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FOR PEACE AND SECURITY

ADVENTURES IN
NUCLEAR RISKS REDUCTION

Cooperation in a Closed Nuclear City

James W. Toevs | April 2023

Jerome Hines, the basso profundo whose 41-year career with the Metropolitan Opera was the longest of any principal singer, sang with our large church choir in the Christmas 1992 performance of Handel's Messiah. During a break in a rehearsal, several of us were talking with him, and somehow the conversation turned to the Cuban Missile Crisis.

He told us that during the crisis, he was singing with the Bolshoi Theatre in Moscow in the role of Boris Godunov in Mussorgsky's opera of the same name. Godunov was a giant at a little over six feet seven. Hines was six feet six, and they had him in three-inch elevator shoes to make him even more impressive on stage. Nikita Khrushchev attended a performance, after which he went backstage to meet Hines.

Khrushchev, only five feet three, looked up and said through the interpreter, "Wow, you are very tall!" Hines replied, "Mr. Khrushchev, I am only an average-sized Californian." "Then we must be very careful," Khrushchev said. Looking Hines closely in the eye, he added, "Please tell your president that we will not go to war with you over these missiles in Cuba." The "red phone" did not yet exist, but somehow Hines was able to place a call through to the White House to convey the message. It was, for a musician, a rather auspicious start in Track 2 nuclear diplomacy during one of history's most dangerous moments.

Hines's story reminded me of a lecture by sociology professor Alex Garber at the University of Colorado. Garber urged us to not work to dispense with the system of nuclear deterrence, at least not yet. Deterrence was working—World War III had not broken out—and it was buying time for "redefinition of the enemy." Sociologically, he said, there are three main definitions: annihilative, instrumental, and agonistic.[1] Garber's thesis was that nuclear deterrence buys time for evolving our relationships to view one another in successively less threatening terms, moving toward an agonistic or even cooperative relationship, reducing the threat of catastrophic war.

Nuclear deterrence alone cannot work forever but only in concert with two more dynamics to reduce the nuclear danger. First, opposing governments must choose to enter into dialogue to figure out how to fight the Cold War and avoid turning it hot by accident. Second, governments and nongovernmental organizations must provide opportunities to bring together people from both countries, so we learn to see one another in less threatening, more agonistic terms.

All these thoughts were with me during my first trip to Russia in November 1992, where, sitting in the Moscow Circus, I was surrounded by families enjoying the circus and each other's company. I felt very comfortable because this was like home. The main differences were that the families spoke a Slavic language, and their children were much better behaved than ours.

Doomed to Cooperate

Of course, nuclear deterrence did not end with the Cold War. The weapons still exist. But the relationship evolved, as the US and Russian governments turned toward collaboration among nuclear weapons scientists, with a number of programs addressing various aspects of nuclear cooperation. Along with the concrete objectives of these programs, the intangible objective of getting to know and respect each other as people is very important and a constant theme in relationship building throughout this paper.

Lev Dmitrievich Ryabev, formerly the first deputy minister of atomic energy of the Russian Federation with responsibility for

the entire Russian nuclear weapons complex, described why cooperation was essential: "We arrived in the nuclear century all in one boat—a movement by anyone will affect everyone. . .. [Russian and American nuclear weapons scientists] were doomed to work on these things together, which pushed us toward cooperation."[2] At his suggestion, that vivid metaphor became the title for *Doomed to Cooperate*, a collection of papers from Russian and US authors that summarize the years of bilateral cooperation.[3]

Communication during these projects gave rise to some surprising opportunities. The following example occurred while I was the project leader for the Los Alamos National Laboratory (LANL) effort in the disposition of excess weapons grade plutonium. In 1995, I led a small US team for a technical exchange to describe the low waste stream method we had developed at LANL for disassembling nuclear weapon "pits," the spheres of plutonium inside warheads that are surrounded by chemical high explosive which is detonated to compress the plutonium, initiating the nuclear explosion. The US Department of Energy (DOE) program office gave us permission to show this method to Russians from the Bochvar Institute for Non-Organic Materials and the All-Russian Research Institute for Experimental Physics (VNIIEF).[4]

Vladimir Yuferev of VNIIEF, whom we knew from the first of the cooperative programs, approached me and asked, "Would you work with us to validate that our protocols and procedures for disassembling nuclear weapons are safe and reliable?" I answered, "Of course, we would be happy to work with you on such a project, but why do you need our participation?" He replied: "Presently, we in the nuclear institutes are not held in high esteem by either the government or the people. In Russia, we must have well-established procedures for any work we do repeatedly with nuclear weapons and materials. Of course we have long had such procedures for assembling nuclear weapons, but we need new procedures for disassembling the weapons, and your validation would be of great help. Disassembling a weapon is not just the reverse of assembly; for example, *how do you undo glue*?"

