

About the Author*

Ken Berry is Senior Consultant to the Global Security Program of the EastWest Institute and International Legal Adviser to the International Crisis Group. He is a former senior Australian Ambassador, and served a period as Assistant Secretary for Arms Control and Disarmament in the Australian Department of Foreign Affairs and Trade.*

**The East West Institute does not generally take positions on policy issues. The views expressed in this publication are those of the author and do not necessarily reflect the views of the organization, its Board of Directors or other staff.*

PROTECT!

THE SECURITY OF PAKISTAN'S NUCLEAR FACILITIES

Ken Berry

Policy Paper 2/2008

SPECIAL ACKNOWLEDGMENT

The EastWest Institute would like to acknowledge the generous support of

The Francis Finlay Foundation

And

Kathryn W. Davis

To our efforts to promote a safer and better world

EXECUTIVE SUMMARY

International concern over the security of Pakistan's nuclear facilities has significantly increased with recent turmoil there. But how justified is this concern? Pakistan carries out a full range of activities relating to nuclear weapons: from mining and milling raw materials; through the production of heavy water, tritium, highly enriched uranium and plutonium; to weaponization. It also has an advanced missile program. Yet little is actually known about the security of all these facilities, apart from the fact that they are guarded by a specially trained force of 10,000 separate from, but under the control of, the military.

It is safe to assume that Pakistan's disciplined and largely non-corrupt armed forces expend considerable effort to safeguard their flagship weapon. The problem is that the military is becoming dangerously overstretched in some areas of the country, and Islamist extremists have managed to spread their violent campaign to major urban areas. Increasing death rates and the emergence of virtual no-go zones in some regions is also starting to demoralize elements of the military, further increasing international concern.

Pakistan will not give up its nuclear weapons unless India does; and India will not do so until not only China, but the other nuclear weapon states (NWS), do so as well. In regard to the proliferation of nuclear weapons and the attendant concerns such proliferation generates, the NWS have only themselves to blame since they have shown no discernible movement toward even a timetable for their own nuclear disarmament—let alone tangible and irreversible disarmament steps—no matter how far off that target might be. Genuine negotiations for a fissile material cut-off treaty will need to begin, and both India and Pakistan will need to play a significant and meaningful role in it. States more generally will need to contribute more, both financially and technically, to the development of new, low enrichment technologies and international stockpiles of nuclear fuel under International Atomic Energy Agency (IAEA) safeguards for civilian power generation. Pakistan might at least take heart from knowing that if it ever gives up its nuclear weapons, its civilian nuclear future is at least guaranteed. In the meantime, countries that might be able to assist Pakistan secure its nuclear facilities—particularly the United States—are constrained by their own legislative and political restrictions imposed on Pakistan following the 1998 nuclear tests and 2004 A.Q. Khan scandal, as well as by Pakistan's own obsessive secrecy about its nuclear weapons program. Assistance given in the form of strengthening of policing and detection at major transportation hubs and in the monitoring of

nuclear personnel when traveling and security for retiring staff might provide sufficient cover in this regard, as well as boosting nuclear security internationally.

There has been no indication that Pakistan's nuclear weapons were in any danger during the latest turmoil; nor is that situation likely to change under any democratically elected civilian government that might replace the current military regime. At the same time, there is an urgent need to bolster confidence and public transparency surrounding Pakistan's policies and practices for securing its nuclear sites and materials.

Key recommendations from this report are:

For the international community at large:

- ❑ Consider what steps states might take, either individually or jointly, to assist Pakistan in bolstering security at its nuclear facilities. Such assistance would need to take into account legislative and other restrictions states might have on extending aid to Pakistan on nuclear matters, as well as Pakistan's own degree of willingness to cooperate with such assistance.

For the United States:

- ❑ Consider whether a multilateral effort to assist Pakistan on nuclear security might allow wide-ranging United States' participation despite existing Congressional and policy limitations on U.S. interaction with Pakistan on nuclear issues generally.

For the government of Pakistan:

- ❑ Review at an early opportunity the sufficiency of existing measures for the security of Pakistan's nuclear weapons and related facilities.
- ❑ Consider the early adoption of a policy of greater openness on matters relating to aspects of security at its nuclear facilities, including willingness to accept international assistance in this regard when offered.
- ❑ Participate actively and positively in the negotiation of an FMCT.

CONTENTS

EXECUTIVE SUMMARY	I
INTRODUCTION: THE SECURITY OF PAKISTAN'S NUCLEAR FACILITIES	1
COMMAND AND CONTROL	2
SCOPE OF PAKISTAN'S NUCLEAR FACILITIES	3
RAW MATERIALS	4
WEAPONIZATION	6
NUCLEAR WEAPON MANUFACTURE AND STORAGE	7
PHYSICAL SECURITY	8
MISSILE CAPABILITY	8
EXPORT CONTROLS	9
PERSONNEL MANAGEMENT	10
NUCLEAR DOCTRINE	10
THE FUTURE.....	12
NPT CONSIDERATIONS.....	13
PERSONNEL	14
POLICING	16
CONCLUSION AND RECOMMENDATIONS	16

INTRODUCTION: THE SECURITY OF PAKISTAN'S NUCLEAR FACILITIES

Since its 1998 nuclear tests, there has been grave international concern about the possibility of Pakistan's nuclear weapons or technology falling into the hands of extremists, either through infiltration, lax security procedures, or the fall of the current military or a subsequent democratic government. Before 2004, when Pakistan was declared a "major ally" by the United States, the general assessment was that Pakistan's military was more than capable of maintaining nuclear security. But with increased Islamic fundamentalist unrest throughout the country since then, particularly in the border regions with Afghanistan, and the crisis caused by President Musharraf's declaration of a state of emergency late in 2007, which culminated in the assassination of Benazir Bhutto at the very end of the year, international concern has grown to new heights. Particular concern has been felt in the United States, given the important role Pakistan is at least theoretically playing in the so-called "war on terror."

The International Atomic Energy Agency (IAEA) head, Mohamed ElBaradei, added fuel to the fire in an interview in early January 2008 in which he expressed concern about Pakistan's nuclear weapons falling into the hands of Islamist militants.¹ While militants gaining possession of nuclear weapons or technology cannot be ruled out entirely—no one could guarantee that—the reality of such a scenario is another matter entirely. It should also be borne in mind that ElBaradei has other fish to fry in the sense that he would in any case find the Pakistani example a useful one to remind other nuclear states of the need to exert constant high vigilance to protect their own nuclear facilities.

