An Assessment of the International Science and Technology Center: Redirecting Expertise in Weapons of Mass Destruction in the Former Soviet Union

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AN ASSESSMENT OF THE INTERNATIONAL SCIENCE AND TECHNOLOGY CENTER

Redirecting Expertise in Weapons of Mass Destruction in the Former Soviet Union

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Preface

The collapse of the Soviet Union brought a long-sought end to the Cold War and the arms race but led to new dangers and threats, particularly with regard to Soviet nuclear weapons and other weapons of mass destruction. The disintegration of central control and deteriorating social and economic conditions in the former Soviet Union (FSU) prompted concerns among Western governments that weapons scientists and engineers would flee to countries eager to acquire nuclear, biological, and chemical weapons know-how. To reduce this threat, the European Atomic Energy Community and the European Economic Community (acting as one party), the United States, Japan, and the Russian Federation signed an agreement in 1992 to establish an International Science and Technology Center (ISTC) in Moscow, Russia.[1] The ISTC began its operations in March 1994 with the signing of the Protocol on the Provisional Application of the Agreement Establishing an International Science and Technology Center.[2]

The United States, Canada, Sweden, and Ukraine subsequently signed a separate agreement in 1993 to establish the Science and Technology Center in Ukraine (STCU), which came into effect in May 1994.[3] The STCU began operations in 1995.

U.S. participation in the ISTC was originally funded under the U.S. Department of Defense's Cooperative Threat Reduction (CTR) program, commonly referred to as the Nunn-Lugar program.[4] The ISTC has been funded by the U.S. Department of State since fiscal year 1996 and administered by the State Department since its inception.

Meanwhile, convinced that a stable science and technology community in the FSU is in the interest of the United States, the National Academy of Sciences (NAS), National Academy of Engineering, and Institute of Medicine, together with the National Research Council's (NRC) Office for Central Europe and Eurasia, carried out numerous activities to help preserve the important base of science and engineering in the FSU and improve relations between the United States and the FSU. Several of these activities, in particular, a workshop convened for the White House in 1992 and a conference in 1993 on sustaining the best of Soviet science, contributed to the present report.[5]

In May 1995 the Office of the Secretary of Defense requested that the NAS, through the NRC, undertake an assessment of the ISTC.[6] The chairman of the NRC appointed a 10-member interdisciplinary committee of specialists to carry out the ISTC assessment. The specific task to the Committee to Assess the International Science and Technology Center was as follows:

> "a) NAS shall establish an expert committee to assess the ISTC's success in providing, and potential to provide, weapons scientists and engineers in the CIS [Commonwealth of Independent States] with opportunities to redirect their knowledge and talents to peaceful activities. The committee shall consider the effect that researcher mobility in Russia has had on the ISTC, and on its ability to achieve the stated

[1] See Appendix A.

[2] See Appendix B.

[3] See Appendix C.

[4] The CTR program was established by the Soviet Threat Reduction Act of 1991, which authorized the transfer of up to $400 million from existing Defense Department programs to finance denuclearization activities in the FSU. Subsequent authorization and appropriations bills have allocated a total of $1.5 billion through fiscal year 1996 to provide Russia, Belarus, Kazakstan, and Ukraine with assistance in the destruction of nuclear, chemical, and other weapons of mass destruction; the transport, storage, and safeguarding of weapons in connection with their destruction; and the establishment of safeguards against proliferation of weapons and weapons-usable material.

[5] The workshop and conference are the subject of two NRC publications: *Reorientation of the Research Capability of the Former Soviet Union: A Report to the Assistant to the President for Science and Technology. Results of a Workshop on March 3, 1992,* National Academy Press, Washington, D.C., 1992; and *Sustaining Excellence in Science and Engineering in the Former Soviet Union. Results of a conference held on February 3, 1993,* National Academy Press, Washington, D.C., 1993.

[6] The NAS/NRC contract is with the Defense Nuclear Agency (DNA). The DNA acts under the authority, direction, and control of the Assistant to the Secretary of Defense and supports the Department of Defense on matters concerning nuclear weapons.

goals. It shall also consider the ISTC's role in relation to other grant-making and assistance efforts. To provide information against which results can be measured, the NAS will collaborate with one or more FSU organizations to carry out studies on this issue.

b) The NAS staff shall conduct discussions with U.S. organizations involved in grant-making and assistance efforts for weapons scientists and researchers in the CIS to ensure [that] duplication of effort is minimized.

c) The committee shall conduct visits to the CIS as required. Committee members shall meet with selected recipients of ISTC grants for on-site evaluation of the projects' relevance to ISTC goals and their progress to date. If appropriate, the committee shall suggest changes to the ISTC's administrative and/or policy activities to better reach the stated goals."[7]

The committee assessed the ISTC's success in meeting its goals and considered the impact on the ISTC of researcher mobility, or so-called "brain drain," as requested. The committee noted other efforts that have complementary goals but did not do an exhaustive study of other such efforts.

The ISTC assessment was carried out in parallel with an NRC study of the effectiveness of U.S. programs to support efforts by Russia, Ukraine, Belarus, and Kazakstan to improve export controls and the protection, control, and accountability of fissile material. The NRC report on export control and fissile material will be completed and published in early 1997. The Department of Defense provided support for both NRC studies from CTR program funds.

The ISTC assessment was conducted during the latter half of 1995 and first half of 1996. In addition to holding several meetings in the United States, committee members visited Russia in November 1995. Smaller subcommittees returned to Russia and visited Ukraine in May 1996.

In Russia, committee members met with representatives of the ISTC and visited (or met with representatives from) 13 institutes that have received ISTC grants. The committee also met with various government officials and others involved in science and technology issues who have an interest in and/or knowledge of the ISTC and its impact on Russian science and technology.

In Ukraine, committee members met with representatives of the STCU, the Ukrainian government, and other organizations knowledgeable about the STCU's activities. Committee members then visited the Kiev Institute of Nuclear Research and the Kharkiv Institute of Physics and Technology, each of which had received several STCU grants.[8]

In addition to the site visits and meetings in the FSU, the committee reviewed many reports on the CTR program and the ISTC, including reports by the U.S. General Accounting Office, the Congressional Research Service, the International Institute for Applied Systems Analysis, the Organisation for Economic Cooperation and Development, and the Monterey Institute. (Citations for these and other documents are provided throughout the text.) The present report is intended to offer an objective view of the status of the ISTC after its first two years of operation and to recommend directions for its future. The committee did not revisit issues pertaining to the initiation of the ISTC or its early progress, but did consider that history in its deliberations. The committee's recommendations were heavily influenced by its visits to institutes in Russia and Ukraine and by the experience of its members in related research and development activities.[9]

The committee wishes to acknowledge the extraordinary assistance it received from the directors and staff of the ISTC and STCU. Their efforts in planning for and arranging our visits to institutes is much appreciated. The U.S. Ambassador to Russia and the staff of the American embassies in Moscow and Kiev were extremely supportive. In the United States, the State Department's Office of Regional Nonproliferation and the Defense Department's CTR Program office were most helpful in providing background data and recommendations for site visits.

The committee wishes to especially thank Inta Brikovskis and Elsa Banks for their cheerful and enthusiastic assistance throughout the entire project. During our visit to Moscow, the first visit to Russia for some, they made difficult things look easy. Inta Brikovskis has been an effective and helpful editor as we brought our various views together in this report.

GERALD P. DINNEEN, *Chairman*
Committee to Assess the
International Science and
Technology Center

[7]From DNA/NAS contract, May 9, 1995.

[8]See Appendix E for a list of sites and meetings in Russia and Ukraine.

[9]At the time of the committee's visit to Ukraine, the STCU was in the very early stages of its activities and was only beginning to sign contracts on funded projects. Therefore, the committee offers only initial observations about the STCU.

Contents

Executive Summary

The International Science and Technology Center (ISTC) was established to help address a perceived crisis that was created by the dissolution of the Soviet Union—that is, the threat of a large exodus of scientists and engineers with knowledge and experience in the development of weapons of mass destruction. The primary objective of the ISTC, as stated in the agreement establishing it, is to "give weapons scientists and engineers, particularly those who possess knowledge and skills related to weapons of mass destruction or missile delivery systems, in the Russian Federation and, if interested, in other states of the CIS [Commonwealth of Independent States] and Georgia, opportunities to redirect their talents to peaceful activities."[1] By providing opportunities for scientists and engineers to work on problems unrelated to weapons, the ISTC's founding parties hoped to reduce the incentive for these scientists and engineers to sell their knowledge and experience to unfriendly governments or organizations.

The ISTC's founding parties anticipated a transition in the former Soviet Union (FSU) to a market economy, which would help alleviate the proliferation risk. In the United States, support and funding for the ISTC were tied to other nonproliferation and assistance programs with limited objectives and finite lifetimes. Thus, U.S. government funding of the ISTC is projected to decline to zero by the year 2003, and, without other nongovernment funds, the United States would withdraw from the ISTC at that time.

The Committee to Assess the International Science and Technology Center reviewed the ISTC's objectives and plans, discussed its activities with U.S. and FSU officials, and met with FSU grant recipients and institute directors. The committee concludes that during its first two years the ISTC was successful and effective in meeting its primary objective, which, in turn, has contributed to the larger goal of diminishing the risk of weapons proliferation. Moreover, the opportunities provided to FSU scientists and engineers do indeed offer *meaningful* nonweapons-related work, which helps address the demoralization that may otherwise contribute to scientists' being lured into work for unfriendly governments.

The committee believes the ISTC has also been successful in addressing its secondary objectives—namely, the solution of national and international technical problems; the support of basic and applied research and technology development for peaceful purposes; and, to a lesser degree, reinforcement of the transition of the FSU to a market-driven economy. In particular, the committee believes that integrating FSU scientists and engineers into the international science and engineering communities is crucial to stabilizing the science and engineering communities in the FSU, and it makes several recommendations in this area.

In addition to the benefits arising from its stated objectives, the committee identified other positive features and impacts of the ISTC. The ISTC enjoys advantages not held by other U.S. organizations operating in the FSU, such as tax and customs privileges and the ability to address intellectual property rights issues. The ISTC has also reinforced important broader U.S. national security objectives by promoting increased confidence building between U.S. and FSU weapons institutes.

While the ISTC has contributed to these positive trends, the proliferation risk remains high, and the ISTC continues to have a role in mitigating that risk. Based on the ISTC's success to date, the other benefits of its activities to U.S. national security objectives, and the continuing threat of proliferation, the committee recommends that the U.S. government sustain annual core funding for the ISTC at least until and probably beyond 2003.

The committee believes that it is crucial for the ISTC to maintain a focus on nonproliferation. Core funding for the center will ensure the continuation of collaborative grants aimed specifically at offering weapons scientists nonweapons-related work. In addition, the committee recommends a financial contribution to, and increased representa-

[1] Agreement Establishing an International Science and Technology Center; see Appendix A.

tion in, the ISTC structure by the U.S. Departments of Defense and Energy.

The committee also notes the growing interest among U.S. agencies and their laboratories in establishing ties with FSU institutes. These agencies and laboratories share a conviction that increased contact with FSU scientists and engineers is in the U.S. national interest. The ISTC is in a unique position to facilitate collaborative research on such joint projects.

The committee notes the ISTC's interest in placing higher priority on projects with strong potential for commercial applications. The committee supports this course of action, with the qualification that projects continue to include a majority of weapons scientists and engineers. The committee believes, however, that the role of the ISTC should not extend beyond precompetitive research (e.g., to product or process commercialization).

Based on its findings, the committee makes the following recommendations:

- The United States should continue core funding of the ISTC.
- To maintain a focus on the nonproliferation goals of the U.S. Departments of Defense and Energy, these departments should increase their roles in the ISTC.
- The U.S. ISTC management should seek new funds from U.S. government mission agencies and the private sector.
- The ISTC should consider organizing an industrial advisory council.
- The ISTC should expand the scope of Western collaboration and encourage more active participation by collaborators.
- The ISTC should place more emphasis on involving biological and chemical warfare institutes in its activities.
- The ISTC should allow grants to fund communications equipment.
- The U.S. government should expedite the appointment of U.S. representatives and staff to the Science and Technology Center in Ukraine.

1

Introduction and Background

Under the Soviet regime, funding for science and engineering came essentially from the central government. The Soviet Academy of Sciences played a significant role in developing basic research in its institutes, while industrial and applied science and engineering were directed principally toward the military sector and were carried out in the defense and industrial ministries. The ministries in charge of nuclear weapons and atomic energy (MINATOM) and the missile and space industry (now the Russian Space Agency) exerted significant influence on research budgets as well as on the direction and implementation of science policy, and many of the country's best engineers were assigned to the institutes involved in this work. Programs and budgets at the Soviet Academy of Sciences institutes were stable and secure, attracting young scholars to graduate and postgraduate work. Soviet strength in space and military fields, foreshadowed by Sputnik, was clearly demonstrated by such accomplishments as the supersonic TU-144 aircraft, the MiG-29, space launch vehicles, and numerous communication and military satellites.

Since the disintegration of the former Soviet Union (FSU), in fact beginning as early as 1985, research funding from the central government(s) for most institutes and in most scientific sectors has declined sharply. Depending on the relative priority the Russian Academy of Sciences and/or relevant ministries place on an institute's work, many institutes and ministry R&D facilities now receive only 25 to 50 percent of their 1980 budgets. As a result, salaries often go unpaid for months.

Severe inflation in the FSU makes it difficult to calculate current budgets or to provide an accurate comparison of the current economic viability of science and technology with that of the 1980s. Moreover, housing, health benefits, and other social services are treated differently among institutes and are no longer automatically included in their budgets, as they were under the communist system. Nevertheless, the committee's many official and private conversations with researchers confirm the reports of a sharp decline in government funding. At the Kurchatov Institute, for example, individuals noted that 70 to 80 percent of the budget now comes from nongovernment sources. Similarly, the Institute of Chemical Physics (ICP) in Chernogolovka receives approximately 70 percent of its budget from nongovernment sources.[1] These two institutes appear to be in relatively good position to attract other sources of support—the Kurchatov Institute because of its ties to the gas and oil giant Gazprom and the Institute of Chemical Physics because of its many ties and contacts with the West as well as the entrepreneurial spirit of its leadership—but their gross income still falls far short of what is needed to sustain high-level personnel, facilities, and research.

Other institutes have not been as successful in replacing government funding. The All-Russian Research Institute of Experimental Physics at Arzamas-16 (hereafter referred to as Arzamas-16), for example, claims that its state budget has been reduced to approximately 25 percent of what it was prior to 1991, and nongovernment sources barely provide half the estimated requirements. At the Ioffe Institute in St. Petersburg, the director noted that prior to 1991 the institute's income came almost equally from government grants, Soviet industry, and the Soviet Academy of Sciences. Today, support from government programs and the academy is a fraction of what it was but nevertheless comprises 70 percent of the institute's income. Very limited industry support and international cooperative programs make up the rest of the budget but do not cover minimal operating expenses.

As a result of the funding shortages, the institutes can pay only very low salaries based on broad government guidance. One hundred dollars per month is the oft-repeated salary estimate for a mid-level researcher. A new source of funding for an institute—an industrial contract or scientific grant, for

[1]Kurchatov Director Yevgeni Velikhov and ICP Deputy General Director George Manelis reported to committee members that these outside sources include the International Science and Technology Center (ISTC), the European Union's International Association for the Promotion of Cooperation with Scientists from the New Independent States of the Former Soviet Union program, and the International Science Foundation as well as domestic industry.

TABLE 1 Ioffe Institute's Income and Expenses, 1991 and 1995

Income (%)			Expenses (%)		
	1991	1995		1991	1995
Soviet Academy of Sciences	33⅓	60	Salaries	25	65
Industrial contracts	33⅓	—	Research/equipment	40–50	5–7
Government grants and programs	33⅓	10	Infrastructure (utilities, etc.)	2–3	25
International programs (e.g., International Science Foundation, ISTC)		30	Scientific materials	22–33	3–5

example—rarely raises salaries; rather, the additional money covers salaries that have not been paid for several months. On the other hand, even though institute directors may reallocate a researcher's other salary and research funds to maintain some overall equity in pay among employees, ISTC grants are given directly to the researchers and allow only 10 percent for overhead.

Table 1 compares the Ioffe Institute's income and expenses for 1991 and 1995; it provides a stark, and typical, example of the impact of the economic decline in the FSU. In 1991 the institute required only 25 percent of its budget for salaries and was able to devote almost 50 percent of its budget to research. Today, most of the institute's funds go toward salaries and infrastructure, with almost nothing left for equipment costs. The director also noted that, overall, the budget is about 5 percent, in real terms, of what it was in 1991. It is not clear what factors are included in his comparison, but the bottom line is one of severe deterioration. The Kurchatov Institute's director told a similar story: whereas previously 10 to 12 percent of his institute's budget was for salaries and up to 70 percent was for equipment, today 60 percent is for salaries, 30 percent for infrastructure, and almost nothing is available for equipment.

The effect of such a drop in funding for the science and engineering infrastructure is severe: institutes have had to redirect their budgets away from operations, equipment, and facilities to pay what amount to barely poverty-level salaries. There is abundant evidence that the science community, particularly the experimentalists, is becoming technically obsolete.

The impact on science and engineering personnel is equally severe: under such deteriorating economic and social conditions, those who remain in science in the FSU do so with little hope of regaining their former prominence or quality of life. Others have left their fields altogether to work abroad or to develop businesses in banking and other commercial sectors in the FSU. In this environment the threat exists that weapons scientists and engineers will be tempted to emigrate to countries of proliferation concern.

The difficulties faced by the science and engineering communities in the FSU clearly are part of the larger economic situation there, and a recovery of the former is dependent on a strong economic recovery overall. In addition, private industry will have to learn that R&D investment is important for long-term survival and profitability. The FSU's financial problems are compounded by the need for structural change. Some research institutes must shift their emphasis to civilian R&D, while others will have to find resources from nongovernment sources. Some institutes (the Kurchatov Institute and the Ioffe Physical-Technical Institute, for example) have already had some success in doing both, while other institutes will probably have to close. The great challenge for Russia is to handle the transition to a market-driven economy in such a way that the intellectual and physical resources in its science community are not completely and irrevocably lost.

Some of the difficulties confronting the science and engineering communities are a legacy of the years of communist control. As noted in a 1994 report by the Organisation for Economic Cooperation and Development: "in the transition towards a new system, the principal sources of resistance may be the corporatist traditions and the patterns of allegiance which have long structured economic and social life and which are now directed towards maintaining acquired advantages or appropriating new sources of wealth in a context of crisis and penury."[2] Although science and technology were given a special prestigious place in Soviet society, the system also led to a number of significant drawbacks, including:

- ideological interference with academic freedom;
- a large and highly distorted research base;
- isolation from the international science community;
- separation of research, design activities, experimental development, and industrial production, even among the republics; and
- an underdeveloped civilian infrastructure (e.g., communications, information, consumables, support services).

[2]Organisation for Economic Cooperation and Development (OECD), *Science, Technology and Innovation Policies, Federation of Russia,* vol. I, OECD, Paris, 1994, p. 13.

During the committee members' visits to Russia, they found that researchers and leaders are aware of these problems and are attempting to change their research structure and attitudes in order to cope with the problems. There are some hopeful signs, particularly in the space and aeronautics fields, for which some outside funds are available. But in general the severe lack of funding makes change difficult.

Although it is impossible to predict what will emerge from the changes now under way, it seems very likely that civilian R&D will be relatively more important and that R&D will be funded from a variety of sources, including, eventually, the private sector. At the present time, the R&D system is caught between two poles, with government funding greatly reduced because of reductions in the defense budget and the general economic collapse and the private sector unable, or perhaps unwilling, to provide larger amounts of financial support.

While the survival of science and technology in the FSU ultimately depends on the interactions of the FSU governments and the science and engineering communities, Western countries, by the early 1990s, recognized the implications of, and their own national interests in, helping the FSU sustain the best of its science and engineering base during its economic transition. A 1992 National Research Council (NRC) report to the assistant to the president for science and technology stressed the broader implications of the FSU's economic decline: "The FSU is in crisis. . . . If FSU science and technology wither and flounder, it is difficult to see how the FSU nations can prosper. Science and technology, together with capital and free social institutions, propel a modern economy."[3] The 1992 report and others stressed the key role that scientists and engineers must play in the economic revitalization necessary for a successful transition by the FSU to an open and stable market-driven democratic society.