As it turns out, both the United States and Russia had bonded high explosive directly to the pit. We had discovered that dimethyl sulfoxide (DMSO), used for arthritis and other applications, was an excellent solvent for high explosive, rather than having some poor soul trying to carefully remove the explosive with a hammer and chisel. We had heard of the Russians' issue from other sources as well, so we arranged to present a paper on DMSO late one day in a joint meeting of the Warhead Safety and Security Exchange program. The next morning, our Russian colleagues thanked us, saying, "This is indeed a gift."

My thinking about US–Russian interactions developed further during those years. Working on the Nuclear Cities Initiative in Sarov, home of Russia's Los Alamos, my opposite number and I crystalized these thoughts into four essential principles for cooperation.

The Nuclear Cities Initiative

After the dissolution of the Soviet Union, the ruble was in free fall, and people working at the nuclear weapons institute were not paid for months at a time. This situation gave rise to a great concern in the United States that Russian nuclear weapons scientists—no longer needed or paid to support weapons design and development—might work for or sell their knowledge to rogue nations wishing to acquire nuclear weapons. Keeping those scientists gainfully employed became an urgent challenge.

The Russian-American Nuclear Security Council (RANSEC) responded to this challenge in 1997 by developing the outline of the Nuclear Cities Initiative (NCI), a defense conversion program whose objectives included converting nuclear weapons facilities to civilian work and helping to find nondefense work for scientists and engineers. But RANSEC was a nongovernmental organization. It had limited ability to promote the program in the US government and with Russia.

Meanwhile, as he prepared to step down from the directorship of LANL that year, Sig Hecker wanted to return to his field of plutonium metallurgy.[5] He had learned that the metallurgical experts in Russia were located at the Bochvar Institute in Moscow. He wished to explore whether there was information that could be shared on basic science regarding the extremely complex metallurgy of plutonium. Knowing that I had worked with the Bochvar Institute on plutonium disposition, he asked if I could arrange an invitation for him to visit the institute. I said that I knew Mikhail Solonin, the Bochvar director, and could arrange for the visit and asked if he would like me to accompany him to make introductions. He said he would. We went to Russia, and after the meeting, Hecker asked me to work with him on other initiatives he wanted to develop in US-Russian cooperation. NCI was one of the first of these. Hecker and I worked from 1998 to 2002 to develop NCI projects.

In late 1997 and early 1998, we traveled to several closed cities in Russia. The 10 closed nuclear cities had been a state within a state. The workers in general were not allowed to travel outside Russia and were limited in their travel even within Russia. On the other hand, they had the best of everything, including food, appliances, and no waiting in long lines. But with the end of the Cold War, the good times had passed. The scientists and other nuclear workers in the closed cities went months at a time without a paycheck.

In Sarov, we asked our counterparts, "On a scale of 1 to 10, how is the morale?" The answer was minus 5. In Snezhinsk, we met with Evgeny Avrorin. He became director of the All-Russian Institute for Technical Physics (VNIITF), their equivalent of Lawrence Livermore National Laboratory, when his predecessor, Vladimir Nechai, took his own life out of guilt and shame that he could not feed his people. Avrorin, Ryabev, and VNIIEF director Rady Ilkaev were three of the most visionary people we had the pleasure of working with. Avrorin asked us to not be too generous in funding the NCI defense conversion projects, but instead asked us to show them how things work in the West. They wanted skills and

Academician Yuri Trutnev (left) and Sig Hecker with the aeroshell of Tsar Bomba in the VNIIEF Nuclear Weapons Museum. All photos courtesy of James Toevs

self-sufficiency, not just a handout. Our efforts were appreciated. Several older Russians commented that "once again you are shoulder to shoulder with us," a reference to World War II. Academician Yuri Trutnev, who, with Andrei Sakharov, was one of the designers of "Tsar Bomba"—the largest nuclear weapon ever tested,[6] told us, "The very fact that you are here with us in these difficult times is even more important than the funds you bring."

To implement a joint program on nuclear matters with a nuclear adversary raises many concerns about potential risk to loss of information and for negative impact on national security. It is essential that people in both countries buy in to the importance and value of the program from the top down: government leadership, leaders in the laboratories and institutes that will be involved, divisions, groups, and the individuals who will do the day-to-day technical work on the project. This vertical integration and buy-in brings organizational and individual support that is essential for the success of the overall program and individual projects.

During our work to implement the NCI program, an important issue arose between the US and Russian governments. VNIIEF had purchased sixteen IBM 6000 computers and were using them for parallel processing computations for nuclear weapons design. This violated US export law, and Congress threatened to terminate cooperative programs with Russia until this was resolved. Victor Reis was the assistant secretary of energy for defense programs. A counterpart to Ryabev, Reis had responsibility for the US nuclear weapons complex. He was working on the IBM computer issue and not making progress. Reis asked us to take him to Sarov to meet with VNIIEF director Ilkaev. We did, and he still got nowhere. He threw up his hands and asked Sig Hecker to figure this out. Back in Moscow at the end of the trip, Reis set up a lunch to introduce us to Ryabev, which became and remains a very valuable relationship. On our return to Los Alamos, we thought further about the computer issue, and Hecker had a superb idea. We could ask VNIIEF to bring the computers out of the classified area and into the "open" part of the city. Together we would use the fledgling Nuclear Cities Initiative program to build an Open Computer Center around the computers and find foreign customers to create jobs using the outstanding skills of the VNIIEF scientists. We knew they were good because they competed successfully with us during the Cold War with grossly inferior computer technology. We had massive computers that allowed us to "brute force" complex computations, while their computers were far more limited, so the algorithms they developed had to be superior.

