Blocking Access to Nuclear Weapons, Materials, and Expertise

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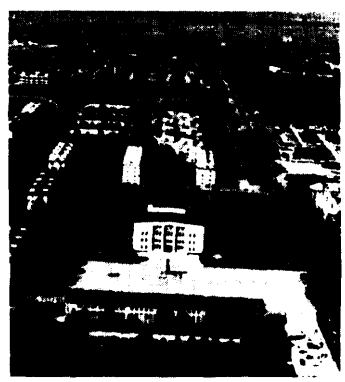
Even if Russia and the other newly independent states meet their obligations under international nonproliferation treaties, considerable dangers will still remain. Nuclear weapons or weapon materials might find their way into the hands of foreign governments or nongovernmental groups. Experts on nuclear weapons or other weapons of mass destruction might assist foreign weapon programs by working directly for them, or by transferring vital information or sensitive technology that would help proliferants produce their own weapons. To forestall these threats, the newly independent states must strengthen controls over nuclear weapons and weapon materials, implement international safeguards at nuclear facilities, institute effective export control and customs procedures, and provide alternate employment for technical professionals.

None of the measures mentioned above can be carried out if the central government authorities in these states do not have effective control over legal, administrative, and other vital activities on their territories. At present, such control cannot always be assumed to exist in Russia or any of the other newly independent states. An obvious indication of this state of affairs was the violent showdown between the president and the parliament in Moscow in September 1993. But beyond the battle among reformers and democrats, nationalists, old communists, and various lesser groupings, central authority appears to have broken down from several points of view. Of particular importance are criminal activity, endemic corruption, and strong, semi-autonomous local authorities which have, to various degrees, taken certain admin-



istrative powers from Moscow.[1] Levels of disorganization and anarchy in other former Soviet republics vary, but in all cases, central authority over important matters-for example, customs services or physical security over nuclear installations-cannot be assumed. Until the situation stabilizes and improves, this reality must set the framework for the policies discussed in the rest of this study.[2]

POLITICAL CONTROL OVER NUCLEAR WEAPONS

When the Soviet Union was dissolved in December 1991, the first concern of the West was who had control over Soviet nuclear weapons while the political situation was in flux. The world saw a news photograph of a military technician handing Boris Yeltsin, the president of Russia, what was purported to be the box for transmitting nuclear launch release codes. A few months earlier, during the aborted coup of the old-line apparatchiks in August, it had not been clear who had effectively controlled the "football" during the four critical days of turmoil.[3]

The situation was more complicated than this might indicate: under the new political structure of the successor republics to the former Soviet Union (FSU), emerging leaders of several of the former Soviet republics formed an entity called the Commonwealth of Independent States (CIS). It comprised the states of the former Soviet Union except for the Baltic republics (Lithuania, Estonia, and Latvia), Georgia, and Azerbaijan.[4] As part of CIS military cooperation, the former Soviet strategic nuclear forces were placed under nominal CIS command, headed by the last Soviet Defense Minister, Marshal Yevgeny Shaposhnikov. In conjunction with Shaposhnikov, control over these nuclear forces was supposed to be exercised by the heads of state of the four former Soviet republics that were left with strategic nuclear weapons on their soil: Russia, Ukraine, Belarus, and Kazakhstan. This temporary resolution mollified concerned policymakers around the world, but only somewhat.

In addition to the strategic nuclear forces, now apparently under control of what appeared to be reasonably stable new nations, there were tens of thousands of tactical nuclear weapons. Russia insisted from January 1992 onwards that these weapons—more portable than their strategic counterparts, and possibly usable by local military commanders—should be returned to its territory forthwith.

In fact, the Soviet Union had in 1990 already begun to withdraw some nuclear weapons from regions where near-civil war had reigned, such as Azerbaijan, Armenia, and Georgia. By exerting

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[1] In some respects, this devolution of power may be considered positive because it would tend to result in greater home rule. However, often the local authorities are not democratically oriented officials but, rather, authoritarian figures who resist Moscow to maximize their own power and wealth. The extreme example of this is in Chechnya, a small republic in the north Caucasus, where a former Soviet Army General, Dzhokar Dudayev, has installed himself as President of a self-declared independent republic. (No other area in the Russian Federation has asserted full independence.) Constant turmoil has resulted, and there is little evidence that Dudayev's government is engaged in carrying out the popular will. The opposition to Dudayev, although strong, is kept in check by military means, and, even within Chechnya, local areas have established varying allegiances.

[2] For example, see Robert Seely, "NuclearTheft Found at Chernobyl," *The Washington Post*, Nov. 12, 1993, p. A44, and "*Nuclear* Fuel Rods Stolen From Murmansk Naval Base," Moscow Ostankino Television, Dec. 2, 1993, FBIS, JPRS-TND-93-001, Jan. 6, 1994, p. 24. The latter case is of particular concern, as the stolen material was probably highly enriched uranium, suitable for weapons. Some press reports later described the missing quantity as only a few kilograms, far short of the amount needed for a nuclear weapon. Later reports asserted that the material had been recovered. Nevertheless, the fact that this extremely sensitive material could be stolen from a military facility in the first place is worrisome.

[3] Explanations were later given that there were actually three "footballs" which all had to be in agreement for a nuclear launch to occur, possessed by the President, the Defense Minister, and the military Chief of Staff. The explanation was not particularly reassuring, since it was not certain who was acting in these positions during the coup. It was clear that President Gorbachev's "football" was not under his effective control.

[4] Azerbaijan and Georgia joined the CIS in 1993.

strong pressure, the Russian government was apparently successful in transferring all Soviet tactical nuclear weapons to its territory by July 1992, as it had earlier promised. This accomplishment was achieved in spite of a temporary halt in the transfers by Ukraine in April.[5] Worldwide interest in the situation, together with Russian economic threats, resulted in a rescission of the Ukrainian effort to freeze the shipment of the tactical nuclear weapons to Russia.

By July 1992, therefore, some of the most immediate nuclear proliferation issues resulting from the end of the Soviet Union—those concerning operational control over the Soviet nuclear stockpile—had been at least partially resolved.[6] Moreover, the discussion of NPT issues in chapter 2 also shows that the ultimate status of the strategic nuclear weapons in Belarus, Kazakhstan, and Ukraine may be close to resolution as well. Nevertheless, many other issues, only slightly less pressing, remain on the agenda, as described below.

SECURITY OVER NUCLEAR WEAPONS AND NUCLEAR MATERIALS

The question of which governments will assert political control over Soviet nuclear weapons appears nearly settled. However, serious questions remain concerning the security and operational control of weapons and nuclear materials in their current locations, particularly given the questionable degree of societal control exercised by central governments in the newly independent states.

