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ANALYSIS

U.S.–Russia Science Cooperation Today

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Abstract

U.S.–Russian scientific collaboration has a long history of engagement among the two scientific communities that persisted though the times of non-existent or bad relations between their governments. The intergovernmental layer of this cooperation became more prominent during the post-World War II nuclear superpower competition and its fallout after the collapse of the USSR. The current state of the bilateral scientific cooperation reflects the complex impact of the wide-ranging Cooperative Threat Reduction (CTR) and International Science and Technology Center (ISTC) programs that channeled the U.S. and international assistance to uphold nuclear security and safety in the former Soviet Union and support Russian scientists in peaceful pursuit of knowledge within international partnerships. The scientific communities of the U.S. and Russia have pressed for continued and increased engagement while the governments on each side qualify their support in line with their respective domestic and international political agendas.

The Strong Role of the State

U.S.–Russian scientific collaboration is part of the global fabric of modern science with complex ties among individuals, research teams, institutions, national academies, networks, grant makers, and international mega projects like The Large Hadron Collider or ITER. At the same time, the bilateral intergovernmental aspect of this relationship is more prominent due to the legacy of the 20th century superpower nuclear competition and its fallout after the collapse of the USSR. Appreciation of this aspect is helpful to understand the recent dynamic in the bilateral scientific cooperation.

Another essential factor, in our mind, is the continuing decline of Russia's science and technology (S&T) power relative to that of the U.S on the long-term historical trajectory. In 2020, the disparity is huge. In terms of resources, in 2017, U.S. R&D expenditure was 2.74 percent of its GDP of $19.485 trillion; it was 1.11 percent of national GDP of $1.578 trillion for Russia[1]. If the U.S. today is facing a fast-growing challenge to its R&D world leadership[2], it is not coming from Russia. In terms of international integration, Russia is among the countries that show relatively low collaboration rates—in 2018, 23 percent of all articles by Russian scientists in the Scopus database were co-authored with international colleagues. It was 39 percent for the U.S.[3] In 2017, 24 percent of all collaborative international publications by Russian scientists were with U.S. co-authors, ahead of collaborators from any other country. The share of collaborative publications with Russian co-authors in the U.S. was below 3 percent. In terms of structural diversity, the Russian R&D sector is generally more dependent on federal budget funding, especially in basic research, while in the U.S. the role of business sector has been growing across all types of R&D, including in basic research.

Yet, historical and cultural aspects of the U.S.–Russian scientific cooperation suggest that similarities may be as important as disparities. They can highlight relative strengths and point to areas of complementarity.

Long Historical Similarities

Going back all the way to the 18th century, parallels have been observed between the two towering scientific giants of their time, Mikhail Lomonosov and Benjamin Franklin. Proof of their direct correspondence has yet to be discovered by historians, but they did engage in communication by referencing each other's ideas. They constitute a pair of genius twins, where Lomonosov may be introduced as "the Russian Franklin", and vice versa. More recently, parallels have been gleaned in the history of nuclear race between the United States and the Soviet Union in the life paths of the two scientists leading their nation's bomb programs, Yuli Khariton and J. Robert Oppenheimer.[4] In between these historic epochs, from the late 18th through the mid-20th century, American

1 Science and Technology Indicators in the Russian Federation: 2019: Data Book. National Research University Higher School of Economics.—Moscow: HSE, 2019. https://www.hse.ru/data/2019/05/07/1502498137/in2019.pdf; U.S. R&D Performance and Funding. the State of U.S. Science and Engineering 2020, https://ncses.nsf.gov/pubs/nsb20201/u-s-r-d-performance-and-funding

2 The State of U.S. Science and Engineering 2020, https://ncses.nsf.gov/pubs/nsb20203/conclusion

3 Publications Output: U.S. Trends and International Comparisons, https://ncses.nsf.gov/pubs/nsb20206/international-collaboration

4 David Holloway (2005). "Parallel Lives? Oppenheimer and Khariton", Reappraising Oppenheimer: "Centennial Studies and Reflections", University of California, Berkeley: 115–128.

and Russian scientists engaged in academic correspondence, collaborations, expeditions, and reciprocal visits. Scientific ties were being built in astronomy, geography, geology, physiology; and institutional relations matured between university networks, national academies, and private firms. As shown by Glenn Schweitzer,[5] scientific contacts continued even in the absence of diplomatic relations in the 1920s. After WWII, they started to rebound in the early 1950s when the bilateral relationship was all but consumed by the Cold War.