The VNIIEF personnel were using the IBM computers for parallel processing to solve difficult mathematical problems. The Russian economy, however, was in such disarray that no firm in Russia could afford to hire VNIIEF software engineers. We realized that we would have to help them develop contracts with foreign companies. Intel Corp. was the first company to develop such a partnership in Sarov.

At the time, Ernest Moniz was the US under secretary of energy, and Rose Gottemoeller was director of the DOE Office of Nonproliferation and National Security. Moniz and Gottemoeller were in-country when we arrived in Russia in late October 1998, to work on the issue. They had reached agreement with Ryabev on the IBM computers and that the Sarov Open Computer Center (SOCC) would be the first project under the Nuclear Cities Initiative. Rose asked how much money was needed to make this happen and I asked for $3 million. She agreed. This turned out to be 60 percent of the $5 million total budget for NCI's first year. Our trip to Sarov went well, and I returned with a small team a few months later to initiate project development.

The Sberbank Building, home of the SOCC.

Beginning the Real Work of NCI and Defense Conversion

It's not easy getting to Sarov.

The trip begins in Moscow with an overnight ride on the Moskva–Bereshchino train, which begins as an electric train, ends up as a diesel, and is reassembled several times during the night. In those days, one fairly long stop at 10 PM was in Gus-Khrustalny, home of the Gus Crystal Factory. The economy was so poor that the factory had neither customers nor income, so it paid workers in product. A large group gathered each evening when the train arrived and offered their goods to the passengers in a free-form auction. The last leg, from Bereshchino to Sarov, is not available to the public. Cabins in these two cars must be reserved by VNIIEF.

After trying to sleep the night on a very narrow bed, travelers arrive at Sarov city limits. They are loaded into vans, where security personnel identify them, check them off the list, and confiscate their passports. It is a daunting experience for first-time visitors from the United States. Sarov is an entirely closed city, like Los Alamos was until 1957. The van proceeds through three layers of security fences with guards and checkpoints at each layer. Finally, travelers arrive at the Centralnaya Gostinitza, or Central Hotel, to have a chance to clean up before breakfast. The hotel is clean but spartan. The sink is a faucet with a long arm in the bathtub. A central steam plant provides heat for the city. Small outside windows in the room are an essential element for temperature control. On arrival at the hotel, travelers' laptop computers and transmitting electronic devices are collected and stored in the hotel safe under supervision of security personnel.

Five of us made that initial journey to Sarov, drawing personnel from diverse technology areas at LANL and a colleague from Lawrence Livermore National Laboratory. Our team was capable of organizing, implementing, and advising on the many different projects that were developed with our Sarov colleagues. Jim Jefferis, a LANL contracts officer, was a critically important member of our team. He cared greatly for the cooperative programs with Russian nuclear weapons institutes. He had configured and carried with him a two-wheel cart with laptop, printer, and two reams of printer paper with which he could write contracts in real time anywhere in Russia.

After breakfast we walked from the hotel past the homes of Nobel laureate Andrei Sakharov and academician Yuri Trutnev to the conference room in the House of Scientists, where the real project work began. We had experienced very pleasant interactions with leadership in the Russian government and at the weapons institutes but did not know how the people who designed and built the Russian nuclear stockpile would react to meeting the enemy. Our concerns were unfounded. Their opening comment was, "We know you! You are just like us!" We quickly found that we were operating under Alex Garber's agonistic definition of the enemy. We were honored as equal competitors, each working in our own countries to maintain nuclear deterrence. I mentioned that our US weapons scientists all felt that if a nuclear weapon on which we had worked was ever used in anger, then we had failed. Our Russian colleagues said, "We all felt the same way." Perhaps there is deeper truth behind Lev Ryabev's comment: we were "doomed to cooperate" because we had already been doomed to compete.

Introductions were made, and we began the work of defining projects and developing contracts. My opposite number was Vladimir Rogachev, the VNIIEF deputy director for international relations. I became good friends with Rogachev and his deputy, Alexey Golubev. In addition, we were fortunate to have as the Sarov contracts administrator Sergei Badin, a young fellow who immediately grasped the intricacies of our contract procedures. These people and most of the international relations staff spoke English well, however, our immediate counterparts who did the technical work spoke little English. My team and I spoke no Russian. All verbal communication was with the help of interpreters.

