in nuclear nonproliferation.

A critical ingredient is still needed to allow the managerial flexibility that can lead to the most efficient and effective implementation of tasks and removal of barriers; that ingredient is trust. This trust evolves primarily through long-term personal relationships both at the governmental level and at the implementation level.[6] In cases in which the risks, e.g., political reaction, are perceived to be too great to allow the needed flexibility, it may be useful to allow such flexibility for a smaller subset of the overall problem and to allow it to increase over time.

Enhanced Communication Across and Within Agencies

The previous report described the observed need for improved interactions at all levels, from individual project teams to the international community. At the highest level, within the international community, nuclear proliferation is clearly a widely shared concern. Although its implementation requires improvement, the nuclear nonproliferation regime has had a history of some success. The pivotal role played by IAEA continues to be critical. Once the United States and Russia have defined a joint strategic vision for the current and future stages of the cooperation, it would be beneficial to explore the role that IAEA can best play in supporting the achievement of that vision. The role of the G-8 partnership is another key element to be integrated. In each case, a range of potential actions, such as meetings, workshops, and bilateral or multilateral initiatives, can be identified and implemented. An example is the IAEA International Conference on Nuclear Security, held in March 2005. U.S. and Russian participants in the bilateral MPC&A program considered this event extremely informative and helpful.[7]

These international interactions can provide significant opportunities to leverage networks, resources, and experiences (both successful and problematic), particularly if they are focused on shared objectives and priorities. These interactions also ensure that duplicate and even conflicting activities are not ongoing. Interactions at the lowest level—within the project teams—can be improved if the composi-

[6]On the basis of conversations with senior Russian MPC&A experts, the consistency of personnel on both sides builds trust. High levels of trust can be important in overcoming challenges of cooperation, such as issues of access and efficiency.

[7]For more information, see http://www-pub.iaea.org/MTCD/Meetings/Announcements.asp?ConfID=136 online. Accessed May 8, 2005.

tions of the teams are better managed to ensure that qualified, knowledgeable staff who are available for the long term are assigned to teams, that upcoming staffing changes are communicated early, and that transitions of responsibility are planned to minimize the impact of staffing changes on the team's effectiveness.

The joint committee recommends that U.S. and Russian program managers and experts enhance communication across and within all levels by employing a broad range of tools available to enhance communication. Enhanced communication is a requirement that underlies a strengthened U.S.-Russian partnership at all levels. Program websites, newsletters, workshops, and working groups and regularly scheduled telephone conferences are examples of means by which communication can be enhanced. The lessons that are learned and the best practices that are identified in connection with the web-based management systems in use by programs such as CRDF, Initiatives for Proliferation Prevention (IPP), and ISTC should become the basis for a more standard web-based management and communication process.

Sharing and Protecting Sensitive Information

An essential element of enhanced communication that requires special attention is the ability to share and protect the sensitive information needed for effective planning and implementation. This requires each party to define "sensitive" information to distinguish between classified information and information that is proprietary to a country, and to obtain clear direction from its government that provides limits and guidelines for the sharing and protection of this type of information. This direction enables the participating parties to negotiate information boundaries and related processes that then must be observed.

Currently, with a few exceptions, U.S.-Russian cooperative programs operate formally in the regime of "unclassified, nonsensitive." This does not imply any lack of discretion among Russian or U.S. participants or any lack of understanding of the intrinsically sensitive nature of much of the work. Rather, it is indicative of a missing and needed framework for the formal sharing of sensitive information between the two countries in areas of mutual benefit. Several areas of U.S. and Russian nuclear information could also usefully be examined to see if they actually continue to serve a tangible security benefit by being kept secret.

Therefore, the joint committee recommends that the governments of the United States and Russia revisit the question of signing a General Security of Information Agreement. Such an agreement does not require that classified information be shared; it merely permits the sharing of information under certain strict conditions, subject to policy direction from the U.S. and Russian governments.

The joint committee also recommends that the governments of the United States and Russia each undertake an examination of the nuclear information currently kept secret to determine if this continues to best serve U.S.-Russian cooperation. One controversial but relevant model is the "openness" initiative under U.S. Energy Secretary Hazel O'Leary, which helped build trust with Russia by increasing the amount of information that could be shared by the U.S. side. Given the growing partnership between the United States and Russia in nonproliferation and the war against terrorism, common objectives might better be served by more openness between the two countries in certain areas.

Scientific and Technical Cooperation

Government-funded scientific and technical cooperation between the United States and Russia has been under way for decades at various levels of intensity. Some of the high points of that collaboration came at some of the darkest periods of the Cold War, such as when a Soviet cosmonaut and a U.S. astronaut shook hands through the joined hatches of their Soyuz and Apollo spacecrafts in 1975. There are a number of reasons why the United States and Russia (preceded by the Soviet Union) have found it useful to collaborate on science and technology and why it is important that they continue and expand that cooperation. First, each of the two countries has a significant pool of scientific and technical expertise on which to draw, as well as extensive research and development infrastructures that were established during their years of Cold War rivalry. Second, the personal and institutional relationships that are built in the course of scientific and technical cooperation help to strengthen the overall ties between the two nations and create a firm foundation for cooperative threat reduction. Third, as their relationship matures into a full partnership, U.S. and Russian collaboration on science and technology can contribute substantially to their joint efforts to promote nonproliferation goals around the world.

THE NATURE OF SCIENTIFIC AND TECHNICAL COOPERATION

The first step toward understanding the potential roles of scientific cooperation and technical cooperation in the U.S.-Russian relationship is to understand the distinctions between them. For the purposes of this study, technical cooperation is defined as the mutual accomplishment of measures that enhance nonproliferation and that go beyond ordinary civil construction in their technical content. The personnel involved in technical cooperation are often engineers and technicians with specialized training. The technologies employed in technical cooperation may be off-the-shelf, or they may require some specialized engineering development; but they are technologies whose technical feasibility is not in doubt. The technologies appropriate for achieving specified goals are relatively easy to define at an early stage.

Scientific cooperation, by contrast, involves the development of new technologies or the establishment of technical feasibility for technologies that have not yet transitioned from the realm of basic and applied research to the realm of engineering development. The personnel involved in scientific cooperation are often scientists (generally applied scientists), with broad perspectives of multiple technologies that range from unproved laboratory ideas to off-the-shelf components. It is often not possible to specify the technological approach in all detail at an early stage; rather, iteration between goal-directed applied research and engineering development is necessary.

Scientific and technical cooperation go hand in hand, but different mixtures of the two are appropriate at different times and for accomplishing different purposes. It is interesting to turn to the very successful record of Russian-American cooperation in space for illustration: following on to the International Geophysical Year (1957-1958), the two countries initiated fruitful exchanges of the scientific data obtained from their exploration of space. Over time, the two space programs developed scientific collaborations based on this exchange of data, which naturally led to collaborations involving the development of joint, or in any case coordinated, instrumentation. What began in the realm of science moved over time into the realm of engineering, culminating today in Russia's essential participation in the International Space Station and in deep and productive connections between the two countries' space programs.[1]

[1]See also Means and Methods of Overcoming Barriers in Cooperation: Mindset Gap as a Legacy of the Cold War; Cooperation in Exploration and Utilization of Cosmic Space (Appendix K).

Importantly, scientific cooperation continued and even increased as technical cooperation and the joint accomplishment of more practical engineering goals became more visible. This is a healthy situation and very likely a necessary prerequisite for the long-term stability of scientific and technical cooperation. Because its goals are both for the longer term and of world interest (as distinct from shorter-term goals of national or bilateral interest), scientific cooperation serves as a flywheel to smooth what are otherwise the potentially destructive starts and stops of a purely project-oriented technical cooperative relationship.

Moreover, a relationship of scientific cooperation provides a framework for working-level discussions that can lead to new forms of technical cooperation and (importantly) to new technical concepts that can be the tools for advancing mutually beneficial national purposes. Sometimes, as suggested below, scientific cooperation can provide new frameworks and paths forward, ranging from universally agreed-upon technical principles (such as those of nuclear physics) to issues over which the two nations' political positions seem irreconcilable.

What are some of the required characteristics of robust, productive scientific cooperation?

- It is primarily directed science, with an appropriate smaller admixture of curiosity-driven science that balances the portfolio. The areas of discourse must be specified in advance, at a high level, by the governments of the two nations, according to their mutual interests.
- It is science and not engineering development. Within specified areas, it begins with working-level discussions. The selection of technologies for accomplishing goals is an output of the scientific process, not an input.
- It involves a peer relationship between scientists of the two nations. Working scientists from both sides are equally and mutually involved in agenda setting, exploratory research, project definition, and project execution.
- It is a partnership. It is reasonable to suppose that each side will contribute resources in support of the cooperation. It is not a one-sided assistance program (although it may have beneficial effects that have that result).

UNDERVALUING OF SCIENTIFIC COOPERATION BY RECENT PROGRAMS

Unfortunately, it appears that after an initial creative burst of laboratory-to-laboratory interactions in the early 1990s, scientific cooperation has rarely met the sustainable cooperation requirements outlined above, and there has been a significant cost in missed opportunities. Although the programmatic successes of the last decade have indubitably made the world a safer place than it might otherwise have been (see the next section), neither the Russian nor the American side has really succeeded in tapping, for the purposes of nonproliferation, that enormous brainpower assembled by each side for national security purposes during the Cold War.

In the opinion of the joint committee, the administration of U.S.-Russian nonproliferation programs has been so inflexible as to generally preclude the kind of creative, midcourse scientific corrections that are necessary for sustainable success. The American scientists involved in these programs believe that their assignments are often little more than project management (financial, administrative, and so on) and that their scientific training and creative abilities are neither engaged nor valued. Russian scientists articulate the frustration of being on the receiving end of this project management, with little or no involvement in project definition phases and little or no flexibility in the execution of projects. They, too, believe that their creative abilities go unrecognized and that innovative possibilities are ignored. When U.S. or Russian scientists turn away from nonproliferation risks because of these frustrations, the cooperative nonproliferation effort loses not only their expertise but also their institutional memory and the continuity that stems from long-term working relationships.

High rates of personnel turnover at the working level on the American side place existing and future programs at risk, in the view of Russian experts. American scientists find that assignments in the existing programs are so unrewarding scientifically ("numbingly bureaucratic") and offer so little opportunity for creative scientific work that assignees seek other work at the earliest opportunity.

At the same time, American scientists believe that their Russian colleagues, when they are dividing their time between U.S.-Russian cooperative projects and purely Russian institute work, exhibit a far greater degree of commitment to the latter. Even though there is nothing intrinsically wrong or unexpected about this, it does highlight the fact that existing cooperative programs are not considered desirable assignments for the best scientific talent of either country.

Both Russian and American scientists are eager to tackle the hard technical issues that might genuinely advance the cause of nonproliferation, not only in a bilateral context but also internationally, if they could do so genuinely as scientists seeking innovative new technologies in an atmosphere of peer partnership. It is important that future programs be structured to take advantage of this talent pool before it becomes irretrievably lost to nonproliferation efforts, specifically, by providing the participants from both countries with an appropriate degree of flexibility and autonomy regarding technical decisions in both the project definition and the project execution phases. **The joint committee recommends that in future projects agency leaders and project planners actively seek opportunities to incorporate appropriate scientific flexibility for participants from both countries so that the scientific expertise can be used as effectively as possible and so that such projects can be made more attractive to the best scientific talent in each country.**

SUCCESSES IN TECHNICAL COOPERATION

Despite the somewhat negative assessment of scientific cooperation of today presented above, the legacy of early scientific cooperation, as well as the subsequent portfolio of technical cooperative efforts that it engendered, has enjoyed many important successes. A wide variety of cooperative science and technology programs on nonproliferation has evolved in the wake of the Cold War. These programs have contributed materially to both international security and scientific knowledge. Although it is not possible to provide an exhaustive discussion here, several key examples are provided below:

- The International Science and Technology Centers (ISTC) were established in 1992 by an agreement among the European Union, Japan, the Russian Federation, and the United States to support nonproliferation efforts. These centers provide funding to scientists from the former Soviet Union to pursue scientific research not related to weapons, thus reducing the risk that scientists with weapons expertise will be hired for that expertise by nonstate actors or states intending to develop their own nuclear, chemical, or biological weapons. ISTC has been extremely successful and now boasts 13 member states. By the end of 2003, ISTC had funded more than 58,000 scientists in 765 research institutes.[2]
- The Initiatives for Proliferation Prevention (IPP) program of the U.S. Department of Energy, which—like ISTC—works to reduce the risk that scientists from the Newly Independent States (NIS) will encourage the proliferation of weapons of mass destruction by selling their weapons expertise. IPP facilitates partnerships between scientists and engineers from the NIS and U.S. national laboratories and private companies. The goal of the program is to develop commercially sustainable nondefense products and services that will use the expertise of scientists from the NIS and keep them employed in work not related to weapons.[3]
- The Nuclear Cities Initiative (NCI) works to provide employment for nuclear weapons scientists and technicians in Russia's closed nuclear cities who lost their jobs after the Soviet Union disintegrated. NCI also converts or shuts down buildings used for nuclear weapons production that are no longer needed. Thus, NCI actively works to reduce the size of the Russian nuclear weapons complex.[4]
- Russian highly enriched uranium (HEU) is downblended into low-enriched uranium, and the diluted nuclear material is exported to the United States for subsequent fabrication into fuel for nuclear power reactors (according to the U.S.-Russian HEU Purchase Agreement of 1993, also known as the Megatons to Megawatts agreement).
- Disposition of decommissioned Russian nuclear-powered submarines and other strategic offensive weapons systems (according to the Strategic Arms Reduction Treaty [START] of 1991).
- Activities within the framework of the Material Protection, Control, and Accounting (MPC&A) program, the Russian Transition Initiatives (which include the NCI and IPP programs), and the Warhead Safety and Security Exchange Agreement (WSSX) programs contribute substantially to nonproliferation goals.[5]

Some possible future cooperative activities, especially under the WSSX and MPC&A programs, are natural extensions of these successes and deserve serious consideration, even (or especially) in a refounded effort that is grounded more firmly in partnership. These include

- Construction of new storage facilities and refurbishment of existing storage facilities at Russia's Minatom (now Rosatom) sites;
- Acceleration of the ongoing work to develop a federal information system for control and accounting (C&A) of nuclear materials;
- Improvement of instrumental, meteorological, and procedural support of activities related to C&A of nuclear materials;
- Extension of efforts to improve radio communications in support of improved physical protection at nuclear facilities;
- Bolstering of ongoing research to improve the safety of nuclear materials during transport;
- Establishment of training centers for internal guard forces;
- Implementation of internal control measures at Rosatom facilities;
- Promotion of the culture of nuclear safety among managers and employees of nuclear sites; and
- The considerable potential of the WSSX program for future opportunities in scientific and technical cooperation, including technologies useful to counterterrorism efforts.

The joint committee recommends that mutually beneficial follow-ons to existing modes of technical cooperation be developed and implemented by the U.S. and the Russian governments.

[2]The ISTC profile is available online at http://www.istc.ru/ISTC/sc.nsf/html/profile-profile.htm. Accessed April 27, 2005.

[3]More information is available online at http://www.nti.org/e_research/cnwm/stabilizing/ipp.asp and at http://ipp.lanl.gov/. Accessed April 28, 2005.

[4]See also http://www.nti.org/e_research/cnwm/stabilizing/nci.asp and http://www.nnsa.doe.gov/na-20/nci/index.shtml online. Accessed April 28, 2005.

[5]Information about RTI is available online at http://www.nnsa.doe.gov/na-20/rti.shtml. Accessed April 30, 2005. Information about the WSSX program is available online at http://www.nnsa.doe.gov/na-20/docs/WSSA1294.pdf and http://www.nnsa.doe.gov/na-20/wfmt.shtml. Accessed April 30, 2005.

NEW OPPORTUNITIES FOR SCIENTIFIC COOPERATION

Opportunities for mutually beneficial scientific and technical cooperation are broader than the two historical core areas of space and of nonproliferation and arms control. With both Russian and American input, the joint committee identified three other areas that seem ripe for engagement at this time. They are (not in priority order) environmental remediation, counterterrorism science and technology, and nuclear energy.

Each of these topics is introduced here, with further discussion of the last two continuing below.

Environmental Remediation

Each side has undertaken domestically a set of moral or legal obligations to remediate the environmental legacies of the Cold War in their countries. Although the problems that each side must address are not identical and one would not anticipate direct financial assistance by one side in the remediation of the purely domestic legacies of the other, many common technologies may be of use to both sides. The United States can bring to a cooperative effort its particular strengths in environmental simulation, digital mapping and databases, and instrumentation development, whereas Russia can brings its traditional strengths in areas that require fundamental ideas in physics and chemistry to be scaled into large engineering efforts. Environmental remediation requires the best of both approaches, and cooperation could be highly synergistic.

Counterterrorism Science and Technology

The United States and Russia have a strong mutual interest in counterterrorism, and cooperation is already under way. For example, the WSSX program develops scientific and technical approaches to countering terrorism in several areas, including radiation detection, detection of high explosives, nuclear threat studies, mitigation of threats from radioactivity dispersal devices, and the development of explosives-resistant containers. Additional cooperation in this area could involve the sharing of test facilities, with the possibility of joint scientific field exercises for the assessment and validation of various technologies. It might also include the development of an appropriate framework for engaging Russian laboratories on equal terms with American contractors in technology competitions. This cooperation could also support expanded efforts to address specific issues. Research is under way, for example, to develop technologies for the detection of HEU. There is definitely room for expansion in this important area, however, and the United States and Russia—with their considerable pools of expertise in nuclear materials—have the human resources needed to expand the effort. Furthermore, research to address the threat of radiological terrorism could benefit from additional U.S.-Russian scientific and technical cooperation. Potential avenues for cooperation on radiological terrorism are discussed below.

Nuclear Energy

Decisions made during the Cold War left both the United States and Russia with considerable expertise and vast physical infrastructures dedicated to nuclear energy. A separate section below considers the possibility that the two countries might pool these resources in support of global nonproliferation goals.

The joint committee recommends that working groups, including government, laboratory, and industry representatives from both nations, be convened under the aegis of the Joint High-Level Commission described above for the initial exploration of possible cooperation in the areas of environmental remediation, counterterrorism science and technology, and nuclear energy.

GROWING NEED FOR A NEW SCIENCE AND TECHNOLOGY FRAMEWORK AGREEMENT

From the Russian perspective, there is a growing need for a new formally recognized science and technology relationship. During discussions in Moscow, Russian experts whom the joint committee consulted argued that it would be desirable to sign a new, high-level framework agreement on collaboration in science and technology. They described two ways in which such a new agreement could be structured. One scenario is that the agreement would assign individual governmental agencies to negotiate subagreements for collaboration on specific issues. The individual agencies would then become the executive agents for the subagreements. The other option is that the specific areas of scientific and technical collaboration be negotiated and then defined within the agreement itself.

Either way, according to the Russians, a much-needed new legal basis for cooperation would be created. The framework agreement would, at a minimum, cover issues generic to all areas of collaboration, including intellectual property and liability for damage. However, even the most expansive umbrella agreement could not possibly account for all of the nuances of collaboration in specific areas. Any collaboration is a "living, breathing" mechanism, so collaboration on new ideas would likely require modifications to the existing agreement or agreements.

The Russian experts noted that a new high-level government-to-government agreement on science and technology would be difficult to pursue, because the process of building consensus for such an agreement, let alone negotiating it, can be very lengthy. They argued, however, that ongoing cooperative efforts could be allowed to continue during the negotiations, as could new efforts that are ripe to proceed.

The Russians suggested that science and technology collaboration in the field of nuclear nonproliferation might especially benefit from such an agreement, because it is a sensitive subject with certain constraints on both sides. Cooperative efforts in this area have thus far relied on two agreements, the first signed in 1990 with the Ministry of Atomic Energy as the Russian executive agent and the second signed in 1993 with the Ministry of Science as the executive agent. Both agreements have expired, which is another argument in favor of considering a new agreement.

Given this clearly expressed Russian perspective, the joint committee recommends a U.S.-Russian review of currently operative agreements and an assessment of the nature and the scope of any new agreements that might be needed.

THE SPECIAL CASE OF COOPERATION ON NUCLEAR ENERGY

Russian scientists and engineers strongly believe that bilateral cooperation in nuclear energy is a natural vehicle for capitalizing on the investments in people and facilities made by both sides during the Cold War and, therefore, an obvious subject for nonproliferation discussions.

Opinion on the American side is more divided, for what seems to be two distinct reasons. First, although the attitude of the U.S. public is measurably more supportive of nuclear power than it has been in the past, specific proposed initiatives in the United States are generally at the early stages of development, both technically and politically. Second, and more germane to this report, is the issue of whether it is possible to build a civilian nuclear power infrastructure in potential proliferator states without significantly encouraging and enabling those states' ambitions toward nuclear weapons development. In the context of U.S.-Russia diplomacy, this issue is frequently oversimplified to a single word: Iran.

The joint committee, both in its fact finding with outside experts and in its internal deliberations, was struck by how rapidly an initial discussion of technical principles could be leaped over and replaced by emotional doctrinal assertions by both sides. However, the joint committee, including both its American and Russian members, has come to believe that there are in fact serious unanswered technical questions regarding the nonproliferation potential of various nuclear technologies and proposed economic regimens and that progress in answering these technical questions may well be essential if one wants to move the U.S.-Russian political dialogue from the single-word level to a more nuanced discussion.

Russia sees the export of civilian nuclear technology and services as an industry essential to its plans for economic growth. In the short run, it proposes to meet its nonproliferation responsibilities through the details of how it structures its export deals, that is, by a combination of surveillance, inspection, international controls, limitations on spent fuel inventory, and so forth. In the longer run, however, Russian experts intend to turn to science and technology to support Russia's nonproliferation efforts. Current civilian nuclear energy technologies are derived from and are closely tied to nuclear weapons production technologies. There is a risk that states that have either reprocessing or uranium enrichment technologies for nuclear energy production may use them to support a clandestine nuclear weapons program. Russian experts believe that it will eventually be possible to develop civilian nuclear technologies that are sufficiently different from the present technologies that the proliferation concerns of these new technologies will be significantly lessened.

American experts are divided on whether, in fact, it is possible to cut the cord that has historically joined nuclear power and nuclear weapons. Even if the nuclear fuel cycle were radically changed, certain core technologies and certain vital areas of personnel know-how may remain common to civilian and military programs. How important are these technologies and this know-how? What kinds of technical mitigations, if any, are possible? Can one make quantitative estimates of the extent by which the barriers to a proliferator's ability to produce nuclear weapons are decreased (in cost or time) by various levels of imported or indigenous civilian nuclear technologies, the numbers of trained personnel in various fields, and other verifiable variables?

The Nuclear Nonproliferation Treaty stipulates that nonnuclear-weapons states (NNWS) have a right to assistance with peaceful applications of nuclear technologies, as long as that assistance is not used to support clandestine nuclear weapons programs. Unfortunately, there is no exhaustive set of requirements (as there is no full-fledged verification mechanism) that countries must satisfy if they do not possess nuclear weapons but are developing nuclear power for civilian uses. This opens the door for the application of double standards: some NNWS are permitted full access to a complete range of nuclear power technologies, whereas others receive intense scrutiny as they develop these technologies. Perhaps an ultimate solution could be achieved through internationalization of the nuclear power industry in the spirit of U.S. President Dwight D. Eisenhower's "Atoms for Peace" speech. Achieving that goal, however, will require a long and complex process. Russia and the United States, as the world's leading nuclear powers, could take the initiative and work with IAEA to strengthen its role—particularly in the implementation of the Additional Protocol[6]—to develop

[6]IAEA member states have the option to supplement their existing safeguards agreements with the IAEA by adopting an additional protocol to those agreements. These are based on a standard "model additional protocol." The Additional Protocol was developed to improve the access of safeguards inspectors to member states' facilities and to increase the amount of information provided by the member states to the IAEA. This makes it much more difficult for a member state with a fully-functioning Additional Protocol in place to carry out covert nuclear activities. More information is available online at http://www.iaea.org/OurWork/SV/Safeguards/safeg_system.pdf. Accessed May 13, 2005.

additional requirements and a verification mechanism capable of ensuring, at least for the foreseeable future, that a country developing a nuclear power industry will not be applying nuclear technologies for military purposes.

As a key step in this process, the joint committee believes that a U.S.-Russian joint technical working group composed of technical experts from each country's national laboratories and universities could, as a minimum, provide significant clarification of these issues to the two governments and, as a maximum, suggest new technical paths forward. This working group may well argue for interaction and cooperation between two major international research efforts that are under way in this area: the Generation IV International Forum and the International Project on Innovative Nuclear Reactors and Fuel Cycles. Such a working group could also develop procedures that could serve as a paradigm for increased scientific cooperation in other areas. The charter of the working group should not specify the case of Iran uniquely (although that situation may be a useful case study) but should require a more general study of nonproliferation risk assessment and mitigation in multinational nuclear energy projects. The working group should use adversarial teams and other mechanisms to ensure a critical look at the assertions of the various views represented.

The joint committee recommends the establishment of a joint technical working group on risk assessment and mitigation relating to nuclear energy projects in non-nuclear-weapons states under the charter of the Joint High-Level Commission.

OPPORTUNITIES FOR COLLABORATION AGAINST RADIOLOGICAL TERRORISM THREATS[7]

Although the scale of death and destruction that would result from the use of a radiological weapon, or "dirty bomb," would be dramatically less than that caused by a nuclear explosive device, the long-term effects of a radiological attack on public health, the environment, and the local economy could be significant. In the earlier section on legal issues, the joint committee considered the legal steps that the United States and Russia could take against this threat. This section examines the ways in which U.S.-Russian cooperation on science and technology may be able to help address the complex threats of radiological terrorism:

- The actual damage that would result from a radiological attack would vary considerably, depending on the design of the weapon and the circumstances of its use. Scientists could work together to select common criteria for prioritizing potential hazards and response measures, as well as designing specialized computer software that could help to optimize the response to an attack.
- Joint scientific research could contribute to ongoing work on radiological monitoring systems to warn of an attack and to assess the progress of cleanup efforts and protective measures that either prevent or reduce human exposure to radiation.
- Scientists could play an important educational role so that policy makers, emergency and medical personnel, and the general public have the information that they need to respond appropriately in the event of an attack.
- Scientific collaboration could inform the development of information management systems designed to reduce the risk that nuclear material will be stolen.

In the joint committee's view, there is much that cooperation between U.S. and Russian scientists and technical experts can contribute to the two nations' efforts to reduce the threat of radiological terrorism and reduce the damage that occurs in the event of such an attack. In addition to the previous recommendations regarding information exchange on legal issues and a new government-to-government agreement on cooperation against radiological terrorism threats, **the joint committee recommends the establishment of a bilateral scientific and technical working group on combating radiological terrorism under the charter of the Joint High-Level Commission to guide this cooperative effort**.

CONCLUSION

The United States and Russia have much to gain by enhancing their ongoing cooperation on scientific and technical issues. This collaboration contributes to scientific knowledge and technical acumen; strengthens national and international security; and builds personal, institutional, and governmental relationships between the two countries. Most importantly in the context of this study, expanded cooperation between U.S. and Russian scientists and technical experts can provide a firm foundation on which to transform the bilateral relationship into a true partnership that strives to improve nuclear security and bolster nuclear nonproliferation efforts both within and beyond the borders of the United States and the former Soviet Union.

[7]The material in this section draws heavily on the paper Radiological Terrorism in the Context of Nonproliferation (Appendix L).

Conclusion: The End of the Beginning

This study suggests that the Cooperative Threat Reduction program and other measures undertaken in the first decades after the Cold War to combat nuclear proliferation have been successful in many ways, but that they continue to be faced with serious impediments in their conception and execution. These impediments, many of which were identified in the earlier workshop report, are susceptible to cooperative solutions between the two governments. The report recognizes, however, that cooperative efforts are at a turning point. No longer should or can the Russian Federation be solely the recipient of assistance. It is now able, politically and economically, as well as militarily, to take its place as a true partner of the United States in the effort to contain the proliferation of nuclear weapons in the world.

It is time, therefore, for the two sides to forge a full partnership in this regard. To accomplish this, a two-pronged program is required. First, remaining impediments to existing and contemplated programs of cooperation must be removed or their effects must be diminished. A number of recommendations throughout this report are intended to accomplish this, and this would be a remarkable achievement in itself for the two governments. Second, however, is a long-term approach to the establishment of a true partnership to reduce and eliminate the threat of further proliferation of nuclear devices, the material to construct them, and their delivery systems. Thus, the joint committee recommends that a high-level commission be appointed to develop a strategic vision and a detailed plan for a renewed cooperative effort by true partners to achieve national security goals. Cooperation must evolve from its present client-supplier relationship to a true partnership in which both sides contribute to a successful outcome.

