# Achieving Nonproliferation Goals: Moving From Denial to Technology Governance

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## Introduction

The forces of globalization continue to erode the efficacy of traditional approaches to arms control. Not only are the denial regimes of the past—focused on weapons of mass destruction and their delivery systems—being eroded by these forces, but these regimes never attained the requisite buy-in to achieve global technology governance. A combination of technological diffusion throughout the world and the violent ambitions of international terrorists require transitioning from reliance on technology denial to increased focus on comprehensive technology governance. Technology denial between states will become less important than ensuring capacities to control access to technology within states and precluding transfers to illegitimate users worldwide—whether states or individuals. Not only is this a tectonic shift from the traditional reliance on "have" and "have not" categories, but the private sector must work in tandem with governments to craft workable solutions to the governance challenge.

## Globalization and Technology Diffusion

The overarching context—from the long history of technology denial to the formulation of new measures for governance—is of import in delineating the conceptual framework argued for in this paper. For over forty years, technology denial regimes reflected the fault lines of the world's ideological and structural conflict.[1] The spread of weapons technology was held in check by a patchwork of denial regimes—at the international and state level. One dimension was an East-West divide between COCOM (Coordinating Committee for Multilateral Export Controls) and the Communist bloc in the sharing of technology[2]; the other is a major source of grievance in the North-South dynamic, perceived as a remnant of colonialism and continued marginalization of the Global South within the international economic order.[3] While the former divide has been relegated to the historic dustbin, the latter continues to undermine widespread support for traditional export controls and the nonproliferation regimes.[4]

At the same time, the major nonproliferation treaties, focused on nuclear, chemical, and biological weapons, attempted to bridge the North-South divide and cajole universal compliance by facilitating technology transfer for peaceful uses of the technology, while limiting (Nuclear Non-Proliferation Treaty) or eliminating (Chemical Weapons Convention, Biological Weapons Convention) the number of "legitimate" actors who may possess such weapons. These treaties all reflect state-centric solutions to the proliferation challenge, meaning that the state is assumed to be the main repository of the technology being controlled and the guarantor of its security from illegitimate states. Not only is globalization eroding the state's ability to adequately control many dual-use items, none of these treaties encompass specific measures related to nonstate actors as a potential source of proliferation. Notably, the nonproliferation treaties also confront the conundrum that the legitimate transfer of dual-use technology within the context of the regime creates the risk that parties can gain weapons capabilities and then subsequently abrogate the treaty, as in the case of North Korea and, possibly, Iran.

In addition to these global nonproliferation treaties, specific countries—largely from the wealthy, industrialized North—participate in several multilateral regimes that limit access to technology via export control norms established by the member states. The Wassenaar Arrangement was brought into being in 1995 as a replacement for COCOM and addresses conventional arms and dual-use items.[5] Established in 1985, the Australia Group restricts the export of sensitive chemical and biological weapons technology or know-how. In the early years of the Nuclear Non-Proliferation Treaty, the Nuclear Suppliers Group was created to limit exports on nuclear technologies and the Missile Technology Control Regime, founded in 1987, is focused on curbing the spread of missile-related technology. Unfortunately, the "vague provisions" and "crippling consensus rules" of these multilateral export control mechanisms will be "no match for terrorist organizations" or savvy regimes dedicated to acquisition of weapons capability.[6]

The last two decades have ushered in a set of dynamics that further confound the ability of denial regimes to meet these challenges. Within the context of globalization, the rise of nonstate actors—including rogue individuals, terrorist groups, nongovernmental organizations, and multinational corporations—the pace of technological advances, increasing trade and lowering of barriers, accelerating transport and communications, and financial liberalization provide a confluence of factors that increasingly challenge the ability of the state or multilateral organizations to provide effective solutions.[7]

Technology denial between states is no longer an efficacious approach to stemming access to today's dual-use technologies. With some significant exceptions, particularly in the nuclear domain, earlier "sensitive" and highly controlled technologies have become ubiquitous. This is particularly true in the electronics and information technology/computing domain.[8] At the same time, advances in biotechnology continue to outpace the ability of the US government and other wealthy advanced states to impose restrictions, not to mention the rapid pace of outsourcing both the research and development and the production of pharmaceuticals to the developing world.[9]