Aside from Russia, the newly independent republics have all had to constitute armed forces and local security personnel more or less from what was left of the Soviet Army after Russia (and, to a lesser extent, Ukraine) appropriated the lion's share. Most Soviet Army officers were Russian or Ukrainian, leaving a leadership vacuum in most of the other republics. For example, in Belarus, most of the officers are still Russian. One of the last of the former Soviet republics to establish its own armed forces was Kazakhstan, one of the four nuclear inheritor states. If the quality and cohesiveness of newly constituted security forces is not of the highest level, the ability of these forces to provide adequate physical protection of nuclear weapons and materials necessarily suffers.[7]

This issue is even more acute considering that some Middle Eastern states (notably Iran), apparently interested in acquiring nuclear weapons, are reportedly actively engaged in efforts to establish strong ties with central Asian states that possess parts of the defunct U.S.S.R. nuclear weapons complex. Again, Kazakhstan, an attractive target due to its nuclear facilities, is a region of concern.

A government seeking to prevent nuclear proliferation must prevent the diversion not only of nuclear weapons, but also of nuclear material useful to weapon manufacture. The two materials of primary concern are highly enriched uranium (consisting of at least 20 percent of the fissionable uranium-235 isotope) and plutonium.[8] There is also some concern about low-enriched uranium,

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[5] See, e.g., TASS report Mar. 12, 1992, from FBIS JPRS-TAC-92-012, Apr. 9, 1992 on the halt in transfers, and TASS report Apr. 16, 1992, from FBIS-SOV-92-075, Apr. 17, 1992, on the agreement, later carried out, to move the weapons from Ukraine to Russia by July 1, 1992.

[6] In June 1993, the military organization of the CIS was dissolved at a meeting of the CIS heads of state. At this point, the nuclear rocket forces came under unambiguous Russian control. (Previously, the control was ambiguously Russian: the heads of state of the four nuclear inheritor states allegedly held the right of veto over a launch, but except for Russia, this right was exercised only by consultation.)

[7] Protection of nuclear weapons in the non-Russian nuclear inheritor states is accomplished by Russian forces, except in Ukraine, where military forces securing nuclear weapons have been pressured to swear allegiance to Ukraine, However, civilian nuclear materials are protected by the security forces of the country in which the facilities are located.

[8] Both weapon-grade plutonium (composed of more than 90 percent of the plutonium-239 isotope most useful for nuclear weapons) and reactor-grade plutonium (that is, with more than 20 percent of the plutonium isotopes other than plutonium-239) pose serious proliferation concerns, since either can be used to make nuclear weapons. See ch. 4 of U.S. Congress, Office of Technology Assessment, *Technologies Underlying Weapons of Mass Destruction*, OTA-BP-ISC-1 15 (Washington, DC: U.S. Government Printing Office, December 1993).

which might be enriched to weapon grade with substantially less effort than needed to enrich natural uranium; heavy water and ultra-pure graphite, either of which can be used as a moderator with natural uranium fuel to operate a plutonium-producing reactor; and tritium, a radioactive isotope of hydrogen that can be used to increase greatly the explosive power of so-called "boosted" nuclear weapons.

Nearly all nations with nuclear power or research reactors have accepted International Atomic Energy Agency (IAEA) safeguards, designed to verify—through inspections and technical analyses—that nuclear material destined for civilian use at declared nuclear facilities has not been diverted to weapon applications. The five declared nuclear-weapon states—the United States, Russia (formerly the Soviet Union), the United Kingdom, France, and China—are exempt from these inspections, but all have agreed, at least in principle, to inspections of some civilian facilities. In practice, very few sites in the Soviet Union were ever submitted to these international safeguards.

Due both to the lack of international safeguards requirements on the Soviet Union and to the political power of the Ministry of Atomic Energy (MINATOM), which has long been successful in protecting its turf against other bureaucracies, most nuclear facilities in the former Soviet Union have never had to meet IAEA standards for material control and accountancy (MC&A). Until early 1992, there was no nuclear energy regulatory authority, analogous to the U.S. Nuclear Regulatory Commission, in any of the former Soviet states. Therefore, none of these republics had an agency with the practical political power and technical expertise to conduct independent assessments of system safety and of safeguards against material diversion. Most of the republics have minimal expertise in these matters; in fact, up to 90 percent of the technical nuclear expertise of the former Soviet Union resides in Russia.[9]

In Russia, an independent nuclear oversight organization, GOSATOMNADZOR, was created in 1992. In an April 1993 decree, President Boris Yeltsin reaffirmed GOSATOMNADZOR'S authority to inspect all nuclear facilities, including those of both the Ministry of Defense and MINATOM.[10] Nevertheless, MINATOM and the Ministry of Defense have resisted GOSATOMNADZOR'S efforts to inspect their facilities.[11] Some other republics, notably Belarus, have moved to set up similar oversight bodies, and Ukraine and Kazakhstan, along with others, have set up atomic energy authorities that at least may begin to monitor, control, or operate nuclear facilities on their territory.

There are potential problems, therefore, not only in Russia, but even more so in other republics with significant nuclear facilities. Lithuania has a nuclear power station with two RBMK (Chernobyl-type) reactors. Ukraine has many reactors of several types. Armenia has a two-reactor power station located in a seismically unstable zone. The Armenian reactors—although undamaged—were shut down following a major earthquake in 1989.

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[9] See W. Potter, "Nuclear Exports From the Former Soviet Union: What's New, What's True, ''Arms *Control Today*, Jan./Feb. 1993, pp. 3-10. Note especially the statement, "A problem common to all of the non-Russian states is the absence of virtually any export control structure or cadre of personnel trained in matters of export controls, material accounting, physical protection and international safeguards. ''The fact that the great majority of the Soviet Union's nuclear expertise resides in Russia is supported by the American Physical Society's discovery, in providing grants to aid physicists from the former Soviet Union, that 90 percent of the physicists were in Russia. Moreover, an analysis of surnames of known staff at the Arzamas-16 nuclear weapon laboratory, prepared by Lawrence Livermore National Laboratory, shows the great majority of them to be of ethnic Russian origin. This test is, of course, not definitive, but supports the conclusion that an overwhelming fraction of nuclear expertise in the Soviet Union was Russian.

[10] Currently, even though GOSATOMNADZOR has been given authority, it has not yet implemented oversight and control over safety and safeguards.