Appendixes

A

Glossary of Acronyms

CRDF	Civilian Research and Development Foundation
CSC	Convention on Supplementary Compensation for Nuclear Damage
CTR	Cooperative Threat Reduction program
HEU	highly enriched uranium
IAEA	International Atomic Energy Agency
IPP	Initiatives for Proliferation Prevention
ISTC	International Science and Technology Centers
MPC&A	Materials Protection, Control, and Accounting
NPT	Treaty on the Non-proliferation of Nuclear Weapons
START	Strategic Arms Reduction Treaty
VAT	value-added tax
WSSX	Warhead Safety and Security Exchange Agreement

B

Committee Biographies

U.S. COMMITTEE ON STRENGTHENING U.S.-RUSSIAN COOPERATION ON NUCLEAR NONPROLIFERATION

Rose Gottemoeller (*Chair*) is a senior associate at the Carnegie Endowment, where she holds a joint appointment with the Russian and Eurasian Program and the Global Policy Program. A specialist on defense and nuclear issues in Russia and the other former Soviet states, Gottemoeller's research at the endowment focuses on issues of nuclear security and stability, nonproliferation, and arms control. Before joining the endowment in October 2000, Gottemoeller was deputy undersecretary for defense nuclear nonproliferation in the U.S. Department of Energy. Previously, she served as the department's assistant secretary for nonproliferation and national security, with responsibility for all nonproliferation cooperation with Russia and the Newly Independent States. She first joined the department in November 1997 as director of the Office of Nonproliferation and National Security. Before working at the Energy Department, Gottemoeller served for three years as deputy director of the International Institute for Strategic Studies in London. From 1993 to 1994, she served on the National Security Council in the White House as director for Russia, Ukraine, and Eurasia Affairs, with responsibility for denuclearization in Ukraine, Kazakhstan, and Belarus. Previously, she was a senior defense analyst at the RAND Corporation and a Council on Foreign Relations international affairs fellow. She has taught on Soviet military policy at Georgetown University and is currently teaching on Russian security in Eurasia, also at Georgetown University.

Major General William F. Burns is a distinguished fellow at the U.S. Army War College. General Burns brings his extensive experience in official positions within military and civilian government departments to the committee. His experience includes command of nuclear weapons military units in Europe and detailed negotiations with representatives of the former Soviet Union on nuclear arms control and reductions. General Burns was the ninth director of the U.S. Arms Control and Disarmament Agency and the deputy assistant secretary of state for political-military affairs. He served as the first U.S. special envoy to the denuclearization negotiations with states of the former Soviet Union under the Nunn-Lugar Act, and he negotiated the government-to-government agreement on sales of highly enriched uranium from dismantled Soviet weapons to the United States. He is a member of the National Academies Committee on International Security and Arms Control (CISAC), chaired its 1997 study *The Future of U.S. Nuclear Weapons Policy*, and is a cochair of CISAC's current project on verifying agreed reductions in nuclear warhead stockpiles. Gen. Burns brings expertise in nuclear arms control and military aspects of nuclear weapons to the committee.

Orde Kittrie is an associate professor at the Arizona State University (ASU) College of Law. Prior to joining the ASU law faculty in 2004, Professor Kittrie served for 11 years at the U.S. Department of State. His current teaching and research interests include homeland security law, law and technology, public international law, international economic and business law, international negotiations, and Middle East law and law reform. Kittrie most recently served as the State Department's director of International Anti-Crime Programs, overseeing U.S. policy and technical assistance programs for promoting the rule of law and combating transnational crime worldwide, including corruption, money laundering, intellectual property piracy, cybercrime, and alien smuggling. Kittrie earlier served as a special assistant to the undersecretary of state for economic, business, and agricultural affairs. In that capacity, he worked on economic aid for Pakistan following the attacks of September 11, 2001, and assisted with planning for the reconstruction of Afghanistan. Kittrie has also served as the State Department's senior attorney for nuclear affairs. In that capacity, he negotiated five nuclear nonproliferation agreements between the United

States and Russia and served as counsel for the U.S. government's sanctions and other responses to the 1998 Indian and Pakistani nuclear tests. Earlier in his State Department career, Kittrie specialized in trade controls governing arms and dual-use items, in which capacity he was a principal drafter of U.N. Security Council resolutions, U.S. executive orders, and U.S. regulations imposing and implementing arms embargoes on terrorism-supporting and other outlaw regimes, including Rwanda during the genocide. Kittrie is a member of the Council on Foreign Relations and a graduate of Yale University and the University of Michigan Law School.

M. Teresa Olascoaga currently leads the Cooperative International Programs (CIP) Group, one of two International Security Center (ISC) groups at Sandia National Laboratories. She is also the former deputy director of the ISC. She manages a broad spectrum of programs focused on nuclear and biological nonproliferation, nuclear materials management, regional security, and arms control and leads the six CIP departments. Terri has 10 years of experience managing and leading U.S. nuclear security programs and strategic initiatives, particularly those with Russia, including the U.S. Department of Energy-National Nuclear Security Administration's Material Protection, Control and Accounting (MPC&A) program. She also has more than 15 years of domestic and international experience in managing and performing security system design, evaluation, technology/policy support, and training for various applications, including U.S Department of Energy, U.S. Department of Defense, Nuclear Regulatory Commission, International Atomic Energy Agency, and North Atlantic Treaty Organization nuclear security and for commercial aviation security in the United States . Terri holds a B.S. degree in mathematics from New Mexico State University and an M.S. in industrial engineering from Columbia University.

Daniel Poneman is principal at The Scowcroft Group, providing strategic advice to the Group clients in the energy, aerospace, information technology, and manufacturing industries, among others. For nine years he practiced law in Washington, D.C., assisting clients in a wide variety of regulatory and policy matters, including export controls, trade policy, and sanctions issues. From 1993 through 1996, Mr. Poneman served as special assistant to the president and senior director for nonproliferation and export controls at the National Security Council (NSC), with responsibilities for the development and implementation of U.S. policy in such areas as peaceful nuclear cooperation, missile technology and space-launch activities, sanctions determinations, chemical and biological arms control efforts, and conventional arms transfer policy. During that period, he participated in negotiations and consultations with governments in Africa, Asia, Europe, Latin America, and the former Soviet Union. Mr. Poneman joined the NSC staff in 1990 as director of defense policy and arms control, after service in the U.S. Department of Energy. He has served as a member of the Commission to Assess the Organization of the Federal Government to Combat the Proliferation of Weapons of Mass Destruction, as well as other federal advisory panels. He received A.B. and J.D. degrees from Harvard University and an M.Litt. in politics from Oxford University. Mr. Poneman is the author of books on nuclear energy policy, Korea, and Argentina and is a member of the Council on Foreign Relations.

William H. Press is senior laboratory fellow at Los Alamos National Laboratory. From 1998 to 2004 he served as the Laboratory's deputy director for science and technology, sharing responsibility for all aspects of managing a research and development organization with an annual budget of $2.0 billion and about 12,000 employees. His responsibilities at times included relations with governmental sponsors and congressional liason; resource allocation; community and tribal relations; environment, safety, and health; and workforce issues (particularly those affecting the Laboratory's 4,000 technical staff members). While deputy director, Press was responsible for ensuring the scientific quality of the Laboratory's technical programs. He was directly responsible for the strategic allocation of all internal research and development funds (about $107 million in fiscal year 2004); oversaw institutional initiatives on technical staff recruitment and retention; chartered and appointed more than 25 outside review committees for the Laboratory's divisions; guided the Laboratory's relationship in academic matters with its parent institution, the University of California; and had line management responsibility for functions such as student and postdoctoral programs, the research library, the office of the chief information officer, and the Laboratory's projectized work (some $200 million) in the national Spallation Neutron Source project. Before going to Los Alamos in 1998, Press was professor of astronomy and of physics at Harvard University. At the time of his arrival there in 1976, he was its youngest tenured professor. Subsequently, he served as chairman of the Department of Astronomy. Earlier, Press was assistant professor of physics at Princeton University, and Richard Chace Tolman Research Fellow in Theoretical Physics at Caltech, where he received a Ph.D. in physics in 1972. His undergraduate degree was from Harvard in 1969. Press, a member of the National Academy of Sciences, has published more than 140 papers in the areas of theoretical astrophysics, cosmology, and computational algorithms.

RUSSIAN COMMITTEE ON STRENGTHENING U.S.-RUSSIAN COOPERATION ON NUCLEAR NONPROLIFERATION

Vice Admiral Ashot Arakelovich Sarkisov (*Chair*) is academician, advisor to the Russian Academy of Sciences, and

head of the Division of Applied Problems of Nuclear Power of the Russian Academy of Sciences' Nuclear Safety Institute. The scientific achievements of Academician Sarkisov lie in the fields of shipboard and stationary nuclear power safety, radioactive waste management, and energy-related ecological problems. He has led and personally participated in many theoretical and experimental studies on various aspects involved in ensuring the safety of complex modern technical systems. His projects have included the development of mathematical models of transient and emergency regimes of ship nuclear power facilities, studies of the effects of high-power shocks on thermohydrodynamic and neutron processes in facilities with boiling nuclear reactors, studies of accidents associated with breaks in primary circuit pipelines at nuclear facilities, studies of the safety of underground nuclear power plants, and the development of thermoelectric generators installed in the active zone of nuclear reactors.

In the past 10 years, Academician Sarkisov has initiated and led large-scale systems studies on problems involved in the disposition and environmental rehabilitation of Russian nuclear naval vessels and facilities. His most recent major study focuses on the development of the Strategic Master Plan for Naval Disposition in the Northwest region of the Russian Federation. This work is being carried out under a contract from the European Bank for Reconstruction and Development within the scope of an agreement made at the 2002 G-8 Summit in Kananaskis, Canada, on providing aid to the Russian Federation in eliminating the vestiges of the Cold War. On four occasions (1955, 1957, 2002, and 2004), Academician Sarkisov has served as Russian cochair of international conferences on various problems of the disposition of nuclear submarines that have been held in Moscow within the framework of the Russia-North Atlantic Treaty Organization partnership. He serves as chair of the Expert Council on Naval and Shipbuilding Problems of the Higher Attestation Commission of the Russian Federation, chair of the Expert Council on the International Russian-American Scientific-Technical Program of the International Science and Technology Center, and deputy chair of the Scientific Council on Atomic Energy of the Russian Academy of Sciences. He is also a member of a number of other scientific councils and editorial boards of various scientific journals. Currently a professor and doctor of technical sciences, Academician Sarkisov received his pregraduate education at the Leningrad Higher Naval Engineering College and Leningrad University. He is the author of more than 200 scientific works, including several monographs and many books. A participant in the Great Patriotic War from 1941 to 1945, he has been awarded nine orders and many medals.

Evgeny Nikolaevich Avrorin is scientific director of the Zababakhin Russian Federal Nuclear Center, Institute of Technical Physics (ZRFNC-VNIITF), in Snezhinsk (Chelyabinsk-70). His primary research accomplishments involve the area of high-energy-density physics and include matter properties study, including the EQS and opacities at extreme conditions (super-high pressure and temperature), the development of nuclear explosive devices for peaceful application, basic investigation on physics under nuclear explosions, high-velocity impact physics, ICF physics, and X-ray laser physics. Dr. Avrorin has also worked on applied problems of nuclear power engineering, the nonproliferation and control of nuclear weapon technology, and environmental monitoring and remediation. During the time of nuclear test experiments (1956 to 1989), he led and participated in the theoretical and experimental basic research performed at the Russian Federal Nuclear Center-VNIITF (Chelyabinsk-70, Russia). That research involved the measurement of equations of state at pressures up to a billion atmospheres, investigations of polymorphous phase changes at shock load, the study of phenomena of high-speed shock, the study of hydrodynamic instability and turbulent mixing, the measurement of energy absorption by matter at temperatures up to 10 million degrees, the study of the processes of thermonuclear burning and thermonuclear detonation, and the simulation of the targets for inertial confinement fusion. Dr. Avrorin studied physics at Moscow State University and received a Ph.D. and a Sc.D. from RFNC-VNIITF (Chelyabinsk-70). In 1963, he was awarded the Lenin Prize.

Valery Ivanovich Rachkov is head of the Nuclear Power Department in the Federal Atomic Energy Agency of the Russian Federation. Dr. Rachkov is author of more than 150 scientific papers, 2 of which are monographs; is a member of the editorial board of *Nuclear Power* magazine and the Rosatom Scientific and Engineering Board on Nuclear Reactors, Nuclear Fuel Cycle and Economics; he is also a member of several Russian Academy of Sciences Steering Committees. In 1999 Dr. Rachkov was appointed leader of nuclear power development strategy activities. The Strategy of Nuclear Power Development in Russia in the First Half of the XXI Century was developed under his leadership. Dr. Rachkov graduated from Moscow Engineering and Physics Institute (MIFI) in 1971 and holds a Ph.D.

Vladimir I. Rybachenkov has worked in industry developing computerized scientific and technical information systems and since 1993 has served as a counselor at the Ministry for Foreign Affairs of the Russian Federation (Department for Security and Disarmament, Nonproliferation and Nuclear International Cooperation Division); he currently serves as counselor at the Russian Embassy in Washington, D.C. In this capacity, his sphere of responsibilities includes international cooperation in the field of excess weapons fissile material management, bilateral nuclear cooperation, Material Protection, Control and Accounting program, and International Atomic Energy Agency (IAEA) activities. He took part in Comprehensive Nuclear-Test-Ban Treaty nego-

tiations, and participated in Nuclear Cities Initiative negotiations as well as in the development of new arrangements for the Russian-American Highly Enriched Uranium–Low Enriched Uranium agreement. From 1994 to 1997 Dr. Rybachenkov participated in the development of the *Guidelines for Management of Plutonium* (published as an IAEA information circular). Since 1993 he has been a member of Russian delegations to the IAEA regular sessions of the board of governors and the general conference. Dr. Rybachenkov has made presentations at different international fora, including Fissile Material Cutoff Treaty (Oxford, 1997; Geneva, 1999; Munich, 1999); Disposition of Excess Weapon-Grade Plutonium (Berlin, 1995; Boston, 1997; Washington, 1999, 2000, 2001); Monitoring of nuclear warhead dismantlement (Washington, D.C., 1998); Helping Russia Downsize Its Nuclear Weapons Complex (Princeton, 2000; Como, Italy, 2001); and The Missile Threat and Plans for Ballistic Missile Defense: Impact on Global Security (Rome, 2001). Dr. Rybachenkov graduated from the Moscow Engineering-Physics Institute and holds a Ph.D. in technical sciences.

Emilia V. Sidorova is an attaché at the Ministry of Foreign Affairs of the Russian Federation in the Department for Security Affairs and Disarmament of the Nuclear Security and Nonproliferation Division. She speaks fluent English and Swedish and has worked for the Russian Academy of Public Administration and the Moscow State Institute of International Relations, specializing in international relations.

C

Cooperative Threat Reduction Negotiations: Lessons Learned

Susan Koch

This paper discusses possible lessons learned from the negotiations between the United States and Russia on the Cooperative Threat Reduction (CTR) Umbrella Agreement and its Extension Protocol in 1992 and 1999, respectively.[1] It does so by suggesting the major factors contributing to the success of the negotiations.

Two cautionary notes are in order. First, this paper does not draw any explicit conclusions regarding the relevance of the CTR negotiation history for specific other nonproliferation or weapons reduction agreements between the United States and Russia. Second, the views presented are the personal, not official, ones of a former United States government official. Much of the discussion considers internal decision making within the Russian government. That discussion is necessarily speculative; Russian colleagues may have quite different, better-informed views.

UMBRELLA AGREEMENT NEGOTIATIONS: JANUARY TO JUNE 1992

The negotiations between the United States and Russia of the original CTR Umbrella Agreement may carry few, if any, lessons for contemporary agreements. Coming immediately after the fall of the Soviet Union, the negotiations occurred at a unique moment in the history of Russia, of the other former Soviet states, and of the bilateral relationship with the United States. As such, many of the factors behind conclusion of the Umbrella Agreement would not be repeated.

It is difficult, and likely would be mistaken, to attempt to isolate one or two primary factors responsible for the speedy, successful negotiation of the CTR Umbrella Agreement. Instead, several converged simultaneously, overlapping and reinforcing each other.

First, there was a strong, shared U.S. and Russian interest in the substantive cooperation envisaged in the original Nunn-Lugar legislation, passed by the U.S. Congress in December 1991. Most important was the common aim to persuade Ukraine, Belarus, and Kazakhstan to abandon the nuclear warheads left on their territory and to ensure the warheads' safe, secure, and rapid transport to storage and then dismantlement in Russia. In addition, both the United States and Russia looked for significant reductions in Russia's weapons of mass destruction and delivery systems. They saw this Russian "strategic overhang" as a phenomenon of the past—unnecessary, unaffordable, and counterproductive in the new, post-Soviet era.

That factor was in turn closely related to the sides' shared concern about the danger that the breakdown of the Soviet state would lead to widespread proliferation of weapons of mass destruction and related material and expertise. Preventing a "brain drain" of newly unemployed, underemployed, and/or underpaid weapons scientists and engineers was a major initial concern, joined shortly by the need to provide appropriate, post-Soviet physical security for weapons and materials.

Overlaying all of those factors was the dire economic situation facing Russia and the other former Soviet states. Russia could not afford to retain—or to provide security for—its huge stockpiles of weapons of mass destruction, related materials, and delivery systems or the massive complex that developed, produced, and deployed them. At the same time, it could not afford the costs of reducing the weapons, materials, and infrastructure. The Nunn-Lugar program offered a means to reduce weapons and materials; to secure those which remained; and to provide alternate employment for weapons scientists, engineers, and technicians.

Both the United States and Russia were also concerned about the potential impact of the severe economic situation and lack of a political/economic/security structure in the

[1]The official title of the Umbrella Agreement is "Agreement Between the United States of America and the Russian Federation concerning the Safe and Secure Transportation, Storage and Destruction of Weapons and the Prevention of Weapons Proliferation." The name "Cooperative Threat Reduction" was coined in 1993, a year after signature of the agreement.

other former Soviet states, particularly in Ukraine, Belarus, and Kazakhstan. It was feared that the resulting difficulties could simultaneously increase those governments' incentive to retain the nuclear weapons on their soil (providing a significant claim to important international status), make them incapable of retaining those weapons safely and securely, and leave them vulnerable to the blandishments of proliferators.

The shared U.S. and Russian substantive concerns which facilitated completion of the Nunn-Lugar Umbrella Agreement in 1992 were joined by the presence of procedural incentives and the absence of procedural obstacles to agreement. The Umbrella Agreement and the framework for the Strategic Arms Reduction Treaty (START) II were major, reinforcing deliverables for the June 1992 summit, the first between the U.S. and Russian presidents. The June 17, 1992, strategic arms framework agreement[2] and the subsequent January 1993 START II encapsulated, in both symbol and reality, much of the new strategic relationship between the United States and Russia, providing for major reductions in strategic warhead levels and a ban on multiple-warhead intercontinental ballistic missiles. The link between strategic reductions and Nunn-Lugar cooperation was explicit; both the June 1992 Joint Understanding and START II provided that reductions could be completed some years before the final deadline if the United States could contribute to the financing of the destruction of strategic offensive arms in Russia.

Finally, the Nunn-Lugar Umbrella Agreement was concluded in something of a legal and regulatory vacuum for Russia. There were few, if any, precedents in international agreements, or constraints in domestic law and regulation, for the new Russian state concerning assistance issues like freedom from taxation, liability protections, and privileges and immunities for government personnel engaged in Nunn-Lugar projects. For its part, the United States did build on a large body of precedent, drawing for the Nunn-Lugar agreement on existing defense assistance agreements with other states.

EXTENSION PROTOCOL NEGOTIATIONS: JANUARY TO JUNE 1999

By 1999, many, if not most, of the factors behind the negotiation of the CTR Umbrella Agreement in 1992 had changed dramatically. On the positive side, the program had become far larger, more important, and longer lasting than either side had expected in 1992. The original agreement had a seven-year duration, tied to the predicted construction time for the fissile material storage facility at Mayak (expected to be the longest-duration Nunn-Lugar project). Even in the mid-1990s, the United States Department of Defense publicly estimated that all CTR work would end in 2001. However, by 1999, it was clear that the program's work was far from complete.

Given the success and importance of CTR to both sides, the United States expected that extension of the Umbrella Agreement would be a simple affair, accomplished through a straightforward exchange of diplomatic notes amending the agreement's expiration date from June 1999 to June 2006. However, Russia called for significant amendments to the agreement, particularly regarding tax exemption, liability protections, and privileges and immunities.

The problems in the negotiation of the CTR Extension Protocol did not stem from a diminution on either side of the substantive interest in the cooperation. To be sure, several of the shared U.S. and Russian aims in establishing Nunn-Lugar cooperation were no longer relevant. One critical common objective in 1992—the denuclearization of Ukraine, Belarus, and Kazakhstan and safe return of their nuclear warheads to Russia—had been successfully achieved by the end of 1996. Further, CTR was no longer the sole United States nonproliferation cooperative effort in Russia. "Brain drain" programs initially funded by CTR were now led by the United States Departments of State and Energy, with their own agreements separate from the CTR Umbrella Agreement. The U.S. Departments of State and Energy also had instituted a large number of important new nonproliferation cooperative programs with Russia, such as plutonium disposition, export control and border security, and biological engagement.

On the other hand, U.S.-Russian cooperation under CTR itself was much broader and more extensive than either side had envisioned in 1992. For the first three years of the program (fiscal years [FY] 1992 to 1994), total CTR funding was $852 million, of which projects in Russia accounted for 51 percent ($436 million). For the three years up to the Extension Protocol negotiations (FY 1997 to 1999), CTR funding had increased to $1.185 billion. Moreover, Russia's share of the total had increased to 73 percent ($866.5 million). Long-standing CTR projects like strategic arms elimination and chemical weapons destruction had grown significantly and had been joined by new efforts like nuclear warhead storage and transport security.

Closely linked to the sides' continued interest in the substance of CTR cooperation was Russia's financial situation. Especially with the economic setback in August 1998, Russia's ability and willingness to pay for CTR-type work remained seriously constrained. Moreover, CTR assistance meant jobs in Russia's military-industrial complex. While the economic and employment impact of CTR in Russia was limited, it was important—even essential—in certain areas of high value to the central and local governments. One of the best examples was strategic submarine dismantlement, which was contracted directly with Russian submarine shipyards.

[2]The framework agreement was officially entitled The Joint Understanding on the Elimination of MIRVed ICBMs and Further Reductions in Strategic Offensive Arms.

Thus, the United States and Russia continued to place a high substantive and economic value on CTR cooperation. Ultimately, that proved decisive, leading to the signature of the Extension Protocol in June 1999. However, several other factors had changed significantly since the original Umbrella Agreement was signed, seriously complicating the negotiations and putting their outcome in question.

First, CTR did not have the same political salience, particularly for Russia, that it had in 1992. The U.S.-Russian relationship was no longer novel, no longer characterized by the great, somewhat naive optimism and sense of change which marked its first months. CTR was now a routine matter rather than an important element of a new strategic era. Moreover, there was not the immediate political pressure of a summit or other senior-level meeting for which CTR extension would be an important deliverable or failure to extend a highly visible defeat.

Closely related, by 1999 Russia had a large body of relevant domestic laws, regulations, and international agreements which did not yet exist in 1992. Some agreements provided precedents on key issues—especially liability protections, tax exemption, and privileges and immunities—which differed from those in the CTR Umbrella Agreement. For example, the July 1998 agreement on plutonium disposition cooperation had no privileges and immunities provision and exempted intentional acts by individuals from liability protection.[3] Further, the Russian government maintained that some CTR Umbrella Agreement provisions—again, liability protections are a prime example—now conflicted with Russian domestic law.

Finally, the Russian government likely viewed many parts of the CTR Umbrella Agreement as politically problematic. They were seen as artifacts of the early days of Russian independence, of a time when the Russian government was too inexperienced and too eager to forge a positive relationship with the United States to negotiate an agreement that best served its interests. The broad provisions on exemption from taxes, other duties, and customs inspections, on audits and examinations, on liability protections, and on privileges and immunities probably were viewed as especially difficult for a major, equal partner to accept.

For its part, the United States strongly opposed any significant substantive changes to the CTR Umbrella Agreement. As a matter of principle, the United States government believed that it could not agree to weaker provisions than those which had governed seven years of successful and growing cooperation. That view was heightened by the fact that the CTR program with Russia was expected to remain extensive for many years.

That administration view was reinforced by the expectation that the U.S. Congress would view negatively any diminution in CTR Umbrella Agreement protections for the United States government and its contractors. The U.S. Congress had over the years increased constraints on the program, sometimes authorizing and appropriating lower annual budgets than the administration requested and ending certain CTR activities such as defense conversion. The administration fully expected that acceptance of an Extension Protocol with terms less favorable than those in the original Umbrella Agreement would significantly increase congressional opposition to the CTR program, leading at a minimum to further budgetary and substantive constraints.

The result of those conflicting U.S. and Russian views and interests was, for some months, an impasse. The Russian government refused to extend the Umbrella Agreement without significant changes, particularly to the provisions regarding exemption from taxes and other duties, liability protections, audits and examinations, and privileges and immunities. The United States for its part rejected the Russian-proposed changes, except for some limited ones that did not go to the core of either U.S. or Russian concerns.

The impasse was broken for a variety of reasons. The key movement was on the Russian side. First, the major Russian ministries benefiting from CTR cooperation seemed to form a stakeholders coalition, which was able to work together to develop and win approval of the final approach. The Ministry for Foreign Affairs led an effective interagency team, including Ministries of Defense and Atomic Energy officials closely engaged in CTR projects, that was able to overcome resistance in nonstakeholder ministries. Some observers have noted that the interagency decision process in Russia was particularly complicated by a May 1999 governmental reorganization.

Second, the Russian stakeholders' determination to find a solution and their leverage with other ministries were undoubtedly strongly reinforced by the United States government's preparations for expiration of the CTR Umbrella Agreement. In mid-May 1999, the United States Department of Defense officially notified CTR contractors that all programs in Russia would be shut down on June 17 if the Umbrella Agreement Extension was not signed before then. The U.S. negotiators informed their Russian counterparts of the notice in advance, making clear that the action was not taken willingly, that it was not "brinkmanship" or any other type of threat. Instead, the U.S. Department of Defense had no choice but to issue the 30-day shutdown notice required under its contracting arrangements, given the very real possibility that the CTR Umbrella Agreement would expire. The United States also made clear to Russia that it was firmly committed to CTR cooperation and hoped that extension was still possible but that it had no flexibility on the key Russian demands.

The combination of the impasse in the negotiations, the U.S. and Russian stakeholders' interest in continuing CTR,

[3] "Liability protection" is used here to refer to agreement provisions addressing both the potential exposure of the United States government, its personnel, its contractors, and/or their personnel to Russian government or third-party claims, and potential Russian government responsibility for third-party claims.

and the near-term prospect of an end to that cooperation was critical to the final success. However, by themselves they were not sufficient. The final, essential element was the creativity shown by the Russian negotiators—most likely by the Foreign Ministry—in proposing a solution that would satisfy all sides' interests.

Specifically, the Russian side proposed in late May 1999 that the Extension Protocol be provisionally applied until national procedures for its entry into force had been completed. For the United States, those "national procedures" were satisfied by simple signature of the extension. For the Russian Federation, they entailed parliamentary ratification of the agreement, required because of the conflicts between its provisions and Russian domestic law. The solution met U.S. requirements by continuing without change the major substantive elements of the original Umbrella Agreement, and Russian requirements by obviating any conflict between the CTR extension and domestic law. The solution also met both sides' interests by allowing CTR work in Russia to continue without any hiatus, even if the Russian ratification process was long delayed.[4]

It also appears that the Russian Foreign Ministry had been careful to ensure Russian interagency support for the approach before proposing it to the United States. To do otherwise would have risked a time-consuming, and potentially uncertain, internal approval process once the United States accepted the approach. The time for that was not available, given the imminence of the expiration deadline.[5] Instead, it took the Russian government several weeks to develop the "provisional application" proposal; once it did so, the United States was able to agree quickly, and the final text was concluded shortly thereafter.

While Russian development of the "provisional application" solution had the greatest impact leading to the successful negotiations, the United States also was willing to use its limited flexibility. The United States viewed the changes that it accepted in the Extension Protocol as clarifications of the original provisions rather than substantive amendments. For Russia, however, they narrowed the potential sweep of some of the original Umbrella Agreement provisions. Thus, for example, the Extension Protocol specifies that freedom from customs inspections applies only to official United States government aircraft or vessels, in accordance with customary international practice. Similarly, the Extension Protocol provides that privileges and immunities extend only to official United States government personnel, not to contractors, and that exemption of assistance from import and export fees does not extend to exemption from Russian export control procedures.