Western countries, recognizing the importance of international cooperation and assistance to such a transition in the FSU, have responded with various programs. The International Science Foundation (ISF) provided timely and significant help to basic research scientists in Russia and the other republics. Shortly after being established in 1992, the ISF made over 25,000 emergency grants of $500 to FSU scientists. The emergency grants program was followed by ISF's major funding activity, the Long-Term Research Grants Program, under which the foundation distributed grants to some 3,500 FSU research teams from 1993 to 1995.[4] In 1992 the NRC's Office for Central Europe and Eurasia, which had long supported U.S.-Soviet exchanges in basic research, implemented the Cooperation in Applied Science and Technology program to allow U.S. scientists to host colleagues from the FSU for joint research in applied science and technology. NATO also provides grants to facilitate collaboration and long-term scientific linkages, and several scientific societies began new programs with the FSU: in 1992, the American Physical Society began providing a limited number of emergency grants, free membership to the society, publications, and training courses, and the American Mathematical Society and American Astronomical Society made similar attempts to alleviate the dire economic conditions and isolation of science and engineering personnel in the FSU.[5] Of course, these programs have not reached all FSU scientists and engineers, and some organizations have already ended their activities, leaving many top scientists and engineers with little or no access to foreign support.[6]

These and other programs have the broader goal of helping to preserve science and technology in the FSU. Western countries also have directed specific efforts at the many scientists and engineers who conducted weapons-related research and designed and manufactured weapons of mass destruction and their delivery systems. As noted in the 1992 NRC report to the president, "Of special concern, temptations are increasing for FSU military scientists to look abroad for opportunities to use their capabilities."[7] Weapons scientists from Los Alamos National Laboratory and Arzamas-16 began working together on basic science projects almost immediately after the collapse of the Soviet Union. This collaboration developed into the so-called Lab-to-Lab Program that today is addressing nuclear materials control throughout the Russian nuclear complex. In 1994 the U.S. Department of Energy initiated its Industrial Partnering Program (IPP), now called the Initiatives for Proliferation Prevention, which is designed to engage former Soviet weapons scientists and engineers in projects with commercial potential. It was in this context of proliferation concern that another unique international effort, the ISTC, took form.

THE ISTC'S ORIGINS

Germany was the first Western country to propose, in 1991, an international program to provide financial support to weapons scientists in the FSU. By early 1992 the United States, Germany, and Russia were discussing the possibility of such an international program, and in February 1992 the

[3] *Reorientation of the Research Capability of the Former Soviet Union: A Report to the Assistant to the President for Science and Technology. Results of a Workshop on March 3, 1992,* National Academy Press, Washington, D.C., 1992, p. 7.

[4] *International Science Foundation, 1994 Annual Report,* ISF, Washington, D.C., 1995, p. 1.

[5] The many joint ventures and other activities involving the U.S. private sector are generally beyond the scope of this report, although some mention of the role of the private sector is made in the context of the discussion on commercialization.

[6] The ISF ceased grant-making activities in 1996. The American Physical Society has discontinued its emergency grants program and no longer provides free membership for FSU physicists, although its training programs increased in 1996.

[7] NRC, op cit., p. 2.

three countries proposed the ISTC. Shortly thereafter, the European Community joined (replacing the individual participation of Germany), and Japan also agreed to participate in the program. In the United States, legislative authority was provided by the fiscal year 1992 Department of Defense Authorization Act (P.L. 102-484).

From early on the participating countries agreed that the ISTC would be an intergovernmental body, and in 1992 they formalized the center's organization, structure, and procedures in the form of two documents: an agreement and a statute.[8] The agreement delineates the purposes of the ISTC and its legal status and governance structure, and the statute contains additional details on its structure and organization. The participating parties reached agreement on the following very significant issues:

- The secretariat's staff and other high-level participants in the center's activities would have diplomatic privileges and immunities.
- The ISTC would have wide-ranging tax and customs exemptions.
- Each party providing funds for projects through the ISTC would have the right to determine which projects it would support, rather than having their financial contributions put into a general pool.

On November 27, 1992, representatives from the United States, Russia, the European Community, and Japan met in Moscow to sign the agreement, which was then submitted to the European Parliament for an opinion and to the Russian Supreme Soviet for ratification.[9]

The debate in the Supreme Soviet was lengthy and involved as many as five committees. It elucidated two broad concerns of members of the Supreme Soviet regarding the proposed center and other Western efforts in science and security: (1) the involvement of foreign governments in the security affairs of Russia and (2) the influence of foreign governments on Russia's scientific priorities. Members of the Supreme Soviet also had a number of specific allegations concerning the agreement:

- First, opponents argued that diplomatic status for secretariat staff members would give them a license to spy without the fear of punishment.
- Second, opponents asserted that the provision in the agreement allowing the ISTC to earn a "profit," for which there would be special currency exchange privileges, would open the door to illegal currency operations.
- Third, opponents criticized the agreement for not having adequate provisions regarding intellectual property rights.
- Finally, opponents claimed that the agreement's provisions on monitoring and auditing granted too many rights to foreign participants, giving them access to highly sensitive Russian facilities.

Although many of the criticisms were addressed in the ISTC statute, which all parties had approved in draft form in February 1993, opponents were concerned that the statute could be changed without the approval of the Supreme Soviet. Finally, an internal agreement was reached under which the Russian government promised not to change the statute without consulting the Supreme Soviet. But ratification of the agreement was interrupted by a larger crisis in the Russian government, when President Yeltsin dissolved the Supreme Soviet in October 1993. Finally, on December 27, 1993, the four parties signed an intergovernmental protocol giving the ISTC temporary status but nonetheless making it fully operational. The ISTC was officially established on March 2, 1994.

Since then, other countries, including Sweden and Finland,[10] have joined the ISTC. Representation by the FSU has expanded to include Georgia, Belarus, Armenia, Kazakstan, and Kyrgyzstan. Kazakstan has a branch office as well as a program on decommissioning nuclear reactors, and Belarus has a small branch office.[11]

THE ISTC'S OBJECTIVES

The agreement codified the ISTC's objectives. The primary one is to provide opportunities for FSU scientists and engineers who work on weapons of mass destruction to redirect their talents to other activities and to find employment in the civilian sector in fields of interest. The ISTC is also intended to contribute thereby to:

> "the solution of national or international technical problems; and to the wider goals of reinforcing the transition to market-based economies responsive to civil needs, of supporting basic and applied research and technology development, inter alia, in the fields of environmental protection, energy production, and nuclear safety, and of promoting the further integration of scientists of the states of the CIS [Commonwealth of Independent States] and Georgia in the international scientific community."[12]

U.S. MANAGEMENT OF THE ISTC

The U.S. Department of State led the negotiations that culminated in the establishment of the ISTC and maintains

[8]See Appendixes A and D.

[9]Internal approval procedures in the United States and Japan were completed beforehand.

[10]Finland joined the ISTC in 1994; as of October 1995, Finland's participation is as a member of the European Union (EU).

[11]The branch offices support development and submission of project proposals to the ISTC in Moscow, which continues to serve as the central coordinating point for all projects. Staff for the branch offices are provided by the countries in which they are located. The committee did not visit either branch office and so does not comment here on their operation.

[12]Agreement Establishing an International Science and Technology Center; see Appendix A.

oversight for the U.S. government of the day-to-day operations of the center.

The ISTC's Governing Board, with representation from each of the four original parties, determines the ISTC's policies and procedures, provides general guidance, and approves projects for funding. The board is assisted by a coordination committee, which prepares recommendations for it and reviews policy and program issues on an ongoing basis. The secretariat, which consists of the executive director, three deputy executive directors, each representing one of the four original parties, and other key staff, is responsible for the daily administration of the ISTC. The Scientific Advisory Committee provides assessments of the technical merit of proposals submitted to the ISTC and advises it on scientific issues.

The United States exerts influence on ISTC policies and activities through its membership on the Governing Board and the Scientific Advisory Committee and through the secretariat's staff. The United States has held the executive directorship since the center was established, but the position will likely be filled by the European Union beginning in early 1997.

FUNDING OF THE ISTC

The original contribution by the United States to the ISTC was $25 million. An additional $24 million in fiscal year 1995 and $15 million in fiscal year 1996 brings the U.S. total to $64 million as of 1996. This amount includes $11 million for projects in Kazakstan, $5 million for projects in Belarus, and $1 million for projects in other former Soviet republics that are members of the ISTC (Armenia, Georgia, and Kyrgyzstan). As of mid-1996, the European Union and Japan had contributed $53.5 million and $17 million, respectively. In 1995, Finland contributed $1.3 million and Sweden $4 million.

Each of the four founding parties also contributes staff, whose salaries and related expenses are paid for by the contributing country from non-ISTC designated funds. The United States has provided the executive director, the chief financial officer, two project managers, the chief accountant, and an adviser. In the United States, substantial additional in-kind support for ISTC activities is also provided by the national laboratories, which contribute employee time and effort to review proposals.

The first $49 million of U.S. funding for the ISTC came out of the Department of Defense's Cooperative Threat Reduction program, which has received a total of $1.5 billion since fiscal year 1991. The ISTC is now funded by the State Department from Freedom Support Act funds, which was funded at $850 million in fiscal year 1995 and $641 million in fiscal year 1996. This transfer of the ISTC from the Defense Department's budget to the State Department's budget did not result in any significant administrative changes since the State Department had administered the ISTC from the start, but it did result in additional congressional committees being involved in the authorization and appropriations process. This may have an effect on the ISTC's future funding, a topic the committee addresses in Chapter 4.

ISTC ACTIVITIES TO DATE

As of March 1996 the ISTC had funded 236 projects (including feasibility studies and second-stage funding to several projects), involving more than 12,000 FSU scientists in five countries. Approximately two-thirds of the scientific personnel funded by ISTC grants are from the nuclear weapons sector, and the largest number of grants has been awarded to the All-Russian Research Institute of Experimental Physics (Arzamas-16), the All-Russian Scientific Research Institute of Technical Physics (Chelyabinsk-70), the Moscow Engineering Physical Institute, and the Kurchatov Institute. Less than 10 percent of funds support scientists from the biological or chemical weapons sectors. In its 1995 annual report,[13] the ISTC noted that, of the science and engineering experts participating in ISTC-funded projects, 63 percent had a background in nuclear weapons, 3 percent in chemical weapons, 4 percent in biological weapons, 16 percent in missile technology, and 14 percent in other areas.[14] The appropriateness of this distribution is discussed in Chapter 4.

In addition, the ISTC has conducted several workshops and technical seminars that complement grants activities. The seminars are intended to stimulate the development of new proposals and increase collaboration among FSU scientists.

All of these activities are directed at the primary goal of diminishing the risk of weapons scientists and engineers emigrating from the FSU to rogue states and terrorist groups eager to acquire their knowledge and experience. Central to understanding and meeting this goal is an understanding of what is actually known about such emigration. The committee addresses this question in the next chapter before proceeding to its assessment of the ISTC's activities.

[13] *The International Science and Technology Center: Second Annual Report;" January–December 1995,* ISTC, Moscow, 1995, p. 6.

[14] While the ISTC's intent is to provide grants to weapons scientists and engineers, most projects necessarily include some nonweapons scientists and engineers.

2

Emigration of Scientists and Engineers

Under the former Soviet system, the country's science sector was inflated beyond the economy's capacity to sustain it. Yet the country's leadership expanded the science sector—encouraged by a bureaucracy that rewarded growth for growth's sake, a system that did not know or consider the true costs of maintaining its science and engineering institutes, and the high prestige attached to science and technology in general.

Downsizing of the Soviet science sector through emigration, attrition, and shifts of personnel to the commercial sector began in the late 1980s, before the collapse of the Soviet Union in 1991. The Organisation for Economic Cooperation and Development (OECD) has estimated that in 1991 Russia's 4,000 institutes employed close to 1 million scientists and engineers.[1] By 1994, the number was reduced to 650,000 to 750,000. In a separate estimate, the Russian Centre for Science Research and Statistics reported that total employment in R&D institutes in the FSU fell by 40 percent between 1989 and 1993; the employment of R&D specialists alone fell by 44 percent during the same period.[2] According to the centre, of the total downsizing, emigration from Russia of workers in the science and scientific services sector was slightly over 2,000 per year from 1990 through 1993.[3] This total includes employees with all levels of education. The number with advanced degrees was much smaller. Separate data on emigrants with advanced degrees in science are not available, but some idea can be gathered from the centre's statement that, of a total of 35,000 emigrants from all sectors in the second half of 1992, only 67 had candidate degrees and only 7 had doctoral degrees.[4]

By 1995 several Russian economists were estimating that scientific personnel had decreased by more than 50 percent since the mid-1980s.[5] The committee's discussions with institute directors and researchers support this estimate. The director of the Institute for Applied Microbiology, Nickolai N. Urakov, claimed that the current level of 1,350 employees at his institute is 50 percent of the 1991 level. The Research Institute for Pulse Technology, currently with a staff of 1,200 to 1,300, is also at 50 percent of its 1991 level. The deputy general director of the Institute of Chemical Physics in Chernogolovka, George B. Manelis, reported that his institute's staff is now approximately 1,800, down from 2,500 several years ago. And the P. N. Lebedev Physics Institute is down from its 1990 level of 3,500 to 2,500 employees today. Less downsizing has occurred at Arzamas-16, where the staff has gone from about 25,000 to 20,000 since the 1980s.

These reductions, large as they are, are not yet sufficient to bring the Russian science sector to a manageable and sustainable size. The uncertain economic future of the region makes it impossible to predict just how far the downsizing should go (there is always the question of quality versus quantity). The OECD estimates the number of researchers and technicians that Russia presently can afford by taking into consideration Russia's per capita income (adjusted for purchasing power parity) and comparing its R&D sector to other countries at comparable levels of wealth. The results suggest that Russia's economy would be able to sustain 350,000 to 400,000 researchers (or full-time equivalents).[6] Whether this figure is accurate is less important than the notion that significant further reductions will be required to correspond with a level that the economy can support.

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[1]OECD, *Science, Technology and Innovation Policies: Federation of Russia*, vol. 1, OECD, Paris, 1994, p. 17.

[2]Centre for Science Research and Statistics, *Science and Technology in Russia 1994*, Moscow, 1995, p. 61.

[3]Centre for Science Research and Statistics, *Emigration of Scientists: Problems, Real Estimations*, Moscow, 1994, p. 32.

[4]Ibid., p. 45.

[5]Quoted in Dorothy S. Zinberg, "The Missing Link? Nuclear Proliferation and the International Mobility of Russian Nuclear Experts," Research Paper No 35, United Nations Institute for Disarmament Research, Geneva, 1995.

[6]The figures used by the OECD are based on "head count" rather than full-time equivalents (FTEs) and are thus somewhat larger. While FTE figures are unknown, the estimates nonetheless provide an indication of the size of cuts likely to occur over the next few years (OECD, op cit., p. 17).

Thus, continued "internal migration" in the FSU of noncritical personnel from the science sector to other newly emerging sectors is not only to be expected but should be welcomed by institute directors, many of whom, for various reasons, have not been able to downsize their staffs. In part, this relates to the traditional responsibility of an institute director for the welfare of his employees. Similarly, the Russian government has been unable, or unwilling, to reduce institute staffs to a level that could be reasonably supported.

While continued downsizing is in the interest of the Russian science sector, the reductions that have occurred have not necessarily preserved the most competent people. Aggregate data on internal migration and downsizing do not reveal the scientific status of those leaving; in other words, are the best scientists and engineers leaving? Are the younger scientists and engineers leaving? Or has the downsizing been random?

A report from the International Institute for Applied Systems Analysis (IIASA) suggests that "the first to leave are leading researchers, experienced, well-educated specialists."[7] The committee's discussions at the Institute of Applied Microbiology support that view. Similarly, a researcher at the Central Aerohydrodynamics Institute commented that the older researchers, who also hold positions at learning institutes, have tended to stay, while the younger and the very competent middle-aged researchers were leaving.

The aggregate data also fail to show the extent to which scientists have actually left the country, as opposed to leaving science for other careers. Official statistics regarding the number of scientists who have emigrated to other countries "are very limited at present," according to Russia's Centre for Science Research and Statistics. Data indicating sensationally large numbers of emigrating scientists appear in various publications, but "the origin of these data is a mystery."[8] Moreover, many scientists have gone abroad under temporary arrangements that enable them to stay at the forefront of research. Of the 1,200 scientists employed at the Ioffe Institute, for example, approximately 100 are working abroad at any given moment. How many will return is uncertain.

The committee heard from several directors and researchers that a significant number of their best people had left for nontechnical commercial jobs in Russia. This internal migration, which has involved disproportionate numbers of younger scientists, who are more mobile than older scientists and who may have more opportunities in nonscientific careers, has been more deleterious to the Russian science community than emigration abroad. As a result, the institute's staffs are aging. Several institute directors commented that the average age of their scientific staffs is now over 50.

Thus, available data and the committee's many discussions confirm that significant downsizing—both internal migration and emigration—is and has been occurring in the FSU. But what of the scientists and engineers who are or have been conducting research in weapons of mass destruction? Nuclear weapons scientists, once the elite of Soviet science, have not been spared from the financial crisis. Budgets for the once all-powerful nuclear weapons laboratories, such as Arzamas-16 and the Kurchatov Institute, have been dramatically reduced. However, the downsizing at Ministry of Defense and Ministry of Atomic Energy institutes has not been as severe as at other institutes (e.g., at institutes of the Russian Academy of Sciences), but the level of frustration, and even desperation, among staff members is increasing and should remain a cause for international concern.

In May 1996 the Russian press reported that a Russian scientist was arrested on charges of producing and smuggling abroad radioactive materials that could be used for nuclear weapons production.[9] The suspect, who had worked at Krasnoyarsk, Siberia, produced 1 kilogram of a radioactive substance in his laboratory and shipped it abroad. This case, and several others in which people have been arrested, are stark reminders of the ongoing threat of proliferation.

Estimates vary on the number of Soviet scientists, engineers, and technicians who were involved in research on weapons of mass destruction. In Russia alone, 10,000 to 20,000 scientists, engineers, and technicians formed the core of research on chemical, biological, and nuclear weapons. Beyond that, 40,000 to 50,000 individuals have knowledge and experience that could be of interest to rogue states.[10]

These professionals are the target of the ISTC's activities. In all of their visits and discussions, committee members sought to gain a clearer understanding of whether the ISTC has been able to reach the relevant scientists and engineers and what impact the center's efforts are having.

Subsequent chapters present the committee's findings and conclusions.

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[7]IIASA, *Military R&D Institutes in the Context of Demilitarization in Russia*, WP-94-002, IIASA, Laxenburg, 1996, p. 9.

[8]Centre for Science Research and Statistics, *Emigration of Scientists: Problems, Real Estimations*, Moscow, 1994, p. 29.

[9]*The Boston Globe*, May 8, 1996, p.10 (as reported by ITAR TASS, May 7).

[10]Estimates used by the ISTC, according to Glenn Schweitzer, then executive director.

3

The ISTC After Two Years

This chapter notes several other appraisals of the International Science and Technology Center's (ISTC) and then presents the committee's assessment of the ISTC's success, after its first two years, in meeting its primary and secondary objectives.

THE ISTC'S TWO-YEAR INTERNAL REVIEW

In 1996 the ISTC parties (Russia, Japan, the European Union, and the United States) conducted an internal review pursuant to Article XV(A) of the agreement and Article II of the protocol on the provisional application of the agreement establishing the ISTC. Their report, issued in March 1996, was generally positive.[1] The parties reaffirmed the ISTC's objectives and their own commitment to the agreement and to the prescribed manner of implementation. The parties also recommended ways to enhance the ISTC's ability to meet its objectives.

The committee agrees in large measure with the findings of the parties in their two-year review. This chapter delineates some of the areas of agreement and disagreement.

THE U.S. CONGRESS

The overall goals of the U.S. Department of Defense Cooperative Threat Reduction (CTR) program enjoy support in the U.S. Congress, as evidenced by the annual appropriations for the program since fiscal year 1992. In 1996 the U.S. Senate Permanent Subcommittee on Investigations conducted a series of hearings on global proliferation of weapons of mass destruction and the U.S. government's response to this threat. A subcommittee staff report acknowledged the role economic hardship plays in creating an atmosphere ripe for nuclear diversion and found that the ISTC "has been critical in the effort to provide challenging civilian alternatives for ex-Soviet weapons scientists."[2]

However, the ISTC also has been subject to criticism from some members of Congress and other policymakers. One argument, heard among members and staff of the U.S. Congress, is that the funds going to the former Soviet Union (FSU), and Russia in particular, are in fact assisting future Russian military capabilities.[3] Some members' constituents are hostile to foreign assistance and ask why the United States is supporting Russia when it has its own pressing domestic needs, and, more specifically, why the United States is supporting Russian scientists and engineers when scientists and engineers at home are being laid off by both government and industrial laboratories. Without discounting the importance of domestic funding needs, proponents of the CTR program and related programs have called such efforts "defense by other means," pointing out the gains that the United States makes by helping to eliminate weapons of mass destruction and curb their proliferation.

THE U.S. GENERAL ACCOUNTING OFFICE

The U.S. General Accounting Office (GAO) issued a report to Congress in 1995 addressing, in part, these concerns. The report was generally favorable regarding the ISTC, noting that it appeared to have "made a good beginning in achieving its nonproliferation objectives by supporting work on peaceful projects for scientists engaged in weapons of mass destruction and missile delivery systems activities."[4] However, the report also noted that because ISTC projects do not necessarily fund 100 percent of scientists' time, and because most scientists funded by the ISTC continue to be employed by institutes engaged in weapons work, it is possible that they continue to spend at least some of their time on weapons-related research.

[1] *Agreement Establishing an International Science and Technology Center: Two Year Review*, ISTC, Moscow, 29, 1996.