Gerson Sher, historian of U.S.–Russian scientific cooperation, further shows that the cooperation developed in several stages. During the "Deep Cold War" period, it was channeled through a program of exchange visits between the U.S. National Academy of Science and the Academy of Sciences of the USSR. The period of détente in the early 1970s introduced an era with a top-down approach including bilateral intergovernmental agreements, high-level joint commissions, and elaborate processes.[6] The 1975 Apollo-Soyuz Test Project, when astronauts from the two nations docked their spacecrafts in orbit, exchanged a historic handshake, and proceeded to perform joint experiments signified the enormous promise of peaceful collaboration and pooling intellectual and technological resources in the exploration of space. The perestroika period produced a truly unprecedented peak of cooperation in the form of the 1988 Joint Verification Experiment that brought nuclear weapons scientists and engineers from the two countries to each other's nuclear testing sites to compare on-site methods of nuclear explosion yield measurement. This unique experience formed connections that later evolved into enduring collaborative relationships.[7]

The Era of Assistance

The defining feature of the next period of the U.S.–Russian scientific cooperation, starkly expressed by Gerson Sher, was that the "previous doctrines of equality, reciprocity, and mutuality of benefit were supplanted with an entirely new notion—assistance". The U.S. government was beset by grave concerns about the perceived dangers of proliferation of nuclear and other weapons of mass destruction (WMD), theft of fissile materials, and leakage of WMD expertise resulting from the economic and social collapse in the former Soviet Union (FSU). The Nunn-Lugar legislation that forged the Cooperative Threat Reduction (CTR) program became the umbrella for a variety of programs designed to dismantle weapons, secure materials and facilities, and redeploy human capital in Russia and other FSU countries. These programs often involved scientific collaboration as the implementation mechanism. These collaborations strictly depended on the intergovernmental agreement framework and involved thousands of Russian R&D workers in international scientific practices.

A unique role in the international socialization of Russian science belongs to the International Science and Technology Center (ISTC). It started operation in early 1994 as a consortium of funding partners and recipient states with the mission of "cooperative Chemical, Biological, Radiological and Nuclear (CBRN) risk mitigation by supporting civilian science and technology partnerships <…> to redirect expertise to peaceful R&D fields."[8] From 1994 to 2014, competitive grants were awarded via a merit-based participatory selection process to 2033 collaborative projects that Russian scientists carried out with American, European, Japanese, and other international counterparts. ISTC supported the livelihood of dozens of thousands of scientists in Russia. Its most lasting impact was the internal transformation and international socialization of Russian science. Lev D. Ryabev, a high-ranking Russian ISTC official, credited the Center for fostering "an environment in which any research specialist or engineer could execute his/her proposal in the form of a project, put together a team and demonstrate his/her leadership skills" and "integration of scientists into the international scientific community."[9] 60,968 scientists from Russia participated in ISTC projects by the end of 2014.

In 2010, the Russian government signaled that the era of assistance was over. In August 2010 President Medvedev decreed Russia's withdrawal from the ISTC Agreement; the ongoing projects were to be completed by 2015[10]. In late 2012 Russia notified the United States that it was not planning to extend the CTR umbrella agreement due to expire in June 2013. In December 2014, the Material Protection, Control and Accounting (MPC&A) Agreement that covered a major area of

5 Glenn Schweitzer (2004). Highlights of Early U.S.-Soviet Scientific Relations (1725–1957). Scientists, Engineers, and Track-Two Diplomacy. A Half-Century of U.S.-Russian Interacademy Cooperation.