[11] "Russian Energy, Defense Ministries Oppose Nuclear Inspections," INTERFAX, Apr. 28, 1993, cited in FBIS, JPRS-TAC-93-O04-L, May 3, 1993, p. 2.

With Russian help, however, the government is trying to restart them. Several republics have research reactors, some with highly enriched uranium fuel. Most importantly, Kazakhstan has a large (350 megawatt thermal) breeder reactor, which is designed to produce plutonium for a civilian nuclear fuel cycle. Some experimental nuclear fuel, containing a large fraction of relatively easily separable plutonium mixed with uranium, may still be located near the site. This fuel was not heavily irradiated and therefore may be relatively easily transported, and its plutonium removed, without the severe radiation hazard that would face anyone seeking to recover plutonium from more heavily irradiated fuel. For that reason, it might prove especially attractive to a nuclear proliferant.

Although the Baltic States, Armenia, Azerbaijan, Belarus, Uzbekistan, Georgia, Kyrgyzstan, and Kazakhstan have ratified the Non-Proliferation Treaty, and other newly independent states have indicated that they will do so, only Lithuania has thus far implemented the agreements with the IAEA that would put international safeguards into practice.[12] Most of the facilities in these states do not have highly enriched uranium or plutonium directly suitable for weapons, but a few—as mentioned above--do. Therefore, until safeguards are put in place, civilian nuclear facilities in the former Soviet Union could, in principle, lose nuclear material suitable for weapons to the black market, or such material could fall into the hands of states seeking nuclear weapons, without the world being any the wiser. The situation is aggravated by:

- the lack of nuclear safeguards expertise in many of the republics;
- the inefficiency of border controls, as new states are just beginning to set up effective customs services;
- the nascent state of export control legislation and implementation in most of the new republics;
- the state of civil turmoil in some of them; and
- near-universal economic hardship.

In the resulting situation, the susceptibility of officials, technicians, and people at all levels of society to bribery and subornation is an inviting factor for those parties seeking to obtain nuclear materials illicitly.

U.S. ASSISTANCE FOR WEAPON AND MATERIAL MANAGEMENT IN THE FSU

It is in the United States' interest to ensure that nuclear weapons and nuclear materials in the former Soviet Union are kept under tight governmental control. A number of different programs have been instituted by the United States for this purpose.

The first involves weapons to be dismantled under parallel arms reduction initiatives announced in fall, 1991, by Presidents Bush and Gorbachev. Formally separate from the START arms control treaties, these initiatives called for thousands of nuclear weapons in the United States and the Soviet Union to be dismantled, including some now in Belarus, Ukraine, and Kazakhstan. (START I and START II call for reductions in deployed weapons, including missile, submarine, and aircraft delivery systems, but they do not address the disposition of the warheads themselves.) The security of the nuclear material removed from the weapons and placed into storage is a paramount issue.

On December 12, 1991, the Nunn-Lugar Amendment (sponsored by the Senators from Georgia and Indiana, respectively) to the Conventional Forces in Europe Treaty Support Act be-

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12 The IAEA is assisting many of the former Soviet republics in both nuclear safety and safeguards, trying to hasten the process Of putting the appropriate agreements and safeguards into place. The list of NPT parties is current as of July 31, 1994. In addition, Moldova ratified the NPT on April 24, 1994 but has not yet deposited its instrument of ratification, which is necessary for it to formally join the treaty.

13 The U.S. initiative, announced in President Bush's speech to the nation on Sept. 27, 1991, encouraged the Soviet Union to fallow suit. President Gorbachev then announced his initiative in a speech delivered on Oct. 5, 1991.

came law (Public Law 102-228). This authorizing legislation provided for the transfer of $400 million of Department of Defense (DOD) funds in fiscal year 1992 to help accomplish the safe destruction and secure storage of weapons of mass destruction in the Soviet Union and its inheritor states. In addition, the legislation provided for programs to establish verifiable safeguards against the proliferation of these weapons, create an International Science and Technology Center to provide research opportunities for Soviet weapon scientists, and increase military contacts between the United States and the Soviet nuclear inheritor states. On the same day, legislation actually appropriating these funds also became law (Public Law 102-229). Equal amounts were authorized in DOD authorization and appropriation bills in fiscal years 1993 and 1994, providing, in all, up to $1.2 billion in available funds. [14] In the fiscal year 1993 legislation, the mandate was broadened to include defense conversion. Moreover, for fiscal year 1994, the Nunn-Lugar funding has become an additional line item, *not* a reprogramming of existing DOD funds.

The program based on these funds has become known as the Cooperative Threat Reduction Program (CTR). Legislation requires that the funded programs:

> should, to the extent feasible, draw upon United States technology and United States technicians.[15]

This language was inserted since many Members of Congress were reluctant to spend money on foreign aid to a former adversary at the same time that domestic programs faced tight fiscal limitations. Nearly all of the funds that have so far been obligated will be used to purchase material support and equipment from U.S. firms or will be used to finance assistance by the U.S. government and its experts, as opposed to purchasing local equipment or funding local experts.

One problem with the program has been the extremely slow pace of implementation, leading many in the FSU to doubt the sincerity of the United States' commitment to assistance (see table 2). For example, of the $1.2 billion authorized for the CTR program, less than 10 percent—$1 17 million—had been obligated as of March 22, 1994.[16] Some of the delays had been due to difficulties in reaching agreements on implementation with the recipient states, but this aspect of the problem has now been generally resolved. An additional source of delay has been the slowness of the U.S. government to implement the program. Decisions by the Department of Defense on funding given projects have sometimes been slow. In fact, about $208 million in fiscal year 1992 Nunn-Lugar funds were lost (until replaced by fiscal year 1994 line item funds) because they were not spent in time. In addition to delays in the executive branch, the four congressional Appropriations and Armed Services committees must be notified 15 days in advance of any obligation of funds. The Department of Defense is reluctant to proceed with obligations against the preference of these committees.

The relative share of Nunn-Lugar funds spent in the FSU, compared to that share spent on U.S. consultants, is another topic of ongoing concern. Defense officials have been quoted as taking the

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[14] An excellent summary of the legislative history and its implementation may be found in Theodor Galdi, Congressional Research Service, "The Nunn-Lugar Cooperative Threat Reduction Program for Soviet Weapons Dismantlement: Background and Implementation," 93- 1057F (Washington, DC: The Library of Congress, Dec. 29, 1993). The related discussion in the text relies heavily on this report.

[15] Public Law 102-228, Sec. 212(b), Dec. 12, 1991. Section 1203 (c) of the Defense Authorization Act of 1993 later added language emphasizing the use of the U.S. private sector. *Congressional Record,* p. H9252, Nov. 10, 1993.