With the eroding efficacy of state-centric denial regimes and rise of nonstate actors, the United States must harness industry as a proactive partner in countering the illicit networks that fuel proliferation.[10] International organizations, treaty regimes and governments still play an important role in establishing the standards and verifying compliance, but the increasing recognition that states must implement comprehensive non- and counterproliferation measures within their jurisdiction, and that industry must be part of the solution, is enshrined in the objectives set forth by UN Security Council Resolution 1540. Unanimously accepted in the wake of the AQ Khan incident, Resolution 1540 would prevent the proliferation of nuclear, biological, and chemical weapons and their delivery systems worldwide. With its passage, the Security Council imposed a sweeping, unfunded nonproliferation mandate, requiring all states to criminalize proliferation, enact strict export and border controls, and secure all sensitive materials within their borders by nonstate actors. The resolution requires that all UN member states "develop appropriate ways to work with and inform industry and the public regarding their obligations under such laws."[11] Resolution 1540's passage demonstrated the urgent need to close the gap in the nonproliferation treaties as it pertains to the growing terrorist threat and industry's critical role in helping contain it.

## Nuclear Renaissance and Global Zero

The widespread diffusion of advanced technologies has brought unprecedented advances in global development to many of the poorest countries of the world. In many ways, the world is a better place to live than it has ever been: life expectancy has doubled in the last 100 years; astonishing new capabilities to diagnose and treat illnesses have been developed; the proportion of the 6.7 billion people in the world who live on $1 a day or less shrank from 63 percent in 1950 to 35 percent in 1980 and to 12 percent in 1999; and new technologies are being applied to bolster food production in both the First World and across the Global South.

Access to affordable energy has made many of these advances possible and also is now hastening unprecedented new demands on global energy supplies. By 2025, experts expect to see a 75 percent growth in electricity demand, with even greater increases by midcentury. Evidence suggests that increased energy needs, combined with concerns about climate change, are making civilian nuclear power more attractive to more countries than at any other point in history. This

suggests a vast increase in the number of states that will develop or expand nuclear power capacity—an increase from 30 nuclear power-using states to perhaps 50 or 60 by 2050. The geographic distribution of new countries expressing an interest in acquiring a nuclear energy capability is telling, including twelve Middle Eastern and North African states, seven new states in Southeast Asia, and five in Central and Southern Asia.

Historically, the United States enjoyed a dominant position in the nuclear supply market which reinforced its leadership role in designing the nonproliferation regime. But with the emerging expansion of civilian nuclear power globally, the United States is no longer the dominant supplier of plants, equipment, or fuel. For instance, with the end of the HEU-LEU (highly enriched uranium-low enriched uranium) Purchase Agreement in 2013, the United States will lose its direct access to about 50 percent of the nuclear material currently available for energy production. This is further exacerbated by the push for reprocessing which is not now economical, but likely will become more so at some point, in the face of the rising cost of fossil fuels. America's marginalization in that industry gives Washington less leverage in this debate. Unless new initiatives for increased nuclear energy are carefully managed, expansion of civilian nuclear power risks introducing serious new global proliferation challenges to countries whose nonproliferation fortitude may not unreasonably be outweighed by desperate in-country economic and other development needs.

Meanwhile, in January 2007, four senior American statesmen breathed new life into the goal of abolishing atomic weaponry. Their worthy cause faces significant hurdles, chief among them, circumventing the vested interests in the status quo both in the US and in other nuclear weapons states. Equally important, but less well understood, are the long-term implications that a growing demand for civilian nuclear power will have on the willingness of the nuclear weapons states to foreswear a nuclear power capability. Getting to zero will require more than disarmament commitments among the P-5 (five permanent members) and the outliers. It requires moving from a model based on technology denial to one premised on technology governance. Long-term success will require a new grand bargain whereby the developing world gains access to critical technologies while being fully vested in a comprehensive nonproliferation and

global control regime. Traditional technology denial mechanisms are simply no longer relevant to modern economic realities. Bridging the security-development divide will be critical to servicing competing demands in a way that ensures the long-term security and economic development of every country. Access to sufficient energy supplies always has and will continue to be a dominant factor in every state's pursuit of prosperity.