While security at Pakistani nuclear sites might be adequate in normal circumstances, it could certainly be improved, as the most recent crisis has highlighted. The United States has spent billions in securing its own nuclear assets, and that is ongoing expenditure just to keep one step ahead of the terrorists. Even with high security and stable domestic political and social systems, accidents can happen, as illustrated by an incident in 2007 in which, due to a series of errors and oversights on a number of different levels, nuclear weapons were flown across the whole of the continental United States without any senior officials being aware of it. Nuclear security in Russia also needed considerable boosting after the fall of the Soviet Union, and despite the billions the United States has spent in Russia on improving nuclear

1 Reuters, "Better atom security needed in Pakistan – ElBaradei," Reuters India, January 10, 2008, <http://in.reuters.com/article/southAsiaNews/idINIndia-31341020080110>.

security, concerns are still widely held about just how secure Russian nuclear and other WMD facilities really are.

While claiming that their security is adequate, there have nonetheless been some hints from Pakistani authorities that they would appreciate some external assistance in this regard.² The matter is complicated for Pakistan, however, by the secrecy surrounding its nuclear weapons development as well as the embarrassment it might feel in the Islamic and non-aligned world if it openly sought assistance from the West. For the United States, providing such assistance would be made extremely difficult by the legislative and other measures imposed on Pakistan in the wake of its 1998 nuclear tests and the 2004 revelations on the A.Q. Khan nuclear network.³ In addition, the United States would not want any material assistance to Pakistan to adversely affect its growing, but still problematic, relationship with India. A more distant concern for the United States might even be possible accusations that it was further disrespecting its Nuclear Non-Proliferation Treaty (NPT) undertakings by providing assistance to a state outside the scope of the treaty. At the same time, however, a fundamental concern for the United States will remain the encouragement of a continuing active role by Pakistan in the “war on terror.”

COMMAND AND CONTROL

The early years of Pakistan’s clandestine nuclear program were fairly lax in terms of security, as the activities of A.Q. Khan and his research laboratories have shown. It was only with its 1998 nuclear tests that Pakistan became much more serious about the security of both its civilian and military nuclear programs. It has undertaken significant improvements in its technical and procedural nuclear security arrangements since then. Pakistan has also more or less willingly engaged with international partners in an attempt to further strengthen its security and control processes.

In early 1999, in the wake of the nuclear tests the year before, the then commander-in-chief of the armed forces, General Pervez Musharraf, announced that a National Command Authority (NCA) aimed at integrating the

² “Pakistan’s Nuclear Dilemma,” Carnegie Endowment for International Peace, Non-Proliferation Project Roundtable, October 2, 2001.

³ Despite these restrictions, the *New York Times* revealed on November 18, 2007 that the United States has covertly provided Pakistan with nearly \$100 million in equipment and training to help secure its nuclear facilities. Part of this assistance was to build a nuclear security training center which remains unfinished, though it was supposed to have commenced operation in 2007. ‘U.S. Secretly Aids Pakistan in Guarding Nuclear Arms’, *New York Times*, November 18, 2007, http://www.nytimes.com/2007/11/18/washington/18nuke.html?_r=3&oref=login&oref=slogin&oref=slogin.

command and control system for nuclear weapons would be established within a month. The reality was a little different since the (then) civilian government did not want to include the armed forces in nuclear planning or control. This was overcome in October 1999 when the democratic government was overthrown and Musharraf installed himself as president. The NCA was quickly established on February 2, 2000, with the president (who was still commander-in-chief) as chair. It also includes the prime minister and foreign minister, the chairman of the Joint Chiefs of Staff, as well as the commanders of the three armed forces, and is assisted by technical experts.

The NCA operates through two committees: the Employment Control Committee and the Development Control Committee. The secretariat of the NCA is the Strategic Plans Division, which is the single authority with day to day oversight of the nuclear sector. Its director-general is a serving military officer (currently Lt Gen Khalid Ahmed Kidwai). As an indication of where the real power still lies in Pakistan, the SPD is physically located in the Joint Services Headquarters in Islamabad. On the positive side, however, control of these assets by the military is not necessarily a bad thing in Pakistan. According to a wide variety of South Asian specialists, the military is the least corrupt and most professional part of Pakistani society.⁴

SCOPE OF PAKISTAN'S NUCLEAR FACILITIES

The exact size of Pakistan's nuclear arsenal, both in terms of the number of weapons and the size of its fissile material stockpiles, is not known in detail. However, there are estimates that it has enough fissile material for about 60 weapons. In this regard, it is thought to have produced approximately 1.3 metric tons of highly enriched uranium (HEU) and slightly more than 500 kg of plutonium.⁵

Although not party to the NPT, Pakistan is a member of the IAEA and two of its nuclear power stations (Karachi⁶ and Chashma-1,⁷ near the border with

⁴ David Albright, "Securing Pakistan's Nuclear Weapons Complex," (paper commissioned and sponsored by the Stanley Foundation for the 42nd Strategy for Peace Conference, Strategies for Regional Security, South Asia Working Group, Warrenton, Virginia October 25-27, 2001), <http://www.isis-online.org/publications/terrorism/stanleypaper.html>.

⁵ Kenneth N Luongo and Brig. Gen. Naeem Salik (Rtd.), "Building Confidence in Pakistan's Nuclear Security," *Arms Control Today* 37, no. 10, (2007) http://www.armscontrol.org/act/2007_12/Luongo.asp; Alexander Glaser, "Global Fissile Material Report 2007," International Panel on Fissile Materials, United Nations, New York City, October 19, 2007, pp. 8, 10, 14.

⁶ This is a small (125 MWe) Canadian pressurized heavy water reactor (PHWR) which started up in 1971. It is generally known as KANUPP.

Afghanistan) and two of its nuclear research reactors at the Pakistan Institute of Nuclear Science and Technology (PINSTECH) at Rawalpindi near Islamabad, are under IAEA safeguards.⁸ Given the secrecy surrounding the rest of Pakistan's nuclear program, some cynicism must be felt about these few, token IAEA safeguarded facilities, though the Pakistani authorities for their part present them as an act of good faith. At the same time, of course, more sensitive facilities relating to the whole gamut of Pakistan's nuclear weapons capabilities are kept well away from IAEA inspectors and other prying eyes.

Despite the cloak of secrecy, quite a bit is known about the Pakistani nuclear weapons complex. It covers the whole range of activities from mining and milling the base materials, the production of heavy water, highly enriched uranium (HEU) and plutonium, and includes Pakistan's indigenous—with a little help from its friends—and now advanced missile industry, a number of whose products are capable of carrying nuclear weapons well into Pakistan's declared target of choice, India.⁹

What is unknown in the public domain, however, are exact details of the physical security measures in place at each of the facilities. They are, of course, likely to be rigorous.