[2] Staff Statement, U.S. Senate Permanent Subcommittee on Investigations (Minority Staff), Hearings on Global Proliferation of Weapons of Mass Destruction: Illicit Trafficking in Nuclear Materials, March 22, 1996, p. 35.

[3] See, for example, Theodor Galdi, *The Nunn-Lugar Program for Soviet Weapons Dismantlement: Background and Implementation*, Congressional Research Service, Washington, D.C., 1995, p. 20.

[4] U.S. GAO, *Weapons of Mass Destruction: Reducing the Threat From the Former Soviet Union: An Update*, Report to Congress, GAO, Washington, D.C., 1995, p. 27.

ISTC officials concur that ISTC grants do not necessarily support all program scientists and engineers full-time, but they disclaim the implication in U.S. newspaper articles that ISTC funds are supporting FSU military work.[5] Moreover, ISTC officials stressed in response to the articles that the ISTC's goal was never to prevent all weapons scientists and engineers from working on weapons-related research in the FSU but rather to offer opportunities for other research to reduce the risk of proliferation. The committee found no evidence of ISTC funds supporting military work.

CRITICISM WITHIN RUSSIA

Russian critics of the ISTC and related scientific collaborative programs claim that the programs allow foreigners to steal Russia's best ideas and brightest scientists, as discussed in the previous chapter. While the committee was confronted with these allegations by several institute heads and by Russian officials, most people with whom the committee met were supportive of the ISTC. In contrast to the early criticisms in Russia, the committee found the ISTC to be well received by the Russian Foreign Ministry and the technical institute managers interviewed for this report. One official at the Ministry of Atomic Energy noted that the "ISTC is our only hope. . . . [It] complements Russia's philosophy of disarmament and collaboration. . . . Russia does not plan to go back to the Cold War era. . . . [Therefore] we have to work [with the West] to remove all barriers."

THE COMMITTEE'S ASSESSMENT OF THE ISTC

The committee was aware of the criticisms made by members of Congress, the GAO, and the news media before its meetings and visits to Russia and paid special attention to these matters. The committee reached its own independent judgments on the effectiveness of the ISTC in meeting its objectives, as described below.

THE ISTC'S PRIMARY OBJECTIVE

FINDING: The ISTC has met its primary objective of providing nonweapons-related work opportunities for weapons scientists and engineers.

The ISTC has given highest priority to meeting its primary objective of providing opportunities for weapons scientists and engineers, particularly those possessing knowledge and skills related to weapons of mass destruction or missile delivery systems, to redirect their talents to nondefense-related activities. The ISTC has endeavored to reach a large number of scientists and engineers in institutes throughout Russia and the other former Soviet republics.

As of March 1996, ISTC grants provided some amount of salary support to approximately 12,500 scientists and engineers in the FSU, the majority of whom possess skills related to weapons of mass destruction or missile delivery systems.[6] The committee visited 13 institutes involved in ISTC activities and met about 100 skillful, energetic, and informed scientists who are now earning enough money to survive in their present establishments while working on nondefense-related research and who, therefore, are less likely to emigrate (except, perhaps, to Europe or the United States).

The impact of ISTC funding on individual institutes varies greatly. At some of the institutes the committee visited, the ISTC was providing between 10 and 50 percent of the total budget. The director of the Institute for Applied Microbiology, for example, noted that the ISTC currently provides 10 percent of the institute's funds and that he hopes to increase the number of ISTC grants over the next several years. At Arzamas-16, the 50 or so ISTC-funded projects support some 1,200 scientists for about 50 percent of their time. At other institutes, ISTC support is less significant. At the Kurchatov Institute, for example, less than 2 percent of the budget comes from the ISTC.

While its activities are clearly directed at weapons scientists, the ISTC itself sets no requirement for a specific level of participation by weapons scientists in a project. Rather, each participating country establishes its own funding criteria. Under its so-called Purity of Objective Criteria, the United States requires that 60 percent of a project's personnel have weapons-related experience. The committee believes that the ISTC-funded projects involve appropriate numbers of weapons scientists and that those scientists are now working on nondefense projects.

As noted above, some critics of the ISTC have expressed concern that FSU weapons scientists may not be completely reoriented to nondefense-related research. It should be noted that the ISTC cannot, nor ever intended to, convert *every* FSU weapons scientist to 100 percent civilian work. Rather, by facilitating other avenues of work and providing incentives for weapons scientists to think about civilian applications of their work, the ISTC is decreasing the likelihood that they will want or need to sell their knowledge and expertise to hostile countries.

Based on committee discussions with directors and researchers, ISTC grants on average support 50 percent of individual researchers' time. The committee finds this to be desirable because the financial benefit reaches more people

[5]While the GAO report never explicitly stated that ISTC funds were being used for weapons-related research, several newspaper articles, referring to a *draft* version of the GAO report, implied that U.S. funds may be supporting weapons-related research. See, for example, "Draft Report Says U.S. May Be Aiding Russian Nuclear-Arms, Nerve-Gas Work," *The Wall Street Journal*, May 22, 1995, and "Russia Uses Pentagon Funds in Constructing New Nukes," *The Washington Times*, May 23, 1995.

[6]Joint Statement of the Governing Board of ISTC from its March 28–29, 1996, meeting.

and even part-time support encourages openness and the potential for increased international collaboration.

FINDING: The opportunities provided to scientists and engineers in the FSU by ISTC grants offer *meaningful* nonweapons-related work.

Since the mid-1980s, scientists and engineers have seen their salaries drop as quickly and significantly as their prestige and stature in society. As discussed in the previous chapter, many have left their scientific professions; others continue their work but see little recognition from their colleagues, superiors, or government that their efforts are of any use. The international recognition that an ISTC grant provides can assure a scientist or engineer that his work has meaning and thereby addresses the demoralization that may otherwise contribute to a scientist's being lured by unfriendly governments. The committee listened to reports from many scientists and engineers and concluded that ISTC-funded research was of high quality and on substantive issues.

Moreover, based on the committee's many discussions, the ISTC is buying an enormous amount of good will toward the United States (and other participating countries) among researchers in the FSU. Scientists and engineers there are very grateful and value the opportunity to interact and communicate with sponsors and collaborators.

FINDING: The ISTC management and its supporting structure (Governing Board, Scientific Advisory Committee) are working well but may need to be modified.

Together, the ISTC staff, the internal Russian screening process, and the country review process are ensuring that ISTC grant requirements regarding the involvement of weapons scientists are met. In general, the committee believes that the administrative structure is appropriate and effective. One remark made by an ISTC-supported scientist was particularly telling. She said that, in contrast to many institutions in Russia today, the "ISTC is *not corrupt*!" A bit too bureaucratic, perhaps, in part because of its multinational responsibilities, but essentially this scientist is convinced that the ISTC operates with integrity and scientific dispassion.

A concern to the committee is that the ISTC staff will soon be stretched thin. At the time of the committee's visit, each project manager was responsible for monitoring about 16 projects. This number increases with each new round of funding, although the number should stabilize as projects near their end. Effective monitoring requires regular contact with researchers and at least one annual site visit. In addition to monitoring existing projects, project managers spend a significant amount of time working with researchers to write proposals and contracts. The ISTC should consider assigning the role of monitoring to a responsible collaborator on each project. The collaborator would have as much interest as the ISTC in ensuring that the project is being carried out properly, and, while the collaborator's work in this regard would not replace all ISTC involvement, it would reduce the burden for ISTC project managers.

The committee also noted some ambiguity in the role of the ISTC's Scientific Advisory Committee (SAC). According to the ISTC agreement, the SAC is responsible for providing scientific advice on proposals submitted to the ISTC. For this task the U.S. members of the advisory committee have relied principally on scientists and engineers at U.S. national laboratories to conduct peer reviews. From the committee's early discussions with laboratory personnel and SAC members, this process is working but is on the verge of overburdening laboratory personnel and SAC members. In its own internal review, the ISTC noted that it is "difficult or impossible for the SAC to submit review results to the Board within the deadlines defined in the Agreement."[7] The committee understands that the ISTC is addressing this issue. In some cases, laboratory employees may not be the most appropriate reviewers (e.g., in cases of commercially oriented research), and more involvement by industrial laboratories may be appropriate. The committee returns to this issue in the next chapter.

The SAC is also responsible for providing advice on questions of policy. However, it is not clear that it has been called on to provide advice or that procedures exist for it to influence the ISTC's policies and future directions.

THE ISTC'S SECONDARY OBJECTIVES

The founding parties of the ISTC recognized that supporting a weapons scientist or engineer for one or two years is not sufficient to induce a permanent career move or reorientation of an individual's and institute's research. But by concentrating on its primary objective, the ISTC has helped to create an environment that is more conducive to the larger R&D transition taking place in the FSU; the primary objective is supplemented by secondary objectives intended to support the broader R&D transition.

Of course, ultimate responsibility for redirection of the R&D effort and revitalization of civilian R&D rests with the governments of the former Soviet republics. But the ISTC can help provide a bridge for the transition. This section, in discussing the secondary objectives of the ISTC, addresses the questions: How long and wide does the bridge have to be? What is at the other end of the bridge? There are also questions that need to be answered and issues to be addressed in the near term.

The ISTC's secondary objectives are to:

- contribute to the solution of national and international technical problems,
- reinforce the transition of the FSU to a market-based economy that is responsive to civilian needs,

[7]ISTC, op cit., p. 2.

- support basic and applied research and technology development for peaceful purposes, and
- promote integration of FSU scientists into the international scientific community.

FINDING: The ISTC is contributing to the solution of national and international technical problems.

Science and engineering are often enhanced when they are directed at solving real problems. The ISTC's 1995 annual report lists examples of projects aimed at solving important national and international technical problems—for example, research on nuclear reactor safety, radiation technologies, development of building blocks for general-purpose communications systems, instrumentation, and nontraditional energy sources.

Three ISTC-sponsored projects at the Central Aerohydrodynamics Institute (TsAGI) are noteworthy illustrations that demonstrate implementation of this ISTC secondary objective. One project involves the development of methods for laminar flow control and turbulent drag reduction, which are fundamental problems of modern fluid and gas dynamics. Major advances could significantly reduce the drag, weight, fuel consumption, and operating costs of a high-speed aircraft. Another project at TsAGI is tackling environmental problems (noise, atmospheric pollution, etc.) that must be solved if a next-generation supersonic transport is to be built. TsAGI engineers have a great deal of expertise to offer in this area because they participated in the design, testing and flight certification of the TU-144, a Russian supersonic transport that operated for 10 years before it was withdrawn from service. Another project concerns wake-vortex evolution. The goal of this project is to develop criteria that will permit less separation of aircraft, particularly in the takeoff and landing phases, without compromising aircraft safety. Results from all of these projects are of great interest not only to the United States but to the international aeronautical community as well. Through ISTC funding, the TsAGI engineers and scientists are bringing a different perspective and a highly competent multidisciplinary approach to bear on the solution of these complex problems.

In a similar demonstration of research directed at solving national and international problems, a project at the Institute of Chemical Physics is aimed at the theoretical understanding of neurological diseases involving neuron degeneration (e.g., Alzheimer's disease) and the development of drugs to counter this degeneration. At the St. Petersburg State Electrical Engineering University, an ISTC grant is allowing researchers to continue work on silicon carbide devices that would operate reliably at much higher temperatures and power levels than devices made from presently available materials. Of particular interest is the potential of these devices to increase the reliability of control systems for power plants.

FINDING: The ISTC's objective of reinforcing the transition of the FSU to a market-driven economy has had only limited success.

Today, science and technology play an important role as an "engine" of economic development. Industries and economies become successful by converting scientific and technological advances into innovative products for the marketplace. Thus, the connection of research activities with market needs is a vitally important one for economic development. This connection between research and market needs was absent under the Soviet system and today is only beginning to develop in Russia and the other former Soviet republics. Traditional Russian industry is in very poor condition (except perhaps the oil and gas industry). High-tech industry, with the exception of aerospace, undertakes almost no research and is without the capital to exploit new developments. The private sector is simply not strong enough to give rise to a substantial domestic demand for innovations.

While the ISTC can and should help, it should be explicit about its goals and objectives in this area. The conversion of weapons institutes to civilian work is an extremely difficult—some would say impossible—task. Critics of the possibilities for successful defense conversion are abundant in the United States. As noted by K. Adelman and N. Augustine in writing on defense conversion, "Defense work has little in common with civilian work. These two areas demand different skills and marketing techniques and have different cultures and organizations."[8] The problem is even larger in the FSU, where many weapons scientists and engineers have lived under greater isolation than in the West and the market system is only starting to develop.

On the other hand, individual defense scientists and engineers can and have used their experience and talents to develop technologies with civilian applications. This requires access to information and an environment conducive to entrepreneurial activity. Unfortunately, the typical weapons scientist in the FSU has no knowledge or experience in how market-driven organizations function or in how to select a potentially useful problem to solve and then transfer significant research results to commercial practice.

Driven by economics, FSU institutes are spinning off small companies, while researchers within institutes are engaging in various forms of entrepreneurial activity in hopes of attracting foreign partners and foreign capital. The committee heard from individuals at the Institute for Applied Microbiology, the Institute of Chemical Physics, Arzamas-16, and others about joint ventures they are pursuing and products and skills they plan to market. In a particularly noteworthy example, a researcher at the Institute of Radioengineering and Electronics has developed his own company within the institute to produce laser metrology instruments. He has received more orders than he could accept and is

[8]Kenneth L. Adelman and Norman R. Augustine, "Defense Conversion: Bulldozing the Management," *Foreign Affairs*, vol. 71, no. 2, 1992, p. 27.

establishing a subsidiary in Germany to handle marketing. This example is perhaps exceptional. The committee found various levels of business and marketing expertise in the FSU, and in most cases the attitude seemed to be closer to "We have a product, so you should buy it" rather than "What is the market demand and how do we meet it?"

Russian science leaders are divided on how much attention the ISTC should pay to this objective at this time. One researcher considers the objective impractical, in the short term, and recommends that the ISTC concentrate its activities on ensuring survival of the scientific work force. Another government official still considers enforcing the transition to a market economy an important ISTC objective, although he recognizes that it is only likely to be met via active "collaboration" with U.S. and European industrial researchers, which currently is not a strong point of the program (see below).

FINDING: The ISTC is supporting basic and applied research and technology development for peaceful purposes.

This objective is closely related to the primary objective of providing weapons scientists in the FSU with opportunities to engage in nonweapons-related work. The scientists and engineers the committee spoke to were nearly unanimous in their opinion that the ISTC has been a major factor in mitigating the decline in basic research and development in the scientific fields in which the ISTC operates and in beginning work on peaceful goals.

An added benefit of the ISTC is the recognition it gives the grantees in their own country and internationally. ISTC proposals go through an extensive review process in Russia and in each of the participating countries. In the United States the national laboratories have taken the lead on reviewing proposals.[9] With similar reviews in the other ISTC participating countries, the award of an ISTC grant carries a recognizable "seal of quality" for a scientific project and its researchers and leads to additional opportunities for funding.

The ISTC process also acts as a stimulus for teaching applicants how to write internationally competitive proposals. Competitive funding of scientific research is new for most scientists and engineers in the FSU. The Russian Foundation for Basic Research (RFBR)[10] and other grant-making organizations have been operating in Russia for only a few years, and most scientists and engineers in the FSU have little or no experience in writing a competitive proposal. ISTC project managers spend a considerable amount of time with scientists and engineers developing their proposals and preparing them for submission to the ISTC. Clearly, the knowledge and experience this process provides will help FSU scientists and engineers obtain other funding.

FINDING: The ISTC is promoting integration of FSU scientists into the international science community but should do more in this regard.

The integration of FSU weapons scientists into the international science community is closely related to the primary goal of nonproliferation of weapons of mass destruction and one of the most important goals of the ISTC. The committee strongly believes that the more contacts a scientist has with the West, and the more opportunities for active collaboration with Western colleagues, the less likely he/she will be to accept offers from other, less friendly, governments. Moreover, integration of FSU scientists into the international science community also will make a reversal to weapons-related research less likely. Hence, one of the most important aspects of the ISTC program is that it alleviates the isolation of FSU scientists by providing collaborations with foreign scientists.

The ISTC encourages those applying for grants to include Western collaborators in their proposed research, which many researchers have done. But the committee repeatedly heard from Russian grant recipients about their desire and need for more active participation from their collaborator(s). At the Institute of Theoretical and Experimental Physics, the St. Petersburg Electrochemical University, and Arzamas-16, Russian researchers lamented the lack of significant professional participation from the Americans who had enthusiastically supported their proposals.

ISTC policy does not allow grant funds to be used for Western collaborators to travel to the FSU or participate in conferences. They must cover such costs on their own. It appears that many of the foreign persons named as collaborators in ISTC grant proposals have demonstrated very limited activity in this regard, perhaps amounting to one brief visit per year. FSU scientists, on the other hand, are called on to issue reports quarterly and many hold formal meetings to discuss research progress and directions.

Under current ISTC policy, funds for travel, publications, and participation in conferences and workshops are very limited; the committee recognizes the importance of making the largest possible percentage of ISTC funds available to FSU scientists and engineers. The committee also recognizes the time and funding constraints faced by U.S. laboratories. But publication of research results and other means of communicating research results to the international community are important ways to reduce isolation. The ISTC should seek other means of achieving these objectives. While it does not recommend using ISTC grant money to pay for visits to the FSU by Western collaborators, the committee does urge the ISTC to do more to increase the participation of foreign collaborators. We return to this issue in the next chapter.

[9]In addition to the scientific review, each proposal is reviewed by an interagency group to ensure that it meets U.S. policy requirements, including the percentage of weapons scientists involved in the project.

[10]The RFBR was established by a decree of the President of the Russian Federation in 1992. It is an independent state organization whose primary goal is to support, on a competitive basis, research initiatives in all fields of basic research. The RFBR's receives most of its funding from the Russian government.

Related to the integration of scientists from the FSU into the international science community is internal integration. As of March 1996, more than 100 funded projects and close to 400 proposals involved more than one institute. The committee saw numerous examples of projects in which two or more institutes were cooperating. Where previously scientists knew very little of what their colleagues in neighboring labs and institutes were doing (to say nothing of institutes in other cities and republics), they are now cooperating on joint proposals and projects. Bringing together research teams as former weapons scientists join in new collaborations constitutes one of the most important contributions of the ISTC, because it acculturates weapons scientists to new ways of thinking and new directions of research.

ARZAMAS-16 AND OTHER CLOSED CITIES

In this section the committee provides its views on the special considerations of formerly closed cities such as Arzamas-16 and Chelyabinsk-70. A subcommittee visited Arzamas-16 in November 1995 to discuss the impact of ISTC grants.

Arzamas-16 and Chelyabinsk-70 are the nuclear weapons design laboratories of the FSU, roughly analogous to Los Alamos and Lawrence Livermore national laboratories in the United States. Both Arzamas-16 and Chelyabinsk-70 are located in remote cities, and even today access to them is closely controlled. Visits by foreigners must be requested months in advance and approved by the Ministry of Atomic Energy.

Arzamas-16 has approximately 20,000 personnel in a city of about 80,000 people. Since the collapse of the FSU, research funding has been reduced to about 25 percent of its former (1980s) level. The funding is augmented, somewhat, by other sources, but the total is much less than what is needed. Consequently, funding priority is given to salaries, even though these are at a poverty level, while funding for facilities maintenance and utilities is meager and funds hardly exist for equipment. There is no realistic plan to deal with this unsatisfactory situation. Arzamas-16 personnel hope for increased general funding and aspire to become an "international R&D center" in five or ten years, but this would require substantial changes as well as funding to open the city and build modern facilities.

Although the number of institute staff has decreased by about 5,000 in recent years, much of this is due to privatization of services; there has been no real downsizing of science and engineering personnel to meet the reduced funding. The reasons for this are several: the government appears to control the movement of these people and seems to allow very little emigration; the Russian economy offers few opportunities for relocation; and the institute personnel seem to prefer that Arzamas-16 retain its current personnel level and remain as a closed city, even though this means reduced funding and loss of some benefits the institute held under the Soviet government.

Because of the tight control on mobility and its remote location, there has been less risk at Arzamas-16 than elsewhere of scientists being lured by undesirable parties. But the committee senses that dissatisfaction is growing among the scientists and that the risk also may grow.

Reflecting the ISTC's goal of reaching core scientists and engineers in the nuclear weapons complex, the largest number of ISTC grants have been awarded to Arzamas-16 and Chelyabinsk-70. As of March 1996 the two institutes combined had primary responsibility for over 40 grants, and their scientists and engineers were involved in many more ISTC-funded projects as collaborating partners. At the time of the subcommittee's visit, the ISTC grants to Arzamas-16 assisted about 1,200 scientists. Although hard to verify, the committee believes that these scientists and engineers are from the weapons field. The committee found the ISTC support to be substantial and important in allowing scientists, who have been quite isolated, to interact with foreign collaborators and to learn where commercial applications of their technologies may exist.

