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What Happens When the Nuts and Bolts of Science Diplomacy Come Loose?

The United States has focused on preventing the transfer of sensitive technology to adversarial nations rather than on improving its ability to collaborate internationally.

In 2015, the US government signed a renewed agreement with CERN, the European Organization for Nuclear Research. There was an air of excitement at the signing about the future of particle physics research, as CERN's Large Hadron Collider had delivered one of the blockbuster achievements of the twenty-first century—confirmation of the Higgs boson particle—only a few years prior. The agreement signaled a new level of international collaboration in particle physics by formalizing CERN's participation in US-based projects under development, including the Long-Baseline Neutrino Facility (LBNF) and the Short-Baseline Neutrino Program (SBNP), which would send intense beams of neutrinos underground from Fermilab, outside Chicago, to a giant detector nestled inside a depleted gold mine in Lead, South Dakota. Construction of the detectors and the neutrino beamline facility, collectively called the Deep Underground Neutrino Experiment (DUNE), would be the first international mega-science project hosted by the United States, with hundreds of institutions from more than 30 countries contributing research and investment.

One of the first major tasks for the DUNE program was transferring ICARUS, the world's largest liquid-argon neutrino detector, from CERN in Geneva to Fermilab. This first transfer would serve as a stress test for whether the United States would be able to clear the bureaucratic hurdles required to build an international mega-science facility. CERN researchers spent months packaging the detector, separated into two identical pieces, into two extra-large repurposed shipping containers lined with panels of sensitive particle detectors for the transatlantic trip. To get the detector into the United States duty-free, the Department of Energy (DOE) needed to acquire a Florence waiver from US Customs and Border Protection (CBP). This waiver would save US taxpayers significant import costs for equipment freely provided to the United States by the Italian government and CERN. The process of acquiring the waiver would likely need to be repeated thousands of times to get all parts of the facility up and running.

DOE officials were not thrilled by the prospect of risking millions of taxpayer dollars to bring in thousands of pieces of equipment donated by collaborating countries for the DUNE-US facility. Likewise, CBP officials were unhappy about having to sign off on thousands of waivers for a single scientific project. Two years into my involvement in the project, DOE asked the State Department to support a legislative waiver like the one used by NASA to bring in specialized equipment, such as the Canadarm on the Space Shuttle. As the officer responsible for high energy physics projects at the State Department, I obliged.

Not everyone was as willing. Even though the legislative proposal was tied to a multibillion-dollar project championed by the powerful Illinois and South Dakota congressional delegations, it was difficult to convince senior State Department officials to spend political capital on such a nuts-and-bolts issue. Teams of new political appointees had unrelated diplomatic and legislative priorities, and the legislative waiver proposal stalled out. ICARUS eventually received its Florence waiver, but all additional deliveries would have to go through the same process.

When the detector finally arrived in Illinois in the summer of 2017, ownership of the device had not been resolved between CERN and Italy, where it was initially built. Consequently, ICARUS sat in the Fermilab parking lot for about a year while lawyers and diplomats worked to resolve the problem. The detector was finally lowered into position in 2018. Other disruptions—including delays on CERN researchers' visas and, later, the COVID-19 pandemic—caused further setbacks. It would take four more years for ICARUS to start hunting for sterile neutrinos.

International agreements such as those supporting a project like the LBNF or SBNP can take years to get off the ground. Both sides must undertake a political assessment of the need for a new international partnership. Once negotiations have begun, agreements can be manipulated or undermined by otherwise unrelated political or economic disputes. Within the United States, the rotational nature of the foreign service and temporary assignments between the White House and other agencies weaken the institutional knowledge needed to get through the often multiyear negotiating process. Complications arise, projects get delayed, costs increase, political faith sinks, and budget hawks swoop in for the kill.

The challenges with ICARUS and DUNE-US reveal an important reality: The US government comes up short on the critical capacity required of a reliable partner in major international scientific collaborations. More than 25 years ago, J. Thomas Ratchford, an associate director of the White House Office of Science and Technology Policy (OSTP) under President George H. W. Bush, made a comparable observation: "Today the United States is in an unenviable position. Among the world's leading nations, its process for developing foreign policy is the least well-coordinated with advances in S&T and the policies affecting them." Despite calls from think tanks and former and current government officials to form technology alliances capable of confronting global technology competition, recent efforts have focused primarily on policies seeking to reduce the transfer of sensitive technology to adversarial nations rather than improving the ability of the United States to meaningfully collaborate with international partners. The US government tends to use punitive hammers (like export controls and sanctions) and employs few constructive nails (like partnership programs) from which to build meaningful alliances. This narrow focus has already weakened US influence globally, convincing some of the country's closest partners of the need to reduce their reliance on the United States.