RAW MATERIALS

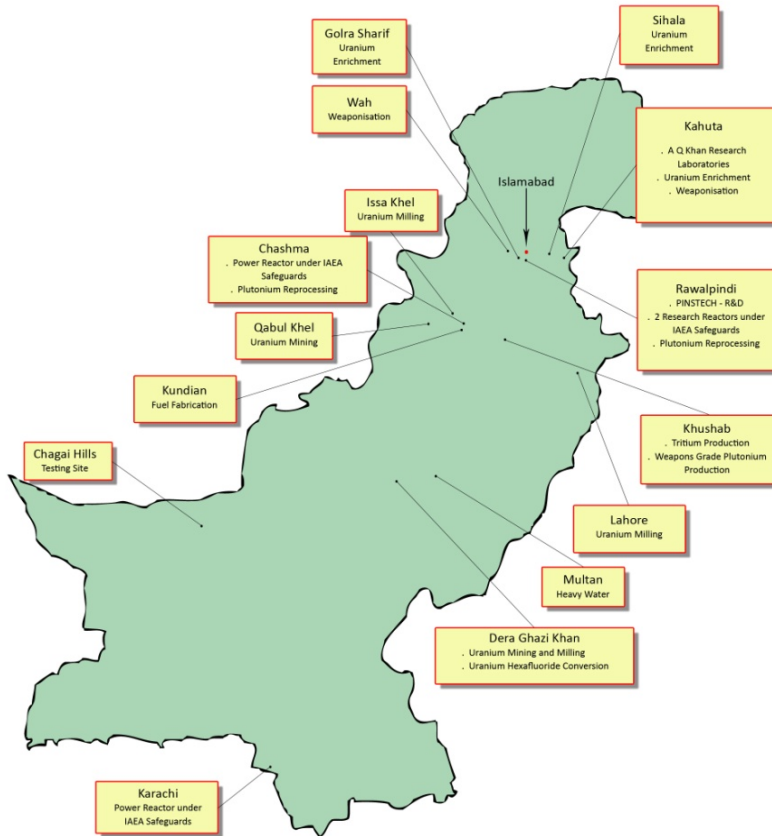
Pakistan currently relies on locally mined low-grade uranium. Deposits are being mined at Dera Ghazi Khan in central Pakistan and Qabul Khel (or Lakka), not far from the border with Afghanistan. The government has set a target of 350 tons of U308 by 2015. However, this is only around one third of the country's projected needs. If Pakistan remains outside the NPT, and thus subject to Nuclear Suppliers Group (NSG) sanctions, its nuclear weapons program will be limited, and plans to significantly expand its civilian nuclear power program curtailed. It can seek to obtain uranium from other sources, but these are limited outside of the NSG.

⁷ A 300 MWe pressurised water reactor (PWR) supplied by China's CNNC. It started up in May 2000 and is also known as CHASNUPP-1. Plutonium reprocessing is carried out there. A second power reactor, CHASNUPP-2, is under construction nearby but is not expected to come on line until 2011.

⁸ The PINSTECH centre also carries out plutonium reprocessing.

⁹ Lt. Gen. Khalid Kidwai, head of Pakistan's Strategic Plans Division, was quoted as saying Pakistan's nuclear weapons were "aimed solely at India," in "Pakistanis see new aggression in Indian nuclear doctrine," *Daily Times*, January 24, 2003, http://www.dailytimes.com.pk/default.asp?page=story_24-1-2003_pg7_39.

MAP OF PAKISTAN'S NUCLEAR FACILITIES AND, MINING AND MILL SITES FOR RAW MATERIALS



PAKISTAN'S NUCLEAR COMPLEX

Note: Only those facilities specifically indicated are under IAEA safeguards

Mined uranium is milled on-site at Dera Ghazi Khan into yellowcake, where the plant also carries out conversion of the yellowcake into uranium hexafluoride, a necessary step in the enrichment process. This conversion is also carried out at Golra Sharif, a little to the west of Islamabad, and Sihala, to the east. A milling plant also exists at Issa Khel close to the Qabul Khel mine, with nuclear fuel fabrication carried out a little further to the east at Kundian.

Heavy water (D₂O) is produced at Multan, to the northeast of Dera Ghazi Khan, while tritium is produced at Khushab, south of Islamabad, which also has a small "multipurpose" 50 MWt heavy water reactor that apparently is used solely for the production of weapons-grade plutonium. It started operation in 1998.¹⁰

WEAPONIZATION

The actual fissile material for nuclear weapons—highly enriched uranium (HEU) and plutonium—is mostly produced at the A.Q. Khan Research Laboratories at Kahuta to the east of Islamabad and not far from the border with India. There is another, newer enrichment facility near Wah, to the northwest of Islamabad.¹¹ In addition, there are smaller enrichment facilities, including ultracentrifuge plants at Sihala (midway between Islamabad and Kahuta) and Golra (near Wah). There may be others though nothing is known of them. There have been reports, however, that construction has started on a 1,000 MW heavy water reactor that will potentially produce adequate plutonium for as many as 50 warheads per year.¹²

At the very least, it is to be expected that there would be stockpiles of low enriched uranium at all of these facilities, and also possibly small stockpiles of HEU. Security arrangements for both the facilities and stockpiles are unknown.

As already mentioned, the unsafeguarded Khushab heavy water reactor is thought to be devoted solely to the production of plutonium. Its 50 MWt output is thought to produce eight to ten kilograms of weapons grade plutonium per year, which is enough for one to two nuclear weapons. The reactor could also produce tritium if it were loaded with lithium-6.¹³ Separation of the plutonium is

¹⁰ "Nuclear Power in Pakistan," *Nuclear Issues Briefing Paper* 108, September 2007, Australian Uranium Association, <http://www.uic.com.au/nip108.htm>.

¹¹ The US government calls this the Gadwal uranium enrichment plant, *Securing Pakistan*.

¹² Ramesh Randeep and Julian Borger, "Pakistan launches huge nuclear arms drive," *The Guardian*, July 25, 2006.

¹³ "Pakistan Nuclear Weapons – A Brief History of Pakistan's Nuclear Program," Federation of American Scientists, <http://www.fas.org/nuke/guide/pakistan/nuke/index.html>.

thought to take place at a laboratory next to the safeguarded PINSTECH facility in Rawalpindi. Storage arrangements for the separated plutonium are unknown, though they may have vaults below the site, or elsewhere, that would be heavily protected. Transport arrangements for nuclear materials are also unknown.

NUCLEAR WEAPON MANUFACTURE AND STORAGE

Little is known about the actual manufacture of Pakistan's nuclear arsenal. However, it is thought that at least part of the manufacture occurs at the Wah facility northwest of Islamabad.

Not surprisingly, little is also known about the location of the completed nuclear weapons. Unlike the United States and Russia, for example, the Pakistani authorities place great emphasis on keeping both the location *and* the security arrangements for their nuclear weapons secret. While the security arrangements at U.S. and Russian nuclear weapons bases may be kept top secret, the actual location of those bases is more readily known, precisely because of the size and quantity of the overt physical plants and the barriers surrounding them.