There are other sources of Western support at Arzamas-16. Under the U.S. Department of Energy's (DOE) Lab-to-Lab Program, scientists and engineers are working with Los Alamos and Sandia national laboratories, and the DOE Initiatives for Proliferation Prevention program provides some support. However, there has been no U.S. private investment.

The committee notes one difficulty for the ISTC that is specific to the closed cities. Periodic audits, which are called for under ISTC regulations, involve work at Arzamas-16 that is done in classified areas where key equipment exists. Reflecting the original concerns expressed by members of the Supreme Soviet during negotiations on the ISTC, some Russian researchers and officials at Arzamas-16 remain concerned that staff members from nonweapons states are intrusive during their visits and may be seeking sensitive weapons technologies. The committee believes that the ISTC's staff understand these concerns and is attempting to resolve them.

The subcommittee reviewed several projects and visited several work areas and found the projects to be addressing important technical problems. In one project, for example, researchers are using a deuterium-fluoride laser and comparing absorption at two wavelengths to develop a technique for environmental monitoring of gas pipeline leaks. They have identified Gazprom as a potential client and are working with Los Alamos National Laboratory. Another project is seeking to develop ways to safely store large amounts of plutonium or highly enriched uranium. A third project uses fibrous composites in the construction of a containment device for the storage and transport of explosives, sensitive materials, or documents. Researchers on this project have already had some success with a two-layer spherical container.

Other projects at Arzamas-16 provide evidence of attempts at commercialization. One group, obviously well versed in piezo-electric transducers, is working on micro-

miniature devices that have a host of applications, including accelerometers and spark plug devices. They already have orders for about 150 and see a market in the tens of thousands. However, they need a manufacturing facility and are looking for partners. The United States and the European Union are funding the work, but the Arzamas-16 researchers claim to have no U.S. contacts. As discussed in the next chapter, this lack of contact is an area in which the committee believes the ISTC can do more.

Overall, the committee found the projects at Arzamas-16 to be of high quality and responsive to ISTC objectives. During this period of economic transition, when conditions are quite poor at these weapons laboratories, the ISTC grants are providing an extremely important bridge. It seems unlikely that the Russians will be able to transition these labs to a status that they can reasonably support for at least several years, and ISTC support will be even more important over that time. The Russians will also have to formulate realistic plans to transition the installations in the closed cities to an appropriate post–Cold War status.

BIOLOGICAL AND CHEMICAL WARFARE

This section provides the committee's views on the special circumstances of biological and chemical warfare (BW/CW) institutes in the FSU, compared to other weapons institutes, with regard to the ISTC and related assistance programs. A subcommittee reviewed the available information on BW/CW research and visited the State Research Center for Applied Microbiology in Russia. Subcommittee members discussed the state of scientific research at the research center and the impact of ISTC grants with the center's director and numerous scientists. In reaching the conclusions and recommendations below, the committee relied on publicly disclosed information about the Soviet Union's BW/CW research program and has not drawn any new conclusions on the existence or extent of an offensive BW/CW program.

The State Research Center for Applied Microbiology was part of the Soviet "Biopreparat" complex, one of three types of BW-related research programs in the Soviet Union. The Biopreparat complex was, ostensibly, under the control of the Ministry of Health but was funded by the Ministry of Defense (MOD). These facilities were clearly engaged in research for the military on dangerous strains with potential BW applications and were at least marginally involved in their use in military applications. The other two groups of facilities were the institutes of the Russian Academies of Sciences and Medicine, which received funds from the Ministry of Defense for basic research with potential relevance to BW, and the military-operated highly secret programs for both offensive and defensive BW. The U.S. government has limited knowledge about the latter group of institutes and their activities.

The research center is in the town of Obolensk, which has a population of approximately 6,000 and is located about 60 miles south of Moscow. The research center is the primary employer for the town. While not a "closed" city, Obolensk is relatively isolated.

The primary source of funding for the research center today is the Ministry of Science and Technology. Being designated a "state research center" (one of 61 in Russia) ensures stable funding from the state. However, as noted by the director and as is obvious from the condition of the buildings and laboratories, the amount of funding received from the ministry does not meet the center's need. Outside sources of funding are sorely needed to upgrade equipment, increase salaries to a reasonable level, and allow useful research to continue. In this respect the research center resembles many other FSU institutes. The perception a visitor receives is that of a deserted campus. Many buildings are half occupied; there are spacious grounds with untended grass and that are overgrown with dandelions; and the main laboratory (only about 20 years old) is poorly lit and the safety doors need repair.

The number of employees—currently 1,350—is 50 percent of the 1990 level, and researchers acknowledged that many of the best scientists have left. They did not know, or would not say, where those scientists are now; the committee was led to believe they had either emigrated to Western Europe or the United States or had gone into other professions in Russia. While no proof was offered by Obolensk representatives, nothing suggested that the scientists who had departed had gone to "rogue" states. But as with all scientific institutes, the economic crisis makes this a continuing threat.

The research center has been trying to develop commercial activities, in particular, contacts and collaborative projects with Western institutes and industry. For example, there is a pharmaceutical company operating at the research institute, and some activities are under way with U.S. firms. But, in general, the research center has had very little success to date in developing commercial and/or research contacts with the West.

The research center's difficulties in developing ties with the West are likely due, in part, to its isolated location, the condition of its facilities, and its inadequate communications abilities (e.g., although the center has access to the Internet, it is very limited because of poor and narrow bandwidth communications). But even more, the institute's lack of contact with the West illustrates the problem that BW institutes face: to an even greater degree than nuclear institutes, BW institutes are still shrouded in a cloak of suspicion and secrecy. Russian leaders have not acknowledged in any detail the work that was done at specific institutes; nor have they acknowledged that any of the BW research performed was offensive in nature.

Verifying chemical and, especially, biological weapons disarmament poses special difficulties for programs designed to assist the conversion of former BW and CW institutes. Both BW and CW involve dual-use technologies, BW completely so. It is very hard to be confident that all the work

taking place at one facility is dedicated to peaceful purposes, and the legacy of Soviet secrecy that surrounded its work on BW and CW makes it hard to dispel suspicions. As the committee argues below, this makes achieving transparency, which is one of the major goals of the ISTC assistance program, especially important, but it also makes it relatively easy for suspicion and mistrust to linger.

The nature of the disarmament regimes for the two types of weaponry also poses special problems. The use of BW and CW was first prohibited by the 1925 Geneva protocol, but neither type of weapon was banned outright. Both the United States and the Soviet Union maintained major offensive and defensive BW and CW research programs.[11] CW was to be banned completely by the 1992 Chemical Weapons Convention (CWC), which has unique and demanding verification provisions. Neither the United States nor Russia has ratified the CWC, but implementation programs are being prepared in anticipation of it taking effect. The Defense Department's CTR program provides assistance to Russia for the destruction of its massive chemical weapons arsenal.

By contrast, BW is governed by the 1972 Biological Weapons Convention (BWC), which not only has no verification provisions beyond periodic reporting but permits *defensive* BW research. The problem is, up to the final stages of weaponization, offensive research and defensive research are virtually indistinguishable. In 1992 the Russian government confirmed the termination of offensive research and agreed to a trilateral process for the United States, Great Britain, and Russia to resolve questions about past activities and provide confidence in Russia's current activities. That process has stalled, however, fueling suspicions that Russia has not ceased all offensive research. These suspicions have led some in Congress to call for restrictions on the CTR program until it can be certified that Russia is in full compliance with the BWC. Assistance to the former BW (and to a lesser extent CW) research institutes therefore operates in a difficult political climate and, in many respects, faces higher standards in proving the effectiveness of the projects.

FINDING: The level of ISTC activity with biological and chemical warfare institutes is not proportional to the threat.

As of March 1996 the State Research Center for Applied Microbiology had received five grants, totaling over $900,000, for projects to develop recombinant and immunobiological preparations, recombinant vaccine preparates, biopesticides, and technology for the elimination of environmental oil pollution. The committee found these projects to be useful and relevant to the ISTC's goals.

The committee notes that for all ISTC grants only 7 percent of scientists funded by ISTC grants have a background in CW or BW.[12] The committee believes that this level of effort is not proportional to the threat and, as discussed in the next chapter, believes more emphasis should be placed on involving scientists and engineers with BW and CW backgrounds.

Biotechnology appears to be an exceptionally fruitful field that fosters the transition of Russian R&D. The Russian program includes scientists engaged in research on antiviral and antimicrobials, immunomodulators, and vaccines, as well as research on disease transmission, many aspects of which have potential utility for human and veterinary medicine. A report prepared for the ISTC in 1995 identified key BW technologies and capabilities that have the potential to be converted to civilian end uses.[13] A follow-up report provided illustrative information on dual-use biotechnologies and related technologies in Russia.[14] The committee notes an upcoming project, to be funded by the Department of Defense and carried out by the National Research Council, to design a comprehensive plan to engage former Soviet BW researchers in continuing collaborative research projects with the West. These projects would address public health problems in Russia as well as broader global health concerns—for example, the need to improve international research, surveillance, and monitoring of emergent diseases. U.S. agricultural research institutes also have shown interest in such research institutes as the Center for Applied Microbiology for potential collaboration on research related to agricultural biotechnology.

FINDING: The U.S. biotechnology industry can benefit from partnerships with former biological warfare institutes in the FSU.

One reason that large U.S. pharmaceutical firms have been hesitant to become involved with BW institutes is that they generally do not meet U.S. good manufacturing process (GMP) standards, raising concerns about liability and dual standards of quality. U.S. companies have also been unwilling to risk investing in new, from-the-ground-up facilities in the FSU to take advantage of the talent of experienced researchers.[15] But the problems with the facilities in the FSU

[11]The United States unilaterally halted its offensive BW research in 1969 and led the effort to create the Biological Weapons Convention.

[12]*The International Science and Technology Center: Second Annual Report; January–December 1995*, ISTC, Moscow, 1995, p. 6.

[13]*Biotechnology: Key Capabilities and Commercial Requirements*, report to International Science and Technology Center, prepared by Orion Enterprises, Inc., Fredericksburg, VA, 1995.

[14]*Report to the International Science and Technology Center: Commercial Opportunities for Russian Biotechnology*, prepared by Novecon and Technoconsult, Reston, VA, 1995.

[15]This view is supported by Anthony Rimmington in a discussion of the conversion of BW facilities to civilian activities: ". . . the absence of international manufacturing standards, the possibility of contamination and the appalling quality of existing buildings has meant that such (military microbiological) facilities have failed to secure the necessary investment of Western pharmaceutical companies" ("From Military to Industrial Complex? The Conversion of Biological Weapons' Facilities in the Russian Federation," *Contemporary Security Policy*, vol. 17, no. 1, 1996, p. 81).

are much more likely to be viewed as barriers by large U.S. or European pharmaceutical companies than from the standpoint of an early-stage research biotechnology company. The latter would not require GMP facilities. The committee believes that many U.S. biotechnology companies are not well informed about the opportunities that exist in the FSU. The U.S. companies are small and highly focused on achieving profitability without distractions and hence are not inclined to actively search out partnerships with Russian institutes. Yet with open lines of communication and a mechanism through which to collaborate, U.S. biotechnology firms have the potential to benefit from some FSU technology and R&D.

THE PROLIFERATION THREAT

The committee's review of the ISTC's primary and secondary objectives yields a fairly positive assessment of the ISTC after two years, with noted caveats and areas for improvement. What, then, of the overall goal of the ISTC—to reduce the threat of proliferation? After two years, what more do we know about emigration and the threat of diffusion of weapons know-how?

Chapter 2 gave an overview of the emigration by FSU scientists and engineers that has been occurring since the mid-1980s and noted the difficulties in assessing emigration as it relates to scientists and engineers involved in research on weapons of mass destruction. During all of its visits and discussions, the committee sought facts concerning the emigration of such scientists and engineers. Not surprisingly, we heard no outright admissions of core weapons scientists leaving for undesirable countries.

The committee did find many scientists and engineers who continue to do outstanding work. There are two factors that mitigate against large-scale emigration. One is that the Russian government still exercises control over its weapons scientists and other individuals with security clearances, particularly those in the closed cities. The second is the desire of these scientists to continue to work in their own country and to do work that will benefit their country. Unfortunately, both of these factors are very difficult to measure.

While anecdotal evidence, particularly in the early 1990s, suggested that large numbers of scientists were leaving the country, no data have emerged to indicate that any scientists or engineers possessing crucial weapons expertise have fled to rogue countries. Although the ISTC cannot be *solely* credited with this positive result, it can certainly take credit for being a positive contributing factor.

FINDING: The proliferation risk remains high, and the ISTC continues to have a role in mitigating that risk.

A recent assessment by R. Adam Moody provides a sanguine update.[16] Remarking on the absence of reliable data concerning the emigration of Russian nuclear scientists and engineers, Moody concludes that, based on an analysis of information from some 150 sources, a "mass exodus of scientists and engineers from the post–Soviet states has not occurred." He adds a statement from a U.S. government official who works on emigration issues: "For those few people who will be tempted to share critical information for money, there is little that can be done, regardless of whether that person is Russian, American, British, or any other nationality."

Therein lies the dilemma in assessing emigration figures as they relate to nuclear issues. The overall figures can help predict the impact of internal and external emigration on the future of Russia's science and engineering enterprise. But figures on the emigration of scientists and engineers with knowledge of weapons of mass destruction do not yield a ready diagnosis. One or two defectors to North Korea or China—rumors are rife about both countries—could create inestimable damage. For now there is no way to accurately measure the extent of the participation of Russian nuclear scientists and engineers in the diffusion of nuclear know-how.

The economic and social conditions remain poor for scientists and engineers, particularly in the weapons institutes. The following points, raised in earlier sections, merit reiteration:

- The key weapons institutes in the FSU are not downsizing commensurate with budget reductions. Consequently, their staff members receive very low salaries and have poor working conditions.
- Although directors are applying all possible funds to salaries, at the expense of facilities and equipment, salaries remain at a poverty level.
- There have been overtures from undesirable parties and the temptation must be significant.

Hence, although there is no evidence of weapons scientists selling out to rogue states, the risk that any would do so remains great.

[16]R. Adam Moody, "Reexamining Brain Drain from the Former Soviet Union," *The Nonproliferation Review*, vol. 2, no. 3, 1996, pp. 92–97.

4

Future ISTC Objectives and Goals

In this chapter the committee makes recommendations to the U.S. government, to include the executive and legislative branches, on the immediate and longer-term future of the International Science and Technology Center (ISTC).

The ISTC was established to meet the perceived crisis that was created by the dissolution of the Soviet Union—that is, the threat of a large exodus of scientists and engineers with knowledge and experience in the development of weapons of mass destruction and delivery systems, which would lead to the proliferation of such weapons. Support for the ISTC was tied to the perceived crisis and in anticipation of a transition within the former Soviet Union (FSU) to a market economy, which would alleviate the crisis. The original funding plan for the ISTC, which scales down U.S. government funding to zero after five to seven years of operation, is consistent with the original conception of the program as a short-term solution to the proliferation crisis.

Now, several years into that transition and more than two years into the operation of the ISTC, it is important to address several questions regarding the future: Are the ISTC's primary goal and secondary objectives still valid? Does a point exist at which the ISTC can claim success and close its doors? How and when does the ISTC hand off its activities to indigenous control?

In the following discussion the committee addresses these and related questions, and suggests the extent to which the ISTC's objectives and goals remain appropriate today and will continue to be in the future. The committee also makes recommendations on how the ISTC can improve its activities in the short term.

The founding parties of the ISTC no doubt realized the long-term nature of the transition taking place in the FSU—that is, the transition to a science and technology infrastructure more related and responsive to a civilian economy. But at the time, long-term plans for the ISTC were less critical than the immediate threat of proliferation. With funding coming originally from the U.S. Department of Defense's Cooperative Threat Reduction (CTR) Program, and subsequently the Freedom Support Act, the ISTC has been, if not explicitly, at least by association, a short-term crisis management program with a relatively near-term end point.

In the previous chapter the committee concluded that the ISTC was successful and effective during its first two years in meeting its primary objective. This has, in turn, contributed to the larger goal of diminishing the risk of diffusion of knowledge and expertise related to weapons of mass destruction. In fact, the feared large exodus of weapons scientists and engineers from the FSU has not occurred. This is likely due, in part, to the ISTC and to many other factors, such as internal Russian controls and the loyalty of Russian scientists and engineers to their homeland.

The committee also believes the ISTC has made progress in addressing its secondary objectives. The ISTC has contributed to the integration of FSU scientists and engineers into the international science community, solving national and international technical problems, and, to a lesser degree, supporting the transition to a market-based economy.

In addition to the benefits arising from its stated objectives, the committee notes other positive features and impacts of the ISTC. First, the ISTC enjoys advantages not held by other U.S. organizations operating in the FSU. The agreement establishing the center gives the ISTC unique tax and customs advantages and the ability to address intellectual property rights issues. In fact, the ISTC's administrative infrastructure—both its international nature and the special agreements with the Russian and other FSU governments—is unparalleled in the region. It is very unlikely that the United States or any U.S. organization would be able to secure such agreements in near-term future negotiations with Russia, and continuing to utilize the agreements is an important benefit to all parties.

Second, the ISTC has contributed to important broader U.S. national security objectives, including increased integration of FSU scientists and engineers in the FSU and internationally and increased transparency and confidence building between U.S. and FSU weapons institutes. The former objective was discussed in the preceding chapter and is addressed again below; the latter is necessary if U.S. and FSU

relations are to move to a level of complete trust and collaboration.

While the ISTC has contributed to these positive trends, the proliferation threat has not abated. Indeed, the concern is growing, with studies and reports appearing almost daily that cite actual instances or potential avenues of proliferation of weapons and weapons expertise. A staff report by the U.S. Senate Permanent Subcommittee on Investigations concluded as much, noting that "what is currently known about illicit trafficking in nuclear materials and know-how demonstrates a threat this Nation cannot ignore. . . . The threat of nuclear diversion and trafficking from the former Soviet Union is our Nation's number one national security threat."[1] Further, as noted earlier, the economic and social conditions remain poor for scientists and engineers in the FSU, and the temptation to respond to overtures from undesirable parties must be high.

The ISTC has provided up to 50 percent of the staff salaries in some of the most important weapons institutes in the FSU. If this source of potential funding, and the opportunities it offers, were withdrawn precipitously, the threat could increase significantly. In particular, Arzamas-16 and other formerly closed cities will become an even higher proliferation risk than they are currently. Russia and the other republics simply are not ready to take the steps needed to continue the progress toward a stable science and engineering sector. Furthermore, as long as the deterioration and despair continues, the threat exists not only of individual defections but also of large-scale emigration and of individuals selling their knowledge and experience to states or groups of proliferation concern.

RECOMMENDATION: The United States should continue core funding of the ISTC.

The committee believes that providing opportunities to former weapons scientists and engineers to apply their knowledge and skills to nondefense-related research is a desirable means of addressing the nonproliferation goal.

U.S. Department of State officials responsible for management of the ISTC envision a U.S. contribution of $18 million annually through 1998 and then a gradual decline to almost zero by fiscal year 2003.[2] They are seeking funding from other U.S. government mission agencies and the private sector to supplant their diminishing department's contribution. The committee agrees that the ISTC should seek other sources of funding, as discussed below, but concludes that this is not sufficient to meet U.S. national security objectives or to allow the United States to exert sufficient influence and leadership in ISTC activities.

In part because of its relatively large financial contribution, the United States has played a significant role in the establishment and management of the ISTC. The center's first two executive directors were from the United States, and the United States has exerted much influence on the overall structure and administration of the ISTC. Now, with the directorship going to the European Union, U.S. financial support decreasing, and other countries and private entities being brought into the ISTC, the United States risks losing some of its influence in determining overall program direction. By continuing to provide core funding, the United States will be able to exert leadership in maintaining existing, and/or in setting new, objectives and priorities.

Therefore, based on its success to date, the continuing threat of proliferation, and the other benefits to U.S. national security objectives, the committee concludes that the activities of the ISTC continue to be in the U.S. national interest and recommends that the U.S. Government continue annual core funding for the center until, and probably beyond, 2003.

In recommending continued core funding for the ISTC, the committee, of course, recognizes the responsibilities of the other participating governments and other related U.S. programs. U.S. participation in, and funding of, the ISTC should be based on Russia and other FSU governments continuing to meet their obligations for funding and access to facilities. Russia, through its Ministry of Atomic Energy, provides the facilities that house the ISTC and other in-kind support. The committee heard no comments to suggest that this economic support would end, although the future political climate in Russia is difficult to predict. As noted earlier, some FSU government officials criticized the ISTC during its implementation, claiming it would be a means for the United States to steal Russia's best technologies, scientists, and engineers. Also, as noted earlier, the Russian Parliament has never formally ratified the agreement establishing the center, which might suggest some doubt about the Russian Government's long-term commitment to the ISTC. However, based on its discussions, the committee believes that the lack of formal ratification is due to the Russian Government having many other higher-priority issues to deal with and does not reflect significant active opposition to the ISTC. While some critics remain, the committee believes that the ISTC is generally well regarded.