## Biotechnology Revolution

In recent decades, biotechnology has spread across the globe at an unprecedented rate. Countries that previously lacked the technology now possess it, while others, such as the United States, have seen rapid growth in related industries. From 2004 to 2006, the United States witnessed a 29 percent increase in biotechnology drug development.[12] As of 2005, China had approximately 20,000 personnel in the biotechnology sector working in more than 200 facilities. Cuba's biotech sector is strong, with its production of vaccines for meningitis, while South Korea, Singapore, and Brazil also have benefited from the globalization of dual-use technology.[13] The World Federation for Culture Collections (WFCC) has registered 538 culture collections in 67 countries, including states such as Zimbabwe, Iran, Uzbekistan, and Papua New Guinea. WFCC statistics also show that more than 2,800 people work in these institutions.[14] As of late 2007, approximately 30 Biosafety Level 4 (BSL-4) laboratories, which work with the most dangerous pathogens in the highest containment environment, existed worldwide, including facilities in Belarus, Gabon, and India.[15] The availability of life-saving technologies and organisms has never been greater, but these benefits come with potentially enormous costs.

The same technology and processes that can be used to develop vaccines can also be used by rogue states or terrorist groups to inflict massive casualties upon unsuspecting populations. In 2006, the alleged leader of Al Qaeda in Iraq called on like-minded scientists "to join the struggle in Iraq and develop unconventional weapons to be used on the battlefield."[16] The spread of biotechnological capabilities has created conditions in which "a trained biologist with a relatively small amount of cash may soon engineer his own nasty bugs."[17] This decade has seen several cases of nonstate actor acquisition of dangerous pathogens, the most noteworthy of which was the anthrax attacks of October 2001 in the United States. According to FBI allegations,

the attacks were carried out by Bruce Ivins, a rogue scientist who worked with anthrax in the United States Army Medical Research Institute of Infectious Diseases; he is believed to have worked alone.[18] Clearly, efforts to prevent the spread of dangerous technology, previously aimed entirely at preventing proliferation to state governments, face significant challenges when dealing with disaffected or fanatical individuals.

## Rise of Nonstate Actors

The rising role and potential power of nonstate actors plays significantly in any assessment of both the threats and solutions to today's proliferation challenges. Nonstate actors include not just the rogue scientist or terrorist network, but also industry actors in relevant technological areas and nongovernment organizations. A.Q. Khan is emblematic of the damage wrought by a "rogue scientist" operating in concert with a network of business actors from Europe to Africa to Malaysia.[19] While international terrorist groups like Al Qaeda represent the threats associated with the democratization of violence resulting from globalization, other nongovernment organizations reflect the flexibility and transnational operational capacity working to elevate human rights, eliminate the scourge of landmines, and respond to environmental challenges worldwide. Whereas governance capacity within states will remain the foundation for achieving long-term nonproliferation objectives, industry and other nongovernment organizations must increasingly work in concert with governments to meet the burgeoning proliferation challenges and will be key agents in providing comprehensive, effective solutions.

## Technology Governance—UNSCR 1540

In tandem with a renewed commitment toward realization of Article VI commitments under the Nuclear Non-proliferation Treaty, the nuclear "haves" must recognize the proliferation risks that will accompany greater access to nuclear technology. More generally than the nuclear case, the waning efficacy of discriminatory or denial regimes requires that the international community—particularly core members of the existing technological "haves"—begin focusing on providing assistance to achieve minimal standards of "governance" worldwide. Good governance, including rule of law, provides the only viable foundation for effective and sustainable implementation of measures designed to achieve controls on, and management of, dangerous dual-use technologies within and between states. Achievement of basic governance capacities will at least ensure that states are not unwittingly contributing to proliferation due to insufficient financial controls, inadequate border security, nonexistent or anachronistic export controls, and the like. In addition, criminalization of the actions of individuals or groups within their borders, as it pertains to proliferation, will only be as effective as the legal framework, policing capacities, and judicial competencies at hand. Lastly, assistance targeting attainment of good governance as a first-order priority helps overcome problems of political will that continue to stymie implementation of the resolution and fosters the necessary ownership of the assistance to bolster sustainability.

