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Technical Cooperation in U.S. – China Relations

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Introduction

The United States and China are committed to a cooperative partnership to address the numerous challenges of the 21st century. At the end of their summit meeting in Washington, D.C. in January 2011, Presidents Obama and Hu issued a Joint Statement that noted the wide range of existing cooperation on security, economic, social, energy, and environmental issues and called for broadening and deepening cooperative activities to "promote peace, stability, prosperity, and the well-being of peoples throughout the world." [1] They noted several areas meriting greater attention:

- Strengthening China – U.S. Relations
- Addressing Regional and Global Challenges
- Building a Comprehensive and Mutually Beneficial Economic Partnership
- Cooperating on Climate Change, Energy and the Environment, and
- Extending People-to-People Exchanges

Technical cooperation can play an important role in all of these areas, and there is a strong tradition of technical cooperation between the United States and China. Indeed, one of the first agreements between the two countries was the bilateral Agreement on Cooperation in Science and Technology, signed on January 31, 1979 by U.S. President Jimmy Carter and China's leader Deng

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[1] For the full text of the China-US Joint Statement following the January 2011 summit in Washington, D.C., see http://www.whitehouse.gov/the-press-office/2011/01/19/us-china-joint-statement.

Xiaoping.[2] The 1997 Agreement of Intent on Cooperation Concerning Peaceful Uses of Technology (PUNT) Agreement[3], that provides a framework for bilateral technical cooperation in civil nuclear energy and nonproliferation, is another example. There also is extensive technical cooperation between the two countries on energy issues.[4] In addition to building technical capacity and producing new scientific knowledge, such cooperation has been an important vehicle to for improving political relationships, enhancing security of both countries, and building technological capacity.

In this paper I focus on technical cooperation between the U.S. and China in the area of nuclear security. First I discuss examples of ongoing activities under the PUNT agreement to enhance security of nuclear and radiological material, including plans for establishing a Center of Excellence on Nuclear Security in Beijing. Next I suggest a number of opportunities for expanding technical cooperation to address a broader range of nuclear security issues, using examples of new research in the United States and bilateral U.S.-Russia and U.S.-United Kingdom technical cooperation to stimulate thinking. I then summarize and suggest possible next steps.

Existing Technical Cooperation under the PUNT Agreement

The PUNT agreement authorized the exchange of technical information and promoted technical cooperation on specific topics such as export control for nuclear materials and technology, nuclear materials control and accounting, physical protection of nuclear materials and facilities, and

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[2] U.S. China: Thirty Years of Science and Technology Cooperation: http://www.state.gov/g/oes/rls/fs/2009/130625.htm .

[3] "Agreement of Intent on Cooperation Concerning Peaceful Uses of Nuclear Technology Between the Department of Energy of the United States of America and the State Planning Commission of the People's Republic of China," 29 October 1997: < http://www.nti.org/db/china/engdocs/sccoop97.htm> .

[4] U.S. – China Energy Cooperation: http://www.pi.energy.gov/usa_china_energy_cooperation.htm .

technology for enhancing international nuclear safeguards. Cooperation between the U.S. Department of Energy and Chinese civilian nuclear agencies has been significant. Examples include:

- Material Protection, Control and Accounting: Cooperation with the China Institute of Atomic Energy (CIAE) and the China Atomic Energy Authority (CAEA) has focused on nuclear security and emergency preparedness. In 2005 the U.S. and China held a joint demonstration of integrated nuclear material management in Beijing in which they jointly evaluated physical protection systems at two CIAE facilities and designed and installed an exterior sensor test field at the CIAE Safeguards Laboratory. There have also been multiple workshops on design basis threat, vulnerability assessment, integrated nuclear safeguards and security and insider analysis.
- Radiological Source Security: Cooperation with China's State Environmental Protection Agency (SEPA), CIAE, and CAEA has focused on securing nuclear and radiological materials at civilian sites in China and building Chinese capacity to address continuing and future security concerns. In the run-up to the 2008 Beijing Olympics physical protection upgrades were implemented at seven sites with radiological sources near Olympic venues, and the Chinese government has requested additional upgrades and training courses over the next few years.
- Megaports Initiative: Cooperation with China's General Administration of Supervision, Inspection, and Quarantine and the General Administration of Customs to enhance the ability to detect special nuclear and other radioactive materials in containerized cargo at Shanghai and Hong Kong is currently underway.
- Nuclear Export Control: Cooperation with China's General Administration of Customs (GAC), in cooperation with the China Arms Control and Disarmament Association (CACDA) focuses on i effective means and ways to recognize and inspect WMD-related goods.
- Nuclear Fuel Cycle R&D: China was among the original sixteen members of what was formerly known as the Global Nuclear Energy Partnership (GNEP) (now referred to as the International Framework for Nuclear Energy Cooperation). Construction is underway in China on the first Westinghouse AP1000 nuclear power reactor and U.S. It is expected to be operational by 2015. U.S. nuclear experts are interested in

learning from the experience as the reactor has not yet been licensed for operation in the United States.

