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Retooling Russia's Nuclear Cities

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Seven years after the breakup of the Soviet Union, the vast nuclear weapons complex Russia inherited is teetering on the brink of economic collapse.

The continuing economic crisis in Russia and the Russian government's empty coffers worsen the situation in the 10 "nuclear cities," which house three-quarters of a million people and remain fenced off from the outside world. The economic meltdown in these cities increases the risks of theft of nuclear materials or that experts will provide their knowledge to help Third World nuclear-weapons programs.

Moreover, the gigantic size of Russia's nuclear complex means that Russia could still produce new nuclear weapons at Cold War rates that no other country could match, should political and economic circumstances radically change.

In short, the United States has several urgent reasons to collaborate with Russia on the economic stabilization and downsizing of its nuclear complex—a downsizing that is also in Russia's interests.

Patriotism and empty pockets

While residents of the "closed cities" once received the best of everything the Soviet Union had to offer, they have shared the pain but not the benefits of reform. With the post-Cold War collapse of state orders for nuclear weapons, budgets have been slashed. Wages are far below what is needed to maintain workers' previous standard of living, and they are paid months late. Desperate to keep their people paid, the facilities have taken out high-interest loans from Russian banks, but have no means to repay them.

In late 1996, Vladimir Nechai, director of Chelyabinsk-70, one of Russia's two nuclear weapons design centers, killed himself. A suicide note reportedly said that Nechai could no longer watch his life's work fall apart; he was ashamed to face the people at his center who had not been paid for five months.

The situation today, unfortunately, is much the same. Last February, Viktor Mikhailov, then head of the Ministry of Atomic Energy (Minatom), reported in a press conference that 1997 had been the worst year ever for financing the nuclear complex; it had received only half the money promised in the budget.

By spring, many at the key nuclear weapons institutes were more desperate than ever. They had not been paid in more than seven months and had used up what was left from the flush years of the Cold War. On July 23, thousands of workers at Russia's premier nuclear weapons lab—Arzamas-16—went on strike, protesting the government's failure to provide the institute's promised funds.

Only the intense pride and patriotism of Russian nuclear experts has prevented a proliferation catastrophe. At a time when virtually everything else in Russia is for sale on the black market, there is an increasing risk that the barrier of security and discipline protecting Russia's nuclear materials will erode.

Fortunately, there is some hope for improvement. Russia recognizes that it no longer needs and can no longer afford such a giant nuclear weapons complex. Some fissile material production facilities have already been redirected to commercial work. In his February press conference, Mikhailov announced that three major facilities, including two of the four plants used for the assembly and disassembly of nuclear weapons, will be completely out of military work by the year 2000.

Also, the nuclear cities themselves, long totally controlled from Moscow, are working on their own to shift to new lines of work, using tax incentives to draw new businesses and to create special

funds to finance the startup of new private enterprises.

The reform effort received a boost last March, when Vice President Albert Gore and then-Prime Minister Viktor Chernomyrdin announced a "Nuclear Cities Initiative" to promote conversion in Russia's nuclear cities. The initiative came, in significant part, in response to the recommendations of the Russian-American Nuclear Security Advisory Council (ransac), in which three of us—Bunn, Luongo, and von Hippel—participate along with Russian colleagues, including Evgeniy Avrorin, Nechai's successor.

Federico Pena, then U.S. secretary of energy, and Russia's new minister of atomic energy, Evgeniy Adamov, quickly followed up the Gore-Chernomyrdin announcement with a joint statement outlining the basics of the new approach. In a government-to-government meeting on the new initiative in Washington on July 9, the two sides established an interagency task force to move the effort forward, and they began discussing funding of specific projects.

On July 24, Gore and Russia's new prime minister, Sergei Kirienko, endorsed the new initiative and announced their intention to start several major projects in the nuclear cities during the remainder of the year.

Achieving the goals of the Nuclear Cities Initiative, however, will require an integrated, comprehensive strategy, including both private-sector development and concrete steps to address the post-Cold War nuclear challenges Russia faces.

Some of the tens of thousands of excess nuclear scientists and workers should be redirected to the tasks of nonproliferation, arms control, management and disposition of surplus fissile materials, and environmental cleanup. There are opportunities for increased U.S.-Russian cooperation in each of these areas. But for the majority of the residents of the nuclear cities, the creation of private-sector jobs is the only long-term answer.