UN Security Council Resolution 1540 sets forth an entire suite of measures to achieve WMD technology governance. The resolution attempted to address the inadequacies of existing treaty measures and the particular challenge of WMD proliferation by nonstate actors in one swift all-encompassing mandate. It mandates a baseline of extensive "appropriate effective" antiproliferation obligations and requires all states to enact and enforce these measures promptly.[20] It requires states to "criminalize proliferation, enact strict export controls, and secure all sensitive materials within their borders."[21] The resolution includes twelve points obligating all UN member states to "adopt and enforce appropriate effective laws which prohibit any nonstate actor to manufacture, acquire, possess, develop, transport, transfer or use nuclear, chemical, or biological weapons and their means of delivery"; develop and maintain "effective physical protection measures", "border controls and law enforcement efforts" to address illicit trafficking, and "national export and trans-shipment controls."[22] In brief, the Security Council legislated obligations for "supply-side measures against proliferation on every other nation in the world."[23]

The resolution's emphasis on nonproliferation assistance must be underscored. As 1540 imposes a demanding suite of obligations on all states, any state, "lacking the legal and regulatory infrastructure, implementation experience and/or resources," may request assistance from those states in a position to do so. 1540 was passed unanimously by the UN Security Council and has enjoyed two follow-on resolutions to provide additional impetus for its implementation and extend the mandate of the 1540 Committee to monitor progress on imple-

mentation. Despite the obvious lack of capacity among a large number of states to implement the resolution, it has not yet engendered the required conceptual shift from a focus on piecemeal efforts or technical measures—such as border security, export controls, legislative drafting—to the more encompassing governance capacities requisite for the effective and sustainable implementation of the resolution's objectives.

Embracing technology governance as opposed to denial is not only needed to address the confluence of forces wrought by globalization, but this transition is a requisite parallel track toward eventual complete nuclear disarmament. Incremental or even radical steps toward nuclear disarmament among the current nuclear weapons states alone will not compensate for the longstanding historic grievances of colonization, industrial imperialism and the like—technology denial being perceived as only one facet of deliberate and coordinated structural oppression. While renewed steps toward disarmament by the nuclear weapons states can help overcome the "legitimacy hurdle" confronted by Resolution 1540, only by embracing it as an opportunity to dismantle the existing denial regimes will the non- and counter-proliferation agenda achieve critical political momentum and eventual universal acceptance.

Operationalizing the shift from denial to governance requires recognition of the role that traditional development assistance plays in achieving minimal standards of good governance and orchestrating our development and security assistance tools to maximum effect. Not only does this greatly expand the type of tools necessary to achieve our nonproliferation objectives, facilitating attainment of technology governance capacities worldwide necessarily entails a "whole of government" approach, i.e. "applying the entire suite of foreign policy tools to effectively address the conditions in weak or failed states in order to promote development."[24] While the Bush administration's 2002 National Security Strategy noted that "weak states…can pose as great a danger to our national interests as strong states," fashioning coherent responses to the wide-ranging and systemic problems of weak states presents substantial challenges to the traditional donor community.

The West's sixteen years of experience in providing nonproliferation assistance to the states of the former Soviet Union suggests the mutually reinforcing conditions necessary for progress in achieving the resolution's objectives. A particular challenge is getting host country buy-in to receive assistance and then sustain the measures put in place, especially when other pressing economic and social priorities already occupy the political agenda. A "whole of government" approach offers the added benefit of facilitating recipient state buy-in regarding the value of the assistance. Addressing the recipient state's capacity-building priorities can help create the conditions for sustainable implementation of the resolution, while addressing the issues of political will, capacity needs, and ownership of assistance in a comprehensive manner. These development priorities of the potential recipient state provide the starting point for a package of assistance that makes sense in light of underlying governance challenges and their link to "effective" implementation of specific obligations in the resolution.

An additional requirement will be achievement of consensus regarding the specific meaning of "appropriate effective" as it pertains to the measures set forth in the resolution. Such consensus will be stymied by assumptions regarding potential use of the resolution to establish standards of continuing detriment to the developing world. This assumption can only be overcome through concerted efforts to dismantle existing exclusionary denial regimes and strive for global governance standards. But efforts to achieve consensus regarding minimal standards and best practices cannot wait for the assistance rendered to actually create the conditions for implementation worldwide, not to mention pushing for full compliance with preexisting treaty obligations as an essential immediate step. For example, this can provide additional impetus for implementation of safeguards agreements by the remaining 29 states which are signatories to the Nuclear Nonproliferation Treaty but have never fulfilled this basic obligation.[25]

Lastly, industry remains the most important nonstate actor for eventual achievement of technology governance. As witnessed in the eventual ratification and implementation of the Chemical Weapons Convention, industry's involvement in ensuring practicable verification measures and support for the convention's implementation was critical. The biotech and pharmaceutical industries provide the opposite example in terms of efforts to provide a verification protocol for the

Biological Weapons Convention. Industry must work in partnership with governments to devise controls that balance the risks of advanced technology, particularly WMD technology, with the benefits that greater access may provide to consumers and, indeed, to humanity.

