
**Partners on the Frontier: The Future of U.S.-Russian Cooperation in Science and Technology**

Office for Central Europe and Eurasia, National Research Council

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# PARTNERS ON THE FRONTIER

## U.S.–Russian Cooperation in Science and Technology

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David Bernstein, Stanford University
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# Contents

# Preface

At the request of the Office of Science and Technology Policy (OSTP), the National Academy of Sciences and the National Research Council (NRC) hosted a workshop on October 28, 1997, to discuss the future of U.S.-Russian cooperation in science and technology (S&T). The purposes of the workshop were to (a) review lessons learned from experiences in bilateral cooperation during the past several years; (b) examine recent developments within the Russian S&T establishment that relate directly to U.S. interests; and (c) discuss bilateral approaches that can best serve U.S. interests during the next several years. An agenda of the workshop is included in Appendix A.

To gain an overview of current cooperative activities, the NRC consulted with a number of government agencies and private sector organizations on October 27, 1997, concerning their recent and current program activities. Several well-informed specialists served as coordinators-rapporteurs for these consultative sessions; they in turn summarized their perceptions of the highlights of the sessions during the workshop on the following day. Their summaries are presented in Chapter 2.

The number and types of cooperative activities that were considered were manifold. The selection of activities was somewhat arbitrary because the boundaries separating S&T from other types of collaboration are not precise. Also, some government officials were unable to attend the workshop due to scheduling conflicts and the private-sector representatives obviously could not speak for many activities beyond the purview of their companies and organizations. Nevertheless, the workshop participants were familiar with most of the significant bilateral activities that involve science and technology.

This report summarizes the discussion at the meeting. No attempt was made

by the NRC to achieve consensus on conclusions and recommendations, and none are offered. The report attempts to capture the sense of the meeting and to report on the views of the participants.

In addition to the vast experience of the workshop participants, the NRC drew upon related activities that it and other organizations had carried out over the past 5 years. A list of some useful background sources is contained in Appendix D.

# 1

# The Political Context

Dr. John Boright of the NRC opened the workshop. He welcomed the participants and emphasized the importance of the discussion for U.S. cooperative S&T programs in general and for U.S.–Russian S&T relations in particular.

Dr. Kerri-Ann Jones of OSTP characterized the workshop as an opportunity to take stock of where we, the United States, are and how to use the experience from our existing programs and other activities to clarify future strategic choices.

Ms. Leslie Gerson of the State Department provided a foreign policy perspective of U.S.–Russian S&T relations. She noted that S&T is international by its nature and that international cooperation is necessary to advance S&T; the result is the growing role of S&T in our foreign policy. Moreover, a country's general security is tied to its economic security, which in turn is tied to innovation. Ms. Gerson also underscored the role of S&T in providing a forum for international cooperation. Even during the height of the Cold War, scientist-to-scientist exchanges took place and laid the foundation for much of the work that is being carried out today. Finally, she noted that in terms of U.S. foreign policy goals, cooperation in S&T assists in the evolution of civil societies.

Ms. Ki Fort of the National Security Council outlined U.S. national security goals with Russia and suggested how S&T cooperation fits in. U.S. goals include ensuring that Russia is included in major international decisions and decision-making forums, if it chooses to be included. Many decisions made by the North Atlantic Treaty Organization, the Paris Club, the World Trade Organization, and other international bodies have an impact on the scientific community and technological development, and the international ties developed by the scientific community are critical. Two other national security goals with Russia are promoting that country's democratization and economic reform agendas and reducing the

risk of proliferation of weapons technology, which is a real and immediate danger. Finally, an important national security goal is to ensure that Russia believes that it is a full and legitimate player on regional issues.

Mr. Mike Hamel of the Office of the Vice President emphasized a theme that was to be repeated throughout the day, namely, that the United States is at a crossroads in its S&T relations with Russia. For the first 5 years after the collapse of the Soviet Union, U.S. assistance and cooperative activities were directed toward stabilization; now U.S. goals are shifting to integration of that country's S&T with the international scientific community. Whereas assistance had been the primary tool for stabilization, the United States now has a variety of tools and organizations for integration of S&T. Mr. Hamel noted that science and technology are a part of every committee of the Gore-Chernomyrdin Commission, because of Russia's competency in many technical fields and because of the recognition that S&T is a powerful force for reform in Russia.

Dr. Jones expanded on the premises and goals of the workshop. She noted that if the United States is pursuing the best science, Russia must be considered a partner in some areas. Also, many problems that require S&T solutions are global in nature. Finally, as had just been emphasized by the two preceding speakers, S&T contributes to U.S. foreign policy and security goals. The challenge for agencies and OSTP stemming from these considerations is to strike a balance between grassroots science programs that come up from mission agencies and science programs that are designed to serve U.S. foreign policy and security goals.

To further illustrate this challenge in addressing competing interests, for example, between U.S. nonproliferation goals and economic goals, one participant proposed the following scenario: If Russia were to develop a revolutionary technology, and U.S. policy affecting cooperation (i.e., export control policy) bans joint efforts for commercialization in the United States or in Russia, would the United States be prepared to revise its policy to permit cooperation? Or would the United States permit a waiver to pursue its economic goals? The discussants suggested that in such a case short-term nonproliferation goals are compelling, but that in the longer term Russia could evolve as an economic power, and U.S. goals and policies would have to evolve accordingly.

# 2

# Program Experiences to Date: Approaches and Lessons Learned

Dr. Gerald Dinneen of the National Academy of Engineering chaired the Program Experiences session of the workshop, which was devoted to a review of the consultations with agencies and organizations the previous day. A list of participating agencies and organizations in the consultations is provided in Appendix B.

Dr. Dinneen opened the session by reminding participants to keep in mind the question of a realistic role for government. Given a declining U.S. budget for assistance to and cooperative activities with Russia, how can the government continue to encourage, facilitate, and monitor cooperative activities? He suggested that, in part, the answer is for the United States to link its bilateral programs better with multilateral programs and consider more joint activities with other Western countries.

During the consultations, the agency representatives were asked to address the following topics:

- What have been the most significant impacts of your programs, in terms of both Russian and American interests, and how have you been able to measure those impacts?
- Looking at the next several years, what program objectives are the most desirable and feasible?
- What trends within Russia are the most encouraging in ensuring program success? What trends are the most threatening to program success?
- From the administrative viewpoint, what have been the most important lessons learned in carrying out programs in Russia?

The views of the four coordinators-rapporteurs of the consultative sessions on October 27 follow.

## NONPROLIFERATION, DEFENSE, SPACE, AND RELATED PROGRAMS; APPLIED TECHNOLOGY AND TECHNOLOGY COMMERCIALIZATION

*By David Bernstein (Stanford University)*

Many programs are in a transitional phase from short-term objectives to long-term ones. A major concern in this transition is how to make individual projects sustainable by means other than continued U.S. government support.

Among U.S. government agencies, the National Aeronautics and Space Administration (NASA) has perhaps the largest portfolio of cooperative S&T activities with Russia. The joint activities, which go back over 20 years, have great historical and contemporary significance for both sides. The cooperation has led to such grand-scale projects as an international space station. The joint cooperation has also stimulated creativity on the part of the Russian partners; for example, the Khrunichev State Research Production Space Center built a second cargo module for its own use. There is a long-term commitment to the cooperative program by both the United States and Russia, but financial resources on the Russian side remain a major problem.

Another large group of joint activities with Russia, in terms of U.S. dollars spent, falls under the general heading of nonproliferation. Those activities include the International Science and Technology Center (ISTC) and the Initiatives for Proliferation Prevention (IPP). The ISTC in particular illustrates the importance and benefits of dealing directly with Russian scientists, although with Russian government approval.

A growing emphasis on technology commercialization by those who design and implement cooperative programs exists, but much of it is a technology-push versus a market-pull approach. There is little evidence of success in the former and considerable evidence of success in the latter. U.S. programs should be aimed at supporting existing company-to-company ventures.