The cities

Built between the late 1940s and the early 1960s, Russia's Cold War nuclear weapons complex was even more oversized than its huge U.S. analog. The biggest facilities are located in the 10 nuclear cities, although other nuclear weapons-related institutes are scattered throughout Russia—including Moscow. Of the roughly 730,000 people who live in the closed cities, some 130,000 actually work in the key nuclear facilities. The cities are:

- Arzamas-16 and Chelyabinsk-70, where the weapons-design laboratories are located. (Arzamas-16 also has a warhead-production plant.)
- Penza-19, Sverdlovsk-45, and Zlatoust-36, which contain warhead-production plants.
- Krasnoyarsk-26, Krasnoyarsk-45, Tomsk-7, Chelyabinsk-65, and Sverdlovsk-44, where highly enriched uranium and plutonium were produced.

These names are taken from post office box numbers in nearby "open" cities -- in Soviet times the very existence of the nuclear cities was secret. The cities now have real names, but they are still commonly known by their "box" numbers. Even today, the nuclear cities and large surrounding areas are enclosed by double fences, with the perimeters patrolled by armed guards of the Ministry of Internal Affairs. Access is restricted and controlled by the Federal Security Service.

The nuclear facilities inside the cities lie within even more tightly controlled security zones. At Krasnoyarsk-26, where the madness of the Cold War reached a peak, the plutonium production complex, including three reactors, is located 600 feet beneath a mountain. That way, it could continue to produce plutonium even after a nuclear war had laid waste to the surface.

Controlled access and armed troops once protected the nuclear installations from foreign spies and sabotage. Today, they help limit the influence of criminal organizations, which have become ubiquitous elsewhere in Russia. But isolation also insulates the cities from important changes in Russia, including many of the opportunities arising from economic reform.

New realities

Even before the collapse of the Soviet Union in 1991, state orders for nuclear weapons began to decline and the nuclear weapons missions of the nuclear cities began to change. For example, the fissile-material production facilities are no longer needed to produce new materials for bombs; now they must provide secure storage for and disposal of excess weapons materials.

Warhead production facilities are now mostly devoted to dismantling nuclear warheads, but their

workload will decline as work on the 10-20,000 nuclear weapons retired in the early 1990s is completed. Meanwhile, the weapons design institutes are trying to maintain the continuing safety and reliability of Russia's reduced arsenal. But all these tasks require many fewer workers than were employed during the Cold War.

In his February press conference, Mikhailov said that the registered unemployment rate in Russia's nuclear cities averaged about 3.5 percent in 1997. But Russia's State Statistics Committee estimates that the real unemployment rate in Russia is at least three times the official figure. Beyond that is the real morale-shattering problem of the nuclear cities, underemployment.

At two nuclear weapons institutes located in Moscow, two-thirds of the staff have reportedly left for better-paid jobs. The staff of the main weapons institutes at Arzamas-16 and Chelyabinsk-70 could shrink by a similar fraction if other employment opportunities were available to their workers.

But very little alternative employment is available in the nuclear cities and most people do not have enough money to buy apartments in "open" cities such as Moscow, where jobs can be found. Fearful of a social explosion, the institute directors avoid layoffs and try to stretch the available funds to support their entire staff, which means that salaries are both insufficient and intermittent for almost everyone. In the absence of consolidation, the risk increases that the long-feared nuclear leakage may finally begin.

Each of the nuclear cities is unique and faces a somewhat different situation. The fissile-material production centers in Sverdlovsk-44, Krasnoyarsk-45, Tomsk-7, and Chelyabinsk-65 are generally less desperate because they have substantial income from blending down highly enriched uranium for the U.S.-Russian uranium purchase agreement, as well as from foreign contracts for commercial nuclear services.

The warhead assembly/disassembly cities are probably in desperate straits, but they are considered particularly sensitive by Russia's security services and are closed to virtually all interactions with non-Russian entities.

Krasnoyarsk-26 is no longer paid for the weapons-grade plutonium it continues to produce from the production reactor, which is still needed to provide heat and power to the city's residents. It, along with Arzamas-16 and Chelyabinsk-70, should be targeted by the Nuclear Cities Initiative along with the nuclear weapons assembly/disassembly cities, if access to them becomes possible.