There is, moreover, nothing known about the condition in which the Pakistani weapons are stored. Media reports suggest that they are, logically enough, scattered around the country, probably on a variety of military bases. But media reports then become somewhat confused as to whether they are stored whole or in parts, with the nuclear core stored separately from the other elements of the weapon. It is also not known whether any of the weapons are actually mounted on missiles, with or without the fissile core itself actually in place, nor whether such missiles are deployed ready for action.

What *is* known, however, concerns the current procedures for the actual use of the assembled weapons. Previously, it was thought that none of the Pakistani nuclear weapons had devices or systems installed in them or procedures aimed at preventing their unauthorized use.¹⁴ Since at least 2004, however, it has been confirmed that all Pakistani nuclear weapons are now fitted with an in-built code lock known as a Permissive Action Link (PAL), such as is used in more advanced nuclear weapon states. In addition, and also in line with the practice of advanced nuclear weapon states, there is a rule

¹⁴ Ibid.

requiring the intervention of at least two, and possibly three, persons to confirm codes for the release of the weapons.¹⁵

PHYSICAL SECURITY

Overall responsibility for the security of Pakistan's civilian and military nuclear facilities lies in the hands of the Strategic Plans Division (SPD) of the National Command Authority (NCA), the ultimate command and control body governing Pakistan's nuclear sector. The SPD has its own integrated security service, consisting of around 10,000 specially trained personnel, which is under the control of a two star general.¹⁶ There is, naturally enough, close coordination with the strategic commands of the three wings of the armed forces, which form another sub-unit of the NCA. Some facilities also have air defense arrangements in place, with no-fly zones established over them.

Fencing at all facilities has apparently been recently upgraded, with electronic sensors and closed circuit TV cameras also installed.¹⁷

MISSILE CAPABILITY

Pakistan has a well advanced missile program, based initially on assistance from North Korea. Part of this effort is aimed at giving Pakistan the capacity to deliver nuclear weapons via this platform, in addition to its conventional bomber aircraft capacity, and of course to match similar efforts in India. The Pakistani missiles developed to date can reach most parts of India. These include the Ghaznavi (Hatf-3, range 290 km), Shaheen-I (Hatf-4, range 600-800 km), and the Ghauri-I (Hatf-5, range 1,500 km). Longer range missiles are also being developed, including the Shaheen-II (Hatf-6, range 2,000-3,000 km), which was successfully tested in February 2007. Pakistan is also developing a cruise missile capability, and successfully tested its nuclear capable Babur (Hatf VII) cruise missile (range 700 km), most recently in March 2007.¹⁸ These missile developments illustrate Pakistan's desire for a more secure deterrent, once the range issue had been dealt with, which it now

¹⁵ This was stated to be the case by a senior Pakistani nuclear scientist and official, Samar Mubarakmand, in a 2004 TV interview, but confirmed in 2006 by Lt General Khalid Kidwai, head of Pakistan's Strategic Plans Division, in an address to the Center for Contemporary Conflict in California, 1 November 2006, *Building Confidence*.

¹⁶ Ibid.

¹⁷ Ibid.

¹⁸ "Pakistan military test fires missile," *USA Today*, March 22, 2007, http://www.usatoday.com/news/world/2007-03-22-pakistan-missile_N.htm.

largely has.¹⁹ In addition, Pakistan has also been seeking a more secure second-strike capability through the local construction (under French license) of a second Agosta 90B class submarine which was completed in late 2007. This vessel can carry nuclear-capable Harpoon cruise missiles.²⁰ A third submarine is under construction in Karachi.²¹

EXPORT CONTROLS

Until the scandal over A.Q. Khan's illicit activities broke in 2004, Pakistani nuclear export policy after its 1998 nuclear tests was largely governed by three statutory regulatory orders issued in July 1998, February 1999, and August 1999. The first completely prohibited the export of fissionable material. The other two required the Pakistan Atomic Energy Commission (PAEC) to issue a "no objection certificate" for the export of nuclear "substances," radioactive material, or nuclear energy-related equipment. Other "substances" already listed in a 1984 ordinance also required such a certificate.

Following the Khan scandal, there was a perceived need for a further tightening of export controls, and the Export Control Act was passed in September 2004. It controls the export (including the re-export, transshipment, and transfer) of goods, technologies, materials, and equipment related to nuclear systems and their delivery platforms. Indeed, its scope also includes biological weapons. A separate ordinance was issued in 2000 covering chemical weapons.

Importantly, the act extends jurisdiction beyond Pakistan's borders to include offences committed by a Pakistani citizen or employee visiting or working abroad, a foreign national while on Pakistani territory, or offences committed on any ground transport, ship, or aircraft registered in Pakistan. Moreover, the control list for the Act includes the lists and export controls scheduled by the Nuclear Suppliers Group, the Missile Technology Control Regime, and the Australia Group (for biological agents).

The act was further strengthened on May 1, 2007, when a new unit was set up in the foreign ministry, the Strategic Export Control Division (SECDIV), which will in the future be the sole body with the authority to approve the export of nuclear-related items, missile technology, biological agents, and toxins.

¹⁹ "Pakistan's Nuclear Forces, 2007," Nuclear Notebook, *Bulletin of the Atomic Scientists* 63, no. 3, (2007); "Pakistani Nuclear Forces, 2006," Stockholm International Peace Research Institute (SIPRI), <http://www.sipri.org/contents/expcon/Pakistan.pdf>.

²⁰ S.M. Hali, "Second Strike Capability," *The Nation* (Pakistan), August 15, 2006, <http://www.nation.com.pk/daily/august-2006/16/columns5.php>.

²¹ "Pakistan – Navy," Global Security Website, <http://www.globalsecurity.org>.

While all of this was obviously designed to calm international concerns over the Khan scandal, many suspicions remain about the extent of official knowledge of, or active connivance in, Khan's activities. Concern also remains that government bodies and officials may still be actively seeking nuclear-related materials from illegal sources internationally. In 2006, for example, the Russian government indicated that a Pakistani national working for a Pakistani corporation in Moscow had attempted to acquire dual-use technology and other materials for Pakistan's nuclear and missile development programs.²²

Before that, there was also the case of two Pakistani physicists with knowledge of the nuclear program who admitted to speaking with Osama Bin Laden (although they denied that any sensitive information was divulged).²³

PERSONNEL MANAGEMENT

This brings us squarely to the question of personnel management in Pakistan, where the Khan scandal continues to cast a wide shadow. While suspicions remain, the scandal had the useful result of a major tightening of controls over the recruitment and subsequent security of all nuclear personnel, civilian and military, as foreshadowed in the Export Control Act. Recruitment is now overseen by one body, the Strategic Plans Division, and vetting appears to be an exhaustive process carried out by a number of intelligence related bodies, with regular update checks after that. The operation is known appropriately enough as the Personnel Reliability Program.²⁴

NUCLEAR DOCTRINE

Widespread international concern had also been expressed in the wake of the 1998 nuclear tests about the perceived lack of any cohesive nuclear doctrine in Pakistan to govern future use of its new nuclear weapons. That situation has now changed in terms of both doctrine and practice. Quite apart from notions of national pride and standing, particularly in the Islamic world, Pakistan's primary reason for developing and maintaining nuclear weapons is deterrence against India. This deterrence is not only against a possible Indian nuclear attack, but a conventional one as well. Other neighbors within reach of Pakistani missiles are either not regarded as a major military threat (Afghanistan) or are countries with which Pakistan has friendly relations

²² Joshi, Sharad, *Nuclear Proliferation in South Asia: Recent Trends*, NTI Issues Brief, August 2007, http://www.nti.org/e_research/e3_91.html.