There was widespread concern among the participants over the decline in the number of active scientists and engineers since the collapse of the Soviet Union. It should be noted, however, that there were too many scientists and engineers for the Russian economy to sustain, so a decline was inevitable. The more important question might be the quality and age distribution of the remainder and the numbers who are being educated and are serious about pursuing technical careers. Scientists and engineers moving into commerce might be a necessary realignment of a distorted economy and should not necessarily be viewed as bad.

Some of the greatest needs in Russia relate to health and the environment. At the same time, there is not nearly enough money to make much progress in those areas in the short term. It is important to minimize further damage from polluting activities to buy time until remediation is feasible. This strategy can be compared to the original nonproliferation strategy of the United States.

A considerable number of participants commented about the absence of contract law and intellectual property rights (IPR) law and enforcement. This is a serious situation and must improve. However, many successful companies have built their ventures on a sound relationship more than on legal protection. IPR is most problematical for old technology in which it is impossible in most cases to obtain a clear provenance. For new technology, it is not nearly as bad. Many companies rely more on trade secrets and fast product cycles than on patents.

Other observations included:

- Agency and organization representatives recognized the need to build the relationships between partners in any type of project.
- It was noted that of new technologies perhaps only 10 percent are commercialized in any country. This is not an insignificant figure, however, particularly as those 10 percent grow and absorb more people.
- No centralized source of data exists on technologies that are available in Russia, but various databases are being developed or exist.
- It is necessary to bring the Russian S&T personnel into the project planning process for cooperative activities as much as possible so as not to go back to a top-down Soviet-style program implementation.
- Finally, there is a major need for a mechanism of financing projects before they become self-sustaining.

## FOREIGN ASSISTANCE

*By John A. Daly (Consultant)*

The common thread of the programs not only of the U.S. Agency for International Development (AID) but also of the World Bank and UN organizations is the emphasis of two objectives of assistance to Russia:

- democratization and the transition from coercive governance to a more open and participatory governmental system; and
- economic restructuring, especially the transition from a centrally planned and directed economic system to a decentralized and free-market system.

In terms of science, the requirements are very broad and include

- bringing knowledge from economics to bear on policy and the management of enterprises;
- bringing knowledge from epidemiology to bear on the allocation of health resources and the delivery of health services; and
- bringing knowledge from ecology to bear on the preservation of biodiversity and the protection of the environment.

Technological change is needed to efficiently produce high-quality goods

and services that are appropriate to the Russian domestic and export markets and that do not pose great environmental or safety risks. New technologies are needed to make preexisting productive systems in Russia work better. Technological innovation is necessary to reduce the technological isolation that Russia faced in the past and to utilize Russia's technological know-how as a development tool.

The need to bring scientific knowledge to bear on Russia's problems and to make radical changes in technology is complicated by the fact that the S&T system is itself in flux as part of the institutional change in Russia in the 1990s. S&T financing has decreased dramatically; many S&T institutions are moribund or greatly weakened; scientists and engineers have left Russia or left their professions in large numbers; young people are not being recruited into these professions in adequate numbers; and the scientific and technological physical infrastructure (equipment and instruments) in many areas is aging and deteriorating. It is difficult to measure how much progress has been made in strengthening the historically weak linkages between research and development and education and industry, but certainly they remain weaker than one would desire.

A major emphasis of AID is in the energy sector, which is beset with problems, including the high cost of energy to the final user, the high levels of pollution of the environment (for example, the production of greenhouse gases and other air pollution), and inadequate safety. The vast costs of modernization and conversion have made it impossible for the Western governments to make a meaningful contribution to the solution of those problems. Also, in areas such as nuclear power, liability of U.S. companies that become involved is a major concern. AID is encouraging improved policies and reform of institutions in the energy sector, but it also recognizes that fundamental technological changes are needed. Such changes include deepening technological mastery in the operation of energy plants to make them more efficient, less polluting, and safer, as well as shifting production from processes using less desirable technologies to those using better technologies. AID is encouraging such changes by a number of initiatives, which include training and technical assistance, demonstration projects, and efforts to encourage linkages of Russian organizations with U.S. firms that have better technology and better technology management expertise.

The technological nature of health programs is less fully appreciated than is the case for energy reform. AID's health program emphasizes policy issues, building health institutions, and reform. A portion of the program focuses on pharmaceuticals and getting the right drug or vaccine to the patient at the time it is needed. This involves manufacturing pharmaceuticals of high quality at low cost, importing appropriate pharmaceuticals if necessary, and distributing them in a timely and efficient manner. Even more basic is enabling the knowledgeable choice of technology by the final user. For example, in the case of family planning, couples need to make informed choices of contraceptive techniques and have relevant goods and services available. Thus, again in the health sector, to-

gether with efforts to help Russia reform health policies and institutions, AID is facing fundamental technological issues.

In the area of environment, AID also deals with a variety of scientific and technological issues as well as policy and institutional issues. At one extreme, AID has helped to save and modernize one of the most important collections of germ plasm in the world, the agricultural gene bank and collection of the Vavilov Institute. Russia faces fundamental needs to deepen technological mastery that allows productive processes to be used cleanly, or to encourage the adoption of clean technologies. AID is promoting the transfer of appropriate technology to contribute to the management of nature preserves and natural resources, including geographical information systems.

In the case of industry, Russian enterprises must make high-quality products if they are to meet the demands of domestic and international markets, and they must sell at competitive prices and avoid environmental or safety problems. The reform of the productive sector involves policy changes, institutional reforms, and the creation of market institutions. Again, the transition in the productive sector has critical technological aspects. AID, while encouraging the policy and institutional reforms necessary for the transition of Russian productive enterprises, is also contributing to the technological transition in this area. Efforts described ranged from giving technical assistance to small enterprises to making financing available to those enterprises for technical and other investments and giving courses in commercialization of technology. AID is also seeking conditions that will enable U.S. firms to bring technology to Russia through trade and investment. The private channels of technology transfer and technological cooperation are likely to be the most important in the long run.

Thus, AID programs in each sector involve technological activities. The agency has no general S&T policy for Russia, however, that deals with cross-cutting issues, nor is there an overall S&T policy for U.S. government programs. Lack of such a policy might have some unfortunate results. If the transformation of the S&T system is not successful in training new generations of scientists and engineers, employing them professionally, providing them with the facilities necessary to carry out efficient and high-quality professional work, and financing the whole cycle, then the long-term ability to apply S&T to national needs will be threatened.

The AID budget for the Newly Independent States (NIS) was cut from $900 million in FY 1996 to $625 million in FY 1997. The administration recommended $900 million for FY 1998, and the Congress now seems likely to appropriate on the order of $750 to $770 million. An estimated $200 million will probably be earmarked for Russia. The health sector budget has been greatly reduced, and AID is seeking to encourage multilateral donors to fund the expansion of its successful projects. In the case of the environmental programs, efforts are under way to transfer the lessons learned in pilot projects to other areas in Russia.

Many positive impacts of AID-funded projects were cited (e.g., specific results of demonstration projects or specific policy or institutional reforms), but the diversity and complexity of the program made it very difficult to understand overall national impacts on the Russian transition. This is the "attribution problem." With radical policy and institutional change going on, with many negative trends occurring simultaneously, with many donors providing assistance, and with some problems in our understanding of the processes at play in the transition from communism, it is difficult to quantify specific changes in national indicators that are solely attributable to AID programs. It is simply not known what would have occurred if U.S. assistance had not been present, or how much worse the situation would now be. Thus, large-scale positive results could in fact have occurred; but even if they occurred they would be inherently difficult to observe and to link causally to U.S.-funded cooperative programs.