### Legal and Technical Requirements

In order to implement UN Security Council Resolution 1540 and the suite of measures that it encompasses, a state must have in place the necessary legal and regulatory infrastructure. Specifically, it is essential to have a bureaucracy capable of implementing and maintaining the required legal framework. Obviously, the state must also have a legal system capable of adjudicating violations. This requires not only an oversight and policing capacity to detect violations of the law, but the wherewithal to meet certain evidentiary standards to prosecute matters related to proliferation by individuals in all its forms—trafficking of weapons or materials, knowledge support to a clandestine effort, as well as providing financial support for illegal activities. Legal systems vary widely and are a result of history, culture, and societal influences, and it is difficult to provide an easy assessment regarding the status of "rule of law" in different states. However, it is safe to say that a majority of states will confront difficulties in implementing the resolution simply because they lack the legal institutional capacity to do so.[26] Providing technical assistance to craft an appropriate legal framework to bring states into compliance with the resolution should only follow long-term institution building to ensure a minimum standard of legal governance for effective application of the laws.

The resolution also requires technical capacities far beyond what most states currently possess. In addition to the collection of evidence relevant to adjudicating proliferation, a state must also have policing capacity to detect any criminal or civil violations against possession, transfer, use, development, or financing of biological, chemical, and nuclear weapons. This includes the staff and technology to monitor any dubious activities such as possible money laundering for weapons financing or unusual border activity. Additionally, states must maintain a robust customs department to oversee end-user controls, border controls, and to regulate transit, transshipment, and reexport of weapons. If a state possesses any nuclear, biolog-

ical, or chemical weapons, it must account for and secure its stockpile. This requires appropriate physical protection measures such as accompanying staff, oversight, and equipment. Should bureaucratic and legal efforts fail to prevent the use of nuclear, biological, or chemical weapons, a state must have in place a competent means of combating such items. For instance, capabilities, infrastructure, organization, and previous training that would allow a government to respond to an attack, provide medical care for its population, and restore order would exist.

## Recommendations

Resolution 1540 is the most all-encompassing nonproliferation mechanism available and the only one focused on the threat of nonstate actors. Although the task ahead seems formidable, the resolution must be viewed as an opportunity to close the gaping hole in the existing nonproliferation regimes and begin addressing the governance needs requisite to rise to the proliferation challenges resulting from globalization. In addition, it should be used to bridge the North-South divide.

- Donor states must embrace Resolution 1540 as an opportunity to move away from technology denial toward a framework of technology governance globally. This is the only means whereby the nonproliferation agenda and the resolution itself can gain critical political momentum and eventual universal acceptance.

- This requires fully leveraging 1540 as a mechanism for sustained engagement between traditional donor countries and the Global South to achieve mutually identified objectives. Without agreement on the value of the assistance, recipient countries will not sustain the measures put in place.

- Operationalizing the shift from denial to governance requires recognition of the role of traditional development assistance in achieving minimal standards of good governance and orchestrating our development and security assistance tools to maximum effect.

- Governance, including rule of law, must be the baseline upon which specific assistance related to countering WMD proliferation occurs. Without the capacity to address existing threats—such as illicit trafficking and epidemics—which plague their society and threaten their stability, recipient

states cannot succeed in sustainably implementing the measures mandated by the resolution.

- Donor states should take a "whole of government" approach, both in assessing needed assistance and adapting their toolkit to respond to a range of governance issues related to effective implementation of the resolution.

- Donor states should provide technical assistance only in cases where fundamental governance standards are met. Without this foundation, the assistance will be neither effective nor sustainable.

- Donor and recipient states must involve relevant industry actors in formulation of the legal and regulatory mechanisms requisite to address proliferation challenges. Industry, working in concert with governments, must have a stake in comprehensive and uniform implementation of processes or standards.