To aid them, we soon learned to think ahead and structure our sentences with simple syntax and not use a five-syllable word when two or three syllables would suffice. In general, the interpreters were not technically trained, but fortunately there are many cognates in technical language—for example, *computer* is *komputer*—and the scientists on both sides could help the interpreters out with the technical language.

The Russians had determined that the fifth floor of the new multistory Sberbank Building in Sarov would be dedicated to the Sarov Open Computing Center, the initial project under NCI. The fifth

Sergei Badin (left) and Jim Jefferis (right) signing initial contracts for the Sarov Open Computing Center. Vladimir Rogachev is standing next to Badin.

floor was basically an empty shell. The first task was to turn this floor into useable space appropriate for computer electronics and software development.

A number of issues arose, many of which came from our Russian colleagues' total lack of experience with Western business practices. It was easy enough to discuss and explain these issues, but the conversations went down surprising rabbit holes. At one point, we noted how the US government determined salary ranges for people with different job descriptions.

> "But we need to pay higher salaries for people to work in the SOCC," replied a Russian colleague.
>
> "Our hands are tied because the salary scales are set by the US State Department and the DOE. But you may specify overhead at local rates," we responded.
>
> "What is overhead?" asked our counterpart.
>
> "Things like administrative costs, utilities, and the like. How much does it cost to keep the lights on?" we said.
>
> "Well, the electricity is free."

Some issues were more difficult, requiring flexibility and creativity. In a scenario that repeated several times during the week, our contracts expert Jim Jefferis brought me aside.

> **Jefferis:** "Jim, you need to tell Rogachev that he needs a cigarette and go for a walk with him to figure out how to fix this problem."
>
> **Toevs:** "What's the problem?"
>
> **Jefferis:** "DOE pays in arrears after the work has been completed. But the companies here in Russia are on such a short string that they must be paid in advance for construction materials, electrical wiring, and the like."
>
> **Toevs:** "So how do we get around this?"
>
> **Jefferis:** "Well, the Russians have already completed the design and layout for the construction work on the second floor. So when the contract is signed we can pay them immediately for the completed design and layout. You and Rogachev have to come to agreement on what fraction of the total contract is for the second floor design and layout. And the right answer is 72 percent."

So Rogachev and I went for a walk on this pleasant summer day in Sarov. Somehow, when we returned, we had found the right answer that allowed the contract to be placed and work to begin. Back in the states, we met with DOE legal counsel and explained the problem. They were very supportive of NCI objectives and found us a more straightforward workaround.

Four Principles for Working Together

As our NCI efforts in Sarov proceeded, Rogachev and I developed a set of four principles for working together that served us well.

Maintain Purity of Objectives

Purity means clarity as well as acceptance that the other side's objectives may—and in many cases, must be—different than your own.

We saw this with the objectives for the SOCC. For Congress, which funded all the cooperative programs, the defense conversion metric for the SOCC was how many nuclear secrets were not given to Iran or another rogue state because of the jobs created. It was an impossible metric. To use it, we would have to know how many nuclear weapons scientists left VNIIEF and weapons work. This made sense in principle but was difficult to measure. Director Ilkaev wanted the SOCC to be a window to the West, opening career opportunities for as many of his scientists as possible. He encouraged all who participated in the SOCC to learn English, with which one can do business anywhere in the world. However, entrepreneurial projects, especially those involving foreign partnerships, had a fairly low probability of long-term success. Understanding this, few people would cut their ties completely with VNIIEF. The difference in US and Russian objectives as reflected by their metrics is an example of the need for clarity of objectives.[7]

In addition to the SOCC, defense conversion projects in Sarov involved conversion of weapons production space to larger industrial projects and helping to supply infrastructure to enable such conversion. A second site in Sarov was the Avangard Electromechanical Plant, a serial production facility analogous to the US Pantex Plant. Converting a site like that was a straightforward metric for Congress.

One day Ryabev and I were discussing the Avangard project, and he indicated on a map the buildings and spaces that would be made available to NCI for conversion. He said, "Unfortunately these spaces are on the side of the Avangard plant farthest away from the open part of Sarov," meaning the residential and market part of the closed city. "But as you know from looking at your satellite photos, there is a road from the open part that passes the side of the Avangard plant and goes directly to this back gate." It was a glancing remark about US national technical means and tacit recognition about where at Avangard they were continuing classified work. I smiled when Ryabev said this because indeed the week before the trip I had gone into LANL intelligence facilities and looked at the photos.[8] Later, Avangard director Yuri Zavalishin told me that the conversion included some 500,000 square feet of industrial space, about 40 percent of the working area of Avangard—a significant conversion indeed. With NCI funding, the work to restore and convert the space took place in 1999 and 2000. The converted space was named the Sarov Technopark. With clarity of objectives, it also included fences and security technology to protect the remaining classified Avangard work from the civilian work of the Technopark.

Find the Proper Balance

Balance means that both sides will benefit from a particular effort. Neither side will get everything it wants. Compromise that leaves both parties happy will contribute to further cooperation in future projects.