Discouraging trends in Russia abound. Gross domestic product is much below its historically highest level. Health service expenditures have decreased, and health services have deteriorated, as has health status. Government concern for environmental protection has been downgraded. Nuclear and other energy plants are aging. Scientific and technological manpower has been radically reduced, and many S&T institutions are in trouble. On the other hand, there are some indications that Russia has turned an economic corner, and one informant called current government officials the "last best hope" of the transition.

Similarly, administrative lessons abound from our experience with Russia. The lessons were learned during years of effort to eliminate taxes and duties on foreign assistance; to improve understanding of Russian managerial, scientific, and technological culture; and to improve models for administrative, economic, and policy reform.

## MISSION-ORIENTED PROGRAMS

*By Bruce L. R. Smith (Brookings Institution)*

Nine mission agencies reported on their cooperative S&T programs with Russia. The picture that emerged was of a highly varied, dynamic, and shifting picture that defies tidy summary. Some success stories were noted. Other agencies pointed to current and long-term problems.

The mission agencies generally do not engage in specifically targeted programs to assist Russian S&T as such (except for the large efforts by the Department of Energy and the Department of Defense that are carried on under the Nunn-Lugar mandate and other specific legislative authorizations). Rather, the mission agencies support American scientific institutions or constituencies and only engage in cooperative ventures to the extent that they might promote their missions. For example, the National Science Foundation (NSF) has long supported Russian scientists when they are part of an American research effort (e.g.,

interferometry in radio astronomy and earthquake observations). NSF, however, also played an important role in the establishment of the Civilian Research and Development Foundation, which supports Russian scientists directly. NSF also provided funds to U.S. nongovernmental organizations to encourage international collaboration, such as its funding of the American Physical Society to promote collaborations between American and Russian physicists by providing funds for journals and Russian scientific meetings.

Significantly, many scientific projects are international in character, and thus wide participation is often necessary. The National Institutes of Health (NIH) has supported Russian scientists as part of its ongoing visitors program. The mission is to expand the pool of biomedical researchers for collaborative efforts and to support specific research deemed important to achieve NIH program goals.

For the purposes of future planning, participants in the consultations agreed that all forms of scientific cooperation should be considered. S&T cooperation for the purpose of this review was therefore broadly defined to include support of basic and applied research, technical assistance, training, exchanges, E-mail communication, and fellowships. OSTP and the agencies need to analyze what forms of cooperation and what combinations of research support or technical assistance will contribute, over time, the most to program goals.

Most agency representatives and workshop participants broadly agreed that a major goal should be to achieve institutional reform whenever possible. Any form of scientific cooperation that strengthens institutions or individuals that obstruct the larger goals of American policy–assisting Russia to make the transition to a stable democracy and market economy–would not be in our national interest. Hard choices remain. If an important objective is to help maintain world-class Russian science, for example, existing elite institutions probably deserve help. Yet to channel S&T cooperation through a centralized, academy-dominated system would not nurture future scientific growth as much as a more university-centered system. At a minimum and to the extent practical, U.S. mission agencies should attempt to avoid the heavy dominance of the scientific effort by nonuniversity-affiliated institutions. Can the mission agencies or any other part of the government meaningfully promote institutional change without running into conflict with the Russian academic establishment? Can U.S. government agencies seek institutional reform without provoking conflict with Russian scientists who resent American intrusion?

U.S. visa policy was another problem area identified by some agency representatives. U.S. visa policy should be reviewed to determine if the government has unintentionally contributed to a Russian brain drain or, alternatively, has made it difficult for some Russian scientists and students to visit the United States.

An overall objective for American government technical agencies–and for the private sector–is to maintain contact with Russian scientists and intellectuals so that Russia does not feel isolated and cut off from the flow of Western ideas and influences. As investment increases and private-sector contacts deepen, the

"normal" flow of ideas, people, goods, and services that now characterizes the American S&T relationship with Western Europe will increasingly take shape. In the interim, government policy that attempts to nurture technical cooperation with Russia will remain important. A challenge will be to assess the overall impact of the numerous uncoordinated mission programs and to gain a broad contribution to Russian science while continuing to operate necessarily within a mission framework.

## SUPPORT OF RUSSIAN RESEARCH AND EDUCATION

*By Harley Balzer (Georgetown University)*

Russia is a large, complex country going through massive changes. Program results will be contradictory. There will be successes and failures; some successes might appear accidental, whereas some failures might appear for people who do absolutely everything "right." In looking at S&T relations with Russia, there is a need to be philosophical.

Russia is neither "just like the United States," nor is it another planet. Indeed, it might be easier if it were Mars, for then Americans could build special equipment and would not have any preconceived expectations. It is a society that has been through massive trauma about once each decade in this century, and it has evolved powerful institutions. It has a "rigidly chaotic" administrative style and an environment in which mistrust is a major feature. However, it is also a society with a tremendous number of talented S&T specialists.

The Russian culture has not changed rapidly, which is no great surprise. Of particular relevance to this discussion are the facts that in the past, Russian groups did not always cooperate with each other and they tended to hoard information.

Positive changes include an increasingly open nature of governance and society; increasing reliance on competitive peer review in allocating some resources; and most striking, a wide access to electronic communication.

Negative trends are primarily continuations of old habits (e.g., information hoarding, acceptance of chaos and dysfunctional elements, and pessimism) and the failure to implement institutional reforms. Lack of adequate institutional reforms is probably the most serious obstacle in basic science and education. For international S&T, reforms are needed in the areas of taxes, customs, and intellectual property rights. Domestically, the needed reforms have to do with institutional structure and funding patterns.

Pessimistic views appear to come most clearly from U.S. institutions that do not see any way to continue formal programs of cooperation with the Russian Academy of Sciences or similar entities rooted in the Soviet era, which the U.S. institutions consider to have a limited future in Russia in their current forms. More optimistic notes are sounded by those Americans working with nongovernmental organizations, small businesses, and small groups of researchers.

U.S. programs and the Russian crisis are now entering a new phase. The Freedom Support Act is about to decline precipitously, forcing many existing programs to the verge of extinction. At the same time, Russia has exhausted the intellectual and infrastructural capital it inherited from the Soviet era and faces a tremendous challenge in replacing those costly necessities. Funds for bricks and mortar are the hardest money to raise everywhere.

In the absence of a clear Russian central government policy, the best approach is to work with the local institutions that seem to be receptive, and to do this with limited and realistic goals, including the realization that

- the United States is not going to "save" the institution;
- if some institutions are saved, it may not be fair to the other institutions, but it will be important; and
- some programs will fail or will have unintended consequences.

We should be willing to work with the federal and local governments, when they show a willingness to be cooperative. However, cooperation is a two-way process; they will not just accept whatever we say. Some Russian S&T leaders have indeed recognized that reform is crucial and inevitable. This is especially true in the educational sector.

Many people in Russia and the United States see a panacea in commercialization. The new mantra asserts commercialization as the solution to such problems as sustainability, exit strategies, and funding cuts. However, few know how to carry out commercialization, and even the people who succeed realize it might cover only 10 percent of development activities. Commercialization is only viable as a long-term program of economic development, and there is a need for S&T management training. The best exit strategy is teaching and training in Russia so that not everyone hoards information, with the realization that it will not work all the time. In short, programs need to be targeted, the programs should encourage competition in Russia, and they should accept variable results.

# 3

# Selected Reviews of Programs

The overview of recent program experiences continued with presentations on four recent evaluative activities.

## ASSESSING INTERNATIONAL COOPERATION IN RESEARCH AND DEVELOPMENT

*Caroline Wagner (Critical Technologies Institute, RAND)*

Ms. Caroline Wagner described a study on international research and development (R&D) cooperation on a worldwide basis undertaken by the Critical Technologies Institute (CTI) as part of their mission to provide objective, independent research and analysis support to OSTP. Conventional wisdom suggests that international cooperation might be leveraging R&D dollars in the United States, but it is unclear how much R&D spending goes to cooperative activities. Policymakers are being asked to justify international R&D spending, but there is no clear picture of the benefits of participating in cooperative R&D activities. Thus, the goal of the study was to assess the level, costs, and benefits of U.S. participation in international R&D.