In January 2011, a Memorandum of Understanding between the United States and China to establish a Center of Excellence (COE) on Nuclear Security in Beijing was signed. This agreement represents a substantial investment by both countries. The COE will have extensive training facilities, analytical laboratories and facilities to test and evaluate a wide spectrum of nuclear security technologies. The scope of cooperation will include: nuclear safeguards, nuclear material physical protection, control, and accounting, nuclear detection technology, nuclear measurement and nuclear emergency preparedness and response. It is intended as a forum exchange of best practices, development of training courses, technical collaboration, technology demonstrations and field testing of physical security and related technology. It will serve as a focal point to promote multilateral nuclear security throughout the Asia/Pacific region as well as the broader international community. Although ground-breaking for the COE is not expected until 2012, there is extensive ongoing cooperation between experts during the design phase. The facilities for test and evaluation of nuclear security technology will be based largely on similar facilities at Sandia National Laboratories.

During the March 2011 meeting of the Joint Coordinating Committee of the PUNT Agreement, U.S. and Chinese officials announced that they would continue expanding cooperation between their two countries in research and development of new technology to guarantee a safe and secure nuclear future. They also agreed to establish a new joint working group on radioactive source security.

Opportunities for Expanding Technical Cooperation in the Future

The January 2011 Joint Statement establishes a framework for expanded technical cooperation between China and the United States in the future. In particular, both reaffirmed their commitment to the eventual realization of a world without nuclear weapons, the need to strengthen the international nuclear nonproliferation regime, and to address the threats of nuclear proliferation and terrorism. They also affirmed their support for early entry into force of the Comprehensive Test Ban Treaty (CTBT) and commencement of negotiations on a Fissile Material Cutoff Treaty (FMCT). They also agreed on the critical importance of maintaining peace and stability on the Korean Peninsula, and noted the importance of improving North-South relations and of taking concrete steps to achieve denuclearization of the Peninsula.

Achieving these goals will require overcoming both political and technical hurdles. Examples of challenges that might be addressed by technical cooperation are tabulated below.

Topic	Technical Challenges
CTBT	• Confidence in legitimacy of ongoing activities at former test sites
FMCT	• Managed access for on-site-inspections to assure protection of sensitive information • Monitoring options for material in classified forms
Nuclear Arms Agreements	• Understanding nuclear weapon lifecycles and production infrastructure in states with nuclear weapons • Monitoring options to provide confidence in nuclear reductions or weapon dismantlement • Security of nuclear weapons and material • Monitoring options for future treaties that minimize impact on ongoing legitimate nuclear weapons operations
Regional Security	• Monitoring to achieve confidence in eventual nuclear disarmament • Environmental restoration at former nuclear sites • Security for land and maritime borders

The United States has invested significantly in developing technical options to meet the challenges of future nuclear arms control – both through domestic research and development and through technical cooperation with other states. To stimulate thinking about possibilities for U.S. – China technical cooperation to achieve these goals, I here provide three examples of current and past technical activities in which the U.S. national laboratories have participated.

1. Integrating Nuclear Arms Control and Nuclear Weapons Stockpile Management

The 2010 Nuclear Posture Review (NPR) sets the stage for ambitious nonproliferation and counter-terrorism efforts and points toward a future of deeper reductions in nuclear stockpiles, even as it underscores the need to invest in modernizing the nuclear weapons complex. Although the goals of nuclear arms control and complex modernization could be pursued along two separate paths that intersect only when necessary, experts at Sandia, Los Alamos and Lawrence Livermore National Laboratories are analyzing opportunities for taking an integrated approach from the outset to assure that mutual impacts are well-understood and to identify options to address mutual needs.[5] Several topics requiring further analysis have been identified, including:

- Developing scenarios for future arms control to provide a concrete basis for discussing possible verification requirements and for analyzing impacts on the U.S. nuclear weapons complex;
- Developing a better understanding of potential needs for transparency in the U.S. nuclear complex, possibly through the use of modeling tools;
- Evaluating the nuclear weapons lifecycle to identify where possible future monitoring and verification approaches would require close integration with nuclear weapons

[5] For an exploration of ideas for accomplishing this, see Lani Miyoshi Sanders, Sharon M. DeLand, and Arian L. Pregenzer, "Integrating Nuclear Weapons Stockpile Management and Nuclear Arms Control Objectives to Enable Significant Stockpile Reductions," *The Nonproliferation Review*, November 2010, pp. 475 – 489.

planning and to assess the feasibility of such approaches. Test and evaluation of promising approaches will be pursued in realistic operational environments.