[16] Telefax communication from the office of the Assistant to the Secretary of Defense for Atomic Energy, Apr. 25, 1994.

TABLE 2: Cooperative Threat Reduction Programs by Country: Notifications to Congress and Obligations as of March 1994 ($ millions)

Country	Program	Notifications	Obligations
Belarus			
	Emergency response	5.00	3.70
	Export control	16.26	0.44
	Communications link	2.30	0.30
	Defense contacts	1.50	
	Site restoration	25.00	0.21
	Defense conversion	20.00	0.52
	Propellant elimination	6.00	
	Subtotal	76.06	5.17
Kazakhstan			
	Material control and accounting	5.00	
	Communication link	2.30	0.01
	Export control	2.26	
	Emergency response	5.00	
	Defense contacts	0.40	
	Defense conversion	15.00	
	Strategic arms elimination	70.00	0.11
	Subtotal	99.96	0.12
Russia			
	Emergency response	15.00	11.34
	Armored blankets	5.00	3.24
	Fissile material containers	50.00	42.90
	Railcar conversion	21.50	20.00
	International Science and Technology Center	25.00	1.42
	Material control and accounting	30.00	0.42
	Chemical demilitarization	25.00	0.05
	Pu storage facility design	15.00	14.95
	Export control	2.26	
	Storage facility equipment	75.00	
	Strategic arms elimination	130.00	4.20
	Arctic waste	20.00	7.37
	Defense contacts	9.20	
	Chemical weapon destruction laboratory	30.00	2.66
	Defense conversion	40.00	0.07
	Subtotal	492.96	108.62
Ukraine			
	Science and Technology Center	10.00	
	Material control and accounting	12,50	
	Emergency response	5.00	
	Communication link	2.40	0.01
	Export control	7.26	0.01
	Defense contacts	3.90	
	Strategic arms elimination	185.00	0.16
	Reactor safety	11.00	0.00
	Defense conversion	40.00	
	Subtotal	277.06	0.18
Other			3.35
	Total	946.04	117.44

SOURCE Department of Defense, Office of the Assistant to the Secretary of Defense for Atomic Energy, April 1994

word "feasible" in the authorizing legislation to provide a "guiding tenet" to spend Nunn-Lugar funds in the United States.[17] However, direct assistance would provide more of a boost to stabilize the local economy. Moreover, it would also generate far more good will in the recipient nation, which now sees U.S. funds going mainly to U.S. firms. Finally, in many cases, given the relative costs of goods and services procured in the FSU as opposed to the United States, the cost to the United States for a given project could be substantially cheaper if purchases were made locally.

The entire program of U.S. assistance in the area of dismantling weapons and safeguarding nuclear material in the FSU is known as the Safe and Secure Dismantlement (SSD) program. This program is directed by the Department of State, but funded by the Department of Defense, which is responsible for the details of its implementation.

The chief issues related to the dismantlement effort are whether and how to monitor the dismantlement process, how to monitor the amount and location of the nuclear material removed from weapons, and the ultimate disposition of the weapon plutonium. The United States would like to be sure that the weapons really are dismantled, and that the resulting nuclear material is placed in storage rather than diverted or recycled into other weapons. **The Russians, however, refuse to accept verification of dismantlement in Russia in the absence of reciprocity regarding monitoring and verification of similar dismantlement in the United States.** This matter is being addressed by the agreement between MINATOM and the U.S. Department of Energy, reached on March 16, 1994, which provides for reciprocal inspection of storage and, possibly, dismantlement facilities. However, many specific issues await resolution through discussions between the United States and the Russian governments.

There is also a question of whether the IAEA should have a role in monitoring the dismantlement or storage of the nuclear material from U.S. and Russian weapons. As an international organization, the IAEA might be considered a neutral and trustworthy third party, and therefore a logical partner in helping put into place a major arms control agreement. On the other hand, both the United States and Russia might feel more comfortable dealing only with inspectors from the other party, rather than with an inspectorate drawn from many different countries. Furthermore, the IAEA has experience in nuclear safeguards, not in verifying and monitoring arms control agreements. New expertise and perspectives would have to be attained by this agency for such a regime to work well. More importantly, if some of the stored nuclear material were in its original weapon form, IAEA involvement would give rise to concerns about keeping nuclear weapon design information secret from the inspectors, who might be nationals of would-be proliferant states. Finally, involving the IAEA would also considerably complicate the political issue, requiring a third party in implementation negotiations.

Another cooperative project between the United States and the nuclear inheritor states of the Soviet Union involves the purchase by the United States of 500 tonnes of highly enriched uranium (HEU) to be recovered from dismantled Soviet weapons, which will be diluted to low-enrichment levels and transferred to the United States.'* The Russians and the other inheritor states will receive much needed hard currency

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17 A description of the situation regarding both U.S. Agency for international Development projects and those under Nunn-Lugar (CTR) may be found in J. Fialka, "Helping Ourselves: U.S. Aid to Russia is Quite a Windfall—For U.S. Consultants," *The Wall Street Journal,* Feb. 24, 1994, p. Al.

18 Transfernng this fuel to the United States serves the purpose of getting it out of the FSU and removes the possibility of diversion. The United States preferred this option to having the Russians sell this fuel on the world market because such a large new supply of uranium would disrupt the market and make it more difficult for the United States, with its much higher-cost enrichment facilities, to compete. With this agreement, the United States can exert some control over the entry of this material into the market.

($11.9 billion over 20 years) .19 The distribution of the revenue among the four inheritor states has not yet been finally worked out, but there appears to bean understanding to that effect among the four states, reflected in the decisions by the three non-Russian governments to return all nuclear weapons on their soil to Russia for dismantlement and removal of the HEU. The purchase is meant to be revenue-neutral in the United States: the material would be resold to electric utilities to fuel their power reactors.

Even less tractable than dealing with HEU is the question of ultimate disposition of plutonium. The United States has yet to decide what to do with its own stores of plutonium recovered from weapons, and it is not in a position to urge any particular long-term solution upon the Russians. The United States is, however, helping design and pay for a plutonium storage facility in Russia.