The results of CTI's inventory indicated that in FY 1995, the U.S. government spent approximately $3.5 billion on international cooperation in R&D, which is about 5 percent of total federal R&D spending. Other S&T activities, including the Global Seismographic Network, Cooperative Threat Reduction program, and education and training transfers might total an additional $1.5 billion or more. The CTI study indicated that, when counted on a bilateral basis, Russia is the largest partner for the U.S. government in terms of dollars spent on coop-

erative activities. Approximately $105 million was spent on bilateral projects with Russia in FY 1995; this figure does not include multinational projects in which Russia might be involved. The U.S. agency spending the most money on projects involving international cooperation in R&D is NASA. Here again, Russia is the largest bilateral partner in terms of dollars spent when only one partner can be identified.

Ms. Wagner then described a case study of a cooperative project in seismology that was intended to assess some costs and benefits of international S&T collaboration. The methodology used for the case study involved identifying the national goals for the international cooperation; matching the goals to measures; choosing measures and conducting an assessment; and assessing lessons learned.

The framework for applying the assessment tools looks first at the reasons for international cooperation, which in this case included the very large-scale equipment; the global nature of the subject; the unique foreign expertise or resources; and the U.S. government mission. The framework then considers the type of cooperation, which can be collaborative research, technical support, operational support, or standard database development.

CTI then chose three tools to match goals and assessments in this case study:

- A survey of internationally co-authored papers in 1985 and 1995. The Science Citation Index was used to provide an indicator of whether there had been an increase or decrease in jointly published papers in this field of science.
- A survey of seismology equipment to determine the extent to which U.S. companies were setting the technical standards for seismology equipment.
- A survey of U.S. investigators working on cooperative projects with foreign counterparts to ask to what extent the foreign partner contributed monetary or in-kind contributions to the project.

Among the findings of the assessment of this particular case study were:

- Jointly authored papers increased from 259 in 1985 to 351 in 1995, even while funding held constant in real terms.
- The United States is leveraging foreign research dollars approximately dollar-for-dollar.
- The United States is setting the standard in approximately 80 percent of the technical equipment used in seismology tools.
- The United States is gaining unprecedented access to unique resources not generally available to foreign researchers.
- Both qualitative and quantitative measures should be used in tandem to get a full picture of the costs and benefits of international collaborative research.

These findings have since been published by RAND (see Appendix D).

## OVERVIEW OF COOPERATIVE PROGRAMS: 1991-1996

*Glenn Schweitzer (National Research Council)*

Mr. Glenn Schweitzer briefly described the findings in his recent book, *Experiments in Cooperation*, which reviewed U.S. collaborative activities with Russia during the period from 1991 to 1996. He considered those activities in which scientists and engineers played key roles. The scope of the activities involved government-funded activities costing the U.S. government about $2.5 billion and U.S. private-sector investments of about $2 billion. The activities included many types of programs, such as nonproliferation, exchanges, joint mission-oriented programs, support of science and education, foreign assistance, and commercial investments.

His approach to the evaluation of the activities was to review program documents; review other U.S., Russian, and international publications; conduct a limited survey of knowledgeable Russian leaders; conduct interviews in Russia and the United States; and consider in more detail 33 case studies. His judgments on the relative success or failure of particular programs were based on (1) the views of funders and participants; (2) the impacts, in terms of achieving project objectives, of follow-on activities, impacts beyond participating individuals and institutions (i.e., leveraging), and impacts on national policies and reform; and (3) "footprints in the sand," or the sustainability of the impacts.

As a result of his research, Mr. Schweitzer was able to identify specific negative reactions in Russia to some U.S. programs and activities. Among those reactions he cited is that of false expectations, that is, some U.S. activities led Russian participants to expect more money, more assistance, and more activity than was actually delivered. Another negative reaction from the Russian side is the inability of the United States to sustain successful projects. The U.S. budget process, decreasing budgets, and a variety of other factors contribute at times to a random stop-and-go approach. The Russians also complain of unfair intellectual property rights arrangements. Finally, there is the lack of appreciation on the U.S. side of Russian capabilities.

He concluded by noting some past approaches in U.S. programs and activities that need attention and possibly revision:

- Emphasizing "assistance." Assistance is a donor-recipient concept that is not an appropriate basis for programs, particularly in science and technology, with Russia. Rather, programs should be based on cooperation.
- Lumping Russia with other states of the former Soviet Union. Russia has unique problems and capabilities and the models for the country to follow should be made in Russia for Russia. Moreover, programs that lump Russia together with the other states of the former Soviet Union, although administratively convenient, lead to distortions in the treatment of Russia.

- Selecting "targets of opportunity" whether or not such activities are supportive of U.S. priorities or indeed divert attention to marginal concerns.
- Developing details of projects in the United States. The details of program implementation are critically important, and the Russians need to be involved.
- Supporting specialists at weak institutions. Even generous grants to scientists in weak institutions will not result in high-quality work. In the end, we are likely better off supporting scientists *and* institutions with the infrastructure to sustain high-quality research.
- Transferring wage payments to institutes. With few exceptions, only a small percentage of funds transferred to Russian institutes for joint projects reaches the researchers. The most effective way to avoid overhead, taxes, social funds, and other government payments (which can total up to 85 percent of the funds) in the absence of special arrangements with the Russian government is to concentrate financial support on maintaining infrastructure and providing equipment and covering costs of travel and per diem and other direct expenses.

## COOPERATIVE VENTURES BETWEEN U.S. COMPANIES AND RUSSIAN DEFENSE ENTERPRISES

*David Bernstein (Stanford University)*

Dr. David Bernstein reported on his work using case studies of cooperative ventures between U.S. industry and the Russian defense sector. He began by noting that his approach in which cases are selected for a particular reason, as compared with a statistical approach, leads to biases in data. His approach is intended to yield models, not statistics. Also, his cases are industrial ventures, and the results and conclusions do not necessarily extrapolate to other types of projects.

He summarized some of his conclusions:

- The amount of U.S. investment into commercial ventures with Russian defense enterprises has been small. There are a few large projects, especially in the space propulsion sector, and many diverse small commercial ventures. Space propulsion may be a unique coincidence of performance, cost, and market growth.
- There are many factors affecting the decision to invest and the degree of success. Of course, all "success" at this stage is interim.
- Among the reasons to invest are the following:
  — market penetration,
  — cost reduction,
  — technology,

— human capital, and
— availability of funds from the U.S. government or international financial institutions.

Dr. Bernstein cited numerous factors influencing the success or failure of a commercial joint venture. First are a number of parameters of the venture itself. These include the sector within which the venture is operating; the type of Russian asset utilized (e.g., human, technical, or physical); the output (e.g., product, service, or research); whether the market to which the venture is looking is foreign or domestic; whether the product is an end item; and the legal form and size of the venture.

There are also operational factors. These include a long-term commitment; the relationship between the parties; flexibility; a strategic versus a purely financial alliance; phasing of the program; compatibility of objectives; and training and technical assistance provided by the Western parties.