U.S. funding for the ISTC must also be done in tandem with that of the European Union and Japan. Indications are that Japan and the European Union will continue to provide at least moderate funding for the ISTC beyond 2003, although that funding may come with different restrictions on its use.[3] Also, Sweden and Finland have joined the Center and contributed funds, and other countries have expressed interest in joining.

Finally, the United States and the ISTC's management must continue to ensure that the center's activities comple-

[1]U.S. Senate Permanent Subcommittee on Investigations, Staff Report, Washington, D.C., 1996, p. 2.

[2]U.S. GAO, *Weapons of Mass Destruction: Reducing the Threat From the Former Soviet Union: An Update*, Report to Congress, GAO, Washington, D.C., 1995, p. 29.

[3]Committee discussions with U.S. State Department officials.

ment and facilitate, not duplicate, other assistance and collaborative programs under way in the FSU that have similar or complementary goals. These programs are numerous: the International Science Foundation, which provided essential support at a critical time, focused on large numbers of small grants with very little bureaucracy and made an important contribution to preventing widespread disintegration of research. The new Civilian Research and Development Foundation could continue to fill this niche, although the funds available to it are much smaller. Also, the Initiatives for Proliferation Prevention (IPP) program and U.S. programs in nuclear materials control and accounting target many of the same laboratories and individuals as the ISTC and have the same secondary goal of integrating Russian scientists with the West. Of course, some overlap of goals exists and is in fact desirable. The ISTC has taken steps to ensure coordination among these and other U.S. programs, and the committee believes there has been little duplication to date. The committee notes, however, that coordination may become more difficult as the scope and number of programs expand.

RECOMMENDATION: To maintain a focus on the nonproliferation goals of the U.S. Departments of Defense and Energy, these departments should increase their roles in the ISTC.

The committee believes that it is crucial for the ISTC to maintain its primary focus on the nonproliferation goal. But, as noted above, wider participation and a broader scope of projects may weaken the primary goal and objectives. To further enhance U.S. influence and the commitment to nonproliferation, the committee believes the U.S. Departments of Defense and Energy should exert influence on ISTC activities through core funding and representation on the ISTC's Governing Board and staff.

The ISTC's objectives and activities complement the Defense Department's nonproliferation activities in Russia and the other states of the FSU. A relatively modest contribution to ISTC's core funding can strengthen the role of the United States in the ISTC, increase the focus on the nonproliferation goal, and increase the number of ISTC-funded projects that complement the Defense Department's collaborative work with FSU scientists and engineers in nonproliferation technologies, nuclear materials protection technologies, and related areas. Therefore, the committee recommends that the Defense Department make a financial contribution to the ISTC's core financing.

The Departments of Defense and Energy have made important contributions to the ISTC. They contribute to policy decisions and participate in the interagency policy review of each proposal. Also, Sandia and Los Alamos national laboratories have coordinated much of the peer review process in the United States. This interagency coordination and support are crucial for the ISTC to continue to meet U.S. national security goals. As the ISTC's executive directorship passes to the European Union, it is important that the United States maintain its ability to exert strong leadership and influence on the ISTC's overall direction and priorities. The United States should exercise its option of appointing two members to the ISTC's Governing Board, with one member from either the Defense Department or the Department of Energy. Similarly, the United States must continue to involve senior-level officials from the Departments of Energy and Defense in ISTC activities to the extent possible.

RECOMMENDATION: The U.S. ISTC management should seek new funds from U.S. government mission agencies and the private sector.

Core funding for the ISTC will ensure the continuation of collaborative grants aimed specifically at offering weapons scientists nonweapons-related work. This, in turn, will ensure a focus on the nonproliferation goal. The committee also notes the growing interest among U.S. agencies and their laboratories in establishing ties with FSU institutes and the opportunity that such ties offer the ISTC. The agencies' motivations and objectives vary, but they share a conviction that increased contact with FSU scientists and engineers is in the U.S. national interest. Some agencies, such as the National Aeronautics and Space Administration, have well-established arrangements with their FSU counterparts. Other agencies are just beginning to investigate ways to manage their activities in the FSU. In many cases their activities will involve high-quality FSU scientists and engineers who have not been involved in weapons research and who therefore are not the current target of the ISTC.

The ISTC is in a unique position to facilitate collaborative research on joint projects while still maintaining the focus of its core grant activities on the goal of nonproliferation. The ISTC's tax, customs, and other advantages can save U.S. laboratories time and money; its financial and administrative infrastructure can save other organizations from having to set up parallel structures; and the center's good relationships with weapons institutes in the FSU can help open doors for U.S. researchers.

The committee suggests the following areas of interest in which the ISTC could facilitate joint collaborative programs between U.S. institutes and/or laboratories and Russian institutes. The committee intends for these areas to be illustrative; certainly others exist.

- As noted in the preview chapter, there is considerable interest in this country on the part of the U.S. Department of Agriculture and others for collaboration with FSU institutes in biotechnology.
- The Office of Naval Research and the U.S. Army Research Laboratory are seeking to increase collaboration with their counterparts in Russia, many of which are weapons institutes.
- The U.S. Department of Energy's Lab-to-Lab Program, jointly funded by the Departments of Energy and Defense until fiscal year 1995 and thereafter by the De-

partment of Energy, is designed to improve the physical protection, control, and accounting of nuclear materials. While several ISTC-funded projects already exist on related technologies, increased U.S.-Russian research utilizing the ISTC will serve U.S. nonproliferation interests in two ways: (1) additional Russian weapons scientists will be involved in nondefense-related work and (2) collaborative efforts may lead to important technical results in the area of materials protection and control.

- In an effort headed by the State Department, the U.S. government is assisting the states of the FSU to improve their export control systems, which directly addresses U.S. nonproliferation goals. The success of these efforts and recommendations for their improvement are the topic of a separate NRC study.[4] This committee notes that the ISTC can help promote indigenous expertise in export control by facilitating the development of export control centers at the industrial level.

PRIVATE SECTOR FINANCING

Earlier, the committee discussed ways that the ISTC could reinforce the transition of the FSU to a market economy, recognizing that the institutes with ISTC grants are a small part of the FSU economy and, in most cases, not those that are most likely to be the engines of economic growth for the FSU. This objective, while difficult, has the potential for large returns, particularly if the ISTC can build partnerships with the private sector either directly or through other organizations. The committee noted that the ISTC needs to be explicit about its goals and objectives in this area.

ISTC officials have considered placing higher priority on projects with strong potential for commercial applications. The committee supports this course, with the qualification that projects continue to include a majority of weapons scientists and engineers. It is likely that the private sector will be willing to fund precompetitive research in such fields as biotechnology, optics, and materials science.

Some have suggested that the role of the ISTC could extend beyond precompetitive research to commercialization, even to the extent of the center becoming self-sustaining (i.e., subsist without government funding). The committee does not believe this is a good idea. Commercialization depends on matters beyond the charter, scope, and competence of the ISTC. Moreover, because some Russian administrators apparently still suspect that the ISTC's fundamental purpose is industrial or national security espionage, direct involvement of the private sector in commercial activities under current ISTC programs will likely raise sensitive issues.

With the proper kind of partnership with a parallel organization, it should be possible for the ISTC to capitalize on those precompetitive research and development projects that show promise for commercial success. To some degree, that parallel organization exists in the Department of Energy's Initiatives for Proliferation Prevention (IPP) program.[5] The IPP is designed to engage former Soviet weapons scientists and engineers in projects with commercial potential. It uses U.S. laboratories as intermediaries to facilitate U.S. private investment in weapons laboratories in the FSU, with the ultimate goal of commercialization of FSU technologies. Thus, both the ISTC and the IPP involve weapons scientists and engineers, although because the IPP is more involved at the stages of technology prototypes and industry cost sharing, it already has in place tools for involving industry. The committee did not study the IPP in detail and therefore does not endorse it, but we do urge the ISTC and the U.S. government to study the strengths of each organization to ensure that their efforts are complementary and not duplicative. The committee is aware of, and applauds, the interaction and exchange of information to date between IPP managers and U.S. ISTC managers.

RECOMMENDATION: The ISTC should consider organizing an industrial advisory council.

As the ISTC moves toward funding more applied projects, it should seek more consultation with industrial researchers and engineers and marketing managers for guidance in precompetitive research activities. The ISTC should consider organizing an industrial advisory council, made up of volunteers from industrial labs and private enterprise, to provide some guidance for its activities in applied fields. The advisory council might also include a representative of the IPP to help ensure complementarity of the two programs.

RECOMMENDATION: The ISTC should expand the scope of Western collaboration and encourage more active participation by collaborators.

In stressing the importance of nonproliferation, the committee does not reject the importance of the ISTC's secondary objectives. In particular, the objective of integrating FSU scientists and engineers into the international science and engineering communities contributes to the larger nonproliferation goal.

The committee noted in the previous chapter that many researchers expressed the desire and need for more active participation by their Western collaborators. The ISTC should encourage this, both to ease its own monitoring burden and to contribute more significantly to the objective of integrating the scientists and engineers into the international community.

[4] An NRC committee is assessing U.S. cooperative programs with the former Soviet Union in the fields of export control, including dual-use technologies, and materials protection, control, and accounting. The NRC will issue a report in early 1997.

[5] The fiscal year 1994 foreign operations appropriations bill appropriated $35 million to initiate the IPP. In fiscal year 1996, the IPP received $10 million from the Department of Energy and $10 million from the Department of Defense.

If active collaboration with U.S., European, and Japanese scientists is key to the ISTC's longer-term viability, as the committee believes it is, a new approach may be required. The U.S. science community should play a larger role in working with Russian institutes toward proposing and funding proposals that are in areas of specific U.S. interest. In some cases, scientists and engineers in the FSU may have a technical or financial comparative advantage in particular research projects that would complement research already funded in the United States. This would serve to bring about closer face-to-face contacts by U.S. and Russian scientists and serve U.S. scientific and technological interests. To a certain degree, the other ISTC parties are moving toward this approach—for example, Japan's focus on nuclear energy projects.

In addition to increasing contacts between ISTC project participants and their Western collaborators, the scope of Western contacts should be expanded. To date, U.S. collaborators have primarily been national weapons laboratories. This is natural in view of the required involvement of Russian weapons institutes as well as desirable given the nonproliferation goals of the ISTC. However, there are good reasons for increased contacts with university scientists, which could further the center's civilian and conversion objectives. The National Science Foundation and other scientific societies and organizations already are taking steps to facilitate and fund communication and collaboration between scientists in the FSU and U.S. universities. Because of their ties to the U.S. academic community, those organizations are in a good position to further communication between former weapons scientists and engineers and U.S. universities. While the costs of active collaboration can be high and often more difficult for universities to bear, from the U.S. standpoint, the longer-term benefits of expanding contacts between our scientists and those in Russian institutes would be valuable.

There are also good reasons for expanding contacts and collaboration with U.S. industrial laboratories. In the long run, wealth for the FSU in large measure will be generated by applied science and engineering, rather than basic research. The ISTC can promote the future economic viability of the FSU and, with it, increase domestic funding sources for scientific research by encouraging FSU scientists and engineers, especially from the closed cities, to collaborate with U.S. industrial researchers. Industrial researchers have more experience in market-oriented research and venture capital formation.

The ISTC's priority has been, and must continue to be, reaching scientists and engineers from FSU weapons institutes. However, there are certain emerging areas of science and technology that are not necessarily found in weapons institutes but that are likely to be "wealth generators" in the near future—for example, microelectronics, biotechnology, and computer and information technology. The ISTC, while maintaining its focus on the weapons institutes, can encourage those institutes to collaborate and seek partnerships with institutes with strengths in these emerging technologies.

RECOMMENDATION: The ISTC should place more emphasis on involving biological and chemical warfare institutes in its activities.

As noted in the previous chapter, only 7 percent of the scientists funded by ISTC grants at the end of 1995 had a background in chemical or biological warfare research. Because of the lingering suspicion and secrecy surrounding these institutes, it is particularly important that the ISTC continue its efforts to increase integration of these scientists. The specific challenge for the ISTC and other agencies is to establish communications across former Biopreparat and Ministry of Defense institutes. A very positive example of how the ISTC has made progress in this area is the symposium it sponsored on biological warfare issues in Pokrov in December 1995. The symposium was attended by a number of scientists, including some from the Ministry of Defense. The committee believes that the ISTC should continue its efforts in this area through similar meetings and activities.

In addition, based on the committee's conclusion that U.S. biotechnology firms can benefit from collaborating with former biological warfare institutes in the FSU, the ISTC can make a difference by bringing in representatives from the biotechnology industry as partners in precompetitive research.

RECOMMENDATION: The ISTC should allow grants to fund communications equipment.

Computer networking and access to the Internet are no longer a luxury but an essential need. They facilitate the exchange and retrieval of information, conferencing among colleagues in different locations, and remote execution of programs. Access to computer networks is particularly important in countries such as Russia, where other means of communication remain unreliable. Yet in many institutes, particularly those outside Moscow, the committee was told that lack of adequate communications systems remains a significant problem. Scientists at the Research Center for Applied Microbiology in Obolensk, for example, admitted they have trouble communicating not only with colleagues in the West but also with other institutes in Moscow and Russia.

The ISTC has funded several projects that are intended to improve communications abilities in the FSU. For example, researchers at the Scientific Production Association Luch in Podolsk are developing hardware and software for transferring medical data.[6] Such projects are important, but the committee also recommends allowing grant recipients to request and allocate a percentage of funds to buy communications equipment. This will assist individual researchers and institutes in gaining access to the Internet, communicating with colleagues, and developing collaborations and thus will have an exponential impact on their future economic viability.

[6]ISTC Project #52, "Hardware and software for medical wide area network," NPO Lutch, Podolsk, Russia.

5

The Science and Technology Center in Ukraine

The United States signed an agreement with Sweden, Canada, and Ukraine in 1993 to establish the Science and Technology Center in Ukraine (STCU).[1] The STCU is completely independent of the International Science and Technology Center (ISTC), although its goals and objectives are similar to those of the ISTC. The STCU's main objective is to keep the pool of talented scientists and engineers, particularly those with knowledge of weapons of mass destruction, in Ukraine and thereby contribute to the conversion to a market-driven economy.

UKRAINIAN R&D

In some respects the STCU appears to have a much easier job than the ISTC. The institutes of proliferation concern are much fewer and are located in a smaller geographic area, and the number of scientists and engineers with knowledge of weapons of mass destruction is much lower. But in terms of supporting a broader transition, the task in Ukraine is made more difficult by its past subordination to Moscow. Before the collapse of the Soviet Union, most science and technology in Ukraine was concentrated in ministry research institutes that were administered by officials in Moscow. The research institutes were cut off from the end users of their products, most of whom were in other republics of the Soviet Union. Thus, today many Ukrainian institutes are small parts that have been cut off from their larger organizations.

Ukrainian science and engineering played a prominent role in the Soviet Union, accounting for 13 to 15 percent of the country's R&D potential, according to some estimates.[2] Apparently, at least 40 percent, and possibly as much as 70 percent, of the projects being carried out in research institutes and technological bureaus on Ukrainian territory were based on military orders.[3] Of particular interest to this report was the Ukrainian role in the Soviet military aerospace industry. Ukraine continues to give very high priority to that sector, in particular, to the development of an economically competitive space industry.

Relatively few nuclear weapons design, development, and testing activities took place on Ukrainian territory, although certainly some Ukrainian scientists and engineers have experience in the nuclear field and should be the target of the STCU's activities. Similarly, although there is no evidence now of biological or chemical warfare activities in Ukraine, there are a number of chemical and biological scientists who have the potential to contribute to such activities in facilities where such research could be carried out.

Emigration from the science sector in Ukraine is similar to that occurring in the former Soviet Union (FSU) as a whole (see Chapter 2). One recent journal paper estimates that Ukraine lost 36 percent of its R&D personnel from 1988 to 1993. The paper further states that "it is recognized that R&D institutes in the former USSR were over-crowded, and that reductions were inevitable. But it is evident, too, that a very high proportion of young researchers left the R&D sector in 1990-1992."[4] The committee believes that most scientists and engineers who have left their fields have shifted to the commercial sector or emigrated to the United States or other Western countries.

The economic decline in Ukraine since independence and its impact on science and technology have both been severe. *Science* magazine reported in March 1996 that "the country's 90,000 researchers and support staff have received almost no state salary for the past 5 months."[5] While there has been moderate improvement in the economic situation, there is little hope that domestic demand for R&D output will increase in the near future.

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[1] See Appendix C.

[2] Igor Egorov, "The Transformation of R&D Potential in Ukraine," *Europe-Asia Studies,* vol. 47, no. 4, 1995, p. 654.

[3] Ibid., p. 661.

[4] Ibid., p. 658.

[5] "Cash-Starved Researchers to Undergo Trial by Peer Review," *Science,* vol. 271, March 1996, p. 1802.

THE STCU'S OBJECTIVES

The STCU's goal and objectives are "to support R&D activities by Ukrainian scientists and engineers, formerly involved with weapons of mass destruction and their means of delivery, as part of the general process of conversion from a largely centralized planning military to a civilian, market-driven competitive environment, more useful for Ukraine" (see Appendix C).

THE STCU'S MANAGEMENT AND FUNDING

Initially, as determined by diplomatic consultations among the four founding parties, the STCU's executive director and administrative officer are Canadian, the principal deputy executive director is from Ukraine, a second deputy executive director and the chief financial officer are from the United States, and the third deputy executive director is from Sweden. All other staff are Ukrainian. At the time of the committee's visit, the deputy executive director from the United States had not yet been appointed and the financial director had just begun.

The United States has contributed $15 million for the activities of the STCU, and Canada and Sweden have provided $5 million and $1.5 million, respectively. Ukraine is providing office space and other in-kind support, similar to the situation with the ISTC. There are strong indications that the European Union will join the STCU in 1996 at a level of $4 million to $5 million, and early in the establishment of the STCU, Japan expressed an interest in joining with a contribution of $3 million.[6]

THE STCU'S ACTIVITIES TO DATE

As of May 15, 1996, the STCU had received 346 proposals from Ukrainian scientists and engineers. Of those, 128 had passed the Ukrainian State Security Review, which is necessary before the STCU will officially accept a proposal and forward it to donor countries for evaluation.

The STCU Governing Board had its first meeting in December 1995, at which time it formally approved various official STCU documents and 12 proposals, for a total dollar amount of $1.6 million. The board held its second meeting in May 1996 and approved 37 additional proposals, bringing the total number of scientists and engineers supported by STCU grants to approximately 1,000.

THE COMMITTEE'S VIEWS

The STCU is in the early stages of its activities and is only beginning to sign contracts on funded projects. Therefore, it is too early to assess its impact on the proliferation threat and on Ukrainian science and technology, but the committee provides some initial observations below.

The STCU's staff and supporting management in the participating countries have established a fully functioning center in a remarkably short time, given the conditions in which they had to operate. The STCU's facilities are first-rate; the telecommunications capabilities surpass those of all other institutes and offices that the committee visited; and the office environment is very pleasant and comfortable. The STCU is independent of other Ukrainian ministries and institutes and has a separate line item in the Ukrainian budget, which will help ensure that it is held in high regard by Ukrainian government officials.

The STCU management has interpreted its objective of supporting the transition to a market-based economy to include supporting and contributing to the conversion of attitudes and work practices to those common in market-driven economies. The STCU staff consider the interactions with scientists and engineers during the proposal preparation process to be an important part of their jobs and strive not only to improve the scientific quality of proposals, but also to impart Western attitudes about peer review, competitive funding, and work ethics. These are valid and important objectives for the STCU.

RECOMMENDATION: The U.S. government should expedite the appointment of U.S. representatives and staff to the STCU.

The committee does make one caution. The STCU staff, with the exception of the senior staff (executive director and principal deputy executive director), do not appear to have significant scientific expertise, leading to some concern that the nonproliferation and scientific goals of the United States are being subordinated to the STCU's broader goals of changing research attitudes and ethics. Of course, the scientific reviews by the United States and other participating countries are the primary means of determining and ensuring scientific merit. But STCU staff have significant input in proposal preparation and project monitoring. Moreover, unlike the ISTC, the STCU does not have a scientific advisory committee. It is important that the United States have representation at the STCU with adequate experience and expertise to support U.S. national interests and scientific goals.

In this regard the committee is concerned about the slow pace at which the United States is assigning staff to the STCU. As noted above, at the time of the committee's visit in May 1996, the U.S. deputy executive director had not been formally appointed and the financial officer had not yet arrived.[7] While this may be attributed to unavoidable bureaucratic delays, the committee is concerned about the message

[6]Committee discussion with U.S. Department of State officials, February 1996.

[7]Since the committee's visit in May 1996, a U.S. deputy executive director has been appointed.

this sends to the Ukrainian government about the importance the United States gives the STCU.

Like the ISTC, one of the STCU's objectives in meeting its primary nonproliferation goal is to support the integration of Ukrainian scientists into the international science community. The committee stresses the importance of this integration and urges the STCU to continue its encouragement of active participation in STCU-funded projects by Western collaborators. The committee discussed this issue in Chapters 3 and 4 with regard to the ISTC; the discussion applies equally to Ukrainian scientists and engineers and the STCU.