To achieve compromise with good balance required an understanding of the differences between a high-context society like Russia and a low-context society such as the United States. After several hundred years under the tsars and 75 under the Soviets in which initiative could be a "punishable offense," relationships in Russia are highly nuanced and crucially important to developing cooperative work. Meanwhile, in the low-context US culture, there can be a spirit of rugged individualism, and we also have the protection of contract law. To be aware of these cultural differences in context was very important to the success of this cooperative initiative.

In the high-context Russian culture, individuals are complex, with many qualities both good and not so good, as well as weaknesses and strengths. The monument marking Nikita Krushchev's tomb in the Novodevichy Cemetery is an example of Russian thinking about an important leader. It includes a bust of Krushchev behind which is white marble on one side, signifying the good things he accomplished, and black marble on the other side for efforts that did not work out so well. Similarly, at the 80th anniversary celebration of Andrei Sakharov's birth, our colleagues spoke highly of him as a scientist but felt he had been co-opted into the activism for which he won the Nobel Peace Prize. In contrast, in a low-context US culture, there can be a tendency to see people as binary and one dimensional—even in our Westerns the good cowboys have white hats and the bad have black hats. We had to be sensitive to these differences in viewing one another as we developed relationships in Russia.

We knew that great importance is attached to doing things a "right way" in a high-context culture like Russia. As an example, Hecker and I visited the Institute of Physics and Power Engineering in Obninsk and met with the director and his deputies. The director asked if the media could be present. Hecker said yes, although we wanted to discuss the new Nuclear Cities Initiative, which was just under development. We preferred to not have the media present during that discussion. The director suggested that as the first topic after lunch.

Returning before the others after lunch, I saw a woman who had not been present that morning. We could not communicate, but she said "gazetta," so I knew she was from the local newspaper. Others returned, and two or three of the Russians were missing. The director could have asked the woman to leave for the discussion, but instead he said, "My remaining associates and I all speak English, so let's give our interpreter a break and send him to the coffee shop during this discussion." The woman said through the interpreter that she would not understand a word of the discussion, so she joined the interpreter in the coffee shop. This was a "right way" because no feelings were hurt.

We also had to learn about group dynamics in high-context societies. Inclusion and protection are essential for all those within the group: family, organization, team, etc. This inclusivity was reflected in the development of several projects in which the Russian side wanted to bid 8 to 10 people for a job that required one or two. We explained that the foreign partner company would not react well to that. To have many people each spending only a few hours a week would not result in an efficient, productive effort. "But we can't leave these people out," they replied.

At the same time, we learned the dynamics are often exclusionary. It can be very difficult for outsiders to join the group, and this can extend even to large organizations. VNIIEF and Avangard are both in Sarov yet rarely interacted or did any work together. Historically, the Russian government established VNIIEF as the first weapon design laboratory. Then, as weapon assembly was required, the production people were spun off from VNIIEF to create Avangard. They were no longer part of the VNIIEF team. As Valery Punin, director of experimental sciences at VNIIEF explained to us, "If I drive my car past VNIIEF to go to Avangard, my people see my car and ask, 'Why are you giving those people projects and funds when we need the projects and funds here?'" The negative relationship between VNIIEF and Avangard became an issue in developing projects that needed the different capabilities of both organizations.

Another lesson was that sometimes someone very much an outsider can help. We initiated an NCI project that required VNIIEF brainpower and Avangard facilities and manufacturing capability. The project teams were formed in the two organizations, and they had their joint plan of action. But nothing happened. So on my next visit I asked for a joint meeting with the two project teams. Opening comments produced a discussion that quickly turned into a rapid-fire donnybrook.

The cacophony was too much for our two interpreters, who said, "We cannot possibly interpret all that is being said." "That's all right," I responded. "This is a very important discussion that they need to have." After 15 minutes or so there was a lull in the conversation. I asked, "Is it my turn?" A little embarrassed to have had such a heated discussion in front of an outsider, they agreed that it was my turn. I said, "It is clear that my presence helped to facilitate this very important discussion among your teams. You must invite me back often."

Our Russian counterparts learned that business problems with foreign partners can arise when the inclusion of all members of a team leads to decision making by consensus, which can take a long time. Once, a partner company sent an email to its SOCC partner group with an urgent question. Two weeks later, I received an email from the company, upset because it had received no response. I talked with the SOCC group and explained that they needed to respond immediately to such a request, which drew blank stares. Finally, I realized that this is not how they work, and their "right way" meant they were not being responsive to their customer. I returned to the group and explained that the partner

company viewed them as their experts in this area and was relying on their response when an urgent question arose. They had to find a new "right way" to give a single individual the authority and responsibility for rapid customer response. I helped them understand that without immediate response they were at risk of losing the customer and the contract.