Self-Help

The city governments of the nuclear cities and the facilities themselves are desperately struggling to find new sources of income to keep their communities afloat. They have mounted a number of conversion projects on their own and there have been a few glimmers of success.

A large plant that produces video and audio tape for BASF, a German-based multinational, has been built in Krasnoyarsk-45, financed in part by the sale of low-enriched uranium; a Korean firm recently announced a \$43 million investment in diamond-cutting capabilities at Arzamas-16; Intel, a U.S. firm, has a contract with scientists at Arzamas-16 to work on software related to new computer chips; and in May, Microsoft's chief technology officer, Nathan Myhrvold, led a mission to some of the closed cities, prospecting for opportunities for low-cost software development.

Some nuclear cities also have exploited a break in the Russian tax law. In Russia, most taxes go to the federal government, with only a small part remaining with city governments. In contrast, closed cities are allowed to keep virtually all the tax receipts collected within their boundaries—a provision that was designed to help them through these hard times.

The cities have used this provision to create "investment zones" where businesses that register within the city get a substantial tax break, even if their operations are located elsewhere. But the tax break expires at the end of the year, and with the central government under pressure from the International Monetary Fund to collect more taxes, prospects for its renewal are not bright.

Arzamas-16 took advantage of the provision by having companies registered within its investment zone pay a fraction of their tax savings into funds to finance the startup of new private businesses, municipal infrastructure, and police protection.

Managers of the new-business start-up fund assert that its books are transparent, that all lending decisions are made on the basis of carefully reviewed business plans, and that none of the money goes to the nuclear facility. More than a hundred businesses have registered in the Arzamas-16 investment zone. As a result, the city government is in far better financial shape than

the nuclear facility.

Overall, however, few conversion efforts have been successful. The nuclear cities may have many outstanding scientists and engineers, but few have business experience. Moreover, the obstacles to investment in the closed cities are great-tight restrictions on access, limited information about capabilities, remote locations, and significant political risks.

To have any hope of creating enough alternative employment for the large number of people no longer needed for weapons work, a concerted effort needs to be made to create a more investment-friendly environment. This will require the Russian government, the U.S. government, and the private sector to work closely together.

Foreign Help

The United States and other countries have launched a variety of cooperative nuclear programs with Russia, which now represent a small but important source of income for the nuclear cities. (In meetings in Moscow in May 1997, the directors of Arzamas-16 and Chelyabinsk-70 told us that in 1996 these programs provided their two institutes with seven and nine percent of their budgets, respectively.) The two broad areas of cooperation are:

Securing and reducing nuclear materials stockpiles. By far the biggest source of income for Russia's nuclear complex from U.S. programs is the uranium purchase agreement. This arrangement reduces stocks of weapons-usable material, provides a valuable commercial product to the United States, provides hard currency for Russia, and gives an economic incentive to continued dismantling of nuclear weapons—all at virtually no net cost to the U.S. taxpayer, because the purchase price is recouped by selling the blended-down material on the commercial market.

The annual income from this deal is hundreds of millions of dollars, although how much finds its way to the facilities doing the work—rather than being spent on other projects by the central government or by Minatom headquarters—is not publicly known.

The next most important program in this category is the Material Protection, Control, and Accounting program, under which U.S. and Russian experts cooperate to install systems to insure that all the plutonium and highly enriched uranium in Russia is secure and accounted for. Progress in this effort is accelerating rapidly, with a 1998 budget of \$137 million. In 1997, \$10-20 million of the program's funds were spent in the nuclear cities on labor and equipment; this year the amount will be greater. However, funding is scheduled to decline after 1999.

The U.S. Defense Department, under the Nunn-Lugar program, is also funding construction of a secure storage facility for weapons-grade material at Chelyabinsk-65, with some of the money spent on labor and materials procured in that city.

In the next few years, hundreds of workers could be put to work in the U.S.-Russian program to convert the three operating plutonium production reactors at Tomsk-7 and Krasnoyarsk-26 so they generate heat and power without producing separated plutonium as a now-unwanted byproduct. And, should the G-7 countries provide the financing, the disposition of Russia's excess weapons plutonium could become a major new mission for a few of the plutonium cities.