APPLICABILITY OF LESSONS LEARNED

In a narrow sense, the direct experience of the negotiations for the CTR Umbrella Agreement and Extension Protocol has little application to other nonproliferation cooperation agreements between the United States and Russia. In the years since the June 1999 extension, the Russian government has refused to bring new projects under the CTR Umbrella Agreement unless they are directly led and funded by the U.S. Department of Defense CTR program. The implementing agreements between the Russian Ministry of Atomic Energy (Minatom) and the U.S. Department of Energy on Material Protection, Control and Accounting and End to Weapons-Grade Plutonium Production are more apparent than real exceptions. Both projects were started with CTR funding and covered by implementing agreements between Minatom and the U.S. Department of Defense. The new implementing agreements after the projects and their funding were transferred to the U.S. Department of Energy and were thus viewed as extensions of existing arrangements rather than wholly new ones.

Russia has also refused to replicate the CTR Umbrella Agreement liability provisions in other agreements. For its part, the United States long insisted on those provisions, particularly in light of the pending ratification of the CTR Umbrella Agreement and of the Russian government's use of other precedents in the Extension Protocol negotiations. (It is worth noting that other CTR Umbrella Agreement provisions which had been viewed as problematic in 1999 are now generally accepted. Those include tax exemption, privileges, and immunities for government personnel and—at least in principle—access to sites to confirm the need for and use of funds.)

In a broader sense, however, the experience of negotiating the CTR Umbrella Agreement, and especially the Extension Protocol, may carry important lessons for other cooperative efforts—both for the United States and Russia and for other countries.

First, the fact of the existence of the Umbrella Agreement itself was important. Although it limited U.S. flexibility in being able to accept changes to the agreement, it had the benefit of precedent for both sides. More important, it encompassed a broad range of cooperative projects. Each side might be willing to accept the failure of negotiations for one cooperative effort rather than compromise its position on one

[4]Russian ratification of the CTR Extension Protocol has in fact been delayed. As of March 2005, the Russian government had still not submitted the agreement to the Duma.

[5]The extension protocol was completed with little time to spare. Because the original agreement was signed by the two presidents, the sides agreed that it would be most appropriate for the two ambassadors to sign the extension. The United States ambassador to Russia signed in Moscow on June 15, 1999; the text was hand carried to Washington, D.C.; and the Russian Ambassador to the United States signed on the morning of the 16th. That required a slight change in the U.S. legal position on when the Umbrella Agreement would expire. The United States had held that the deadline was midnight on the 16th in the farthest eastern (i.e., earliest) portion of Russia. When it became clear that the logistics of signature and transportation between the two countries would not make that possible, the United States decided that midnight in Washington, D.C., was a valid deadline.

or more provisions; the long stalemate in U.S.-Russian plutonium disposition negotiations may be a case in point. In the CTR case, however, a large number of cooperative activities was at stake, including strategic arms elimination, chemical weapons destruction, nuclear warhead and material storage and transport security, defense and military contacts, and other efforts. The costs of failure were much higher than they would have been for a single-project agreement.

Second, and closely related, the substance of CTR cooperation had evolved over time, so that the sides' interest in the effort did not diminish, even as some initial important motives for the program were no longer relevant. The Umbrella Agreement was drawn broadly enough to encompass work that had not been envisaged when it was first negotiated. Thus, for example, CTR's initial work in nuclear security was intended primarily to facilitate denuclearization in Ukraine, Belarus, and Kazakhstan and warhead dismantlement in Russia. By 1999, nuclear security work had actually increased, designed to prevent proliferation from Russia as well as warhead reduction. Overall, the emphasis of the program was shifting from arms reduction to nonproliferation; that trend has accelerated since 1999, reflecting major changes in the U.S.-Russian relationship and shared threat perceptions.

Third, and just as closely related, the breadth and importance of cooperation under the CTR Umbrella Agreement meant that there were several important CTR stakeholders among Russian agencies. In contrast, only one or two agencies might benefit directly from a single-project agreement, with correspondingly less weight in the Russian government decision-making process. Moreover, the benefit to the Russian government from ongoing CTR projects was real and measurable. Failure to extend the Umbrella Agreement would mean the loss of major ongoing efforts which addressed stated Russian priorities, rather than of hypothetical future possibilities or of efforts which Russia had not identified as priorities.

In addition, the Russian government, and likely especially the Foreign Ministry, had an overall political interest in the continuation of the cooperation. Although the general political motive regarding the U.S. and Russian relationship which underlay CTR cooperation had changed greatly since 1992, it was still important. For both the United States and Russia, expiration of CTR cooperation would have been a real political failure.

Finally, the success of the extension negotiations owed much to the human factor. The Russian negotiators were extremely skillful in forging and maintaining consensus within their own government and in devising a creative solution to the impasse in the negotiations. It is difficult to imagine alternatives to the "provisional application" approach that would have been equally acceptable to both the United States and Russia. It is also difficult to speculate on the internal Russian process that led to its development. But it worked.

In sum, the key factor behind the success of the negotiations of both the CTR Umbrella Agreement and its Extension Protocol was the strong common U.S. and Russian interest in their conclusion. The sources of that common interest can be many. On the substantive side, it appears necessary to have either a strong political incentive and expectation of future benefit (as in the 1992 negotiations) or a practical interest in ongoing cooperation that carries measurable, important benefits that address both sides' priorities (as in the 1999 negotiations). Procedurally, intragovernmental support for the cooperation is also required. A forcing function like a presidential summit is very useful, but not essential, if the necessary consensus within and between governments can otherwise be achieved.

D

The Experience of Cooperation in Accounting, Control, and Physical Protection of Nuclear Materials Between the Ministry of Defense of Russia and the Department of Energy of the United States

N. N. Yurasov, Vice Adm., R.F. Navy (ret.)

Simultaneously with the establishment of nuclear security-challenged installations under the Russian Ministry of Defense in the 1950s and 1960s, the system of their security and defense was being created. The site safety requirements proceeded from threat assessments prevalent at that time and became obsolete, along with the deployed equipment, in the early 1990s. At the same time, organizational and structural changes in the armed forces under the conditions of insufficient deployment of technical measures of control and security at nuclear installations, growing social tensions, aggravation of the criminal environment, and emerging and escalating interethnic conflicts in the 1990s necessitated drastic changes in the methodology of security coverage at these sites.

In addition, lapses in the physical security of nuclear materials were registered at numerous nuclear security-challenged installations during the same period. This called for the immediate introduction of additional solutions to prevent the theft or unsanctioned circulation of highly enriched uranium, plutonium, and other components potentially useful as weapons of mass destruction.

However, the programs enacted with a view to providing elevated security measures at nuclear security-challenged installations have not been implemented in full because of extremely low levels of funding. Thus, for example, the funds assigned to the Ministry of Defense of Russia for the acquisition of physical security elements in 1996 could satisfy only 3 percent of the request submitted by the armed forces, preventing supplies of critical technical security equipment from reaching even the most pressing task areas.

During that period the Navy faced an acute need to solve the task of providing modern equipment for accounting, control, and physical security for its nuclear security-challenged installations. The Navy Command was alert to the fact that procrastination in providing physical security for nuclear materials could result in grave consequences, with the impact of the damage far exceeding the costs of implementation of programs of accounting, control, and physical security of these materials.

Under conditions of insufficient funding, a promising solution to the above-mentioned problem was presented through the use of funds allocated to Russia within the framework of U.S. assistance for the implementation of programs for the demolition and nonproliferation of weapons of mass destruction.

From the 1990s onwards, the establishment of an effective regime for physical security, accounting, and control of nuclear materials appeared to be one of the fundamental priorities in Russian-American nuclear cooperation. This program was geared to the upgrading and modernization of security systems at weapons-grade fissionable material storage facilities, as well as the production of modern accounting and control systems with a view to replacing traditional accounting methods and, in part, enabling operational supervision of movements of fissionable materials.

In 1995, the Russian Navy and the Kurchatov Institute Russian Research Center (RRC) adopted a joint resolution on cooperation in the area of design and implementation of systems of accounting, control, and physical security of nuclear materials at the nuclear security-challenged Navy installations. This joint resolution was predicated by the need to replace obsolete physical security equipment with modern measures, as well as to create an up-to-date system of accounting and control of nuclear materials that would subsequently be incorporated into the nationwide nuclear material accounting system.

RRC was chosen as the general contractor for the implementation of design projects to produce physical security systems at the Navy's nuclear security-challenged installations. RRC was chosen on the basis of its long and productive cooperation with the Navy in the areas of design and research methodology in the operation of nuclear power plants, its experience with the training of highly qualified expert operators, its extensive international contacts, and its

previous experience in organizing international cooperation in the sphere of accounting, control, and physical security with the U.S. Department of Energy.

The activities to be implemented at naval installations included

- The development of a technical outline for and the design, production, and commissioning of a computerized system of accounting and control of nuclear materials;
- The development of a technical outline for and the design, production, and commissioning of physical security systems for land- and sea-based installations;
- The completion of normative documentation (methodology, instruction, and guidance manuals);
- The training of personnel assigned to operations for the systems described above;
- Assessment of the vulnerability at nuclear security-challenged installations;
- Construction work; and
- The design, development, production, and commissioning of communications systems to enable functioning physical security systems and the actions of security force units.

The cooperation between the Ministry of Defense of Russia and the U.S. Department of Energy was commenced with the Joint Statement on Cooperation in the Area of Accounting, Control and Physical Security of Nuclear Materials, signed in Moscow in 1996 within the framework of the seventh session of the Russian-American Joint Commission on economic and technological cooperation (the Chernomyrdin-Gore Commission). This statement assigned the Kurchatov Institute RRC the role of coordinator of cooperative activities and fundraising for additional aid.

The immediate funding was provided by the U.S. Department of Energy through its national laboratories (Sandia, Livermore, Oak Ridge, and Los Alamos, with the Pacific National Laboratory joining the program at a later date) within the framework of the joint Russian-American program for the nonproliferation of nuclear materials.

The new cooperation program developed quite dynamically, accounting for tangible activities at Northern and Pacific Fleets, including

- Modern storage facilities for new nuclear reactors on nuclear submarines and surface ships have been constructed and commissioned, consistent with up-to-date nuclear and radiation safety requirements; systems of accounting, control, and physical security for these sites have been completed, along with construction of buildings that house security force units and service operators;
- Storage facilities for fresh and depleted nuclear fuel at three sea-based technical maintenance bases have been equipped with systems of accounting, control, and physical security;
- Communications systems for guard units have been purchased and deployed;
- Seven specialized vehicles for nuclear material transportation, seven escort vehicles, two buses for personnel, and a bulldozer have been received;
- Reaction force personnel have been issued body armor and helmets;
- Systems of physical security have been installed at storage facilities for depleted nuclear fuel, and TUK-18 transportation container loading units have been received;
- Buildings for guard units have been constructed, and physical security systems have been installed at special designated sites in the Okol'naya Inlet and nuclear submarine base Skalistii; and
- Feasibility studies for a projected coastal compound for unloading depleted nuclear fuel and dismantling nuclear submarines at the Kamchatka ship repair and maintenance facility have been completed.

Meanwhile, the continuation and development of further cooperative efforts called for the drafting of a full-scale legal document. The joint statement was, to a great extent, a political declaration reflecting the general intents of the parties toward bilateral cooperation; it did not contain any legally binding clauses or specific directions for cooperative efforts and their coordinated mechanisms. Besides, continued realization of the joint program required mutually acceptable and coordinated methods and procedures for inspections of facilities to determine whether the assistance rendered had been appropriately applied.

The American side has repeatedly raised the issue of granting extended access to various installations or individual buildings within installations to verify that the allocated funds have been appropriately applied. This situation was sensitive, as cooperative programs were implemented at the installations under the jurisdiction of the Ministry of Defense of Russia, whose secrecy regime requirements prohibit the access of outsiders, especially foreign nationals, to the installations. Contradictions of this nature could not have been completely resolved; but on a positive note, both sides always seemed willing to find mutually acceptable solutions and continued active cooperation, despite the serious problems encountered during the process.

In part, these contradictions accounted for rather slow progress in the realization of the first Russian-American agreement in the area of accounting, control, and physical security of nuclear materials within the framework of the Nunn-Lugar program. In October 1999, Russian Federation Minister for Atomic Energy Yevgeniy Adamov and U.S. Secretary of Energy Bill Richardson signed a new intergovernmental agreement aimed at expanding bilateral cooperation within the framework of the program of accounting, control, and physical security of nuclear materials. The agreement stipulated the formation of the Joint Coordination

Committee; its mission included the development of joint action plans, recommendations, and respective executive agreements. The committee was also designed as a forum for the arbitration of disagreements between the parties to the agreement. Russia agreed to take all necessary steps to provide permits to allow American representatives access to the facilities involved in the joint activities within the framework of the cooperation program.

For their part in the realization of cooperation between the Ministry of Defense of Russia and the U.S. Department of Energy, the military construction organizations of the Ministry of Defense of Russia have performed and are performing all construction and assembly operations at the installations. The design and deployment of engineering and technical equipment, as well as the accounting and control systems, are being conducted exclusively by specialized Russian enterprises that have been granted by government licenses to perform these types of operations at nuclear sites and Ministry of Defense installations. Within the framework of the compliance procedures of the agreements on strategic offensive weapons reduction, it has been demonstrated to representatives of the U.S. Department of Energy that the work that has been completed, mostly at installations previously visited by American inspectors, and the targeted use of the allocated resources has been verified. In instances in which the access of foreign nationals to certain localities or structures is completely excluded, alternative mutually acceptable and coordinated procedures are being applied.

In August 2000 the Ministry of Defense of Russia and the U.S. Department of Energy signed the Agreement on Cooperation in the Area of Accounting, Control and Physical Security of Nuclear Materials (the Agreement), according to the provisions of the 1999 Intergovernmental Agreement.

The Agreement defines the principal obligations of the parties and guidelines for bilateral cooperation, including

- Upgrading of conditions for safe and reliable storage and transportation of nuclear materials;
- Maintaining efficient and continuous functioning of newly produced and modernized systems of accounting, control, and physical security of nuclear materials;
- Upgrading of physical security at land- and sea-based nuclear fuel storage facilities for the Northern and Pacific Fleets;
- Outfitting of a training center for personnel assigned to the areas of the accounting, control, and physical security of nuclear materials; and
- Development of systems of accounting, control, and physical security of nuclear materials at nuclear submarine bases, naval industrial enterprises, etc.

Consequently, the framework of the Agreement's implementation provides for cooperation not only in the development of up-to-date measures of physical security and their modernization but also in the maintenance of these systems in workable order, which is critically important for the Ministry of Defense of Russia under conditions of limited funding.

Similar to the Intergovernmental Agreement, the Joint Coordinating Committee (JCC) has been established as a policy-making body to develop joint action plans and mechanisms for their implementation, organize meetings for the evaluation of the progress that has been made in the realization of the Agreement, develop recommendations to the parties on the initiation of new projects, etc. The JCC adopts all decisions on the basis of consensus. The Agreement delineates the requirements for the personnel assigned to work on cooperation activities, as well as the rules associated with the acquisition of information. According to Article 5 of the Agreement, the American side has been granted the right to audit and inspect personnel training, equipment, materials, and services rendered within the framework of the Agreement, preferably at their locations or sites of application.

To implement the Agreement with the U.S. Department of Energy, the parties developed a memorandum of understanding on guarantees of the proper use of the assistance rendered (the memorandum). The memorandum delineates the general principles and approaches to the inspection procedures. The guarantees presume verification of the targeted use of assistance exclusively for implementation of the Agreement.

According to the memorandum, as part of their verification activities, the American representatives

- Inspect the security challenges at a given site and evaluate the needs and requirements in the upgrade projects;
- Review the security systems upgrade process and verify that the work has been completed and that the equipment is functioning in compliance with the site upgrade project; and
- Verify that the proper technical services and maintenance operations are included in the scope of assistance rendered by the U.S. side.

Specific methods used to demonstrate that the work has been completed have been developed and are described in greater detail in the Administrative Procedures of the Memorandum; They include

- Demonstration that the work at the installation receiving assistance has been completed;
- The inspection of documentation;
- The inspection of the equipment supplied; and
- The taking of photographs.

In addition, the memorandum specifies the number of individuals who may be engaged in the verification operations, the general requirements for representatives of the U.S. Department of Energy and Ministry of Defense of Russia in the

course of the inspections, and the American side's obligations for the security of the information obtained from the inspections and provides for the development of a verification plan and timetable, etc.

The plan and timetable for verification activities are coordinated and endorsed annually by the JCG cochairs. These specify the terms and methods of inspection of the assistance rendered for the current year. This allows, on the one hand, the installations' work plans to be adjusted and for the installations to be prepared for the inspections beforehand and, on the other, improves the planning process for the supply of resources. Besides, for the first time within the framework of Russian-American cooperation in the area of the physical security of nuclear materials, both sides employed annual planning as a mechanism of ensuring mutual agreement on the requirements, priorities, and responsibilities in the process of inspection of the assistance rendered.

All of the documents described above have been developed and signed with the American side and legally confirm the forms and methods of inspections of the assistance rendered without giving the U.S. representatives the right to access the installations of the Ministry of Defense of Russia. A positive example here is the fact that up-to-date measures of physical security have been deployed at one of the first installations under General Directorate 12 (GD 12) without access of U.S. Department of Energy representatives to the site.

Thus, inspections of the assistance rendered within the framework of the Agreement utilize principles of annual planning and other verification methods, which allow for a considerable increase in the degree of mutual trust in the process of cooperation.

The approaches and methods of inspections of the assistance rendered that have been developed within the framework of the Agreement's implementation have shown positive results and have been used for the development of similar inspection procedures within the framework of implementing the 1995 Agreement with the U.S. Department of Defense on cooperation in the area of secure storage of nuclear weapons by means of supplying materiel, services, and respective training, and of the 2003 agreement that is slated for implementation with the Federal Ministry of Foreign Affairs of Germany on cooperation in the area of providing physical security for nuclear materials and nuclear weapons.

The deployment of modern physical security equipment at nuclear security-challenged installations of the Ministry of Defense of Russia within the framework of bilateral cooperation with the U.S. Department of Energy is being carried out in compliance with state-of-the-art requirements for site security. Instead of focusing on site perimeter as the key element of the defense system, these requirements emphasize security for certain buildings, depots, and premises on the guarded territory, while the perimeter of the installation as a whole is guarded.

The process of physical security systems upgrade begins with a site vulnerability assessment, followed by project development and so-called fast upgrades of physical security systems. Full-scale upgrades include the assembly of physical security systems by the use of state-of-the-art technical detection and security systems, as well as control instruments manufactured domestically that have been certified and commissioned. Engineering systems at checkpoints and installation perimeters are designed to withstand terrorist group attacks. Access zones at checkpoints are equipped with antipenetration barriers and sensors for the detection of nuclear materials, metal items, and explosives; the guards at pedestrian entry points are placed behind bulletproof glass; and the perimeters are augmented with security roads, ditches, reinforced fencing, etc. Centralized site security command and control centers are being set up. Guard units and reaction force personnel are issued state-of-the-art communications equipment. Special emphasis is placed on providing security for nuclear materials during transport, during loading and unloading, and at points in between.

Currently, the implementation of the Agreement involves not only naval installations but also those of the Special Missile Forces (SMF) and GD 12 of the Ministry of Defense. Storage facilities for fresh and depleted nuclear fuel, guard buildings, vehicle inspection stations, armored vehicle boxes for reaction forces, control access buildings, armored installation defense points, armored guard towers, modular diesel generator units, and up-to-date physical security equipment have been constructed and commissioned at 18 installations of the Ministry of Defense of Russia. Similar work is in progress at 12 more sites under the Navy, SMF, and GD 12; and construction of the Kola training technical center is nearing completion. In addition, fast upgrades of physical security systems have been completed at 23 naval installations; fast upgrades at 7 SMF sites are under contract.

Guard units and reaction forces at all installations under the Ministry of Defense have been equipped with body armor and helmets; radio communications systems have been deployed for the operational interaction of these units. Thirty armored vehicles for site defense have been purchased, and snow removal equipment has been provided. The U.S. Department of Defense allocates funding for technical maintenance of physical security systems at fully commissioned installations. Service personnel who work with the physical security systems undergo routine training; instructors at the Kola training technical center take professional courses to upgrade their skills. The development of physical security systems and the utilization of radioisotope-based thermoelectric generators with subsequent deployment of alternative power sources has begun.

As indicated above, the cooperation process was developing in a positive direction from the very beginning because of special attention displayed by the leadership of the U.S. Department of Energy on one side and the Russian Navy and Ministry of Defense in its entirety on the other. In this

context, U.S. Assistant Deputy Secretary of Energy Rose Gottemoeller and Commander-in-Chief of the Russian Navy Fleet Admiral V. Kuroyedov have actively supported the cooperation effort.

In 2003, the U.S. Secretary of Energy praised the results of the bilateral cooperation, having said that a tangible sector of the Navy and SMF installations has been equipped with up-to-date physical security systems. As of December 2004, overall funding for the development of modern physical security systems and systems of accounting and control of nuclear materials exceeded US$300 million. Cooperation in this area has also received the highest marks from the Government Accountability Office of the U.S. Congress, and U.S. senators and representatives, who, together with technical experts, have witnessed the actual results of bilateral cooperation. At the same time, today it can be said with assurance that high-quality results have been achieved because of the cooperation and organizational efforts that were achieved from the very start of the process by both the Russian and the American sides. Many of those who started work on these systems back in 1996 continue to work on them today. This process has created a nucleus of like-minded individuals who have built the foundations of today's cooperation based on mutual trust.

E

Meetings and Discussions

JANUARY AND FEBRUARY 2005

Moscow, Russia

Anatoly Antonov, *Ministry of Foreign Affairs*
Maria Balieva, *Rosatom*
Valery Nikolaevich Barinov, *Russian Academy of Sciences' Nuclear Safety Institute (IBRAE-RAS)*
Valentin Ivanov, *Duma*
Norbert Jousten, *International Science and Technology Center*
Remos I. Kalinin, *IBRAE-RAS*
Natalia Klishina, *Department of External Affairs, Rosatom*
Nikolai Pavlovich Laverov, *Russian Academy of Sciences*
Nikolai N. Ponomarev-Stepnoi, *Kurchatov Institute*
Sergei Popov, *Head of Space Energy Research Department, Keldish Institute of Applied Mathematics*
Tatiana S. Povetnikova, *Chief Expert, Office for International Scientific and Technical Projects, IBRAE-RAS*
Mikhail Nikitovich Rizhov, *International and External Economic Cooperation Department, Rosatom*
Lev Ryabev, *Advisor to Minister of Atomic Energy*
Leonid F. Ryabikhin, *Executive Secretary, Committee of Scientists for Global Security and Arms [Control]*
Ashot A. Sarkisov, *Russian Academy of Sciences Advisor, IBRAE-RAS*
Lev V. Tocheny, *International Science and Technology Center*
Nikolai Nikitevich Yurasov *(V. Adm, R.F. Navy, ret.), personal advisor to Mr. Koreedev*
Yuri Filipovich Zabaluev, *Technical Export Control Service*
Sergey A. Zykov, *International Science and Technology Center*

United States

Steven Aoki, *U.S. Department of Energy*
Omer Brown, *Harmon, Wilmot, and Brown LLP*
Matthew Bunn, *Harvard University*
R. Stockton Butler, *Government Accountability Office*
Cathleen Campbell, *Civilian Research and Development Foundation*
Camille Dewalder, *Civilian Research and Development Foundation*
Michael Elleman, *Booz Allen Hamilton*
Dan Fenstermacher, *U.S. Department of State*
Marvin V. Fertel, *Nuclear Infrastructure Support & International Programs, Nuclear Energy Institute*
Brian Finlay, *Henry L. Stimson Center*
John Gerrard, *U.S. Department of Energy*
Seth Grae, *Thorium Power Inc.*
Amb. Michael Guhin, *U.S. Department of State*
William Hoehn, *Russian American Nuclear Security Advisory Council*
Laura Holgate, *Nuclear Threat Initiative*
David Huizenga, *U.S. Department of Energy*
Susan Koch, *formerly of the National Security Council*
Sarah Lennon, *U.S. Department of Energy*
Cynthia Lersten, *U.S. Department of Energy*
Edward Levine, *Staff of Senate Committee on Foreign Relations*
Glen Levis, *Government Accountability Office*
Michael Lieberman, *Staff of Representative John Spratt*
Edward Lyman, *Union of Concerned Scientists*
Monte Mallin, *U.S. Department of Energy*
Cindi Warren Mentz, *Civilian Research and Development Foundation*
Thomas Moore, *Staff of Senate Committee on Foreign Relations*
Ken Myers, Jr., *Staff of Senate Committee on Foreign Relations*

Mary Beth Nikitin, *Center for Strategic and International Studies*
Thomas Owens, *Civilian Research and Development Foundation*
James Reid, *U.S. Department of Defense*
Adam Scheinman, *U.S. Department of Energy*
Mark Scheland, *U.S. Department of State*
E. James Shafer, Jr., *Government Accountability Office*
Kurt Siemon, *U.S. Department of Energy*
Michelle Smith, *U.S. Department of Energy*
Wendin Smith, *Booz Allen Hamilton*
Leonard Spector, *Monterey Institute of International Studies*
Paul Walker, *Global Green*
Andrew Weber, *U.S. Department of Defense*
Shawn Wheeler, *Civilian Research and Development Foundation*
Stephen Young, *Union of Concerned Scientists*

F

On Some Issues of Global Security and Nonproliferation of Nuclear Weapons

L. D. Ryabev, Advisor, Rosatom

NUCLEAR DISARMAMENT

The standoff between the former USSR and the United States was the main motif of global security from about the end of World War II until the early 1990s. The nuclear arms race that started in 1945 after the detonation of the first nuclear bomb led to the accumulation by the former USSR and the United States of tens of thousands of nuclear munitions and to the appearance of new nuclear weapons states.

The accumulated nuclear weapons stockpiles could have led to mutual destruction of the two countries.

In the 1970s, the USSR and the United States reached parity in nuclear arms. Each side could inflict unacceptable damage to the other side through a retaliatory strike, and ballistic missile defense could not protect either country from the adversary's retaliation. Gradually, an understanding materialized that neither of the sides could win that race and different (non-power-based) foundations for international relations needed to be sought. Military equilibrium had become a deterrent insurance from possible aggression.

It is clear, however, that it could not become a long-term basis for global security. This led to a series of arms reduction negotiations and resulting agreements between the United States and the former USSR.

As a result, from 1990 to December 2001 the following was accomplished:

- The number of delivery vehicles for strategic offensive arms has been reduced from 2,500 in the former USSR and 2,246 in the United States to 1,600 on either side. The number of munitions has been cut from approximately 10,000 to 6,000;
- Nuclear stockpiles, including tactical weapons, have been cut dramatically;
- Further production of nuclear weapons materials (uranium and plutonium) has been stopped;
- Production of nuclear munitions has been reduced by more than a factor of 10 in Russia and has been completely suspended in the United States;
- 500 tons of Russian weapons-grade uranium has been deweaponized, along with 34 tons of plutonium each in Russia and the United States alike;
- A part of the weapons-grade materials has been blended down to nonweapons grade;
- Nuclear testing has been banned;
- A number of nuclear weapons complex production facilities has been shut down;
- Defense industrial base personnel have been cut; and
- Finally, many hundreds of missiles (specifically, 1,846 missiles in the former USSR and 846 in the United States) have been eliminated in compliance with the Intermediate-Range Nuclear Forces treaty.

A certain contribution to arms control has been made by the Cooperative Threat Reduction (CTR) program (also known as the Nunn-Lugar program).

The situation in the Russian nuclear weapons complex in the early 1990s gave grounds for concern—first of all, on the part of the United States. Following precipitous economic deterioration and weakening of government control, export control measures gave way. For the first time, the threat of nuclear material theft by the employees of the nuclear weapons complex had materialized.

However, Russia has realized its responsibility for the safety and security of its nuclear stockpile all along. In recent years, the following drastic steps have been taken:

- An up-to-date regulatory environment has been created and implemented;
- A government-mandated system of nuclear material control and accounting has been enforced;
- Physical protection has been strengthened;
- Storage facilities for nuclear materials and munitions compliant with the strictest of norms have been made available;
- An export control law has been passed, and dual-use item lists have been reviewed;

• Safe transportation and storage containers for special items and materials have been introduced; and
• The material well-being of personnel has been improved.