2. Warhead Dismantlement Transparency (Cooperation with the U.K.)

The United States and the United Kingdom have an ongoing cooperative program on transparency measures for warhead dismantlement. The purpose of the collaboration is to share information about issues and technical approaches to transparency and to develop technologies for possible use under future treaties or agreements. Activities to date have included technical workshops on topics such as information barriers and data authentication, measurement campaigns to evaluate technologies and procedures, and exercises to simulate monitored dismantlement and test technical approaches. An exercise is scheduled for November 2011 to test radiation detection technologies and to demonstrate the use of tags and seals to maintain chain of custody through the dismantlement process.

3. Warhead Safety and Security Tests and Evaluations (Cooperation with Russia)

In a project conducted under the Warhead Safety and Security Exchange (WSSX) agreement between the United States and Russia, experts from Sandia National Laboratories worked with their Russian counterparts to evaluate approaches to monitoring warheads at operational storage sites, during transportation, and at final central storage, all of which might be required in future agreements.[6] Experts at the All-Russia Research Institute of Automatics (VNIIA) developed an automated monitoring and inventory system based exclusively on Russian technologies. They also constructed an operational simulation facility

[6] The Warhead Safety and Security Exchange (WSSX) agreement provided a legal basis for cooperation between the U.S. and Russia on safety and security of nuclear warheads, technologies for potential future nonproliferation and arms control initiatives, and technologies to combat nuclear terrorism. Examples of projects included: warhead and fissile material monitoring, warhead safety in storage, warhead authentication, tamper-indicating devices, dismantlement transparency, accident characterization and response, and high-explosives aging. WSSX was signed in 1994, extended in 2000, and expired in 2005. Both sides are hoping to re-establish technical cooperation on nuclear security under a new agreement in the future.

for testing the system in both storage and transportation scenarios. Sandia and VNIIA experts jointly evaluated the design and test results. The project ended just short of a planned end-to-end test in December 2008. Previously, Sandia also partnered with The All-Russian Research Institute of Experimental Physics (VNIIEF) to conduct a series of storage monitoring field trials in which data was exchanged between monitoring demonstrations in the United States and Russia.

These three examples demonstrate the range of possibilities for technical analysis and cooperation to enhance nuclear security and to prepare for possible future agreements. There are numerous other examples, including multilateral technical cooperation under the Group of Scientific Experts to develop approaches to seismic monitoring for a CTBT, and the 1988 Joint Verification Experiment between the Soviet Union and the United States to test verification measures for the Threshold Test Ban Treaty. In fact, technical cooperation has played a critical role in the negotiation, agreement, and implementation of all major arms control and nonproliferation agreements.

Potential Topics for Enhanced U.S. - China Technical Cooperation

Should the governments of China and the United States decide to pursue a broader range of bilateral technical cooperation, a number of options could be considered. The following ideas are intended to stimulate discussion.

1. Military applications of nuclear security

To date, cooperation on nuclear security has focused on civilian applications. The same principles apply to military assets, however. The COE on Nuclear Security will have facilities and capabilities that are broadly applicable to military applications. Exchanging information about best practices for safety and security of nuclear weapons and weapons-useable material could be a first step.

2. Anticipation of future nuclear arms reductions

China and the United States are both committed to a world without nuclear weapons while at the same time modernizing their nuclear weapons complexes. Exchanging information about the technical and operational challenges of pursuing these objectives in an integrated manner could be useful. In addition, joint development of scenarios for future arms control, joint development of modeling tools to allow assessment of impacts of future treaties on nuclear complexes, and joint assessment of monitoring options for future agreements could be considered.

Should joint analysis result in promising approaches, test and evaluation of monitoring options could be a next step. The facilities at Sandia National Laboratories used for test and evaluation of arms control monitoring options closely resemble those planned for the COE on Nuclear Security in Beijing. This might be another option to for expanding the role of the COE.

3. Technical cooperation related to CTBT and FMCT

Confidence in the legitimacy of ongoing activities at former nuclear weapon test sites in member states could be a challenge, even after the CTBT enters into force. Exchange of information, possibly through site visits, about such activities could help build confidence. It could also elucidate concerns and pave the way for additional cooperative measures, should they be required.