Civilian research and development. The International Science and Technology Center was established in Moscow in 1992 by the United States, the European Union, and Japan to underwrite civilian research by scientists who formerly worked on the development of weapons of mass destruction. Currently, the center's expenditures in the nuclear cities total about \$10 million annually and support about a thousand scientists there, primarily at Arzamas-16 and Chelyabinsk-70.

The Industrial Partnership Program—now called Initiatives for Proliferation Prevention—was established within the U.S. Energy Department in 1994 to use experts at its national labs to facilitate joint ventures between U.S. companies and technical institutes in the former Soviet Union.

Funding for fiscal year 1998 totals \$30 million, but only a small fraction is being spent in the closed cities—principally in Arzamas-16 and Chelyabinsk-70—and the Clinton administration's 1999 budget request to Congress for this initiative was only \$15 million.

The Defense Enterprise Fund—now called the Global Partners Venture—was established by the Defense Department to invest in defense conversion in the former Soviet Union. Since 1994 it has received a total of \$71 million in Nunn-Lugar funds, which are now fully committed.

Its only project in the closed cities is a joint effort with the Industrial Partnership Program to develop a business plan for a proposed \$200 million plant in Krasnoyarsk-26, which would produce purified silicon for the Russian electronics industry and for export abroad. The project has received political and financial backing from the government of the Krasnoyarsk region, but it still needs to find a strategic partner and investor.

A Strategy for Change

The United States and Russia need to mount a more focused and multifaceted program that would more directly help Russia restructure its nuclear weapons complex. The Nuclear Cities Initiative announced by Gore and Chernomyrdin in March should be structured around a coordinated plan, with new funding for targeted initiatives in four key areas: nonproliferation and arms reduction, nuclear cleanup technology, private sector development, and downsizing.

Such a strategy would require resources. In June, two senators—Pete Domenici, a Republican from New Mexico, and Joseph Biden, a Democrat from Delaware—attached an amendment to the Energy and Water appropriations bill setting aside \$45 million for efforts to promote conversion in Russia's nuclear cities—\$15 million in additional funding for Energy's Industrial Partnership Program, and \$30 million for the Nuclear Cities Initiative itself.

At the Bulletin's deadline in late July, however, it was uncertain how much of this funding would survive the House-Senate conference on the bill.

Nonproliferation and arms reduction. At an April workshop in Moscow with senior Minatom officials and leaders of the Russian nuclear labs, we worked out a broad agenda of potential cooperative work relating to nuclear nonproliferation and arms reduction. The work would range from improving export controls to reconciling the differences between U.S. and Russian nuclear secrecy requirements, which impede cooperation.

Weapons laboratories in the United States have already shifted hundreds of weapons experts to specialized centers or divisions focused on nonproliferation and arms reduction programs, providing a broad range of technical support for U.S. policy-makers and for international organizations such as the International Atomic Energy Agency.

For example, when a U.S. company requests a license for a nuclear-related export, the request is sent to the U.S. national labs, which analyze it against databases of sensitive technologies involved in nuclear weapons programs and recipients of concern. At present, the Russian government does not have a comparable database system to help it make export decisions—but it would be very much in the U.S. interest for Russia to have such a system.

A central goal of increased cooperation should be to help build up centers of expertise at the Russian labs to provide similar support to the Russian government. Initial U.S. government support of such centers would have to be coupled to products of direct interest to the United States. Over time, however, as the Russian labs succeed in demonstrating the importance of these capabilities and Russia's economy improves, the Russian government should become the principal customer.

As a first step, the United States should underwrite fellowships for experts from Russian institutes to visit national laboratories and universities that work on nonproliferation and arms control. The fellows would gain insight into how the national laboratories operate in these areas, and while visiting universities they could learn how non-governmental analysts contribute to policy-making. Princeton University and Sandia National Laboratory are cooperating in a pilot effort by hosting two scientists from Chelyabinsk-70 during the 1998-99 academic year.

To initiate these efforts, we recommend that \$10 million of the 1999 budget of the Energy Department's Office of Nonproliferation and National Security be set aside for expanding these cooperative nonproliferation and arms reduction programs.

Nuclear cleanup technology. Nuclear cleanup is another key area of common interest. The nuclear complexes in both countries—particularly the plutonium production facilities face contamination problems that will cost hundreds of billions of dollars to address.

The United States spends roughly \$300 million per year developing new cleanup technologies. A small portion of this research and development effort should be contracted to Russian experts.