3. Proceed Step by Step

Proceeding carefully with small, balanced steps contributes to the development of personal and professional relationships, leading to trust that allows even greater ventures into cooperation. When we began work with the SOCC on the NCI conversion projects, they were relatively straightforward and agreed on by all. As time progressed, the list of projects grew. The projects became more intricate and complex, as did the relationships.

One day in Sarov, one of the international relations protocol officers said, "Jim, you must have supernatural powers." Curious, I asked, "Why do you say this?" "Because when other Americans ask to visit Sarov and list four or five people with whom they wish to meet, the security head says, 'No. He can meet this one but he doesn't need to see the others.' When you come with a list of 10 to 12 people, the security head says, 'Oh sure—he can talk with all of them.'" This seemed like evidence that the relationships were coming along well.

Eleanor Melamed, the very fine DOE program manager for the NCI, began each season by working out the overall NCI budget and determining the funding for each of the three cities in which the program was active. She then passed the Sarov information to me to work with Vladimir Rogachev and our Russian colleagues to define and develop projects and recommend funding. Our recommendations were usually accepted without question, which contributed strongly to the positive atmosphere in Sarov, because our colleagues knew that we truly were working together.

One year we had a long list of joint projects. I proposed that we divide the funding among the three or four top projects that both sides wanted to do so that these few would be funded with a "critical mass," that is, enough money to give them a chance to succeed. Rogachev immediately said they would prefer to put a small amount of funds in each of the projects on the long list because they were not allowed to work with us on projects that had no NCI funding. We took this argument back to NCI and they agreed we could do this. In this case, the difference in objectives was easily resolved.

The next visit to Sarov began our work on that long list. Our team of five or six from LANL walked into a conference room in which 19 Russians were seated on the opposite side of the table. I quickly realized that I knew them all. I addressed Vladimir Rogachev by his familiar name, "Volodya, would you allow me to introduce your colleagues to my team?" A little uncertain, he said, "Well, okay." So I began introducing each by name and the project or function they had, hopefully demonstrating the depth of my investment in NCI in Sarov—and, I have to admit, with a bit of ego as motivation because in a sense I was showing off. I had introduced successfully the first 18 when the door opened and number 20 walked in and sat down against the wall because the seats at the table were filled. I thought, "Oh, s - - t!" I introduced number 19 and stopped. Rogachev pointed to number 20 and asked, "What about him?" I walked over to number 20 and said, "Friend, I know that you have responsibility for providing internet service to all of Sarov, but I cannot remember your name!" He kindly said, "that's alright," and the Russians, well aware of my purpose, chuckled gently at my discomfort. And until my last day, I shall remember the name Yakov Vladimirov.

Soon, the NCI program was ready to expand beyond Sarov and the other two original NCI cities.[8] To do so required a step-by-step approach that showed the value of relationships. The Washington program office wanted to pursue work in the closed city of Zarechny in the Penza Oblast, code name Penza-19. It is the home of Production Association START (PA START), a serial production facility like Avangard.

The NCI people were concerned about how to begin. One told me, "We want to begin discussions with Penza-19 but we can't even find the director's name and are afraid that it is classified." I said, "It may or may not be classified, but his name is Andrey Anatolievich Yesin." Mouths fell open. "How do you know that?" "Because I have met him and described the NCI program to him."

How did I meet Yesin? Knowing of NCI interest in Penza-19, and having heard that VNIIEF director Rady Ilkaev was good friends with the director of PA START, I had told Ilkaev of the DOE interest and asked if he had any suggestions about how we might start a dialogue with the PA START director. He said, "The next time you visit Sarov I will invite him here, telling him that there is an American I want to meet him."

During my next trip, Yesin and I were provided a small conference room. The only VNIIEF person in the room was the usual security fellow taking notes to report to the Federal Security Service in Moscow about the topics of the conversation. Yesin expressed interest in making contact with the US oil and gas industry. They had equipment and facilities, like very long bed lathes, that might be useful. One member of our team was an oil and gas expert with good contacts, so between us we were able to get Yesin to the United States to meet the leading oil and gas service providers and the Washington NCI program manager.

4. Develop Mutual Trust

Developing relationships engenders mutual trust that can enable many positive interactions to help reduce the nuclear danger.

Throughout our work in Sarov, we established mutual trust at many levels with our Russian colleagues. The US Department of Commerce (DOC) trip to Sarov regarding the IBM 6000 computers in the SOCC provides good examples of trust at different levels.

The DOC had an obligation to Congress to verify that the computers had been removed from weapons work and were indeed in the

SOCC. In addition, Commerce needed to verify that export control rules were being followed in SOCC projects. To accomplish both objectives, Amanda DeBusk, assistant secretary for export control, and her "chief cop" for enforcement, Mark Menefee, wanted to visit Sarov with a small entourage.