## Conclusion

The forces of globalization will continue to erode traditional approaches to nonproliferation, especially those approaches that are focused on technology denial. These same approaches are further evidence of a discriminatory international economic order, hindering universal acceptance of the nonproliferation regimes. In order to address these challenges to our nonproliferation objectives, the global community must work to achieve a minimum standard of technology governance. UN Security Council Resolution 1540 is one mechanism to achieve this objective, but it will require a whole of government approach in order to provide assistance aimed at achieving the minimum foundation of governance capacities conducive to effective, sustainable implementation of the resolution's nonproliferation mandate.

## Endnotes

1 "Structural conflict" was coined by Stephen D. Krasner in *Structural Conflict: The Third World against Global Liberalism* (University of California Press, Berkeley; 1985), which discusses the North-South divide extensively, including the formation of the Group of 77 and the subsequent calls for a New International Economic Order.

2 COCOM included all NATO countries (except Iceland) as well as Japan and Australia. COCOM established a uniform set of export controls to prevent access to technologies that might enhance the military capabilities of the Warsaw Pact, People's Republic of China, and several other countries. As early as the summer of 1991, COCOM began trying to adapt to changes in countries' status with the end of the Cold War and the rapid diffusion of technologies that confounded the existing export control system.

3 Formation of the Group of 77 by developing countries in the mid-1960s led to demands for a New International Economic Order, or NIEO. This aspiration grew out of the neo-Marxist political economy theory of the 1960s, which argued that the international trading system was condemning the "periphery"—Latin America and other developing countries—to poverty, exploitation, and dependency. Among other measures, NIEO specifically called for technology transfer and the negotiated redeployment of some developed country industries to developing nations. See Krasner, p. 7-13.

4 Michael Moodie, "Beyond Proliferation: The Challenge of Technology Diffusion—A Research Survey" in: *Weapons Proliferation in the 1990s*, Brad Roberts, ed. (Cambridge, MA: MIT Press, 1996), pp. 71-92, and Brad Roberts, "Technology Diffusion and International Security" and Nabil Fahmy, "Export Control Regimes: A Critique" in: *Arms Control in a Multi-Polar World*, James Brown, ed. (Amsterdam: VU University Press: 1996), pp. 214-251.

5 For a concise history of the transition from COCOM to the Wassenaar Arrangement go to: *http://www.cns.miis.edu/pubs/inven/pdfs/wass.pdf*.

6 For a discussion of export control regimes, see Michael Beck and Seema Gahlaut, "Creating a New Multilateral Export Control Regime," *Arms Control Today* 33, no. 3 (April 2003), accessed at: *http://www.armscontrol.org/act/2003_04/beckgahlaut_apr03.asp*.

7 See, for example: Moisés Naím, *Illicit: How Smugglers, Traffickers and Copycats are Hijacking the Global Economy*. (New York: Anchor Books, 2006); Michael Kenneyl, *From Pablo to Osama: Trafficking and Terrorist Networks, Government Bureaucracies, and Competitive Adaptation* (University Park: The Pennsylvania State University Press, 2007); Leslie Holmes, ed. *Terrorism, Organised Crime and Corruption: Networks and Linkages* (Cheltenham, United Kingdom: Edward Elgar Publishing Limited, 2007); Willem van Schendel and Itty Abraham, eds. *Illicit Flows and Criminal Things: States, Borders, and the Other Side of Globalization* (Bloomington: Indiana University Press, 2005); H. Richard Friman and Peter Andreas, eds. *The Illicit Global Economy and State Power*. (Lanham, MD: Rowman & Littlefield Publishers, Inc., 1999).

8 Glenn J. McLoughlin and Ian F. Fergusson, "High Performance Computers and Export Control Policy: Issues for Congress," CRS Report for Congress RL31175 (Updated May 5, 2005), accessed at: *http://fas.org/sgp/crs/natsec/RL31175.pdf*.

9 Committee on Research Standards and Practices to Prevent the Destructive Application of Biotechnology and the National Research Council. *Biotechnology Research in an Age of Terrorism* (Washington: National Academies of Science, 2004). Working Party on Biotechnology Task Force on Biotechnology for Sustainable Industrial Development, "Globalisation of Industrial Biotechnology R&D," Committee for Scientific and Technological Policy, Organization for Economic Co-operation and Development DSTI/STP/BIO(2008)13 (February 8, 2008), accessed at: *http://www.olis.oecd.org/olis/2008doc.nsf/NEWRMSFRED AT/NT00000AD6/$FILE/JT03240092.PDF*.