Verification measures for an FMCT run the risk of compromising sensitive information, especially through on-site-inspections. Development of tools to assess managed access procedures during on-site-inspections, including methods to monitor material in

classified form without revealing sensitive information, could be a topic for technical cooperation.

4. Korean Peninsula

Ultimate denuclearization of the Korean Peninsula will involve a range of challenges, ranging from environmental clean-up to continued monitoring of prohibited nuclear activities. Although all parties to the 6-Party talks must be involved in the solution, U.S. and Chinese technical experts could play an important role by identifying key issues and developing a common approach to implementation. Analysis of technical measures could build on a significant body of previous work, including work by resident and visiting scholars at Sandia's Cooperative Monitoring Center (CMC). [7]

Reducing North-South tensions also presents an array of challenges. Assessing how technology could facilitate implementation of confidence and security building measures between the two sides could be another topic of analysis by U.S. and Chinese experts. Such analysis could build on previous work conducted by resident and visiting scholars at the CMC on topics ranging from inter-Korean military confidence building, maritime cooperation for the Korean Peninsula, and maritime confidence building for South Asia.[8]

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[7] Examples include: "Dismantlement and Radioactive Waste Management of DPRK Nuclear Facilities," Whang Jooho and George T. Baldwin, 2005, SAND2005-1981p; and "Regional Verification of a Denuclearized Korean Peninsula," John Olsen, 2003, SNAD2003-1390p. Both can be found on the CMC website: http://www.cmc.sandia.gov/papers-reports.htm .

[8] See "Inter-Korean Military Confidence Building After 2003," Michael Vannoni, John Olsen, Jenny Koelm, and Adriane Littlefield, 2003, SAND2003-2892; "Maritime Cooperation for the Koreas," John Olsen, Michael Vannoni, and Jenny Koelm, 2003, SAND2003-1843p; and "Confidence Building Measures at Sea: Opportunities for India and Pakistan," Read Admiral Hasan Ansari and Rear Admiral Ravi Vohra, 2004, SAND2004-0102. All are located on the CMC website: http://www.cmc.sandia.gov/papers-reports.htm.

5. Multilateral Cooperation on Nuclear Security

In addition to bilateral technical cooperation, U.S. and Chinese experts could work together in multilateral environments, e.g., the ongoing P-5 process on nuclear security. In September 2009 the United Kingdom hosted a conference of the P-5 on Verification and Transparency of nuclear arms control. This conference set the stage for countries to discuss a wide range of nuclear issues. As a follow on to the 2009 Conference, the French government has announced that they will host a P-5 conference in Paris in 2011. The United States supports cooperation among the P-5 on nuclear weapons issues and hopes that such conferences will become a regular occurrence.

Establishing a P-5 technical working group to support the process has been suggested, and could provide another venue for technical cooperation. Possible projects could be to build on the U.S. / Chinese lexicon developed by the U.S. National Academies of Science, conduct joint exercises for nuclear incident response, explore the concept of best practices or common standards for nuclear weapons security, and if appropriate, evaluate technical approaches to monitoring future nuclear arms reductions.

6. Research and Development on Unclassified Nuclear Science and Technology

In addition to application-specific technical cooperation, joint research and development on unclassified nuclear science and technology can help establish and sustain long-term relationships. Topics for research that would be relevant to a broad range of nuclear security topics include: nuclear detection technologies, material response to high-radiation, risk and safety analysis techniques for high-energy material performance. Depending on mutual interests, other topics in materials science, computational techniques, and plasma physics could be explored.

Summary

China and the United States have a broad base of shared interests in nuclear security, nuclear arms control, and regional peace and stability. Technical cooperation under the PUNT agreement has played an important role in achieving common goals for material protection, control, and accounting, securing radiological sources, detecting special nuclear materials at ports, and controlling nuclear exports. It has also promoted joint nuclear fuel cycle R&D. The planned Center of Excellence on Nuclear Security will significantly expand the scope of cooperation between the two countries.

In this paper I have identified numerous opportunities for expanding technical cooperation between the United States and China to address a broader set of common interests, including military applications of nuclear security, anticipation of future nuclear arms reductions, planning for CTBT and FMCT, and Korean Peninsula denuclearization and security.

Should governments agree to pursue a broader agenda for technical cooperation, there are a range of possible next steps. First, there must be commitment at the government level and a clear legal framework for technical cooperation. The PUNT agreement has played this role in cooperation on civilian nuclear issues. Next, topics should be selected that represent the most important common interests, and the goals for cooperation should be clearly articulated. Cooperation through multilateral forums or through academic institutions could be an interim measure.