²³ Retired Pakistan Atomic Energy Commission (PAEC) scientists Sultan Bashiruddin Mahmood and Abdul Majid. See Luongo and Salik, *op. cit.*

²⁴ Luongo and Salik, *op. cit.*

(Saudi Arabia and the Gulf states) or even a history of cooperation on nuclear issues (China, Iran). Moreover, any hard-headed Pakistani assessment of its own natural and other resources in the nuclear field would lead to the conclusion that its indigenous potential for any significant expansion of its current nuclear capability is limited. This in turn would lead to the conclusion in terms of nuclear doctrine that its targets would need to be carefully selected and limited.

The problem is, however, that for India, Pakistan is not its sole security concern. China is also regarded as a major threat. Thus, while China continues to maintain, or even expand, its nuclear arsenal, and has the potential to continue to produce fissile material (if it is not still doing so despite its NPT commitments), India will simply not give up its own nuclear arsenal or desist from expanding it. The flow-on effect is that Pakistan will not do so either, and the remainder of the on-again, off-again discussions between Pakistan and India on nuclear and military matters is largely window-dressing to this central fact. India offers a no first-strike deal to Pakistan, which is rejected. Pakistan counters with a no first-war proposal, which India rejects. And so it goes.²⁵

The spillover of this central impasse has ramifications for much wider international disarmament and non-proliferation issues. Both India and Pakistan are designated states whose ratification is required before the Comprehensive Nuclear Test Ban Treaty (CTBT) can enter into force. But neither will act without the other, much less movement by some of the other major nuclear weapon states, including the United States, which still remain outside the CTBT.

Pakistan and India would also be key players in any negotiation of a Fissile Material Cut-off Treaty (FMCT), but instead are two of the major stumbling blocks—though by no means the only ones. India has expressed interest in the goal of an FMCT while not committing itself to specific negotiations. Pakistan has done the same, though it wants to see such a treaty include existing stockpiles²⁶—something India opposes. While none of the other key states largely outside the NPT (Israel, North Korea, and Iran) currently seems interested in participating in such negotiations, that could change in the future—which is probably as likely as the United States changing its opinion about the need for a verification regime for such a treaty.²⁷

²⁵ For a more detailed consideration of these and other issues, see Joshi, Sharad, *op. cit.*

²⁶ Weapons of Mass Destruction Commission (the 'Blix Commission'), Weapons of Terror: Freeing the World of Nuclear, Biological and Chemical Arms, Stockholm, 2006, p.37.

²⁷ In July 2004, in a move not dissimilar to that which scuttled the negotiation of a Biological Weapons Protocol in 2001, the Bush administration announced that while the United States still

THE FUTURE

With ongoing instability in Pakistan and its surrounding region, it is inevitable that concern will continue in the West and elsewhere over the immediate and long term security of Pakistan's nuclear arsenal regardless of the outcome of the February parliamentary elections. That concern, exacerbated since 9/11, is centered on fears that Pakistan will fail as a state and slip into anarchy or be taken over by religious extremists, with the country's nuclear assets falling into the wrong hands in either situation. Such fears were only made worse by reports that two nuclear scientists from the PAEC were kidnapped in the border area by the Taliban at the request of al-Qaeda in late 2006, and as of March 2007 remained in captivity.²⁸ Soon after that kidnapping, there was an aborted attempt to capture six more PAEC officials in the North West Frontier Province of Pakistan in January 2007. While it is not clear if the officials and scientists were targeted specifically because of their links to Pakistan's nuclear program, these incidents demonstrate the potential danger of non-state actors' participation in the illegal market in nuclear technology.

As for the notion of Pakistan slipping into anarchy or a radical Islamist government winning office, however, the International Crisis Group (ICG) has reached a different conclusion. "Poll after poll has found that if fair and free elections were held under constitutional protections and monitored by national and international observers, the result would be a moderate, pro-Western, anti-extremist government in Pakistan."²⁹ A potentially serious destabilizing factor was, of course, the assassination of Benazir Bhutto on December 27, 2007. But the ICG is definitely of the view that it is now time for the West to ditch its support for Musharraf, who is no longer a source of stability but has become a major cause of instability in his own right. The ICG report argues "[i]t is time that the West acknowledges that only a legitimate elected government, led by one of the moderate parties, would have the authority and the popular backing to return Pakistan to its moderate democratic moorings."³⁰

supported a legally binding FMCT, it no longer supported including verification measures in such a treaty. This was because such measures could compromise the national security of key states, and moreover would be unsustainably costly. See also George P. Shultz, William J. Perry, Henry A. Kissinger and Sam Nunn, "Toward a Nuclear-Free World", *The Wall Street Journal*, 15 January 2008, page A13, http://online.wsj.com/article/SB120036422673589947.html?mod=opinion_main_commentaries.

²⁸<http://www.innworldreport.net/archives/2007/03/2007-03-08.html> The Pakistani government was understandably embarrassed by the incident and kept it secret. There has been no subsequent indication that the scientists have been released.

²⁹ Thomas R. Pickering, Carla Hills, and Morton Abramowitz, "The Answer in Pakistan," *The Washington Post*, November 14, 2007.

³⁰ International Crisis Group, "After Bhutto's Murder: A Way Forward for Pakistan", Asia Briefing No. 4, 2 January 2008. <http://www.crisisgroup.org/home/index.cfm?id=5246>.

How stable such a government might be in the short to medium term, particularly in view of the accelerated weakening of state structures in 2007, and how willing it might be to change in any significant way Pakistan's current nuclear posture, is another matter entirely.