With these points in mind, he gave some observations on successful joint ventures:

- Well-nurtured, trustful alliances have the best chance of success. In a U.S.-to-U.S. venture, both partners understand the rules of the game and can look out for themselves. In a U.S.-to-Russian venture, the U.S. partners have to be sensitive to the fact that many of the rules are new to Russians. There is a need for more of a positive-sum philosophy for the venture to be sustainable over the long term.
- There are successes in both manufacturing and in research, but success in research or software projects seems to be easier to achieve.
- Market-driven projects are usually more successful than technology-driven projects.
- Component projects or projects that provide equipment for further use appear to be more successful than end-product projects.
- Enterprises that are willing to carry out low- to medium-technology work are often better matches to the market and their partners' needs than high-technology organizations.
- Russian technologists, like their U.S. counterparts, can be challenged by semitechnical tasks such as improving efficiency, quality assurance, and marketing.
- Russian enterprises willing to decentralize, delegate, and spin off units are better at attracting and working with U.S. partners. Privatization is less important than these other factors.
- U.S. companies hold a variety of views on seeking help from the U.S. government. Many companies will not touch government programs; others find it a necessary condition for investing; still others are engaged in joint venture merely because of the availability of U.S. government funding.

U.S. government participation has helped to facilitate joint ventures in a variety of direct and indirect ways. To date, the government's participation is largely at the margins, but it can be significant. For example, the U.S. government should consider removing or reducing barriers, such as export controls, and offsetting some risks and costs to make it easier to find private capital. Government-to-government facilitation, as takes place under the Gore-Chernomyrdin Commission, is also very important. Finally, the U.S. government can provide logistical and informational help and technical assistance. Other less direct ways in which the U.S. government can assist a joint venture is through encouraging openness and access throughout the Russian industrial complex.

Dr. Bernstein concluded by noting that there is no good benchmark for comparison in assessing the success of either government or industrial efforts with Russia. The projects of most value to building a Russian economy are those that give the Russians a business proprietorship.

## EVALUATING SCIENTIFIC GRANTS PROGRAMS

*Kelly Robbins (National Research Council)*

Taking the discussion from the aggregate to an individual program level, Ms. Kelly Robbins reported on evaluations of scientific grants programs. She focused in particular on the Collaboration in Basic Science and Engineering (COBASE) program, which is funded by the National Science Foundation and administered by the National Research Council. The program funds U.S. researchers in the basic sciences to host or visit colleagues in the former Soviet Union and Eastern Europe for developing and carrying out joint research. Grants vary in amount from just over $2,000 to $15,000, depending on the time period of the joint activity.

Grantees' reports submitted at the end of the visits provide information on immediate results. To find out more long-term impacts and program results, however, Ms. Robbins began the practice of contacting COBASE grantees approximately 1 year after the end of their programs. The informal survey approach used is certainly not all-encompassing or highly scientific, but by asking a few open-ended questions, it prompts the grantees to provide valuable longer-term outcomes of their visits. The questions asked of grantees, and some of the results from recent program years, follow.

- Are you still in contact with your foreign colleague? This is a basic indicator of whether the U.S. grantee felt it was worthwhile to continue the interaction. Ms. Robbins reported that results had been surprisingly positive on this question, with well over 80 percent answering yes.
- Have you applied for, or received, follow-on funding for the joint collaboration? The results here have also been good, with approximately one-

third of grantees having received funding. Moreover, a large number of grantees report that they had continued their collaboration even without funding specifically intended for international collaboration.

- Have you and your colleague published any articles or made conference presentations? Any other results? This question prompts for specific outcomes as well as less quantifiable follow-on activities. Over one-half the respondents had publications.

Ms. Robbins then went on to point out some other benefits of the grant-funded projects. Some, such as publications, patents, and presentations, are easy to quantify. Other benefits seen in the evaluation include curriculum enrichment, involvement of graduate students and junior researchers in international activities, access to unpublished foreign data, and establishment of lasting individual and institutional linkages.

Finally, Ms. Robbins noted some trends that were evident in recent years in the grants programs.

- The number of female applicants and grantees was diminishing, which might be the result of budget cuts at foreign institutes affecting females first.
- As would be expected, there has been an increase in foreigners using the grants to emigrate to the United States. This can of course be considered positive or negative, depending on the perspective. The foreigner receives a stable job and vastly improved lifestyle and the U.S. host obtains a well-trained addition to his or her laboratory; both benefit from the emigration opportunities. In the larger picture, it is questionable as to whether such emigration is in the best interests of the United States or Russia. If some of these emigres return to Russia when it has restored its economy and started to rebuild its S&T capacity, the long stay abroad by the returnees could have real benefits for Russia.
- Regarding the duration of foreign visits, it is increasingly the case that good researchers from Russia and elsewhere cannot afford to be away from their laboratories for even 6 months. Grants programs such as COBASE might have to be flexible in splitting visits or using the model of another NRC program that allows back-and-forth visits by both the foreigner and the American over a longer period.
- Results from collaborative activities take time. Depending on the scientific field and the people involved, major results can be achieved in just several weeks or might take many years. Thus, program evaluations and measurements of success should not set rigid standards on duration and outcomes.

# 4

# Directions for the Future: What Directions Are in the U.S. Interest?

Dr. Kerri-Ann Jones opened the afternoon discussion by reiterating the purpose of the workshop, namely, OSTP's need for input as it considers U.S. strategic choices for a policy that ties into security and foreign policy goals. The morning's presentations provided the political and program background for a discussion of future directions for S&T cooperation. The afternoon session examined policy and program trends within Russia and raised a number of issues that are relevant to the future character of many bilateral programs. Dr. Jones reminded the participants of certain parameters that must be considered and certain themes that had come out of the morning's presentations and discussion:

- S&T programs and an S&T policy toward Russia must promote U.S. mission agency goals, but they also should strive to balance specific objectives with the broader goals of foreign assistance and overall security.
- By definition, cooperative S&T programs cross different cultures and different sectors; they also involve public and private institutions and basic and applied research.
- The United States is shifting resources to different kinds of programs and revising programs, but the bottom line is still a situation of inadequate resources.

Reflecting comments from the earlier sessions and anticipating the discussion to follow, Dr. Jones also raised the issue of the desirable balance between support for commercialization and applied technology compared with basic science and education.

There were some general beliefs voiced throughout the day's discussion that cut across programs and activities but would not generally be considered a formal

element of any program. For example, the importance of personal relationships with Russian colleagues was emphasized by government as well as industry specialists. The industrialists commented that personal relationships in some cases could make up for the lack of adequate legal infrastructure. Representatives from agencies noted that most productive and positive experiences come from projects that involve individuals who have known each other for some time. Similarly, participants were sensitive to the desirability, in most cases, of defining programs carried out with Russia as "cooperative" rather than "assistance" activities. Such principles will not be further elaborated below but should nonetheless be recognized as a component of U.S.–Russian activities.

## INDIVIDUAL VERSUS INSTITUTIONAL SUPPORT

Participants were interested in whether U.S. programs that provide peer-reviewed grants should support institutions as well as individual scientists so that the individuals will have a workplace. One view expressed was that the United States does not help Russia by encouraging the retention of institutional structures that cannot possibly be viable in a market economy. In fact, many support programs, and in particular those initiated several years ago, have been aimed at the best scientists without assessing the viability of their institutions.

On the other hand, most projects and activities involve a mix of support to individuals and to institutions. A representative from the Nuclear Regulatory Commission, for example, explained that paying for work only when it is acceptable and when the allocation of funds is clear will lead to a "normal" channeling of money to individuals and the infrastructure to support those individuals. The former International Science Foundation's long-term grant program provided a small percentage of funding for infrastructural support in recognition of the fact that working scientists need light, heat, and other supporting services.

With programs under the applied S&T commercialization category, the different models are evident: One U.S. company is working together with a start-up company in Russia that emerged from a larger institute; another U.S. company is working only with established institutions; and a third U.S. company is hiring individuals. Each of these approaches has its advantages and disadvantages, with varying amounts of monetary support going to the Russian infrastructure and to individuals.

Many participants agreed that the question of individuals versus institutions is a false dichotomy. Some programs have supported individuals (e.g., the International Science Foundation's Emergency Grants Program); the opposite extreme is supporting only institutions, which was characteristic of the old Soviet system. When good science and good research are supported, however, this usually helps sustain effective institutions. This holds true in Russia as in the United States. The better institutions in Russia, in which individuals have received many grants, are surviving.