10 James A. Russell "Non-State Actors and the 2016 Proliferation Environment." *Nonproliferation Review* 13, no. 3 (2006): 645-657.

11 Access UN Security Council Resolution 1540 at:

*http://www.un.org/Docs/sc/unsc_resolutions04.html.*

[12] "2006 Report: Medicines in Development" and "2004 Survey: Medicines in Development," Pharmaceutical Research and Manufacturers of America, Washington DC.

[13] Committee on Advances in Technology and the Prevention of Their Application to Next Generation Biowarfare Threats, *An International Perspective on Advancing Technologies and Strategies for Managing Dual-Use Risks: Report of a Workshop* (Washington: National Research Council, 2005), accessed at: *http://www.nap.edu/catalog/11301.html.*

[14] World Federation for Culture Collections, "WDCM Statistics" (August 26, 2008), accessed at: *http://wdcm.nig.ac.jp/statistics.html.*

[15] Gigi Kwik Gronvall, Joe Fitzgerald, Allison Chamberlain, Thomas V. Inglesby, and Tara O'Toole, "High-Containment Biodefense Research Laboratories: Meeting Report and Center Recommendations," *Biosecurity and Bioterrorism: Biodefense Strategy, Practice, and Science*, Volume 5, Number 1 (New Rochelle, NY: Mary Ann Liebert Publisher, Inc., 2007): 75, accessed at: *http://www.liebertonline.com/doi/pdfplus/10.1089/bsp.2007.0902.*

[16] Sammy Salama and Gina Cabrera-Farraj, "New Leader of Al-Qaeda in Iraq Calls for Use of Unconventional Weapons against U.S. Forces," *WMD Insights* No. 10 (November 2006), accessed at: *http://www.wmdinsights.org/PDF/FP_NovIssue.pdf.*

[17] "Bioterrorism: A Mystery Unraveled," *The Economist* Vol. 66, No. 950 (August 9, 2008).

[18] Carrie Johnson and Joby Warrick, "FBI Elaborates on Anthrax Case," *The Washington Post* (August 19, 2008), accessed at: *http://www.washingtonpost.com/wp-dyn/content/article/2008/08/18/AR2008081802174.html.*

[19] See *Nuclear Black Markets: Pakistan, A.Q. Khan and the rise of proliferation networks: a net assessment*, International Institute for Strategic Studies (London, 2007): 23-30.

[20] "Appropriate effective" is not defined by the Resolution and continues to be a point of debate in technical, expert circles related to specific WMD threats, nuclear in particular. Achievement of consensus on a standard definition of what this means for different aspects of the resolution likely will not be possible in the immediate future due to differing circumstances and priorities.

[21] White House, "President Announces New Measures to Counter the Threat of WMD," February 11, 2004.

[22] UN Security Council Resolution 1540, Adopted by the Security Council at its 4956th meeting, S/RES/1540, April 28, 2004. Access resolution at: *http://www.un.org/Docs/sc/unsc_resolutions04.html.*

[23] A resolution was used in lieu of a negotiated treaty or an agreed reinterpretation of Article 3 to address nuclear proliferation concerns, see Chaim Braun and Christopher F. Chyba, "Proliferation Rings: New Challenges to the Nuclear Nonproliferation Regime," *International Security* 29, No. 2 (Fall 2004): 43-44.

[24] Development in this context is generally defined as "institutions capable of delivering economic growth, human security and good governance." See Stewart Patrick, "U.S. Policy toward Fragile States: An Integrated Approach to Security and Development" in *The White House and the World: A Global Development Agenda for the Next U.S. President* (Washington, DC: Center for Global Development, 2008), 257-258.

[25] Twenty-nine members of the NPT still do not have safe-

guards agreements with the IAEA in force. For an index of status see: *http://www.iaea.org/OurWork/SV/Safeguards/sir_table.pdf.*

[26] As one example, Freedom House's "Freedom in the World 2008" survey ranks states' civil and political rights according to an array of different indices, including a "rule of law" measurement. Available at: *http://www.freedomhouse.org/template.cfm?page=363&year=2008.*

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