NPT CONSIDERATIONS

In a wider sense, a number of Western and other governments need to bear in mind that they have at least in part brought the problems associated with nuclear armed India and Pakistan upon themselves. And here the finger of blame points firmly in the direction of the NPT nuclear weapon states (China, France, Russia, the UK, and the United States) who have, over a long period, failed to live up to their basic NPT undertaking to give up their own nuclear arms. It should be recalled, for example, that then Indian Prime Minister Rajiv Gandhi in his address to the UN General Assembly on June 8, 1988, stated that India would not pursue its nuclear weapons program if the NPT nuclear weapon states would give a firm undertaking to give up their own. That, of course, never occurred despite the general assessment that Gandhi was sincere in his offer. The Strategic Arms Reduction Treaty (START) process gave cause for hope, but has been stalled for years. Not only are existing arsenals maintained, but the United States even talks about designing new nuclear weapons while maintaining that other states should not acquire them. The argument becomes circular as more states do in fact work to acquire nuclear weapons and the NPT NWS say they cannot disarm while this occurs. The inevitable result is an increasing undermining of the NPT itself.

What is needed now is some sort of indication of good faith and willingness by the NPT NWS to break down the barriers between the nuclear haves and the have-nots. It need not be far reaching, though some have made ambitious proposals in this regard.³¹ Such a step could take the form of developing a timetable—or even just committing to developing a timetable—for the eventual elimination of their own arsenals.³² It goes without saying that committing to a timetable is not the same as total disarmament itself. Such a timetable in any case would, in practical terms, probably take many years, if not decades, to achieve its goal.

³¹ George P. Shultz, William J. Perry, Henry A. Kissinger and Sam Nunn, "A World Free of Nuclear Weapons", *The Wall Street Journal*, 4 January 2007, Page A15. See also George P. Shultz, William J. Perry, Henry A. Kissinger and Sam Nunn, "Toward a Nuclear-Free World", *The Wall Street Journal*, 15 January 2008, page A13, http://online.wsj.com/article/SB120036422673589947.html?mod=opinion_main_commentaries.

³² The idea is developed in greater detail in Berry, Ken, *Defeating Nuclear Terrorism: The Moscow-Washington Alliance*, EastWest Institute Policy Paper 2/2007. <http://www.ewi.info/pdf/TerrorNukesFeb7.pdf>.

It is the gesture itself that is important. It would be foolish to imagine that developing disarmament timetables would unlock the floodgates and suddenly lead to rapid progress in preventing the continued proliferation of nuclear weapons. But it might at least start to pry them open just a crack. It could in turn possibly induce states such as India and Pakistan (and others) to be more willing to consider an FMCT, not to mention their own eventual commitment to a timetable for total nuclear disarmament. At the very least it might save the NPT from total collapse.

The NPT nuclear weapons states and other states should also be giving more accelerated political and financial attention to the development of alternative technologies to allow the gradual phasing out of highly enriched uranium in peaceful civilian nuclear programs. At the same time, practical steps need to be taken for the establishment of international nuclear fuel enrichment centers under the control of international organizations, principally the IAEA,³³ and other aspects of the 2006 U.S. proposal for a Global Nuclear Energy Partnership.

While such proposals are unlikely to have any immediate attractions to Pakistan (or India) while they are locked in their current strategic stalemate, such technologies and enrichment centers would provide some optimism for Pakistani leaders that their country's civilian energy needs would at least be addressed if they felt willing to surrender their nuclear arsenals. It would at the same time diminish the temptation for other states interested in nuclear energy to pursue a more aggressive weapons-related program. It would also eradicate a source of envy for states not having the technology to highly enrich uranium of those that do. And finally, it would lessen the possibility of disaffected states in this category making nuclear weapons or related materials, technology, or expertise available to terrorist groups.

PERSONNEL

Although Pakistan has tightened its procedures relating to personnel recruitment, challenges clearly remain. Just as Russia, with U.S. financial assistance, has done away with its own excess nuclear personnel, Pakistan has found new jobs for scientists with potentially sensitive expertise in other areas of the nuclear program so that their expertise can continue to be used. More importantly, this will also keep them from accepting the blandishments of states or groups of concern to work for them. However, once more new, educated recruits enter the nuclear workforce and more of the existing scientists approach retirement age and wish to leave the program, dealing

³³ Ibid.

with these older personnel will become more of a problem, and the newer recruits will need to be monitored closely on an ongoing basis. It is also highly likely that at least some of the younger scientists and military personnel in Pakistan have developed a greater sympathy for radical Islamist philosophies than their elders and so would be more prone to smuggle nuclear materials or offer their services clandestinely to extremists groups.

Pakistan has spoken with the United States on this issue and is exploring ideas for scientists who leave the program, including retraining them in other areas of expertise and systems for the protection of sensitive information held by personnel who have left government employment.³⁴ There are limits, however, to what the United States is willing to do politically, or is even able to do in the context of legislative bans on cooperating with or assisting states involved in proliferation, such as those contained in the Nuclear Black Market Counter Terrorism Act passed in January 2007. While repeatedly supportive of the Musharraf regime's efforts in the so-called "war on terror," the United States has consistently refused to offer Pakistan the sort of nuclear cooperation agreement of the kind it reached with India.

One proposal that might conceivably have some attraction for both sides would be the development of a shared database of personnel known to be involved in nuclear programs and identification of the activities of such personnel should they travel abroad. Such a database could aid in preventing, or at worst monitoring, any contacts between such personnel and representatives of states or non-state groups of proliferation concern and even possibly lead to the interdiction/arrest of such personnel should they appear to be heading for a country of proliferation concern.³⁵

There would be obvious and inevitable opposition to such an idea in the Pakistani military and intelligence community. However, a government craving Western political and financial support—and particularly a democratically elected civilian government—might see such a proposal as consistent with their export control legislation that already criminalizes the sort of behavior such a database would be aimed at when carried out by Pakistanis or persons acting for Pakistan abroad. It could also be argued to the Pakistani authorities that they would have the assistance of advanced intelligence surveillance in third countries to detect illegal activities.

It has to be said that such a proposal as this would probably also provoke a knee-jerk negative reaction from U.S. and other Western intelligence

³⁴ Luong and Salik, *op. cit.*

³⁵ Berry, *op. cit.*

agencies. However, if those countries want diplomatic support for such controls on Russian or Pakistani scientists, then some middle ground will have to be found that shows that all scientific communities are subject to similar observation. In terms of acting within U.S. legislative restrictions on dealings with Pakistan, moreover, the U.S. administration might even see some advantages in a database that resulted from multilateral cooperation, rather than being seen as based only on cooperation with a state such as Pakistan.

POLICING

It might similarly be argued that seeking to develop globally applicable standards for inventory of nuclear materials and tracking their movement could justify at least some assistance to Pakistan to boost its own policing efforts. The 2006 murder of Russian dissident Alexander Litvinenko, while confirming the long recognized threat of radiological weapons, was also a reminder that criminals and terrorists can obtain a key component for producing nuclear weapons and smuggle it undetected through the airports of countries on high alert against terrorist threats. States will thus need to arrive quickly at procedures for detecting the presence of nuclear materials in significant civilian transportation hubs.