Providing a private-sector perspective, one participant noted that his company had set up a Russian company precisely because they found it impossible to pay individuals without paying too much for infrastructure that supports projects of others as well (e.g., electricity).

Many participants agreed that grants should include institutional support, with the qualification that the strategies might still be different for supporting individuals and institutions. Specifically, any support of institutions should have a transformative as well as a supportive function. In addition, one participant pointed out the need to know the laboratory that receives support; too often, U.S. program managers or others are not aware that a laboratory to which they intend to give a grant in fact has been gathering dust for years.

An idea that was well received by participants was to consider portable grants that would permit recipients to move to different institutions and that would include a certain amount of overhead. Thus, no individual or set of individuals would be ruled out because they are at the "wrong" institute. Movement of researchers might also facilitate alliances between laboratories, and thus help to sustain the best ones. Moreover, rather than focusing on institutions versus individuals, U.S. policy does and should encourage economic restructuring that strengthens institutions by allocating resources to the best institutions. Focusing on merit-based and portable grants, which allow people to move, supports this goal.

Finally, one participant noted that institutional support included support not only for organizations, but for other institutions such as for the development of markets for technology and technology-intensive products.

## BRAIN DRAIN

As had been pointed out earlier, the science and technology sector during the Soviet era was bloated beyond the economy's capacity to sustain it, making some movement of scientists into other sectors desirable. Downsizing of the sector began in the late 1980s and increased significantly after the breakup of the Soviet Union. A common estimate is that many institutes have lost 50 percent of their scientific personnel over the past 10 years.

However, the large outflow of scientists and engineers of a few years ago is largely over. Brain drain within and from Russia is now close to being a normal phenomenon, with people choosing their places of work and life. A normal society permits and even encourages mobility. It is also important to differentiate between scientific mobility and emigration contributing to brain drain. In some fields, for example, high-energy physics and other experimental areas, scientists travel for extended periods to participate in international research activities. Thus, many Russian scientists might spend extended periods abroad, but then return to their home institutes after the completion of a project or as required by institutional duties. This mobility could be mistaken as a part of the brain-drain problem.

The concern continues to exist nonetheless about brain drain, and in particular about the quality and age of those remaining in Russian science. The viability of most institutions is threatened as a result of the outflow of many of the best and youngest scientists. Moreover, internal brain drain might be flight to industry, but not always to production activities. In fact, there is some evidence that industry has not benefited from the migration of scientists.

## U.S. GOVERNMENT ROLE IN INSTITUTIONAL REFORM

When considering the broad objectives of U.S. activities with Russia, the importance of supporting institutional reform was stressed to accelerate the pace of economic development and enhance Russia's capacity to innovate successfully on its own. Of course, Russia itself must implement such reforms, a task that it has failed to do adequately thus far. For example, one participant noted that the government continues to over-invest in the Academy's Institute of Space Research and under-invest in new competitive programs such as the Russian Foundation for Basic Research. However, the question from the U.S. perspective is whether institutional reform should be considered more broadly than just facilitating and supporting joint activities.

Pointing out the risk of too large a U.S. role, some participants reminded the group that the U.S. government cannot accomplish institutional reform in Russia, nor can the United States save or not save an institution. That is the role of the Russian government. The U.S. government can encourage each cooperative program to be structured in such a way that it encourages openness, individual choice, portability, and institutional change.

## BALANCING BASIC SCIENCE AND EDUCATION WITH APPLIED RESEARCH AND COMMERCIALIZATION

Much of the discussion centered around the increasingly important role for Russia of commercialization of applied sciences and technology, and the critical need for the United States to define a role for itself that takes into account available resources and focuses on cultivating partnerships with the U.S. private sector. Although technology commercialization will not solve all of Russia's problems, participants in general agreed on the importance of programs and activities that help develop the Russian private sector and drive the economy. That is, technology commercialization is considered by many as one way to transform S&T projects into sustainable economic activity. The U.S. government's role is to encourage and help create an environment in which business can operate.

It is ironic that during Soviet times, U.S. cooperative programs were confined to basic research and any applied research was out of bounds, whereas today, basic research in Russia is largely ignored by U.S. programs. This emphasis illustrates the changing U.S. national interests, and the importance of Russian

economic success. Surveys indicate that many Americans consider Russian technologies to be of very high quality; a problem is how to work with the Russians to commercialize them.

Support of applied research should not eclipse the need to support basic research, as any technology requires a firm basis in science. Companies benefit from a supportive educational system and supportive government policies.

Similarly, the lines of causation are not always as clear-cut as one might desire. That is, some would argue that technology does not lead to a strong economy, rather a strong economy leads to the ability to support creation and commercialization of technology. The United States should not rely on S&T as an economic driver.

One participant noted that there are clear cases of U.S. programs beneficially supporting technology through a market pull; but there are many Russian institutes with technologies for which there is little market interest. What is the U.S. role in such cases?

With the above cautions in mind, participants stressed the importance of the roles of the U.S. and Russian governments in promoting an atmosphere in which scientists can cooperate and businesses can operate. This includes encouraging policy reforms that support entrepreneurship, private investment, and business development. There is also a need to support management training in Russia.

The discussion of technology commercialization led to the issue of risk—that is, how much risk the U.S. government and U.S. industry should be willing to take in supporting joint ventures and other commercial activities in Russia. The often-criticized practice of resource-extraction programs of U.S. (and other Western) companies in Russia is popular largely because it involves lower risk than other types of partnerships.

The discussion of technology commercialization also provoked comments on the need for the U.S. government to encourage specific types of policy and legal reforms in Russia. Unlike basic research in which the issue is building institutions, the issue in commercialization is better laws and policy reforms. The status of the courts and the legal system, in general, is unclear, thus providing no protection for intellectual property. This impedes both domestic innovation and foreign investment. It was suggested that the need for a reliable banking system and financial infrastructure will force the needed reforms in Russia. At the same time, Russian professional societies and other scientific organizations can address some issues more effectively than the government can.

## NEED FOR LINKAGES AND ATTENTION TO THE UNIVERSITY SYSTEM

There had been little effort by U.S. government agencies or individual projects to influence S&T reforms in Russia, according to several participants. One area in which the U.S. government should consider placing greater effort is

in encouraging linkages between research and industry and research and the university structure.

The traditional link between the large universities, such as Moscow State University and St. Petersburg University, and the academy institutes was that of developer of scientific talent for recruitment by the institutes. Scientists did not have a role in the universities, nor did the universities benefit from the large research programs that were directed primarily to other organizations. Today, universities in Russia on the average are in a better situation financially than research institutes. One challenge, then, is how to transfer research from the research institutes to the universities and how to strengthen the linkages between the universities and research institutes. For example, NASA has a sizable program with Russia and should have an interest in the educational infrastructure of that country.

The link between research and industry also deserves attention. The Department of Defense's Cooperative Threat Reduction program, although working with scientists in the military sector, is encouraging Russian industry to take advantage of technologies for cooperative programs. U.S. policy should encourage agencies to think more systematically about such linkages in their programs and activities.

In addition to paying more attention to linking research with industry and the educational sector, participants believed that universities themselves deserve more attention, that is, strengthening the university structure. There was a striking lack of evidence of U.S. interactions with the university structure, although the U.S. Information Agency, which is charged with promoting exchanges, especially educational exchanges, was not represented at the meeting. Also, some nongovernmental organizations indicated an intention to give more emphasis to university science in an effort to strengthen university-based research and to encourage university-academy cooperation.

## MULTIPLIER EFFECT OF S&T

The question was raised of how S&T programs can be designed and implemented to encourage multiplier effects. One participant suggested that a multiplier effect is obtained by having the Russian collaborators build a business proprietorship rather than by just providing a service. Another participant noted that the multiplier effect is in education. In the latter case, the strongest justification for supporting basic science is that it provides a training ground for young scientists. A third view was offered that no matter what the product, the multiplier effect depends on the investment. The real issue, then, is investment, which is lacking in Russia.