Inattention to the nuts and bolts of science and technology diplomacy has undermined the ability of the United States to be a destination country for major physics projects. Leadership in the field now comes from Europe and Asia, where smaller countries with smaller budgets have no choice but to work together to build major projects. Empowered by its single market and freedom of movement, the European Union has embraced this role; it is now the host of many major facilities including CERN, the Extreme Light Infrastructure laser facility, the European Centre for Medium-Range Weather Forecasts, the ITER fusion experiment, and many others. To support this growing advantage, the EU has also created funding mechanisms under the Horizon Europe umbrella that facilitate large international consortia and enable non-EU countries to directly participate.

In contrast, working with the United States is seen as "difficult"—as a science advisor from a Five Eyes Anglosphere intelligence alliance country characterized it to me. Foreign partners often cite as challenges a lack of centralized processes, a legalistic approach to even simple collaborations, an inability to commit resources beyond a fiscal year or continuing resolution, the complexity of the US visa process, and a resistance or inability to implement joint programs. This perception can put US scientists

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involved in international collaborations in a precarious position. US researchers at universities and companies increasingly rely on resources from abroad to stay at the top of their fields or to test and validate new technologies. Since the United States does not have a mechanism to guarantee sustained contributions to international facilities, foreign governments can threaten to deny US scientists access if the US government is unwilling to help them keep the lights on. Foreign facilities (including leading labs in China) can also require companies to pay or share intellectual property with the host country in exchange for facility access. As the US taxpayer shoulders more of the cost of its independent research infrastructure, the lack of investment in international collaborations disrupts the scientific enterprise and weakens the security of US research.

At the surface, leveraging science for diplomacy and diplomacy for science still has broad appeal. The National Security Council, OSTP, and the State Department under presidents from both parties routinely ask other federal agencies to offer big STEM projects to their preferred partners as deliverables in diplomatic engagements. However, these requests almost always run into a singular brute reality: Science agencies rarely have the budgetary or mission flexibility to fulfill those requests. Consequently, interagency officials can do very little to deliver on promised collaborations beyond managing expectations.

Science and technology agreements are often treated as political gifts to foreign countries rather than as pragmatic instruments that can meaningfully improve the ability of scientists to successfully partner with one another. As described in 2010 by German scientists Tim Flink and Ulrich Schreiterer, "Unlike in most other cases, [science and technology agreements] with the USA do not bear a commitment of the signatories to spend money together. This is one of the reasons why they are not taken very seriously." Extremely rare exceptions occur when the government's focus is placed on specific, congressionally authorized, and appropriated large-scale investments or when domestic foreign policy debate participants decouple themselves from an agreement's written text.

Press releases, joint statements, or memorandums of understanding released at the end of a bilateral or multilateral meeting are important tools of science and technology diplomacy, but most are structured to place value on the importance of collaboration without creating any resource commitment for participating governments. Valuable international statements must be accompanied by participants' willingness and ability to use the statement to drive outcomes. For example, the Galway Statement on Atlantic Ocean Collaboration resulted in years of coordination activities among the United States, Canada, the EU, and other Atlantic partner countries and led to the *Okeanos Explorer* mapping a substantial portion of the North Atlantic. Similarly, the Tokyo Statement on Quantum Cooperation helped motivate US and Japanese companies to elevate collaborative activities, overcoming administrative hurdles in both governments. In both cases, research institutions and companies from participants' countries had already committed to doing the work together, had detailed work plans, and recognized that they could use a joint statement to elevate their existing desire to work with one another. Politically driven statements, though easy to execute, rarely result in actual cooperation without significant working-level commitment and budget flexibility.

All these hurdles—political and procedural—create an atmosphere where ambitious ideas are frequently downgraded to more achievable, lower-effort projects. A request for a joint program might become a one-off trip for foreign officials to several US science centers under the international visitor leadership program. A "tiger team" intended to combat an international disease outbreak might get turned into a quick list of experts, put together by international officers to protect the ability of actual emergency responders to focus on response activities. When funding commitments for joint activities are announced, they might assume substantial investment from private-sector entities that weren't involved in the negotiations. Professional associations might commit to international partnerships with their counterparts even though the government does not provide them with necessary resources to effectuate any outcome. This confluence of activities creates a culture that sets the bar low to avoid failure but hardly serves taxpayers' strategic interests.