Work along these lines is continuing and is becoming more and more routine and habitual in nature. As a matter of fact, in the context of nuclear-powered submarine disposition, political, technological, and organizational issues have been worked out; extensive experience has been accumulated; the scope of work has been defined, both in general terms and on an annual basis; and the deadline for these activities has been clearly identified. The 2002 Global Partnership Initiative has been taking cooperative efforts to a whole new level. The main objective of the partnership is to eliminate chemical weapons, nuclear-powered submarines, and weapons-grade materials to prevent the proliferation of weapons of mass destruction (WMD) and their requisite materials.

However, boiling all collaborative efforts down to just stockpile elimination activities would be a move of questionable utility. As time goes on, constructive themes promoting the interests of the United States, Russia, and other countries must start dominating the collaborative engagement more and more.

In 2003, the Moscow Treaty entered into force between Russia and the United States. It calls for strategic offensive reductions to 1,700 to 2,200 warheads on either side by 2012. Unfortunately, however, the treaty has no clear schedules, interim milestones, or means of assessing the compliance associated with it. This is the first treaty that does not call for a commensurate reduction in delivery vehicles and that does preserve the warheads, which can be easily returned to operationally deployed status.

All of the treaty's provisions are reversible at any time. The United States has clearly lost interest in any further steps to reduce nuclear weapons stockpiles. At the same time, it has become abundantly clear that even the 1,700 to 2,200 warheads left on either side by 2012 are still excessive for the purposes of defending a country and can only be directed at each other. On more than one occasion, Russia has introduced proposals to reduce the stockpiles to as low a level as 1,000 warheads on either side.

The remaining significant nuclear stockpiles contradict the commitments taken by the nuclear weapons states upon conclusion of the Non-Proliferation Treaty (NPT).

The nuclear powers are losing their leadership positions and initiative in nuclear disarmament, which is a constituent element of the nonproliferation policy, threat reduction, and security building. Possible ways to achieve a nuclear weapons-free world have been all but neglected.

In this context, the role of nongovernmental and academic organizations in studying these issues and working out appropriate recommendations becomes all the more important. The question of the role of nuclear weapons in the modern world also warrants further consideration.

It would seem that the United States is the country with the least need for nuclear weapons. As such, the United States could very well lead by example by taking further sweeping steps in nuclear disarmament without sacrificing anything in the way of national security. In contrast, Russia, with its different geopolitical profile, weak economy, and inadequate conventional weapons, may be an example of a country better suited to resort to some other approach.

When the United States and the former USSR had piles upon piles of weapons, the disarmament process was going neck and neck. In the future (say, upon reaching the level of 1,000 warheads on either side), further nuclear stockpile reduction steps must be tied to finding a comprehensive solution to the security issues of both sides. The principle of equal security will have to be exercised on the basis of both nuclear and nonnuclear components.

The United States has already taken some asymmetrical political-military steps:

• The Warsaw Treaty Organization no longer exists, while the North Atlantic Treaty Organization (NATO) is expanding eastward; and it is not apparent from what kinds of threats that NATO will be defending Europe. Possibly, this will be clarified at the Russia-NATO Council meeting; and
• The United States has withdrawn from the Antiballistic Missile Treaty, which Russia considered the cornerstone of strategic stability.

One cannot assume that Russia will not take adequate steps in terms of beefing up its arsenals. Here, it would be appropriate to remind the reader of Russian President Vladimir Putin's statement made in November 2004: "I am confident that in the next several years these capabilities [i.e., new nuclear missile systems] will be fielded and they will embody the kind of R&D [research and development] which other nuclear weapons states do not possess currently and will not possess for years to come."

It would be helpful to investigate, in a joint fashion, how the U.S. National Missile Defense program, which is at various stages in its development, can affect the security of Russia and the United States itself and whether or not the United States and Russian share any commonalities in terms of defense from third countries.

Discouraging is the hard-to-explain position of the United States regarding ratification of the Comprehensive Test Ban Treaty. Such unilateral actions speak to the lack of trust and commitment to honor agreements between our two countries reached earlier.

Only an open and impartial discussion of disagreements can lead us on to the right path. The sequence of further steps in nuclear disarmament is important.

We believe that it is critical to make sure that

- Mutual threat analysis for the United States and Russia is conducted and
- Each side's concerns are identified.

After that, measures to ensure further disarmament, transparency, and control need to be thought through. While convincing other countries that they need not have nuclear weapons, one has to figure out why the United States and Russia do need them and other countries do not. Can one make do without nuclear weapons? What are the prerequisites for that? The still significant nuclear stockpiles that will remain as of 2012 can be explained in only one way: they are still viewed as a way for the United States and Russia to deter each other.

The concept of nuclear weapons nonproliferation as such is at odds with the enormous nuclear stockpiles held by the five nuclear weapons states. This kind of arrangement disenfranchises non-nuclear-weapons states, undermines further strengthening of the nuclear nonproliferation regime, makes the nuclear nonproliferation regime unstable, and delays the implementation of Article VI of the NPT (i.e., negotiations on nuclear disarmament). A number of countries are still pursuing nuclear weapons programs. First, at the present level of advancement of nuclear technologies and knowledge, this does not require tremendous expenditures. These technologies and knowledge are already available to many countries. Second, having nuclear weapons is still a matter of political prestige and boosts a country's international image. Finally, and possibly most importantly, nuclear weapons serve as an additional, last-resort measure in terms of protecting one's country from external pressures: it is doubtful that the United States would have attacked Iraq if Iraq had possessed nuclear weapons.

Still, there is no international security system that would protect a country against external threats.

Many of us do not like the North Korean regime. However, this cannot serve as a justification for a regime change unless the regime is engaged in acts of aggression against some other country. It is not clear why the United States cannot give North Korea security guarantees in exchange for its steps to dismantle its nuclear weapons program. Some of the new developments under discussion in the United States today also give grounds for concern. They are

- Lowering of the nuclear weapons use threshold, which, in effect, makes nuclear weapons a usable battlefield weapon (e.g., low-yield nuclear weapons);
- The possibility of nuclear weapons use in nonnuclear conflicts; and
- The possibility of a preventing or preemptive nuclear strike.

Analysis of military doctrines is also important. In the Russian doctrine of 2000, the role of nuclear weapons is defined as a deterrent against aggression, as a security insurance for Russia and its allies, and as a tool for maintaining international stability and peace. Similar justification rationales may also be put forth by other countries.

Therefore, it is evident that the nuclear disarmament process has somewhat stalled and that confidence- and security-building measures are insufficient. This ultimately impacts the effectiveness of nuclear weapons nonproliferation policies.

NONPROLIFERATION OF NUCLEAR WEAPONS

The NPT, which entered into force in 1970, has been a source of positive influence in resolving issues of nuclear security. However, over the past 35 years, its shortcomings have become apparent as well:

- It has not stopped nuclear proliferation (India and Pakistan have become defacto nuclear powers; Israel is generally believed to have an unacknowledged nuclear weapons program, and a number of other countries are suspected of illicit activities);
- Nuclear weapons states are still a long way away from addressing the issue of nuclear disarmament with the ultimate objective of complete elimination of these weapons (as per Article VI of the NPT); this issue is not even as much as being discussed;
- There have been difficulties with transferring peaceful nuclear technologies to nonnuclear NPT member states;
- There are nonstate actors and terrorist groups that are actively pursuing nuclear weapons and materials, while clearly existing outside the NPT;
- The black market for nuclear materials and technologies has expanded, considering that privately owned companies and individuals possess nuclear knowledge;
- Not all states are signatories to the NPT;
- It is possible to come close to achieving a nuclear weapons capability while remaining compliant with the NPT; and
- A withdrawal from the NPT with impunity cannot be ruled out; this is possible even after nuclear technology has been acquired in compliance with the NPT.

Besides, the global uncertainty situation (is this a unipolar or a multipolar world?) creates new opportunities for and elevates interest in the acquisition of nuclear weapons.

The list of countries engaged in peaceful nuclear activities has become longer, which creates scientific and technological prerequisites for the possession of nuclear weapons, especially if a closed nuclear fuel cycle capability becomes available. It also increases the mass of nuclear materials in circulation and therefore expands opportunities for their theft. Dissemination of nuclear knowledge lets a significant number of countries quickly master nuclear technologies at a minimum level of expenditure. The role of a force-based

(as opposed to a law-based) approach to dealing with countries suspected of nuclear weapons activities has become more prominent. As new threats materialize and displace old ones, for some states complete security still proves elusive.

The United States and Russia, two leading nuclear weapons powers, hold diametrically opposite views regarding practicable approaches to nonproliferation. There is also a lack of coordination in the actions of the two countries. There is no unified approach to different countries; i.e., double standards have prevailed; countries are divided into "good" and "bad," even though they all have accepted the conditions of the NPT. There is no legal recourse if an NPT-nonmember country is pursuing nuclear weapons, withdraws from the NPT for the same purpose, or violates its provisions. Nonproliferation rules and norms must be universal in nature. They must include a commitment by each country to curtail terrorist activities on its territory.

A need has arisen to consider the issue of switching from voluntary nonproliferation compliance to mandatory enforcement (with an element of coercion, if necessary). A year ago, the United States came out with a Proliferation Security Initiative to interdict illicit trading in nuclear weapons and materials. There also have been other proposals as well. In effect, the United States has proposed a new strategy for combating WMD proliferation. This strategy significantly oversteps the bounds of the NPT. However, we have not been discussing or assessing it in more detail, never mind working out appropriate forms of international agreements or identifying the roles and responsibilities of the International Atomic Energy Agency (IAEA) and the United Nations to assist in its implementation.

In most general terms, we are talking about a new system of international relations as we move away from the Cold War era and its rigid bipolar world order. We need to custom tailor the NPT to fit the new security environment. Of course, the nonproliferation regime is being improved already. To illustrate, there is now an Additional Protocol to the NPT, and it broadens the opportunities for monitoring. Other important measures have also been implemented.

For many years now, Russia and the United States have been engaged in close cooperation on nonproliferation. Relevant bilateral agreements have been concluded. First, they had to do with measures to strengthen the nonproliferation regime in Russia (physical protection, export control, control and accounting of nuclear materials, etc.). However, even though Russia has done a lot in the course of these years to instill order in its nuclear complex, it has proven by deeds that it is a responsible country (there have been no recorded cases of theft or loss of weapons-grade nuclear materials—much less nuclear munitions—or leaks of nuclear experts or technologies), and has had nothing to do with India's, Pakistan's, or Israel's nuclear weapons capabilities or with Iraq's or Libya's nuclear ambitions, the West still embraces its consistent proliferation concerns embodied by Russia, especially now that terrorism is on the rise. For example, the director of the Central Intelligence Agency stated in March of 2004, "Russian WMD materials and technologies remain vulnerable to theft and unauthorized use." Senator Richard Lugar stated in his interview to the *Izvestia* daily on January 12, 2005, "Of great importance is not only the control over nuclear-tipped missiles, but also over . . . tactical nuclear warheads which can fall prey to terrorists."

So, the main thrust of U.S.-Russian programs is directed at the countries of the former Soviet Union—for the most part, at Russia.

In accordance with Russia's national security concept adopted in 2000, strengthening of the nonproliferation regime for WMD and their means of delivery is viewed as one of Russia's main national security objectives. It is being resolved, and will continue to be resolved, to the best of Russia's ability to comply with today's requirements.

Nonproliferation collaboration between Russia and the United States must have an international component to it. Even the strongest of states cannot tackle the global nonproliferation challenge in isolation; this effort must be well coordinated within the framework of the international community. A specialized cooperative program must be devised under the tutelage of the two most powerful nuclear weapons states. Priority must be assigned not to force-based methods of dispute resolution but to an overall improvement of the international climate and to threat reduction measures.

One cannot help but be troubled by the fact that prohibitive measures have been an increasingly popular tool used against NPT member states that wish to develop a nuclear power industry.

Iran is a case in point here. Neither the signing by Iran of the NPT, the adoption of the Additional Protocol (which provides for the right of inspection of any facility at any time with no prior notice), placement of nuclear facilities under IAEA safeguards, nor Russia's and Iran's commitments to repatriate spent nuclear fuel to Russia is seen as a good enough argument by the United States. It suspects Iran of nuclear weapons ambitions and continues to demand that the Iranian nuclear program be shut down altogether. Foreign and domestic policy considerations may very well be additional factors at play here. However, these considerations have not been verbalized. Ultimately, someone simply does not like the existing Iranian regime.

Besides, the United States believes that Iran does not need a nuclear power industry because it possesses large deposits of oil and natural gas. Demands presented to Iran go way beyond the NPT and the Additional Protocol; i.e., it is implied that compliance with just their requirements does not ensure the impossibility of developing a nuclear weapons capability.

At the same time, such requirements are not imposed on, for example, Brazil, which has been developing its nuclear power industry and nuclear fuel cycle, including uranium enrichment. This situation requires a detailed and in-depth review by a joint U.S-Russian working group. The NPT may

not meet the new requirements of today, and additional caveats need to be worked out that would make possible the further continuation of peaceful nuclear activities while ruling out the possibility of their diversion to support military programs.

Besides, the right of withdrawal from the NPT because of extraordinary events (see Article X) is also in need of clarification. Of special significance is the issue of regime change in a country that already possesses nuclear technologies. Perhaps norms of behavior in the world community need to be worked out to account for the presence of potentially dangerous nuclear technologies in the world. All these issues could become the subject of a nonproliferation dialog between Russia and the United States. At meetings of the managers of national nuclear weapons laboratories, ideas have been voiced regarding further ways to collaborate in this area. In particular, these ideas called for, among other things, opportunities for collaboration on the following:

- Work regarding detection of signs of undeclared nuclear activities;
- Development of technical assets in support of antiterrorist activities;
- Development of supersensitive instruments for the detection of small quantities of nuclear materials and explosives;
- Development of means of remote monitoring of reactor units and nuclear fuel cycle facilities; and
- Risk assessment for nuclear technologies and other proposals.

Besides, interlaboratory collaboration could be expanded to involve other countries in areas of science such as thermonuclear fusion, computing technologies and programming, laser technologies, and nanomaterials. All this could boost confidence building among weapons scientists and allow them to switch their activities to a peaceful track.

NUCLEAR ENERGY AND NONPROLIFERATION ISSUES

The peaceful use of nuclear energy was considered virtually at the very first stage of the atomic weapons project. As of late 2002, 31 countries had a total of 438 operating nuclear reactors producing a cumulative power output of 325 million kilowatts. In the future, as energy needs increase, the role of nuclear energy in satisfying these needs will likely be significant—even more so since the problems that feed terrorism as a phenomenon (e.g., poverty, economic backwardness, and power deficits) will be aggravated. At the same time, nuclear technologies and related knowledge may be of the dual-use variety and can therefore be used for military purposes or as a disguise for undeclared nuclear activities.

This is why numerous attempts have been made to constrain the development of nuclear technology. In 1978, for example, President Jimmy Carter called on nuclear power countries to give up reprocessing activities to curb the proliferation of nuclear materials—most notably, plutonium extracted from spent nuclear fuels produced by nuclear power plants.

At the same time, the large-scale development of nuclear energy, which compensates for the shortage of fossil fuels and helps resolve environmental problems, is only possible with introduction of fast breeder reactors and a closed nuclear fuel cycle.

It goes without saying that proscriptive measures will not stop technological progress. Besides, such measures as such are in contravention of the guiding principles of the NPT. We need to seek a way out of this situation.

One of the promising ways is closely connected with President Putin's initiative voiced at a U.N. Summit in 2000. Russia suggested that new designs for nuclear reactors and proliferation-resistant fuel cycles be developed. Russia itself is engaged in such research, and these efforts should be combined with the efforts of other countries (first of all, the United States).

Recently, Russia has also put forth a proposal regarding the return of spent nuclear fuel to countries that have the appropriate infrastructure and experience with the safe management of spent nuclear fuel.

Several countries have already put forth the idea of conducting uranium enrichment, spent nuclear fuel reprocessing, and fresh nuclear power plant fuel fabrication only at so-called international centers. As part of the proposal, remote monitoring techniques will be developed to preclude unauthorized activities, including such activities at nuclear fuel cycle facilities or power generation facilities; and nuclear technologies and facilities will be assessed and rated in terms of their proliferation potential.

Overall, these proposal are worthy of serious consideration and implementation of relevant rules and norms. Possibly, a set of requirements will have to be compiled for countries that wish to develop nuclear energy. Countries must also realize that there are economic benefits stemming from nuclear collaboration.

After the U.S.-Russian summit in 2002, pursuant to directives of the two presidents, issues pertaining to collaboration in the development of "reactors of the future" and innovative nuclear fuel cycles have been worked out. The recommendations have been reviewed and approved at the ministerial level but remain unrealized because of disagreements on the Iran issue. The same fate befell the draft agreement on the peaceful use of nuclear energy.

SOME CONCLUDING REMARKS

The United States and Russia must be the champions of advancement of the NPT and proliferation regime in general. They should pay more attention to making headway in nuclear disarmament and the peaceful use of nuclear energy

in the interests of the international community. The United States has to gradually transition from programs fostering economic aid and assistance in science and technology to joint programs based on partnership and collaboration to the timely identification and analysis of existing obstacles, difficulties, and disagreements and finding ways to resolve them.

The global partnership must encompass not only nuclear-powered submarine disposition, nuclear material disposal, and elimination of nuclear weapons but also the development of a new nonproliferation regime and finding solutions to the related key scientific and technological challenges that lie ahead.

A mechanism needs to be set up to address the most critical nonproliferation issues, as well as existing disagreements. Disagreements between the United States and Russia on a number of issues must not undermine the foundations of our cooperation since we agree on the most important thing, which is that U.S.-Russian collaboration on nuclear disarmament and nonproliferation is essential for the strengthening of strategic stability and security and is in the best interest of both countries and the entire global community as a whole.

Another important aspect is addressing, through such fora as U.S.-Russian joint working groups at both the governmental and the nongovernmental levels, the issues of security and nonproliferation and providing relevant recommendations to policy makers.

G

Analysis of the Legal and Regulatory Environment Governing the Disposition of Nuclear-Powered Submarines: Major Difficulties and Obstacles in Improvement of International Cooperation and Ways to Mitigate or Overcome Them

V. N. Barinov, IBRAE, and A. P. Zotov
Kurchatov Institute

One of the most prominent examples of international cooperation undertaken by Russia on both multilateral and unilateral bases has to do with the disposition of decommissioned nuclear-powered submarines and the management of the spent nuclear fuel and radioactive waste. The degree to which the relevant legal framework is complete and adequate will determine how efficiently the disposition and rehabilitation activities will be organized, planned, and executed from the level of international cooperation all the way down to the level of individual production enterprises.

Despite good results and many years of experience in international cooperation (especially with the United States), this extraordinarily important endeavor has recently run into a number of bottlenecks and obstacles which clearly complicate the further development of international cooperation in the area of nuclear materials management. In fact, some of them have to do with matters of principle. Analysis of these obstacles can help group them into the following several categories:

- Summit-level political issues,
- Issues of science and technology,
- Logistics and program management,
- The interactions of parties at different levels,
- Mindset gap as a legacy of the Cold War,
- Funding, and
- Legal issues.

G-8 Summit resolutions have been instrumental in furthering the development of international cooperation. In the declaration of the 1996 G-8 Summit in Moscow, the participants expressed their commitment to paying priority attention to the comprehensive safety of nuclear energy use.

One of the priorities spelled out in the Global Partnership Program adopted at the G-8 Summit in Kananaskis, Canada, in 2002, was the disposition of nuclear-powered submarines and fissionable material. Today, Russia is already engaged in negotiations with a few countries, primarily those with which Russia has standing intergovernmental agreements. This negotiation process has made possible substantial progress in getting to the point where practical implementation of specific large-scale projects can be started. To illustrate, the construction of a coastal facility for the long-term storage of the reactor compartments of nuclear-powered submarines and the disposition of nuclear-powered attack submarines has been initiated at Saida Bay. A series of projects intended to improve the state of the environment in the Arctic is being implemented within the framework of the Arctic Military Environmental Cooperation (AMEC) program. The European Union's Tempus-TASIS technical assistance program continues to gain momentum.

Worth mentioning is the fact that Russia goes beyond these measures and strives to adequately, and in cooperation with other countries, respond to new threats and challenges, including the threat of proliferation of nuclear weapons, terrorist threats, and the illicit circulation of nuclear materials. These issues have been under continuous discussion in both bilateral and multilateral formats.

A hierarchical representation of the existing legal and regulatory environment is provided in Figure 1.

Overall, the regulatory and legal frameworks of the Russian Federation are in compliance with the generally accepted approaches to ensuring nuclear, radiation, and environmental safety, as well as to the management of radioactive waste and spent nuclear fuel. This bodes well for the prospects of international cooperation in the field of multifaceted disposition of nuclear-powered submarines. The existing body of the Russian law does provide for the safe planning and implementation of disposition activities and environmental rehabilitation of coastal facilities, territories, and waters affected by radiation.

Obstacles and problems that affect the effectiveness of international cooperation can be split into those that are "external" and those that are "internal."

"External" obstacles include the other side's resolve to "push through" projects which are not necessarily suited to

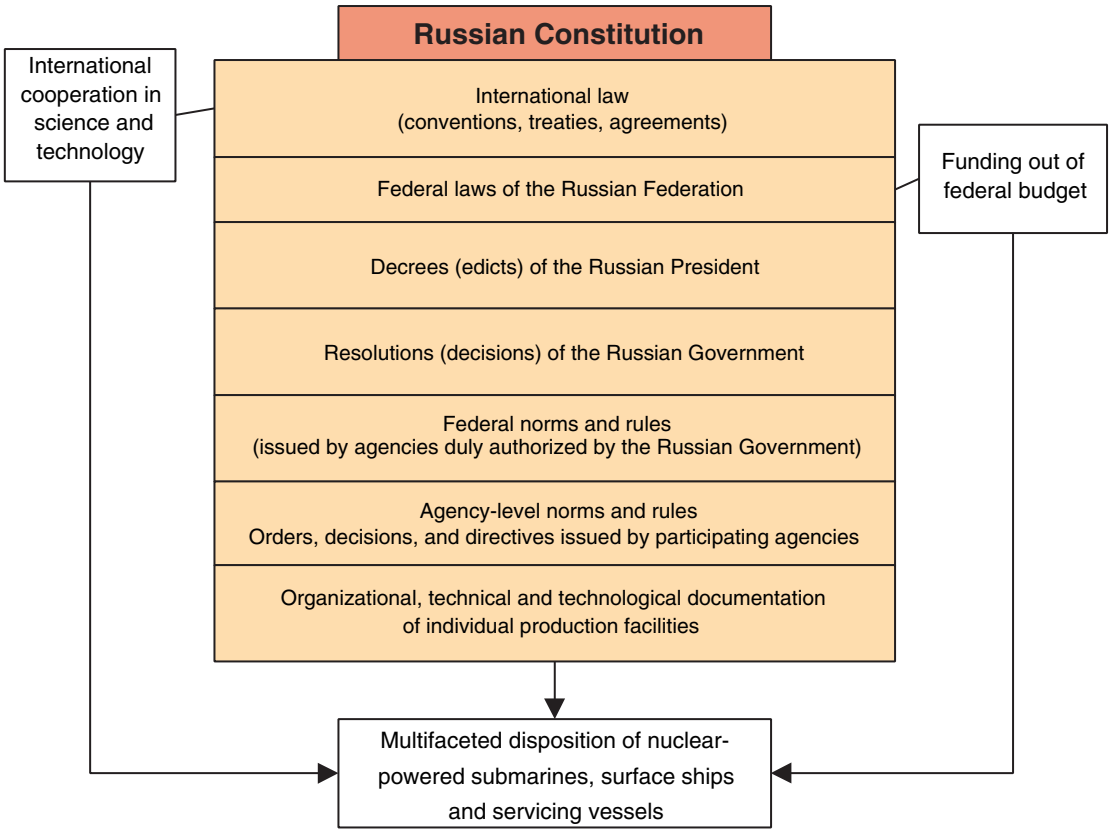

FIGURE 1 Structure of legal, regulatory, organizational, and managerial documentation applicable to multifaceted disposition and rehabilitation activities.

our needs and saddle us with additional obligations significantly exceeding those which are in keeping with our domestic laws and the international norms. The practice of political "linkage" also belongs in this category. The issue of funding for the Russian weapons-grade plutonium disposition program has not yet been resolved.

The "internal" obstacles include

- The need to adopt legislation implementing Russian ratification of the 1963 Vienna Convention on Civil Liability for Nuclear Damage;
- The need to complete legal formalities associated with Russia's ascension to the Joint Convention on the Safety of Radioactive Waste Management, the format and objectives of which are related to those of the Convention on Nuclear Safety;
- The need to finalize the issues of granting access to secure facilities to foreign nationals;
- Taxation issues; and
- Civil liability for damage (nuclear and otherwise).

The regulatory and legal aspects of multifaceted disposition and environmental rehabilitation may be affected by the following large-scale reforms currently under way in Russia:

1. Changes in the delineation of authority within the federal government of the Russian Federation, constituent regional entities, and local authorities are being made. In May 2004, the Russian government sent a draft of a federal legislation on the subject to the floor of the State Duma.
2. The federal law "On Technical Regulation" entered into force on July 1, 2003. By 2010, a transition from the currently functioning system of federal and industry-specific norms and rules to safety regulation through a combination of technical protocols that set mandatory requirements, on the one hand, with voluntarily adopted standards, on the other, must be completed.
3. Administrative reform of the federal executive branch triggered by Presidential Edict No. 314 of March 9, 2004 ("On System and Structure of the Federal Executive Branch") may have an impact on the logistical side of the strategic master plan, including relevant coordination and approval.

However, current regulatory and legal documents are quite precise in their definitions of the roles and responsibilities of various federal and executive branch entities in the realm of the disposition and environmental rehabilitation of

what formerly belonged to the Russian Navy. The mechanics of activities involving spent nuclear fuel and radioactive waste resulting from operations of Russia's nuclear-powered icebreaker fleet, as well as management of the Murmansk Marine Shipping Company's nuclear maintenance support vessels, are executed in full compliance with the requirements and stipulations of the federal law "On Use of Atomic Energy." As far as safety issues related to the management of spent nuclear fuel and radioactive waste—both of civilian and of military origin—are concerned, both enterprises in charge of operational implementation and regulatory authorities go by the universal, Russia-wide bylaws and standards.

When activities involving the disposition of nuclear-powered submarines and surface ships and vessels or having to do with environmental rehabilitation of dangerously radioactive sites are conducted with the use of international financial aid or technical assistance, issues may arise related to granting foreign nationals access to certain sites or the degree to which available privileged information may be shared with the foreign donor.

These problems are regulated by laws and bylaws exemplified by such federal laws of the Russian Federation as "On State Secrets," "On Restricted-Access Jurisdictions and Administrative Entities," a number of Russian government resolutions, and some others. Among other things, these laws and bylaws outline the specific requirements, and a special access process for foreign citizens and Russian nationals alike is in place at various restricted-access facilities. They also spell out a list of "knowledge items" that constitute state secrets, describe the established process for transfer of technical information abroad, etc.

The experiences from past years of interactions with international partners on multifaceted nuclear-powered submarine disposition shows that these issues have been and continue to be successfully resolved in complete compliance with Russian law, even though certain constraints do persist.

In summary, the following are the main obstacles hindering further development of international cooperation in nuclear material management:

• **Access to Russian restricted-access facilities where cooperative programs are implemented.** Issues of granting foreign nationals access to restricted-access facilities are governed by a Russian government resolution which defines the granting of such access in exceptional cases. To visit such facilities, a special authorization pass must be issued following receipt of the approval of the Russian Ministry of Defense and the Russian Federal Security Service. Even though access restrictions are in effect for such Russian facilities, access by foreign collaborators is still provided on the basis of mutual agreements that spell out the scope of the visitors' background information required, the deadlines by which this information must be provided, the duration of their visit, and some other formalities. However, some problems in this area still remain. They include, for example, the amount of time that it takes to process all the paperwork (up to 45 days), the extent of the visitors' background information requested, and difficulties in coordinating how frequently and for how long these facilities can be visited.

• **Taxation issues.** International partners insist on complete and unconditional tax exemption for the financial aid and technical assistance. For example, such an approach is exercised in the U.S.-Russian agreement of 1992 and in the Agreement on the Multilateral Nuclear Environmental Program in the Russian Federation (MNEPR). This, however, contradicts the stipulations of the Tax Code of the Russian Federation, which requires ratification of these agreements. Similar issues arise with regional and local taxation. Progress in resolving taxation issues started to materialize after the 1999 law on gratuitous aid (assistance) was adopted and entered into force. It also followed the introduction of modifications and additions to some taxation laws and the granting of certain benefits to aid- and assistance-rendering entities in terms of the amount of tax deductions to the state. The problem has not been resolved completely, however. The Russian Tax Code is in need of further improvements along the following lines:

1. Reduce the amount of time that it takes to complete the bureaucratic procedure needed to assign projects and programs the status of gratuitous technical aid.
2. Improve the mechanism of value-added tax (VAT) recovery for "gratuitous aid projects." Right now, VAT reimbursement is significantly delayed, which constrains the process of project implementation.
3. Address and resolve the issue of exemption from taxes collected by Russia's regional entities (this issue is now at the discretion of local authorities).
4. Preserve the single social tax rate for individual persons (local Russian taxpayers) who participate in such bilateral programs.