There are many other aspects of policing and customs control that bear on the threat of nuclear terrorism. These need to be coordinated against a clear risk management strategy: there are simply not enough police and intelligence resources to detect all potentially threatening activity. Although Pakistan has tightened its export control legislation and procedures considerably, it could be helped greatly with outside assistance in beefing up its border security, including in the type of detection equipment used in major transportation hubs in more developed countries.

CONCLUSION AND RECOMMENDATIONS

2007 was a bad year for Pakistan. Adding to the progressive undermining of constitutional rule that has occurred since the 1999 coup, the Musharraf regime also seriously undermined another of the main elements of any state—the judiciary—last year. Although finally forced out of his uniform, Musharraf managed to coerce his way into an additional term as president. Despite the chaos surrounding the declaration of a state of emergency in late 2007 and the subsequent assassination of Benazir Bhutto, the third main element of a state—its political system—emerged paradoxically strengthened in the sense of a new willingness to confront military rule in a more determined and concerted way.

But equally, it must be conceded that the year saw a growth of radical Islamist militancy and violence, not only in border areas, but also in major population centers. Extremists and elements of the Taliban have created virtual no-go areas along the border with Afghanistan. The Pakistani armed forces are becoming over-extended in many parts of the country, with high death rates and consequent demoralization and desertion. Some of the unrest in border regions may even have been fomented by military intelligence for perverted strategic reasons.³⁶ In short, the prospects for any government elected in the February parliamentary elections, whether it consists of more military puppets or democratic civilians, are bleak in the short term. The important thing from a nuclear point of view, however, is that it is extremely unlikely that the new government will consist of Islamist extremists or jihadists who might seek to misuse the country's nuclear weapons.

More to the point, there was not the slightest suggestion during the latest crises that Pakistan's nuclear facilities, let alone its arsenal of nuclear weapons, were in any danger of falling into the wrong hands. No matter how over-stretched the armed forces may have been in some parts of the country, Pakistan's nuclear assets apparently remained under the firm control of not only the military, but also the large, specially trained security force created precisely to protect those assets. It seems as though the improvements wrought in security arrangements over the past nine years have achieved that much at least.

It is, however, becoming increasingly apparent that Musharraf is himself becoming a major cause of instability in the country. Several hundred retired Pakistani generals, admirals and senior officers have recognized this fact and on January 22, 2008 issued a written statement calling for Musharraf to resign. On February 5, they repeated their call, and in an unprecedented move, have even begun demonstrating openly against him.³⁷ The inescapable conclusion is that it is time for Musharraf to go, and for countries such as the United States to urgently review their support for him as one of their best weapons in the 'war on terror.'

While it is still far too early to assess what sort of relationship might develop between a democratically elected civilian government and the military over the longer term, a good argument could be made for such a government to

³⁶ See for example "Militants Turn On Spy Agency Masters", *Sydney Morning Herald*, 16 January 2008, <http://www.smh.com.au/news/world/militants-turn-on-spy-agencymasters/2008/01/15/1200159448480.html>.

³⁷ 'Go now, army group orders Musharraf', *Sydney Morning Herald*, February 7, 2008, <http://www.smh.com.au/news/world/go-now-army-group-orders-musharraf/2008/02/06/1202233948281.html>.

continue the current deep military involvement in nuclear planning and security, however undesirable that might be to Western idealists. Quite apart from anything else, the armed forces would probably balk at being sidelined. But in a wider, more practical sense, while a civilian government will undoubtedly have to expend considerable effort in trying to heal a splintering country for an equally considerable period of time, it would only make sense to leave the country's most valuable—and dangerous—military asset under military protection, though of course not necessarily under its full political control, if for no other reason than that the Pakistani armed forces remain one of the best trained, cohesive, and disciplined elements of an otherwise dangerously fractious country.

In a wider geopolitical sense, there is no reason to suppose that a democratic civilian government would seek to change Pakistan's existing nuclear doctrine or policies to any significant degree. The nuclear weapons program and the 1998 tests were developed under various civilian governments, including those of Zulfikar Ali Bhutto, his daughter Benazir, and the last civilian government of Nawaz Sharif. Relations with India will not change significantly in the near future, and India's own nuclear doctrine and policy will remain much as it currently is. Quite apart from reasons of national pride and, more to the point, perceptions—no matter how flawed—of national security, wider bilateral concerns (India's worries about China), and multilateral obstacles (including the failure of the NPT nuclear weapon states to give any credible indication that they themselves are willing to give up their nuclear arsenals) actively work against this.

A return to democratic rule, however, could be key to overcoming U.S. legislative hurdles and congressional objections to some form of nuclear cooperation agreement between the United States (and others) with Pakistan. While direct assistance in securing Pakistan's facilities and weapons might continue to be resisted by Pakistan itself, assistance in improving the policing of major transportation hubs, ports, and airports, including the provision of more sophisticated detection equipment, would probably be greatly appreciated by Pakistan and be a positive step for international security.

Assistance in retraining superfluous nuclear personnel or providing secure financial and other arrangements for retiring staff might also then be parlayed into Pakistani cooperation in the sort of database of nuclear personnel proposed in this paper. Given Pakistan's economic and resource base and its burgeoning energy needs, Pakistan is also far more likely than India to see the attractions of alternative low enrichment civilian nuclear energy technologies and international stockpiles under IAEA safeguards, even if its access to them is currently out of the question.

But it cannot be a one way street. Longer term Pakistani policy regarding nuclear weapons will not change until Indian policies change, and Indian policies will only change if there is a quantum shift in the stance of the NPT NWS—particularly China and the United States—on central nuclear policy issues. The most important one will be some sort of firm indication from these states that they are indeed serious about their NPT commitment to give up their own nuclear arsenals. Absent such a move, however, there is no real incentive for a change in Pakistani or Indian policy. South Asia will remain a major source of global concern and insecurity, and other states of proliferation concern will only draw comfort from the current impasse.

Recommendations

For the international community at large:

1. Consider what steps states might take, either individually or jointly, to assist Pakistan in bolstering security at its nuclear facilities. Such assistance would need to take into account legislative and other restrictions states might have on extending aid to Pakistan on nuclear matters, as well as Pakistan's own degree of willingness to cooperate with such assistance.
2. Consider assistance to Pakistan in policing and detection at major transportation hubs within Pakistan. Such assistance might include both training of Pakistani civilian police personnel, as well as the provision of modern equipment capable of detecting trace amounts of nuclear and radiological material.
3. Consider also the establishment of a shared database of personnel known to be involved in nuclear programs; identification of the activities of such personnel should they travel abroad; preventing, or at worst monitoring, any contacts between such personnel and representatives of states or non-state groups of proliferation concern; and even possibly the interdiction/arrest of such personnel should they appear to be heading for a country of proliferation concern.
4. Consider greater sharing of national intelligence relating to illicit dealings in nuclear materials, technology, and expertise.
5. Support—either financially or technically—the development of alternative technologies for the low enrichment of uranium and the establishment of international stockpiles of low enriched uranium under IAEA safeguards for use by countries in civilian nuclear energy generation.