The U.S. Department of Energy, through its newly created Office of Fissile Material Disposition, is currently examining various means of plutonium disposal, ranging from burning the material in various types of reactors to burial after vitrification with high-level nuclear waste. Proliferation resistance is but one of the criteria that will be used to select an ultimate disposition mechanism-others include health, safety, and environmental considerations. Regardless of the approach selected for ultimate disposition of plutonium, the bulk of the plutonium will be placed into storage for at least the next 10 years and probably longer.[20]

Besides the Nunn-Lugar legislation and the HEU purchase agreement, another vehicle for providing funds to the FSU is the FREEDOM Support Act of 1992 (Public Law 102-51 1), with its follow-on authorizing legislation for fiscal year 1994.[21] This law provides for technical and humanitarian assistance through the foreign aid budget to promote reform, democratization, and trade; help attract foreign investment to the FSU; and improve civilian nuclear reactor safety. Although this law does not directly affect DOD funds, it is linked to the Nunn-Lugar legislation: Title V of this act restates the Nunn-Lugar legislation as then pending before the armed services committees. Moreover, section 1441 of the fiscal year 1993 Defense Authorization Act authorizes DOD to participate in joint civilian R&D programs with the FSU states through a non-governmental foundation established by the FREEDOM Support Act.

Section 511 of the FREEDOM Support Act authorizes the establishment of a nongovernmental foundation intended to foster joint research projects between scientists from the United States and republics of the FSU. Unlike the International Science and Technology Center (ISTC), the project is not aimed at weapon scientists, but civilian ones. But like the ISTC, goals include defense conversion, stabilizing the economy of the states of the FSU, and providing R&D opportunities for scientists there. The director of the National Science Foundation is authorized to establish this foundation in consultation with the director of the National Institute of Standards and Technology. Further, within the Nunn-Lugar Amendment, reprogramming of up to $25 million was permitted for this purpose. Until recently, the Defense Department had not moved ahead with this program. However, in April 1994, there were indications

19 Press Release] Inited States Enrichment Corp., Jan. 1 4, 1994. This publicly owned corporation is acting as the "executive agent" for the United States in the transaction. The government intends to privatize it eventually.

20 A number of studies have looked at the dismantlement of nuclear weapons and the disposition of the resulting nuclear materials. See, for example, U.S. Congress, Office of Technology Assessment, *Disbanding the Bomb and Managing the Nuclear Materials*, OTA-O-572 (Washington, DC: U.S. Government Printing Office, September 1993), B. Chow and K. Solomon, *Limiting the Spread of Weapon-Usable Fissile Materials* (Santa Monica, CA: RAND, 1993), and National Academy of Sciences, "Management and Disposition of Excess Weapons Plutonium" (Washington, DC: National Academy Press, 1994).

21 FREEDOM is an acronym for Freedom for Russia and Emerging Eurasian Democracies and Open Markets.

that at least $10 million would be made available, thus starting a new mechanism for providing assistance to FSU scientists.[22]

A final major program of U.S. government scientific and technical cooperation with the FSU is contained in the fiscal year 1994 Foreign Operations Appropriations Act (Public Law 103-87), which appropriates $35 million for partnerships among U.S. industry, universities, Department of Energy (DOE) national laboratories, and major FSU institutes. The purpose of this program—known as the Laboratory-Industry Partnership Program (LIPP)—is to "stabilize the technology base in the cooperating [FSU] states" and "prevent and reduce the proliferation of weapons of mass destruction."

Ten national laboratories proposed joint projects involving themselves, U.S. industry, and U.S. universities, together with partners in the FSU.[23] Private industry is represented by a group of corporations (the membership is still open) called the United States Industry Coalition (USIC). The Department of Energy, working with the Department of State, set up LIPP to select which projects will be funded. The scope of projects is similar to those under Nunn-Lugar funding. At present, funding is only available for fiscal year 1994, and the funding mechanism is highly unusual in that money for DOE projects at DOE laboratories is taken from the Department of State's budget ($5.3 billion in fiscal year 1993), rather than DOE's budget (which, for comparison, was over three times larger than State's, at $17.7 billion in fiscal year 1993).

The LIPP is aimed at commercialization of products in collaboration with the private sector and does not emphasize basic research, presumably since such research is meant to be funded through the International Science and Technology Center. Some current lab-to-lab projects that are focused on basic research, including several run out of Los Alamos and Livermore laboratories, might thus not receive LIPP funding. **This situation could be resolved by providing separate line items in the DOE budget for lab-to-lab projects (selected and run by each laboratory individually) and for the LIPP program, or one line item for joint projects both within LIPP and outside it. The** amount of funding for such possible line items would have to be determined both by the demonstrated need of promising projects (which could be gleaned from the proposals already submitted to the ISTC and to be submitted to LIPP) and by a decision on the general availability of funds for joint research projects with scientists of the FSU.

NONPROLIFERATION EXPORT CONTROLS

Russia

Of all the newly independent republics of the former Soviet Union, only Russia has established a meaningful export control system. Nearly all the Soviet expertise, capability, databases, and other elements essential to export controls remain in Moscow.[24] Since the export control systems in all the republics are only in early stages of creation, the legal bases for these systems lie largely in presidential decrees, not legal statutes, with the exception of a single law passed in late May 1993 by the Russian parliament.[25] The United States has offered all four nuclear inheritor states techni-

22 Science Scope, *Science*, Apr. 29, 1994, p. 647.

23 The U.S. laboratories are Argonne National Laboratory, Brookhaven National Laboratory, Idaho National Engineering Laboratory, Lawrence Berkeley Laboratory, Lawrence Livermore National Laboratory, Los Alamos National Laboratory, Oak Ridge National Laboratory, the National Renewable Energy Laboratory, Pacific Northwest Laboratory, and Sandia National Laboratories.

24 This conclusion can be drawn from statements made by several representatives of former Soviet republics at a symposium on export control, sponsored by the U.S. Department of Energy and held at Airlie House, Warrenton, VA on June 14-16, 1993.

25 This law defines export control violations as criminal acts, punishable by three to eight years in detention.

cal aid in establishing export control systems, consisting of conferences for experts from those countries, training of officials, help in drafting legislation, and the transfer of technical equipment for border controls. These offers were contingent on reaching "umbrella" agreements for the Safe and Secure Dismantlement (SSD) program between the United States and each state. As noted in the previous chapter, the SSD program is designed to help the former Soviet republics dismantle those nuclear weapons to be eliminated under the Russian unilateral initiative of October 1991. By the end of 1993, all four nuclear inheritor states had signed those agreements and several subsidiary implementing accords. The only exception is the implementation agreement with Russia on export control assistance. Corresponding accords in this area have been signed with the other three.