The subcommittee heard criticisms from scientists and engineers at the Kharkiv Institute of Physics and Technology (KIPT) that the distribution of grants from the first two funding rounds was biased toward Kiev. Though the Kharkiv Institute played a significant role in the Soviet weapons program, and therefore should be a primary focus for the STCU, KIPT personnel pointed out that almost 60 percent of current grants (29 out of 49) have Kiev institutes as their primary site. Subsequent conversations led the committee to conclude that while Kiev-based institutes may have had an advantage over institutes in other cities and regions during the first few months of the STCU's operation because of easier access to information about the STCU and easier interaction with its staff, information about the STCU has since become more widely disseminated and STCU staff and representatives have increased their direct contacts with institutes around the country, thereby minimizing any regional advantages. The committee also notes that many proposals submitted by KIPT were undergoing the Ukrainian internal security review at the time of the first meetings of the STCU's Governing Board and are only now under consideration by the STCU itself. In this report the committee merely notes the criticisms expressed by KIPT.

6

Conclusion

The Committee believes the International Science and Technology Center (ISTC) has made, and continues to make, a positive impact on international security. It offers meaningful nonweapons-related work to scientists and engineers in the former Soviet Union (FSU) who might otherwise continue to design weapons or, worse, sell their experience and expertise abroad. Among the various programs in place to deal with the proliferation threat, the ISTC has been modest in cost, relatively noncontroversial, and successful. As a result, it has not needed, nor received, much high-level attention. The committee applauds the ISTC's success but cautions that its raison d'etre is still important.

Proliferation of weapons of mass destruction could occur in many ways. Nations of concern can acquire the weapons themselves through illegal means. The components and manufacturing equipment to enable and accelerate development can be acquired by illegal means, in some cases by legal means, and in the case of dual use items through failures of the export control system. The knowledge needed to develop weapons of mass destruction can be transferred by the emigration of weapons scientists and engineers from weapons states. Unfortunately, large numbers of FSU weapons scientists do not have to emigrate to produce a proliferation problem—one or two "Klaus Fuchs's" could cause damage. Moreover, proliferation of weapons expertise does not take place only through the migration of scientists and engineers. Information can be acquired by hostile governments from scientists on travel, by way of the Internet, and in other ways.

Each of these threats is serious, and the United States and other nations have programs to minimize the risks. While often described as an organization to *prevent* the emigration of Russian weapons scientists to rogue states, the ISTC cannot by itself prevent determined espionage. *Minimizing the incentives* for weapons scientists to engage in activities that result in proliferation of their knowledge and expertise is a realistic goal. The ISTC has been successful in pursuing this goal, and the committee believes that it should continue to do so.

Similarly, in meeting its secondary objectives, the ISTC has made, and will continue to make, significant contributions to the renewal of science and engineering in the FSU. But the ISTC cannot be expected to save Russian science by itself. Its grants have reached over 12,000 scientists and engineers in five countries. Even for those weapons scientists and engineers in the FSU who have not received ISTC grants, the *opportunity* to engage in nonweapons-related work contributes to their hope for renewal of a strong science and engineering community.

APPENDIXES

APPENDIX A

Agreement Establishing an International Science and Technology Center

The United States of America, Japan, the Russian Federation, and, acting as one party, the European Atomic Energy Community and European Economic Community:

Reaffirming the need to prevent the proliferation of technologies and expertise related to weapons of mass destruction — nuclear, chemical, and biological weapons;

Taking note of the present critical period in the states of the Commonwealth of Independent States (hereinafter referred to as "CIS") and Georgia, a period that includes the transition to a market economy, the developing process of disarmament, and the conversion of industrial-technical potential from military to peaceful endeavors;

Recognizing, in this context, the need to create an International Science and Technology Center that would minimize incentives to engage in activities that could result in such proliferation, by supporting and assisting the activities for peaceful purposes of weapons scientists and engineers in the Russian Federation and, if interested, in other states of the CIS and Georgia;

Recognizing the need to contribute, through the Center's projects and activities, to the transition of the states of the CIS and Georgia to market-based economies and to support research and development for peaceful purposes;

Desiring that Center projects provide impetus and support to participating scientists and engineers in developing long-term career opportunities, which will strengthen the scientific research and development capacity of the states of the CIS and Georgia; and

Realizing that the success of the Center will require strong support from governments, foundations, academic and scientific institutions, and other inter-governmental and non-governmental organizations;

Have agreed as follows:

ARTICLE I

There is hereby established the International Science and Technology Center (hereinafter referred to as the "Center") as an inter-governmental organization. Each Party shall facilitate, in its territory, the activities of the Center. In order to achieve its objectives, the Center shall have, in accordance with the laws and regulations of the Parties, the legal capacity to contract, to acquire and dispose of immovable and movable property, and to institute and respond to legal proceedings.

ARTICLE II

(A) The Center shall develop, approve, finance, and monitor science and technology projects for peaceful purposes, which are to be carried out primarily at institutions and facilities located in the Russian Federation and, if interested, in other states of the CIS and Georgia.

(B) The objectives of the Center shall be:

(i) To give weapons scientists and engineers, particularly those who possess knowledge and skills related to weapons of mass destruction or missile delivery systems, in the Russian Federation and, if interested, in other states of the CIS and Georgia, opportunities to redirect their talents to peaceful activities; and

(ii) To contribute thereby through its projects and activities: to the solution of national or international technical problems; and to the wider goals of reinforcing the transition to market-based economies responsive to civil needs, of supporting basic and applied research and technology development, inter alia, in the fields of environmental protection, energy production, and nuclear safety, and of promoting the future integration of scientists of the states of the CIS and Georgia into the international scientific community.

ARTICLE III

In order to achieve its objectives, the Center is authorized to:

(i) Promote and support, by use of funds or otherwise, science and technology projects in accordance with Article II of this Agreement;

(ii) Monitor and audit Center projects in accordance with Article VIII of this Agreement;

(iii) Establish appropriate forms of cooperation with governments, inter-governmental organizations, non-governmental organizations (which shall, for the purposes of this Agreement, include the private sector), and programs;

(iv) Receive funds or donations from governments, intergovernmental organizations, and non-governmental organizations;

(v) Establish branch offices as appropriate in interested states of the CIS and Georgia; and

(vi) Engage in other activities as may be agreed upon by all the Parties.

ARTICLE IV

(A) The Center shall have a Governing Board and a Secretariat, consisting of an Executive Director, Deputy Executive Directors, and such other staff as may be necessary, in accordance with the Statute of the Center;

(B) The Governing Board shall be responsible for:

(i) Determining the Center's policy and its own rules of procedure;

(ii) Providing overall guidance and direction to the Secretariat;

(iii) Approving the Center's operating budget;

(iv) Governing the financial and other affairs of the Center, including approving procedures for the preparation of the Center's budget, drawing up of accounts, and auditing thereof;

(v) Formulating general criteria and priorities for the approval of projects;

(vi) Approving projects in accordance with Article VI;

(vii) Adopting the Statute and other implementing arrangements as necessary; and

(viii) Other functions assigned to it by this Agreement or necessary for the implementation of this Agreement.

Decisions of the Governing Board shall be by consensus of all Parties on the Board, subject to the conditions and terms determined pursuant to Article V, except as provided otherwise in this Agreement.

(C) Each of the four Signatory Parties shall be represented by a single vote on the Governing Board. Each shall appoint no more than two representatives to the Governing Board within seven (7) days after entry into force of this Agreement.

(D) The Parties shall establish a Scientific Advisory Committee, made up of representatives to be nominated by the Parties, to give to the Board expert scientific and other necessary professional advice within forty-five (45) days of every project proposal's submission to the Center; to advise the Board on the fields of research to be encouraged; and to provide any other advice that may be required by the Board.

(E) The Governing Board shall adopt a Statute in implementation of this Agreement. The Statute shall establish:

(i) The structure of the Secretariat;

(ii) The process for selecting, developing, approving, financing, carrying out, and monitoring projects;

(iii) Procedures for the preparation of the Center's budget, drawing up of accounts, and auditing thereof;

(iv) Appropriate guidelines on intellectual property rights resulting from Center projects and on the dissemination of project results;

(v) Procedures governing the participation of governments, intergovernmental organizations, and non-governmental organizations in Center projects;

(vi) Personnel policies; and

(vii) Other arrangements necessary for the implementation of this Agreement.

ARTICLE V

The Governing Board shall have the discretion and exclusive power to expand its membership to include representatives appointed by Parties that may accede to this Agreement, on such conditions and terms as the Board may determine. Parties not represented on the Governing Board and

inter-governmental and non-governmental organizations may be invited to participate in Board deliberations, in a non-voting capacity.

ARTICLE VI

Each project submitted for approval by the Governing Board shall be accompanied by the written concurrence of the state or states in which the work is to be carried out. In addition to the prior agreement of that state or those states, the approval of projects shall require the consensus of Parties on the Governing Board, subject to the conditions and terms determined pursuant to Article V, other than such Parties that are states of the CIS and Georgia.

ARTICLE VII

(A) Projects approved by the Governing Board may be financed or supported by the Center, or by governments, inter-governmental organizations, or non-governmental organizations, directly or through the Center. Such financing and support of approved projects shall be provided on terms and conditions specified by those providing it, which terms and conditions shall be consistent with this Agreement.

(B) Representatives of the Parties on the Board and personnel of the Center Secretariat shall be ineligible for project grants and may not directly benefit from any project grant.

ARTICLE VIII

(A) The Center shall have the right, within the Russian Federation and other interested states of the CIS and Georgia in which the work is to be carried out:

(i) To examine on-site Center project activities, materials, supplies, use of funds, and project-related services and use of funds, upon its notification or, in addition, as specified in a project agreement;

(ii) To inspect or audit, upon its request, any records or other documentation in connection with Center project activities and use of funds, wherever such records or documentation are located, during the period in which the Center provides the financing, and for a period thereafter as determined in a project agreement.

The written concurrence required in Article VI shall include the agreement, of both the state or states of the CIS or Georgia in which the work is to be carried out and the recipient institution, to provide the Center with access necessary for auditing and monitoring the project, as required by this paragraph.

(B) Any Party represented on the Governing Board shall also have the rights described in paragraph (A), coordinated through the Center, with regard to projects it finances in whole or in part, either directly or through the Center.

(C) If it is determined that the terms and conditions of a project have not been respected, the Center or a financing government or organization may, having informed the Board of its reasons, terminate the project and take appropriate steps in accordance with the terms of the project agreement.

ARTICLE IX

(A) The Headquarters of the Center shall be located in the Russian Federation.

(B) By way of providing material support to the Center, the Government of the Russian Federation shall provide at its own expense a facility suitable for use by the Center, along with maintenance, utilities, and security for the facility.

(C) In the Russian Federation, the Center shall have the status of a legal person and, in that capacity, shall be entitled to contract, to acquire and dispose of immovable and movable property, and to institute and respond to legal proceedings.

ARTICLE X

In the Russian Federation:

(i)(a) In determining profits of the Center subject to taxation, funds received by the Center from its founders and sponsors—governments, inter-governmental organizations, and non-governmental organizations—and any interest arising from keeping those funds in banks in the Russian Federation, shall be excluded;

(b) The Center, or any branch thereof, shall not be subject to any taxation on property that is subject to taxation under the tax laws of the Russian Federation;

(c) Commodities, supplies, and other property provided or utilized in connection with the Center, and its projects and activities may be imported into, exported from, or used in the Russian Federation free from any tariffs, dues, customs duties, import taxes, and other similar taxes or charges imposed by the Russian Federation;

(d) Personnel of the Center who are not Russian nationals shall be exempt from payment of the income tax in the Russian Federation for physical persons;

(e) Funds received by legal entities, including Russian scientific organizations, in connection with the Center's projects and activities, shall be excluded in determining the profits of these organizations for the purpose of tax liability;

(f) Funds received by persons, in particular scientists or specialists, in connection with the Center's projects or activities, shall not be included in those persons' taxable incomes;

(ii)(a) The Center, governments, inter-governmental organizations, and non-governmental organizations shall have the right to move funds related to the Center and its projects or activities, other than Russian currency, into or out of the Russian Federation without restriction. Each shall have the right to so move only amounts not exceeding the total amount it moved into the Russian Federation.

(b) To finance the Center and its projects and activities, the Center shall be entitled, for itself and on behalf of the entities referred to in subparagraph (ii) (a), to sell foreign currency on the internal currency market of the Russian Federation.

(iii) Personnel of non-Russian organizations taking part in any Center project or activity and who are not Russian nationals shall be exempt from the payment of any customs duties and charges upon personal or household goods imported into, exported from, or used in the Russian Federation for the personal use of such personnel or members of their families.

ARTICLE XI

(A) The Parties shall closely cooperate in order to facilitate the settlement of legal proceedings and claims under this Article.

(B) Unless otherwise agreed, the Government of the Russian Federation shall, in respect of legal proceedings and claims by Russian nationals or organizations, other than contractual claims arising out of the acts or omissions of the Center or its personnel done in the performance of the Center's activities:

(i) Not bring any legal proceedings against the Center and its personnel;

(ii) Assume responsibility for dealing with legal proceedings and claims brought by the aforementioned against the Center and its personnel;

(iii) Hold the Center and its personnel harmless in respect of legal proceedings and claims referred to in subparagraph (ii) above.

(C) The provisions of this Article shall not prevent compensation or indemnity available under applicable international agreements or national law of any state.

(D) Nothing in paragraph (B) shall be construed to prevent legal proceedings or claims against Russian nationals or permanent residents of the Russian Federation.

ARTICLE XII

(A) Personnel of the Governments of the States or the European Communities that are Parties present in the Russian Federation in connection with the Center or its projects and activities shall be accorded, by the Government of the Russian Federation, status equivalent to that accorded to administrative and technical staff under the Vienna Convention on Diplomatic Relations of 18 April 1961.

(B) Personnel of the Center shall be accorded, by the Government of the Russian Federation, the privileges and immunities usually accorded to officials of international organizations, namely:

(i) Immunity from arrest, detention, and legal process, including criminal, civil, and administrative jurisdiction, in respect of words spoken or written and all acts performed by them in their official capacity;

(ii) Exemption from any income, social security, or other taxation, duties, or other charges, except those that are normally incorporated in the price of goods or paid for services rendered;

(iii) Immunity from social security provisions;

(iv) Immunity from immigration restrictions and from alien registration; and

(v) Right to import their furniture and effects, at the time of first taking up their post, free of any Russian tariffs, dues, customs duties, import taxes, and other similar taxes or charges.

(C) Any Party may notify the Executive Director of any person, other than those in paragraphs (A) and (D), who will be in the Russian Federation in connection with the Center's projects and activities. A Party making such a notification shall inform such persons of their duty to respect the laws and regulations of the Russian Federation. The Executive Director shall notify the Government of the Russian Federation, which shall accord to such persons the benefits in subparagraph (B)(ii) - (v) and a status adequate for carrying out the project or activity.

(D) Representatives of the Parties on the Governing Board, the Executive Director, and the Deputy Executive Directors shall be accorded by the Government of the Russian Federation, in addition to the privileges and immunities listed in paragraphs (A) and (B) of this Article, the privileges, immunities, exemptions, and facilities generally accorded to the representatives of members and executive heads of international organizations in accordance with international law.

(E) Nothing in this Article shall require the Government of the Russian Federation to provide the privileges and immunities provided in paragraphs (A), (B), and (D) of this Article to its nationals or its permanent residents.

(F) Without prejudice to the privileges, immunities, and other benefits provided above, it is the duty of all persons enjoying privileges, immunities, and benefits under this article to respect the laws and regulations of the Russian Federation.

(G) Nothing in this Agreement shall be construed to derogate from privileges, immunities, and other benefits granted to personnel described in paragraphs (A) to (D) under other agreements.

ARTICLE XIII

Any state desiring to become Party to this Agreement shall notify the Governing Board through the Executive Director. The Governing Board shall provide such a state with certified copies of this Agreement through the Executive Director. Upon approval by the Governing Board, that state shall be permitted to accede to this Agreement. This Agreement shall enter into force for that state on the thirtieth (30th) day after the date on which its instrument of accession is deposited. In the event that a state or states of the CIS and Georgia accede to this Agreement, that state or those states shall comply with the obligations undertaken by the Government of the Russian Federation in Articles VIII, IX(C), and X-XII.

ARTICLE XIV

Although nothing in this Agreement limits the rights of the Parties to pursue projects without resort to the Center, the Parties shall make their best efforts to use the Center when pursuing projects of character and objectives appropriate to the Center.

ARTICLE XV

(A) This Agreement shall be subject to review by the Parties two years after entry into force. This review shall take into account the financial commitments and payments of the Parties.

(B) This Agreement may be amended by written agreement of all the Parties.

(C) Any Party may withdraw from this Agreement six months after written notification to the other Parties.

ARTICLE XVI

Any question or dispute relating to the application or interpretation of this Agreement shall be the subject of consultation between the Parties.

ARTICLE XVII

With a view to financing projects as soon as possible, the four Signatories shall establish necessary interim procedures until the adoption of the Statute by the Governing Board. These shall include, in particular, the appointment of an Executive Director and necessary staff and the establishment of procedures for the submission, review, and approval of projects.

ARTICLE XVIII

(A) This Agreement shall be open for signature by the United States of America, Japan, the Russian Federation and, acting as one party, the European Atomic Energy Community and European Economic Community.

(B) Each Signatory shall notify the others through diplomatic channels that it has completed all internal procedures necessary to be bound by this Agreement.

(C) This Agreement shall enter into force upon the thirtieth (30th) day after the date of the last notification described in paragraph (B).

IN WITNESS WHEREOF, the undersigned, being duly authorized thereto, have signed this Agreement.

Done at Moscow on 27 November 1992, in the English, Danish, Dutch, French, German, Greek, Italian, Japanese, Portuguese, Russian, and Spanish languages each text being equally authentic.

(Followed by five signatures)

For the European Atomic Energy Community
For the European Economic Community
For the United States of America
For Japan
For the Russian Federation

APPENDIX B

Protocol on the Provisional Application of the Agreement Establishing an International Science and Technology Center

The United States of America, Japan, the Russian Federation, and the European Atomic Energy Community and the European Community, acting as one party, hereinafter referred to as the "Signatory Parties,"

Recognizing the importance of the Agreement Establishing an International Science and Technology Center, signed in Moscow on November 27, 1992, hereinafter referred to as the "Agreement,"

HAVE AGREED AS FOLLOWS:

Article I

(1) The Agreement shall be provisionally applied in accordance with its terms by the Signatory Parties from the date of the last notification of the Signatory Parties of the completion of internal procedures necessary for entry into force of this Protocol.

(2) The Agreement shall be applied provisionally until its entry into force in accordance with Article XVIII thereof.

Article II

The Agreement shall be subject to review by the parties two years after the beginning of provisional application of the Agreement notwithstanding the provisions of Article XV(A) of the Agreement.

Article III

Any of the Parties may withdraw from this Protocol six months from the date on which written notification is provided to the other parties.

Article IV

(1) Any state desiring to become a Party to the Agreement in accordance with Article XIII thereof, after fulfilling the conditions set forth in that Article, and after completing its internal procedures that will be necessary for accession to the Agreement, shall notify the Signatory Parties of its intention to provisionally apply the Agreement in accordance with this Protocol.

(2) The provisional application by that state shall begin from the date of notification referred to in Paragraph (1) of this Article.

Done in Moscow on December 27, 1993, in the English and Russian languages, each text being equally authentic.

For:

The United States of America, Japan, the Russian Federation, and the European Atomic Energy Community and the European Community (with four appropriate signatures)

APPENDIX C

Agreement To Establish a Science and Technology Center in Ukraine

Canada, Sweden, Ukraine, and the United States of America:

Reaffirming the need to prevent the proliferation of technologies and expertise related to weapons of mass destruction — nuclear, chemical, and biological weapons;

Taking note of the present critical period in the states of the former Soviet Union, a period that includes the transition to a market economy, the developing process of disarmament, and the conversion of industrial-technical potential from military to peaceful endeavors;

Recognizing, in this context, the need to create an international Science and Technology Center in Ukraine that would minimize incentives to engage in activities that could result in such proliferation, by supporting and assisting the activities for peaceful purposes of weapons scientists and engineers in Ukraine and, if interested, in other states of the former Soviet Union;

Responding to the need to contribute, through the Center's projects and activities, to the transition of the states of the former Soviet Union to market-based economies and to support research and development for peaceful purposes;

Desiring that Center projects provide impetus and support to participating scientists and engineers in developing long-term career opportunities, which will strengthen the scientific research and development capacity of Ukraine; and

Realizing that the success of the Center will require strong support from governments, foundations, academic and scientific institutions, and other inter-governmental and non-governmental entities;

Have agreed as follows:

ARTICLE I

The Science and Technology Center in Ukraine (hereinafter referred to as the "Center") is hereby established as an inter-governmental organization. Each Party shall facilitate, in its territory, the activities of the Center. In order to achieve its objectives, the Center shall have, in accordance with the laws and regulations of the Parties, the legal capacity to contract, to acquire and dispose of immovable and movable property, and to institute and respond to legal proceedings.