While U.S. laboratory or commercial experts, fully loaded with benefits and overhead, can cost the U.S. government \$250,000 per year, the cost of a senior Russian scientist is in the range of \$10,000 per year. Further, contaminated Russian facilities can be used as test-beds for new

cleanup technology. This would be a "win-win-win" scenario, in which the United States would get technology developed at far lower cost; Russian nuclear experts would get interesting and useful jobs; and Russia would be able to use the technology developed to help clean up its complex as well.

There is already a small U.S.-Russian program, which has spent about \$10 million cumulatively since 1992 in this area—although little of it has gone to the nuclear cities. We recommend that this effort be substantially expanded. As a first step, it would make sense to set aside roughly \$5-10 million of 1999 funding for the development of nuclear cleanup technology. That would put 500-1,000 Russian experts to work.

Private sector development. While high-tech research and development funded by the International Science and Technology Center and Industrial Partnership Program is important, it is not enough. Neither of these programs has yet succeeded in fostering the establishment of a single self-sustaining commercial enterprise employing a significant number of people in a nuclear city.

In any case, the bulk of future private sector employment in these cities will not necessarily be high-tech. Small businesses—most of them low-tech—have provided one of the few bright spots in Russia's largely stalled economy. By some estimates, small business employment in Russia had grown from 6.6 million in 1994 to 13 million—or 13 percent of Russia's workforce—by 1997.

Russian nuclear-city officials estimate that some 30,000 jobs need to be created in the nuclear cities over the next few years to employ excess nuclear workers, and that a combination of public and private investment totalling almost \$1 billion might be necessary. (In fact, the number of new jobs needed may be even larger. Some experts estimate that two-thirds of the entire workforce at the nuclear facilities—more than 80,000 people—ultimately will not be retained.)

During discussions in July, city and Minatom officials proposed a joint program involving \$100 million each from the U.S. and Russian governments. The program would be designed to leverage several times that amount in private investment.

What is needed now is for both governments, working closely with the private sector, to flesh out the reality behind these preliminary estimates. Both governments should finance some initial projects—after expert review by people in firms with experience in private business, not just by government officials and laboratory scientists.

The private sector will have to be front and center in any such initiative. As Senators Biden and Richard Lugar, a Republican from Indiana, recently suggested, the administration should use the power of persuasion to pull together a high-level private-sector team that could assess the capabilities and potential opportunities in the nuclear cities, identify promising projects, and make recommendations for steps that governments could take to foster investment and reduce barriers to private-sector growth.

In short, the primary role of the U.S. and Russian governments in the Nuclear Cities Initiative would be to facilitate efforts by the private sector. This will require a range of steps that go well beyond research and development. The governments will have to work together—ideally in concert with other governments and international financial institutions, such as the World Bank and the European Bank for Reconstruction and Development (EBRD)—to break down the barriers to, and provide incentives for, private investment. If done properly, a little bilateral and multilateral money could leverage a lot of private investment.

Meanwhile, Russia's central and local governments need to create an enterprise-friendly climate in the nuclear cities, providing information, clarifying tax and property-rights issues, cutting through the legal tangles for possible investors, and—where necessary—negotiating new legislation.

The central and local governments should, for instance, provide information concerning the expertise and infrastructure available and the businesses already in place in each nuclear city, to help interested businesses know where they might look to invest.

They should also loosen restrictions on physical access. Some projects have already been able to negotiate multiple-entry permits, so that 45-day advance notice is no longer required every time a foreign participant needs to visit a facility in a nuclear city.

Over time, however, the nuclear cities will have to become more open, with the perimeter security around the individual nuclear facilities becoming the principal line of defense, rather than a fence around the entire city. Local law enforcement will have to be beefed up to help limit

the penetration of organized crime.

On a broader level, international financial institutions should help stimulate private-sector growth by providing money for:

- Market research, feasibility studies, and preparation of business plans.
- Investment missions to bring business executives to the closed cities to explore possible investment opportunities, and other assistance in making connections with potential investors.
- Equity investment funds and revolving credit lines to provide the initial capital to start up new businesses, and loan guarantees and political risk insurance to reduce the risks faced by private investors.

This complex program cannot be implemented through occasional visits. In-depth, on-the-ground training by Russian speakers with experience doing business in Russia needs to be provided to give people in the nuclear cities the tools they need to translate their ideas and energy into successful businesses.