In Russia, the most important presidential decree relating to export controls is Decree 388 (April 11, 1992) creating an interministerial commission to handle approvals for export licenses. Corresponding to U.S. practice, the relevant Russian Ministries (e.g., Defense, Foreign Economic Relations, and Foreign Affairs) participate in decisionmaking. Decisions on granting licenses are based in part on a set of developed lists, which the Russian government claims are consistent with the lists formulated by existing multilateral export control regimes: COCOM guidelines for high-technology conventional weapons,[26] the Nuclear Suppliers Group Guidelines for nuclear dual-use items, and the Australia Group guidelines restricting transfers of chemical and biological materials and equipment. The Russians also claim to adhere to Missile Technology Control Regime guidelines, even though Russia is not formally a member of that regime (see section below on Missile Technology). In summary, the Russian government has a mechanism in place for regulating exports of weapons of mass destruction and means of their delivery, and it has declared that it will comply with international norms in this area. However, the Russian system does not yet have an adequate legislative basis.

Even with an adequate set of export control laws, however, there is still the matter of implementation. Under the Soviet Union, the flow of goods had been controlled by highly intrusive and restrictive border police actions, and more directly by the fact that foreign trade was a state monopoly and that all major vendors were state owned. Customs services, as they are known in Western countries, did not really exist. Since the dissolution of the Soviet empire, the role of the border police in controlling flows of commodities and people has become considerably less draconian. At the same time, corruption has increased in all segments of society, including border control personnel. It is therefore essential for Russia to establish, train, motivate, and equip an effective customs service that is both competent and resistant to corruptibility. This latter requirement is difficult, given the current parlous state of economic affairs.

Other Newly Independent States

In Ukraine, Belarus, and Kazakhstan, the state of export controls is considerably more rudimentary than in Russia. Presidential decrees have set up governmental commissions to make policy and handle export licenses. Belarus and Kazakhstan apparently intend to follow the Russian model closely. The Minsk Accord on CIS Export Control Coordination, seeking to coordinate policies, facilitate communication, and establish common elements of an export control regime, was agreed to by Belarus, Kazakhstan, and Russia plus five other republics of the FSU (but not including Ukraine) on June 26, 1992. On February 9, 1993, these three states and three other CIS republics agreed to cooperate on controlling exports of items that could be used for weapons of mass destruction. On August 10, 1993, an agreement to

26 COCOM stands for the Coordinating Committee on Export Controls, an informal association of Western nations originally created to control the spread of Western high technology to the Eastern bloc. With the end of the Cold War, COCOM expired on Mar. 31, 1994.

deepen economic integration among Belarus, Russia, and Ukraine was reached in Moscow. The Belarusian government reportedly continues to advocate a single customs control system among the three countries.[27] Some level of coordination of export control systems among at least these nuclear inheritor participants is highly likely. All three republics plan to use export control lists similar to those indicated by Russian policymakers.

In Belarus, export licenses had been required since 1991 under Soviet law, and they continue to be required after independence. Licenses are controlled by the parliamentary Committee on Foreign Economic Relations. In August 1992, the Committee promulgated a decree that set procedures for obtaining export licenses for dual-use, advanced weapon technologies and for nuclear weapon-related items. The decree requires that importing countries be politically stable, that they have no known clandestine programs for developing weapons of mass destruction, and that they allow end-use inspections on the goods exported—criteria that are intended to be consistent with multilateral nonproliferation export control regimes. License decisions are made by the appropriate government agency (e.g., the Ministry of Defense for items related to conventional arms) and an export commission. Lists of controlled items are being developed in all areas, including dual-use technologies and nuclear, biological, chemical, missile, and advanced conventional weapon systems. The Belarusian government has asked for advice from the United States, Germany, Poland, and Sweden as well as from Russia on formulating laws and procedures for export control systems, and it intends to present a proposed law to parliament by the end of summer 1994. If adopted, it would be the first law of this kind passed by a parliament in any of the newly independent states of the FSU.

In Kazakhstan, a January 1992 presidential decree set the basis for an export-import licensing system. In the nuclear area, export control decisions apparently rest with the Atomic Energy Agency, the Ministry of Foreign Relations, and an export control committee. Licenses are provided by the Ministry of Foreign Economic Relations. The government has asked for help from Russia in setting up the rest of its system. It is interested in close export control coordination with Russia and other members of the Commonwealth of Independent States. Kazakhstan has not progressed very far beyond these initial steps.

In Ukraine, political instability provides an additional impediment to rapid establishment of controls and policies. A detailed export control list has been started, but has still not been completed. In January 1993, a presidential decree established an export control commission with representatives from six government agencies. The commission, chaired by the Deputy Prime Minister, is a consultative body. It has an attached, larger working group of about 40 technically qualified personnel. The commission's decisions can be overruled by the Cabinet.

Recently, Major General Volodymyr I. Tsimbalyuk was appointed as head of the Expert Technical Committee that advises the Ukrainian parliamentary consultative commission on export control. Earlier, General Tsimbalyuk had been Deputy Head of Armaments in the Ministry of Defense.[28] His appointment indicated that the Ukrainian export control system is likely to adopt policies that reflect Defense Ministry views and presumably will support arms exports.

In March 1993, a preliminary, incomplete list of items controlled for export was developed, including the usual categories of items (e.g., those included in the various international export con-

27 Radio Minsk, Aug. 11, 1993, FBIS-SOV-93-154, Aug. 12, 1993.

28 William potter, Director, Center for Russian and Eurasian Studies, Monterey Institute of International Studies, personal communication, January 1994.