ARTICLE II

(A) The Center shall develop, approve, finance, and monitor science and technology projects for peaceful purposes, which are to be carried out primarily at institutions and facilities located in Ukraine and, if interested, in other states of the former Soviet Union.

(B) The objectives of the Center shall be:

(i) To give weapons scientists and engineers, particularly those who possess knowledge and skills related to weapons of mass destruction or missile delivery systems, in Ukraine and, if interested, in other states of the former Soviet Union, opportunities to redirect their talents to peaceful activities; and

(ii) To contribute thereby through its projects and activities: to the solution of national or international technical problems; and to the wider goals of reinforcing the transition to market-based economies responsive to civil needs, of supporting basic and applied research and technology development, *inter alia,* in the fields of environmental protection, energy production, and nuclear safety, and the remediation of the consequences of nuclear power reactor accidents, and of promoting the further integration of scientists of Ukraine and the former Soviet Union into the international scientific community.

ARTICLE III

In order to achieve its objectives, the Center is authorized to:

(i) Promote and support, by use of funds or otherwise, science and technology projects in accordance with Article II of this Agreement;

(ii) Monitor and audit Center projects in accordance with Article VIII of this Agreement;

(iii) Disseminate information, as appropriate, to promote its projects, encourage proposals, and broaden international participation;

(iv) Establish appropriate forms of cooperation with governments, inter-governmental organizations, non-governmental organizations (which shall, for the purposes of this Agreement, include the private sector), and programs;

(v) Receive funds or donations from governments, inter-governmental organizations, and non-governmental organizations;

(vi) Establish branch offices as appropriate; and

(vii) Engage in other activities as may be agreed upon by the Parties.

ARTICLE IV

(A) The Center shall have a Governing Board and a Secretariat, consisting of an Executive Director, Deputy Executive Directors, and such other staff as may be necessary, in accordance with the Statute of the Center.

(B) The Governing Board shall be responsible for:

(i) Determining the Center's policy and its own rules of procedure;

(ii) Providing overall guidance and direction to the Secretariat;

(iii) Approving the Center's operating budget;

(iv) Governing the financial and other affairs of the Center, including approving procedures for the preparation of the Center's budget, drawing up of accounts, and auditing thereof;

(v) Formulating general criteria and priorities for the approval of projects;

(vi) Approving projects in accordance with Article VI;

(vii) Adopting the Statute and other implementing arrangements as necessary; and

(viii) Other functions assigned to it by this Agreement or necessary for the implementation of this Agreement.

Decisions of the Governing Board shall be by consensus of all Parties on the Board, subject to conditions and terms determined pursuant to Article V, except as provided otherwise in this Agreement.

(C) Each of the signatory Parties shall be represented by a single vote on the Governing Board. Each shall appoint one representative to the Governing Board within seven (7) days after entry into force of this Agreement.

(D) The Governing Board shall adopt a Statute in implementation of this Agreement. The Statute shall establish:

(i) The structure of the Secretariat;

(ii) The process for selecting, developing, approving, financing, carrying out, and monitoring projects;

(iii) The process by which the Executive Director shall obtain scientific and other necessary professional advice with regard to proposed projects directly from international experts;

(iv) Procedures for the preparation of the Center's budget, drawing up of accounts, and auditing thereof;

(v) Appropriate guidelines on intellectual property rights resulting from Center projects and on the dissemination of project results;

(vi) Procedures governing the participation of governments, inter-governmental organizations, and non-governmental organizations in Center projects;

(vii) Provision for allocating the Center's property upon termination of this Agreement or withdrawal of a Party;

(viii) Personnel policies; and

(ix) Other arrangements necessary for the implementation of this Agreement.

ARTICLE V

The Governing Board shall have the discretion and exclusive power to expand its membership to include representa-

tives appointed by Parties that accede to this Agreement, on such conditions and terms as the Board may determine. Parties not represented on the Governing Board and inter-governmental and non-governmental organizations may be invited to participate in Board deliberations, in a non-voting capacity.

ARTICLE VI

Each project submitted for approval by the Governing Board shall be accompanied by the written concurrence of the state(s) in which the work is to be carried out. In addition to the prior concurrence of that state(s), the approval of projects shall require consensus of Parties on the Governing Board other than any state eligible for projects under Article II (A). (Such consensus shall be subject to the conditions and terms determined pursuant to Article V.)

ARTICLE VII

(A) Projects approved by the Governing Board may be financed or supported by the Center, or by governments, inter-governmental organizations, or non-governmental organizations, directly or through the Center. Such financing and support of approved projects shall be provided on terms and conditions specified by those providing it, which shall be consistent with this Agreement.

(B) Representatives of the Parties on the Board and personnel of the Center Secretariat shall be ineligible for project grants and may not directly benefit from any project grant.

ARTICLE VIII

(A) The Center shall have the right, within Ukraine or other states of the former Soviet Union that accede to this Agreement:

(i) To examine on-site Center project activities, materials, supplies, use of funds, and project-related services and use of funds, upon its notification or, in addition, as specified in a project agreement; and

(ii) To inspect or audit, upon its request, any information, including records or documents, in connection with Center project activities and use of funds, wherever such records or documentation are located, during the period in which the Center provides the financing, and for a period thereafter as determined in the project agreement.

The written concurrence required in Article VI shall include the agreement, of both the state of the former Soviet Union in which the work is to be carried out and the recipient institution, to provide the Center with access necessary for auditing and monitoring the project, as required by this paragraph.

(B) Any Party represented on the Governing Board shall also have the rights described in paragraph (A), coordinated through the Center, with regard to projects it finances in whole or in part, either directly or through the Center.

(C) If it is determined that the terms and conditions of a project have not been respected, the Center or a financing government or organization may, having informed the Board of its reasons, terminate the project and take appropriate steps in accordance with the terms of the project agreement.

ARTICLE IX

(A) The Headquarters of the Center shall be located in Ukraine.

(B) By way of providing material support to the Center, the Government of Ukraine shall provide at its own expense a facility suitable for use by the Center, along with maintenance, utilities, and security for the facility.

(C) In Ukraine, the Center shall have the status of a legal person and, in that capacity, shall be entitled to contract, to acquire and dispose of immovable and movable property, and to institute and respond to legal proceedings.

ARTICLE X

The Government of Ukraine shall ensure that:

(i)(a) Funds and property of the Center or any branch thereof, including any interest arising from keeping funds in banks in Ukraine, are exempt from taxation or other charges imposed by the Government of Ukraine and any subdivision thereof;

(b) Commodities, supplies, and other property provided or utilized in connection with the Center and its projects and activities may be imported into, exported from, or used in Ukraine free from any tariffs, dues, customs duties, import taxes, and other similar taxes or charges imposed by Ukraine. In order to receive exemptions under this paragraph, commodities, supplies, and other property must either be specified in a project agreement or be certified by the Executive Director as items to be used by the Center or in a Center project. The procedures for such certifications shall be described in the Statute;

(c) Funds received by natural and legal persons, including Ukrainian scientific organizations or scientists and specialists, in connection with the Center's projects and activities, shall not be subject to taxation or other charges by the Government of Ukraine or any subdivision thereof;

(ii)(a) The Center, governments, inter-governmental organizations, and non-governmental organizations shall have the right to move funds related to the Center and its projects or activities, other than the local currency in Ukraine, into or out of Ukraine without restriction, each in amounts not to exceed the total amount it moved into Ukraine;

(b) To finance the Center and its projects and activities, the Center shall be entitled, for itself and on behalf of the entities referred to in subparagraph (ii)(a), to sell foreign currency in Ukraine.

ARTICLE XI

(A) The Parties shall closely cooperate in order to facilitate the settlement of legal proceedings and claims under this Article.

(B) Unless otherwise agreed, the Government of Ukraine shall, in respect of legal proceedings and claims by Ukrainian nationals or organizations, other than contractual claims, arising out of the acts or omissions of the Center or its personnel done in the performance of the Center's activities:

(i) Not bring any legal proceedings against the Center and its personnel;

(ii) Assume responsibility for dealing with legal proceedings and claims brought by the aforementioned against the Center and its personnel; and

(iii) Hold the Center and its personnel harmless in respect of legal proceedings and claims referred to in subparagraph (ii) above.

(C) The provisions of this Article shall not prevent compensation or indemnity available under applicable international agreements or national law of any state.

(D) Nothing in paragraph (B) shall be construed to prevent legal proceedings or claims against Ukrainian nationals.

ARTICLE XII

(A) Personnel of the United States Government, Canadian Government, and Swedish Government who are present in Ukraine in connection with the Center or its projects and activities shall be accorded by the Government of Ukraine status equivalent to that accorded to administrative and technical staff under the Vienna Convention on Diplomatic Relations of April 18, 1961.

(B) Personnel of the Center shall be accorded by the Government of Ukraine the following privileges and immunities, which usually accord to employees of international organizations, to wit:

(i) Immunity from arrest, detention, and legal proceedings, including criminal, civil, and administrative jurisdiction with regard to words said or written by themselves or any acts performed in the course of their official duties;

(ii) Exemption from any income, social security, or other taxation duties, customs duties, or other charges on income derived from Center activities, except those that are normally incorporated in the price of goods or paid for services rendered;

(iii) Immunity from social security provisions, immigration restrictions, and alien registration; and

(iv) The right to import their furniture and personal effects, at the time of first taking up their post, free of any Ukrainian tariffs, dues, customs duties, import taxes, and other similar taxes or charges.

(C) Representatives of the Parties on the Governing Board, the Executive Director, and the Deputy Executive Directors shall be accorded by the Government of Ukraine, in addition to the privileges and immunities listed in paragraphs (A) and (B) of this Article, the privileges, immunities, exemptions, and facilities accorded to representatives of members and executive heads of international organizations in accordance with international law.

(D) Any Party may notify the Executive Director of any person, other than those in paragraphs (A) and (C), who will be in Ukraine in connection with the Center's projects and activities. A Party making such a notification shall inform such persons of their duty to respect the laws and regulations of Ukraine. The Executive Director shall notify the Government of Ukraine, which shall accord to such persons the privileges described in subparagraphs (ii)-(iv) of paragraph (B) of this Article.

(E) Nothing in this Article shall require the Government of Ukraine to provide the privileges and immunities provided in paragraphs (A), (B), and (C) of this Article to its nationals.

(F) Without prejudice to the privileges, immunities, and other benefits provided above, it is the duty of all persons enjoying privileges, immunities, and benefits under this Article to respect the laws and regulations of Ukraine.

(G) Nothing in this Agreement shall be construed to derogate from privileges, immunities, and other benefits granted to personnel described in paragraphs (A) to (D) under other agreements.

ARTICLE XIII

Any state desiring to become Party to this Agreement shall notify the Governing Board through the Executive Director. The Governing Board shall provide such a state with certified copies of this Agreement through the Executive Director. Upon approval by the Governing Board, that state shall be permitted to accede to this Agreement. In the event that a state or states of the Former Soviet Union accede to this Agreement, that state or those states shall comply with the obligations undertaken by the Government of Ukraine in Articles VIII, IX(C), and X-XII.

ARTICLE XIV

Although nothing in this Agreement limits the rights of the Parties to pursue projects without resort to the Center, the Parties shall make their best efforts to use the Center when pursuing projects of character and objectives appropriate to the Center.

ARTICLE XV

(A) This Agreement shall be subject to review by the Parties two years after entry into force. This review shall take into account the financial commitments and payments of the Parties.

(B) This Agreement may be amended at any time by written agreement of all the Parties.

(C) Any Party may withdraw at any time from this Agreement six months after written notification to the other Parties.

ARTICLE XVI

Any question or dispute relating to the application or interpretation of this Agreement shall be the subject of consultation between the Parties.

ARTICLE XVII

With a view to financing projects as soon as possible, the Signatories shall establish necessary interim procedures until the adoption of the statute by the Governing Board. These shall include, in particular, the appointment of an Executive Director and necessary staff and the establishment of procedures for the submission, review, and approval of projects.

ARTICLE XVIII

(A) Each Signatory shall notify the others through diplomatic channels that it has completed all internal procedures necessary to be bound by this Agreement.

(B) This Agreement shall enter into force upon the thirtieth (30th) day after the date of the last notification described in paragraph (A).

IN WITNESS WHEREOF, the undersigned, being duly authorized thereto, have signed this Agreement.

DONE at KIEV, on 25 October, 1993, in a single original, in the English, French, and Ukrainian languages, each text being equally authentic.

APPENDIX D

Statute of the International Science and Technology Center

[Adopted by the ISTC Governing Board on March 17, 1994]

This Statute is adopted pursuant to Article IV of the Agreement Establishing an International Science and Technology Center (hereinafter referred to as "the ISTC Agreement"). In the event of a discrepancy between it and the ISTC Agreement, the latter shall prevail.

ARTICLE I
(NAME, LOCATION)

A. The International Science and Technology Center (hereinafter referred to as "the Center") is established pursuant to Article I of the ISTC Agreement. Pending its entry into force, the Agreement shall be provisionally applied pursuant to Article I of the Protocol signed in Moscow on December 27, 1993.

B. The Headquarters of the Center is located at Moscow, in the Russian Federation.

ARTICLE II
(POWERS)

A. Article II of the ISTC Agreement provides as follows:

"The Center shall develop, approve, finance, and monitor science and technology projects for peaceful purposes, which are to be carried out primarily at institutions and facilities located in the Russian Federation and, if interested, in other states of the CIS and Georgia.

The objectives of the Center shall be:

(i) To give weapons scientists and engineers, particularly those who possess knowledge and skills related to weapons of mass destruction or missile delivery systems, in the Russian Federation and, if interested, in other states of the CIS and Georgia, opportunities to redirect their talents to peaceful activities; and

(ii) To contribute thereby through its projects and activities: to the solution of national or international technical problems; and to the wider goals of reinforcing the transition to market-based economies responsive to civil needs, of supporting basic and applied research and technology development, inter alia, in the fields of environmental protection, energy production, and nuclear safety, and of promoting the further integration of scientists of the states of the CIS and Georgia into the international scientific community."

B. The Center is authorized to carry out the activities enumerated in Article III of the ISTC Agreement and shall use its resources solely for the accomplishment of its objectives.

C. Without prejudice to the privileges and immunities provided by the ISTC Agreement, the Center and individuals related to its activities and the implementation of projects on the territory of the Russian Federation shall respect the national legislation of the Russian Federation.

ARTICLE III
(PARTIES, NEW PARTIES)

A. The United States of America, Japan, the Russian Federation, and, acting as one Party, the European Community and European Atomic Energy Community (hereinafter referred to as "the Parties") are the initial Parties to the ISTC Agreement.

B. Accession to the ISTC Agreement:

(i) A state desiring to accede to the ISTC Agreement shall so inform the Governing Board (hereinafter referred to as the "Board") through the Executive Director and shall provide information required by the Board. The Board shall, inter alia, require information con-

cerning the requesting state's anticipated contributions to the Center and its expected proposals and activities.

(ii) The Executive Director shall transmit requests for accession to the Board without delay and shall place the request for accession on the agenda of the first Board meeting after the receipt of the information requested in accordance with subparagraph (i) of this Article.

(iii) The Executive Director shall communicate the Board's decision to the State requesting accession.

(iv) Upon approval by the Board, the acceding state shall be permitted to deposit its instrument of accession with the Board through the Executive Director.

ARTICLE IV
(BOARD PURPOSE, MEMBERSHIP, PROCEDURES)

A. The Board has the responsibilities set forth in Article IV of the ISTC Agreement.

B. Each initial Party has one vote on the Board. The United States of America, Japan, the Russian Federation, and, acting as one party, the European Community and the European Atomic Energy Community, have each appointed their representatives.

C. It is intended that the Board's membership be expanded from the size provided for in paragraph B. of this Article.

(i) A Party acceding to the ISTC Agreement may request Board membership through the Executive Director.

(ii) A Party is eligible for membership on the Board when the Board approves and upon such terms and conditions, in particular as to voting rights, as the Board may determine. Such terms and conditions must not be inconsistent with the ISTC Agreement.

(iii) One acceding Party that is a state of the CIS will have membership be expanded from the size provided for in paragraph B. of this Article. The term of that Party's representative shall be one year or a period until another such state has acceded, whichever is longer. A representative from another acceding state that is a state of the CIS shall be appointed subsequently to a one-year term.

(iv) A Party joining the Board under subparagraph (iii) of this Article shall not be eligible to vote on applications for accession or Board membership by other states of the CIS.

D. The Board shall select its Chair, who shall serve for one year.

E. The Board shall meet as needed, but not less than four times annually, upon thirty (30) days prior notice from the Chair, except whenever a shorter period of notice is agreed to by all Parties. At the request of the representatives of two Parties on the Board to the Chair, an extraordinary meeting of the Board shall be held upon fifteen (15) days prior notice except whenever a shorter period of notice is agreed to by all the Parties.

F. The Board shall decide its own rules of procedure, which shall address, inter alia, the method by which representatives to the Board shall cast their votes and the participation of non-Board members, including Parties, governments, inter-governmental organizations, non-governmental organizations, in Board meetings, and the establishment of any committees and task forces.

ARTICLE V
(SECRETARIAT)

A. The Secretariat of the Center consists of the Executive Director, Deputy Executive Directors, and other staff.

B. The Executive Director supervises the daily administration of the Center and is responsible for implementing the policies and decisions of the Board. The Deputy Executive Directors report directly to the Executive Director. In addition, the Executive Director directly oversees the chief officers for administration, procurement, and finance. The Executive Director is appointed for a two-year term by, and may be dismissed upon the decision of, the Board.

C. There are initially three Deputy Executive Directors, who are appointed by the Board for two-year terms and who may be dismissed upon the decision of the Board. Without prejudice to paragraph B., the Board shall designate one Deputy Executive Director as a Principal Deputy Executive Director, who shall fulfill the duties of Executive Director in the absence of the Executive Director for a period up to three months. After three months's absence, or upon the earlier permanent incapacity of the Executive Director or Deputy Executive Director, the Party which nominated the Executive Director or Deputy Executive Director will have the option to nominate a new Executive Director or Deputy Executive Director, who will be approved by the Board, for the remainder of the term.

D. After consultation with the Deputy Executive Directors, the Executive Director shall recommend to the Board the division of responsibilities among them.

E. Staff other than the Executive Director and the Deputy Executive Directors shall be nominated by the Parties and approved by the Executive Director, consistent with decisions of the Board. In approving staff nominations, the Executive Director shall consider the paramount importance of employing staff of the highest standards of efficiency, technical competence, and integrity.

F. Under the guidance of the Executive Director, the Secretariat shall be responsible for, inter alia:

(i) Disseminating information about the Center, including its objectives and functions;

(ii) Receiving project proposals and information required in accordance with this Statute and preparing proposals for transmission to the Board;

(iii) Responding to statements of interest from institutions in the CIS;

(iv) Assisting the Parties and participants in the development of project proposals;

(v) Collating the advice on the scientific and technical merit of project proposals given pursuant to Article VIII of this Statute;

(vi) Communicating with those who submit project proposals;

(vii) Bringing together specialists in the CIS with other specialists with similar interests;

(viii) Proposing the Center's activity plan and a budget for each year;

(ix) Preparing Annual Reports of the Center's activities, with the first Report to be submitted to the Board at the end of 1994;

(x) Making the necessary arrangements for handling business confidential information, as defined in Article XIII.A., in the Center Secretariat. The Center personnel shall conclude confidentiality agreements with the Secretariat for the period of their work at the ISTC and two years thereafter. Upon a complaint or on his or her own initiative, the Executive Director shall take appropriate administrative actions, up to and including dismissal, against an ISTC employee who has disclosed business confidential information; and

(xi) Other functions assigned to it by the ISTC Agreement, this Statute, or the Board.

G. In respect of the ISTC Agreement, the Executive Director shall, in fulfilling the following functions of a depository, notify the Parties of:

(i) Deposits of instruments of accession;

(ii) Amendments and their dates of entry into force; and

(iii) Notifications of a Party's withdrawal.

ARTICLE VI
(SCIENTIFIC ADVISORY COMMITTEE)

A. Within seven (7) days of the ISTC Agreement's entry into force, each initial Party may appoint not more than two (2) persons to the Scientific Advisory Committee (SAC) , which is established pursuant to Article IV.D. of the ISTC Agreement. The Board may allow any state admitted to membership under Article III to appoint, alone or in conjunction with others, another such person. The persons appointed shall be prominent members of scientific disciplines relevant to the Center's objectives. The Parties are encouraged to appoint members with expertise in a broad range of scientific disciplines.

B. The SAC members shall serve in their personal capacities and shall not serve as representatives of the Parties appointing them.

C. The SAC shall meet at least once a year to advise the Board on fields of research and application to be encouraged. Its first meeting shall occur within thirty (30) days of the ISTC Agreement's entry into force.

D. In addition to meetings described in paragraph C. of this Article, the SAC shall meet upon request of the Board, to provide advice on questions referred to it by the Board. To this end, a SAC member may ask his or her Party or the Chair of the Board to recommend that the Board call a meeting of the SAC.