• **Exemption from civil liability for damage inflicted in the course of cooperative project implementation.** The United States and some other Western donor nations often insist on unconditional exemptions for domestic legal entities and individual persons from civil liability for damage inflicted in the course of bilateral project work performed in Russia. This is stipulated in the provisions of the 1992 Framework Agreement. This presented an obstacle for the implementation of an intergovernmental agreement on the disposition of plutonium declared to no longer be required for defense purposes, as well as for plutonium management and cooperative efforts in this domain. The same goes for the 1998 agreement on science and technology cooperation in dispositioning of excess plutonium produced by the disarmament and implementation of the Nuclear Cities Initiative. Our U.S. partners insist on the stipulations of the 1992 Agreement, despite the fact that the U.S.-Russian bilateral agreements made since 1993 have offered other stipulations

which are more aligned with the times and more acceptable to the Russian side.

MAJOR CONCLUSIONS AND PROPOSALS REGARDING ANALYSIS OF THE LEGAL AND REGULATORY ENVIRONMENT IN THE DOMAIN OF NUCLEAR-POWERED FLEET DISPOSITION

In general, Russia's existing legal and regulatory environment ensures the safety of multifaceted disposition operations and is conducive to international cooperation in this area. It is also compliant with the international standards (rules and norms) underpinning nuclear and radiation safety.

To overcome these obstacles and disconnects, the following measures are deemed prudent:

• **Exemption from civil liability for damage inflicted in the course of collaborative project work.** For projects that will be proposed in the future, one should go by the stipulations of the Agreement on Multilateral Nuclear Environmental Program in the Russian Federation (MNEPR). These stipulations contain an agreed-to formula of exemption from liability: exemption claims will be accepted only if the actions or inactions that led to damage were not intentional. At the same time, the Russian side needs to take specific steps to improve its national regulatory environment and to move along and further develop the system of insurance against civil liability for damage.

• **Access to restricted Russian facilities where collaborative programs are implemented.** It would be advisable to further address the issues of how long it takes to review requests for access to restricted facilities and how much background information is to be requested of prospective visitors. A two-pronged approach can be proposed here: our partners would submit lists of prospective visitors to the Russian side ahead of time (e.g., at the beginning of each calendar year), and we would become more efficient at taking care of all organizational formalities. Another option here would be to move some of the production lines subject to conversion outside the overall jurisdiction of the restricted facility of which they are a part. In Russia, such experience already exists.

• **Taxation issues.** Pursuant to the law "On Gratuitous Aid (Assistance) to the Russian Federation and Introduction of Modifications and Supplements to Selected Acts on Taxation and on Extra-Budgetary Deductions Benefits in Return to Such Gratuitous Aid (Assistance)," Government Resolution No. 1046 of September 17, 1999, has been passed. It is entitled "On Approval of Registration Process for Technical Assistance Projects and Programs, Issuance of Certificates for Assets, Products, Operations, and Services Constituting this Technical Aid (Assistance), and Monitoring of Its Proper Use." Implementation of the law and the resolution has been entrusted to the Commission for International Technical Assistance, which operates under the auspices of the Russian government (hereinafter referred to as the Commission), which, when it is reviewing technical aid (assistance) projects and programs, will also take into account a whole host of other laws and regulations.

Over three years of its work, the Commission has reviewed international technical assistance projects and programs worth US$2,230.8 million. However, since 2002, the amount of international technical assistance (aid) rendered has decreased somewhat. The main reason for this is the mutually exclusive interpretation of selected tax benefit and customs privilege provisions envisaged in multilateral and bilateral technical collaboration agreements. The main contradiction here is the fact that the Russian Tax Code does not make room for an exemption from the VAT paid by the providers of assorted material resources intended for use in production activities. The contradiction materialized when Article 21 of the Tax Code entered into force. As a result, foreign and international donors find themselves on an uneven playing field in terms of the tax breaks available to them. Currently, work is under way to prepare amendments to the Russian Tax and Budgetary Codes. The amendments call for a return—from the federal budget to the recipients of technical aid—of an amount equal to the VAT that they had to pay in the course of providing gratuitous technical aid (assistance) on Russian territory. Adoption of such amendments will be conducive to an increase in the inflow of technical aid (assistance) into the Russian Federation and will also allow implementation of the stipulations of Article 149 of the Russian Tax Code. The Agreement on Multilateral Nuclear Environmental Program in the Russian Federation provides for full tax exemption of the aid. Here, the Russian side has to engage in coordination with the donors over the exact details of the process—within the framework of the Russian law—by which the technical aid (assistance) in question will be rendered tax exempt. Work along these lines continues to be done by local and regional authorities, which will have to confirm to the donor nations the tax-exempt status of international assistance. However, further improvement of the mechanism for actual enforcement of the already existing norms will clearly be in order.

• **Improvement of the legal and regulatory environment for international cooperation.** It is necessary to complete the ongoing administrative reform of the federal executive branch and pass domestic laws and regulations regarding the ratification of international treaties that shape Russia's cooperative engagement with other countries. In this context, one of the highest priorities is adoption of a law on radioactive waste management. We also need to make an effort to get the 1996 Vienna Convention on Civil Liability for Nuclear Damage ratified as soon as possible. A Russian government resolution will be required to bring into force, on the territory of the Russian Federation, the 1999 Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management. Finally, work needs to continue to improve the Tax Code.

In addition to above-mentioned action items in pursuit of regulatory and legal environment improvements, the following are deemed prudent:

- The possibility and the need for amending "Main Sanitary Rules for Ensuring Radiation Safety" (OSPORB-99, SP.2.6.1.799-99) to additionally include the category of "very low-activity radioactive wastes" needs to be considered.
- The introduction of the notion of "nondangerous wastes" into the practice of radioactive waste management, based on Radiological Safety Norms (NRB-99), along with predefined acceptable methods of the deposition of such wastes in the natural environment, needs to be considered. Besides, a procedure needs to be developed, on the basis of the NRB-99 requirements, for determination of what quantitative criteria should be used for an environmental impact assessment—with respect to local conditions; international practice; and specific formulated objectives of the rehabilitation of compound areas, buildings, and structures—once the rehabilitation is complete.
- Functional requirements and criteria for accepting radioactive waste for final disposal, in compliance with the existing process, need to be developed and commissioned. This should be made as a clarification to the "Sanitary Rules for Radioactive Waste Management" document (SPORO-2002, SP2.6.6.1168-02).
- Criteria for the complete rehabilitation of the former coastal servicing bases of the Navy's Northern Fleet need to be formulated.
- The procedures for the coordination of design documentation and the interaction among various regulatory bodies (e.g., the sanitary oversight committee and the fire authority) that participate in the processes of coordination and approval of design documentation relevant to the disposition and environmental rehabilitation of hazardously radioactive sites and items need to be updated (i.e., brought into compliance with the Russian government's decisions regarding the functions of the federal executive branch). This should be done after the ongoing reform of the federal executive branch has been completed.

H

Development of a Strategic Master Plan for Disposition of Decommissioned Russian Nuclear-Powered Fleet and Rehabilitation of Hazardously Radioactive Sites and Facilities of Its Support Infrastructure

S. Antipov, L. Bolshov, and A. Sarkisov[1]

Over the course of the last 20 years, a lot of work has been done in Russia to increase the safety of the nuclear power industry, dispose of excess nuclear weapons stockpiles, and resolve a multitude of environmental problems that had piled up over the many years of the Cold War. In this work, domestic resources have been used alongside active technical and financial assistance that came from foreign countries interested in boosting their own sense of safety and security and mitigating the contamination hazard to their own territories. Quite often, however, the use of foreign aid stemming from bilateral and multilateral agreements has been impeded by a whole host of objective and subjective factors which inevitably affected the outcome.

The international community has developed an appreciation for the fact that the effective use of international financial aid provided to the Russian Federation to effect strategic arms reductions compliant with relevant international agreements, as well as to overcome the major environmental challenges which materialized as a legacy of many years of the Cold War, does, indeed, warrant solid scientific analyses and justification. One of the first examples of such a multifaceted international collaborative investigation into an issue was the development of a strategic master plan (SMP) for disposition of some of Russia's nuclear fleet and rehabilitation of hazardously radioactive infrastructure in the Russian Northwest. The objective of the plan was to provide rationale for undertaking some high-priority projects and engaging in some activities of critical significance.

The authors believe that the valuable experience acquired during the development of the SMP and in the course of the initial stages of its implementation may be instructive and useful in other areas of bilateral and multilateral cooperation in science and technology.

[1]V. Antipov, deputy administrator of the Federal Agency for Atomic Energy. L. Bolshov, director of the Nuclear Safety Institute, Russian Academy of Sciences. A. Sarkisov, academician and advisor to the Russian Academy of Sciences.

International cooperation in science and technology is carried out by initiating and implementing programs and projects in various subject areas. In each particular case, the program's success depends on a variety of factors, one of which is application of a systemic approach. A systemic approach implies linking all elements that characterize technical, technological, and organizational features of the programs. Areas of work and final goals, work sites, particular tasks and projects, as well as actions, deadlines, and many other parameters should be arranged into a unified, interrelated system.

The entire conglomerate of physical sites, related technologies, transportation routes, a whole host of natural and sociopolitical factors, as well as external limitations that are imposed by the enterprises that are part of nuclear fuel cycle and that are involved in complex disposition, represents an example of a complex system that requires systemic analysis. In carrying out this analysis, priorities should be given to issues of human safety, the security of the nuclear and the radioactive materials, and risk analyses.

ESSENCE AND SCOPE OF THE PROBLEM

The Cold War and the years of the arms race brought about a quantitatively and qualitatively unparalleled Soviet nuclear-powered fleet and a well-developed sea-based and coastal support infrastructure. Examples of nuclear-powered vehicles in the Russian fleet appear in Figures 1 through 9.

In total, the number of nuclear reactors installed exceeded 450; their cumulative power output was comparable to that of all nuclear power plants of the country.

In the late 1980s and in the 1990s, Russia ran into a serious problem: nuclear fleet decommissioning began en masse. The main reasons were the expiration of the nominal service lives of ships and vessels and the need to fulfill the Strategic Arms Reductions Treaty (START) obligations.

The total numbers of ships and vessels with nuclear-powered propulsion systems are as follows:

FIGURE 1 Nuclear-powered missile submarine (Delta I).

FIGURE 2 Nuclear-powered attack submarine with a water-moderated, water-cooled reactor (Victor II).

FIGURE 3 Nuclear-powered attack submarine with a liquid metal-cooled reactor (Alpha).

FIGURE 4 Icebreaker *Sovetskiy Soyuz*.

FIGURE 5 Nuclear-powered cruiser *Pyotr Velikiy*.

FIGURE 6 Container ship *Sevmorput*.

FIGURE 7 Buoyant servicing boat *Malina*.

FIGURE 8 Buoyant servicing boat *Imandra*.

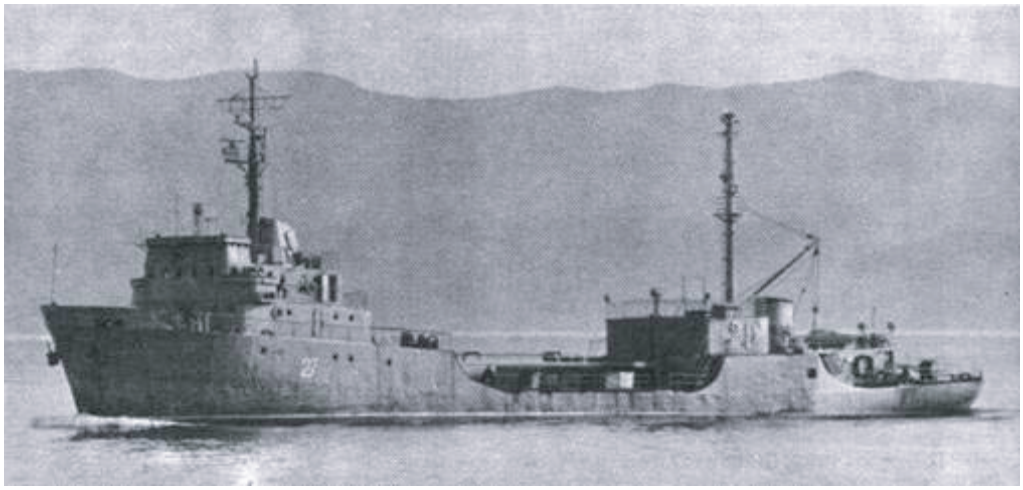

FIGURE 9 Oil tanker *Vala*.

- Nuclear-powered submarines = 248
- Surface ships with a nuclear-powered propulsion system = 5
- Nuclear-powered icebreakers = 8
- Nuclear-powered container ships = 1

The schedule for decommissioning of the Russian Navy's nuclear-powered submarines is depicted in Figure 10.

Implementation of a practicable solution of such a topical problem as disposition of the nuclear-powered fleet and its support infrastructure has become much more challenging because of a confluence of the following circumstances:

- Rapidity of decommissioning of nuclear-powered submarines;
- Lack of preparedness, on the part of the industrial infrastructure, to handle massive numbers of ships and vessels subject to disposition; and
- Severe economic depression brought about by the economic reforms of the time and, as a consequence, an inability to secure adequate budgetary funding for the disposition effort to move forward.

An important aspect of the situation at hand is the environmental impact of the nuclear fleet subject to disposition. This causes concerns not only in this country but also within the international community as a whole. These concerns have unique implications in the context of a globalized role played by the Arctic region.

The present radiological and environmental situation in the region and the problems that it entails constitute a direct heritage of the Cold War.

The most significant contributor to the present level of regional contamination was the global fallout resulting from nuclear weapons testing (10^{16} becquerels [Bq]). An appreciably smaller share (less than 10^{15} Bq) can be ascribed to liquid radioactive waste dumps which had taken place prior to Russia's de facto joining the 1993 agreements regarding a comprehensive prohibition on the disposal of radioactive waste at sea. The nuclear fleet and support infrastructure facilities to be dispositioned have contributed about 10^{14} Bq. Ever since nuclear weapons testing was stopped, gradual improvement has been taking shape across the expanse of Artic seas as a whole.

However, the presence of a considerable amount of spent nuclear fuel on nuclear-powered submarines, coastal servicing bases, and other facilities subject to a multipronged disposition effort represents a substantial potential hazard. The levels of radioactivity at disposition sites are almost 40 times higher than those that result from nuclear weapons testing. The situation is further aggravated by the highly compact spatial concentration of the radiation potential accumulated in Russia's northwestern region. This can be visualized very well by looking at Figure 11. Figure 12 depicts disposition sites and the radiation level profile along the Barents Sea shore in the vicinity of Murmansk.

While the improvement of overall radiological and environmental situation in the seas up North is obvious, recent years have seen increasingly salient localized sources of radionuclide contamination in places used for the laying up, disposition, and maintenance of nuclear-powered ships and vessels. As an example, Figure 12 depicts the concentrations of technogenic radionuclides in seabed sediments in spots collocated with decommissioned nuclear-powered ships and support infrastructure. As can be seen in Figure 12, the concentration of ^{60}Co in some locales is 30 to 70 times the natural background, and the concentrations of ^{137}Cs exceed the norm by factors of hundreds and thousands. Although at present even these levels do not really constrain economic activity in the region as a whole, the negative effects on the environment will, if the problem is not attended to through a series of preventive measures, become increasingly more

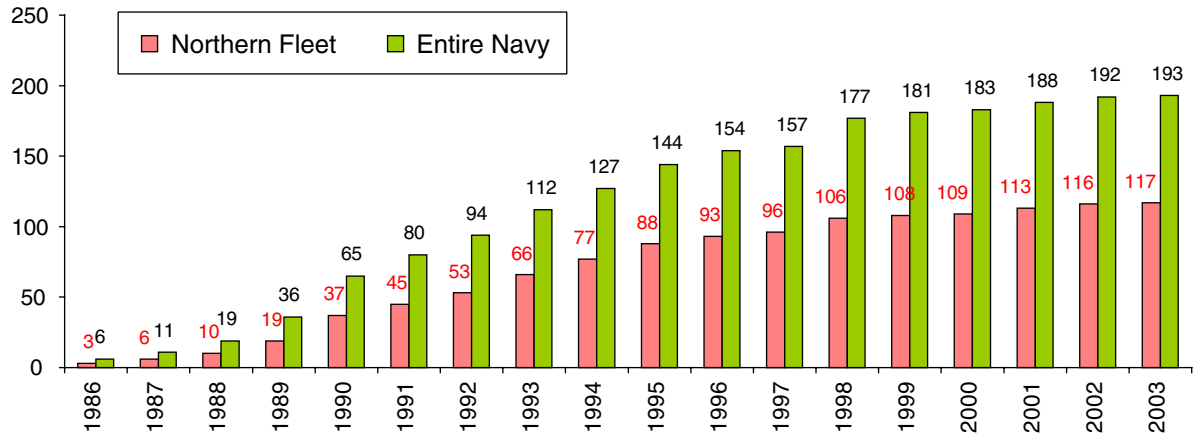

FIGURE 10 Schedule for decommissioning of the Russian Navy's nuclear-powered submarines.

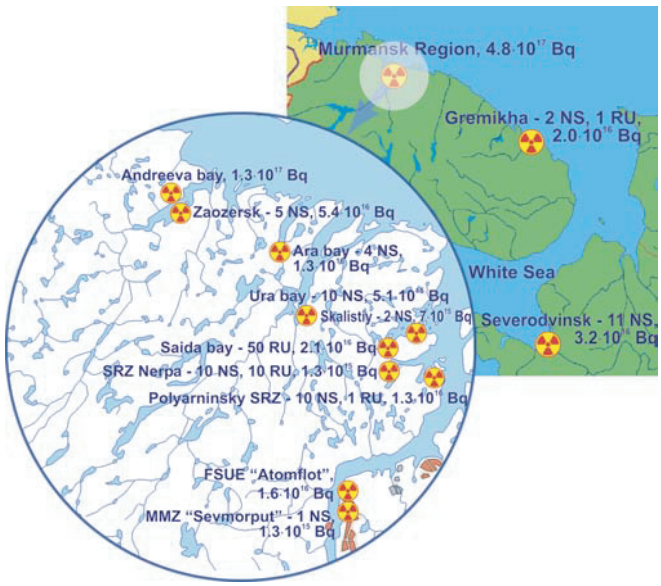

FIGURE 11 Radiation level profiles at disposition sites in the Russian Northwest.

pronounced because of the continually deteriorating condition of the nuclear-powered ships and vessels and their servicing and maintenance infrastructures.

It needs to be pointed out that alongside the mean levels of contamination—which are still acceptable—there already exist rather significant spikes in certain spots, where the values lie far outside of the range of the acceptable norm. The coastal servicing bases in Andreeva Bay and in Gremikha serve as but a few specific examples of such excessive values. The compounds of these bases and the exterior surfaces of buildings and structures feature some highly contaminated spots. In isolated areas of the Andreeva Bay base, the effective dose rate, surface contamination, and specific concentrations of ^{137}Cs and ^{90}Sr exceed the natural background by a factor of tens of thousands. An equally unfavorable environmental situation is the case at some facilities at the Gremikha base.

The present state of affairs in the field of the multifaceted disposition of nuclear-powered submarines is characterized by the following statistics:

- None of the 117 nuclear-powered submarines decommissioned in the Northwest has been dispositioned completely, that is, all the way to placement of the reactor compartment in long-term, controlled shore-based storage. Facilities for such storage conditions have not been set up yet.
- The 56 nuclear-powered submarines and 62 reactor units are kept afloat awaiting disposition. As such, they warrant continuous monitoring of their floatability, while their technical condition continues to deteriorate.
- A great amount of spent nuclear fuel and radioactive waste is confined at the two former coastal servicing bases in Andreeva Bay and Gremikha. Even though the true condition of these bases is not quite clear, the compounds of these two bases are in need of a large-scale rehabilitation effort.
- Remaining open is the task of the disposition of a large number (23) of nuclear servicing vessels and one surface ship with a nuclear-powered propulsion system berthed at a pier in the port of Severodvinsk.
- Awaiting custom-tailored solutions and unique technological approaches is the issue of management of spent nuclear fuel from liquid metal reactors, defective or dam-

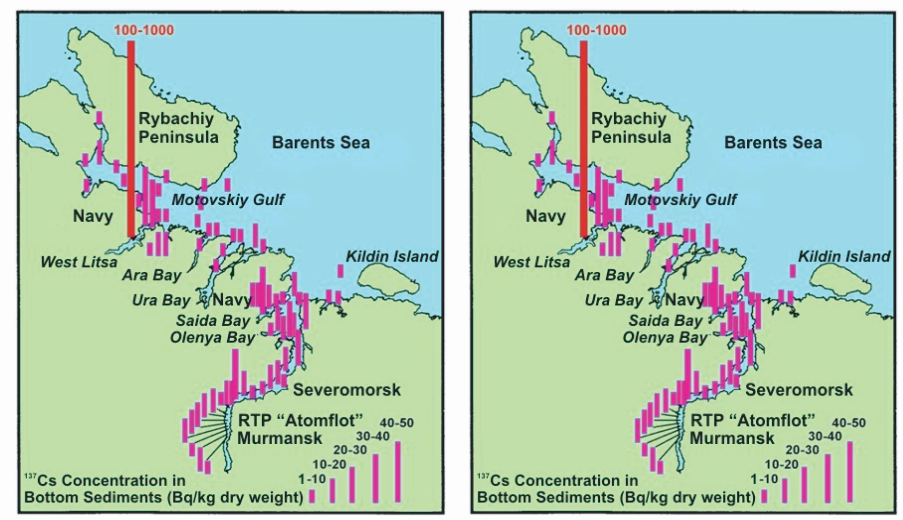

FIGURE 12 Concentrations of technogenic radionuclides in seabed sediments in spots collocated with decommissioned nuclear-powered ships and the support infrastructure.

aged fuel from the water-moderated, water-cooled reactors of nuclear-powered submarines, and uranium-zirconium fuel from nuclear icebreaker reactors.

• Decisions regarding where to situate regional disposal sites for solid radioactive waste and where to build the requisite infrastructure have not yet been made.

MAIN OBJECTIVES AND CONTENTS OF THE STRATEGIC MASTER PLAN

According to estimates of the Russian Federal Agency for Atomic Power (Rosatom), about US$4 billion will be required to complete Russian nuclear-powered fleet disposition activities in the Northwest and Far East in the 2010 to 2012 time frame. Currently, federal budget appropriations equal US$70 million annually. At such a level of funding, it may take 40 to 50 years to complete these activities, which is absolutely unacceptable given the increasingly worsening states of the ships and vessels. Loss of buoyancy and gradual disintegration of levels of containment may lead to a realistic hazard of large-scale environmental contamination. Besides, the cost of activities will inevitably climb because of the need to develop new technical solutions to handle destroyed fuel assemblies and because of the increasing complexity and scale of the rehabilitation activities. Therefore, the aid provided to the Russian Federation within the framework of bilateral and multilateral international cooperation is seen as all the more indispensable.

Information regarding funding secured for the disposition of nuclear-powered submarines since 1999—with international sources of financing singled out—is given in Figure 13. As Figure 13 suggests, international aid has not been on any significant rise over the last six years.

Keeping in mind the amount of domestic funding allocated by Russia for disposition activities and realizing that a dramatic increase in the amount of this funding is not to be expected in the near future, one clearly sees that resolution of the problem in the next 10 years will be possible only if international aid is available.

The issue of the disposition of decommissioned Russian nuclear-powered submarines and the management of spent nuclear fuel and solid nuclear waste at coastal facilities is one of the key parts of the 10-year program entitled G-8 Global Partnership Against the Spread of Weapons and Materials of Mass Destruction, which was adopted by the G-8 leaders in Kananaskis, Canada, in June 2002.

In this context, one extremely important aspect of international cooperation is the legal groundwork for and the support of this cooperation. In recent years, a series of requisite documents has been signed here.

The first is the Agreement on Multilateral Nuclear Environmental Program in the Russian Federation (MNEPR), signed by Russia with 10 countries, the European Union, and EURATOM in Stockholm, Sweden, on May 21, 2003. This is a universal legal instrument that can be used to resolve a whole host of practical issues. By as early as the end of 2003, it had already been ratified by virtually all member states—including Russia—for which ratification is a legally mandated requirement.

The Agreement on Multilateral Nuclear Environmental

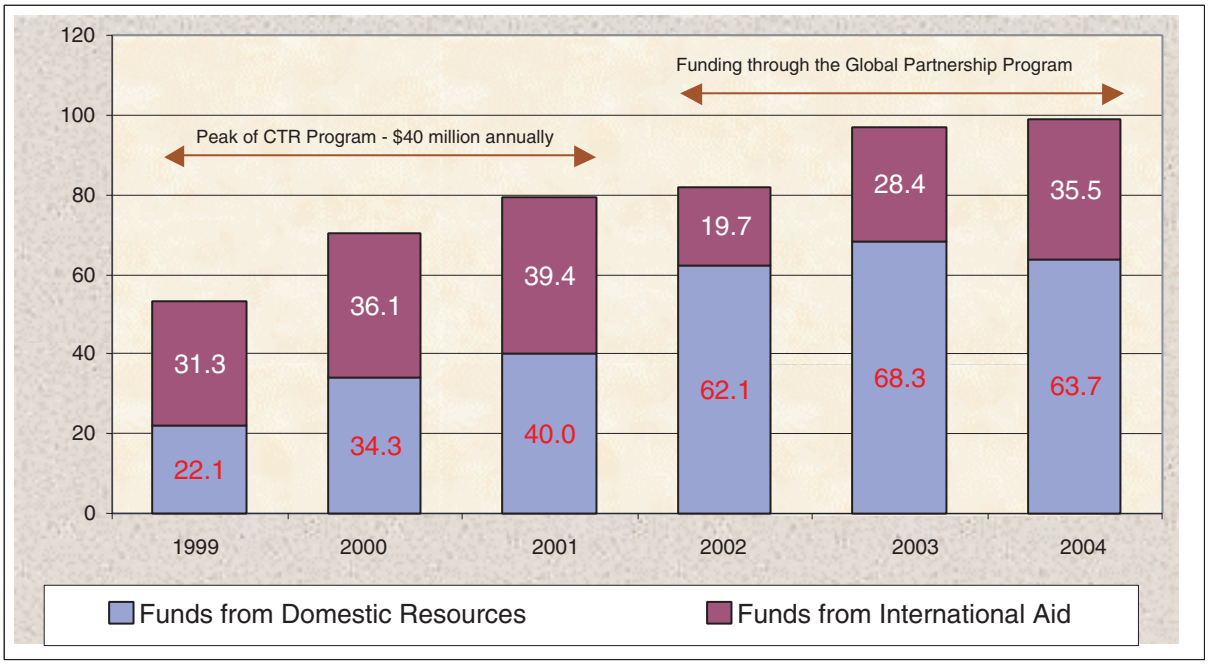

FIGURE 13 Funding comprehensive disposition activities through domestic resources and international aid.

Program in the Russian Federation became a logical continuation of the 2001 initiative undertaken by European states and Russia, entitled Northern Dimension Environmental Partnership (NDEP). Its goal is to unite the efforts of its member states to tackle environmental problems in the Northwest. To implement this initiative, a dedicated Support Fund was set up. Donor nations (such as NDEP member states, as well as other countries willing to take part in resolving these issues) have been contributing moneys to this Fund. The Fund runs two "windows": a "nuclear window" designated to address nuclear environmental problems (including the disposition of nuclear-powered submarines) and a "non-nuclear window" to resolve generic environmental issues. The Foundation uses a specialized mechanism to select and prioritize projects for each of the windows. The European Bank for Reconstruction and Development (EBRD) acts as administrator of the NDEP Support Fund. The Agreement on Multilateral Nuclear Environmental Program in the Russian Federation has set up a legal groundwork for NDEP project implementation. The SMP development project is the first project undertaken in the "nuclear window."