When such a visit was being discussed, Rogachev took me aside and said, "We are concerned about giving permissions for the visit by the US Department of Commerce personnel. We know you and Sig, and we trust you. But we are concerned that the government people may find something we are doing wrong and just shut down all our programs with the US—programs that are very important to us." I responded that Sig Hecker and I had met with DeBusk and Menefee to discuss NCI, the SOCC, and a visit to Sarov. One of the questions we raised during that meeting was just that: What if you and your team department officials find something wrong, in terms of export controls, in how the Russians are handling the work at the SOCC? Or what if there is an issue, for example, in how they are separating the work in the SOCC from weapons work at VNIIEF?

DeBusk said the DOC believed that these programs were very important for both countries. She noted that if they found issues, they would address them and suggest how our Russian counterparts might modify procedures to come into compliance. The objective of their trip to Sarov was not to find a way to shut projects down but to help the projects move forward. I emphasized to Rogachev that we believed the DOC people were sincere and asked him to proceed with the visit permission.

The trip went forward in March 1999. Hecker and I arrived in Sarov on a Monday along with Dale Nielsen of Lawrence Livermore. Nielsen was an excellent colleague who was working with people in the SOCC on nondefense multiprocessor computations. He and I were to examine the 16 computers and verify that they were in the now-completed SOCC in the Sberbank Building. Except the permission for us to do so had not arrived from Moscow.

The DOC entourage arrived Tuesday morning. At breakfast we got word from Director Rady Ilkaev's office that Nielsen and I would see the computers that afternoon. Menefee heard the news and asked Dale and me to join him in a quiet corner of the restaurant. He said, "Raise your right hands" and said some mumbo jumbo, after which I asked, "Mark, did you just deputize us as DOC export enforcement agents?" "Yes, I did," he said. I held out my hand and asked, "Then where are our badges?" He responded, "You won't need badges for this. We need you to examine the computers and verify their identity by their serial numbers, comparing with the serial numbers listed on the original IBM sales contract, and write us a report that we can take back to Congress."

We inspected the computers, and all was well. But I had no computer on which to write the report. Rogachev's deputy Alexey Golubev said, "Jim, sit here at my desk and use my computer to write the report." And he left me alone with his computer. It was an incredible display of the trust we had built. Neither LANL nor any other US national weapons lab would ever have allowed us to offer the use of our lab computer to a Russian. I wrote and printed the report. With that, our short career as export agents ended.

The next day, Wednesday, we visited the Sberbank Building and the SOCC with the DOC entourage. They randomly approached people working at their computers and asked a variety of questions about how they did their work and what connection their SOCC work had with VNIIEF. The workers' answers showed they were appropriately sensitive to export control issues.

During the tour I quietly asked a favor of Rogachev and he said, "Yes, that might be possible." So I found Hecker and said, "If you can herd the rest of the entourage to a far corner of the building, I think the security people will let me walk Amanda and Mark to the room with the computers and let them look in the door." Hecker said, "I can do that," and he did. I took Amanda and Mark to the room in which the 16 computers were lined up in a row in front of a window and told them, "These are the computers Dale and I inspected yesterday. Note that even though they are so critical to US–Russian cooperation, they are now old and so far behind current technology that their only use is as a window bench." This simple act allowed Commerce to tell Congress that in addition to the inspection that Dale and I performed, they personally saw the computers in the SOCC, which is in the commercial/residential area of Sarov, no longer in the VNIIEF nuclear weapons institute. As a result of this visit, the DOC issued an advisory opinion, with the force of statutory law, that found the SOCC was a separate entity from VNIIEF and specified the type of US-made computers and other equipment that could be acquired and used by the SOCC. Secretary of Energy Bill Richardson and Russian Minister of Atomic Energy Evgeny O. Adamov presided at the official opening ceremony of the SOCC on October 1, 1999. During that visit, Richardson also toured the Sarov Technopark at Avangard.

At the end of the tour, a group photograph was taken of all the participants on both sides. Late the next day, Russian Deputy Director of Security Sergei Safranov approached me, handed me a photo, and said, "Jim, here is your copy of the group picture taken yesterday. Do you see me in the picture?"

"No, Sergei, why are you not in the picture?"

"Because I was in Moscow getting the final approval for you and Dale to examine the IBM computers."

"That we examined on Tuesday?"

"Yes" said Sergei. "This is top secret—we must protect Rady."

A month or two later, Mark Menefee came to LANL to give Hecker and me an award for service to the Department of Commerce. It was an engraved plaque that included a small DOC shield. With a smile, Mark said, "Jim, finally here is your badge, but do not try to use it!"

Epilogue

Closing banquets with our Russian colleagues had a familiar format. Food and drink would be formally laid out at a conference table. The evening would begin in the usual Georgian custom, with a "captain of the table" making the first toast then calling on others to make subsequent toasts.

Late in our NCI effort, we attended a closing banquet after a work week in Sarov. Perhaps 18 Russians and Americans were at the table. We knew each other well by that point. After three or four toasts, we spontaneously abandoned the formal arrangement and rearranged chairs into small circles, with Russians and Americans in each circle. The evening proceeded pleasantly with gentle discussion in each circle among friends enjoying one another's company.