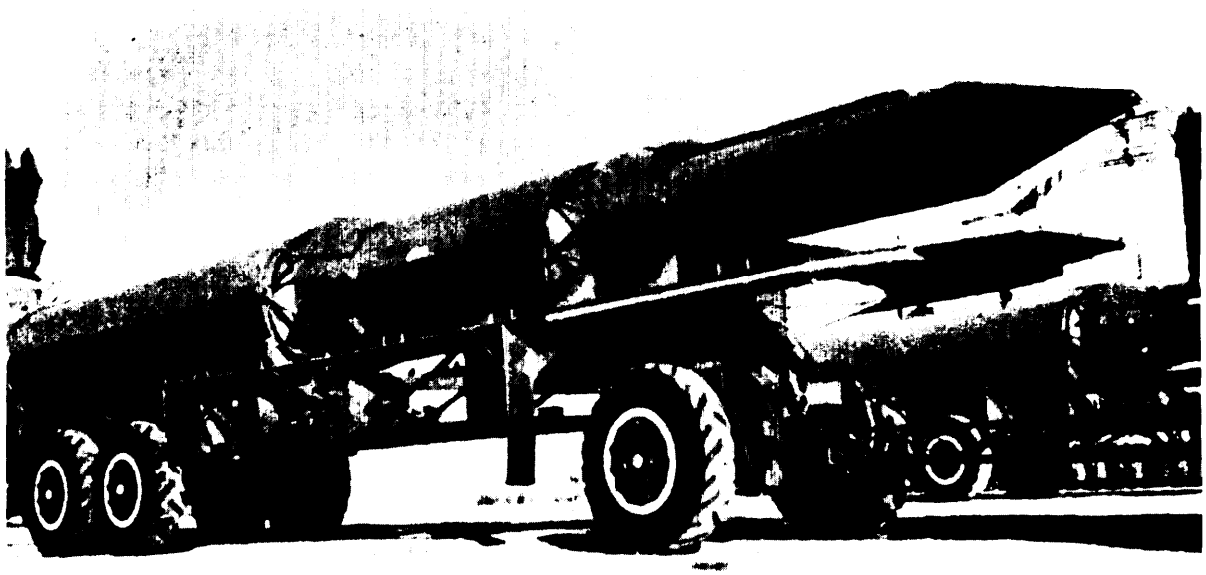
trol regimes mentioned above), plus strategic raw materials. Only two organizations (both governmental) are currently able even to apply for licenses to export items on the list. When an export control system is in place, it is likely that more organizations will be allowed to apply for licenses. Ukraine has asked for international help in setting up its system because of its lack of expertise.

In conclusion, outside Russia, export control systems in the FSU are, at best, emerging. Moreover, implementation is an even worse problem in the non-Russian states than it is in Russia, due to lack of expertise.

MISSILE TECHNOLOGY

Equipment or technology transfers from the former Soviet Union could promote the proliferation of systems to deliver weapons of mass destruction, in addition to fostering the spread of the weapons themselves. For example, Russia and Ukraine have well-developed missile systems and production facilities that, in some categories, are the most advanced in the world. They also possess extremely able rocket scientists and engineers.

Several recent events typify worries about this category of proliferation. The first, and best known, is the Russian-Indian agreement, concluded in 1992, which would have transferred cryogenic propellant technology and a number of liquid-fueled rockets from Russia to India. The agreement would have provided Russia with hundreds of millions of dollars. The United States interpreted this sale as violating the Missile Technology Control Regime (MTCR) by transferring proscribed technologies. Some Russians apparently also believed the sale violated the MTCR.[29] Russia, while not a member of the MTCR, had pledged to abide by its terms. More-



DEPARTMENT OF DEFENSE

The Soviet SS-13 intercontinental ballistic missile, capable of delivering a nuclear warhead over 5,000 miles.

29 See commentary by Sergey Goryachev on the agreement between the United States and Russia to modify the accord on rocket assistance to India on Moscow Ostankino Television, 1700 GMT, July 19, 1993: "For a year Russian spokesmen persistently argued that the contract with India did not contravene international rules. It is fortunate that in the end common sense got the upper hand..." This, and other articles in FBIS-SOV-93-137, July, 20, 1993, show a division of opinion in Russia on the outcome of the affair. Those sympathetic to the government's eventual decision to modify the agreement with India argued that it was, after all, in Russia's own interest m help prevent the spread of long-range missile technology that could have strategic implications.

over, U.S. law requires the imposition of sanctions for transfers that violate MTCR restrictions, even when the state involved had not agreed to abide by the MTCR.

The United States did not strongly object to the sale of the rockets themselves, but for several months it had pressured Russia to limit sharply the associated transfer of technology. U.S. efforts finally succeeded on July 17, 1993, when Russia agreed to modify its accord with India unilaterally, giving up a substantial part of its envisioned profits. Under the revised agreement, the Russians would transfer the missiles and engines, but not the technology and production facilities.[30] Apparently in return, the United States is inviting Russia to compete in the U.S. space launch market, and it is attempting to arrange a marriage between the Soviet/Russian MIR space station and the projected United States space station *Freedom,* being built in conjunction with Europe and Japan. This collaboration was later formalized in the accords reached by Vice President Gore and Russian Prime Minister Chernomyrdin during the former's trip to Moscow, in December 1993. Russia has also renewed its pledge to adhere to the MTCR. Given the Indian deal, the United States may be expected to monitor such adherence closely.

The second incident involves not Russia, but Ukraine. Last May, the *London* Observer reported British intelligence claims that Iran had purchased eight SS-N-22 "Sunburn" supersonic cruise missiles from Ukraine for deployment at the mouth of the Persian Gulf. Within a short time, the Ukrainian Ministry of Foreign Affairs denied the reports. However, a report in *Defense Week,* several months later, indirectly cited U.S. Navy sources in support of the allegations.[31] At this writing, it is unclear what the truth of the matter is.

"BRAIN DRAIN"

Scientists, engineers, and technicians who had worked in Soviet programs to develop and produce weapons of mass destruction could pose a significant proliferation risk if they sold their services or supplied vital information or technology to proliferant states seeking such weapons. The greater the economic stresses facing these workers, the more dangerous this threat becomes. Given the lack of analogous civilian applications, those working on nuclear weapons or ballistic missiles probably offer the greatest concerns. Chemical and biological weapon scientists might also be useful to a proliferant, but their skills also have more obvious civilian utility.

As is the case with smuggling nuclear materials, the unsuccessful attempts to smuggle missile expertise are more visible than the successful ones. One such case showed that this problem is not purely hypothetical. In December, 1992, over 50 Russian rocket scientists from the leading Makeyev Design Bureau were arrested at Moscow's Sheremetyevo Airport en route to North Korea, where they had been offered astronomical (to the Russians) salaries. The fact that the individuals had all been granted the necessary visas, and that they were apprehended just as they were

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[30] Several articles giving different Russian perspectives on the agreement with the United States on this issue are M. Ponomarev, "Moscow Yields to Unconcealed Pressure, " *Krasnaya Zvezda,* July 21, 1993; and commentaries on Moscow Mayak Radio, July 18, 1993 and on Moscow Radio, Moscow World Service, July 20, 1993, all three from FBIS, SOV-93-138, July 21, 1993; and V. Nadein, "First Serious Dispute Between Russia and the United States Ends in Beneficial Compromise," *Isvestiya,* July 20, 1993, from FBIS-SOV-93-137, July 20, 1993.