Under current conditions, it is particularly important that material resources not be wasted. First of all, they should be focused on the most pressing tasks of disposition and environmental rehabilitation. In this context, it is especially critical that the choice of disposition priorities be justified. Therefore, in late 2003, the EBRD and the Russian Ministry for Atomic Energy (now known as Federal Agency for Atomic Energy) initiated a project entitled "Development of a Strategic Plan (also known as the "Master Plan") for Disposition of Decommissioned Nuclear-Powered Submarines, Surface Ships with a Nuclear Propulsion System, Nuclear Servicing Vessels, Nuclear-Powered Icebreaker Fleet, and for Environmental Rehabilitation of Hazardously Radioactive Facilities in the Russian Northwest." Three leading institutes with a core competency in this field have been tasked to collaborate on this project. They are the Nuclear Safety Institute of the Russian Academy of Sciences (IBRAE RAS), the Kurchatov Institute (RRC KI), and the Research and Development Institute of Power Engineering (NIKIET). More than 50 experts representing these institutes and other organizations have taken part in this work.

The goal of the first phase of the project was to justify the high-priority objectives that should be undertaken immediately. In addition, it was proposed to take this one step further and formulate specific high-priority activities (projects).

The following are proposals regarding the role and place of the SMP in the context of existing Russian legislation. They have been coordinated with the Federal Agency for Atomic Energy. It is proposed that the SMP should

- Serve as the basis for disposition and rehabilitation project selection from both the decommissioned Navy and civil nuclear-powered fleet;
- Serve as the basis for strategic decision making by the government of the Russian Federation regarding disposition and rehabilitation, as well as the management of spent nuclear fuel and radioactive waste;
- Assist donor nations in conducting feasibility studies for disposition projects, including those which seek to increase nuclear, radiation, and environmental safety and improve physical protection;
- Promote balanced and justified decision making with due regard to the interests of the Russian Federation and donor nations; and
- Bring coordination into actions, verify their consistent focus, and monitor the results at all stages of implementation.

The SMP was developed in close contact and collaboration with the Federal Agency for Atomic Energy (which, according to a Russian Government resolution, acts as the customer and coordinating authority for the multipronged disposition activities), the Russian Navy, a major Russian shipbuilding company (Rossudostroyenie), the Federal Agency for Industry, and other involved agencies and organizations. The objective of the SMP is to optimize activities that would rid, in as speedy a fashion as possible, the population and the environment of the Russian Northwest of nuclear, radiation, and chemical hazards, while also taking into account the interests of adjacent territories and Europe as a whole.

This document consists of six interrelated sections (tasks), all of which are geared toward achievement of the end objective: to specifically identify high-priority activities (projects). Structural interlinkages among tasks accomplished at the initial stage of the SMP development process and an outline of the resultant report are depicted in Figure 14.

Compared to all previous conceptual documents, the SMP has a few important distinctions:

1. Even though the SMP is addressed to Rosatom and was compiled in close contact and collaboration with the agency, it is not an agency-specific document because many of the participating organizations do not report to ROSATOM.
2. The document for the first time comprehensively addresses the issues of the disposition and environmental rehabilitation of not only the Navy's ships and facilities but also those of the closely related civil nuclear-powered icebreaker fleet.
3. The document is characterized by a high degree of openness, which is a function of both the amount of information that it spells out and the expected broad distribution.
4. The document for the first time directly formulates the tasks of putting high priority on the all-inclusive entirety of items, tasks, activities, and specific projects.

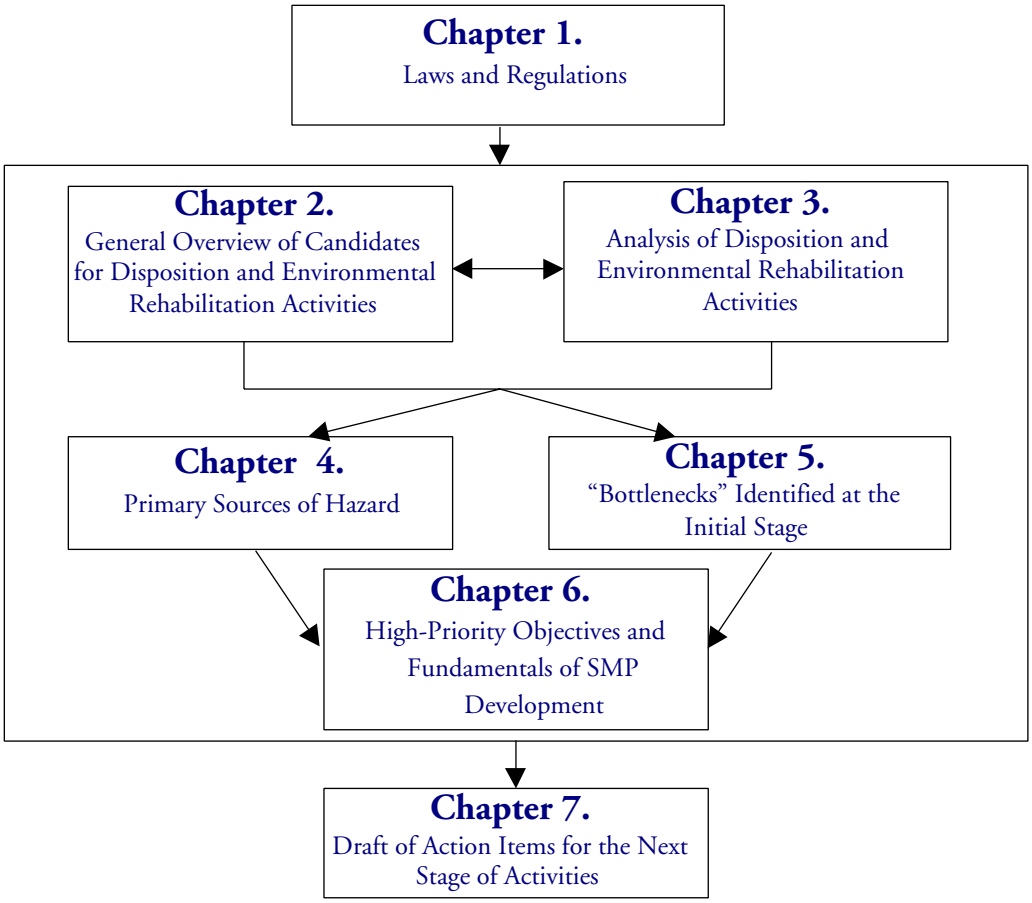

FIGURE 14 Structural interlinkages among tasks of the initial stage of the SMP.

STATUS OF THE REGULATORY AND LEGAL FRAMEWORKS REGARDING DISPOSITION OF NUCLEAR-POWERED FLEET

The first task summarizes, in a systemic and analytic way, a wide variety of documents governing the implementation of the activities envisioned in the SMP. The degree to which the legal framework is complete and adequate will determine how efficiently the disposition and rehabilitation activities will be organized, planned, and executed—from the level of international cooperation all the way through the level of individual production enterprises.

Overall, the regulatory and legal frameworks of the Russian Federation are in compliance with the generally accepted approaches to ensuring nuclear, radiation, and environmental safety, as well as to the management of radioactive waste and spent nuclear fuel. This bodes well for the prospects of international cooperation in the field of the multifaceted disposition of nuclear-powered submarines. The existing body of Russian law provides for safe planning and implementation of disposition activities and environmental rehabilitation of coastal facilities, territories, and waters affected by radiation.

At the same time, analysis of the existing legal and regulatory environment has revealed a number of legal shortfalls and issues of concern, the main of which are the following:

1. The federal law "On Use of Atomic Energy" does not apply to military-use nuclear propulsion systems, and the federal law that is meant to complement it ("On Military-Use Nuclear Propulsion Systems") has not yet been passed.
2. The radiological safety of the environment is regulated by, among other things, the federal law "On Environmental Protection." The issue of what could serve as the norm of radiation properties of natural objects has not been resolved. Some of the provisions of the law "On Environmental Protection" contradict the existing body of Russian law and the practical realities of ensuring radiological protection of the environment. In compliance with current recommendations of the International Commission on Radiological Protection (Publication 60), both the existing body of law and practice go by the mantra from sanitation and hygiene: "If the man is protected through the radiological standards, then the environment is also protected."
3. Russian law does not define spent nuclear fuel as a stand-alone item subject to regulation.

4. Some provisions of other pieces of legislation which regulate the issues of radiation and environmental safety need to be revisited. Examples here would be the Water Code of the Russian Federation and the law "On Radiation Safety of the Population."

5. The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management signed in 1998 still has not been ratified. Also, there is no law "On Management of Radioactive Waste and Spent Nuclear Fuel."

6. The regulatory environment governing the issues of low-activity and medium-activity solid radioactive waste management requires further work and expansion.

7. Procedures for the adoption by the Russian Federation of amendment LC/51 and the 1996 Protocol to the London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter have not been implemented.

8. The Vienna Convention on Civil Liability for Nuclear Damage was ratified in March 2005. However, the federal law "On Liability for Nuclear Damage" has not been passed. The law establishes liability for causing nuclear damage and spells out a regulatory mechanism for financial recovery of the damage (including government guarantees). It also covers international cooperative projects and international technical assistance.

Comprehensive analyses of the legal and regulatory environment in the field of multifaceted disposition have been put at the core of the following overarching conclusions and specific proposals for its further improvement:

1. In general, Russia's existing legal and regulatory environment ensures the safety of multifaceted disposition operations and is conducive to international cooperation in this area. It is also compliant with the international standards (rules and norms) underpinning nuclear and radiation safety.

2. The main future milestones in the improvement of the legal and regulatory environment in the field of multifaceted disposition are as follows:

- To pass the above-mentioned legislation for the peaceful and military uses of nuclear energy;
- To introduce changes into the Russian Tax Code, Customs Code, and Budget Code and advance the mechanism for implementation of the already existing norms (as a continuation of the Agreement on Multilateral Nuclear Environmental Program in the Russian Federation);
- To ratify the 1998 Joint Convention on the Safety of Spent Fuel Management;
- To ratify the Vienna Convention on Civil Liability for Nuclear Damage; and
- To develop region-specific legislation and legal and regulatory provisions at the local level that would provide tax benefits for those entities which provide free assistance to Russia.

3. In addition to the above-mentioned milestones in the improvement of the top-level legal and regulatory environment, the following measures are deemed prudent:

- To consider the possibility and the need for amending "Main Sanitary Rules for Ensuring Radiation Safety" (OSPORB-99) to additionally include the category of "very-low-activity radioactive wastes";
- To develop and commission, in compliance with the existing process, functional requirements and criteria for accepting radioactive waste for final disposal. Make this a clarification to the "Sanitary Rules for Radioactive Waste Management" document (SPORO-2002);
- To formulate criteria for complete rehabilitation of the former coastal servicing bases of the Navy's Northern Fleet; and
- To update (i.e., bring into compliance with the Russian government's decisions regarding the functions of the federal executive branch) the procedures for the coordination of design documentation and interaction among various regulatory bodies (for example, the sanitary oversight committee and the fire authority) that participate in the processes of coordination and approval of design documentation relevant to the disposition and environmental rehabilitation of hazardous radioactive sites and items.

GENERAL CHARACTERIZATION OF DISPOSITION AND ENVIRONMENTAL REHABILITATION ITEMS

Over the last 10 years, many international and national scientific conferences and workshops have been conducted, numerous items of scientific research have been performed, a lot of papers have been published, all of which have been dedicated to characterization of the overall condition of the Russian nuclear-powered fleet to be dispositioned. However, the published data are disparate and fragmented and are often contradictory. They also date back to different periods of time and are, in many cases, outdated. Besides, there are gaps in the body of the published data. Some of the data that are lacking are critically important for SMP development.

The document summarizes all this extensive disjointed information, verifies it, and supplements it where appropriate. In a number of cases, specialized calculations had to be done to obtain some of the supplemental data. In dubious cases, the data were verified through Minatom (now Rosatom), the Navy, and the Russian shipbuilding company Rossudostroyenie (i.e., through the authorized keepers of information in question).

The document has analyzed and presented data regarding the conditions of the following nuclear disposition items:

- 56 nuclear-powered submarines, including 31 with spent nuclear fuel onboard;
- 62 reactor units, including two with spent nuclear fuel;
- two coastal servicing bases;
- 27 nuclear maintenance support vessels;
- one nuclear-powered surface ship (the cruiser *Admiral Ushakov*);
- five ship repair facilities;
- two "accumulation areas" for shipping containers;
- nominal locations for ~44,000 spent fuel assemblies;
- storage facilities for ~24,000 m^3 of solid radioactive waste; and
- storage facilities for ~10,000 m^3 of liquid radioactive waste.

The document also discusses civil nuclear-powered vessels and their servicing infrastructure facilities:

- eight nuclear-powered icebreakers;
- one nuclear-powered container ship;
- five nuclear maintenance support vessels; and
- the servicing and maintenance company Atomflot.

Detailed data regarding the numbers, locations, radiation levels, and technical conditions of all items to be dispositioned and rehabilitated have been submitted and analyzed. The document features a multitude of data which testify to the utterly dire condition of decommissioned nuclear-powered submarines and the associated servicing vessels. Special attention is dedicated to analysis of the difficult current situation at former coastal servicing bases in the Russian Northwest.

Coastal Servicing Bases in Andreeva Bay and Gremikha

The coastal servicing bases in Andreeva Bay and Gremikha had enjoyed a well-developed infrastructure and had been extensively used as venues for the servicing of active nuclear-powered submarines for decades. They included numerous storage facilities for spent nuclear fuel, various kinds of solid and liquid radioactive waste, and other service facilities and systems.

At present, the condition of the majority of coastal facilities is unsatisfactory. For example, at the Andreeva Bay base, temporary storage facilities for spent nuclear fuel (Figure 15, Buildings 2A, 2B, and Figure 16, Building 3A) were constructed in 1965 and were originally intended as storage facilities for liquid radioactive waste. From 1983 to 1986, they were modified to serve as temporary "dry" storage facilities for spent fuel assemblies. "Dry" storage facilities are designed for operation for six years. Today, precipitation seeps through the joints in the ceiling in Buildings 3A and 2B. There is water in some cells of the fuel storage facility. This can be partially ascribed to extended continuous operation, a lack of timely preventive repairs, and harsh climatic conditions.

The storage facility for spent removable blocks (Building 1B) at the Gremikha base was constructed back in 1961. It houses six spent removable blocks. Currently, the building is showing signs of sinking into the ground. Also, the walls and the foundation are cracked, and the roof is leaking.

The situation at such bases is exacerbated by the bases' old age and the change of bureaucratic chain of subordination (in 2001, the bases were transferred from under the umbrella of the Navy to the Ministry of Atomic Energy). As

FIGURE 15 View of the rooftops of Buildings 2A and 2B of the spent nuclear fuel dry storage facility at the Andreeva Bay base.

FIGURE 16 View of the concrete ceiling of Building 3A of the spent nuclear fuel dry storage facility at the Andreeva Bay base.

such, there is no exhaustive information on the radiological or technical conditions of the bases at present. This goes double for the spent nuclear fuel in storage at the bases. Some limited recent inspections of the fuel have shown that the condition of the fuel is extremely poor. Damage has been noted in fuel assembly wrappers and spent fuel assemblies themselves. Measured values of the specific water activity (10^7 to 10^8 Bq/liter) in certain cells of the storage facility imply a loss of structural integrity of the fuel assemblies' cladding and, in all likelihood, some initial degradation of the fuel.

Removal of such fuel from storage is a complex engineering challenge. Detailed inspection of this fuel is further complicated by the elevated radiation exposure inside the facilities. The unsatisfactory and sometimes simply dire conditions of the coastal servicing bases illustrated in Figures 17 and 18 need no further explanation.

Analysis and characterization of the overall state of the disposition and rehabilitation items lead to the following conclusions:

1. The cumulative residual activity of spent nuclear fuel in the region equals 5.1×10^{17} Bq, and ^{137}Cs and ^{90}Sr account for more than 90 percent of it.
2. The cumulative activity ascribed to solid radioactive waste located in the region amounts to approximately 2.75×10^{16} Bq, and this number may substantially increase as rehabilitation activities at coastal servicing bases and disposition work on nuclear maintenance support vessels get under way.
3. The cumulative activity ascribed to liquid radioactive waste located in the region is roughly 9.4×10^{12} Bq.
4. There is a lack of trustworthy information regarding the numbers, types, and current conditions of spent nuclear fuels and radioactive waste at coastal servicing bases. For certain solid radioactive waste storage facilities, estimates may be off by as much as 100 percent.
5. The current condition of items subject to disposition and environmental rehabilitation unequivocally points to the need to complete the following pressing tasks:

   • Perform a comprehensive radiological survey of the "technical bases";
   • Ensure the unsinkability of submarines during lay-up and transportation to ship repair facilities;
   • Set up an infrastructure which would allow placement of reactor compartments at a coastal long-term storage facility; and
   • Develop an infrastructure for the management of radioactive waste and set up a regional facility for reprocessing and long-term storage (disposal).

ANALYSIS OF DISPOSITION AND ENVIRONMENTAL REHABILITATION ACTIVITIES

Section Three of the document provides a summarized analysis of ongoing disposition activities involving nuclear-powered submarines, surface ships with a nuclear propulsion system, and nuclear maintenance support vessels. It also describes the state of current rehabilitation activities at former Navy servicing bases.

In the course of work, the following was accomplished:

• The end objectives of disposition and environmental rehabilitation have been formulated, in most general terms, for all types of items of interest.
• Major guidelines and technological stages have been identified for operations involving nuclear-powered submarines, nuclear maintenance support vessels, nuclear-powered surface ships, coastal servicing bases, spent nuclear fuel, and radioactive waste.
• The capabilities of all buoyant and shore-bound assets used for the removal of spent nuclear fuel have been reviewed. The production capacities of the facilities where sev-

FIGURE 17 View of an open accumulation area for solid radioactive waste at the Andreeva Bay base.

FIGURE 18 Storage area for solid radioactive waste in Gremikha.

ering operations and reactor unit formation take place have also been assessed.

- The current status and capabilities of the production and technological assets required for the management of spent nuclear fuel and radioactive waste in the Murmansk and Archangelsk regions have been analyzed.

It needs to be pointed out, however, that the end objectives of the disposition and environmental rehabilitation of hazardous radioactive items have been formulated on the basis of a detailed feasibility study of the available options. The study was conducted at initial stages of the process by Russian research institutes subordinated to various umbrella agencies. Concept development rooted in the results of this analysis has essentially produced ways for Russia to strategically resolve these issues.

The SMP development process has made effective and advantageous use of international scientific, technological, and financial opportunities. It has also tapped into the results of additional research and brought new factual data into the picture. As such, the SMP provides an additional point of verification and, in some instances, corrects some individual premises of the above-mentioned concepts.

What makes the SMP fundamentally new compared to other Russian strategic-level documents are the SMP's priority-setting methodology and the proposed priority listing that it yielded. The listing can serve as a starting point for the selection of specific high-priority projects.

The analysis presented in this section of the SMP provided the basis on which the end objectives of the dispositions of nuclear-powered submarines, surface ships, and nuclear maintenance support vessels have been formulated and assigned the justification rationale. Some uncertainty still remains with respect to the end states of the management of solid radioactive waste, damaged (defective) spent nuclear fuel, removable blocks (active zones) from liquid metal-cooled reactors, and the coastal bases.

The document does identify and present various options for resolving these problems, but additional specialized research will have to be performed before a final concept can be worked out. This is planned for execution during Phase Two of the SMP development process.

MAIN SOURCES OF RADIOLOGICAL AND NUCLEAR HAZARD UNDER CURRENT CONDITIONS

Section Four of the document sequentially looks at all main sources of actual and potential hazard while conducting multifaceted disposition and environmental rehabilitation activities. Three categories have been identified for all disposition and environmental rehabilitation items under review in the document. The categories take into account the radioenvironmental and any other risk that the items that they contain pose for the operating personnel, the population at large, and the environment. The categories are as follows:

- The real risks stemming from the existing condition of disposition and environmental rehabilitation items;
- Potential risks which are *not* associated with the technology involved in disposition and environmental rehabilitation activities; this category splits into two subgroups of risks: those that increase as time goes on and those that remain constant over time; and
- Potential risks which *are* related to the technology involved in disposition and environmental rehabilitation activities.

Analysis of the main sources of hazard has shown that all disposition and environmental rehabilitation items do contribute, to various degrees, to all categories of risk in question.

The *actual environmental risk* for the operating personnel and the environment of the Russian Northwest lies mostly with such entities related to nuclear-powered submarine disposition at coastal servicing bases and ship repair facilities. The bases are sources of both radiation and radioenvironmental risks. The ship repair facilities are, on top of that, sources of chemical risks. In contrast, laid-up nuclear-powered submarines, reactor units, and civilian nuclear-powered vessels have virtually no appreciable effect on the radioenvironmental situation in those particular locations.

Coastal servicing bases have a great number of heavily contaminated areas (Figures 19 and 20) where the dose rate reaches 1 to 10 millisieverts per hour. Finally, the partially submerged nuclear maintenance support vessels contaminate the littoral area.

At the compounds of the servicing bases, the rate of β-contamination on the surface reaches 10^5 decays/min·cm^2, and the concentrations of technogenic radionuclides in the soil reach 10^4 to 10^7 Bq/kg, i.e., many times the natural background and thousands of times the maximum allowable concentrations. Some contaminated areas have become sources of radiological contamination of the littoral areas and the outer sea.

The knowledge of the radiological situation at lay-up sites of nuclear-powered submarines and reactor units is limited; no radiation maps are available. However, the measured equivalent dose rate at control points does not exceed the natural background level; and the concentrations of the technogenic radionuclides ^{60}Co and ^{137}C in the soil equal 1 to 10 Bq/kg and 10 to 30 Bq/kg, respectively, which do not exceed 0.01 of the maximum allowable concentrations.

In the area where the Atomflot servicing and maintenance company has kept, for many years now, its nuclear-powered icebreakers and buoyant servicing boats *Lepse*, *Imandra*, and *Lotta* with spent nuclear fuel onboard, seabed sediments show the presence of ^{60}Co at levels of 2 to 30 Bq/kg, ^{137}Cs at levels of 2 to 40 Bq/kg, and ^{152}Eu at levels of up to 55 Bq/kg. This is tens of times the natural background concentration but is still below the allowable concentrations. In the waters of the Kolsky Bay, the ^{137}Cs concentration equals 5 to 8 Bq/

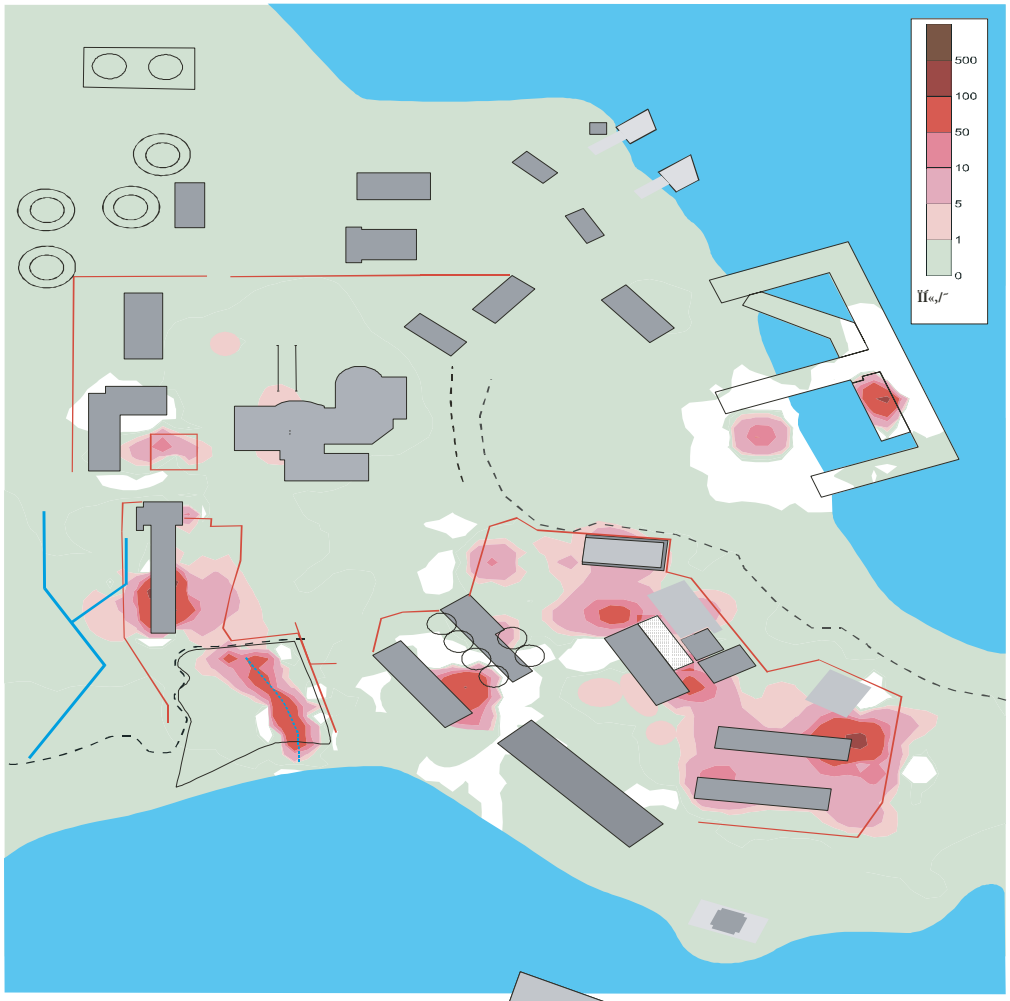

FIGURE 19 Dose rate at the Andreeva Bay base (at 0.1 m off the ground).

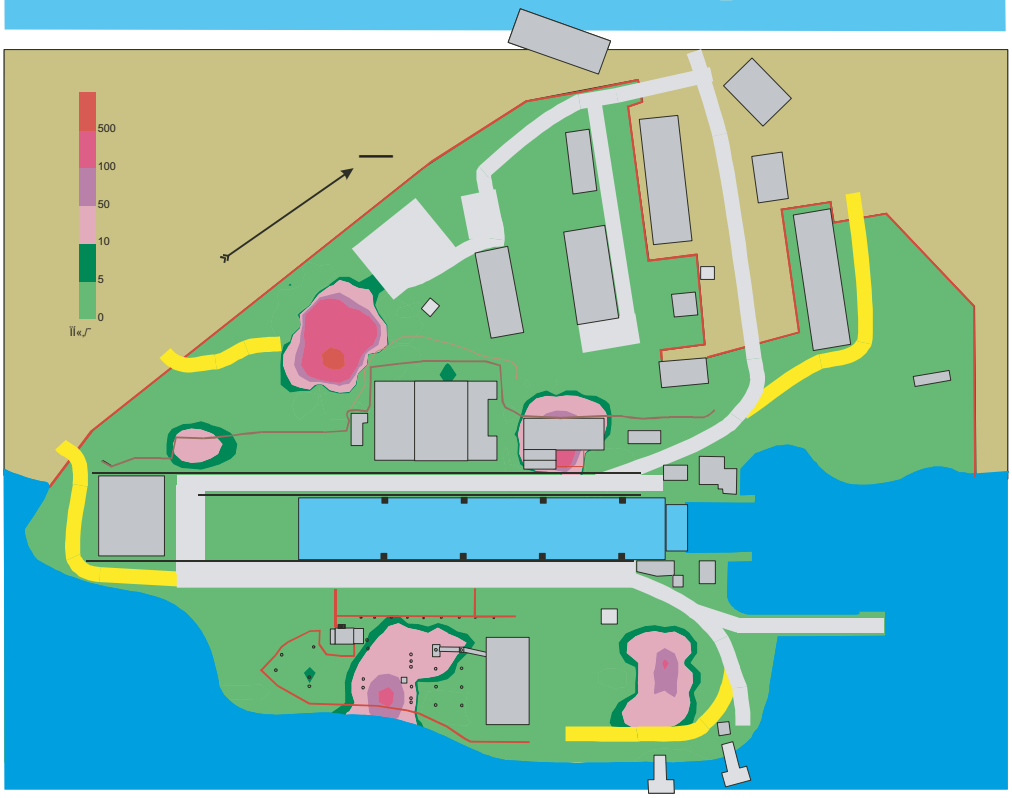

FIGURE 20 Dose rate at the Gremikha base (at 0.1 m off the ground).

m^3, which is the same as the natural background concentration. However, as early as back in the 1990s, trace concentrations of ^{134}Cs (0.2 to 0.4 Bq/m^3), ^{60}Co, and ^{152}Eu in seabed sediments point to their manmade origin. Fish caught at the outlet of the Kolsky Bay contain ^{137}Cs at levels of 0.3 to 1.0 Bq/kg. These levels compare well with the concentrations of these elements in fish of the same variety (e.g., cod and haddock) in the Barents Sea.

The document carefully addresses the issues of environmental contamination associated with the operation of industrial facilities that carry out the disposition activities.