6 Gerson S. Sher (2019). Science Knows Boundaries: Reflections on Sixty Years of U.S.–Former Soviet Union Scientific Cooperation. Science and Diplomacy. http://www.sciencediplomacy.org/article/2019/science-knows-boundaries-reflections-sixty-years-us-former-soviet-union-scientific

7 Joint Verification Experiment, https://lab2lab.stanford.edu/lab-lab/joint-verification-experiment

8 ITSC Facts Sheet, http://www.istc.int/en/fact-sheet

9 Lev Ryabev (2014). International Science and Technology Center. 21 Years in the Russian Federation. International Science and Technology Center Annual Report 2014, http://www.istc.int/upload/files/2znjeu3iwfwgsowc00o4.pdf

10 Glenn Schweitzer (2013). Containing Russia's Nuclear Firebirds: Harmony and Change at the International Science and Technology Center. Appendix C and Appendix D.

collaboration in nuclear materials security was terminated with little notice extended to the American side. The underlying intent of these steps was not to curtail Russia's ties with the global scientific and R&D community but rather to restructure these ties in a restored capacity of equal partnership rather than as a recipient of assistance channeled according to the funding party's interests. CTR and ISTC, however beneficial for Russia in many important ways, were associated with the traumatic experience of being on the recipient end of assistance.

Building a Relationship Based on Equality

At the same time, the Russian government valued its relationship with the United States in such prestigious S&T areas as fundamental science, nuclear energy, and outer space. It kept alive key bilateral agreements signed in the early 1990s—and pursued new ones. The 1992 U.S.–Russian Agreement on Cooperation in the Exploration and Peaceful Uses of Outer Space was extended in 2002, 2007, and 2011 (currently to expire in December 2020). The 1993 U.S.–Russian Agreement on Scientific and Technical Cooperation was extended in 2005 and 2016.[11] In September 2013, a long-awaited Agreement on Cooperation in Nuclear- and Energy-Related Scientific Research and Development was signed in Vienna by the heads of Rosatom and the U.S. Department of Energy (DOE). The point was made that the United States and Russia were equal partners under the Agreement, with each country bearing its own cost. The document enumerated facilities and installations in Russia and the U.S. "that may be used to conduct cooperative activities," thus authorizing site access to each other's nuclear weapons laboratories and major nuclear energy scientific and R&D centers.[12]

The scope and the depth of cooperation under CTR and ISTC, with dozens of thousands of participants on both sides, a shared sense of the importance of many projects, and the sheer excitement of doing science together built strong ties between scientific communities on both sides. It was the sentiment "on the ground" that pressed for the 2013 Rosatom-DOE agreement. Nuclear S&T communities in both countries pushed for the opportunity to renew collaborations in civil nuclear energy, thermonuclear fusion, high-energy density physics, pulse energy, material science, and other areas of fundamental science and applied research. Alerted in 2010 about Russia's impending withdrawal from ISTC, another part of scientific community represented by the U.S. National Academies and the Russian Academy of Sciences initiated a joint study of U.S.–Russian bilateral engagement in the biological sciences and biotechnology. They set up a joint committee to assess the past cooperation (which they called bioengagement) and suggest a path forward. The report they produced in 2013 detailed the infrastructure of the cooperation, its stakeholders and participant organizations, its scientific achievements, benefits, opportunities and difficulties as well as recommendations for future engagement. The report made a forceful case for expanding the U.S.–Russian bioengagement: "The stakes are significant, the established base for collaboration is unprecedented, and many of the potential payoffs from future joint efforts are clear."[13] To follow with action, in 2011 the Russian Foundation for Basic Research (RFBR) and the National Institutes of Health opened a bilateral co-funding program of Collaborative Research Partnerships (CRP) on the Prevention and Treatment of HIV/AIDS. In 2013, they started a CRP on Cancer, with both programs still running in 2020.[14]

Chilled Relations After 2014 Hostilities in Ukraine

The intergovernmental layer of the cooperative framework did suffer after 2014. The 2013 Agreement was suspended within a few months of entering into force along with other ostentatious rollbacks in nuclear cooperation. In the years since, both DOE and Rosatom, in a tit for tat fashion, withheld authorization for the vast majority of conference visits and joint seminars that had previously been a staple in the U.S.–Russian nuclear cooperation, let alone any new research collaborations. However, at the same time, the two governments chose to quietly preserve other standing scientific cooperation agreements and allow the scientific community to stay the course in a broad range of collaboration areas. The national academies stepped up to continue running the mill of cooperation through inter-academy agreements, mem-

11 The Russian Foreign Affairs Ministry runs the web archive of Russian–U.S. bilateral agreements at https://www.mid.ru/ru/foreign_policy/international_contracts/2_contract