[31] See *Defense Week,* Oct. 4, 1993, The article claimed that an American defense contractor had been offered the same missiles in 1991, and had turned them down in a botched bargaining ploy. The same arms dealer reported that the Iranians had later told him of their purchase; he further claimed that U.S. Navy intelligence sources confirmed deployment of these missiles on the ground in Iran, although they were designed as sea- or air-launched cruise missiles.

about to leave, gives rise to some suspicion that the whole event may have been a "sting" operation.[32] In spite of the fact that the arrest has a positive aspect, reinforcing the belief that Russian authorities are alert to foreign efforts to recruit or corrupt their specialists, there is also a negative aspect: the event demonstrates an active, advanced effort by a state to gain technologies controlled by an international nonproliferation regime. Previously, there had only been rumors and vague statements by Russian officials that such efforts were being made, notably to gain nuclear information.

One potential solution to this "brain drain" problem being pursued with support from the United States and other countries is to provide weapon scientists and engineers with meaningful opportunities outside the realm of developing weapons of mass destruction. This would reduce any incentive that might exist for them to help proliferant states and at the same time permit Russia (where most of these professionals now live) to retain its valuable stock of human capital. This issue and some of the options available to address it are further discussed in chapter 6.

32 A long article on the episode, including interviews with several of the scientists, appeared in Moscow *News*, Apr. 2, 1993, from FBIS, JPRS-TND-93-013, May 10, 1993.

Part III: The Individual Nuclear Inheritor States

The following chapters examine each of the nuclear inheritor republics in turn, discussing their backgrounds, the nuclear material on the territory of each, and the unique problems each poses. The discussion focuses on nuclear proliferation. Each chapter presents findings and a series of options for U.S. policy makers regarding the individual state.

OVERVIEW

At a Lisbon conference in 1992, Russia, Ukraine, Belarus, and Kazakhstan, with the concurrence of the United States, designated themselves as the successor states to the former Soviet Union for the purposes of the START I arms reduction agreement that the United States and the Soviet Union had signed prior to the Soviet Union's demise in December 1991. Those four new republics had strategic nuclear weapons on their territory when the Soviet Union ceased to exist and are referred to in this report as nuclear inheritor states.[1] The great majority of these weapons are in Russia. Relatively few remain in Belarus (54 warheads on SS-25 missiles); about 1,400 are in Kazakhstan, and about 1,400 remain in Ukraine, mostly on intercontinental missiles but some deployed on cruise missiles. In a protocol signed at the Lisbon Conference on May 23, 1992, Ukraine, Belarus, and Kazakhstan agreed to accede to the Non-Proliferation Treaty (NPT) as non-nuclear-weapon states within the shortest possible time. Table 3 shows the number and type of strategic nuclear weapons on the

"Significant advances have been made over the past two years in arranging programs of assistance to the inheritor states."

[1] Some additional republics arising from the former Soviet Union had tactical nuclear weapons (short-range missiles, field artillery shells, nuclear mines, etc.) on their territories in December 1991, but by July 1992, all those weapons had been relocated to Russia.

TABLE 3: Strategic Nuclear Weapons on the Territories of the Nuclear Inheritor States

Country	Intercontinental missiles	Cruise missiles and gravity bombs
Belarus	Maximum (since MOU) was 81 SS-25s; now 54 (all single warhead missiles).	—
Kazakhstan	104 SS-18s (1 ,040 warheads) at MOU; now 92 missiles (920 warheads). All 1,040 warheads still in Kazakhstan.	370 air-launched cruise missiles (bombers returned to Russia, missiles and warheads still in Kazakhstan).
Russia	1,064 ICBMS with 4,278 warheads at MOU. Now 844-1112 ICBMS with 4,010-4,276 warheads. 940 SLBMS with 2,804 warheads at MOU; now 780-864 SLBMS with 2,640-2,728 warheads.	176+ at MOU; now 459.
Ukraine	176 ICBMS at MOU (130 SS-19s and 46 SS-24s). Now 126 (110 SS-19s and about 16 SS-24s). 1,240 warheads at MOU, now about 818.	324 declared in MOU; now 564. All probably in storage.

NOTE: Numbers are either as of START I memorandum of understanding (MOU) of September 1990, which provided declarations of numbers, or as of May 1994 Cruise missiles **and gravity bombs are tabulated according to the counting rules in the START I treaty, under which a single weapon can represent** more than one actual warhead

ICBM = Intercontinental Ballistic Missile; MOU = Memorandum of Understandmg; SLBM = Submarine-Launched Ballistic Missile.

SOURCES Carnegie Endowment for International Peace and the Monterey Institute of International Studies, May 1994

territory of each, according to a recent analysis by nongovernmental experts.

If the four nuclear inheritor states are to reassure the rest of the world that their custody over nuclear material is adequate, they need to improve their export control systems and establish effective safeguards over nuclear materials. Further, the states need to stabilize their economic, social, and political situations and establish cohesive social structures that would lessen the temptations to sell sensitive information, technology, or nuclear material.

The United States has a strong interest in helping these states address their problems. However, **there are clearly limitations on what external forces may accomplish.** In particular, for countries such as Russia and Ukraine, internal difficulties are so great and complex that U.S. efforts to improve the overall situation there may be expected to succeed only at the margins. As one example, converting defense to civilian production is proving difficult enough for the United States to accomplish at home. In the former Soviet Union (FSU), the problem is far more complicated. Not only had a far larger share of the economy there been devoted to defense, but converting it to civil production will require simultaneously reconstructing the nation's social, political, and economic infrastructure.

Nevertheless, the United States can make an important contribution in providing advice, targeted assistance, training programs, and political discussions. Indeed, **significant advances have been made over the past two years in arranging programs of assistance to the inheritor states.** The Safe and Secure Dismantlement program, for example, has made considerable progress helping control and protect nuclear materials and offering nonmilitary opportunities to former nuclear weapon scientists. Its extension to the area of defense conversion shows an awareness of the importance of this problem in stabilizing the economic situations in the nuclear inheritor states.

United States diplomacy has had a remarkable series of successes in obtaining ratifications of the two principal arms control agreements of concern to nuclear proliferation in the FSU: START I and

TABLE 4: Status of Ratification of the Non-Proliferation Treaty (NPT) and START I

Date	Belarus	Kazakhstan	Ukraine
February 1993	Neither	START	Neither
February 1994	NPT, START	NPT, START	START

SOURCE Office of Technology Assessment, 1994

the Non-Proliferation Treaty. In February 1993, Russia was the only nuclear inheritor state to have reaffirmed the ratifications of these treaties, and its ratification of START I was conditional on each of the other three states ratifying both. One year later, what had appeared to be a difficult problem was well on the way to solution (table 4); of the three non-Russian nuclear inheritor states of the Soviet Union, only Ukraine's ratification of the NPT remains, and this may be accomplished soon.