A business assistance team is needed in each targeted nuclear city. Each team should include a project manager, an investment officer, a scientist or engineer with experience in industry, a business development consultant with significant work experience in Russia, and a lawyer with experience in international and Russian corporate law.

It would also make sense to establish permanent business training centers to help foster the creation of new businesses, and to provide consulting services to help those businesses overcome problems as they arise.

Multilateral institutions such as the World Bank's International Finance Corporation and the EBRD could sponsor such teams and business centers. They are chartered by the international community to promote private-sector growth and have demonstrated track records of doing so, including hundreds of millions of dollars in investments and in financing for investments within Russia.

These institutions have already created regional business centers in other parts of the former Soviet Union. With sufficient support from the United States and other governments, they could also establish a small investment fund to help provide initial start-up capital for new enterprises in the nuclear cities.

We estimate the total cost of funding business assistance teams and business centers in three nuclear cities for two years at about \$20 million. The U.S. government should set aside roughly \$10 million of its 1999 funding for economic assistance in Russia for activities in the nuclear cities. It should also direct the U.S. Overseas Private Investment Corporation (OPIC) and encourage the World Bank Group to make loan guarantees and political risk insurance available for investments. And it should also direct OPIC and other agencies to organize investment and trade missions to the closed cities.

Downsizing the complex. These initiatives may make it possible to shrink Russia's nuclear weapons complex from its Cold War size while employing the tens of thousands of workers the complex no longer needs. Doing so is in Russia's interest, because a smaller complex would be more efficient and sustainable in meeting Russia's post-Cold War requirements. And it is certainly in the U.S. interest to insure that nuclear arms reductions could not be rapidly reversed.

In the past, Minatom has sought to maintain its gigantic empire. Now, however, its officials recognize that a major downsizing is needed, and they are asking for more information on how the United States is consolidating its complex.

This discussion has begun at the "lab-to-lab" level, where it has been established in recent years that productive exchanges can occur on the most sensitive topics. The goal of the dialogue should be to help Minatom develop a feasible plan to downsize the Russian complex to a level that matches its new missions and is sustainable.

Molding all of these disparate initiatives—from nonproliferation and cleanup cooperation, to private-sector development, to complex downsizing—into a coherent, effective, and sustained restructuring will require high-level leadership in both Russia and the United States. Success is not assured.

On the Russian side, Minatom's Adamov has appointed an energetic and capable adviser for the Nuclear Cities Initiative, reporting directly to him. Making U.S. support for this effort effective will

require strong leadership from a similar high-level, full-time central coordinator, and sustained support from the White House. Serious business expertise should be brought to bear on the business-promotion task, something that has not yet been done.

Making the Nuclear Cities Initiative work will also require sustained investment by both governments. If they are preserved in conference, the funds set aside by Senators Domenici and Biden would be enough to make a substantial start on the monumental task of shrinking the Russian nuclear weapons complex and redirecting its workers to productive civilian tasks. But these funds would need to be combined with other U.S. government resources such as opic guarantees and Energy Department environmental technology development funding, matched by Russian government support.

High Stakes

The effort proposed here could make a genuine difference in key areas and demonstrate the U.S. commitment to easing Russia's transition. To sustain support both in the U.S. Congress and in Russia, however, it is absolutely crucial to achieve some tangible successes in the first 12-18 months.

The nonproliferation stakes could hardly be higher. Nothing the United States does to build improved security systems for fissile material is likely to be enough if workers with access to that material and the guards who run the security systems continue to go unpaid for months at a time, and the economies of the nuclear cities continue to collapse around them.

And nothing else the United States can do to prevent nuclear proliferation will be enough if the essential ingredients of nuclear bombs—and the expertise needed to make them—become available on a nuclear black market.

After the funeral of Vladimir Nechai, Grigory Yavlinsky, the leader of the liberal Yabloko party, wrote in the New York Times: "At the funeral, I could not look at these people without compassion. Here was the pride of Russian science; here were the physicists of world stature, dressed in their threadbare jackets and faded shirts with frayed cuffs."

Did Moscow not understand, Yavlinsky asked, "how dangerous it is to drive people who hold the nuclear arsenal in their hands to this state?" The same question could be asked of Washington.