When submarines are cut up, an insubstantial amount of radionuclides (^{60}Co, ^{90}Sr, ^{137}Cs, and ^{85}Kr) is released into the air. Such releases do not exceed 10% of the accepted norms. Such amounts of radioactive substances have practically no impact on the facility-specific radiological situation, much less on region-wide radiation levels. The concentrations of technogenic radionuclides in the air do not exceed 10^5 of the respective maximum allowable concentrations.

Also, effluents of industrial plants dump a certain amount of radionuclides (^{60}Co, ^{90}Sr, and ^{137}Cs) into the sea. As a result, their concentration in seawater and seabed sediments exceeds the normal background by a factor of 1.5 to 2 but quantitatively constitutes no more than 0.01 to 0.03 of the respective maximum allowable concentrations.

The fact of the matter is that nominal and accident-free execution of nuclear-powered submarine disposition activities does not violate the allowable concentration levels for technogenic radionuclides in the layer of the atmosphere closest to the ground and in seawater.

A much greater hazard to the environment, personnel, and the population at large lies with the harmful *chemical* contaminants involved in disposition activities.

This factor has been neglected for many years since public opinion tended to significantly overestimate the actual level of hazard represented by radiation. From the standpoint of the actual day-to-day reality of nuclear-powered submarine disposition activities, it is chemical contamination that is so much more hazardous for operating personnel and the population at large. Annually, these production facilities emit, in the form of an aerosol, 35 to 45 tons of various metal oxides. This results in the contamination of adjacent areas and broader surrounding territories. One of the most prominent sources of contamination is represented by processes related to gas cutting and severing of metal (Figure 21).

The disposition of one nuclear-powered submarine produces a large amount of chemical wastes (propellant and oil, ~40 tons; gaseous waste, ~2 tons; solid waste, ~600 tons). Only a small share of these wastes is utilized. Significant quantities of these wastes are not reprocessed or neutralized, so these potential sources of hazard pile up in depots and open storage areas.

The air in both indoor production shops and over the adjacent territory is filled with a lot of dust. At almost all corners of the facilities involved in nuclear-powered submarine disposition, the dust content in the air exceeds the maximum allowable concentrations by a factor of 1.3 to 6. Gas cutting of structural elements covered with red lead (minium)—and virtually the entire hull of a nuclear-powered submarine is painted with it—is associated with high concentrations of lead (13 to 60 times the maximum allowable concentration). Aerosols sometimes contain elevated concentrations of nickel (2 to 10 times) and other materials.

Some liquid waste gets dumped into the sea with wastewater. For example, the rainwater sewer system at the Zvyozdochka ship repair facility dumps chemical suspensions, oil products, and iron-containing compounds into the

FIGURE 21 Severing of nuclear-powered submarines by gas cutting.

waters of the Nikolski Mouth of the Severnaya Dvina River at levels exceeding the maximum allowable concentrations. Forecasts show that unless corrective measures are taken, the increase in the scale of disposition activities expected in the next several years will result in the consistent contamination of air and seawater with selected pollutants at levels of up to three to five times the maximum allowable concentration. The issue needs to be addressed as early as today. Also, the first order of priority needs to be assigned to the problem of dust formation.

The document also features extensive data regarding every kind of potentially hazardous factor. The analysis of such factors identifies the most consequential contingencies for each type of site or disposition item. Also, mathematical modeling, cumulative damage assessment, and risks for operating personnel and the population at large have been done for the cases of such contingencies.

The analysis provided in this section of the SMP gives grounds for the following observations:

1. Multifaceted disposition activities do not cause any appreciable radiological impact on the population or the environment. At the same time, significant chemical contamination and hazardous waste buildup do result from submarine severing operations. The concentrations of harmful chemical substances in the air and seawater in the vicinities of ship repair facilities are several times the maximum allowable concentrations for sources of contamination.
2. The highest radiation hazard for the operating personnel is presented by activities with spent nuclear fuel and radioactive waste at the Andreeva Bay and Gremikha coastal bases, where some buildings, storage facilities, and outdoor storage spaces contain contaminated spots with elevated radiation levels.
3. The radiological potential of the spent nuclear fuel stored under unacceptable conditions at the Andreeva Bay and Gremikha bases is comparable to that of decommissioned nuclear-powered submarines subject to disposition. Given the intact condition of the containment barriers on nuclear-powered submarines with unloaded spent nuclear fuel, activities that will ensure the speediest possible development and implementation of projects that will lay a safe groundwork for the removal of spent nuclear fuel and that will allow the removal of spent nuclear fuel to be carried out need to be assigned the highest rank of priority.
4. The increase in the risk over time that a submarine will sink determines the degree of urgency assigned to the unloading of spent nuclear fuel from submarines which have been in the buoyant storage mode the longest.
5. The main source of actual and potential hazard is the spent nuclear fuel in storage on nuclear-powered submarines; at coastal bases; and on the civil nuclear fleet's buoyant servicing boats *Lepse*, *Lotta*, and *Imandra*. Of these, the most concerning is the spent nuclear fuel located at coastal bases and on the *Lepse*.

A logical continuation of Tasks Three and Four was a review, within the framework of Task Five, of each of the items on the list of topical issues and "bottlenecks." The issues and "bottlenecks" were identified on the basis of analytical assessments of many factors, which included, first of all, the safety and the logic of the technological processes.

At the current stage of SMP development, issues were identified through expert assessments done by leading specialists of Rosatom, the Russian Academy of Sciences, and other involved agencies. Also, the issues identified take into account the state of work, by action items and by main tasks, critical for implementation of the multifaceted disposition of nuclear-powered submarines, surface ships with a nuclear propulsion system, and nuclear maintenance support vessels, as well as for environmental rehabilitation of hazardous radioactive coastal sites.

Spelled out below are the main results of the "bottleneck" identification process, grouped by action item and in relation to individual disposition items and environmental rehabilitation sites under discussion.

Action Item: Disposition of nuclear-powered submarines, surface ships with nuclear propulsion systems, and nuclear maintenance support vessels

Of the main tasks essential for successful implementation of this action item (see above), the following have been identified by experts as critical issues:

- Ensure the safe transportation of laid-up nuclear-powered submarines to facilities entrusted with disposition operations;
- Set up a "groundtop" long-term storage facility for the reactor compartments of nuclear-powered submarines and surface ships with nuclear propulsion systems;
- Resolve issues of management and reprocessing of spent nuclear fuel from liquid-metal coolant reactors on Alpha-class nuclear-powered submarines;
- Set up a modern, high-capacity complex for processing, conditioning, and providing long-term storage for solid radioactive waste;
- Resolve issues of the handling and disposition of the buoyant servicing base Lepse (which at present is in a critically defunct state);
- Bring closure to the issue of handling defective and unreprocessable uranium-zirconium fuel in storage on the nuclear maintenance support vessels of the Murmansk Marine Shipping Company; and
- Resolve issues related to the safe management and disposal of toxic wastes.

Action Item: Environmental rehabilitation of hazardous radioactive sites and facilities in Andreeva Bay and Gremikha

Under this action item, the absence of the following could legitimately be characterized as a critical issue which requires that strategic (i.e., corrective) decisions be made immediately:

- Technology needed to ensure the safety of the operating personnel during whatever activities they are performing;
- Reliable data on the amount, type, and condition of spent nuclear fuel and radioactive waste in storage at such sites;
- Conceptual solutions for the management of the spent nuclear fuel (including defective spent nuclear fuel) in storage at such sites;
- A final decision committing to the management of reactor fuel from Alpha-class nuclear-powered submarines;
- The category of "very-low-activity solid radioactive wastes" in Russian legal, regulatory, and technical documents;
- Clearly formulated and well-justified assessment criteria for describing the conditions of the buildings and compounds of coastal bases upon completion of rehabilitation activities;
- Functional requirements and criteria for acceptance of radioactive wastes for final disposal;
- A modern, high-capacity center for processing, conditioning, and storing solid radioactive waste;
- An approved concept and decisions committed to selecting a type and location and conducting the requisite research and development and design activities for a regional disposal facility for final burial of low- and medium-activity radioactive wastes and for a storage facility for storage of high-activity waste; and
- Physical protection that meets the present-day requirements.

Action Item: Ensuring external safety when performing multifaceted disposition activities with hazardous radioactive items and conducting environmental rehabilitation of hazardous radioactive sites

Problems of ensuring external safety are of systemic significance and have a bearing on all activities, sites, items, and tasks. It is abundantly clear that the reliable provision of a comprehensively safe setting is a prerequisite for undertaking any activities with items presenting a radiation hazard. Safety issues constitute the first order of priority and, as such, must be resolved as early as at the initial stage of engaging in large-scale disposition and environmental rehabilitation activities.

Among the most pressing tasks here are

- Safe working conditions for the operating personnel involved in the disposition and environmental rehabilitation of hazardous radioactive items and sites;
- The physical protection of valuable and radioactive materials; and
- Radiation monitoring of the environment.

In the course of resolving the most important task—Task 6, which called for the creation of a methodology for priority-level justification and a rank-order listing of sites, items, pressing tasks, and priority activities—all the requisite data were collected through a combination of calculations, analyses, and expert assessments with the broad-based engagement of specialists from the scientific community and production and operations entities.

Implementation of specific projects selected on the basis of the listing of the most topical activities featured in the document will be conducive to the elimination of disposition-driven actual and potential sources of environmental hazard.

The results of the first phase of project work that has been completed ensure that the SMP—a living guideline for management of the investment in the nuclear disposition field—will be successfully completed during the second phase.

At all stages of its development, the SMP was being compiled in close collaboration with Russian agencies dealing with disposition issues. The list includes, first of all, the MINATOM (later on named Rosatom), complemented by EBRD experts and the International Expert Committee. Therefore, this document can justifiably be viewed as a product of international cooperation in science and technology; the sheer fact that it has been developed speaks to the effectiveness of the partnership between the Russian Federation and the international community in this critically important area.

The SMP was consecutively approved by the NDEP Nuclear Executive Committee (on November 5, 2004) and by the Assembly of Donor Nations (in December 2004). In addition, on December 1, 2004, the SMP came into force under the Rosatom Administrator's Order No. 257. All of this secures the document a respectable legal status and gives hope for a qualitative improvement in cooperation among countries seeking to overcome the grim legacy of the Cold War.

The useful experience gained from the systemic approach to resolving such a huge problem as the disposition of nuclear naval vessels and the rehabilitation of radiologically hazardous sites in the Northwest region of the Russian Federation may also be applied in the course of international cooperation on many other problems.

I

Overcoming Impediments to Cooperation Between the United States and Russia: Improving Communication During Project Definition

Michael S. Elleman and Wendin D. Smith
Booz Allen Hamilton, Inc.

The late 1980s and early 1990s were witness to thawing relations between the superpowers, strategic arms reduction treaties, the fall of the Soviet Union, and post-Soviet economic instability. The last two events generated concern among policy makers and security experts that the former Soviet Union's nuclear weapons could be inadvertently or accidentally launched against the United States or that nuclear materials or entire nuclear weapons systems could be transferred to third parties. In response to these potential threats, the United States initiated an ambitious program aimed at eliminating obsolete, treaty-restricted strategic weapons systems, and enhancing security at facilities storing and/or processing nuclear materials.

These cooperative weapons elimination and facility safeguard programs were relatively easy to identify, define, and implement. Today, however, the potential threats emanating from the states of the former Soviet Union, as well as other states in unstable regions across the globe, have evolved. Policy makers must now grapple with the more ambiguous complexities of conducting threat assessments, redirecting scientists, and securing materials at chemical, biological, and nuclear facilities around the world. Indeed, no longer can the threat emanating from the territory of the former Soviet Union be captured in a Polaroid image of a nuclear armed ballistic missile. Rather, policy makers must now commission voluminous vulnerability assessments that contain few clear recommendations on how to enhance security, let alone reduce the proliferation threat. Some scholars suggest that a crisis is impending, and many policy makers are inclined to agree; yet few new, actionable ideas have been presented for implementation. To forestall the oft-purported nuclear and/or proliferation crisis, we must put aside the obsolete 1990s model of U.S.-Russia nuclear relations and recognize the potential threats posed by the proliferation of nonconventional weapons technologies. We must define, develop, and implement programs that address today's evolving threat environment.

A new model for cooperative nuclear nonproliferation—as well as chemical, biological, radiological, and missile nonproliferation—should comprise specific components and should be designed against a timeline ranging from (1) project identification (reaching consensus that a particular program or project should be undertaken); to (2) project definition (establishing and agreeing upon clear, joint requirements that can be used to meet project goals); and finally, to (3) project implementation, sustainability, and closeout (engaging key stakeholders and commercial or government entities to execute and sustain the project's goals). Specific measures can and should be taken to improve project *identification* and *implementation*. In this paper, however, we focus on the second and, we argue, the most critical phase—*project definition*—which bridges policy directives with implementation.

Across the range of cooperative threat reduction programs administered by the U.S. Departments of Defense, Energy, and State, project definition receives inadequate focus. Instead, a project or goal is often identified by senior policy makers; government agencies and their contractors, in turn, implement these objectives with few concretely defined requirements. When the critical bridge of project definition is overlooked, the burden for developing project requirements falls to the implementing agency or, worse, the implementation contractors. Thus, implementation is often plagued by confused host nation executive agencies, unanticipated hurdles, escalating costs, sliding schedules, and, perhaps most troubling, frustrated interagency and international communications. Below, we present an argument aimed at bridging the gap between policy and implementation. The discussion is divided into two sections: (1) recommendations for and advantages of enhanced project definition, which will lead to (2) enhanced communications and confidence-building measures with our Russian partners.

RECOMMENDATIONS FOR AND ADVANTAGES OF ENHANCED PROJECT DEFINITION

In the current model, high-level U.S. policy makers identify individual project objectives and then task relevant agen-

cies to implement the program. Thus, much of the project definition is conducted by the implementer, a body often inadequately familiar with the project's terrain, key players, risks, and political constraints. The implementing agencies are also often unaware, or poorly informed about, similar projects being pursued by other U.S. agencies or international entities. Thus, when project definition is conducted in a partial vacuum and simultaneously with implementation, many of the initial steps taken in the project must later be altered at higher cost and with corresponding schedule delays. Similarly, poor project definition can lead to confusion at the political or diplomatic level, as the host nation is sometimes left unaware of its obligations and later fails to satisfy them. As such, enhanced project definition would warrant several considerable advantages.

First, projects would be implemented more quickly. For example, projects driven prematurely to implementation may require one year or more to complete conceptual designs for potential destruction facilities, to only later understand that the design would not be accepted by Russian regulatory and implementing agents. Or, being unaware of local technical norms or political sensitivities, the implementing contractor may provide an unusable design. Instead, a well-managed project definition phase would engage and build partnerships with key Russian entities, including regulatory agencies and local representatives, to deliver a defined and actionable project to implementers in a shorter amount of time. On the basis of our experience, we estimate that following this model could reduce the time required to define program requirements from the typical 8 to 12 months to 4 to 6 months, depending on the complexity of the project.

Second, overall program costs would be reduced if agile entities focused on risk management and the sustainability of the defined projects. The definition of program requirements through large U.S. national laboratories or Cooperative Threat Reduction Integrating Contractors can add millions of dollars to the project cost. While these bodies are irreplaceable in project implementation, they are not focused on cooperatively engaging Russian partners to define project goals. In the short time identified above, a more refined and agile entity could define program requirements with far less than the multiple millions of dollars currently required to sustain the implementation contractor's team. Most important, implementing a more clearly defined project would reduce costs not only for program definition but also, more dramatically, for program implementation.

The third advantage of improved project definition—enhanced communications and trust—represents the strongest potential benefit to project implementation and long-term nonproliferation success. Successful project definition, conducted in a way that asks, assesses, and integrates host nation concerns and goals, would enhance communications during project implementation and would strengthen program sustainability. The multiplicity of U.S. government contractors, subcontractors, government teaming partners, policy makers, congressional delegations, and other bodies perceived to be implementing nuclear nonproliferation programs can be confusing and perplexing. Especially because many aspects of the program involve sensitive information and controlled access to facilities, such confusion can cause host nation partners to become frustrated and disinclined to remain engaged. A better model would be to invite a single, small team composed of integrated in-country and U.S. personnel who possess cultural familiarity to define the program. Sensitivity to and awareness of multiple stakeholder concerns and goals would reduce confusion, build trust, and enhance clarity in program implementation for host nation *and* U.S. agency and congressional partners.

Finally, improved project definition would significantly mitigate project risks. One of the key products of project definition and an aspect that is essentially overlooked in current nonproliferation models is the identification of project risks across the gamut of political, fiscal, engineering, environmental, and other factors. Conducting project definition would identify risks as well as potential mitigating options, thereby reducing negative impacts on program cost, schedule, and performance. This advantage is discussed in more detail below.

ENHANCED COMMUNICATIONS AND CONFIDENCE-BUILDING MEASURES

Conducting robust project definition would improve interagency and U.S.-Russian communications, build trust, and strengthen program sustainability. Beyond this, however, more robust project definition could enable funds dedicated to U.S.-Russia nonproliferation to be expended more confidently. Below, we outline recommendations that will yield these results.

First, policy makers must take a comprehensive look at U.S. nonproliferation goals in Russia. The disconnect between various nuclear threat reduction programs is compounded by a lack of integration within nuclear initiatives, not to mention integration with chemical or biological nonproliferation initiatives. Through the National Security Council or another appropriate body, the U.S. government needs to identify and prioritize what it believes are the proliferation threats. As part of this effort, the United States should ask Russia to do the same: establish a prioritized list of nuclear nonproliferation goals from the Russian perspective.

Second, U.S. and Russian policy makers and implementing partners should discuss these perceived threats in an open dialogue. It may be true that long-negotiated arms control treaties are no longer required, but the dialogue that these elicited is still essential. For years, many academicians and policy makers have called on the United States to engage Russia not as an aid recipient but as a partner. Mutual agree-

ment on the nuclear threats confronting both nations and subsequent consensus on their prioritization would enable smooth project implementation. For example, many in the United States believe that the focus of the 21st century should be on physical security and personnel reliability at Russian institutions. Does Russia agree? If not, U.S. efforts to enhance physical security and personnel reliability are likely to fail.

The third step to enhanced communications would be to open joint project offices in each country. Currently, U.S. government nonproliferation representation in Russia consists of a handful of hard-working departmental personnel who are understaffed to support project definition and implementation. The U.S. Department of Defense Cooperative Threat Reduction programs now require on-site program managers at each project site in Russia, a requirement that should apply to all U.S.-Russia nonproliferation programs.

Fourth, U.S. and Russian project managers should be briefed on the lessons learned and should integrate these lessons into the project definition and implementation phases. In most cases, the lessons learned center around risks, many of which could have been mitigated. A number of U.S. Department of Energy and Defense programs struggle because programmatic risks were not identified in a timely manner or managed effectively. These risks can be divided into broad categories that include (1) the costs associated with contract design, reporting requirements, and other factors; (2) the schedules associated with optimistic estimates for implementation and completion of program elements; (3) the technical performance associated with the capabilities of U.S. and Russian participating organizations and contractors; and (4) the working environment risk related to the different laws, traditions, motivations, and conditions in participating countries.

Outside of the risk areas identified above, we recommend a focus on three lessons learned from past programs. First, the host nation must appoint an executive agent (EA) who is recognized by the affected ministries and enterprises as the arbiter of program decisions. The EA must have local, regional, and bureaucratic authority to enforce its decisions and to identify controversial issues before they affect project implementation. The project definition phase should identify all ministries, laboratories, and enterprises that will be affected by program activities; determine their roles in the program; and assess the EA's relationship with each. The EA, working with the joint program offices, must ensure that the affected entities are aware of their roles in the project and the potential effects on their enterprise, agency, or ministry. If one or more of these entities operates outside the authority of the EA, immediate action must be taken to make them a part of the team with a stake in the successful outcome of the project.

The second lesson that must be learned is that local politics and groups opposed to project implementation can impede progress or prevent success. The following actions, which can be enhanced by the proposed joint program office, can limit the potential adverse impacts of the local political environment:

- Inform the public of the project objectives as early as possible and identify concerns before they evolve into points of opposition. Before addressing the public, assess the local political environment, study the history of public opposition to government-sponsored programs, and determine if the public understands the program objectives.
- Evaluate the local government's attitude toward the project and identify the timing of local elections. Determine if project implementation will affect elections and take necessary actions to minimize the politics of opposition, such as the creation of a public outreach program.
- Evaluate the relationship between the local, regional, and national governments. If there is a history of conflict, consider the impact that this history might have on project implementation.

The third and final lesson is that regulatory issues and project technology compatibility must be considered in project definition and implementation. A central aspect in improved communications in the project definition phase would be to frame key regulatory issues that will affect implementation. The following actions should be taken:

- All regulatory bodies must be identified and relevant requirements must be studied before significant project decisions can be made. Key regulatory agencies should be visited to communicate project intentions and to identify regulatory requirements. Regulatory bodies should be central to the project definition and implementation phases.
- U.S. team members should understand and appreciate the analytical methods used by Russian scientists and engineers. Project managers must ensure that host nation management and scientific personnel approve of the modified approaches being considered in the implementation phase.

CONCLUSION

Over the past dozen years, nonproliferation programs have evolved. Today's programs are less concerned with arms control and are focused on the more ambiguous goals of threat identification, prioritization, and reduction. The less tangible objectives of today's programs necessitate new approaches not only to reduce cost and keep schedules but also to cooperatively develop and sustain threat reduction initiatives. Focusing on the project definition phase will improve project implementation and help the United States and Russia overcome impediments to cooperation in the nuclear sphere. Success in the familiar ground of nuclear cooperation will, in turn, bolster cooperation and threat reduction in chemical, biological, and radiological realms.

J

Overcoming Impediments to Cooperation Between the United States and Russia: Elements of Successful Project Preparation

Michael S. Elleman and Wendin D. Smith
Booz Allen Hamilton, Inc.

As discussed during our meeting on February 10, 2005, we believe that the definition phase of nonproliferation projects comprises several steps, with particular components inherent to each. We recommend that, prior to engaging the Cooperative Threat Reduction Integrating Contractor (CTRIC) in a contractual relationship, a U.S. technical team composed of relevant government and support specialists (technical and diplomatic) deploy to the country of engagement for a short, 3- to 6-month period. During this period, the goal of the technical team would be to clarify key elements to enable smooth and efficient project implementation. These elements are outlined below.

ELEMENTS

1. Clarify the task
   a. Articulate the high-level questions that need to be answered, such as which institutes will be engaged and the amount or type of material to be secured.
   b. Determine if (1) cooperative (contractual) frameworks are in place to proceed with the project, (2) funding is secured, (3) a site(s) is selected (in compliance with treaties) and land is allocated, and (4) appropriate processes and entities to obtain permits and licenses are in place.

2. Define the problem and gap analysis
   a. Political environment/dynamics
      i. Assess and select the implementing agent and identify by name appropriate points of contact within the executive agency.
      ii. Identify regional/local versus federal interests on the part of the host nation.
      iii. Consider an international agreement(s) for large-scale projects to avoid federal versus regional/local controversies.
      iv. Determine the local political situation and agree on how this will continually be monitored.
      v. Assess nongovernmental organization involvement and any history of controversy related to similar projects.
      vi. Coordinate outreach activities and messages for public relations.
      vii. Determine election schedules and potential overlap with project schedules.
      viii. Determine the degree of host nation's fulfillment of certification requirements.
      ix. Assess host nation's stance on foreign policy issues important to the United States.
   b. Assess host nation support for the project, such as budgets, public attitudes, and access/openness to vested players and stakeholders. Design and agree upon a process to iteratively monitor stakeholders' interests.
   c. U.S. interests: understand and discuss with host nation stakeholders the following: (1) congressional perception of the planned enhancement of host nation capabilities (the imperative); (2) linkages between program goals and outcomes, money spent, and return on investment; and (3) the potential for the suspension of assistance if the host nation fails to comply with certification requirements, treaty obligations, deadlines, etc. In addition, understand the alignment with the budget cycle (cost and schedule), formulation of the president's and congressional budgets, and possibly, exercise of presidential waivers (if pertinent).

3. Technical understanding: validate the technology planned, especially if it is novel, and assess the political/economic implications of the technology slated for use (i.e., open-burn stands, biosafety level 3 laboratories). Understand and outline the evolution of the tech-

nology that will be used, including the motivations of the technology's advocates, and how the choice in technology may or may not serve host nation capacity-building goals. Finally, characterize the materials to be utilized, and determine if the technology will be available in time for project execution.

4. Regulatory issues
   a. Licensing and approval processes
      i. Develop a detailed list of the ministries, government agencies, and quasi regulatory bodies whose rules must be followed and whose input must be secured.
      ii. Ensure that regulatory stakeholders are involved and motivated at the preconcept/predesign phase.
      iii. Assess which host nation entity will be the regulatory applicant and assess the key relationships involving that entity.
      iv. Assess the motivations/biases/stressors of each regulatory body and develop motivational strategies across the project life cycle.
      v. Assess the risk of major changes in the regulatory structure and the presence of implementation gaps in the legislation.
      vi. Identify key host nation players who may play dual roles (especially on expert review panels) or who may become roadblocks to implementation.
   b. International/federal/regional/local differences and similarities: assess general interactions, especially known structural conflicts or cross-jurisdictional differences, as well as the impact of structural political conflicts on the project.
      i. Integration across contracts: identify projects requiring similar regulatory regimes.
      ii. Identify similar internationally funded projects in the host nation that may involve the same stakeholders.
   c. Treaties: evaluate the impacts of applicable treaties, including requirements and limitations.

5. Capabilities and resources
   a. Staff: a significant number of dedicated in-country staff will be needed to create and maintain nonproliferation projects. Are the appropriate individuals available, and/or do they require training? If so, who will provide and maintain training?
   b. Develop an understanding of the key organizational and individual players, especially those in charge of staff selection, and the composition of expert review panels.
   c. Training: have training processes been granted regulatory approvals, and are appropriate trainers in place?

6. Clarify assumptions, goals, linkages (cross-project dependencies) and implications (risks) related to implementation
   a. Supply chain concerns, including choices of indigenous versus imported equipment.
   b. Economics/end state of the program, including sustainability questions. For example, who will be responsible for salaries, utilities, and security; and who will take on the responsibility of the "ownership" of the facilities and equipment.
   c. Cost/schedule: gain concurrence on overall project schedule, cost, and budgets to be expended on U.S. versus host nation personnel.

CONCLUSION

Consideration of and agreement upon the framework of these elements should occur prior to contract award to a national laboratory, CTRIC, or a similar body. Furthermore, most of these factors should be considered iteratively throughout the project, thereby reducing the number of risks and enabling stronger communications within and between the host nation and U.S. stakeholders. The comprehensive completion of a project definition phase with a small body of technical personnel (with appropriate levels of authority) would ease intercountry relations throughout the program, reduce costs, and enhance program sustainability.

K

Means and Methods of Overcoming Barriers in Cooperation: Mindset Gap as a Legacy of the Cold War and Cooperation in Exploration and Utilization of Cosmic Space

S. A. Popov
Keldysh Research Center

Both in Russia and in the United States, the foundations of the infrastructure for the exploration and the utilization of space were laid in the 1950s to 1970s time frame, i.e., when the creation of progressively more powerful means of weapons of mass destruction (WMD) delivery and space exploration with unmanned and manned spacecraft had both been the highest government priorities and served as metrics of competition between the former USSR and the United States. In effect, each of the two sides had accumulated its own experience. These experiences have shown that space can be a multipurpose venue not only for research objectives but also for practical, socially significant needs, such as economic development, defense, and security. During that period, low-Earth orbits were also viewed as an arena for the deployment of WMD-capable assets and were used for the missions of spacecraft with nuclear propulsion systems.

In the 1970s, the political leaders of the two countries strived to reach mutual understanding on a whole host of world problems. Of course, this could not have left such a priority domain as space out of the picture. A bilateral decision was made to conduct a joint space experiment in the form of the Soyuz-Apollo program. The experiment took place in 1975 and included a docking of the two piloted spacecraft—both of which had been designed by their respective countries in a standalone fashion and to their own standards and specifications—and a docked flight in a low-Earth orbit. This first experience of bilateral space cooperation had shown that, if the political will of the leadership is there, legal, economic, and technological issues can be resolved on the shortest possible notice. However, this successful experience of mutual understanding and cooperation did not receive any worthwhile continuation in the 15 years that followed.

Changes in the Russian political landscape, especially in the early 1990s, have led to a substantial change in government policies in the domain of space-related activities. In today's Russia, space-related activities are regulated in compliance with generally accepted principles and norms of international law, international treaties to which Russia is a party, and the law "On Space-Related Activities." A number of other laws and regulations are also in effect in Russia, including those on international military cooperation in technology, space-based nuclear energy development, and export control.