12 The Agreement between the Government of the United States of America and the Government of the Russian Federation on Cooperation in Nuclear- and Energy-Related Scientific Research and Development https://www.state.gov/wp-content/uploads/2019/02/14-124-Russian-Federation-Atomic-Energy.pdf

13 The Unique U.S.-Russian Relationship in Biological Science and Biotechnology: Recent Experience and Future Directions. National Academies Press, 2013. https://www.ncbi.nlm.nih.gov/books/NBK201554/pdf/Bookshelf_NBK201554.pdf

14 U.S.-Russia Bilateral Collaborative Research Partnerships on Cancer (R21). Funding opportunity announcement, https://grants.nih.gov/grants/guide/rfa-files/rfa-ca-16-015.html; Paul Pearlman & Sophia Michaelson (2017) NCI supports 10 New Bilateral Collaborative Research Partnerships on Cancer, https://www.cancer.gov/about-nci/organization/cgh/blog/2017/bilateral-partnerships

orandums of understanding, joint committees, grant programs, etc. In 2019, they formally concluded the most recent inter-academy cooperation agreement for the next five-year period and pledged to "devote special efforts <…> to continue to decrease the impediments to cooperation."[15] The U.S. National Science Foundation (NSF) and RFBR awarded grants to collaborative projects, though statistics to assess their relative share or trends are not immediately available. On the RFBR side, a big number of grant applications seems to have been for conference participation, while on the NSF side, awarded grants have involved research collaborations in geo- and climate sciences, physics, and socio-economic studies.

Under chilled intergovernmental relations, much in cooperation depends on the agency of the scientists themselves. "Unmediated by formal exchange or bilateral programs,"[16] cooperation among U.S. and Russian scientists has the potential to develop more organically, following the patterns of scientific cooperation worldwide. The anti-Western and anti-U.S. mindset exists in certain parts of the Russian government and may complicate the conduct of cooperation activities. Anti-Russian attitudes may likewise influence choices of U.S. agencies or institutions. On the Russian side, however, a number of beneficial factors also exist. Declared policy priorities include reclaiming the international prestige of Russian science. A slew of programmatic documents on S&T policy have set the goals of greater international scientific integration and enhancing the international footprint of Russian science. The 5-100 program that the government launched in 2013 stimulates twenty-one participating universities to increase their standing in top international academic rankings through attracting international faculty, increasing enrollment of international students, creating research collaborations and publishing in quality journals. Participating universities may use the program funds to support academic exchanges and collaborative research projects. One such exchange initiative for young nuclear professionals between the Moscow Engineering Physics Institute (MEPhI) and Stanford University is funded through the 5-100 program on the Russian side. Russian universities actively encourage and facilitate international engagement by their graduate students and faculty. This grassroot international engagement through participating in international fellowships and grant competitions effectively advances Russia's integration into the globalized R&D networks. As an example, the Moscow Institute of Physics and Technology (MIPT) recently announced that its DREAM team of graduate students working at MIPT Neural Networks and Deep Learning Lab[17] competed in Amazon's Alexa Prize Socialbot Grand Challenge and was the only international team that reached the semifinals.

Hopes have been expressed that the current crisis caused by the global COVID19 pandemic will lead to a reassessment of the hierarchy of priorities for nations and the world as a whole. The next potential threat may be altogether different and come from a stray asteroid. The U.S.-Russian scientists have done collaborative work in the past both in infectious disease and in planetary defense. At the moment, the governments of the U.S. and Russia have the option to extend a firmer and more consistent support to existing cooperation and institute joint efforts in solving the crisis, though the prospect for this is not strong. Cooperation on the ground will continue and it remains to be seen whether it is able to self-organize and play a role in dealing with the pandemic.

About the Author
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15 Agreement on Cooperation in the Fields of Science, Engineering, and Medicine between the U.S. National Academy of Sciences, National Academy of Engineering, Institute of Medicine and the Russian Academy of Sciences. March 12, 2019. https://www.nationalacademies.org/_cache_1ce1/content/4885770000059264.pdf

16 Gerson Sher (2019). Op. cit., http://www.sciencediplomacy.org/article/2019/science-knows-boundaries-reflections-sixty-years-us-former-soviet-union-scientific

17 DREAM Team http://deeppavlov.ai/dream_alexa