6. Actively support the early negotiation and conclusion of a fissile material cut-off treaty (FMCT).
7. Bring what pressure they can to bear on President Musharraf to stand down from office and to encourage any democratically elected government of Pakistan to be more open on nuclear security issues than their predecessors have been.

For the NPT nuclear weapon states:

8. Consider the early development of a firm timetable for their NPT commitment to disarm and destroy their arsenals of nuclear weapons.
9. Participate constructively in the negotiation and conclusion of an FMCT.
10. Contribute finance, technological expertise, and the raw materials necessary for the alternative technologies and stockpiles mentioned in (5) above.

For the United States:

11. Give early consideration to a policy shift which might allow it to offer Pakistan a nuclear cooperation agreement of the kind it has already entered with India.
12. Consider whether a multilateral effort to assist Pakistan on nuclear security of the kind outlined in (2), (3), and (4) above might allow United States' participation despite existing Congressional and policy limitations on U.S. interaction with Pakistan on nuclear issues generally.
13. Discontinue its policy of supporting Musharraf's presidency as being the best way of ensuring Pakistan's participation in the "war on terror."
14. Revoke its decision not to support a verification regime for an FMCT.

For the government of Pakistan:

15. Review at an early opportunity the sufficiency of existing measures for the security of Pakistan's nuclear weapons and related facilities.
16. Consider the early adoption of a policy of greater openness on matters relating to aspects of security at its nuclear facilities, including willingness to accept international assistance in this regard when offered.
17. Participate actively and positively in the negotiation of an FMCT

BOARD OF DIRECTORS

CHAIRMAN OF THE BOARD

George F. Russell, Jr.
Chairman Emeritus
Russell Investment Group
Russell 20-20

PRESIDENT, FOUNDER AND CEO

John Edwin Mroz
EastWest Institute

MEMBERS

Urban Ahlin
Chairman, Committee on
Foreign Affairs
Parliament of Sweden

Martti Ahtisaari
Former President of Finland

Jerald T. Baldridge
Chairman, Republic Energy
Inc.

Thor Bjorgolfsson
Chairman, Novator

Peter Castenfelt
Chairman, Archipelago
Enterprises Ltd.

Maria Livanos Cattau
Member of the Board of
Directors, Petropus Holdings
AG Switzerland

Mark Chandler
Chairman and CEO,
Biophysical

Emil Constantinescu
Former President of Romania

Joel H. Cowan
President, Habersham &
Cowan

Rohit Desai
President, DesaiCapital

Francis Finlay
Chairman, Clay Finlay Inc.

Olafur Grímsson
President of Iceland
(On leave for Government
service)

Stephen B. Heintz
President, Rockefeller
Brothers Fund

Emil Hubinak
CEO, Slovak Telecom

R. William Ide III
Partner, McKenna Long &
Aldridge LLP

Wolfgang Ischinger
Ambassador, Embassy of the
Federal Republic of Germany
in the UK

Sigrid RVC Kendall
Managing Partner, Kendall-
Verwaltungs-GmbH

Richard M. Kessler
President, Empire City
Capital Corp.

Rudi Lamprecht
Member of the Managing
Board, Siemens AG

James A. Lash
Chairman, Manchester
Principal LLC

Zhengang Ma
President, China Institute of
International Studies

Mark Maletz
Senior Fellow, Harvard
Business School

Michael Maples
Former Executive Vice
President, Microsoft
Corporation

Peter Maurer
Ambassador, Permanent
Mission of Switzerland to the
United Nations

Thomas J. Meredith
Co-Founder and Principal,
Meritage Capital L.P.

Fraser Morrison
Chairman, Teasses Capital
Ltd

Frank Neuman
President, AM-TAK
International

Ahmet Mucahid Oren
Chief Executive Officer, Ihlas
Holding A.S.

Robert Oxnam
President Emeritus, Asia
Society

Ross Perot Jr.
Chairman, Perot Systems
Corporation

Louise Richardson
Executive Dean, Radcliffe
Institute for Advanced Study,
Harvard University

Laurent M. Roux
President, Gallatin Wealth
Management
LLC

Ramzi Sanbar
Chairman, Sanbar
Development Corporation,
S.A.

Armen Sarkissian,
President, Eurasia House
International

Leo Schenker, Senior
Executive Vice President,
Central National-Gottesman
Inc.

Rockwell Schnabel
Founder, Director &
Chairman, Sage Capital Inc.

Henry J Smith
CEO, Bud Smith
Organization Inc.

Hilton Smith
President and CEO, East Bay
Co. Ltd.

Elizabeth Symons
Former Minister of State,
Foreign & Commonwealth
Office (UK)

Henrik Torgersen
Executive Vice President-
International Operations,
Telenor

Pierre Vimont
Ambassador, Embassy of the
Republic of France in the
United States

Matthias Warnig
Managing Director, Nord
Stream AG

Bengt Westergren
Senior Vice President of AIG
Companies
Corporate & Government
Affairs, Europe & C.I.S.,
American International Group
(AIG)

Igor Yurgens
First Group Vice President,
Renaissance Capital

Zhang Deguang
President, China Foundation
for International Studies

CHAIRMEN EMERITI

Berthold Beitz
President, Alfried Krupp von
Bohlen und Halbach-Stiftung

Ivan T. Berend
Professor, University of
California at Los Angeles

Hans-Dietrich Genscher
Former Vice Chancellor and
Minister of Foreign Affairs of
the Federal Republic of
Germany

Donald M. Kendall
Former Chairman & CEO,
PepsiCo. Inc.

Whitney MacMillan
Former Chairman and CEO,
Cargill Inc.

DIRECTORS EMERITI

Jan Krzysztof Bielecki
Chief Executive Officer, Bank
Polska Kasa Opieki S.A.

William D. Dearstyne
Former Company Group
Chairman, Johnson &
Johnson

John W. Kluge
Chairman of the Board,
Metromedia International
Group

Maria-Pia Kothbauer
Ambassador, Embassy of
Liechtenstein

William E. Murray (1925-
2007)

John J. Roberts
Senior Advisor, American
International Group (AIG)

Daniel Rose
Chairman, Rose Associates
Inc.

Mitchell I. Sonkin
Managing Director, MBIA
Insurance Corporation

Thorvald Stoltenberg
President, Norwegian Red
Cross

Liener Temerlin
Chairman, Temerlin
Consulting

John C. Whitehead
Former US Deputy Secretary
of State

NON-BOARD COMMITTEE MEMBERS

John A. Roberts
President, Chilmark
Enterprises Inc

J Dickson Rogers
President, Dickson Partners
LLC

George Sheer
Founder and CEO,
International Consulting
Group USA

CO-FOUNDER

Ira D. Wallach (1909-2007)