In Russia, space-related activities include the design and operation of space vehicles, related hardware, materials, and technologies; rendering of other space-related services; and Russia's international cooperative efforts in the fields of space exploration and utilization. The list of Russia's space priorities includes, but is not limited to, the following:

- Expansion in scale and an increase in the returns from the operation of space-based systems and infrastructure and the use of space technology for economic, scientific, and social well-being needs;
- Strengthening of Russia's defense and security; and
- Expansion of international cooperation to stimulate further integration of Russia into the global economic system and to ensure international security.

The vision is that Russia's space activities should

- Observe modern international law and international agreements regulating countries' activities related to the exploration and utilization of cosmic space (including agreements made by the former USSR, as well as those in effect today);
- Observe the stipulations of the regime governing the transfer of Russia's space technologies to other countries; and
- A balanced combination and development of dual-use space technologies (which have scientific or economic significance along with a defense/security application).

Currently, Russia's exports of missile technologies, products, and technologies of dual use are conducted in a legal environment constituted by federal laws, presidential edicts,

and government resolutions and directives. These documents define the process established for the issuance of export licenses and relevant export control mechanisms. At the core of this body of law are the guiding principles of the international control regime for the export of conventional weapons and dual-use items and technologies.

The Missile Technology Control Regime (MTCR) was set up in 1987, at the initiative of the United States, Great Britain, France, Germany, Canada, and Japan. Its introduction was motivated by the need to prevent missile technology proliferation.

An important milestone in activities seeking to maintain the MTCR was Russia's ascension to it in 1995. Today, a total of 28 countries support the MTCR. The main elements of the MTCR include guiding principles and export restrictions on the delivery of the items, materials, and technologies used to produce missile weaponry.

The guiding principles of the MTCR define general criteria for the control of missile technology transfer, as well as specifics relevant to the logistical side of exports. The MTCR remains the world's only multilateral mechanism which actually counters the proliferation of dangerous missile weaponry. It has become an important part of the system of international treaties and agreements that seek to prevent the transfer of arms and technology which could be used to produce WMD or the means of their delivery.

In the late 1980s-early 1990s, the issue of a conventional weapons ban and reductions as a means of strengthening world security grew rapidly in significance, alongside the reductions in strategic arms. To respond to this development, representatives of 28 countries, including Russia, gathered in December 1995 in Wassenaar, The Netherlands, outside The Hague, to form a multilateral control regime for exports of conventional weapons and sensitive products and technologies. On June 12, 1996, in Vienna, Austria, the participants of a meeting that had just been held there made the decision to have the Wassenaar Agreement enter into force. The goal of the Agreement was to expand cooperation in the prevention of arms acquisition and dual-use items for a military end use in cases in which the situation in some country or the politics of this country's government became a concern for the international community.

Pursuant to the Wassenaar Agreement, Russia has set up a system of export controls for sensitive items and technologies of the military or dual-use variety. At the core of the legal environment here are federal laws "On Export Control" (No. 183 of July 18, 1999) and "On Military and Technical Cooperation between the Russian Federation and Foreign States" (No. 114 of July 9, 1998) and associated presidential edicts and government resolutions.

The main objectives of export control are

- To protect the interests of the Russian Federation;
- To honor the requirements of international treaties to which Russia is a signatory in terms of the nonproliferation of WMD, their means of delivery, and the establishment of export controls over military and dual-use items; and
- To create conditions for the integration of Russia's economy into the world economy.

In the Russian Federation, export control is conducted through regulation of foreign economic activity. The regulation methods include

- Identification of items and technologies subject to control, i.e., comparing specific raw materials, equipment, scientific and technical information, operations, services, and results of intellectual work traded in external economic transactions against items and technologies included in "control lists" approved by the president;
- The process which mandates that an approval must be granted before one can engage in external economic transactions involving controlled items and technologies; it employs licensing or some other form of state regulation as a tool;
- Customs control and customs clearance, upon leaving the Russian Federation, of controlled items and technologies, in accordance with Russian Customs Law;
- Hard currency control over the conduct of external economic transactions in items, information, services, and the results of intellectual work, including the timeliness and completeness of hard currency transfers to accounts in authorized Russian banks; and
- Use by the state of coercive measures (sanctions) against persons who have violated (or attempted to violate) the established process—spelled out in the Russian federal laws and other government regulations—for the conduct of external economic transactions in items, information, services, and results of intellectual work which could be used to produce WMD, their means of delivery, and other armaments and weaponry.

When conducting space-related activities

- The Russian party has the right to attract nonbudget sources of funding, including personal savings;
- Organizations and private citizens participating in implementation of space-related projects may be entitled to significant guarantees and benefits by the government;
- Foreign investment in space activities associated with the execution of federal space programs may be guaranteed through the federal budget funds and federal property;
- Foreign investment in space activities into space-related activities conducted by Russian entities and nationals may be guaranteed through the assets of those entities and nationals or through intellectual or other property;
- Russia ensures protection of technologies and commercial secrets that belong to foreign entities and nationals engaged in space-related activities on territory under its jurisdiction;
- Foreign entities and nationals conducting space-related

activities under the jurisdiction of the Russian Federation, as well as hardware involved in such activities, are insured against risks associated with space-related activities as per Russian Civil Code and the law "On Space-Related activities"; and

• Russian entities and nationals participating in implementation of international space-related projects enter into contracts with foreign entities and nationals according to the Russian body of law, unless these contracts stipulate otherwise.

The regulatory and legal environment that guides the international cooperation of Russian high-tech and science-intensive entities attests to the fact that Russian government policies support Russian participation in international projects dedicated to missile and space technology. The only caveat here is that export control requirements mandated by Russian law and Russia's international obligations, as they apply to nuclear and missile technologies, duel-use technologies, and the protection of Russian intellectual property, be observed.

Despite the fact that an overwhelming majority of achievements in space technology may have a dual purpose, these new principles of the Russian government's space policy have allowed expansion of the U.S.-Russian mutual interests realm manifold.

Among the most prominent projects that have been or that are being implemented by the government were joint space experiments on the Russian space station *Mir* and U.S. Space Shuttle vehicles (in the mid-1990s) and the ongoing International Space Station (ISS) assembly and operation program. At present, Russia's Federal Space Program has provisions that call for the completion of international commitments to manufacture, deploy, and operate the Russian Orbital Segment of the ISS. The objectives include: fundamental and applied research, ISS resupply and outfitting, and International Search and Rescue System (COSPAS-SAPSAT) satellite constellation maintenance.

The assembly, operation, and purposed utilization of the ISS are the clearest examples of international cooperation in space research. The partner space agencies participating in the assembly of the ISS expect that the cooperation and coordination of activities during the preparation and implementation of science programs on the ISS will help achieve most efficient utilization of each individual partner's capabilities and core competencies.

Among the projects constituting the Russian Federal Space Program in the years leading to 2015, special importance is assigned to manned spaceflight and research on the ISS. The Russian side views the ISS as a base for further international cooperation on the basis of the experience of working together logistically, legally, and organizationally. In the context of future manned spaceflight projects, the already existing experience of running the ISS testifies to the need to keep in mind the notions of the compatibility, mutual complementarity, and interchangeability of life support assets provided by the different international partners. This means that when national space programs are implemented, one should also work toward the universal interoperability of various key components achieved as early in the project sequence as possible. Examples here include such systems as crew transportation vehicles to deliver crew to their long-term outposts and bring them back (both nominally and in the event of an emergency) and life support systems which make possible their life and work onboard.

It is noteworthy that both Russia and the United States view the ISS assembly and operation program as a necessary stage before future implementation of research projects and programs on the Moon, Mars and beyond can be undertaken. It also serves as a prerequisite for prospective studies of the Sun-Earth linkages, astrophysics research, and other programs intended to expand our knowledge base about the solar system and the universe. A certain number of such projects are already envisioned in the Russian Federal Space Program for implementation before 2015 and in the new U.S. Vision for Space Exploration announced on January 14, 2004. Work has already started on hammering out common approaches to multilateral implementation of new projects in a broad international cooperative setting. For instance, on November 16-18, 2004, the United States hosted an international conference attended by representatives of 19 space agencies of principal international partners.

The participants voiced their support for the idea of long-term cooperation, but they also pointed out the importance of government support of this cooperation. Continuous coordination and ongoing contacts are vital for its development. The participants also supported the idea of continuation of this dialog and equal partnership rooted in mutual respect. Finally, they expressed interest in working out the common standards needed to resolve the compatibility problem.

Therefore, it follows that U.S.-Russian projects and programs undertaken on an intergovernmental level are possible; they work and have prospects for long-term development. However, the Russian law also allows, under the government's control and with its assistance, mutually beneficial cooperation in space-related activities on lower levels (e.g., joint ventures, the interaction of individual scientific and production facilities, and projects under the auspices of the International Science and Technology Center).

Among successful joint ventures, the Sea Launch venture can be singled out for the novelty of its organizational and technical solutions. The joint venture Sea Launch is an international company that has set up and operated, on a commercial basis, a sea-based space launch facility which combines modified Zenit booster rockets with DM upper stages. The venture comprises constituent facilities in Russia, Ukraine, the United States, and Norway. The Yuzhnoe design bureau (Ukraine) is the lead organization for the launch vehicles; the Russian Space Corporation Energia is the lead

organization for the DM upper stage and integration of the launch support equipment located on the Assembly and Command Ship and Launch Platform; the Boeing Commercial Space Company of the United States is the lead organization for the payload unit; and the Kvarner Group of Norway is the lead organization for the Assembly and Command Ship and the Launch Platform. The first demonstration launch was conducted on March 27, 1999; the first commercial launch was conducted on October 10, 1999. So far, about 10 launches have been conducted.

In terms of the issues of concern which the Sea Launch joint venture has encountered, the following challenges need to be pointed out:

- Preservation of scientific and technological know-how and intellectual property;
- Definition and incorporation into international space law—which regulates countries' liabilities for space-related activities—of the unique features of the Sea Launch project run by privately owned companies (i.e., the notions of "launching country" and "liability for damage to a third party" will gain in prominence); and
- Provision of legal support for the project (e.g., delineating ownership rights, defining areas of liability and criminal responsibility, licensing, and insurance).

In terms of gaps in the existing body of law, it needs to be noted that aspects of the technology protection regime such as technology protection plans still have not made it into law. Still, some progress has been made:

- Russian Government Resolution No. 62 of January 25, 2000, entitled "On Signing an Agreement between the Government of the Russian Federation and the Government of the United States of America on Measures to Protect Technologies in Light of Launches from Russian Launch Sites in Plesetsk and Svobodny and Launch Pad in Kapustin Yar of U.S.-Licensed Spacecraft" and
- "Agreement between the Government of the Republic of Kazakhstan, the Government of the Russian Federation, and the Government of the United States of America on Measures to Protect Technologies in Light of Launches by Russia from Launch Site in Baikonur of U.S.-Licensed Spacecraft" of January 26, 1999. The Agreement was ratified by Federal Law No. 165-F3 on December 29, 2000.

Among the projects initiated by individual production facilities of the space industry, Energomash's RD-180 engine production for U.S. Atlas boosters deserves to be mentioned. So, too, does the sale to the United States of Russian NK-33 liquid-propellant engines designed by the Kuznetsov design bureau left over from Russia's Moon Program, granting to the Aerojet company of the United States the licensing rights to manufacture these engines; and Khimavtomatika research into upgrading of the U.S. RL-10 oxygen-hydrogen engine.

There are also examples of mutually beneficial cooperation in satellites (e.g., Bion biosatellites, hydrometeorological Meteor satellites, downlink of Earth remote-sensing data from Russian spacecraft, and the use of U.S. equipment on Russian spacecraft and vice versa. However, to ensure that favorable conditions for efficient and mutually beneficial cooperation in space technology are secured, it makes sense to provide government support to the most important innovative space and rocketry projects. The support may be provided through

- Government guarantees for international loans taken to implement such projects and
- Exemption from the value-added tax, duties, and other customs fees on foreign components, elements, and other units intended for a limited-number production of various Russian spacecraft needs to upgrade its orbital constellation or to ensure its extended active existence in orbit. This provision could also work for foreign experimental, simulation, or testing articles that do not have domestically produced equivalents and are procured to upgrade the facilities of lead research and development institutes.

Currently, U.S.-Russian cooperation in space exploration for defense purposes is limited to only one such project: RAMOS (Russian-American Observation Satellite). Work has been started; but in 2004, at the initiative of the U.S. side, this cooperative effort was put on hold. The project entailed joint development, launch, and on-orbit utilization of two experimental spacecraft, the Russian ROS (Russian Observation Satellite) and the U.S. AOS (American Observation Satellite), designed to monitor the target environment, detect and track launched ballistic missiles with the use of multispectral sensing equipment, and compile a ballistic missile plume spectra database. The RAMOS system could have been used for Earth observation and environmental applications. The RAMOS project was funded from the budget of the U.S. Ballistic Missile Defense Organization (BMDO). On the Russian side, the development of ROS was led by the Khrunichev Center. Its area of responsibility included spacecraft platform design, some detection sensor work, and two spacecraft launches on the Russian Rokot delivery vehicle. The spacecraft were scheduled for launch in 2008. The U.S. side was stressing the importance of the RAMOS program for the overall security of the two countries, given the improvements in missile launch detection and early-warning technologies. However, in 2004, the NDA decided to terminate work on the RAMOS project, stating that it would make more sense to cooperate in more beneficial ballistic missile defense projects. Since both participants were supposed to have equal access to information, the U.S. side was especially concerned with the possibility of a leak regarding U.S. technologies used in early-warning sensors

and the effectiveness of the U.S. space-based early-warning system that employs them. Essentially, the termination of the RAMOS program came as a consequence of the fundamentally new political situation that materialized after the United States had decided to withdraw from the Antiballistic Missile Treaty and expedite the development of the National Missile Defense system and its space component.

Space-based nuclear power could be an important and promising aspect of the U.S.-Russian high-tech cooperation which contributes to the building of greater mutual trust. The cooperation could be geared toward the joint development of nuclear power generation, as well as nuclear propulsion systems and spacecraft that use such systems. It seems that cooperation in this field will be most instrumental for boosting the collaborative spirit and mutual understanding in the area of nuclear nonproliferation.

In the early 1990s, the TOPAZ International Program was initiated. It was funded from the U.S. Strategic Defense Initiative Organization's budget, specifically, from the line item intended for space-based nuclear power generation systems (*Assessment of the TOPAZ International Program*, TOPAZ Committee, Washington, D.C., 1996). The TOPAZ program included the following activities: nonnuclear testing in the United States of Russian Yenisey-class units (the TSET subprogram), flight testing of a TOPAZ II reactor in conjunction with electric rocket engines (the NEPSTEP subprogram), and development of a 40-kilowatt thermal emission unit. The TOPAZ system was not completed because of insufficient funding and, most importantly, as a result of the absence of clear plans, on the part of the United States, to launch space missions which would require nuclear propulsion. At the same time, the TOPAZ Evaluation Commission noted the need to reorient the program and recommended that it be continued on a long-term basis. That, the commission argued, would take advantage of mergers of mutually beneficial U.S. and Russian programs and utilize Russian technologies to achieve national security objectives.

In the United States, the efforts to develop new nuclear power generation systems for space use resumed in 2002 within the framework of the Nuclear System Initiative. In 2003, this program was supplemented by the development of a spacecraft with a nuclear propulsion system. The spacecraft was to explore three moons of Jupiter: Callisto, Ganymede, and Europa. The program was dubbed Prometheus; the project of designing interplanetary station JIMO was started within its framework. Russia's proposals regarding participation in the Prometheus and JIMO projects on high-power nuclear propulsion systems (100 kilowatts and higher) found no support from the U.S. side. One could venture an assumption that this has to do with national security interests because high-power nuclear propulsion may be effectively used in space surveillance systems, including those supporting the ballistic missile defense system.

Many years of U.S.-Russian bilateral cooperation in space have shown that the most fruitful and useful form of such cooperation is joint implementation of high-tech projects, including military projects. The logistical organization of such projects can vary and may include joint venture formation. The joint work of project managers and their large teams, the purpose of which is the achievement of a common objective, is most helpful in fostering mutual understanding and uprooting mutual mistrust. The mistrust may actually be a by-product of the one's determination to secure his nation's interests rather than a result of the negative stereotypes of the Cold War.

L

Radiological Terrorism in the Context of Nonproliferation

R. V. Arutyunyan and V. P. Bilashenko
IBRAE

Fundamental opportunities exist for creating radiological weapons, or "dirty bombs," that, if they were used, would result in radioactive contamination of territory that could be accompanied by high radiation doses that would lead to human disease and death, as well as to the inability to operate in the contaminated territory.

In the beginning of the third millennium, terrorism, which is characterized by unpredictability, by a variety of forms, and by the high degree of danger that it poses to society, became one of the most serious global security threats. Terrorism adapts to the new conditions that are shaped by the process of globalization. Radiological terrorism (RT) occupies a special place among the different varieties of technical terrorism. In contrast to terrorist acts that are committed through explosions, arson, or the use of poisonous gas, RT can lead to radioactive contamination that presents a source of long-term exposure of humans to radiation. Even in situations in which low-activity radioactive substances are dispersed, radioactive contamination can still be registered over long distances, affecting massive numbers of people who find themselves in an environment that they perceive as dangerous for their own health and for the health of their loved ones.

Studies of ways in which contemporary societies react to the "radioactivity factor" demonstrate that considerable negative effects on socioeconomics, public psychology, and social stability (in particular, in large cities) begin in the presence of much lower levels of radioactive contamination than those at which real (material) damage to human health occurs. For instance, the level of radiological contamination that leads to an additional exposure of 1 to 10 millisieverts (mSv) per year is subjectively perceived by the general public as dangerous.

Studies conducted by Russian and American scientists demonstrate that various RT scenarios in large cities are capable of resulting in tremendous economic losses for the city, and maybe for the entire nation. The recent 177-page report from the U.S. State Department, *Patterns of Global Terrorism 2001*, calls 2001 the bloodiest in the last decade. A total of 3,547 people died at the hands of terrorists. No one on this planet has the luxury to stand by and not take part in fighting this evil. Many observers noted the friendly tone that the U.S. State Department's report took with respect to Russia.

Cooperation between Moscow and Washington in the area of combating terrorism took unprecedented and invaluable dimensions in a number of aspects, such as political, economic, law enforcement, intelligence, and military.

At the same time, common problems and issues that require additional study remain.

We would like to point out just a few of them, which could be regarded as possible areas of joint research. These are described in the sections that follow.

PRIORITIZING POTENTIAL HAZARDS AND RESPONSE MEASURES

Selection of common criteria for prioritizing potential hazards and response measures should be selected, and specialized computer software that could provide scientific and technical expertise for an optimized response to the acts of radiological terror should be developed.

For example, our evaluations and assessments of the possible damage that an aircraft ram attack against one of the spent nuclear fuel storage facilities at Andreeva Bay, where spent fuel from disposed nuclear submarines is kept, showed that the attack could lead to radioactive contamination of a large industrial center (the city of Murmansk). Under certain weather conditions, radioactivity could also spread across the border and affect parts of Scandinavia (Norway). However, such a scenario is very unlikely in comparison with the likelihood of the theft of spent nuclear fuel. As for the actual act of theft of one or more fuel assemblies, it can be committed, for example, at the time of a preplanned, full-fledged inventory tally and at the time of certification of fuel assemblies at storage facilities. The amount of highly active spent

nuclear fuel in one assembly is sufficient for use in several "dirty bombs."

EXAGGERATED PERCEPTION OF RADIOLOGICAL HAZARD

An exaggerated perception of radiological hazard is characteristic of laypersons who are afraid of radiation. But a fact of no lesser importance is that the same inadequate perception of radiological danger is also characteristic of most decision makers at all levels of the legislative and executive branches.

The magnitude of response and the efforts required to alleviate the effects of radiation in contaminated areas will depend on the actual levels of radioactive contamination, as well as on the choice of criteria for defining an "acceptable" radiological risk. On the basis of past experience gained from nuclear accidents, one can conclude that local authorities, acting under pressure from politicians, set acceptable contamination levels on the basis of the everyday situation rather than on levels that may be appropriate in the context of either a radiological cleanup or a recovery phase. For instance, in 1986 in Goanna, Brazil (during the loss of an unaccounted medical radiological source), response measures, such as defining evacuation zones and close monitoring zones, were based on exposures that were 10 times lower than the lowest acceptable radiation accident levels set by the International Atomic Energy Agency. Similar situations took place after the Chernobyl accident. One could forecast that after an act of radiological terrorism, decision making by various authorities will be dictated by enormous political and popular pressures, as well as by the desire to avoid drawing parallels between the actual event and past nuclear power plant accidents.

MEASURES THAT SHAPE ADEQUATE PUBLIC PERCEPTION

To make the public's response to an act of radiological terror more measured, as well as lower the effect of socially multiplied factors of risk, one needs to keep in mind the fact that public perception is shaped at two parallel levels: at the level of perception of the decision makers and at the level of perception of the general public. The mass media plays an important role in linking these two. Mass media needs to work with the decision makers. The mass media can increase public anxiety over the attack. It is also the fastest and the most efficient way of spreading official information on protective measures. In the context of radiological threat, we look beyond the mere recognition by a journalist of his or her social responsibilities. It is necessary to prepare in advance specialized sources of information on such science-intensive subjects as radiological terror and to engage in a conscious effort to get journalists familiar with them. It is necessary to create a strategy for informing the public of a radiological terrorist attack and to conduct joint training with emergency managers and journalists based on procedures established for a joint effort to inform the public.

MEDICAL CARE

The medical community, to which people will turn for information and advice, plays a major role in shaping public perception. It will be necessary to establish large-scale dose metering and medical evaluation capabilities for the exposed victims, as well as for the responders. Later, prevention, treatment, and rehabilitation will take place. Individuals who have been exposed to radiation will be in need of periodic clinical examinations that need to be conducted by highly qualified doctors. General practitioners are the ones who enjoy most people's trust when it comes to questions related to the effects of radiation. Today, however, most general practitioners are not much different from the majority of the general population in terms of their perception of the "radiological hazard." It is necessary to continuously educate general practitioners on the issues of medical radiology. Dozens or hundreds of people may require specialized medical help, which will include psychological rehabilitation. The victims should also be included in an epidemiological radiology registry, and a reconstruction of their exposure must take place. It is extremely important that, at the stage of mass examination, doctors should understand the specific psychological condition of the exposed, as well as their common behavioral patterns, and that they can provide mental counseling to those who were exposed, as well as to those who were not directly exposed but who are anxious.

PROTECTIVE MEASURES

The necessity of work on protective measures that either prevent or lower the levels of human exposure. These measures may include

- Isolating the source of the attack and creating additional protective barriers around it that would limit migration of the radionuclides in the environment;
- Limiting the duration of contact of the population to the radioactive source (i.e., limiting access, shelter, evacuation, and relocation);
- Setting and observing strict limits regulating additional exposure;
- The use of hygienic measures and pharmaceuticals (sanitary treatment, limiting the consumption of contaminated food, etc.); and
- Protective measures for various environments (deactivation, water safety measures, etc.).

The effectiveness of these protective measures varies, as do their efficiencies and social effects.

RADIOLOGICAL MONITORING

The system of radiological monitoring in large cities today does not provide a capability for the timely detection of factors that contribute to an increase in the amount of radioactive pollution. For example, today the city of Moscow has about 150 posts for automated control over radiological conditions (detectors of the Automated System for Control of Radiation [ASCRC]). When it is considered that the city covers an area of 1,081 km^2, one could estimate that, on average, one post "oversees" an area of about 7 km^2, or an area with a radius of about 1.5 km. Besides, it seems necessary to equip certain areas of the underground Metropolitan Transportation System with dosimeters that would allow the timely detection of radioactive substances in subway cars and inside passenger transfer points. It is also necessary to work on new methods for calculating, modeling, and measuring radioactive contamination under conditions mostly characteristic of large cities.

AREAS FOR ADDITIONAL WORK

Work on countering radiological terrorism needs to continue in two directions: (1) strengthening control over the possible movements of radioactive sources, particularly in places for the mass assembly of people and critical city sites, and (2) working on methods of real-time radiological intelligence gathering and airborne geomagnetic photography in cities in case of a terrorist act. In this way, an adequate evaluation of the situation can be made and optimal protective measures can be taken in the interests of the city's population.

WATER SAFETY

Many scenarios of radiological terrorism indicate potential problems with countermeasures for water safety. Under the extremely stringent rules that apply to the radionuclides in drinking water today, metric control of possible contamination may be required, additional water purification measures may be necessary, etc.

HUMAN RESOURCES

Current difficulties in the area of human resources are caused, on the one hand, by the absence of comprehensive educational programs that would prepare adequate human resources, and, on the other hand, by issues that are tightly linked to financing of continuous education programs for those professionals who need to attend such specialized courses. The Russian Federation has gained experience in professional programs through work within the framework of the system of government inventory control of radioactive substances and radioactive waste. Core courses should cover

- Inventory control over radioactive substances and radioactive waste;
- Physical protection of radioactive materials and of their storage areas;
- Safe transportation of radioactive substances; and
- Special software applications for inventory control over radioactive substances and radioactive waste;

In the area of cooperation on the issue of radiological terrorism, it is also necessary to point out certain obstacles and difficulties, which, if they are overcome, will help to achieve more adequate understanding of the issues. In particular, one needs to note the necessity of a unified methodological approach to the issue as a pledge for fruitful joint work in the future.

REGULATORY IMMPROVEMENTS

Applicable legal acts, rules, and regulations in the area of inventory control and the physical protection of radioactive substances, as well as working on special documents that discuss issues of possible external threats and their repercussions in handling radioactive substances, need to be improved.

These should create more obstacles for the illegal acquisition of radiological materials, elevate the level of physical protection of the radiological substances that are in circulation, and facilitate their timely transfer to specialized organizations.

IMPROVE INFORMATION EXCHANGE

Shortcomings in the database structures that store information on radioactive sources in circulation in the inventory databases do not allow tight control or the exchange of either scientific or operational information.

This is particularly true of sources of radiation that are accessed easily, like those used in medicine, geological exploration, and production. Some countries lose and never recover tens and hundreds of such sources every year. Countries of the former USSR do stand out as examples.

UNIFY PERMISSION AND LICENSING PROCEDURES

The procedures for obtaining permissions and licenses for enterprises and research organizations that use radioactive substances and other sources of radiation in their work should be unified. Approaches to keeping appropriate information about these organizations should also be unified.

EVALUATION OF RADIOLOGICAL HAZARDS

The system of evaluating radiological hazards is controversial, overly tight, and, in many cases, scientifically unsound. The system in some instances may become an objective basis for an inadequate response to radiation factors.

Despite the absence of direct evidence that small doses of radiation are dangerous for humans (doses of less than 100 mSv of acute irradiation), even exposure at the level of natural background variations (up to 1 mSv per year) is believed to be marginally acceptable in terms of additional human exposure from human sources under normal circumstances, according to many guidelines that are issued by the international scientific organizations, as well as those approved by the legislatures of some countries, including Russia. (In Russia, the level of exposure that warrants intervention is set at 0.3 mSv per year of the additional detected local radioactive pollution.)

SCIENTIFIC COOPERATION

Scientific cooperation in the area of combating radiological terrorism is a sensitive subject; certain limitations exist on both sides. The establishment of formal relationships while designating clear procedures is necessary.

Nuclear specialists who up to recent times participated in scientific and technical cooperation based their efforts on two agreements: the 1990 Agreement (with the Ministry of Atomic Energy acting as the executive on the Russian side) and the 1993 Agreement (Ministry of Science acting as actionee on the Russian side). Both agreements have expired. It would be helpful if there were prepared and signed government agreements similar to the 1999 agreement between the governments of Russia and the United States on cooperation in the area of inventory control and physical protection of nuclear materials.

BILATERAL U.S.-RUSSIA COMMISSION

It is advisable to establish a bilateral U.S.-Russia commission on combating radiological terrorism (analogous to the former Russian-American Commission on Economic and Technical Cooperation) that could be cochaired by representatives of both countries. Attention on the part of high-level political leaders is important for the successful implementation of cooperative agreements. This commission, depending on the actual agreements with the agencies that are involved in international cooperation in the area of nuclear nonproliferation, could help to coordinate activities and set priorities, as well as select projects and report on their implementation. Moreover, while current cooperation in the area of nuclear nonproliferation is based on the U.S.-Russia interagency agreements that were reached after the Umbrella Agreement between Russia and the United States was signed as part of the Cooperative Threat Reduction program, there are no such agreements in the area of combating radiological terrorism. There is no doubt that with the appropriate coordination of efforts at the intergovernmental level this cooperation could become even more efficient.