ARTICLE VII
(PROPOSAL SUBMISSIONS)

A. Any person, institution, government, or intergovernmental or non-governmental organization may submit a proposal.

B. Proposals shall be made through the Executive Director.

C. Each acceptable proposal shall comply with the instructions of the Center, which shall set forth requirements concerning information to be contained in proposals

and the format for proposals. These instructions are prepared by the Executive Director and approved by the Board. At a minimum, the instructions shall require for each proposal:

(i) A summary of the project, including the name of the project manager; a short narrative description of the project's purpose, activities, anticipated results, location, and participants; and the project's estimated duration and costs, identified by element of expense to include at least: salaries, equipment, materials, travel, and standard overhead of up to 10% of direct costs, excluding equipment and travel;

(ii) A description of all program and financial aspects of the project, including anticipated commercial results and intellectual property rights;

(iii) A statement of whether concurrence has been obtained from participating individuals, institutions, and state(s) in which work is to be carried out and an acknowledgement that such concurrence is required prior to Board consideration: and

(iv) Monitoring and auditing assurances sufficient for implementing obligations of Article VIII of the ISTC Agreement.

These instructions should help ensure that each proposal contains information sufficient for the Executive Director, Scientific Advisory Committee, and Board to fulfill their responsibilities under this Statute and the ISTC Agreement.

D. Each Party is encouraged to disseminate the Center's instructions within its territory.

E. The Center will give due regard to preventing, in soliciting proposals, disseminating proposals and related reports for review, and making available project results:

(i) the seeking or disseminating of any information of a national security nature;

(ii) the transfer of sensitive information that is prohibited under relevant international rules and practices for the nonproliferation of weapons and other sensitive technologies, in particular information related to special nuclear materials; and

(iii) unauthorized disclosures of proprietary and business confidential information.

Proposers are responsible for ensuring that their proposals comply with applicable laws and regulations regarding sensitive information.

F. Proposals are regarded as submitted when the Executive Director determines that the information required in paragraph C. of this Article is substantially complete.

G. The Executive Director shall transmit proposals to the State(s) in which work is to be carried out within five (5) days of their submission, in order to obtain the prior concurrence required in Article VI of the ISTC Agreement, unless such concurrence has been obtained. When no response is received within 30 days of the request's transmission to the state(s), the Executive Director shall so notify the Board. In accordance with Article VI of the ISTC Agreement, the Executive Director must obtain the concurrence of the state(s) in which work is to be carried out before transmitting the proposal to the Board for approval.

ARTICLE VIII
(SCIENTIFIC AND OTHER PROFESSIONAL ADVICE)

A. The Executive Director shall send each submitted proposal to at least one SAC member of each Party no more than five (5) days after its submission. The Executive Director shall include at least the information required in Article VII.C. and other information he or she deems relevant, and a form on which the review shall be completed. The Executive Director shall prepare that form after consultation with the SAC.

B. Each SAC member may obtain, without expense to the Center, up to three (3) expert scientific, economic, or other professional reviews for each project.

C. Not more than thirty (30) days after receiving the proposal from the Executive Director, each SAC member shall return a single completed form synthesizing the reviews obtained in accordance with paragraph B. of this Article, together with copies of those reviews and his or her own recommendation as appropriate; or confirmation that no review has been undertaken.

D. A completed review shall contain:

(i) The reviewers' names and qualifications, including any qualifications related to the specific proposal;

(ii) An analysis of the scientific and technical merit and importance of the proposals;

(iii) An opinion as to whether the project's objective can be accomplished within the framework proposed and time allowed;

(iv) An analysis, to the extent possible, of the qualifications of the proposed participants and of the skills necessary to meet the project's objectives; and

(v) Recommendations for the proposal's improvement.

E. When the Executive Director receives all reviews of a proposal, but no later than forty-five (45) days after its submission, he or she shall either:

(i) Transmit the proposal to the Board, accompanied by all reviews and other relevant information; or

(ii) Consult with the proposer to consider revision in accordance with the reviews. The Executive Director shall decide whether a revised proposal requires further review by the SAC before it is transmitted to the Board. If a proposal is being revised, the Executive Director may extend the forty-five (45) day period as necessary. The Board will be informed of the status of such proposals which are under revision within the forty-five (45) day time period.

ARTICLE IX
(PROJECT APPROVAL)

A. The Executive Director shall transmit proposals to at least one member of the Board of each Party, along with the information required by this Statute. The Executive Director shall also attach:

(i) An initial assessment by the Executive Director as to whether the project is in accordance with the objectives of the Center, as described in Article II of the ISTC Agreement;

(ii) The results of scientific and professional reviews of the project proposals conducted in accordance with Article VIII of this Statute, if available; and

(iii) Recommendations by the Executive Director, when he or she deems it appropriate.

B. Approval of projects by the Board:

(i) Unless the Board decides otherwise with regard to a specific proposal, it shall have at least forty-five (45) days to consider a proposal after the proposal has been transmitted to it by the Executive Director. It shall consider the proposal no later than its first meeting after the forty-five (45) day period ends.

(ii) The Executive Director shall communicate the Board's decision to the person, institution, or government proposing the project.

C. In deciding whether to approve a project, the Board will be guided by criteria and priorities established according to Article IV.B.(v) of the ISTC Agreement. The Board shall adopt these criteria at its first meeting.

D. Each project approved by the Board shall be subject to a project agreement that is binding upon the participants in the project before the project is carried out.

E. In approving each project, the Board shall consider financing for the project.

ARTICLE X
(PROJECT AGREEMENTS)

A. For each approved project financed through the Center, the Center, acting through the Executive Director or his or her designee, shall enter into a written project agreement for the project with the recipient entity or entities. The project agreement shall expressly provide that it is subject to the provisions of the ISTC Agreement and the Statute, which shall govern in the case of conflict with the project agreement. The Secretariat shall ensure that this is the case.

B. At a minimum, the Project Agreements referred to in paragraph A. of this Article shall contain provisions which:

(i) Specify conditions under which costs shall be eligible for reimbursement and ensuring that they are allowable under the terms of the Project, reasonable as to amount, and properly allocated to the Project;

(ii) Designate responsibility for performance of technical and financial tasks under the project and delineate procedures to be followed in the resolution of disputes;

(iii) Establish a schedule for performance and conditions to be met in order to obtain payment;

(iv) Provide for each Party which wholly or partly finances a project and for the Center the right of full ISTC Agreement access, after notice of not less than 20 days or as specified in the project agreement, to carry out on-site monitoring and audit of all activities of the project; specify the portions of the facilities, equipment, documentation, information, data systems, materials, supplies, personnel, and services which will concern the project and so will be accessible for the monitoring and audit; such specification shall permit the recipient entity the right to protect those portions of facilities which are not related to the project.

(v) Require the recipient entity to account for resources used, to identify the types of records required to support expenditures for the project, and to return unspent funds within a stated time;

(vi) Require regular technical and financial reports detailing the expenditures made against the projects by

the same elements of expense identified in the approved proposal, including accounting for any interest earned by the recipient on funds accepted from the Center;

(vii) Require that allowable costs not include, inter alia, any element of profit;

(viii) Set a standard contribution for overhead costs up to 10% of direct costs, excluding equipment and travel;

(ix) Require that allowable costs not include amounts imposed for taxes of any kind, including profit tax, value added tax, personal income tax, local taxes as well as any other tariffs, dues, custom duties, import taxes, fees, or any other similar taxes or charges;

(x) Prohibit the transfer of sensitive information that is prohibited under relevant international rules and practices for the nonproliferation of weapons and other sensitive technologies, in particular information related to special nuclear materials, and unauthorized disclosures of proprietary and business confidential information.

(xi) Provide for the termination of the project as follows:

(a) When the agreement is terminated other than pursuant to paragraph (b) below, costs shall be limited to the allowable costs incurred by the recipient entity prior to the termination and such other costs as the Center considers to be fair and reasonable, having regard to commitments reasonably entered into and which cannot be cancelled or avoided. The recipient entity shall comply with any directions of the Center in the termination notice to reduce or mitigate these costs.

(b) When the Center or the financing Party(s) determines that the recipient entity has not complied with the terms and conditions of the project agreement, the recipient entity shall, upon demand, promptly return all payments and equipment contributions previously made.

(c) Any disputes on the above matter shall be settled by a procedure involving, in case of appeal, a final decision of the Board.

C. When an approved project is financed other than through the Center, the persons or institutions providing financing shall conclude a project agreement with the recipient entity and with the Center, represented by the Executive Director. The project agreements shall take fully into consideration the provisions specified in paragraph B. of this Article and be fully consistent with the provisions of the ISTC Agreement.

ARTICLE XI
(CONTRIBUTIONS TO THE CENTER)

A. Without prejudice to Articles XII and XIV, each Party may deposit any or all of its monetary contribution to the Center for operating costs, projects, and all other expenses in accordance with its laws and regulations into an account in the name of the Center or directly into the Center project and administrative accounts. At the discretion of the financing Party, this contribution may be made subject to a written agreement with the Center and may be maintained in any currency.

B. Funds that are deposited in the center's bank accounts pursuant to paragraph A. of this Article shall be disbursed from the bank account by the Executive Director or his designee in accordance with procedures approved by the Board and/or any agreement between the Center and the relevant financing Party.

C. The Russian Federation shall provide at its own expense an appropriately furnished facility suitable for use by the Center along with maintenance, utilities, and security for the facility and vehicles. The Russian Federation shall also provide full financial resources to cover its personnel in the Center Secretariat.

D. Contributions made to the center by persons, states that are not Parties to the ISTC Agreement, intergovernmental organizations, or non-governmental organizations may be maintained in a Center account established by the Executive Director, with the approval of the Board. Disbursement procedures for these funds shall be established by the Board.

E. In financial transactions, the Center shall not pay in the Russian Federation taxes of any kind, including profit tax, value added tax, personal income tax, local taxes as well as any other tariffs, dues, custom duties, import taxes, fees, or any other similar imposed taxes or charges.

F. Disbursements of funds for projects may be made to the appropriate organizations and individuals in hard currency or local currency.

ARTICLE XII
(FINANCING PROJECTS THROUGH THE CENTER)

A. The Center shall establish appropriate project and administrative hard currency bank accounts outside the CIS and also appropriate accounts as approved by the Board, in each of the States of the CIS that are Parties to the ISTC Agreement, in order to consolidate financing for projects and administration.

B. Each Party which has undertaken responsibility to finance a project through the Center shall do so in a written commitment to the Center and will ensure that funds are available for use by the Center in those amounts required to execute the project agreement.

ARTICLE XIII
(INTELLECTUAL PROPERTY RIGHTS)

A. For the purposes of the Agreement and this Statute:

"Intellectual property" shall have the meaning defined in Article 2 of the Convention Establishing the World Intellectual Property Organization, done at Stockholm on July 14, 1967.

"Business confidential information" means information containing know-how, trade secrets, or technical, commercial or financial information, which either:

(i) Has been held in confidence by its owner;

(ii) Is not generally known or available from other sources;

(iii) Has not been made available by its owner to other parties without an obligation concerning its confidentiality; or

(iv) Is not available to the receiving party without obligations concerning confidentiality.

B. Each project agreement shall provide for the adequate protection of intellectual property and business confidential information exchanged or provided in the course of a project.

C. Each Party shall use its best endeavors to ensure that rights acquired are exercised in such a way as to encourage, consistent with the Statute:

(i) The dissemination and use of non-confidential information created, provided, or exchanged in the course of a project;

(ii) The adoption and implementation of international technical standards; and

(iii) Fair competition in areas affected by the Agreement.

D. Entities having rights should make adequate efforts to exploit their intellectual property rights consistent with the objectives of the Agreement. To that end, except as provided in paragraph E. of this Article, each project agreement shall provide that:

(i) All rights worldwide to intellectual property arising from the project, including patent protection for industrial property, shall be held by the recipient entity (or its designee), which shall provide adequate protection of such intellectual property (except as provided below). If the recipient entity (or its designee) decides not to protect the intellectual property in the territory of a Party other than the recipient entity's Party, each such Party and the financing Party have the option to protect the intellectual property in that territory.

(ii) Each Party and the Center shall be entitled to a non-exclusive, irrevocable, royalty-free license with the right to sub-license in all countries to translate, reproduce, and publicly distribute scientific and technical journal articles, reports, and books directly arising from the project. When the objective of a project is only to produce an article, report, or book that is expected to be valuable in itself, the provisions of paragraph E. of this Article shall be applied.

(iii)

(a) The recipient entity (or its designee) shall grant the financing Party (or its designee) an exclusive, irrevocable, royalty-free license (with the right to sublicense) for commercial purposes in that Party's territory. In such cases, the financing Party and recipient entity shall agree on appropriate compensation for persons named as inventors. Costs of protection in that territory shall be borne by the licensee. When the benefits from the exploitation of intellectual property arising from the project are expected to exceed significantly the financing Party's expected contribution, the provisions of paragraph E. of this Article shall be applied.

(b) When two or more Parties finance a project, it is expected that the provisions of paragraph E. of this Article shall be applied. When the Parties and the recipient entity agree not to do so, in such cases the co-financing parties (or their designees) shall agree on the allocation among themselves of the rights received pursuant to this paragraph.

(c) Upon the request of the financing Party (or its designee), the recipient entity (or its designee) shall enter negotiations for licenses in additional territories on fair and reasonable terms.

(d) Upon the request of a non-financing Party (or its designee), a non-exclusive license for commercial purposes, with the right to sublicense, shall be granted in that non-financing Party's territory, on fair and rea-

sonable terms to be mutually agreed, taking into account that non-financing Party's contribution to the establishment and operation of the ISTC; the financing Party (or its designee) shall be entitled to a license on the same terms in that non-financing Party's territory.

(e) The financing Party will, if requested, provide assistance to the recipient entity in managing the intellectual property;

(iv) A non-exclusive, irrevocable license on transfer conditions for non-commercial purposes, with the right to sublicense, shall be granted to the Center and to each Party (or its designee) for the territory of each Party in which the intellectual property is protected. Upon request the Parties will exchange information on licenses and sub-licenses granted under this paragraph;

(v) Persons named as inventors shall receive not less than 15% of any royalties earned by the executing entity;

(vi) All publicly distributed copies of a copyrighted work arising from cooperation under the project shall indicate the names of the authors of the work unless an author explicitly declines to be named;

(vii) The recipient entity shall grant on reasonable conditions access rights for intellectual property and information owned by the recipient entity necessary for the exploitation of intellectual property arising from the project, provided that the recipient entity is free to disclose such intellectual property or information, that no major business interests of the recipient entity oppose the granting of access rights, and that in making this opposition such interests are not abusively restricting the exploitation of such rights.

E. The financing Party (or its designee) and the recipient entity (or its designee) may agree to protect, allocate, and manage intellectual property arising under the project agreement differently than paragraph D. of this Article provides, consistent with the principles of the Agreement and their laws and regulations. In order to avoid increasing the work of the Center's staff, any provisions agreed under this paragraph will be provided by those entities to the Center for inclusion in the project agreement.

ARTICLE XIV
(FINANCING OF ADMINISTRATIVE EXPENSES)

A. The fiscal year of the Center shall be the calendar year.

B. By November 15 of each year, the Executive Director shall submit to the Board the annual budget estimates for the expenses of the Center. The Center's budget shall exclude costs of facilities, materials, services, and vehicles provided by the Russian Federation free of charge pursuant to the Memorandum of Understanding between the Center and the Government of the Russian Federation. The Board shall approve the annual budget with any amendments and return the budget for execution to the Executive Director by December 31 of that same year. The initial budget shall be for the remainder of the fiscal year in which it is submitted.

C. Upon the approval of the annual budget by the Board, the Board will establish and inform each Party of the amount of its share, if any, of the Center's annual operating budget. In accordance with this budget, each Party shall ensure that funds are credited for their share for use by the Center.

D. Any funds remaining uncommitted at the end of each fiscal year shall be applied to the budget for the following year.

E. Withdrawal by a Party from the ISTC Agreement shall not affect its budgetary contributions committed under paragraph C. of this Article to the Center's administrative account.

F. In addition to financial contributions, the Parties will be encouraged to second staff and provide other support at no cost to the Center's budget. The Center may, as necessary, enter into agreements concerning these secondments and support.

ARTICLE XV
(FINANCIAL PROCEDURES)

A. Periodic financial reports shall be provided to the Parties and the Board on the Center's administrative costs, project awards, and expenditures in the format and detail required by the Parties and the Board.

B. An annual audit by an auditor approved by the Board shall be conducted of the Center's expenditures and related financial activities. Results of the audit shall be reported to the Board within 30 days after completion.

ARTICLE XVI
(AUDITING AND MONITORING)

A. All funds contributed for a project through the Center shall be subject to audit by the Center or by a Party represented on the Board with regard to projects it finances or their representatives in accordance with the following principles:

(i) Audit of costs shall assure that costs reimbursed are allowable under the terms of the project agreement;

(ii) The Center, a Party represented on the Board with regard to projects it finances, or audit organizations as specified by the Board, may perform such audits, or engage others to do so.

(iii) Accounting systems used by project recipients must be acceptable to the Center or the Party represented on the Board in regard to projects it finances and shall be subject to review and audit.

(iv) Audit reports pertaining to a project shall be available to the entities audited, to the Center, and to all Parties represented on the Board.

(v) Allowable costs based on the results of an audit shall be determined by the entity performing the audit or engaging others to do so. Any disputes shall be settled in accordance with resolution of dispute procedures contained in the project agreement.

(vi) Provisions for each Party which wholly or partly finances a project and for the Center to have the right of full ISTC Agreement access, after notice of not less than 20 days or as specified in the project agreement, to carry out on-site monitoring and audit of all activities of the project; specifications of the portions of the facilities, equipment, documentation, information, data systems, materials, supplies, personnel, and services which will concern the project and so will be accessible for the monitoring and audit; such specification shall permit the recipient entity the right to protect those portions of facilities that are not related to the project. After completion or termination of a Center project the recipient entity may utilize the facility or portion of the facility previously used for the Center project for other work; however, all documentation and records including those associated with equipment, data systems, materials, supplies, and services utilized on the Center project must be maintained for up to two years following such completion or termination and such documents and records and personnel must be available to the auditor for up to two years following such completion or termination.

B. Approved projects funded other than through the Center shall be subject to audit by the financing Party and/or their representatives, taking into account the principles set forth in paragraph A of this Article.

ARTICLE XVII
(SUPPLEMENTARY AGREEMENTS)

Each Party may conclude supplementary written agreements with the Center as approved by the Board consistent with the ISTC Agreement in order to comply with its national laws, rules, and regulations applicable to the Center.

ARTICLE XVIII
(AMENDMENT OF STATUTE)

This Statute may be amended by unanimous consent of the Board.

Statements on the Statute by the Parties

Statement of the United States, European Community, and Japan:

"Any element of profit" in Article X.B.(vii) is recognized to include contributions to pension funds, social insurance, and other social funds.

The Russian Federation, as part of its in-kind contribution, has agreed to indicate on each project proposal transmitted to the Board its contribution of the costs listed above."

Statement of the Russian Federation:

"The Russian Federation interprets 'fair and reasonable terms', referred to in Article XIII.D.(iii). as terms established at the moment on the international license market."

APPENDIX E

Committee Site Visits and Meetings, November 1995 and May 1996

RUSSIA

Institute Site Visits and Meetings

- Institute of Theoretical and Experimental Physics
- Scientific Research Institute of Pulse Technique
- Central Aerodynamic Institute
- All-Russian Research Institute of Experimental Physics (Arzamas-16)
- P. N. Lebedev Physics Institute
- Moscow Engineering Physics Institute
- Russian Research Center, Kurchatov Institute
- St. Petersburg State Electrical Engineering University
- Research Center for Applied Microbiology
- Ioffe Physical Technical Institute

Meetings with Institute Representatives

- G. T. Petrovsky, General Director, Vavilov State Optical Institute
- A. I. Karelin, Director General, Radium Institute
- Zhores I. Alferov, Chairman and Vice President, Russian Academy of Sciences (and Director, Ioffe Physical Technical Institute)
- George B. Manelis, Deputy General Director, United Institute of Chemical Physics

Other Meetings

- International Science and Technology Center
- U.S. Ambassador Thomas Pickering and U.S. Embassy staff
- Ministry of Foreign Affairs
- Alexander Yakovenko, Russian Representative to ISTC Governing Board and Deputy Director, Ministry of Foreign Affairs Department for Security and Disarmament Issues
- Centre for Science Research and Statistics
- Boeing Computer Laboratory
- Lev Ryabev, First Deputy Minister, Ministry of Atomic Energy
- Yuri Ossipyan, former Director of the Scientific Centers at Chernogolovka
- Eduard A. Tropp, Russian Academy of Sciences Scientific Center

UKRAINE

Institute Site Visits and Meetings

- Kiev Institute of Nuclear Research
- Kharkiv Institute of Physics and Technology

Other Meetings

- The Science and Technology Center in Ukraine
- U.S. Embassy staff
- Viacheslav L. Knyazhnitsky, Ministry of Foreign Affairs