All this tactical effort ends up deflecting the long-run priorities of science diplomacy away from actually facilitating international science and technology cooperation. Worse, organizing meetings in which the United States cannot make commitments starkly contrasts the nation's weak level of diplomatic engagement with that of other countries and multilateral organizations such as China and the EU. This

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contrast further undermines the US government's ability to build and sustain technology alliances.

In 2022, I co-led a report by the National Science and Technology Council's Subcommittee on International Science & Technology Coordination that provided Congress with 12 findings and 16 recommendations to improve the government's international science and technology capacity. The report covered everything from the ability of the government to recruit and retain international science talent to the lack of support mechanisms for bilateral science activities. One of the most critical aspects recommended allocating funding within the State Department to science and technology diplomacy activities to force US diplomats to strategically prioritize resources for S&T, rather than siphoning funding and human resource capacity away from other government agencies. A subsequent report, released in 2024, found that making progress on all the recommendations "will require additional time, congressional support, and sustained action from US departments and agencies."

These reports left out some of the most politically and administratively sensitive recommendations for improving US standing internationally and freeing up science officers to focus on their core objectives. For example, science agencies could be encouraged to seek blanket Circular 175 authority for multilateral science projects, which would make it easier to get approval for complex project agreements and annexes with international partners. Agencies could alternatively seek congressional authorization to enter into agreements or collaborations—like Congress's authorization of US participation in ITER through the Energy Policy Act of 2005—to codify the necessary flexibilities to facilitate major projects like the LBNF or the Electron-Ion Collider. In the same vein, Congress should grant more government agencies blanket waiver authority consistent with the Florence Agreement (already possessed by NASA) to support the import of foreign in-kind contributions to meeting congressional priorities—thus avoiding lengthy evaluation processes for each individual delivery and the struggles and delays experienced by the LBNF/DUNE project. And if Congress formally recognized international scientific organizations like CERN under the International Organizations Immunities Act, it would be easier for them to contribute to US domestic efforts and mirror the privileges granted to them by other countries.

These changes would signal a seriousness of intention about international collaboration and could unlock additional strategies to reduce red tape. For example, institutions could make more proactive use of multiple-entry O-1 visas for scientists whose contributions and ongoing technical support are necessary to sustain congressionally appropriated scientific activities. The director of OSTP or the secretary of state could be given the authority to grant emergency authorizations to rescue scientists, technologists, and technicians from conflict zones to prevent loss of critical sources of knowledge to foreign adversaries and to maintain scientific capacity in displaced populations. Finally, the State Department and National Security Council could spend less time planning bilateral meetings that take program officers away from their core duties and more time using these engagements to elevate scientific activities in which there is a need for international and political support.

Time and attention are often in short supply on the Hill, and it will be difficult to make these changes to improve the execution of real science diplomacy. It is far easier to approve a major project than it is to devote time and resources to building the necessary administrative, financial, logistical, and diplomatic support structures that ensure its success. The current tendency is to simply remove administrative capacity rather than add to it or improve it. Look no further than the Department of Government Efficiency.

In this atmosphere, science and technology projects are particularly vulnerable, as the cost and ability to do things that have never been done before are often unknown and difficult to predict. Amid the current administration's attention to higher tariffs, increased export controls, and fewer visas, as well as the dismantling of offices for science diplomacy, the future development of technology alliances is even murkier.

Even so, the appetite for international partnerships remained evident during OSTP director Michael Kratsios's confirmation hearing. If leadership is serious about building strategic international science partnerships and saving US taxpayers' money, it will be necessary to rebuild and redesign the substantive science and technology diplomacy capacity that enabled development of the modern international research ecosystem.

Taking advantage of these opportunities requires reckoning with the fact that international partners and adversaries alike have already developed hundred-billion-dollar association frameworks and networks of international laboratories to promote such partnerships. There is no escaping the fact that the United States will need to undertake substantial efforts to restore its status as a preferred and reliable international partner and to build tangible—instead of punitive or aspirational—technology alliances.

It's helpful to remember that the technological leadership position the United States enjoyed during World War II and throughout the Cold War had as much to do with the country's management of projects and supply chains as it did the skills of its scientists. Other countries took note and have moved to replicate this competitive advantage. We cannot afford to see our capacity to build big things and take on impossible challenges diminish further. If the United States is to remain the world's scientific superpower, then we have no choice but to sweat the small stuff.

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