## MULTILATERAL PROJECTS

The issue of reinvigorating multilateral projects and multilateral channels of

cooperation with Russia, both to decrease the financial burden on U.S. agencies and organizations and to build on other activities in Russia, was considered.

Cautionary remarks underscored that some multilateral organizations operate under inappropriate parameters. For example, the World Bank requires a 3- to 5-year payback on loans, which might not be feasible for sustained technological development. Also, the future of the large multilateral programs is uncertain; for example, multilateral funding has decreased as a percentage of total global official development assistance in the last decade. It was pointed out that the problem in Russia is not the lack of capital, which some believe Russia has, but rather the influence that any foreign government can realistically have. This comment brought the participants back to points raised previously, namely, that the U.S. government cannot provide large investment funds, but can facilitate partnerships, build infrastructure, and reduce risks to facilitate business. Given that, to the extent that multilateral channels are an option, the challenge is not so much to reinvigorate the multilateral agencies themselves but to reinvigorate S&T so it finds a place in their agendas.

## SUSTAINABILITY AND IMPACTS

A theme central to the day's discussion was that the nature of U.S. science and technology relations with Russia is, and must continue, changing from short-term assistance activities to long-term sustainable joint activities. As one example, citing his experience with the physics community, one participant stated that support among U.S. scientists for remedial emergency grants to Russia is waning. Many physicists no longer support an intensive program of aid to Russians that might not meet international standards; rather, they prefer to normalize Russian science through a sustainable program of competitive peer review. Of course this takes time.

Another question addressed by the workshop participants was how to sustain over the longer term activities stimulated by U.S. cooperative programs. Participant views differed, with some recommending that sustainability of a project after U.S. funding runs out should be a criterion for funding the project in the first place. In some applied projects, sustainability in the form of industrial interest or market interest should be built into the project from the start. Others pointed out that in basic research, commercial firms might not be willing to pay for the results. In addition to commercial interests, the United States is interested in working together with Russia to explore the frontiers of science, that is, in good basic science for science's sake. Having sustainability as a criterion might reduce the willingness of individuals and institutions to participate.

A suggested solution was to define sustainability to mean that a program will meet its technical objectives, or to define it as requiring a potential alternative source of funding to support further research once U.S. funding runs out. Here again, participants did not fully agree. A National Institutes of Health (NIH)

representative pointed out that NIH gives grants to Russian scientists specifically because they would not fare well in international competitions. At the same time, NIH does expect the Russian scientists to meet their stated objectives. A National Science Foundation (NSF) representative noted that proposals to NSF, which must be submitted by American scientists but may include Russians on their team, are reviewed on their scientific merits without sustainability as such being a criterion. The most the agency can ask from the investigators is their best effort. Yet a different view was offered that, in basic research, sustainability is less of an issue because agencies such as NIH and NSF fund projects with U.S. partners whose projects fall within the interests of the agencies. However, sustainability clearly becomes an issue in areas linked to national policies that might transcend the interests of individual agencies, such as nonproliferation.

One leading obstacle to sustainability is the fragmentation of the research effort in Russia, particularly in medicine and biology. In this regard, efforts should help Russia consolidate research at the universities.

In the end, the participants came back to a well-known theme: to ensure sustainability in a general sense, there is need for a good viable environment and a good educational system that will support research and technology-based business. Moreover, sustainability will depend on the Russian commitment to build on bilateral and multilateral programs by committing their own resources to the S&T enterprise. Ultimately, the recovery of the Russian S&T sector will depend on Russian resolve.

In addition to looking at sustainability, participants agreed that programs must consider the question of impacts. In some cases, the objective is sustainable impacts, for example, nonproliferation and commercialization. But with other programs, such as NSF and NIH grants, the goal is producing excellent science. How can achievement of that goal be measured?

Measuring impacts and achievements of programs requires a distinct effort, and mission agencies are generally not provided with resources to monitor the efficacy of their programs. This is an endemic problem with almost all governmental programs and programs supported by nongovernmental organizations. Nonetheless, it was recommended that every program should have built into its design the anticipated impact and how it is to be measured.

One participant noted that evaluation and impact assessments would differ for each agency and each program, and a better way of measuring success and impacts would be by having an outside group or academic organization conduct a qualitative review. Such a group from outside the government might be useful in identifying areas in which more effort is warranted.

The issue of geographical spread in Russia of U.S. activities was touched upon briefly, with participants raising the question of whether clustering activities in a few cities, and thus making “big footprints” in a few places, is advantageous. Of course, consciously clustering or spreading out activities requires agency time in coordination and organization.

## ROLE OF INFORMATION TECHNOLOGIES

Participants in general agreed that access to telecommunications and information technologies is crucial for the future viability of Russian S&T institutions. With U.S. government funding for international activities declining in many areas, new modes of scientific collaboration are being developed. The Internet and other information technologies can help Russia develop its S&T sector and facilitate and improve S&T collaboration between the United States and Russia. Access to the Internet also will bolster private-sector development within Russia and encourage foreign direct investment into the Russian private sector.

The Internet is being installed in Russia, but at a rate slower than in the United States, due partly to funding constraints and inadequate infrastructure. Some U.S. cooperative programs have been directed to assist Russian universities and research institutes obtain access to Internet and other information technologies, and some cooperative activities with other goals have included installation of equipment in Russian institutions.

## ADDITIONAL CONCERNS AND SUGGESTIONS

Throughout the day, workshop participants discussed specific problems and future directions about S&T policy and program activities with Russia. During the final session of the workshop, participants were given the opportunity to clarify points they had made or add new suggestions that they felt might not have received adequate attention. Individuals made the following points, but there was no attempt to gain a consensus on any item.

- One participant pointed to the problem of the lack of appropriate S&T expertise in the U.S. Embassy in Moscow. This view was challenged by others. Moreover, it was pointed out that it is not necessary to work through the embassy and other government channels. The private sector and nongovernmental organizations can sometimes provide information and facilitation.
- Although many U.S. programs receive Russian researchers at American laboratories, it is sometimes difficult for young U.S. researchers to visit Russia due to logistics and other difficulties. Particularly in the geosciences, there is some research that can be done only in Russia, and the U.S. government should ensure that programs encourage a true exchange with visits in both directions.
- Concerning commercialization, there is need for a "development corporation" that would bring immature projects and proposals to the point that they can be funded, given the considerable financing that is available for bankable projects in Russia.
- When discussing sustainability, current U.S. efforts must be considered. For example, the Civilian Research and Development Foundation is a new,

but struggling, institution. The U.S. government, having gone to great lengths to create it, should now provide the necessary core support to ensure that it survives.

- More of an effort should be made to provide public reports on the positive aspects of S&T development in Russia.
- Many U.S. nongovernmental organizations have successfully mediated with the Russian government exemptions to burdensome taxes on the transfer of funds and equipment under collaborative projects. To further facilitate joint research, U.S. government programs should encourage Russian reforms in such areas as S&T tax law and customs.
- There is a need for S&T management training in Russia.
- Russia needs to build up a viable business and investment environment and educational system to sustain joint ventures and other activities. To make sure such infrastructure issues are addressed, instruments such as industrial educational fellowships should be considered.
- In the area of technology commercialization, a U.S. leadership forum composed of private-sector representatives had previously made recommendations on steps the government could take. Those proposals should be made available and, if appropriate, incorporated into current activities.
- In a recent evaluation of the Department of Energy's fissile material protection, control, and accountability (MPC&A) and export control programs, the National Research Council recommended that institutes doing well in MPC&A and export control be given preference in other U.S. government programs such as the Initiatives for Proliferation Prevention. This recommendation could be expanded to other government activities and programs. A State Department representative, however, suggested that this might dilute the objectives of the other programs.
- U.S. visa policy should be reviewed to determine if it has unintentionally contributed to a Russian brain drain or, alternatively, has made it difficult for some Russian scientists and students to visit the United States.
- Research grants to Russian universities and institutions should have provisions for supporting students and young researchers.
- U.S. programs should put more emphasis on, and a larger investment in, telecommunications technologies. They have helped enable collaboration between Russian and U.S. scientists, and offer the potential for still more benefits. For example, limited support to local networking and increased bandwidth would greatly help integrate Russian scientists into the world scientific community.
- The United States should not let the fear of dual-use technologies block commercialization and establishment of new businesses in Russia.
- The U.S. private sector can find scientists, find technologies, and build laboratories. What the private sector cannot do is remove government

impediments, such as Russian tax laws, Russian customs barriers, and U.S. encryption laws if they develop.