When we first arrived in Sarov, I wondered whether our work could engender real cooperation that would advance national security and help all of us redefine our relationships and attitudes toward one another. With regard to national security, the question remains open because of the evolution of the relationship between our two governments. We seem to be restarting the Cold War and have lost the dialogue and desire for cooperation that evolved after the Cuban Missile Crisis. As Hecker pointed out early on, we had a window that was open and very likely would not remain open for many years. Through our work, we believe that many in Sarov were able to see through the "window to the West" that Rady Ilkaev wanted for his people. But today we have almost no communication with our colleagues in Sarov, who are allowed only careful, limited—if any—communication with us.

Regarding developing more positive attitudes toward one another and redefinition of the enemy, the experience that last evening showed that we had developed mutual respect, acceptance of one another as friends, and trust.

Would I do this again? I would without question. In many respects, these experiences felt like a big part of my reason for being on this earth. As states, will we have to do it again? Yes, probably many times.

Dr. James W. Toevs earned his PhD in nuclear astrophysics at Caltech; his thesis adviser was Noble laureate William A. Fowler. Toevs was a professor at Hope College in Holland, Michigan, for the decade of the 1970s and joined Los Alamos National Laboratory in 1980. He conceived and developed one of the approaches to nuclear-driven directed energy, then went to Kaman Sciences Corp. in 1988. With the end of the Cold War, Toevs returned to LANL to focus on nonproliferation and sustainable arms control. He initiated the LANL effort in the Plutonium Disposition Program, then began working in Russia. He has made over 50 Russian trips, working mostly in Sarov, the Russian Los Alamos, on defense conversion and job creation.

Notes

1 In the annihilative definition, the enemy is inferior and subhuman, therefore easy to kill. The second, less-vicious instrumental definition applies to one nation or tribe attacking another to get something the attacker wants, e.g., water, land, natural resources, or, in Russian President Vladimir Putin's current case with Ukraine, a buffer against NATO and his own self-aggrandizement. But to get his troops to kill, he invokes an annihilative definition by calling the Ukrainian leadership Nazis. The least violent and vicious definition, called agonistic, is when one group calls another the enemy or opponent for reasons of honor alone, such as knights jousting or the aerial warfare in World War I.

2 *Doomed to Cooperate: How American and Russian Scientists Joined Forces to Avert Some of the Greatest Post-Cold War Nuclear Dangers*, ed. Siegfried S. Hecker (Los Alamos, NM: Bathtub Row Press, 2016), 54.

3 *Doomed to Cooperate*, in which Russian and US writers detail the joint efforts between US and Russian weapons institutes to avert nuclear dangers after the end of the Cold War, shows the breadth and depth of the many cooperative programs between nuclear weapons scientists and engineers in the United States and Russia.

4 VNIIEF, located in the closed city of Sarov, was Russia's Los Alamos, its first nuclear weapons design institute. During the Cold War, Sarov was unknown to us and was called Arzamas-16, Arzamas being a much larger city an hour away from Sarov. Sometimes we called it Los Arzamas. And why 16? "So you would waste a lot of time looking for the other 15."

5 Siegfried S. Hecker, a metallurgist by training, is a member of the National Academy of Engineering. He directed Los Alamos National Laboratory from 1986 through 1997. He edited and was the driving force behind *Doomed to Cooperate*. He has just published *Hinge Points: An Inside Look at North Korea's Nuclear Program*.

6 One day we were talking with Trutnev, and he saw a photo we had of Sig Hecker with Boris Litvinov, the chief VNIITF weapons designer, in the Snezhinsk Nuclear Weapons Museum standing next to the aeroshell for Tsar Bomba, the largest nuclear explosive ever tested. Trutnev exclaimed, "Litvinov didn't design that weapon, Sakharov and I did. Jim, get your camera and Sig come with me." We went to the VNIIEF Nuclear Weapons Museum and took the "appropriate" photo with Hecker and Trutnev. We asked, "Yuri, can you answer a question for us? Sig understood that Tsar Bomba was designed at 100 megatons and tested at 50 megatons; I had been told that it was designed at 120 and tested at 56. Which is correct?" In his deep Russian voice, Trutnev said ominously, "When it is that big, it doesn't matter!"

7 The different metrics caused a debate on the US side between those of us working the NCI program and DOE, Congress, and other US government agencies. The debate continued throughout the duration of the NCI program.

8 The other original NCI cities were Snezhinsk (Russia's Livermore) and Zheleznogorsk (analogous to Rocky Flats). Furthermore, in addition to LANL, other US labs and personnel were involved in the work in Sarov.

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The Stanley Center for Peace and Security partners with people, organizations, and the greater global community to drive policy progress in three issue areas—mitigating climate change, avoiding the use of nuclear weapons, and preventing mass violence and atrocities. The center was created in 1956 and maintains its independence while developing forums for diverse perspectives and ideas. To learn more about our recent publications and upcoming events, please visit stanleycenter.org.

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