- The U.S. government should continue to put emphasis on nonproliferation. Another issue is military reform, including reform of research and development. The U.S. government should consider how our S&T policy can make a difference in furthering military reform.

# APPENDICES

APPENDIX

# A

# Workshop Agenda on U.S.–Russian Cooperation in Science and Technology

## *Policy and Strategy Framework for Bilateral Programs*

National Academy of Sciences
2101 Constitution Avenue, NW
Lecture Room

October 28, 1997

9:00 Welcome from *Dr. John Boright, NRC Office of International Affairs*

9:15 The Political Context: *Dr. Kerri-Ann Jones, OSTP*

Foreign Policy Perspective: *Ms. Leslie Gerson, Department of State*
National Security Objectives: *Ms. Ki Fort, National Security Council*
Gore-Chernomyrdin Activities: *Mr. Mike Hamel, Office of the Vice President*

10:00 Recent Program Experience: Approaches and Lessons Learned
*Gerald Dinneen*

- Summary of Day 1 Consultations
- External reviews
  —*Ms. Caroline Wagner: RAND*
  —*Mr. Glenn Schweitzer: Experiments in Cooperation*
  —*Dr. David Bernstein: Report on Joint Ventures*
  —*Ms. Kelly Robbins: Scientific Grants Programs*

12:00 Lunch

1:00 Future Directions for S&T Cooperation: Where Is Russia Going and What Directions Are in the U.S. Interest?
*Dr. Kerri-Ann Jones*

*Strategic Questions Facing the United States*

- How do we help Russia move from the small-scale quick fixes to finding long-term solutions to systemic problems? How can S&T programs achieve a multiplier effect? How can S&T programs avoid becoming emigration paths? To what extent should the United States rely on multilateral mechanisms in lieu of bilateral approaches?

*Developments in Russia: Special Concerns*

- To what extent should we be worried about employment alternatives for displaced specialists? What can we do about the decline in cadres of young scientists? Can or should we address the obsolescence in Russian R&D facilities?

2:45 Break

3:00 *Maximizing the Impact of Future U.S. Cooperative Programs*

- How can programs become more sustainable? How can the payoffs of S&T programs be measured? Should U.S. agencies attempt to target specific institutes in preference to others for support? In central or outlying regions? How can the impact of programs in individual regions be magnified? How can we make sure the money gets to the researchers for research?

*Future Programs That Can Stimulate Reform*

- Should the U.S. reorient current efforts? Are there appropriate additional program initiatives? What are the appropriate roles of the U.S. public and private sectors?

4:30 Adjourn

APPENDIX

# B

# Participating Agencies and Organizations in October 27 Consultations

American Association for the Advancement of Science
American Physical Society
The Boeing Company
Carnegie Endowment for International Peace
Civilian Research and Development Foundation
Decision Management International
Defense Enterprise Fund
Department of Commerce
Department of Defense
Department of Energy
Department of the Interior
Department of State
Environment Research Institute of Michigan
Environmental Protection Agency
Eurasia Foundation
Incorporated Research Institutions for Seismology
International Research and Exchanges Board
National Aeronautics and Space Administration
National Institute of Standards and Technology
National Institutes of Health
National Oceanic and Atmospheric Administration
National Research Council
National Science Foundation
Nuclear Regulatory Commission
Office of Science and Technology Policy
Overseas Private Investment Corporation
Sun Microsystems
U.S. Agency for International Development
U.S. Army Medical Research Institute of Infectious Diseases
U.S. Geological Survey

APPENDIX

# C

# Participants in October 27 Consultations and October 28 Workshop

Lee Bailey, Department of Commerce
Harley Balzer, Georgetown University
David Bernstein, Stanford University
Michael Blake, Defense Enterprise Fund
Kevin Bliss, U.S. Agency for International Development
Robert Borchers, National Science Foundation
John Boright, National Research Council
Inta Brikovskis, National Research Council
Richard Brody, Department of Commerce
Matt Bryza, Department of State
Catherine Campbell, Office of Science and Technology Policy
Albert Ciafre, Eurasia Foundation
Robert Clarke, Environment Research Institute of Michigan
Rudy D'Alessandro, Department of the Interior
John Daly, Consultant
Ed Dandar, Department of Defense
Gerald Dinneen, National Academy of Engineering
Cassandra Dudka, National Science Foundation
Kimberly Eaglin, Department of Agriculture
Robert Eiss, National Institutes of Health
Ki Fort, National Security Council
Gordon Fowler, Nuclear Regulatory Commission
Jim Gale, Overseas Private Investment Corporation
Leslie Gerson, Department of State
Peter Green, Department of Energy
Emily Guthrie, American Association for the Advancement of Science
Mike Hamel, Office of the Vice President
Anne Harrington, Department of State
Paul Hearn, U.S. Geological Survey
Robert Hedland, U.S. Agency for International Development
Paul Holmes, U.S. Agency for International Development
Peter Jahrling, U.S. Army Medical Research Institute of Infectious Diseases
Kerri-Ann Jones, Office of Science and Technology Policy
Rodney Jones, Carnegie Endowment for International Peace
Elizabeth Kirk, American Association for the Advancement of Science
Clarence Kitchens, Department of Defense

Brian Kremer, Department of Energy
Thomas Laughlin, National Oceanic and Atmospheric Administration
Irving Lerch, American Physical Society
John Metzler, Department of Energy
Mary Ann Micka, U.S. Agency for International Development
Carl Mitchell, U.S. Agency for International Development
John Modzelewski, Civilian Research and Development Foundation
Jeff Moore, Department of Defense
Scott Nichols, National Research Council
William Nitze, Environmental Protection Agency
Richard Nordin, Defense Enterprise Fund
John Nowell, Defense Enterprise Fund
Michael O'Brien, National Aeronautics and Space Administration
Tom Owens, Civilian Research and Development Foundation
John Paty, Strategy Management Company
Suzanne Petroni, Department of State
Rajiv Rasbogil, U.S. Agency for International Development
Lucy Richards, Department of Commerce
Kelly Robbins, National Research Council
Claire Saundry, National Institute of Standards and Technology
Kim Savit, Department of State
Glenn Schweitzer, National Research Council
Gerson Sher, Civilian Research and Development Foundation
David Simpson, Incorporated Research Institutions for Seismology
Bruce Smith, Brookings Institution
Linda Staheli, National Institutes of Health
Richard Steelman, U.S. Agency for International Development
Alexandra Stepanian, National Science Foundation
E. Stephen, U.S. Army Medical Research Institute of Infectious Diseases
Frank Theil, Decision Management International
Ken Thomas, Department of State
Natalie Tomitch, National Institutes of Health
Caroline Wagner, RAND
William Walster, SUN Microsystems
Rob Waltemyer, Eurasia Foundation
Peter Ward, Department of the Interior
Gary Waxmonsky, Environmental Protection Agency
Ken Yamashita, U.S. Agency for International Development

APPENDIX
# D

# Background Information Sources

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